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FIVE NEW SPECIES OF TRICHOPTERA WITH THE FAUNISTIC LIST OF SİNOP AND SAMSUN PROVINCES IN TURKEY (GLOSSOSOMATIDAE, PHILOPOTAMIDAE, HYDROPSYCHIDAE, SERICOSTOMATIDAE)

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ABSTRACT: In the present paper the following new species are described and illustrated: *Agapetus sinopicus* sp. n. (central part of northern Turkey), *Wormaldia mahiri* sp. n. (north eastern Turkey), *W. erzincanica* sp. n. (eastern Turkey), *Hydropsyche taskalensis* sp. n. (southern Turkey) and *Schizopelex sinopica* sp. n. (central part of northern Turkey). The faunistic list of Trichoptera for Sinop and Samsun provinces located central part of northern Anatolia is given, a sketch map for the locations is provided.

KEY WORDS: Trichoptera, taxonomy, new species, *Agapetus*, *Wormaldia*, *Hydropsyche*, *Schizopelex*, Sinop, Samsun, faunistic list, Turkey.

The Trichoptera fauna of two provinces in the central part of northern Turkey, namely Sinop and Samsun provinces, are listed. They were poorly known prior to this study, with only seven species recorded (Sipahiler & Malicky, 1987; Sipahiler, 2004 and 2007). Most of the listed specimens were collected from the mountains. In the region, in Sinop province, two mountain ranges, the Küre and Ilgaz Mountains, run parallel to the coast, separated from each other by a large plain; the mountains become lower through Samsun province. In this area, 59 species were found belonging to 18 families; of these, 50 species are recorded for the first time in the region (Fig. 1).

The Trichoptera fauna of Sinop and Samsun provinces is composed of 17 endemic species (29%), of which five species are found only in Sinop province, including the new species *Agapetus sinopicus* sp.n. and *Schzopelex sinopica* sp. n. described below. Thirty-two species (54%) that occur in the region have western type distribution, of which 19 species (32%) are found in Europe or western Turkey; the rest of the species (13 species) are widely distributed. Only ten species are also found in the Caucasus (17%).

The new species *Wormaldia mahiri* sp. n. and *W. erzincanica* sp. n. are found in northeastern and eastern Turkey, respectively. *Hydropsyche taskalensis* sp. n. belongs to the *instabilis* species group and occurs in southern Turkey.

MATERIALS AND METHODS

specimens were collected by hand net and light trap with a blacklight tube (6 W), which was set up near rivers and streams. The list of species includes those collected in 2009, formerly recorded species and new species, described in this paper. The pupae and some known larvae are also included in the list. The species of the genus *Dinarthrum* and of the *Hydropsyche pellucidula* species group, which need revision, are not listed. A sketch map of the distribution of the species is provided (Fig.). In the faunistic list, the number in parentheses shows the locations on the map. For the code of the depository the abbreviation CD is used.

Unless otherwise stated, the specimens were collected by the author and deposited in her collection in the Biology Education Department at Hacettepe University.

DESCRIPTIONS

Agapetus sinopicus sp. n.
(Figs. 2-6)

Material: Holotype male: Turkey, Sinop, Ayancık, Tarakçı, Gebelit Köprüsü,CD: F-356, 20 m, 41° 56' N, 34° 46' E, 16.7.2009 1 male, leg. and coll. Sipahiler.

Antennae, maxillary palps and wings brown, legs pale brown; head dorsal and thorax dark brown; the length of the anterior wing of male is 4 mm.
Male genitalia (Figs. 2-6): In lateral view, anterioventral part of segment IX is slightly protruding anteriorly. Segment X is somewhat shorter than the inferior appendage; in lateral view, a strongly sclerotized band, beginning from the dorsal part of segment X continues on the ventral margin; above the ventral margin a short and thin sclerotized band is present on the basal half of segment X; in dorsal view, the apical margin is excised medially, forming rounded lobes on each side. The inferior appendage is laterally oval, rather broad, ventral and the dorsal margins dilated, narrowing towards the apex; the apex has a small lobe on the dorsal corner, the ventral portion of the apical margin is smooth; in ventral view, the inner margin is gradually rounded, possesses two small projections near the base, two larger projections medially and two projections at the apex. The phallic apparatus is rather broad at the base, narrow at the subdistal part, the apex is deeply excised medially, bilobed, the aedeagus is located between them; the median portion of the phallic apparatus is sclerotized; dorsally, a Y-shaped sclerotized band is located on the basal half, the paramere is shorter, slightly curved to the right side.
The female is unknown.
Remarks: *Agapetus sinopicus* sp. n. is closely related to *A. caucasicus* Martynov, 1913 (Malicky, 2004) by having a relatively narrow segment IX and the shape of segment X with rounded lobes apically. It differs from the related species by the following characters: In *A. caucasicus* segment X has only a long sclerotized band near the ventral margin, while in the new species it is short but the margin has a long sclerotized band, beginning from the dorsolateral part of segment X; the inferior appendage of *A. caucasicus* is narrow, the apex is pointed, ventrally, the inner margin of the basal part forms a corner subdistally; the median projections are located on the broad dilatation, the apex is without projections; in *A. sinopicus* sp.n., the inferior appendage is oval, the apex is broad, with a small lobe and it possesses two small projections at the tip; the phallic apparatus of *A. caucasicus* is simple, it possesses only the paramere, while in the new species the paramere and a Y-shaped sclerotized band are found.
Etymology: This species is named after the place around where the specimens were collected.

Wormaldia mahiri sp. n.
(Figs. 7-11)

Material: Holotype male: Turkey, Ordu, Koyulhisar, Mesudiye direction, Arpaalan 1610 m, CD: C-485, 40° 21' N, 37° 52' E, 5.7.2007; paratypes: Ordu, Ünye direction, 5 km north of Esentepe, 3.7.2007 1 male; Ordu, Niksar-Akkuş direction, 10 km south of Akkuş, 1300 m CD: C-491, 3.7.2007, 1 male, 1 female; Giresun, Bektaş yaylası, 2010 m, CD: C-496, 40° 39' N, 38° 14' E, 9.8.2007, 1 male; Tokat, Niksar, Çamiçi Yaylası, 1200 m, CD: C-497, 2.7.2007, 1 male; Giresun, Kümbet yaylası, 1630 m, CD: C-499, 40° 32' N, 38° 26' E, 10.8.2007, 1 male; same place, Çıkrıkkapı, 1871 m, CD: C-508, 2.10.2008, 5 males, 1 female; same place and date, 1786 m, CD: C-507, 40° 32' N, 38° 32' E, 2 males, 1 female; same place , Yağlıdere direction, 17.8.2008, 1035 m, CD: C-529, 40° 36' N, 38° 36' E, 5 males, 3 females; Gümüşhane, Zigana village, Limni Lake direction, 11.8.2007, 1230 m, CD: C-504, 1 male; leg. and coll. Sipahiler.

Antennal segments are brown; with narrow pale yellowish annulations; head and thorax dorsal dark brown; wings pale brown; legs pale brown yellowish; the length of the anterior wing of males is 5.5-6 mm.
Male genitalia (Figs. 7-11): Tergite VIII is deeply excised on the median portion, forming narrow and rounded lobes on the apical margin; the side edges of the excision are sinuate; in lateral view, the sides of segment IX are broadly and rather roundly dilated on the anterior margin. Segment X is broad on the basal part; in lateral view, the distal portion is short and rounded. The preanal appendages are narrower at the base; dorsal and ventral edges are almost parallel to each other; the posterior margin is smooth. In dorsal view, the apex of the preanal appendage is rounded. The segments of the inferior appendages are almost equal in length; in lateral view, the coxopodite is roundly dilated on the ventral margin; the dorsal margin is smooth; the harpago is slender and rounded at the apex. The phallic apparatus possesses two long and thin spines and an apical spine, which is stout, and numerous thin spines, forming together a rounded shape, located between the thin spines.
Etymology: This new species is named in memory of the author's father, Mahir Sipahiler (1919-1974).

Wormaldia erzincanica sp. n.
(Figs.12-16)

Material: Holotype male pupa: Turkey, Erzincan, Sivas direction, 115 km west of Erzincan, 2100 m, a small mountain spring, CD: C-520, 39° 43' N, 38° 06' E, 12.7.2008, leg. and coll. Sipahiler.

Antennal segments are pale brown-yellowish; head and thorax dorsal brown; wings pale brown-yellowish; legs yellow. The length of the pupa is 6 mm.
Male genitalia (Figs. 12-16): Tergite VIII is deeply and roundly excised on the median portion, forming broadly triangular lobes on the apical margin. Segment IX is rather narrow, in lateral view, the anterior margin is broadly dilated on the dorsal half, and the ventral edge is rather broad. Laterally the preanal appendage is rather broad, almost quadrangular; its ventroapical corner is dilated in a triangular manner towards ventral part. In dorsal view, the apex of the preanal appendage is pointed. In lateral view, the basal portion of segment X is straight, roundly excised on the median part, forming a small projection dorsally; the distal portion is short, apically rounded. The dorsal and ventral edge of the coxopodite of the inferior appendages is dilated dorsally and ventrally; the harpago is slightly shorter than the coxopodite, the ventral edge is dilated ventrally, becoming narrower on the subdistal portion, the apex is rounded. The phallic apparatus possesses six long and thin spines, which are located on the distal portion; behind

them, five shorter and thinner spines and smaller spines are found; on the basal portion, one short and thick spine is found.

Remarks: *Wormaldia erzincanica* sp. n. and *W. mahiri* sp. n. are closely related to each other by having a deep excision on the median part of tergite VIII and a straight basal part and a short and rounded distal portion of segment X. The differences are seen in many parts of the genitalia, especially the spines of the phallic apparatus, which are composed of three long spines and numerous small spines in *W. mahiri* sp. n., while in *W. erzincanica* sp. n. six long and thin spines and one thick spine and also smaller spines are found. In addition, the shape of segment IX (which is narrower in *W. erzincanica* sp. n., while it is broad in *W. mahiri* sp. n.) and the preanal appendage (of which the ventral edge is dilated ventrally in *W. erzincanica* sp. n., while it is narrower in *W. mahiri* sp. n.) separates these species.

Both new species are also related to *W. balcanica* Kumanski, 1979 (Kumanski, 1979), described from Bulgaria, by having a similar shape of segment X. It differs from the new species by the following features: in *W. balcanica* tergite VIII is nearly smooth on the apical margin; in both new species, tergite VIII is deeply excised medially; in *W. balcanica* the subdistal portion of segment X has a small pointed projection and the apex of the preanal appendages is dorsally pointed, curving inwards, while in *W. mahiri* sp. n. and *W. erzincanica* sp. n. the subdistal part of segment X is rounded in both new species and the apex of the preanal appendages is rounded in *W. mahiri* sp. n. and pointed in *W. erzincanica* sp. n., but not curving inside; in *W. balcanica*, the phallic apparatus possesses apically three small spines and numerous short and thin spines, which are located at the basal portion, forming together a long cylindrical structure, while in both new species the spines are different in shape and quantity.

Etymology: This species is named after the place around where the specimens were collected.

***Hydropsyche taskalensis* sp. n.**

(Figs. 17-21)

Material: Holotype male (pupa) and paratype 1 male (pupa): Turkey, Karaman, Taşkale, İbrala Stream, CD: H-842, 37° 10'N, 33° 29' E, 6.7.2010, leg. F. Erk'akan, coll. Sipahiler.

Antennae, palps and legs pale brown-yellowish; head, thorax and abdomen dorsally brown, length of the pupa is 10 mm.

Male genitalia (Figs. 17-21): Cavity IX and X are moderately deep; dorsal keel of segment IX is broad and oval, the base is large. In lateral view, the dorsal stripe of segment X has a basal lobe, which is almost quadrangular and bears dense long hairs; the apical portion of the dorsal stripe protrudes as a large and rounded lobe; the ventral portion of the posterior margin of segment X is nearly straight; the digitiform appendages are rather short and thick. The dorsomedian area of segment X is almost as broad as the dorsal keel, oval, with a lobe on each side of the base, possessing dense hairs; the apical margin is U-shaped excised. The harpago of the inferior appendage is almost equal in breadth, gradually curved inside, the apex is pointed. In lateral view, the phallic apparatus is somewhat curved at the base; the dorsal edge is slightly sinuate on the distal half; in ventral view, the lateroapical projections are broadly rounded.

Remarks: *Hydropsyche taskalensis* sp. n. is closely related to *H. ayasi* Sipahiler, 2010 (Sipahiler, 2010) described from Erzincan province in Turkey by having rounded lateroapical projections on the phallic apparatus and differs from this species by the following features: In *H. ayasi* the posterior margin and the dorsal stripe of segment X are laterally straight, the digitiform appendices are rather thin and long; in *H. taskalensis* sp. n. the dorsal stripe of segment X has a quadrangular lobe at the base, the apical lobe is rounded, the digitiform appendages are thick and shorter; in the related species the harpago of the inferior appendages is narrower at the base, curved on the basal portion, the harpago is long, the ratio of harpago/coxopodite is 1/2, while in the new species the harpago is equal in breadth and gradually curved inside, the harpago is short, the ratio of harpago/coxopodite is 1/3.6. In addition to these differences the dorsal keel of segment IX of the new species is larger than that of the related species. The shapes of the dorsomedian area of segment X also separate these species.

Etymology: This species is named after the place around where the specimens were collected.

***Schzopelex sinopica* sp. n.**
(Figs. 22–27)

Material: Holotype male and paratype 1 male: Turkey, Sinop, Dikmen, Durağan direction, CD: U–166, 1015 m, 41° 31' N, 35° 08' E, 13.7.2009, 2 ♂, leg. and coll. Sipahiler.

Antennae dark brown, scapus is elongated posteriorly (Fig. 22); the first six segment after pedicellus are annulated; the last segment of the labial palpus is dark brown, the rest segments are paler; maxillary palpus is thin, curved upwards, the subdistal portion covered with long pale hairs; wings brown, the anterior wing with two large white spots located on the end of the discoidal cell and the Media, other spots are small and densely found; the posterior wing is sparsely spotted. Discoidal cell of the posterior wing is closed. The length of the anterior wing of males is 12-13 mm.

Male genitalia (Figs.23-27): Segment IX is broad; in lateral view, broadly dilated on the anterior edge; in ventral view, the ventromedian part is weakly sclerotized, protrudes on the posterior margin forming a trapezoidal lobe, curving towards ventral; in dorsal view, the dorsomedian part is roundly dilated on the apical margin. In dorsal view, the median part of segment X is elongated, broadly triangular in shape, narrowing towards the apex; the sides are strongly sclerotized, longer than the median part, rather broad, the apex is rounded apically, curving on the sides, protrudes a triangular long projection; the ventral portion of segment X is broad, shorter than the dorsal part, the apical margin protrudes a long triangular projection on the corner of the ventral margin. The preanal appendage is oval. In lateral view, the dorsal branch of the inferior appendage is rather narrow on the dorsal portion, the ventral margin is elongated, and the apical margin is slightly concave; the ventral branch of the inferior appendage is strongly sclerotized, broad at the base, narrowing towards the apex. The phallic apparatus is long and narrow, somewhat dilated apically.

The female is unknown.

Remarks: *Schizopelex sinopica* sp. n., differs from the all known species by many parts of the genitalia, especially the shape of segment X, of which the sclerotized side projections are apically broad, bird-head shaped, curving on the sides and the upper branch of the inferior appendages, which is long, and not notched on the apical edge. Although the close relationship is not evident, this

new species is closer to *S. anatolica* Schmid 1964 (Schmid, 1964), both have short and weakly sclerotized ventromedian projections on segment IX and rather thin and long maxillary palpus. *S. anatolica* has simple segment X, of which the sclerotized projections are straight and thin and the apical margin of the inferior appendages is notched, in addition the scapus is small.
Etymology: This species is named after the place around where the specimens were collected.

FAUNISTIC LIST OF SİNOP AND SAMSUN PROVINCES

RHYACOPHILIDAE

***Rhyacophila fasciata fasciata* Hagen, 1859**
Distribution in Turkey: North western Turkey (Malicky & Sipahiler, 1993), new for Sinop province.
Distribution: Europe.
Localities: Kastamonu, Tosya, Çaybaşı yaylası, Ilgaz Mountains, east part, 1534 m, 41° 08' N, 34° 11' E, 11.7.2009, 1 ♂ pupa (1); Sinop, Ayancık direction, Çangal Mountains, Akgöl, 340 m, 41° 42' N, 34° 36' E, 13.7.2009, 1 ♂, 1 ♀ (2); Sinop, Türkeli, 450 m, 11.8.2009, 41 50' N, 34° 18' E, 2 ♀ pupae (3); Çorum-Sinop province border, Ilgaz Mountains, Kargı, Pelit yaylası, 24.10.2009, 4 ♂ (4); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1190 m, 41° 43' N, 34° 40' E, 26.10.2009, 1 ♂ (5); Sinop, Dikmen, Durağan direction, 917 m, 41° 33' N, 35° 10' E, 25.10. 2009, 2 ♂, 2 ♀ (6); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1140 m, 41° 42' N, 34° 38' E, 3.10.2009, 1 ♂ (13).

***Rhyacophila osellai* Malicky, 1981**
Distribution in Turkey: Konya, Sultan Mountains (type), Central, North West and North East Turkey; new for Sinop province.
Distribution: Endemic to Turkey.
Localities: Sinop, Gerze, Dikmen-Durağan direction, Küre Mountains, 1015 m, 13.7.2009, 3 ♀ pupae (7); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1190 m, 41° 43' N, 34° 40' E, 9.8. 2009, 2 ♂, 1 ♂ pupa (5).

***Rhyacophila clavalis* Martynov, 1913**
Distribution in Turkey: North western and north eastern Turkey; new for Samsun province.
Distribution: Caucasus, Turkey.
Localities: Samsun, Ladik, Taşova direction, Büyükkızoğlu Village, 976 m, 40° 53' N, 35° 55' E, 15.7.2009, 1 ♂ pupa (29).

***Rhyacophila zwickorum* Malicky, 1972**
Distribution in Turkey: North eastern and north western Turkey; new for Samsun province.
Distribution: Endemic to Turkey.
Localities: Samsun, Salıpazarı, south direction, 700 m, 40° 01' N, 36° 53' E, 17.8.2009, 3 ♂ (30); same place, (light) 2.10.2009, 1♀.

GLOSSOSOMATIDAE

***Agapetus altineri* Sipahiler, 1989**
Distribution in Turkey: Ankara, (Elmadağ, Eymir direction); Bolu (Aladağlar Mountains), Ordu.
Distribution: Endemic to Turkey.
Localities: Kastamonu, Tosya, Çaybaşı yaylası, Ilgaz Mountains east part, (near Sinop province border), 1534 m, 41° 08' N, 34° 11' E, 11.7.2009, 1♂ pupa (1); Çorum-Sinop province border, Ilgaz Mountains, Kargı, Pelit Yaylası, 1668 m, 41° 10' N, 34° 20' E, 11.7.2009, 14 ♂, 3 ♀ (+ larvae and pupae) (10); Kargı, Pelit Yaylası north direction, 1500 m, 41° 11' N, 34° 20' E, 11.7.2009, 3 ♂, 3 ♀ (+ larvae and pupae) (11), Samsun, Durağan-Vezirköprü, Mezra, Kunduz Mountain direction, 1233 m, 41° 09' N, 35° 02' E, 14.7.2009, 1 ♂ (31); Sinop, Dikmen, Durağan direction, 1015 m, 41° 31' N, 35° 08' E, 13.7.2009, 1 ♂ (7).

***Agapetus karabagi* Çakın, 1983**
Distribution in Turkey: Çankırı, İsmetpaşa (type); new for Samsun province.
Distribution: Endemic to Turkey.

Localities: Samsun, Salıpazarı, south direction, Alan Village, Terme Stream, 170 m, 41° 03' N, 36° 46' E, 17.8.2009, 1 ♂ (40).

Agapetus sinopicus **sp. n.**

Distribution in Turkey: Sinop.

Distribution: Endemic to Turkey.

Localities: Turkey, Sinop, Ayancık, Tarakçı, Gebelit Köprüsü, 20 m, 41° 56' N, 34° 46' E, 16.7.2009 1 male (16).

Synagapetus anatolicus **Çakın, 1983**

Distribution in Turkey: Bolu, Yedigöller (types); south and north east (Ordu province) Turkey; new for Samsun province.

Distribution: Endemic to Turkey.

Localities: Samsun, Alaçam, Durağan–Kızlan direction, 1235 m, 41° 27' N, 35° 28' E, 14.7.2009, 5 ♂, 7 ♀ (32).

HYDROPTILIDAE

Hydroptila atargatis **Malicky, 1997**

Distribution in Turkey: Southern, northern and eastern Turkey; new for Sinop and Samsun provinces. Distribution: Libanon, Turkey.

Localities: Samsun, Vezirköprü Çalköy, Tatarkale direction, Kuz stream, (light), 304 m, 41° 08' N, 35° 33' E, 14.7.2009, 6 ♂ (33); Sinop, Boyabat, Gökırmak, 286 m, 41° 30' N, 34° 45' E, (light), 12.7.2009, 2 ♂, 13 ♀ (14); Samsun, Salıpazarı, south direction, 700 m, 40° 01' N, 36° 53' E, (light) 2.10.2009, 7 ♂, 21 ♀ (30).

Hydroptila angustata **Mosely, 1939**

Distribution in Turkey: Central, western, southern and eastern Turkey; new for Samsun province.

Distribution: Eigypt, Iran, Cyprus, south and south Eastern Europe, Turkey.

Localities: Samsun, Vezirköprü Çalköy, Tatarkale direction, Kuz stream, (light), 304 m, 41° 08' N, 35° 33' E, 14.7.2009, 3 ♂ (33).

Oxyethira falcata **Morton, 1893**

Distribution in Turkey: Western and southern Turkey; new for Sinop province.

Distribution: Europe, North Africa, Cyprus, Levante, Iran, Pakistan, Turkey.

Localities: Sinop, Boyabat, Gökırmak, 286 m, 41° 30' N, 34° 45' E, (light), 12.7.2009, 1 ♂ (14).

PTILOCOLEPHIDAE

Ptilocolepus colchicus **Martynov, 1913**

Distribution in Turkey: North eastern and north western Turkey; new for Sinop and Samsun provinces.

Distribution: Caucasus, Iran, Turkey.

Localities: Çorum-Sinop province border, Kargı, Pelit Yaylası, north direction, 1446 m, 41° 12' N, 34° 21' E, 11.7.2009, 3 ♂, 3 ♀ (12); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 733 m, 41° 39' N, 34° 39' E, 9.8.2009 4 ♂, 2 ♀ (15), Samsun, Salıpazarı, south direction, 700 m, 41° 01' N, 36° 53' E, 17.8.2009, 2 ♂, 1 ♀ (30); Durağan, Dikmen- Uzunöz direction, 917 m, 41° 31' N, 35° 09' E, 10.8.2009, 7 ♂ (6); Samsun, Salıpazarı, southern part, Konakören Village, 585 m, 40° 04' N, 36° 54' E, 17.8.2009,1 ♂, 1 ♀ (38).

Ptilocolepus dilatatus **Martynov, 1913**

Distribution in Turkey: Northern Turkey; new for Sinop province.

Distribution: Caucasus, Turkey.

Localities: Sinop, Hanönü- Ayancık direction, Çangal Mountain, 733 m, 41° 39' N, 34° 39' E, 9.8.2009, 2 ♂ (15); Sinop, Dikmen, Durağan direction, 917 m, 41° 31' N, 35° 09' E, 3.7.2009, 1 ♂ (17).

PHILOPOTAMIDAE

Philopotamus montanus **(Donovan, 1813)**

Distribution in Turkey: Marmara region, new for Sinop province.

Distribution: Europe, Turkey.

Localities: Çorum-Sinop province border, Kargı, north of Pelit yaylası, 1500 m, 41° 11' N, 34° 20' E, 11.7.2009, 5 ♂ (11); Sinop, Bürnük, 1146 m, 41° 39' N, 34° 51' E, 12.7.2009, 5 ♂ (18); Sinop, Dikmen, Durağan direction, 917 m, 41° 31' N, 35° 09' E, 13.7.2009, 9 ♂ (17);

Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1140 m, 41° 42' N, 34° 38' E, 9.8.2009, 1 ♂, 1 ♀ (13); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1190 m, 41° 43' N, 34° 40' E, 9.8.2009, 1 ♂ (5).

***Philopotamus variegatus* (Scopoli, 1763)**

Distribution in Turkey: Northern Turkey; new for Samsun province.

Distribution: Europe, Turkey.

Localities: Samsun, Durağan- Vezirköprü, Mezra-Kunduz Mountain direction, 1233 m, 41° 09' N, 35° 02' E, 14.7.2009, 1 ♂, 1 ♀ (31).

***Wormaldia khourmai* Schmid, 1959**

Distribution in Turkey: Northern Turkey; new for Sinop province.

Distribution: Iran, Turkey.

Localities: Çorum- Sinop province border, Ilgaz Mountains, Kargı, Pelit Yaylası, 1668 m, 41° 10' N, 34° 20' E, 11.7.2009, 1 ♂, 1 ♀ (10).

***Wormaldia balcanica* Kumanski, 1979**

Distribution in Turkey: Northern Turkey; new for Sinop province.

Distribution: Bulgaria, Greece, Turkey.

Localities: Çorum- Sinop province border, Ilgaz Mountains, Kargı, Pelit Yaylası, 1668 m, 41° 10' N, 34° 20' E, 11.7.2009, 1 ♂ (10); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 733 m, 41° 39' N, 34° 39' E, 9.8.2009, 2 ♂ (15); Çorum-Sinop province border, Ilgaz Mountains, Kargı, Göktepe Village, 26.10.2009, 1 ♂ (19); Çorum-Sinop province border, Kargı, Pelit Yaylası, north direction, 1446 m, 41° 12' N, 34° 21' E, 24.10.2009, 12 ♂, 1 ♀ (12); same place, 1550 m, 24.10.2009, 9 ♂; Sinop, Hanönü- Ayancık direction, Çangal Mountain, Akgöl, 41° 41' N, 34° 34' E, 3. 10. 2009, 5 ♂, 1 ♀ (21); Samsun, Salıpazarı, south direction, Alan Village, Terme Stream, 170 m, 41° 03' N, 36° 46' E, 2.10.2009, (light), 2 ♂ (39).

***Wormaldia subnigra* McLachlan, 1865**

Distribution in Turkey: Northern Turkey; new for Samsun province.

Distribution: Europe, Turkey.

Localities: Samsun, Salıpazarı, south direction, Alan Village, Terme Stream, 170 m, 41° 03' N, 36° 46' E, 2.10.2009, (light), 2 ♂ (39).

POLYCENTROPODIDAE

***Polycentropus flavomaculatus* (Pictet, 1834)**

Distribution in Turkey: Widely distributed in Turkey.

Distribution: Europe, Turkey.

Localities: Sinop, Ayancık, 10 km west, 7.6.2002, 1 ♂; same place, (light), 41° 52' N, 34° 37' E, 116 m, 10.8.2009, 2 ♂ (22); Sinop, Hanönü- Ayancık direction, Çangal Mountain, Akgöl, spring, 1080 m, 41° 41' N, 34° 35' E, 9.8.2009, 1 ♂ pupa (23); Sinop, Bürnük, (light), 1146 m, 41° 39' N, 34° 51' E, 8.8.2009, 1 ♂ (18).

PSYCHOMYIIDAE

***Tinodes dificilis* Martynov, 1927**

Distribution in Turkey: Known from noth eastern Turkey; new for Samsun prowince.

Distribution: Caucasus, Turkey.

Localities: Samsun, Salıpazarı, south, 585 m, 40° 01' N, 36° 04' E, 17.8.2009, 1 ♂ (40).

***Tinodes popovi* Kumanski, 1975**

Distribution in Turkey: North western Turkey; new for Sinop province.

Distribution: Bulgaria, Turkey.

Localities: Sinop, Dikmen, Durağan direction, 917 m, 41° 31' N, 35° 09' E, 10.8.2009, 1 ♂, 1 ♀ (17).

***Tinodes valvatus* Martynov, 1913**

Distribution in Turkey: Northern, central and southern Turkey; new for Sinop province.

Distribution: Caucasus, Libanon, Turkey.

Localities: Çorum-Sinop province border, Kargı, Pelit Yaylası north, 1446 m, 41° 12' N, 34° 21' E, 11.7.2009, 2 ♂ (12); Sinop, Dikmen, Durağan direction, 917 m, 41° 31' N, 35° 09' E, 10.8.2009, 1 ♂, 1 ♀ (6).

***Psychomyia dadayensis* Sipahiler, 2006**

Distribution in Turkey: North western, north eastern and south eastern Turkey; new for Samsun province.

Distribution: Endemic to Turkey.

Localities: Samsun, Vezirköprü Çalköy direction, Tatarkale direction, Kuz Stream, (light), 304 m, 41° 08' N, 35° 33' E, 14.7.2009, 76 ♂, 10 ♀ (33); Samsun, Havza, Ladik direction, Tersakan Stream, 770 m, 40° 59' N, 35° 53' E, 16.8.2009, 50 ♂, 3 ♀ (34).

***Psychomyia pusilla* (Fabricius, 1781)**

Distribution in Turkey: Widely distributed in Turkey.

Distribution: Europe, North Africa, Turkey.

Localities: Samsun, Melet, 20.7.1981, 4 ♂ (Sipahiler & Malicky, 1987), Samsun, Salıpazarı, south direction, Alan Village, Terme Stream, 170 m, 41° 03' N, 36° 46' E, 17.8.2009, 4 ♂, 1 ♀ (40); Samsun, Salıpazarı, south direction, 700 m, 40° 01' N, 36° 53' E, (light) 2.10.2009, 87 ♂, 28 ♀ (30).

***Lype phaeorpa* (Stephens, 1836)**

Distribution in Turkey: Northern Turkey; new for Sinop province.

Distribution: Europe, Iran, Turkey.

Localities: Sinop, Hanönü- Ayancık direction, Çangal Mountain, Akgöl, spring, 1080 m, 41° 41' N, 34° 35' E, 9.8.2009, 1 ♂ pupa, (23).

HYDROPSYCHIDAE

***Diplectrona atra* McLachlan, 1878**

Distribution in Turkey: Western and central Turkey; new for Sinop province.

Distribution: Southeastern Europe, south west France, Bosnia, Turkey.

Localities: Sinop, Hanönü- Ayancık direction, Çangal Mountain, 733 m, 41° 39' N, 34° 39' E, 9.8.2009, 1 ♂, 2 ♀ (15); Sinop, Dikmen, Durağan direction, 1015 m, 41° 31' N, 35° 08' E, 10.8.2009, 1 ♂, 1 ♀ (7); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1140 m, 41° 42' N, 34° 38' E, 9.8.2009, 1 ♂ (13); same place, 1190 m, 41° 43' N, 34° 40' E, 9.8.2009, 2 ♂ (5); same place, Akgöl, spring, 1180 m, 41° 41' N, 34° 34' E, 9.8.2009, 1 ♂ (21); Sinop, Bürnük, (light), 1146 m, 41° 39' N, 34° 51' E, 8.8.2009, 1 ♂, 1 ♀ (18); Sinop, Küre Mountains, 1031 m, Durağan-Dikmen direction, Uzunöz, (Ice cave direction), 41° 31' N, 35° 05' E, 10.8.2009, 2 ♂ (8).

***Hydropsyche botosaneanui* Marincovic, 1966**

Distribution in Turkey: North western Turkey

Distribution: Central and south Europe, Turkey.

Localities: Sinop, Erfelek, 400 m, (light), 41° 53' N, 34° 54' E, 3.6.2002, 1 ♂ (Sipahiler, 2007), (20).

***Hydropsyche bulbifera* McLachlan, 1878**

Distribution in Turkey: Widely distributed in Turkey; new for Sinop and Samsun provinces.

Distribution: Europe, Iran, Irak, Turkey.

Localities: Sinop, Boyabat, Gökırmak, 286 m, 41° 30' N, 34° 45' E, (light), 15.7.2009, 7 ♂, 6 ♀ (14); same place, 12.7.2009, 10 ♂, 127 ♀; Samsun, Havza, Ladik direction, Tersakan Stream, 770 m, 40° 59' N, 35° 53' E, 16.8.2009, 1 ♂, 1 ♀ (34).

***Hydropsyche burnukensis Sipahiler*, 2010**

Distribution in Turkey: Sinop, Bürnük.

Distribution: Endemic to Turkey.

Localities: Turkey, Sinop, Bürnük, 1146 m, 41° 39' N, 34° 51' E, 12.7.2009, 1 ♂, 1 ♀ (and 1 ♀ pupa) (18).

***Hydropsyche contubernalis* McLachlan, 1865**

Distribution in Turkey: Except south and west, widely distributed in Turkey.

Distribution: Europe, Iran, Central Asia, Siberia, Turkey.

Localities: Sinop, Boyabat, Gökırmak, 286 m, 41° 30' N, 34° 45' E, (light), 15.7.2009, 1 ♂, 1 ♀ (14); same place, 1 ♀.

***Hydropsyche cornuta* Martynov, 1909**

Distribution in Turkey: North east, east and south east Turkey.

Distribution: Caucasus, Syria, Turkey.

Localities: Samsun 10 km NW Havza, 500 m, 40° 58' N, 35° 37' E, 19.5.1975, 1 ♂, (Sipahiler & Malicky, 1987) (37).

***Hydropsyche delamarei* Jacquemart, 1965**
Distribution in Turkey: Widely distributed from Aşkale to Ankara.
Distribution: Endemic to Turkey.
Localities: Çorum, Kargı, Ilgaz Mountains, Günyazı Village, 41° 09' N, 34° 21' E, 15.8.2009, 3 ♂ (24); same place, Pelit yaylası, north, 41° 12' N, 34° 20' E, 15.8.2009, 5 ♂ (12); same place, 41° 12' N, 34° 21' E, 11.7.2009, 3 ♂; same place, Dağlıca yaylası direction, 41° 14' N, 34° 33' E, 1526 m, 8.8.2009, 3 ♂, 1 ♀ (near 19); Çorum-Sinop province border, Kargı, Pelit Yaylası, north direction, 1500 m, 41° 11' N, 34° 20' E, 11.7.2009, 25 ♂, 2 ♀(11).
***Hydropsyche kebab* Malicky, 1974**
Distribution in Turkey: Widely distributed in Turkey; new for Sinop and Samsun provinces.
Distribution: Endemic to Turkey.
Localities: Samsun, Ladik, Çakırgümüş Yaylası, 1070 m, 40° 53' N, 35° 57' E, 16.8.2009, 2 ♂ pupae (35); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1140 m, 41° 42' N, 34° 38' E, 9.8.2009, 1 ♂ pupa (13).
***Hydropsyche instabilis* (Curtis, 1834)**
Distribution in Turkey: Widely distributed in Turkey.
Distribution: Europe, Iran, Levant, Turkey.
Localities: Sinop, Gerze, Kabalı direction, 288 m, 41° 47' N, 35° 00' E, 13.7.2009, 1 ♂, 6 ♀ pupae (26); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1140 m, 41° 42' N, 34° 38' E, 9.8.2009, 1 ♂ (13).
***Hydropsyche sinopensis* Sipahiler, 2004**
Distribution in Turkey: Sinop.
Distribution: Endemic to Turkey.
Localities: Sinop, 10 km west of Ayancık, 3.6.2002, 1 ♂(type), (25); Ayancık, 41° 52' N, 34° 37' E, 116 m, 10.8.2009, 10 ♀ (22); Sinop, Dikmen, Durağan direction, 666 m, 41° 33' N, 35° 10' E, 13.7.2009, 3 ♂ pupae (27).

UENOIDAE
***Thremma anomalum* McLachlan, 1876**
Distribution in Turkey: Northern Turkey.
Distribution: South east Europe.
Localities: Kastamonu, Tosya, Çaybaşı Village, Ilgaz Mountains east part, 1534 m, 41° 08' N, 34° 11' E, 11.7.2009, 1 ♂ (1); Sinop, Ayancık direction, Çangal Mountain, Akgöl, 340 m, 41° 42' N, 34° 36' E, 13.7.2009, larva (2); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 733 m, 41° 39' N, 34° 39' E, 9.8.2009, 2 ♂, 1 ♀ (15); same place, 1140 m, 41° 42' N, 34° 38' E, 9.8.2009, 1 ♂ (13); Samsun, Yakakent, Durağan direction, Kızlan, 1235 m, 14.7.2009, 2 ♂ (32); Kastamonu, Tosya, Çaybaşı Village, 1534 m, 11.7.2009, 1 ♂ (1).

GOERIDAE
***Lithax musaca* Malicky 1972**
Distribution in Turkey: North western and southern Turkey; new for Sinop and Samsun provinces.
Distribution: Bulgaria, Turkey.
Localities: Çorum, Ilgaz Mountains, Kargı, Pelit Yaylası, 1668 m, 41° 10' N, 34° 20' E, 11.7.2009, larva (10); Sinop, Ayancık direction, Çangal Mountains, Akgöl, 340 m, 41° 42' N, 34° 36' E, 13.7.2009, larva (2); Çorum-Sinop province border, Kargı, Pelit Yaylası north direction, 1500 m, 41° 11' N, 34° 20' E, 11.7.2009, 1 ♂, 1 ♀ (11); Samsun, Ladik, Taşova, Büyükkızoğlu yaylası direction, 976 m, 40° 53' N, 35° 55' E, 14.7.2009,1 ♀ (and pupae, larvae) (29).

APATANIIDAE
***Apatania subtilis* Martynov, 1909**
Distribution in Turkey: North east Turkey; new for Samsun province.
Distribution: Caucasus, Turkey.
Localities: Localities: Samsun, Ladik, Taşova, Büyükkızoğlu yaylası direction, 976 m, 40° 53' N, 35° 55' E, 14.7.2009,1 ♂ (29).

LIMNEPHILIDAE
Drusinae
***Drusus bayburtii* Çakın, 1983**
Distribution in Turkey: North east, north west and south Turkey; new for Samsun province.
Distribution: Endemic to Turkey.
Localities: Samsun, Ladik, Taşova, Büyükkızoğlu yaylası direction, 976 m, 40° 53' N, 35° 55' E, 14.7.2009, 7 ♂, 2 ♀ pupae (29).

Limnephilinae
Limnephilini
***Grammotaulius nigropunctatus* (Retzius, 1783)**
Distribution in Turkey: Widely distributed in Turkey; new for Sinop province.
Distribution: Europe, Turkey.
Localities: Sinop, Dikmen, Durağan direction, 1015 m, 41° 31' N, 35° 08' E, 13.7.2009, 1 ♂ (7).
***Limnephilus ponticus McLachlan*, 1898**
Distribution in Turkey: Widely distributed in Turkey; new for Sinop province.
Distribution: Endemic to Turkey.
Localities: Kastamonu, Tosya, Kargı direction, Günyazı Village, Ilgaz Mountains, 41° 09' N, 34° 21' E, 1524 m, 15.8.2009, 3 ♂, 2 ♀ (24); Çorum-Sinop province border, Kargı, Pelit Yaylası, north direction, 1446 m, 41° 12' N, 34° 21' E, 11.7.2009, 2 ♂, 1 ♀ (12); same place, 15.8.2009, 2 ♂, 4 ♀; same place, 24.10.2009, 1 ♂, 1 ♀; same place, 1500 m, 41° 11' N, 34° 20' E, 1.10.2009, 2 ♀ (11).
***Limnephilus hirsutus* (Pictet, 1834)**
Distribution in Turkey: Widely distributed in Turkey; new for Sinop province.
Distribution: Europe, Iran Turkey.
Localities: Kastamonu, Tosya, - Kargı direction, Günyazı Village, Ilgaz Mountains, 41° 09' N, 34° 21' E, 1524 m, 15.8.2009, 1 ♀ (24); Sinop, Bürnük, (light), 1146 m, 41° 39' N, 3°4 51' E, 8.8.2009, 2 ♀ (18).
***Limnephilus sparsus* Curtis, 1834**
Distribution in Turkey: Widely distributed in Turkey; new for Sinop province.
Distribution: Europe, Siberia, Turkey.
Localities: Sinop, Bürnük, 1146 m, 41° 39' N, 34° 51' E, 2.10.2009, 2 ♂, 1 ♀ (18).
Stenophylacini
***Micropterna hatatitla* Malicky, 1985**
Distribution in Turkey: Widely distributed in Turkey; new for Sinop province.
Distribution: Bulgaria, Iran, Turkey.
Localities: Çorum-Sinop province border, Kargı, Pelit Yaylası, north, 1446 m, 41° 12' N, 34° 21' E, 24.10.2009, 1 ♀ (12).
***Potamophylax latipennis* (Curtis, 1834)**
Distribution in Turkey: North and eastern Turkey; new for Sinop province.
Distribution: Europe, Turkey.
Localities: Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1190 m, 41° 43' N, 34° 40' E, 9.8.2009, 1 ♂ (and ♂, ♀ pupae (5); Sinop, Hanönü- Ayancık direction, Çangal Mountain, Akgöl, spring, 1080 m, 41° 41' N, 34° 35' E, 9.8.2009, 1 ♂, 7 ♀ pupae, (23).
Chaetopterygini
***Chaetopteryx sinopica* Sipahiler, 2010**
Distribution in Turkey: Sinop.
Distribution: Endemic to Turkey.
Localities: Sinop, Bürnük, 1146 m, 41° 39' N, 34° 51' E, 2.10.2009, 5 ♂, 2 ♀ (18); Sinop, Hanönü- Ayancık direction, Çangal Mountain, 3.10.2009, 1140 m, 3 ♂, 2 ♀ (13); same place, 733 m, 41° 39' N, 34° 39' E, 26.10.2009, 4 ♂, 4 ♀ (15); same place, Akgöl, 1130 m, m, 41° 41' N, 34° 34' E, 3.10.2009, 1 ♂, 1 ♀ (21); Sinop, Dikmen, Durağan direction, 917 m, 41° 31' N, 35° 09' E, 25.10.2009, 2 ♂, 2 ♀ (17).
***Chaetopteryx bosniaca* Marinkovic, 1955**
Distribution in Turkey: Ordu; new for Sinop province.
Distribution: Balkans, Turkey.

Localities: Sinop, Çangal Mountain, Akgöl- Hanönü direction, 1130 m, 41° 41' N, 34° 34' E, 3.10.2009, 1 ♂ (21); same place, 26.10.2009, 2 ♂, 2 ♀.

***Chaetopteryx akgolensis* Sipahiler, 2010**

Distribution in Turkey: Sinop.

Distribution: Endemic to Turkey.

Localities: Sinop, Çangal Mountain, Akgöl- Hanönü direction, 1130 m, 41° 41' N, 34° 34' E, 3.10.2009, 1 ♂, 1 ♀, same place, 26.10.2009, 1 ♀ (21).

SERICOSTOMATIDAE

***Sericostoma flavicorne* Schneider, 1845**

Distribution in Turkey: Widely distributed in Turkey; new for Sinop and Samsun provinces.

Distribution: Europe, Turkey.

Localities: Çorum-Sinop province border, Kargı, Pelit Yaylası, north, 1500 m, 41° 11' N, 34° 20' E, 11.7.2009, 1 ♂ pupa (11).

***Schzopelex anatolica* Schmid, 1964**

Distribution in Turkey: North and cencral Turkey; new for Sinop province.

Distribution: Endemic to Turkey.

Localities: Çorum-Sinop province border, Kargı, Pelit Yaylası, north, 1446 m, 41° 12' N, 34° 21' E, 11.7.2009, 15 ♂, 1 ♀ (12); same place, 15.8.2009, 4 ♂; Samsun, Yakakent, Durağan direction, Kızlan, 1235 m, 41° 27' N, 35° 27' E, 14.7.2009, 2 ♂, 1 ♀ (32).

***Schzopelex sinopica* sp.n.**

Distribution in Turkey: Sinop.

Distribution: Endemic to Turkey.

Localities: Sinop, Dikmen, Durağan direction, 1015 m, 41° 31' N, 35° 08' E, 13.7.2009, 2 ♂ (7).

LEPTOCERIDAE

***Adicella altandroconia* Botosaneanu & Novak, 1965**

Distribution in Turkey: Western Turkey; new for Sinop province.

Distribution: Bulgaria, south Romania, Greece, Turkey.

Distribution:Sinop, Hanönü- Ayancık direction, Çangal Mountain, 733 m, 41° 39' N, 34° 39' E, 9.8.2009, 4 ♂ (15); same place, Çangal Mountain, Akgöl- Hanönü direction, 865 m, 41° 39' N, 34° 40' E, 18.8.2009, 1 ♂ (9); same place, Akgöl, spring, 1080 m, 41° 41' N, 34° 35' E, 9.8.2009, 1 ♂ (23).

***Leptocerus interruptus* (Fabricius, 1775)**

Distribution in Turkey: Widely distributed in Turkey.

Distribution: Europe, Turkey.

Localities: Samsun, Canik, E Terme, 6.6.1969, 41° 11' N, 37° 00' E, 1 ♂ (Sipahiler & Malicky, 1987).

***Ylodes kawraiskii* (Martynov, 1909)**

Distribution in Turkey: Widely distributed in Turkey; new for Sinop province.

Distribution: Europe, Caucasus, Iran, Turkey.

Localities: Sinop, Boyabat, Gökırmak, 286 m, 41° 30 N, 34° 45 E, (light), 12.7.2009 (14).

BERAEIDAE

***Beraea walteri* Malicky, 1975**

Distribution in Turkey: West, south and north east Turkey.

Distribution: Cyprus, Turkey.

Localities: Sinop, Ayancık, 10 km west, 7.6.2002, 1 ♂ (25); Çorum-Sinop province border, Kargı, Pelit Yaylası, north direction, 1446 m, 41° 12' N, 34° 21' E, 11.7.2009, 1 ♂(12).

***Ernodes anatolicus* Çakın, 1983**

Distribution in Turkey: Known only from Ankara; new for Sinop province.

Distribution: Endemic to Turkey.

Localities: Sinop, Küre Mountains, 1161 m, Durağan, Dikmen direction, Uzunöz, (Ice cave direction), 41° 31' N, 35° 05' E, 14.7.2009, 1 ♂, 1 ♀ (8).

ODONTOCERIDAE
***Odontocerum hellenicum* Malicky, 1973**
Distribution in Turkey: Western Turkey (Kazdağlar), Ordu and Giresun provinces; new for Sinop province.
Distribution: Balkans, Turkey,
Localities: Sinop, Hanönü- Ayancık direction, Çangal Mountain, 1190 m, 41° 43' N, 34° 40' E, 9.8.2009, 1 ♂, pupa (5).

HELICOPSYCHIDAE
***Helicopsyche bacesqui* Orghidan & Botosaneanu, 1953**
Distribution in Turkey: West Turkey; new for Sinop province.
Distribution: South east Europe, Turkey.
Localities: Çorum-Sinop province border, Ilgaz Mountains, Kargı, 1526 m, 41° 14' N, 34° 33' E, 8.8.2009, 9 larvae; same place, 1.10.2009, 1 larval case (19).

CALAMOCERATIDAE
***Calamoceras illiesi* Malicky & Kumanski, 1974**
Distribution in Turkey: Widely distributed in Turkey; new for Sinop province.
Distribution: Greece, Bulgaria, Turkey.
Localities: Sinop, Türkeli, south direction, 435 m, 41° 50' N, 34° 21' E, 11.8.2009, 1 ♀ pupa (28).

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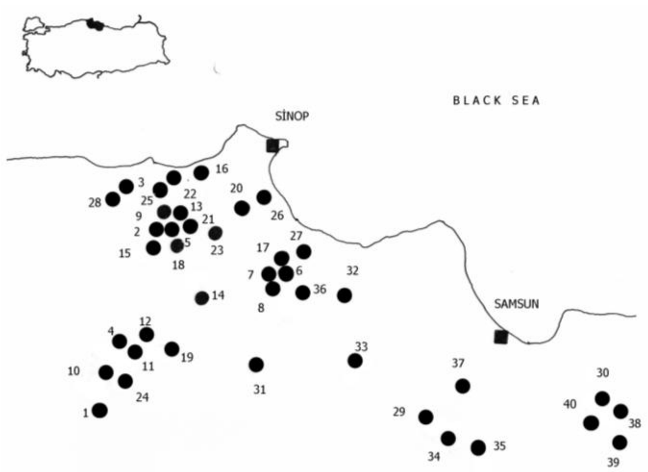
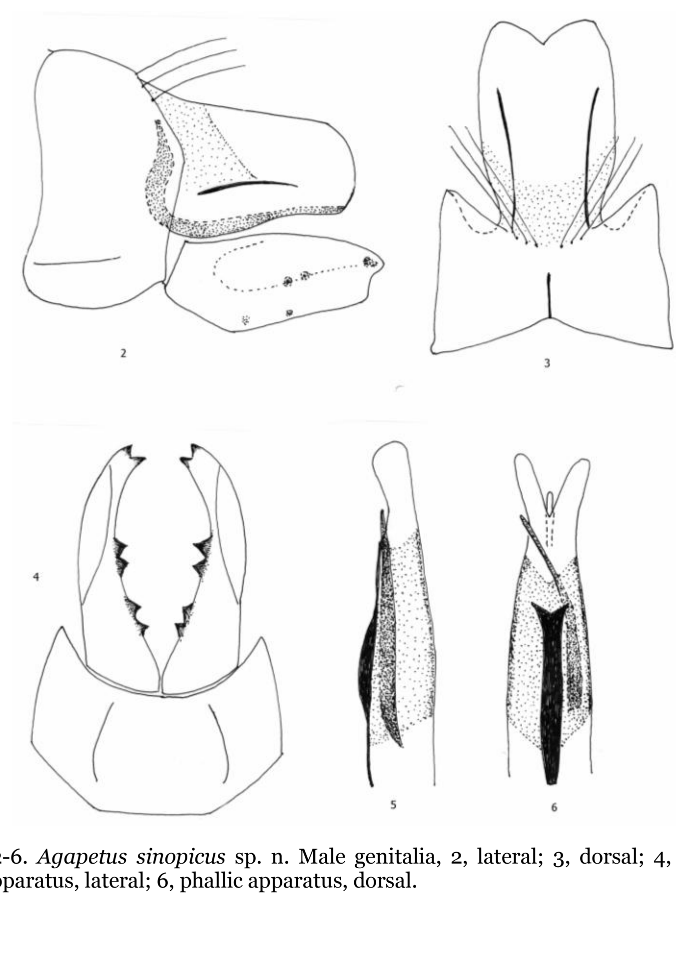
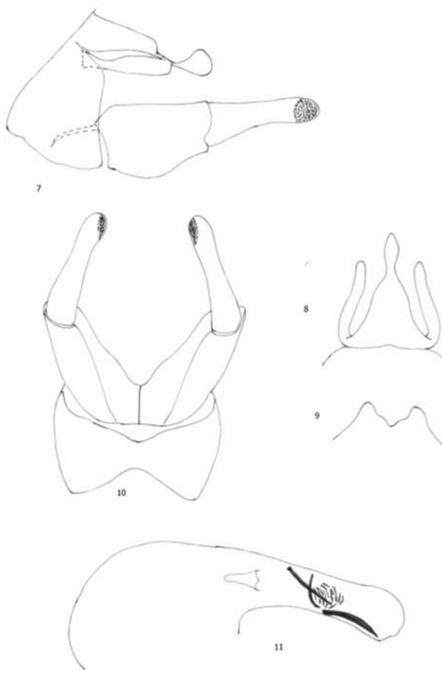


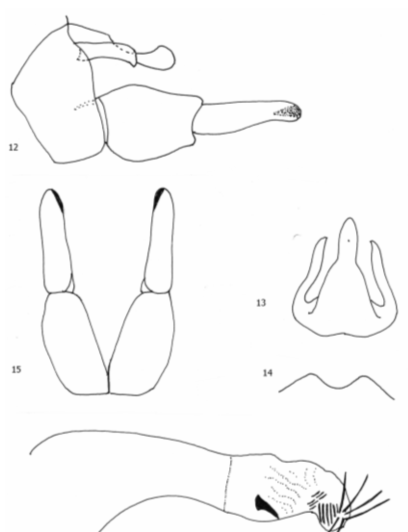
Figure 1. Map of Sinop and Samsun provinces showing the localities.



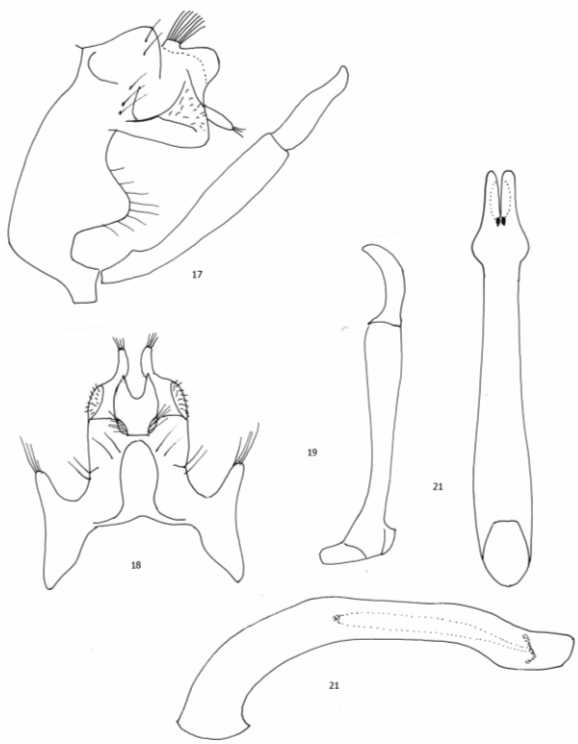
Figures 2-6. *Agapetus sinopicus* sp. n. Male genitalia, 2, lateral; 3, dorsal; 4, ventral; 5, phallic apparatus, lateral; 6, phallic apparatus, dorsal.



Figures 7-11. *Wormaldia mahiri* sp. n. Male genitalia, 7, lateral; 8, dorsal; 9, VIII. tergite, dorsal; 10, ventral; 11, phallic apparatus, lateral.



Figures 12-16. *Wormaldia erzincanica* sp. n. Male genitalia, 12, lateral; 13, dorsal; 14, VIII. tergite, dorsal; 15, ventral; 16, phallic apparatus, lateral.



Figures 17-21. *Hydropsyche taskalensis* sp. n. Male genitalia, 17, lateral; 18, dorsal; 19, inferior appendage, ventral; 20, phallic apparatus, ventral; 21, phallic apparatus, lateral.

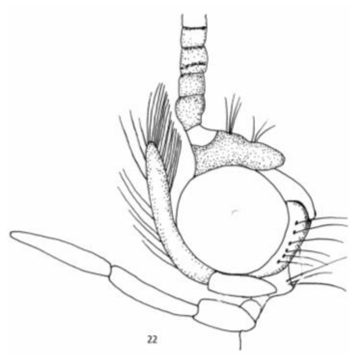
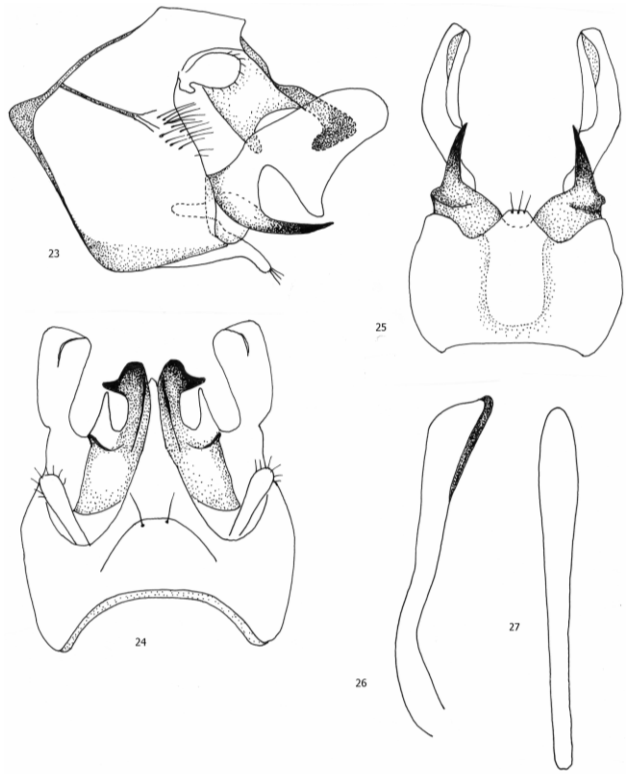


Figure 22. *Schzopelex sinopica* sp. n., head, lateral.



Figures 23-27. *Schzopelex sinopica* sp. n. Male genitalia, 23, lateral; 24, dorsal; 25, ventral; 26, phallic apparatus, lateral; 27, phallic apparatus, ventral.

A NEW SPECIES OF THE GENUS *STENURELLA* VILLIERS, 1974 FROM TURKEY (COLEOPTERA: CERAMBYCIDAE: LEPTURINAE)

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[**Özdikmen, H., Mercan, N. & Cihan, N.** 2012. A new species of the genus *Stenurella* Villiers, 1974 from Turkey (Coleoptera: Cerambycidae: Lepturinae). Munis Entomology & Zoology, 7 (1): 18-21]

ABSTRACT: The following new taxon is described: *Stenurella zehrae* sp. n. from Northwestern Turkey, close to *Stenurella samai* Rapuzzi, 1995 and *Stenurella pamphyliae* Rapuzzi & Sama, 2009. A key to the identification of Turkish *melanura* species-group is proposed. On the other side, a discussion on taxonomic status of Turkish taxa in *-melanura* species-group is realized.

KEY WORDS: Cerambycidae, Lepturini, *Stenurella*, new species, Turkey.

During the study of the Cerambycidae from Düzce province in Northwestern Turkey, we have identified some specimens belonging to a new species of *Stenurella* Villiers, 1974 which will be described in this paper.

Stenurella zehrae sp. n.
(Plate I)

Type series. Holotype ♂: Turkey, Düzce prov.: Hacı Yakup village, Orta district, N 40 45 E 31 02, 03.VII.2011 on *Anthemis* sp.. Allotype ♀: Turkey, Düzce prov.: Hamamönü village, Dere district, N 40 45 E 31 02, 03.VII.2011 on *Anthemis* sp.. Paratype: 1 ♂: same data like the holotype (Map 1).

Description. Body length: 9-11 mm (holotype 9 mm; allotype 10 mm; paratype 11 mm). Body elongated, integument black including the abdomen (with reddish colored transversal lines in posterior margins of some segments). Head colored black except yellowish clypeo-labral sutur and margins of labrum. Antenna reaches about the apex of elytra, clothed with verging on yellowish-gold pubescence. Pronotum elongate, convex, deeply and densely punctate, clothed with thin, semi-recumbent, verging on yellowish-gold pubescence. Elytra yellowish, blackened at apex and along the suture. Elytra yellowish, densely and shallowly punctate and clothed with long erect hairs, verging on yellowish-gold entirely; apex obliquely truncate. Sexual dimorphism analogous to *S. melanura* (Linnaeus, 1758) except elytra yellowish in both sexes.

Differential diagnosis. The new species is in *-melanura* species-group definitely. Its closely related species are *S. samai* Rapuzzi, 1995 and *S. pamphyliae* Rapuzzi & Sama, 2009 because of verging on yellowish-gold pubescence on upper surface. The pubescence is black in *S. melanura* (Linnaeus, 1758). So it can easily distinguish from *S. melanura*.

S. zehrae **sp. n.** is very close to *S. samai* Rapuzzi, 1995 and close to *S. pamphyliae* Rapuzzi & Sama, 2009 from which differ as follows:

The original description of *S. samai* Rapuzzi, 1995:

Elongated body, entirely black, only the elytra in the male brownish-yellow with apex (and very often the suture) blacks, reddish in the female with a large black sutural stripe which reaches always the scuteIlum, elytral apex and broadly base black.

In both sexes the abdomen is black.

Pronotum longer than wide, with maximum width just over half, posterior angles sharp and protracted outward.

Pubescence of elytra, antennae, legs and extreme base of pronotum long and gold, the remainder portion of pronotum and on the head of with short black pubescence.

Punctuation of pronotum and head strong, made by large and deep punctures, elytral punctures dense and deep that makes the insect-aspect opaque. Elytral apex obliquely truncated with a outside tooth.

Antennae in the male with the last article beyond the apex of the elytra; while in the female reach 4 / 5 of elytral lenght.

The original description of *S. pamphyliae* Rapuzzi & Sama, 2009:

Body length: 11-12 mm (holotype 11 mm), integument black including the abdomen. Elytra reddish, blackened at apex and along the suture. Pronotum elongate, convex, deeply and moderately densely punctate, clothed with very thin, semi-recumbent, silvery pubescence. Elytra reddish, densely and shallowly punctate and clothed with robust long erect hairs, somewhat finer at base, blackish brown, verging on yellowish-gold on the disc and towards the shoulders depending on lighting; apex obliquely truncate. Antennae slightly longer than body, clothed with recumbent black pubescence. Sexual dimorphism analogous to *S. melanura* (Linnaeus, 1758) except elytra reddish in both sexes.

In the new species, integument black including the abdomen (with reddish colored transversal lines in posterior margins of some segments in males and totally black in female). Elytra yellowish in both sexes. In the males, elytra with black apex and the suture. In the female, elytra with a large black sutural stripe which not reaches the scuteIlum, elytral apex and broadly base black, but the black area smaller than that of *S. samai*. Pubescence of elytra, antennae, legs, ventral surface, head and pronotum entirely long and yellowish-gold. In the male, antennae reach about the apex of elytra; while in the female reach about 3 / 4 of elytral lenght. Antennae clothed with yellowish-gold pubescence.

Variations. The number of abdominal segments with reddish colored transversal lines in posterior margins change 1 to 3 in males. Integument black including the abdomen completely in female. Head colored black except yellowish clypeo-labral sutur in both sexes and margins of labrum in males.

Etymology. We dedicated to Zehra Özdikmen (Turkey) who lived an honorable life. She was grand mother of the first author.

A discussion on taxonomic status of Turkish taxa in -*melanura* species-group:

We think that it will be in good taste to achieve an explanation about a problem on the Turkish –*melanura* species-group which includes six taxa (incl. **sp. n.**) as *S. jaegeri* (Hummel, 1825); *S. melanura* (Linnaeus, 1758); *S. novercalis* Reitter, 1901; *S. pamphyliae* Rapuzzi & Sama, 2009; *S. samai* Rapuzzi, 1995 and *S. zehrae* Özdikmen, Mercan & Cihan, 2012.

Among them, *S. jaegeri* (Hummel, 1825) and *S. novercalis* Reitter, 1901 are accepted by all authors as separate species collectively. The remaining taxa are under discussion.

The discussion on this subject is in form “are these taxa separate species?” or “are these taxa subspecies of *S. melanura* (Linnaeus, 1758)?”.

As known, *S. pamphyliae* Rapuzzi & Sama, 2009 and *S. samai* Rapuzzi, 1995 was described as separate species originally. Then, Danilevsky (2011) gave the taxa as subspecies of *S. melanura* (Linnaeus, 1758).

The new species, *S. zehrae* Özdikmen, Mercan & Cihan, 2012, is presented a rightful reason about being separate species of *S. pamphyliae* Rapuzzi & Sama, 2009 and *S. samai* Rapuzzi, 1995, not subspecies of *S. melanura* (Linnaeus, 1758). Since we collected many specimens of both species, *S. melanura* and *S. zehrae* from same localities in Düzce province. Anyway, *S. samai* Rapuzzi, 1995 was given by Löbl & Smetana (2010) as a separate species like Sama (2002).

A short key for Turkish -*melanura* species-group

1. Legs partly or completely red..**2**
- Legs usually completely black **3**

2. All femora red, tibiae and tarsi entirely black..........***S. novercalis*** Reitter, 1901
- All femora and tibiae red..***S. jaegeri*** (Hummel, 1825)

3. Pronotum with black pubescence.......................***S. melanura*** (Linnaeus, 1758)
- Pronotum with yellowish pubescence...**4**

4. In males, elytra and abdomen reddish..
....***S. pamphyliae*** Sama & Rapuzzi, 2009
- In males, elytra yellowish and abdomen black (with reddish colored transversal lines in posterior margins of some segments)..**5**

5. In female, elytra reddish..***S. samai*** Rapuzzi, 1995
- In female, elytra yellowish...***S. zehrae* sp. n.**

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The authors wish to thank Pierpaolo Rapuzzi (Italy) and Mikhail Leontievitch Danilevsky (Russia) for their contribution on reference.

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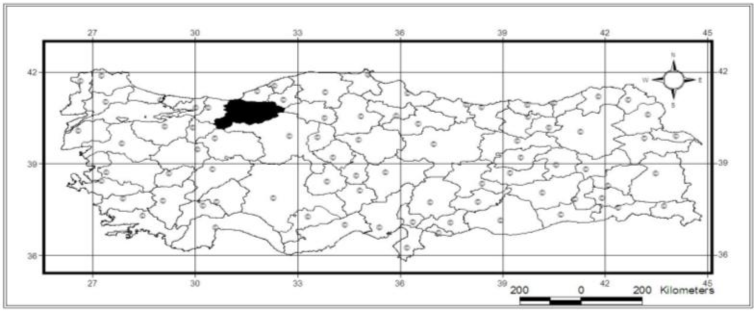

Map 1. The distribution of *S. zehrae* **sp. n.**

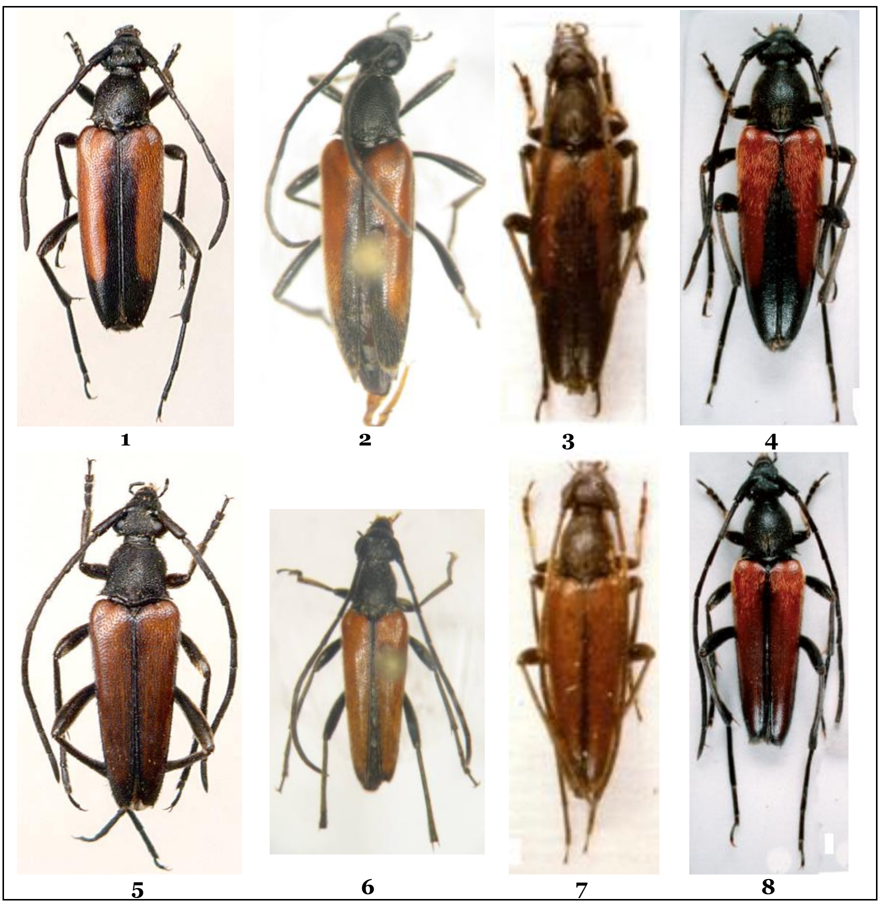

Plate I. 1. Female of *S. melanura*, 2. Female of *S. zehrae* **sp. n.** (Allotype), 3. Female of *S. samai*, 4. Female of *S. pamphyliae*, 5. Male of *S. melanura*, 6. Male of *S. zehrae* **sp. n.** (Holotype), 7. Male of *S. samai*, 8. Male of *S. pamphyliae* [The photos of *S. melanura* from Oleg Berlov in http://www.zin.ru/Animalia/Coleoptera/rus/sten_mel.htm; the photos of *S. pamphyliae* from Rapuzzi & Sama (2009); the photos of *S. samai* from Rapuzzi (1995)].

PRELIMINARY REPORT OF THE ENTOMOLOGICAL SURVEYS (2010, 2011) OF G. SAMA AND P. RAPUZZI TO TURKEY (COLEOPTERA: CERAMBYCIDAE)

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[**Sama, G., Rapuzzi, P. & Özdikmen, H.** 2012. Preliminary report of the entomological surveys (2010, 2011) of G. Sama and P. Rapuzzi to Turkey (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 7 (1): 22-45]

ABSTRACT. The paper gives an annotated list of the Cerambycidae collected during the entomological surveys carried on in the years 2010 and 2011 by G. Sama and P. Rapuzzi in central and eastern Turkey. The most interesting records regard *Trichoferus fissitarsis* Sama, & Fallahzadeh & Rapuzzi, 2005 and *Turanoclytus ilamensis* (Holzschuh, 1975) which are new records for the Turkish fauna. Many species constitute the first record for various Turkish provinces. *Phytoecia katarinae* (Holzschuh, 1974) is transferred to the genus *Semiangusta* Pic, 1893.

KEY WORDS: Cerambycidae, Coleoptera, new records, Turkey.

During the years 2010 and 2011 G. Sama and P. Rapuzzi organized scientific expeditions to the Anatolian peninsula in order to verify the distribution of Coleoptera, Cerambycidae, especially in the southern and eastern provinces of this country. H. Özdikmen gave assistance during both trips solving serious problems of various kind.

The itinerary of the first trip (13 June–2 July 2010) included the following provinces: Ankara, Yozgat, Sivas, Erzincan, Tunceli, Elazığ, Bingöl, Muş, Bitlis, Van, Hakkari, Şırnak, Mardin, Adıyaman, Kahramanmaraş, Malatya, Tokat and Ordu. Besides by sweeping with net and by beating, the bettles were collected by sugar traps (fermenting bait traps).

During the second trip (8–28 May 2011) the students Nihal Mercan and Naciye Cihan of the Fen-Edebiyat Fakültesi, Biyoloji Bölümü (Gazi University, Ankara) joined the expedition, giving a precious help actively and attentively collecting many specimens especially of Dorcadionini. During this trip new provinces were visited, with a special attention to interesting biotopes in Sivas, Erzincan, Tunceli, Mardin, Şırnak, Siirt, Hatay and Mersin provinces.

About 150 different species of Cerambycidae were collected during the surveys or were obtained by rearing larvae or pupae from the attacked wood; 130 species are discussed in this paper. For each species we give full collecting data, the complete list of Turkish provinces (abbreviated) where previous records were available, new records taken from authors archives, some remark about biology, host plants and, if necessary, taxonomic notes.

Further families of Coleoptera other than Cerambycidae were also found. The identification of this material submitted to specialists gave interesting results. Paper on Coleoptera Buprestidae, Scarabaeoidea, Carabidae will be proposed for the publication by Munis in this Bulletin or in the next future.

Abreviations of Turkish provinces (from Özdikmen, 2011)

ADANA (AD)
ADIYAMAN (ADY)
AFYON (AF)
AĞRI (AG)
AKSARAY (AK)
AMASYA (AM)
ANKARA (AN)
ANTALYA (ANT)
ARDAHAN (AR)
ARTVIN (ART)
AYDIN (AY)
BALIKESIR (BL)
BARTIN (BR)
BATMAN (BA)
BAYBURT (BY)
BILECIK (BI)
BINGÖL (BN)
BITLIS (BT)
BOLU (BO)
BURDUR (BU)
BURSA (BS)
ÇANAKKALE (CA)
ÇANKIRI (CN)
ÇORUM (CO)
DENIZLI (DE)
DIYARBAKIR (DI)
DÜZCE (DU)
EDIRNE (ED)
ELAZIĞ (EL)
ERZINCAN (ER)
ERZURUM (EZ)
ESKIŞEHIR (ES)
GAZIANTEP (GA)
GIRESUN (GI)
GÜMÜŠHANE (GU)
HAKKARI (HA)
HATAY (HT)
IĞDIR (IG)
ISPARTA (IP)
IÇEL (MERSIN) (IC)
ISTANBUL (IS)
IZMIR (IZ)
KAHRAMANMARAŞ (KA)
KARABÜK (KR)
KARAMAN (KM)
KARS (KAR)
KASTAMONU (KS)
KAYSERI (KY)
KIRIKKALE (KI)
KIRKLARELI (KK)
KIRŞEHIR (KIR)
KILIS (KL)
KOCAELI (KO)
KONYA (KN)
KÜTAHYA (KU)
MALATYA (MA)
MANISA (MN)
MARDIN (MR)
MUĞLA (MG)
MUŞ (MU)
NEVŞEHIR (NE)
NIĞDE (NI)
ORDU (OR)
OSMANIYE (OS)
RIZE (RI)
SAKARYA (SA)
SAMSUN (SM)
SIIRT (SI)
SINOP (SN)
SIVAS (SV)
ŞANLIURFA (SU)
ŞIRNAK (SK)
TEKIRDAĞ (TE)
TOKAT (TO)
TRABZON (TB)
TUNCELI (TU)
UŞAK (US)
VAN (VA)
YALOVA (YA)
YOZGAT (YO)
ZONGULDAK (ZO)
THRACE (EUROPEAN TUR.) (TRA)

***Callergates gaillardoti* (Chevrolat, 1854)**

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011. Larvae in dead stumps of *Pinus brutia*, remnants of one specimen in pupal cell.
Records in Turkey: AD, ANT, AY, HT, IC, KN, MG, OS (Özdikmen, 2011a).

***Aegosoma scabricorne* (Scopoli, 1763)**

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011. Larvae in dead stumps of *Fagus orientalis*. Three specimens emerged from 23.VI to 15.VII.2011.
Records in Turkey: ANT, BL, BR, GU, IP, IS, KA, KN, KR, OS, SM, VA, TRA (Özdikmen, 2011a). **A new record for Hatay province.**

***Rhamnusium* sp. (n. sp. ?)**

Tunceli: 40 km west of Tunceli (road to Ovacık), 1100m, 11/18.V.2011, pupae and larvae in dead parts of living trunks of *Populus* sp; two specimens emerged on 1.VI.2011. This taxon will be discussed in a separate article.

***Rhagium* (*Rhagium*) *inquisitor fortipes* Reitter, 1898**

Mersin: Çamlıyayla, 1600 m, larvae in pupal cells under and in the bark of dead trunks of *Abies cilicica*, 24.V.2011; 7 specimens emerged on 10.X.2011.
Records in Turkey: HT (Type locality). **A new record for Mersin (Içel) province.**
Remark. According the original description this population belongs to ssp. *fortipes*. It is possible that is a good species and not a subspecies of *R. inquisitor* for the peculiar characters and for the distance with other populations.

***Akimerus berchmansi* Breit, 1915**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Muş**: Buğlan pass, 1600 m., 16/27.VI.2010; **Tunceli:** 12 km south of Pülümür, 16/17.VI.2004, Lugowoj lgt. (Coll. P. Rapuzzi).
Records in Turkey: Tunceli (Pülümür) (Tauzin, 2000); Bingöl (Tozlu et al., 2002). **A new record for Muş province.**

***Anisorus quercus quercus* (Götz, 1783)**

Tunceli: 16 km south of Pülümür, 1800 m, 27.VI.2010, one specimen on wing.
Records in Turkey: AN, BN, EZ, RI, TRA (Özdikmen, 2007). **A new record for Tunceli province.**

***Dinoptera* (*Dinoptera*) *collaris* (Linnaeus, 1758)**

Tunceli: 16 km south of Pülümür, 1800 m, 27.VI.2010, 2 specimens, one with reddish pronotum, the second one with black pronotum; **Mersin**: Çamlıyayla, 1300 m, 24/26.V.2011, on flowering Apiaceae. **Hatay:** Nurdağları, east of Dörtyol, 950 m, 21.V.2011, on flowering Apiaceae.
Records in Turkey: AM, AN, ANT, ART, BO, BS, CN, EZ, IC, IP, IS, KR, KS, KO, OS, RI, SM, TRA (Özdikmen, 2011a). **New records for Hatay and Tunceli provinces.**

***Cortodera umbripennis* Reitter, 1890**

Cortodera alpina umbripennis Reitter, 1890 (sensu Danilevsky, 2010)
Erzincan: Kızıldağı pass, 2190 m, 14.VI.2010; **Muş**: Varto, 1517 m, 17.V.2011; Buğlan pass, 1600 m, 17.V.2011; **Tunceli**: 15 km west of Ovacık, 1328m, 11/18.V.2011, very common on flowering *Ranunculus* sp.
Records in Turkey: AN, ANT, AR, ART, EZ, IC, KAR, KN, MU, NI, VA (Özdikmen, 2011a). **New records for Erzincan and Tunceli provinces.**

***Cortodera ranunculi* Holzschuh, 1975**

Muş: Varto, 1517 m, 17.VI.2011, two females specimens on flowering *Potentilla* sp.
Remark. Endemic species from Turkey, only known from the type locality, a wet plain near Varto, where it was described from a small series of specimens collected, together with *C. umbripennis*, on *Ranunculus* sp.; later on, a few specimens were collected in the same locality, on the same plant, by C. Pesarini & A. Sabbadini on 18.VI.2001.

***Fallacia elegans* (Faldermann, 1837)**

Ordu: Akkuş, 1300 m, 28.VI.2010, some specimens on flowering *Spiraea sp.*
Records in Turkey: ART, BO, KK, RI, SN, TB (Özdikmen, 2008a). **A new record for Ordu province.**

***Pedostrangalia (Neosphenalia) emmipoda* (Mulsant, 1863)**

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011, ex larva from *Quercus sp.*; **Mersin**: Çamlıyayla, 1300 m, 24/26.V.2011, one specimen emerged ex pupa from *Ostrya* sp.
Records in Turkey: AD, ADY, ANT, BN, BT, BU, CA, EL, GA, HA, HT, IC, IP, IZ, KA, KN, MA, MN, MU, NI, OS, TU, US (Özdikmen, 2011a).

Pedostrangalia (Neosphenalia) kurda Sama, 1996

Adıyaman: Nemrut Mt., 1700 m, ex larva from *Quercus* sp., emergence 2.VI.1997; **Siirt:** Meşindağı pass, 1300/1600 m, 15/16.V.2011, ex larvae *Quercus* sp.; **Tunceli**: 16 km south of Pülümür, 27.VI.2010, several adults on flowering Apiaceae.
Records in Turkey: This species was described from Tunceli, Bingöl and Bitlis provinces (Sama, 1996) and recorded from Diyarbakır**:** Silvan (Tozlu & al., 2002). We also know it from **Bingöl**: 20 km east of Bingöl, 10.VI.1992, leg. M. Formánek; idem, 10.VI.1993, leg. V. Bíža & K. Koštál; **Elazığ**: Karga Mt., 1500 m. 30.V.1994, leg. M. Janata; **Hakkari**: Akçalı 35 km south of Hakkari, 1700 m, 21.VI.2010, leg. M. Halada; **Kahramanmaraş**: 40 km south-east of Kahramanmaraş, 10.VI.1998, leg. M. Halada; **Mardin**: Haberli (1020 m) 33 km south-east of Midyat, 17. and 19.V.2001, leg. M. Rejzek; Alanyurt east of Gercüş, 18.V.2001, leg. M. Rejzek; Hop pass, 6.VI.1998, leg. Halada; **Siirt**: Meşindağı pass, 1620 m, 11.VI.1993, leg. V. Bíža & K. Koštál; **Tunceli**: 15 km north of Pülümür, 1876 m, 15.VI.2010; 16 km south of Pülümür, 1876 m, 27.VI.2010; rather common on flowering Apiaceae. **New records for Adıyaman, Elazığ, Hakkari, Kahramanmaraş and Siirt provinces.**

Anastrangalia montana montana (Mulsant & Rey, 1863)

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011, some adults in pupal cell in *Pinus brutia*.
Records in Turkey: AD, ANT, CA, HT, IC, IZ, KN, OS (Özdikmen, 2011a); Burdur (Sama et al., 2011).

Stictoleptura scutellata inscutellata (Pic, 1892) (1891 ?)

Hatay: Nurdağları, east of Dörtyol, 950 m 21.V.2011, some specimens reared ex pupa from *Fagus orientalis*.
Records in Turkey: Endemic species from Turkey only known from the type locality: “Syrie, Akbes (currently in SE Turkey, Hatay).
Remark: The correct year of description of this taxon needs verification. According to Pic (1892: 415) it was firstly described in the paper “Descr. Longic. Syrie pag. 3” printed in 1891; according to Pic (1900) it was published in the same paper on pag. 1; the Catalogue of Löbl & Smetana (2010), gives 1892 as the year of description.

Stictoleptura cordigera cordigera (Fuessly, 1775)

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Bitlis:** Güroymak, 1651 m, 19.VI.2010; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010, common on flowers and attracted to sugar traps; **Tunceli**: 16 km south of Pülümür, 27.VI.2010.
Records in Turkey: ADY, AK, AN, ANT, ART, BL, BN, BO, BT, BU, CA, DE, ED, EZ, GA, GU, HT, IC, IS, IZ, KA, KK, KN, KO, MG, MN, MU, NE, NI, OS, TE, TU, YA, TRA (Özdikmen, 2011a).

Stictoleptura tripartita (Heyden, 1889)

Bingöl: Ağacaeli (18 km east of Bingöl), 1400 m, 27.VI.2010, two specimens on flowering *Onopordon* sp..
Records in Turkey: Bitlis prov., Tatvan: Hanelmalı, 1730 m, 9.VII.2006 (Koçak & Kemal, 2009); ADY, ER, EZ, HA, KA, KAR, KY, MA, RI, TU, YO (Özdikmen, 2011a). **A new record for Bingöl province.**

Stictoleptura rufa dimidiata (K. & J. Daniel, 1891)

Tunceli: 16 km south of Pülümür, 27.VI.2010, two specimens on Apiaceae; **Hakkari**: Akçalı 35 km S Hakkari, 1700 m, 21.VI.2010, leg. M. Halada.
Records in Turkey: Tunceli (Fuchs et Breuning, 1971); Erzincan (Tozlu et al., 2002). **A new record for Hakkari province.**

Paracorymbia fulva (DeGeer, 1775)

Tunceli: 16 km S of Pülümür, 27.VI.2010, several adults on flowering Apiaceae.
Records in Turkey: AD, ANT, ART, BO, BR, BS, BU, HT, IC, IP, IS, IZ, KA, KK, KN, KO, KR, KS, MN, OS, ZO, TRA (Özdikmen, 2011a). **A new record for Tunceli province.**

***Anoplodera (Anoplodera) rufipes lucidipes* Sama, 1999 (?)**

Hatay: Nurdağları, east of Dörtyol, 1860 m, 1.VII.2011, on *Crataegus* sp.

Records in Turkey: The nominotypical subspecies is recorded in Turkey from AN, BN, BO, BS, EZ, GU, KK, KS, OR, RI, TB (Özdikmen, 2011a); it is represented in Southern Turkey by *A. rufipes lucidipes* Sama, 1999, which is only known from its type locality: Erdemli (Içel prov.) (Adlbauer, 1988; Sama, 2002). Old records of Pic (1892) as *Leptura (Anoplodera) rufipes* Schall. *var. fuscipes* Muls., from Akbès and K. & J. Daniel, (1906) as *Leptura (Anoplodera) rufipes* Schall. from "Efrenk und Funduk Pungar (Südseite des kilikischer Taurus)" probably refer to the same subspecies.

Remark. All specimens differ from *A. rufipes lucidipes* by the entirely black legs.

***Anoplodera (Anoplodera) sexguttata* (Fabricius, 1775)**

Hatay: Nurdağları, east of Dörtyol, 1311 m, 22.VI.2011.

Records in Turkey: GU, HT, KO (Özdikmen, 2011a); the present record confirms a very old citation from "Akbés, Asie Mineure" as *Leptura 6-guttata* Fab. (Fairmaire, 1884).

***Vadonia unipunctata* (Fabricius, 1787)**

Bitlis: Güroymak, 1651 m, 19.VI.2010; 18 km east of Tatvan, 19.VI.2011, a single specimens by sweeping Apiaceae; **Erzincan**: Kizildagi geçidi, 2190 m, 14.VI.2010, one specimen on *Euphorbia* sp.; **Tunceli**: 14 km south of Tunceli, 1000 m, 12.V.2011, one specimen on Apiaceae; 15 km north of Pülümür, 1876 m, 15.VI.2010, two specimens on *Euphorbia* sp.; **Van**: Kurubas geç., 2225 m., 19.VI.2010.

Records in Turkey: AF, AK, AM, AN, ANT, ART, BI, BN, BO, BT, BU, BY, CN, EL, EZ, IP, IZ, KA, KAR, KIR, KO, KR, KS, KY, KU, MA, NE, NI, OS, RI, SV, TO, US, TRA (Özdikmen, 2011a). **New records for Tunceli and Van provinces.**

***Vadonia bitlisiensis* Chevrolat, 1882**

Tunceli: 46 km N Tunceli, 27.VI.2010. The identification needs confirmation after a study of the whole group.

Records in Turkey: BI, BT, ER, EZ, GU, TU, VA (Özdikmen, 2008a; Özdikmen & Turgut, 2009).

***Vadonia instigmata* (Pic, 1889)**

Muş: Buğlan pass, 1600 m, 16/27.VI.2010, one specimen in sugar traps.

Records in Turkey: This species was previously recorded only from Bitlis (type locality) and Adıyaman: Nemrut Mt.) (Özdikmen & Turgut, 2009). **A new record for Muş province.**

***Pachytodes erraticus erraticus* (Dalman, 1817)**

Bitlis: Güroymak, 1651 m, 19.VI.2010; **Elazığ**: Huruca pass, 1700 m, 16.VI.2010; **Erzincan**: 9 km east of Kızıldağı pass, 2190 m, 14.VI.2010; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010; **Tokat**: Çamiçi north of Niksar, 1000 m, 26.VI.2010; Almuş, 28.VI.2010; **Tunceli**: Pülümür, 27.VI.2010; 15 km north of Pülümür, 1876 m, 15.VI.2010; 46 km N Tunceli, 27.VI.2010.

Records in Turkey: AF, AM, AN, ANT, ART, BI, BO, BR, BS, BT, CN, CO, EL, ER, EZ, GA, GU, HT, IP, IS, IZ, KAR, KK, KO, KN, KR, KS, MN, MU, RI, SM, SN, SV, TB, TO, TU, YO, ZO, TRA (Özdikmen, 2011a).

***Alosterna tabacicolor subvittata* Reitter, 1885**

Ordu: Akkuş, 1300 m, 28.VI.2010, some specimens on flowering *Spiraea sp.*

Records in Turkey: ART, TB (Özdikmen, 2007). **A new record for Ordu province.**

***Pseudovadonia livida livida* (Fabricius, 1777)**

Hatay: South of Senköy, 834 m, 23.V.2011, several specimens on various flowers; **Ordu**: Akkuş, 1300 m, 28.VI.2010, some specimens on flowers.

Remark. All specimens have pronotal hairs bent from sides medially and posteriorly (*P. livida* form *pecta* K. & J. Daniel, 1891).

Records in Turkey: ADY, AM, AN, ANT, ART, BI, BO, BR, BS, BT, BY, CN, ER, EZ, GA, GI, GU, HT, IC, IP, IS, IZ, KAR, KK, KO, KR, KS, MN, NI, OS, RI, SM, US, TRA (Özdikmen, 2011a). **A new record for Ordu province.**

***Pseudovadonia livida desbrochersi* (Pic, 1891)**

Bitlis: Güroymak, 1651 m, 19.VI.2010.

Remark. This subspecies, described from "Bitlis" and based on specimens with red legs, has recently been resurrected from synonymy with *Pseudovadonia livida pecta* (K. & J. Daniel, 1891), by Danilevsky in Löbl & Smetana (2010) "based on original descriptions and matching specimens from Armenia". Its true taxonomical value is rather doubtfull; our series from Bitlis (topotypical) includes specimens with both red (prevalent) and black legs.

***Rutpela maculata maculata* (Poda, 1761)**

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011, one adult in pupal cell in *Pinus brutia* and several specimens ex larva from *Fagus orientalis* (emerged July 2011); **Muş**: Buğlan pass, 1600 m, 16/27.VI.2011, some specimens attracted to sugar traps; **Tokat**: Çamiçi north of Niksar, 1000 m, 26.VI.2010; Almuş, 28.VI.2010; **Tunceli**: 16 km south of Pülümür, 27.VI.2010; uncommon on flowers and attracted to sugar traps.

Records in Turkey: AD, AM, ANT, ART, BL, BN, BO, BS, BT, CA, CN, HT, IC, IS, KK, KN, KO, KR, KS, MA, MU, OS, RI, SM, SN, SV, TB, TO, TU, VA (Özdikmen, 2011a).

***Stenurella septempunctata suturata* (Reiche & Saulcy, 1858)**

Ordu: Akkuş, 1300 m, 28.VI.2010, some specimens on flowers.

Records in Turkey: ART, BI, BO, BS, CA, EZ, GU, IS, KK, KO, KS, RI, SM, TB, TO, YA, ZO (Özdikmen, 2008a). **A new record for Ordu province.**

***Carlandrea syriaca* (Pic, 1891)**

Muş: Buğlan pass, 1600 m, 16/27.VI.2010, some specimens on flowers; **Bingöl**: 30/36 km east of Bingöl, 16/27.VI.2010, some specimens on flowers.

Records in Turkey: HT (Pic, 1891, 1892); ANT, IC, TU (Özdikmen, 2011a). **New records for Bingöl and Muş provinces.**

***Spondylis buprestoides* (Linnaeus, 1758)**

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011, emerged from *Pinus nigra*.

Records in Turkey: AN, ART, BO, BS, IS, KAR, KR, OS, SN, TB (Özdikmen, 2011a,b). **A new record for Hatay province.**

***Nothorhina muricata* (Dalman, 1817)**

Gümüşhane: North of Tersundağı pass, 1500 m, reared from a large pine tree (R. Pettersson, pers. comm.); **Hatay**: Syrie: Cheiklé" (Pic, 1905); Nurdağları, east of Dörtyol, 950 m, 21.V.2011, old frass and exit holes in *Pinus nigra*; **Tokat**: Özdemir over Çamiçi, 1182 m, 28.VI.2010, pupae and immature adults in pupal cells in living trunks of *Pinus sylvestris*, emergence 1-15.VII.2010.

Records in Turkey: According to Özdikmen & Turgut (2006), this apparently uncommon species has only been reported, as *N. punctata*, by Lobanov et al., 1981 and by Svacha & Danilevsky, 1986 from Turkey without exact locality. In fact two specimens were previously recorded by Pic (1905a) from "Cheiklé en Syrie" (Hatay, Şıhlı village). **New records for Gümüshane and Tokat provinces.**

***Asemum tenuicorne* Kraatz, 1879**

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011. Several larvae and some pupae in *Pinus* nigra. Four specimens emerged 28.V.2011.

Our finding confirms a very old record of Pic (1893, under the name "*? Megasemum 4.costulatum* Kr."), regarded as wrong by Danilevsky (2011) "*The nature of the taxon recorded by Pic (1893d: 417) as "?Megasemum 4, costulatum Kr." on the base of two specimens from "mont Amanus, pays d'Akbes" [now Hatay in south, east Turkey] rests uncertain. Only one pale specimen was described as Megasemum quadricostulatum var. semilividum Pic, 1893d: 417, so Pic "expressly gave it infrasubspecific rank" (Article 45.6.4 of ICZN), and the name is unavailable. It is more probable that both specimens belong to*

A. striatum, which can be light, brown rather often, and Asemum tenuicorne absent in Hatay". In fact the material recorded by Pic really belongs to *A. tenuicorne* as showed by Pic's material studied by G. Sama.

The var. *semilividum* Pic, 1892 could be regarded as infrasubspecific as proposed by Danilevsky (2011), however it has been accepted as an available name by the Catalogue of Löbl & Smetana (2010).

? Megasemum 4.costulatum v.semilividum Pic, 1893, Annales de la Société entomologique de France, 61: 417. Type locality: Haute Syrie; 2 ex. (coll.Delagrange).

Original description.

" *Espèce offrant le prothorax plus élargi à la base, les antennes longues, deux côtes bien visibles sur les elytres, avec une troisième plus courte, moins saillante; ceux, ci tantôt noirs, tantôt testacés (var.semilividum), 2 ex*."

The lectotype and the paralectotype designation by G. Sama were never published. The lectotype is a male, 13,5 mm long, in bad condition (abdomen, left antenna, hind left leg and tarsi missing) bearing the following labels: "Syrie/ Akbes/ CD 1891" [printed, Delagrange's original label]; "? tenuicorne Kr/ var." [whitish, handwritten by Pic]; "v. semililividum/ Pic" [whitish, handwritten by Pic]; "type" [whitish, handwritten by Pic]; "Holotype [red, printed, recent); "Museum Paris/ Coll. Pic" [white, printed, recent); "Lectotypus ♂ / Asemum tenuicorne/ v. semilividum Pic, 1892/ G.Sama des. 1993". The paralectotype is a male , 16 mm long, front left missing, labelled as follows: "Syrie/ Akbes/ CD 1891" [printed, Delagrange's original label]; "tenuicorne/ v.semilividum / Pic , Pic det." [white recent, handwritten by ? [A. Villiers ?]; "Lectotypus ♂ Asemum tenuicorne / v. semilividum Pic, 1892 / G.Sama des. 1993".

Asemum tenuicorne was also recorded from Kızılcahamam (Ankara prov.), 5.VI.1965 (Demelt, 1967).

Arhopalus rusticus (Linnaeus, 1758)

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011. Two specimens reared ex larva from *Pinus nigra*, emergence 22.VI.2011.

Records in Turkey: AN, ANT, ART, BL, BO, BU, BY, DE, GU, IS, KAR, KR, KS, KU, MG, OR, OS, RI, SM, SN, TB, TO (Özdikmen, 2011a). **A new record for Hatay province.**

Arhopalus syriacus (Reitter, 1895)

Hatay: 3 km South-West of Yayladağı, 478 m, 23.V.2011. Mature larvae and pupae in *Pinus* sp., emergence 18.VI/4.VII.2011.

Records in Turkey: AD, ANT, ART, GA, IC, IZ, MG, NE, OS, SU (Özdikmen, 2011a). **A new record for Hatay province.**

Drymochares starcki cavazzutii Sama & Rapuzzi, 1993

Ordu: 2 km N Akkuş, 28.VI.2010, some specimens emerged from dead stumps of *Fagus orientalis*.

Records in Turkey: ART, GI, GU, KS, OR, SM, SN, TO, ZO (Özdikmen, 2007).

Trichoferus lunatus (Szallies, 1994)

Mardin: Hop pass, 1138 m, 28.VI.2010, one immature female in pupal cell and several fresh exit holes in *Quercus* sp.; idem, 14.V.2011, several larvae in twigs of *Quercus* sp. (one specimen emerged on 15.VI.2011); 6 km east of Arıçlı, 1000 m, larvae in twigs of *Quercus* sp.; 11 km east of Midyat, idem; **Şırnak**: Meşindağı pass, 1300/1600 m, 15/16.V.2011, larvae and old exit holes in twigs of *Quercus* sp.; env. Uludere, 16.V.2011, young larvae in twigs of *Quercus* sp.

Records in Turkey: This species was described from a single specimen collected on the Hop pass (east of Mardin). Our surveys allowed to ascertain the occurrence of this apparently uncommon species, which on our knowledge, was known only from the type locality, in a relatively wide area extended from south-east of Mardin to about 20 km east (Hakkari road) and 30 km north west of Şırnak (road to Siirt). **A new record for Şırnak province.**

Trichoferus griseus (Fabricius, 1792)

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011. Few specimens emerged ex larva from *Ficus carica*.
Records in Turkey: AD, ANT, AY, GA, HT, IC, IZ, KN, MN, OS (Özdikmen, 2011a).

Trichoferus preissi (Heyden, 1894)

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011. Few specimens emerged ex larva from *Ficus carica*.
Records in Turkey: AD, ANT, IC, SU (Özdikmen, 2011a).

Trichoferus fissitarsis Sama, & Fallahzadeh & Rapuzzi, 2005

Siirt: 7 km SE Eruh, 1400 m, 16.V.2011. Larvae in living or dying branches and stumps of *Ficus carica*. One adult emerged on 15.VII.2011.
Remark: A new record for the Turkish fauna.

Cerambyx cerdo cerdo Linnaeus, 1758

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010. Common in sugar traps or sitting on *Quercus* sp.
Records in Turkey: AD, ADY, AN, ANT, ART, BR, BS, CA, DE, HT, IC, IS, IZ, KA, KK, KN, KO, KS, KY, MG, NI, OS, SA, SK, SM, SN, TU, TRA (Özdikmen, 2011a). **New records for Bingöl and Muş provinces.**

Cerambyx dux (Faldermann, 1837)

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010. Common in sugar traps or sitting on *Quercus* sp.
Records in Turkey: AD, ADY, AN, ANT, BI, BN, BS, BU, DE, EL, ER, EZ, GA, HT, IC, IP, IS, IZ, KA, KAR, KK, KN, KS, KY, MA, MG, NI, OS, TO, TU, VA (Özdikmen, 2011a). **A new record for Muş province.**

Cerambyx heinzianus Demelt, 1976

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010. Common in sugar traps or sitting on *Quercus* sp.
Records in Turkey: BN, BT (Özdikmen, 2009c). **A new record for Muş province.**

Cerambyx scopolii scopolii Fuessly, 1775

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011, several larvae and remnants of one adult in dead trunks of *Fagus orientalis*.
Records in Turkey: ANT, ART, BN, BO, ED, HT, IC, IS, KAR, KK, NI, OS, RI, SA, SM, SN, TB, TO, TRA (Pic, 1892; Özdikmen, 2011a).
Remark: It was recorded from "Haute Syrie: Akbes" (in fact SE Turkey: Hatay), under the name *Cerambyx scopolii* var. *nitidus* Pic, 1892, currently regarded as a synonym of *C. scopolii*.

Rosalia (*Rosalia*) *alpina syriaca* Pic, 1895

Hatay: Nurdağları, east of Dörtyol, 1170, one specimen on *Fagus*, 7.VI.2010, leg. D. & S. Marklund; idem, 950 m, 21.V.2011, three specimens emerged on early July ex larva from dead trunks of *Fagus orientalis*.
This isolated population was originally described from "Syrie: Akbes", currently in SE Turkey: Hatay", as a variety, but later (Pic, 1895) regarded as a subspecies ("*sans doute une race propre à la région syrienne*") and finally (Pic, 1900b) as a distinct species. "*Rosalia syriaca Pic, de Syrie (sans doute espèce propre, plutôt que varieté de Rosalia alpina L.) se distinguera de celle ci, non seulement par la coloration foncière très distinctement d'un gris bleu, mais aussi par des taches et bandes veloutées non bordées d'une coloration plus claire, ainsi que par la forme de la tache antérieure, celle ci très irregulière, plus ou moins étranglée au milieu ".*
Remark. These are the first records of this wonderful beetle after the description.

Purpuricenus (Purpuricenus) kaehleri (Linnaeus, 1758)

Ordu: Akkuş, 1300 m, 28.VI.2010, one dead specimen in pupal cell on *Quercus* sp..

Records in Turkey: ART, IS, KK, RI, TRA (Özdikmen, 2007 and 2008a). **A new record for Ordu province.**

***Purpuricenus (Purpuricenus) budensis* (Götz, 1783)**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010, Common on flowers; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010; **Tunceli**: Pülümür, 1873 m, 15.VI.2010. Common everywhere in Turkey on flowers.

Records in Turkey: AD, ADY, AF, AM, AN, ANT, ART, AY, BL, BN, BO, BS, BU, CA, CO, DE, ED, EZ, GA, GU, HT, IC, IP, IS, IZ, KA, KI, KN, KO, MG, MN, MU, NI, OS, RI, SI, SM, SN, TO, TU, YO (Özdikmen, 2009).

***Purpuricenus (Purpuricenus) bitlisiensis* T. Pic, 1902**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010; **Tunceli:** Pülümür, 1800 m, leg. F. Cavazzuti (G. Sama collection), some specimens sitting on leaves of *Quercus* sp.

Records in Turkey: Bitlis (type locality), Muş (Malmusi & Saltini, unpublished note, in Özdikmen, 2007). **New records for Bingöl and Tunceli provinces.**

***Purpuricenus (Purpuricenus) cornifrons* Sabbadini & Pesarini, 1992**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Muş**: Buğlan pass, 1600 m, 26.VII.2002, ex larva from *Quercus* sp., two specimens emerged on 16.V. and 3.VI.2003; idem, 16/27.VI.2010, uncommon on leaves of *Quercus* sp.

Records in Turkey: Bingöl (type locality); Adıyaman (Rejzek & Hoskovec, 1999). **A new record for Muş province.**

***Purpuricenus (Purpuricenus) dalmatinus* Sturm, 1843**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Mersin**: Çamlıyayla, 1300 m, 24.V.2011; larvae in living stems and branches of *Quercus coccifera*; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010; some specimens sitting on leaves of *Quercus* sp.; **Tunceli**: Pülümür, 1873 m, 15.VI.2010.

Records in Turkey: ADY, ANT, AY, BN, HT, IC, IZ, KA, MG, MN, MR, MU, OS, SI (Özdikmen, 2011a). **A new record for Tunceli province.**

***Purpuricenus (Purpuricenus) apicalis* Pic, 1905**

= *Purpuricenus tommasoi*, Sama, 2001.

Hakkari: 5 km east of the crossroad to Çukurca, 22.VI.2010, one specimen sitting on leaves of *Quercus* sp.

Records in Turkey: **Siirt**: "Zw. Siirt u. Baykan" (Fuchs & Breuning, 1971 as *P. dalmatinus apicalis*); Eruh SE Siirt, 26.V.1983, leg. Gerstmeier (Adlbauer, 1988, as *P. dalmatinus*); **Van**, Çatak: Dalbaştı, 1600 m, 9.VI.2009 (Koçak & Kemal, 2009). We also know it from **Mardin**: Haberli, 33 km SE Midyat, 1020 m, 17.-19.V.2001, ex larva from *Quercus*, leg. P. Kábatek (G. Sama & P. Rapuzzi coll.).

Remark: Both *P.apicalis* and *P. tommasoi* were described from Iraq (Mar.Yakoub near Mossoul and Penjwin respectively; the latter is also known from Iran. **A new record for Hakkari province.**

***Purpuricenus* (*Purpuricenus*) *wachanrui* Levrat, 1858**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; some specimens on flowers of *Althaea sp.* (Malvaceae) or attracted to sugar traps; **Bitlis:** Güroymak, 1651 m, 19.VI.2010, some specimens on *Verbascum sp.*; **Muş**: Buğlan geçidi, 1600 m, 16/27.VI.2010; **Tunceli:** Pass North from Pülümür, 1600-1800 m., 6.VII.2005, I. Rapuzzi lgt.; Pülümür dint., 1400-1600 m., 26.VI.2005, I. Rapuzzi lgt. (Coll. P. Rapuzzi)

Records in Turkey: VA (Koçak & Kemal, 2009); AD, ADY, BN, BT, DI, MA, TU (Özdikmen, 2011a). **A new record for Muş province.**

***Axinopalpis gracilis gracilis* (Krynicki, 1832)**

Hatay: 4 km south of Şenköy, 834 m, 23.V.2011; some specimens emerged from dead branches of *Juglans regia* L.

Records in Turkey: IC, IP (Özdikmen, 2011a). However, this species was already recorded by Pic (1896) who described a single female from “Syrie: Akbes” (currently Turkey, Hatay prov.) as *A. gracilis v. latior* (type material examined by G. Sama).

***Stenhomalus (Obriopsis) bicolor* (Kraatz, 1862)**

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011, common on flowers of Apiaeae and bushes.
Records in Turkey: ANT, IC, NE, NI, OS (Özdikmen, 2011a).

***Nathrius brevipennis* (Mulsant, 1839)**

Hatay: 4 km south of Şenköy, 834 m, 23.V.2011, larvae and pupae in dead branches of *Juglans regia* L; several specimens emerged from 1.VI. to 7.VII.2011.
Records in Turkey: ANT, HT, IC, IS, IZ (Özdikmen, 2011a).

***Brachypteroma holtzi* Pic, 1905**

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011; rather common on flowering bushes (*Crataegus*, *Cornus*) and Apiaceae.
Records in Turkey: IC, OS (Özdikmen, 2011a).

***Molorchus juglandis* Sama, 1982**

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011, common on flowering Apiaceae and bushes.
Records in Turkey: ANT, IC, NI (Özdikmen, 2011a).

***Stenopterus rufus syriacus* Pic, 1892**

Hatay: 4 km south of Şenköy, 834 m, 23.V.2011, several specimens collected on different flowers.
Records in Turkey: ANT, HT, IC, OS (Özdikmen, 2011a).

***Stenopterus rufus geniculatus* Kraatz, 1863**

Ordu: Akkuş, 1300 m, 28.VI.2010, some specimens on flowers; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010; **Tunceli**: 16 km south of Pülümür, 27.VI.2010; 15 km north of Pülümür, 15.VI.2010; common on flowers.
Records in Turkey: widespread throughout Turkey except the area occupied by *S. r. syriacus*.

***Stenopterus atricornis* Pic, 1891**

Tunceli: 20 Km S Pülümür, 1100 m., 8.VII.2005, I. Rapuzzi lgt. (Coll. P. Rapuzzi); **Kastamonu:** Boyabat, 15.VII.1987, P. Rapuzzi lgt. (Coll. P. Rapuzzi).
Records in Turkey: ANT-IC-KN (Adlbauer, 1988; Özdikmen, 2010). **New records for Kastamonu and Tunceli provinces.**

***Stenopterus adlbaueri* Sama, 1995**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Tunceli**: 20 km south of Pülümür, 1100 m., 6.VII.2005, leg. I. Rapuzzi; idem, 27.VI.2010, some specimens on flowering Apiaceae.
Remark: On our knowledge this species was never found again after the description based on two specimens from the Hakkari province. Tauzin (2000), however, reported it from Hakkari. **New records for Bingöl and Tunceli provinces.**

***Lampropterus femoratus* (Germar, 1824)**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Bitlis:** Güroymak, 1651 m, 19.VI.2010: **Elazığ**: Kuruca pass (eastern slopes), 1700 m, 16.VI.2010; **Hakkari**: Kolbaşı, 2000 m, 21.VI.2010, two specimens emerged ex larva from a dead stump of *Prunus* sp., 20.V.2011; **Hatay:** S of Şenköy, 934 m., 23.V.2011, several specimens on flowers; **Mardin:** Hop pass, 1138 m, 14.V.2011, several adults in pupal cell on *Quercus* sp.; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010; **Tokat:** Almus lake, VI.2010, ex larva dead branches of *Quercus* sp., emerged 10.VII.2011; **Tunceli**: 14/21 km south of Tunceli, 1050 m, 12/19.V.2011, on flowers; idem, 15 km N of Pülümür, 1873 m, 10.V.2011, ex larva from a branch of *Quercus* sp. girdled and killed by *Coraebus fasciatus* (Villers, 1789) (Coleoptera Buprestidae), emergence 1/24.VI.2011; idem, 16 km south of Pülümür, 27.VI.2010, common on flowers.

Records in Turkey: VA (Koçak & Kemal, 2009); AD, ADY, AM, AN, ANT, ART, BL, BN, BS, BU, CA, DI, ED, EZ, GA, HA, HT, IC, IS, IZ, KA, KI, KK, KN, MA, MG, MN, MU, NI, OS, YO, TRA (Özdikmen, 2011a). **New records for Bitlis, Mardin, Tokat and Tunceli provinces.**

***Callimus angulatus angulatus* (Schrank, 1789)**

Tokat: Çamiçi north of Niksar, 1000 m, 20.III.2010, 28.VI.2010; ex larva from *Quercus* sp.; emergence 20.III.2011.
Records in Turkey: ADY, ANT, BO, IC, IS, KK, OR, SM, TRA (Özdikmen, 2011a). **A new record for Tokat province.**

***Certallum ebulinum* (Linnaeus, 1767)**

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011, common on Cruciferae; **Yozgat***:* Sekeli, 8.V.2011, some specimens on unidentified Cruciferae.
Records in Turkey: AD, ADY, AK, AM, AN, ANT, AY, BI, BL, BS, CA, CN, DE, DI, ER, GA, HT, IC, IP, IS, IZ, KA, KN, KY, MG, MN, MR, NE, NI, OS, SN, SU, TB, ?YO, TRA (Özdikmen, 2011a).

***Delagrangeus angustissimus angustissimus* Pic, 1892**

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011, two specimens on wing; several larvae feeding in branches of *Juniperus* sp.
Records in Turkey: IC (Özdikmen, 2011a).

***Ropalopus sculpturatus* (Pic, 1931)**

Tunceli: 40 km north of Tunceli (road to Pülümür), 1050 m, 10/18.V.2011, ex larva from dead branches of *Juglans regia* L.; one specimen emerged on 15.VI.2011.
Records in Turkey: ART, EZ, TO (Özdikmen, 2011a). We also know it from **Kastamonu**: Yaralıgöz plateau, 1300 m, 15.VII.80 (leg. N. Auvray, G. Sama and P. Rapuzzi coll.); **Ağrı**: dint. Ağrı, 1700/2000 m, V.1993, leg. Nicastro (G. Gobbi coll.). **New records for Ağrı, Kastamonu and Tunceli provinces.**

***Callidium syriacum* Pic, 1892**

Mersin: Çamlıyayla, 1500 m, 24.V.2011, immature adults in pupal cell in a dead branch of *Abies cilicica* Carr. Emergence 28.V.2011.
Records in Turkey: ANT, HT (Özdikmen, 2011a). **New record for Mersin (=Içel) province.**

***Phymatodes testaceus* (Linnaeus, 1758)**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010.
Records from Turkey: ADY, ANT, ART, BO, CA, GU, HT, IC, IS, NI, OS, TRA (Özdikmen, 2011a). **A new record for Bingöl province.**

***Poecilium rufipes syriacus* (Pic, 1891)**

Hatay: 4 km south of Şenköy, 834 m, 23.V.2011, several exit holes observed in dead branches of *Prunus* sp.; several specimens by beating from *Prunus* sp.
Records in Turkey: The nominotypical subspecies is known from Bolu and Samsun, the subspecies *syriacum* from Antalya, Hatay (type locality), Icel (Mersin), Niğde and Osmaniye (Özdikmen, 2011a).

***Poecilium pusillum* (Fabricius, 1787)**

Tunceli: 15 km N of Pülümür, 1873 m, 10.V.2011, ex larva from a branch of *Quercus* sp. girdled and killed by *Coraebus fasciatus* (Villers, 1789) (Coleoptera Buprestidae). Emergence 15/20.V.2011.
Records in Turkey: This species is apparently very rare in Turkey where it was only recorded from the Istanbul and Konya provinces (Cebeci et al, 2011). **A new record for Tunceli province.**

Xylotrechus (Xylotrechus) arvicola **(Olivier, 1795)**

Hakkari: Kolbaşı, 2000 m, 21.VI.2010, two specimens emerged ex larva from a dead stump of *Prunus* sp., 14.VI.2011; **Hatay**: Nurdağları, east of Dörtyol, 950 m, 21.V.2011, some specimens emerged from dead branches of *Quercus* sp.
Records in Turkey: AD, GI, HT, KK, TB, TRA (Özdikmen, 2011a). **A new record for Hakkari province.**

Turanoclytus sieversi **(Ganglbauer, 1890)**

Bingöl: Kuruçu pass, VI.2010, ex larva from *Astragalus* sp., emergence 11.VII.2010; **Tunceli**: 15 km west of Ovacık, 1328m, 11/18.V.2011, several larvae feeding in a dead stump of *Astragalus* sp.; emergence 2/18.VI.2011; 15 km. Nord Pülümür, 1873 m, 11.V.2011, several larvae feeding in a dead stump of *Astragalus* sp.; emergence 2/18.VI.2011.
Records in Turkey: The nominotypical subspecies is known to occur in Turkish Armenia: (Kasikoporan = Kazkoporan, type locality in Iğdır prov.), Trabzon (type locality of *X. deyrollei* Pic, 1897, currently regarded as a synonym of *T. sieversi*). We also know specimens from the Gümüşhane prov.: 14 km. NW Gümüşhane, 10.VI.1996 and 14 km south of Kelkit, 18.V.1995 (leg. S. Lundberg & R. Pettersson) and north-west of Kelkit, north of Köse, 18.V.1995 (leg. G. Sama). Moreover, Muş (Malmusi & Saltini, unpublished note). The subspecies *T. sieversi akbesianus* (Pic, 1902), described from Akbès (Hatay), was also mentioned from Göksun env. (Kahramanmaraş) (Sama & Rapuzzi, 2002). **New records for Bingöl, Gümüşhane and Tunceli provinces.**

Turanoclytus ilamensis **(Holzschuh, 1979) (n. ssp. (?)).**

Hakkari: Kolbaşı vill., VI.2010, ex larva from *Astragalus* sp., emergence 20.VII.-16.VIII.2010.
T. ilamensis was described on a single male specimen from Western Iran (Kermanshahan, NW Ilam) and, later on, found again near Razan pass (east of Khorram Abad, W. Lorestan) (Sama & Rapuzzi, 2002). The subspecies *T. i. campadellii* Sama & Rapuzzi, 2003 was described based on specimens from NW Iran, Azarbaygan-e-Garbi. Specimens from Kolbaşı is closely related to *T. i. campadellii* but differs from this taxon by a different pronotal punctation. **A new record for the Turkish fauna.**

Rusticoclytus rusticus **(Linnaeus, 1758)**

Tunceli: 40 km west of Tunceli (road to Ovacık), 1100m, 11.V.2011; some specimens emerged ex pupa and ex larva from a dead trunk of *Populus* sp. We also know it from Antalya: Osmandede, Irmasan pass (R. Pettersson, pers. comm.) and from Artvin: Yusufeli, 8.VI.2004, leg. C. Reuter (P. Rapuzzi collection).
Records in Turkey: AN, BO, BU, CN, DU, ES, IS, IZ, KAR, KK, KN, KO, KS, KY, MU, SA, SM, TO, TU (Özdikmen, 2008b). **New records for Antalya and Artvin provinces.**

Clytus gulekanus **Pic, 1904**

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011. Larvae and pupae in dead part of living branches of *Ficus carica*. Emergence 4/14.VI.2011.
Records in Turkey: Endemic species from Turkey, only known from the Mersin province.

Clytus rhamni **Germar, 1817**

Bitlis: Kuzgunkıran, 2274 m, 19.VI.2010; 18 km east of Tatvan, 1786 m, 19.VI.2010; **Elazığ**: Kuruca pass (eastern slopes), 1700 m, 16.VI.2010; **Tokat**: Almuş, 28.VI.2010; **Tunceli**: 15 km north of Pülümür, 15.VI.2010; Pülümür, 1626 m, 15.VI.2010.
Records in Turkey: AD, ADY, AM, AN, ANT, ART, BI, BS, BY, CA, CN, GA, GU, HT, IC, IP, IS, IZ, KA, KK, KN, KO, KR, KS, KY, MA, OS, RI, SM, SN, SV, TO, YA, YO, TRA (Özdikmen, 2011a). Bolu (Özdikmen, 2011b). **New records for Elazığ and Tunceli provinces.**

Plagionotus arcuatus **(Linnaeus, 1758)**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; some specimens attracted to sugar traps; **Muş**: Buğlan geçidi, 1600 m, 16/27.VI.2011, some specimens on *Quercus* log piles and attracted to sugar traps.

Records in Turkey: VA (Koçak & Kemal, 2009); ART, BI, CA, DU, IP, IS, KS, MU, OS, SM, TO, TRA (Özdikmen, 2011a). **A new record for Bingöl province.**

***Plagionotus bobelayei* (Brullé, 1832)**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2011, some specimens on flowering Malvaceae.
Records in Turkey: ADY, AG, ANT, ART, BN, EZ, GU, HT, IC, IP, IZ, KAR, KI, KN, MA, MU, SM, TU, YO, TRA (Özdikmen, 2011a).

***Plagionotus floralis* (Pallas, 1773)**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Bitlis:** Güroymak, 1651 m, 19.VI.2010; **Elazığ:** Kuruca pass (eastern slopes), 1700 m, 16.VI.2010; **Erzincan**: 9 Km E Kızıldağ pass, 2000 m., 14.VI.2010; **Hakkari**: 12 km N Bağışlı, 20.VI.2010; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2011; **Tokat**: Almuş, 28.VI.2010; **Tunceli**: 16 km south of Pülümür, 27.VI.2010; 15 km north of Pülümür, 15.VI.2010; 16 km N Kovancılar, 16.VI.2010; **Yozgat**: Ozan, 1300 m., 1300 m., 14.VI.2010.
Records in Turkey: very common everywhere in Turkey (Özdikmen, 2011a).

***Chlorophorus varius damascenus* (Chevrolat, 1854)**

Hakkari: Kolbaşı, 2000 m, 21.VI.2010, one specimen emerged ex larva from a dead stump of *Prunus* sp., 20.V.2011; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2011, one specimen on flowers; **Tunceli**: 16 km south of Pülümür, 27.VI.2010; one specimen on flowers.
Records in Turkey: The present subspecies is known to occur in southern provinces (Antalya, Adana, İçel and Osmaniye (Özdikmen, 2011a). **New records for Muş, Hakkari and Tunceli provinces.**

***Chlorophorus robustior* (Pic, 1900)**

Erzincan: Kızıldağı pass, 2190 m, 14.VI.2010. One specimen by sweeping on herbs.
Records in Turkey: AG, AM, BI, EZ, GU, KN, SN, TO (Özdikmen, 2007; Özdikmen & Turgut, 2009b). **A new record for Erzincan province.**

***Chlorophorus sartor* (O. F. Müller, 1766)**

Tokat: Almuş, 28.VI.2010.
Records in Turkey: AD, AM, AN, ANT, ART, AY, BI, BL, BR, BS, BU, CA, CN, DE, EL, ES, EZ, GA, GU, HT, IC, IP, IS, IZ, KA, KK, KN, KR, KS, KY, MG, MN, OS, RI, SM, SN, TE, YO, TRA (Özdikmen, 2011a). **A new record for Tokat province.**

***Chlorophorus wewalkai* Holzschuh, 1969**

Tunceli: 46 km N Tunceli, 27.VI.2010; 20 km S Pülümür, 1100 m., 8.VII.2005, I. Rapuzzi lgt. (Coll. P. Rapuzzi).
Records in Turkey: AN, TU (Özdikmen & Turgut, 2009b)

***Chlorophorus nivipictus* (Kraatz, 1879)**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Muş**: Buğlan pass, 1600 m, 16/27.VI.2010. Three specimens emerged ex larva from a dead stump of *Quercus* sp.; emergence 10.V.2011. Idem, 16/27.VI.2011, some specimens on flowers; **Tunceli**: 16 km south of Pülümür, 27.VI.2010.
Records in Turkey: BT (Koçak & Kemal, 2009); AD, ANT, IC, KN, NI, OS, VA (Özdikmen, 2011a). **New records for Bingöl, Muş and Tunceli provinces.**

***Isotomus syriacus* (Pic, 1902)**

Mersin: Çamlıyayla, 1300 m, 24.V.2011, five males specimens emerged ex pupa from dead stumps of *Ostrya sp.*; emergence on 15/23.VI.2011.
Records in Turkey: Apparently an endemic species from Turkey, described from "Syrie, Akbes (type locality) (currently in SE Turkey, Hatay) and recorded from Çamlıyayla (Mersin) (Sama, 1996).

***Dorcadion* (*Pedestredorcadion*) *scrobicolle scrobicolle* Kraatz, 1873**

Yozgat: Ozan, 1300 m, 14.VI.2010, remnants of one specimen.

Records in Turkey: AM, TO, YO (Özdikmen, 2010).

***Dorcadion* (*Pedestredorcadion*) *naciyeae* n. sp.**

Holotypus: Sivas: 20 km Est bivio Zara, 1680 m, 9.V.2011, leg. Nihal Mercan. This taxon will be described in a separate article.

***Dorcadion* (*Pedestredorcadion*) *nihalae* n. sp.**

Holotypus: Sivas: Beypinari, 1500/1600 m, 9.V.2011. This taxon will be described in a separate article.

***Dorcadion (Pedestredorcadion) urmianum* Plavilstshikov, 1937**

Hakkari: Kolbaşı, 2000 m, 21.VI.2010; three specimens walking on the ground.

Remark: A single female of this beatiful species, described from NW Iran, was previously known from Oramar (Sat Mt.) in Hakkari prov., collected on 15.VII.1974 by W. Heinz (Braun, 1975; Özdikmen, 2010).

***Dorcadion (Pedestredorcadion) infernale infernale* Mulsant & Rey, 1863**

Sivas: 20 km east of the crossroad to Zara, 1680 m, 9.V.2011; Beypınarı, 1500/1600 m, 9.V.2011.

Records in Turkey: AM, AN, ANT, BI, BL, BU, CO, DI, ES, IC, IZ, KA, KN, NI, SV, US (Özdikmen, 2010).

***Dorcadion* (*Pedestredorcadion*) *hellmanni* Ganglbauer, 1884**

Mardin: Hop pass, 1138 m, 14.V.2011, one dead specimen under stones; **Tunceli**: 15 km west of Ovacık, 1328 m, 11/18.V.2011, several adults sitting or walking on the ground. We know this species also from Buğlan pass (Muş).

Records in Turkey: Hakkari, Van (Özdikmen, 2010). **New records for Mardin, Tunceli and Muş provinces.**

***Dorcadion* (*Pedestredorcadion*) *dimidiatum dimidiatum* (Motschulsky, 1838)**

Erzincan: Kızıldağı pass, 2190 m, 14.VI.2010, one dead specimen under stones.

Records in Turkey: AG, ER, EZ, MA (Özdikmen, 2010).

***Dorcadion* (*Pedestredorcadion*) *dimidiatum korgei* Breuning, 1966**

Tunceli: 15 km N of Pülümür, 1873 m, 10.V.2011.

Records in Turkey: TU (Özdikmen, 2010).

***Dorcadion* (*Pedestredorcadion*) *nigrostriatum* Adlbauer, 1982**

Tunceli: 15 km west of Ovacık, 1328m, 11/18.V.2011, several adults sitting or walking on the ground.

Remarks: Endemic species to E Turkey, only known from the Tunceli province (Özdikmen, 2010).

***Dorcadion* (*Pedestredorcadion*) *scabricolle* (Dalman, 1817)**

Sivas: 20 km east of the crossroad to Zara, 1680 m, 9.V.2011; Beypınarı, 1500/1600 m, 9.V.2011; **Tunceli**: 15 km. north of Pülümür, 1873 m, 10.V.2011.

Records in Turkey: AD, AF, AG, AN, ANT, AR, BI, BL, BS, CO, ER, EZ, GU, IC, IP, KA, KAR, KN, KS, KY, MA, NI, SV, US, VA, YO (Özdikmen, 2010). **A new record for Tunceli province.**

***Dorcadion* (*Pedestredorcadion*) *oezdurali* Önalp, 1988**

Adıyaman: Nemrut Mt., 1700 m, 13.V.2011; a single female under a stone.

Records in Turkey: ADY, KA (Özdikmen, 2010).

***Dorcadion* (*Pedestredorcadion*) *kurdistanum* Breuning, 1944**

Adıyaman: Nemrut Mt., 1700 m, 13.V.2011; a single female under a stone.

Records in Turkey: BI, DI (Özdiknem, 2010). **A new record for Adıyaman province.**

***Dorcadion (Pedestredorcadion) sonjae* Peks, 1983**

Tunceli: 21 km south of Tunceli, 1050 m, 12.V.2011. Some adults under stones or walking on the ground.
Records in Turkey: Previously known from Elazığ prov.: Elmapınarı and Çaybağ (type locality). **A new record for Tunceli province.**

***Monochamus galloprovincialis* (Olivier, 1795)**

Tokat: Çamiçi north of Niksar, 1000 m, 28.VI.2010, ex larva from *Pinus sylvestris*, emergence 5.VI.2011.
Records in Turkey: AD, ANT, ART, AY, BO, BS, DE, IC, IP, KAR, KN, KR, KS, MG, OR, SN, TB (Özdikmen, 2011a). **A new record for Tokat province.**

***Agapanthia* (*Agapanthia*) *suturalis* (Fabricius, 1787)**

Erzincan: Kızıldağı pass, 2190 m, 14.VI.2010; **Hakkari**: 12 km north of Bağışlı, 1700 m, 20.VI.2010; **Hatay**: 4 km south of Şenköy, 834 m, 23.V.2011. Several specimens collected by sweeping herbaceous plants; **Malatya:** 10 km E Malatya, 20.V.2011; **Mersin**: Çamlıyayla, 1300 m, 24/26.V.2011; **Tunceli**: 14 km south of Tunceli, 1000 m, 12.V.2011; 15 km north of Pülümür, 15.VI.2010.
Records in Turkey: AD, AN, ANT, ART, AY, BI, BN, BS, BU, BY, CA, CN, DE, DI, ED, EL, ER, ES, EZ, GA, GU, HT, IC, IS, IZ, KA, KAR, KIR, KK, KL, KN, KO, KS, MG, MN, OS, RI, SI, SV, TRA (Özdikmen, 2011a). **New records for Malatya and Tunceli provinces.**

***Agapanthia* (*Agapanthia*) *violacea* (Fabricius, 1775)**

Erzincan: Kızıldağı pass, 2190 m., 14.VI.2010; 9 km E Kızıldağı pass, 2000 m., 14.VI.2010.
Records in Turkey: AD, AF, AK, AN, BI, BO, BS, CO, DE, DU, ED, EZ, GA, HAT, IC, IP, IS, IZ, KA, KIR, KK, KN, KO, KR, KS, KY, MG, MN, NE, NI, OS, SA, ZO, TRA (Özdikmen, 2011a). **A new record for Erzincan province.**

***Agapanthia* (*Agapanthia*) *pesarinii* Sama & Rapuzzi, 2010**

Erzincan: Kızıldağı pass, 2190 m, 14.VI.2010; **Mersin**: Çamlıyayla, 1300 m, 24/26.V.2011. Some adults sitting on leaves of *Psoralea bituminosa* L.; **Tunceli**: 14 km south of Tunceli, 1000 m, 12.V.2011, some adults sitting on leaves of *Psoralea bituminosa* L. and *Onobrychis* sp. (Fabaceae).
Remarks: This small blue or greenish *Agapanthia* has recently been described from Turkey and northern Syria and recorded from Mersin, Adana, Niğde, Tokat, Erzurum, Gaziantep and Kars provinces (Sama & Rapuzzi, 2010). It develops in living stems of *Psoralea bituminosa* L., *Onobrychis* sp., *Medicago* sp. (Fabaceae); from the Erzurum province it was recorded (under the name *Agapanthia erzurumensis* Önalp, 1974) as a pest of cultivated *Onobrychis sativa* (sanfoin). **New records for Erzincan and Tunceli provinces.**

***Agapanthia (Agapanthia*) n. sp.**

Holotypus: Erzincan: 12 km west of Refahiye, 1589 m, 13.VI.2010, some adults on *Onobrychis* sp.; idem, 9.V.2011, mature larvae and adults in pupal cell in dead stems of *Onobrychis* sp. Emergence 15/20.V.2011. This taxon will be described in a separate article.

***Agapanthia (Agapanthia*) *osmanlis* Reiche & Saulcy, 1858**

Sivas: 20 km east of the crossroad to Zara, 1680 m, 9.V.2011; ex larva from dead stems of *Cephalaria* sp. (Dipsacaceae). Emergence 30.V/6.VI.2011.
Records in Turkey: ART, BI, BY, ER, EZ, GU, HT, IS, KAR, SM, SV (Özdikmen, 2011a).

***Agapanthia (Agapanthia*) *cfr. osmanlis* Reiche & Saulcy, 1858**

Tunceli: 46 km north of Tunceli (road to Pülümür), 1050 m, 18.V.2011, larvae, pupae and immature adults in pupal cell in dead stems of *Cephalaria* sp. (Dipsacaceae). Emergence 28/30.V.2011. This taxon will be discussed in a separate article.

***Agapanthia* (*Epoptes*) *kirbyi* (Gyllenhal, 1817)**

Erzincan: 12 km west of the crossroad to Tunceli, 1150 m, 10.V.2011, adults on *Verbascum* sp.; Kızıldağı pass, 2190 m, 14.VI.2010; **Tunceli**: 40 km west of Tunceli (road to Ovacık),

1100m, 18.V.2011, ex pupa in dead stems of *Verbascum* sp.; 16 km south of Pülümür, 27.VI.2010; 15 km north of Pülümür, 15.VI.2010.
Records in Turkey: AG (Koçak & Kemal, 2009); AD, AF, AK, AM, AN, ANT, BI, BS, BT, BU, CO, ED, ER, ES, EZ, IC, IP, IZ, KA, KAR, KIR, KN, KO, KY, MN, NI, OS, SI, TO, VA, TRA (Özdikmen, 2011a). **A new record for Tunceli province.**

Agapanthia (*Epoptes*) *walteri* (Reitter, 1898)

Hakkari: 12 km north of Bağışlı, 1700 m, 20.VI.2010, several specimens sitting and mating on leaves and stems of big Apiaceae (*Prangos* sp. ?); **Tunceli**: 40 km west of Tunceli (road to Ovacik), 1100m, 18.V.2011.
Records in Turkey: AM, BN, EZ, HA, MR, TU (Özdikmen, 2007).
Remarks: The record from Hatay province (proposed by Fuchs & Breuning, 1971) is unreliable; according to Holzschuh (1980) it refers to *A. dahli* (Richter, 1820) which, however, appears also doubtful.

Agapanthia (*Epoptes*) *lateralis* Ganglbauer, 1884

Erzincan: Kızıldağı pass, 2190 m., 14.VI.2010; **Sivas**: 7 km east of the crossroad to Zara, 1680 m, 9.V.2011, several larvae in dead stems of an unidentified Carduaceae. Emergence 30.V/6.VI.2011.
Records in Turkey: AF, AG, AK, AM, AN, ANT, BI, BO, CA, CN, CO, ES, IC, IP, IS, IZ, KA, KIR, KM, KN, KR, KS, MG, MN, NE, NI, TE, TO, ZO, TRA (Özdikmen, 2011a). **New records for Erzincan and Sivas provinces.**

Agapanthia (*Epoptes*) *simplicicornis* Reitter, 1898

Erzincan: Tanyeri, 1250 m, 1.VI.1998, G. Sama & P. Rapuzzi leg. and coll.; **Tunceli**: 16 km south of Pülümür, 27.VI.2010; one female collected by sweeping unidentified herbaceous plants. We also known it from **Muş:** Buğlan pass, 11/17.VI.1973, leg. C. Holzschuh (G. Sama collection); 14.VI.1992, leg. S. Kadlec (P. Rapuzzi collection); idem, 12.VI.2004, A. Lason leg. and coll.
Records in Turkey: Mardin (type locality); Hakkari: Yüksekova (Fuchs & Breuning, 1971); Muş: Buğlan pass (Rejzek et al., 2003). **New records for Erzincan and Tunceli provinces.**
Remarks: This uncommon species develops in living stems of *Paeonia mascula* L. (Mill.) (M. Rejzek, pers. comm.).

Agapanthia (*Epoptes*) *coeruleipennis* Frivaldszky, 1878

Tunceli: 21 km south of Tunceli, 1050 m, 11 and 19.V.2011, common on its host plant *Gundelia tournefortii* L.. We also know it from **Bitlis**: 20 km NW Tatvan, 20.V.2001 (M. Rejzek leg. & coll.); **Hatay**: Akbés (Pic, 1893, as *A. brevis* Pic, 1891); Yayladağı, 10.IV.1991; Harbiye, 15.IV.1983, leg. Wellschmied (G. Sama collection); **Şanlıurfa:** Dutluca, 700 m, 14.IV.2004, leg. S. Ziani (G. Sama collection.
Records in Turkey: ADY, ANT, BN, EZ, HA, IC, IP, KA, KY, MA, MR, MU, TU (Özdikmen, 2011a). **New records for Bitlis, Hatay and Şanlıurfa provinces.**

Calamobius filum (Rossi, 1790)

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011, common on Graminaceae; **Tunceli**: 14 km south of Tunceli, 1000 m, 12.V.2011.
Records in Turkey: AD, AN, ANT, BO, BS, BU, CA, GA, HT, IC, IP, IS, IZ, KA, KL, KN, KO, MG, MN, OS, SA, TRA (Özdikmen, 2011a). **A new record for Tunceli province.**

Deroplia genei genei (Aragona, 1830)

Hatay: 4 km south of Şenköy, 834 m, 23.V.2011, a single specimen by beating from *Quercus* sp.; **Mersin:** Erdemli, Aydınlar, 6.VI.1996, M. Snižek lgt. (Coll. P. Rapuzzi).
Records in Turkey: İçel**:** north of Erdemli (Sama, 1996); Isparta: Eğirdir: Yukarı Gökdere, Kasnak forest (Sama et al., 2010). **A new record from Hatay province.**

Pogonocherus decoratus (Fairmaire, 1855)

Erzincan: 12 km west of Refahiye, 1589 m, 9.V.2011; one specimen reared from *Pinus* sp: emergence 10.VIII.2011.

Records in Turkey: Kastamonu: Ilgaz pass (Adlbauer, 1992); Yaralıgöz, 1000 m, ex larva from *Pinus* sp., 16/26.VII.1994, G. Sama leg. & coll.; Ankara: Soğuksu National Park (Kızılcahamam), 1000 m, 24.V.1967, leg. Wittmer (Muséum d'Histoire Naturelle de Genève). AN, BO, KS (Özdikmen, 2007). **A new record for Erzincan province.**

***Pogonocherus fasciculatus* (DeGeer, 1775)**

Tokat: Çamiçi north of Niksar, 1000 m, 26.VI.2010, few specimen emerged from *Pinus sylvestris*, emerged from 20.VIII.2010.
Records for Turkey: AM, KAR, KS, TB (Özdikmen, 2007). **A new record for Tokat province.**

***Pogonocherus* n. sp.**

Holotypus: Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011, three specimens reared from dead branches of *Pinus nigra*, emergence 25.VII.2011. This taxon will be described in a separate article.

***Exocentrus adspersus* Mulsant, 1846**

Hatay: Nurdağları, east of Dörtyol, 950 m, 21.V.2011, several specimens reared from dead branches of *Quercus* sp., emergence 28.V/20.VI.2011; **Tokat**: Çamiçi north of Niksar, 1000 m, 26.VI.2010, few specimen on *Quercus* sp. or emerged from branches of the same plant. We also know it from **Antalya**: Gündoğmuş; Side (R. Pettersson leg. & coll.); Alanya env., VI.1969 (P. Schurmann leg. & coll.); Alanya Yayla, VI.1988 (P. Schurmann leg. & coll.); Çakıllı pass, ex larva from *Quercus* sp., 15/25.V.1994, V/VI.1996 (G. Sama leg. & coll.); Yarpuz, ex larva from *Quercus* sp. (S. Lundberg leg. & coll.); **Tokat**: Almus, 1050-1300 m, 19/29.VI.1994 (G. Sama leg. & coll.)); 11 km north of of Niksar NE Tokat, 28.V.2001 (M.Rejzek leg. & coll.)).
Records in Turkey: IS, KA, KO, TRA (Özdikmen, 2007). **New records from Antalya, Hatay and Tokat provinces.**

Leiopus sp.

Tunceli: 46 km north of Tunceli (road to Pülümür), 1050 m, 18.V.2011, several larvae, pupae and immature adults in pupal cell in dead trunks and big branches of *Juglans regia* L. Emergence 28.V.-145.VI.2011. This taxon will be discussed in a separate article.

***Leiopus syriacus tauricus* Sama & Rapuzzi, 2010**

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011; emerged from dead branches of *Ficus carica*. The present subspecies (known from the Taurus mountain range, from Antalya to Mersin) has recently been separated from *L. syriacus syriacus* (Ganglbauer, 1884), described from Lebanon (type locality) and recorded from SE Turkey: Akbes (as *L. major* Pic, 1898), Syria and Israel (Sama & Rapuzzi, 2010).

***Saperda scalaris scalaris* (Linnaeus, 1758)**

Tunceli: 46 km north of Tunceli (road to Pülümür), 1050 m, 10/18.V.2011, several larvae, pupae and immature adults in pupal cell in dead trunks and big branches of *Juglans regia* L. Emergence 25.V/15.VI.2011. We also know it from **Erzurum**: 10 km east of Ispir, 1400 m, 3.VII, leg. Moberg (S. Lundberg collection).
Records in Turkey: AM, ART, IS, TB, TRA (Özdikmen, 2011a). **New records for Erzurum and Tunceli provinces.**

***Oberea (Amaurostoma) erythrocephala erythrocephala* (Schrank, 1776)**

Erzincan: Kızıldağı pass, 2190 m, 14.VI.2010; **Tunceli**: 15 km north of Pülümür, 15.VI.2010.
Records in Turkey: AF, AM, AN, ANT, ART, BY, CO, ER, EZ, GU, IS, KA, KAR, KN, KO, KS, NI, OS, SV, VA, TRA (Özdikmen, 2011a). **A new record for Tunceli province.**

***Coptosia (Coptosia) bithynensis* (Ganglbauer, 1884)**

Sivas: Beypınarı, 1500 m, 9.V.2011; **Erzincan:** 9 km E Kızıldağı pass, 2000 m., 14.VI.2010; **Tunceli**: 15 km north of Pülümür, 1873 m, 15.VI.2010, two specimens under the basal leaves of *Echium* sp.

Records in Turkey: AD, ADY, ANT, BI, BS, DI, EL, EZ, HT, IC, IP, IZ, MU, OS (Özdikmen, 2011a). **New records for Erzincan, Sivas and Tunceli provinces.**

Coptosia compacta **(Ménétriés, 1832) n. ssp. or n. sp. (?)**

Van: Güzeldere pass, 2700 m, 20.VI.2010. A small series of specimens found under the basal leaves of *Solenanthus cincinnatus* Ledeb. (?) (Boraginaceae).
Records in Turkey: *Coptosia compacta* is recorded in Turkey from ADY, BT, EZ, KAR, MA, TO (Özdikmen, 2007). The true identification of specimens from Güzeldere pass will be discussed in a separate article. The correct identification of the population from Adıyaman province (Nemrut Mt.) needs verification.

Semnosia scovitzi **(Faldermann, 1837)**

Tunceli: 15 km north of Pülümür, 1873 m, 15.VI.2010. A few specimens on *Prangos* sp.
Records in Turkey: BT, EZ, HA, KAR, MA, VA (Özdikmen, 2007). **A new record for Tunceli province.**
Remark. The Catalogue of Löbl & Smetana (2010) does not list this species from Turkey. This is an obvious mistake. The true distribution of this species in Turkey needs verification.

Micromallosia heinzorum **(Holzschuh, 1991)**

Tunceli: 21 km south of Tunceli, 1050 m, 12.V.2011. Remnants of some specimens under a stone, killed by *Steatoda paykulliana* (Walckenaer, 1805) (Araneae, Theridiidae).
Records in Turkey: Bingöl: "Westl. Bingöl, Yolçatı, m.1300", 18 e 28.IV.1981 (Holzschuh, 1991, type locality); **Tunceli:** Munzur-Valley Nat. Park, 1000/1400, 23/27.VIII.88 (Holzschuh, 1991, type locality); we know it also from **Elazığ:** Gözeli 40 km SW Elazığ (vill. Sakabaşı near Gözeli). **A new record for Elazığ province.**

Oxylia argentata argentata **(Ménétriés, 1832)**

Bingöl: 30/36 km east of Bingöl, 16/27.VI.2010; **Tunceli**: 14 km south of Tunceli, 1000 m, 12.V.2011; 15 km north of Pülümür, 15.VI.2010, single adults sitting on *Echium* sp.
Records in Turkey: ADY, AG, AN, ANT, ART, BT, BY, CO, DI, EL, ER, EZ, GI, GU, HT, IC, IP, IZ, KAR, KI, KN, KS, NI, SI, SN, YO (Özdikmen, 2011a). **New records for Bingöl and Tunceli provinces.**

Opsilia coerulescens **(Scopoli, 1763)**

Erzincan: 12 km west of the crossroad to Tunceli, 1150 m, 10.V.2011; Kızıldağı pass, 2190 m., 14.VI.2010 **Mersin**: Çamlıyayla, 1300 m, 24/26.V.2011; **Tunceli**: 14 km south of Tunceli, 1000 m, 12.V.2011.
Remarks: Very common and widespread throughout Turkey.

Musaria puncticollis **(Faldermann, 1837)**

Erzincan: 12 km west of the crossroad to Tunceli, 1150 m, 10.V.2011; **Tunceli**: 21 km south of Tunceli, 1050 m, 19.V.2011; 15 km west of Ovacık, 1328m, 11/18.V.2011; **Hakkari**: Kolbaşı, 2000 m, 21.VI.2010; 5, 7 km east of the crossroad to Çukurca, 22.VI.2010; 12 km N Bağışlı, 20.VI.2010. Adults are usually found on *Eryngium* sp. or walking on the ground close to this plant.
Records in Turkey: BN, BT, DI, ER, EZ, HA, MA, VA, TU (Özdikmen, 2007; Özdikmen & Turgut, 2007).

Musaria astarte lederi **(Pic, 1899)**

Hakkari: Dilezi pass east of Yüksekova, 2017 m, 20.VI.2010; 12 km north of Bağışlı, 1700 m, 20.VI.2010; Kolbaşı, 2000 m, 21.VI.2010; **Tunceli**: 15 km north of Pülümür, 1873 m, 15.VI.2010. Everywhere rather common on *Cirsium* sp.; **Van**: Kurubaş pass, 2225 m., 19.VI.2010; Güzeldere pass, 2700 m., 20.VI.2010.
We also know it from **Kars**: Sarıkamış, 2000 m, 21.VI.94; 23/27.VII.2002; 10 km. SW Sarıkamış, 23/27.VII.2002 (G. Sama & P. Rapuzzi leg. & coll.); **Niğde**: Ulukışla, 18/21.VI.1964, leg. Seidenstucker (P. Schurmann leg. & coll.); **Ağrı**: 18 km south-east of Patnos, 25.VII.2002 (G. Sama leg. & coll.).
Records in Turkey: VA (Koçak & Kemal, 2009), ADY, NI (Özdikmen & Turgut, 2007). **New records for Hakkari, Tunceli, Kars and Ağrı provinces.**

***Musaria kurdistana* (Ganglbauer, 1884)**

Hakkari: 12 km north of Bağışlı, 1700 m, 20.VI.2010; Kolbaşı, 2000 m, 21.VI.2010; **Elazığ**: Kuruca pass, 10-15.VII.2011, I. Rapuzzi lgt. (Coll. P. Rapuzzi).

Records in Turkey: Bitlis: "Bitlis" (Muséum d'Histoire Naturelle, Genève, Holotypus of *M. kurdistana m. bitlisiensis* Breuning, 1947); **Van:** Çatak: Karadana 2000 m, 18.VI.2009 (Koçak & Kemal, 2009). We also know it from **Hakkari:** Hakkari Mts., 1800 m, 16/18.VI.1997, leg. P. Kábatek; Şemdinli, VI.1976, 1500 m, leg. Schubert; 20 km west of Yüksekova, 1800 m, 18.VI.1988, leg. Barries & Cate; **Muş**: Buğlan pass, 1600 m,, 21-26.VI.2002 (all in P. Rapuzzi & G. Sama collection). **New records for Elazığ, Hakkari and Muş provinces.**

***Semiangusta katarinae* (Holzschuh, 1974) comb. nov.**

Tunceli: 40 km west of Tunceli (road to Ovacık), 1100m, 18.V.2011, adults on unidentified Lamiaceae (very likely *Scutellaria* sp., *S. altissima* L. ?).

Records in Turkey: This interesting species was previously known only from the localities listed in the original description: Muş**:** Buglan pass, 1600 m, 11/17.VI.1973, 21/23.VI.1972 and Bingöl**:** 35 km east of Bingöl, 1500 m, 10.VI.1973 (Holzschuh, 1974). **A new record for Tunceli province.**

***Pilemia hirsutula hirsutula* (Frölich, 1793)**

Şırnak: Meşindağı pass, 1300/1600 m, 15/16.V.2011; **Tunceli**: 40 km west of Tunceli (road to Ovacik), 1100 m, 18.V.2011, adults on unidentified herbs; 15 km west of Ovacık, 1328 m, 11/18.V.2011, one specimen flying.

Records in Turkey: ADY, AF, ANT, BI, BY, EZ, HA, IC, IP, IZ, KAR, KN, OS (Özdikmen, 2007). **New records for Şırnak and Tunceli provinces.**

***Neomusaria merkli* (Ganglbauer, 1884)**

Tunceli: 16 km south of Pülümür, 27.VI.2010, one specimen by sweeping unidentified herbs.

Records in Turkey: AD, ADY, AM, AN, ES, IC, KN, NI, OS, TRA (Özdikmen, 2011a). **A new record for Tunceli province.**

***Helladia humeralis* (Waltl, 1838)**

Hatay: 4 km south of Şenköy, 834 m, 23.V.2011, one specimen collected by sweeping herbaceous plants; **Yozgat**: Sekeli, 8.VII.2011, some specimens on unidentified thistles; **Malatya:** Reşadiye pass, 1510 m., 20.V.2011; **Mersin**: Çamlıyayla, 1300 m, 24/26.V.2011; **Siirt**: 7 km SE Eruh, 1400 m, 16.V.2011.

Records in Turkey: AD, ADY, AK, AM, AN, ANT, AY, BU, DE, DI, ED, ES, HA, HT, IC, IP, IZ, KA, KN, MN, NI, OS, US (Özdikmen, 2007). **New records for Malatya, Siirt and Yozgat provinces.**

***Helladia pretiosa pretiosa* (Faldermann, 1837)**

Mardin: 6 km east of Arıçlı, 1000 m, 14.V.2011, two specimens sitting on *Onopordon* sp.; **Şirnak**: Meşindağı pass, 1300/1600 m, 15/16.V.2011, some specimens sitting on leaves and stems of *Onopordon* sp.

Records in Turkey: Erzurum: "Erzerum" (Breuning, 1947, as H. *pretiosa m. basiimmaculata*) (type material in coll. Breuning, Muséum d'Histoire Naturelle de Genève, examined by G. Sama); Batman, Mardin, Şanlıurfa, Siirt (Rejzek et al., 2003; Özdikmen & al., 2005; Sama & al., 2007; Özdikmen & Turgut, 2010). **A new record for Şırnak province.**

Remark. This beautiful species develops in living stems and roots of Asteraceae such as *Onopordon carduchorum* Bornm. et Beauverd, *Serratula oligocephala* DC. and *Centaurea* sp. (Rejzek & al., 2003).

***Helladia praetextata praetextata* (Steven, 1817)**

Erzincan: Kızıldağı pass, 2190 m, 14.VI.2010, one specimen by sweeping.

Records in Turkey: AN, BY, DU, EZ, GU, KS, SV, ZO (Özdikmen & Turgut, 2010). **A new record for Erzincan province.**

Helladia praetextata nigricollis (Pic, 1891)

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011, several adults by sweeping on *Lapsana communis* L. (Asteraceae).
Records in Turkey: The nominotypical subspecies, described from Crimea, is chiefly distributed, in Turkey, in central and northen provinces from Düzce to Erzurum; the present subspecies, described from Akbes (Hatay), is recorded from the south-eastern mountains from Adana to Hatay provinces (Özdikmen & Turgut, 2010).

Helladia millefolii (Adams, 1817)

Muş: Buğlan geçidi, 1600 m, 17.V.2011; **Van**: Kurubas geç., 2225 m., 19.VI.2010.
Records for Turkey: ANT, ADY, KO, EZ, IS, KAR, KN, KS (Özdikmen & Turgut, 2010). **New records for Muş and Van provinces.**

Phytoecia cylindrica (Linnaeus, 1758)

Tunceli: 40 km north of Tunceli (road to Pülümür), 19.V.2011, three specimens by sweeping herbaceous plants.
We also know this species from Kars: 14 km south of Sarıkamış, 7/8.VI.1998, leg. P. Rapuzzi; **Izmir**: Ephesus, VI.1961, leg. P. Schurmann; Istanbul: "Bosporus", V.1961.
Records in Turkey: AN, IS, IZ, KA, KO, KS, KY, NI, TRA (Özdikmen & 2011a). **A new record for Tunceli province.**
Remark: All specimens we know from Turkey are somewhat different from the true *P. cylindrica* from Europe. Pic (1891) described *P. cylindrica v. grandis* based on larger specimens from "Syria" (in fact Akbes in SE Turkey). The true identity of Turkish populations needs verification.

Phytoecia pustulata pustulata (Schrank, 1776)

Sivas: Beypınarı, 1500/1600 m, 9.V.2011, one specimen under a stone.
Records in Turkey: AD (Adlbauer, 1988); AN (Breuning & Villiers, 1967); AM, BI, BO, DU, KA, KN, OS, SM, TRA (Özdikmen, 2007 and 2011a). We also know it from **Burdur** Burdur (Frey coll., Naturhistorisches Museum, Basel), **Gümüshane**: Kelkit, Km 6 east, road to Siran, 1400 m., 14.VI.2009 (F. Angelini leg. & coll.); **Istanbul:** Alem dagh, V.1973 (P. Schurmann leg. & coll.); **Kars**: 14 Km. south of Sarikamiş, 2000 m., 7-8.VI.1998 (P. Rapuzzi & G. Sama leg. & coll.); **Muğla:** Muğla, 22.V.1969, leg. F. Ressl (P. Schurmann coll.). **New records for Burdur, Gümüshane, Istanbul, Kars, Mugla and Sivas provinces.**

Phytoecia virgula (Charpentier, 1825)

Erzincan: Kızıldağı pass, 2190 m, 14.VI.2010; **Tunceli**: 40 km west of Tunceli (road to Ovacik), 1100m, 18.V.2011, adults on wing or sitting on thistles; **Van**: Kurubaş pass, 2225 m., 19.VI.2010.
Records in Turkey: Afyon: (Demelt, 1963), ADY, AK, AM, AN, BI, BN, BO, BR, BU, DE, ER, ES, EZ, HT, IP, IS, IZ, KA, KAR, KN, KR, KS, MN, NI, OS, TRA (Özdikmen, 2007 and 2011a).
We also know it from **Adana**; Nurdagi geçidi above Fevzipasa, 16.V.1997 (G. Sama leg. & coll.); **Bayburt**: Bayburt, 5-8 Km NW road to Gümüshane, 13.VI.2009 (F. Angelini leg. & coll.); **Gümüshane:** Gümüshane (P. Rapuzzi coll.); **Kütahya**: 15 km from Kütahya, 27.V.81 (G. Sama coll.); **Nevsehir**: Ürgüp, VI.1983 (P. Schurmann coll.); Göreme, 12.VI.83 (!); **Samsun:** Karadag, 11.VII.1976, leg. M. Bologna (G. Sama coll.). **New records for Bayburt, Gümüshane, Kütahya, Nevsehir, Samsun, Tunceli and Van provinces.**

Phytoecia croceipes Reiche & Saulcy, 1858

Mardin: 6 km east of Arıçlı, 1000 m, 14.V.2011; **Hatay**: 4 km south of Şenköy, 834 m, 23.V.2011, several specimens collected by sweeping herbaceous plants; **Mersin**: Çamlıyayla, 1300 m, 24/26.V.2011, two specimens by sweeping; **Tunceli**: 14 km south of Tunceli, 1000 m, 12.V.2011.
Records in Turkey: AD, DI, HT, IZ, KN, NI, OS (Özdikmen, 2008a and 2011a). **New records for Içel and Tunceli provinces.**

Phytoecia geniculata Mulsant, 1862

Hatay: 4 km south of Şenköy, 834 m, 23.V.2011, several specimens collected by sweeping herbaceous plants; **Siirt:** 10 km N Meşindağı pass, 16.V.2011.
Records in Turkey: AD, AN, ANT, AY, BI, BS, BU, DE, ED, GA, HT, IC, IS, IZ, KA, KS, MN, OS, TRA (Özdikmen, 2007 and 2011a). We also know it from **Afyon:** Afyon, 27.V.1981(G. Sama leg. & coll.); **Balıkesir**: Karaman 7 km east of Balikesir, 7.V.2001 (M. Rejzek leg. & coll.). **New records for Afyon, Balıkesir and Siirt provinces.**

Phytoecia pubescens Pic, 1895

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011, several adults collected by sweeping unidentified herbaceous plants.
Records in Turkey: AM, AN, KO (Özdikmen, 2007) and AD, AM, AN, DI, EZ, HT, IS, KO (Özdikmen, 2011a).
Due to the confusion between this taxon and *Phytoecia manicata* Reiche & Saulcy, 1858, old records must be regarded as doubtful, or even wrong, This question was partly explained by Danilevsky (1993), who, however, did not solved all problems. According to this author, "*P. manicata* is known only from Syria and neighbour territories"; this is not correct, because *P. manicata* was certainly collected in Bulgaria: Primorsko, 13.V.1983, leg. O. Odvarka (4 specimens) and also in Turkey: Termessos, 20.V.1969, leg. F. Ressl, 1 specimen (all in G. Sama coll.). Furthermore it is recorded from Osmaniye and Hatay provinces (Özdikmen, Güven & Gören, 2010). We know checked records of *P. pubescens* for the following Turkish provinces: **Adana, Amasya, Ankara, Erzurum, Hatay, Izmir, Kars, Mersin, Nigde, Tekirdağ, Tracia**.

Phytoecia caerulea caerulea (Scopoli, 1772)

Mersin: Çamlıyayla, 1300 m, 24/26.V.2011, common on Cruciferae.
Records in Turkey (P. Rapuzzi & G. Sama collections): Aksaray, Antalya, Amasya, Erzincan, Erzurum, Hatay, Mersin, Nigde, Sinop, Samsun, Tekirdag, Manisa. The species was recorded by Özdikmen (2007) from AD, AF, AK, AN, ANT, AY, BI, BO, BU, DE, DU, ES, EZ, GA, HT, IC, IP, IS, IZ, KA, KM, KN, KR, KS, KU, KY, MG, MN, NE, NI, OS, SM, SV, YO, TRA in Turkey. **New records for Erzincan, Sinop and Tekirdağ provinces.**

Phytoecia caerulea baccueti (Brullé, 1832)

Yozgat: Sekeli, 8.VII.2011, some specimens on unidentified Cruciferae.
Records in Turkey (P. Rapuzzi & G. Sama collections): Afyon, Amasya, Antalya, Bilecik, Bursa, Burdur, Denizli, Isparta, Istanbul, Izmir, Kırşehir, Konya, Kütahya, Nevşehir, Tekirdağ, Kırıkkale, Istanbul, Ankara.
Remark: As written by Pesarini & Sabbadini (2007) the subspecific rank of *Phytoecia caerulea baccueti* (Brullé, 1832) seems to be confirmed, both concerning the Greek and Turkish fauna. Almost all specimens from Peloponnese (southern Greece) and from western Turkey belong to the subspecies *baccueti* while the nominotypical subspecies occurs in continental Greece and in northern and southern Turkey. **New records for Bursa, Kırıkkale and Tekirdağ provinces.**

Phytoecia (Blepisanis) vittipennis vittipennis Reiche, 1877

Erzincan: Kızıldağı pass, 2190 m, 14.VI.2010. One specimen by sweeping on herbs.
Records in Turkey: AD, ADY, AN, ANT, BU, DE, ER, EZ, IZ, KA, KN, MN, NI, OS, YO (Özdikmen, 2011a).

Tetrops praeustus praeustus (Linnaeus, 1758)

Hatay: 4 km south of Şenköy, 834 m, 23.V.2011, several specimens by beating from *Prunus* sp.
Remark. The collected specimens are very variable in color of legs and elytrae: fore legs are entirely light or with the base of femora blackened; intermediate and hind legs usually have femora and tibiae blackish, rarely entirely light. Elytra are totally light or with a black apical spot. Özdikmen & Turgut (2008), describing a new subspecies from Turkey (*Tetrops praeustus anatolicus* ssp. n.) referred to it six specimens from Zorkun (Osmaniye), not far from Hatay province. The population from Şenköy cannot be separated from the nominotypical subspecies. This area (Nurdağları) may be an hybridization area for the

subspecies as an overlapping area of the populations of both subspecies. Anyway, **Hatay is the first record for the species.**
Records in Turkey: AN, ANT, BI, CO, IS, NI, SA, SM, SN, TRA (Özdikmen, 2007 and 2011a).

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A NEW SUBSPECIES OF *DORCADION* (S. STR.) *GLICYRRHIZAE* (PALLAS, 1773) (COLEOPTERA: CERAMBYCIDAE) FROM WEST KAZAKHSTAN

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[Danilevsky, M. L. 2012. A new subspecies of *Dorcadion* (s. str.) *glicyrrhizae* (Pallas, 1773) (Coleoptera: Cerambycidae) from West Kazakhstan. Munis Entomology & Zoology, 7 (1): 46-50**]**

ABSTRACT. One more new subspecies of *Dorcadion* (s. str.) *glicyrrhizae* (Pallas, 1773) was recently discovered in West Kazakhstan. The new taxon occupies a very special landscape – large dry cretaceous mountain system Aktolagay (Figs 9-10) with purely white soil.

KEY WORDS: Coleoptera, Cerambycidae, *Dorcadion*, new subspecies, Kazakhstan.

Dorcadion (s. str.) *glicyrrhizae chuvilini* ssp. n.

(Figs. 1-8)

Description (Figs. 1-4). Body big, black, with red legs and 1st antennal joint, white stripes well developed, wide and bright; female androchromal.

Frons black; male antennae reaching posterior elytral fifth or seventh; 2nd antennal joint can be also as red as 1st, 1st joint can be slightly darkened apically; prothorax with long lateral spines curved posteriorly; hind pronotal width less than its anterior width; pronotal white stripe moderately wide, about as wide as elytral sutural stripe; elytra regularly oval, widest near middle, in males bout 2 times longer than middle width, in female – in 1.7 times; humeral and dorsal elytral carinae well developed, both can be with rough sculpture; marginal elytral white stripe very wide, covering about whole curved margin, with irregular borders; humeral stripe wide, wider than interval between humeral and dorsal stripe, with several scattered black dots, which are rather numerous in female; external stripe moderately wide or narrow, about as wide as sutural stripe or much narrower, always narrower than interval between humeral and dorsal stripe, many times interrupted with black dots; internal dorsal stripe totally absent; sutural stripe relatively wide; ventral body pubescence partly consists of dense white recumbent setae, including wide white lateral areas of abdominal segments; body length in males: 20-24 mm, width: 6.8-8.0 mm; body length in female: 22 mm, width: 8.5 mm.

Another available series (Figs. 5-8) of *Dorcadion* is allegedly collected from about closely situated locality, but 12 years later by another collectors. I also provisionally identify this series as *D. g. chuvilini* ssp. n., but don't include in the type series, as it looks as another subspecies. All specimens (in very bad condition) are distinctly smaller with relatively lager prothorax, with sometimes shortened lateral spines; 1st antennal joint widely black apically, as well as distal parts of all femora, one female with totally black 1st antennal joint; elytral carinae smooth; white elytral stripes with much more numerous black spots, dorsal elytral stripe very narrow, can be about totally absent (Fig. 7); body length in males: 18-22 mm, width: 6.0-6.8 mm; body length in females: 20-21 mm, width: 7.9-8.0 mm.

Remark. All subspecies of *D. glicyrrhizae*, surrounding Aktolagay Mountains, are connected with sandy soils or even sandy dunes, and so also have well developed white pubescence. The nearest northern populations belong to *D. g. uvarovi* Suvorov, 1911, distributed in sands along main road Aktiubinsk – Atyrau (about 120km northwards Aktolagay) from about Temir to Zharly. *D. g. uvarovi* is a small subspecies with usually narrow dorsal elytral stripe in males and with typical very wide autochromal females. A single known male of *D.g. fedorenkoi* Danilevsky, 2001 described from Emba environs (about 260km north-eastwards Aktolagay) is very big (22.5 mm) and wide, with wide dorsal stripe many times interrupted. Numerous populations of *D. g. androsovi* Suvorov, 1909 distributead in sands around north and north-east borders of Aral Sea (about 300km eastwards Aktolagay) is the biggest subspecies of *D. glicyrrhizae* (to 27 mm) with maximal width of pronotal and humeral white stripes.

Type materials. Holotype, male, West Kazakhstan, Aktolagay Mts., about 80km southwards Sagiz, 30.5.- 2.6.1998, A. Chuvilin leg. – author's collection; paratypers: 2 males with same label – author's collection; 1 male and 1 female with same label - collection of A. Romanenko (Tula).

Additional materials. 2 males, West Kazakhstan, Aktolagay Mts., 40 km NW Miyaly, 209 m, 47°30'N, 55°07'E, 17.5.2010, P.Gorbunov leg. - author's collection; 6 males, 2 females, Aktolagay Mts., 40 km NW Miyaly, 47°27'24.1''N, 55°06'45.9''E, 16.5.2010, A. Ivanov leg. - author's collection.

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Figures 1-4. *Dorcadion glicyrrhizae chuvilini*, ssp. n., type series: 1 – male, holotype, 2-3 – males, paratypes, 4 – female, paratype.

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Figures 5-8. *Dorcadion glicyrrhizae chuvilini*, ssp. n., not paratype series collected later: 5-7 – males, 8 – female.

Figure 9. Aktolagay Mts., locality of type series (photo by A. Chuvilin).

Figure 10. Aktolagay Mts., locality of additional series (photo by P. Gorbunov).

NAKED LISTS OF TURKISH CERAMBYCOIDEA AND CHRYSOMELOIDEA (COLEOPTERA)

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[Özdikmen, H. 2012. Naked lists of Turkish Cerambycoidea and Chrysomeloidea (Coleoptera). Munis Entomology & Zoology, 7 (1): 51-108**]**

ABSTRACT: The paper gives faunistical lists of the Turkish Cerambycoidea and Chrysomeloidea. Subfamilies of Cerambycidae and Chrysomelidae are reorganized in the text.

KEY WORDS: Cerambycoidea, Chrysomeloidea, Coleoptera, Fauna, Turkey.

In general, many authors for this important animal group prefer to be used a single superfamily name as Chrysomeloidea Latreille, 1802. The superfamily Chrysomeloidea is considered to comprise Vesperidae, Oxypeltidae, Disteniidae, Cerambycidae, Megalopodidae, Orsodacnidae and Chrysomelidae (Lawrence et al. 1999). However, Löbl & Smetana (2010) stated four families as Cerambycidae (incl. Vesperinae, Disteniinae), Megalopodidae, Orsodacnidae and Chrysomelidae in the Palaearctic catalogue of Chrysomeloidea. In accordance to this, Bouchard et al. (2011) in the lastest catalogue were used only superfamily Chrysomeloidea Latreille, 1802 instead of two superfamilies Cerambycoidea Latreille, 1802 and Chrysomeloidea Latreille, 1802 for this group. However, the great morphological diversity of beetles has led to the proliferation of suprageneric taxa at various ranks. Reid (1995) stated that "*The Chrysomeloidea are resolved as two groups of taxa: the "cerambycid and "chrysomelid" lineages*. So I prefer to use 2 names for superfamily levels of this group as CERAMBYCOIDEA Latreille, 1802 and CHRYSOMELOIDEA Latreille, 1802 now.

In accordance with the case, the superfamily CERAMBYCOIDEA Latreille, 1802 includes currently 4 families as Cerambycidae Latreille, 1802; Disteniidae Thomson, 1861;Oxypeltidae Lacordaire, 1868 and Vesperidae Mulsant, 1839 [Švácha and Danilevsky (1987: 17) recognized Vesperinae, Oxypeltinae and Disteniinae at the family level, and later Švácha et al. (1997: 361) placed Anoplodermatinae and Philinae as subfamilies of Vesperidae; although the classification is based primarily on larval characters, it is also supported by adult features, as pointed out by Švácha et al. (1997), as well as by some earlier workers]. The families Cerambycidae Latreille, 1802 and Vesperidae Mulsant, 1839 are represented in Turkey. The superfamily consist of the family-group taxa (274 tribes of 15 subfamilies of 4 families). Consequently, Turkish CERAMBYCOIDEA includes a total of 800 taxa (699 species and 101 subspecies belonging to 130 genera of 56 tribes of 12 subfamilies of 2 families). The ratio of endemism is approximately 40 % for Turkey (see the following list).

SUPERFAMILY CERAMBYCOIDEA Latreille, 1802

2 families, 12 subfamilies, 56 tribes, 130 genera, 699 species (136 subspecies), 101 subspecies

FAMILY VESPERIDAE Mulsant, 1839: 214

1 subfamily, 1 tribe, 1 genus, 1 species

FAMILY CERAMBYCIDAE Latreille, 1802: 211
11 subfamilies, 55 tribes, 129 genera, 698 species (136 subspecies), 101 subspecies

SUBFAMILY PRIONINAE Latreille, 1802: 212
5 tribes, 7 genera, 12 species (2 subspecies)
SUBFAMILY LEPTURINAE Latreille, 1802: 218
6 tribes, 30 genera, 129 species (30 subspecies), 23 subspecies
SUBFAMILY NECYDALINAE Latreille, 1825: 401
1 tribe, 1 genus, 2 species
SUBFAMILY ASEMINAE Thomson, 1861: 139
2 tribes, 4 genera, 8 species
SUBFAMILY SAPHANINAE Gistel, 1848: [1]
2 tribes, 4 genera, 4 species (2 subspecies), 1 subspecies
SUBFAMILY SPONDYLIDINAE Audinet-Serville, 1832: 123
1 tribe, 1 genus, 1 species
SUBFAMILY DORCASOMINAE Lacordaire, 1868: 456
1 tribe, 1 genus, 4 species
SUBFAMILY CERAMBYCINAE Latreille, 1802: 211
16 tribes, 40 genera, 134 species (32 subspecies), 14 subspecies
SUBFAMILY STENOPTERINAE Gistel, 1848: [9] (unnumbered section)
5 tribes, 6 genera, 21 species (5 subspecies), 2 subspecies
SUBFAMILY DORCADIONINAE Swainson, 1840: 290
1 tribe, 2 genera, 194 species (32 subspecies), 41 subspecies
SUBFAMILY LAMIINAE Latreille, 1825: 401
15 tribes, 33 genera, 190 species (34 subspecies), 20 subspecies

On the other side, subfamilies of Cerambycidae are reorganized with the present work. In this manner, the subfamily Spondylidinae which has been accepted as a single subfamily commonly, is divided into 3 subfamilies as Aseminae Thomson, 1861: 139, Saphaninae Gistel, 1848: [1] and Spondylidinae Audinet-Serville, 1832: 123. Likewise, the subfamilies Cerambycinae and Lamiinae which have also been accepted as a single subfamily each of them commonly, are divided into 2 subfamilies each one as Cerambycinae Latreille, 1802: 211 and Stenopterinae Gistel, 1848: [9] (unnumbered section) for Cerambycinae, and Lamiinae Latreille, 1825: 401 and Dorcadioninae Swainson, 1840: 290 for Lamiinae respectively.

With respect to this reorganization:

Subfamily ASEMINAE Thomson, 1861

Asemitae Thomson, 1861: 139 (key), 259 [Type gen.: *Asemum* Eschscholtz, 1830. Type sp.: *Cerambyx striatus* Linnaeus, 1758 designated by Westwood, 1838: 40]

Synonyms.

- Criomorphates Mulsant, 1862: 79, 115 (based on *Criomorphus* Mulsant, 1839). Nomen nudum.
- Criocéphalites Fairmaire, 1864: 125, 192 (based on *Criocephalus* Mulsant, 1839). Nomen nudum.
- Tetropiina Seidlitz, 1891: 179 [Type gen.: *Tetropium* Kirby, 1837. Type sp.: *Callidium cinnamopterum* Kirby, 1837 (see ICZN 1988: 71).
- Criocephalinae Sharp, 1905: 147 [Type gen.: *Criocephalus* Mulsant, 1839. Type sp.: *Cerambyx rusticus* Linnaeus, 1758 by monotypy]
- Criomorphini Portevin, 1927: 36 [Type gen.: *Criomorphus* Mulsant, 1839 (junior homonym of *Criomorphus* Curtis, 1831 in Hemiptera. Type sp.: *Callidium aulicum* Fabricius, 1775 by monotypy]

Original discription:

ASEMITAE

Frons convexa; oculi transversi, elongati, intus vix lunulati, aliq. divisi; antennae oculis paulo séparatae, ante illos insertae, brèves; palpi apice dilatati; mandibulae intégrae, subacutae; prolhorax subglobosus, later, inermis; sterna mutica; coxoe anticae; globosae, aut quasi subtransversae; acetabula antica intégra, extus valde angulata; femora paulo clavata.

Diagnostic characters: Sides of pronotum regularly arched from anterior to posterior margin without any type of tooth. Antennae moderately long, exceed the base of pronotum with cylindrical segments.

The subfamily Aseminae Thomson, 1861 includes 3 tribes worldwide.

- Tribe Asemini Thomson, 1861

The tribe has 9 genera as *Arhopalus* Audinet-Serville, 1834; *Asemum* Eschscholtz, 1830; *Atripatus* Fairmaire, 1902; *Hypostilbus* Brancsik, 1898; *Macrocaulus* Fairmaire, 1899; *Megasemum* Kraatz, 1879; *Tetropium* Kirby, 1837 and *Zamium* Pascoe, 1864. It is represented by 3 genera as *Arhopalus* Audinet-Serville, 1834; *Asemum* Eschscholtz, 1830 and *Tetropium* Kirby, 1837 in Turkey.

- Tribe Atimiini LeConte, 1873

The tribe has 3 genera as *Atimia* Haldeman, 1847; *Paratimia* Haldeman, 1847 and *Proatimia* Gressitt, 1951. It is not represented in Turkey.

- Tribe Nothorhinini Zagajkevich, 1991

The tribe has only 1 genus as *Nothorhina* Redtenbacher, 1845. It is represented in Turkey.

So, only the tribes Asemini and Nothorhinini are represented in Turkey.

Subfamily SAPHANINAE Gistel, 1848

Saphanidae Gistel, 1848: [8] [Type gen.: *Saphanus* Audinet-Serville, 1834. Type sp.: *Callidium spinosum* Fabricius, 1801 by monotypy].

Synonym.

- Michthysomini LeConte, 1873: 330 (key), 332 (incorrect original stem) [Type gen.: *Michthisoma* LeConte, 1850. Type sp.: *Michthisoma heterodoxus* LeConte, 1850 by monotypy].

There is original description, only name.

Diagnostic characters: Sides of pronotum not regularly arched from anterior to posterior margin with a tooth in the middle. Antennae moderately long, exceed the base of pronotum with cylindrical segments.

The subfamily Saphaninae Gistel, 1848 includes 2 tribes worldwide.

- Tribe Anisarthrini Mamaev and Danilevsky, 1973

The tribe has 4 genera as *Alocerus* Mulsant, 1862; *Anisarthron* Redtenbacher, 1845; *Metalocerus* Aurivillius, 1913 and *Schurmannia* Sama, 1979. It is represented by 1 genus as *Alocerus* Mulsant, 1862 in Turkey.

- Tribe Saphanini Gistel, 1848

The tribe has 8 genera as *Daramus* Fairmaire, 1892; *Derolophodes* Brancsik, 1898; *Drymochares* Mulsant, 1847; *Masatopes* Breuning & Villiers, 1958; *Michthisoma* LeConte, 1850; *Oxypleurus* Mulsant, 1839; *Pectoctenus* Fairmaire, 1896 and *Saphanus* Audinet-Serville, 1834. It is represented by 3 genera as *Drymochares* Mulsant, 1847; *Oxypleurus* Mulsant, 1839 and *Saphanus* Audinet-Serville, 1834 in Turkey.

So, both tribes are represented in Turkey.

Subfamily SPONDYLIDINAE Audinet-Serville, 1832

Spondylii Audinet-Serville, 1832: 123 (incorrect original stem) [Type gen.: *Spondylis* Fabricius, 1775. Type sp.: *Attelabus buprestoides* Linnaeus, 1758 designated by Latreille, 1810: 431]

Original description:

Spondyliens, Spondylii.
Antennes courtes, presque moniliformes et de onze articles. Corselet presque globuleux, arrondi latéralement.

Diagnostic characters: Sides of pronotum regularly arched from anterior to posterior margin without any type of tooth. Antennae very short, at most scarcely exceed the base of pronotum with globular segments.

The subfamily Spondylidinae Audinet-Serville, 1832 includes only 1 tribe worldwide.

- Tribe Spondylidini Audinet-Serville, 1832

The tribe has 3 genera as *Neospondylis* Sama, 2005; *Scaphinus* LeConte, 1851 and *Spondylis* Fabricius, 1775. It is represented only by 1 genus as *Spondylis* Fabricius, 1775 in Turkey.

So, the tribe is represented in Turkey.

Subfamily STENOPTERINAE Gistel, 1848

Stenopteridae Gistel, 1848: [9] [Type gen.: *Stenopterus* Illiger, 1804. Type sp.: *Necydalis rufa* Linnaeus, 1767 by monotypy].

There is original description, only name.

Diagnostic characters: In general, it has reduced elytra, elevations on pronotum and other characters of pronotum and elytra.

The subfamily Stenopterinae Gistel, 1848 includes 10 tribes worldwide.

- Tribe Brachypteromatini Sama, 2008

The tribe has only 1 genus as *Brachypteroma* Heyden, 1863. It is represented in Turkey.

- Tribe Hesthesini Pascoe, 1867

The tribe has only 1 genus as *Hesthesis* Newman, 1840. It is not represented in Turkey.

- Tribe Hyboderini Linsley, 1940

The tribe has 9 genera as *Berndgerdia* Holzschuh, 1982; *Callimus* Mulsant, 1846; *Guerryus* Pic, 1903; *Hybodera* LeConte, 1873; *Kunbir* Lameere, 1890; *Megobrium* LeConte, 1873; *Microdebilissa* Pic, 1925; *Pachymerola* Bates, 1892 and *Pseudopilema* Linsley, 1940. It is represented only by 1 genus as *Callimus* Mulsant, 1846 in Turkey.

- Tribe Macronini Lacordaire, 1868

The tribe has 5 genera as *Brachopsis* Saunders, 1850; *Enchoptera* Saunders, 1850; *Macrones* Newman, 1841; *Myacopterus* Fairmaire, 1893 and *Oroderes* Saunders, 1850. It is not represented in Turkey.

- Tribe Molorchini Gistel, 1848

The tribe has 14 genera as *Afromolorchus* Tippmann, 1959; *Anomoderus* Fairmaire, 1871; *Earinis* Pascoe, 1864; *Elongatomerionoeda* Hayashi, 1977; *Epania* Pascoe, 1858; *Leptepania* Heller, 1924; *Mecynopus* Erichson, 1842; *Merionoedopsis* Gounelle, 1911; *Molorchoepania* Picard, 1949; *Molorchus* Fabricius, 1793; *Nadezhdiana* Tsherepanov, 1976; *Omotes* Newman, 1842; *Paranomoderus* Breuning, 1954 and *Tsujius* Ikeda, 2001. It is represented only by 1 genus as *Molorchus* Fabricius, 1793 in Turkey.

- Tribe Oxycoleini Martins and Galileo, 2003

The tribe has 4 genera as *Merionoeda* Pascoe, 1858; *Merionoedina* Villiers, 1968; *Oxycoleus* Lacordaire, 1869 and *Oxylopsebus* Clarke, 2008. It is not represented in Turkey.

- Tribe Psebiini Lacordaire, 1868

The tribe has 19 genera as *Bostrychopsebium* Quentin et Villiers, 1971; *Bottegia* Gestro, 1895; *Chorotyse* Pascoe, 1867; *Cleptopsebium* Quentin & Villiers, 1971; *Dodecocerus* Dalens & Touroult, 2008; *Duffyia* Quentin et Villiers, 1971; *Frondipedia* Martins & Napp, 1984; *Haplopsebium* Aurivillius, 1891; *Hovorea* Chemsak & Noguera, 1993; *Idiopsebium* Quentin et Villiers, 1971; *Macropsebium* Bates, 1878; *Mourgliana* Holzschuh, 1993; *Nathriobrium* Hovore, 1980; *Nathrius* Brethes, 1916; *Paraleptidea* Gounelle, 1913; *Pembius* Quentin et Villiers, 1971; *Plectopsebium* Boppe, 1914; *Psebium* Pascoe, 1864 and *Pseudobottegia* Duffy, 1955. It is represented only by 1 genus as *Nathrius* Brethes, 1916 in Turkey.

- Tribe Rhinotragini Thomson, 1861

The tribe has 52 genera as *Acorethra* Bates, 1873; *Acyphoderes* Audinet-Serville, 1833; *Aechmutes* Bates, 1867; *Anomalotragus* Clarke, 2010; *Antennommata* Clarke, 2010; *Apostropha* Bates, 1873; *Bromiades* Thomson, 1864; *Cantharoxylymna* Linsley, 1934; *Carenoptomerus* Tavakilian & Peñaherrera-Leiva, 2003; *Catorthontus* Waterhouse, 1880; *Clepitoides* Clarke, 2009; *Corallancyla* Tippmann, 1960; *Crossomeles* Champlain & Noguera, 1993; *Cylindrommata* Tippmann, 1960; *Ecliptoides* Tavakilian & Peñaherrera-Leiva, 2005; *Epimelitta* Bates, 1870; *Erythroplatys* White, 1855; *Ischasia* Thomson, 1864; *Ischasioides* Tavakilian & Peñaherrera-Leiva, 2003; *Isthmiade* Thomson, 1864; *Lygrocharis* Melzer, 1927; *Mimommata* Peñaherrera-Leiva & Tavakilian, 2003; *Monneus* Magno, 2001; *Neophygopoda* Melzer, 1933; *Neoregostoma* Monné & Giesbert, 1992; *Odontocera* Audinet-Serville, 1833; *Ommata* White, 1855; *Optomerus* Giesbert, 1996; *Oregostoma* Audinet-Serville, 1833; *Ornistomus* Thomson, 1864; *Oxylymma* Pascoe, 1859; *Pandrosos* Bates, 1867; *Parischasia* Tavakilian & Peñaherrera-Leiva, 2005; *Pasiphyle* Thomson, 1864; *Phespia* Bates, 1873; *Phygopoda* Thomson, 1864; *Phygopoides* Peñaherrera-Leiva & Tavakilian, 2003; *Pseudacorethra* Tavakilian & Peñaherrera-Leiva, 2007; *Pseudagaone* Tippmann, 1960; *Pseudisthmiade* Tavakilian & Peñaherrera-Leiva, 2005; *Pseudophygopoda* Tavakilian & Peñaherrera-Leiva, 2007; *Rhinotragus* Germar, 1824; *Sphecomorpha* Newman, 1838; *Stenochariergus* Giesbert & Hovore, 1989; *Stenopseustes* Bates, 1873; *Stultutragus* Clarke, 2010; *Sulcommata* Peñaherrera-Leiva & Tavakilian, 2003; *Thouvenotiana* Peñaherrera-Leiva & Tavakilian, 2003; *Tomopteropsis* Peñaherrera-Leiva & Tavakilian, 2003; *Tomopterus* Audinet-Serville, 1833; *Xenocrasis* Bates, 1873 and *Xenocrasoides* Tavakilian & Peñaherrera-Leiva, 2003. It is not represented in Turkey.

- Tribe Stenopterini Gistel, 1848

The tribe has 7 genera as *Anencyrus* Sharp, 1886; *Callimoxys* Kraatz, 1863; *Gastrosarus* Bates, 1874; *Holangus* Pic, 1902; *Obscuropterus* Adlbauer, 2003; *Pectinocallimus* Niisato, 1989 and *Stenopterus* Illiger, 1804. It is represented by 2 genera as *Callimoxys* Kraatz, 1863 and *Stenopterus* Illiger, 1804 in Turkey.

- Tribe Thraniini Gahan, 1906

The tribe has 2 genera as *Psebena* Gahan in Shelford, 1902 and *Thranius* Pascoe, 1859. It is not represented in Turkey.

So, 5 tribes are represented in Turkey as Brachypteromatini, Hyboderini, Molorchini, Psebiini and Stenopterini.

Subfamily DORCADIONINAE Swainson, 1840

Dorcadioninae Swainson, 1840: 290, 291 (incorrect original stem) [Type gen.: *Dorcadion* Dalman, 1817 (stem = Dorcadi- (see Vives and Alonso-Zarazaga, 2000: 659)). Type sp.: *Cerambyx glycyrrhizae* Pallas, 1773 designated by Thomson, 1864: 43]. This family-group name was incorrectly credited to Swainson & Shuckard (1840) by Bousquet et al. (2009: 29); current spelling maintained (Art. 29.5): Dorcadioninae Swainson, 1840 (in prevailing usage).

Synonym.

- Dorcadodiidae Gistel, 1856: 376 [Type gen.: *Dorcadodium* Gistel, 1856. Type sp.: *Lamia morio* Fabricius, 1787 designated by Vives & Alonso-Zarazaga (2000: 659)]. *Dorcadodium* Gistel, 1856 is a nomen oblitum (this name is a senior synonym of Carinatodorcadion Breuning, 1943).

Original description:

Dorcadioninae

Antennae remerkably short; often apterous. The Dorcadioninae are apterous insects, which sometimes have the elytra soldered together. They chiefly occur upon the ground in sandy districts. These insects have usually *an elliptical body and remerkably short antennae, and are slow and heavy in their motion: They are usually also of small size.*

Diagnostic characters: Remerkably short antennae, elliptical body shape and life style (they are often apterous and chiefly occur upon the ground).

The subfamily Dorcadioninae Swainson, 1840 includes 3 tribes worldwide.

- Tribe Dorcadionini Swainson, 1840

The tribe has 12 genera as *Austrosomatidia* McKeown, 1945; *Corestheta* Pascoe, 1875; *Dorcadion* Dalman, 1817; *Elasmotena* McKeown, 1945; *Eodorcadion* Breuning, 1946; *Microlamia* Bates, 1874; *Mimostenellipsis* Breuning, 1956; *Neodorcadion* Ganglbauer, 1883; *Paraxylotoles* Breuning, 1973; *Parmenomorpha* Blackburn, 1889; *Stenellipsis* Bates, 1874 and *Xylotoles* Newman, 1840. It is represented by 2 genera as *Dorcadion* Dalman, 1817 and *Neodorcadion* Ganglbauer, 1883 in Turkey.

- Tribe Moneilemini Thomson, 1864

The tribe has only 1 genus as *Moneilema* Say, 1824. It is not represented in Turkey.

- Tribe Phantasini Kolbe, 1897

The tribe has 3 genera as *Acanthesthes* Kolbe, 1894; *Phantasis* Thomson, 1860 and *Trichophantasis* Sudre & Teocchi, 2000. It is not represented in Turkey.

So, only 1 tribe is represented in Turkey as Dorcadionini.

Consequently, the world Cerambycidae are divided into 12 subfamilies as Parandrinae Blanchard, 1845; Prioninae Latreille, 1802; Lepturinae Latreille, 1802; Necydalinae Latreille, 1825; Aseminae Thomson, 1861; Saphaninae Gistel, 1848; Spondylidinae Audinet-Serville, 1832; Dorcasominae Lacordaire, 1868 (=Apatophyseinae Lacordaire, 1869); Stenopterinae Gistel, 1848; Cerambycinae Latreille, 1802; Lamiinae Latreille, 1825 and Dorcadioninae Swainson, 1840 phylogenetically.

Family CERAMBYCIDAE Latreille, 1802

Subfamily PARANDRINAE Blanchard, 1845
Tribe Erichsoniini Thomson, 1861
Tribe Parandrini Blanchard, 1845

Subfamily PRIONINAE Latreille, 1802
Tribe Acanthophorini Thomson, 1864
Tribe Aegosomatini Thomson, 1861
Tribe Anacolini Thomson, 1857
Tribe Cacoscelini Thomson, 1861
Tribe Callipogonini Thomson, 1861
Tribe Calocomini Galileo and Martins, 1993
Tribe Cantharocnemini Thomson, 1861
Tribe Ergatini Fairmaire, 1864
Tribe Eurypodini Gahan, 1906 (1868)
Tribe Hopliderini Thomson, 1864
Tribe Macrodontiini Thomson, 1861
Tribe Macrotomini Thomson, 1861
Subtribe Archetypina Lameere, 1912
Subtribe Basitoxina Lameere, 1912
Subtribe Macrotomina Thomson, 1861
Subtribe Platygnathina Gilmour, 1954

Subtribe Xixuthrina Lameere, 1912
Tribe Mallaspini Thomson, 1861
Tribe Mallodonini Thomson, 1861
Tribe Meroscelisini Thomson, 1861
Tribe Prionini Latreille, 1802
Tribe Remphanini Lacordaire, 1868
Tribe Solenopterini Lacordaire, 1868
Tribe Tereticini Lameere, 1913
Tribe Vesperoctenini Vives, 2005

Subfamily LEPTURINAE Latreille, 1802
Tribe Desmocerini Blanchard, 1845
Tribe Encyclopini LeConte, 1873
Tribe Enoplodeerini Bartenev, 2009
Tribe Lepturini Latreille, 1802
Tribe Oxymirini Danilevsky, 1997
Tribe Rhagiini Kirby, 1837
Tribe Rhamnusiini Sama, 2009
Tribe Teledapini Pascoe, 1871
Tribe Sachalinobiini Danilevsky, 2010
Tribe Xylosteini Reitter, 1913

Subfamily NECYDALINAE Latreille, 1825

Subfamily ASEMINAE Thomson, 1861
Tribe Asemini Thomson, 1861
Tribe Atimiini LeConte, 1873
Tribe Nothorhinini Zagajkevich, 1991

Subfamily SAPHANINAE Gistel, 1848
Tribe Anisarthrini Mamaev and Danilevsky, 1973
Tribe Saphanini Gistel, 1848

Subfamily SPONDYLIDINAE Audinet-Serville, 1832
Tribe Spondylidini Audinet-Serville, 1832

Subfamily DORCASOMINAE Lacordaire, 1868 (=APATOPHYSEINAE Lacordaire, 1869)

Subfamily STENOPTERINAE Gistel, 1848
Tribe Brachypteromatini Sama, 2008
Tribe Hesthesini Pascoe, 1867
Tribe Hyboderini Linsley, 1940
Tribe Macronini Lacordaire, 1868
Tribe Molorchini Gistel, 1848
Tribe Oxycoleini Martins and Galileo, 2003
Tribe Psebiini Lacordaire, 1868
Tribe Rhinotragini Thomson, 1861
Tribe Stenopterini Gistel, 1848
Tribe Thraniini Gahan, 1906

Subfamily CERAMBYCINAE Latreille, 1802
Tribe Acangassuini Galileo and Martins, 2001
Tribe Achrysonini Lacordaire, 1868
Tribe Agallissini LeConte, 1873
Tribe Alanizini Di Iorio, 2003
Tribe Anaglyptini Lacordaire, 1868
Tribe Aphanasiini Lacordaire, 1868
Tribe Aphneopini Lacordaire, 1868
Tribe Auxesini Lepesme and Breuning, 1952
Tribe Basipterini Fragoso, Monné and Campos Seabra, 1987
Tribe Bimiini Lacordaire, 1868
Tribe Bothriospilini Lane, 1950
Tribe Callichromatini Swainson, 1840
Tribe Callidiini Kirby, 1837
Tribe Callidiopini Lacordaire, 1868
Tribe Cerambycini Latreille, 1802

Subtribe Cerambycina Latreille, 1802
Subtribe Sphallotrichina Martins and Monné, 2005
Tribe Certallini Fairmaire, 1864
Tribe Chlidonini Waterhouse, 1879
Tribe Cleomenini Lacordaire, 1868
Tribe Clytini Mulsant, 1839
Tribe Compsocerini Thomson, 1864
Tribe Coptommatini Lacordaire, 1869
Tribe Curiini LeConte, 1873
Tribe Deilini Fairmaire, 1864
Tribe Dejanirini Lacordaire, 1868
Tribe Diorini Lane, 1950
Tribe Distichocerini Pascoe, 1867
Tribe Dodecosini Aurivillius, 1912
Tribe Dryobiini Arnett, 1962
Tribe Eburiini Blanchard, 1845
Tribe Ectenessini Martins, 1998
Tribe Elaphidiini Thomson, 1864
Tribe Eligmodermini Lacordaire, 1868
Tribe Erlandiini Aurivillius, 1912
Tribe Eroschemini Lacordaire, 1868
Tribe Eumichthini Linsley, 1940
Tribe Gahaniini Quentin and Villiers, 1969
Tribe Glaucytini Lacordaire, 1868
Tribe Graciliini Mulsant, 1839
Tribe Hesperophanini Mulsant, 1839
Subtribe Daramina Sama, 2008
Subtribe Hesperophanina Mulsant, 1839
Tribe Heteropsini Lacordaire, 1868
Tribe Hexoplini Martins, 2006
Tribe Holopleurini Chemsak and Linsley, 1974
Tribe Holopterini Lacordaire, 1868
Tribe Hylotrupini Zagajkevich, 1991
Tribe Ibidionini Thomson, 1861
Subtribe Compsina Martins and Galileo, 2007
Subtribe Ibidionina Thomson, 1861
Subtribe Tropidina Martins and Galileo, 2007
Tribe Ideratini Martins and Napp, 2009
Tribe Lissonotini Swainson, 1840
Tribe Luscosmodicini Martins, 2003
Tribe Lygrini Sama, 2008
Tribe Megacoelini Quentin and Villiers, 1969
Tribe Methiini Thomson, 1860
Tribe Mythodini Lacordaire, 1868
Tribe Necydalopsini Lacordaire, 1868
Tribe Neocorini Martins, 2005
Tribe Neostenini Lacordaire, 1868
Tribe Obriini Mulsant, 1839
Tribe Ochyrini Pascoe, 1871
Tribe Oedenoderini Aurivillius, 1912
Tribe Oemini Lacordaire, 1868
Subtribe Methioidina Martins, 1997
Subtribe Oemina Lacordaire, 1868
Tribe Opsimini LeConte, 1873
Tribe Paraholopterini Martins, 1997
Tribe Phalotini Lacordaire, 1868
Tribe Phlyctaenodini Lacordaire, 1868
Tribe Phoracanthini Newman, 1840
Tribe Phyllarthriini Lepesme and Breuning, 1956
Tribe Piesarthriini McKeown, 1947
Tribe Piezocerini Lacordaire, 1868
Subtribe Haruspicina Martins, 1976
Subtribe Piezocerina Lacordaire, 1868
Tribe Platyarthrini Bates, 1870
Tribe Plectogasterini Quentin and Villiers, 1969
Tribe Plectromerini Nearns and Braham, 2008
Tribe Pleiarthrocerini Lane, 1950

Tribe Protaxini Gahan, 1906
Tribe Prothemini Lacordaire, 1868
Tribe Pseudocephalini Aurivillius, 1912 (1861)
Tribe Pseudolepturini Thomson, 1861
Tribe Psilomorphini Lacordaire, 1868
Tribe Pteroplatini Thomson, 1861
Tribe Pyrestini Lacordaire, 1868
Tribe Rhagiomorphini Newman, 1841
Tribe Rhopalophorini Blanchard, 1845
Tribe Rosaliini Fairmaire, 1864
Tribe Sestyrini Lacordaire, 1868
Tribe Smodicini Lacordaire, 1868
Tribe Spintheriini Lacordaire, 1869
Tribe Stenhomalini Miroshnikov, 1989
Tribe Stenoderini Pascoe, 1867
Tribe Strongylurini Lacordaire, 1868
Tribe Tessarommatini Lacordaire, 1868
Tribe Thyrsiini Marinoni and Napp, 1984
Tribe Tillomorphini Lacordaire, 1868
Tribe Torneutini Thomson, 1861
Tribe Trachyderini Dupont, 1836
Subtribe Ancylocerina Thomson, 1864
Subtribe Trachyderina Dupont, 1836
Tribe Tragocerini Pascoe, 1867
Tribe Trichomesiini Aurivillius, 1912
Tribe Tropocalymmatini Lacordaire, 1868
Tribe Typhocesini Lacordaire, 1868
Tribe Unxiini Napp, 2007
Tribe Uracanthini Blanchard, 1853
Tribe Vesperellini Sama, 2008
Tribe Xystrocerini Blanchard, 1845

Subfamily LAMIINAE Latreille, 1825
Tribe Acanthocinini Blanchard, 1845
Tribe Acanthoderini Thomson, 1860
Tribe Acmocerini Thomson, 1864
Tribe Acridocephalini Dillon and Dillon, 1959
Tribe Acrocinini Swainson, 1840
Tribe Aderpasini Breuning and Teocchi, 1978
Tribe Aerenicini Lacordaire, 1872
Tribe Agapanthiini Mulsant, 1839
Tribe Amphoecini Breuning, 1951
Tribe Ancitini Aurivillius, 1917
Tribe Ancylonotini Lacordaire, 1869
Tribe Anisocerini Thomson, 1860
Tribe Apodasyini Lacordaire, 1872
Tribe Apomecynini Thomson, 1860
Tribe Astathini Thomson, 1864
Tribe Batocerini Thomson, 1864
Tribe Calliini Thomson, 1864
Tribe Ceroplesini Thomson, 1860
Subtribe Ceroplesina Thomson, 1860
Subtribe Crossotina Thomson, 1864
Tribe Cloniocerini Lacordaire, 1872
Tribe Colobotheini Thomson, 1860
Tribe Compsosomatini Thomson, 1857
Tribe Cyrtinini Thomson, 1864
Tribe Desmiphorini Thomson, 1860
Tribe Dorcaschematini Thomson, 1860
Tribe Elytracanthinini Bousquet, 2009
Tribe Enicodini Thomson, 1864
Tribe Eupromerini Galileo and Martins, 1995
Tribe Forsteriini Tippmann, 1960
Tribe Gnomini Thomson, 1860
Tribe Gyaritini Breuning, 1950
Tribe Heliolini Breuning, 1951
Tribe Hemilophini Thomson, 1868

Tribe Homonoeini Thomson, 1864
Tribe Hyborhabdini Aurivillius, 1911
Tribe Lamiini Latreille, 1825
Tribe Laticraniini Lane, 1959
Tribe Mauesiini Lane, 1956
Tribe Megabasini Thomson, 1860
Tribe Mesosini Mulsant, 1839
Tribe Microcymaturini Breuning and Teocchi, 1985
Tribe Monochamini Gistel, 1848
Tribe Morimonellini Lobanov, Danilevsky and Murzin, 1981
Tribe Morimopsini Lacordaire, 1869
Tribe Nyctimeniini Gressitt, 1951
Tribe Obereini Thomson, 1864
Tribe Oculariini Breuning, 1950
Tribe Onciderini Thomson, 1860
Tribe Oncideropsidini Aurivillius, 1922
Tribe Onocephalini Thomson, 1860
Tribe Onychogleneini Aurivillius, 1923
Tribe Parmenini Mulsant, 1839
Tribe Petrognathini Blanchard, 1845
Tribe Phacellini Lacordaire, 1872
Tribe Phrynetini Thomson, 1864
Tribe Phymasternini Teocchi, 1989
Tribe Phytoeciini Mulsant, 1839
Tribe Pogonocherini Mulsant, 1839
Tribe Polyrhaphidini Thomson, 1860
Tribe Pretiliini Martins and Galileo, 1990
Tribe Proctocerini Aurivillius, 1922
Tribe Prosopocerini Thomson, 1864
Tribe Pteropliini Thomson, 1860
Tribe Rhodopinini Gressitt, 1951
Tribe Saperdini Mulsant, 1839
Tribe Stenobiini Breuning, 1950
Tribe Sternotomini Thomson, 1860
Tribe Tapeinini Thomson, 1857
Tribe Tetraopini Thomson, 1860
Tribe Tetraulaxini Breuning and Teocchi, 1977
Tribe Tetropini Portevin, 1927
Tribe Theocrini Lacordaire, 1872
Tribe Tmesisternini Blanchard, 1853
Tribe Tragocephalini Thomson, 1857
Tribe Xenicotelini Matsushita, 1933
Tribe Xenofreini Aurivillius, 1923
Tribe Xenoleini Lacordaire, 1872
Tribe Xylorhizini Lacordaire, 1872
Tribe Zygocerini Thomson, 1864

Subfamily DORCADIONINAE Swainson, 1840
Tribe Dorcadionini Swainson, 1840
Tribe Moneilemini Thomson, 1864
Tribe Phantasini Kolbe, 1897

The superfamily CHRYSOMELOIDEA Latreille, 1802 includes 4 families as Bruchidae Latreille, 1802; Chrysomelidae Latreille, 1802; Megalopodidae Latreille, 1802 and Orsodacnidae Thomson, 1859. All families are represented in Turkey. The superfamily consist of the family-group taxa (80 tribes of 27 subfamilies of 4 families). Finally, Turkish CHRYSOMELOIDEA includes a total of 906 taxa (880 species and 26 subspecies belonging to 108 genera of 22 tribes of 18 subfamilies of 4 families). The ratio of endemism is approximately 10 % for Turkey. The list that was given by Özdikmen (2011) is revised and completed in the present work (see the following list).

SUPERFAMILY CHRYSOMELOIDEA Latreille, 1802

4 families, 18 subfamilies, 22 tribes, 108 genera, 880 species (115 subspecies), 26 subspecies

FAMILY MEGALOPODIDAE Latreille, 1802: 227
2 subfamilies, 2 genera, 3 species

FAMILY ORSODACNIDAE Thomson, 1859: 154
1 subfamily, 1 genus, 3 species (1 subspecies)

FAMILY BRUCHIDAE Latreille, 1802: 192
4 subfamilies, 4 tribes, 14 genera, 117 species

SUBFAMILY BRUCHINAE Latreille, 1802: 192
2 tribes, 10 genera, 103 species
SUBFAMILY AMBLYCERINAE Bridwell, 1932: 103
1 tribe, 2 genera, 9 species
SUBFAMILY PACHYMERINAE Bridwell, 19299: 142
1 tribe, 1 genus, 3 species
SUBFAMILY RHAEBINAE Blanchard, 1845: 180
1 genus, 1 species

FAMILY CHRYSOMELIDAE Latreille, 1802: 220
11 subfamilies, 18 tribes, 91 genera, 758 species (114 subspecies), 26 subspecies

SUBFAMILY DONACIINAE Kirby, 1837: 222
2 tribes, 2 genera, 17 species (5 subspecies)
SUBFAMILY CRIOCERINAE Latreille, 1804: 159
2 tribes, 4 genera, 13 species
SUBFAMILY CLYTRINAE Kirby, 1837: 207
1 tribe, 8 genera, 73 species (16 subspecies), 3 subspecies
SUBFAMILY CRYPTOCEPHALINAE Gyllenhal, 1813: 582
1 tribe, 4 genera, 101 species (13 subspecies), 2 subspecies
SUBFAMILY EUMOLPINAE Hope, 1840: 162
3 tribes, 10 genera, 25 species (4 subspecies)
SUBFAMILY CHRYSOMELINAE Latreille, 1802: 220
2 tribes, 15 genera, 81 species (33 subspecies), 14 subspecies
SUBFAMILY TIMARCHINAE Motschulsky, 1860: 187
1 tribe, 1 genus, 4 species (3 subspecies)
SUBFAMILY GALERUCINAE Latreille, 1802: 228
3 tribes, 16 genera, 66 species (9 subspecies), 3 subspecies
SUBFAMILY ALTICINAE Newman, 1834: 421
1 tribe, 22 genera, 327 species (29 subspecies), 4 subspecies
SUBFAMILY HISPINAE Gyllenhal, 1813: 448
1 tribe, 3 genera, 4 species
SUBFAMILY CASSIDINAE Gyllenhal, 1813: 434
1 tribe, 6 genera, 47 species (2 subspecies)

On the other side, subfamilies of Chrysomelidae are reorganized with the present work. In this manner, the subfamily Chrysomelinae which has been accepted as a single subfamily commonly, is divided into 2 subfamilies as Chrysomelinae Latreille, 1802 and Timarchinae Motschulsky, 1860 that has been regarded as a tribe of the subfamily Chrysomelinae in general.

With respect to this reorganization:

Subfamily TIMARCHINAE Motschulsky, 1860

Timarchaeines Motschulsky, 1860: 187 [Type gen.: *Timarcha* Samouelle, 1819.
Type sp.: *Chrysomela tenebricosa* Fabricius, 1775]

Original discription:
Timarchaeines
a. Corselet sans rebords renflés latéraux.

Diagnostic characters: Elytral epipleuron situated rather vertically; ridge separating it from dorsal part of elytra flattened, broad, often blurred or transformed into a smooth convexity. Parameres of aedeagus fused dorsally.

The subfamily Timarchinae Motschulsky, 1860 includes only 1 tribe worldwide.

- Tribe Timarchini Motschulsky, 1860

The tribe has only 1 genus as *Timarcha* Samouelle, 1819. It is represented in Turkey.

So, the tribe is represented in Turkey.

Consequently, the world Chrysomelidae are divided into 16 subfamilies as Sagrinae Leach, 1815; Donaciinae Kirby, 1837; Criocerinae Latreille, 1804; Clytrinae Kirby, 1837; Cryptocephalinae Gyllenhal, 1813; Eumolpinae Hope, 1840; Chrysomelinae Latreille, 1802; Timarchinae Motschulsky, 1860; Lamprosomatinae Lacordaire, 1848; Galerucinae Latreille, 1802; Alticinae Newman, 1834; Hispinae Gyllenhal, 1813; Cassidinae Gyllenhal, 1813; Spilopyrinae Chapuis, 1874; Synetinae LeConte and Horn, 1883 and †Protoscelidinae Medvedev, 1968 phylogenetically.

Family CHRYSOMELIDAE Latreille, 1802

Subfamily SAGRINAE Leach, 1815
Tribe Carpophagini Chapuis, 1874
Tribe Diaphanopsidini Monrós, 1958
Tribe Megamerini Chapuis, 1874
Tribe Sagrini Leach, 1815

Subfamily DONACIINAE Kirby, 1837
Tribe Donaciini Kirby, 1837
Tribe Haemoniini Chen, 1941
Tribe Plateumarini Böving, 1922

Subfamily CRIOCERINAE Latreille, 1804
Tribe Criocerini Latreille, 1804
Tribe Lemini Gyllenhal, 1813
Tribe Pseudocriocerini Heinze, 1962

Subfamily CLYTRINAE Kirby, 1837

Subfamily CRYPTOCEPHALINAE Gyllenhal, 1813
Tribe Cryptocephalini Gyllenhal, 1813
Subtribe Achaenopina Chapuis, 1874
Subtribe Cryptocephalina Gyllenhal, 1813
Subtribe Monachulina Leng, 1920
Subtribe Pachybrachina Chapuis, 1874
Subtribe Stylosomina Chapuis, 1874
Tribe Fulcidacini Jakobson, 1924

Subfamily EUMOLPINAE Hope, 1840
Tribe Bromiini Baly, 1865 (1863)
Tribe Caryonodini Bechyné, 1951
Tribe Cubispini Monrós, 1954
Tribe Eumolpini Hope, 1840
Tribe Euryopini Chapuis, 1874
Tribe Habrophorini Bechyné and Springlová de Bechyné, 1969
Tribe Hemydacnini Bechyné, 1951
Tribe Megascelidini Chapuis, 1874
Tribe Merodini Chapuis, 1874

Tribe Pygomolpini Bechyné, 1949
Tribe Rosiroiini Bechyné, 1950
Tribe Typophorini Baly, 1865

Subfamily CHRYSOMELINAE Latreille, 1802

Subfamily TIMARCHINAE Motschulsky, 1860

Subfamily LAMPROSOMATINAE Lacordaire, 1848
Tribe Lamprosomatini Lacordaire, 1848
Tribe Neochlamysini Monrós, 1959
Tribe Sphaerocharini Chapuis, 1874

Subfamily GALERUCINAE Latreille, 1802
Tribe Decarthrocerini Laboissière, 1937
Tribe Galerucini Latreille, 1802
Tribe Hylaspini Chapuis, 1875
Tribe Luperini Gistel, 1848
Tribe Metacyclini Chapuis, 1875
Tribe Oidini Laboissière, 1921 (1875)

Subfamily ALTICINAE Newman, 1834

Subfamily HISPINAE Gyllenhal, 1813
Tribe Alurnini Chapuis, 1875
Tribe Anisoderini Chapuis, 1875
Tribe Aproidini Weise, 1911
Tribe Arescini Chapuis, 1875
Tribe Botryonopini Chapuis, 1875
Tribe Callispini Chapuis, 1875
Tribe Callohispini Uhmann, 1960
Tribe Cephaloleiini Chapuis, 1875
Tribe Chalepini Weise, 1910
Tribe Coelaenomenoderini Weise, 1911
Tribe Cryptonychini Chapuis, 1875
Tribe Eurispini Chapuis, 1875
Tribe Exothispini Weise, 1911
Tribe Gonophorini Chapuis, 1875
Tribe Hispini Gyllenhal, 1813
Tribe Hispoleptini Chapuis, 1875
Tribe Hybosispini Weise, 1910
Tribe Leptispini Fairmaire, 1868
Tribe Oediopalpini Monrós and Viana, 1947 (1910)
Tribe Oncocephalini Chapuis, 1875
Tribe Promecothecini Chapuis, 1875
Tribe Prosopodontini Weise, 1910
Tribe Sceloenoplini Uhmann, 1930
Tribe Uroplatini Weise, 1910

Subfamily CASSIDINAE Gyllenhal, 1813
Tribe Aspidimorphini Chapuis, 1875
Tribe Basiprionotini Gressitt, 1952 (1929)
Tribe Cassidini Gyllenhal, 1813
Tribe Delocraniini Spaeth, 1929
Tribe Dorynotini Monrós and Viana, 1949 (1923)
Tribe Eugenysini Hincks, 1952
Tribe Goniocheniini Spaeth, 1942
Tribe Hemisphaerotini Monrós and Viana, 1951 (1929)
Tribe Imatidiini Hope, 1840
Tribe Ischyrosonychini Chapuis, 1875
Tribe Mesomphaliini Hope, 1840
Tribe Nothosacanthini Gressitt, 1952 (1929)
Tribe Omocerini Hincks, 1952 (1923)
Tribe Spilophorini Chapuis, 1875

Subfamily SPILOPYRINAE Chapuis, 1874

Subfamily SYNETINAE LeConte and Horn, 1883

†Subfamily PROTOSCELIDINAE Medvedev, 1968

Finally, both superfamilies (CERAMBYCOIDEA and CHRYSOMELOIDEA) as a single group comprise of 1706 species group taxa (1579 species and 127 subspecies belonging to 238 genera of 78 tribes of 30 subfamilies of 6 families) (see the following list).

The following lists includes all taxa of Turkish Cerambycoidea and Chrysomeloidea.

SUPERFAMILY CERAMBYCOIDEA Latreille, 1802

FAMILY VESPERIDAE Mulsant, 1839: 214

SUBFAMILY VESPERINAE Mulsant, 1839
TRIBE VESPERINI Mulsant, 1839
SUBTRIBE -
GENUS *VESPERUS* Dejean, 1821: 111
SUBGENUS -
SPECIES *V. ocularis* Mulsant & Rey, 1863: 172

FAMILY CERAMBYCIDAE Latreille, 1802: 211

SUBFAMILY PRIONINAE Latreille, 1802: 212
TRIBE ERGATINI Fairmaire, 1864: 117
SUBTRIBE -
GENUS *CALLERGATES* Lameere, 1904: 47
SUBGENUS -
SPECIES *C. gaillardoti* (Chevrolat, 1854: 481)
GENUS *ERGATES* Audinet-Serville, 1832: 143
SUBGENUS -
SPECIES *E. faber* (Linnaeus, 1760: 187)
SUBSPECIES *E. faber faber* (Linnaeus, 1760: 187)
TRIBE MACROTOMINI Thomson, 1861: 312
SUBTRIBE MACROTOMINA Thomson, 1861: 312
GENUS *PRINOBIUS* Mulsant, 1842: 207
SUBGENUS -
SPECIES *P. myardi* Mulsant, 1842: 207
SUBSPECIES *P. m. myardi* Mulsant, 1842: 207
TRIBE REMPHANINI Lacordaire, 1868: 103
SUBTRIBE REMPHANINA Lacordaire, 1868: 103
GENUS *RHAESUS* Motschulsky, 1875: 153 [RN]
SUBGENUS -
SPECIES *R. serricollis* (Motschulsky, 1838: 187)
TRIBE AEGOSOMATINI Thomson, 1861: 308
SUBTRIBE -
GENUS *AEGOSOMA* Audinet-Serville, 1832: 162
SUBGENUS -
SPECIES *A. scabricorne* (Scopoli, 1763: 54)
TRIBE PRIONINI Latreille, 1802: 212
SUBTRIBE -
GENUS *MESOPRIONUS* Jakovlev, 1887: 323
SUBGENUS -
SPECIES *M. angustatus* (Jakovlev, 1887: 327)
SPECIES *M. asiaticus* (Faldermann, 1837: 263)
SPECIES *M. besikanus* (Fairmaire, 1855: 318)
SPECIES *M. lefebvrei* (Marseul, 1856: 47)
SPECIES *M. persicus* (Redtenbacher, 1850: 49)
GENUS *PRIONUS* Geoffroy, 1762: 198
SUBGENUS -
SPECIES *P. coriarius* (Linnaeus, 1758: 389)
SPECIES *P. komiyai* Lorenc, 1999: 13

SUBFAMILY LEPTURINAE Latreille, 1802: 218
TRIBE XYLOSTEINI Reitter, 1913: 5
SUBTRIBE -
GENUS *XYLOSTEUS* Frivaldszky, 1837: 180
SUBGENUS -
SPECIES *X. caucasicola* Plavilstshikov, 1936: 496
SPECIES *X. kadleci* Miroshnikov, 2000: 38
SPECIES *X. spinolae* Frivaldszky, 1837: 180
GENUS *LEPTORHABDIUM* Kraatz, 1879: 118
SUBGENUS -
SPECIES *L. caucasicum* (Kraatz, 1879: 118)
TRIBE ENOPLODERINI Bartenev, 2009: 6
SUBTRIBE -
GENUS *ENOPLODERES* Faldermann, 1837: 309
SUBGENUS *ENOPLODERES* Faldermann, 1837: 309
SPECIES *E. sanguineus* Faldermann, 1837: 310
TRIBE RHAMNUSIINI Sama [in Sama and Sudre], 2009: 383
SUBTRIBE -
GENUS *RHAMNUSIUM* Latreille, 1829: 130
SUBGENUS -
SPECIES *R. bicolor* (Schrank, 1781: 132)
SUBSPECIES *R. b. bicolor* (Schrank, 1781: 132)
SPECIES *R. graecum* Schaufuss, 1862: 311
SUBSPECIES *R. g. graecum* Schaufuss, 1862: 311
SPECIES *R. testaceipenne* Pic, 1897: 299
TRIBE OXYMIRINI Danilevsky, 1997: 8
SUBTRIBE -
GENUS *OXYMIRUS* Mulsant, 1862: 464
SUBGENUS -
SPECIES *O. cursor* (Linnaeus, 1758: 393)
SPECIES *O. mirabilis* (Motschulsky, 1838: 183)
TRIBE RHAGIINI Kirby, 1837: 178
SUBTRIBE -
GENUS *RHAGIUM* Fabricius, 1775: 182
SUBGENUS *HAGRIUM* Villiers, 1978: 85
SPECIES *R. bifasciatum* Fabricius, 1775: 183
SUBGENUS *MEGARHAGIUM* Reitter, 1913: 6
SPECIES *R. caucasicum* Reitter, 1889: 287
SUBSPECIES *R. c. caucasicum* Reitter, 1889: 287
SPECIES *R. elmaliense* Schmid, 1999: 157
SPECIES *R. fasciculatum* Faldermann, 1837: 304
SPECIES *R. mordax* (DeGeer, 1775: 124)
SPECIES *R. phyrigium* K. Daniel, 1906: 176
SPECIES *R. sycophanta* (Schrank, 1781: 137)
SPECIES *R. syriacum* Pic, 1892: CXI [1893: 414]
SUBGENUS *RHAGIUM* Fabricius, 1775: 182
SPECIES *R. inquisitor* (Linnaeus, 1758: 393)
SUBSPECIES *R. i. fortipes* Reitter, 1898: 357
SUBSPECIES *R. i. inquisitor* (Linnaeus, 1758: 393)
SUBSPECIES *R. i. schtschukini* Semenov, 1898: 601
GENUS *AKIMERUS* Audinet-Serville, 1835: 212
SUBGENUS -
SPECIES *A. berchmansi* Breit, 1915: 353
GENUS *STENOCORUS* Geoffroy, 1762: 221
SUBGENUS *ANISORUS* Mulsant, 1862: 467
SPECIES *S. brunnescens* (Holzschuh, 1991: 5)
SPECIES *S. heterocerus* (Ganglbauer, 1882: 139)
SPECIES *S. homocerus* (K. Daniel, 1900: 139)
SPECIES *S. quercus* (Götz, 1783: 74)
SUBSPECIES *S. q. quercus* (Götz, 1783: 74)
SUBSPECIES *S. q. aureopubens* (Pic, 1908: 2)
SUBGENUS *STENOCORUS* Geoffroy, 1762: 221
SPECIES *S. auricomus* (Reitter, 1890: 250)
SPECIES *S. insitivus* (Germar, 1824: 520)
SUBSPECIES *S. i. insitivus* (Germar, 1824: 520)
SPECIES *S. meridianus* (Linnaeus, 1758: 398)
SPECIES *S. serratus* Holzschuh, 1974: 86

SPECIES *S. vittidorsum* (Reitter, 1890: 250)
GENUS *BRACHYTA* Fairmaire, 1864: 185
SUBGENUS -
SPECIES *B. balcanica* Hampe, 1871: 336
SPECIES *B. delagrangei* Pic, 1891: 102
GENUS *ACMEOPS* LeConte, 1850: 235
SUBGENUS -
SPECIES *A. marginatus* (Fabricius, 1781: 247)
GENUS *GNATHACMEOPS* Linsley & Chemsak, 1972: 135
SUBGENUS -
SPECIES *G. pratensis* (Laicharting, 1784: 172)
GENUS *DINOPTERA* Mulsant, 1863: 494
SUBGENUS *DINOPTERA* Mulsant, 1863: 494
SPECIES *D. collaris* (Linnaeus, 1758: 398)
GENUS *CORTODERA* Mulsant, 1863: 572
SUBGENUS -
SPECIES *C. aestiva* Sama & Rapuzzi, 1999: 466
SPECIES *C. alpina* (Ménétries, 1832: 230)
SUBSPECIES *C. a. umbripennis* Reitter, 1890: 280
SUBSPECIES *C. a. xanthoptera* Pic, 1898: 115
SPECIES *C. cirsii* Holzschuh, 1975: 82
SPECIES *C. colchica* Reitter, 1890: 246
SUBSPECIES *C. c. colchica* Reitter, 1890: 246
SPECIES *C. differens* Pic, 1898: 50
SPECIES *C. discolor* Fairmaire, 1866: 277
SPECIES *C. flavimana* (Waltl, 1838: 471)
SPECIES *C. humeralis* (Schaller, 1783: 297)
SUBSPECIES *C. h. humeralis* (Schaller, 1783: 297)
SPECIES *C. imrasanica* Sama & Rapuzzi, 1999: 464
SPECIES *C. longipilis* Pic, 1898: 50
SPECIES *C. obscurans* Pic, 1892: CXI
SPECIES *C. omophloides* Holzschuh, 1975: 77
SPECIES *C. orientalis* Adlbauer, 1988: 264
SPECIES *C. pseudomophlus* Reitter, 1889: 40
SPECIES *C. pumila* Ganglbauer, 1882: 710
SUBSPECIES *C. p. pumila* Ganglbauer, 1882: 710
SPECIES *C. ranunculi* Holzschuh, 1975: 80
SPECIES *C. rubripennis* Pic, 1891: 102
SPECIES *C. semilivida* Pic, 1892: CXCIII
SPECIES *C. simulatrix* Holzschuh, 1975: 83
SPECIES *C. syriaca* Pic, 1901: 90
SUBSPECIES *C. s. syriaca* Pic, 1901: 90
SUBSPECIES *C. s. nigroapicalis* Holzschuh, 1981: 95
SPECIES *C. uniformis* Holzschuh, 1975: 79
SPECIES *C. wewalkai* Holzschuh, 1995: 9
SPECIES *C. wittmeri* Holzschuh, 1995: 9
GENUS *FALLACIA* Mulsant & Rey, 1863: 180
SUBGENUS -
SPECIES *F. elegans* (Faldermann, 1837: 319)
TRIBE LEPTURINI Latreille, 1802: 218
SUBTRIBE -
GENUS *GRAMMOPTERA* Audinet-Serville, 1835: 215
SUBGENUS *GRAMMOPTERA* Audinet-Serville, 1835: 215
SPECIES *G. abdominalis* (Stephens, 1831: 262)
SPECIES *G baudii* Sama, 1985: 97
SUBSPECIES *G. b. pistacivora* Sama, 1996: 94
SPECIES *G. merkli* Frivaldszky, 1884: 4
SPECIES *G. ruficornis* (Fabricius, 1781: 247)
SUBSPECIES *G. r. ruficornis* (Fabricius, 1781: 247)
SPECIES *G. ustulata* (Schaller, 1783: 298)
GENUS *ALOSTERNA* Mulsant, 1863: 576
SUBGENUS *ALOSTERNA* Mulsant, 1863: 576
SPECIES *A. anatolica* Adlbauer, 1992: 490
SPECIES *A. scapularis* (Heyden, 1878: 325)
SPECIES *A. tabacicolor* (DeGeer, 1775: 139)
SUBSPECIES *A. t. tabacicolor* (DeGeer, 1775: 139)
SUBSPECIES *A. t. subvittata* Reitter, 1885: 391

SUBSPECIES *A. t. tokatensis* Pic, 1901: 59
GENUS *VADONIA* Mulsant, 1863: 559
SUBGENUS -
SPECIES *V. bicolor* (Redtenbacher, 1850: 50)
SPECIES *V. bipunctata* (Fabricius, 1781: 245)
SUBSPECIES *V. b. mulsantiana* (Plavilstshikov, 1936: 341)
SPECIES *V. bisignata* (Brullé, 1832: 264)
SUBSPECIES *V. b. bisignata* (Brullé, 1832: 264)
SPECIES *V. bitlisiensis* Chevrolat, 1882: 59
SPECIES *V. bolognai* Sama, 1982: 207
SPECIES *V. ciliciensis* (Daniel & Daniel, 1891: 13)
SPECIES *V. danielorum* Holzschuh, 1984: 142
SPECIES *V. frater* Holzschuh, 1981: 96
SPECIES *V. imitatrix* (Daniel & Daniel, 1891: 6)
SPECIES *V. instigmata* Pic, 1890: CLXXVI
SPECIES *V. ispirensis* Holzschuh, 1993: 14
SPECIES *V. moesiaca* (Daniel & Daniel, 1891: 6)
SPECIES *V. monostigma* (Ganglbauer, 1882: 29)
SPECIES *V. soror* Holzschuh, 1981: 95
SUBSPECIES *V. s. soror* Holzschuh, 1981: 95
SUBSPECIES *V. s. tauricola* Holzschuh, 1993: 14
SPECIES *V. unipunctata* (Fabricius, 1787: 157)
SUBSPECIES *V. u. unipunctata* (Fabricius, 1787: 157)
GENUS *PSEUDOVADONIA* Lobanov, Danilevsky & Murzin, 1981: 787
SUBGENUS -
SPECIES *P. livida* (Fabricius, 1777: 233)
SUBSPECIES *P. l. bicarinata* (Arnold, 1869: 137)
SUBSPECIES *P. l. desbrochersi* (Pic, 1891: XVI)
SUBSPECIES *P. l. livida* (Fabricius, 1777: 233)
GENUS *ANOPLODERA* Mulsant, 1839: 285
SUBGENUS *ANOPLODERA* Mulsant, 1839: 285
SPECIES *A. rufipes* (Schaller, 1783: 296)
SUBSPECIES *A. r. rufipes* (Schaller, 1783: 296)
SUBSPECIES *A. r. lucidipes* Sama, 1999: 46
SPECIES *A. sexguttata* (Fabricius, 1775: 198)
GENUS *STICTOLEPTURA* Casey, 1924: 280
SUBGENUS *AREDOLPONA* Nakane & Ohbayashi, 1957: 244
SPECIES *S. rubra* (Linnaeus, 1758: 398)
SUBSPECIES *S. r. rubra* (Linnaeus, 1758: 398)
SUBGENUS *STICTOLEPTURA* Casey, 1924: 280
SPECIES *S. cordigera* (Fuessly, 1775: 14)
SUBSPECIES *S. c. cordigera* (Fuessly, 1775: 14)
SUBSPECIES *S. c. anojaensis* Slama, 1982: 207
SPECIES *S. deyrollei* (Pic, 1895: 40)
SPECIES *S. erythroptera* (Hagenbach, 1822: 7)
SPECIES *S. excisipes* (Daniel & Daniel, 1891: 6)
SPECIES *S. fulva* (DeGeer, 1775: 137)
SPECIES *S. gevneensis* Özdikmen & Turgut, 2008: 549
SPECIES *S. heydeni* (Ganglbauer, 1889: 469)
SPECIES *S. pallens* (Brullé, 1832: 264)
SPECIES *S. pallidipennis* (Tournier, 1872: 346)
SPECIES *S. rufa* (Brullé, 1832: 263)
SUBSPECIES *S. r. rufa* (Brullé, 1832: 263)
SUBSPECIES *S. r. dimidiata* (Daniel & Daniel, 1891: 11)
SPECIES *S. sambucicola* (Holzschuh, 1982: 65)
SPECIES *S. scutellata* (Fabricius, 1781: 247)
SUBSPECIES *S. s. scutellata* (Fabricius, 1781: 247)
SUBSPECIES *S. s. inscutellata* (Pic, 1892: 415)
SPECIES *S. tesserula* (Charpentier, 1825: 227)
SPECIES *S. tonsa* (Daniel & Daniel, 1891: 31)
SPECIES *S. tripartita* (Heyden, 1889: 329)
GENUS *ANASTRANGALIA* Casey, 1924: 280
SUBGENUS -
SPECIES *A. dubia* (Scopoli, 1763: 47)
SUBSPECIES *A. d. dubia* (Scopoli, 1763: 47)
SUBSPECIES *A. d. melonota* (Faldermann, 1837: 315)
SPECIES *A. montana* (Mulsant & Rey, 1863: 179)

SUBSPECIES *A. m. montana* (Mulsant & Rey, 1863: 179)
SPECIES *A. sanguinolenta* (Linnaeus, 1760: 196)
GENUS *PEDOSTRANGALIA* Sokolov, 1897: 461
SUBGENUS *PEDOSTRANGALIA* Sokolov, 1897: 461
SPECIES *P. revestita* (Linnaeus, 1767: 638)
SPECIES *P. tokatensis* Sama, 1996: 103
SUBGENUS *NEOSPHENALIA* Löbl, 2010: 110
SPECIES *P. adaliae* (Reitter, 1885: 390)
SPECIES *P. emmipoda* (Mulsant, 1863: 531)
SPECIES *P. kurda* Sama, 1996: 104
SPECIES *P. verticalis* (Germar, 1822: 9)
SPECIES *P. verticenigra* (Pic, 1892: 416)
GENUS *ETOROFUS* Matsushita, 1933: 204
SUBGENUS *ETOROFUS* Matsushita, 1933: 204
SPECIES *E. pubescens* (Fabricius, 1787: 158)
GENUS *JUDOLIA* Mulsant, 1863: 496
SUBGENUS -
SPECIES *J. cerambyciformis* (Schrank, 1781: 154)
SPECIES *J. erratica* (Dalman, 1817: 490)
SUBSPECIES *J. e. erratica* (Dalman, 1817: 490)
GENUS *LEPTURA* Linnaeus, 1758: 397
SUBGENUS *LEPTURA* Linnaeus, 1758: 397
SPECIES *L. aethiops* Poda, 1761: 38
SPECIES *L. aurulenta* Fabricius, 1792: 348
SPECIES *L. quadrifasciata* Linnaeus, 1758: 398
SUBSPECIES *L. q. quadrifasciata* Linnaeus, 1758: 398
SUBSPECIES *L. q. lederi* Ganglbauer, 1882: 697
GENUS *STRANGALIA* Audinet-Serville, 1835: 220
SUBGENUS -
SPECIES *S. attenuata* (Linnaeus, 1758: 398)
GENUS *RUTPELA* Nakani & Ohbayashi, 1957: 242
SUBGENUS -
SPECIES *R. maculata* (Poda, 1761: 37)
SUBSPECIES *R. m. maculata* (Poda, 1761: 37)
SUBSPECIES *R. m. nigricornis* (Stierlin, 1864: 153)
SUBSPECIES *R. m. irmasanica* Sama, 1996: 105
GENUS *SOLAIA* Sama, 2003: 69
SUBGENUS -
SPECIES *S. antonellae* Sama, 2003: 71
GENUS *CARLANDREA* Sama & Rapuzzi, 1999: 467
SUBGENUS -
SPECIES *C. syriaca* (Pic, 1891: 1)
GENUS *STENURELLA* Villiers, 1974: 217
SUBGENUS -
SPECIES *S. bifasciata* (Müller, 1776: 93)
SUBSPECIES *S. b. bifasciata* (Müller, 1776: 93)
SUBSPECIES *S. b. ferruginipes* (Pic, 1895: 76)
SUBSPECIES *S. b. limbiventris* (Reitter, 1898: 21)
SUBSPECIES *S. b. nigrosuturalis* (Reitter, 1895: 88)
SUBSPECIES *S. b. safronovi* Danilevsky, 2011: 2
SPECIES *S. jaegeri* (Hummel, 1825: 68)
SPECIES *S. melanura* (Linnaeus, 1758: 397)
SPECIES *S. nigra* (Linnaeus, 1758: 398)
SPECIES *S. novercalis* Reitter, 1901: 78
SPECIES *S. pamphyliae* Rapuzzi & Sama, 2009: 182
SPECIES *S. samai* Rapuzzi, 1995: 618
SPECIES *S. septempunctata* (Fabricius, 1792: 346)
SUBSPECIES *S. s. latenigra* (Pic, 1915: 5)
SPECIES *S. zehrae* Özdikmen, Mercan & Cihan, 2012: 18

SUBFAMILY NECYDALINAE Latreille, 1825: 401
TRIBE NECYDALINI Latreille, 1825: 401
SUBTRIBE -
GENUS *NECYDALIS* Linnaeus, 1758: 421
SUBGENUS *NECYDALIS* Linnaeus, 1758: 421
SPECIES *N. sabatinelli* Sama, 1994: 10
SPECIES *N. ulmi* Chevrolat, 1838: unnumb. [NP]

SUBFAMILY ASEMINAE Thomson, 1861: 139
TRIBE ASEMINI Thomson, 1861
SUBTRIBE -
GENUS *ARHOPALUS* Audinet-Serville, 1834: 77
SUBGENUS -
SPECIES *A. ferus* (Mulsant, 1839: 64)
SPECIES *A. rusticus* (Linnaeus, 1758: 395)
SPECIES *A. syriacus* (Reitter, 1895: 86)
GENUS ASEMUM Eschscholtz, 1830: 66
SUBGENUS -
SPECIES *A. striatum* (Linnaeus, 1758: 396)
SPECIES *A. tenuicorne* Kraatz, 1879: 97
GENUS *TETROPIUM* Kirby, 1837: 174
SUBGENUS -
SPECIES *T. castaneum* (Linnaeus, 1758: 396)
SPECIES *T. fuscum* (Fabricius, 1787: 154)
TRIBE NOTHORHININI Zagajkevich, 1991: 110
SUBTRIBE -
GENUS *NOTHORHINA* Redtenbacher, 1845: 109
SUBGENUS -
SPECIES *N. muricata* (Dalman, 1817: 193)

SUBFAMILY SAPHANINAE Gistel, 1848: [1]
TRIBE ANISARTHRINI Mamaev & Danilevsky, 1973: 1260
SUBTRIBE -
GENUS *ALOCERUS* Mulsant, 1862: 127
SUBGENUS -
SPECIES *A. moesiacus* (Frivadszky, 1837: 177)
TRIBE SAPHANINI Gistel, 1848: [1]
SUBTRIBE -
GENUS *DRYMOCHARES* Mulsant, 1847: 518
SUBGENUS -
SPECIES *D. starcki* Ganglbauer, 1888: 398
SUBSPECIES *D. s. cavazzutii* Sama & Rapuzzi, 1993: 288
SUBSPECIES *D. s. ivani* Sama & Rapuzzi, 1993: 287
GENUS *SAPHANUS* Audinet-Serville, 1834: 81
SUBGENUS -
SPECIES *S. piceus* (Laicharting, 1784: 56)
SUBSPECIES *S. p. ganglbaueri* Brancsik, 1886: 71
GENUS *OXYPLEURUS* Mulsant, 1839: 57
SUBGENUS -
SPECIES *O. nodieri* Mulsant, 1839: 57

SUBFAMILY SPONDYLIDINAE Audinet-Serville, 1832: 123
TRIBE SPONDYLIDINI Audinet-Serville, 1832: 123
SUBTRIBE -
GENUS *SPONDYLIS* Fabricius, 1775: 159
SUBGENUS -
SPECIES *S. buprestoides* (Linnaeus, 1758: 388)

SUBFAMILY DORCASOMINAE Lacordaire, 1868: 456
TRIBE DORCASOMINI Lacordaire, 1868: 456
SUBTRIBE -
GENUS *APATOPHYSIS* Chevrolat, 1860: 95
SUBGENUS *APATOPHYSIS* Chevrolat, 1860: 95
SPECIES *A. anatolica* Heyrovsky, 1938: 93
SPECIES *A. kadleci* Danilevsky, 2008: 29
SPECIES *A. karsica* Danilevsky, 2008: 28
SPECIES *A. vedica* Danilevsky, 2008: 26

SUBFAMILY CERAMBYCINAE Latreille, 1802: 211
TRIBE ACHRYSONINI Lacordaire, 1868: 203
SUBTRIBE -
GENUS *ICOSIUM* Lucas, 1854: VIII
SUBGENUS -
SPECIES *I. tomentosum* Lucas, 1854: IX
SUBSPECIES *I. t. atticum* Ganglbauer, 1882: 743

TRIBE HESPEROPHANINI Mulsant, 1839: 61
SUBTRIBE HESPEROPHANINA Mulsant, 1839: 61
GENUS *HESPEROPHANES* Dejean, 1835: 328
SUBGENUS -
SPECIES *H. sericeus* (Fabricius, 1787: 152)
GENUS *TRICHOFERUS* Wollaston, 1854: 427
SUBGENUS -
SPECIES *T. fasciculatus* (Faldermann, 1837: 266)
SUBSPECIES *T. f. fasciculatus* (Faldermann, 1837: 266)
SPECIES *T. fissitarsis* Sama, Fallahzadeh & Rapuzzi, 2005: 125
SPECIES *T. griseus* (Fabricius, 1792: 325)
SPECIES *T. holosericeus* (Rossi, 1790: 153)
SPECIES *T. kotschyi* (Ganglbauer, 1883: 300)
SPECIES *T. lunatus* (Szallies, 1994: 261)
SPECIES *T. preissi* (Heyden, 1894: 85)
SPECIES *T. samai* Kadlec & Rejzek, 2001: 296
SPECIES *T. sbordonii* Sama, 1982: 217
SPECIES *T. spartii* (Müller, 1948: 67)
GENUS *STROMATIUM* Audinet-Serville, 1834: 80
SUBGENUS -
SPECIES *S. unicolor* (Olivier, 1795: 58)
TRIBE PHORACANTHINI Newman, 1840: 2
SUBTRIBE -
GENUS *PHORACANTHA* Newman, 1840: 19
SUBGENUS -
SPECIES *P. recurva* Newman, 1840: 4
SPECIES *P. semipunctata* (Fabricius, 1775: 180)
TRIBE CERAMBYCINI Latreille, 1802: 211
SUBTRIBE CERAMBYCINA Latreille, 1802: 211
GENUS *CERAMBYX* Linnaeus, 1758: 388
SUBGENUS *CERAMBYX* Linnaeus, 1758: 388
SPECIES *C. carinatus* (Küster, 1845: 46)
SPECIES *C. cerdo* Linnaeus, 1758: 392
SUBSPECIES *C. c. cerdo* Linnaeus, 1758: 392
SPECIES *C. dux* (Faldermann, 1837: 264)
SPECIES *C. heinzianus* Demelt, 1976: 65
SPECIES *C. miles* Bonelli, 1812: 178
SPECIES *C. nodulosus* Germar, 1817: 220
SPECIES *C. welensii* (Küster, 1845: 44)
SUBGENUS *MICROCERAMBYX* Mikšic & Georgijevic, 1973: 22
SPECIES *C. scopolii* Fuessly, 1775: 12
SUBSPECIES *C. s. scopolii* Fuessly, 1775: 12
SUBSPECIES *C. s. nitidus* Pic, 1892: CXI
TRIBE ROSALIINI Fairmaire, 1864: 137
SUBTRIBE -
GENUS *ROSALIA* Audinet-Serville, 1834: 561
SUBGENUS *ROSALIA* Audinet-Serville, 1834: 561
SPECIES *R. alpina* (Linnaeus, 1758: 392)
SUBSPECIES *R. a. alpina* (Linnaeus, 1758: 392)
SUBSPECIES *R. a. syriaca* Pic, 1895: CCLXXXV
TRIBE TRACHYDERINI Dupont, 1836: 1
SUBTRIBE TRACHIDERINA Dupont, 1836: 1
GENUS *PURPURICENUS* Dejean, 1821: 105
SUBGENUS -
SPECIES *P. apicalis* Pic, 1905: 163
SPECIES *P. bitlisiensis* Pic, 1902: 27
SPECIES *P. budensis* (Götz, 1783: 70)
SPECIES *P. caucasicus* T. Pic, 1902: 27
SUBSPECIES *P. c. caucasicus* T. Pic, 1902: 27
SPECIES *P. cornifrons* Sabbadini & Pesarini, 1992: 58
SPECIES *P. dalmatinus* Sturm, 1843: 353
SPECIES *P. desfontainii* (Fabricius, 1792: 258)
SUBSPECIES *P. d. inhumeralis* Pic, 1891: 24
SPECIES *P. interscapillatus* Plavilstshikov, 1937: 247 [RN]
SUBSPECIES *P. i. interscapillatus* Plavilstshikov, 1937: 247 [RN]
SUBSPECIES *P. i. nudicollis* Demelt, 1968: 65

SPECIES *P. kaehleri* (Linnaeus, 1758: 393)
SUBSPECIES *P. k. kaehleri* (Linnaeus, 1758: 393)
SUBSPECIES *P. k. menetriesi* Motschulsky, 1845: 87
SPECIES *P. nanus* Semenov, 1907: 254
SPECIES *P. nigrotatatus* Pic, 1907: 169
SPECIES *P. wachanrui* Levrat, 1858: 261
GENUS *CALCHAENESTHES* Kraatz, 1863: 97
SUBGENUS -
SPECIES *C. diversicollis* Holzschuh, 1977: 129
SPECIES *C. oblongomaculata* (Guerin-Meneville, 1844: 234)
TRIBE CALLICHROMATINI Swainson & Shuckard, 1840: 293
SUBTRIBE -
GENUS *AROMIA* Audinet-Serville, 1834: 559
SUBGENUS -
SPECIES *A. moschata* (Linnaeus, 1758: 391)
SUBSPECIES *A. m. moschata* (Linnaeus, 1758: 391)
SUBSPECIES *A. m. ambrosiaca* (Steven, 1809: 40)
GENUS *OSPHRANTERIA* Redtenbacher, 1850: 50
SUBGENUS -
SPECIES *O. coerulescens* Redtenbacher, 1850: 50
SUBSPECIES *O. c. inaurata* Holzschuh, 1981: 98
TRIBE GRACILIINI Mulsant, 1839: 99
SUBTRIBE -
GENUS *GRACILIA* Audinet-Serville, 1834: 81
SUBGENUS -
SPECIES *G. minuta* (Fabricius, 1781: 235)
GENUS *PENICHROA* Stephens, 1839: 270
SUBGENUS -
SPECIES *P. fasciata* (Stephens, 1831: 250)
GENUS *AXINOPALPIS* Dejean, 1835: 332
SUBGENUS -
SPECIES *A. gracilis* (Krynicki, 1832: 162)
SUBSPECIES *A. g. gracilis* (Krynicki, 1832: 162)
GENUS *HYBOMETOPIA* Ganglbauer, 1889: 282
SUBGENUS -
SPECIES *H. starcki* Ganglbauer, 1889: 285
SUBSPECIES *H. s. ivani* Sama, 1996: 106
SUBSPECIES *H. s. starcki* Ganglbauer, 1889: 285
TRIBE OBRIINI Mulsant, 1839: 95
SUBTRIBE -
GENUS *OBRIUM* Dejean, 1821: 110
SUBGENUS -
SPECIES *O. brunneum* (Fabricius, 1792: 316)
SPECIES *O. cantharinum* (Linnaeus, 1767: 637)
SUBSPECIES *O. c. cantharinum* (Linnaeus, 1767: 637)
GENUS *ANATOLOBRIUM* Adlbauer, 2004: 419
SUBGENUS -
SPECIES *A. eggeri* Adlbauer, 2004: 421
TRIBE CERTALLINI Fairmaire, 1864: 149
SUBTRIBE -
GENUS *CERTALLUM* Dejean, 1821: 111
SUBGENUS -
SPECIES *C. ebulinum* (Linnaeus, 1767: 637)
SPECIES *C. thoracicum* (Sharp, 1880: 247)
TRIBE DEILINI Fairmaire, 1864: 154
SUBTRIBE -
GENUS *DELAGRANGEUS* Pic, 1892: XCIII
SUBGENUS *DELAGRANGEUS* Pic, 1892: XCIII
SPECIES *D. angustissimus* Pic, 1892: XCIII
SUBSPECIES *D. a. angustissimus* Pic, 1892: XCIII
GENUS *DEILUS* Audinet-Serville, 1834: 73
SUBGENUS -
SPECIES *D. fugax* (Olivier, 1790: 253)

TRIBE STENHOMALINI Miroshnikov, 1989: 742
SUBTRIBE -
GENUS *STENHOMALUS* White, 1855: 243
SUBGENUS *OBRIOPSIS* Müller, 1948: 65
SPECIES *S. bicolor* (Kraatz, 1862: 126)
TRIBE HYLOTRUPINI Zagajkevich, 1991: 67
SUBTRIBE -
GENUS *HYLOTRUPES* Audinet-Serville, 1834: 77
SUBGENUS -
SPECIES *H. bajulus* (Linnaeus, 1758: 396)
TRIBE CALLIDIINI Kirby, 1837: 170
SUBTRIBE -
GENUS *ROPALOPUS* Mulsant, 1839: 40
SUBGENUS *ROPALOPUS* Mulsant, 1839: 40
SPECIES *R. clavipes* (Fabricius, 1775: 188)
SPECIES *R. femoratus* (Linnaeus, 1758: 395)
SPECIES *R. hanae* Sama & Rejzek, 2002: 105
SPECIES *R. insubricus* (Germar, 1824: 154)
SUBSPECIES *R. i. insubricus* (Germar, 1824: 154)
SPECIES *R. ledereri* (Fairmaire, 1866: 269)
SUBSPECIES *R. l. ledereri* (Fairmaire, 1866: 269)
SUBSPECIES *R. l. wittmeri* Demelt, 1970: 31
SPECIES *R. lederi* (Ganglbauer, 1882: 747)
SPECIES *R. macropus* (Germar, 1824: 514)
SPECIES *R. sculpturatus* (Pic, 1931: 9)
GENUS *LEIODERES* Redtenbacher, 1849: 482
SUBGENUS -
SPECIES *L. kollari* Redtenbacher, 1849: 482
SPECIES *L. tuerki* (Ganglbauer, 1886: 517)
GENUS *SEMANOTUS* Mulsant, 1839: 54
SUBGENUS -
SPECIES *S. russicus* (Fabricius, 1777: 232)
SUBSPECIES *S. r. russicus* (Fabricius, 1777: 232)
GENUS *CALLIDIUM* Fabricius, 1775: 187
SUBGENUS *CALLIDIUM* Fabricius, 1775: 187
SPECIES *C. syriacum* Pic, 1892: CXI
SPECIES *C. violaceum* (Fabricius, 1775: 395)
SUBGENUS *CALLIDOSTOLA* Reitter, 1913: 37
SPECIES *C. aeneum* (DeGeer, 1775: 89)
SUBSPECIES *C. a. aeneum* (DeGeer, 1775: 89)
GENUS *PYRRHIDIUM* Fairmaire, 1864: 133
SUBGENUS -
SPECIES *P. sanguineum* (Linnaeus, 1758: 396)
GENUS *PHYMATODES* Mulsant, 1839: 47
SUBGENUS *MELASMETUS* Reitter, 1913: 39
SPECIES *P. femoralis* (Ménétriés, 1832: 228)
SUBSPECIES *P. f. demelti* Heyrovsky, 1962: 41
SUBGENUS *PHYMATODES* Mulsant, 1839: 47
SPECIES *P. testaceus* (Linnaeus, 1758: 396)
SUBGENUS *PHYMATODERUS* Reitter, 1913: 39 nec Dejean, 1837
SPECIES *P. lividus* (Rossi, 1794: 98)
SPECIES *P. pusillus* (Fabricius, 1787: 155)
SUBSPECIES *P. p. pusillus* (Fabricius, 1787: 155)
SUBGENUS *PHYMATODELLUS* Reitter, 1913: 40
SPECIES *P. rufipes* (Fabricius, 1777: 232)
SUBSPECIES *P. r. rufipes* (Fabricius, 1777: 232)
SUBSPECIES *P. r. syriacus* (Pic, 1891: 118)
SUBGENUS *POECILIUM* Fairmaire, 1864: 134
SPECIES *P. alni* (Linnaeus, 1767: 639)
SUBSPECIES *P. a. alni* (Linnaeus, 1767: 639)
SPECIES *P. kasnaki* (Sama, 2011: 826)
SPECIES *P. magnanii* (Sama & Rapuzzi, 1999: 468)
SUBGENUS *PARAPHYMATODES* (Plavilstshikov, 1934: 215)
SPECIES *P. fasciatus* (Villers, 1789: 257)
GENUS *LIODERINA* Ganglbauer, 1886: 517
SUBGENUS -
SPECIES *L. linearis* (Hampe, 1871: 335)

TRIBE ANAGLYPTINI Lacordaire, 1868: 404
SUBTRIBE -
GENUS *PARACLYTUS* Bates, 1884: 234
SUBGENUS -
SPECIES *P. sexguttatus* (Adams, 1817: 308)
GENUS *ANAGLYPTUS* Mulsant, 1839: 91
SUBGENUS *ANAGLYPTUS* Mulsant, 1839: 91
SPECIES *A. arabicus* (Küster, 1847: 95)
SPECIES *A. croceus* Pesarini & Sabbadini, 1997: 47
SPECIES *A. danilevskii* Miroshnikov, 2000b: 77
SPECIES *A. ganglbaueri* Reitter, 1886: 67
SPECIES *A. mysticoides* Reitter, 1894c: 128
SPECIES *A. mysticus* (Linnaeus, 1758: 398)
SPECIES *A. simplicicornis* Reitter, 1906: 298
TRIBE CLYTINI Mulsant, 1839: 70
SUBTRIBE -
GENUS *PLAGIONOTUS* Mulsant, 1842: 1
SUBGENUS *PLAGIONOTUS* Mulsant, 1842: 1
SPECIES *P. arcuatus* (Linnaeus, 1758: 399)
SPECIES *P. detritus* (Linnaeus, 1758: 399)
SUBSPECIES *P. d. detritus* (Linnaeus, 1758: 399)
SUBSPECIES *P. d. caucasicola* Plavilstshikov, 1936: 435
SUBGENUS *ECHINOCERUS* Mulsant, 1862: 143
SPECIES *P. floralis* (Pallas, 1773: 724)
SUBGENUS *NEOPLAGIONOTUS* Kasatkin, 2005: 51
SPECIES *P. bobelayei* (Brullé, 1832: 253)
SPECIES *P. scalaris* (Brullé, 1832: 254)
GENUS *ISOTOMUS* Mulsant, 1862: 143
SUBGENUS -
SPECIES *I. comptus* (Mannerheim, 1825: 36)
SUBSPECIES *I. c. comptus* (Mannerheim, 1825: 36)
SPECIES *I. speciosus* (Schneider, 1787: 125)
SPECIES *I. syriacus* (Pic, 1902: 25)
GENUS *CHLOROPHORUS* Chevrolat, 186: 290
SUBGENUS *CHLOROPHORUS* Chevrolat, 1863: 290
SPECIES *C. herbstii* (Brahm, 1790: 148)
SPECIES *C. varius* (Müller, 1766: 188)
SUBSPECIES *C. v. damascenus* (Chevrolat, 1854: 483)
SUBSPECIES *C. v. varius* (Müller, 1766: 188)
SUBGENUS *CRASSOFASCIATUS* Özdikmen, 2011: 538
SPECIES *C. aegyptiacus* (Fabricius, 1775: 194)
SPECIES *C. convexifrons* Holzschuh, 1981: 100
SPECIES *C. cursor* Rapuzzi & Sama, 1999: 331
SPECIES *C. hungaricus* Seidlitz, 1891: 828
SPECIES *C. niehuisi* Adlbauer, 1992: 497
SPECIES *C. oezdikmeni* Sama & Rapuzzi, 2011
SPECIES *C. robustior* (Pic, 1900: 11)
SPECIES *C. trifasciatus* (Fabricius, 1781: 244)
SUBGENUS *PERDEROMACULATUS* Özdikmen, 2011: 537
SPECIES *C. gratiosus* (Marseul, 1868: 203)
SUBSPECIES *C. g. gratiosus* (Marseul, 1868: 203)
SUBSPECIES *C. g. sparsus* (Marseul, 1868: 203)
SPECIES *C. grosseri* Sama & Rapuzzi, 2011
SPECIES *C. sartor* (Müller, 1766: 188)
SPECIES *C. wewalkai* Holzschuh, 1969: 77
SUBGENUS *HUMEROMACULATUS* Özdikmen, 2011: 537
SPECIES *C. dinae* Rapuzzi & Sama, 1999: 329
SPECIES *C. dominici* Sama, 1996: 110
SPECIES *C. figuratus* (Scopoli, 1763: 55)
SPECIES *C. nivipictus* (Kraatz, 1879: 91)
GENUS *XYLOTRECHUS* Chevrolat, 1860: 456
SUBGENUS *XYLOTRECHUS* (Chevrolat, 1860: 456)
SPECIES *X. antilope* (Schoenherr, 1817: 465)
SUBSPECIES *X. a. antilope* (Schoenherr, 1817: 465)
SPECIES *X. arvicola* Olivier, 1795: 64
SPECIES *X. stebbingi* Gahan, 1906: 244

GENUS *RUSTICOCLYTUS* Vives, 1977: 130
SUBGENUS -
SPECIES *R. rusticus* (Linnaeus, 1758: 398)
GENUS *TURANOCLYTUS* Sama, 1994: hevrolat, 1860: 456
SUBGENUS -
SPECIES *T. ilamensis* (Holzschuh, 1979: 115)
SUBSPECIES *T. i. ilamensis* (Holzschuh, 1979: 115)
SPECIES *T. sieversi* (Ganglbauer, 1890)
GENUS *PSEUDOSPHEGESTHES* Reitter, 1913: 50
SUBGENUS -
SPECIES *P. brunnescens* (Pic, 1897: 262)
SPECIES *P. longitarsus* Holzschuh, 1974: 90
SPECIES *P. samai* Danilevsky, 2000: 44
GENUS *CLYTUS* Laicharting, 1784: 88
SUBGENUS -
SPECIES *C. arietis* (Linnaeus, 1758: 399)
SUBSPECIES *C. a. arietis* (Linnaeus, 1758: 399)
SUBSPECIES *C. a. lederi* Ganglbauer, 1882: 730
SUBSPECIES *C. a. oblitus* Roubal, 1932: 17
SPECIES *C. buglanicus* Kadlec, 2005: 106
SPECIES *C. ciliciensis* (Chevrolat, 1863: 334)
SPECIES *C. gulekanus* Pic, 1904: 65
SPECIES *C. insignitus* Fairmaire, 1866: 269 [DA]
SPECIES *C. kumalariensis* Johanides, 2001: 219
SPECIES *C. madoni* Pic, 1891: CCXI
SPECIES *C. rhamni* Germar, 1817: 223
SUBSPECIES *C. r. temesiensis* (Germar, 1824: 519)
SPECIES *C. schneideri* Kiesenwetter, 1878: 313 [= 1879: 57]
SUBSPECIES *C. s. inapicalis* Pic, 1895: 38
SUBSPECIES *C. s. schneideri* Kiesenwetter, 1878: 313
SPECIES *C. schurmanni* Sama, 1996: 108
SPECIES *C. taurusiensis* (Pic, 1903: 139)
SPECIES *C. tropicus* (Panzer, 1795: 265)
GENUS *SPHEGOCLYTUS* Sama, 2005: 69
SUBGENUS -
SPECIES *Sphegoclytus vesparum* (Reitter, 1889: 375)

SUBFAMILY STENOPTERINAE Gistel, 1848: [9] (unnumbered section)
TRIBE STENOPTERINI Gistel, 1848: [9]
SUBTRIBE -
GENUS *STENOPTERUS* Illiger, 1804: 120
SUBGENUS -
SPECIES *S. adlbaueri* Sama, 1995: 408
SPECIES *S. atricornis* Pic, 1891: 102
SPECIES *S. flavicornis* Küster, 1846: 75
SPECIES *S. kraatzi* Pic, 1892: 21
SPECIES *S. rufus* (Linnaeus, 1767: 642)
SUBSPECIES *S. r. geniculatus* Kraatz, 1863: 104
SUBSPECIES *S. r. syriacus* Pic, 1892: 22
GENUS *CALLIMOXYS* Kraatz, 1863: 105
SUBGENUS -
SPECIES *C. gracilis* (Brullé, 1832: 257)
TRIBE MOLORCHINI Gistel, 1848: [9] (unnumbered section)
SUBTRIBE -
GENUS *MOLORCHUS* Fabricius, 1792: 356
SUBGENUS *CAENOPTERA* Thomson, 1859: 150
SPECIES *M. abieticola* Holzschuh, 2007: 218
SPECIES *M. juglandis* Sama, 1982: 219
SPECIES *M. minor* (Linnaeus, 1758: 421)
SUBSPECIES *M. m. minor* (Linnaeus, 1758: 421)
SUBGENUS *MOLORCHUS* Fabricius, 1792: 356
SPECIES *M. kiesenwetteri* Mulsant & Rey, 1861: 189
SUBSPECIES *M. k. hircus* Abeille de Perrin, 1881: 133
SPECIES *M. malmusii* (Sama, 1995: 370)
SPECIES *M. marmottani* (Brisout, 1863: 118)
SUBSPECIES *M. m. frischi* (Sama, 1995: 373)
SUBSPECIES *M. m. marmottani* (Brisout, 1863: 118)

SPECIES *M. tenuitarsis* Holzschuh, 1981: 97
SPECIES *M. umbellatarum* (Schreber, 1759: 9)
TRIBE PSEBIINI Lacordaire, 1868: 479
SUBTRIBE -
GENUS *NATHRIUS* Brèthes, 1916:
SUBGENUS -
SPECIES *N. brevipennis* (Mulsant, 1839: 105)
TRIBE BRACHYPTEROMINI Sama, 2008: 229
SUBTRIBE -
GENUS *BRACHYPTEROMA* Heyden, 1863: 128 [NP]
SUBGENUS -
SPECIES *B. holtzi* Pic, 1905: 114
SPECIES *B. ottomanum* Heyden, 1863: 128 [NP]
TRIBE HYBODERINI Linsley, 1840: 367
GENUS *CALLIMUS* Mulsant, 1846: [5]
SUBGENUS *CALLIMUS* Mulsant, 1846: [5]
SPECIES *C. akbesianus* Pic, 1892: CXI
SPECIES *C. angulatus* (Schrank, 1789 77)
SUBSPECIES *C. a. angulatus* (Schrank, 1789 77)
SUBGENUS *LAMPROPTERUS* Mulsant, 1862: 214
SPECIES *C. femoratus* (Germar, 1824: 519)
SUBGENUS *PROCALLIMUS* Pic, 1907: 7
SPECIES *C. egregius* Mulsant & Rey, 1863: 146

SUBFAMILY DORCADIONINAE Swainson, 1840: 290
TRIBE DORCADIONINI Swainson, 1840: 290
SUBTRIBE -
GENUS *DORCADION* Dalman, 1817: 397
SUBGENUS *CARINATODORCADION* Breuning, 1943: 524
SPECIES *D. aethiops* (Scopoli, 1763: 53)
SPECIES *D. carinatum* (Pallas, 1771: 465)
SUBSPECIES *D. c.* ssp.?
SPECIES *D. fulvum* (Scopoli, 1763: 53)
SUBSPECIES *D. f. fulvum* (Scopoli, 1763: 53)
SPECIES *D. hybridum* Ganglbauer, 1884: 441
SUBSPECIES *D. h. hybridum* Ganglbauer, 1884: 441
SPECIES *D. ingeae* Peks, 1993: 3
SUBGENUS *CRIBRIDORCADION* Pic, 1901: 12
SPECIES *D. abstersum* Holzschuh, 1982: 75
SPECIES *D. accola* Heyden, 1894: 87
SPECIES *D. afflictum* Pesarini & Sabbadini, 1999: 54
SPECIES *D. albicolle* Breuning, 1943: 89
SPECIES *D. albolineatum* Küster, 1847: 86
SPECIES *D. albonotatum* Pic, 1895: 39
SPECIES *D. amanense* Breuning, 1943: 94
SPECIES *D. anatolicum* Pic, 1900: 12
SPECIES *D. apicerufum* Breuning, 1943: 91 [RN]
SPECIES *D. arcivagum* Thomson, 1867: 121
SPECIES *D. ardahense* Breuning, 1975: 10
SPECIES *D. arenarium* (Scopoli, 1763: 53)
SUBSPECIES *D. a.* ssp.?
SPECIES *D. atritarse* Pic, 1931: 10
SPECIES *D. auratum* Tournier, 1872: 291
SPECIES *D. bangi* Heyden, 1894: 89
SUBSPECIES *D. b. bangi* Heyden, 1894: 89
SUBSPECIES *D. b. heinzorum* Braun, 1975: 17
SUBSPECIES *D. b. roridum* Pesarini & Sabbadini, 1999: 55
SPECIES *D. banjkovski* Plavilstshikov, 1958: 147
SPECIES *D. beckeri* Kraatz, 1873: 71
SUBSPECIES *D. b. beckeri* Kraatz, 1873: 71
SPECIES *D. beloni* Pic, 1891: LXXVII
SPECIES *D. bisignatum* Jakovlev, 1900: 66
SPECIES *D. bistriatum* Pic, 1898: 55
SPECIES *D. bithyniense* Chevrolat, 1856: 88
SPECIES *D. blanchardi* Mulsant & Rey, 1863: 147
SPECIES *D. blandulum* Holzschuh, 1977: 131
SPECIES *D. bodemeyeri* K. Daniel, 1900: 140

SPECIES *D. boluense* Breuning, 1962: 38
SUBSPECIES *D. b. boluense* Breuning, 1962: 38
SUBSPECIES *D. b. corallinum* Pesarini & Sabbadini, 1999: 53
SUBSPECIES *D. b. imitator* Pesarini & Sabbadini, 1999: 53
SPECIES *D. boszdaghense* Fairmaire, 1866: 275
SPECIES *D. bouilloni* Breuning & Ruspoli, 1975: 116
SPECIES *D. brauni* Breuning, 1979: 92
SPECIES *D. bremeri* Breuning, 1981: 181
SPECIES *D. breuningi* Heyrovsky, 1943: 78
SPECIES *D. bulgharmaadense* Breuning, 1946: 116
SPECIES *D. cachinno* Thomson, 1867: 120
SPECIES *D. carinipenne* Pic, 1900: 13
SPECIES *D. carolisturanii* Breuning & Ruspoli, 1971: 128
SPECIES *D. cinctellum* Fairmaire, 1866: 272
SPECIES *D. cinerarium* (Fabricius, 1787: 140)
SPECIES *D. cingulatum* Ganglbauer, 1884: 484
SPECIES *D. crux* (Bilberg, 1817: 175)
SPECIES *D. coiffaiti* Breuning, 1962: 392
SPECIES *D. complanatum* Ganglbauer, 1884: 485
SPECIES *D. condensatum* Küster, 1852: 92
SPECIES *D. confluens* Fairmaire, 1866: 274
SPECIES *D. culminicola* Thomson, 1867: 122
SPECIES *D. delagrangei* Pic, 1894: 110
SPECIES *D. deyrollei* Ganglbauer, 1884: 482
SPECIES *D. dimidiatum* Motschulsky, 1838: 186
SUBSPECIES *D. d. dimidiatum* Motschulsky, 1838: 186
SUBSPECIES *D. d. korgei* Breuning, 1966: 21
SUBSPECIES *D. d. kelkiticum* Özdikmen & Hasbenli, 2004: 23
SPECIES *D. divisum* Germar, 1839: 15
SUBSPECIES *D. d. divisum* Germar, 1839: 15
SUBSPECIES *D. d. dissimile* Ganglbauer, 1884: 458
SUBSPECIES *D. d. intercisum* Kraatz, 1873: 66
SUBSPECIES *D. d. loratum* Thomson, 1867: 123
SUBSPECIES *D. d. oedemischense* Heyrovsky, 1932: 104
SUBSPECIES *D. d. subdivisum* Breuning, 1955: 263
SPECIES *D. dobrovljanskii* Suvorov, 1915: 116
SPECIES *D. drusoides* Breuning, 1962: 375
SPECIES *D. elazigi* Fuchs & Breuning, 1971: 439
SPECIES *D. enricisturanii* Breuning & Ruspoli, 1971: 127
SUBSPECIES *D. e. enricisturanii* Breuning & Ruspoli, 1971: 127
SUBSPECIES *D. e. densepunctatum* Braun, 1978: 107
SPECIES *D. equestre* (Laxmann, 1770: 596)
SUBSPECIES *D. e. nogelli* Fairmaire, 1866: 270
SUBSPECIES *D. e. reclinatum* Kraatz, 1892: 173
SPECIES *D. ferruginipes* Ménetries, 1836: 151
SPECIES *D. formosum* Kraatz, 1871: 411
SUBSPECIES *D. f. formosum* Kraatz, 1871: 411
SUBSPECIES *D. f. ponticum* Breuning, 1964: 1
SPECIES *D. gallipolitanum* Thomson, 1867: 59
SUBSPECIES *D. g. gallipolitanum* Thomson, 1867: 59
SPECIES *D. gebzeense* Breuning, 1974: 148
SPECIES *D. glabricolle* Breuning, 1943: 92
SPECIES *D. haemorrhoidale* Hampe, 1852: 313
SPECIES *D. halepense* Kraatz, 1873: 72
SUBSPECIES *D. h. halepense* Kraatz, 1873: 72
SUBSPECIES *D. h. sehitkamilense* Özdikmen at al., 2012: 595
SPECIES *D. hampii* Mulsant & Rey, 1863: 157
SUBSPECIES *D. h. hampii* Mulsant & Rey, 1863: 157
SUBSPECIES *D. h. aureuvittatum* Kraatz, 1873: 81
SPECIES *D. heinzi* Breuning, 1964: 1
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    SUBSPECIES *D. s. subsericatum* Pic, 1901: 12
    SUBSPECIES *D. s. vulneratum* Pesarini & Sabbadini, 1999: 51
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SPECIES *D. wolfi* Krätschmer, 1985: 24
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SPECIES *D. walteri* Holzschuh, 1991: 55
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SPECIES *N. laqueatum* (Waltl, 1838: 469)
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SPECIES *N. pelleti* (Mulsant & Rey, 1863: 149)

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SPECIES *P. pontocircassica* Danilevsky & Miroshnikov, 1985: 289
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SPECIES *M. verecundus* (Faldermann, 1836: 396)
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GENUS *PARMENOPSIS* Ganglbauer, 1882: 693
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SPECIES *P. caucasica* (Leder, 1880: 484)
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SPECIES *P. anatolicus* Daniel & Daniel, 1898: 76
SPECIES *P. eugeniae* Ganglbauer, 1891: 131
SUBSPECIES *P. e. eugeniae* Ganglbauer, 1891: 131
SPECIES *P. hispidulus* (Piller & Mitterpacher, 1783: 35)
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SPECIES *P. perroudi* Mulsant, 1839: 158
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SPECIES *P. sieversi* Ganglbauer, 1887: 139
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SPECIES *P. decoratus* Fairmaire, 1855: 320
SPECIES *P. fasciculatus* (DeGeer, 1775: 71)
SUBSPECIES *P. f. fasciculatus* (DeGeer, 1775: 71)
SPECIES *P. inermicollis* Reitter, 1894: 247
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SPECIES *A. aedilis* (Linnaeus, 1758: 392)
SPECIES *A. griseus* (Fabricius, 1792: 261)

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SPECIES *L. femoratus* Fairmaire, 1859: 62
SPECIES *L. nebulosus* (Linnaeus, 1758: 391)
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SPECIES *L. syriacus* (Ganglbauer, 1884: 532)
SUBSPECIES *L. s. abieticola* Sama & Rapuzzi, 2010: 186
SUBSPECIES *L. s. syriacus* (Ganglbauer, 1884: 532)
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SPECIES *E. lusitanus* (Linnaeus, 1767: 1067)
SPECIES *E. punctipennis* Mulsant & Guillebeau, 1856: 103
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SPECIES *T. gilvipes* (Faldermann, 1837: 290)
SPECIES *T. praeustus* (Linnaeus, 1758: 399)
SUBSPECIES *T. p. anatolicus* Özdikmen & Turgut, 2008: 627
SUBSPECIES *T. p. praeustus* (Linnaeus, 1758: 399)
SPECIES *T. warnckei* Holzschuh, 1977: 133
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SPECIES *S. octopunctata* (Scopoli, 1772: 101)
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SPECIES *S. punctata* (Linnaeus, 1767: 1067)
SPECIES *S. scalaris* (Linnaeus, 1758: 394)
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SUBSPECIES *S. f. ferrea* (Schrank, 1776: 67)
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SPECIES *O. oculata* (Linnaeus, 1758: 394)
SPECIES *O. pupillata* (Gyllenhal, 1817: 185)
SPECIES *O. ressli* Demelt, 1963: 150
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SPECIES *O. erythrocephala* (Schrank, 1776: 67)
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SPECIES *O. duponcheli* (Brullé, 1832: 260)
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SPECIES *P. albolineata* (Hampe, 1852: 314)

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SPECIES *M. interrupta* Pic, 1905: 28
SPECIES *M. mirabilis* (Faldermann, 1837: 283)
SUBSPECIES *M. m. devexula* Holzschuh, 1989: 176
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SPECIES *M. tristis* Reitter, 1888: 134
SUBGENUS *EUMALLOSIA* Danilevsky, 1990: 364
SPECIES *M. armeniaca* Pic, 1897: 188
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SPECIES *M. herminae* Reitter, 1890: 241
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SPECIES *M. heinzorum* (Holzschuh, 1991: 27)
SPECIES *M. heydeni* (Ganglbauer, 1888: 76)
SPECIES *M. theresae* Pic, 1900: 15
GENUS *COPTOSIA* Fairmaire, 1864: 177
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SPECIES *C. albovittigera* (Heyden, 1863: 130)
SPECIES *C. antoniae* (Reitter, 1889: 42)
SPECIES *C. bithynensis* (Ganglbauer, 1884: 573)
SPECIES *C. compacta* (Ménétriés, 1832: 228)
SUBSPECIES *C. c. compacta* (Ménétriés, 1832: 228)
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SPECIES *C. demelti* (Breuning, 1973: 143)
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GENUS *MIMOCOPTASIA* Breuning & Villiers, 1972: 37
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SPECIES *P. speciosa* (Frivaldszky, 1884: 5)
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SUBSPECIES *P. a. wawerkana* Reitter, 1905: 239
SPECIES *P. breverufonotata* (Pic, 1952: 2)
SPECIES *P. griseomaculata* (Pic, 1891: 102)
SPECIES *P. hirsutula* (Frölich, 1793: 141)
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SPECIES *P. konyaensis* Danilevsky, 2010: 20
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SPECIES *P. smatanai* (Holzschuh, 2003: 240)
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SUBGENUS *CARDORIA* Mulsant, 1862: 436
SPECIES *P. scutellata* (Fabricius, 1792: 317)
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SPECIES *P. adelpha* Ganglbauer, 1886: 522
SPECIES *P. alziari* (Sama, 1992: 306)
SPECIES *P. armeniaca* Frivaldszky, 1878: 10 [= 1878: 318]
SUBSPECIES *P. a. armeniaca* Frivaldszky, 1878: 10 [= 1878: 318]

SPECIES *P. demelti* (Sama, 2003: 73)
SPECIES *P. diademata* Faldermann, 1837: 297
SPECIES *P. fatima* Ganglbauer, 1884: 570
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SPECIES *P. humeralis* (Waltl, 1838: 471)
SUBSPECIES *P. h. humeralis* (Waltl, 1838: 471)
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SPECIES *P. praetextata* (Steven, 1817: 184)
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SPECIES *P. pretiosa* Faldermann, 1837: 298
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SUBSPECIES *P. a. affinis* (Harrer, 1784: 209) [NP]
SPECIES *P. anatolica* Fuchs & Breuning, 1971: 75
SPECIES *P. astarte* Ganglbauer, 1886: 523
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SPECIES *P. puncticollis* Faldermann, 1837: 291
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SPECIES *P. tuerki* Ganglbauer, 1884: 575
SPECIES *P. wachanrui* Mulsant, 1851: 120
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SPECIES *P. adusta* Reitter, 1889: 43
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SPECIES *P. pauliraputii* (Sama, 1993: 295)
SPECIES *P. salvicola* Holzschuh, 1889: 176
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SPECIES *P. annulipes* Mulsant & Rey, 1863: 165
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SPECIES *P. bangi* Pic, 1897: 189
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SPECIES *P. croceipes* Reiche & Saulcy, 1858: 17 [RN]
SPECIES *P. cylindrica* (Linnaeus, 1758: 394)
SPECIES *P. geniculata* Mulsant, 1862: 420
SPECIES *P. icterica* (Schaller, 1783: 292)
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SPECIES *P. manicata* Reiche & Saulcy, 1858: 17
SPECIES *P. nigricornis* (Fabricius, 1782: 499)
SPECIES *P. pubescens* Pic, 1895: 64
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SPECIES *P. rufipes* (Olivier, 1795: 25)
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SPECIES *P. shokhini* Kasatkin, 2010: 61

SPECIES *P. virgula* (Charpentier, 1825: 225)
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SUBSPECIES *P. v. inhumeralis* (Pic, 1900: 7)
SUBSPECIES *P. v. leuthneri* Ganglbauer, 1886: 523
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SPECIES *A. cynarae* (Germar, 1817: 222)
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SPECIES *A. dahli* (Richter, 1820: 12)
SPECIES *A. detrita* Kraatz, 1882: 336
SPECIES *A. kindermanni* Pic, 1905: 13
SPECIES *A. lateralis* Ganglbauer, 1884: 541
SPECIES *A. schmidti* Holzschuh, 1975: 89
SPECIES *A. simplicicornis* Reitter, 1898: 133
SPECIES *A. subchalybaea* Reitter, 1898: 134
SPECIES *A. subflavida* Pic, 1903: 163
SPECIES *A. verecunda* Chevrolat, 1882: 63
SPECIES *A. villosoviridescens* (DeGeer, 1775: 76)
SPECIES *A. walteri* Reitter, 1898: 132
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SPECIES *A. maculicornis* (Gyllenhal, 1817: 189)
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SPECIES *A. coeruleipennis* Frivaldszky, 1878: 9
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SPECIES *A. cardui* (Linnaeus, 1767: 632)
SPECIES *A. suturalis* (Fabricius, 1787: 149)
SUBGENUS *STICHODERA* Pesarini & Sabbadini, 2004: 126
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SPECIES *A. amitina* Holzschuh, 1989; 174
SPECIES *A. chalybaea* Faldermann, 1837: 303
SPECIES *A. fallax* Holzschuh, 1974: 95
SPECIES *A. frivaldszkyi* Ganglbauer, 1884: 546
SPECIES *A. intermedia* Ganglbauer, 1884: 543
SPECIES *A. lais* Reiche & Saulcy, 1858: 21
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SPECIES *A. persicola* Reitter, 1894: 146
SPECIES *A. pesarinii* Sama & Rapuzzi, 2010: 177
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SPECIES *Z. scutellaris* Suffrian, 1840: 99
SPECIES *Z. subspinosa* (Fabricius, 1781: 155)

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SPECIES *O. humeralis* Latreille, 1804: 350
SUBSPECIES *O. h. humeralis* Latreille, 1804: 350
SPECIES *O. variabilis* Baly, 1877: 377

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SPECIES *B. affinis* J. A. Frölich, 1799: 55
SPECIES *B. altaicus* Fahraeus, 1839: 80
SPECIES *B. anatolicus* Anton, 1999: 655
SPECIES *B. atomarius* (Linnaeus, 1760: 183)
SPECIES *B. brachialis* Fahraeus, 1839: 79
SPECIES *B. dentipes* (Baudi di Selve, 1886: 33)
SPECIES *B. emarginatus* Allard, 1868: 104
SPECIES *B. ervi* J. A. Frölich, 1799: 56
SPECIES *B. hamatus* Miller, 1881: 228
SPECIES *B. laticollis* Boheman, 1833: 71
SPECIES *B. lentis* Frölich, 1799: 57
SPECIES *B. libanensis* Zampetti, 1993: 215
SPECIES *B. loti* Paykull, 1800: 13
SPECIES *B. lugubris* Fahraeus, 1839: 84
SPECIES *B. luteicornis* Illiger, 1794: 619
SPECIES *B. pisorum* (Linnaeus, 1758: 356)
SPECIES *B. rufimanus* Boheman, 1833: 58
SPECIES *B. rufipes* Herbst, 1783: 29
SPECIES *B. sibiricus* Germar, 1824: 179
SPECIES *B. signaticornis* Gyllenhal, 1833: 64
SPECIES *B. tetragonus* (Baudi di Selve, 1886: 28)
SPECIES *B. tristiculus* Fahraeus, 1839: 81
SPECIES *B. tristis* Boheman, 1833: 63
SPECIES *B. ulicis* Mulsant & Rey, 1858: 33
SPECIES *B. venustus* Fahraeus, 1839: 75
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SPECIES *A. obtectus* (Say, 1831: 1)
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SPECIES *A. spiniger* (Baudi di Selve, 1886: 47)
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SPECIES *B. albolineatus* (Blanchard, 1844: 1XXXII)
SPECIES *B. albopictus* (Allard, 1883: 11)
SPECIES *B. annulicornis* (Allard, 1868: 107)
SPECIES *B. anobioides* (Baudi di Selve, 1886: 72)
SPECIES *B. armeniacus* Ter-Minassian, 1969: 273
SPECIES *B. biguttatus* (Olivier, 1795: 20)
SPECIES *B. bimaculatus* (Olivier, 1795: 18)
SPECIES *B. bituberculatus* Schilsky, 1905: 90
SPECIES *B. borowieci* Anton, 1998: 3
SPECIES *B. bythinocerus* (Reitter, 1890: 197)
SPECIES *B. calabrensis* (Blanchard, 1844: 1XXXII)
SPECIES *B. canescens* (Motschulsky, 1874: 231)
SPECIES *B. caninus* (Kraatz, 1869: 334)
SPECIES *B. cinerascens* (Gyllenhal, 1833: 55)
SPECIES *B. cisti* (Fabricius, 1775: 65)
SPECIES *B. dilutus* (Motschulsky, 1874: 209)
SPECIES *B. dispar* (Gyllenhal, 1833: 45)
SPECIES *B. fischeri* (Hummel, 1827: 9)
SPECIES *B. foveolatus* (Gyllenhal, 1833: 81)
SPECIES *B. fulvescens* (Baudi di Selve, 1886: 68)
SPECIES *B. holosericeus* (Schoenherr, 1832: 213)
SPECIES *B. imbricornis* (Panzer, 1795: 292)
SPECIES *B. kieneri* Zampetti, 1992: 249
SPECIES *B. koenigi* Schilsky, 1906: no. 96
SPECIES *B. lateobscurus* (Pic, 1904: 40)
SPECIES *B. lineatus* (Allard, 1868: 117)
SPECIES *B. lividimanus* (Gyllenhal, 1833: 68)
SPECIES *B. loebli* Borowiec, 1985: 777
SPECIES *B. longulus* Schilsky, 1905: 79
SPECIES *B. lucifugus* (Boheman, 1833: 47)
SPECIES *B. lutescens* (Blanchard, 1844: 1XXXIV)
SPECIES *B. marginalis* (Fabricius, 1776: 212)
SPECIES *B. monstrosicornis* (Pic, 1904: 40)
SPECIES *B. mordelloides* (Baudi di Selve, 1886: 44)
SPECIES *B. mulsanti* (Brisout de Barneville, 1863: 50)
SPECIES *B. murinus* (Boheman, 1829: 113)
SPECIES *B. nanus* (Germar, 1824: 182)
SPECIES *B. obscuripes* (Gyllenhal, 1839: 21)
SPECIES *B. ochraceus* (Baudi di Selve, 1886: 61)
SPECIES *B. olivaceus* (Germar, 1824: 183)
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SPECIES *B. poecilus* (Germar, 1824: 180)
SPECIES *B. poupillieri* (Allard, 1868: 116)
SPECIES *B. pubicornis* Lukjanovitch & Ter-Minassian, 1957: 159
SPECIES *B. pusillus* (Germar, 1824: 181)
SPECIES *B. pygmaeus* (Boheman, 1833: 80)
SPECIES *B. quinqueguttatus* (Olivier, 1795: 15)
SPECIES *B. reitteri* Schilsky, 1906: 95
SPECIES *B. richteri* Lukjanovitch & Ter-Minassian, 1954: 70
SPECIES *B. robustus* Lukjanovitch & Ter-Minassian, 1957: 134
SPECIES *B. rufisurus* (Allard, 1883: 6)
SPECIES *B. seminarius* (Linnaeus, 1767: 605)
SPECIES *B. sericatus* (Germar, 1824: 184)
SPECIES *B. serraticornis* (Fabricius, 1775: 66)
SPECIES *B. sivasensis* Zampetti, 1984: 399
SPECIES *B. steveni* (Gyllenhal, 1839: 99)
SPECIES *B. talyshensis* Ter-Minassian, 1969: 275

SPECIES *B. tibialis* (Boheman, 1829: 114)
SPECIES *B. trifollii* (Motschulsky, 1874: 235)
SPECIES *B. tuberculatus* (Hochhut, 1847: 453)
SPECIES *B. unicolor* (Olivier, 1795: 2)
SPECIES *B. varipictus* (Motschulsky, 1874: 240)
SPECIES *B. varius* (Olivier, 1795: 19)
SPECIES *B. villosus* (Fabricius, 1792: 373)
SPECIES *B. virgatoides* Lukjanovitch & Ter-Minassian, 1957: 168
SPECIES *B. virgatus* (Fahraeus, 1839: 20)
GENUS *CALLOSOBRUCHUS* Pic, 1902: 6
SUBGENUS -
SPECIES *C. analis* (Fabricius, 1781: 75)
SPECIES *C. chinensis* (Linnaeus, 1758: 386)
SPECIES *C. maculatus* (Fabricius, 1775: 65)
GENUS *MIMOSESTES* Bridwell, 1946: 54
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SPECIES *M. mimosae* (Fabricius, 1781: 76)
GENUS *PALEOACANTHOSCELIDES* Borowiec, 1985: 457
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SPECIES *P. gilvoides* (Lukjanovitch & Ter-Minassian, 1957: 177)
SPECIES *P. gilvus* (Gyllenhal, 1839: 30)
GENUS *PALAEOBRUCHIDIUS* Egorov, 1989: 750
SUBGENUS -
SPECIES *P. plagiatus* (Reiche & Saulcy, 1857: 649)
GENUS *PSEUDOPACHYMERINA* Zacher, 1952: 467
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SPECIES *P. spinipes* (Erichson, 1833: 252)
GENUS *SALVIABRUCHUS* Decelle, 1982: 244
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SPECIES *S. retusus* (Baudi di Selve, 1886: 102)

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GENUS *SPERMOPHAGUS* Schoenherr, 1833
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SPECIES *S. calystegiae* (Lukjanovitch & Ter-Minassian, 1957: 193)
SPECIES *S. caricus* Decelle, 1982: 31
SPECIES *S. caucasicus* Baudi di Selve, 1886: 111
SPECIES *S. confusus* Borowiec, 1986: 163
SPECIES *S. kuesteri* Schilsky, 1905: 4
SPECIES *S. lukjanovitschi* Savitsky, 2000: 556
SPECIES *S. pubiventris* Baudi di Selve, 1886: 110
SPECIES *S. sericeus* (Geoffroy, 1785: 112)
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SPECIES *Z. subfasciatus* (Boheman, 1833: 111)

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GENUS *CARYEDON* Schoenherr, 1823: 1134
SUBGENUS -
SPECIES *C. angeri* (Semenov, 1896: 383)
SPECIES *C. germari* (Küster, 1845: 37)
SPECIES *C. halperini* Anton & Delobel, 2004: 81

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GENUS *RHAEBUS* Fischer von Waldheim, 1824: 178
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SPECIES *R. mannerheimi* Motschulsky, 1845: 108

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GENUS *DONACIA* Fabricius, 1775
SUBGENUS *DONACIELLA* Reitter, 1920: 38
SPECIES *D. cinerea* Herbst, 1784: 100
SPECIES *D. clavipes* Fabricius, 1792: 117
SUBSPECIES *D. c. clavipes* Fabricius, 1792: 117
SPECIES *D. tomentosa* Ahrens, 1810: 42
SUBGENUS *DONACIOMIMA* Medvedev, 1973: 876
SPECIES *D. aquatica* (Linnaeus, 1758: 397)
SPECIES *D. bicolora* Zschach, 1788: 27
SUBSPECIES *D. b. bicolora* Zschach, 1788: 27
SPECIES *D. delagrangei* Pic, 1896: 35
SPECIES *D. impressa* Paykull, 1799: 193
SPECIES *D. jacobsoni* Semenov & Reichardt, 1927: 218
SPECIES *D. kraatzi* Weise, 1881: 38
SPECIES *D. marginata* Hoppe, 1795: 42
SPECIES *D. microcephala* Daniel, 1904: 89
SPECIES *D. mistshenkoi* Jakobson, 1910: 53
SPECIES *D. simplex* Fabricius, 1775: 195
SPECIES *D. thalassina* Germar, 1811
SUBSPECIES *D. t. thalasina* Germar, 1811
SPECIES *D. vulgaris* Zschach, 1788: 27
SUBSPECIES *D. v. vulgaris* Zschach, 1788 : 27
TRIBE PLATEUMARINI Böving, 1922: 50
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GENUS *PLATEUMARIS* Thomson, 1859
SUBGENUS *EUPLATEUMARIS* Iablokoff-Khnzorian, 1966: 121
SPECIES *P. sericea* (Linnaeus, 1760: 196)
SUBSPECIES *P. s. sericea* (Linnaeus, 1760: 196)
SUBGENUS *PLATEUMARIS* C. G. Thomson, 1859: 154
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GENUS *CRIOCERIS* Geoffroy, 1762: 237
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SPECIES *C. asparagi* (Linnaeus, 1758: 376)
SPECIES *C. bicruciata* (C. R. Sahlberg, 1823: 54)
SPECIES *C. duodecimpunctata* (Linnaeus, 1758: 376)
SPECIES *C. paracenthesis* (Linnaeus, 1767: 1066)
SPECIES *C. quatuordecimpunctata* (Scopoli, 1763: 14)
SPECIES *C. sokolowi* Jakobson, 1894: 270
GENUS *LILIOCERIS* Reitter, 1913: 79 [NP]
SUBGENUS -
SPECIES *L. faldermanni* (Guérin-Méneville, 1844: 264)
SPECIES *L. lilii* (Scopoli, 1763: 36)
SPECIES *L. merdigera* (Linnaeus, 1758: 275)
TRIBE LEMINI Gyllenhal, 1813: 632
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GENUS *LEMA* Fabricius, 1798: 90
SUBGENUS *LEMA* Fabricius, 1798: 90
SPECIES *L. cyanella* (Linnaeus, 1758: 376)
GENUS *OULEMA* Des Gozis, 1886: 33
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SPECIES *O. duftschmidi* (L. Redtenbacher, 1874: 446)
SPECIES *O. gallaeciana* Heyden, 1870: 164
SPECIES *O. melanopus* (Linnaeus, 1758: 376)

SUBFAMILY CLYTRINAE Kirby, 1837: 207
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GENUS *CHEILOTOMA* Chevrolat, 1836: 420
SUBGENUS *CHEILOTOMA* Chevrolat, 1836: 420
SPECIES *C. beldei* Kasap, 1984: 216
SPECIES *C. erythrostoma* Faldermann, 1837: 376
SUBSPECIES *C. e. erythrostoma* Faldermann, 1837: 376
SPECIES *C. musciformis* (Goeze, 1777: 319)
SUBSPECIES *C. m. musciformis* (Goeze, 1777: 319)
SPECIES *C. voriseki* L. N. Medvedev & Kantner, 2003: 268
GENUS *CLYTRA* Laicharting, 1781: 165
SUBGENUS *CLYTRA* Laicharting, 1781: 165
SPECIES *C. aliena* Weise, 1897: 64
SPECIES *C. laeviuscula* Ratzeburg, 1837: 202
SPECIES *C. quadripunctata* (Linnaeus, 1758: 374)
SUBSPECIES *C. q. quadripunctata* (Linnaeus, 1758: 374)
SUBGENUS *CLYTRARIA* Semenov, 1903: 173
SPECIES *C. atraphaxidis* (Pallas, 1773: 725)
SUBSPECIES *C. a. atraphaxidis* (Pallas, 1773: 725)
SPECIES *C. novempunctata* Olivier, 1808: 852
SPECIES *C. valeriana* Ménétriés, 1832: 237
SUBSPECIES *C. v. taurica* L. N. Medvedev, 1961: 646
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SUBGENUS *OVOCLYTRA* L. N. Medvedev, 1961: 640
SPECIES *C. binominata* Monros, 1953: 49 [RN]
SPECIES *C. bodemeyeri* Weise, 1900: 134 [=1900: 163]
SUBSPECIES *C. b. bodemeyeri* Weise, 1900: 134
SPECIES *C. nigrocincta* Lacordaire, 1848: 200
SUBSPECIES *C. n. nigrocincta* Lacordaire, 1848: 200
SPECIES *C. ovata* Lacordaire, 1848: 200
SUBSPECIES *C. o. ovata* Lacordaire, 1848: 200
SUBSPECIES *C. o. borealis* L. N. Medvedev & Kantner, 2002: 259
SPECIES *C. rotundata* L. N. Medvedev, 1961: 650
SPECIES *C. weisei* Monros, 1953: 49 [RN]
GENUS *COPTOCEPHALA* Chevrolat, 1836: 419
SUBGENUS -
SPECIES *C. destinoi* Fairmaire, 1884: 174
SPECIES *C. fallaciosa* Fairmaire, 1884: 175
SPECIES *C. gebleri* Gebler, 1841: 617
SPECIES *C. rubicunda* (Laicharting, 1781: 169)
SUBSPECIES *C. r. rossica* L. N. Medvedev, 1977: 34
SPECIES *C. simillima* Lodewyckx, 1995: 103
SPECIES *C. unifasciata* (Scopoli, 1763: 66)
SUBSPECIES *C. u. unifasciata* (Scopoli, 1763: 66)
GENUS *LABIDOSTOMIS* Chevrolat, 1836: 418
SUBGENUS *LABIDOSTOMIS* Chevrolat, 1836: 418
SPECIES *L. asiatica* Faldermann, 1837: 370
SPECIES *L. axillaris* (Lacordaire, 1848: 69)
SPECIES *L. basanica* J. R. Sahlberg, 1913: 63
SPECIES *L. brevipennis* Faldermann, 1837: 375
SPECIES *L. cyanicornis* (Germar, 1822: 7)
SPECIES *L. decipiens* Faldermann, 1837: 373
SPECIES *L. diversifrons* Lefévre, 1872: 90
SPECIES *L. elegans* Lefévre, 1876: 1XXII
SPECIES *L. hebraea* (Lacordaire, 1848: 55)
SPECIES *L. humeralis* (D. H. Schneider, 1792: 192)
SPECIES *L. karamanica* Weise, 1900: 134 [=1900: 163]
SPECIES *L. kaszabi* L. N. Medvedev, 1962: 333
SPECIES *L. korbi* Weise, 1902: 203
SPECIES *L. longimana* (Linnaeus, 1760: 170)
SPECIES *L. lucida* (Germar, 1824: 548)
SPECIES *L. maculipennis* Lefévre, 1870: 42
SPECIES *L. mesopotamica* Heyden, 1886: 279
SPECIES *L. oertzeni* Weise, 1889: 62
SPECIES *L. pallidipennis* (Gebler, 1830: 199)
SPECIES *L. peregrina* Weise, 1900: 271

SPECIES *L. propinqua* Faldermann, 1837: 372
SUBSPECIES *L. p. propinqua* Faldermann, 1837: 372
SPECIES *L. rufa* (Waltl, 1838: 472)
SPECIES *L. rugicollis* Lefevre, 1872: 86
SPECIES *L. subfasciata* Weise, 1885: 313
SPECIES *L. sulcicollis* (Lacordaire, 1848: 49)
SPECIES *L. testaceipes* Pic, 1900: 93
GENUS *LACHNAIA* Chevrolat, 1836: 418
SUBGENUS *LACHNAIA* Chevrolat, 1836: 418
SPECIES *L. sexpunctata* (Scopoli, 1763: 67)
GENUS *MACROLENES* Chevrolat, 1836: 419
SUBGENUS -
SPECIES *M. dentipes* (Olivier, 1808: 857)
GENUS *SMARAGDINA* Chevrolat, 1836: 419
SUBGENUS -
SPECIES *S. affinis* (Illiger, 1794: 611)
SUBSPECIES *S. a. affinis* (Illiger, 1794: 611)
SPECIES *S. amasina* (Pic, 1897: 197)
SPECIES *S. aurita* (Linnaeus, 1767: 596)
SUBSPECIES *S. a. aurita* (Linnaeus, 1767: 596)
SPECIES *S. biornata* (Lefévre, 1872: 322)
SUBSPECIES *S. b. angorensis* (Lopatin, 2002: 89)
SUBSPECIES *S. b. biornata* (Lefévre, 1872: 322)
SPECIES *S. chloris* (Lacordaire, 1848: 83)
SUBSPECIES *S. c. chloris* (Lacordaire, 1848: 83)
SPECIES *S. djebellina* (Lefévre, 1872: 349)
SPECIES *S. flavicollis* (Charpentier, 1825: 236)
SPECIES *S. graeca* (Kraatz, 1872: 217)
SPECIES *S. hypocrita* (Lacordaire, 1848: 288)
SPECIES *S. judaica* (Lefévre, 1872: 342)
SPECIES *S. laeviceps* (Abeille de Perrin, 1895: CDV)
SPECIES *S. limbata* (Steven, 1806: 157)
SPECIES *S. persica* Pic, 1911: 107
SPECIES *S. salicina* (Scopoli, 1763: 65)
SPECIES *S. scutellaris* (Lefévre, 1872: 335)
SPECIES *S. tibialis* (Brullé, 1832: 268)
SPECIES *S. unipunctata* (Olivier, 1808: 870)
SPECIES *S. vaulogeri* (Pic, 1895: CC1XXXV)
SPECIES *S. viridana* (Lacordaire, 1848: 291)
SUBSPECIES *S. v. viridana* (Lacordaire, 1848: 291)
SPECIES *S. xanthaspis* (Germar, 1824: 547)
GENUS *TITUBOEA* Lacordaire, 1848: 141
SUBGENUS -
SPECIES *T. arabica* (Olivier, 1808: 860)
SPECIES *T. macropus* (Illiger, 1800: 128)
SPECIES *T. sexmaculata* (Fabricius, 1781: 138)

SUBFAMILY CRYPTOCEPHALINAE Gyllenhal, 1813: 582
TRIBE CRYPTOCEPHALINI Gyllenhal, 1813: 582
SUBTRIBE CRYPTOCEPHALINA Gyllenhal, 1813: 582
GENUS *CRYPTOCEPHALUS* Geoffroy, 1762: XIII
SUBGENUS *ASIONUS* Lopatin, 1988: 8 [RN]
SPECIES *C. amasiensis* Weise, 1894: 91
SPECIES *C. apicalis* Gebler, 1830: 201
SPECIES *C. curda* Jakobson, 1897: 215
SPECIES *C. flexuosus* Krynicki, 1834: 173
SPECIES *C. gloriosus* Mulsant & Wachanru, 1853: 127
SPECIES *C. phaleratus* Tappes, 1871: 256
SPECIES *C. pseudoreitteri* Tomov, 1976: 83
SPECIES *C. quatuordecimmaculatus* D. H. Schneider, 1792: 195
SPECIES *C. tappesi* Marseul, 1868: 206
SPECIES *C. volkovitshi* Lopatin, 1976: 106
SUBGENUS *BURLINIUS* Lopatin, 1965: 455
SPECIES *C. ayvazi* Gök & Sassi, 2002: 155
SPECIES *C. bilineatus* (Linnaeus, 1767: 597)
SPECIES *C. chrysopus* Gmelin, 1790: 1713
SPECIES *C. connexus* Olivier, 1807: 836

SPECIES *C. elegantulus* Gravenhorst, 1807: 152
SPECIES *C. exiguus* D. H. Schneider, 1792: 204
SUBSPECIES *C. e. amiculus* Baly, 1873: 98
SUBSPECIES *C. e. variceps* Weise, 1884: 161
SPECIES *C. fausti* Weise, 1882: 236
SPECIES *C. fulvus* (Goeze, 1777: 321)
SUBSPECIES *C. f. fulvus* (Goeze, 1777: 321)
SUBSPECIES *C. f. schatzmayri* Burlini, 1969: 114
SPECIES *C. labiatus* (Linnaeus, 1760: 169)
SPECIES *C. lederi* Weise, 1889: 259
SPECIES *C. macellus* Suffrian, 1860: 53
SPECIES *C. ocellatus* Drapiez, 1819: 201
SUBSPECIES *C. o. ocellatus* Drapiez, 1819: 201
SPECIES *C. populi* Suffrian, 1848: 76
SPECIES *C. pusillus* Fabricius, 1777: 221
SPECIES *C. pygmaeus* Fabricius, 1792: 70
SUBSPECIES *C. p. vittula* Suffrian, 1848: 63
SPECIES *C. rufipes* (Goeze, 1777: 321)
SPECIES *C. strigosus* Germar, 1824: 560
SPECIES *C. sultani* Pic, 1920: 22
SPECIES *C. tshorumae* Tomov, 1984: 376
SUBGENUS *CRYPTOCEPHALUS* Geoffroy, 1762: XIII
SPECIES *C. androgyne* Marseul, 1875: 184
SUBSPECIES *C. a. androgyne* Marseul, 1875: 184
SPECIES *C. anticus* Suffrian, 1848: 37 [RN]
SPECIES *C. aureolus* Suffrian, 1847: 132
SUBSPECIES *C. a. aureolus* Suffrian, 1847: 132
SPECIES *C. bameuli* Duhaldeborde, 1999: 124
SPECIES *C. bicolor* Eschscholz, 1818: 466
SPECIES *C. biguttatus* (Scopoli, 1763: 65)
SPECIES *C. biledjekensis* Pic, 1909: 153
SPECIES *C. bipunctatus* (Linnaeus, 1758: 374)
SUBSPECIES *C. b. bipunctatus* (Linnaeus, 1758: 374)
SPECIES *C. concolor* Suffrian, 1847: 127 [RN]
SPECIES *C. cordiger* (Linnaeus, 1758: 375)
SPECIES *C. crassus* Olivier, 1791: 620
SPECIES *C. cribratus* Suffrian, 1847: 90
SPECIES *C. duplicatus* Suffrian, 1847: 126
SPECIES *C. flavipes* Fabricius, 1781: 146
SPECIES *C. ilicis* Olivier, 1808: 801
SPECIES *C. imperialis* Laicharting, 1781: 179
SPECIES *C. janthinus* Germar, 1824: 555
SPECIES *C. moraei* (Linnaeus, 1758: 374)
SPECIES *C. octomaculatus* Rossi, 1790: 96 [RN]
SPECIES *C. octopunctatus* (Scopoli, 1763: 67)
SUBSPECIES *C. o. octopunctatus* (Scopoli, 1763: 67)
SPECIES *C. paphlagonius* Sassi & Kısmalı, 2000: 97
SPECIES *C. paradisiacus* Weise, 1900: 276
SPECIES *C. parvulus* O. F. Müller, 1776: 58 [RN]
SPECIES *C. peyroni* Marseul, 1875: 169
SPECIES *C. praticola* Weise, 1889: 1
SPECIES *C. quadriguttatus* C. F. W. Richter, 1820: 12
SPECIES *C. rugicollis* Olivier, 1791: 611
SPECIES *C. sericeus* (Linnaeus, 1758: 374)
SPECIES *C. sexpunctatus* (Linnaeus, 1758: 375)
SUBSPECIES *C. s. sexpunctatus* (Linnaeus, 1758: 375)
SPECIES *C. signatifrons* Suffrian, 1847: 172
SPECIES *C. solivagus* Leonardi & Sassi, 2001: 25
SPECIES *C. surdus* Rapilly, 1980: 81
SPECIES *C. trimaculatus* Rossi, 1790: 96
SPECIES *C. tschimganensis* Weise, 1894: 68
SUBSPECIES *C. t. tschimganensis* Weise, 1894: 68
SPECIES *C. turcicus* Suffrian, 1847: 173
SPECIES *C. virens* Suffrian, 1847: 125
SPECIES *C. violaceus* Laicharting, 1781: 172
SUBSPECIES *C. v. violaceus* Laicharting, 1781: 172

SUBGENUS *HETERICHNUS* Warchalowski, 1991: 76 [RN]
SPECIES *C. loebli* Sassi, 1997: 57
SPECIES *C. prusias* Suffrian, 1853: 95
SUBGENUS *LAMELLOSUS* Tomov, 1979: 43
SPECIES *C. angorensis* Pic, 1908: 14
SPECIES *C. laevicollis* Gebler, 1830: 205
SUBGENUS *PROTOPHYSUS* Chevrolat, 1836: 422
SPECIES *C. schaefferi* Weise, 1884: 158
SUBSPECIES *C. s. moehringi* Weise, 1884: 158
SPECIES *C. wehnkei* Weise, 1881: 179
SUBTRIBE PACHYBRACHINA Chapuis, 1874
GENUS *ACOLASTUS* Gerstaecker, 1855: 636
SUBGENUS *ANOPSILUS* Jakobson, 1917: 268
SPECIES *A. glabratus* (Lopatin, 1985: 765)
SPECIES *A. iranicus* (Lopatin, 1980: 621)
GENUS *PACHYBRACHIS* Chevrolat, 1836: 420
SUBGENUS *PACHYBRACHIS* Chevrolat, 1836: 420
SPECIES *P. adaliensis* (Weise, 1886: 25)
SPECIES *P. akbesianus* (Pic, 1907: 4)
SPECIES *P. albicans* (Weise, 1882: 248)
SPECIES *P. anatolicus* Lopatin, 1985: 768
SPECIES *P. bodemeyeri* Weise, 1906: 472
SPECIES *P. cordatus* Sassi & Schöller, 2003: 144
SPECIES *P. excisus* (Weise, 1897: 66)
SPECIES *P. fimbriolatus* (Suffrian, 1848: 142)
SPECIES *P. glycyrrhizae* (Olivier, 1808: 838)
SPECIES *P. hieroglyphicus* (Laicharting, 1781: 182)
SPECIES *P. humeralis* Burlini, 1956: 86
SPECIES *P. laticollis* (Suffrian, 1860: 61)
SPECIES *P. leonardii* Sassi & Schöller, 2003: 141
SPECIES *P. limbatus* (Ménétriés, 1836: 151)
SPECIES *P. mardinensis* (Weise, 1900: 279)
SPECIES *P. mendax* (Suffrian, 1860: 60)
SUBSPECIES *P. m. mendax* (Suffrian, 1860: 60)
SPECIES *P. nigropunctatus* (Suffrian, 1854: 152)
SPECIES *P. nitidicollis* (Weise, 1894: 69)
SPECIES *P. pentheri* Ganglbauer, 1905: 280
SPECIES *P. scripticollis* Faldermann, 1837: 381
SPECIES *P. scriptidorsum* Marseul, 1875: 261 [NP]
SPECIES *P. sinuatus* (Mulsant & Rey, 1859: 47)
SPECIES *P. tessellatus* (Olivier, 1791: 618)
SUBSPECIES *P. t. tauricus* (Suffrian, 1848: 137)
SPECIES *P. velarum* Warchalowski, 1998: 85
SUBTRIBE STYLOSOMINA Chapuis, 1874
GENUS *STYLOSOMUS* Suffrian, 1848: 146
SUBGENUS *STYLOSOMUS* Suffrian, 1848: 146
SPECIES *S. flavus* Marseul, 1875: 295
SUBSPECIES *S. f. flavus* Marseul, 1875: 295
SPECIES *S. subelongatus* Pic, 1913: 179
SPECIES *S. tamaricis* (Herrich-Schaffer, 1836: 143: 24)

SUBFAMILY EUMOLPINAE Hope, 1840: 162
TRIBE BROMIINI Baly, 1865: 438
SUBTRIBE -
GENUS *BROMIUS* Chevrolat, 1836: 412
SUBGENUS -
SPECIES *B. obscurus* (Linnaeus, 1758: 375)
GENUS *DAMASUS* Chapuis, 1874: 321
SUBGENUS -
SPECIES *D. albicans* Chapuis, 1874: 322
GENUS *MACROCOMA* Chapuis, 1874: 292
SUBGENUS -
SPECIES *M. brunnipes* (Olivier, 1808: 913)
SUBSPECIES *M. b. obscuricolor* (Pic, 1905: 179)
SPECIES *M. delagrangei* (Pic, 1898: 93)
SPECIES *M. dimorpha* (Medvedev, 1956: 897)
SPECIES *M. doboszi* Borowiec, 2005: 374

SPECIES *M. fortidens* (Berti & Rapilly, 1973: 874)
SPECIES *M. korbi* (Pic, 1901: 19)
SPECIES *M. rubripes* (Schaufuss, 1862: 311)
SUBSPECIES *M. r. rubripes* (Schaufuss, 1862: 311)
SPECIES *M. substriata* Weise, 1904: 100
GENUS *MALEGIA* Lefevre, 1883: CXV
SUBGENUS -
SPECIES *M. colchica* Reitter, 1912: 92
GENUS *PACHNEPHORUS* Chevrolat, 1836: 408
SUBGENUS *PACHNEPHORUS* Chevrolat, 1836: 408
SPECIES *P. bistriatus* Mulsant & Wachanru, 1852: 17
SPECIES *P. canus* Weise, 1882: 285
SPECIES *P. cylindricus* P. H. Lucas, 1849: 519
SPECIES *P. pilosus* (Rossi, 1790: 100)
SPECIES *P. robustus* Desbrochers, 1870: 132
SPECIES *P. syriacus* Reitter, 1886: 71
SPECIES *P. tessellatus* (Duftschmid, 1825: 217)
SPECIES *P. villosus* (Duftschmid, 1825: 217)
TRIBE EUMOLPINI Hope, 1840: 162
SUBTRIBE -
GENUS *CHRYSOCHARES* Morawitz, 1861: 160
SUBGENUS -
SPECIES *C. asiaticus* (Pallas, 1771: 463)
SPECIES *C. punctatus* (Gebler, 1845: 106)
SUBSPECIES *C. p. constricticollis* Lopatin, 1963: 300
GENUS *CHRYSOCHUS* Chevrolat, 1836: 413
SUBGENUS -
SPECIES *C. asclepiadeus* De Monte, 1948: 57
SUBSPECIES *C. a. asiaeminoris* De Monte, 1948: 57
GENUS *COLASPINELLA* Weise, 1893: 1121
SUBGENUS -
SPECIES *C. grandis* (Frivaldszky, 1880: 264)
GENUS *EUPALES* Lefévre, 1885: 50 [RN]
SUBGENUS -
SPECIES *E. ulema* (Germar, 1813: 125)
TRIBE NODININI S.-H. Chen, 1940
SUBTRIBE -
GENUS *BEDELIA* Lefévre, 1875: X
SUBGENUS -
SPECIES *B. insignis* Lefévre, 1875: XI

SUBFAMILY CHRYSOMELINAE Latreille, 1802: 220
TRIBE CHRYSOMELINI Latreille, 1802: 220
SUBTRIBE CHRYSOMELINA Latreille, 1802
GENUS *CHRYSOMELA* Linnaeus, 1758: 368
SUBGENUS -
SPECIES *C. collaris* Linnaeus, 1758: 371
SPECIES *C. populi* Linnaeus, 1758: 370
SPECIES *C. saliceti* (Weise, 1884: 565)
SUBSPECIES *C. s. saliceti* (Weise, 1884: 565)
SPECIES *C. tremula* Fabricius, 1787: 69
SUBSPECIES *C. t. tremula* Fabricius, 1787: 69
SPECIES *C. vigintipunctata* (Scopoli, 1763: 78)
SUBSPECIES *C. v. vigintipunctata* (Scopoli, 1763: 78)
GENUS *PLAGIODERA* Chevrolat, 1836: 404
SUBGENUS -
SPECIES *P. versicolora* (Laicharting, 1781: 148)
GENUS *PLAGIOSTERNA* Motschulsky, 1860: 196
SUBGENUS -
SPECIES *P. aenea* (Linnaeus, 1758: 369)
SUBSPECIES *P. a. aenea* (Linnaeus, 1758: 369)
SUBTRIBE GASTROPHYSINA Kippenberg, 2010: 393
GENUS *GASTROPHYSA* Chevrolat, 1836: 405
SUBGENUS *GASTROPHYSA* Chevrolat, 1836: 405
SPECIES *G. polygoni* (Linnaeus, 1758: 370)
SUBSPECIES *G. p. polygoni* (Linnaeus, 1758: 370)

SPECIES *G. viridula* (DeGeer, 1775: 311)
SUBSPECIES *G. v. viridula* (DeGeer, 1775: 311)
SUBTRIBE PHRATORINA Motschulsky, 1860
GENUS *PHRATORA* Chevrolat, 1836: 405
SUBGENUS *PHRATORA* Chevrolat, 1836: 405
SPECIES *P. vulgatissima* (Linnaeus, 1758: 370)
SUBGENUS *PHYLLODECTA* Kirby, 1837: 216
SPECIES *P. horioni* (Mohr, 1968: 48)
SPECIES *P. laticollis* (Suffrian, 1851: 262)
SPECIES *P. tibialis* (Suffrian, 1851: 259)
SUBSPECIES *P. t. tibialis* (Suffrian, 1851: 259)
SPECIES *P. vitellinae* (Linnaeus, 1758: 370)
SUBTRIBE PRASOCURINA Reitter, 1913
GENUS *NEOPHAEDON* Jakobson, 1901: 90
SUBGENUS -
SPECIES *N. pyritosus* (Rossi, 1792: 31)
GENUS *PHAEDON* Latreille, 1829: 151
SUBGENUS *PHAEDON* Latreille, 1829: 151
SPECIES *P. armoraciae* (Linnaeus, 1758: 369)
SPECIES *P. cochleariae* (Fabricius, 1792: 330)
SUBSPECIES *P. c. cochleariae* (Fabricius, 1792: 330)
GENUS *PRASOCURIS* Latreille, 1802: 224
SUBGENUS *HYDROTHASSA* C. G. Thomson, 1859: 158
SPECIES *P. flavocincta* (Brullé, 1832: 271)
SPECIES *P. glabra* (Herbst, 1783: 60)
SUBGENUS *PRASOCURIS* Latreille, 1802: 224
SPECIES *P. junci* (Brahm, 1790: 62)
SPECIES *P. phellandrii* (Linnaeus, 1758: 376)
TRIBE DORYPHORINI Motschulsky, 1860
SUBTRIBE CHRYSOLININA S.-H. Chen, 1936
GENUS *CHRYSOLINA* Motschulsky, 1860: 210
SUBGENUS *BITTOTAENIA* Motschulsky, 1860: 206
SPECIES *C. aeneipennis* (Reiche & Saulcy, 1858: 34)
SPECIES *C. grata* (Faldermann, 1837: 361)
SUBSPECIES *C. g. grata* (Faldermann, 1837: 361)
SPECIES *C. salviae* (Weise, 1898: 191)
SUBSPECIES *C. s. compuncta* (Weise, 1898: 191)
SUBSPECIES *C. s. salviae* (Germar, 1824: 586)
SUBGENUS *CHALCOIDEA* Motschulsky, 1860: 209
SPECIES *C. analis* (Linnaeus, 1767: 592)
SPECIES *C. marginata* (Linnaeus, 1758: 371)
SUBSPECIES *C. m. marginata* (Linnaeus, 1758: 371)
SUBSPECIES *C. m. unificans* Bechyné, 1950: 166
SPECIES *C. sellata* (Weise, 1894: 92)
SPECIES *C. songarica* (Gebler, 1843: 39)
SPECIES *C. tesari* (Roubal, 1936: 68)
SUBSPECIES *C. t. tesari* (Roubal, 1936: 68)
SUBGENUS *CHRYSOLINA* Motschulsky, 1860: 210
SPECIES *C. blanchei* (Fairmaire, 1865: 75)
SUBSPECIES *C. b. blanchei* (Fairmaire, 1865: 75)
SPECIES *C. staphylaea* (Linnaeus, 1758: 370)
SUBSPECIES *C. s. staphylaea* (Linnaeus, 1758: 370)
SUBGENUS *CHRYSOLINOPSIS* Bechyné, 1950: 82
SPECIES *C. americana* (Linnaeus, 1758: 372)
SUBGENUS *CHRYSOMORPHA* Motschulsky, 1860: 204
SPECIES *C. cerealis* (Linnaeus, 1767: 588)
SUBSPECIES *C. c. cerealis* (Linnaeus, 1767: 588)
SUBSPECIES *C. c. cyaneoaurata* (Motschulsky, 1860: 227)
SUBGENUS *COLAPHODES* Motschulsky, 1860: 212
SPECIES *C. haemoptera* (Linnaeus, 1758: 369)
SUBSPECIES *C. h. byzantia* Jolivet, 1951: 194 [RN]
SUBSPECIES *C. h. haemoptera* (Linnaeus, 1758: 369)
SUBGENUS *COLAPHOPTERA* Motschulsky, 1860: 215
SPECIES *C. abchasica* (Weise, 1892: 405)
SPECIES *C. adzharica* Lopatin, 1988: 589
SPECIES *C. differens* (Franz, 1952: 6)
SPECIES *C. kataevi* Lopatin, 2000: 858

SPECIES *C. planicollis* (Breit, 1919: 14)
SUBGENUS *COLAPHOSOMA* Motschulsky, 1860: 216
SPECIES *C. sturmi* (Westhoff, 1882: 268)
SUBGENUS *ERYTHROCHRYSA* Bechyné, 1950: 91
SPECIES *C. polita* (Linnaeus, 1758: 370)
SUBSPECIES *C. p. polita* (Linnaeus, 1758: 370)
SUBGENUS *DIACHALCOIDEA* Bechyne, 1955: 349
SPECIES *C. sacarum* (Weise, 1890: 479)
SUBSPECIES *C. s. sacarum* (Weise, 1890: 479)
SUBGENUS *EUCHRYSOLINA* Bechyné, 1950: 83
SPECIES *C. graminis* (Linnaeus, 1758: 369)
SUBSPECIES *C. g. graminis* (Linnaeus, 1758: 369)
SUBGENUS *FASTUOLINA* Warchalowski, 1991: 281
SPECIES *C. fastuosa* (Scopoli, 1763: 74)
SUBSPECIES *C. f. fastuosa* (Scopoli, 1763: 74)
SUBSPECIES *C. f. inexplicabilis* (Brancsik, 1910: 189)
SUBGENUS *HYPERICIA* Bedel, 1892: 258
SPECIES *C. anatolica* (Dahlgren, 1984: 42)
SPECIES *C. cuprina* (Duftschmid, 1825: 177)
SUBSPECIES *C. c. cuprina* (Duftschmid, 1825: 177)
SUBSPECIES *C. c. staneki* Bechyné, 1949: 52
SPECIES *C. didymata* (L. G. Scriba, 1791: 294)
SUBSPECIES *C. d. didymata* (L. G. Scriba, 1791: 294)
SUBSPECIES *C. d. syriaca* (Weise, 1884: 408)
SPECIES *C. geminata* (Paykull, 1799: 65)
SPECIES *C. hyperici* (Forster, 1771: 20)
SUBSPECIES *C. h. hyperici* (Forster, 1771: 20)
SUBSPECIES *C. h. daghestanica* (Reitter, 1913: 111)
SUBGENUS *OVOSOMA* Motschulsky, 1860: 214
SPECIES *C. halysa* Bechyné, 1950: 127
SPECIES *C. orientalis* (Olivier, 1807: 512)
SUBSPECIES *C. o. orientalis* (Olivier, 1807: 512)
SUBSPECIES *C. o. thraeissa* Bechyné, 1950: 126
SPECIES *C. sahlbergi* (Ménétriés, 1832: 235)
SPECIES *C. turca* (Fairmaire, 1865: 74)
SPECIES *C. vernalis* (Brullé, 1832: 269)
SUBSPECIES *C. v. ottomana* (Weise, 1906: 554)
SPECIES *C. wittmeri* L. N. Medvedev, 1975: 13
SUBGENUS *OVOSTOMA* Motschulsky, 1860: 215
SPECIES *C. olivieri* (Bedel, 1892: 148)
SUBSPECIES *C. o. azurea* Bechyné, 1946: 108
SUBSPECIES *C. o. olivieri* (Bedel, 1892: 148)
SUBGENUS *PARADIACHALCOIDEA* Daccordi, 1978: 752
SPECIES *C. palmyrensis* Bechyné, 1955: 350
SUBSPECIES *C. p. assurensis* Bechyné, 1955: 350
SUBSPECIES *C. p. palmyrensis* Bechyné, 1955: 350
SUBGENUS *SPHAEROMELA* Bedel, 1892: 260
SPECIES *C. varians* (Schaller, 1783: 271)
SUBGENUS *STICHOPTERA* Motschulsky, 1860: 209
SPECIES *C. gypsophilae* (Küster, 1845: 71)
SPECIES *C. sanguinolenta* (Linnaeus, 1758: 371)
SUBGENUS *SULCICOLLIS* J. R. Sahlberg, 1913: 247
SPECIES *C. chalcites* (Germar, 1824: 587)
SPECIES *C. impavida* Bechyné, 1949: 54
SPECIES *C. oricalcia* (O. F. Müller, 1776: 82)
SUBGENUS *SYNERGA* Weise, 1900: 283
SPECIES *C. coerulans* (L. G. Scriba, 1791: 286)
SUBSPECIES *C. c. coerulans* (L. G. Scriba, 1791: 286)
SPECIES *C. herbacea* (Duftschmid, 1825: 192)
SUBSPECIES *C. h. alacris* Bechyné, 1950: 77
SUBSPECIES *C. h. herbacea* (Duftschmid, 1825: 192)
SUBSPECIES *C. h. recticollis* (Motschulsky, 1860: 225)
SUBGENUS *THRENOSOMA* Motschulsky, 1860: 213
SPECIES *C. anceyi* (Marseul, 1868: 211)
SUBSPECIES *C. a. anceyi* (Marseul, 1868: 211)
SUBGENUS *ZEUGOTAENIA* Motschulsky, 1860: 206
SPECIES *C. limbata* (Fabricius, 1775: 101)

SUBTRIBE DORYPHORINA Motschulsky, 1860
GENUS *COLAPHELLUS* Weise, 1916: 113 [RN]
SUBGENUS -
SPECIES *C. apicalis* (Ménétriés, 1849: 270)
SPECIES *C. sophiae* (Schaller, 1783: 272)
SUBSPECIES *C. s. transsylvanicus* Machatschke, 1954
SUBSPECIES *C. s. amasiae* (Machatschke, 1954: 212)
GENUS *CYRTONASTES* Fairmaire, 1874: 42
SUBGENUS *CYRTONASTES* Fairmaire, 1874: 42
SPECIES *C. confusus* Berti & Daccordi, 1974: 607
SPECIES *C. grandis* Lopatin, 1994: 527
GENUS *ENTOMOSCELIS* Chevrolat, 1836: 426
SUBGENUS -
SPECIES *E. adonidis* (Pallas, 1771: 462)
SPECIES *E. sacra* (Linnaeus, 1758: 372)
SPECIES *E. suturalis* Weise, 1882: 312
GENUS *GONIOCTENA* Chevrolat, 1836: 403
SUBGENUS *GONIOCTENA* Chevrolat, 1836: 403
SPECIES *G. decemnotata* (Marsham, 1802: 175)
SPECIES *G. linnaeana* (Schrank, 1781: 69)
SUBSPECIES *G. l. linnaeana* (Schrank, 1781: 69)
SPECIES *G. viminalis* (Linnaeus, 1758: 371)
SUBSPECIES *G. v. viminalis* (Linnaeus, 1758: 371)
SUBGENUS *SPARTOMENA* Reitter, 1913: 128
SPECIES *G. akbesiana* Fairmaire, 1884: 175
SPECIES *G. fornicata* Brüggemann, 1873: 518 [RN]
GENUS *LEPTINOTARSA* Chevrolat, 1836: 397
SUBGENUS -
SPECIES *L. decemlineata* (Say, 1824: 453)
GENUS *ZYGOGRAMMA* Chevrolat, 1836: 398
SUBGENUS -
SPECIES *Z. suturalis* (Fabricius, 1775: 95)

SUBFAMILY TIMARCHINAE Motschulsky, 1860: 187
TRIBE TIMARCHINI Motschulsky, 1860: 187
SUBTRIBE -
GENUS *TIMARCHA* Latreille, 1829: 150
SUBGENUS *METALLOTIMARCHA* Motschulsky, 1860: 187
SPECIES *T. hummelii* Faldermann, 1837: 351
SUBSPECIES *T. h. hummelii* Faldermann, 1837: 351
SUBGENUS *TIMARCHA* Latreille, 1829: 150
SPECIES *T. olivieri* Fairmaire, 1868: 261
SUBSPECIES *T. o. olivieri* Fairmaire, 1868: 261
SPECIES *T. rugulosa* Herrich-Schaffer, 1838: 156: 22
SUBSPECIES *T. r. rugulosa* Herrich-Schaffer, 1838: 156: 22
SPECIES *T. tenebricosa* (Fabricius, 1775: 94)

SUBFAMILY GALERUCINAE Latreille, 1802: 228
TRIBE GALERUCINI Latreille, 1802: 228
SUBTRIBE -
GENUS *ATYSA* Baly, 1864: 238
SUBGENUS -
SPECIES *A. diversicornis* (Pic, 1931: 22)
GENUS *DIORHABDA* Weise, 1883: 316
SUBGENUS -
SPECIES *D. carinata* (Faldermann, 1837: 329)
SPECIES *D. elongata* (Brullé, 1836: 271)
GENUS *GALERUCA* Geoffroy, 1762: 251
SUBGENUS *GALERUCA* Geoffry, 1762: 251
SPECIES *G. armeniaca* Weise, 1886: 643
SPECIES *G. circassica* Reitter, 1889: 104
SPECIES *G. impressicollis* Pic, 1934: 22
SPECIES *G. interrupta* (Illiger, 1802: 423)
SPECIES *G. jucunda* (Faldermann, 1837: 328)
SPECIES *G. littoralis* (Fabricius, 1787: 74)
SPECIES *G. pomonae* (Scopoli, 1763: 83)
SUBSPECIES *G. p. pomonae* (Scopoli, 1763: 83)

SPECIES *G. spectabilis* (Faldermann, 1837: 326)
SUBSPECIES *G. s. orientalis* (Osculati, 1844: 72)
SUBSPECIES *G. s. spectabilis* (Faldermann, 1837: 326)
SPECIES *G. tanaceti* (Linnaeus, 1758: 369)
SUBSPECIES *G. t. tanaceti* (Linnaeus, 1758: 369)
SUBGENUS *EMARHOPA* Weise, 1886: 657
SPECIES *G. rufa* Germar, 1824: 603
SUBGENUS *HAPTOSCELIS* Weise, 1886: 658
SPECIES *G. melanocephala* (Ponza, 1805: 57)
GENUS *GALERUCELLA* Crotch, 1873: 55
SUBGENUS *GALERUCELLA* Crotch, 1873: 55
SPECIES *G. grisescens* (Joannis, 1865: 98)
SPECIES *G. nymphaeae* (Linnaeus, 1758: 376)
SUBGENUS *NEOGALERUCELLA* Chujo, 1962: 38
SPECIES *G. calmariensis* (Linnaeus, 1767: 600)
SPECIES *G. lineola* (Fabricius, 1781: 149)
SUBSPECIES *G. l. lineola* (Fabricius, 1781: 149)
SPECIES *G. pusilla* (Duftschmid, 1825: 230)
SPECIES *G. tenella* (Linnaeus, 1760: 171)
GENUS *LOCHMAEA* Weise, 1883: 316
SUBGENUS -
SPECIES *L. caprea* (Linnaeus, 1758: 376)
SPECIES *L. crataegi* (Forster, 1771: 28)
SPECIES *L. limbata* Pic, 1898: 93
SPECIES *L. machulkai* Roubal, 1926: 246
GENUS *RADYMNA* Reitter, 1913: 135
SUBGENUS -
SPECIES *R. fischeri* (Faldermann, 1837: 334)
SPECIES *R. nigrifrons* (Laboissiére, 1914: 83)
SPECIES *R. persica (*Fadermann, 1837: 331)
GENUS *XANTHOGALERUCA* Laboissiére, 1934: 67
SUBGENUS -
SPECIES *X. luteola* (O. F. Müller, 1766: 187)
SPECIES *X. subcoerulescens* (Weise, 1884: 159)
TRIBE HYLASPINI Chapuis, 1875: 237
SUBTRIBE -
GENUS *AGELASTICA* Chevrolat, 1836: 381
SUBGENUS -
SPECIES *A. alni* (Linnaeus, 1758: 369)
SUBSPECIES *A. a. alni* (Linnaeus, 1758: 369)
GENUS *SERMYLASSA* Reitter, 1913: 138 [RN]
SUBGENUS -
SPECIES *S. halensis* (Linnaeus, 1767: 589)
TRIBE LUPERINI Gistel, 1848: [9]
SUBTRIBE AULACOPHORINA Chapuis, 1875
GENUS *AULACOPHORA* Chevrolat, 1836: 378
SUBGENUS -
SPECIES *A. foveicollis* (P. H. Lucas, 1849: 542)
SUBTRIBE LUPERINA Gistel, 1848
GENUS *CALOMICRUS* Dillwyn, 1829: 52
SUBGENUS -
SPECIES *C. angorensis* (Pic, 1912: 34)
SPECIES *C. apicalis* Demaison, 1891: CXCIV
SPECIES *C. azureus* (Fairmaire, 1884: 176)
SPECIES *C. circumfusus* (Marsham, 1802: 227)
SPECIES *C. koenigi* (Jakobson, 1897: 216)
SPECIES *C. lividus* (Joannis, 1865: 125)
SPECIES *C. malkini* Warchalowski, 1991: 49
SPECIES *C. pinicola* (Duftschmid, 1825: 234)
SPECIES *C. syriacus* (Weise, 1924: 116)
SPECIES *C. turcicus* L. N. Medvedev, 1975: 14
GENUS *EULUPERUS* Weise, 1886: 662
SUBGENUS -
SPECIES *E. major* Weise, 1886: 665
SPECIES *E. xanthopus* (Duftschmid, 1825: 234)
SUBSPECIES *E. x. xanthopus* (Duftschmid, 1825: 234)

GENUS *EXOSOMA* Jacoby, 1903: 25
SUBGENUS -
SPECIES *E. flavipes* (Heyden, 1878: 336)
SPECIES *E. gaudionis* (Reiche, 1862: 545)
SPECIES *E. neglectum* Mohr, 1968: 241
SPECIES *E. thoracicum* (L. Redtenbacher, 1843: 989)
GENUS *LUPERUS* Geoffroy, 1762: 230
SUBGENUS -
SPECIES *L. armeniacus* Kiesenwetter, 1878: 337
SPECIES *L. discolor* Faldermann, 1837: 340
SPECIES *L. flavipes* (Linnaeus, 1767: 601)
SUBSPECIES *L. f. flavipes* (Linnaeus, 1767: 601)
SPECIES *L. floralis* Faldermann, 1837: 341
SPECIES *L. graecus* Weise, 1886: 598
SPECIES *L. perlucidus* Iablokoff-Khnzorian, 1956: 137
SPECIES *L. rectangulus* Weise, 1898: 214
SPECIES *L. viridipennis* Germar, 1824: 597
SPECIES *L. xanthopoda* (Schrank, 1781: 93)
GENUS *NYMPHIUS* Weise, 1900: 135
SUBGENUS -
SPECIES *N. ensifer* (Guillebeau, 1891: 297)
SPECIES *N. forcipifer* (Weise, 1900: 135) [=1900: 164]
SPECIES *N. lydius* (Weise, 1886: 594)
SPECIES *N. stylifer* (Weise, 1899: 380)
SUBSPECIES *N. s. kadleci* Bezdek, 2008: 83
SUBSPECIES *N. s. ogloblini* (Bogatchev, 1947: 16)
SUBSPECIES *N. s. stylifer* (Weise, 1899: 380)
GENUS *PHYLLOBROTICA* Chevrolat, 1836: 381
SUBGENUS -
SPECIES *P. adusta* (Creutzer, 1799: 121)
SUBSPECIES *P. a. adusta* (Creutzer, 1799: 121)
SPECIES *P. binotata* Ogloblin, 1936: 194
SPECIES *P. elegans* Kraatz, 1866: 285
SPECIES *P. frontalis* Weise, 1886: 587
SPECIES *P. malinka* Bezdek, 2010: 564

SUBFAMILY ALTICINAE Newman, 1834: 421
TRIBE ALTICINI Newman, 1834: 421
SUBTRIBE -
GENUS *AESCHROCNEMIS* Weise, 1888: 855
SUBGENUS -
SPECIES *A. anatolica* (Heikertinger, 1922: 332 [=1925: 171])
SPECIES *A. laterufa* (Pic, 1909: 178)
SPECIES *A. serbica* (Kutschera, 1860: 74)
SPECIES *A. turcica* Nadein & Gök, 2009
SPECIES *A. whiteheadi* (Warchalowski, 1998: 361)
GENUS *ALTICA* Geoffroy, 1762: 244
SUBGENUS -
SPECIES *A. ampelophaga* (Guerin-Meneville, 1858: 415)
SUBSPECIES *A. a. ampelophaga* (Guerin-Meneville, 1858: 415)
SPECIES *A. ancyrensis* (Weise, 1897: 67)
SPECIES *A. bicarin*ata (Kutschera, 1860: 14)
SPECIES *A. brevicollis* Foudras, 1861: 40
SUBSPECIES *A. b. brevicollis* Foudras, 1861: 40
SPECIES *A. bulgharensis* Kral, 1969: 79
SPECIES *A. carduorum* Guérin-Méneville, 1858: 415
SPECIES *A. cornivorax* Kral, 1969: 72
SPECIES *A. deserticola* (Weise, 1889: 635)
SPECIES *A. globicollis* (Weise, 1889: 635)
SPECIES *A. graeca* Kral, 1966: 164
SPECIES *A. hampei* (Allard, 1867: 499)
SPECIES *A. impressicollis* (Reiche, 1862: 298)
SPECIES *A. jarmilae* Kral, 1979: 98
SPECIES *A. longicollis* (Allard, 1860: 83)
SPECIES *A. lythri* Aube, 1843: 8
SPECIES *A. oler*acea (Linnaeus, 1758: 372)
SUBSPECIES *A. o. oleracea* (Linnaeus, 1758: 372)

SPECIES *A. palustris* (Weise, 1888: 844)
SPECIES *A. pontica* (Ogloblin, 1925: 94)
SPECIES *A. quercetorum* Foudras, 1861: 37
SUBSPECIES *A. q. querceto*rum Foudras, 1861: 37
SPECIES *A. tamaricis* Schrank, 1785: 318
SUBSPECIES *A. t. tamaricis* Schrank, 1785: 318
SPECIES *A. talyshana* Konstantinov, 1995: 196
GENUS *ANTHOBIODES* Weise, 1887: 402
SUBGENUS -
SPECIES *A. turcicus* (L. N. Medvedev, 1975: 15)
GENUS *APHTHONA* Chevrolat, 1836: 391
SUBGENUS -
SPECIES *A. abdomin*alis (Duftschmid, 1825: 262)
SPECIES *A. aeneomicans* Allard, 1875: 439
SPECIES *A. alanyensis* Fritzlar, 2004: 107
SPECIES *A. atrocaerulea* (Stephens, 1831: 299)
SPECIES *A. atrovirens* (Förster, 1849: 37)
SPECIES *A. bergeali* Fritzlar, 2001: 205
SPECIES *A. bergealoides* Fritzlar, 2004: 116
SPECIES *A. bonvouloiri* Allard, 1861: 333
SPECIES *A. carbonaria* Rosenhauer, 1856: 337
SPECIES *A. crassicornis* Lopatin, 1990: 601
SPECIES *A. cyparissiae* (Koch, 1803: 80)
SPECIES *A. euphorbiae* (Schrank, 1781: 83)
SPECIES *A. flava* Guillebeau, 1895: CXCIII
SPECIES *A. flaviceps* Allard, 1859: C
SPECIES *A. franzi* Heikertinger, 1944: 52
SPECIES *A. fuentei* Reitter, 1901: 202
SPECIES *A. gracilis* Faldermann, 1837: 344
SPECIES *A. konstantinovi* Lopatin, 1998: 132
SPECIES *A. kuntzei* Roubal, 1931: 116
SPECIES *A. lacertosa* Rosenhauer, 1847: 60
SPECIES *A. lutescens* (Gyllenhal, 1813: 546)
SPECIES *A. maculata* Allard, 1876: 23
SPECIES *A. nigriceps* (W. Redtenbacher, 1842: 27)
SPECIES *A. nigriscutis* Foudras, 1860: 101
SPECIES *A. nonstriata* (Goeze, 1777: 312)
SPECIES *A. ovata* Foudras, 1861: 116
SPECIES *A. pygmaea* (Kutschera, 1861: 246)
SPECIES *A. rhodiensis* Heikertinger, 1944: 67
SPECIES *A. rugipennis* Ogloblin, 1927: 290
SPECIES *A. semicyanea* Allard, 1859: CI
SPECIES *A. syriaca* Heikertinger, 1944: 92
SPECIES *A. venustula* Kutschera, 1861: 244
SPECIES *A. violacea* (Koch, 1803: 56)
SPECIES *A. warchalowskii* Fritzlar, 2001: 201
GENUS *BATOPHILA* Foudras, 1860: 378
SUBGENUS -
SPECIES *B. fallax* Weise, 1888: 854
SPECIES *B. olexai* Kral, 1964: 37
SPECIES *B. rubi* (Paykull, 1799: 112)
GENUS *CHAETOCNEMA* Stephens, 1831: 325
SUBGENUS *CHAETOCNEMA* Stephens, 1831: 325
SPECIES *C. aerosa* (Letzner, 1847: 84)
SPECIES *C. arenacea* (Allard, 1860: 569)
SPECIES *C. arida* Foudras, 1860: 234
SPECIES *C. aridula* (Gyllenhal, 1827: 663)
SPECIES *C. confusa* (Boheman, 1851: 234)
SPECIES *C. hortensis* (Geoffroy, 1785: 98)
SPECIES *C. mannerheimii* (Gyllenhal, 1827: 664)
SPECIES *C. montenegrina* Heikertinger, 1912: 44
SPECIES *C. obesa* (Boieldieu, 1859: 480)
SPECIES *C. procerula* (Rosenhauer, 1856: 344)
SPECIES *C. sahlbergii* (Gyllenhal, 1827: 662)
SUBGENUS *TLANOMA* Motschulsky, 1845: 108
SPECIES *C. breviuscula* (Faldermann, 1837: 349)
SPECIES *C. chlorophana* (Duftschmid, 1825: 286)

SPECIES *C. concinn*a (Marsham, 1802: 196)
SPECIES *C. conducta* (Motschulsky, 1838: 180)
SPECIES *C. coyei* (Allard, 1864: 659)
SPECIES *C. delarouzeei* (Brisout de Barneville, 1884: 89)
SPECIES *C. major* (Jacquelin du Val, 1852: 717)
SPECIES *C. picipes* Stephens, 1831: 327
SPECIES *C. orientalis* (Bauduer, 1874: C1XII)
SPECIES *C. scheffleri* (Kutschera, 1864: 315)
SPECIES *C. semicoerulea* (Koch, 1803: 40)
SUBSPECIES *C. s. semicoerulea* (Koch, 1803: 40)
SPECIES *C. tibialis* (Illiger, 1807: 64)
SPECIES *C. turhala* Allard, 1889: 307
GENUS *CREPIDODERA* Chevrolat, 1836: 391
SUBGENUS -
SPECIES *C. aurata* (Marsham, 1802: 195)
SPECIES *C. aurea* (Geoffroy, 1785: 100)
SPECIES *C. fulvicornis* (Fabricius, 1792: 30)
SPECIES *C. lamin*a (Bedel, 1901: 398)
SPECIES *C. nigricoxis* Allard, 1878: 340
SPECIES *C. nitidula* (Linnaeus, 1758: 373)
SPECIES *C. plutus* (Latreille, 1804: 7)
GENUS *DEROCREPIS* Weise, 1886: 686
SUBGENUS -
SPECIES *D. rufi*pes (Linnaeus, 1758: 373)
GENUS *DIBOLIA* Latreille, 1829: 155
SUBGENUS *DIBOLIA* Latreille, 1829: 155
SPECIES *D. cryptocephala* (Koch, 1803: 22)
SPECIES *D. cynoglossi* (Koch, 1803: 20)
SPECIES *D. depressiuscula* Letzner, 1847: 83
SPECIES *D. kralii* Mohr, 1981: 437
SPECIES *D. numidica* Doguet, 1971: 133
SPECIES *D. occultans* (Koch, 1803: 23)
SPECIES *D. phoenicia* Allard, 1866: 424
SPECIES *D. rufofemorata* Reitter, 1896: 267
SPECIES *D. rugulosa* L. Redtenbacher, 1849: 541
SPECIES *D. timida* (Illiger, 1807: 71)
SUBGENUS *EUDIBOLIA* Iablokoff-Khnzorian, 1968: 270
SPECIES *D. carpathica* Weise, 1893: 1030
SPECIES *D. femoralis* L. Redtenbacher, 1849: 540
SUBSPECIES *D. f. femoralis* L. Redtenbacher, 1849: 540
SPECIES *D. schillingii* Letzner, 1847: 82
SPECIES *D. tricolor* Reitter, 1898: 127
SUBGENUS *PSEUDODIBOLIA* Iablokoff-Khnzorian, 1968: 269
SPECIES *D. zangezurica* Iablokoff-Khnzorian, 1968: 266
GENUS *EPITRIX* Foudras, 1861: 52
SUBGENUS -
SPECIES *E. abeillei* (Bauduer, 1874: CLXIII)
SPECIES *E. atropae* Foudras, 1861: 55
SPECIES *E. caucasica* (Heikertinger, 1950: 120)
SPECIES *E. dieckmanni* (Mohr, 1968: 58)
SPECIES *E. hirtipennis* (Melsheimer, 1847: 165)
SPECIES *E. intermedia* Foudras, 1861: 55
SPECIES *E. pubescens* (Koch, 1803: 37)
GENUS *HERMAEOPHAGA* Foudras, 1860: 43
SUBGENUS *HERMAEOPHAGA* Foudras, 1860: 43
SPECIES *H. mercurialis* (Fabricius, 1792: 33)
SUBGENUS *ORTHOCREPIS* Weise, 1888: 850
SPECIES *H. ruficollis* (P. H. Lucas, 1849: 546)
GENUS *HIPPURIPHILA* Foudras, 1861: 50
SUBGENUS -
SPECIES *H. modeeri* (Linnaeus, 1760: 167)
GENUS *LONGITARSUS* Latreille, 1829: 155
SUBGENUS *LONGITARSUS* Latreille, 1829: 155
SPECIES *L. absynthii* Kutschera, 1862: 217
SPECIES *L. aeneicollis* (Faldermann, 1837: 346)
SPECIES *L. albineus* (Foudras, 1860: 310)

SPECIES *L. alfierii* Pic, 1923: 7
SUBSPECIES *L. a. alfierii* Pic, 1923: 7
SUBSPECIES *L. a. antineae* (Peyerimhoff, 1929: 144)
SUBSPECIES *L. a. furthi* Gruev, 1982: 471
SPECIES *L. allotrophus* Furth, 1979: 85
SPECIES *L. almorae* Maulik, 1926: 342
SPECIES *L. angelikae* Fritzlar, 2001: 211
SPECIES *L. aramaicus* Leonardi, 1979: 296
SPECIES *L. artvinus* Gruev & Aslan, 1998: 164
SPECIES *L. atricillus* (Linnaeus, 1760: nr. 537)
SPECIES *L. audisioi* Biondi, 1992: 342
SPECIES *L. australis* (Mulsant & Rey, 1874: 227)
SPECIES *L. baeticus* Leonardi, 1979: 292
SPECIES *L. ballotae* (Marsham, 1802: 205)
SPECIES *L. barbarae* Doguet & Bergeal, 2002: 372
SPECIES *L. bertii* Leonardi, 1973: 467
SPECIES *L. brisouti* Heikertinger, 1912: 293
SPECIES *L. bytinskii* Furth, 1979: 91
SPECIES *L. callidus* Warchalowski, 1967: 59
SPECIES *L. celticus* Leonardi, 1975: 206
SPECIES *L. cerinthes* (Schrank, 1798: 562)
SPECIES *L. corpulentus* Weise, 1887: 333
SPECIES *L. echii* (Koch, 1803: 52)
SPECIES *L. eminus* Warchalowski, 1967: 62
SPECIES *L. exsoletus* (Linnaeus, 1758: 373)
SUBSPECIES *L. e. exsoletus* (Linnaeus, 1758: 373)
SUBSPECIES *L. e. rufulus* (Foudras, 1860: 317)
SPECIES *L. fallax* Weise, 1888: 929
SPECIES *L. foudrasi* Weise, 1893: 987
SPECIES *L. ganglbaueri* Heikertinger, 1912: 292 [RN]
SUBSPECIES *L. g. ganglbaueri* Heikertinger, 1912: 292 [RN]
SPECIES *L. georgianus* (Allard, 1866: 362)
SPECIES *L. gracilis* Kutschera, 1864: 275
SPECIES *L. helvolus* Kutschera, 1864: 269
SPECIES *L. hermonensis* Furth, 1979: 99
SPECIES *L. holsaticus* (Linnaeus, 1758: 373)
SPECIES *L. jacobaeae* (G. R. Waterhouse, 1858: 94 [RN])
SPECIES *L. jailensis* Heikertinger, 1913: 145
SPECIES *L. juncicola* (Foudras, 1860: 301)
SPECIES *L. karlheinzi* Warchalowski, 1972: 315
SPECIES *L. kopdagiensis* Gruev & Aslan, 1998: 165
SPECIES *L. kutscherai* (Rye, 1872: 199 [RN])
SPECIES *L. latens* Warchalowski, 1998: 291
SPECIES *L. lateripunctatus* Rosenhauer, 1856: 339
SUBSPECIES *L. l. personatus* Weise, 1893: 964
SPECIES *L. ledouxi* Doguet, 1979: 52
SPECIES *L. lewisii* (Baly, 1874: 199)
SPECIES *L. linnaei* (Duftschmid, 1825: 265)
SPECIES *L. longipennis* Kutschera, 1863: 306
SPECIES *L. luridus* (Scopoli, 1763: 70)
SUBSPECIES *L. l. luridus* (Scopoli, 1763: 70)
SPECIES *L. lycopi (*Foudras, 1860: 305)
SPECIES *L. manfredi* Fritzlar, 2004: 120
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SPECIES *L. melanocephalus* (DeGeer, 1775: 348)
SPECIES *L. membranaceus* (Foudras, 1860: 334)
SPECIES *L. meridionalis* Weise, 1888: 938
SPECIES *L. minimus* Kutschera, 1864: 144
SPECIES *L. minusculus* (Foudras, 1860: 266)
SPECIES *L. nanus* (Foudras, 1860: 335)
SPECIES *L. nasturtii* (Fabricius, 1792: 31)
SPECIES *L. niger* (Koch, 1803: 57)
SPECIES *L. nigrofasciatus* (Goeze, 1777: 312)
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SUBSPECIES *L. o. ochroleucus* (Marsham, 1802: 202)
SPECIES *L. ozbek* Aslan & Warchalowski, 2005: 222
SPECIES *L. parvulus* (Paykull, 1799: 102)
SPECIES *L. pellucidus* (Foudras, 1860: 322)
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SPECIES *L. pratensis* (Panzer, 1794: 16)
SPECIES *L. pulmonariae* Weise, 1893: 998
SPECIES *L. quadriguttatus* (Pontoppidan, 1763: 670)
SPECIES *L. rectilineatus* (Foudras, 1860: 250)
SPECIES *L. reichei* (Allard, 1860: 132)
SPECIES *L. rubiginosus* (Foudras, 1860: 316)
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SUBSPECIES *L. s. dichrous* (Iablokoff-Khnzorian, 1962: 118)
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SPECIES *L. strigicollis* (Wollaston, 1864: 412)
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SPECIES *L. tabidus* (Fabricius, 1775: 115)
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SPECIES *L. trepidus* Warchalowski, 1973: 674
SPECIES *L. violentus* Weise, 1893: 1016
SUBGENUS *TESTERGUS* Weise, 1893: 1013
SPECIES *L. anatolicus* Weise, 1900: 138
SPECIES *L. anchusae* (Paykull, 1799: 101)
SPECIES *L. aubozaorum* Biondi, 1997: 383
SPECIES *L. corynthius* (Reiche & Saulcy, 1858: 47)
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SPECIES *L. pinguis* Weise, 1888: 935
SPECIES *L. weisei* Guillebeau, 1895: CCC1XXXVII
SPECIES *L. truncatellus* Weise, 1890: 115
GENUS *MANTURA* Stephens, 1831: 322
SUBGENUS *MANTURA* Stephens, 1831: 322
SPECIES *M. chrysanthemi* (Koch, 1803: 45)
SUBSPECIES *M. c. chrysanthemi* (Koch, 1803: 45)
SPECIES *M. mathewsii* (Curtis, 1833: 435)
SPECIES *M. rustica* (Linnaeus, 1767: 595)
SUBGENUS *STENOMANTURA* Heikertinger, 1909: 307
SPECIES *M. cylindrica* Miller, 1881: 2
GENUS *MNIOPHILA* Stephens, 1831: 330
SUBGENUS -
SPECIES *M. muscorum* (Koch, 1803: 48)
SUBSPECIES *M. m. turcica* (L. N. Medvedev, 1970: 317)
GENUS *NEOCREPIDODERA* Heikertinger, 1911: 34
SUBGENUS -
SPECIES *N. crassicornis* (Faldermann, 1837: 343)
SPECIES *N. ferruginea* (Scopoli, 1763: 70)
SPECIES *N. impressa* (Fabricius, 1801: 496)
SUBSPECIES *N. i. obtusangula* (J. Daniel, 1904: 249)
SPECIES *N. motschulskii* (Konstantinov, 1991: 143)
SPECIES *N. nigritula (*Gyllenhal, 1813: 557)
SPECIES *N. transversa* (Marsham, 1802: 203)
GENUS *OCHROSIS* Faudras, 1861: 46
SUBGENUS -
SPECIES *O. ventralis* Illiger, 1807: 58

GENUS *ORESTIA* Chevrolat, 1836: 440
SUBGENUS -
SPECIES *O. delagrangei* Pic, 1909: 155
SPECIES *O. loebli* Biondi, 1992: 346
SPECIES *O. olympica* Frivaldszky, 1884: 7
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GENUS *PHYLLOTRETA* Chevrolet, 1836: 391
SUBGENUS -
SPECIES *P. acutecarinata* Heikertinger, 1941: 41
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SPECIES *P. atra* (Fabricius, 1775: 115)
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SPECIES *P. bolognai* Biondi, 1992: 349
SPECIES *P. caucasicola* Heikertinger, 1941: 82
SPECIES *P. corrugata* Reiche & Saulcy, 1858: 46
SPECIES *P. cruciferae* (Goeze, 1777: 312)
SPECIES *P. dacica* Heikertinger, 1941: 83
SPECIES *P. diademata* Foudras, 1860: 369
SPECIES *P. egridirensis* Gruev & Kasap, 1985: 60
SPECIES *P. erysimi* Weise, 1900: 138
SUBSPECIES *P. e. erysimi* Weise, 1900: 138
SPECIES *P. exclamationis* (Thunberg, 1784: 14)
SPECIES *P. fallociosa* Heikertinger, 1941: 76
SPECIES *P. fornuseki* Cizek, 2003: 63
SPECIES *P. ganglbaueri* Heikertinger, 1909: 290
SPECIES *P. ispartaensis* Gök, 2005: 2
SPECIES *P. judaea* Pic, 1901: 27
SPECIES *P. lativittata* Kutschera, 1860: 307
SPECIES *P. lorestanica* Warchalowski, 1973: 664
SPECIES *P. maculicornis* Pic, 1906: 35
SPECIES *P. nemorum* (Linnaeus, 1758: 373)
SPECIES *P. nigripes* (Fabricius, 1775: 113)
SUBSPECIES *P. n. nigripes* (Fabricius, 1775: 113)
SPECIES *P. nodicornis* (Marsham, 1802: 204)
SPECIES *P. ochripes* (Curtis, 1837: 630)
SPECIES *P. oltuensis* Gruev & Aslan, 1998: 166
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SPECIES *P. pallidipennis* Reitter, 1891: 34
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SPECIES *P. praticola* Weise, 1887: 333
SPECIES *P. procera* (L. Redtenbacher, 1849: 530)
SPECIES *P. punctulata* (Marsham, 1802: 200)
SPECIES *P. reitteri* Heikertinger, 1911: 159
SPECIES *P. sisymbrii* Weise, 1888: 860
SPECIES *P. striolata* (Illiger, 1803: 293)
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SPECIES *P. variipennis* (Boieldieu, 1859: 477)
SUBSPECIES *P. v. variipennis* (Boieldieu, 1859: 477)
SPECIES *P. vilis* Weise, 1888: 861
SPECIES *P. vittula* (L. Redtenbacher, 1849: 532)
SPECIES *P. weiseana* Jakobson, 1901: 141
GENUS *PODAGRICA* Chevrolat, 1836: 394
SUBGENUS -
SPECIES *P. fuscicornis* (Linnaeus, 1767: 595)
SPECIES *P. malvae* (Illiger, 1807: 67)
SUBSPECIES *P. m. malvae* (Illiger, 1807: 67)
SPECIES *P. menetriesii* (Faldermann, 1837: 396)
GENUS *PSYLLIODES* Latreille, 1829: 154
SUBGENUS *MINICNEMA* Nadein, 2007: 313
SPECIES *P. elliptica* Allard, 1861: 340
SUBGENUS *PSYLLIODES* Latreille, 1829: 154
SPECIES *P. aerea* Foudras, 1860: 165
SPECIES *P. affinis* (Paykull, 1799: 109)
SPECIES *P. anatolica* Gök & Çilbiroğlu, 2004: 2
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SPECIES *P. attenuata* (Koch, 1803: 34)
SPECIES *P. brisouti* Bedel, 1898: 202
SPECIES *P. cerenae* Gök, Doguet & Çilbiroğlu, 2003:
SPECIES *P. chalcomera* (Illiger, 1807: 75)
SPECIES *P. chrysocephala* (Linnaeus, 1758: 372)
SUBSPECIES *P. c. chrysocephala* (Linnaeus, 1758: 372)
SPECIES *P. circumdata* (W. Redtenbacher, 1842: 27)
SPECIES *P. cuprea* Koch, 1803: 28
SPECIES *P. diversicolor* Nadein, 2006: 868
SPECIES *P. dogueti* Warchalowski, 1993: 359
SPECIES *P. drusei* Furth, 1983: 52
SPECIES *P. dulcamarae* Koch, 1803: 24
SPECIES *P. gibbosa* Allard, 1860: 820
SUBSPECIES *P. g. gibbos*a Allard, 1860: 820
SPECIES *P. hyoscyami* (Linnaeus, 1758: 372)
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SPECIES *P. kasnakensis* Gök & Aslan, 2007: 372
SPECIES *P. kiesenwetteri* Kutschhera, 1864: 394
SPECIES *P. littoralis* Biondi, 1997: 386
SPECIES *P. longicollis* Weise, 1900: 292
SPECIES *P. luteola* (O. F. Müller, 1776: 84)
SPECIES *P. magnifica* Gruev, 1975: 92
SPECIES *P. marcida* (Illiger, 1807: 175)
SPECIES *P. milleri* Kutschhera, 1864: 390
SUBSPECIES *P. m. milleri* Kutschhera, 1864: 390
SPECIES *P. napi* (Fabricius, 1792: 29)
SPECIES *P. ozisiki* Leonardi & Arnold, 1995: 306
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SPECIES *P. thlaspis* Foundras, 1860: 154
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SPECIES *P. tricolor* Weise, 1888: 806
SPECIES *P. valida* Weise, 1889: 2
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SPECIES *P. wachsmanni* Csiki, 1903: 40
SPECIES *P. wrasei* Leonardi & Arnold, 1995: 300
SPECIES *P. yalvacensis* Gök, 2005: 133
SUBGENUS *SEMICNEMA* Weise, 1888: 784
SPECIES *P. reitteri* Weise, 1888: 784
SUBSPECIES *P. r. reitteri* Weise, 1888: 784
GENUS *SPHAERODERMA* Stephens, 1831: 328
SUBGENUS -
SPECIES *S. rubidum* (Graells, 1858: 97)
SPECIES *S. testaceum* (Fabricius, 1775: 114)

SUBFAMILY HISPINAE Gyllenhal, 1813: 448
TRIBE HISPINI Gyllenhal, 1813: 448
SUBTRIBE -
GENUS *ACMENYCHUS* Weise, 1905: 318
SUBGENUS -
SPECIES *A. caucasicus* (Heyden, 1878: 343)
SPECIES *A. inermis* (Zubkov, 1833: 337)
GENUS *DICLADISPA* Gestro, 1897: 81
SUBGENUS -
SPECIES *D. testacea* (Linnaeus, 1767: 603)
GENUS *HISPA* Linnaeus, 1767: 603
SUBGENUS -
SPECIES *H. atra* Linnaeus, 1767: 603

SUBFAMILY CASSIDINAE Gyllenhal, 1813: 434
TRIBE CASSIDINI Gyllenhal, 1813: 434
SUBTRIBE -
GENUS *CASSIDA* Linnaeus, 1758: 362
SUBGENUS -
SPECIES *C. algirica* P. H. Lucas, 1849: 513
SPECIES *C. atrata* Fabricius, 1787: 62
SPECIES *C. azurea* Fabricius, 1801: 389
SPECIES *C. bella* Faldermann, 1837: 325
SPECIES *C. berolinensis* Suffrian, 1844: 270
SPECIES *C. brevis* Weise, 1884: 159
SPECIES *C. canaliculata* Laicharting, 1781: 109
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SPECIES *C. linnavuorii* Borowiec, 1986: 573
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SPECIES *C. murraea* Linnaeus, 1767: 575
SUBSPECIES *C. m. murra*ea Linnaeus, 1767: 575
SPECIES *C. nebulosa* Linnaeus, 1758: 363
SPECIES *C. nobilis* Linnaeus, 1758: 363
SPECIES *C. palaestina* Reiche, 1858: 55
SPECIES *C. pannonica* Suffrian, 1844: 147
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SUBSPECIES *C. r. rubiginosa* O. F. Müller, 1776: 65
SPECIES *C. rufovirens* Suffrian, 1844: 144
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SPECIES *C. seladonia* Gyllenhal, 1827: 644
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SPECIES *C. strejceki* Sekerka, 2006: 562
SPECIES *C. stigmatica* Suffrian, 1844: 206
SPECIES *C. subreticulata* Suffrian, 1844: 244
SPECIES *C. vibex* Linnaeus, 1767: 575
SPECIES *C. viridis* Linnaeus, 1758: 362
SPECIES *C. vittata* Villers, 1789: 93
GENUS *HYPOCASSIDA* Weise, 1893: 1074
SUBGENUS -
SPECIES *H. cornea* (Marseul, 1868: 214)
SPECIES *H. meridionalis* (Suffrian, 1844: 276)
SPECIES *H. subferruginea* (Schrank, 1776: 62)
GENUS *ISCHYRONOTA* Weise, 1891: 204
SUBGENUS -
SPECIES *I. desertorum* (Gebler, 1833: 305)
SPECIES *I. jordanensis* Borowiec, 1986: 575
GENUS *MACROMONYCHA* Spaeth, 1911: 271
SUBGENUS -
SPECIES *M. anatolica* (Weise, 1900: 139)
SPECIES *M. apicalis* (Gebler, 1845: 105)
SPECIES *M. kantner*orum Sekerka, 2008: 99
GENUS *OXYLEPUS* Desbrochers des Loges, 1884: 170
SUBGENUS -
SPECIES *O. deflexicollis* (Boheman, 1862: 333)
GENUS *PILEMOSTOMA* Desbrochers des Loges, 1891: 14
SUBGENUS -
SPECIES *P. fastuosum* (Schaller, 1783: 259)

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ABSTRACT. More than 300 misprints, wrong combinations, wrong geographical records, wrong references, wrong status of certain names, wrong synonyms, wrong authorships and dates of certain names, wrong original combinations, wrong spelling of several names and so on are fixed. Sometimes unavailable names were published as available. Missing names, geographical data and references are added.

KEY WORDS: Coleoptera, Cerambycidae, taxonomy, Palaearctic.

Third part of additions and corrections to the Cerambycidae Catalog (Löbl & Smetana, 2010) continues two parts published before (Danilevsky, 2010 and 2011). Next parts are being prepared now for publication. All three parts include more than 1000 corrections, which are all shown in http://www.cerambycidae.net/catalog.html together with acceptable corrections published by A. I. Miroshnikov (2011a,b), I. Löbl & A. Smetana (2011), D. G. Kasatkin & A. I. Miroshnikov (2011) and H. Özdikmen (2011). The WEB information is updated each two months.

The references to the present article include only the publications absent in the references to the Catalog (Löbl & Smetana, 2010). The references inside the text of the present article to the publications included in the references to the Catalog have same letters after the number of the year as in the Catalog.

1. pages 46 and 332

PRINTED (p. 43):

Tetrops: Kirby (in Kirby & Spence 1826: 498) proposed the genus-group name *Tetrops* for *Lamia Tornator* Fabricius, 1775 (= *Cerambyx tetrophthalmus* Forster, 1771). He added in a footnote that *Saperda praeusta* (Linnaeus, 1758) has also four eyes, a character state of *Tetrops*. However, in no case Kirby indicated that *S. praeusta* belongs to his new genus. Stephens (1829a: 16) listed "*praeusta* Lin." under the name "*Tetrops* Kir." and many authors have credited the name *Tetrops* to Stephens with *L. praeusta* as type species (see Vives and Alonso-Zarazaga 2000: 660-661; Sama 2002: 120). Currently *Cerambyx tetrophthalmus* Forster belong to the genus *Tetraopes* Dalman, 1817 and acceptance of this species as type species of *Tetrops* would require nomenclatural changes. For that reason, we believe, as suggested by Vives and Alonso-Zarazaga (2000: 660-661), that a request should be submitted to the Commission to suppress the name *Tetrops* Kirby, 1826 for the Principle of Homonymy.

and (p. 332)

genus *Tetrops* <u>Stephens, 1829a: 16</u> type species *Leptura praeusta* Linnaeus, 1758
Anaetia Dejean, 1835: 350 type species *Leptura praeusta* Linnaeus, 1758

MUST BE (p. 332):
genus *Tetrops* Kirby (in Kirby & Spence 1826: 498) type species *Leptura praeusta* Linnaeus, 1758
Anaetia Dejean, 1835: 350 type species *Leptura praeusta* Linnaeus, 1758

NOTES:
The name *Tetrops* was originally introduced for several Cerambycidae species with divided eyes by W.Kirby (in Kirby & Spence, 1826a: 498): "*Lamia tornator* (*Cerambyx tetraophthalmus* Forst.) and some others, of which I make a genus under appellation of *Tetrops,* are also so distinguished [by divided eyes – M.D.]."

In the Index of names to 4th volume, page 619 (Kirby & Spence, 1826b): "*Tetraopes* (*Tetrops*), iii. 498." So, W.Kirby himself regarded both names as synonyms. It looks, that Kirby was informed about *Tetraopes* in the period between 3rd and 4th volumes.

There is a "foot-note" in the original introduction of *Tetrops* Kirby (same page 498) with the statement that *Saperda praeusta* L. also has same character [divided eyes]. So, in fact two species were definitely mentioned by Kirby inside genus *Tetrops* originally: *Cerambyx tetraophthalmus* Forst. and *Leptura praeusta* L.

J. Thomson (1866: 115-116) mentioned *Leptura praeusta* Linnaeus, 1758 as a type species of genus *Tetrops* Kirby.

Many authors (Plavilstshikov, 1948; Breuning, 1965; Villiers, 1978; Vives, 2000; Sama, 2002 and others) regarded J.S. Stephens (1829) as the author of the genus, while others (Bily & Mehl, 1989; Bense, 1995; Althoff & Danilevsky, 1997) reasonably addressed it to W.Kirby (1826).

In fact Stephens (1829) was just the first, who published the combination "*Tetrops*, Kir. *praeusta*, Lin." in his list of British insects.

According to E. Vives and M. A. Alonzo-Zarazaga (in Vives. 2000: 660-661) the introduction of *Tetrops* by Kirby, 1826 was just a wrong spelling of *Tetraopes,* but there are no reasons for such conclusion.

According to Bousquet (2010: 43): "However, in no case Kirby indicated that *S. praeusta* belongs to his new genus." and "a request should be submitted to the Commission to suppress the name *Tetrops* Kirby, 1826 for the Principle of Homonymy".

Any way, until the corresponding opinion by the Commission is not published it is better to accept *Tetrops* Kirby, 1826 with the type species *Leptura praeusta* Linnaeus, 1758, otherwise *Tetraopes* Dalman, 1817 = *Tetrops* Kirby, 1826, and *Anaetia* Dejean, 1835 could be accepted as valid.

2. page 46

PRINTED:
*Etor**u**fus circaocularis* Pic, 1934, **syn. nov**. of *Etor**u**fus nemurensis* Matsushita, 1933; these names were previously placed in synonymy, the latter erroneously listed as invalid.

MUST BE:
*Etor**o**fus circaocularis* Pic, 1934, **syn. nov**. of *Etor**o**fus nemurensis* Matsushita, 1933; these names were previously placed in synonymy, the latter erroneously listed as invalid.

NOTE:
The spelling "*Etorufus*" traditional for European publications (Villiers, 1978: 210; Švácha, 1989: 130; Sama, 1992b: 297, 301; 2002: 24; Sláma, 2006: 8) is wrong. The original spelling accepted in Japan publications is "*Etorofus*".

3. page 50

PRINTED:
*Dorcadion (Cribr**o**dorcadion) macedonicum* Jureček, 1929

MUST BE:
*Dorcadion (Cribr**i**dorcadion) macedonicum* Jureček, 1929

4. page 53

PRINTED:
Stictoleptura gevneensis Özdikmen & Turgut, 2008, **syn. nov.** of <u>*Stictoleptura rufa rufa*</u> (Brullé, 1832), based on the description, the type locality and on examination of the holotype illustration of *S. gevneensis*, as well as a long series of specimens from several counties of southern Turkey, including the type locality of *S. gevneensis*. The distinguishing characters used in the description, based on a single male, fall within the variability of *S. rufa*.

NOTE:
The real nature of *Stictoleptura gevneensis* Özdikmen & Turgut, 2008 is not clear, because of the peculiarity of a single known specimen, but if Sama is right, and it is really *S. rufa*, then it can not belong to the nominative subspecies. The holotype was described from Antalya prov., so it could be a synonym of <u>*Stictoleptura rufa dimidiata*</u> (K. Daniel & J. Daniel, 1891) (= *attaliensis* K. Daniel & J. Daniel, 1891 – described from Antalya), as far as *S. r. dimidiata* is accepted as a subspecies.

5. page 53

PRINTED:
Strangalia suturata was described from "Peloponnese" and "Romelie". The former is certainly wrong (similarly to the type locality "Peloponnese" given by the same authors for their *Agapanthia lais* (only known from Near Orient); the second one (Rumelia is an historical region including southern Bulgaria, north-eastern Greece and north-western Turkey) is certainly correct and may be assumed as the restricted type locality.

NOTES:
It is just a mistake. Only one locality was mentioned after the original description: "Du Péloponèse". The type series includes at least two specimens, as both male and female were described. Then one more sentence is added in another paragraph after distinguishing characters: “Nous possédons un individu de la *suturata* provenant de la Romélie”. It means, that another specimen was identified by the authors as *S. suturata*, but it hardly could be attributed to the type series. So, the type locality of the taxon is Peloponnesus.

Only *Stenurella s. septempunctata* is distributed in Peloponnesus (available materials: 41 specimens collected by A. Napolov in the environs of Sparta and Kalamata in May 2010 – all with red pronotum). So, *Stenurella s. septempunctata* (Fabricius, 1792b) = *S. septempunctata suturata* (Reiche & Saulcy, 1858). Similar specimens of *S. s. septempunctata* with red pronotum were collected by Napolov in south-western Bulgaria (Kresna), so north-eastern Greece must be also included in the area of the nominative subspecies.

The possibility of the occurrence in Peloponnesus two specimens with totally black thorax is not impossible. Such dark specimens are also known inside typically light populations of the nominal subspecies in many other regions.

The valid name of the dark south-east subspecies distributed in south-east Bulgaria, European Turkey, Anatolia and Transcaucasia is <u>*Stenurella septempunctata latenigra* (Pic, 1915e)</u> described from “Asie Mineure”.

6. pages 55 and 115

PRINTED (p. 55):
Stictoleptura scutellata ssp. *ochracea* Faust, <u>1879</u> raised from var. of *Stictoleptura scutellata* Fabricius, 1781. I have examined a long series of specimens from northern Iran (chiefly Gilan and Mazandaran prov.) and from Azerbaijan. All specimens constantly differ from those of *S. scutellata* s. str. by the pronotum more elongate in both sexes, clothed with short uncinate or long recumbent hairs and numerous erect setae, particularly dense at sides. It may be regarded with reason as a distinct subspecies, similar to *S. scutellata melas* (P. H. Lucas, 1849).

and (p. 115)
scutellata ochracea Faust, <u>1879: 22</u> (*Leptura*) **E**: AB **A**: IN

NOTES:

The reference to Faust absent in the Catalog:

The type locality of *Leptura scutellata* var. *ochracea* Faust, 1878 (: 135) is "Baku" - according to the original description, so it is very far from Talysh – the northern most area, where the Iranian subspecies is also distributed. It was described in details (but not named!) by Miroshnikov (1998: 595-596). I do not know *S. scutellata* from Baku environs, but the species is very numerous in North Azerbaidzhan (specimens from Ismailly and Zeyva are available) and represented here by usual Caucasian form without erect setae on lateral sides of prothorax – the unique character of Iranian subspecies. In general the fauna of Baku region is much closer to North Azerbaidzhan, than to Talysh. So (Miroshnikov, 2011a, 2011b), *S. s. scutellata* (Fabricius, 1781) = *Leptura scutellata* var. *ochracea* Faust, 1878. The subspecies from Talysh and Iran must be described as new.

7. page 60

PRINTED:

Nupserha bicolor J. Thomsson, 1857

MUST BE:

Nupserha bicolor (J. Thomson, 1857)

8. page 62

PRINTED:

subobliterata Pic, 1902: 62

MUST BE:

subobliterata Pic, 1901m: 62

9. page 84

PRINTED:

Fabricius, 1792b

NOTE:

And all other records to Fabricius (1792b) – about 100.

MUST BE:

Fabricius, 1793

NOTES:

According to Bousquet (2008): "Fabricius (1793): Entomologia systematica Fabricius' *Entomologia systematica* was published in two parts with the date 1792 indicated on the title page of the first part. The Cerambycid section is included in the second part which was published in 1793, on May 4 (Evenhuis 1997: 248), not in 1792 as listed by authors."

Not a single Cerambycidae name was published by Fabricius (1792).

10. page 87

PRINTED:

genus *Aegosoma* Audinet-Serville, 1832: 162 type species *Cerambyx scabricornis* Scopoli, 1763

sinicum hainanensis Gahan, 1900d: 347 **A**: FUJ GUA GUX HAI JIA SCH TAI YUN **ORR**

mushensis Kano, 1933a: 259 (*Megopis*)

sinicum ornaticolle A. White, 1853: 30 **A**: BT GUI NP SCH SD XIZ YUN **ORR**

sinicum sinicum A. White, 1853: 30 **A**: ANH BEI FE GAN HEB HEI HEN HUB HUN LIA JIA JIL JIX NC NMO SC SHG SHN TAI ZHE **ORR**

amplicolle Motschulsky, 1854a: 48

corniculum Yoshida, 1931: 273 (*Megopis*)

sinicum savoryi Kusui, 1973: 119 (*Megopis*) **A**: JA (Bonin Is.)

sinicum validicornis Gressitt, 1951a: 205 (*Megopis*) **A**: JA (Ishigaki-shima, Iriomote-shima) *ogurai* Takakuwa, 1984: 9 (*Megopis*)

NOTE:

According to Löbl & Smetana (2011) "*Aegosoma*" is neutral, so several endings must be changed (according to Smetana – personal message, 2011):

MUST BE:

genus *Aegosoma* Audinet-Serville, 1832: 162 type species *Cerambyx scabricornis* Scopoli, 1763
sinicum hainanense Gahan, 1900d: 347 **A**: FUJ GUA GUX HAI JIA SCH TAI YUN **ORR**
mushense Kano, 1933a: 259 (*Megopis*)
sinicum ornaticolle A. White, 1853: 30 **A**: BT GUI NP SCH SD XIZ YUN **ORR**
sinicum sinicum A. White, 1853: 30 **A**: ANH BEI FE GAN HEB HEI HEN HUB HUN LIA JIA JIL JIX NC NMO SC SHG SHN TAI ZHE **ORR**
amplicolle Motschulsky, 1854a: 48
corniculum Yoshida, 1931: 273 (*Megopis*)
sinicum savoryi Kusui, 1973: 119 (*Megopis*) **A**: JA (Bonin Is.)
sinicum validicorne Gressitt, 1951b: 205 (*Megopis*) **A**: JA (Ishigaki-shima, Iriomote-shima)
ogurai Takakuwa, 1984: 9 (*Megopis*)

11. page 90

PRINTED:
elliotti C. O. Waterhouse, 1884b: 379 (*Macrotoma*) **A**: NP SD **ORR**

MUST BE:
elliotti C. O. Waterhouse, 1884b: 379 (*Macrotoma*) **A**: NP SD YUN **ORR**

NOTE:

Anomophysis elliotti (C. O. Waterhouse, 1884) was recorded for Yunnan by Wu et al. (2010).

12. pages 96-97

PRINTED:
dubia dubia Scopoli, 1763: 47 (*Leptura*) **E**: AB AL AN AR AU BH BU BY CR CZ EN FR GE GG GR HU IT LA LS LT MC PL RO SK SL SP ST SZ UK YU **N**: AG **A**: TR
atrovittata Pic, 1941b: 1 (*Leptura*)
basinotata Pic, 1932d: 31 (*Leptura*)
birubronotata Pic, 1941b: 1 (*Leptura*)
birubrosignata Pic, 1941b: 1 (*Leptura*)
chamomillae Fabricius, 1801b: 359 (*Leptura*)
cincta Fabricius, 1801b: 356 (*Leptura*)
circascutellaris Pic, 1945b: 6 (*Leptura*)
curierensis Pic, 1945b: 6 (*Leptura*)
curtelineata Pic, 1941e: 5
dereensis Pic, 1932d: 31 (*Leptura*)
graeca Pic, 1932d: 31 (*Leptura*)
inbasalis Pic, 1917g: 4 (*Leptura*)
limbata Laicharting, 1784: 166 (*Leptura*)
luctuosa Mulsant, 1839: 278 (*Leptura*)
moreana Pic, 1906h: 96 (*Leptura*)
notata Olivier, 1795: 11 (*Leptura*)
planeti Pic, 1945b: 5
starcki Schilsky, 1892: 205 (*Leptura*)
triangulifera Reitter, 1898d: 195 (*Leptura*)
dubia melanota Faldermann, 1837: 315 (*Leptura*) **E**: AB AR GG ST **A**: IN TR
distincta Tournier, 1872: 347 (*Leptura*)
ratchaensis Pic, 1911a: 4 (*Leptura*)

MUST BE:
dubia dubia Scopoli, 1763: 47 (*Leptura*) **E**: AL AN AU BH BU ?BY CR CZ FR GE GR HU IT LS ?LT MC PL RO SK SL SP SZ UK YU **A**: TR **N**: AG
basinotata Pic, 1932d: 31 (*Leptura*)
birubronotata Pic, 1941b: 1 (*Leptura*)
chamomillae Fabricius, 1801b: 359 (*Leptura*)
cincta Fabricius, 1801b: 356 (*Leptura*)
graeca Pic, 1932d: 31 (*Leptura*)
limbata Laicharting, 1784: 166 (*Leptura*)
luctuosa Mulsant, 1839: 278 (*Leptura*)
notata Olivier, 1795: 11 (*Leptura*)
planeti Pic, 1945b: 5 (*Leptura*)
dubia moreana Pic, 1906h: 96 (*Leptura*) **E**: GR (Peloponnese)
atrovittata Pic, 1941b: 1 (*Leptura*)
birubrosignata Pic, 1941b: 1 (*Leptura*)
inbasalis Pic, 1917g: 4 (*Leptura*)
dubia melanota Faldermann, 1837: 315 (*Leptura*) **E**: AB AR GG ST **A**: TR
circascutellaris Pic, 1945b: 6 (*Leptura*)
curierensis Pic, 1945b: 6 (*Leptura*)
curtelineata Pic, 1941e: 5 (*Leptura*)
dereensis Pic, 1932d: 31 (*Leptura*)
distincta Tournier, 1872: 347 (*Leptura*)
ratchaensis Pic, 1911a: 4 (*Leptura*)
starcki Schilsky, 1892: 205 (*Leptura*)
triangulifera Reitter, 1898d: 195 (*Leptura*)

NOTES:
The species absent in Estonia (Süda & Miländer, 1998), absent in Latvia (Telnov, 2004), absent in Iran (Sama et al., 2008).
Anastrangalia dubia moreana (Pic, 1906h) was accepted by Slama & Slamova (1996).

13. page 97
PRINTED:
sanguinolenta Linnaeus, 1760: 196 (*Leptura*) **E**: AB AL AR AU BH BU BY CR CT CZ DE EN FI FR GB GE GG GR HU IR IT LA LS LT MC MD NL NR NT PL RO SK SL SP ST SV SZ UK YU **A**: TR

MUST BE:
sanguinolenta Linnaeus, 1760: 196 (*Leptura*) **E**: AB AL AR AU BH BU BY CR CT CZ DE EN FI FR GB GE GG GR HU IR IT LA LS LT MC MD NL NR NT PL RO SK SL SP ST SV SZ UK YU **A**: KZ TR WS

NOTE:
The species is rather common in Transurals Siberia in Sverdlovsk, Cheliabinsk and Orenburg regions. All published records for Kazakhstan must be connected with another species, but it definitely presents at least in Kustanay Region of Kazakhstan as known from Kvarkeno District of Orenburg Region – very close to the Kazakhstan border. The record of Plavilstshikov (1936) for East Siberia to about Baikal was never proved. The species was not ever collected in Siberia by Tsherepanov.

14. page 96-97, 104
PRINTED:
genus *Anastrangalia* Casey, 1924: 280 type species *Leptura sanguinea* LeConte, 1859
...
lavinia Gahan, 1906a: 83 (*Leptura*) **A**: NP **ORR**

MUST BE (p.104):
genus *Leptura* Linnaeus, 1758: 397 type species *Leptura quadrifasciata* Linnaeus, 1758
...
lavinia Gahan, 1906a: 83 **A**: NP XIZ YUN **ORR**

NOTES:
Leptura lavinia Gahan, 1906 does not belong to the genus *Anastrangalia* Casey, 1924 – see holotype published by Vives & Huang (2010).
Leptura lavinia Gahan, 1906 was recorded for Tibet and Yunnan (Vives & Huang, 2010).

15. page 97
PRINTED:
scotodes continentalis Plavilstshikov, 1936: 371 (*Leptura*) **A**: FE NC NE SC
scotodes scotodes Bates, 1873: 194 (*Leptura*) **A**: JA NE SCH SHA
kongoensis Matsushita, 1933**a**: 201 (*Leptura*)

MUST BE:
scotodes continentalis Plavilstshikov, 1936: 371 (*Leptura*) **A**: FE NC NE SC SCH SHA
scotodes scotodes Bates, 1873: 194 (*Leptura*) **A**: FE JA
kongoensis Matsushita, 1933**b**: 201 (*Leptura*)

16. page 97
PRINTED:
sequensi Reitter, 1898d: 194 (*Leptura*) E: CT **A**: ES FE FUJ HEB HEI JA JIL KZ MG NC NMO SC WS XIN

MUST BE:
sequensi Reitter, 1898d: 194 (*Leptura*) **A**: ES FE FUJ HEB HEI JA JIL KZ MG NC NMO SC WS XIN

NOTE:
Anastrangalia sequensi absent in Europe, though several wrong records were published.

17. page 98
PRINTED:
rufihumeralis Tamanuki, 1938b: 167 (*Leptura*) **A**: CH FE JA NC SC

MUST BE:
rufihumeralis Tamanuki, 1938b: 167 (*Leptura*) **A**: CH FE NC

NOTE:
The species absent in Japan; no records for South Korea were published.

18. page 98
PRINTED:
rufipes rufipes Schaller, 1783: 296 (*Leptura*) **E**: AB AR AU BH BU BY CR CT CZ EN FR GE GB GG GR HU IT LA LT MD NT PL RO SK SL SP ST SV SZ YU UK **A**: ES IN KZ
astrabadensis Pic, 1900s: 82
atra Paykull, 1800: 125 (*Leptura*)
fuscipes Mulsant, 1839: 287
krueperi Ganglbauer, 1882: 707 (*Leptura*)
medea Pic, 1909b: 99 (*Leptura*)
rufiventris Tournier, 1872: 348 (*Leptura*)
ventralis Heyden, 1886a: 85
villosa Schoenherr, 1817a: 486 (*Leptura*)

MUST BE:

rufipes rufipes Schaller, 1783: 296 (*Leptura*) **[HN]** **E**: AB AR AU BH BU BY CR CT CZ EN FR GE GB GG GR HU IT LA LT MD NT PL RO SK SL SP ST SV SZ YU UK **A**: ES IN KZ TR
astrabadensis Pic, 1900s: 82
atra Paykull, 1800: 125 (*Leptura*) [HN]
fuscipes Mulsant, 1839: 287
krueperi Ganglbauer, 1882: 707 (*Leptura*)
medea Pic, 1909b: 99 (*Leptura*)
rufiventris Tournier, 1872: 348 (*Leptura*) [HN]
ventralis Heyden, 1886a: 85 [RN]
villosa Schoenherr, 1817a: 486 (*Leptura*) [HN]

NOTES:

According to Vives & Alonso-Zarazaga (2000: 602) *Anoplodera rufipes* (Schaller, 1783) was described as *Leptura rufipes* (not Goeze, 1777) and so, is a primary homonym and must be replaced to *A. krueperi* (Ganglbauer, 1882).

According to Sama (2002) the change can not be accepted according to the Article 23.9.5 of ICZN [not congeneric after 1899], which required a refer to the Commission, but up to now a corresponding Opinion was not published. Besides Sama (2002) declared the name "*Leptura rufipes* var. *krueperi* Ganglbauer, 1882" (described from Greece) to be unavailable because only color characters[!] were used by Ganglbauer in the original description. Sure, that name is available.

The nominative subspecies is widely distributed in Turkey (Sama, 1999; Özdikmen, 2007).

Not *Leptura rufiventris* Gebler, 1830.

19. page 98

PRINTED:

punctatomaculata Marsham, 1802: 357 (*Leptura*)

MUST BE:

*punc**to**maculata* Marsham, 1802: 357 (*Leptura*)

20. page 98

PRINTED:

cyanea Gebler, 1832: 70 (*Leptura*) **A**: ES FE HEB HEI HUB JA JIL MG NC SC TAI

MUST BE:

cyanea Gebler, 1832: 70 (*Leptura*) **A**: ES FE HEB HEI HUB JA JIL MG NC NMO SC

NOTES:

Anoplodera cyanea absent in Taiwan, but very common in the north of Inner Mongolia.

Old records of the species for Taiwan were connected with the attribution of *A. izumii* (Tamanuki & Mitono, 1939) to *A. cyanea* as Taiwanese subspecies.

21. pages 99 and 104

PRINTED (p. 104):
inauraticollis Pic, 1933b: 26 **A**: SCH
[as *Leptura* Linnaeus, 1758]

MUST BE (p. 99):
inauraticollis Pic, 1933b (*Leptura*): 26 **A**: SCH
[as *Anoplodera* (*Robustanoplodera* Pic, 1954a)]

NOTE:

The species was accepted as *Robustanoplodera* by Miroshnikov (1998).

22. page 100

PRINTED:

pubescens Fabricius, 1787: 158 (*Leptura*) **E**: AL AU BH BU BY CR CT CZ EN FI FR GE GG GR IT LA LT MC NR NT PL RO SK SL SP ST SV SZ UK YU **A**: TR
auriflua L. Redtenbacher, 1858: 874 (*Strangalia*)
carinthiaca Pic, 1933h: 16
holosericea Fabricius, 1801b: 358 (*Leptura*)
nigra DeGeer, 1775: 144 (*Leptura*)
obscura Thunberg, 1787: 56 (*Leptura*)
ottoi Pic, 1907b: 6 (*Leptura*)
perobscura Reitter, 1901b: 77 (*Strangalia*)

MUST BE:

pubescens Fabricius, 1787: 158 (*Leptura*) **E**: AL AU BH BU BY CR CT CZ EN FI FR GE GG GR IT LA LT MC NR NT PL RO SK SL SP ST SV SZ UK YU **A**: TR
anticemaculata Pic, 1933h: 5 (*Strangalia*)
carinthiaca Pic, 1933h: 16 (*Strangalia*)
holosericea Fabricius, 1801b: 358 (*Leptura*)
nigra DeGeer, 1775: 144 (*Leptura*)
nigroapicalis Pic, 1933h: 5 (*Strangalia*)
obscura Thunberg, 1787: 56 (*Leptura*)
ottoi Pic, 1907b: 6 (*Leptura*)
perobscura Reitter, 1901b: 77 (*Strangalia*)

NOTE:

The name *Leptura auriflua* Redtenbacher, 1858 was introduced without any character, and so, must be eliminated from the Catalog as nomen nudum.

23. page 100

PRINTED:

genus *Eustrangalis* Bates, 1884: 221 type species *Eustrangalis distenoides* Bates, 1884
...
distenioides Bates, 1884: 221 **A**: FE JA TAI

MUST BE:

genus *Eustrangalis* Bates, 1884: 221 type species *Eustrangalis distenioides* Bates, 1884
...
distenioides Bates, 1884: 222 **A**: FE JA

24. page 100

PRINTED:

rubra Geoffroy, 1785: 89 (*Leptura*)

MUST BE:

rubra Geoffroy, 1785: 89 (*Stenocorus*)

25. pages 102-103

PRINTED:

genus *Judolia* Mulsant, 1863: 496 type species *Leptura sexmaculata* Linnaeus, 1758
Julodia Pic, 1891b: 12 type species *Leptura sexmaculata* Linnaeus, 1758
japonica Tamanuki, 1942: 179 (*Strangalia*) **A**: JA
parallelopipeda Motschulsky, 1860b: 146 (*Grammoptera*) **E**: NT **A**: ES FE JA MG NC SC WS "Korea"
abbreviata Motschulsky, 1875: 143 (*Grammoptera*)
multidisjuncta Pic, 1914c: 5
shirarakensis Matsumura, 1911a: 137 (*Leptura*)

sexmaculata Linnaeus, 1758: 398 (*Leptura*) **E**: AN AU BY CT CZ EN FI FR GB GE GR HU IR IT LA LT NR NT PL RO SK SP ST SV SZ UK **A**: KZ
alpestris Pic, 1914c: 5
<u>*dentatofasciata* Mannerheim, 1852b: 308 (*Grammoptera*)</u>
helvetica Pic, 1914c: 5
milliati Pic, 1945b: 6
<u>*rostiana* Pic, 1902f: 19 (*Julodia*)</u>
testaceofasciata DeGeer, 1775: 133 (*Leptura*)
trifasciata Fabricius, 1792b: 349 (*Leptura*)
tyrolensis Pic, 1914c: 5

MUST BE:
genus *Judolia* Mulsant, 1863: 496 type species *Leptura sexmaculata* Linnaeus, 1758
japonica Tamanuki, 1942: 179 (*Strangalia*) **A**: JA
parallelopipeda Motschulsky, 1860b: 146 (*Grammoptera*) **E**: NT **A**: ES FE JA MG NC SC WS
abbreviata Motschulsky, 1875: 143 (*Grammoptera*)
<u>*dentatofasciata* Mannerheim, 1852b: 308 (*Grammoptera*)</u>
multidisjuncta Pic, 1914c: 5
rufimembris Pic, 1917g: 3 (*Leptura*)
shirarakensis Matsumura, 1911a: 137 (*Leptura*)
<u>*rostiana* Pic, 1902f: 19 (*Julodia*)</u>
sexmaculata Linnaeus, 1758: 398 (*Leptura*) **E**: AN AU BY CT CZ EN FI FR GB GE GR HU IR IT LA LT NR NT PL RO SK SP ST SV SZ UK **A**: KZ
alpestris Pic, 1914c: 5
helvetica Pic, 1914c: 5
milliati Pic, 1945b: 6
testaceofasciata DeGeer, 1775: 133 (*Leptura*)
trifasciata Fabricius, 1793: 349 (*Leptura*)
tyrolensis Pic, 1914c: 5
<u>*x-flava* Roubal, 1937: 81</u>

NOTES:
The name "*Julodia*" was just used by Pic (1891b: 12-13) in three combinations: "*Julodia cerambyciformis*", "*Julodia erratica*" and "*Julodia sexmaculata*", and then (Pic, 1891b: 54) as "*Julodia* Muls." – so it was not a new name, but simply a wrong spelling of *Judolia*. The name is unavailable and must be excluded from the Catalog.

Grammoptera dentatofasciata Mannerheim, 1852b: 308 was described from "Dauria", so it was *Judolia parallelopipeda*.

Julodia sexmaculata var. *rostiana* Pic, 1902f: 19 was described from "Amour", so it was *Judolia parallelopipeda*.

26. page 103

PRINTED:
genus *Judolidia* Plavilstshikov, 1936: 399 type species *Judolidia znojkoi* Plavilstshikov, 1936
bangi Pic, 1901v: 340 (*Leptura*) **A**: JA <u>SC</u>
akitensis Matsushita, 1931a: 42 (*Leptura*)
stygica Gressitt, 1935b: 168 (*Leptura*)
kyushuensis Kusakabe & N. Ohbayashi, 1992: 28 **A**: JA
znojkoi Plavilstshikov, 1936: 400 **A**: FE <u>"Korea"</u>

MUST BE:
genus *Judolidia* Plavilstshikov, 1936: 399 type species *Judolidia znojkoi* Plavilstshikov, 1936
bangi Pic, 1901v: 340 (*Leptura*) **A**: JA
akitensis Matsushita, 1931a: 42 (*Leptura*)
stygica Gressitt, 1935b: 168 (*Leptura*)
kyushuensis Kusakabe & N. Ohbayashi, 1992: 28 **A**: JA

znojkoi Plavilstshikov, 1936: 400 **A**: FE HEI JIL NC SC

NOTES:

J. znojkoi was definitely recorded for several localities of South Korea by Kusakabe & N. Ohbayashi (1992).

It was recorded for Jilin province of China by Hua (2002).

27. page 104

PRINTED:

duodecimguttata duodecimguttata Fabricius, 1801b: 353 **A**: ES FE FUJ HEI HEN JA JIL KZ MG NC NMO QIN SC SCH SHX WS ZHE
bisbijuncta Pic, 1904d: 14
kapfereri Pic, 1912j: 89

MUST BE:

duodecimguttata Fabricius, 1801b: 363 **A**: ES FE FUJ HEI HEN JA JIL KZ MG NC NMO QIN SC SCH SHX WS ZHE
bisbijuncta Pic, 1904d: 14
kupfereri Pic, 1912j: 89

NOTE:

The distribution in China must be studied.

28. page 104

PRINTED:

latipennis Matsushita, 1933a: 214 (*Strangalia*) **A**: FE

MUST BE:

latipennis Matsushita, 1933b: 214 (*Strangalia*) **A**: FE JP

29. page 105

PRINTED:

quadrifasciata lederi Ganglbauer, 1882: 697 **E**: AB AR GG ST **A**: IN TR
caucasica Plavilstshikov, 1924: 226 (*Strangalia*)
quadrifasciata quadrifasciata Linnaeus, 1758: 398 **E**: AL AN AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT LU MD NL NR NT PL RO SK SL SP ST SV SZ TR UK YU **A**: ES FE KZ MG QIN SCH SHA WS XIN "Korea"
amanusensis Pic, 1955a: 14
apicalis Curtis, 1831: 362
apicata Stephens, 1839: 278
guillemoti Desbrochers des Loges, 1895: 130 (*Stenura*)
lividosa G. Schmidt, 1951: 13 (*Strangalia*)
Materialis Pic, 1941c: 1 (*Strangalia*)
melgunowi Jakobson, 1896a: 523 (*Strangalia*)
mosquensis Pic, 1915e: 5 (*Strangalia*)
notatipennis Pic, 1897b: 5
octomaculata DeGeer, 1775: 132
quadripustulata Fabricius, 1792b: 345
suramensis Pic, 1915e: 5 (*Strangalia*)

MUST BE:

quadrifasciata lederi Ganglbauer, 1882: 697 **E**: AB AR GG ST **A**: IN TR
caucasica Plavilstshikov, 1924: 226 (*Strangalia*)
notatipennis Pic, 1897b: 5 (*Strangalia*)
suramensis Pic, 1915e: 5 (*Strangalia*)
quadrifasciata quadrifasciata Linnaeus, 1758: 398 **E**: AL AN AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT LU MD NL NR NT PL RO SK SL SP ST SV SZ TR UK YU **A**: ES FE KZ MG QIN SCH SHA WS XIN "Korea"

apicalis Curtis, 1831: 362
apicata Stephens, 1839: 278
benedicta Pic, 1945b: 6 (*Strangalia*)
bidivisa G. Schmidt, 1951: 13 (*Strangalia*)
guillemoti Desbrochers des Loges, 1895: 130 (*Stenura*)
interrupta Heyden, 1877a: 397 (*Strangalia*)
Materialis Pic, 1941c: 1 (*Strangalia*)
melgunowi Jakobson, 1896a: 523 (*Strangalia*)
mosquensis Pic, 1915e: 5 (*Strangalia*)
octomaculata DeGeer, 1775: 132
quadripustulata Fabricius, 1793: 345

NOTE:
Strangalia quadrifasciata ab. *amanusensis* Pic, 1955: 14 – "Syrie" – not available name.

30. page 104

PRINTED:
subtilis Bates, 1884: 219 **A**: FE JA

MUST BE:
subtilis Bates, 1884: 219 **A**: JA

NOTE:
Leptura subtilis Bates, 1884 was originally recorded for Kuriles by H. Kôno (1936: 32 as *Strangalia* – "Ins. Shikotan"). The record was repeated by Krivolutzkaya (1973) and Lobanov et al. (1981), but ignored by Tsherepanov (1979). Then the species was recorded once more for Shikotan by Krivolutzkaya and Lobanov (Cherepanov, 1996) without any comments and for Far East Russia by Löbl and Smetana (2010).

In fact the species is known up to now from Central Honshu and Kyushu only. According to N.Ohbayashi (personal message, 2011) the old record for Shikotan was based on misidentification. It must be excluded from Russian fauna.

31. page 106 and 107

PRINTED:
genus *Macroleptura* Nakane & K. Ohbayashi, 1957: 241 type species *Leptura thoracica* Creutzer, 1799
quadrizona Fairmaire, 1902a: 244 (*Strangalia*) **A**: YUN **ORR**
anticejuncta Pic, 1943c: 1 (*Strangalia*)
magdelanei Pic, 1937b: 6 (*Strangalia*)
thoracica Creutzer, 1799: 125 (*Leptura*) **E**: BH BY CT EN FI LA LT NT PL RO SK ST UK YU **A**: ES FE FUJ GUI HEB HEI HUB JA JIL KZ LIA MG NMO WS XIN ZHE "Korea"
altaica Gebler, 1817: 331 (*Leptura*)
obscurissima Pic, 1900i: 17 (*Leptura*)
maculiceps G. Schmidt, 1951: 12 (*Strangalia*)
mixtepilosa G. Schmidt, 1951: 12 (*Strangalia*)
ussurica Pic, 1902b: 8 (*Leptura*)
and
genus *Noona* Sama, 2007c: 102 [RN] type species *Strangalia regalis* Bates, 1884
Nona Sama, 2002: 25 [HN] type species *Strangalia regalis* Bates, 1884
regalis Bates, 1884: 223 (*Strangalia*) **A**: CH FE JA NC SC
coreana Pic, 1907d: 20 (*Leptura*)
maindroni Pic, 1901m: 61 (*Leptura*)

MUST BE:
genus *Leptura* Linnaeus, 1758: 397 type species *Leptura quadrifasciata* Linnaeus, 1758
...

subgenus *Macroleptura* Nakane & K. Ohbayashi, 1957: 241 type species *Leptura thoracica* Creutzer, 1799
thoracica Creutzer, 1799: 125 **E**: BH BY CT EN FI LA LT NT PL RO SK SL ST UK YU **A**: ES FE FUJ GUI HEB HEI HUB JA JIL KZ LIA MG NMO WS XIN ZHE "Korea"
altaica Gebler, 1817: 331
obscurissima Pic, 1900i: 17
maculiceps G. Schmidt, 1951: 13 (*Strangalia*)
mixtepilosa G. Schmidt, 1951: 12 (*Strangalia*)
pliginskii G. Schmidt, 1951: 13 (*Strangalia*)
ussurica Pic, 1902c: 8 (*Strangalia*)
and
subgenus *Noona* Sama, 2007c: 102 [RN] type species *Strangalia regalis* Bates, 1884
Nona Sama, 2002: 25 [HN] type species *Strangalia regalis* Bates, 1884
quadrizona Fairmaire, 1902a: 244 (*Strangalia*) **A**: YUN **ORR**
anticejuncta Pic, 1943c: 1 (*Strangalia*)
magdelanei Pic, 1937b: 6 (*Strangalia*)
regalis Bates, 1884: 223 (*Strangalia*) **A**: FE JA ?NC ?SC
coreana Pic, 1907d: 20
maindroni Pic, 1901m: 61

NOTES:
Leptura (M.) thoracica Creutzer, 1799 was described from Slovenia. The species was included in the fauna of Slovenia (Brelich et al., 2006). At least one specimen is definitely known to be collected there in 1914.
Leptura (N.) quadrizona (Fairmaire, 1902) is much closer to *L. (N.) regalis* (Bates, 1884), than to *L. (M.) thoracica* Creutzer, 1799 – on the base of male genitalia.
Leptura (N.) regalis (Bates, 1884) was never recorded for China, the records for Korea are doubtful (N.Ohbayashi, 2008).

32. page 107
PRINTED:
gebleri Ganglbauer, 1889c: 470 [RN] **E**: CT NT UK **A**: ES FE FUJ HEB HEI JA JIL KZ MG NC NMO SC WS XIN

MUST BE:
gebleri Ganglbauer, 1889c: 470 [RN] **E**: CT NT ST UK **A**: ES FE FUJ HEB HEI JA JIL KZ MG NC NMO SC WS XIN

NOTE:
The species is widely distributed in Orenburg Region.

33. page 108
PRINTED:
cerambyciformis Schrank, 1781a: 154 (*Leptura*) **E**: AB AL AR AU BE BH BU BY CR CT CZ DE EN FR GB GE GG GR HU IR IT LA LS LT LU MC MD NL NT PL PT RO SK SL SP ST SZ UK YU
anticeundulatus Pic, 1915a: 29 (*Leptura*)
beskidicus Pic, 1915h: 18 (*Leptura*)
bisbistigma Pic, 1906g: 67 (*Leptura*)
bisquadristigmatus Pic, 1915a: 29 (*Leptura*)
breveseparatus Pic, 1953a: 9
decempunctatus Olivier, 1795: 26 (*Leptura*)
digoniensis Pic, 1915a: 29 (*Leptura*)
fauconneti Pic, 1916b: 4 (*Leptura*)
humerifera Pic, 1915h: 18 (*Leptura*)
lateseparatus Pic, 1953a: 9
Materialis Pic, 1916b: 4 (*Leptura*)
multiinterupta Pic, 1915a: 30 (*Leptura*)

octomaculatus Schaller, 1783: 299 (*Leptura*)
quadrimaculatus Scopoli, 1763: 47 (*Leptura*) [HN]
salbachi Pic, 1908b: 3 (*Leptura*)
sexmaculatus Panzer, 1795: 272 (*Leptura*)
sexpunctatus Mulsant, 1839: 244 (*Pachyta*)
urbisensis Pic, 1915a: 29 (*Leptura*)
valesiaca Pic, 1915a: 29 (*Leptura*)

MUST BE:
cerambyciformis Schrank, 1781a: 154 (*Leptura*) **E**: AL AU BE BH BU BY CR CT CZ DE EN FR GB GE GR HU IR IT LA LS LT LU MC MD NL NT PL PT RO SK SL SP ST SZ UK YU
anticeundulatus Pic, 1915a: 29 (*Leptura*)
beskidicus Pic, 1915h: 18 (*Leptura*)
bisbistigma Pic, 1906g: 67 (*Leptura*)
bisquadristigmatus Pic, 1915a: 29 (*Leptura*)
breveseparatus Pic, 1953a: 9
decempunctatus Olivier, 1795: 26 (*Leptura*)
digoniensis Pic, 1915a: 29 (*Leptura*)
efasciatus Pic, 1916: 9 (*Leptura*) ["Hongrie"]
fauconneti Pic, 1916b: 4 (*Leptura*)
hoverlanus Roubal, 1937: 81 (*Judolia*)
humerifer Pic, 1915h: 18 (*Leptura*)
lateseparatus Pic, 1953a: 9
Materialis Pic, 1916b: 4 (*Leptura*)
multiinterupta Pic, 1915a: 30 (*Leptura*)
octomaculatus Schaller, 1783: 299 (*Leptura*) [HN]
parvonotatus Pic, 1916: 10 (*Leptura*) ["Europe"]
quadrimaculatus Scopoli, 1763: 47 (*Leptura*) [HN]
salbachi Pic, 1908b: 3 (*Leptura*)
sexmaculatus Panzer, 1795: 272 (*Leptura*)
sexpunctatus Mulsant, 1839: 244 (*Pachyta*)
transylvanicus Pic, 1916: 9 (*Leptura*) ["Transylvanie"]
urbisensis Pic, 1915a: 29 (*Leptura*)
valesiacus Pic, 1915a: 29 (*Leptura*)

NOTE:
All records for Caucasus and Transcaucasia (Plavilstshikov, 1936) seem to be wrong. A single published specimen from Abastumani preserved in Zoological Museum of Moscow University (Miroshnikov, 2011a; Miroshnikov, 2011b) could be wrongly labeled.

According to Miroshnikov (2009): the record of *Pachytodes cerambyciformis* for Krasnodar region by Nikitsky et al. (2008) with the reference to D. Kasatkin was wrong, as Kasatkin's data were connected with *Pachytodes erraticus*.

34. pages 108-109 and 113-114

PRINTED:
erraticus bottcheri Pic, 1911a: 5 (*Leptura*) **A**: ES KZ WS XIN
erraticus erraticus Dalman, 1817a: 490 (*Leptura*) **E**: AB AL AR AU BH BU BY CR CT CZ FR GE GG GR HU IT MC MD PL RO SK SL SP ST SZ TR UK YU **A**: IN SY TR
akbesianus Pic, 1898a: 6
anticedivisus Pic, 1914d: 14 (*Leptura*)
anticenotatus Pic, 1914d: 13 (*Leptura*)
atroapicalis Pic, 1913c: 186 (*Leptura*)
atrosuturalis Pic, 1915a: 38 (*Leptura*)
eibesianus Pic, 1914d: 13 (*Leptura*)
erythrurus Küster, 1848c: 90 (*Pachyta*)
gasturius Pic, 1915a: 38 (*Leptura*)
heyrovskyi Pic, 1924c: 26 (*Leptura*)
hungaricus Pic, 1913c: 186 (*Leptura*)
italicus Pic, 1916b: 4

kalavaritanus Pic, 1913c: 186 (*Leptura*)
quinquepunctatus Pic, 1915h: 18 (*Leptura*)
ragusai Pic, 1923d: 3
roberti Pic, 1915a: 38 (*Leptura*)
rosinae Pic, 1914d: 13 (*Leptura*)
rufoapicalis Pic, 1913c: 186 (*Leptura*)
rufonotatus Pic, 1913c: 186 (*Leptura*)
russicus Pic, 1898h: 54
septemsignatus Küster, 1848c: 89 (*Pachyta*)
siculus Pic, 1916b: 4
subapicalis Pic, 1914d: 15 (*Leptura*)
testaceofasciatus Pic, 1913c: 186 (*Leptura*)
unijunctus Pic, 1914d: 14 (*Leptura*)

and (109):
orthotrichus Plavilstshikov, 1936: 393 (*Judolia*) **A**: ES MG NMO

and (113-114):
septempunctata septempunctata Fabricius, 1792b: 346 (*Leptura*) **E**: AL AU BH BU CR CZ GE GR HU IT MC MD PL RO SK SL ST SZ UK YU
atrosuturalis Pic, 1915a: 38 (*Leptura*)
corcyrica Pic, 1915e: 5 (*Strangalia*)
dobiachi Pic, 1916b: 4 (*Strangalia*)
gasturica Pic, 1915a: 38 (*Leptura*)
holtzi Pic, 1916b: 5 (*Strangalia*)
latenigra Pic, 1915e: 5 (*Strangalia*)
montandoni Pic, 1915e: 5 (*Strangalia*)
notaticollis Pic, 1915e: 5 (*Strangalia*)
pallidicolor Pic, 1915e: 5 (*Strangalia*)
roberti Pic, 1915a: 38 (*Leptura*)
rubronotata Pic, 1916b: 5 (*Strangalia*)
semireducta Pic, 1915e: 5 (*Strangalia*)
velebitica Pic, 1916b: 4 (*Strangalia*)
septempunctata suturata Reiche & Saulcy, 1858: 22 (*Strangalia*) **E**: AR BU GG **A**: TR
anatolica Heyrovský, 1961a: 45 (*Strangalia*)
latenigra Pic, 1915e: 5 (*Strangalia*)

MUST BE:
bottcheri Pic, 1911a: 5 *(Leptura)* **A**: WS ES MG NMO
orthotrichus Plavilstshikov, 1936: 393 *(Judolia)*
erraticus Dalman, 1817a: 490 (*Leptura*) **E**: AB AL AR AU BH BU BY CR CT CZ FR GE GG GR HU IT MC MD PL RO SK SL SP ST SZ TR UK YU **A**: ES IN KZ SY TR WS XIN
akbesianus Pic, 1898a: 6
anticedivisus Pic, 1914d: 14 (*Leptura*)
anticenotatus Pic, 1914d: 13 (*Leptura*)
atroapicalis Pic, 1913c: 186 (*Leptura*)
eibesianus Pic, 1914d: 13 (*Leptura*)
erythrurus Küster, 1848c: 90 (*Pachyta*)
heyrovskyi Pic, 1924c: 26 (*Leptura*)
hungaricus Pic, 1913c: 186 (*Leptura*)
italicus Pic, 1916b: 4
kalavaritanus Pic, 1913c: 186 (*Leptura*)
quinquepunctatus Pic, 1915h: 18 (*Leptura*)
ragusai Pic, 1923d: 3
rosinae Pic, 1914d: 13 (*Leptura*)
rufoapicalis Pic, 1913c: 186 (*Leptura*)
rufonotatus Pic, 1913c: 186 (*Leptura*)
russicus Pic, 1898h: 54
septemsignatus Küster, 1848c: 89 (*Pachyta*)
siculus Pic, 1916b: 4
subapicalis Pic, 1914d: 15 (*Leptura*)

testaceofasciatus Pic, 1913c: 186 (*Leptura*)
unijunctus Pic, 1914d: 14 (*Leptura*)

and (113-114):
septempunctata septempunctata Fabricius, 1793: 346 (*Leptura*) **E**: AL AU BH BU CR CZ GE GR HU IT MC MD PL RO SK SL SZ UK YU
atrosuturalis Pic, 1915a: 38 (*Leptura*) ["Morée"]
corcyrica Pic, 1915e: 5 (*Strangalia*)
dobiachi Pic, 1916b: 4 (*Strangalia*)
gasturica Pic, 1915a: 38 (*Leptura*)
holtzi Pic, 1916b: 5 (*Strangalia*) ["Morée"]
montandoni Pic, 1915e: 5 (*Strangalia*)
notaticollis Pic, 1915e: 5 (*Strangalia*)
pallidicolor Pic, 1915e: 5 (*Strangalia*)
rubronotata Pic, 1916b: 5 (*Strangalia*)
semireducta Pic, 1915e: 5 (*Strangalia*)
suturata Reiche & Saulcy, 1858: 22 (*Strangalia*) ["Péloponése"]
velebitica Pic, 1916b: 4 (*Strangalia*)
septempunctata latenigra Pic, 1915e: 5 (*Strangalia*) ["Asie Mineure"] **E**: AR BU GG ST TR **A**: TR
anatolica Heyrovský, 1961a: 45 (*Strangalia*)
roberti Pic, 1915a: 38 (*Leptura*) ["Transsylvanie et Turquie"]

NOTES:
See also a remark to the p. 53.
All three names were proposed as variations of "*Leptura (Strangalia) 7-punctata*".
Leptura (Strangalia) septempunctata var. *roberti* Pic, 1915f is better to be regarded as a synonym of the dark south-west subspecies because black prothorax was described, and a specimen from Turkey must be designated as lectotype.
The holotype male of *Leptura (Pachytodes) erratica* race *bottcheri* Pic, 1911 from "Altai" (see "Gallery" in www.cerambycidae.net – photos by G.Tawakilian) preserved in Paris Museum is quite conspecific to rather variable *Pachytodes orthotrichus* (see "Gallery" in www.cerambycidae.net), so *Pachytodes bottcheri* (Pic, 1911) = *P. orthotrichus* (Plavilstshikov, 1936), **syn. nov.** The species is distributed from Altay to Baikal and absent eastwards Baikal.

35. page 109

PRINTED:
longipes Gebler, 1832: 67 (*Pachyta*) **A**: ES FE MG NC NE NO SC
amurianus Pic, 1902f: 19
bodoi Pic, 1914c: 5
nigrosuturalis Pic, 1917g: 3 (*Leptura*)
octoguttatus Pic, 1914c: 5

MUST BE:
longipes Gebler, 1832: 67 (*Pachyta*) **A**: ES FE MG NC NE NO SC
amurianus Pic, 1902f: 19
bodoi Pic, 1914c: 5 (*Leptura*)
nigrosuturalis Pic, 1917g: 3 (*Leptura*)
octoguttatus Pic, 1914c: 5 (*Leptura*)

36. pages 110 and 858

PRINTED (p.110):
discicollis W. G. H. Scriba, **1865**: 32 (*Leptura*)

and (p.858)
Scriba W. G. H. 1865: Die Käfer im Grossherzogthum Hessen und seiner nächsten Umgebung. *Bericht der Oberhessischen Gesellschaft für Natur und Heilkunde* (Giessen) **11**: 1-59.

NOTE:
There are no Cerambycidae at all in the publication by Scriba (1865).

MUST BE:
discicollis W. G. H. Scriba, **1867:** 32 (*Strangalia*)
and
Scriba W. G. H. 1867: Die Käfer im Grossherzogthum Hessen und seiner nächsten Umgebung. *Bericht der Oberhessischen Gesellschaft für Natur und Heilkunde* (Giessen) **12**: 1-51.

37. page 110
PRINTED:
jaegeri Fairmaire, 1866b: 279 (*Leptura*)

NOTE:
The name was published as: "*Leptura joegeri* Humm.", so it was not a new name, but wrong identification (and wrong spelling) with the name *Leptura jaegeri* Hummel, 1825 (now in *Stenurella*), and must be eliminated from the catalog as unavailable.

38. page 111
PRINTED:
verticenigra Pic, 1892v: 416 (*Strangalia*) **E**: GG GR (Samos) **A**: TR

MUST BE:
verticenigra Pic, 1892v: 416 (*Leptura*) **E**: ?GG GR (Samos) **A**: TR

NOTE:
The name was introduced as: "*Leptura (Strangalia) verticalis* var. *verticenigra*"

39. page 112
PRINTED:
inermis J. Daniel & K. Daniel, 1898: 74 (*Strangalia*) **E**: AB **A**: IN TM

MUST BE:
inermis **K.** Daniel & **J.** Daniel, 1898: 74 (*Strangalia*) **E**: AB **A**: IN TM

40. page 112
PRINTED:
calcarata Olivier, 1790a: 73 (*Leptura*)
dayremi Pic, 1904a: 4 (*Strangalia*)

MUST BE:
calcarata Olivier, 1795: 14 (*Leptura*)
dayremi Pic, 1903a: 4 (*Strangalia*)

41. page 112
PRINTED:
fasciata Scopoli, 1763: 54 (*Leptura*)

MUST BE:
fasciata Scopoli, 1763: 54 (*Cerambyx*)

42. page 112

PRINTED:

nicodi Pic, 1933: 6 (*Strangalia*)

MUST BE:

nicodi Pic, 1933d: 6 (*Strangalia*)

43. page 112

MISSING NAME:

Strangalia maculata f. *wuenschi* Roubal, 1937: 81 – "Banska Bystrica"

44. pages 113 and 846

PRINTED (p. 113):

hybridula Reitter, 1901h: 188 (*Strangalia*) **E**: PT SP

and (p. 846)

Reitter E. 1901h: Vierzehnter Beitrag zur Coleopteren-Fauna von Europa und den angrenzenden Ländern. *Wiener Entomologische Zeitung* **20**: 200-202.

NOTE:

The publication mentioned above contains only one new Cerambycidae name: *Rosalia alpina* var. *quadripunctata* Reitter, 1901h: 202 – "Aus Central Ungarn" – missing in the Catalog!

MUST BE:

hybridula Reitter, 1902: 188 (*Strangalia*) **E**: PT SP

NOTE:

The corresponding publication absent in the references.

45. page 113

PRINTED:

samai Rapuzzi, 1995: 618 **E**: BU GR TR

MUST BE:

melanura samai Rapuzzi, 1995: 618 **E**: BU GR TR **A**: TR

NOTES:

No evidence is known of the species rank of that local color variation. The record of the taxon for Asian Turkey (Bursa) was published by Rapuzzi & Georgiev (2007).

Another Turkish taxon *Stenurella melanura* ssp. *pamphiliae* Rapuzzi & Sama, 2009 from Antalia was also published as a species.

46. page 114

PRINTED:

dichroa Blanchard, 1871: 812 (*Leptura*) **A**: ANH ES FE FUJ GUI HEB HEI HEN HUB HUN JIL JIX SCH SHA SHN SHX ZHE

MUST BE:

dichroa Blanchard, 1871: 812 (*Leptura*) **A**: ANH ES FE FUJ GUI HEB HEI HEN HUB HUN JIL JIX **NC SC** SCH SHA SHN SHX ZHE

47. page 114

PRINTED:

rubra rubra Linnaeus, 1758: 398 (*Leptura*) **E**: AL AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT LU MD NL NR NT PL PT RO SK SL SP ST SV SZ UK YU **A**: ES KZ NC SC WS

MUST BE:
rubra rubra Linnaeus, 1758: **397** (*Leptura*) **E**: AL AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT LU MD NL NR NT PL PT RO SK SL SP ST SV SZ UK YU **A**: ES KZ WS

48. page 114

MISSING NAME:
Leptura cardinalis var. *rubidiventris* Jankowski, 1934: 104.

NOTE:
It is a synonym of *Stictoleptura* (s. str.) *cardinalis* (K. Daniel & J. Daniel, 1898).

49. page 114

PRINTED:
cordigera anojaensis Sláma, 1982: 207 **E**: GR (Kríti) **A**: TR
cordigera cordigera Fuessly, 1775: 14 (*Leptura*) **E**: AB AR BE BU DE FR GE GG GR (north-east) IT RO SP SZ RO UK **N**: LB **A**: CY IN IQ IS LE SY TR

MUST BE:
cordigera anojaensis Sláma, 1982: 207 (*Brachyleptura*) **E**: GR (Kríti) **A**: TR
cordigera cordigera Fuessly, 1775: 14 (*Leptura*) **E**: AB AR BE BU DE FR GE GG GR (north-east) IT RO SP SZ RO ST UK **N**: LB **A**: CY IN IQ IS LE SY TR

NOTE:
Stictoleptura cordigera was recorded (Miroshnikov, 2011a, 2011b) for Dagestan (Derbent).

50. page 115 and 117

PRINTED: (p.117):
eckweileri Holzschuh, 1989a: 154 **A**: PA
[as *Vadonia* **Mulsant, 1863**]

MUST BE (p.115):
eckweileri Holzschuh, 1989a: 154 (*Vadonia*) **A**: PA
[as *S.* (*Stictoleptura* **Casey, 1924)**]

NOTE:
The species was accepted as *Stictoleptura* in "CERAMBYCOIDEA - (Palaearctic & Oriental Reg.)" by S. Kadlec (2007 – not published), and it is quite evident on the base of original description.

51. page 115

PRINTED:
erythroptera Hagenbach, 1822: 7 (*Leptura*) **E:** AB AL AR AU BH BU CR CZ FR GE GR GG HU IT RO SK SP ST SZ YU
rufipennis Mulsant, 1839: 272

MUST BE:
erythroptera Hagenbach, 1822: 7 (*Leptura*) **E:** AB AL AR AU BH BU CR CZ FR GE GR GG HU IT RO SK SP ST SZ YU **A:** IN TR
rufipennis Mulsant, 1839: 272 (*Leptura*)

NOTES:
The occurrence of the species in Iran is generally accepted (Plavilstshikov, 1936; Villiers, 1967; Švácha, 1989; Sama, 2002; Sama et al., 2008).
The occurrence of the species in Turkey was accepted by K. Daniel and J. Daniel (1891), Plavilstshikov (1936), Švácha (1989); Özdikmen (2007) and others.

52. page 115

PRINTED:

fontenayi Mulsant, 1839: 271 (*Leptura*) **E**: AZ FR PT SP **N**: AG MO TU
erythrodera Chobaut, 1896b: 201 (*Leptura*)
nigrovittata Chobaut, 1896b: 201 (*Leptura*)
hardenbergi Bodemeyer, 1927: 70 (*Leptura*)
pici Chobaut, 1896b: 201 (*Leptura*)

MUST BE:

fontenayi Mulsant, 1839: 271 (*Leptura*) **E**: AZ FR PT SP **N**: AG MO TU
erythrodera Chobaut, 1896b: 201 (*Leptura*)
nigrovittata Chobaut, 1896b: 201 (*Leptura*)
pici Chobaut, 1896b: 201 (*Leptura*)

NOTES:

According to I. Löbl (personal message, 2010) the name «*Leptura hardenbergi*» absent in the publication mentioned in the References to the Catalog (Bodemeyer, 1927 [Bd. 4.]).

It was published same year in the previous publication (Bodemeyer, 1927 [Bd. 3.]: 70), which was absent in the references.

The name was introduced as: «*Leptura pontenayi* Muls., ... ab. *hardenbergi* Bobem.» and so unavailable.

53. page 116 and 153

PRINTED (p. 116)**:**

slamai Sama, **nom. nov**. [see New Acts] **E**: GR (Kríti)
martini Sláma, 1985: 17 (*Brachyleptura*) [HN]
and (p. 153)
alni latenigrum Pic, 1945b: 6 **E**: AB **A**: IN
elbursense Holzschuh, 1977a: 128

NOTES:

According to Löbl & Smetana (2011: 36) all new names by Pic (1945) are not available because of Pic's sentence: "Des variétés nouvelles (certains diraient aberrations ["somebody could say aberrations", which means nothing])... " and "the numerous new varieties are infrasubspecific names, and there for it was unnecessary to replace *S. martini* (Slama, 1985)".

Poecilum alni elbursense Holzschuh, 1977a was published (Löbl & Smetana, 2011: 41) as valid.

Such a position is not acceptable as directly contradicts to the Article 45.6.4 of the ICZN (1999).

The attribution of the name "*Stictoleptura slamai*" to "Danilevsky, 2010" by Löbl & Smetana (2011: 36) was just a mistake.

All new names by Pic (1945) were adequately accepted as available in the previous volume of the Catalog (Löbl & Smetana, 2010), including *Poecilum alni latenigrum* Pic, 1945b.

54. page 116

PRINTED:

bisignata Ménétriés, 1832: 232 (*Leptura*)

MUST BE:

bisignata Ménétriés, 1832: 232 (*Leptura*) [HN]

NOTE:

Not *Leptura bisignata* Brullé, 1832 (now in *Vadonia*)

55. page 116

PRINTED:

attenuata Linnaeus, 1758: 398 (*Leptura*) **E**: AB AL AR AU BE BH BU BY CR CT CZ DE EN FI FR GE GG HU IR IT LA LS LT LU MC MD NL NR NT NE PL RO SK SL SP ST SV SZ TR UK **A**: ES FE HEB JA JIX KZ MG NC NE SC SW TR WS XIN
balcanica Pic, 1915e: 6 (*Typocerus*)
grenieri Pic, 1912c: 3 (*Leptura*)
imperfecta Gerhardt, 1910: 556 (*Leptura*)
maculicollis Gerhardt, 1910: 556 (*Leptura*)
obscuriventris Pic, 1901n: 59 (*Typocerus*)

MUST BE:

attenuata Linnaeus, 1758: 398 (*Leptura*) **E**: AB AL AR AU BE BH BU BY CR CT CZ DE EN FI FR GE GG GR HU IR IT LA LS LT LU MC MD NL NR NT NE PL RO SK SL SP ST SV SZ TR UK **A**: ES FE HEB JA JIX KZ MG NC NE SC SW TR WS XIN
balcanica Pic, 1915e: 6 (*Typocerus*)
grenieri Pic, 1912c: 3 (*Leptura*)
imperfecta Gerhardt, 1910: 556 (*Leptura*)
obscuriventris Pic, 1901n: 59 (*Typocerus*)

NOTES:

The name “*maculicollis*” was proposed (1) by Gabriel and (2) as aberration, so not available.

The records for Greece see in Sama (2002: 39).

56. page 117

PRINTED:

mirabilis Aurivillius, 1902: 207 (*Strangalia*) **A**: FUJ GUA GUX HAI **ORR**

MUST BE:

mirabilis mirabilis Aurivillius, 1902: 207 (*Strangalia*) **A**: FUJ GUA GUX HAI **ORR**

Teratoleptura mirabilis shibatai N. Ohbayashi, 2008: 425 and *Teratoleptura mirabilis yoshitomii* N. Ohbayashi, 2008: 422 were described from Laos.

57. page 118

PRINTED:

moesiaca K. Daniel & J. Daniel, 1891: 6 (*Leptura*) **E**: AL BU GR MC SB TR YU **A**: TR

MUST BE:

moesiaca K. Daniel & J. Daniel, 1891: 6 (*Leptura*) **E**: AL BU GR MC **RO** SB TR YU **A**: TR

NOTE:

Vadonia moesiaca (K. Daniel & J. Daniel, 1891) was recorded for Roumania by Dascălu (2010).

58. page 118

PRINTED:

rufiventris Gebler, 1830: 193 (*Leptura*) **A**: ES KZ MG WS
jenseni Gressitt, 1951a: 83 (*Anoplodera*)
maculata Gebler, 1841b: 614 (*Leptura*)
theresae Pic, 1912c: 2 (*Leptura*)

MUST BE:

rufiventris Gebler, 1830: 193 (*Leptura*) [HN] **A**: ES KZ MG WS
jenseni Gressitt, 1951a: 83 (*Anoplodera*)
maculata Gebler, 1841b: 614 (*Leptura*) [HN]
theresae Pic, 1912c: 2 (*Leptura*)

NOTE:

The junior homonym (not *Leptura rufiventris* Marsham, 1802; now in *Stenocorus*) can not be changed to the next available name now because both names were not used inside one genus after 1899 (Article 23.9.5.).

59. pages 120 and 121:

PRINTED:

immaculatus Pic, 1933i: 28

...

marginellus Fabricius, 1792b: 346 (*Leptura*)

multiguttatus Pic, 1933i: 31

MUST BE:

immaculata Pic, 1934f: 28 *(Evodinus)*

...

marginella Fabricius, 1793: 346 (*Leptura*)

...

multiguttata Pic, 1934f: 31 *(Evodinus)*

60. page 121

PRINTED:

punctata Faldermann, 1833: 67 (*Pachyta*) **A**: ES MG NMO

MUST BE:

punctata Faldermann, 1833: 67 (*Pachyta*) **A**: ES MG NC NMO

NOTE:

A male of *Brachyta punctata* was recorded for North Korea by Lee (1987: Pl.3 – 22b) as "*B. interrogationis*".

61. page 121

PRINTED:

sachalinensis Matsumura, 1911: 135 **A**: FE JA

MUST BE:

sachalinensis Matsumura, 1911: 135 **A**: FE JA JIL

NOTE:

B. sachalinensis was recorded (Gao et al., 2009) for Jilin province of China.

62. page 121

PRINTED:

Acmaeopsilla Casey, 1913: 240 type species *Acmaeops falsus* LeConte, 1860

NOTE:

The corresponding reference absent in the Catalog.

63. page 122

PRINTED:

holosericea Fabricius, 1801b: 366 (*Leptura*) **E**: AU BH BU HU CR GR HU IT RO SK SL ST UK YU

MUST BE:

holosericea holosericea Fabricius, 1801b: 366 (*Leptura*) [HN – not *L. holosericea* Fabricius, 1801b: 358 = *Etorofus pubescens* (Fabricius, 1787)] **E**: AU BU HU RO SK ST UK

64. pages 122 and 123

PRINTED:
discolor Fairmaire, 1866b: 277 **A**: TR
  differens Pic, 1898g: 50
  prescutellaris Pic, 1933d: 5
  testaceipes Pic, 1898k: 112
and
steineri Sama, 1997b: 112 **E**: GR

MUST BE:
differens Pic, 1898g: 50 **E**: GR RO
  prescutellaris Pic, 1933d: 5
  steineri Sama, 1997b: 112
and
discolor Fairmaire, 1866b: 277 E: BG **A**: TR
  testaceipes Pic, 1898k: 112

NOTES:
According to Dascălu (2010) *Cortodera differens* Pic, 1898 is also distributed in Roumania, and similar populations from Bulgaria must be described as a new subspecies of *C. differens*. Possibly the best way is to regard all corresponding populations as subspecies of *C. discolor* Fairmaire, 1866.

Unfortunately type material of *C. discolor* Fairmaire, 1866 is not available, neither good series from its type locality – Boz-Dagh near Izmir.

65. page 122

PRINTED:
humeralis humeralis Schaller, 1783: 297 (*Leptura*) **E**: AU BE BH BU CR CT CZ FR GE GR HU IT MC MD NL PL RO SK SP SZ TR UK YU **A**: TR

MUST BE:
humeralis humeralis Schaller, 1783: 297 (*Leptura*) **E**: AU BE BH BU CR CT CZ FR GE GR HU IT MC MD NL PL RO SK SP **ST** SZ TR UK YU **A**: TR

NOTE:
One female (see "Gallery" in www.cerambycidae.net) of *C. h. humeralis* from south-west of Russian Belgorod Region was sent to me for study ("Les Na Vorskle", Borisovka distr., 11-22.5.2010, Yakov Kovalenko leg.).

66. page 124

PRINTED:
villosa miroshnikovi Danilevsky, 2009 [see New Acts] **E**: GG

MUST BE:
villosa miroshnikovi Danilevsky, **ssp. nov.** [see New Acts] **E**: GG

67. page 125

PRINTED:
oligothrix Chiang, 1996: 188 **A**: SCH
  glabratula Holzschuh, 1998: 6 [RN]
  glabricollis Holzschuh, 1993a: 8 [HN]

NOTES:
"*Gaurotes* (*Carilia*) *oligothrix* Chiang, 1996" was mentioned by Chiang [Jiang] & Chen (2001: 77) as a valid name for *Gaurotes* (*Carilia*) *glabricollis* Holzschuh, 1993.

The description by Chiang mentioned above seems to be never published.

MUST BE:
glabratula Holzschuh, 1998: 6 [RN] **A**: SCH
glabricollis Holzschuh, 1993a: 8 [HN]
oligothrix Chiang, 2001: 77 [RN]

NOTE:
Gaurotes glabratula Holzschuh, 1998 was published as valid (Löbl & Smetana, 2011).

68. page 127
MISSING NAME:
Pachyta quadrimaculata f. *basinotata* Roubal, 1937: 81 – "Slovensky Raj".

69. page 132
PRINTED**:**
bicolor Olivier, 1790**a**: 69 (*Stenocorus*)

MUST BE:
bicolor Olivier, 1790**b**: 69 (*Stenocorus*)

70. pages 132
PRINTED:
caucasicum caucasicum Reitter, 1889e: 287 **E**: AB AR GG ST

MUST BE:
caucasicum caucasicum Reitter, 1889e: 287 **E**: AB AR GG ST **A:** TR

NOTE:
According to Plavilstshikov (1936: 139) the taxon penetrates to Kars and Kagyzman.

71. pages 132
PRINTED:
syriacum Pic, 1892s: cxi [= 1893d: 414] **A**: SY TR
phrygium K. Daniel, 1906b: 176

MUST BE:
syriacum phrygium K. Daniel, 1906b: 176 **A**: TR
syriacum syriacum Pic, 1892s: cxi [= 1893d: 414] **A**: SY TR

NOTE:
The first taxon was described from Taurus (Konya prov.); the second – from Amanos Mts. Both taxa were regarded as different species by Sama (2002: 12). This point of view was supported by Özdikmen & Turgut (2010: 971-972). According to comparison of my single pair of *Rh. syriacum phrygium* from Erdemli (south-westwards Mersin) with a single specimen of *Rh. syriacum syriacum* from Syria, both taxa are really very close, but have rather different type of dorsal pubescence. So, untill more materials available the rank of subspecies is accepted.

72. pages 132 and 133
PRINTED (p. 132)**:**
sudetica Plavilstshikov, 1915a: 46
[as a synonym of *Rhagium bifasciatum*]
and (p. 133)
sudeticum Plavilstshikov, 1915a: 35
[as a synonym of *Rhagium inquisitor inquisitor*]

NOTE:
The name is unavailable as forth after trinomen. It was introduced as: *Rhagium inquisitor inquisitor* var. *sudetica* Plavilstshikov, 1915a: 46.

73. page 133

PRINTED:

inquistor inquisitor Linnaeus, 1758: 393 (*Cerambyx*) **E**: AL AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT MD NE NL NR NT PL PT RO SK SL SP ST SV SZ TR UK YU **A**: ES KZ MG WS **NAR**
americanum Podaný, 1964: 32
boreale Casey, 1913: 195
canadense Podaný, 1964: 30
cariniventre Casey, 1913: 195
crassipes Casey, 1913: 195
exile Gmelin, 1790: 1844
fortipes Reitter, 1898e: 357
indagator Fabricius, 1787: 145
iberonis Ericson, 1916: 240
investigator Mulsant, 1839: 227
lineatum Olivier, 1795: 13 (*Stenocorus*)
mexicanum Casey, 1913: 197
minutum Fabricius, 1787: 146
montanum Casey, 1913: 197
nigrum Podaný, 1978: 4
nubecula Bergsträsser, 1778: 25 (*Cerambyx*)
parvicorne Casey, 1913: 195
quadricostatum Podaný, 1964: 34
sudeticum Plavilstshikov, 1915a: 35
thoracicum Casey, 1913: 196

MUST BE:

inquistor inquisitor Linnaeus, 1758: 393 (*Cerambyx*) **E**: AL AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT MD NE NL NR NT PL PT RO SK SL SP ST SV SZ TR UK YU **A**: ES KZ MG WS
exile Gmelin, 1790: 1844 (*Cerambyx*)
fortipes Reitter, 1898e: 357
indagator Fabricius, 1787: 145
iberonis Ericson, 1916: 240
investigator Mulsant, 1839: 227
minutum Fabricius, 1787: 146
nubecula Bergsträsser, 1778: 25 (*Cerambyx*)

NOTE:

The attribution of the names, which were introduced for North American taxa (from Alaska to Mexico), to the nominative subspecies was just nonsense.

74. page 133

PRINTED:

qinghaiene L. Chen & Chiang, 2000: 32, 36 **A**: QIN

NOTE:

According to Löbl & Smetana (2011: 40) the spelling must be changed from "*qinhaiene*" (sic!) to "*qinhaiense*". The original spelling was: "*Rhagium qinghaiensis*".

MUST BE:

qinghaiense L. Chen & Chiang, 2000: 32, 36 **A**: QIN

75. page 134

PRINTED:

vittatus Fischer von Waldheim, 1842: 19 (*Toxotus*) **A**: KZ XIN
obliquus Motschulsky, 1845a: 86 (*Toxotus*)
suvorovi Reitter, 1907a: 208 (*Toxotus*)

turkestanicus Ganglbauer, 1889b: 280 (*Toxotus*)

MUST BE:
vittatus Fischer von Waldheim, 1842: 19 (*Toxotus*) [prevailing usage] **A**: KZ **XIN**
obliquus Motschulsky, 1845a: 86 (*Toxotus*)
suvorovi Semenov, 1910: 27 (*Toxotus*) [unjustified emendation]
suworowi Reitter, 1907a: 208 (*Toxotus*)
turkestanicus Ganglbauer, 1889b: 280 (*Toxotus*)
vittattus Fischer von Waldheim, 1842: 19 (*Toxotus*) [original spelling]

76. page 135

PRINTED:
testaceipenne Pic, 1897p: 299
as a synonym of *Rhamnusium juglandis* Fairmaire, 1866b described from "Bosz-Dagh" – Western Turkey.

NOTE:
Rhanusium testaceipenne Pic, 1897p (described from Caucasus) is a valid name, which was never before (neither in the Acts of the Catalog) published as a synonym. Only once it was published by Sama (2002) as a supposition: "*R. juglandis* Fairmaire, 1866 (? = *R. testaceipenne* Pic, 1897)".

77. pages 136-137

PRINTED:
genus *Xylosteus* Frivaldszky von Frivald, 1837: 180 type species *Xylosteus spinolae* Frivaldszky von Frivald, 1837
bartoni Obenberger & Mařan, 1933: 131 [RN] **E**: BU
merkli Pic, 1913c: 178 [HN]
caucasicola caucasicola Plavilstshikov, 1936: 496 **E**: GG ST
caucasicola kadleci Miroshnikov, 2000a: 38 **A**: TR
spinolae Frivaldszky von Frivald, 1837: 180 **E**: AU BH BU CR IT MC RO SL YU
merkli Pic, 1910h: 66
rufiventris Germar, 1845: 16 (*Rhagium*)

MUST BE:
genus *Xylosteus* Frivaldszky von Frivald, 1837: 180 type species *Xylosteus spinolae* Frivaldszky von Frivald, 1837
bartoni Obenberger & Mařan, 1933: 131 [RN] **E**: BU
merkli Pic, 1913c: 178 [HN]
caucasicola caucasicola Plavilstshikov, 1936: 496 **E**: GG ST
caucasicola kadleci Miroshnikov, 2000a: 38 **A**: TR
spinolae Frivaldszky von Frivald, 1837: 180 **E**: AU BH BU CR IT MC RO SL **TR** YU
merkli Pic, 1910h: 66
rufiventris Germar, 1845: 16 (*Rhagium*)

NOTE:
According to Sama (2002: 10) the population of *Xylosteus* from European Turkey must be identified as *X. spinolae caucasicola,* that is impossible after the system accepted in the Catalog. If *Xylosteus* from European Turkey really differs from *X. s. spinolae* as another subspecies, then it must be described as a new taxon that was adequately noted by Özdikmen (2010: 929). Until new study of corresponding specimens the taxon must be regarded a *X. spinolae*.

78. pages 138-139 and 154-155

PRINTED:
genus *Nothorhina* L. Redtenbacher, 1845: 109 type species *Callidium muricatum* Dalman, 1817
gardneri Plavilstshikov, 1934b: 1 **A**: UP

muricata Dalman, 1817b: 193 (*Callidium*) **E**: AL AU BH BY BU CR CT CZ EN FI FR GE GR IT LA LT NR NT PL PT SK SP ST SV UK **A**: JA KZ TR WS
scabricollis W. Redtenbacher, 1842: 24 (*Callidium*)

and (p. 154-155)
genus *Ropalopus* Mulsant, 1839: 40 type species *Callidium clavipes* Fabricius, 1775
...
femoratus Linnaeus, 1758: 395 (*Cerambyx*) **E**: AU BE BH BU CR CT CZ FR GE HU IT LA MD PL RO SK SL SP SV SZ TR UK
castaneipennis Roubal, 1934b: 43
punctatus Fabricius, 1798: 149 (*Callidium*)
punctuosus Geoffroy, 1785: 83 (*Leptura*)

MUST BE (138-139):
genus *Nothorhina* L. Redtenbacher, 1845: 109 type species *Callidium muricatum* Dalman, 1817
gardneri Plavilstshikov, 1934b: 1 **A**: UP
punctata Fabricius, 1798: 149 *(Callidium)* **E**: AL AU BH BY BU CR CT CZ EN FI FR GE GR IT LA LT NR NT PL PT SK SP ST SV UK **A**: JA KZ TR WS
muricata Dalman, 1817b: 193 (*Callidium*)
scabricollis W. Redtenbacher, 1842: 24 (*Callidium*)

and (p. 154-155)
genus *Ropalopus* Mulsant, 1839: 40 type species *Callidium clavipes* Fabricius, 1775
...
femoratus Linnaeus, 1758: 395 (*Cerambyx*) **E**: AU BE BH BU CR CT CZ FR GE HU IT LA MD PL RO SK SL SP SV SZ TR UK
castaneipennis Roubal, 1934b: 43
punctuosus Geoffroy, 1785: 83 (*Leptura*)

NOTES:
According to G.Sama (2002), the original description of *Callidium punctatum* Fabricius, 1798 refers to *Ropalopus femoratus*, but not to *Nothorhina*, as it was generally accepted (see *Nothorhina punctata*: Plavilstshikov, 1936; Heyrovsky, 1955; Kojima & Hayashi, 1969; Villiers, 1978; Hayashi, 1979; Kusama & Takakuwa, 1984; Sama, 1988; Bily & Mehl, 1989; Ohbayashi et al., 1992; Bense, 1995; Vives & Alonso-Zarazaga, 2000; Ohbayashi & Niisato, 2007 and many others).

The main reason by Sama (2002) is the size described by Fabricius (1798) in his description of *Callidum punctatum*: "*statura sequentium*", which was translated by Sama as: "being of the same size as *Callidim ungaricum* Herbst, 1784 (now in *Ropalopus*)". Sure, *Ropalopus ungaricus* is much larger than *Nothorhina*.

First of all, Sama's translation of the Latin text is not adequate (according to the opinon of A.Smetana – personal message, 2011): "sequentium" is plural genitive of sequentia, -ae, f., so the statement concerns not only the first following species (*Callidim ungaricum*), but all (or several) following species.

In fact the size cannot be the reason for the choice between *Nothorhina* and *Ropalopus femoratus*, as both species are of about same length!

So, there are no good reasons to cancel generally used *Nothorhina punctata* (Fabricius, 1798) = *Nothorhina muricata* (Dalman, 1817).

79. pages 140

PRINTED:
starcki cavazzutii Sama & Rapuzzi, 1993: 288 **E**: AR GG **A**: TR

NOTE:
That subspecies was recorded by Plavilstshikov (1931g: 42) as "var. *pubescens* Pic" from "Trapezunt". The fact of the corresponding Pic's publication is not proved. The name absents in the Catalog (Lobl & Smetana, 2010). But the corresponding type was discovered in Pic's collection (Sama & Rapuzzi, 1993: 288-289) with the label "Trebizonde / Th. Deyr.".

It was identified (Sama & Rapuzzi, 1993) as *Saphanus piceus,* and new synonyms were published (Sama & Rapuzzi, 1993: 289): "*Drymochares starcki* var. *pubescens* Pic = *Saphanus piceus* Laicharting".

If Pic's publication really exists, then Plavilstshikov wrongly used his name – wrong determination, and the published synonyms are correct. If Plavilstshikov was the first who published the name, then he was its author, and adequately described local Trabzon subspecies, and *Drymochares starcki pubescens* Plavilstshikov, 1931 = *D. s. cavazzutii* Sama & Rapuzzi, 1993.

The taxon is so peculiar, that it could be in fact a good species.

80. page 141

PRINTED:
hadullai Szallies, 1994: 260 **A**: TR
and
ulmi Chevrolat, 1838: [unnumb.] [NP] **E**: AB AR AU BH BU BY CR CZ FR GE GG GR HU IT LA LT MC MD PL RO SK SP ST SZ TR UK YU **A**: TR
annulata L. Petagna, 1819: 19 (*Melorchus*) [NO]
mesembrina Plavilstshikov, 1936: 467
panzeri Harold, 1876c: 174

MUST BE:
ulmi Chevrolat, 1838: [unnumb.] (*Molorchus*) [NP] **E**: AB AR AU BH BU BY CR CZ FR GE GG GR HU IT LA LT MC MD PL RO SK SP ST SZ TR UK YU **A**: IN TR
annulata L. Petagna, 1819: 19 (*Melorchus*) [NO]
hadullai Szallies, 1994: 260
mesembrina Plavilstshikov, 1936: 467
panzeri Harold, 1876c: 174

The synonyms were published (Özdikmen & Turgut, 2006) on the base of the original description and canceled (Sama, 2010) without any new data. Then the synonyms *N. ulmi* = *N. hadullai* Szallies, 1994 were published (Sama et al., 2011: 825) once more as new [!?].

N. major was recorded (Villiers, 1967) for Iran ("Tariki-Rud").

81. page 144

PRINTED:
major aino Kusama, 1974: 54 **A**: FE JA TAI
major major Linnaeus, 1758: 421 **E**: AB AL AU BE BH BU BY CR CT CZ DE EN FI FR GE GR HU IT LA LT LU MD NL NR NT PL RO SK SP ST SV SZ UK YU **A**: ES FE KZ MG NC WS XIN

MUST BE:
major aino Kusama, 1974: 54 **A**: ?FE JA
major major Linnaeus, 1758: 421 **E**: AB AL AU BE BH BU BY CR CT CZ DE EN FI FR GG GE GR HU IN IT LA LT LU MD NL NR NT PL RO SK SP ST SV SZ UK YU **A**: ES FE IR KZ MG NC WS XIN

NOTES:

The existence of a special Japan subspecies *Necydalis major aino* Kusama, 1974 is very doubtful. It was described after 4 specimens only (compared with *N. major* from France!) on the base of characters with strong individual variability in the species: "Pronotum with denser punctures, especially anterior and basal constrictions with finer and closer ones, and with denser golden pubescence. Elytra with much shallower and sparser punctures and denser and longer pubescence."

The record of *N. m. aino* for Mongolia (Niisato, 1994 – on the base of a single female!) just proved its artificiality. Sometimes specimens from European Russia can have denser and longer pronotal pubescence that certain specimens from near Krasnoyarsk, Ussuri-land or Sakhalin. From the other side it seems, in general eastern specimens are usually denser and longer pubescent, so it could be possible to accept *N. m. aino* for East Siberia and Japan as a relatively poor determinated subspecies. According to T.Niisato (personal message, 2011) *N. m. aino* from Japan does not differ from *N. major* from Ussuri-land.

Japanese *N. major* is known from NE Hokkaido and so, similar populations could be discovered on Kunashir.

A male of *N. major* from Gantiadi (Abkhazia) is preserved in my collection.

The record of *N. m. aino* for Taiwan was just a mistake.

82. page 144

PRINTED:
danilevskyi Miroshnikov, 2000b: 77 **E**: AB AR GG

MUST BE:
danilevskii Miroshnikov, 2000b: 77 **E**: AB AR GG **A**: IN TR

NOTE:

Anaglyptus danilevskii was recorded for Turkey (Miroshnikov, 2011a, 2011b). The species undoubtedly present in North Iran, as it was collected in several localities of Nakhichevan, and specimens with the label "Araxes Thal" are known.

83. page 147

PRINTED:
moschata ambrosiaca Steven, 1809: 40 **E**: AB AR GG IT PT SP ST **N**: AG MO TU **A**: IN IQ JO LE SY

MUST BE:
moschata ambrosiaca Steven, 1809: 40 (*Cerambyx*) **E**: AB AR GG IT PT SP ST **N**: AG MO TU **A**: IN IQ JO LE SY TR

84. page 151

PRINTED:
violaceum Fabricius, 1775: 395 (*Cerambyx*) **E**: AB AL AR AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GG HU IR IT LA LS LT LU MD NL NR NT PL RO SK SL ST SV SZ UK YU **A**: ES FE HEI JA JIL KZ MG NC NMO SC TAI WS XIN

MUST BE:
violaceum Fabricius, 1775: 395 (*Cerambyx*) **E**: AB AL AR AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GG HU IR IT LA LS LT LU MD NL NR NT PL RO SK SL **SP** ST SV SZ UK YU **A**: ES FE HEI JA JIL KZ MG NC NMO SC TAI WS XIN

NOTE:

See: Alcantara et al. (2010).

85. page 151

PRINTED:

cognatum Laicharting, 1784: 59

MUST BE:

cognatum Laicharting, 1784: 58

86. page 151

PRINTED:
aeneum longipenne Villiers, 1978: 345 **E**: AB GG ST

MUST BE:
aeneum longipenne Plavilstshikov, 1940: 300 **E**: AB GG ST

NOTE:

The name was introduced by Plavilstshikov (1940) with different ranks [in Russian]: "if that **form** has a geographical value, is not clear now, but it is definitely not a simple aberration" and then: "we separate it now as a special **morph** – morpha *longipenne* m." So, for Plavilstshikov it was a name with doubtful geographical sense, and so available.

87. page 151 and 334

PRINTED:

lucidum Scopoli, 1772: 98 (*Stenocorus*) [NO]

and (p.334):

family Cerambycidae, nomina dubia

Cerambyx carbonarius Scopoli, 1763: 56

Stenocorus lucidus Scopoli, 1772: 98

NOTE:

The name *Stenocorus lucidus* Scopoli, 1772 can not be regarded as nomen oblitum, as just was published as valid (Brelich et al., 2006: 170), so, second case is acceptable.

88. page 152

MISSING NAME:

Phymatodes testaceus var. <u>*barbarorum* Pic, 1917g: 5</u> – "Allemagne"

NOTE:

It is a synonym of *Phymatodes testaceus* (Linnaeus, 1758)

89. page 154

PRINTED:

Rhopalopus <u>Agassiz, 1846b: 325</u> [unjustified emendation]

MUST BE:

Rhopalopus <u>L. Redtenbacher: 1845: 110</u> [unjustified emendation]

90. pages 155

PRINTED:

lederi Ganglbauer, 1882: 747 (*Rhopalopus*) **E**: AB AR GG ST <u>TR</u> UK

MUST BE:

lederi Ganglbauer, 1882: 747 (*Rhopalopus*) **E**: AB AR GG ST UK <u>**A**: TR</u>

NOTE:

The record of *Ropalopus lederi* for European Turkey could be just a misprint, as no such records were published before. The taxon absent in the list of the area (Özdikmen, 2010).

According to Sama (1996: 106) a record of *Ropalopus lederi* for Anatolia (Adlbauer, 1992: 495 - Merzifon) was connected with *R. sculpturatus* (Pic, 1931), but the taxon was recorded for "Türk. Armenien" by Plavilstshikov (1940: 255, 682). The occurrence of the species in NE Turkey seems to be very probable as it is not too much rare in South Georgia and Armenia.

91. page 159

PRINTED:

pfisteri Stierlin, 1864: 152

MUST BE:

cerambyx pfisteri Stierlin, 1864: 152 (<u>*Hammaticherus*</u>) **E:** GR IT

92. page 159

PRINTED:
dux Faldermann, 1837: 264 (*Hammaticherus*) **E**: AB AR BU GG MC ST UK **A**: IN IS JO LE SY

MUST BE:
dux Faldermann, 1837: 264 (*Hammaticherus*) **E**: AB AR BU GG MC ST UK **A**: IN IS JO LE SY TR

93. page 160 and 163

PRINTED (p. 160):
genus *Dymasius* J. Thomson, 1864: 234 type species *Dymasius strigosus* J. Thomson, 1864 (= *Cerambyx macilentus* Pascoe, 1859)
subgenus *Dymasius* J. Thomson, 1864: 234 type species *Dymasius strigosus* J. Thomson, 1864 (= *Cerambyx macilentus* Pascoe, 1859)
aureofulvescens Gressitt & Rondon, 1970: 80 **A**: JIX **ORR**
miser Holzschuh, 2005: 14 **A**: SHA
subvestitus Holzschuh, 1984a: 146 **A**: NP UP
and (p. 160)
genus *Gibbocerambyx* Pic, 1923e: 12 type species *Gibbocerambyx aureovittatus* Pic, 1923
aurovirgatus Gressitt, 1939b: 96 (*Zegriades*) **A**: ANH GUX HEN HUB HUN SCH ZHE
unitarius Holzschuh, 2003a: 173 **A**: SHA
and (p. 163)
genus *Zegriades* Pascoe, 1869: 509 type species *Xoanodera magister* Pascoe, 1857
gracilicornis Gressitt, 1951a: 147 **A**: FUJ YUN
maculicollis Matsushita, 1933b: 248 **A**: TAI

MUST BE (p. 160):
genus *Dymasius* J. Thomson, 1864: 234 type species *Dymasius strigosus* J. Thomson, 1864 (= *Cerambyx macilentus* Pascoe, 1859)
subgenus *Dymasius* J. Thomson, 1864: 234 type species *Dymasius strigosus* J. Thomson, 1864 (= *Cerambyx macilentus* Pascoe, 1859)
aureofulvescens Gressitt & Rondon, 1970: 80 **A**: JIX **ORR**
gracilicornis Gressitt, 1951a: 147 **A**: FUJ YUN **ORR**
miser Holzschuh, 2005: 14 **A**: SHA
subvestitus Holzschuh, 1984a: 146 **A**: NP UP
and (p. 160)
genus *Gibbocerambyx* Pic, 1923e: 12 type species *Gibbocerambyx aureovittatus* Pic, 1923
aurovirgatus Gressitt, 1939b: 96 (*Zegriades*) **A**: ANH GUX HEN HUB HUN SCH ZHE
maculicollis Matsushita, 1933b: 248 (*Zegriades*) **A**: TAI
unitarius Holzschuh, 2003a: 173 **A**: SHA

NOTE:
See: Holzschuh (2010: 151).

94. pages 165-166

PRINTED (p. 165):
genus *Chlorophorus* Chevrolat, 1863b: 290 type species *Callidium annulare* Fabricius, 1787
...
arciferus Chevrolat, 1863b: 330 (*Amauresthes*) **A**: ANH BT HAI JIX NP SCH SD YUN ZHE **ORR**
pieli Pic, 1924a: 15 (*Clytanthus*)
rectefasciatus Pic, 1937a: 14 (*Clytanthus*)
socius Gahan, 1960: 264 (*Caloclytus*)

MUST BE (p. 166) (according to Löbl & Smetana, 2011: 41):
socius Gahan, 1906a: 264 (*Caloclytus*) **A**: SD

NOTE:
Chloropterus Löbl & Smetana, 2011: 41 is wrong subsequent spelling of *Chlorophorus* - not available.

95. page 166

PRINTED:
elaeagni Plavilstshikov, 1956: 818 **E**: AB ST **A**: KI KZ TD TM UZ

MUST BE:
elaeagni Plavilstshikov, 1956: 818 **E**: AB KZ ST **A**: KI KZ TD TM UZ

96. page 166 and 169

PRINTED (166):
faldermanni Faldermann, 1837: 269 (*Clytus*) **E**: AB AR BU GG ST **A**: AF IN KI KZ ?MG TD TM UZ XIN YUN **ORR**
caucasicus Pic, 1897o: 262 (*Clytanthus*)
johannisi Théry, 1896: 108
and (169):
simillimus Kraatz, 1879d: 91 (*Clytus*) **A**: ES FE FUJ GAN GUX HEB HEI HEN HUB HUN JA JIL JIX MG NC NMO QIN SC SCH SHA SHN XIN YUN ZHE
duodecimmaculatus Kraatz, 1879d: 91 (*Clytus*) [RN]
griseopubens Pic, 1904d: 17 (*Clytanthus*)
joannisi Théry, 1896: 108 (*Clytanthus*)

NOTE:
Second case is correct.
Chlorophorus faldermanni (Faldermann, 1837) absent in Bulgaria and Yunnan, and rather doubtful for Mongolia.

97. page 166

PRINTED:
figuratus Scopoli, 1763: 55 (*Cerambyx*) **E**: AB AL AR AU BH BU BY CD CR CT CZ EN FR GE GG GR HU IT LA LS LT LU MC MD NT PL PT RO SK SL SP ST SZ UK YU **A**: ES IN JIA JIX KZ LIA
conglobatus Fügner, 1891: 201 (*Clytus*)
cordiger Aragona, 1830: 26 (*Clytus*)
funebris Laicharting, 1784: 111 (*Clytus*)
latifasciatus Fischer von Waldheim, 1832: 439 (*Clytus*)
leucozonias Gmelin, 1790: 1846 (*Callidium*)
plebejus Fabricius, 1781: 243 (*Callidium*)
rusticus O. F. Müller, 1776: 93 (*Cerambyx*) [HN]
tapaensis Pic, 1924c: 22 (*Clytanthus*)

MUST BE:
figuratus Scopoli, 1763: 55 (*Cerambyx*) **E**: AB AL AR AU BH BU BY CD CR CT CZ EN FR GE GG GR HU IT LA LS LT LU MC MD NT PL PT RO SK SL SP ST SZ TR UK YU **A**: ES IN KZ TR WS
conglobatus Fügner, 1891: 201 (*Clytus*)
cordiger Aragona, 1830: 26 (*Clytus*)
funebris Laicharting, 1784: 111 (*Clytus*)
latifasciatus Fischer von Waldheim, 1832: 439 (*Clytus*)
leucozonias Gmelin, 1790: 1846 (*Cerambyx*)
plebejus Fabricius, 1781: 243 (*Callidium*)
rusticus O. F. Müller, 1776: 93 (*Leptura*) [HN]
tapaensis Pic, 1924c: 22 (*Clytanthus*)

98. page 167

PRINTED:

herbstii Brahm, 1790: 148 (*Leptura*) **E**: AU BH BU BY CR CT CZ EN FI FR GE HU LA LS LT MD NR NT PL RO SK SP ST SV SZ UK YU **A**: ES KZ LIA TR WS
sulphureus Schaum, 1862: 103 (*Clytus*)

MUST BE:

herbstii Brahm, 1790: 148 (*Leptura*) **E**: AU BH BU BY CR CT CZ EN FI FR GE HU KZ LA LS LT MD NR NT PL RO SK SP ST SV SZ TR UK YU **A**: ES KZ TR WS
sulphureus Schaum, 1862: 103 (*Clytus*) [RN]

99. page 168

PRINTED:

sartor O. F. Müller, 1766: 188 (*Cerambyx*) **E**: AB AL AR AU BH BU BY CR CT CZ FR GE GG GR HU IT LA LU MD PL PT RO SK SL SP ST SZ TR UK YU **A**: ES FE IN IS JO KZ LE SY TM TR WS

MUST BE:

sartor O. F. Müller, 1766: 188 (*Cerambyx*) **E**: AB AL AR AU BH BU BY CR CT CZ FR GE GG GR HU IT KZ LA LU MD PL PT RO SK SL SP ST SZ TR UK YU **A**: ?ES IN IS JO ?KZ LE SY TM TR WS

100. page 168

PRINTED:

griseus Gerhardt, 1910: 556 (*Clytanthus*)

MUST BE:

griseus Gabriel, 1910: 556 (*Clytanthus*)

101. page 168 and 171

PRINTED (p. 168):

corsicus Chevrolat, 1882: 58 (*Clytus*)

NOTE:

as a synonym of *Chlorophorus sartor* (O. F. Müller, 1766)

and (p. 171):

corsicus Chevrolat, 1882: 58

NOTE:

As a synonym of *Clytus rhamni* Germar, 1817
First case is correct.

102. page 169

PRINTED:

aegyptiacus Ganglbauer, 1882: 733 [HN]
c-duplex Scopoli, 1787: 46 (*Stenocorus*)

MUST BE:

c-duplex Scopoli, 1786: 46 (*Stenocorus*)

NOTES:

Clytus aegyptiacus, Ganglbauer, 1882 was not a new name, but wrong identification. It was introduced as „*aegyptiacus* Fabr.“

“*Clytus aegyptiacus* Ganglbauer, 1882” was also wrongly regarded (Miroshnikov, 2011a) and published (Miroshnikov, 2011b) as available name.

103. page 170

PRINTED:

arietis arietis Linnaeus, 1758: 399 (*Leptura*) **E**: AL AU BE BH BU BY CR CT CZ DE ES FI FR GB GE GR HU IR IT LA LS LT LU MC MD NL NR NT PL PT RO SK SL SP ST SV SZ TR UK YU **N**: MR
arcuatus Sulzer, 1761: 12 (*Leptura*)
bichhardti Pic, 1913c: 98
bourdilloni Mulsant, 1839: 81
chapmani Pic, 1937c: 13
cloueti Théry, 1893: ccxiii
gazella Fabricius, 1792b: 333 (*Callidium*)
heyrowskyi Pic, 1931c: 14
quadrifasciatus DeGeer, 1775: 81 (*Cerambyx*)
arietis lederi Ganglbauer, 1882: 730 [= 1886: 232] **E**: AB **A**: IN TM
arietis oblitus Roubal, 1932: 17 **E**: AB AR GG ST

MUST BE:

arietis arietis Linnaeus, 1758: 399 (*Leptura*) **E**: AL AU BE BH BU BY CR CT CZ DE ES FI FR GB GE GR HU IR IT LA LS LT LU MC MD NL NR NT PL PT RO SK SL SP ST SV SZ TR UK YU **A: TR** **N**: MR
arcuatus Sulzer, 1761: 12 (*Leptura*)
bichhardti Pic, 1913c: 98
bourdilloni Mulsant, 1839: 81
chapmani Pic, 1937c: 13
cloueti Théry, 1893: ccxiii
gazella Fabricius, 1793: 333 (*Callidium*)
heyrowskyi Pic, 1931c: 14
quadrifasciatus DeGeer, 1775: 81 (*Cerambyx*)
arietis lederi Ganglbauer, 1882: 730 [= 1886: 232] **E**: AB **A**: IN TM
arietis oblitus Roubal, 1932: 17 **E**: AB AR GG ST **A: TR**

104. page 170

MISSING NAME:

Clytus buglanicus Kadlec, 2005: 106 **A:** TR

105. page 171

PRINTED:

rhamni Germar, 1817: 223 **E**: AB AL AR AU BH BU CR CT CZ FR GE GG GR HU IT **LA** MC MD PT RO SK SL SP ST **SV** SZ TR UK YU **A**: CY IN IS KZ LE SY TR
bellieri Gautier des Cottes, 1862: 77
corsicus Chevrolat, 1882: 58
ferruginipes Pic, 1891b: 26
innormalis Pic, 1927e: 11
longicollis Reitter, 1904: 82
paliuri Depoli, 1940: 304
siculus Wagner, 1927b: 93 [HN]
temesiensis Germar, 1824: 519 (*Callidium*)

MUST BE:

rhamni rhamni Germar, 1817: 223 **E**: AL BH CR GR IT MC SL YU
innormalis Pic, 1927e: 11
paliuri Depoli, 1940: 304
rhamni bellieri Gautier des Cottes, 1862: 77 **E**: FR GE IT PT SP SZ
corsicus Chevrolat, 1882: 58
siculus Wagner, 1927b: 93 [HN]
rhamni temesiensis Germar, 1824: 519 (*Callidium*) **E**: AB AR AU BU CT CZ GE GG HU MD RO SK SL ST TR UK **A**: CY IN IS KZ LE SY TR
ferruginipes Pic, 1891b: 26

longicollis Reitter, 1904: 82

106. page 175

PRINTED:
notabilis cuneatus Fairmaire, 1888: 35 (*Clytus*) **A**: GUA HEN HUB SCH SHA YUN
semiobliteratus Pic, 1902i: 31 (*Clytus*)
subobliteratus Pic, 1918b: 4 (*Chlorophorus*) [RN]

MUST BE:
notabilis cuneatus Fairmaire, 1888: 35 (*Clytus*) **A**: GUA HEN HUB SCH SHA YUN
semiobliteratus Pic, 1902i: 31 (*Clytanthus*)

NOTE:
Chlorophorus subobliteratus Pic, 1918b: 4 was proposed as a replacement name for "*Chlorophorus obliteratus* Pic, 1902", which was never described, but published by Aurivillius (1912) as "*Chlorophorus notabilis* var. *obliteratus* Pic, Longic. IV, 1, 1902: 31", so *Chlorophorus notabilis* var. *obliteratus* Aurivillius, 1912: 398 was wrong subsequent spelling of *Clytanthus notabilis* var. *semiobliteratus* Pic, 1902i: 31. All names (*Chlorophorus obliteratus* Pic, 1902; *Chlorophorus subobliteratus* Pic, 1918b; *Chlorophorus notabilis* var. *obliteratus* Aurivillius, 1912) are not available.

107. page 177

PRINTED:
detritus Linnaeus, 1758: 399 (*Leptura*) **E**: AB AL AR AU BE BH BU BY CR CT CZ EN FR GE GG GR HU IT LA LT MD NL NT PL PT RO SK SL SP ST SV SZ TR UK YU **A**: KZ SY TR
africaeseptentrionalis Tippmann, 1952a: 143
anticereductus G. Schmidt, 1951: 14
convertini L. Petagna, 1819: 38 (*Callidium*)
interrupteconnatus G. Schmidt, 1951: 16
obscurebasalis Pic, 1942b: 2
rufescens Pic, 1891b: 24
uralensis Tippmann, 1952a: 144

MUST BE:
detritus detritus Linnaeus, 1758: 399 (*Leptura*) **E**: AL AU BE BH BU BY CR CT CZ EN FR GE GR HU IT LA LT **MC** MD NL NT PL PT RO SK SL SP ST SV SZ TR UK YU **A**: KZ
africaeseptentrionalis Tippmann, 1952a: 143
anticereductus G. Schmidt, 1951: 14
apicebimaculatus G. Schmidt, 1951: 14
convertini L. Petagna, 1819: 38 (*Callidium*)
obscurebasalis Pic, 1942b: 2
rufescens Pic, 1891b: 24
uralensis Tippmann, 1952a: 144
detritus caucasicola Plavilstshikov, 1936: 435 **E:** AB AR GG ST **A**: SY TR

NOTES:
Plagionotus detritus caucasicola Plavilstshikov, 1940 was described with two taxonomical rank in one page (435) "form" and "morph": ["... evidently it is not more than poorly pronounced geographical form; we separate it now as a morph (m. *caucasicola* n. fig. 263)."] [in Russian]. So, it is available name, as its geographical character was stated.
Plagionotus detritus was recorded for Macedonia by L.Stefanov (personal message of 2011): "Central Macedonia, Kavadarci, 11. 07. 2005, L.Stefanov leg."
«f. *interrupteconnata*» (G. Schmidt, 1951: 16) from Fort Bredow was described in *Plagionotus arcuatus*.

108. page 178-179

PRINTED (p. 178)**:**
kantiae Holzschuh, 1989c: 398 **A**: BT

According to Löbl & Smetana (2011) it is not a species, but a subspecies of "*Rhaphuma manipurensis*"
So, it must it be added to (p. 179)
manipurensis kantiae Holzschuh, 1989c: 398 **A**: BT

NOTE:
Rhaphuma manipurensis Gahan, 1906: 274 was described from Manipur (India).

109. page 179

PRINTED:
genus *Rusticoclytus* Vives, 1977: 130 type species *Leptura rustica* Linnaeus, 1758

NOTE:
The taxon must be regarded as a subgenus of *Xylotrechus* Chevrolat, 1860.

110. page 179

PRINTED:
pantherinus Savenius, 1825: 65 (*Clytus*) **E**: AU BY CT CZ FI FR GE HU IT NT PL RO SK ST SV SZ **A**: ES FE KZ MG WS XIN

MUST BE:
pantherinus Savenius, 1825: 65 (*Clytus*) **E**: AU BY CT CZ FI FR GE HU IT <u>LT</u> NT PL RO SK ST SV SZ **A**: ES FE KZ MG WS XIN

NOTE:
Xylotrechus pantherinus was recorded for Lithuania (Inokaitis, 2004).

111. page 180

PRINTED:
plavilstshikovi Zaitzev, 1937: 213 **A**: FE JA SC

MUST BE:
plavilstshikovi Zaitzev, 1937: 213 **A**: FE JA NE SC SHX

NOTE:
According to T. Tichý (personal message with a photo, 2011), the species was collected in Yongji (Shanxi) by E.Kučera. So, it is definitely widely distributed in NE China.

112. page 181

PRINTED:
antilope antilope Schoenherr, 1817a: 465 (*Clytus*) **E**: AB AL AR AU BH BU BY CR CT CZ FR GE GG GR HU IT MD NL NR PL PT RO SK SL SP ST SV SZ TR UK YU **A**: CY IN TR

MUST BE:
antilope antilope Schoenherr, 1817a: 465 (*Clytus*) **E**: AB AL AR AU BH BU BY CR CT CZ FR GE GG GR HU IT <u>LT</u> MD NL NR PL PT RO SK SL SP ST SV SZ TR UK YU **A**: CY IN TR

NOTE:
X. antilope was recoded for Lithuania by R.Ferenca & V.Tamutis (2009).

113. page 181

PRINTED:

arvicola Olivier, 1795: 64 **E**: AB AL AR AU BE BH BU BY CR CT CZ EN FR GE GG GR HU IT LA LT LU MC MD NL PL PT RO SK SL SP ST SZ TR UK YU **N**: AG MO **A**: KZ SY TR

MUST BE:

arvicola Olivier, 1795: 64 (*Callidium*) **E**: AB AL AR AU BE BH BU BY CR CT CZ EN FR GE GG GR HU IT KZ LA LT LU MC MD NL PL PT RO SK SL SP ST SZ TR UK YU **N**: AG MO **A**: ?KZ SY TR

114. page 181

PRINTED:

capricornus Gebler, 1830: 182 (*Clytus*) **E**: **AU** CT KZ PL SK ST UK **A**: KZ WS

MUST BE:

capricornus Gebler, 1830: 182 (*Clytus*) **E**: CT KZ PL SK ST UK **A**: KZ WS

NOTE:

Xylotrechus capricornus (Gebler, 1830) absent in Austria.

115. pages 183

PRINTED:

Dilus Agassiz, 1846b: 118 [unjustified emendation]

MUST BE:

Dilus Agassiz, 1846b: 124 [unjustified emendation]

116. page 184

PRINTED:

gracilis gracilis Krynicki, 1832: 162 (*Obrium*) **E**: AL AU BH BU CR CT CR CZ GE GG GR HU IT LT MC MD PL RO SK SL ST UK YU **A**: IS SY TR

MUST BE:

gracilis gracilis Krynicki, 1832: 162 (*Obrium*) **E**: AL AU BH BU CR CT CR CZ GE GG GR HU IT **LA** LT MC MD PL RO SK SL ST UK YU **A**: IS SY TR

NOTE:

Axinopalpis gracilis was recorded for Latvia (Barsevskis, 2009).

117. page 184

PRINTED:

minuta Fabricius, 1781: 235 (*Saperda*) **E**: AB AL AR AU AZ BE BH BU CR CT CZ DE EN FI FR GB GE GG GR HU IR IT LA LT LU MA MD NL NT NR PL PT RO SK SL SP ST SV SZ TR UK YU **N**: AG AZ CI EG MO MR TU **A**: HEN IN NE NO NW SHA TR **AUR**i **NAR**i **NTR**i **ORR**

MUST BE:

minuta Fabricius, 1781: 235 (*Saperda*) **E**: AB AL AR AU AZ BE BH BU CR CT CZ DE EN FI FR GB GE GG GR HU IR IT KZ LA LT LU MA MD NL NT NR PL PT RO SK SL SP ST SV SZ TR UK YU **N**: AG AZ CI EG MO MR TU **A**: HEN IN NE NO NW SHA TR **AUR**i **NAR**i **NTR**i **ORR**

118. page 186

PRINTED:

unicolor Olivier, 1795: no. 70: 58 (*Callidium*) **E**: AB AR AL BH BU CR FR GG GR HU IT MA MC PT RO SP ST TR UK YU **A**: CY IN IQ IS JO LE SY TM TR

MUST BE:
unicolor Olivier, 1795: no. 70: 58 (*Callidium*) **E**: AB AR AL BH BU CR FR GG GR HU IT MA MC PT RO SP ST TR UK YU **A**: CY IN IQ IS JO LE SY TM TR **N**: AG MO TU LB

NOTE:
The record for Lybia see in:
http://jcringenbach.free.fr/website/beetles/cerambycidae/Stromatium_unicolor.htm

119. page 186

PRINTED:
holosericeus Rossi, 1790: 153 (*Callidium*) **E**: AB AR GG ST UK **N**: AG LB MO TU

MUST BE:
holosericeus Rossi, 1790: 153 (*Callidium*) **E**: AB AR GG ST UK **A:** TR **N**: AG LB MO TU

NOTE:
See: Adlbauer, 1992: 494.

120. page 187

MISSING NAME:
Hylotrupes bajulus var. *theresae* Pic, 1924c: 26 – described from "Mont-Prenelay dans le Morvan".

121. page 189

PRINTED:
kiesenwetteri kiesenwetteri Mulsant & Rey, 1861a: 189 (*Molorchus*) **E**: AU BH BU CR CZ FR GE GR HU IT MC RO SK SL ST SZ UK YU
and
schmidti Ganglbauer, 1883b: 300 (*Molorchus*) **E**: AB CT CZ HU MD PL SK ST UK **A**: KI KZ TM UZ

MUST BE:
kiesenwetteri kiesenwetteri Mulsant & Rey, 1861a: 189 (*Molorchus*) **E**: AU BH BU CR CZ FR GE GR HU IT MC ?PL RO SK SL ST SZ UK YU
and
schmidti Ganglbauer, 1883b: 300 (*Molorchus*) **E**: AB CT CZ HU MD ?PL SK ST UK **A**: KI KZ TM UZ

NOTE:
According to Ziarko (1993), the occurrence of *M. kiesenwetteri* in Poland is rather doubtful.

According to Kurzawa (personal message, 2011): "First report on *Glaphyra schmidti* (Ganglbauer, 1883) from Poland was published by Althoff, Danilevsky (1997: 19), later repeated by Sama (2002: 61) as supposition without giving specific data. Then Gutowski (2005) placed *G. schmidti* on his Cerambycidae list of Poland on the base of Sama (1995a: 375) without any examined specimens (Gutowski, pers. comm. 2010, JK) assuming that *G. kiesenwetteri* as mediterranean species is not present in Poland. As a result of this assumption Gutowski (2005) treated all records of *Glaphyra kiesenwetteri* (Mulsant et Rey, 1861) from Poland published before as records of *G. schmidti* and deleted *G. kiesenwetteri* from fauna of Poland. Slama (2006: 18) repeated this point of view without any new information. The presence of *G. schmidti* in Poland and absence here of *G. kiesenwetteri* was accepted in the new Cerambycidae Catalog (Löbl & Smetana, 2010). At present there are no specimens identified as *G. schmidti* from Poland and published or known. Thus, *G. kiesenwetteri* must restored for fauna of Poland and *G. schmidti* must be deleted."

122. page 191

PRINTED:
minor fuscus Hayashi, 1955: 164 **A:** FE JA NC SC

minor minor Linnaeus, 1758: 421 (*Necydalis*) **E**: AL AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT LU MD NL NR NT PL RO SK SL ST SV SZ UK YU **A**: ES FE GAN HEI LIA KZ MG NC QIN SC SHA TR WS XIN
ceramboides DeGeer, 1775: 151 (*Leptura*)
dimidiatus Fabricius, 1775: 199 (*Leptura*)
medius Schrank, 1798: 688 (*Gymnopterion*)
monticola Plavilstshikov, 1931a: 38
rufescens Kiesenwetter, 1878: 316 [= 1879: 60]
monticola Plavilstshikov, 1931a: 38 **E**: AB AR GG **A**: IN TM

MUST BE:
minor fuscus Hayashi, 1955: 164 **A:** JA
minor minor Linnaeus, 1758: 421 (*Necydalis*) **E**: AL AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT LU MD NL NR NT PL RO SK SL ST SV SZ UK YU **A**: ES FE GAN HEI LIA KZ MG NC QIN SC SHA TR WS XIN
ceramboides DeGeer, 1775: 151 (*Ndecydalis*)
dimidiatus Fabricius, 1775: 199 (*Leptura*)
medius Schrank, 1798: 688 (*Gymnopterion*)
rufescens Kiesenwetter, 1879: 316 [= 1879: 60]
monticola Plavilstshikov, 1931: 38 **E**: AB AR GG **A**: IN TM

NOTES:
According to the references (p. 837):
Plavilstshikov N. N. 1931a: Cerambycidae I. Teil. Cerambycinae: Disteniini Cerambycini I. *Bestimmungs-Tabellen der europäischen Coleopteren. Heft 101*. Troppau: Edmund Reitter's Nachfolger Emmerich Reitter, 102 pp.
But there is no such name in that publication.
The name was introduced in another publication, which absent in the references:
Plavilstshikov N. N. 1931: Zwölf neue Cerambyciden-Aberrationen (Coleopt.). *Entomologisches Nachrichtenblatt* 5 (2): 37–39.
According to T. Niisato (personal message, 2011): "*Molorchus minor fuscus* is an isolated population in the northern part of Japanese Alps, and mainly recorded from Kamikochi (type locality). It is very rare in field. The population in Hokkaido should be placed in the nominotypical subspecies or in an undescribed subspecies common with the continental side of Far East Asia (including the Korean Peninsula)". *M. m. fuscus* absent in Kunashir and in Sakhalin.

123. page 191

PRINTED:
mollina Holzschuh, 2006a: 235 **A**: OM
vanharteni Sama, 2006: 175 **A**: OM

MUST BE:
mollina Holzschuh, 2006a: 235 **A**: AE OM
vanharteni Sama, 2006: 175

NOTES:
According to Batelka (2010), *Mourgliana mollina* Holzschuh, 2006 and *Mourgliana vanharteni* Sama, 2006 are synonyms. Both were described in December. *M. mollina* Holzschuh, 2006 was published on December 22nd according to the journal. The publication of *M. vanharteni* Sama, 2006 was not exactly dated in the journal. According to the Article 21.3.1. (ICZN, 1999), in the absence of the exact evidence on the day of the publication the last day of the month must be accepted. So, preliminary, *Mourgliana vanharteni* Sama, 2006 must be accepted as a junior synonym.
Mourgliana vanharteni Sama, 2006 was described from Arab Emirates.

124. page 191

PRINTED:

brevipennis Mulsant, 1839: 105 (*Leptidea*) **E**: AB AR AU AZ BE BH BU CR CT CZ DEi FIi GE GG HU IR IT MA MC MD NL NRi PL PT RO SK ST SL SP SVi SZ UK YU **N**: AG EG LB MO TU **A**: CY IN IS KZ LE SHX SY TR **NAR**i **NTR**i

MUST BE:

brevipennis Mulsant, 1839: 105 (*Leptidea*) **E**: AB AR AU AZ BE BH BU CR CZ DEi FIi GE GG HU IR IT MA MC MD NL NRi PL PT RO SK ST SL SP SVi SZ UK YU **N**: AG EG LB MO TU **A**: CY IN IS KZ LE SHX SY TR **NAR**i **NTR**i

NOTE:

Nathrius brevipennis (Mulsant, 1839) is not known from Central Russia.

125. page 192

PRINTED:

buettikeri Holzschuh, 1993b: 123 **A**: SA YE

MUST BE:

buettikeri Holzschuh, 1993b: 123 **A**: AE SA YE

NOTE:

Iranobrium buettikeri Holzschuh, 1993b was recorded for Arab Emirates by Batelka (2010).

126. page 196

PRINTED:

agababiani Danilevsky, 1999b: 41 (*Asias*) **E**: AR

MUST BE:

agababiani Danilevsky, 2000b: 41 (*Asias*) **E**: AR

127. page 197

PRINTED:

genus *Bunothorax* Gressitt, 1936: 101 type species *Sternoplistes takasagoensis* Kano, 1933

takasagoensis Kano, 1933a: 278 (*Sternoplistes*) **A**: SCH TAI **ORR**

and

genus *Falsanoplistes* Pic, 1915a: 27 type species *Falsanoplistes guerryi* Pic, 1915

guerryi Pic, 1915a: 27 **A**: YUN XIZ

MUST BE:

genus *Falsanoplistes* Pic, 1915a: 27 type species *Falsanoplistes guerryi* Pic, 1915

Bunothorax Gressitt, 1936: 101 type species *Sternoplistes takasagoensis* Kano, 1933

guerryi Pic, 1915a: 27 **A**: YUN XIZ

takasagoensis Kano, 1933a: 278 (*Sternoplistes*) **A**: SCH TAI **ORR**

NOTE:

See: Holzschuh (2010: 175).

128. page 198

PRINTED:

caputorubens P.-Y. Yu, 1935: 1 **A**: GUA

MUST BE:

caputorubeus S. T. Yu, 1935: 10 [*caputorubeus, caputoeubeus, caputocubes* – wrong original spellings] **A**: GUA

NOTE:
The corresponding reference absent in the Catalogue. See the original publication in: http://www.zin.ru/ANIMALIA/COLEOPTERA/pdf/You-1935-new_species_Purpuricenus_of_Kwangtung.pdf

129. page 198
PRINTED:
kabakovi Miroshnikov & Lobanov, 1990: 15 **A**: AF

MUST BE:
kabakovi Miroshnikov & Lobanov, 1990: 15 **A**: AF <u>KA PA</u>

NOTE:
Purpuricenus kabakovi Miroshnikov & Lobanov, 1990 was recorded for Pakistan in the original description and for Kashmir by Ghate et al. (2006).

130. page 199
PRINTED:
wachanrui Levrat, 1858: 261 **E**: AB **A**: IN IQ
aleppensis Witte, 1872: 208
atricolor Pic, 1912c: 4
diversipennis Pic, 1915e: 6
haussknechti Witte, 1872: 207

MUST BE:
wachanrui Levrat, 1858: 261 **E**: AB **A**: <u>CY</u> IN IQ <u>SY TR</u>
aleppensis Witte, 1872: 208
atricolor Pic, 1912c: 4
diversipennis Pic, 1915e: 6
haussknechti Witte, 1872: 207

NOTE:
Purpuricenus wachanrui Levrat, 1858 is well known to be widely distributed in Turkey; it was recorded for Cyprus (Plavilstshikov, 1940). *Purpuricenus haussknechti* var. *aleppensis* Witte, 1872 and *Purpuricenus aleppensis* var. *diversipennis* Pic, 1915e were described from Aleppo (Syria).

131. page 202
MISSING NAMES:
Rosalia alpina f. *triformis* Roubal, 1937: 81 - “Pelite Trala”
Rosalia alpina f. *korbeli* Roubal, 1937: 82 - “Pelile Falra”
Rosalia alpina f. *bystricensis* Roubal, 1937: 82 - “Slovakia centralis”
Rosalia alpina var. *quadripunctata* Reitter, 1901h: 202 – “Aus Central Ungarn”

132. page 203
PRINTED:
gracilis Brullé, 1832: 257 (*Stenopterus*) **E**: AB AR BH BU CR GG GR HU MC RO SK SL ST UK YU **A**: IN TM

MUST BE:
gracilis Brullé, 1832: 257 (*Stenopterus*) **E**: AB AR BH BU CR GG GR HU MC RO SK SL ST UK YU **A**: IN TM <u>TR</u>

133. page 204
PRINTED:
Liopus Agassiz, 1846b: <u>204</u> [unjustified emendation]

MUST BE:
Liopus Agassiz, 1846b: 212 [unjustified emendation]

134. page 205
PRINTED:
ater Linnaeus, 1767: 642 (*Necydalis*) **E**: BH CR FR GG GR IT MC PT SK SL SP UK YU **N**: AG LB MO TU
auriventris Küster, 1851: 96
biskrensis Dayrem, 1922b: 28
flavipes Pic, 1892e: 66
inustulatus **Pic, 1892a: 22**
nigripes A. Costa, 1855: 67
praeustus Fabricius, 1792b: 354 (*Necydalis*)
ruficollis Pic, 1918d: 23
subhumeralis Pic, 1905j: 156
theryi Pic, 1918d: 23
ustulatus Mulsant, 1839: 115
atricornis Pic, 1891h: 102 **E**: GR **A**: TR
creticus Sama, 1995b: 403 **E**: GR
flavicornis Küster, 1846b: 75 **E**: AL AU BU CR CZ GR HU IT MC RO SK SL TR YU **A**: IS JO SY
procerus A. Costa, 1855: 64
kraatzi **Pic, 1892c: 21** **A**: TR
mauritanicus P. H. Lucas, 1849: 496 **E**: PT SP **N**: AG MO TU
rufus geniculatus Kraatz, 1863: 104 **E**: AL BU CR GR MC RO SL TR YU **A**: IN
rufus rufus Linnaeus, 1767: 642 (*Necydalis*) **E**: AB AR AU BE BH BU CR CZ FR GE GG HU IT LU MA MD NL PL SK SL SP ST SZ UK **N**: CI (Gran Canaria) **A**: TM
attenuatus Geoffroy, 1785: 84 (*Leptura*) [HN]
rufus syriacus **Pic, 1892c: 22** **A**: IS LE SY TR

NOTE:
Both references Pic M. (1892a) and Pic M. (1892c) are connected with one publication (see note to the page 820).

MUST BE:
ater Linnaeus, 1767: 642 (*Necydalis*) **E**: BH CR FR GG GR IT MC PT SK SL SP UK YU **N**: AG LB MO TU
auriventris Küster, 1851: 96
biskrensis Dayrem, 1922b: 28
flavipes Pic, 1892e: 66
inustulatus **Pic, 1892b: 22**
nigripes A. Costa, 1855: 67
praeustus Fabricius, 1793: 354 (*Necydalis*)
ruficollis Pic, 1918d: 23
subhumeralis Pic, 1905j: 156
theryi Pic, 1918d: 23
ustulatus Mulsant, 1839: 115
atricornis Pic, 1891h: 102 **E**: GR **A**: TR
creticus Sama, 1995b: 403 **E**: GR
flavicornis Küster, 1846b: 75 **E**: AL AU BU CR CZ GR HU IT MC RO SK SL TR UK YU **A**: IS JO SY
procerus A. Costa, 1855: 64
kraatzi **Pic, 1892b: 21** **A**: TR
mauritanicus P. H. Lucas, 1849: 496 **E**: PT SP **N**: AG MO TU
rufus geniculatus Kraatz, 1863: 104 **E**: AB AL AR BU CR GG GR MC RO SL TR YU
rufus rufus Linnaeus, 1767: 642 (*Necydalis*) **E**: AU BE BH BU CR CZ FR GE HU IT LU MA MD NL PL SK SL SP ST SZ UK **N**: CI (Gran Canaria)
attenuatus Geoffroy, 1785: 84 (*Leptura*)
rufus syriacus **Pic, 1892b: 22** **A**: IS LE SY TR

rufus transcaspicus Lazarev, 2008: 132 **A**: TM IR

NOTE:

Stenopterus flavicornis Küster, 1846 was recorded for Ukraine by Zamoroka (2009) and Zamoroka & Panin (2011).

135. page 207

PRINTED:

carinulatus Gebler, 1833: 302 E: CT NT **A**: ES FE HEI MG NC NE NO SC WS

MUST BE:

carinulatus Gebler, 1833: 302 **A**: ES FE HEI MG NC NE NO SC WS

NOTE:

The numerous records of *A. carinulatus* for NE Russia are all connected with dark eastern form of *A. griseus* (see "Gallery" in www.cerambycidae.net)

136. page 208

PRINTED:

griseus Fabricius, 1792b: 261 (*Cerambyx*) **E**: AB AB AL AN AR AU BE BU BY CR CT CZ EN FI FR GE GG GR HU IT LA LS LT MC MD ND NR PL PT RO SK SL SP ST SV SZ TR UK YU **A**: CY ES FUJ GAN GUA GUI GUX HEB HEI HEN HUB JIL JIX KZ LIA MG NC NMO SC SHA TR WS XIN ZHE

MUST BE:

griseus Fabricius, 1793: 261 (*Cerambyx*) **E**: AB AB AL AN AR AU BE BU BY CR CT CZ EN FI FR GE GG GR HU IT LA LS LT MC MD ND NR NT PL PT RO SK SL SP ST SV SZ TR UK YU **A**: CY ES FUJ GAN GUA GUI GUX HEB HEI HEN HUB JIL JIX KZ LIA MG NC NMO SC SHA TR WS XIN ZHE

137. page 208

PRINTED:

nebulosus Sulzer, 1761: 11 (*Cerambyx*)

NOTE:

It was not a new name [also accepted as an available synonym by Miroshnikov, 2011a, 2011b], but wrong identification of *Acanthocinus griseus* (Fabricius, 1`792) as *Cerambyx nebulosus* Linnaeus, 1758.

138. page 209

PRINTED:

femoratus Fairmaire, 1859a: 62 **E**: AB AR BE BU FR GG IT LU NL ST TR UK **A**: IN TR

MUST BE:

femoratus Fairmaire, 1859a: 62 **E**: AB AR BE BU FR GG IT LT LU NL ST TR UK **A**: IN TR

NOTE:

Leiopus femoratus was recorded for Lithuania (Ferenca, 2004).

139. page 209

PRINTED:

linnei Wallin, Nylander & Kvamme, 2009: 39 **E**: AU BU CR CZ DE FR GB GE NR PL RO SK SV

and

nebulosus nebulosus Linnaeus, 1758: 391 (*Cerambyx*) **E**: AL AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT LU MD NL NR NT PL PT RO SK SL SP SV SZ TR UK YU **A:** KZ

MUST BE:
linnei Wallin, Nylander & Kvamme, 2009: 39 **E**: ?AL AU BU BY CR CT CZ DE EN FR GB GE ?GR ?HU KZ LA LT MD NR ?NT PL ?PT RO SK ?SP ST SV UK ?YU **A:** ?KZ
and
nebulosus nebulosus Linnaeus, 1758: 391 (*Cerambyx*) **E**: ?AL ?AU BE BH BU ?CR CT[Kaliningrad] DE FI FR GB GE ?GR ?HU IR IT LS LU ?MD NL NR PL ?PT RO SL ?SP SV SZ TR UK ?YU

NOTE:
Leiopus linnei was recorded for Belarus, Lithuania, and Ukraine (Gutowski et al., 2010).

140. page 209
PRINTED:
japonicus Pic, 1901v: 342

MUST BE:
japonicus Pic, 1901v: 342 (*Liopus*)

141. page 214
PRINTED:
amitina Holzschuh, 1989a: 174 **A**: IN

NOTE:
Several *Agapanthia amitina* from Turkey were published by Adlbauer (1992: 503) on the base of Sama's determination. Most probably that identification was wrong.

142. page 214
PRINTED:
cardui Linnaeus, 1767: 632 (*Cerambyx*) **E**: AL AR AU BE BH BU CR CT CZ FR GE GR HU IT MC PL PT RO SK SL SP ST SZ UK YU

MUST BE:
cardui Linnaeus, 1767: 632 (*Cerambyx*) **E**: AL AU BE BH BU CR CT CZ FR GE GR HU IT KZ MC PL PT RO SK SL SP ST SZ UK YU

143. pages 214 and 215
PRINTED (p. 214):
frivaldszkyi Ganglbauer, 1884: 546 **E**: BU RO **A**: IS IN IQ JO SY TR
[in subgenus *Agapanthia*]
and (p. 215)
frivaldzskyi Ganglbauer, 1884: 546 **E**: BU
[in subgenus *Epoptes*]

NOTE:
The first position is more natural, though for subgenus *Smaragdula* Pesarini & Sabbadini, 2004b.

144. page 214
PRINTED:
suturalis Fabricius, 1787: 149 (*Saperda*) **E**: AB AR FR GR (Dodecanissos) IT MA PT SP UK **N**: AG CI LB MO TU **A**: CY IN IS IQ JO KZ LE SY TR

MUST BE:
suturalis Fabricius, 1787: 149 (*Saperda*) **E**: AB AR FR GG GR (Dodecanissos) IT MA PT SP **N**: AG CI LB MO TU **A**: CY IN IS IQ JO LE SY TR

145. page 214
PRINTED:
osmanlis Reiche & Saulcy, 1858: 19 **E**: BU GR HU RO YU **A** TR

MUST BE:
osmanlis Reiche & Saulcy, 1858: 19 **E**: BU GR HU RO SK YU **A** TR

NOTE:
Agapanthia osmanlis was recorded for Slovakia by Sabol (2009).

146. page 214
PRINTED:
annulata Fabricius, 1792b: 313 (*Saperda*)

MUST BE:
annulata Fabricius, 1793: 314 (*Saperda*)

147. page 215
PRINTED:
spencei Gyllenhal, 1817: 187

MUST BE:
spencii Gyllenhal, 1817: 187

148. page 215
PRINTED:
boeberi Fischer von Waldheim, 1805: 16 [DA]

MUST BE:
boeberi Fischer von Waldheim, 1805: 16 (*Saperda*) [DA]

149. page 215
PRINTED:
cynarae michaeli Sláma, 1986: 465 **E**: GR (Kríti)

MUST BE:
cynarae michaeli Sláma, 1986: 469 **E**: GR (Kríti)

150. page 215
PRINTED:
dahli C. F. W. Richter, 1820: pl. 12 (*Saperda*) **E**: AL AU BH BU BY CR CT CZ FR GE GR GG HU MC MD RO SK SL SL SP ST SZ UK YU **A**: CH ES MG KZ NC TD UZ WS

MUST BE:
dahli C. F. W. Richter, 1820: pl. 12 (*Saperda*) **E**: AL AU BE BH BU BY CR CT CZ FR GE GR GG HU MC MD RO SK SL SL SP ST SZ UK YU **A**: CH ES MG KZ TD UZ WS

NOTE:
Agapanthia dahli (C. F. W. Richter) was recorded for Belgium (Drumont & Leduc, 2010).

151. page 215 and 307
PRINTED: (p. 215):
tristriga Reitter, 1913a: 70

NOTE:
As a synonym of *Agapanthia dahli* C. F. W. Richter, 1820

and (p. 307)
tristriga Reitter, 1913a: 70

NOTES:
As a synonym of *Phytoecia nigricornis* (Fabricius, 1782)
Second case is correct.

152. page 217

PRINTED:
leucaspis Steven, 1817: 184 (*Saperda*) **E**: AB AR AU BH BU CR CT CZ GG GR HU MC MD RO SK ST TR UK YU **A**: ES KI KZ MG TD UZ WS

MUST BE:
leucaspis Steven, 1817: 184 (*Saperda*) **E**: AB AR AU BH BU CR CT CZ GG GR HU MC MD RO SK ST TR UK YU **A**: ES KI KZ MG TD TR UZ WS

153. page 221

PRINTED:
testacea testacea Fabricius, 1781: 235 (*Saperda*) **E**: AL AN AU BE BH BU BY CR CT CZ FR EN GE GR HU IT LU MD NL PL RO SK SL SP ST SV SZ UK YU **A**: CY KZ TR

MUST BE:
testacea testacea Fabricius, 1781: 235 (*Saperda*) **E**: AL AN AU BE BH BU BY CR CT CZ ES FR EN GE GR HU IT LA LT LU MD NL PL RO SK SL SP ST SV SZ UK YU **A**: CY KZ TR

154. page 228

PRINTED:
genus *Zotalemimon* Pic, 1925a: 29 type species *Zotalemimon apicale* Pic, 1925 (= *Sybra posticata* Gahan, 1894)
Diboma J. Thomson, 1864: 46 [HN] type species *Diboma tranquilla* J. Thomson, 1864 (= *Hathlia procera* Pascoe, 1859)
Donysia Gressitt, 1940b: 179 type species *Sydonia costata* Matsushita, 1933
Sybrocentrura Breuning, 1947a: 57 type species *Sybrocentrura obscura* Breuning, 1947 (= *Sydonia ropicoides* Gressitt, 1939)
bhutanum Breuning, 1975a: 38 (*Diboma*) **A**: BT
ciliatum Gressitt, 1942h: 212 (*Donysia*) **A**: FUJ GUA HAI HKG
costatum Matsushita, 1933b: 379 (*Sydonia*) **A**: FUJ HAI JA (Ryukyus) TAI ZHE
loochooanum Breuning, 1940a: 78 (*Diboma*)
formosanum Breuning, 1975a: 38 (*Diboma*) **A**: TAI
lineatoides Breuning, 1969e: 192 (*Diboma*) **A**: SD
malinum Gressitt, 1951a: 511 (*Diboma*) **A**: YUN
obscurior Breuning, 1940a: 78 (*Diboma*) **A**: UP
posticata Gahan, 1894a: **77** (*Sybra*) **A**: SD
apicale Pic, 1925a: 29 (*Zotalemimon*)
ropicoides Gressitt, 1939f: 214 (*Sydonia*) **A**: FUJ HAI
obscurum Breuning, 1947a: 57 (*Sybrocentrura*)

MUST BE:
genus *Sybrocentrura* Breuning, 1947a: 57 type species *Sybrocentrura obscura* Breuning, 1947
obscura Breuning, 1947a: 57 **A**: GUX YUN
ropicoides Gressitt, 1939f: 214 (*Sydonia*) **A**: FUJ JIX HAI
and
genus *Zotalemimon* Pic, 1925a: 29 type species *Zotalemimon apicale* Pic, 1925 (= *Sybra posticata* Gahan, 1894)
Diboma J. Thomson, 1864: 46 [HN] type species *Diboma tranquilla* J. Thomson, 1864 (= *Hathlia procera* Pascoe, 1859)
Donysia Gressitt, 1940b: 179 type species *Sydonia costata* Matsushita, 1933

bhutanum Breuning, 1975a: 38 (*Diboma*) **A**: BT
ciliatum Gressitt, 1942h: 212 (*Donysia*) **A**: FUJ GUA HAI HKG
costatum Matsushita, 1933b: 379 (*Sydonia*) **A**: FUJ HAI JA (Ryukyus) TAI ZHE
loochooanum Breuning, 1940a: 78 (*Diboma*)
formosanum Breuning, 1975a: 38 (*Diboma*) **A**: TAI
lineatoides Breuning, 1969e: 192 (*Diboma*) **A**: SD
malinum Gressitt, 1951a: 511 (*Diboma*) **A**: YUN
obscurior Breuning, 1940a: 78 (*Diboma*) **A**: UP
posticata Gahan, 1894a: 77 (*Sybra*) **A**: SD
apicale Pic, 1925a: 29 (*Zotalemimon*)

NOTE:
See: Holzschuh (2010: 213-214)

155. page 234

PRINTED:
alternans Wiedemann, 1823: 11 (*Lamia*) **A**: TAI **ORR**
angustata Pic, 1926b: 6 (*Atelais*)
carolina Matsushita, 1935: 121
latiuscula Aurivillius, 1928a: 23
multilineata Pic, 1927: 16 (*Atelais*)

MUST BE:
alternans Wiedemann, 1823: 11 (*Lamia*) **A**: TAI **ORR**
angustata Pic, 1926b: 6 (*Atelais*)
carolina Matsushita, 1935: 121
fuscobiplagiata Breuning, 1939b: 265
fuscovittata Aurivillius, 1928a: 24
latiuscula Aurivillius, 1928a: 23
multilineata Pic, 1927: 16 (*Atelais*)

NOTE:
See: Weigel & Skale (2009).

156. pages 243 and 247-248

PRINTED (p.243):
albanicum Heyrovský, 1934b: 135 **E**: AL
iconiense K. Daniel, 1900: 140 **A**: TR
albicolle Breuning, 1943b: 89
albolineatum Küster, 1847a: 86 **A**: TR
and (pp. 247-248)
iconiense K. Daniel, 1900: 140 **A**: TR
albicolle Breuning, 1943b: 89
fulvovestitum Pic, 1903a: 5
muchei Breuning, 1962c: 38
parescherichi Breuning, 1966e: 146
semisetosum Jakovlev, 1901a: 85
subatritarse Breuning, 1966e: 146

NOTE:
Second case is correct.

157. pages 241, 244, 245, 248, 249 and 753

PRINTED (p.241):
arietinum phenax Jakovlev, 1900b: 68 **A**: KZ XIN
and (p.244)
bisignatum Jakovlev, 1900b: 66 **A**: TR
and (p.245)

ciscaucasicum Jakovlev, 1900b**:** 59 **E**: ST
and (p.248)
jacobsoni Jakovlev, 1899: 243 **A**: KZ XIN
    amymon Jakovlev, 1906c: 276
    apicipenne Jakovlev, 1900b**: 61**
and (p.249)
laeve hyrcanum Jakovlev, 1900b**:** 64 **A**: IN
and (p.753)
Jakovlev B. E. [Jakowleff] 1900b**:** Nouvelles espèces du genre Dorcadion Dalm. *Horae Societatis Entomologicae Rossicae* **34**: 59-70.

NOTE:
According to Kerzhner (1984: 855) the reprints of the corresponding article were distributed in 1899**.**

MUST BE (p.241):
arietinum phenax Jakovlev, 1899b: 68 **A**: KZ XIN
and (p.244)
bisignatum Jakovlev, 1899b: 66 **A**: TR
and (p.245)
ciscaucasicum Jakovlev, 1899b**:** 59 **E**: ST
and (p.248)
apicipenne Jakovlev, 1899b: 61 **A**: KZ XIN
    amymon Jakovlev, 1906c: 276
    jacobsoni Jakovlev, 1899a: 243
and (p.249)
laeve hyrcanum Jakovlev, 1899**:** 64 **A**: IN
and (p.753)
Jakovlev B. E. [Jakowleff] 1899b**:** Nouvelles espèces du genre Dorcadion Dalm. *Horae Societatis Entomologicae Rossicae* **34**: 59-70.

NOTE:
According to Kerzhner (1984: 855) the reprints with the description of *Dorcadion apicipenne* Jakovlev, 1899b were distributed in May 1899. *Dorcadion jacobsoni* Jakovlev, 1899a seems to be published later.

158. page 244
PRINTED:
blandulus Holzschuh, 1977a: 131 **A**: TR

MUST BE:
blandulum Holzschuh, 1977a: 131 **A**: TR

159. page 246
PRINTED:
divisum divisum Germar, 1839: 15 **A**: TR
    bonyi Pic, 1942b: 1
    catenatum Waltl, 1838: 469
    dorsale Pic, 1907j: 179
    mancum Gistel, 1848: 431
    smyrnanum Breuning, 1946: 106
    smyrnense Pic, 1917a: 10
    sparsedivisum Pic, 1911h: 185
    subobliteratum T. Pic, 1899: 351
    thebesianum Pic, 1942a: 1
    uninterruptum T. Pic, 1899: 351

MUST BE:
divisum divisum Germar, 1839: 15 **A**: TR
catenatum Waltl, 1838: 469
dorsale Pic, 1907j: 179
mancum Gistel, 1848: 431
smyrnanum Breuning, 1946: 106
smyrnense Pic, 1917a: 10
sparsedivisum Pic, 1911h: 185
subobliteratum T. Pic, 1899: 351
uninterruptum T. Pic, 1899: 351

NOTE:
The nature of *Dorcadion divisum* var. *bonyi* Pic, 1942b described from "Syrie" and *Dorcadion divisum* var. *thebesianum* Pic, 1942a described from "Thèbes" (Greece) rest unclear, as well as the nature of *D. koehlini* Pic, 1898h described from "Syrie" (as similar to *D. triste*!), but treated by Breuning (1962: 388) and Steiner (2003: 154) as "*D. divisum* m. *koehlini*".

160. page 246

PRINTED:
equestre nogelli Fairmaire, 1866b: 270 **A**: TR
bisuturale Jureček, 1933: 128
exclamationis J. Thomson, 1867: 53
immaculatum Kraatz, 1892: 174
equestre reclinatum Kraatz, 1892: 173 **E**: AL BU GR MC TR YU
bisuturale Jureček, 1933: 128

MUST BE:
equestre nogelli Fairmaire, 1866b: 270 **A**: TR
exclamationis J. Thomson, 1867: 58
immaculatum Kraatz, 1892: 174
equestre reclinatum Kraatz, 1892: 173 **E**: AL BU GR MC TR YU
bisuturale Jureček, 1933: 128 [described from Greece]

161. page 247

PRINTED:
holosericeum holosericeum Krynicki, 1832: 159 **E**: BL CT KZ PL RO ST UK

MUST BE:
holosericeum holosericeum Krynicki, 1832: 159 **E**: BL CT KZ **MD** PL RO ST UK

NOTE:
Dorcadion holoseriseum was regularly recorded for Moldavia (Miller & Zubowsky, 1917; Medvedev & Shapiro, 1959 and others).

162. pages 248, 257, 258 and 752

PRINTED (p.248):
interruptum Jakovlev, 1896: 510
and (p.257)
mongolicum Jakovlev, 1896**:** 508 (*Neodorcadion*)
and (p.258)
oryx Jakovlev, 1896: 506 (*Neodorcadion*) **A**: MG
and (p.752)
Jakovlev B. E. [Jakowlew] 1896**:** Description de quelques longicornes paléarctiques nouveaux ou peu connus. *Horae Societatis Entomologicae Rossicae* **29** [1894-1895]: 506-514.

NOTE:

According to Kerzhner (1984: 854) the reprints of the corresponding article were distributed in 1895.

MUST BE (p.248):

interruptum Jakovlev, 1895: 510

and (p.257)

mongolicum Jakovlev, 1895: 508 (*Neodorcadion*)

and (p.258)

oryx Jakovlev, 1895: 506 (*Neodorcadion*) **A**: MG

and (p.752)

Jakovlev B. E. [Jakowlew] 1895: Description de quelques longicornes paléarctiques nouveaux ou peu connus. *Horae Societatis Entomologicae Rossicae* **29** [1894-1895]: 506-514.

163. pages 250 and 254

PRINTED (p. 250):

olympicola Heyrovský, 1941d: 148 **E**: GR

and (p.254)

tuleskovi Heyrovský, 1937a: 30 **E**: GR

frigidum Meschnigg, 1947: 137

olympicola Heyrovský, 1941d: 148

NOTE:

According to Pesarini & Sabbadini (2007) the second case is acceptable.

164. page 250

PRINTED:

olympicum olympicum Kraatz, 1873a: 78 **A**: TR

graecum Kraatz, 1873a: 78 [HN]

obsoletum Kraatz, 1873a: 78

oreophilum Ganglbauer, 1884: 500

subalpinum Kraatz, 1873a: 78

NOTE:

Dorcadion graecum, Kraatz, 1873a: 78 was not a new name, but wrong identification as *Dorcadion graecum* Waltl, 1838 [= *D. crux* (Billberg, 1817)].

The records of *D. graecum* for European Turkey and Greece (Kraatz, 1873a) and *D. olympicum* Kraatz, 1873a for Bulgaria (Migliaccio et al., 2007: 46) could be connected with another species.

165. page 251

PRINTED:

molitor L. Redtenbacher, 1849: 496 [HN]

NOTE:

It was not a new name – just a wrong identification. L. Redtenbacher (1849: 496) used here "*molitor*" by Fabricius.

166. page 253

PRINTED:

striolatum Kraatz, 1873a: 93 **E**: AR GG IN TR

MUST BE:

striolatum Kraatz, 1873a: 93 **E**: ?AB AR GG **A**: ?IN TR

167. page 254

PRINTED:
subinterruptum Pic, 1900g: 12 **A**: TR

MUST BE:
subinterruptum Pic, 1900g: 12 <u>E: TR</u> **A**: TR

NOTE:
The taxon was recorded for European Turkey by Sama et al., 2010.

168. page 264

PRINTED:
nipponensis L. S. Dillon & E. S. Dillon, 1948: 229

MUST BE:
bilobus nipponensis L. S. Dillon & E. S. Dillon, 1948: 229 **A**: JA

NOTES:
Olenecamptus bilobus nipponensis L. S. Dillon & E. S. Dillon, 1948 is generally accepted in Japan publications (Kusama & Takakuwa, 1984; Makihara, 2007)
The name "*Oleocamptus*" used by Löbl & Smetana (2011: 44) was just a wrong subsequent spelling – not available.

169. page 272

PRINTED:
<u>*curculioides* Scopoli, 1772: 101</u>
nigronotata Pic, 1906h: 86 (*Haplocnemia*)
oculata Geoffroy, 1785: 78 (*Leptura*)

MUST BE:
nigronotata Pic, 1906h: 86 (*Haplocnemia*)
oculata Geoffroy, 1785: 78 (*Leptura*) <u>[HN]</u>

NOTE:
«*Leptura curculioides* Linn.» (Scopoli, 1772) was just a wrong spelling of "*curculionoides* Linnaeus, 1760" – not available. It was also used as available name by Miroshnikov (2011a, 2011b).

170. page 272

PRINTED:
myops Dalman, 1817b: 168 (*Lamia*) **E**: CT FI LA NT PL ST SV UK **A**: ANH ES FE GAN GUA GUI HEB HEI HEN HUB JIL KZ LIA MG NC NMO QIN SC SCH SHA TAI WS XIN ZHE

MUST BE:
myops Dalman, 1817b: 168 (*Lamia*) **E**: <u>BY</u> CT FI LA <u>LT</u> NT PL ST SV UK **A**: ANH ES FE GAN GUA GUI HEB HEI HEN HUB JIL KZ LIA MG NC NMO QIN SC SCH SHA TAI WS XIN ZHE

NOTE:
Mesosa myops was recorded for Lithuania by Ferenca et al. (2006).

171. page 282

PRINTED:
galloprovincialis Olivier, 1795: No. 67: 125 (*Cerambyx*) **E**: AB AL AR AU BH BU BY CR CT CZ EN FI FR GE GG GR HU IT LA LT MC MD NL NT PL PT RO SK SL SP ST SV SZ UK <u>WS</u> YU **N**: AG MO TU **A**: ES FE KZ MG NE TR WS
cinerascens Motschulsky, 1860b: 150

heinrothi Solsky, 1871a: 389 [HN]
lignator Krynicki, 1832: 158
nitidior Abeille de Perrin, 1870: 87 (*Monohammus*)
parendeli Théry, 1891: xxiii (*Monohammus*)
pistor Germar, 1818: 242 (*Lamia*)
sibiricus Pic, 1908b: 5
subrufopubens Pic, 1912g: 18
tauricola Pic, 1912g: 18
unifasciatus Pic, 1915f: 12 (*Monochamus*)

MUST BE:
galloprovincialis cinerascens Motschulsky, 1860b: 150 **E**: NT **A**: ES FE KZ MG NE WS
sibiricus Pic, 1908b: 5 (*Monochammus*)
unifasciatus Pic, 1905a: 12 (*Monochammus*) ["Altaï"]
galloprovincialis galloprovincialis Olivier, 1795: No. 67: 125 (*Cerambyx*) **E**: FR IT(Sicily) PT SP **N**: AG MO TU
parendeli Théry, 1891: xxiii (*Monohammus*)
subrufopubens Pic, 1912g: 18
galloprovincialis pistor Germar, 1818: 242 (*Lamia*) **E**: AL AU BH BU BY CR CT CZ EN FI FR GE GR HU IT LA LT MC MD NL NT PL RO SK SL ST SV SZ UK YU **A**: KZ WS
lignator Krynicki, 1832: 158
nitidior Abeille de Perrin, 1870: 87 (*Monohammus*)
galloprovincialis tauricola Pic, 1912g: 18 **E**: AB AR GG ST **A**: TR

NOTES:
"Monohammus heinrothii" (Cederhjelm, 1798) [wrong subsequent spelling – not available] was just mentioned by Solsky (1871: 389) as a synonym of *M. sutor*. It was not a new name by Solsky.

The diagnoses of subspecies see in "New Acts and Comments" (p. 48).

According to D. Milko (personal message, 2009) Monochamus galloprovincialis was collected in West Kirgizia: female, SE slope of Pskem Ridge, 42°04'N, 71°12'E, 2-5.4.2008, G.Lazkov leg.; besides, several specimens were observed in the region; besides several available specimens were collected inside Bishkek city.

172. page 283

PRINTED:
saltuarius Gebler, 1830: 184 (*Monohammus*) **E**: AU BH BY CR CT CZ GE HU IT LA NT PL RO SK SL SL UK **A**: ES FE KZ HEI JA JIL JIX MG NC NMO SC SHA SHN SHX WS XIN ZHE

MUST BE:
saltuarius Gebler, 1830: 184 (*Monohammus*) **E**: AU BH BY CR CT CZ GE HU IT LA LT NT PL RO SK SL SL UK **A**: ES FE KZ HEI JA JIL JIX MG NC NMO SC SHA SHN SHX WS XIN ZHE

NOTE:
Monochamus saltuarius was recorded for Lithuania (Pileckis & Jakaitis, 1982).

173. page 283

PRINTED:
urussovii Fischer von Waldheim, 1805: 12 (*Cerambyx*) **E**: BY **CZ** CT EN FI LA LT NR NT **PL** SV ST UK **A**: ES FE KZ MG NC NIN NMO NW HEB HEI HEN JA JIL SC SHA WS XIN

MUST BE:
urussovii Fischer von Waldheim, 1805: 12 (*Cerambyx*) **E**: BY CT EN FI LA LT NR NT SV ST UK **A**: ES FE KZ MG NC NIN NMO NW HEB HEI HEN JA JIL SC SHA WS XIN

NOTE:

According to Slama (1998) *M. urussovii* absent in Czechia and Slovakia. Rather typical female of *M. sartor* from West Ukraine (Rakhov) is preserved in Zoological Institute (S.-Petersburg). A series of *M. sartor* from West Belorussia (Belovezhskaya Pushcha) was received by me from A.Pisanenko. So, M. *urussovii* is replaced here by *M. sartor*, and does not penetrate to Slovakia or to Poland.

174. pages 292, 301, 308

PRINTED (p. 292):
genus *Coptosia* Fairmaire, 1864a: 177 type species *Phytoecia languida* Fairmaire, 1864 (= *Phytoecia albovittigera* Heyden, 1863)
(p. 301):
genus *Opsilia* Mulsant, 1862: 387 type species *Opsilia flavicans* Mulsant, 1862 (= *Leptura coerulescens* Scopoli, 1763)
(p. 308):
genus *Pilemia* Fairmaire, 1864a: 175 type species *Phytoecia tigrina* Mulsant, 1851

NOTE:

All three names are better to be regarded now as subgenera of *Phytoecia* Dejean, 1835.

175. page 292

PRINTED:
annularis Holzschuh, 1984a: 160 (*Conizonia*) **A**: TR

MUST BE:
anularis Holzschuh, 1984a: 160 (*Conizonia*) **A**: TR

NOTE:

According to the original description.

176. page 294

PRINTED:
iranica K. Daniel & L. Daniel, 1898: 79

MUST BE:
iranica K. Daniel & **J.** Daniel, 1898: 79

177. page 297 and 300

PRINTED:
atropunctata Pic, 1916h: 17 **A**: ANH GUA GUI GUX HUB HUN JIX NP SCH SHA YUN ZHE YUN "Korea"
flavescens Breuning, 1947d: 146
toi Gressitt, 1939b: 106
and
coreensis Breuning, 1947c: 58 **A**: JA SC
and (p.300)
simplex Gressitt, 1942g: 91 **A**: ANH CE FE NE SC

MUST BE:
atropunctata Pic, 1916h: 17 **A**: ANH GUA GUI GUX HUB HUN JIX NP SCH SHA YUN ZHE
flavescens Breuning, 1947d: 146
toi Gressitt, 1939b: 106
and (p.300)
simplex Gressitt, 1942g: 91 **A**: ANH CE FE NE SC SHG

NOTE:

Oberea atropunctata Pic, 1916 (described from Yunnan) was recorded for Russian Far East (Ussuriysk environs) by Danilevsky (1993d).

According to Dr. T. Kurihara (personal messages 2008 and 2011) the species distributed in Korea and Russia is definitely not *Oberea atropunctata* Pic, 1916, but most close to *O. simplex* Gressitt, 1942 (described from Shanghai) – see holotype-male ("Gallery" in www.cerambycidae.net) preserved in Institute of Zoology, Chinese Academy of Sciences (Beijing). So, for now the name "*O. simplex* Gressitt, 1942" could be provisionally used for the species, which is most probably new. According to the opinion of Dr. Kurihara it is also necessary to study the type of *Oberea infratestacea* Pic, 1936 also described from Shanghai. The taxon was published as "*O. atropunctata* m. *coreensis*" Breuning, 1947 - unavailable name.

O. simplex absent in Japan.

178. page 299

PRINTED:
morio Kraatz, 1879d: 117 **A**: FE MG SC

MUST BE:
morio Kraatz, 1879d: 117 **A**: ES FE MG SC

NOTE:

Oberea morio Kraatz, 1879d is known from Transbaikalia.

179. page 303

PRINTED:
alziari Sama, 1992b: 306 (*Phytoecia*) **A**: CY IS JO LE SY TR

MUST BE:
alziari Sama, 1992b: 306 (*Helladia*) **E**: GR **A**: CY IS JO LE SY TR

NOTE:

Phytoecia (Helladia) millefolii alziari Sama, 1992 was recorded for Crete (Pesarini & Sabbadini, 1994: 61).

180. pages 303 and 304

PRINTED: (p. 303):
scapipicta Reitter, 1898e: 358

NOTE:
As a synonym of *Phytoecia (Helladia) diademata* Faldermann, 1837.
and (p. 304):
scapipicta Reitter, 1898e: 358

NOTE:
As a synonym of *Phytoecia (Helladia) orbicollis orbicollis* Reiche & Saulcy, 1858
Second case is correct.

181. page 303

PRINTED:
millefolii Adams, 1817: 311 (*Saperda*) **E**: AB AR BU GG ST UK **A**: IN TR

MUST BE:
millefolii Adams, 1817: 311 (*Saperda*) **E**: AB AR BU GG GR ST UK **A**: IN TR

NOTE:

Phytoecia (Helladia) millefolii was recorded for Greece by Berger et al. (2010).

182. page 303

PRINTED:

sellata Ganglbauer, 1884: 567

MUST BE:

sellata Ganglbauer, 1887: 296

NOTE:

The name "*sellata*" absent in the publication by Ganglbauer (1884). It was introduced later by Ganglbauer (1887). The corresponding publication absent in the references to the Catalog.

183. pages 304-305

PRINTED (p.305):

tuerki Ganglbauer, 1884: 575 **A**: TR

MUST BE (p.304):

affinis *tuerki* Ganglbauer, 1884: 575 **E:** BU TR **A**: TR

NOTE:

According to my materials both subspecies of *Ph. (Musaria) affinis* are represented in Bulgaria: *Ph. a. affinis* in west Bulgaria (Lozenska Planina) and *Ph. a. tuerki* in south-east (Kiten). According to the last localality, *Ph. a. tuerki* is undoubtedly represented in European Turkey.

184. page 308

PRINTED:

virgula Charpentier, 1825: 225 (*Saperda*) **E**: AB AL AR AU BH BU BY CR CT CZ FR GE GG GR HU IT MC MD PL PT RO SK SL SP ST SZ TR UK YU **A**: CY IN IS JO KI KZ LE SY TD TM TR UZ XIN

MUST BE:

virgula Charpentier, 1825: 225 (*Saperda*) **E**: AB AL AR AU BH BU BY CR CT CZ FR GE GG GR HU IT **LT** MC MD PL PT RO SK SL SP ST SZ TR UK YU **A**: CY IN IS JO KI KZ LE SY TD TM TR UZ XIN

NOTE:

Phytoecia virgula was recorded for Lithuania by Ferenca et al. (2006).

185. page 308

PRINTED:

hirsutula hirsutula Frölich, 1793: 141 (*Saperda*) **E**: AB AL AR BH BU CR GG GR HU MC RO SK SL ST UK YU **A**: IN IS JO LE SY TR WS

MUST BE:

hirsutula hirsutula Frölich, 1793: 141 (*Saperda*) **E**: AB AL AR BH BU CR GG GR HU KZ MD MC RO SK SL ST UK YU **A**: IN IS JO KZ LE SY TR WS

186. page 308

PRINTED:

holosericea Ganglbauer, 1884: 568 (*Phytoecia*) [HN]

NOTE:

It was not a new name, but just a subsequent using of *holosericea* Faldermann, 1837 as "*Ph. holosericea* Fald."

187. page 309

PRINTED:
albolineata Hampe, 1852b: 314 (*Phytoecia*) **E**: AB AR GG **A**: IN

MUST BE:
albolineata Hampe, 1852b: 314 (*Phytoecia*) **E**: AB AR GG **A**: IN TR

188. page 310

PRINTED:
lusitanus Linnaeus, 1767: 1067 (*Cerambyx*) **E**: AB AL AR AU BH BU BY CR CT CZ DE EN FI FR GE GG GR HU IT LA LS LT MC MD NR NT PL RO SK SL SP ST SV SZ UK YU **A**: KZ NE WS
balteatus Gyllenhal, 1817: 163 (*Lamia*)
crinitus Panzer, 1795: 269 (*Cerambyx*)
lusitanicus Olivier, 1790b: 269 (*Lamia*)

MUST BE:
lusitanus Linnaeus, 1767: 1067 (*Cerambyx*) **E**: AB AL AR AU BH BU BY CR CT CZ DE EN FI FR GE GG GR HU IT LA LS LT MC MD NR NT PL RO SK SL SP ST SV SZ UK YU **A**: KZ WS
balteatus Gyllenhal, 1817: 163 (*Lamia*)
crinitus Panzer, 1795: 269 (*Cerambyx*)

NOTE:
Callidium lusitanicum Olivier, 1790b: 269 [unavailable] is not a new name but wrong spelling of *Cerambyx lusitanus* Linnaeus, 1767.
Exocentrus lusitanus (Linnaeus, 1767) is impossible in NE China.

189. page 311

PRINTED:
punctipennis Mulsant & Guillebeau, 1856: 103 **E**: AB AL AU BH BU BY CR CT CZ FR GE GR HU IT MD PL RO SK SL SP SZ UK YU

MUST BE:
punctipennis Mulsant & Guillebeau, 1856: 103 **E**: AB AL AU BH BU BY CR CT CZ FR GE GR HU IT MD PL RO SK SL SP SZ UK YU **A**: TR

NOTE:
See: Adlbauer (1992: 502).

190. page 312

PRINTED:
anatolicus K. Daniel & L. Daniel, 1898: 76 **E**: GR (Rodos) **A**: CY SY TR

MUST BE:
anatolicus K. Daniel & **J.** Daniel, 1898: 76 **E**: GR (Rodos) **A**: CY SY TR

191. page 323

PRINTED:
gleneoides Gressitt, 1935c: 177 (*Phytoecia*)

MUST BE:
gleneoides Gressitt, 1935c: 177 (*Phytoecia*) **A**: JP

192. page 327

PRINTED:

bipunctata Zubkov, 1829: 167 (*Saperda*) **E**: AU BH BY CR CT CZ EN FR GE HU IT LA LS LT NT PL RO SK SL ST SZ UK YU **A**: MG

MUST BE:

bipunctata Zubkov, 1829: 167 (*Saperda*) **E**: AU BH BY CR CT CZ EN FR GE HU IT **KZ** LA LS LT NT PL RO SK SL ST SZ UK YU **A**: MG

NOTE:

The type locality of the species (Kalmykovo) is situated on the west bank of Ural river – so, in European Kazakhstan.

193. page 330

PRINTED:

octopunctata Scopoli, 1772: 101 (*Leptura*) **E**: AB AL AR AU BE BH BU BY CR CT CZ FR GE GG GR HU IT MD PL RO SK SL SP ST SZ UK YU

MUST BE:

octopunctata Scopoli, 1772: 101 (*Leptura*) **E**: AB AL AR AU BE BH BU BY CR CT CZ FR GE GG GR HU IT **LT** MD PL RO SK SL SP ST SZ UK YU

NOTE:

Saperda octopunctata was recorded for Lithuania (Milender et al., 2004).

194. page 330

PRINTED:

punctata Linnaeus, 1767: 1067 (*Cerambyx*) **E**: AB AL AN AR AU BH BU BY CR CT CZ EN FR GE GG GR HU IT LA LT MA MC MD NT PL RO SK SL SP ST SZ TR UK YU **N**: AG **A**: CY TR

MUST BE:

punctata Linnaeus, 1767: 1067 (*Cerambyx*) **E**: AB AL AN AR AU BH BU BY CR CT CZ EN FR GE GG GR HU IT KZ LA LT MA MC MD NT PL RO SK SL SP ST SZ TR UK YU **N**: AG **A**: CY TR

195. page 333

PRINTED:

Yezohammus Matsushita, 1933b: 347 type species *Yezohammus nubilus* Matsushita, 1933

MUST BE:

Jezohammus Matsushita, 1933b: 347 type species *Jezohammus nubilus* Matsushita, 1933

196. page 654

PRINTED:

Bassi C. 1834: Description de quelques nouvelles espèces de coléoptères de l'Italie. *Annales de la Société Entomologique de France* **3**: 463-471.

MUST BE:

Bassi C. 1834: Description de quelques nouvelles espèces de coléoptères de l'Italie. *Annales de la Société Entomologique de France* **3**: 463-472.

197. page 694-695

PRINTED:

Daniel K. & Daniel L. 1891: Revision der mit Leptura unipunctata F. und fulva Deg. verwandten Arten. Pp. 1-40. In: *Coleopteren-Studien I*. München: Kgl. Hof-und Universitäts-Buchdruckerei von Dr. C. Wolf & Sohn, [3] + 64 pp.

Daniel K. & Daniel L. 1898: Zwanzig neue Arten aus dem palaearktischen Faunengebiete. Pp. 61-82. In: *Coleopteren-Studien II*. München: Kgl. Hof-und Universitäts-Buchdruckerei von Dr. C. Wolf & Sohn, [2] + 88 pp.

Daniel K. & Daniel L. 1898: Kleinere Mitteilungen. Pp. 83-88. In: *Coleopteren-Studien II*. München: Kgl. Hof-und Universitäts-Buchdruckerei von Dr. C. Wolf & Sohn, [2] + 88 pp.

MUST BE:

Daniel K. & Daniel J. 1891: Revision der mit Leptura unipunctata F. und fulva Deg. verwandten Arten. Pp. 1-40. In: *Coleopteren-Studien I*. München: Kgl. Hof-und Universitäts-Buchdruckerei von Dr. C. Wolf & Sohn, [3] + 64 pp.

Daniel K. & Daniel J. 1898: Zwanzig neue Arten aus dem palaearktischen Faunengebiete. Pp. 61-82. In: *Coleopteren-Studien II*. München: Kgl. Hof-und Universitäts-Buchdruckerei von Dr. C. Wolf & Sohn, [2] + 88 pp.

Daniel K. & Daniel J. 1898: Kleinere Mitteilungen. Pp. 83-88. In: *Coleopteren-Studien II*. München: Kgl. Hof-und Universitäts-Buchdruckerei von Dr. C. Wolf & Sohn, [2] + 88 pp.

198. page 706

PRINTED:

Fabricius J. C. 1792a: *Entomologia systematica emendata et aucta, secundum classes, ordines, genera, species, adjectis, synonimis, locis, observationibus, descriptionibus. Tomus I. Pars I.* Hafniae: C. G. Proft, x + 330 pp.

Fabricius J. C. 1792b: *Entomologia systematica emendata et aucta, secundum classes, ordines, genera, species, adjectis, synonimis, locis, observationibus, descriptionibus. Tomus I. Pars II.* Hafniae: C. G. Proft, xx + 538 pp.

MUST BE:

Fabricius J. C. 1792: *Entomologia systematica emendata et aucta, secundum classes, ordines, genera, species, adjectis, synonimis, locis, observationibus, descriptionibus. Tomus I. Pars I.* Hafniae: C. G. Proft, x + 330 pp.

Fabricius J. C. 1793: *Entomologia systematica emendata et aucta, secundum classes, ordines, genera, species, adjectis, synonimis, locis, observationibus, descriptionibus. Tomus I. Pars II.* Hafniae: C. G. Proft, xx + 538 pp.

NOTE:

According to Bousquet (2008):

"Fabricius (1793): Entomologia systematica Fabricius' *Entomologia systematica* was published in two parts with the date 1792 indicated on the title page of the first part. The Cerambycid section is included in the second part which was published in 1793, on May 4 (Evenhuis 1997: 248), not in 1792 as listed by authors."

199. page 722

PRINTED:

Gmelin J. F. 1790: *Caroli a Linné, systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio decima tertia, aucta, reformata. Tom I. Pars IV. Classis V. Insecta.* Lipsiae: Georg Enanuel Beer, 1517-2224.

MUST BE:

Gmelin J. F. 1790: *Caroli a Linné, systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis.*

Editio decima tertia, aucta, reformata. Tom I. Pars IV. Classis V. Insecta. Lipsiae: Georg Emanuel Beer, 1517-2224.

200. page 731

PRINTED:

Harrer G. A. 1784: *Beschreibung derjenigen Insecten, welche D. Schaefer in CCLXXX ausgemalten Kupfertafeln unter dem Titel: Icomes Insectorum circa Ratisbonam indigenorum in 3 Theilen herausgegeben hat. Theil I Hartschalihe Insekten.* Regensburg: Kayser, 328 pp.

MUST BE:

Harrer G. A. 1784: *Beschreibung derjenigen Insecten, welche Herr D. Jacob Christoph Schäffer in CCLXXX ausgemahlten Kupfertafeln unter dem Titel: Icones Insectorum circa Ratisbonam indigenorum in drey Theilen herausgegeben hat. Theil I Hartschaalige Insecten.* Regensburg: Kayserischer Verlag,, 328 pp.

201. page 776

PRINTED:

Levrat J. N. G. B. 1858: Description de deux coléoptères nouveaux. *Annales de la Société Linnénne de Lyon* (2) **5**: 260-263.

MUST BE:

Levrat J. N. G. B. 1858: Description de deux coléoptères nouveaux. *Annales de la Société Linnénne de Lyon* (2) **5**: 261-263.

202. page 798

PRINTED:

Miroshnikov A. I. 1992: Novyy vid zhukov-drovosekov roda Apophysis Chevr. (Coleoptera, Cerambycidae) iz Turkmenistana. *Entomologicheskoe Obozrenie* **71**: 392-394.

MUST BE:

Miroshnikov A. I. 1992: Novyy vid zhukov-drovosekov roda Apatophysis Chevr. (Coleoptera, Cerambycidae) iz Turkmenistana. *Entomologicheskoe Obozrenie* **71**: 392-394.

203. page 798

PRINTED:

Miroshnikov A. I. 1998: Novaya klassifikacia zhukov-drovosekov kompleksa Anoplodera triby Lepturini (Coleoptera, Cerambycidae). *Entomologicheskoe Obozrenie* 77: 588-618.

MUST BE:

Miroshnikov A. I. 1998: Novaya klassifikacia zhukov-drovosekov kompleksa Anoplodera triby Lepturini (Coleoptera, Cerambycidae) fauny Golarktiki. II. *Entomologicheskoe Obozrenie* 77(3): 587-618.

204. page 798

PRINTED:

Miroshnikov A. I. & Lobanov A. 1990: A n. sp. of the genus Purpuricenus from Afghanistan (Coleoptera: Cerambycidae). *Vestnik Zoologii* **1990** (5): 15-18.

MUST BE:

Miroshnikov A. I. & Lobanov A. 1990: Novyy vid zhukov-drovosekov roda Purpuricenus (Coleoptera: Cerambycidae) iz Afganistana. *Vestnik Zoologii* **1990** (5): 15-18.

205. page 812

PRINTED:

Olivier A. G. 1790a: *Encyclopédie méthodique ou par ordre de matières; par une société de gens de lettres, de savans et d'artistes; précédée d'un vocabulaire universel, servant de* *table pour tout l'ouvrage, ornée des portraits de Mm. Diderot et d'Alembert, premiers éditeurs de l'Encyclopédie. Histoire Naturelle. Insectes. Tome quatrième.* Paris: C.-J. Panckoucke et Liége: Plomteux pp. 45-331. [pp. i-ccclxxiii issued in 1792, pp. 1-44 in 1789, following pp. in 1790].

The reference is superfluous. No names of Cerambycidae or Chrysomelidae are in.

206. page 819

PRINTED:
Pic M. 1889a: Un peu de longicornes. *L'Échange, Revue Linnéenne* **5**: <u>5-6</u> [note: issue mispaginated, pages <u>5-6</u> are in fact pages 20-21]

MUST BE:
Pic M. 1889a: Un peu de longicornes. *L'Échange, Revue Linnéenne* **5**: <u>4-5</u> [note: issue mispaginated, pages <u>4-5</u> are in fact pages 20-21]

207. page 819

PRINTED:
Pic M. 1891a: *Descriptions de longicornes de Syrie*. Lyon: L. Jacquet.

MUST BE:
Pic M. 1891a: *Descriptions de longicornes de Syrie*. Lyon: L. Jacquet: <u>2pp.</u>

208. page 820 (and 205, 304)

PRINTED:
Pic M. <u>1892a:</u> *Variétés, 2nd article*. Lyon: L. Jacquet.
Pic M. 1892b: Descriptions et corrections. *L'Échange, Revue Linnéenne* **8**: 4.
Pic M. <u>1892c:</u> Petite étude sur le genre Stenopterus Steph. *L'Échange, Revue Linnéenne* **8**: 21-23.

NOTE:
Both references Pic M. (1892a) and Pic M. (1892c) are connected with one publication, which contains three new names published in the page 205 of the Catalog:
inustulatus <u>Pic, 1892a: 22</u>
kraatzi Pic, 1892c: 21 **A**: TR
rufus syriacus <u>Pic, 1892c: 22</u> **A**: IS LE SY TR

MUST BE (p. 820):
Pic M. <u>1892a:</u> Descriptions et corrections. *L'Échange, Revue Linnéenne* **8**: 4.
Pic M. <u>1892b:</u> Petite étude sur le genre Stenopterus Steph. *L'Échange, Revue Linnéenne* **8**: 21-23.
and (p. 205)
inustulatus Pic, <u>1892b</u>: 22
kraatzi <u>Pic, 1892b: 21</u> **A**: TR
rufus syriacus <u>Pic, 1892b:</u> 22 **A**: IS LE SY TR
and (p. 304)
mutata Pic, <u>1892a:</u> 4 [RN]

209. page 843

PRINTED:
Reiche L. 1878a: <u>Description deux nouvelles espèces de coléoptères de longicornes.</u> *Bulletin de la Société Entomologique de France* **1877**: cxlix-<u>cli.</u>

MUST BE:
Reiche L. 1878a: <u>[description de deux nouvelles espèces de Longicornes]</u>. *Bulletin de la Société Entomologique de France* **1877**: cxlix-<u>cl.</u>

210. page 875

PRINTED:

Tsherepanov [=Cherepanov] A. I. 1971: Novyy vid roda Chlorophorus (Coleoptera, Cerambycidae). Pp. 14-16. In: Novosti fauny Sibiri. *Novye i maloizvestnye vidy fauny Sibiri* **4**. Novosibirsk: Nauka, 107 pp.

...

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MUST BE:

Tsherepanov [=Cherepanov] A. I. 1971: Novyy vid roda Chlorophorus (Coleoptera, Cerambycidae). Pp. 14-16. In: *Novye i maloizvestnye vidy fauny Sibiri* **4**. Novosibirsk: Nauka, 107 pp.

...

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Tsherepanov A. I. 1973c: Novye vidy zhukov-drovosekov roda Exocentrus (Coleoptera, Cerambycidae). Pp. 138-139. In: *Novye i maloizvestnye vidy fauny Sibiri* 7. Novosibirsk: Nauka, 148 pp.

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A PRELIMINARY LIST FOR LONGHORNED BEETLES FAUNA OF IRAQ WITH ADDITIONS TO THE PALAEARCTIC CATALOGUE OF LOBL & SMETANA (2010) (COLEOPTERA: CERAMBYCIDAE)

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[**Özdikmen, H. & Ali, M. A.** 2012. A preliminary list for longhorned beetles fauna of Iraq with additions to the Palaearctic Catalogue of Löbl & Smetana (2010) (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 7 (1): 174-183]

ABSTRACT: The paper gives a preliminary list of Iraqi longhorned beetles with additions to the Palaearctic Catalogue.

KEY WORDS: Cerambycidae, Faunal List, Iraq.

Unfortunately, Iraqi fauna of longhorned beetles has not been known well, although fauna of neighboring areas is rather well known. In fact Iraqi fauna when considering the neighboring faunas, deserves detailed works. The fauna has not been included a remarkable work until now. Known the most comprehensive work is belonging to Ismail (1983) that is not a sufficient work for the fauna.

Somewhat data into piecemeal fashion studies accumulated in time to time. As a result of this, the fauna includes a total of 46 species of 25 genera [as 3 genera and 3 species of subfamily Prioninae; 2 genera and 4 species of subfamily Lepturinae; 1 genus and 1 species of subfamily Saphaninae; 12 genera and 18 species of subfamily Cerambycinae; 1 genus and 3 species of subfamily Dorcadioninae; and 6 genera and 17 species of subfamily Lamiinae] according to Palaearctic catalogue of Löbl & Smetana (2010). Ismail (1983) gave a total of 47 species of 26 genera [as 3 genera and 5 species of subfamily Prioninae; 3 genera and 5 species of subfamily Lepturinae; 10 genera and 17 species of subfamily Cerambycinae; 1 genus and 1 species of subfamily Stenopterinae; 1 genus and 3 species of subfamily Dorcadioninae; and 8 genera and 16 species of subfamily Lamiinae] for the fauna in his thesis. However, Ismail's work was overlooked by the authors of the Palaearctic catalogue (see below).

As seen above, the taxa number for the Iraqi fauna is just same in both works. But they included some different taxa. So the Iraqi fauna comprises of more than the known taxa. The present study, therefore, is aimed to determine real status of the fauna on the base of Ismail (1983) now. Finally, we must be declaring that Iraqi fauna should be richer than the known. For this reason, to determine the real number of taxa is needed new works on the fauna.

In Löbl & Smetana (2010), Iraqi fauna was presented as follows:

FAMILY CERAMBYCIDAE Latreille, 1802: 211

SUBFAMILY PRIONINAE Latreille, 1802: 212

Ergates faber faber (Linnaeus, 1760: 187)
Mesoprionus persicus (Redtenbacher, 1850: 49)
Pogonarthron semenowi (Lameere, 1912: 224)

SUBFAMILY LEPTURINAE Latreille, 1802: 218

Stictoleptura cordigera cordigera (Fuessly, 1775: 14)
Stictoleptura rufa dimidiata (Daniel & Daniel, 1891: 11)
Stictoleptura tripartita (Heyden, 1889: 329)
Stenurella bifasciata bifasciata (Müller, 1776: 93)

SUBFAMILY SAPHANINAE Gistel, 1848: [1]

Alocerus moesiacus (Frivadszky, 1837: 177)

SUBFAMILY CERAMBYCINAE Latreille, 1802: 211

Hesperophanes sericeus (Fabricius, 1787: 152)
Trichoferus fasciculatus fasciculatus (Faldermann, 1837: 266)
Trichoferus fissitarsis Sama, Fallahzadeh & Rapuzzi, 2005: 125
Trichoferus griseus (Fabricius, 1792: 325)
Stromatium unicolor (Olivier, 1795: 58)
Jebusaea hammerschmidtii Reiche, 1878: CLIV
Cerambyx apiceplicatus Pic, 1941: 2
Cerambyx cerdo cerdo Linnaeus, 1758: 392
Purpuricenus apicalis Pic, 1905: 163
Purpuricenus mesopotamicus Al-Ali & İsmail, 1987: 536, 543
Purpuricenus wachanrui Levrat, 1858: 261
Calchaenesthes diversicollis Holzschuh, 1977: 129
Aromia moschata ambrosiaca (Steven, 1809: 40)
Osphranteria coerulescens coerulescens Redtenbacher, 1850: 50
Certallum ebulinum (Linnaeus, 1767: 637)
Certallum thoracicum (Sharp, 1880: 247)
Phymatodes testaceus (Linnaeus, 1758: 396)
Chlorophorus varius damascenus (Chevrolat, 1854: 483)

SUBFAMILY DORCADIONINAE Swainson, 1840: 290

Dorcadion hellmanni Ganglbauer, 1884: 486
Dorcadion irakense Al-Ali & İsmail, 1987: 1
Dorcadion mesopotamicum Breuning, 1944: 12

SUBFAMILY LAMIINAE Latreille, 1825: 401

Apomecyna lameeri (Pic, 1895: 77)
Oberea oculata (Linnaeus, 1758: 394)
Oxylia argentata languida (Ménétriés, 1839: 42)
Mallosia mirabilis mirabilis (Faldermann, 1837: 283)
Phytoecia humeralis humeralis (Waltl, 1838: 471)
Phytoecia pretiosa Faldermann, 1837: 298
Phytoecia kurdistana Ganglbauer, 1884: 572
Phytoecia puncticollis puncticollis Faldermann, 1837: 291
Phytoecia balcanica (Frivaldszky, 1835: 268)
Phytoecia mesopotamica Breuning, 1948: 91
Phytoecia croceipes Reiche & Saulcy, 1858: 17 [RN]
Phytoecia drurei Pic, 1909: 153
Phytoecia geniculata Mulsant, 1862: 420
Phytoecia coerulescens (Scopoli, 1763: 49)
Phytoecia irakensis Breuning, 1967: 435
Agapanthia suturalis (Fabricius, 1787: 149)
Agapanthia frivaldszkyi Ganglbauer, 1884: 546

In Ismail (1983), Iraqi fauna was presented as follows:

FAMILY CERAMBYCIDAE Latreille, 1802: 211

SUBFAMILY PRIONINAE Latreille, 1802: 212

Prinobius myardi Mulsant, 1842: 207 (as *Macrotoma scutellaris*)
Aegosoma scabricorne (Scopoli, 1763: 54) (as *Megopis sinica*)
Mesoprionus angustatus (Jakovlev, 1887: 327) (as *Prionus angustatus*)
Mesoprionus besikanus (Fairmaire, 1855: 318) (as *Prionus besicanus*)
Mesoprionus persicus (Redtenbacher, 1850: 49) (as *Prionus persicus*)

SUBFAMILY LEPTURINAE Latreille, 1802: 218

Stenocorus quercus (Götz, 1783: 74)
Stictoleptura cordigera (Fuessly, 1775: 14)
Stictoleptura rufa (Brullé, 1832: 263)
Stenurella bifasciata (Müller, 1776: 93)
Stenurella jaegeri (Hummel, 1825: 68)

SUBFAMILY CERAMBYCINAE Latreille, 1802: 211

Hesperophanes sericeus (Fabricius, 1787: 152)
Trichoferus griseus (Fabricius, 1792: 325) (as *Hesperophanes griseus*)
Trichoferus preissi (Heyden, 1894: 85) (as *Hesperophanes preissi*)
Jebusaea hammerschmidtii Reiche, 1878: CLIV (as *Jebusaea persica*)
Cerambyx cerdo Linnaeus, 1758: 392
Cerambyx welensii (Küster, 1845: 44) (as *Cerambyx velutinus*)
Purpuricenus dalmatinus Sturm, 1843: 353
Purpuricenus interscapillatus Plavilstshikov, 1937: 247 [RN] (*P. budensis*)
Purpuricenus mesopotamicus Al-Ali & İsmail, 1987: 536, 543 (as *P. mesopotamicus* n. sp. + *Purpuricenus* sp.)
Purpuricenus wachanrui Levrat, 1858: 261
Aromia moschata (Linnaeus, 1758: 391)
Osphranteria coerulescens Redtenbacher, 1850: 50
Certallum ebulinum (Linnaeus, 1767: 637)
Certallum thoracicum (Sharp, 1880: 247)
Plagionotus bobelayei (Brullé, 1832: 253) (as *P. speciosus* and *P. scalaris*)
Chlorophorus sartor (Müller, 1766: 188)
Chlorophorus varius (Müller, 1766: 188)

SUBFAMILY STENOPTERINAE Gistel, 1848: [9] (unnumbered section)

Stenopterus rufus (Linnaeus, 1767: 642)

SUBFAMILY DORCADIONINAE Swainson, 1840: 290

Dorcadion hellmanni Ganglbauer, 1884: 486 (as *D. scopolii* and *D. hampii*)
Dorcadion irakense Al-Ali & İsmail, 1987: 1 (as n. sp.)

SUBFAMILY LAMIINAE Latreille, 1825: 401

Monochamus galloprovincialis (Olivier, 1795: No. 67: 125)
Apomecyna lameeri (Pic, 1895: 77)
Oberea oculata (Linnaeus, 1758: 394)
Oxylia argentata languida (Ménétriés, 1839: 42) (as *O. duponcheli*)
Mallosia mirabilis (Faldermann, 1837: 283)
Coptosia compacta sancta Reiche, 1877: CXXXVI (as *Conizonia* sp.)
Phytoecia humeralis (Waltl, 1838: 471)
Phytoecia puncticollis Faldermann, 1837: 291
Phytoecia caerulea (Scopoli, 1772: 102)
Phytoecia cylindrica (Linnaeus, 1758: 394)
Phytoecia geniculata Mulsant, 1862: 420
Phytoecia molybdaena (Dalman, 1817: 186)
Phytoecia vittipennis Reiche, 1877: CXLI

Agapanthia kirbyi (Gyllenhal, 1817: 186)
Agapanthia suturalis (Fabricius, 1787: 149)
Agapanthia frivaldszkyi Ganglbauer, 1884: 546 (as *A. violacea*)

Moreover, the details on Ismail (1983) are presented as follows:

SUBFAMILY PRIONINAE Latreille, 1802: 212

***Prinobius myardi* Mulsant, 1842: 207 (as *Macrotoma scutellaris*)**
Rawandiz (N Iraq), July 1973, the specimens in the museum of Arbil. According to description of İsmail (1983), examined specimens are females. So the species is confirmed for Iraq.
***Aegosoma scabricorne* (Scopoli, 1763: 54) (as *Megopis sinica*)**
Sulaymaniyah (Biyara) (N Iraq), July 1973, the specimens in the museum of Baghdad: Abu Garip.
Wrong identification as *A. sinicum* that is impossible for Iraq.
***Mesoprionus angustatus* (Jakovlev, 1887: 327) (as *Prionus angustatus*)**
Al Amadiyah, Dahuk (Sersenk) (N Iraq), June 1958, with light traps, the specimens in the museum of Baghdad: Abu Garip. According to description of İsmail (1983), the species is confirmed for Iraq.
***Mesoprionus besikanus* (Fairmaire, 1855: 318) (as *Prionus besicanus*)**
Sulaymaniyah (Bakrajo) (N Iraq), June 1964, the specimens in the museum of Baghdad: Abu Garip. According to description of İsmail (1983), the species is confirmed for Iraq.
***Mesoprionus persicus* (Redtenbacher, 1850: 49) (as *Prionus persicus*)**
Rawandiz (Shaqlawan) (N Iraq), August 1962, with light traps, the specimens in the museum of Entomology in Baghdad.

SUBFAMILY LEPTURINAE Latreille, 1802: 218

***Stenocorus quercus* (Götz, 1783: 74)**
Dahuk (Zawita), Al Amadiyah (N Iraq), May 1944, the specimens in the entomology museum of Baghdad: Abu Garip. The species is confirmed for Iraq. The examined specimens are females according to description of İsmail (1983).
***Stictoleptura cordigera* (Fuessly, 1775: 14)**
Rawandiz (Joman, Mirkah Sur), Sulaymaniyah (Qara Dagh) and Al Amadiyah (N Iraq), June 1970, 1973, 1980, the specimens in the entomology museum of Baghdad: Abu Garip and the natural history museum of Baghdad.
***Stictoleptura rufa* (Brullé, 1832: 263)**
Rawandiz (Mirkah Sur) (N Iraq), June 1973, the specimens in the entomology museum of Arbil.
***Stenurella bifasciata* (Müller, 1776: 93)**
Al Amadiyah (N Iraq), June 1958, the specimens in the entomology museum of Baghdad: Abu Garip.
***Stenurella jaegeri* (Hummel, 1825: 68)**
Arbil (Hasar-i Rost) (N Iraq), July 1971, the specimens in the natural history museum of Baghdad. The species is confirmed for Iraq according to description of İsmail (1983).

SUBFAMILY CERAMBYCINAE Latreille, 1802: 211

***Hesperophanes sericeus* (Fabricius, 1787: 152)**
Rawandiz (Shaqlawan), Al Amadiyah, Salahaddin region (N Iraq), July, the specimens in the entomology museum of Baghdad: Abu Garip and the natural history museum of Baghdad.
***Trichoferus griseus* (Fabricius, 1792: 325) (as *Hesperophanes griseus*)**
Mosul (Sinjar) (N Iraq), May 1982, the specimens in the entomology museum of Baghdad: Abu Garip.

***Trichoferus preissi* (Heyden, 1894: 85) (as *Hesperophanes preissi*)**
Dahuk (Akra) (N Iraq), June 1970, on *Ficus*, the specimens in the entomology museum of Baghdad: Abu Garip. The species is confirmed for Iraq according to description of İsmail (1983).
***Jebusaea hammerschmidtii* Reiche, 1878: CLIV (as *Jebusaea persica*)**
Mosul (Al Kasib) (N Iraq), Al Kifl region (C Iraq), Basra city (S Iraq), June 1961, on *Phoenix*, the specimens in the entomology museum of Baghdad: Abu Garip.
***Cerambyx cerdo* Linnaeus, 1758: 392**
Dahuk (Solaf and Sersenk), August 1981, Sulaymaniyah (Qara Dagh), June 1954, (N Iraq).
***Cerambyx welensii* (Küster, 1845: 44) (as *Cerambyx velutinus*)**
Sulaymaniyah (Suwari Toka) (N Iraq), July 1973, the specimens in the natural history museum of Baghdad. The species is confirmed for Iraq according to description of İsmail (1983).
***Purpuricenus dalmatinus* Sturm, 1843: 353**
Salahaddin, Sulaymaniyah (Izmer), Dahuk (Kani Masi) (N Iraq), May, the specimens in the entomology museum of Baghdad: Abu Garip and the natural history museum of Baghdad. The species is confirmed for Iraq according to description of İsmail (1983).
***Purpuricenus interscapillatus* Plavilstshikov, 1937: 247 [RN] (*P. budensis*)**
Dahuk (Kani Masi), Mosul (Sinjar) (N Iraq), June, the specimens in the entomology museum of Baghdad: Abu Garip. The species is confirmed for Iraq according to description of İsmail (1983).
***Purpuricenus mesopotamicus* Al-Ali & İsmail, 1987: 536, 543 (as *P. mesopotamicus* n. sp. + *Purpuricenus* sp.)**
Salahaddin (N Iraq), May 1982, the specimen in the natural history museum of Baghdad.
***Purpuricenus wachanrui* Levrat, 1858: 261**
Arbil (Haj Omran, Rayat) (N Iraq), May 1981, the specimens in the entomology museum of Baghdad: Abu Garip.
***Aromia moschata* (Linnaeus, 1758: 391)**
Al Amadiyah (N Iraq), July 1981, the specimens in the entomology museum of Baghdad: Abu Garip.
***Osphranteria coerulescens* Redtenbacher, 1850: 50**
Arbil (Khanzad), Sulaymaniyah (Halapja) (N Iraq), May 1982, the specimens in the entomology museum of Baghdad: Abu Garip.
***Certallum ebulinum* (Linnaeus, 1767: 637)**
Baghdad (Abu Garip), Baqubah (CE Iraq), May, on Leguminosae, the specimens in the natural history museum of Baghdad.
***Certallum thoracicum* (Sharp, 1880: 247)**
No data.
***Plagionotus bobelayei* (Brullé, 1832: 253) (as *P. speciosus* and *P. scalaris*)**
Mosul, Zaho (N Iraq), June 1981, the specimens in the entomology museum of Baghdad: Abu Garip as *P. speciosus*. Dahuk: Solaf (N Iraq), June 1964, the specimens in the entomology museum of Baghdad: Abu Garip as *P. scalaris*. So the species is confirmed for Iraq according to description of İsmail (1983).
***Chlorophorus sartor* (Müller, 1766: 188)**
Dahuk (Kani Masi) (N Iraq), June 1975, the specimens in the entomology museum of Baghdad: Abu Garip. The species is confirmed for Iraq according to description of İsmail (1983).
***Chlorophorus varius* (Müller, 1766: 188)**
Baghdad (Kazımiyah), Tarimiyye, Dahuk (Sersenk), Mosul (Hamam Al Alil) (N Iraq), May, the specimens in the entomology museum of Baghdad: Abu Garip and the natural history museum of Baghdad.

SUBFAMILY STENOPTERINAE Gistel, 1848: [9] (unnumb. section)

***Stenopterus rufus* (Linnaeus, 1767: 642)**
Sulaymaniyah (Halapja) (N Iraq), May 1972, the specimens in the entomology museum of Baghdad: Abu Garip. The species is confirmed for Iraq according to description of İsmail (1983).

SUBFAMILY DORCADIONINAE Swainson, 1840: 290

Dorcadion hellmanni **Ganglbauer, 1884: 486 (as *D. scopolii* and *D. hampii*)**
As *D. scopolii,* Mosul (Sinjar Mt.) (N Iraq), May 1973, the specimens in the entomology museum of Baghdad: Abu Garip. As *D. hampii*, Sulaymaniyah (Izmer region) (N Iraq), April 1973, the specimens in the entomology museum of Baghdad: Abu Garip.
Dorcadion irakense **Al-Ali & İsmail, 1987: 1 (as n. sp.)**
Sulaymaniyah (Izmer region) (N Iraq), April 1973. The species was published as a new species by Al-Ali & Ismail (1987).

SUBFAMILY LAMIINAE Latreille, 1825: 401

Monochamus galloprovincialis **(Olivier, 1795: No. 67: 125)**
Rawandiz (Shaklawan) (N Iraq), June, the specimens in the museum of Erbil and Musul. The species is confirmed for Iraq according to description of İsmail (1983).
Apomecyna lameeri **(Pic, 1895: 77) (as *A. arabica*)**
Baghdad (Abu Garip) (CE Iraq), Basra: Zubayr, and Shebce, Saffan, (S Iraq), April, with light traps, the specimens in the entomology museum of Baghdad: Abu Garip.
Oberea oculata **(Linnaeus, 1758: 394)**
Dahuk (Kani Masi region, Solaf) (N Iraq), May-July 1975, 1981, the specimens in the museum of Baghdad: Abu Garip.
Oxylia argentata languida **(Ménétriés, 1839: 42) (as *O. duponcheli*)**
Arbil (Koyer region) (N Iraq), June 1944, the specimens in the museum of Baghdad: Abu Garip. According to description of İsmail (1983), the species is not O. duponcheli.
Mallosia mirabilis **(Faldermann, 1837: 283)**
Arbil (Hasar-i Rost Mt.) (N Iraq), July 1971, the specimens in the Natural history museum of Baghdad.
Coptosia compacta sancta **Reiche, 1877: CXXXVI (as *Conizonia* sp.)**
Dahuk (Shikan region) (N Iraq), May 1955, the specimen in the entomology museum of Baghdad: Abu Garip. According to description of İsmail (1983), the species is confirmed for Iraq.
Phytoecia humeralis **(Waltl, 1838: 471)**
Odeym (CE Iraq) and Sulaymaniyah (Qara Dagh), Mosul (Sinjar) (N Iraq), the specimens in the entomology museum of Baghdad: Abu Garip and natural history museum of Baghdad.
Phytoecia puncticollis **Faldermann, 1837: 291**
Rawandiz (Rayat region) (N Iraq), July 1943, Suleymaniye: Karadagh region (N Iraq), August 1972, the specimens in the entomology museum of Baghdad: Abu Garip and Erbil.
Phytoecia caerulea **(Scopoli, 1772: 102)**
Dahuk (Zawita) (N Iraq), May 1944, the specimens in the entomology museum of Baghdad: Abu Garip. The species is confirmed for Iraq according to description of İsmail (1983).
Phytoecia cylindrica **(Linnaeus, 1758: 394)**
Rawandiz (Shaklawan) (N Iraq), May 1973, the specimens in the entomology museum of Erbil. The species is confirmed for Iraq according to description of İsmail (1983).
Phytoecia geniculata **Mulsant, 1862: 420**
Mosul (Sinjar) (N Iraq), April 1965, the specimens in the entomology museum of Baghdad: Abu Garip.
Phytoecia molybdaena **(Dalman, 1817: 186)**
Sulaymaniyah (Biyara) (N Iraq), May, the specimens in the entomology museum of Baghdad: Abu Garip. The species is confirmed for Iraq according to description of İsmail (1983).
Phytoecia vittipennis **Reiche, 1877: CXLI**
Al Amadiyah (N Iraq), June 1958, the specimens in the entomology museum of Baghdad: Abu Garip. The species is confirmed for Iraq according to description of İsmail (1983).
Agapanthia kirbyi **(Gyllenhal, 1817: 186)**
Mosul (Sinjar region) (N Iraq), May 1963, the specimens in the entomology museum of Baghdad: Abu Garip. The species is confirmed for Iraq according to description of İsmail (1983).

***Agapanthia suturalis* (Fabricius, 1787: 149)**
Baghdad (Abu Garip) (CE Iraq), Salih Castle (S Iraq), Mosul (Sinjar region), Sulaymaniyah (Qara Dagh) (N Iraq), May-June, on Leguminosae, the specimens in the museum of Baghdad: Abu Garip and the museum of Entomology in Baghdad. Ismail (1983) gave the species as A. cardui.
***Agapanthia frivaldszkyi* Ganglbauer, 1884: 546 (as *A. violacea*)**
Mosul (Sinjar region) (N Iraq), June 1968.

As a result of the present study, 20 species and 1 subspecies are added to the Palaearctic Catalogue. Thus, the fauna of Iraq includes 67 taxa (as 66 species and 1 subspecies) now as in the following list (additional taxa to the Palaearctic Catalogue are underlined).

A LIST OF IRAQI CERAMBYCIDAE

- **FAMILY CERAMBYCIDAE Latreille, 1802: 211**
  - **SUBFAMILY PRIONINAE Latreille, 1802: 212**
    - **TRIBE** ERGATINI Fairmaire, 1864: 117
      - **SUBTRIBE -**
        - **GENUS** *ERGATES* Audinet-Serville, 1832: 143
          - **SUBGENUS -**
            - **SPECIES** *E. faber* (Linnaeus, 1760: 187)
              - **SUBSPECIES** *E. faber faber* (Linnaeus, 1760: 187)
    - **TRIBE** MACROTOMINI Thomson, 1861: 312
      - **SUBTRIBE** MACROTOMINA Thomson, 1861: 312
        - **GENUS** *PRINOBIUS* Mulsant, 1842: 207
          - **SUBGENUS -**
            - **SPECIES** *P. myardi* Mulsant, 1842: 207
              - **SUBSPECIES** *P. m. myardi* Mulsant, 1842: 207
    - **TRIBE** AEGOSOMATINI Thomson, 1861: 308
      - **SUBTRIBE -**
        - **GENUS** *AEGOSOMA* Audinet-Serville, 1832: 162
          - **SUBGENUS -**
            - **SPECIES** *A. scabricorne* (Scopoli, 1763: 54)
    - **TRIBE** PRIONINI Latreille, 1802: 212
      - **SUBTRIBE -**
        - **GENUS** *MESOPRIONUS* Jakovlev, 1887: 323
          - **SUBGENUS -**
            - **SPECIES** *M. angustatus* (Jakovlev, 1887: 327)
            - **SPECIES** *M. besikanus* (Fairmaire, 1855: 318)
            - **SPECIES** *M. persicus* (Redtenbacher, 1850: 49)
        - **GENUS** *POGONARTHRON* Semenov, 1900: 257
          - **SUBGENUS -**
            - **SPECIES** *P. semenowi* (Lameere, 1912: 224)
  - **SUBFAMILY LEPTURINAE Latreille, 1802: 218**
    - **TRIBE** RHAGIINI Kirby, 1837: 178
      - **SUBTRIBE -**
        - **GENUS** *STENOCORUS* Geoffroy, 1762: 221
          - **SUBGENUS** *ANISORUS* Mulsant, 1862: 467
            - **SPECIES** *S. quercus* (Götz, 1783: 74)
              - **SUBSPECIES** *S. q. aureopubens* (Pic, 1908: 2)
    - **TRIBE** LEPTURINI Latreille, 1802: 218
      - **SUBTRIBE -**
        - **GENUS** *STICTOLEPTURA* Casey, 1924: 280
          - **SUBGENUS** *STICTOLEPTURA* Casey, 1924: 280
            - **SPECIES** *S. cordigera* (Fuessly, 1775: 14)
              - **SUBSPECIES** *S. c. cordigera* (Fuessly, 1775: 14)

SPECIES *S. rufa* (Brullé, 1832: 263)
SUBSPECIES *S. r. dimidiata* (Daniel & Daniel, 1891: 11)
SUBSPECIES *S. r. rufa* (Brullé, 1832: 263)
SPECIES *S. tripartita* (Heyden, 1889: 329)
GENUS *STENURELLA* Villiers, 1974: 217
SUBGENUS -
SPECIES *S. bifasciata* (Müller, 1776: 93)
SUBSPECIES *S. b. bifasciata* (Müller, 1776: 93)
SPECIES *S. jaegeri* (Hummel, 1825: 68)
SUBFAMILY SAPHANINAE Gistel, 1848: [1]
TRIBE ANISARTHRINI Mamaev & Danilevsky, 1973: 1260
SUBTRIBE -
GENUS *ALOCERUS* Mulsant, 1862: 127
SUBGENUS -
SPECIES *A. moesiacus* (Frivadszky, 1837: 177)
SUBFAMILY CERAMBYCINAE Latreille, 1802: 211
TRIBE HESPEROPHANINI Mulsant, 1839: 61
SUBTRIBE HESPEROPHANINA Mulsant, 1839: 61
GENUS *HESPEROPHANES* Dejean, 1835: 328
SUBGENUS -
SPECIES *H. sericeus* (Fabricius, 1787: 152)
GENUS *TRICHOFERUS* Wollaston, 1854: 427
SUBGENUS -
SPECIES *T. fasciculatus* (Faldermann, 1837: 266)
SUBSPECIES *T. f. fasciculatus* (Faldermann, 1837: 266)
SPECIES *T. fissitarsis* Sama, Fallahzadeh & Rapuzzi, 2005: 125
SPECIES *T. griseus* (Fabricius, 1792: 325)
SPECIES *T. preissi* (Heyden, 1894: 85)
GENUS *STROMATIUM* Audinet-Serville, 1834: 80
SUBGENUS -
SPECIES *S. unicolor* (Olivier, 1795: 58)
GENUS *JEBUSAEA* Reiche, 1878: CLIII
SUBGENUS -
SPECIES *J. hammerschmidtii* Reiche, 1878: CLIV
TRIBE CERAMBYCINI Latreille, 1802: 211
SUBTRIBE CERAMBYCINA Latreille, 1802: 211
GENUS *CERAMBYX* Linnaeus, 1758: 388
SUBGENUS *CERAMBYX* Linnaeus, 1758: 388
SPECIES *C. apiceplicatus* Pic, 1941: 2
SPECIES *C. cerdo* Linnaeus, 1758: 392
SUBSPECIES *C. c. cerdo* Linnaeus, 1758: 392
SPECIES *C. welensii* (Küster, 1845: 44)
TRIBE TRACHYDERINI Dupont, 1836: 1
SUBTRIBE TRACHIDERINA Dupont, 1836: 1
GENUS *PURPURICENUS* Dejean, 1821: 105
SUBGENUS -
SPECIES *P. apicalis* Pic, 1905: 163
SPECIES *P. dalmatinus* Sturm, 1843: 353
SPECIES *P. interscapillatus* Plavilstshikov, 1937: 247 [RN]
SUBSPECIES *P. i. interscapillatus* Plavilstshikov, 1937: 247 [RN]
SPECIES *P. mesopotamicus* Al-Ali & İsmail, 1987: 536, 543
SPECIES *P. wachanrui* Levrat, 1858: 261
GENUS *CALCHAENESTHES* Kraatz, 1863: 97
SUBGENUS -
SPECIES *C. diversicollis* Holzschuh, 1977: 129
TRIBE CALLICHROMATINI Swainson & Shuckard, 1840: 293
SUBTRIBE -
GENUS *AROMIA* Audinet-Serville, 1834: 559

SUBGENUS -
SPECIES *A. moschata* (Linnaeus, 1758: 391)
SUBSPECIES *A. m. ambrosiaca* (Steven, 1809: 40)
GENUS *OSPHRANTERIA* Redtenbacher, 1850: 50
SUBGENUS -
SPECIES *O. coerulescens* Redtenbacher, 1850: 50
SUBSPECIES *O. c. coerulescens* Redtenbacher, 1850: 50
TRIBE CERTALLINI Fairmaire, 1864: 149
SUBTRIBE -
GENUS *CERTALLUM* Dejean, 1821: 111
SUBGENUS -
SPECIES *C. ebulinum* (Linnaeus, 1767: 637)
SPECIES *C. thoracicum* (Sharp, 1880: 247)
GENUS *PHYMATODES* Mulsant, 1839: 47
SUBGENUS *PHYMATODES* Mulsant, 1839: 47
SPECIES *P. testaceus* (Linnaeus, 1758: 396)
TRIBE CLYTINI Mulsant, 1839: 70
SUBTRIBE -
GENUS *PLAGIONOTUS* Mulsant, 1842: 1
SUBGENUS *NEOPLAGIONOTUS* Kasatkin, 2005: 51
SPECIES *P. bobelayei* (Brullé, 1832: 253)
GENUS *CHLOROPHORUS* Chevrolat, 186: 290
SUBGENUS *CHLOROPHORUS* Chevrolat, 1863: 290
SPECIES *C. varius* (Müller, 1766: 188)
SUBSPECIES *C. v. damascenus* (Chevrolat, 1854: 483)
SUBGENUS *PERDEROMACULATUS* Özdikmen, 2011: 537
SPECIES *C. sartor* (Müller, 1766: 188)
SUBFAMILY STENOPTERINAE Gistel, 1848: [9] (unnumbered section)
TRIBE STENOPTERINI Gistel, 1848: [9]
SUBTRIBE -
GENUS *STENOPTERUS* Illiger, 1804: 120
SUBGENUS -
SPECIES *S. rufus* (Linnaeus, 1767: 642)
SUBSPECIES *S. r. syriacus* Pic, 1892: 22
SUBFAMILY DORCADIONINAE Swainson, 1840: 290
TRIBE DORCADIONINI Swainson, 1840: 290
SUBTRIBE -
GENUS *DORCADION* Dalman, 1817: 397
SUBGENUS *CRIBRIDORCADION* Pic, 1901: 12
SPECIES *D. hellmanni* Ganglbauer, 1884: 486
SPECIES *D. irakense* Al-Ali & İsmail, 1987: 1
SPECIES *D. mesopotamicum* Breuning, 1944: 12
SUBFAMILY LAMIINAE Latreille, 1825: 401
TRIBE MONOCHAMINI Gistel, 1848: [9]
SUBTRIBE -
GENUS *MONOCHAMUS* Dejean, 1821: 106
SUBGENUS *MONOCHAMUS* Dejean, 1821: 106
SPECIES *M. galloprovincialis* (Olivier, 1795: No. 67: 125)
TRIBE APOMECYNINI Thomson, 1860: 66
SUBTRIBE -
GENUS *APOMECYNA* Dejean, 1821: 108
SUBGENUS *APOMECYNA* Dejean, 1821: 108
SPECIES *A. lameeri* (Pic, 1895: 77)
TRIBE PHYTOECIINI Mulsant, 1839: 191
SUBTRIBE -
GENUS *OBEREA* Dejean, 1835: 351
SUBGENUS *OBEREA* Dejean, 1835: 351
SPECIES *O. oculata* (Linnaeus, 1758: 394)

GENUS *OXYLIA* Mulsant, 1862: 398
SUBGENUS -
SPECIES *O. argentata* (Ménétriés, 1832: 227)
SUBSPECIES *O. a. languida* (Ménétriés, 1839: 42)
GENUS *MALLOSIA* Mulsant, 1862: 399
SUBGENUS *SEMNOSIA* Daniel, 1904: 304
SPECIES *M. mirabilis* (Faldermann, 1837: 283)
SUBSPECIES *M. mirabilis* (Faldermann, 1837: 283)
GENUS *COPTOSIA* Fairmaire, 1864: 177
SUBGENUS *COPTOSIA* Fairmaire, 1864: 177
SPECIES *C. compacta* (Ménétriés, 1832: 228)
SUBSPECIES *C. c. sancta* Reiche, 1877: CXXXVI
GENUS *PHYTOECIA* Dejean, 1835: 351
SUBGENUS *HELLADIA* Fairmaire, 1864: 176
SPECIES *P. humeralis* (Waltl, 1838: 471)
SUBSPECIES *P. h. humeralis* (Waltl, 1838: 471)
SPECIES *P. pretiosa* Faldermann, 1837: 298
SUBGENUS *MUSARIA* Thomson, 1864: 121
SPECIES *P. kurdistana* Ganglbauer, 1884: 572
SPECIES *P. puncticollis* Faldermann, 1837: 291
SUBSPECIES *P. p. puncticollis* Faldermann, 1837: 291
SUBGENUS *NEOMUSARIA* Plavilstshikov, 1928: 123
SPECIES *P. balcanica* (Frivaldszky, 1835: 268)
SPECIES *P. mesopotamica* Breuning, 1948: 91
SUBGENUS *PHYTOECIA* Dejean, 1835: 351
SPECIES *P. caerulea* (Scopoli, 1772: 102)
SUBSPECIES *P. c. caerulea* (Scopoli, 1772: 102)
SPECIES *P. croceipes* Reiche & Saulcy, 1858: 17 [RN]
SPECIES *P. cylindrica* (Linnaeus, 1758: 394)
SPECIES *P. drurei* Pic, 1909: 153
SPECIES *P. geniculata* Mulsant, 1862: 420
SUBGENUS *OPSILIA* Mulsant, 1862: 387
SPECIES *P. coerulescens* (Scopoli, 1763: 49)
SPECIES *P. irakensis* Breuning, 1967: 435
SPECIES *P. molybdaena* (Dalman, 1817: 186)
SUBGENUS *BLEPISANIS* Pascoe, 1866: 365
SPECIES *P. vittipennis* Reiche, 1877: CXLI
SUBSPECIES *P. v. vittipennis* Reiche, 1877: CXII
TRIBE AGAPANTHIINI Mulsant, 1839: 172
SUBTRIBE -
GENUS *AGAPANTHIA* Audinet-Serville, 1835: 35
SUBGENUS *SYNTHAPSIA* Pesarini & Sabbadini, 2004: 121
SPECIES *A. kirbyi* (Gyllenhal, 1817: 186)
SUBGENUS *AGAPANTHIA* Audinet-Serville, 1835: 35
SPECIES *A. suturalis* (Fabricius, 1787: 149)
SUBGENUS *SMARAGDULA* Pesarini & Sabbadini, 2004: 128
SPECIES *A. frivaldszkyi* Ganglbauer, 1884: 546

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TWO NEW SPECIES OF THE GENUS *SCHIZOPELEX* MC LACHLAN, FROM NORTHERN TURKEY (TRICHOPTERA, SERICOSTOMATIDAE)

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[Sipahiler, F. & Pauls, S. 2012. Two new species of the genus *Schizopelex* Mc Lachlan, from northern Turkey (Trichoptera: Sericostomatidae). Munis Entomology & Zoology, 7 (1): 184-190**]**

ABSTRACT: Two new species of the genus *Schzopelex*, *S. yenicensis* Sipahiler & Pauls sp. n. and *S. boluensis* Sipahiler sp. n. (Sericostomatidae) from northwestern Turkey are described and figured. A brief description and illustrations of *S. anatolica* Schmid, 1964, based on the specimen collected from type locality are also given. The new species are closely related to each other and to *S. anatolica*.

KEY WORDS: Trichoptera, taxonomy, new species, *Schizopelex*, Sericostomatidae, northwestern Turkey.

The small genus *Schzopelex* Mc Lachlan with eight described species, is distributed mostly in the eastern Mediterranean region, namely, the Balkans, Turkey, the Caucasus and Iran, only two species are found in western Europe. In Turkey the genus well represented by seven species, including the new species *S. yenicensis* Sipahiler & Pauls sp. n., and *S. boluensis* Sipahiler sp. n., described in the present paper (Sipahiler, 2005, 2011). In the Balkans and Iran the genus is represented by one species each; in the Caucasus two species are found, which are also recorded in northeastern Turkey (Sipahiler, 2005, Oláh, 2010).

Schmid described *S. anatolica* based on one male collected from Akşehir (Schmid, 1964), given only the lateral and ventral aspects, which are insufficient to see the differences between it and the new species. Thus, a brief description and illustrations of this species are given, based on the specimen collected from the type locality. After that, *S. anatolica* was discovered in a few localities around Ankara province; the specimens that collected from one of such locality (Çubuk, Karagöl), were regarded as a variation for this species (Çakın, 1981). The figures of this specimen are stated as the variation of *S. anatolica* in the Atlas of European Trichoptera, with a mistake in the arrangement of the figures of the male genitalia, namely, the lateral aspect of the Karagöl specimen was put on the right-hand side with the figures of the *S. anatolica* specimen, it should has been on the left-hand side of the page (Malicky, 2004: 288). An example similar to this specimen, with the unusual lower branch of the inferior appendage having two short projections at the apex was rediscovered in northwestern Turkey and is described in the present paper as a new species, *S. boluensis* Sipahiler sp. n. It is closely related to *S. yenicensis* Sipahiler & Pauls sp. n., also having two apical projections on the lower branch of the inferior appendage but much longer.

MATERIALS AND METHODS

specimens were collected by hand net. For the code of the depository the abbreviation CD is used. The holotype of *Schzopelex yenicensis* Sipahiler & Pauls, sp. n., was collected by S. Pauls and deposited in Senckenberg Museum, Germany, other specimens were collected by F. Sipahiler and deposited in her collection in the Biology Education Department at Hacettepe University.

DESCRIPTIONS

Schzopelex yenicensis Sipahiler & Pauls, sp. n.
(Figs. 1-5)

Material: Holotype ♂: Turkey, Karabük, Bolkuş, Yenice direction, 41° 09' N/ 32° 27' E, 230 m, 9.6.2011, leg. Pauls, coll. Senckenberg Museum (Frankfurt am Main), Germany.

Antennae black, scapus long and broad, the ratio of scapus/eye diameter is 0.77; maxillary palps are blackish, rather thin, curved upwards; wings blackish; labial palps blackish; forewings sparsely and hind wings densely white spotted; the anterior wing has two large white spots located on the end of the discoidal cell and the media; thorax and abdomen dorsally black, intersegmental areas whitish; coxa and two-third of the length of the femur of the legs black, the rest of the femur and tibia yellow; first and the second tarsal segments yellow, the rest are blackish. The length of the anterior wing of male is 12.5 mm.

Male genitalia (Figs. 1-5): The sides of the anterior edges of segment IX broadly dilated; the ventral part strongly sclerotized, in ventral view, the ventromedian portion is almost membranous, its posterior margin roundly dilated and a rounded lobe protrudes on the median part, the apical margin of this lobe is sclerotized and possesses five long setae. The preanal appendage is nearly quadrangular, apical edge rounded. In dorsal view, the median part of segment X is triangular, narrowing towards the apex; the sclerotized side projections are long and straight; in dorsal view, the inner edges are roundly dilated on the subdistal portions, the apex is pointed; in lateral view, the ventral projections of segment X are long, straight and thin; in ventral view, slightly curved inside. In lateral view, the dorsal branch of the inferior appendage broadly dilated dorsally, the posterior edge roundly excised on the ventral portion, the ventral edge is shorter than the dorsal portion; the ventral branch of the inferior appendage is broad, strongly sclerotized, the apical part bifurcated, the upper branch of which is thin, longer than the ventral branch and subdistally curved inside, the lower branch is directed posteriorly, both are pointed at the apex. The phallic apparatus is long, apical part somewhat broad, the sides with sclerotized bands, which make two rounded bands ventrally.
The female is unknown.

Etymology: This species is named after the place around where the specimens were collected.

Schzopelex boluensis Sipahiler, sp. n.
(Figs. 6-10)

Material: Holotype ♂: Turkey, Bolu, Yedigöller, (CD: U-138), 780 m, 40° 52' N/ 31° 41' E, 10.6.2005, leg. and coll. Sipahiler; paratypes: Turkey, Ankara, Çubuk, Karagöl, 40° 21' N/ 32° 59' E, (Code of Depository: U-3-4), 9.7.1980, 2 ♂, leg. Çakın, coll. Sipahiler.

Antennae, maxillary palps head and thorax dark brown blackish, scapus long and broad, the ratio of scapus/eye diameter is 0.75; legs brown, wings dark brown; anterior wings with sparsely white spotted between costa and radius, the forewing with two large white spots located at the end of the Discoidal cell and the Media; hind wings with a few small spots. The length of the anterior wing of male is 12.5 mm.

Male genitalia (Figs. 6-10): The sides of the anterior edges of segment IX broadly dilated, the apex is also broad; the ventromedian portion is membranous, broadly trapezoidal, bearing a few setae at the tip. The preanal appendage is elongated oval. In dorsal view, the dorsolateral branch of segment X rather long, the subdistal part somewhat broader, curving on the sides, narrowing towards the rounded apex; the ventrolateral projection is sinuate, thin narrowing at the tip; in lateral view, it is broad, the apex is rounded. In lateral view, the dorsal edge of the dorsal branch of the inferior appendage is rounded, the posterior edge with two excisions on the ventral half, forming a small median lobe and a ventral lobe, which is slightly longer than the median one; the ventral branch of the inferior appendage is strongly sclerotized, broad at the base, the ventral edge is roundly dilated in the middle, narrowing on the subdistal portion, the distal part becoming somewhat broader, forming two short projections, which are pointed at the apex. The phallic apparatus becomes narrower and curved before the base, dilating towards the tip.
The female is unknown.

Etymology: This species is named after the place around where the specimens were collected.

Remarks: *Schzopelex yenicensis* Sipahiler & Pauls, sp. n. and *S. boluensis* Sipahiler, sp. n., differ from the other species of the genus *Schzopelex* by many parts of the male genitalia, especially the shape of the lower branch of the inferior appendage, which is broad, bifurcated, possessing two projections apically. Both new species are closely related to each other by having two projections on the lower branch of the inferior appendage, which are short in *S. boluensis* and long in *S. yenicensis*. The following differences are also seen in the male genitalia: In *S. yenicensis* the dorsolateral projections of segment X are long, knife-shaped, acute at the tips, and the ventolateral projections are short and thin, while in *S. boluensis*, the dorsolateral projections of segment X are shorter and rounded at the apex; the ventrolateral projections of segment X are rather long and broad. In *S. yenicensis*, the dorsal branch of the inferior appendage has a rounded excision on the posterior edge, and the ventral edge is shorter than the dorsal edge, in *S. boluensis*, the apical edge of the dorsal branch of the inferior appendage has two excisions on the ventral portion; the lower branch of *S. yenicencis* is very broad, almost quadrangular at the basal part, possessing two long projections apically; in *S. boluensis*, the lower branch is narrower subdistally and possesses two short projections at the apex; in *S. yenicensis*, the membranous ventromedian process of segment IX with a median rounded lobe, while in *S. boluensis* it is largely trapezoidal.

Both these new species are related to *S. anatolica*, differ from this species by the lower branch of the inferior appendage, which is bifurcated in the new species and in *S. anatolica* gradually narrower towards the tip; the posterior edge of the dorsal branch has a long, oval ventral lobe, while in *S. yenicensis* it has a large and short lobe and *S.boluensis* has two short lobes. In *S. anatolica*, in dorsal view, the ventrolateral projections of segment X are rather broad, only slightly narrower than the dorsolateral projections, which are thin in the new species. In addition, the scapus of *S. anatolica* is smaller than that of these new species.

Schzopelex anatolica Schmid, 1964
(Figs. 11-15)

Material: Turkey, Ankara, Kalecik, Baykuş Boğazı, (CD: U-1), 22.6.1980 2 ♂, 1 ♂; same place, 15.6.1981, (CD: U-5), 23 ♂, 17 ♀; same place, 3.7.1981,(CD: U-7), 3 ♂, 3 ♀; Bolu, Abant, 19.6.1982, (CD: U-16), 2 ♂, 1 ♀; same place, 6.6.1983, 2 ♂; Çankırı, Ilgaz Mountains, Kadın Çayırı, 27.5.1984, (CD: U-20), 2 ♀; Ankara, Elmadağ, Eymir direction, 4.6.1988, (CD: U-49), 11 ♂, 8 ♀; Konya, Akşehir, Sultan Mountains, Saray Village, direction Yalvaç, Yellibel, 1500 m, 11.6.1994, (CD: U-87), 8 ♂; same place, 1800 m, 12.6.1994, (CD: U-93), 1 ♂, 2 ♀; Bolu, Abant, 1400 m, 24.6.1995, (CD: U-99), 15 ♂, 5 ♀; same place, 21.6.1999, (CD: U-117), 5 ♂, 4 ♀; same place, Bulanık Yaylası, 26.6.1999, (CD: U- 120), 2 ♂; Bolu, Gölcük, 27.6.1999, (CD: U-123) 1 ♂; Samsun, Yakakent, Durağan direction, 1235 m, Kızlan, 14.7.2009, (CD: U-164), 2 ♂, 1 ♀; Sinop-Çorum province border, Ilgaz Mountains, Pelit Yaylası, 1446 m, (CD: U-167), 11.7.2009, 15 ♂, 1 ♀, same place, 15.8.2009, (CD: U-169), 4 ♂, leg. and coll. Sipahiler.

Antennae blackish, scapus shorter, the ratio of scapus/eye diameter is 0.62; maxillary palps somewhat broader than those of the related species; dark brown-blackish; the wings are dark brown, fore and hind wings spotted; fore wing with two larger spots on the discoidal cell and media; the legs are pale brown, tarsi brown. The length of the anterior wing of male is 12.5-13 mm.

Male genitalia (Figs.11-15): In lateral view, the sides of the anterior edges of segment IX dilated forming a triangle, the apex is narrow. In dorsal view, the sclerotized dorsolateral projections of segment X are directed posteriorly, the apex are rounded, only slightly curving on the sides; the ventrolateral branch is slightly narrower than the dorsolateral branch, straight at the base, directed subdistally towards the dorsolateral branch; in lateral view, the dorsolateral branch pointed at the tip. The preanal appendage is dorsally broadly oval. In lateral view, the dorsal branch of the inferior appendage with a large and long ventral lobe on the posterior margin; the ventral branch is pointed at the apex. The phallic apparatus is somewhat curved at the base.

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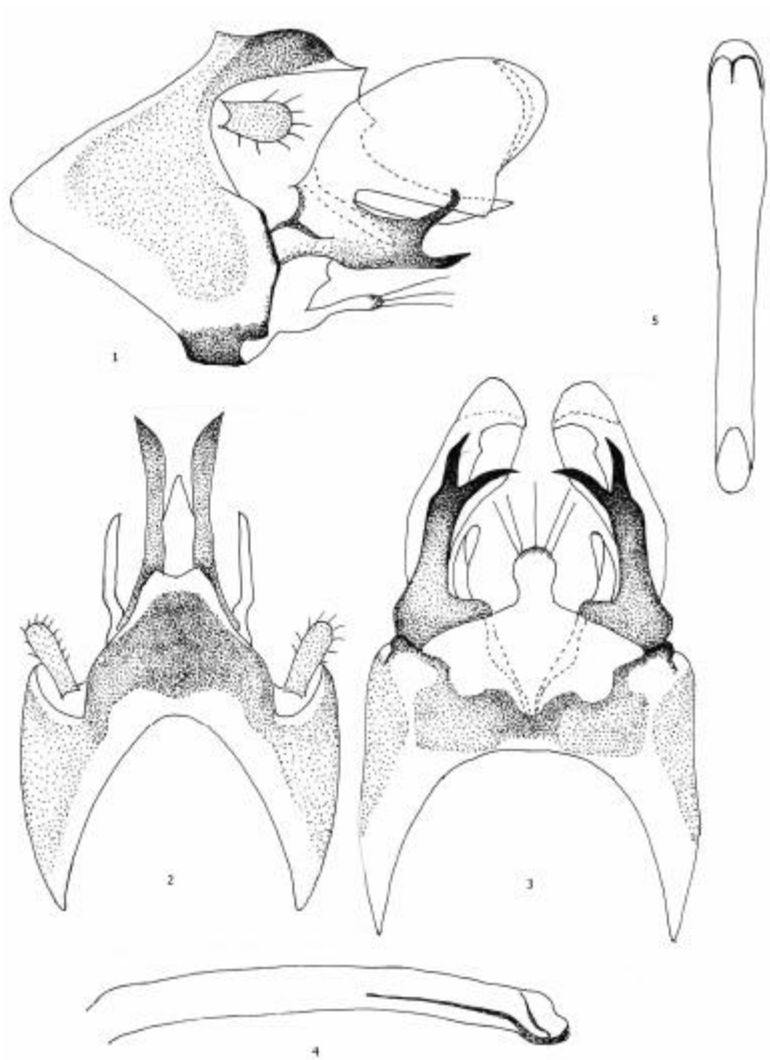
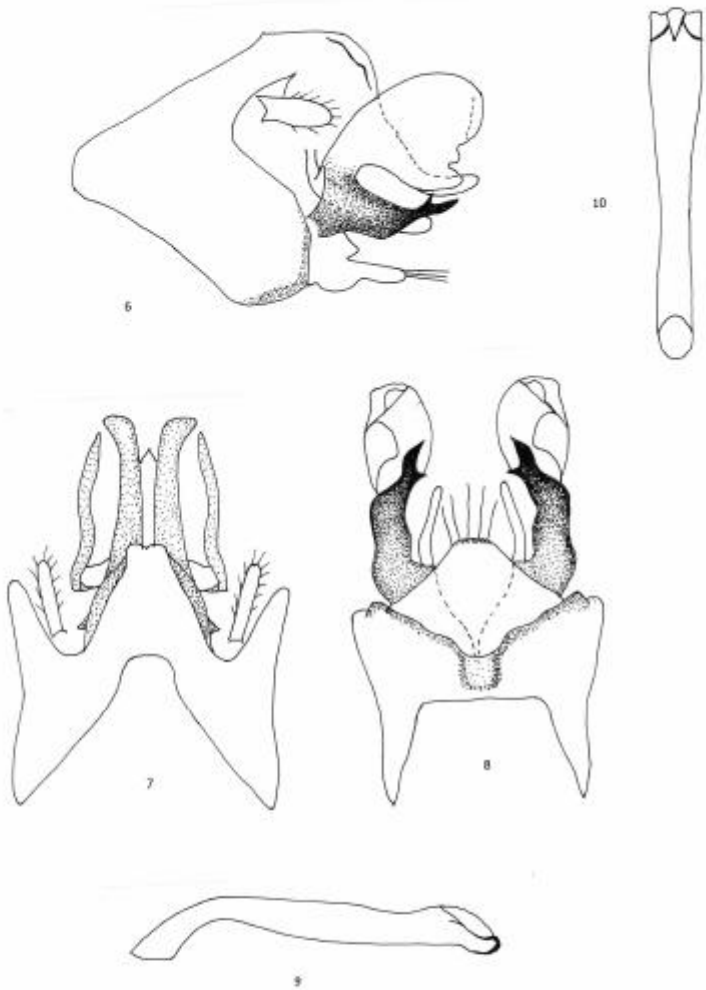
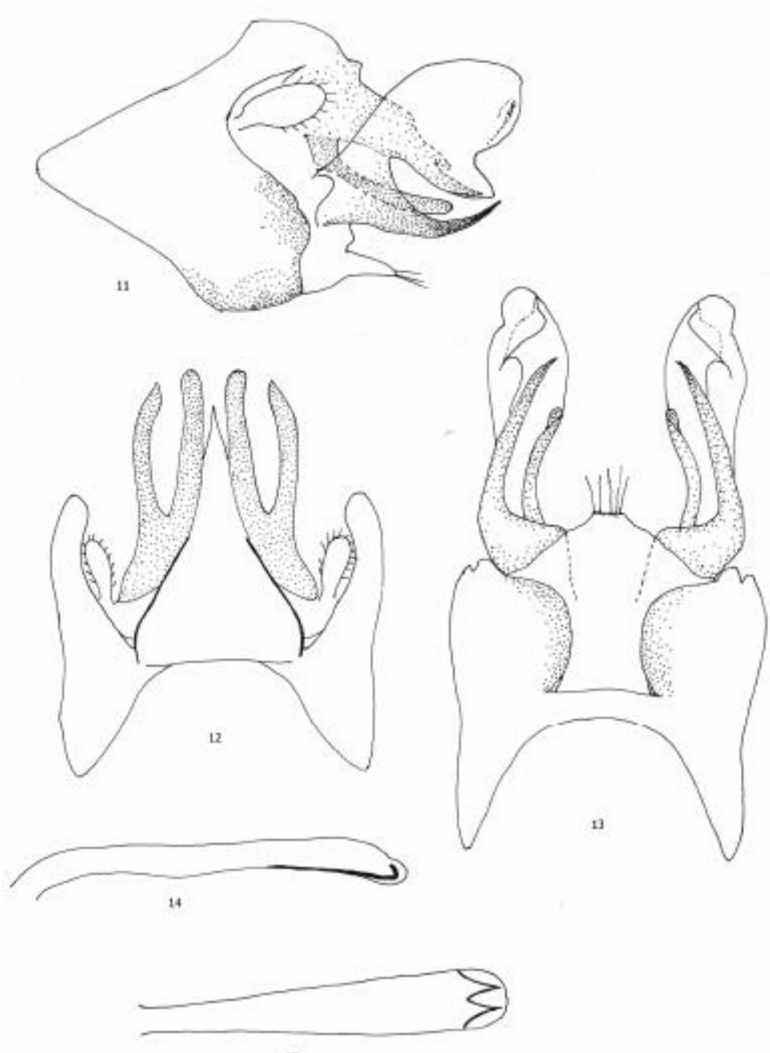


Figures 1-5. *Schzopelex yenicensis* Sipahiler & Pauls, sp. n. Male genitalia: 1. lateral; 2. dorsal; 3. ventral; 4. phallic apparatus, lateral; 5. phallic apparatus, ventral.



Figures 6-10. *Schzopelex boluensis* Sipahiler, sp. n. Male genitalia: 6. lateral; 7. dorsal; 8. ventral; 9. phallic apparatus, lateral; 10. phallic apparatus, ventral.



Figures 11-15. *Schzopelex anatolica* Schmid, 1964, Male genitalia: Male genitalia: 11. lateral; 12. dorsal; 13. ventral; 14. phallic apparatus, lateral; 15. phallic apparatus, ventral.

SEXUAL RECOGNITION AND MATING BEHAVIOR OF THE POPULUS LONGICORN BEETLE, *BATOCERA LINEOLATA* (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT: We studied the sexual recognition and mating behavior of *B. lineolata* by video tracking capture system (EthoVision 3.1) and field observation, for laying the foundation of the effective control of *Batocera lineolata* Chevrolat (Coleoptera: Cerambycidae) and enrich the reproductive behavior of the insect. The result showed that, during the encountering, the intersection time of two tracks and net relative movements for female-male group were longer than female-female group or male-male group; while the reaction time was shorter than the latters. A complete mating of *B. lineolata* included three stages, i.e. Pair-bonding, Mating and Post-copulatory guarding. The average time of Pair-bonding is 2.16 mins, and 10.28 mins, 5.37 mins for Mating and Post-copulatory guarding, respectively. In mating experiments with different sex ratios, the mating number fluctuated regularly, and it was greatly different in mating number for male or female individuals. The virgin female or male, takes more total mating time longer duration for single mating, higher insert genital frequency than un-virgin ones. The mating on the host plant had higher mating rate and longer duration time than on the open ground. The mating behavior in the field test was similar with that in the laboratory experiment.

KEY WORDS: *Batocera lineolata*, Mating, Sexual recognition, Behavior analysis.

Longhorn or longicorn beetles are a large group of beetles with more than 35,000 species (Lawrence, 1982) and the reproductive strategy of species is variant. However, only about 80 species have been studied in the aspect of reproductive behavior so far (Hanks, 1999). The longhorn beetle has a nature of multiple mating. For example, *Anoplophora glabripennis* (Motsoh) fed in the cagecan copulate 38 times through the whole life at most , and 28.25 times averagely (Zhang et al., 1997). Before the mating, there is no complicated courtship. When female and male individuals encountered, it is easy for them to mate. But the duration of single mating is different - (Hanks, 1999; He & Huang, 1993). During the study on the behavior of longicorn beetle, He and Huang (1993) found that the mating behavior of adult *A. glabripennis* involved five stages, i.e. Lingering, Approaching, Taking place, Wing licking and Mating. Those experts such as Yang et al. (2007) said that a complete mating process of *Monochamus alternatus* (Hope) included three stages, i.e. Encountering pair-bonding, Mating and Post-copulatory guarding. Li (1999) found that non-contact olfactory recognition did not play a leading role in the process of spouse seeking of *A. glabripennis*, and the mating action of adults generally started with the vision stimulation of female adults to the male adults. Through the observation in details at each stage from the encountering to mating display of *Philus antennatus* adults, Yin (1996) found that male adults were active and could recognize the female within a short distance, and the mating process involved five stages, i.e. Chasing, Mounting dorsally, Insertion of genetalia, Abdominal spasms and Ejaculation. Wang (2002), Wang and Davis (2005) stated that the sexual pheromone was not used during the mating behavior of *Zorion guttigerum* (Westwood), and host features played an important role in their mating.

Batocera lineolata Chevrolat (Coleoptera: Cerambycidae) is an important wood-boring insect that damages many hardwoods, such as *Populus* spp., *Juglans regia* (L.), *Fagus engleriana* (Seem), *Rosa multiflora* (Thunb), *Viburnum awabuki* (K.), *Betula luminifera* (H.Winkl), and *Ligustrum lucidum* (Ait) (Sun & Zhao, 1991). *B. lineolata* mainly distributed in China, Vietnam, Japan, India, Burma (Chen et al., 1959). *B. lineolata* is the main wood-boring insect on *Populus* spp.in the central and southern part of China, and badly affects the construction of forestry eco-environment and the development of *Populus* spp. Industry (Chen & Luo, 2001). In recent years, *J. regia* in the north part of China also seriously suffered from the damage. More than 70% trees have been attacked, which becomes an important factor that restrains the development of *J. regia* (Wang et al., 2004).

B. lineolata adult is the unique insect with behavior-orientation expressed in obvious taxis to the host plant, and the taxis is to meet nutrition needs for reproduction activities (Yan et al., 1997). So, after-emergence of *B. lineolata* is the key stage both for reseach and preventing them from large areas. And the research on the mating behavior of *B. lineolata* not only can lay the foundation for effective control of *B. lineolata*, but also can enrich the study of insect reproductive behavior.

MATERIAL AND METHOD

Insect source

Adult virgin *B. lineolata*: collected from *Populus* in Luojiang County in Deyang, China in late April 2010. These adult longicorn beetles had just finished their emergence and had not mated. Put these beetles in two cages (60 cm x 60 cm x 60 cm, stainless steel mesh) at room temperature (25 ± 2) by female and male separately until mating experiment, feeding them with *R. multiflora*.

Sexual recognition

There were three groups in the experiment, i.e. two females, two males, one female and one male (no size difference between two *B. lineolatas* and no malformation). In automation of behavioral experiments, we placed two *B. lineolata* of one group into a fixed area, and use video tracking system to record the activities. Then use behavior analysis software (EthoVision3.1) (Noldus Information Technology Co. Ltd. located in Netherland) to compare the encountering situations of *B. lineolata* among different groups. Repeat the experiment for 8 times, and record for 20 s each time.

Laboratory mating

At the room temperature (25 ± 2), 4 pairs of collected *B. lineolata* with same emergence time (no size difference between females and males, who have been fed for 8 days after the emergence) was marked by different numbers - on the abdomen of the female and the backside of the male, placed in one cage (60 cm x 60 cm x 60 cm, stainless steel mesh) with *R. multiflora*. And put fresh pieces of

Populus spp. (Length: 100 cm; Φ: 15 cm) in the cage to lure the oviposition. Change the *R. multiflora* and pieces of *Populus* spp. - every 2 days.

Using the method of Ji's (Ji et al., 1996) to identify mated *B. lineolata*. Record the duration of first-copulate and re-copulate of each individual.

Every day, observed from 8:00-20:00. After 20:00 removed the male from the cage, fed separately, then put them back to the original cage next morning to continue the experiment.

The experiment continued 4 days. Repeated for 4 times.

Field mating

In late April, 2010, in the *Populus* in Luojiang County in Deyang, China, we observed mating *B. lineolata* on *R. multiflora* twigs from 8:00-20:00 every day. The observation lasted for 10 days.

Multiple mating

After the emergence, *B. lineolata* gathered on the feeding plant for extra nutrition, seeking partner and mating (Yan et al., 1997). This random gather will cause different mating ratios between male and female adults; as a result, mating number will be different.

In this experiment, *B. lineolata* adults from homochronous emergence was placed into mating cage (30 cm x 30 cm x 30 cm, stainless steel) with female-male ratio of 1:1, 2:2, 3:3, 4:4 and feed them by *R. multiflora* at room temperature (25 ± 2). Observe their behaviors from 8:00-20:00 every day. Observe for 4 days continuously and repeat the experiment for 3 times.

Statistical analysis

Statistical analysis was performed using the SPSS 10.0 statistical package (SPSS Inc., Chicago, IL). A one-factor randomized complete block analysis of variance (ANOVA) was conducted on the behavior analysis instrument data. Fisher`s protected least significant difference (LSD) multiple comparison procedure was used in the behavior analysis instrument of sexual recognition of *B.lineolata* adults. Independent sample *T* was used to check and compare the influences from the different mating experience of the females and males on mating behavior.

RESULT AND ANALYSIS

Sexual recognition

Encountering between a female and another female (Fig. 1-1,2,3,4): There is always certain distance between two females, and they will change their crawling direction to avoid each other after antennae or leg touching. It is rarely for them to stand against each other and fight.

Encountering between one male and another male (Fig. 2): in most cases, they will avoid contact with others (Fig. 2-2,3). In few cases, they will stand against each other and display their strength by friction sound between rear part of the prothorax and medithorax (Fig. 2-4). In extremly few cases, they will fight when the conflict is intensified. During the fighting, their antennas and legs will be bitten off by the opponent. Finally, the loser will flee (Fig. 2-1).

Encountering between a male and a female (Fig. 3): if the male has no intention to copulate, they will change their crawling direction to avoid each other (Fig. 3-1). Otherwise, it will follow the female and contact her body with his antennae. When he gets closer to the female, he will use his maxillary palps and labial palps to lick the pronotum and elytra of the female constantly, clasp and ride on her back and bend his abdomen. If the female defies, the mating cannot be made although the male has an obvious abdomen spasms, but if the female obeys, they can mate successfully (Fig. 3-2,3,4).

The result of sexual recognition behavior experiment indicated that intersection time for two tracks (F=61.70, P<0.01) and net relative movement (F=274.20, P<0.01) for a female and male are significantly longer than that for two females or two males. In above three groups, it is clear that reaction time for female-male group (F=147.89, P<0.01) is significantly shorter than that for the other two groups. But there is no significant difference in the velocity of three groups (F=1.05, P>0.05) (refer to Table. 1).

Mating behavior

The observation of mating behavior in the laboratory reveals that the entire mating process of *B. lineolata* includes three stages, i.e. Pair-bonding (male and female contact each other until the female agrees to mate), Mating (the genital of male mated with the genital of the female) and Post-copulatory guarding (after mating completion and the sepeartion of their genitals, their bodies still kept to be contacted). The average time required for a complete mating is 17.81 minutes, including average time of 2.16±0.015 (mean±SE) min for pair-bonding (n=121), 10.28±0.191 min for total mating (n=169), 23.4±0.059 s (n=955) for single mating and 5.37±0.035 min for post-copulatory guarding (n=121) (Table 2).

The observation of field mating behavior continued for 10 days. All mating behaviors were observed on host plant, including the average time of 3.69±0.04 min for pair-bonding, 32.54±0.564 min for total mating time (n=5), 65.62±1.423 s for single mating (n=5) and 15.73±0.342 min of the post-copulatory guarding (n=5) (Table 3).

Multiple mating

In the mating experiments with different sex ratios (Table 4), it was found that mating frequency fluctuated as the female and male ratio varied. When the sex ratio of female-male is 3:3, the frequency of mating can reach the maximum, i.e. female is 12.33±2.19 (mean±SE, range: 8-18 times) times, male is 18.00±2.85 (range: 18-5 times) times; while the number down to the minimum, i.e. female is 9.33±2.40 (range: 21-4 times) times, male is 9.07±0.88 (range: 20-6 times) times if the ratio is 4:4.

Influences from different mating experiences on mating behavior

If it is the first mating both for the female and male, the total time of mating (female: F=4.10, df=2, P<0.05; male: F=4.20, df=2, P<0.05) and post-copulatory guarding (female: F=2.59, df=2, P<0.05; male: F=11.47, df=2, P<0.05) shall be longer than that for those females or males who experienced previous mating(s). And mating number of the former shall be far more than that for the latter (female: F=5.23, df=2, P<0.05; male: F=4.92, df=2, P<0.05). But the pair-bonding for experienced females (F=14.66, df=2, P<0.05) or males (F=10.14, df=2, P<0.05) is far more than that for the males or females who take the first mating(Table 5).

Influences from different mating places on mating behavior

When *B. lineolata* mate on the host plant (F=5.10, df=4, P<0.05), the mating rate and duration time shall be higher than that for on the open ground (Table 6).

DISCUSSION

During the study on mating behavior of *B. lineolata*, many scholars regard the process from the insertion of internal sac to ejaculation completion as a complete mating process (Hanks, 1999; Zhang et al., 2006). In fact, the mating of longicorn beetle is a complicated process that is related to several stages before and after the mating (Yang et al., 2007). This study found that the complete mating process of *B. lineolata* included three stages: Pair-bonding, Mating and Post-copulatory guarding. And there is no obvious courtship. When a male meets a female, he will use the maxillary palpi and labial palpi to lick the pronotum and elytra of the female constantly, clasp and ride on her back and bend his abdomen. If the female obeys, the mating will be completed successfully. There are many factors which can affect the mating of *B. lineolata*, but the most important environmental factor is the temperature. When the temperature is low, the mating usually happens between 10:00-14:00; when it is high, it usually happens in the evening or at dawn (Yan et al., 1997).

It was discovered from the multiple mating test of *B. lineolata* that the male will choose some to mate when there are enough females for them. Xiang and Yang (2008) thought that the male may want to devote their limited resources to those females who have stronger reproduction abilities. When one female stays with more than 2 males or one male stays with more than 2 females, their mating capacities will be increased a lot. The result shows sex ratio can play a great influence upon the mating capacity of the female and male *B. lineolata*.

Generally, remote gather of *B. lineolata* adults will be achieved through attraction function of the host plant. During their habitation activity on the host plant, both female and male adults will approach for close gather caused by common taxis to micro habitat of host plants in specific areas. Mostly, when male *B. lineolata* meet females, they will crawl to the female promptly and make the mating. In mating activities, contact semiochemicals in female *B. lineolata* is very important for contact stimulation in males (Yang, 2008). During the mating process of *B. lineolata* adults, the direct contact will inspire the sexual excitation of the male to chase the female, clasp and ride on her back, bend his abdomen, and finally insert his internal sac to finish the mating. In this paper, it is indicated that the host plant not only plays an important role in the remote communication between different sexes of *B. lineolatas*, but also plays an obvious effect on the success rate of the mating. It is demonstrated by the study that the odor of host plant can strengthen the reactions of *Aphis glycines* (Matsumura), *Agrotis segetum* (Denis & Schiffermüller), *Trichoplus ni* (Hübner) and *Cyrtotrachelus buqueti* (F.) to the semiochemicals (Du et al., 1994; Hansson et al., 1989; Landolt et al., 1994; Yang et al., 2010). Further study is required to confirm the existence in *B. lineolata*.

During mating experiments of *B. lineolata*, many pair-bonding activities between males were observed. Usually males started pair-bonding with other males and tried to mate regardless of the sex. And the male who were pair-bonded would not defy but kept motionless, and the male who made pair-bonding would perform some mating behaviors such as abdomen spasms. During the experiment, it was seldom to find pair-bonding between females, which was only observed once. Pair-bonding with the same sex is also reported in the study on *M. alternatus* (Fauziah et al., 1987; Kim et al., 1992; Yang et al., 2007; Zhang et al., 2006). The reason for it needs further study.

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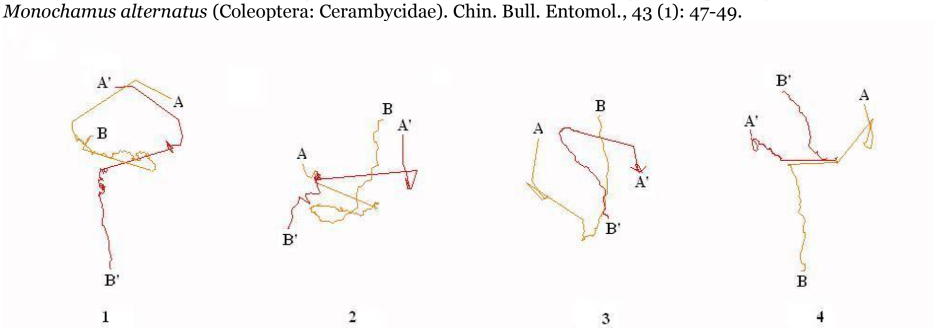

Figure 1. Encountering tracks of two females. 1-4. Behavior track acted unruly. Note: A-B and A'-B' are movement tracks of two *B. lineolata*, which starts from point A and A' and ends with point B and B'. Sic passim.

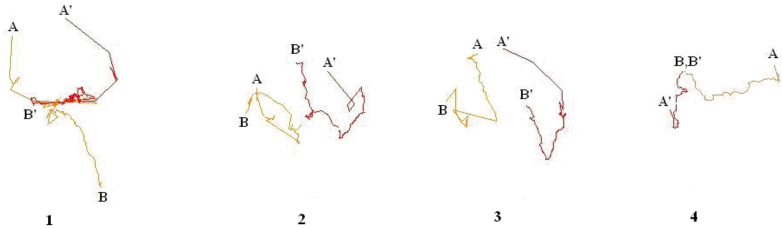

Figure 2. Encountering tracks of two males. 1.Two tracks contacted temperately, and then separated; 2-3. Parallel track; 4. Two tracks adjacency.

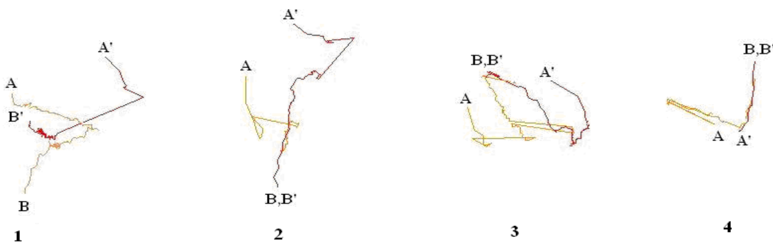

Figure 3. Encountering tracks of one female and one male. 1. Two tracks crossed and then separated; 2-4. Two tracks combined to be a line.

Table 1. Analysis upon sexual encountering behavior of *Batocera lineolata*.

	Intersection time for two tracks (s)	Velocity (cm/s)	Net Relative Movement (cm)	Reaction time (s)
Two Females	0.13±0.05B	9.78±0.56A	0.01±0.01C	1.68±0.03A
Two Males	0.10±0.06B	8.38±0.39A	0.08±0.01B	1.03±0.16B
One Female and One Male	2.50±0.24A	9.93±1.83A	0.28±0.14A	0.40±0.15C

Note: The data in the table indicate mean±SE, and different capital letters followed in the same line means the significant difference (P<0.05), ANOVA followed by LSD.

Table 2. Duration at each stage of mating behavior of *Batocera lineolata* in the laboratory.

	Number of Observations	Maximum	Minimum	Mean±*SE*
Pair-bonding (min)	121	16.72	0.05	2.16±0.015
Total time of mating (min)	169	82.85	0.12	10.28±0.191
Mating frequency	98	27	1	7.60±0.110
Duration of single mating (s)	955	257.00	2.00	23.40±0.059
Post-copulatory guarding (min)	121	86.52	0.03	5.37±0.035

Table 3. Duration at each stage of mating behavior of *Batocera lineolata* in the field.

	Number of Observations	Maximum	Minimum	Mean±SE
Pair-bonding (min)	5	7.25	0.13	3.69±0.040
Total time of mating (min)	5	60.82	4.25	32.54±0.564
Mating frequency	5	16	1	8.50±0.152
Duration of single mating (s)	5	127.00	4.24	65.62±1.423
Post-copulatory guarding (min)	5	31.23	0.22	15.73±0.342

Table 4. Mating number of *Batocera lineolata* at different sex ratios.

Sex ratio	Female			Male		
(♂:♀)	Mean±SE	Maximum	Minimum	mean±SE	Maximum	Minimum
1: 1	10.00±0.58B	10	8	10.00±0.33C	10	8
2: 2	11.67±0.33A	14	10	14.00±1.73B	23	1
3: 3	12.33±2.19A	18	8	18.00±2.85A	18	5
4: 4	9.33±2.40B	21	4	9.15±0.88D	20	4

Note: The data in the table refer to mean±SE, and different capital letters followed in the same line means obvious difference ($P<0.05$), ANOVA followed by LSD.

Table 5. Influences from different mating experiences on duration at each stage of the mating behavior of *Batocera lineolata* in the laboratory (mean±SE).

		Pair-bonding	Total time of mating	Post copulatory guarding	Mating frequency
Female	(n=16) First mating	0.64±0.08	17.76±2.14*	5.91±1.43*	9.60±0.45*
	(n=48) Mating again	2.23±0.30*	8.10±1.22	3.73±0.42	7.41±0.22
Male	(n=16) First mating	1.01±0.04	20.56±2.14*	7.34±2.41*	10.42±0.60*
	(n=48) Mating again	2.19±0.18*	6.49±0.89	3.88±1.32	7.54±0.20

*$P<0.05$ (t-test)

Table 6. Influence from different mating places on mating behavior of *Batocera lineolata* (mean±SE).

Mating Place	Mating Rate (%)	Minimum (min)	Maximum (min)	Mean±SE (min)
Host	67.30	6.00	52.00	33.29±2.94*
Open Ground	44.20	0.50	26.00	8.29±1.65

*$P<0.05$ (t-test)

ON THE MYGALOMORPHS (ARANEAE: MYGALOMORPHAE) IN THE COLLECTION OF ENTOMOLOGY LABORATORY, UNIVERSITY OF CALCUTTA

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ABSTRACT: Six mygalomorphs of the family Idiopidae and Theraphosidae are dealt with. The taxa, *Heligmomerus* Simon, *H. barkudensis* (Gravely, 1921), *H. garoensis* (Tikader, 1977) comb. nov. and *Chilobrachys khasiensis* (Tikader, 1977) are reported for the first time from the state of West Bengal and *Chilobrachys stridulans* (Wood Mason, 1877) from Arunachal Pradesh. All these rare and poorly known mygalomorphs are diagnosed and illustrated in the interest of Indian Arachnology.

KEY WORDS: Taxonomy, Mygalomorphae, *Chilobrachys*, *Heligmomerus*, new record, West Bengal, Arunachal Pradesh.

Spiders of the infraorder Mygalomorphae or primitive spiders belong to 15 families (Raven, 1985; Platnick, 2011). Indian mygalomorphs are now placed within 8 of the 15 families namely Atypidae, Barychelidae, Ctenizidae, Dipluridae, Hexathelidae, Idiopidae, Nemesiidae and Theraphosidae (Sebastian & Peter, 2009; Platnick, 2011). Till date, a total of 83 species under 23 genera are known from India (Platnick, 2011). Wood-Mason (1877), Cambridge (1883, 1885, 1890), Simon (1884, 1888, 1891, 1892, 1897, 1906), Pocock (1895, 1899a,b,1900a,b), Hirst (1909), Gravely (1915, 1921, 1935), Chamberlin (1917), Tikader (1969, 1977), Barman (1978), Biswas & Biswas (1992), Coyle (1995), Schmidt (2003), Molur & Siliwal (2004), Molur et al. (2004), Smith (2004, 2006), Rao et al. (2005, 2006), Siliwal et al. (2007, 2009a,b, 2010), Siliwal (2009), Siliwal & Molur (2009a,b), Javed et al. (2010) and Siliwal & Raven (2010) studied the Indian mygalomorphs.

In the past two decades during our survey on the spiders in the states of North-East India we came across with 6 mygalomorph species under 2 genera viz. *Heligmomerus barkudensis* (Gravely, 1921) and *H. garoensis* (Tikader, 1977) comb. nov. [Idiopidae]; *Chilobrachys hardwickei* (Pocock, 1895), *C. himalayensis* (Tikader, 1977), *C. khasiensis* (Tikader, 1977) and *C. stridulans* (Wood Mason, 1877) [Theraphosidae]. Out of these *H. barkudensis* (Gravely), *H. garoensis* (Tikader, 1977) comb. nov. and *C. khasiensis* (Tikader) are reported for the first time from West Bengal while *C. stridulans* (Wood Mason) from Arunachal Pradesh. It is worthwhile to mention that all 6 species are so far known to be endemic to India. *Chilobrachys himalayensis* (Tikader), *C. khasiensis* (Tikader) and *H. garoensis* (Tikader) comb. nov. are recorded nearly after three decades. The above named species are treated sensu Raven (1985), Dippenaar-Schoeman (2002), Siliwal & Raven (2010) and Siliwal et al. (2010).

These rarely known Indian mygalomorphs otherwise demand serious attention because of their economic, medicinal and toxicological values. Accordingly, we are tempted to diagnose- illustrate and indicate new distributional range of the recorded mygalomorph species following the present trend on spider taxonomy.

MATERIAL AND METHODS

Mygalomorphs were collected and preserved following Tikader (1987) and Barrion & Litsinger (1995). The materials were studied under Stereo Zoom Binocular Microscopes, model Olympus SZX-7 and Zeiss SV-11. The measurements indicated in the text are in millimeters, made with an eye piece graticule. Leg measurements are shown as: total length (femur, patella, tibia, metatarsus, tarsus).

Abbreviations used: CL= Cephalothorax length, CW= Cephalothorax width, AL= Abdominal length, AW= Abdominal width, TL= Total length, AME= Anterior median eyes, ALE= Anterior lateral eyes, PME= Posterior median eyes, PLE= Posterior lateral eyes, PMS= Posterior median spinnerets, PLS= Posterior lateral spinnerets.

All material are in the deposition of Entomology Laboratory, Department of Zoology, University of Calcutta.

TAXONOMIC ACCOUNT

Family: Idiopidae Simon

Heligmomerus Simon, 1892: 90-91.

Type species: Heligmomerus taprobanicus Simon, 1892.
Distribution: Africa, India and Sri Lanka (Dippenaar-Schoeman, 2002; Siliwal et al., 2010; Platnick, 2011).
Remark: The genus is reported for the first time from West Bengal.

Heligmomerus barkudensis (Gravely, 1921)

(Figures. 1-10, 58)

Acanthodon barkudensis Gravely, 1921: 399.
Idiops barkudensis (Gravely), Roewer, 1942: 155.
Heligmomerus barkudensis (Gravely), Siliwal, Molur & Raven, 2010: 941.

Material examined: 1♀, Sodepur, North 24 PGS, West Bengal, India, 19.iv.2005, coll. S. Basu, S. Biswas and A. Roy.

Measurements (♀)*:* CL- 6.93, CW- 6.53, AL- 8.66, AW- 6.33, TL- 15.59.

Eye group 1.25 long and 1.53 wide. Eye diameter: AME=0.17, ALE=0.35, PME=0.14, PLE=0.28. Inter ocular distance: AME–AME=0.10, ALE–AME=0.42, ALE–ALE=0.08, PME–PME= 0.42, PLE–PME=0.14, PLE–PLE=0.96, ALE–PLE=0.71, AME–PME=0.14.

Chelicerae: length=3.43 and width=2.08.

Legs: I 11.20 (0.6, 3.0, 1.11, 3.55, 2.11, 1.44); II 10.54 (3.11, 1.66, 3.0, 1.77, 1.0); III 9.43 (3.33, 1.22, 2.22, 1.66, 1.0); IV 15.42 (5.0, 2.55, 2.88, 3.22, 1.77). Leg formula 4123.

Spinneret length: PMS=0.43, PLS=2.75; Inter spinneret distance: PMS–PMS=0.25, PLS–PLS=0.87.

Distribution: India: Orissa (Siliwal et al., 2010; Platnick, 2011); West Bengal (new record).

Remark: Siliwal et al. (2010) provided a detail description of *Heligmomerus barkudensis* (Gravely). Besides being longer than those described by Siliwal et al. (2010), the species shows differences in the number of cheliceral teeth (6/5), blunt spines in rastellum (27) and number of cuspules in labium and maxillae (12 & 95).

Heligmomerus garoensis (Tikader, 1977) **comb. nov.**
(Figures. 11-19, 59)

Acanthodon garoensis Tikader, 1977: 306.
Idiops garoensis (Tikader), Brignoli, 1983: 115.

Material examined: 1♂, Scotish Church College campus, Kolkata, West Bengal, India, other data not available.

Diagnosis: Cephalothorax densely warty; eye diameter PLE>AME>ALE>PME, ALE situated far away from AME on clypeal edge; promargin and retromargin of chelicerae with 5 and 4 teeth respectively, cheliceral rastellum with 9 blunt, stout spines; tarsal claw 3, paired claw with 2 denticles; leg formula 4123; male palp (figs.17-18): tibia basally bulging, with a prolateral excavation, bearing short, thorn-like spines arranged in a half-circle.

Measurements (♂)*:* CL- 5.29, CW- 5.0, AL- 5.11, AW- 3.41, TL- 10.40.

Eye group 1.20 long and 1.0 wide. Eye diameter: AME=0.16, ALE=0.12, PME=0.09, PLE=0.19. Inter ocular distance: AME–AME=0.14, ALE–AME=0.31, PME–PME= 0.36, PLE–PME=0.40, PLE–PLE=0.81, ALE–PLE=0.68, AME–PME=0.16.

Chelicerae: length=2.0 and width=1.10.

Legs: I 10.97 (3.88, 1.22, 2.55, 2.44, 0.88); II 10.75 (4.44, 1.22, 2.77, 1.55, 0.77); III 8.08 (2.88, 0.88, 1.55, 1.66, 1.11); IV 11.87 (4.33, 1.33, 2.77, 2.44, 1.0). Leg formula 4123.

Spinneret length: PMS=0.37, PLS=1.25; Inter spinneret distance: PMS–PMS=0.29, PLS–PLS=0.44.

Distribution: India: Meghalaya (Tikader, 1977; Platnick, 2011); West Bengal (new record).

Remark: Somatic structures of the aforesaid species are strongly coherent to the diagnosis of *Heligmomerus* Simon (for details of diagnosis see Dippenaar-Schoeman, 2002; Siliwal *et al.,* 2010). We therefore propose a new combination *Heligmomerus* Simon for *Idiops garoensis* Tikarder.

Family: Theraphosidae Thorell
Chilobrachys Karsch, 1891: 271.

Type species: *Chilobrachys nitelinus* Karsch, 1891.
Distribution: South East Asia, India (Raven, 1985; Schmidt, 2003; Zhu & Zhang, 2008; Platnick, 2011)

Chilobrachys hardwickei (Pocock, 1895)
(Figures. 20-30, 60)

Musagetes hardwickii Pocock, 1895: 174.

Chilobrachys hardwickii (Pocock), Pocock, 1900: 198.

Material examined: 3♀♀, Dinhata, Cooch Behar, West Bengal, India, 29.ix.2007, coll. D. Raychaudhuri; 1♀ & 1♂, Gorumara, Gorumara National Park, West Bengal, India, 06.v.2008, coll. S. Sen; 1♀, Beleghata, Kolkata, West Bengal, India, 05.v.2009, coll. S. Saha.

Diagnosis: Eye diameter AME>ALE>PME>PLE; cephalothorax longer than metatarsus and tarsus together of leg IV and shorter than patella and tibia together of leg I; tarsal claw 2, each with 3 denticles (tarsi IV without denticle); leg formula 1423; labium and maxillae with ca. 610 and ca. 341cuspules respectively, prolateral side of maxillae with a row of paddle setae and few thorn setae; retrolateral side of chelicerae with distinct spinules; spermatheca 1 pair, elongate, broad at base, medially narrowed, apically broad, clubbed; male palpal bulb pear like, embolus long, flat, broad, suddenly narrowed towards apex, inwardly twisted near base, prolateral superior and inferior keels evident.

Measurements (♀): CL-11.30, CW-8.88, AL-12.0, AW-6.44, TL-23.30.

Eye group 1.14 long and 1.82 wide. Eye diameter: AME=0.42, ALE=0.39, PME=0.35, PLE=0.32. Inter ocular distance: AME–AME=0.17, ALE–AME=0.10, ALE–ALE=1.25, PME–PME=0.85, PLE–PME=0.08, PLE–PLE=1.32, ALE–PLE=0.25, AME–PME=0.10.

Chelicerae: length=6.81 and width=4.72.

Legs: I 30.42 (9.66, 3.33, 8.22, 5.33, 3.88); II 26.70 (7.77, 3.22, 7.0, 5.44, 3.27); III 23.53 (5.66, 2.77, 6.22, 5.0, 3.88); IV 29.31 (7.44, 2.88, 8.22, 6.55, 4.22). Leg formula 1423.

Spinneret length: PMS=2.77, PLS=10.60; Inter spinneret distance: PMS–PMS=0.44, PLS–PLS=2.66.

Distribution: India: Andhra Pradesh, Chhattisgarh, Kerala, Maharashtra, West Bengal (Pocock, 1900; Schmidt, 2003; Rao et al. 2005; Sebastian & Peter, 2009; Platnick, 2011).

Chilobrachys himalayensis (Tikader, 1977)
(Figures. 31-40, 61)

Phlogiodes himalayensis Tikader, 1977: 317.
Chilobrachys himalayensis (Tikader), Siliwal & Raven, 2010: 73.

Material examined: 1♂, Kharagpur town, West Midnapur, West Bengal, India, 15.vi.2004, coll. S. P. Paria.

Diagnosis: Eye diameter ALE>AME=PLE>PME; cephalothorax shorter than patella and tibia together of leg I and longer than metatarsus and tarsus together of leg IV; tarsal claw 2, each with 2 denticles (tarsi I and IV without denticle); leg formula 1423; anterior $3/4^{th}$ of metarsus IV without scapulae; labium and maxillae with ca. 502 and ca. 298 cuspules; prolateral side of maxillae with a row of paddle setae and few thorn setae; retrolateral side of chelicerae with distinct spinules; male palpal bulb globose, compressed at both ends, embolus long, straight, gradually narrowed and apically pointed.

Measurements (♂): CL-10.40, CW-8.77, AL-11.66, AW-5.77, TL-22.06.

Eye group 1.0 long and 1.96 wide. Eye diameter: AME=0.28, ALE=0.42, PME=0.14, PLE=0.28. Inter ocular distance: AME–AME=0.28, ALE–AME=0.21, ALE–ALE=1.35, PME–PME=0.89, PLE–PME=0.14, PLE–PLE=1.42, ALE–PLE=0.21, AME–PME=0.16.

Chelicerae: length=6.27 and width=4.27.

Legs: I 31.53 (8.77, 4.55, 9.44, 5.11, 3.66); II 24.08 (6.66, 3.33, 7.55, 3.77, 2.77); III 21.31 (6.55, 1.66, 5.55, 4.44, 3.11); IV 26.89 (8.11, 2.22, 8.11, 5.22, 3.33). Leg formula 1423.

Spinneret length: PMS=1.77, PLS=6.0; Inter spinneret distance: PMS–PMS=0.77, PLS–PLS=1.88.

Distribution: India: West Bengal (Sebastian & Peter, 2009; Siliwal & Raven, 2010; Platnick, 2011).

Remark: Chilobrachys himalayensis (Tikader) was previously known only from the type locality but during the present survey it was sampled from other location in West Bengal.

Chilobrachys khasiensis (Tikader, 1977)

(Figures. 41-49, 62)

Ischnocolus khasiensis Tikader, 1977: 314.
Chilobrachys khasiensis (Tikader), Siliwal, 2009: 533.

Material examined: 2♀♀, Kalipur, Gorumara National Park, West Bengal, India, 29.ix.2007, coll. B. Debnath.

Diagnosis: Eye diameter AME=ALE>PLE>PME; cephalothorax longer than patella and tibia together of leg I and nearly equal to the length of tarsus and metatarsus together of leg IV; tarsal claw 2, each with 4 denticles; leg formula 4123; anterior half of metatarsus IV without scapulae, metatarsi I and II weakly scopulate; labium and maxillae with ca. 430 and ca. 290 cuspules respectively; prolateral side of maxillae with a row of paddle setae and few thorn setae; retrolateral side of chelicerae with strong, pointed spinules; spermatheca 1 pair, elongate, triangular, basally broad.

Measurements (♀): CL-11.75, CW-8.33, AL-11.60, AW-6.44, TL-23.35.

Eye group 1.10 long and 1.77 wide. Eye diameter: AME=0.38, ALE=0.38, PME=0.27, PLE=0.33. Inter ocular distance: AME–AME=0.17, ALE–AME=0.10, ALE–ALE=1.25, PME–PME= 0.85, PLE–PME=0.08, PLE–PLE=1.30, ALE–PLE=0.24, AME–PME=0.12.

Chelicerae: length=6.88 and width=4.50.

Legs: I 27.78 (7.21, 2.80, 7.22, 6.55, 4.0); II 26.29 (7.0, 3.22, 7.4, 5.4, 3.27); III 23.64 (5.77, 2.77, 6.0, 5.22, 3.88); IV 30.56 (7.44, 3.33, 8.22, 7.33, 4.24). Leg formula 4123.

Spinneret length: PMS=2.10, PLS=7.0; Inter spinneret distance: PMS–PMS=0.40, PLS–PLS=2.60.

Distribution: India: Meghalaya (Siliwal, 2009; Sebastian & Peter, 2009; Platnick, 2011); West Bengal (new record).

Chilobrachys stridulans (Wood Mason, 1877)
(Figures. 50-57, 63)

Mygale stridulans Wood-Mason, 1877: 281.
Chilobrachys stridulans (Wood Mason), Pocock, 1900: 198.

Material examined: 1♀ (damaged), Doimukh, Arunachal Pradesh, India, 15.i.2005, coll. M. K. Biswas.

Diagnosis: Eye diameter ALE=PLE>AME>PME; cephalothorax longer than patella and tibia together of leg I and shorter than metatarsus and tarsus together of leg IV, tarsal claw 2, each with 2 denticles; labium and maxillae with ca. 569 and ca. 300 cuspules respectively, prolateral side of maxillae with a row of large paddle setae; retrolateral side of chelicerae with distinct spinules; spermatheca 1 pair, basally broad, outwardly curved, closely approximating, apically round.

Measurements (♀): CL-10.20, CW-8.55, AL-11.44, AW-6.11, TL-21.60.

Eye group 1.03 long and 1.64 wide. Eye diameter: AME=0.28, ALE=0.32, PME=0.21, PLE=0.32. Inter ocular distance: AME–AME=0.32, ALE–AME=0.12, ALE–ALE=1.14, PME–PME= 0.87, PLE–PME=0.07, PLE–PLE=1.35, ALE–PLE=0.21, AME–PME=0.16.

Chelicerae: length=6.81 and width=5.0.

Legs: I 24.19 (6.66, 3.55, 5.77, 4.33, 3.88); II 18.52 (4.88, 1.66, 4.66, 3.77, 3.55); III 17.14 (5.77, 2.22, 4.44, 2.44, 2.27); IV 29.31 (7.66, 3.77, 6.33, 7.22, 4.33). Leg formula 4123.

Spinneret length: PMS=1.50, PLS=5.92; Inter spinneret distance: PMS–PMS=0.44, PLS–PLS=1.66.

Distribution: India: Assam (Pocock, 1900; Schmidt, 2003; Sebastian & Peter, 2009; Platnick, 2011); Arunachal Pradesh (new record).

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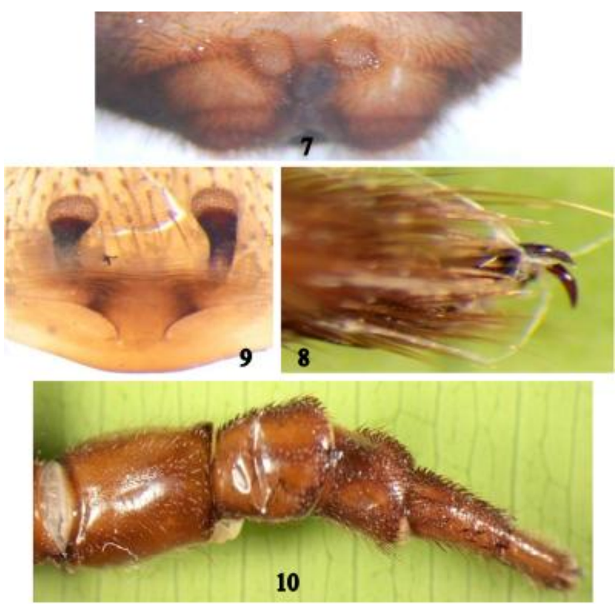
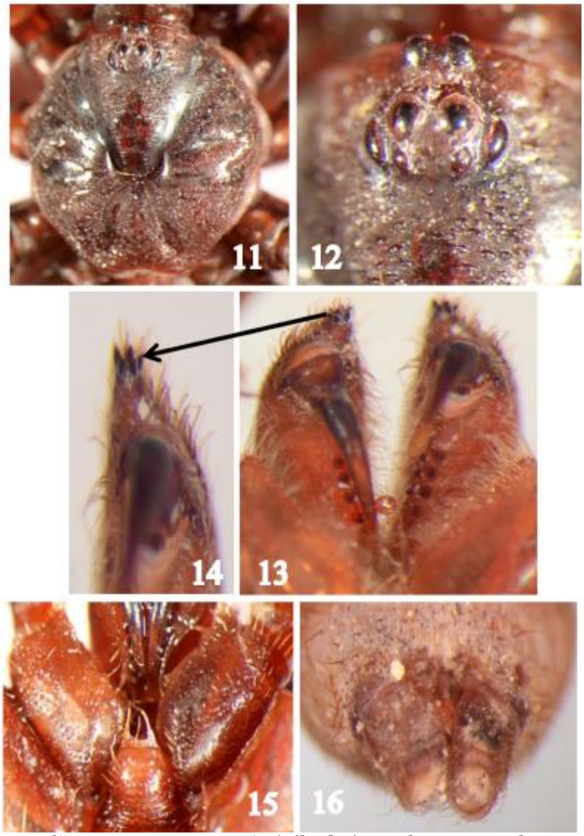
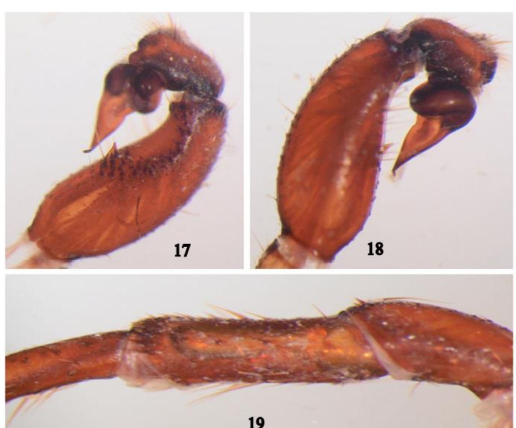
Figures 1-6: *Heligmomerus barkudensis* (Gravely): Female: 1. Cephalothorax, dorsal view; 2. Eyes, dorsal view; 3. Chelicerae, ventral view; 4. Cheliceral rastellum; 5. Labium and Maxillae, ventral view; 6. Sternum, ventral view.



Figures. 7-10: *Heligmomerus barkudensis* (Gravely): Female: 7. Spinnerets, ventral view; 8. Tarsal claw; 9. Spermathecae, dorsal view; 10. Leg III, retrolateral view.

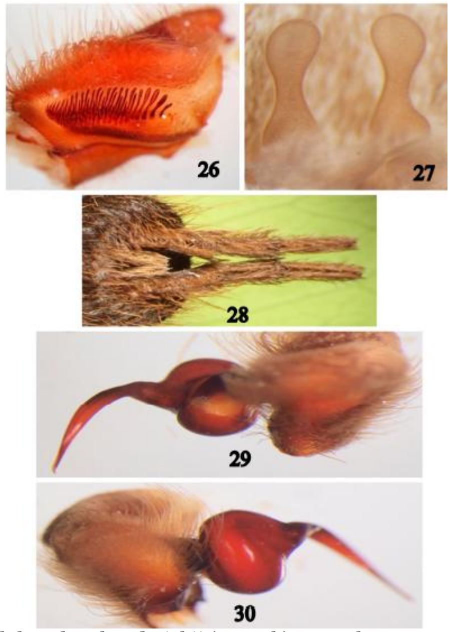


Figures. 11-16: *Heligmomerus garoensis* (Tikader) comb. nov.: Male: 11. Cephalothorax, dorsal view; 12. Eyes, dorsal view; 13. Chelicerae, ventral view; 14. Cheliceral rastellum; 15. Labium and Maxillae, ventral view; 16. Spinnerets, ventral view.

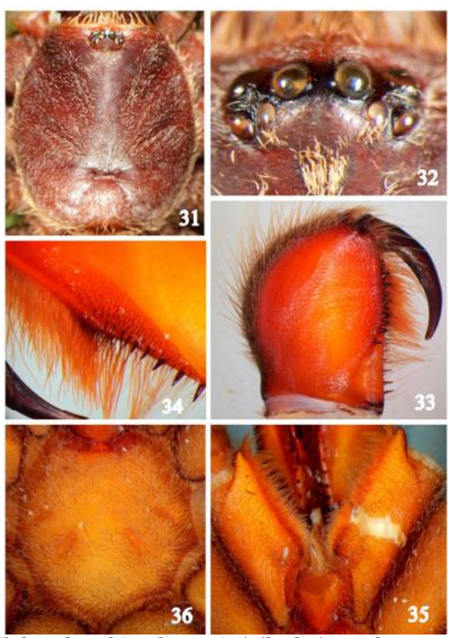


Figures. 17-19: *Heligmomerus garoensis* (Tikader) comb. nov.: 17. Palp, prolateral view; 18. Palp, retrolateral view. 19. Leg III, retrolateral view.

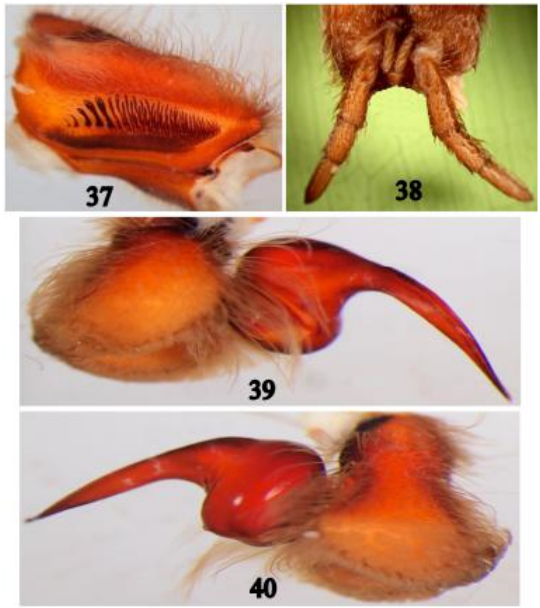
Figures. 20-25: *Chilobrachys hardwickii* (Pocock): Female: 20. Cephalothorax, dorsal view; 21. Eyes, dorsal view; 22. Chelicerae, prolateral view; 23. Chelicerae, retrolateral view; 24. Labium and Maxillae, ventral view; 25. Sternum, ventral view.



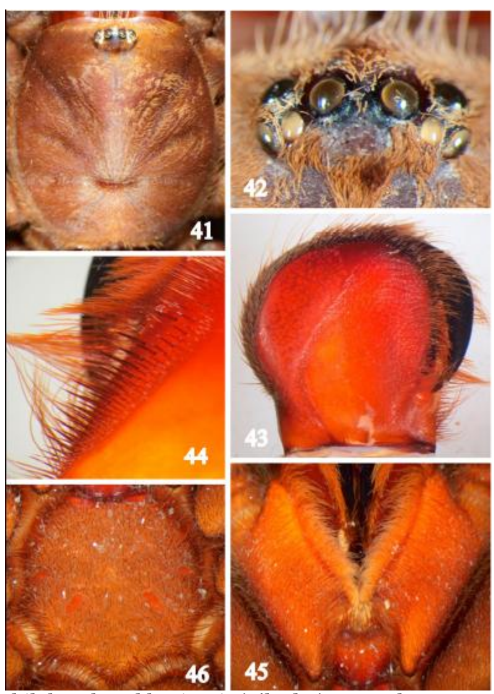
Figures. 26-30: *Chilobrachys hardwickii* (Pocock): Female: 26. Maxillae, prolateral view, 27. Spermathecae, dorsal view; 28. Spinnerets, ventral view; Male: 29. Palp, prolateral view; 30. Palp, retrolateral view.



Figures. 31-36: *Chilobrachys himalayensis* (Tikader): Male: 31. Cephalothorax, dorsal view; 32. Eyes, dorsal view; 33. Chelicerae, prolateral view; 34. Chelicerae, retrolateral view; 35. Labium and Maxillae, ventral view; 36. Sternum, ventral view.

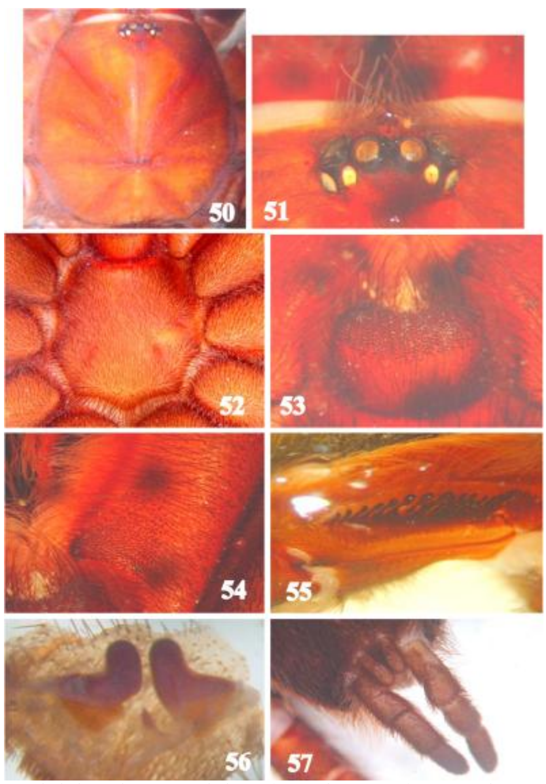


Figures. 37-40: *Chilobrachys himalayensis* (Tikader): Male: 37. Maxillae, prolateral view, 38. Spinnerets, ventral view; Male: 39. Palp, prolateral view; 40. Palp, retrolateral view.



Figures. 41-46: *Chilobrachys khasiensis* (Tikader): Female: 41. Cephalothorax, dorsal view; 42. Eyes, dorsal view; 43. Chelicerae, prolateral view; 44. Chelicerae, retrolateral view; 45. Labium and Maxillae, ventral view; 46. Sternum, ventral view.

Figures. 47-49: *Chilobrachys khasiensis* (Tikader): Female: 47. Maxillae, prolateral view, 48. Spermathecae, dorsal view; 49. Spinnerets, ventral view.



Figures. 50-57: *Chilobrachys stridulans* (Wood Mason): Female: 50. Cephalothorax, dorsal view; 51. Eyes, dorsal view; 52. Sternum, ventral view; 53. Labium, ventral view; 54. Maxillae, ventral view; 55. Maxillae, prolateral view, 56. Spermathecae, dorsal view; 57. Spinnerets, ventral view.

Figures. 58-59: General habitus: 58. *Heligmomerus barkudensis* (Gravely), female; 59. *Heligmomerus garoensis* (Tikader) comb. nov., male.

Figures. 60-63: General habitus: 60. *Chilobrachys hardwickii* (Pocock), female; 61. *Chilobrachys himalayensis* (Tikader), male; 62. *Chilobrachys khasiensis* (Tikader), female; 63. *Chilobrachys stridulans* (Wood Mason), female.

CHEMICAl COMPOSITION AND FUMIGANT TOXICITY OF ESSENTIAL OIL FROM *THYMUS CARMANICUS* AGAINST TWO STORED PRODUCT BEETLES

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ABSTRACT: Chemical composition of the essential oil from *Thymus carmanicus* Jalas, and its fumigant activity was investigated against two stored product insects, *Callosobruchus maculatus* (F.) and *Sitophilus granarius* (L.). Essential oil was isolated via hydrodistillation from dry leaves of *T. carmanicus* using a modified Clevenger-type apparatus and the chemical composition of the oil was assessed via GC and GC-MS. Twenty one compounds (100% of the total composition) were identified. Carvacrol (41.14%), *p*-cymene (12.09%), Thymol (6.35%) and γ-terpinene (6.21%) were found to be the major compounds of the essential oil. The fumigant toxicity of the essential oil was tested against 1-3 day-old adults of *C. maculatus* and *S. granarius* at 27±1°C and 65±5% r.h. in darkness. The mortality of adults was tested at different concentrations (28.12, 40.62, 53.12 and 65.62 µl/l air) and different exposure times. The highest concentration (65.62 µl/l air), caused 84% and 56% mortalities with a 5 h exposure On *C. maculatus* and *S. granarius*, respsctively. Based on LC_{50} values, *C. maculatus* (9.28 µl/l air) was significantly more susceptible than *S. granarius* (12.71 µl/l air). These results showed that the essential oil of *T. carmanicus* can play an important role in stored-product protection.

KEY WORDS: Fumigant toxicity, Essential oil, *Thymus carmanicus*, *Callosobruchus maculatus*, *Sitophilus granarius*.

Stored products are attacked by many species of pests (Rajendran, 2002). Hence, there is a need to develop new types of selective insecticides with fumigant action. Nowadays, management of stored product pests, using substances of natural origion, is the subject of many studies (Isman, 2006). Most of the essential oils have been tested against stored product pests, in order to find new control substances with lower mammalian toxicity, low persistence in the environment and potential for commercial application (Liu et al., 2005). *C. maculates* causes extensive loss, especially to cowpea in storages (Hu et al., 2008). The granary weevil, *S. granarius* is an important pest of stored cereals (Rees, 1996). Larva of *S. granarius* consume approximately half of a wheat kernel (Hurlock, 1965).

Labiatae family is best known for their essential oils common to many members of the family. (Naghibi et al., 2005). The genus *Thymus* L. (Labiatae) is represented in Iranian flora by 14 species, four of which including *T. carmanicus* are endemic in Iran. (Rechinger, 1982; Nickavar et al., 2005). In Iranian folk medicine leaves of this plant is used in treatment of Rheumatism, skin disorders and as an antibacterial agent (Zargari, 1990). Recently, several studies have assessed the ability of the *Thymus* essential oils as fumigants against a number of pests. The insecticidal activity of *Thymus persicus* (Ronniger ex Rech. f.) has been reported against *Tribolium castaneum* (Herbst) and *Sitophilus oryzae* (L.) (Taghizadeh et al., 2010). *Thymus numidicus* (Poiret) has contact toxicity against

Rhizopertha dominica (F.) (Saidj et al., 2008). The insecticidal and fumigant activities of *Thymus vulgaris* L. have been reported against *S. oryzae* (Lee et al., 2001), *Plodia interpunctella* (Hübner) (Passino et al., 2004), *T. castaneum* (Clemente et al., 2003), *Lasioderma serricorne* (F.) (Hori, 2003), *Spodoptera litura* (F.) (Hummelbrunner & Isman, 2001). Moreover *Thymus mandschuricus* Ronniger has insecticidal activity against *S. oryzae* (kim et al., 2003). However, There are no reports in the insecticidal bioactivity of *T. carmanicus*. Therefore the present study was carried out to determine the fumigant toxicity of the essential oil of *T. carmanicus* against *C. maculatus* and *S. granarius*.

MATERIALS AND METHODS

Insect cultures

Callosobruchus maculatus was reared in 1-liter jars containing cowpea seeds. *S. granarius* was reared in a 0.5-liter jars containing whole kernels of wheat, which were covered by a fine mesh cloth for ventilation. The cultures were maintained in the dark in a growth chamber set at 27±1°C and 65±5% r.h. Adult insects, 1-3 day-old, were used for the fumigant toxicity test. All experimental procedures were carried out under the same environmental conditions as the cultures.

Plant materials

Aerial parts of *T. carmanicus* were collected at full flowering stage in may 2009 from the farm of Shahid Fozveh Research station in Isfahan Center for Research of Agricultural Science and Natural Resources. The plant material was dried naturally on laboratory benches at room temprature (23-24°C) for 5 days. The dried material was stored at -24°C until needed and then hydrodistilled to extract its essential oil.

Fumigant toxicity bioassay

To determine the fumigant toxicity of the *T. carmanicus* oil and the median effective time to cause mortality in 50% of test insects (LT_{50} values), filter papers (Whatman No.1, cut into 6 cm diameter pieces) were impregnated with an appropriate concentration (28.12 to 65.62 µl/l air) of the oil without using any solvent. The impregnated filter paper was then attached to the undersurface of the screw cap of a 320 ml glass vial. The caps were screwed tightly onto the vials, each of which contained ten adults of each species of insect separately. The combination of each concentration and exposure time (1-10 h) was replicated five times. When no leg or antennal movements were observed, insects were considered dead. The data was computed using SPSS 16.0 software package. The estimates were compared using overlap of the 95% fiducial limits. Non-overlap at the 95% fiducial limits is equivalent to a test for significant differences.

Another experiment was designed to assess 50% and 95% lethal doses. Ten adult insects of *C. maculatus* were put into 90 ml glass bottles, Whereas *S. granarius* adults were held in 60 ml glass bottles. *C. maculatus* adults were exposed to the essential oil at the doses of 3.33, 4.44, 6.66, 10, 15.55 and 22.22 µl/l air and *S. granarius* at 5, 6.66, 10, 13.33, 18.33, 25 and 33.33 µl/l air. Control insects were kept under the same conditions without any essential oil. Each dose was replicated five times. The insects were exposed for 24 h to the essential oil vapor and after 24 h the dead insects were counted. Probit analysis (Finney, 1971) was used to estimate LC_{50} and LC_{95} values with their fiducial limits by SPSS. 16.0.

Samples for which the 95% fiducial limits did not overlap were considered to be significantly different.

Extraction and analysis of essential oil

Dried leaves and flowers were subjected to hydrodistillation using a modified Clevenger- type apparatus in order to obtain essential oil. Condition of extraction was: 50 g of leaves and flowers; 600 ml distilled water and 3 h distillation. Anhydrous sodium sulfate was used to remove water after extraction. *T. carmanicus* oil yield was 1.8±0.09 % v/w, as calculated on a dry weight basis . Extracted oil was stored in a refrigerator at 4°C. GC analysis was carried out on a HP-6890 gas chromatograph equipped with a HP-5 MS (non-polar) capillary column (30m×0.32mm; 0.25µm film tickness). The oven temperature was held at 60°C for 3 min then programmed at 6°C/min to 220°C. Other operating conditions were as follows: carrier gas He, at a flow rate of 1 ml/min; injector temperature 250°C, Mass system, the operating conditions was as the same as described above. Mass spectra were taken at 60 eV. Quantitative data were abtained by comparison of their mass spectra and retention indices with those published in the literature (Adams, 1995) and presented in the MS computer library.

RESULTS

Fumigant toxicity

In all cases, considerable differences in mortality of insects to essential oil vapor were observed with different concentrations and times. From the graph in Fig.1 it can be seen that, *T. carmanicus* oil was relatively more toxic to *C. maculatus* than to *S. granarius*. The lowest concentration (28.12 µl/l) of the oil yielded 84% mortality of *C. maculatus* after a 7.5 h exposure but mortalities of *S. granarius* at the lowest concentration were 60% after 7.5 h. At 40.62 µl/l air *T. carmanicus* oil against *C. maculatus* caused about 50% mortality with a 5 h exposure and 80% mortality after 6 h. At this concentration 80% mortality was achieved after 8 h for *S. granarius*. The oil at 53.12 µl/l air caused 85% morality for *C. maculatus* and *S. granarius* with 5.5 and 7.3 h exposure, respectively. At the highest concentration (65.62 µl/l air) kills of *C. maculatus* reached 84% with a 5 h exposure. By contrast only about 56% mortality was achieved for *S. granarius* at the same time exposure. Probit analysis showed that *C. maculatus* was more susceptible (LC_{50}=9.28 µl/l air) to *T. carmanicus* oil than *S. granarius* (LC_{50}=12.71 µl/l air). The corresponding LC_{90} were 18.79 and 24.92 µl/l air, respectively (Table 1).

Chemical constituents of essential oil

The chemical constituents of the essential oil of *T. carmanicus*, the retention indices and the percentage of the individual components are summarized in Table 2. Twenty-one components were identified. Carvacrol (41.14%) and *p*-cymene (12.09%) were the major constituents of the oil.

DISCUSSION

The potential for pest control or crop protection using *T. carmanicus* essential oil has not been investigated previously. Shaaya et al. (1997) reported that essential oil extracted from Labiatae family has shown fumigant toxicity against stored-product insects. Carvacrol, is the major component in *T. carmanicus* essential oil. Carvacrol has fumigant toxicity against agricultural and stored-product insects (Ahn et al., 1998 ; Isman, 2000). Carvacrol is very effective in inhibiting *Acanthoscelides obtectus* (say) reproduction (Regnault-Roger & Hamraoui, 1995). This compound is also effective against *Oryzaephilus surinamensis* (L.) (Shaaya et al., 1990). *p*- cymene (12.09%) is the second main component of *T. carmanicus* oil that has insecticidal activity. *p*- cymene had fumigant toxicity on *A. obtectus* (Regnault-Roger & Hamraoui, 1995). Therefore, the toxicity of this oil could be attributed to these chemicals. As major compounds of *T. carmanicus* are montoterpenoids, they are typically volatile and rather lipophilic compounds that can penetrate into insects rapidly (Lee et al., 2002). In our study, *T. carmanicus* was characterized by a rapid knockdown effect, hyperactivity, convulsion and paralysis and death. These effects show that this essential oil could resemble traditional fumigants. Results of this study and other studies indicate that some plant essential oils might be useful for insect control in enclosed spaces because of their fumigant action (Iamsn , 2000). In traditional medicine, leaves and flowering parts of *Thymus* species are used as tonic and herbal tea, antiseptic and carminative as well as treating colds (Amin, 2005), so it had fewer risk to human healthy and can be less harmful than insecticides. There is a need to conduct further studies on the essential oil against other stored-product pests, like *R. dominica* and against all life stages of the insects, particularly in the presence of the commodity load to establish its efficacy as a fumigant. There is a global interest by agro-chemical companies in developing plant-based pesticides. However, further studies are necessary to develop formulations to improve their efficacy and stability.

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Table 1. LC_{50} values of *Thymus carmanicus* essential oil to *Callosobruchus maculatus* and *Sitophilus granaries*.

Insect species	LC_{50} (µl/l air)	LC_{90} (µl/l air)	Slope ± SE	Degree of freedom	Chi-square (χ^2)	*P*-Value
C. maculatus	9.28 (8.40 – 10.28)*	18.79 (16.21 – 22.91)	4.18 ± 0.38	4	6.01	0.198
S. granarius	12.71 (11.63 – 13.87)	24.92 (22.0 – 29.34)	4.38 ± 0.37	5	4.25	0.513

*95% lower and upper fiducial limits are shown in parenthesis.

Table 2. Chemical constituents of the essential oil from *Thymus carmanicus*.

Compounds	Retention Index	% Composition
α-phellandrene	1092	1.10
α-pinene	1101	1.26
Camphene	1118	1.84
3-octanone	1144	1.77
Myrcene	1149	0.90
α-terpinene	1180	1.48
p-cymene	1187	12.09
1,8-cineole	1196	2.48
γ-terpinene	1221	6.21
trans-sabinene hydrate	1232	1.53
Borneol L	1339	9.65
Terpinene-4-ol	1346	1.09
Carvacrol methyl ether	1402	1.83
Cyclohexasiloxane, dodecamethyl	1414	0.98
Thymol	1445	6.35
Carvacrol	1460	41.14
β-pinene	1509	0.85
β-caryophyllene	1599	0.82
β-bisabolene	1668	0.95
Naphtalene	1788	0.87
α-cadinol	1811	4.83

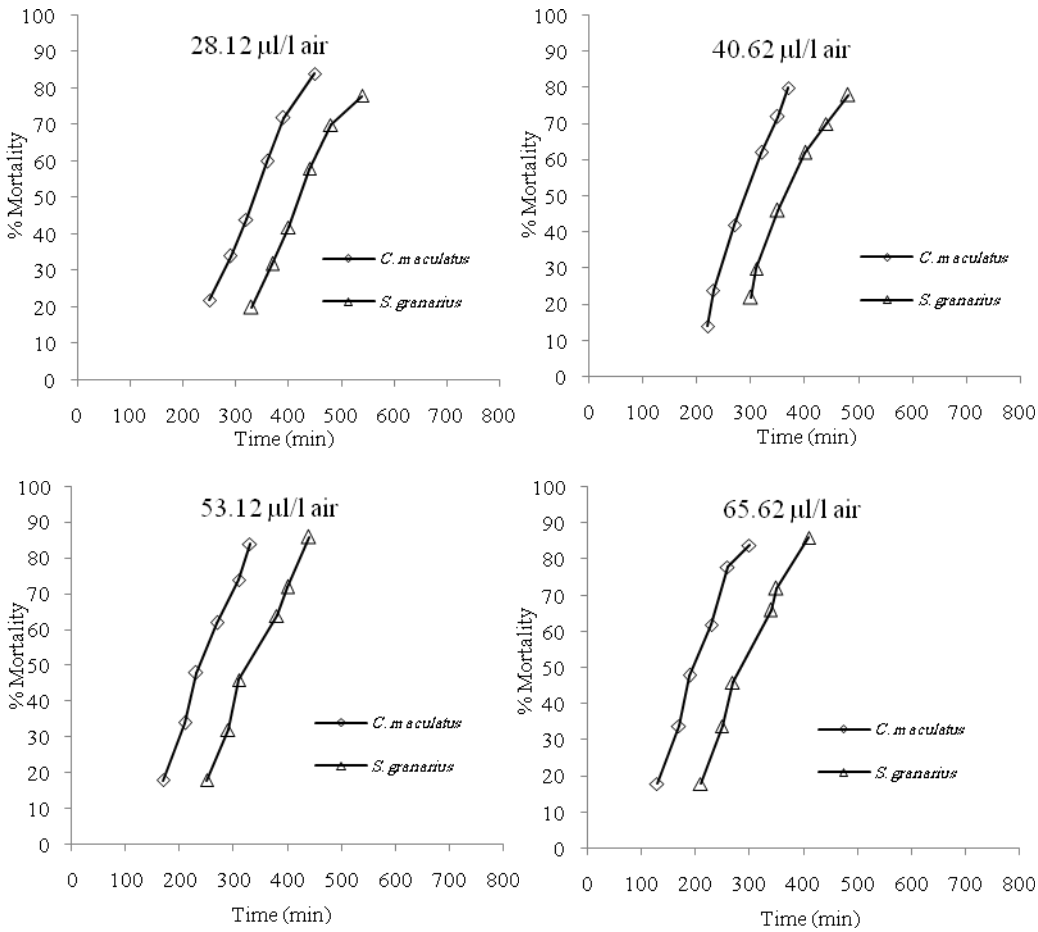

Figure 1. Mortality (%) of *Callosobruchus maculatus* and *Sitophilus granarius* exposed to essential oil from *Thymus carmanicus* for various periods.

NEW RECORD OF *BRACHYMERIA TIBIALIS* (WALKER) (HYMENOPTERA: CHALCIDIDAE) ON *CRICULA TRIFENESTRATA* (HELFER) FROM INDIA

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[Tikader, A. 2012. New record of *Brachymeria tibialis* (Walker) (Hymenoptera: Chalcididae) on *Cricula trifenestrata* (Helfer) from India. Munis Entomology & Zoology, 7 (1): 222-225**]**

ABSTRACT: *Brachymeria tibialis* (Walker), belongs to the family Chalcididae is commonly known as chalcid fly. *Brachymeria tibialis* Walker, a parasitoid recorded on *Cricula trifenestrata,* (Lepidoptera: Saturniidae), during grainage operation in 2010-2011. The parasitoid damages and eats the pupae inside the cocoon to restrict the population for future generation. The literature cited indicates that the occurrence of *Brachymeria* is the first record on wild silkworm *Cricula* in India. The manuscript highlights the detail report of new parasitoids on *Cricula*.

KEY WORDS: *Brachymeria*, parasitoid, new record, *Cricula*, silkworm, wild.

The wild silk moth *Cricula* is widely distributed in the Indian Sub-continent, thriving on different host plant. It is abundantly available in North-eastern region particularly in Assam (Tikader, 2011). North-east India is the centre of wild silk culture and commercially exploited mulberry, eri, muga, tasar and oak tasar silkworm. The other wild silk varieties available e.g. *Actias selene*, *Antheraea roylei*, *Antheraea* spp. novo, *Attacus atlas*, *Samia canningi*, *Cricula trifenestrata*, *Loepa sikkima* etc. are available in nature (Chutia et al., 2010). The *Cricula* is a silk producing insect but considered as pest of muga silkworm host plants (Sarmah et. al., 2010). The insect is also termed as pest of mango, (Ahmad & Alam, 1993), cashew (Pal & Medda, 2006), som and soalu plants (Tikader, 2011). The report of pest, parasites and predators was highlighted in muga food plants and silkworm where *Brachymeria* and *Cricula trifenestrata* is termed as Chalcid fly and defoliating insect (Singh & Das, 1996). The *Brachymeria* is found to be parasitoids of *Cricula trifenestrata* and is the first report from this region. The detail study of *Brachymeria* parasitoid on *Cricula* is not available. The present study of *Brachymeria*, a parasitoid on *Cricula* is recorded and presented in this paper.

MATERIALS AND METHODS

Fifty *Cricula* cocoons each was collected from different host plants i.e., mango, *Magnifera indica* Lin. (Family: Anacardiaceae), black berry, *Syzygium cumini* (L) Steels, (Family: Myrtaceae), cashew, *Anacardium occidentalis* Lin. (Family: Anacardiaceae) and Indian olive, *Elaeocarpus floribundus* Blume (Family: Elaocarpaceae) and kept for observation on grainage behaviours. The cocoons were collected after rearing from October-November 2010. After a period of 5 months pupal diapauses the moth emerged out during March 2011. The photographs of the good cocoon and damaged cocoon were taken. The hole on the cocoon and pupae was also taken. The detail observation recorded during emergence of moth.

RESULTS AND DISCUSSION

Out of 200 cocoons kept for grainage, 50 cocoons were damaged which is about 25% of total cocoons. During moth emergence, some of the cocoons were found damaged and pierced with small hole. The pupa was eaten by the parasitoid and makes a hole on it. The adult form of *Brachymeria* emerged out from cocoon and moved here and there. After close observation, it was found that in one cocoon about 10-15 insect available. The insect was identified as *Brachymeria tibialis*, a parasitoid. The maximum cocoon was damaged in olive plant.

The characteristic feature of *Brachymeria* are distinguished by a head with frons somewhat flattened; antennae inserted at or above level of ventral eye margin; margin vein touches wing margin; hind tibia acute, ventroapically forming sharp projection; mid tibia have single apical spur. The adults develop in *lepidopterous* pupae and emerge by biting away a hole at the anterior end, in a wing pad, or at the middle of the dorsum of the pupal shell. Adults of species attacking carrion-infesting hosts are believed to derive a part of their food from the meat juices, and feeding on the hosts fluid has been observed in *B. tibialis*. The parasitoids of Lepidoptera oviposit in young pupae. Adults are relatively long-lived in most species. *B. tibialis* survives in winter and a considerable portion of the following season. The life cycle from egg to adult is having one generation. Only female of *B. tibialis* hibernate which parasitize *Lepidoptera*. A portion of the females of the early broods may also carry over the winter. The habits and availability of hosts determine the number of generations produced each year. *B. tibialis* may have two generations and a partial third by utilizing several host species. Sex appears to occur in about equal number, based on current information. The eggs of the majority species of the family are elongated and broadest at the anterior end, with both ends smoothly rounded and the length is four to six times the maximum width. Egg incubation is completed in 2-3 days in all species of *Brachymaeria*. The first instar larvae are caudate and endoparasitic in lepidopterous pupae. The second instar larva is more robust and in the caudate form the tail persists though reduced in size. The third instar larvae show a further convergence of the two forms. The fourth instar larva presents no distinctive features. The fifth instar of *Brachymeria* is oval in outline, distinctly segmented and yellowish white in colour. *Brachymeria tibialis* developed in lepidopterous pupae partially consume the pupa which contains sufficient foods for several parasitoids. Only one parasitoid individual develops to maturity. The semi fluid surplus is usually in the abdomen for parasitoid feeding is limited to the anterior portion of the pupa, and in smaller host individuals it dries out quickly. Most of the Hymenoptera is easily recognized as belonging to the order because of their "wasp waists". The constricted waist characterizes ants, wasps, parasitic and bees in the sub order Apocrita. It varies from minute parasitoids of other insect eggs up to huge wasps and bees but all have the wasp waist. The species of *Brachymeria* are common and widely distributed throughout the world (Askew & Shaw, 2001). The Chalcidids are a moderately sized family with circa 115 valid genera and 1415 species (Fry, 1989). The *Brachymeria* was reported from Madagascar as parasite on *Anomis flava* (Steffan, 1958). They are cosmopolitan but are most abundant in the tropics.

Narendran (1986) noted that the family *Chalcididae* comprises medium to large chalcids whose hind femur is greatly modified into a swollen structure. These chalcids are important and interesting but also difficult parasitic insects to study taxonomically. All the species of *Brachymeria* develop as parasite on various other insects, mainly in their pupae. The natural enemies like *Lymantria* *obfuscate* was reported from Kashmir and India (Massod et al., 1986; Dharmadhikari et al., 1985). This family is cosmopolitan in distribution and is represented most commonly by the genus *Brachymeria*. It is primary or secondary parasitoids of *Lepidoptera, Diptera, Coleoptera* and also *Trigonura* and *Phasgonophora* (Boucek, 1992). Few species have been utilized in biological control, and none has shown any marked degree of effectiveness. One species of *Brachymeria* has been introduced to the United States for gypsy moth control with moderate success (Williams et al., 1993).

The parasitoid like *Brachymeria* suppresses the population of host to a considerable limit to maintain balance in nature. The observation of *B. tibialis* on *Cricula* is the new report. More work is required to verify the feasibility to utilize the *B. tibialis* parasitoid as biological control of muga silkworm.

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Figures 1-7. *Brachymeris tibialis* Walker, 1. Adult parasitoid on leaf, 2, 3. Parasitoid enlarged dorsal view, 4. Parasitoid ventral view, 5. *Cricula* cocoon, 6. Hole in *Cricula* cocoon, 7. Hole in pupa of *Cricula*.

SOME ADDITIONAL NOTES ABOUT ELATERIDAE (COLEOPTERA) FAUNA IN ADIYAMAN, DİYARBAKIR AND ŞANLIURFA PROVINCES OF TURKEY

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ABSTRACT: In this study, additional notes are given on four species belonging to Elateridae fauna (Coleoptera) collected by sweeping net in Adıyaman, Diyarbakır and Şanlıurfa provinces of Southeastern Turkey.

KEY WORDS: Elateridae, new record, fauna, Adıyaman, Diyarbakır, Şanlıurfa, Turkey.

Elateridae is one of the largest families of Coleoptera with more than 10 000 described species in approximately 750 genera worldwide (Laibner, 2000). According to Gülperçin & Tezcan (2010), 433 species and subspecies belonging to 66 genera existing in total 10 subfamilies of Elateridae have been reported for Turkey.

Although the Elateridae family is an important group among the Coleoptera, studies carried out in especially South-east Anatolia of Turkey concerning Elateridae fauna are not sufficient. It was planned that this insufficiency on faunistic studies will be exterminated by various faunistic studies.

The present paper is based primarily on material collected by sweeping net during three field trips to Adıyaman, Diyarbakır and Şanlıurfa carried out by Celalettin Gözüaçık in May and June 2007. Classification and nomenclature of the Elateridae suggested by Laibner (2000) and Löbl & Smetana (2007) has been followed in this study.

For each species, information on the name of locality, date of collection, plant or place on which the material collected, and the number of species have been given in brackets. Material evaluated in this study is listed below in alphabetical order in the following list.

Aeoloderma crucifer (Rossi, 1790)

Material examined: Diyarbakır (Ergani-Hançerli), 05.V.2007, Sinapis arvensis, (4). Totally 4 specimens.
Distribution in Turkey: Antalya (Elmalı-Avlan Lake), Burdur (Çeltikçibeli), Mersin (Susanoğlu) (Guglielmi & Platia, 1985); İzmir (Ödemiş-Gereli, Seferihisar-Sığacık) (Gülperçin & Tezcan, 2009).

Drasterius bimaculatus (Rossi, 1790)

Material examined: Diyarbakır (Ergani-Salihli), 05.V.2007, weeds, (1); (Ergani-Pınarkaya), 05.V.2007, *Triticum aestivum*, (1). Totally 2 specimens.
Distribution in Turkey: Western Anatolia, Karaman (Sahlberg, 1912-1913); Adapazarı, İstanbul, İzmir (Bornova) (Zümreoğlu, 1972); Adana (Pozantı),

Amasya, Artvin (Borçka), Bolu, (Akçakoca-Konuralp, Gerede), Bursa (İnegöl), Erzurum (Kop Mountain Pass), Eskişehir (Sivrihisar), Gaziantep (Islahiye), Isparta (Central province), İzmir (Selçuk-Efes), Kastamonu (Central province), Mersin (Namrun-Çamlıyayla), Muğla (Yatağan), Samsun (Bafra), Siirt (Baykan), Trabzon (Sümela-Maçka) (Guglielmi & Platia, 1985); İzmir (Gülperçin & Tezcan, 2006); Adana [Kozan (Bağtepe)], Ankara (Central province, Ayaş, Kocatepe), Erzurum (Horasan, Köprüköy, Oltu), Eskişehir, Hatay, Iğdır [Central province, Suveren, Tuzluca (Çincevat), Kırıkkale, Konya [Güneysınır (Gürağaç)], Muğla, Yozgat (Kesdek et al., 2006); İzmir [Bornova, Kemalpaşa (Central province, Armutlu), Kınık, Kiraz, Menderes (Gümüldür), Ödemiş, Seferihisar (Central province, Sığacık), Urla] (Gülperçin & Tezcan, 2009); İzmir (Kemalpaşa) (Tezcan & Gülperçin, 2009; Üzüm et al., 2009).

Cardiophorus nigratissimus Buysson, 1891

Material examined: Adıyaman [Central province-Akpınar (Küçükboyalı)], 16.VI.2007, *Glycyrrhiza glabra*, (1); **Şanlıurfa** (Hilvan), 01.VI.2007, weeds, (2); 08.VI.2007, weeds, (1); 14.VI.2007, weeds, (2); (Hilvan-Bahçecik), 21.V.2007, weeds, (3); 30.V.2007, *Triticum aestivum*, (1); 14.VI.2007, weeds, (4); (Hilvan-Faik), 17.V.2007, weeds, (1); 30.V.2007, weeds, (1). Totally 16 specimens.

Distribution in Turkey: Western Anatolia, Denizli (Babadağ), İzmir (Menderes, Menemen) (Sahlberg, 1912-1913); Amasya, Ankara (Elmadağ, Kalecik), Bayburt, Çorum (Boğazkale), Eskişehir (Sivrihisar), Gümüşhane, Hatay (Antakya-Güvenç), İzmir (Selçuk-Efes), Manisa (Akhisar), Mersin (Gülek-Çamalan, Mut, Tarsus) (Guglielmi & Platia, 1985); Adana (Seyhan), Erzincan (Gölbaşı), Erzurum (Gavurdağı), Hakkari (Şemdinli), Hatay (İskenderun-Kırıkhan), İçel (Çamlıyayla-Namrun), Kahramanmaraş (Narlı), Kayseri (Suşehri), Nevşehir, Mersin (Çamalan, Gülek, Tarsus), Osmaniye, Siirt, Şanlıurfa (Sama) (Platia & Gudenzi, 2002); Adana (Nallıhan, Seyhan), Erzincan (Gölbaşı, Tercan), Erzurum (Gavurdağı), Hakkari (Şemdinli), Hatay (Kırıkhan), Kahramanmaraş (Narlı), Kayseri (Kültepe), Mersin (Tarsus), Nevşehir, Osmaniye, Sivas (Suşehri), Şanlıurfa (Kabalak & Sert, 2005); Ankara (Hacıkadın, Nallıhan, Polatlı), Diyarbakır (Silvan), Erzincan (Tercan), Eskişehir, Konya [Güneysınır (Gürağaç)] (Kesdek et al., 2006).

Cardiophorus vestigialis Erichson, 1840

Material examined: Diyarbakır (Ergani-Salihli), 05.V.2007, weeds, (1). Totally 1 specimen.

Distribution in Turkey: Western Anatolia, Karaman (Sahlberg, 1912-1913); Ankara (Kazan), Kars (Değirmenlidere), Mersin (Silifke) (Guglielmi & Platia, 1985); Ankara (Beypazarı) as *Cardiophorus maritimus* Dolin, 1971 (Kabalak & Sert, 2005); İzmir (Gülperçin & Tezcan, 2006); Ankara, Artvin (Hatila Valley), Erzurum [Aşkale (Kop Pass), Pınarkapan, Pasinler (Çalıyazı), Şenkaya (Turnalı), Yumaklı], İçel (Tarsus) (Kesdek et al., 2006); İzmir (Narlıdere, Ödemiş, Seferihisar) (Gülperçin & Tezcan, 2009).

Cardiophorus nigratissimus was recorded for Diyarbakır by Kesdek et al. (2006), for Şanlıurfa by Platia & Gudenzi (2002) and Kabalak & Sert (2005). Also this species was more abundant than other three species and widespread species in this area.

Aeoloderma crucifer (Rossi, 1790), ***Drasterius bimaculatus*** (Rossi, 1790) and ***Cardiophorus vestigialis*** Erichson, 1840 are the first record for Diyarbakır fauna. ***Cardiophorus nigratissimus*** Buysson, 1891 is the first record for Adıyaman fauna.

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PROTEIN MAP OF GUT IN ADULT SUNN PEST, *EURYGASTER INTEGRICEPS* PUT. (HEM.: SCUTELLERIDAE): TWO-DIMENSIONAL ELECTROPHORESIS TECHNIQUE

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ABSTRACT: Gut is main part of digestive system in sunn pest. Digestion and absorption of food materials is the main role of gut and proteins are key molecules for such a function. In this study protein pattern of gut in new adult insects was investigated by Two-dimensional gel electrophoresis in which 100 protein spots could identified by CBB staining. Seventy one protein spots were tagged by molecular weight and isoelectric point. These proteins were divided into different functional category based to their physiological role. These proteins were belong to musculature proteins; carbohydrate, lipid and protein metabolism; energy metabolism; immune related proteins and nutrition proteins. This is the first report of 2-DE pattern of gut in sunn pest and with these ongoing studies, our aim will be to develop organ-related proteome map in sunn pest.

KEY WORD: Gut, protein, proteomics, sunn pest, digestion.

Sunn pest, *Eurygaster integriceps* is a key pest against wheat and barley in Middle east countries such a Iran, Iraq, Turkey and Syria (Javaheri et al., 2009). This insect is monovoltine and has two different phases in life cycle. Sunn spend two to three months as active form and feed from wheat. Then, immigration phase occurs in which they immigrate to wintering sites and diapauses take place. This insect has five insatr nymphs that 1st instars cannot feed and feeding startfrom end of 2nd instars (Critchley, 1998). The most of nutrition performed in adult insects and 5th insatrs. In iran, chemical control against this insect performed in adult stage and sometimes in 5th instars.

Digestive system of hemiptera consisted of two organs, salivary gland and gut (Saxena, 1963). These insects have extra oral digestion in which salivary gland injects some of saliva to tissue plant and after liquefy substrates, pumped them to gut. Main digestion of food materials performed in gut to prepare for absorption (Habibi et al., 2008). Gut of sunn pest like the other hemipterous bugs consisted of three parts, foregut, midgut and hindgut in which midgut divided to four parts. The largest part of gut in hemiptera is midgut.

Gut is a barrier to enthomopathogenic agents that entered from oral (Pauchet et al., 2008). For example Bt toxins act in gut of insects and disturbed ion balances in epitheliums cells (Hakim et al., 2010). Also some of digestive insecticides and plant toxins like plant protease inhibitors acts in gut and interrupt feeding process (Jouanian et al., 1998; Alborn et al., 1997). Using of oral toxins that posses selectivity effects only against of target insects are new strategies for pest management.

Efficiency of gut in digestion and immunity system is related to expressed proteins in it (Pauchet et al., 2008). Proteins are product of genes activity which causes an action cell. The study of protein is a critical step in understanding physiological role of a selected organ (Liu et al., 2010; Alborn et al., 2007). Proteomics is a new technique for protein researchers. In this technology at first, total proteins separated by two dimensional electrophoresis and then some (Proteomics analysis) or all of them (Protein mapping) were identified by mass spectrometry.

Protein mapping of gut were studied in several insects such a *Helicoverpa armigera* (Pauchet et al., 2008), *Bombyx mori* (Zhang et al., 2011), *Aedes aegypti* (Popva-butler and Dean, 2008), *Tribolium castaneum* (Moris et al., 2009) and *Spodoptera littoralis* (Liu et al., 2009).

In this study, we separated gut proteins from new adult of sunn pest and identified some of them according to molecular weight and isoelectric point. To our knowledge this is the first report of sunn pest proteome analysis.

MATERIAL AND METHODS

Insects

Adult insect collected from wheat farm around Tabriz area in summer 2010 and transferred to insectary room for rearing. Insects was reared on wheat var. Alvand in 27°C±1 and humidty 40% with 16:8 (L:D) photoperiod regime. Gut of adults dissected under stereomicroscope and washed with PBS (pH= 6.9). After dissection, guts were transferred to micro tube contains ice PBS and cocktail of protease inhibitors and kept in -80°C until use.

Protein extraction

A portion including three guts in one ml PBS was homogenized and centrifuged at 30000 g, 30 min, 4°C to remove insoluble materials. Gut proteins were precipitated by 10% trichloroacetic acid and then washed by 100% acton three times and pellets were solubilized in lysis buffer (7 M Urea, 2 M thiourea, 2% CHAPS, 60 mM DDT and 1% ampholyte (pH:3-10)). Insoluble material was removed after two times centrifugation (20000g, 20min, 25°C). Total protein was determined according to Bradford method using protein dye reagent and bovine serum albumin as standard.

Two- dimensional polyacrylamaide gel electrophoresis (2-DE)

A total of 600 µg of extracted proteins were separated in the first dimension by isoelectric focusing (IEF) tube gels and in the second dimension by SDS-PAGE. An IEF tube gel of 11 cm length and 3 mm diameter was prepared. IEF gel solution consisted of 8 M urea, 3.5% polyacrylamide, 2% NP-40, 2% ampholines (pH 3.5–10.0 and pH 5.0–8.0), ammonium persulfate and TEMED. Electrophoresis was carried out at 200 V for 30 min, followed by 400 V for 17 h and 600 V for 1 h. After IEF, SDS–PAGE in the second dimension was performed using 15% polyacrylamide gels with 5% stacking gels. The gels were stained with Coomassie brilliant blue (CBB), and image analysis was performed. The position of individual proteins on gel was evaluated automatically with Melanie 7 software. The pI and Mr of each protein were determined using 2D-PAGE markers (Bio-Rad, Hercules, CA, USA).

The information of gut proteins from other insects available in data banks were used for identifiing of gut proteins in sunn pest.

RESULTS

Proteome pattern of gut in new adult insects were analysed with 2-DE technique. A total of 100 clear protein spots were marked as showed in figure 1.

Vertical margin of the gel showing molecular weight determined experimentally using a protein ladder. Upper side of gel indicating range of pI of protein spots calculated according to gradient of pH in first dimension. Out of marked protein spots, 71 proteins were identified and 29 spots reported as not identified (ni) proteins (Table 1). Identified proteins based on their physiological roles classified into 10 functional groups containing musculature proteins (spots 1, 2, 3, 4, 20, 21, 71, 72 and 83), energy metabolism (spots 5, 6, 7, 35, 36, 45, 50, 68 and 69), protein metabolism (spots 8, 9, 10, 15, 16, 22, 23, 24, 54, 61, 95 and 97), lipid metabolism (spots 11, 12, 13, 14, 39, 57, 62, 66, 67, 77, 80, 85 and 94), carbohydrate metabolism (spots 17, 18, 25, 26, 27, 37, 53, 55 and 56), nutrition storage (spots 19, 63, 92 and 93); cell growth (spots 33); immune related (spots 51, 52, 58, 59 and 60); epithelium (spots 47 and 48) and other proteins (spots 38, 64, 65, 81 and 84) as indicated in table 2.

DISCUSSION

Gut of insects contains various proteins that are necessary for keeping of homeostasis in normal condition. Efficiency of gut is related to proteins existing in this organ and proteomics is suitable approach for investigation proteome (Yao et al., 2009). Main role of gut is food digestion which performed in two ways, mechanical and chemical digestion. Mechanical digestion was performed by muscular action which is effected with muscle contraction (Zhang et al., 2011). Muscle cells components from myofibrils themselves constituted from thick and thin filaments. Sliding between thick and thin filament is due to muscle contraction. Myosin is the abundant protein in thick filament in invertebrates world (Parry et al., 1973). Also myosin is hexamer protein which possesses two heavy chain, two alkali light chain and two regulatory light chain (Yao et al., 2009). In this study six protein spots was identified as myosin heavy chain and myosin tail, three each, , respectively. . The thin filament is composed actin and tropomyosin. Argnine kinase is an effective protein that bound to actin to prepare energy for muscle contraction (Pauchet et al., 2008; Yao et al., 2009). Our result proved that these three proteins in thin filaments are expressed in gut. Mechanical digestion has a key role in preliminary digestion of food particle and it seems that all effective proteins in this process was expressed in gut. Chemical digestion performs by digestive enzyme in which divided into two main groups, ectoenzyme and endoenzyme (Morris et al., 2009; Boyd, 2003; Barbehenn, 2002). Ectoenzymes secreted to lumen of gut and performed preliminary hydrolysis and then produced metabolites hydrolyzed with endoenzymes which can be absorbed from gut cells.

Our result showed that trypsin is ectoenzyme exists in lumen of gut in sunn pest. Carboxy peptidase Cpep-1 identified in present study, before was reported as ectoenzyme that secreted in lumen of *H.armigera* (Pauchet et al., 2008). Aspartate aminotransferase is an important enzyme in amino acid metabolism which transfer a amino group between aspartate and glutamate. Glyoxylate reductase belongs to oxidoreductases which act on the CH-OH group of donor with NAD+ or NADP+ as acceptor (Zhang et al., 2011). Peptidylprolyl isomerase B catalyse the *cis–trans* isomerisation of peptide bonds N-terminal to proline residues in polypeptide chains in which this function is very important in immunity reactions in organism. Also this protein is very important in folding of new synthesized proteins (Liu et al., 2009). Protein disulfide isomerase or PDI is an important enzyme in the endoplasmic reticulum that is effective in hydrolyzing of disulfide bounds between cysteine residue and protein folding (Male and

Storey, 1983). Dihydrolipomide dehydrogenase is a part of mitochondrial glycine cleavage system. Ribosomal proteins related to rRNA and are effective in protein synthesis. Overall, eight different proteins related to protein metabolism were identified in protein map of gut in sunn pest.

α-amylase is essential enzyme in carbohydrate metabolism which hydrolyze α-bound in starch (Zeng and Cohen, 2000). Glycosyl hydrolase also called glycosidaes catalyzes glycosidic bound between two or more carbohydrates (Kunieda et al., 2006). β-galactosidase is effective enzyme in converting β-galactosides to monosaccharide (Mattiaci et al., 1995). Triosephosphate isomerase is an enzyme (EC 5.3.1.1) that catalyzes the reversible interconversion of the triose phosphate isomers dihydroxyacetone phosphate and D-glyceraldehyde 3-phosphate in glycolysis process. Glyceraldehide 3-phosphate dehydrogenase and GADPH breaks down glucose for energy production (Kunieda et al. 2006). These proteins expressed in gut of sunn pest are related to carbohydrate metabolism.

Lipase is enzyme that act on the glycerol backbone and catalyzes triglyceride to monoglyceride and fatty acids (Pauchet et al., 2007). Lipases are a subclass of esterases. Fatty acid binding protein are a family of protein carriers that transfer fatty acids and other hydrophilic substrate a cross membrane (Hou et al., 2010). Acyl- Co A dehydrogenase is a key enzyme in lipid metabolism and beta oxidation (Chandra et al., 2006). Lysophospholipase is belong to family of hydrolysis and catalyzed on the carboxylic ester bounds (Zhang et al., 2011). Apolipophorin III precursor is carrier protein that transfer hydrophilic substrate. Enol- CoA acyltransferase catalyzed the final step of beta oxidation. This enzyme belongs to thiolase family of proteins (Yao et al., 2009). Acetoacetyl Co A thiolase also called β-ketothiolase has two physiological role, at first it breakdown acetoacety Co A generated from beta oxidation and secondly catalyze the final step in metabolism of isoleucine. Expression of these proteins in gut of sunn pest indicate dynamic role of gut in lipid metabolism.

Six proteins were identified in gut of sunn pest were effective in energy metabolism. ATP synthase is a complex enzyme that has proton canal in creating of energy with ATP (Chandra et al., 2006). Arginine kinase is a specific enzyme in insect organs. This enzyme has a critical role in producing of ATP that needed in muscle contraction. Cytochrome C and ubiquinol- cytochrome C reductase are important enzymes in electron transport chain in mitochondrial (Zhang et al., 2011).

Immune related Hdd 13, Cyclophilin A and Prophenol oxidase belong to immunity system of gut. This result suggest the contribution of gut in defense mechanisms.

In conclusion, organ specific proteome map generated valuable information in functional genomics. So far, genome studies was important but, nowadays proteome investigation is more interesting for researchers, since proteins are key responsible macromolecule for most of physiological functions. This is the first proteome study of gut in sunn pest reported here and we hope to complete the total proteome map of different organs in this insect in near future.

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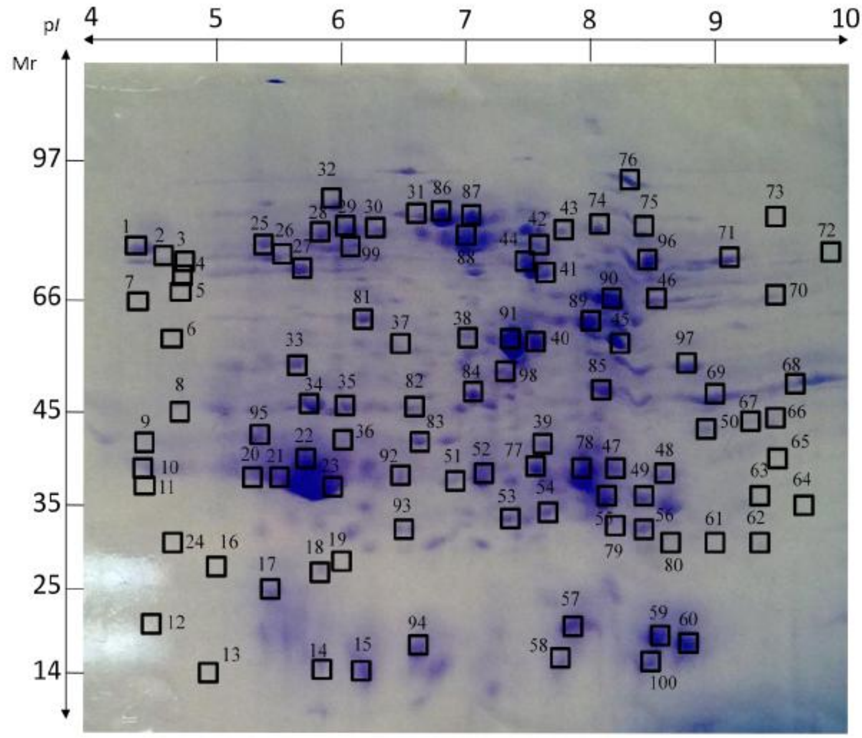

Figure 1. Protein patterns in new adult sunn pest, *E. integriceps*. Proteins (600 µg) were extracted from the adult sunn, separated by 2D-PAGE and stained by CBB. Following scanning, the gel patterns were analyzed using the Melanie software, and the relative abundance ratio of proteins was analyzed of three times experiment.

Table 1. List of adult sunn pest proteins identified by molecular weigt (Mr) and isoelectric point(pI).

SSP	Mr	pI	protein	Species	Reference
1	94	4.2	Myosin heavy chain	*Bombyx mori*	Zhang et al., 2011
2	92	4.5	Myosin heavy chain	*B.mori*	Zhang et al., 2011
3	88	4.7	Myosin heavy chain	*B. mori*	Zhang et al., 2011
4	77	4.8	Tropomyosin(A)	*B. mori*	Yao et al., 2009
5	69	4.9	ATP synthase subunit A	*B. mori*	Zhang et al., 2011
6	57	4.8	ATP synthase subunit B	*B. mori*	Zhang et al., 2011
7	69	4.6	ATP synthase	*B. mori*	Yao et al., 2009
8	47	4.6	Carboxy peptidase Cpep-1	*Helicovepa armigera*	Pauchet et al., 2008
9	44	4.4	Carboxy peptidase Cpep-1	*H.armigera*	Pauchet et al., 2008
10	42	4.4	Carboxy peptidase Cpep-1	*H.armigera*	Pauchet et al., 2008
11	37	4.4	Lipase	*Aedes aegypti*	Pauchet et al., 2008
12	25	4.5	Phosphatidyl ethanolamine binding protein	*B. mori*	Zhang et al., 2011
13	14	4.8	Fatty acid binding protein	*B. mori*	Zhang et al., 2011
14	23	6.2	Phosphatidyl ethanolamine binding protein	*B. mori*	Zhang et al., 2011
15	21	6.4	Ribosomal protein	*B. mori*	Zhang et al., 2011
16	28	4.9	Trypsin	*Ostrinia nubilialis*	Pauchet et al., 2008
17	29	5.3	Triosephosphate isomerase	*B. mori*	Zhang et al., 2011
18	29	5.5	Triosephosphate isomerase	*B. mori*	Zhang et al., 2011
19	28	5.8	30 kDa protein	*B. mori*	Zhang et al., 2011
20	37	5.2	Actin A3	*B. mori*	Zhang et al., 2011
21	37	5.5	Actin A3	*B. mori*	Zhang et al., 2011
22	38	5.7	Aspartate aminotransferase	*B. mori*	Zhang et al., 2011
23	37	5.8	Aspartate aminotransferase	*B. mori*	Zhang et al., 2011
24	35	4.7	trypsin	*H.armigera*	Pauchet et al., 2008
25	87	5.6	glycosyl hydrolase	*Tribolium castaneum*	Morris et al., 2009
26	88	5.8	glycosyl hydrolase	*T. castaneum*	Morris et al., 2009
27	85	5.9	B-galactosidase	*Tribolium castaneum*	Morris et al., 2009
28	88	6.2	ni		
29	85	6.3	ni		
30	85	6.4	ni		
31	84	6.6	ni		
32		5.8	ni		
33	66	5.4	Transferrin	*B. mori*	Yao et al., 2009
34	55	5.7	isomerase	*B. mori*	Zhang et al., 2011
35	53	5.9	ATP synthase subunit B	*B. mori*	Zhang et al., 2011
36	42	6.1	Arginin kinase	*Poecilus intepunctella*	Pauchet et al., 2008
37	60	6.3	α-amylase	*Spodoptera frugiperda*	Pauchet et al., 2008
38	70	6.9	Heat shock protein 90	*B. mori*	Yao et al., 2009
39	45	7.4	Acyl- Co A dehydrogenase	*B. mori*	Zhang et al., 2011
40	69	7.4	ni		
41	79	7.4	ni		
42	86	7.5	ni		
43	96	7.8	ni		
44	76	7.3	ni		
45	61	8.2	cytochrome C	*B. mori*	Yao et al., 2009
46	76	8.6	ni		
47	45	8.3	3-hydroxy isobutyrate dehydrogenase	*B. mori*	Yao et al., 2009

Table 1. continued

48	45	8.8	3-hydroxy isobutyrate dehydrogenase	*B. mori*	Yao et al., 2009
49	42	8.6	Lipase	*Aedes aegypti*	Pauchet et al., 2008
50	43	9	ubiquinol- cytochrome C reductase	*B. mori*	Zhang et al., 2011
51	38	6.7	Immune related Hdd 13	*B. mori*	Zhang et al., 2011
52	35	6.9	Immune related Hdd 13	*B. mori*	Zhang et al., 2011
53	33	7.5	GAPDH	*B. mori*	Yao et al., 2009
54	35	7.8	Glyoxylate reductase	*B. mori*	Zhang et al., 2011
55	33	7.9	GAPDH	*B. mori*	Yao et al., 2009
56	35	8.3	Glyceraldehide 3-phosphate dehydrogenase	*B. mori*	Zhang et al., 2011
57	25	7.3	Lysophospholipase	*B. mori*	Zhang et al., 2011
58	14	7.3	Cyclophilin A	*B. mori*	Zhang et al., 2011
59	16	7.8	Prophenol oxidase	*B. mori*	Yao et al., 2009
60	14	8	Cyclophilin A	*B. mori*	Zhang et al., 2011
61	27	8.9	Peptidylprolyl isomerase B	*B. mori*	Zhang et al., 2011
62	25	9.3	Apolipophorin III precursor	*B. mori*	Zhang et al., 2011
63	32	9.5	Low molecular mass 30 Kda lipophorin	*B. mori*	Zhang et al., 2011
64	34	9.4	NADPH oxidae	*B. mori*	Zhang et al., 2011
65	38	9.5	NADPH oxidae	*B. mori*	Zhang et al., 2011
66	38	9.6	Enol- CoA acyltransferase	*B. mori*	Yao et al., 2009
67	39	9.3	Enol- CoA acyltransferase	*B. mori*	Yao et al., 2009
68	50	9.3	ATP synthase	*B. mori*	Yao et al., 2009
69	59	9.1	ATP synthase	*B. mori*	Yao et al., 2009
70	69	9.7	ni		
71	84	9.6	myosin tail	*B. mori*	Yao et al., 2009
72	83	10	myosin tail	*B. mori*	Yao et al., 2009
73	90	9.5	myosin tail	*B. mori*	Yao et al., 2009
74	86	8.3	ni		
75	93	8.1	ni		
76	93	8.4	ni		
77	40	7.7	Acetoacetyl Co A thiolase	*B. mori*	Zhang et al., 2011
78	39	8.1	ni		
79	37	8.2	ni		
80	35	8.6	Enol- CoA hydrotase precursor 1	*B. mori*	Zhang et al., 2011
81	60	6.1	Heat shock protein 70	*B. mori*	Zhang et al., 2011
82	48	6.4	ni		
83	42	6.3	Actin	*B. mori*	Zhang et al., 2011
84	50	7	Mitochondrial aldehyde deydrogenase	*B. mori*	Zhang et al., 2011
85	48	8	Acyl- Co A dehydrogenase	*B. mori*	Zhang et al., 2011
86	90	6.8	ni		
87	90	7	ni		
88	88	7	ni		
89	64	7.9	ni		
90	66	8.1	ni		
91	66	7.4	ni		
92	38	6.5	Low molecular mass 30 Kda lipophorin	*B. mori*	Zhang et al., 2011
93	32	6.5	Low molecular mass 30 Kda lipophorin	*B. mori*	Zhang et al., 2011
94	17	6.6	ni		
95	43	5.2	protein disulfide isomerase	*B. mori*	Zhang et al., 2011
96	73	8.3	ni		
97	51	8.6	Dihydrolipomide dehydrogenase	*B. mori*	Zhang et al., 2011
98	50	7.1	ni		
99	73	6	ni		
100	16	8.2	ni		

Table 2. Functional classification of proteins in adult sunn pest. A total of 100 unique proteins identified in Fig. 1 were grouped into 10 functional categories and unknowns.

Protein classification	SSP	Description
Musculature	1, 2, 3	Myosin heavy chain
	4	Tropomyosin(A)
	20, 21, 83	Actin A3
	71, 72 , 73	myosin tail
Energy metabolism	5	ATP synthase subunit A
	6, 35	ATP synthase subunit B
	7, 68, 69	ATP synthase
	36	Arginin kinase
	45	Cytochrome C
	50	ubiquinol- cytochrome C reductase
Protein metabolism	8, 9, 10	Carboxy peptidase Cpep-1
	16, 24	Trypsin
	22, 23	Aspartate aminotransferase
	15	Ribosomal protein
	54	Glyoxylate reductase
Protein classification	**SSP**	**Description**
	61	Peptidylprolyl isomerase B
	95	Protein disulfide isomerase
Table 2. Continued		
Protein classification	SSP	Description
	97	Dihydrolipomide dehydrogenase
Lipid metabolism	11, 94	Lipase
	12, 14	Phosphatidyl ethanolaminebinding protein
	13	Fatty acid binding protein
	39, 85	Acyl- Co A dehydrogenase
	57	Lysophospholipase
	62	Apolipophorin III precursor
	66, 67	Enol- CoA acyltransferase
	77	Acetoacetyl Co A thiolase
	80	Enol- CoA hydrotase precursor 1
Carbohydrate metabolism	17, 18	Triosephosphate isomerase
	25, 26	glycosyl hydrolase
	27	β-galactosidase
	37	α-amylase
	56	Glyceraldehide 3-phosphate dehydrogenase
	53, 55	GAPDH
Nutrition storage	19	30 kDa protein
	63,92,93	Low molecular mass 30 Kda lipophorin
Transport protein/cell growth	33	Transferrin
Immune related	51, 52	Immune related Hdd 13
	58, 60	Cyclophilin A
	59	Prophenol oxidase
Epithelium	47, 48	3-hydroxy isobutyrate dehydrogenase
Other proteins	38	Heat shock protein 90
	81	Heat shock protein 70
	84	Mitochondrial aldehyde deydrogenase
	64, 65	NADPH oxidae

CHELONUS FLAVIPALPIS SZÉPLIGETI, 1896 AND *MIRAX RUFILABRIS* HALIDAY, 1833 (HYMENOPTERA: BRACONIDAE): TWO NEW LARVA-PUPA PARASITOIDS OF PISTACHIO TWIG BORER *KERMANIA PISTACIELLA* AMSEL, 1964 (LEPIDOPTERA: OINOPHILIDAE) WITH THE PARASITIZATION RATIOS FROM TURKEY

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[Özgen, I., Bolu, H. & Beyarslan, A. 2012. *Chelonus flavipalpis* Szépligeti, 1896 and *Mirax rufilabris* Haliday, 1833 (Hymenoptera: Braconidae): Two new larva-pupa parasitoids of Pistachio twig borer *Kermania pistaciella* Amsel, 1964 (Lepidoptera: Oinophilidae) with the parasitization ratios from Turkey. Munis Entomology & Zoology, 7 (1): 238-242**]**

ABSTRACT: The study was carried out to determine the parasitoids and their parasitization ratios on Pistachio twig borer (PTB) *Kermania pistaciella* Amsel (Lepidoptera: Oinophilidae) in pistachio orchards of Central province and Aydınlar counties of Siirt province of southeastern Turkey in 2009. So, the two new parasitoid species *Chelonus flavipalpis* Szépligeti and *Mirax rufilabris* Haliday (Hymenoptera: Braconidae) were determined on *K. pistaciella*. The parasitization ratios of *C. flavipalpis* are more than *M. rufilabris* across study area. The total maximum parasitization ratios were realized as 52 % and 54 % in mid April in Aydınlar and in early March in Central province respectively. It is recorded that the parasitization ratios were reduced at the last times of PTB adult emergence. The study results have importance for the next studies on biological control and integrated pest management (IPM) about PTB.

KEY WORDS: Pistachio, *Kermania pistaciella, Chelonus flavipalpis, Mirax rufilabris,* new records, Parasitization ratio, Turkey.

Pistachio is an economically important cultivated plant grown easily on heavy soil conditions, and 90% of Turkey's pistachio production is met from the Southeastern Anatolia Region (Anonymous, 2008).There are important pests causing crop losses in the production of pistachio. Pistachio twig borer (PTB) *Kermania pistaciella* Amsel (Lepidoptera: Oinophilidae) is the main pest in all areas of the pistachio production in Iran (Abbaszadeh et. al, 2006, Seiedoleslami, 2006, Samih, & Hatami, 2006; Mehrnejad, 2001; Mehrnejad & Reza Basirat, 2009; Achterberg & Mehrnejad, 2002; Erik Nieukerken van, 2007) and Southeast Anatolia regions (Bolu, 2002; Yanık & Yücel, 2001). PTB is a harmful insect making significant losses since 1970 (Günaydın 1978). It overwinters as larva and it pupates in near a few cm of the exit hole, leaving shoots from the end of February. Significant damage is resulting from the larvae entering into shoots. During this period, growth cone will be damaged because of destruction of the shoots and fruit bunches. So, the shoot growth, development and fruit creation are prevented. The short time entering of the larvae to shoots is of great importance in the control. Previously, two pupa parasitoids of PTB have been identified as *Mirax* sp. and *Microchelonus* sp. (Hymenoptera: Braconidae) by Küçükaslan (1966). The study was carried out to determine the parasitoids and their parasitization ratios on PTB in pistachio orchards of Central and Aydınlar countries of Siirt province in 2009. Two new larva-pupa parasitoid species *Chelonus flavipalpis* Szépligeti and *Mirax rufilabris* Haliday (Hymenoptera: Braconidae) were determined on *K. pistaciella*.

MATERIALS AND METHODS

Materials of this study are consisted of pistachio, pupae of pistachio twig borer *K. pistaciella*, larvae-pupa parasitoids C. *flavipalpis* and *M. rufilabris*. The study material was supplied as shoots from pistachio orchards of Central and Aydınlar countries of Siirt province. At each pistachio orchard, in each sampling period between the dates 01.03.2009 and 17.05.2009, totally 450 ea pest pupa and soiled shoots, being 5 ea from 10 trees, were brought to the laboratory. The shoots were placed inside the culture box painted a dark black color and the paper bag with the tip of the glass tube. Only the shoot containing the pest pupa were placed into culture boxes. The shoots were cultured to get the parasitoid adults at 25 C temperature and 65 % humidity conditions in climate cabins. The emerged moth and the parasitoids adults were counted and parasitization ratios were recorded. The unopened pupae were examined by opening with the help of thin-tipped needle. These pupas were examined after all the parasitoids came out and it was recorded as to whether they contain any parasitoid or pest pupa. Furthermore, by considering the parasiting feature of the *Chelonus* spp species pests and the ovum phase, 10 ovum samples were taken with culturing from each garden from where shoots were taken, during the ovulation phase of the pest, however no parasitoid outing was obtained. Therefore, it is assumed that the parasitoid parasites the pest in larva stage. The identification of the parasitoid species was conducted by the second author via comparing with the diagnosed samples at St. Petresburg museum.

RESEARCH FINDINGS AND DISCUSSION

Chelonus flavipalpis and *M. rufilabris* species were obtained from PTB pupae. No out parasitoid outing was observed from the pupas. *C. flavipalpis* was known in Georgia, Hungary, Mongolia, Russia, Moldova, Turkey, Ukraine in East and West Palearctic region. Yet as the host species *Parametriotes thea* Kuznetsov and *Sparganothis pilleriana* Denis & Schiffermüller (Lep.: Agonoxenidae, Tortricidae) was known (Yu et al. 2006, Ozgen and Beyarslan, 2010). With this study, *C. flavipalpis* was obtained from PTB pupae in Turkey, also. *M. rufilabris* is registered in 17 countries in western and three countries in eastern palearctic region (Yu et al., 2006). It was found only in Kastamonu in Turkey (Beyarslan, 2009). This species is derived from one host species of Nepticulidae and 51 hosts of Coleophoridae families from Lepidoptera (Van Neiukerken et al., 2005; Yu et al., 2006). Most likely, both species parasited PTB at the larval stage and left it at the pupal stage. The number of parasitoids and PTB adults emerged from cultured pupae and parasitization ratios are shown in Figure 1 and Figure 2. When the figures are examined, It is seen that parasitization ratios of *C. flavipalpis* have been higher according to *M. rufilabris* in both orchards. The parasitization ratios of *C. flavipalpis* were realized with the highest ratios of 38% on 31/03/2009 in Central county and 32% on 15/04/2009 in Aydınlar county. The maximum parasitization ratios of *C. rufilabris* took place in both orchards with 22% on 07/03/2009 in Central county and on 31/03/2009 in Aydınlar county. The sum of parasitization ratios of both species were held as 54% on 07/03/2009 in the Central County and 52% on 15/04/2009 in the Central

County. In general, it was determined that the parasitization ratios have fallen on the dates progressed. This situation is particularly important in terms of the introduction to overwintering and continuation of next generations of PTB. When the pupae which are not opened were also checked, it was seen that PTB adults could not exit. When the insides of the unopened pupas were examined, it is observed that they all contain pest but not parasitoid. Previously, some other parasitoids of PTB were recorded generally with parasitization ratios. Bolu (2002) determined *Chelonus fissilis* (Tobias,1985) with an efficiency of 29-57% on PTB. Most of the studies about PTB parasitoids were carried out in Iran. While van Achterberg and Mehrnejad (2002) determined *Chelonus (Chelonus) kermakiae* and *Centistidea (Paracentistidea) pistaciella* (Braconidae), Manickavasagam et al. (2008) determined a hyperparasitoid *Cheiloneurus pistaciae* (Encyrtidae) on PTB. Mehrnejad and Basirat (2009) determined the parasitoid complex of PTB. They recorded three species as primer parasitoids, two species as obligat parasitoids and 10 species as facultative hyperparasitoid. *C. (Chelonus) kermakiae* has finding ratio of 85% in this parasitoid complex. As a result, the parasitization ratios of both parasitoids were found hopefully in the areas which are studies realized. Determination of new host of the parasitoids is an important finding. This situation has the importance of biological control of PTB which is controlled chemically difficult. In these areas, it is needed to avoid and minimize chemical control practices for conservation and sustainability of the parasitoid activity. It will be important to investigate the biology and ecology and to increase activity of the parasitoids within the ecosystem for biological control and IPM in the areas of pistachio.

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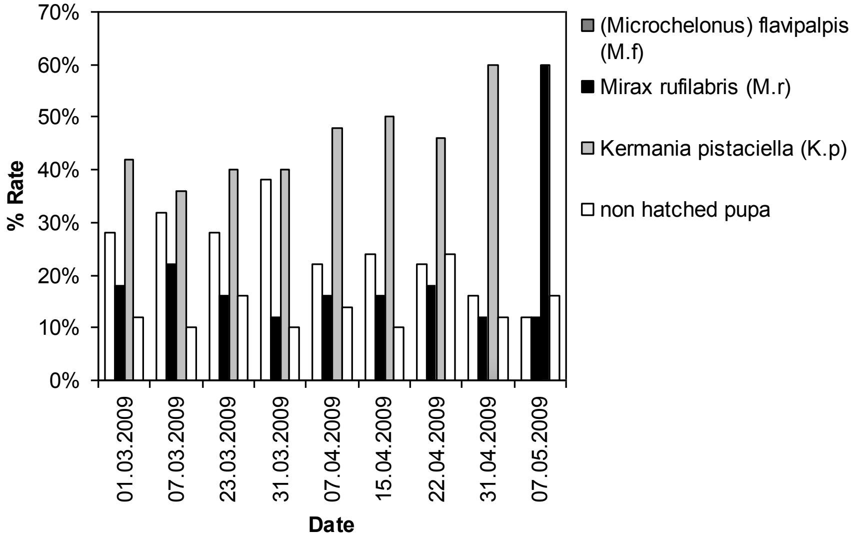

Figure 1. Finding ratios of C*helonus flavipalpis*, *Mirax rufilabris* and *Kermania pistaciella* with unopened pupae in the pistachio orchard of Central province in Siirt.

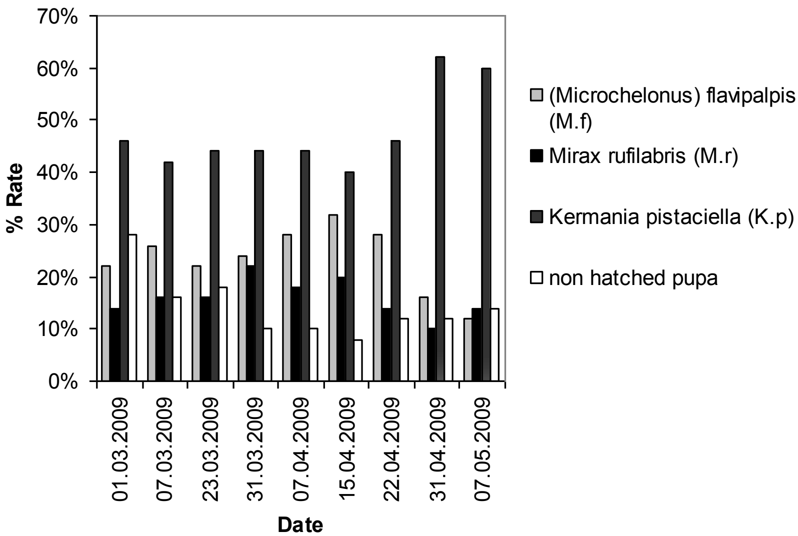

Figure 2. Finding ratios of C*helonus flavipalpis*, *Mirax rufilabris* and *Kermania pistaciella* with unopened pupae in the pistachio orchard of Aydınlar province in Siirt.

SPATIAL DISTRIBUTION PATTERN OF *TETRANYCHUS URTICAE* AND ITS EGG PREDATOR *SCOLOTHRIPS LONGICORNIS* ON DIFFERENT BEAN CULTIVARS

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[Pakyari, H. 2012. Spatial distribution pattern of *Tetranychus urticae* and its egg predator *Scolothrips longicornis* on different bean cultivars. Munis Entomology & Zoology, 7 (1): 243-254**]**

ABSTRACT: Bionomics of two-spotted spider mite, *Tetranychus urticae* Koch, and its egg predator *Scolothrips longicornis* Priesner was studied in the southeast of the Tehran province, Varamin from 11th July to 22th September 2010 on six bean cultivars including Goli, Akhtar, Sadaf, Parastoo, Talash and Baker. The mean population densities of the overall life stages of *T. urticae* and *S. longicornis* per leaf on Goli (36.27 and 2.87, respectively) were significantly more than other cultivars. The spatial distribution of *T. urticae* and *S. longicornis* was determined by the following four methods: index of dispersion, Lloyd's mean crowing, Taylor's power law and Iwao's patchiness regression, whereas Morisita's coefficient of dispersion was calculated for *T. urticae* on different crops. The index of dispersion, Morisita's index and Lloyd's mean crowding indicated an aggregated pattern for spatial distribution of this mite and their predator on all bean cultivars. The spatial distribution pattern of *T. urticae* and *S. longicornis* using Taylor's power law and Iwao's patchiness in most cases was aggregated and in few cases random. The linear regression between the predator and prey population densities indicated a density-dependant predation by *S. longicornis* on *T. urticae*. Spatial distribution parameters of two-spotted spider mite and its predator can be used to outline a sampling program, estimate population density of these mites and efficiency of the predator for using in IPM programs.

KEY WORDS: *Tetranychus urticae*, *Scolothrips longicornis*, population density, spatial distribution, density dependence interaction, optimum sample size.

Spider mites (Acari: Tetranychidae) are wide-spread agricultural pests, which often cause severe damage on a cultivar of annual and perennial crops (Gerlach & Sengonca, 1986; Han et al., 2003; Jung, 2005; Jung et al., 2005). This species is adapted to various environmental conditions and distributed worldwide. *T. urticae* feeds using a piercing-sucking process that leaf cells to turn whitish or yellowish spots. Currently, natural enemies of spider mites are employed to avoid increase of these pests in both indoor and outdoor environments. Acarophagous ladybird beetles (Obrycki & Kring, 1998; Mori et al., 2005; Taghizadeh et al., 2008a,b), predatory anthocorids (Coll & Ridgway, 1995; Funao & Yoshiyasu, 1995; Cocuzza et al., 1997; Kohno & Kashio, 1998; Gitonga et al., 2002), and predatory mites (McMurtry & Croft, 1997; Marisa & Sauro, 1999) have received a great deal of research particularly on their impact on spider mites populations, but little attention has been paid to predatory thrips (e.g., Nakagawa, 1993; Kishimoto, 2003; Gotoh et al., 2004a,b). *Scolothrips longicornis* Priesner (Thysanoptera: Thripidae) is native to Iran (Pakyari et al., 2009) and also has been reported from many countries such as India, Turkey, Iraq and North America (Priesner, 1950; Gilstrap & Oatman, 1976). This species is common on bean (Aydemir & Toros, 1990), cucumber and eggplant (Pakyari and Fathipour 2009) and is an important predator of numerous spider mite species, so it is a good candidate for biological control of these mite pests (Aydemir & Toros, 1990; Chazeau, 1985).

Estimating the population density of arthropods is the cornerstone of basic research on agricultural ecosystems and the principal tool for building and implementing pest management strategies (Kogan & Herzog, 1980). At this estimating plan, the reliable sampling program conducted at specific times using a suitable sampling technique with a given sampling unit and sample size all based on the spatial distribution characteristics of the pest population (Pedigo & Buntin, 1994).

Quantitative knowledge about spatial distribution of a prey and predator is important to evaluate a natural enemy potential to reduce its prey density and system's persistence (Slome & Croft, 1998). Understanding spatial distribution is a prerequisite for ecological and behavioral studies (Faleiro et al., 2002), learning of population dynamics (Jarosic et al., 2003), binomial sampling (Binns & Bostanian, 1990) and population growth evaluation (Jarosik et al., 2003).

There are various studies that described the spatial distribution and population density of *T. urticae*. Aggregative spatial distribution of *T. urticae* was reported in different crop such as soybean (Sedaratian et al., 2008), bean (Ahmadi et al., 2005; Mehrkhou et al., 2008), strawberry (Greco et al., 1999), pear (Takahashi et al., 2001) and apple (Slone & Croft, 1998), but no studies were found about the spatial distribution of predatory thrips, *Scolothrips longicornis* on *T. urticae*. Takahashi et al. (2001) evaluated the role of the predatory thrips *S. takahashii* Priesner in an experimental pear orchard primarily to improve a new IPM program for the control of spider mites.

The aim of this research is to determine the population density and spatial distribution pattern of *T. urticae* and its predator *S. longicornis* and interaction between them on bean cultivars. The results of this study can be used to improve the management program of *T. urticae* on bean. This plan is critical to develop and optimize reliable sampling plans, monitor methods and control of mites for establishing IPM strategies on this crop.

MATERIALS AND METHODS

Experimental design

A screening trial was conducted from July to September 2009 to examine the population trend in *T. urticae* and its predator *S. longicornis* at experimental field at the southeast of the Tehran province, Varamin. Six bean cultivars including common bean *Phaseolus vulgaris* L. var. Talash; lima bean *P. lunatus* L. var. Sadaf; *P. acutifolius* var. Akhtar; *P. coccineus* var. Baker; Aduki bean *P. calcaratus* Roxb var. Goli and cowpea *Vigna sinensis* L. var. Parastoo were planted in a randomized complete block design in field.

Sampling program

The sampling method is random collecting so that every sampling unit has an equal chance to be chosen (Pedigo and Buntin, 1994). In this study, different life stages of *T. urticae* and *S. longicornis* colonized on the under-surface of leave thus one leaf of bean was selected as a sampling unit. The leaves were selected randomly and the number of different life stages of *T. urticae* and *S. longicornis* were measured by counting the number per leaf using a stereomicroscope in the laboratory. The sampling was conducted once a week from 11th July to 22th September 2010 at 8-12 A.M.

For determining the sample size, primary sampling with 60 samples unites of different bean cultivar was taken on 4th July 2010. The relative variation (*RV*) was calculated to compare the efficiency of various sampling methods (Hillhouse and Pitre, 1974) as:

$$RV = (SE/m)\ 100$$

where *SE* is the standard error of the mean and *m* is the mean of primary sampling data. The reliable sample size was determined using the following equation:

$$N = (ts/dm)^2$$

Where N = sample size, t = t-student, s = standard deviation, d = desired fixed proportion of the mean of the mean and m = the mean of primary data (Pedigo & Buntin, 1994).

The mean density of total life stages of *T. urticae* and *S. longicornis* were statistically analyzed using ANOVA and compared among different bean cultivars within each sampling data and overall dates.

Response of *S. longicornis* to the population density of *T. urticae*

A linear regression analysis of the mean density of *S. longicornis* versus mean density of *T. urticae* was used to qualify the interaction between these two species on different cultivars of bean. If (b = 0) the linear regression among two variable is not significant, in reality the predator's response to its prey density is density independent. If the regression is significant where $b < 0$, the predator's response is inversely density dependent however, if $b > 0$, this predator's response is density dependent.

Spatial distribution

The spatial distribution of *T. urticae* and *S. longicornis* was determined by the following four methods: index of dispersion, Lloyd's mean crowing, Taylor's power law and Iwao's patchiness, whereas Morisita's coefficient of dispersion was calculated for *T. urticae* on different crops.

Index of dispersion

Dispersion of population can be classified by calculating the variance to mean ratio as follows:

$$S^2/m > 1 \text{ Aggregated}$$
$$S^2/m = 1 \text{ Random}$$
$$S^2/m < 1 \text{ Regular}$$

Departure from a random distribution can be tested by calculating the index of dispersion (I_D), that n is the number of samples:

$$I_D = (n-1)\ S^2/m$$

The Z coefficient should be calculated to test the goodness-of- fit:

$$Z = \sqrt{2I_D} - \sqrt{(2v-1)}$$

Where v is degree of freedom (n-1).

If $1.96 \geq Z \geq -1.96$ the spatial distribution will be random whereas if $Z < -1.96$ or $Z > 1.96$ it will be uniform and aggregated, respectively (Pedigo and Buntin, 1994).

Taylor's power law and Iwao's patchiness regression

The Taylor's power law a function between the variance (S^2) and the sample mean (m) as follows:

$$S^2 = am^b$$

where S^2 is the variance; m is the sample mean; a is a scaling factor related to sample size and b measure the species aggregation. If b = 1, <1 or >1, the distribution is random, regular and aggregated, respectively (Taylor, 1961).

By using a log transformation, we can calculate the coefficients with linear regression as:

$$\text{Log}\,(S^2) = \text{Log}\,(a) = b\,\text{Log}\,(m)$$

where a and b are the parameters of the model, which were calculated by linearzing the equation by a log-log transformation (Martinez-Ferrer et al., 2006).

Iwao's patchiness regression method was utilized to quantify the relationship between mean crowding index (m^*) and (m) using the following equation:

$$m^* = \alpha + \beta m$$

Where α indicates the tendency to crowding (positive) or repulsion (negative) and β reflects the distribution of population on space and is interpreted in the same manner as b of Taylor's power law (Iwao and Kuno, 1968). Student t-test can be used to determine whether the colonies are randomly dispersed.

$$\text{Test } b = 1 \quad t = (b-1) / S_b \quad \text{and} \quad \text{Test } \beta = 1 \quad t = (\beta - 1) / S_\beta$$

where S_b and S_β are the standard error of slop of mean crowding regression. Estimated values compared with tabulated t-vales with n-2 degree of freedom.

Lloyd's mean crowding x^*

Mean crowding (x^*) was suggested by Lloyd to demonstrate the possible effect of mutual interference or competition among individuals. Theoretically mean crowding is the mean number of other individual per individual in the same quadrate:

$$x^* = m + S^2 / m - 1$$

As an index, mean crowding is highly dependent upon both the degree of clumping and density of population. To remove the effect of density changes, Lloyd introduced a patchiness index which is expressed as mean crowding ratio to the mean. Similar to variance to ratio of mean, index of patchiness is dependent upon quadrate size, x^*/m = 1 random, < 1 regular and > 1 aggregated (Lloyd, 1967).

Morisita's coefficient of dispersion I_δ

Morisita (1962) suggested a hypothesis for testing the uneven distribution coefficient of I_δ and is calculated by the following equation:

$$\mathrm{I}_\delta = \frac{n \sum x_i (x_i - 1)}{N(N-1)}$$

where n = the number of sample units, x_i = the number of individuals in each sample unit and N = the total number of individuals in n samples. To determine if the sampled population significantly differs from random, the following large sample test of significance was used (Hucheson and Lyons, 1989).

$$Z = \frac{(I_\delta - 1)}{\left(\dfrac{2}{nm^2}\right)^{\frac{1}{2}}}$$

If 1.96 $\geq Z \geq$ -1.96 the spatial distribution will be random whereas if Z < -1.96 or Z > 1.96 it will be regular and aggregated, respectively (Pedigo and Buntin, 1994).

Optimum number of sample units (sample size)

Taylor's *a* and *b* coefficients, taken from Taylor's power law explain the relationship between variance and mean ($S^2 = am^b$) for individuals distributed in a natural population. The mean and variance of sampled mites was determined for each sampling date. Taylor's *a* and *b* coefficient estimated by log-log linear transformation of the mean-variance data, where *b* is the slop of the transformed data and *a* equals the antilog of transformed intercept. An equation for estimating pest sample size was developed by Karandinos (1976). Ruesink (1980), Wilson & Room (1982) integrated Taylor's power law into Karandinos' equation to form the sample size model used in this study (Cullen et al., 2000):

$$N_{opt} = a\left(\frac{t_{\alpha/2}}{D}\right)^2 (\mu^{b-2})$$

Where N_{opt}= sample size, $t_{\alpha/2}$= t-student of table, μ= mean density, *a* and *b* = Taylor's coefficient and *D* = the range of accuracy.

RESULT

Sampling program

One leaf of the bean cultivars was selected as a sample unit, due to activity place of *T. urticae* and *S. longicornis*. The results from the primary sampling was used to calculate *RV*. The maximum calculated *RV* and reliable sample size were 12.15% and 85.28, respectively for parastoo cultivar (Table 1).

Population density of *T. urticae* and *S. longicornis*

Mean population densities of overall life stages of *T. urticae* (immatures and adults) per leaf on six cultivars are shown in Table 2. The results showed that there was a significant difference (P < 0.05) among population densities of *T. urticae* on different cultivars of bean in overall dates. The maximum population density of *T. urticae* per leaf was observed on Goli (36.27) during sampling dates, which was significantly different from other bean cultivars.

The minimum population density of the mite was observed on Akhtar and Sadaf cultivars 3.27 and 4.93 overall life stages per leaf, respectively, that was significantly different from other bean cultivars. The population density of *S. longicornis* peaked at 3 thrips per Goli leaf during the warm months from July to September.

Spatial distribution

The results of the variance to mean ratio (S^2/m), coefficient of dispersion (I_D) and *Z* test of *T. urticae* and *S. longicornis* are showed in Table 3. The results of sampling presented that the spatial distribution was aggregated for all bean cultivars.

In Taylor's model, the regression between log S^2 and log *m T. urticae* was significant for all bean cultivars (P < 0.05). Slope of this model was varied from 1.10 to 1.84 for *T. urticae* and varied from 1.09 to 1.71 for *S. longicornis* and it was significantly bigger than one on all bean cultivars (Table 4). The estimated *t* (t_c) was bigger than *t*-table (t_t) for all cultivars, indicating an aggregated spatial distribution of *T. urticae* and *S. longicornis*, however, Parastoo cultivar had a t_c less than t_t, showing a random spatial distribution of *T. urticae* and *S. longicornis*.

Iwao's model indicated that there was a significant relation between the mean crowding and the density of *T. urticae* and *S. longicornis* (Table 4). Iwao's slope was varied from 1.01 to 1.34 for *T. urticae* and varied from 1.06 to 1.57 for *S. longicornis* all bean cultivars had an aggregated (slope > 1) spatial distribution of *T. urticae* and *S. longicornis*, however, Parastoo cultivar had a random pattern with t_c less than t_t. Morisita's index (I_δ) and Lloyd's mean crowding showed an aggregated pattern for *T. urticae* on all cultivars of bean and Lloyd's mean crowding showed an aggregated pattern for *S. longicornis*. Calculated Z was significantly greater than 1.96 in all sampling dates for *T. urticae*. The m^*/m value for *T. urticae* and their predator, *S. longicornis* in all sampling dates was significantly greater than 1 indicated aggregated pattern in all examined cultivars (Table 6).

Optimum number of sample size units

Re-calculated sample size using Taylor's coefficient (a and b) on six cultivars are presented in Table 4. The sample size calculated with Taylor's coefficient for *T. urticae* lower than *S. longicornis*. These values of sample size can help to develop sampling program of *T. urticae* and *S. longicornis*.

Density dependence in prey-predator interaction

The correlation coefficient between population densities of *T. urticae* and *S. longicornis* was statistically significant for six cultivars indicating high relation between species fluctuations. Statistically significant linear regression was observed between *T. urticae* and their predator (Table 7) revealing that *S. longicornis* in interaction with *T. urticae* does have density-dependent activity.

DISCUSSION

Several methods are accessible for the sampling of spider mites in row crops such as individual plant unit observation, imprint on paper, machine brushing on to a plate, beat cloth, paper or funnel techniques. The most exact method is direct counting of all life stages of mite on plant leaflets using a stereomicroscope (Kogan & Herzog, 1980). Regarding the life stage of *T. urticae* and *S. longicornis*, bean leaves were selected as sampling units and counts made of individuals per sampling unit. Via stereomicroscope and visual counts techniques, respectively.

Shimoda and Ashihara (1996) used the stereomicroscope in order to count the number of each stage of *T. urticae* on the cedar leaves. The population density of *T. urticae* was determined on raspberry leaves using stereomicroscope (Roy et al., 2005).

In most sampling dates, the highest population density of the mite was significantly recorded on Goli in comparision with the other bean cultivars (Table 2), suggesting that of dense trichomes and large leaf size of this cultivar may be the most important factors for its suitability leading to increase the mite population density. The lack of trichomes and waxy leaves in Parastoo cultivar may be the most important reasons for decrease of the population density of the mite. Mehrkhou et al. (2008) reported the same results with *T. urticae* on bean.

Spatial distributionis one of the most important ecological characters of a population that can be used in extended sampling programs for pest managements (Kuno, 1991). In a extended sampling which is a quick and precise method for estimating mean population or decision of control time, spatial distribution data is crucial in determination of equations and necessary sample size for the decision (Young & Young, 1985). In this research aggregated spatial distribution pattern was found for *T. urticae* by using variance to mean ratio Morisita's coefficient regression methods (Taylor & Iwao) and Lloyd's mean crowding for all bean cultivars due to the limited mobility of *T. urticae* females (Table 3,5 and 6). This behavior has been reported for *T. urticae* on other crop systems (Kennedy and Smitley, 1985), and it implies that large samples are required to obtain density estimates at on acceptable level of precision (Nachman, 1985).

Regression models of Taylor's power law and Iwao's patchiness were more exactly than the variance to mean ratio, since the mean and variance of each sampling date was used separately. Spatial distribution pattern of *T. urticae* using Taylor's power law and Iwao's patchiness were obtained random on Parastoo cultivar and were recorded aggregated on all bean cultivars (Table 4), suggestion that the different statistical methods have various results and accuracy in estimating spatial distribution of an organism.

Aggregated spatial distribution of *T. urticae* on a four bean cultivars was evaluated by Ahmadi et al. (2005). Shih & Wang (1996) evaluated that the aggregated spatial distribution of *T. urticae* in a carambula orchard. Greco et al. (1999) indicated that spatial distribution of *T. urticae* on strawberry was aggregated. Yasuyuki et al. (2004) determined that spatial distribution of *T. urticae* on apple orchard was aggregated. These results were similar to those found by So (1991) on rose and Raworth (1986) on strawberries.

The spatial distribution pattern of predatory thrips, *S. longicornis* using a variance to mean ratio was random on Akhtar, Parastoo and Talash and was aggregated on other three bean cultivars, suggesting that different plant cultivars can influence spatial distribution of the predator. Regression methods (Taylor & Iwao) and Lloyd's mean crowding indicated that the aggregated spatial distribution pattern of *S. longicornis* on bean cultivars. This behavior of *S. longicornis* is a positive response to the aggregative behavior of *T. urticae* for enhancing the predation efficiency. These results demonstrated that due to similarity of spatial distribution pattern of *T. urticae* and *S. longicornis* (aggregated pattern) on some plant cultivars, it could be a beneficial agent for biological control of the mite on these plants. Yasuyuki et al. (2004) studied the spatial distribution pattern and sampling technique for the predatory thrips *S. takahashii* in apple orchards and observed an aggregated spatial distribution pattern for this predator and its prey, *T. urticae* using regression analysis method to estimate the spatial distribution.

This study showed that the different plant cultivars had distinct effect on population density of *T. urticae* and its predator *S. longicornis*. The population density of the mite during the growing season, on different cultivars was significantly different. The highest and lowest population density of *T. urticae* was observed on Goli and Akhtar, respectively. The reaction of *S. longicornis* to population of *T. urticae* on various cultivars was density dependent. Therefore it seems that *S. longicornis* can act as a suitable predator for controlling spider mites in IPM on various bean cultivars. The coefficient acquired from spatial distribution models can be used in developing a sampling program of *T. urticae* on each crop. To upgrade the management of *T. urticae* on agricultural crops an exact sampling program is needed. Additionally, our finding may provide essential information for comprehensive IPM of *T. urticae* on bean species.

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Table 1. Estimated parameters by primary sampling of *T. urticae* on different bean cultivars in 2010.

Cultivar	n	SE	SD	RV	m	d	N
Goli	60	1.567	12.141	4.289273	36.533	0.2	10.60695
Akhtar	60	0.365	2.824	8.939505	4.083	0.2	45.94336
Sadaf	60	0.421	3.261	9.020784	4.667	0.2	46.88977
Parastoo	60	0.156	1.209	12.159	1.283	0.2	85.28083
Talash	60	0.996	7.715	8.064777	12.35	0.2	37.47918
Baker	60	0.179	1.384	11.93333	1.5	0.2	81.76018

n = Number of samples, SE = Standard error of the mean, SD = Standard deviation of the mean, RV = Relative variation, m = Mean of primary data, d = Desired fixed proportion of the mean and N = Sample size

Table 2. Mean (±SE) population density of overall life stages of *T. urticae* (per leaf) on different bean cultivars in 2010.

Date	Goli	Akhtar	Sadaf	Parastoo	Talash	Baker
11Jul.	41.90 ± 2.53^{a}	6.12 ± 0.50^{cd}	8.22 ± 0.89^{c}	1.40 ± 0.17^{e}	16.24 ± 0.79^{b}	2.56 ± 0.29^{de}
18Jul.	86.44 ± 3.17^{a}	1.02 ± 0.18^{d}	8.54 ± 0.74^{bc}	0.86 ± 0.17^{d}	11.38 ± 1.04^{b}	5.96 ± 0.66^{cd}
23Jul.	81.60 ± 1.44^{a}	1.12 ± 0.20^{d}	4.46 ± 0.49^{c}	1.50 ± 0.23^{d}	7.94 ± 0.67^{b}	10.38 ± 0.87^{b}
30Jul.	55.68 ± 2.64^{a}	1.22 ± 0.14^{c}	3.84 ± 0.48^{c}	3.02 ± 0.31^{c}	10 ± 0.74^{b}	14.32 ± 0.86^{b}
5Aug.	42.96 ± 1.39^{a}	0.56 ± 0.10^{d}	8.52 ± 0.64^{c}	3.78 ± 0.32^{d}	7.90 ± 0.76^{c}	16.40 ± 1.38^{b}
13Aug.	23.64 ± 0.73^{a}	3.42 ± 0.38^{e}	4.56 ± 0.38^{de}	6.48 ± 0.36^{cd}	8.42 ± 1.61^{c}	11.66 ± 0.59^{b}
19Aug.	20.52 ± 0.83^{a}	5.16 ± 0.39^{d}	5.46 ± 0.49^{d}	9.46 ± 0.78^{c}	5.32 ± 0.53^{d}	15.38 ± 1.33^{b}
28Aug.	33.84 ± 0.68^{a}	3.82 ± 0.29^{d}	3.02 ± 0.28^{d}	13.58 ± 0.57^{b}	3.68 ± 0.39^{d}	11.76 ± 0.35^{c}
2Sep.	30.64 ± 1.26^{a}	7.54 ± 0.43^{d}	1.74 ± 0.16^{e}	10.62 ± 0.49^{c}	13.32 ± 0.75^{b}	11.46 ± 0.68^{bc}
10Sep.	8.06 ± 0.48^{ab}	3.24 ± 0.33^{d}	4.98 ± 0.46^{c}	7.80 ± 0.33^{ab}	6.68 ± 0.52^{b}	8.48 ± 0.52^{a}
16Sep.	7.32 ± 0.38^{bc}	4.47 ± 0.41^{d}	3.02 ± 0.25^{e}	12.10 ± 0.62^{a}	8.40 ± 0.60^{b}	6.60 ± 0.45^{c}
22Sep.	2.68 ± 0.27^{bc}	1.26 ± 0.26^{d}	2.82 ± 0.34^{bc}	3.62 ± 0.30^{ab}	4.06 ± 0.34^{a}	2.32 ± 0.30^{cd}
Overalls dates	36.27 ± 3.87^{a}	3.27 ± 0.32^{d}	4.93 ± 0.33^{cd}	6.18 ± 0.63^{bcd}	8.61 ± 0.52^{bc}	9.77 ± 0.66^{b}

* The means followed by different letters in the same row are significantly different (p<0.01, LSD)

Table 3. Spatial distribution parameters (variance to mean ratio) of *T. urticae* and *S. longicornis* on different bean cultivars during 2010.

Cultivars	S^2/m	I_D	Z
T. urticae			
Goli	3.581	175.497	8.886
Akhtar	1.598	78.312	2.666
Sadaf	2.596	127.226	6.103
Parastoo	1.477	72.368	2.182
Talash	3.679	180.271	9.139
Baker	3.076	150.720	7.513
S. longicornis			
Goli	1.705	83.556	3.078
Akhtar	1.091	53.449	0.490
Sadaf	1.431	70.141	1.995
Parastoo	1.086	53.233	0.496
Talash	1.189	58.242	0.944
Baker	1.337	65.531	1.599

Table 4. Spatial distribution of *T. urticae* and *S. longicornis* on different bean cultivars during 2010 using Taylor's power law and Iwao's patchiness regression analysis.

Cultivar	Taylor							Iwao						
	a	b	SE_b	r^2	P_{reg}	t_c	N_{opt}	a	b	SE_β	r^2	P_{reg}	t_c	t_t
Mite														
Goli	-0.179	1.55	0.21	80.8	0.00	2.64	65.46	0.20	1.37	0.12	99.5	0.00	2.99	2.23
Akhtar	0.149	1.28	0.13	88.2	0.00	2.24	111.51	0.58	1.21	0.06	95.2	0.00	3.68	2.23
Sadaf	-0.243	1.84	0.19	89.7	0.00	4.25	129.58	-0.45	1.31	0.09	94.7	0.00	3.26	2.23
Parastoo	0.148	1.11	0.13	85.7	0.00	0.83	97.47	0.39	1.09	0.15	98.1	0.00	0.58	2.23
Talash	0.194	1.69	0.23	47.4	0.01	3.01	75.64	2.37	1.71	0.16	50	0.01	4.37	2.23
Baker	0.099	1.57	0.22	61.6	0.00	2.64	86.28	-0.17	1.29	0.11	93.5	0.00	2.56	2.23
Thrips														
Goli	0.009	1.24	0.02	91.4	0.00	10	7.98	-0.23	1.26	0.08	95.8	0.00	3.13	2.23
Akhtar	-0.034	1.12	0.05	74.6	0.00	2.35	58.91	-0.23	1.23	0.04	72.3	0.00	5.61	2.23
Sadaf	0.139	1.34	0.10	72.7	0.00	3.4	55.04	0.47	1.58	0.25	60.8	0.00	2.33	2.23
Parastoo	0.053	1.01	0.04	42.6	0.01	0.23	27.03	0.44	1.07	0.23	52.2	0.00	0.28	2.23
Talash	-0.147	1.33	0.13	57.6	0.00	2.62	42.14	-0.54	1.40	0.10	68	0.00	3.82	2.23
Baker	0.028	1.19	0.08	71.4	0.00	2.44	29.58	-0.39	1.27	0.10	82.1	0.00	2.62	2.23

Table 5. Parameters of Morisita's index and Z calculated of *T. urticae* on different bean cultivars during 2010.

	Goli		Akhtar		Sadaf		Parastoo		Talash		Baker	
Date	I_δ	Z	I_δ	Z	I_δ	Z	I_δ	Z	I_δ	Z	I_δ	Z
11Jul.	1.16	230.36	1.17	37.26	1.45	131.23	1.12	5.84	1.06	31.36	1.22	20.29
18Jul.	1.05	167.28	1.65	23.33	1.25	75.36	1.77	23.47	1.33	131.47	1.43	92.36
23Jul.	1.01	9.15	1.69	27.26	1.37	57.63	1.48	25.32	1.22	63.01	1.25	92.22
30Jul.	1.09	182.64	1.07	2.83	1.51	69.70	1.18	19.09	1.17	59.66	1.11	55.84
5Aug.	1.03	42.86	1.32	6.39	1.16	47.67	1.10	13.42	1.33	91.83	1.29	167.7
13Aug.	1.01	4.47	1.30	36.73	1.13	20.38	1.11	2.54	2.68	499.99	1.23	93.03
19Aug.	1.03	24.39	1.09	16.49	1.22	42.49	1.23	75.72	1.30	56.32	1.31	165.9
28Aug.	1.03	31.04	1.03	3.39	1.08	8.72	1.01	6.30	1.27	35.66	1.03	14.51
2Sep.	1.01	7.46	1.03	6.86	1.38	22.64	1.01	5.43	1.08	38.72	1.09	35.41
10Sep.	1.05	15.64	1.21	23.80	1.21	38.06	1.02	6.34	1.15	36.26	1.07	19.81
16Sep.	1.05	13.39	1.15	25.67	1.12	2.71	1.05	20.23	1.13	32.02	1.08	19.19
22Sep.	1.15	12.24	2.25	55.82	1.37	36.67	1.07	9.51	1.10	14.68	1.40	32.96

Table 6. Estimated parameters by Lloyd's mean crowding to mean for *T. urticae* and *S. longicornis* on different bean cultivars during 2010.

	Goli	Akhtar	Sadaf	Parastoo	Talash	Baker
Mite						
m^*	38.85	3.87	6.53	6.66	11.29	11.84
m^*/m	1.07	1.18	1.32	1.08	1.31	1.21
Thrips						
m^*	3.57	1.12	1.76	1.41	1.92	2.07
m^*/m	1.25	1.09	1.33	1.07	1.11	1.19

Table 7. Statistics of the linear regression between the mean population density of *T. urticae* and *S. longicornis* on different bean cultivars during 2010.

Cultivar	a	b	SE_b	r^2	P_{reg}
Goli	1.08	0.049	0.32	82.7	0.00
Akhtar	0.37	0.203	0.22	56.3	0.00
Sadaf	0.96	0.075	0.37	10.6	0.00
Parastoo	0.65	0.109	0.11	83.6	0.02
Talash	0.97	0.088	0.30	43.1	0.00
Baker	0.67	0.109	0.26	67	0.03

THE SPECIES OF SUBORDER HETEROPTERA (HEMIPTERA) ON VINEYARDS AGROECOSYSTEMS WHICH IS FOUND IN DİYARBAKIR, ELAZIĞ AND MARDİN PROVINCES, TURKEY

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ABSTRACT: This study has been realized in the localities of Diyarbakır, Elazığ and Mardin during 2006-2007 where vineyards agroecosystem plantations are common. In total, 10 Heteroptera species from five families (Pentatomidae, Scutelleridae, Miridae, Coreidae and Lygaeidae) were recorded in these provinces. The distribution of collected species in each province varied greatly; these were in total, 2 species from two families recorded at two sampling locations in Diyarbakır, 3 species from two families recorded at one sampling locations in Elazıg, 5 species from three families at two sampling locations in Mardin respectively. From these families was collected of 59 specimens. Apart the *Nysius cymoides* and *Holcostethus vernalis* Wolff, 1804, all species were recorded of first times of the vineyards agroecosystem.

KEY WORDS: Vineyard, Heteroptera, fauna, Turkey.

Our country is the most favorable climate for wine-growing. The country is very old and well-established wine-growing culture, a gene has the potential to rich. The people of Anatolia was used with different ways to grape production. On the other hand; The processing of grape must obtained in different ways. This products were wine, vinegar and nutritional products such as molasses, and uses to meet energy needs. One of the most important problems in the areas were pests which affected to vineyard area. Oztürk et al. (2005) was listed 267 specimens of 63 families to reported that the harmful species between 1938 to 2004 years in vineyard area from Turkey. There were 25 specimens in these species, also belonging to the Hemipera in the vineyard areas of the Southeastern and Eastern Anatolia region. Günaydın (1972) was studied on the vineyard pests Southeastern and Eastern Anatolia regions. He was determined to important pest: *Eriophyes vitis* Colomerus, *Arboridia adanae* Dlabola, *Haplothrips glabiceps* Bagnall, *Anaphothrips vitis* Priesner specimens in the vineyard areas. Maçan (1984) was determined to 5 specimens in Homoptera order; 3 specimens in Lepidoptera order, 3 specimens in Coleoptera order, 2 specimens in Thysanoptera order, 1 specimens in Diptera order in Diyarbakir, Elazığ, Malatya, Mardin, Siirt and Şanlıurfa provinces. The studies in this area were to determine of general insect order. This study was conducted to determine of Hemiptera specimens between 2006 to 2007 years in Diyarbakır, Elazığ and Mardin provinces.

MATERIAL AND METHODS

The present study on fauna of Hemiptera order was carried out during 2006-2007 in different vineyards areas of the Diyarbakır, Elazığ and Mardin provinces. Surveys have been performed with sweep net and knock down metods. Classification and nomenclature of Pentatomidae, Scutelleridae, Miridae, Coreidae and Lygaeidae suggested by Tamanini (1959) and Stichel (1960, 1961, 1962). Material have been identified by Dr. Meral FENT (Department of Zoology, Faculty of Science,Trakya University).

RESULT AND DISCUSSION

In this study, was determined of the ten species belong five family of Heteroptera suborder in Diyarbakır, Elazığ and Mardin provinces of Turkey.

List of the species:

Family: Pentatomidae

Holcostethus strictus vernalis Wolff, 1804

Material examined: Elazığ, Central province, 14.VI.2006, 8 exs.

Remarks: Distribution in East and southeastern Anatolia region of this specimen was in Diyarbakır (central, Ergani, Bismil, Hazro, Silvan), Batman (Central), Elazığ (Sivrice,Gezin), Gaziantep, Şanlıurfa, Mardin, Siirt (Central, Kurtalan), Şırnak (Cizre, Silopi) provinces (Uygun et al., 1995; Önder et al., 1995; Özgen et al., 2005; Kaplan, 2007). Host plants of this species have been strawberry, wheat and almond (Özgen et al., 2005; Bolu et al., 2006; Kaplan, 2007).

Eurydema fieberi Schummer & Fieber, 1837

Material examined: **Diyarbakır**, Çermik, 01.VII.2006, 6 exs.

Remarks: This species have been determined in Gaziantep (Central, Kilis, Oğuzeli, Yavuzeli) province (Önder et al., 1995). It is the first record for the study area.

Eurydema putoni Jakovlev, 1877

Material examined: **Mardin**, Derik, 01.VII. 2007, 7 exs.

Remarks: This species have been determined in Erzurum province (Önder et al., 2006). It is the first record for the study area and vineyard area.

Tholagmus flavolineatus Wagner, 1955

Material examined: **Elazığ**, 12.V.2006, 6 exs.

Remarks: This species have been determined in Gaziantep (Oğuzeli) province (Önder et al., 1995). It is the first record for the study area and vineyard area.

Sciocoris distinctus Fieber, 1857

Material examined: **Mardin**, Derik, 19.VIII.2007, 3 exs, 05.IX.2007, 1 exs, Totally: 4 exs.

Remarks: This species have been determined in Ankara, Kars and Ordu provinces (Önder et al., 2006). It is the first record for the study area and vineyard area.

Family: Scutellaridae

Psacasta tuberculata Stichel, 1960

Material examined: **Elazığ**, 15.V. 2006, 3 exs.

Remarks: This species have been determined in Adana, Ankara, Antalya, Aydın, Gaziantep, Hatay, Kırşehir and Mersin provinces (Önder et al., 1996). It is the first record for the study area and vineyard area.

Family: Miridae

Horistus orientalis Gmelin, 1790

Material examined: **Diyarbakır**, Lice, 14.V. 2006, 6 exs.

Remarks: It is the first record for the study area and vineyard area.

Family: Lygaeidae

Nysius graminicola graminicola Kolenati, 1846

Material examined: **Mardin**, Savur, 17.V.2006, 4 exs.

Remarks: This species have been determined in Diyarbakır, Şanlıurfa and Mardin provinces (Akkaya; 1995; Uygun et al., 1995). It is the first record for vineyard area.

Nysius cymoides (Spinola, 1837)

Material examined: **Mardin**, Savur, 17.V.2006, 3 exs.

Remarks: This species have been determined in Diyarbakır, Şanlıurfa and Kilis provinces (Akkaya; 1995; Lodos et al., 1999). This species was known in weeds (Lodos et al., 1999). It is the first record for Mardin province and vineyard area.

Family: Coreidae

Centrocoris variegatus Kolenati, 1845

Material examined: Mardin: Derik, 01.VII.2006, 12 exs.

Remarks: This species is the first record for the study area and vineyard area. It is polyphagous. It is generally found on Chenopodiacea family plants (Anonymous 2009).

In the previously studies have been determined *Camptopus lateralis, Coreus marginatus* (L.), *Heterogaster urticae* F., *Lygaeus equestris* (L.), *L. pandurus* Scop., *Megalonotus sabulicola* Thomson, *Metopoplax origani* Kolenati, *Nysius cymoides* Spinola, *Lygus pratensis* L., *Exolygus pratensis* Kuzn., *Tuponia elegans* (Jakovlev), *Aelia acuminata* L., *Ancyrosoma leucogrammes* Gmelin, *Carpocoris mediterraneus* Tamanini, *C. purpuripennis* (De Geer), *Dolycoris baccarum* (L.), *Eurydema ornatum* (L.), *E. ventrale* Kolenati, *Graphosoma lineatum* L. *Holcostethus vernalis* Wolff., *Mustha spinosula* (Lef.), *Nezara viridula* (L.), *Raphigaster nebulosa* Poda, *Maccevethus caucasicus*, *Eurygaster maura* (L.) in the Turkey's vineyard areas (Öztürk, 2005). *Nysius cymoides* and *Holcostethus vernalis* are also determined with the present investigation. The other species are firstly determined in the vineyard area. These species are polyphagous generally. They will be hazardous species with climatic changes of the region in the following years. Detailed studies on feeding behaviour and flora/fauna interactions of these species are required.

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BIONOMICS OF *ALCIDODES AFFABER* AURIVILLIUS (COLEOPTERA: CURCULIONIDAE: ALCIDODINAE), A SERIOUS PEST OF BHENDI, *ABELMOSCHUS ESCULENTUS* (L.) MOENCH.

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ABSTRACT: *Alcidodes affaber* (Auriv.) has been observed as a major pest of bhendi crop in the Jammu region. A maximum of 16 specimen at different stages of development were recorded from a single plant. Weevils were found to breed from August to December and overwinters in soil or in the debris of harvested plants. Adults feed on soft tender parts of the plant viz. petiole, leaf buds, tender terminal portions and sometimes fruit also. Larvae borers and bored the stem and side branches to form irregular zig-zag galleries resulting into galls. Infestation varies from 20.8 to 90.3% with an average of 59.42±30.18%. Mating lasts for about half an hour. Incubation period varies from 3-6 days with an average of 4.20±1.18 days. Total larval period varies from 48 to 68 days with an average of 55.04±5.21 days. Pupal period ranges from 10 to 14 days with an average of 12.15±1.69 days. Total life span takes 61 to 84 days with an average of 71.39±8.08 days. Only one generation was observed.

KEY WORDS: Bionomics, *Alcidodes affaber, Abelmoschus esculentus,* Alcidodinae, Curculonidae, Coleoptera, India.

Weevils have been found infesting a variety of host plants not only in the field but also in storage. Among these *Alcidodes affaber* Aurivillius was first noted and described by Aurivillius in 1891. Fletcher (1919) described its occurrence, distribution and host plants whereas Ayyar (1922) gave a brief account of the same. Both Ayyar and Fletcher recorded it from cotton (*Gossypium* sp.), Bhendi (*Hibiscus esculentes*) and gogu (*Hibiscus cannabinus*). Subramanian (1959) studied the biology of the weevil whereas Devaiah et al. (1981) described its various life history stages. Thippeswamy et al. (1992) studied the life cycle of the weevil on Bhendi. Brief survey conducted at Jammu revealed the seriousness of the damage done by the weevil to the bhendi crop. The pest was recorded for the first time from Jammu region of J & K. Hence detailed studies were made on the weevil towards its biology and the results are presented herein.

MATERIAL AND METHODS

The weevils were collected from five different sites viz. Naran, Sagal, Treli, Rajpura and Khandwal of Samba district of Jammu province where bhindi is commonly grown. Studies were conducted during the period 2009-2010 when the occurrence of the weevil was at peak. Rearings were made through culture on potted cage plants. Adults were rarely seen in copulation in the field though they did so freely in the Laboratory. Eggs were obtained both from the field as well as in the Laboratory. The shoots containing eggs were kept in glass tubes of 10×2.5

cm keeping the wet cotton at the base of shoot. On hatching, the first and second instars kept feeding in fresh petioles whereas remaining instars fed inside the main stem. Only the total larval period could be counted and to determine the individual larval periods newly hatched larvae and subsequent larvae of different ages were collected and subjected to Dyar›s law for subsequent analysis. To determine the pupal period mature larvae collected from infested plants were observed at regular intervals till the emergence of adults. For morphological studies larvae, pupae and adults were preserved in 90% ethyl alcohol. Eggs were preserved in 5% formalin with few drops of glycerine. The mode and extent of damage caused by the adults and larvae were studied by visual observations of the symptoms of damage and counting the number of damaged plants during July to November when the attack on plants was easily discernible.

OBSERVATION AND DISCUSSION

Distribution: The results of the present study revealed the distribution in Jammu and Kashmir as Samba: Naran, Sagal, Rajpura, Khandwal, Ghagwal, Samba, Nud, Vijaypur, Ramgarh, Jakh and Sarore. Bengal (Beeson, 1919); Saidapet (Rao, 1919); South India (Ayyar, 1922); Punjab (Hussain, 1925); Coimbatore (Subramanian, 1959); Ceylon (Huston, 1930); Dehradun (Gardner, 1934); Karnataka (Thippeswamy et al., 1980; Devaiah, 1981; Kumar, 2011).

Host plants: It is a polyphagous pest and its grubs form galls on the stem of bhendi. Adults feed on leaf buds, petioles, tender terminal portions and sometimes fruits also. It was also recorded from cotton. Other host plants include: *Hibiscus esculentus*, *Gossypium* sp. and *H. cannabis* (Aurivillius, 1891); *Ficus bengalensis* (Beeson, 1919); Paddy (Ayyar, 1922); Cotton (Hussain, 1925); *Eriodendron anfractuosum* (Huston, 1930); *Hibiscus mutabilis*, *Kydia calcyina*, *Bombax malabaricum* and *Althea rosea* (Gardner, 1934), and *Hibiscus ficulneus*, *Urena lobata* and *Urena sinuata* (Subramanian, 1959).

Pest status: It was recorded as a serious pest of bhendi in the area under investigation. Grubs do serious damage to the plant by boring the stems and side branches. Initially they feed on the tissue around the point of entry resulting into a gall like swelling around the site of injury. Later they bore downwards if the eggs have been laid at the terminal end and when the eggs are laid in side branches, the first and second instars feed inside side branches and later migrate downwards into the main stem where they finally pupate after passing through the remaining instars. Adults feed by scooping the tissue of succulent shoots towards the tip, leaf buds and petioles. The damage done by the adults is quite insignificant. Maximum number of adults recorded from a single plant (5 feet) is 4; however a maximum of 16 specimen at different stages of development were recorded from a single plant in the month of October. Percentage infestation recoded at Naran, Sagal, Treli, Rajpura and Khandwal was 34.9%, 68.8%, 82.3, 20.96% and 90.3% respectively ranging from 20.96% to 90.3% with average of 59.42±30.18%. Almost similar observations were recorded by Subramanian (1959) who observed it as a serious pest of bhendi in South India with a maximum of 12 grubs from a single plant and more than 80% infestation amounting to 20 to 30% damage to bhendi crop.

Seasonal occurrence: The weevil appears in the field in the first week of August and remains in the field upto December. The weevil is absent on bhendi during the rest of year when it overwinters inside dead remains of the harvested stems and stumps in the soil. The weevil is more abundant in the field during the rainy season at Samba in North India from August to November. Maximum oviposition had been observed in the months of August and September with no oviposition observed after second week of October. Crop is raised at Samba in two seasons. One from April to July and other from July to December. The weevil attacks only the crop raised in July and the rainy season is more conducive for breeding. Only one generation of the weevil was recorded.

Nature and Symptoms of damage: The presence of adults in the field is indicated by the scratches on the petioles, tender leaves, buds and tip of young stem with careful search revealing adults hidden under the leaves. Mature female oviposits by notching out holes with the help of its snout in the tender and succulent side branches, petioles, leaf buds or the tender terminal portion of the stem; after ovipositing the mouth of the holes were sealed with a yellow secretion which turns black in a day or two which further confirms the attack. The feeding of the grub around the site of injury results into a gall like swelling which further confirms the infestation. A frothy secretion oozes out of the holes in the stem which indicates larval feeding inside the stem (Fig. H). Exit holes for the emergence of adults, tunnelled stems seen after longitudinal splitting, presence of broken side branches, leaf buds, petioles and stem with slight winds are the late stage symptoms of damage. Adults feed by scooping the tender portions of the plant and the damage is quite insignificant (Fig. F & L). Larvae tunnel the stem and side branches and feed on middle succulent tissues thereby reducing the vitality and vigour of the plant. As a result many side branches, petioles, buds fall down with the wind thus reducing the fruit output. Too many exit holes made by the grubs in heavy damage weakens the stem resulting into its rupture and breakage further reducing yield. Similar observations had earlier been recorded by Subramanian (1959), Thimmaiah et al. (1975) and Thippeswamy et al. (1992).

LIFE HISTORY

Emergence: The adults emerged from August to November both during day and night. Freshly emerged adults are soft, light greenish brown without any colour dimorphism between the male and female and gradually became hard in 2 days. The newly emerged adults showed no feeding for 5 to 8 days.

Mating behaviour: After a few minutes of courtship male succeeds in ridding over the female. Copulation lasts for 25-40 minutes and multiple matings were observed. The weevils are rarely seen in copulation in the field but they copulate freely under laboratory. With slight disturbance the copulating pair falls to the ground intact in copulating posture but sometimes they separate and feign death.

Oviposition behaviour: Pre-oviposition period occupied 5-9 days (average 6.5±1.90 days) and a maximum of 25 eggs were laid by a single female at the rate of 1-3 eggs per day. Maximum period of oviposition was 16 days. Eggs are laid in excavations made by the female with her rostrum in soft tender parts of the plant and their depth equals the length of the rostrum. Usually three excavations are made very close to each other and the egg is laid in the middle one only. Usually only one egg is laid in a single excavation. Similar observations were recorded earlier by Subramanian (1959) in Coimbatore who recorded pre-oviposition period of 8-11 days, oviposition period of 34 days with a single female laying 45 eggs at the rate of 1-3 eggs per day. Thippeswamy et al. (1992) recorded almost similar observations with pre-oviposition period of 10-14 days (average 11) with a single female laying 8-52 eggs (average 32) in 16-30 days (average 28 days) in soft tender parts of the plant.

Egg (Fig.A): Egg creamy white to light yellowish, oblong with anterior end slightly narrower, having minute pits on the chorion and laid in hollow scoop on the petiole. Egg turns to light brownish on the penultimate day with the two mandibles of the developing grub clearly visible through the chorion. It measures 1.09±0.07 mm in length ranging from 1.02-1.19 mm and 0.60±0.036 mm in width ranging from 0.56-0.64 mm.

Egg period: Egg hatches in 3-6 days with an average of 4.20±1.18. Subramanian (1959) recorded incubation period of 6-7 days (average 6.3 days) at Coimbatore whereas Thippeswamy et al. (1992) recorded it to be of 3-7 days with an average of 4.95 days at Dharwad.

Larva and larval instars: Nine larval instars were recorded in the study (Fig. G). There is not much difference in general characters among the different larval instars and only the size of body and head capsule vary and therefore only the first and last larval instars are described and measurements of the body and head capsule of the different larval instars are given in the table 1.

First instar: Larva apodous, soft, C- shaped**,** pale yellow in colour and best with soft hairs. Head smooth, freely movable, pale brown with a median dark line on the posterior end of frons. Mandibles dark brown and bifid. Body glabrous, wrinkled with posterior end more or less rounded. The terga of thorax and abdomen except that of prothorax and last and second last segments are divided by one or two grooves into two or more folds.

Final instar (Fig. B): Fully grown grub creamy yellow, apodous with stout, cylindrical, moderately curved and wrinkled body. Head capsule dark, subcircular with irregular and deeply pitted surface. Frons bears transverse sculpture on the surface along with a dark streak posteriorly which extends forwards to about a quarter of its length and bears five pairs of setae. Mouth parts bitting and chewing type. Prothorax undivided dorsally with prescutal and scutal areas roughly indicated by rows of setae. Meso and metathorax divisible divisible into prescutellum and scutoscutellum; former with two small setae and the later with four setae set in a straight line. Abdomen 10 segmented with three distinct transverse folds viz. prescutellum, scutum and scutellum. Each epiplural lobe of abdomen with a single setae and each hypoplural lobe with two setae. Last two segments simple provided with a number of hairs. Spiracles short, circular tubes and do not project beyond the peritreme. Posterior spiracles are placed more dorsally whereas anterior ones are placed laterally.

Larval period: Larval period varied from 48 to 62 days with an average of 55.04±5.21 days. However larval period is extended in the months of November-December when it extends to 80 days. Subramanian (1959) recorded average larval period of 59 days at Coimbatore. Thippeswamy et al. (1992) observed larval average larval period of 68.04 days ranging from 52.50 to 86.50 at Dharwad.

Feeding behaviour (Fig. E): Immediately after emergence, the grub begins to feed on the tissues around the hole in which it was laid and later bores downwards. A frothy secretion comes out of the holes in the stem which is a sign of larval feeding in the stem. First and second instars feed in the side branches and third instar bores down into the main stem if the eggs are laid in side branches. However all the instars remain feed inside the main stem if the eggs are laid in the petiole or stem tip. Larva feeds on the central succulent part and eventually tunnels the stem and side branches. In severe damage hole of the pith region is eaten up by the larvae, move down until fully fed and gets ready for pupation. It makes small exit holes on the stem through which frass is ejected out.

Pupation: Fully fed grub stops feeding, its diameter increases and length decreases. It encloses itself in the pupal by plugging the larval tunnel with frass both anteriorly and posteriorly. Length of pupal chamber is more than the length of pupa.

Pupa (Fig. C): Exarate, naked with all its appendages distinctly visible, projecting freely on the ventral surface. Color creamy yellow which turns darker wih time. Head as long as broad, provided with five pairs of setae arising from minute tubercles. One pair of setae situated near the base, two pairs situated behind the eyes and two pairs situated between the eyes. Rostrum about one fourth of the total length of the body and bears a pair of setae. Prothorax one and a half times broader than its length having nine pairs of setae. Mesothorax as long as wide and bears two pairs of setae. Metathorax one and a half times as long as wide. Abdomen nine segmented with each of first eight segments bearing six pairs of setae dorsally. Last segment bears a pair of curved pleural processes. Ventral surface bare. Length of pupa varies from 8 mm to 9.8 mm with an average of 8.8±0.72 mm. Pupal period extends from 10 to 14 days with an average of 12.15±1.69 days.

Total life span from egg to adult varied from 61 to 84 days with an average of 71.39±8.08 days.

Adult (Fig. K): Freshly emerged adults soft, reddish brown which later turn hard and dark grey. Male smaller in length and width. The snout was shorter and stouter than the female. Body measured 9 to 11.3 in length with an average of 10.3±1.02 and 3.10 to 3.40 mm in width with an average of 3.25±0.12 mm. Body measures from 11.4 to 12.4 mm in length with an average of 11.9±0.14 mm and 3.15 to 3.50 mm in width with an average of 3.29±0.15 mm. Longivity in case of male averaged 28 days and 39 days in case of female (Thippeswamy et al., 1992). Subramanian (1959) recorded average adult longevity of 19.1 and 19.4 days respectively for male and female with food at Coimbatore. He recorded the adult longevity of only 8 days for both the sexes in case of female. Geniculate antenna arise one on either side in a groove in the middle of the snout; scape long and enlarged at the apex; funicle six segmented; club five segmented with the terminal segmented conical. Funicle and club bear setae of varied length. Mouth parts mandibulate, located at the tip of snout and enclosed in a sheath. Mandibles, maxilla and labium clearly visible. Mandible dark brown, tridentate with the middle denticle being the most prominent. Prothorax large, narrow at the apex, broad towards the middle with tubercle like elevations all over. Mesothorax bears a pair of elytra. Elytra dark brown, convex with dark margins and longitudinal rows of punctuations alternating with rows of fine setae. Metathorax bears a pair of membranous hind wings. Ventrally each thoracic segment bears a pair of legs that are dissimilar. Fore coxa triangular and broad at the base. Mid coxa roughly circular and bulged ventrally. Hind coxa triangular and broad at the apex. Prothoracic femur better developed than others. Vedge shaped femora with a prominent spine ventrally. Spine of metathoracic leg is less developed than others. All tibia possess a prominent process postero-ventrally. Tarsi 4-jointed and ends with a pair of bifid claws. Five abdominal segments clearly visible ventrally with the last segment being the largest.

Emergence and habits: Fully formed adults remain in the pupal chamber for 4 to 6 days. Then they emerge through the hole (Fig. F) made by the full grown grubs at the sides of the stem. Newly emerged adults are soft and delicate but become hard in a day or two. Generally less active and found clinging to the terminal branches usually at the axils of the leaves. If approached they try to hide beneath the leaves and a slight disturbance makes them fall on the ground and feign death. Adults are rarely seen in abundance in the field. They fly rarely inspite of having well developed hind wings.

Natural enemies: Ayyar (1934) Two Hymenopterous parasites on the grubs of this weevil are *Aphrastobracon alcidophagous* (Braconidae) (Ayyar, 1934) and Xoridescopus sp. (Ichneumonidae) (Ayyar, 1943). No parasites were recorded during the present studies.

Number of generations: Present author recorded only one generation. Subramanian (1959) recorded only one generation at Coimbatore whereas Thippeswamy et al. (1992) recorded two generations at Dharwad. First generation starting on the crop sown in the month of May and the second generation starting in the month of August.

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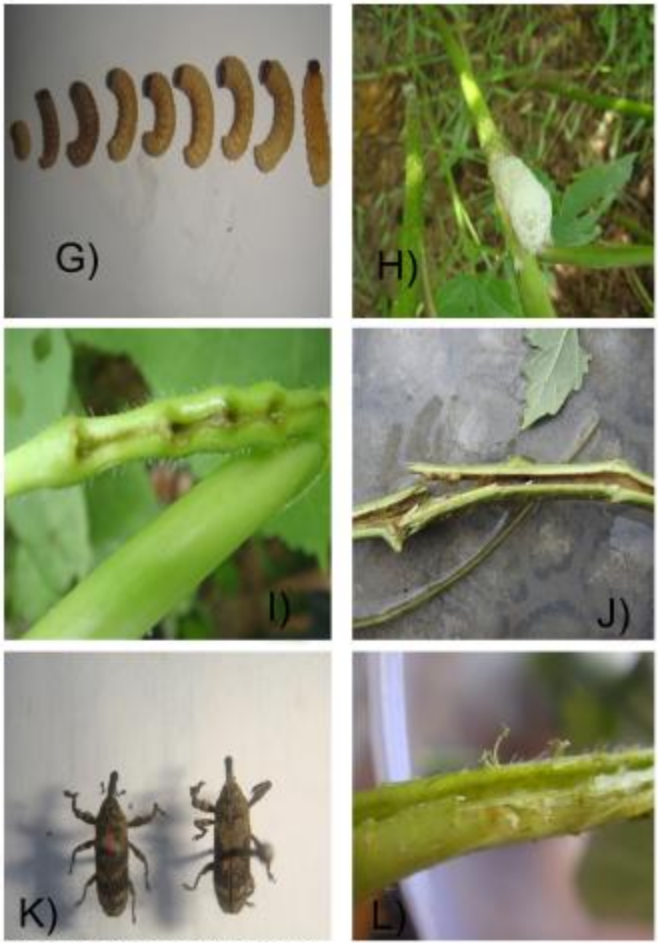
Table 1. Showing measurements of head width and body length.

Life stages	Head width (mm)			Body length (mm)		
	Min.	Max.	Mean	Min.	Max.	Mean
1st instar	0.48	0.72	0.60±0.10	1.20	1.40	1.31±0.08
2nd instar	0.62	0.82	0.73±0.08	1.50	2.0	1.80±0.22
3rd instar	0.80	0.95	0.9±0.07	2.10	2.5	2.47±0.29
4th instar	0.88	1.0	0.94±0.05	2.70	3.3	2.92±0.26
5th instar	1.0	1.18	1.11±0.07	3.5	4.5	4.02±0.48
6th instar	1.30	1.50	1.42±0.09	4.8	6.0	5.4±0.58
7th instar	1.60	1.90	1.72±0.12	6.10	6.7	6.4±0.27
8th instar	1.98	2.10	2.04±0.05	7.0	8.0	7.5±0.43
9th instar	2.18	2.56	2.32±0.17	8.2	10.4	9.2±0.92

Figures A-F. Life cycle *Alcidodes affaber*: A) Egg B) Larva in the stem. C) Pupa D) Newly formed adult (Light colored) E) Fully formed adult feeding on leaf bud F) Emergence hole.



Figures G-L. Life cycle stages of *Alcidodes affaber*: G) Nine instars H) Frothy secretion coming out of stem due larval feeding I) Holes made for oviposition J) Tunneled stem K) Male and female (adult) L) Damaged stem due to adult feeding.

STUDY ON THE EFFECTS OF SOME IRANIAN ISOLATES OF THE FUNGUS *BEAUVERIA BASSIANA* (BALSOMO) VUILL. (DEUTEROMYCOTINA: HYPHOMYCETES) ON THE BIRD CHERRY-OAT APHID, *RHOPALOSIPHUM PADI* (LINNAEUS) (HEMIPTERA: APHIDIDAE), UNDER LABORATORY CONDITIONS

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ABSTRACT: According to the importance of non-chemical controlling methods based on integrated pest managment, *Beauveria bassiana* was considered as a pathogen of the bird cherry-oat aphid, *Rhopalosiphum padi*. In this study, the pathogenicity effects of some Iranian isolates of *B. bassiana* against adult aphids were evaluated using the spray bioassay method. Seven isolates, including DEBI 001, DEBI 002, DEBI 003, DEBI 006, DEBI 008, DEBI 010 and DEBI 015, were cultured on the SDA medium and incubated under dark conditions at 25°C for 15 days. The minimum and maximum dosages of each strain was determined and then 5 different conidial concetrations were prepared based on the logarithmic distances Experiments were carried out based on RCD, and repeated 4 times and for each replicate 20 adult aphids were treated. The control aphids were treated with distilled water_tween 80. Treated aphids put in plexiglass cups in an incubator at 25±2°C, and mortality was recorded daily for 5 day. Data were analyzed using SAS (6.2) and Curve Expert 1 4 to determine LC_{50} and LT_{50}. The lowest and highest LC_{50} were recorded 0 06 and 119 26 Spore⁄ml, and the lowest and highest LT_{50} were recorded 2 08 and 4 57 days, both respectively using DEBI 015 and DEBI 001 isolates.

KEY WORDS: Fungus, *Beauveria bassiana*, isolate, aphid, *Rhopalosiphum padi*, LC_{50}, LT_{50}.

The bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus), is one of the important aphid species related to gramineous plants. Species is widely distributed in most areas of grain-growing in Iran, and also has been observed on some rosaceous plants, including plum and wild plum (*Prunus* spp.) in north of the country (Rezwani, 2001 and 2004; Radjabi & Behrouzin, 2003). This aphid attacks to several gramineous species, especially wheat, barley, corn, rice and even herbs (Rezwani, 2001 and 2004), and produces toxic saliva and vectors plant viruses (Morrill, 1995), in which Barley Mosaic Virus, Barley Yellow Dwarf Virus, and some rice viruses can be mentioned (Rochow & Eastop, 1966; Rochow & Gill, 1978; Radjabi & Behrouzin, 2003). Using pathogens, as biological control agents of some insect's species, has been increased during the last few years (Hafez et al , 2001). There are over 500 fungi known to be associated with insect diseases.Among them, *Beauveria bassiana* (Balsomo) Vuill**.** is recognized as the first entomopthogenic microorganism (Romoer & Stoffolano, 1998). This fungus is one of the most important fungi associated with insects, and a wide range of insect orders, including Coleoptera, Hemiptera, Lepidoptera, Orthoptera and Thysanoptera are considered as its hosts (Hajek, 2004). It has several characters which help it to be more effective against pests. The growth rate is moderately rapid. It possesses many strains that exhibit considerable variation in virulence, pathogenicity and host range (Herington, 2006). Several studied have been carried out on fungal pathogens against cereal aphids. For example, Ganassi et al. (2001) studied the effect of some entomopathogens against the greenbug, *Schizaphis graminum* (Rond), and found that many fungal species, such as *B. bassiana*, might be good candidates as biocontrol agents of the aphid. Virulence of *Verticillium lecanii* (Zimm) Viegas and an aphid-derived isolate of *B. bassiana* for six species of cereal-infesting aphids were evaluated by Feng et al. (1990). They found that *B. bassiana* kills aphids more rapidly. This fungus species has been examined on other aphid species. For example, during Van Hanh et al. (2007) studies, it was evaluated on Green peach aphid *Myzus persicae* (Sulz) and it could be one of the most effective fungi against the pest, with other entomopathogenic fungi. The effect of entomopathogenic fungi in Iran has extremely been studied, but their roles against aphid pests have been evaluated more or less. For example, Savafi et al. (2003) investigated the virulence of *V. lecanii.* against pea aphid *Acyrthosiphom pisum* (Harris). In the other research, Derakhshan Shadmehri (2009) tested the effect of 25 isolates of pathogenic fungi on mealy cabbage aphid *Brevicoryne brassicae* (L.).

Because of the problems related to using chemical insecticides against pests, such as environmental contamination, adverse effects on non-target organisms, residues in food and water, and accumulation of chemicals in food chain, there has been renewed interest in using microbial insecticides for controlling crop pests (Powell et al , 2005). This study evaluated seven isolates of the entomopathogenic fungus for their virulence to the bird cherry-oat aphid, in order to select a suitable isolate with the greatest potential for controlling the pest in a successful integrated management program. According to the importance of this aphid in Iran, it is necessary to achieve safe control ways for environments. So this study has been done for recognizing the entomopathogens for controlling aphids.

MATERIALS AND METHODS

Collecting, rearing, and preserving aphids

Aphids were collected in autumn with cutting the stem of wheat from, Karaj. This region is cold and one of the most important areas of *R. padi* in Iran. Collected insect were identified by Dr. Rezwani in Iranian Research Institute of Plant Protection. After separating aphids, they were transferred to the plastic little vases (8 diameters) that were planted 15 days before. Every week vases were changed until aphids were fed on fresh wheat. They were maintained in the laboratory of the Department of EntomologyIranian Research Institute of Plant Protection, Tehran, Iran under controlled conditions (23±2 °C, 60±10 RH and 16L: 8D).

Fungal culture

Seven isolates of *Beauveria bassiana* were obtained from a collection at the Iranian Research Institute of Plant Protection. Table1 shows a list of the isolates, their hosts, in which the isolate was collected, and their reigns. The fungus was culture on Sabouraud Dextrose Agar (SDA) in 90 mm petridishes and covered with parafilm. Fungal culture were kept in an incubator at 25±1°C and photoperiod of 16:8 hours (L: D) for 15 days.

Spore germination

Fungal suspensions were prepared by scrapping conidia from the surface of cultures using a sterile loop and added to tween 80 (0 5 sterile distilled water) Tween 80 were sterilized with membranous filter before. Suspensions were shaken fast. Resulting suspension were filtered through three layer sheer to separate mycelium. Resulting suspensions were kept in Mc cartney bottle with some sterile tiny balls in order to break hypha chain. Viability was determined by using Agar-agar (granulated) medium. Suspensions were sprayed all over medium. After 18 hours the germinated spores were counted in 100 random spores in a microscope field. The viability of all isolates was confirmed before using in experiments. By haemoctometere lam, the concentration series were determined.

Pathogenicity assay

Repeated cultures in artificial medium were decreased viability of each isolate. So, each suspension was used against *Galleria mellonella* (L.) larva. Each larva was dipped through water for 10-20 seconds. Larvae were kept in sterile petri in incubator for 7-10 days. After appearance of spores through larva bodies, new culture of each isolate were culture in SDA medium. All aphids used in this study were as adult stage. The minimum and maximum dosages of each strain were determined and 5 different conidial concentrations were prepared based on the logarithmic distance. Experiments were carried out based on RCD and repeated 4 times and for each replicate 20 adult aphids were treated. The control aphids were treated with distilled water-tween 80. Each 20 adult aphids were put in Buchner funnel that was covered with whatman paper (9cm diameters/Whatman No.1). The funnel was connected with vacuum flask. Aphids were sprayed for 5 seconds from 25 centimeter distance. Treated aphids were put into sterile petridish that contained with wet cotton and fresh wheat leaves. They were kept in incubator at 23±2˚C, 60±10 humidity and 16:8 (L: D). Petridishea were observed daily for ten days and dead aphids were counted and transferred to another petridishes to observation of fungal growth.

Statistical analysis

Mortality data were corrected by Abbott s formula (Goettel and Inglis,1997). LC_{50} and LC_{99} estimates were carried out using SAS (6.2) program. Also analysis of variance was carried out by SAS program.LT_{50} of each isolates was recorded by Curve Expert 1.4. Data were analyzed using SAS (6 2) and Curve Expert 1 4 to determine LC_{50} and LT_{50}

RESULTS

The observations of the developing of the fungal hypha through insect bodies were made sure that the death of aphids cussed by fungi attack no other agents Germination of all isolates ranged from 85 to 95 Lethal time of every isolates was calculated (table 2) Between the Lethal times of every isolates were not significant differences (Figure 1).

Probit used for calculating LC_{50} The lowest lc_{50} on the adult aphids were pertained to DEBI 015 and the highest LC_{50} was recorded for DEBI 002 (Table 3).

According to the amount of P_value, there were significant differences among various isolates (Table 4) Comparing LC_{50} of each isolate with one Index isolate (the index was DEBI 002 with the highest LC_{50}) indicated that there were not significant differences between DEBI 003, DEBI 001, and DEBI 021 with DEBI 002 And also there were significant differences between DEBI015, DEBI004 and

DEBI 021 with DEBI 002. These analyses were obtained with θ analysis (Robertson et al , 2007).

DISCCUSSION

Result showed that DEBI 002 isolate with maximum LC_{50} had a lowest virulence and DEBI015 with the minimum LC_{50} had highest virulence again the *Rhopalosiphum padi* (Table 3) DEBI002 was an isolate derived from soil. Although some soil derived isolates imposed higher mortality in comparison with other isolates of coleopteran and orthopteran (Goettel et al., 1990), DEBI002 showed the lowest impact in our tests. That needs more revision. The investigation on Russian aphid indicated that DEBI 002 isolate with the lowest LC_{50} had the maximum virulence in comparison to other isolates (Mohamadipor, 2006). In bioassay tests on *Eurygaster integriceps,* the DEBI 002 3 78×10^3 (spore insect) was the best native isolate (Rastegar, 2007). In study on the common pistachio psylla, *Agonoscena brunneus*, results showed that DEBI008 the native isolate that extract from a grasshopper, *Chorthippus brunnes* (Thunberg) with 3 91 × 10^2 spore insect has minimum LD50 (Alizadeh et al , 2007). The comparison of the LT50 showed that there were not significant diffrences between various isolate in 10 days (Table 2). The study on the LT50 of different isolates against *Sitobion aveane* showed that their LT50 were 3 – 5 4 days (Miranpuri & Khachatourians, 1995). The lowest LT50 that was recorded for DEBI 002 isolate against Russian aphid was 2 4 day (Mohamadipor, 2006) in bioassay tests of pathogens, LT50 and LC50 are indicative of their pathogenicity intensity (Miranpuri & Khachatourians 1995). The high virulence of the isolates DEBI004 and DEBI 015 against *Rhopalosiphum padi* indicates that these isolate are appropriate agents for biological control against cereals aphids. However, there is nearly no use of formulated entomopathogenic fungi in less developed countries, such as Iran (Safavi, et al., 2010). According to the importance of this aphid in Iran, It is necessary to acchive safe control ways for environment. It seems that the usage of entomopathogense in framework of IPM is promising and encouraging in Iran.

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Table 1. Details of the isolates of entomopathogenic fungi used in tests.

Letter name	Uppercase	Lowercase
DEBI 001	Soil	Fashan,Iran
DEBI 002	Soil	Karaj,Iran
DEBI 003	*Rhynchophorous ferrugineus*	Saravan,Iran
DEBI 004	*Hyper postica*	Ghazvin,Iran
DEBI 010	*Eurygaster integriceps*	Varamin ,Iran
DEBI 015	*Shingonotus sp*	Garmsar,Iran
DEBI 021	*Ceroplastes sinensis*	Sari,Iran

Table2. LT50 of entomopathogenic fungi against *R. padi.*

Fungal Isolate	LT50
DEBI 001	2 08
DEBI 002	2 53
DEBI 003	2 29
DEBI 004	2 41
DEBI 010	2 38
DEBI 015	2 41
DEBI021	2 96

Table 3. The log of LC 50 and LC 99 of population and slop

Fungal	LC50	Limits 50	LD99	Limit 99	Slop
DEBI 001	1 71	(1 16-2 02)	4 04	(3 58-4 95)	1 00
DEBI 002	2 21	(1 57-2 63)	6 9	(6 1-8 27)	0 44
DEBI 003	1 17	(0 21-1 87)	6 65	(5 69-8 62)	0 42
DEBI 004	0,22	(0 5-0 75)	5 17	(4 17-8 91)	0 58
DEBI 010	2 16	(1 44-2 62)	7 27	(6 36-7 86)	0 45
DEBI 015	0 23	(o 43-0 99)	3 73	(3 08-6 57)	0 58
DEBI 021	2 08	(2 71-2 91)	5 26	(0 91-4 07)	0 72

Table 4. Analysis of variance.

Source	DF	Sum of Square	Mean Square	F-value	P-value
Isolates	6	83.48	13 91	6.39	0.0006*
Error	21	45.70	2 17		
Total Error	27	129.18			

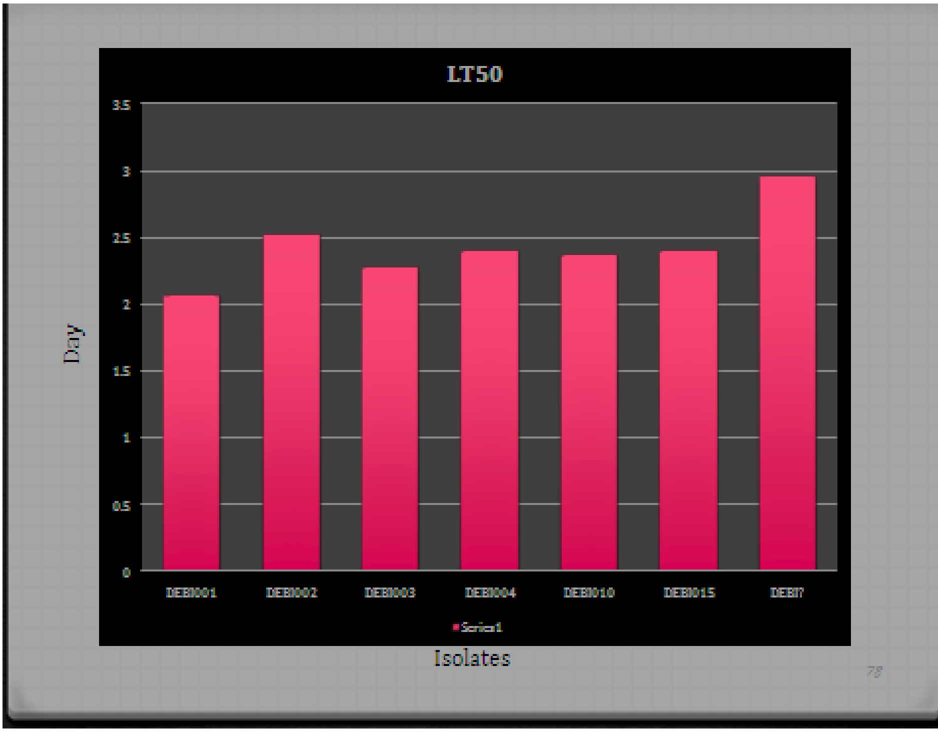

Figure 1. Lethal time of different isolates of *B. bassiana*.

BIOECOLOGICAL STUDIES OF INDIAN GOLDEN SILK MOTH, *ANTHERAEA ASSAMENSIS* HELFE*R* (LEPIDOPTERA: SATURNIIDAE)

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ABSTRACT: The bio-ecology of wild parental stocks of muga silk moth, A*ntheraea assamensis* Helfer collected from the natural habitat of Meghalaya (India) and its potential for breeding in North-East India are studied. The morphological characteristics and behaviour at the different developmental stages of the silkmoth are discussed. Colour polymorphism of the larva is observed. The wild silk moth is purely multivoltine in nature and four life cycles are completed in a year. After October-November crop it undergoes diapause at the pupal stage and remained in this stage till 2nd or 3rd week of March of the next year. The average fecundity ranged from 132 -147 in wild race and from 130 to 150 in semidomestic race during the different rearing seasons. The ERR% of wild race ranged from 12.54 to 48.50 with the highest value during Late Kotia (November-December), while in semi-domestic stock it ranged from 14.48 to 60.12 with the highest value during Baisakhi (April-May). The cocoon shell weight ranged from 1.32g to 1.51g in wild race without any significant variations during the different seasons ($p>0.05$). In semi-domestic race the shell weight ranged from 0.39g to 0.49g without any significant variations during the different seasons ($p<0.05$). The wild race can be used in breeding for introgression of the genes for higher shell weight to the semi domestic race.

KEY WORDS: A*ntheraea assamensis* Helfer, bioecology, characterisation, conservation.

The muga silkworm *Antheraea assamensis* Helfer is a holometabolus insect endemic to North East India only. This silkworm produces the unique golden colour silk which is more durable and has high demand in the global market. This silkworm is polyphagous in nature and feeds on a wide range of host plants.(Choudhury, 1970). Among the food plants, 'som' *Persea bombycina* and 'soalu' *Litsea monopetala*, are the two major primary food plants. Out of these two primary food plants 'soalu' *Litsea monopetala* is semi-deciduous in nature while the other is evergreen. The cultivated race of muga silkworm is multivoltine in nature and completes five to six life cycles in a year and the farmers rear this silkworm for production of the muga silk. Annually, India produces about 150 tons of muga raw silk. The parental stocks of this silkworm still exist in the wild habitat in different zones of North-East India. Many economically important characters are still observed in the wild race of this silkworm. The climatic conditions of North-Eastern region of India are congenial for the lepidopteran species and are found distributing up to 1370m AMSL (Das et al., 2000). The Indian Sub-Himalayan belt in the North East India is the natural abode of many wild sericigenous insects. Out of the thirty five species of *Antheraea* recorded so far, thirty one species belong to Indo-Australian biographic region (Seitz, 1933; Crotch, 1956). A few workers have studied some aspects of wild silkmoths in general and *Antheraea* species in particular in North east India during last four decades (Jolly et al., 1976; Thangavelu, 1991; Singh & Singh, 1998; Baruah et al., 2000; Singh et al., 2000, 2011a,b,c; Singh & Maheswari, 2003).

The naturally existing wild race of muga silk moth will become extinct due to deforestation, pest and predators and rapidly changing environmental conditions. Therefore, proper strategies must be taken up for the in-situ and ex-situ conservation of the important wild genetic resources of muga silk moth for utilization in future breeding programme and subsequent commercial exploitation for higher production of muga silk. Therefore, the present study was undertaken to know the bio ecology of wild parental race of *A. assamensis* Helfer and its potential for breeding in North-East India. The results are presented in this paper showing the potential of the silk moth for future breeding programmes.

MATERIALS AND METHODS

The survey and collection of wild parental races of *Antheraea assamensis* Helfer were conducted in Tura, Meghalaya (India). The collected seed cocoons were consigned for conducting grainage in the laboratory of Central Muga Eri Research & Training Institute, Lahdoigarh, Assam (India). The characteristic features of the wild silk moth were recorded and compared with the semi-domestic race maintained in the Institute. The behaviour of moth emergence, coupling and oviposition were recorded. The moths were allowed to couple for 6-8 hours and after decoupling moths were kept individually for egg laying in the straw made sticks locally called 'Khorika" by binding the female moth with the help of cotton thread. The prepared disease free layings (dfl) were disinfected by dipping in 3% formalin for 10 minutes followed by washing in plain water, dried in shade and kept each dfls of the mother moths in small paper packets. The dfls were incubated at 24 ±2^{o}C and 70-80% R. H. Eggs packets were kept in a plastic tray covered by a perforated black cotton cloth to obtain uniform hatching till the morning hour of the date of hatching. A few tender twigs of 'som' *Persea bombycina* or 'soalu' *Litsea monopetala* were placed on the hatched larvae inside the paper packets. The worms crawl over the leaves within half an hour and then the twigs were directly shifted in outdoor on the foliages of 'som' *Persea bombycina*. The paper bags containing eggs may be directly shifted on branches when the hatching starts so that the worms can crawl over the leaves.

The rearing field was well cleaned and disinfected before 15-20 days of rearing by spraying of 5% bleaching powder solution in the whole rearing plot and there after dusting of slacked lime and bleaching powder mixture (9:1). The early stage rearing was conducted in the properly pruned plantations of 'som' *Persea bombycina* or 'soalu' *Litsea monopetala* following RBD with four replications successively for ten generations in outdoor condition under nylon net cover in five seasons per year *i.e.*, April-May, May-June, July-August, September-October, and October-November for two years in Lahdoigarh (Assam), India. While using nylon nets especially during summer crops, nets were lifted up as much as possible during day time, while during night time, trees were fully covered with nylon nets to protect the larvae from predators. Normally, larvae are transferred by picking up on a triangular bamboo made tray locally called 'Chaloni" when they come down after consuming the leaves of the tree and the tray with the larvae are shifted to a new bush having quality leaves. Worms are not touched by hand as far as practicable. The grainage and rearing performance along with salient features of different life stages of the silk moth were recorded and analysed. The conservation in the *ex-situ* condition of the moth was continued for six generations to acclimatize in the semi-domesticated condition. The important yield contributing characters *viz.,* fecundity, hatching percentage, number of cocoons per dfl, effective rate of rearing (ERR %), average cocoon weight, single cocoon shell weight, cocoon shell ratio (SR %), single cocoon filament length were recorded.

RESULT AND DISCUSSION

Regular field survey revealed that the wild parental stocks of *A. assamensis* is distributed in the undisturbed forest of North-East India on the foliages of 'som' *Persea bombycina* or 'soalu' *Litsea monopetala* at the altitude of 780-2000 m AMSL. It was particularly more abundant in South Garo hills district of Meghalya (India). The cocoons and larvae are found mostly on 'soalu' *Litsea monopetala* and less on 'som' *Persea bombycina* showing more preference on foliages of 'soalu' *Litsea monopetala* in wild habitat.

Life cycle and Voltinism:Voltinism is one of the important self regulating character in the life cycle of *Antheraea assamensis* . The wild silk moth is purely multivoltine in nature and four life cycles are completed in a year viz April-May, June-July, August-September, and October-November respectively. After October-November crop it undergoes diapause at the pupal stage and remained in this stage as such till 2nd or 3rd week of March. The moths undergo 70% self coupling under captive condition. Inducing of mechanical coupling of the uncoupled moths though possible, however, it is very time consuming and labourious task. The life cycle (egg to adult) of this silkmoth under fluctuating environment varies from 52-55 days in summer (temp. 26-35^{o}C) and 90-95 days in winter (12-23^{o}C) with four moulting stages during the entire larval period (Fig. 1). The pupal diapause of this wild silk moth may be a physiological mechanism to withstand the cold climate of the winter.

Moth emergence and Coupling: The emergence of moth occurs in the night from 18.00 to 22.00 hr. Self coupling of moths just after emergence is not allowed by keeping male and female moths separately in the cages for about 2-3 hr so as to allow full development of the emerged moths. Coupling starts in the night time mostly from 20.00 hr and continued up to 07 hr of next day. Coupling upto70 % takes place in the captive condition inside cages and the coupling of the remaining moths was induced mechanically. The optimum temperature and relative humidity for moth emergence and coupling are 22-24^{o}C and 75-85 % respectively. On reaching the female moth, the male moth starts courtship behaviour with raised antennae, fluttering wings around the female followed by mating. The antennae of the male moth bent downwards during mating period. Mating lasts for 10-12 hr but it continues up to 24 hr of the next day if not disturbed. Similar behaviour of mating was reported was reported in other wild silk moths (Kuang-Ming & Ta-Yuan, 1958; Singh & Debaraj, 2011; Singh et al., 2011a,b,c). Copulation by one male moth is enough for complete fertility of the female moth. Male moths are utilized for second time mating when there is shortage of fresh male moths. In the natural condition the male moth flies long distances in search of females and the female moth also flies particularly after mating to lay the eggs on the leaves and branches of the food plants. However, they usually do not fly at day time. The moths do not lay all eggs at one place only but in a scattered way. The coupled moths detach at the slight mechanical disturbance. The life span of the adult moths is 7-10 days.

***Oviposition*:** After decoupling, the individual female moths are kept for egg laying in straw made stick (locally called 'Khorika') in dark condition at 24 ±2^{o}C and 75+5 % R.H. Eggs are collected after 72 hr of oviposition but egg laying continues up to 5-6 days. The average fecundity ranges from 120-185 eggs in all the different cropping seasons.

***Incubation and Hatching*:** After proper disinfection the eggs are incubated at the temperature of 24 ±2°C and relative humidity of 70-80%. Hatching takes place after 8-10 days of incubation. Profuse hatching does not occur initially and it continues up to late hours of the day. The average hatching varies from 70-80%.

***Larval Development and behaviour*:** The larva spins the cocoon after about 21-22 days of active feeding in summer and 40-45 days of active feeding in winter through five larval instars but it is prolonged up to 50 days depending upon the climatic condition. The brushing and rearing of *A. assamensis* need special care. The duration of development of first, second, third, and fourth instars varied seasonally depending upon environmental temperature. Generally it takes 3-4 days, 3-5 days, 5-7 days, 7-10 days in summer and 6-8 days, 7-10 days, 10-12 days, 11-14 days in winter respectively while the fifth instar took prolong time 9-11 days in summer and 14-18 days in winter. From 3rd instar onwards the larvae have the habit of moving to the base of the food plants very frequently which may be due to rising of temperature or in search of suitable leaves. Therefore, strips of plastic sheet (12 inch breadth) are tied around the trunk of the food plant to prevent them from straying. Laboratory studies have shown that the optimum favourable temperature and relative humidity for larval development are 24°C-28°C and 80-85 % from first to fifth instars respectively. During the entire larval period, it passes five larval instars through four moulting stages.

***Feeding behavior*:** The larvae prefer tender leaves to mature and hard leaves irrespective of the instars. Just after hatching the larvae crawl in search of food. The newly hatched larvae have the habit of eating bits of egg shell just after hatching which provides immediate energy. It is observed that the worms crawl up to the tip of the branches and start eating tender leaves. It is desirable to provide tender leaves to the chawki worms (1st-3rd instars) while semi-mature and mature leaves should be provided to the 4th and 5th instars respectively for healthy growth of the larvae. The larvae feed on the entire leaves including midrib. It stops feeding at the slight disturbance. A larva consumes about 70-75 g of leave during the entire larval development.

***Cocooning Pupation and Adult development*:** The mature larva stop feeding and either rest on the food plant or comes down to the tree trunk near the strips of plastic sheet tied around the tree trunk. The larvae remain there by raising their head upwards till evening and released their last excreta. Afterwards the larvae start searching suitable location for cocooning and pupation. In that time the matured larvae are picked up and put in the bundle of dry twigs or in the bamboo made mountage for cocooning. It completes the pupation inside the cocoon within 5-7 days in summer and 12-15 days in winter. Cocoons are harvested after full pupation. The pupa develops into adult moth after about 18 days in summer and 30-35 days in winter.

Morphological characteristics

Egg: Egg shell is brown and oval in shape (Fig.2). The size of the egg varies from 2.3-2.8. mm in length and 1.9-2.5 mm in breadth. The weight of the egg ranges from 0.06-0.07 mg. At the time of oviposition, the eggs look brownish grey in colour but after washing they appear light green or creamy. At the cephalic end there is a minute hole called micropyle.

Larva: The colour of the newly hatched larvae is black with distinct yellow lines at the intersegmental region. The length of the newly hatched larva is 6.50 mm to 12 mm while in the second, third, fourth, and fifth instars it ranged from

13-20 mm, 20-26 mm, 26-36 mm and 42-55 mm respectively. The weight of the first instar larva ranges from 0.07 mg to 0.075 mg while the second, third, fourth, and fifth instars it ranged from 0.83-9.10 mg, 4.2-6.4 mg, 21-36 mg and 45-120 mg respectively. There is colour polymorphism in the late instar larvae. The larval colour varies from light green , dark green, blue, Yellow and orange (Fig. 3a,b,c). The weight of mature larvae varies from 6-8 gm in male and 9-12 g in female. The colour of the tubercles varied in different instar and it becomes red in 5th instar. Some of the mature larva forms cocoon on the tree itself in wild condition (Fig. 4), however normally they comes down in search of suitable location for cocooning during which, they are picked up by hand and keep in specially made cocooning devices. The peduncle supports the cocoon in hanging from the branch.

Cocoon: Cocoons are oval in shape, length varies from 3.4–4.6 cm and breadth varies from 1.6-2.6 cm and golden-brown in colour (Fig. 5). The cocoon weight ranges from 3.5-5.75 g in male and 6.2-9.5 g in female. The shell weight ranges from 0.35-0.5.5 g in male and that of female ranged from 0.5-0.75 g. The shell ratio ranges from 10-12% in male while in female it ranges from 6-8%. The length of the peduncle ranges from 3.2-6.4 cm. The filament length varies from 250-440 m. The denier ranges from 4.15-5.30 during the different seasons and the reelability varies from 55-75%. The boil-off loss is 20-25%.The silk recovery is 25-40%.

***Pupa*:** The pupa is light metallic in colour (Fig. 6). The length of the pupa varies from 2.5-3.5 cm in male and 3.5-4.5 cm in female. The breadth varies from 1.2-1.8 cm in male and 1.5-2.8 cm in female. The pupal weight varies from 3.05 - 5.2 g in male and 5.5-8.2 g in female respectively.

***Moth*:** There are variations in the colour of both male and female moths. Males are reddish dark brown while the females are reddish brown in colour (Fig. 7a,b). The body length of the moth varies from 2.5-3.4 cm. The wing span varies from 12-13.5 cm in male and 11 -13.5 cm in female. The fore wing area of the male moth is 1370-1400 mm^2 and the hind wing area is 1015-1040 mm^2, while in the female it range from 1470-1510 mm^2 and 1030-1085 mm^2 .The eye spot in both forewings and hind wings of both the sexes is very distinct and is round to oval with a large transparent round to elliptical fenestra. The ground colour of the male moth is reddish dark brown and that of female is reddish brown. The lateral line over the wings is almost black colour in male and that of female is black flanked by whitish line in both sides. The male moth can be distinguished from the female moth by the prominent antennae, smaller abdomen and shape and colour of the wing.

Comparative Rearing performance of the Wild silk moth and the Semi-domestic moth:

Seasonal influence on rearing performances have been observed in fecundity, hatching percentage, weight of male and female matured larvae, ERR%, cocoon weight, Shell weight and Shell ratio percentage in both wild silk moth and the Semi-domestic silk moth races in *ex-situ* condition as presented in table 1(A) and 1(B).

***Fecundity**:* The average fecundity ranged from 132 -147 in wild race and from 130 to 150 in semidomestic race throughout different rearing seasons. Significantly highest fecundity was recorded during “Baishaki” crop i.e. April-May and July-August, while, there was no significant difference in realized fecundity during May-June,September-October and October-November in wild race ($p>0.05$). In semidomestic race, significantly higher fecundity was observed during April-May and July-August ($p>0.05$) but no significant differences was observed in other seasons ($p>0.05$). However, no significant difference was observed in the fecundity of wild and semi-domestic races throughout different rearing seasons.

Hatching: The hatching percentage ranged from 60.08% to 80.62% in wild and from 70% to 78.8% in semi-domestic race throughout different rearing seasons. The hatching percentage of wild race was significantly higher during April-May crop than the other seasons ($p<0.05$). Significant differences in hatching percentage were not observed in other crops in wild as reflected in table-1(A). In semi-domestic stock, there was no significant difference of hatching percentage in all the rearing seasons ($p>0.05$). No significant difference was observed in the hatching percentage between the wild and semi-domestic races throughout the different rearing seasons.

Larval weight:The male larval weight ranged from 6.74g to 7.96g in wild race whereas in the semidomestic race it ranged from 4.92g to 6.02g. Female larval weight in wild ranged from 8.96g to 11.16g and in semidomestic it ranged from 8.66g to 9.42g during different seasons. In male and female larval weight significant differences were observed in wild and semi-domestic races during different rearing seasons ($p<0.05$).

ERR%: The ERR% of wild race ranged from 12.54 to 48.50 with the highest value during Kotia (October-November), while in semi-domestic stock it ranged from 14.48 to 60.12 with the highest value during Baisakhi (April-May). No significant difference was observed in the ERR% between the wild and semi-domestic races during different rearing seasons ($p>0.05$).

Cocoon weight: The cocoon weight ranged from 5.86g to 7.24g in wild whereas it ranged from 5.42 g to 6.84 g in semidomestic race throughout all rearing seasons. However, there was no any significant difference of cocoon weight between the wild and semi-domestic races during different rearing seasons ($p<0.05$).

Cocoon Shell weight: The cocoon shell weight ranged from 1.32g to 1.51g in wild race without any significant variations during the different seasons ($p>0.05$). In semi-domestic race the shell weight ranged from 0.39g to 0.49g without any significant variations during the different seasons ($p<0.05$). Highly significant difference was observed in the shell weight between the wild and semi-domestic races throughout different rearing seasons ($p<0.05$).

Cocoon Shell ratio(SR%): Significantly higher SR% in wild race was recorded during Sept-Oct crop ($p<0.05$) but no significant differences was observed in other seasons. In semi-domestic race, the SR% was significantly higher during September-October and October-Nobember crop ($p<0.05$). In this character, highly significant difference was observed between wild and semidomestic races during different rearing seasons ($p<0.05$).

The wild silk moths play an important role in the conservation and utilization of biodiversity (Frankel, 1982; Peigler, 1993). The conservation links genetic diversity to utilization, protecting diverse gene pool, habitat or ecosystem for human socio-economic needs (Metzler & Zebold, 1995). The ecorace conservation is must for utilizing their valuable genes in enhancing productivity and to build variation in new population through hybridization (Mirhoseini et al., 2004; Kumaresan et al., 2004). The studies carried out in the silkworm have shown that the characters could be pooled to suit the breeder's choice since selection for one trait has a correlation with genetic changes for other traits (Gamo, 1976; Tazima,, 1984). The stability of the characters like cocoon weight and cocoon shell ratio of the muga silkworm shows that the expression of these characters are more of genetic nature and the genes controlling these characters can be introgressed from the wild variety to the semi domestic variety through suitable breeding method. Siddiqui & Das, (1998) have reported the high heritability of the traits-cocoon shell weight, single cocoon filament length, weight of reeled silk, reelability, reelability ratio, denier and weight of waste silk in muga silkworm.

Biodiversity conservation is increasingly recognized as a fundamental component of sustainable development of natural resources by protecting and using biological resources in the ways that do not diminish the world's variety of genes and species or destroy important habitat or ecosystem. The wild muga silk moth constitutes a significant component of wild silk moth genetic diversity that cannot be ignored in the assessment of quantitative and qualitative characters, conservation and utilization of silk moth biodiversity. The stability of the different rearing parameters in all generations of the wild race showed that it can be successfully conserved in ex-situ condition in climatic condition of Lahdoigarh (India). The present study showed that this wild muga silkmoth can be effectively utilized for commercial muga silk production and in the breeding for introgression of the genes controlling the shell weight.

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Table 1(A). Pre-Cocoon characters of wild and semidomestic (s/d) races of muga silkworm.

Crops	Fecundity		Hatching		Mature Larval wt. (g)				ERR%	
					male		female			
	Wild	Semi Domestic (S/d)	Wild	S/d	wild	S/d	wild	S/d	Wild	S/d
April-May	147*	150**	80.62**	73.8	7.96	6.02*	11.16*	9.42	12.54	60.12*
May-June	136	138	60.28	72.2	7.54	5.32	10.02	8.82	44.39*	38.48
July-Aug	143*	144**	63	70	7.88	6.00	9.84	9.08	29.80	14.48
Sept-Oct	132	132	62.42	71.2	6.74	5.94	8.96	8.72	20.73	34.44
Oct.-Nov.	135	130	60.08	78.8*	7.14	4.92	10.78	8.66	48.50	37.04
CD 5%	8.27	10.94	11.62	45.94	0.68	0.66	1.14	0.42	20.47	21.73
CD 1%	11.39	15.06	16.00	6.33	0.93	0.91	1.58	0.57	28.20	29.93

* significant at 5%., ** significant at 1%

Table 1(B). Cocoon characters of wild and semidomestic (s/d) races of muga silkworm.

Crops	Cocoon wt(g)		Shell wt(g)		Shell ratio(%)	
	Wild	s/d	Wild	s/d	Wild	s/d
April-May	7.24	6.2	1.32	0.41	18.23	6.61
May-June	6.36	6.84	1.35	0.48	21.22	7.02
July-Aug	6.08	5.46	1.32	0.39	21.71	7.14
Sept-Oct	5.86	5.42	1.51	0.49	25.77	9.04
Oct.-Nov	6.08	6.12	1.32	0.49	21.71	8.01
CD 5%	0.72	0.79	0.36	0.07	3.01	0.78
CD 1%	0.99	0.09	0.50	0.09	4.15	1.08

* significant at 5%., ** significant at 1%

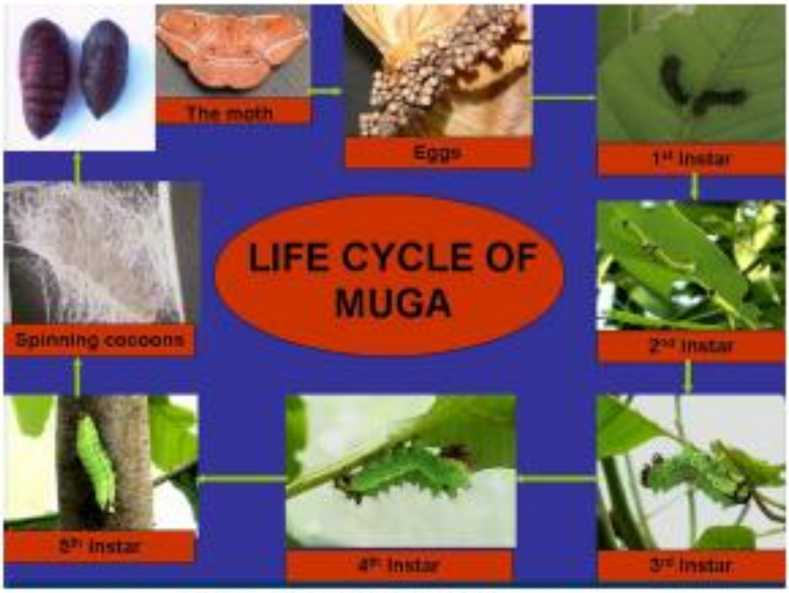

Fig. 1- Life Cycle of muga silkworm.

Fig. 2-Egg

Fig. 3-A Larva

Fig. 3-B Larva

Fig. 3-C Larva

Fig. 3-D Larva

Fig. 4-Cocoon on Tree

Fig. 5-Cocoon

Fig. 6-Pupa

Fig. 7-Male Moth

Fig. 8-Female Moth

NEW RECORDS OF THE GRAPE BERRY MOTH HYMENOPTEROUS PARASITOIDS IN IRAN

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ABSTRACT: The hymenopterous parasitoids of grape berry moth *Lobesia botrana* (Denis & Schiffermüller) (Lepidoptera: Tortricidae) in Iran were studied sparsely. This aggregation includes to twelve species belong to five families Bethylidae, Braconidae, Ichneumonidae, Pteromalidae and Trichogramatidae are listed as egg (two species), larva (nine species) and pupa (four species). During this study, two species *Dibrachys affinis* Masi (Hym.: Pteromalidae, Pteromainae) and *Itoplectis alternans* (Gravenhorst) (Hym.: Ichneumonidae, Pimplinae) are newly records for Iranian insect fauna and larval parasitoid of *L. botrana*. Finally all of the hymenopterous parasitoids of grape berry moth in Iran were reviewed.

KEY WORDS: Biological control, Lobesia botrana, parasitoid, Tortricidae, vineyard, new record, Iran.

The grape berry moth, *Lobesia botrana* (Denis & Schiffermüller) (Lepidoptera: Tortricidae), is a polyphagous insect that develops on various families plants and is a key pest of grapevine in vineyards worldwide. *Lobesia botrana* is known by different common names such as European vine moth, Grape moth, Grapevine moth, Mediterranean vine moth and Vine moth. Its ability to produce several generations annually, developing on the grapes and wild plants and its indirect damage by favoring the installation of rot fungi like *Aspergillus*, *Alternaria*, *Rhizopus*, *Cladosporium*, *Penicillium* and especially the grey rot caused by *Botrytis cinerea* (Fermaud, 1990; Ben Mosbah, 2005), make grape berry moth as an economically important pest in the wine growing areas around the world. In the most wine growing areas chemical treatment is the main control measure against this pest. Adults emerge in early spring from diapausing pupae, and females from the three or more successive generations which cause a direct damage to grapes by perforating berries and an indirect damage oviposit on flower buds, green berries, and mature grapevine berries, respectively (Saber et al., 1998; Jalil-Navaz, 1998; Saeedi, 2000). Crop losses from the pest can be substantial in some years and may be reach over 90% (Mashhadi-Jafarloo et al., 2004) or 95% of products (Jalil-Navaz, 1998) in some part of Iran. In the adjacent countries such as Uzbekistan, Azerbaijan, its damage can be 30-70% and may reach up to 80%.

This pest is widely distributed in the North Africa, Europe, Caucasus, Middle Asia, Middle East and some African countries (CAB International, 2002).

It mainly controls by chemical method using broad-spectrum insecticides. But considerable efforts have taken to explore and exploit to use natural enemies of grape berry moth. Seven parasitoid species: *Ascogaster quadridentata, Campoplex difformis, Dibrachys affinis, Dibrachys cavus, Hemiteles aerator,* *Pimpla turionellae* and *Trichogramma evanescens* have been recorded on *L. botrana* (CAB International, 2002). While, Noyes (2010) listed 28 chalcidoid species as reported parasitoids of grape berry moth worldwide. They belong to Chalcididae (one species), Eulophidae (eight species), Eupelmidae (one species), Perilampidae (one species), Pteromalidae (five species) and Trichogrammatidae (twelve species). Ben Mosbah (2005) reported presence of predators that belong to the Arachnida and some insect orders (Neuroptera, Dermeptera, Orthoptera) and the parasitoids belong to the family of Tachinidae (Diptera) and the family of Braconidae (Hymenoptera), subfamily of Aghatidinae in Tunisia. The overall larval parasitism rate found on the experimental vineyard of France varied from 23% in 2000 to 53% in 2001 (Xuereb & Thiery, 2006). Eight hymenopterous species have been recorded as parasitic on the grape berry moth from southern Romania (Bărbuceanu & Jenser, 2009). Akbarzadeh-Shoukat et al. (2008a) reported six parasitoid species (five Hymenopterans and one Dipterans species) on grape berry moth larvae from north-west of Iran.

This pest is attacked by some predacious and parasitic insects. This review aimed to present an analytical presentation of all of known hymenopterous parasitoids of *L. botrana* in Iran and reporting new records.

MATERIALS AND METHODS

Grapevine plant material and larvae of *L. botrana* originated from a vineyard located within East-Azarbayjan province (Azarshahr) and Fars provinces (Ghasr-e dasht). Insects were reared under Laboratory conditions.

Identifications of reared parasitoids were made using Doğanlar (1987) and Kolarov (2000). All of the families and species of reported parasitoids on grape berry moth from different areas of Iran were reviewed. List of occurred species is presented. Each family was discussed separately. Composition of each life stage parasitoids of *L. botrana* was compared.

RESULTS AND DISCUSSION

This study shows that parasitoids of grape berry moth in Iran distributed in five families of Hymenoptera include in three super-families Chrysidoidea (Bethylidae), Chalcidoidea (Pteromalidae and Trichogrammatidae) and Ichneumonoidea (Braconidae and Ichneumonidae). In this research two species of the families Ichneumonidae and Pteromalidae were identified that are new record for Iranian fauna.

Itoplectis alternans (Gravenhorst) (Hym.: Ichneumonoidea, Ichneumonidae)

The family Ichneumonidae is one of the most species-rich families of all organisms with an estimated 60,000 species in the world (Townes, 1969). This family is currently split into 39 subfamilies (Yu et al., 2005). Two ichneuomonid species were reared on *L. botrana* collected from south and northeast of Iran. *Enytus apostata* was reared only in the first generation of grape berry moth's larvae but Akbarzadeh-Shoukat et al. (2008b) reported this species on pupal stage of pest. The second species wqas identified as *Itoplectis alternans* (Gravenhorst) from subfamily Pimplinae that is new presented as larval parasitoid of *L. botrana*. This species wasp is emerged from larval stage of grape berry moth which was collected in the grape garden in Ghasr-e Dasht area of Shiraz city (Fars Province).

Eight ichneumonid species (50% of total parastoids of *L. botrana*) have been reared on larvae and pupa of *L. botrana* in Iran (Akbarzadeh-Shoukat et al., 2008a, b) (see Table 1). Three ichneumonid species *Campoplex difformis*, *Hemiteles aerator* and *Pimpla turionellae* attack in Europe and North Africa larvae and pupae of grape berry moth (CAB International, 2002).

Dibrachys affinis **Masi (Hym.: Chalcidoidea, Pteromalidae)**

Within the collected materials from East-Azarbayjan province, Azarshahr, we found *Dibrachys affinis* Masi, 1907. *D. affinis* is widely distributed in Europe and has been recorded from North Africa and Turkey in the Middle East (Noyes, 2010) but has not yet been reported from Iran. This species is parasitoid of different orders Diptera (Calliphoridae), Lepidoptera (such as Gelechiidae, Lymantriidae, Sesiidae, Tortricidae, Yponomeutidae). Its association with grape berry moth has been reported in France by Babi et al. (1992). They studied mass release of *D. affinis* against *L. botrana* in Alsace. Its parasitism rate was varied from 18% to 41.4% in overwintring generation and 9 to 12 wasps were emerged from each grape berry moth's pupae.

Coscolla Ramon (1981) reports this species as a pupae parasitoid of grape berry moth in Valencia, Spain with 34.8-61% parasitism rate. While, this species known a larval and pupal parasitoid in Algeria, Austria, France, Italy, Spain and Switzerland (CAB International, 2002).

Five pteromlaid species have been listed world wide as parasitoids of grape berry moth *Ascogaster quadridentata* (CAB International, 2002), *Mesopolobus mediterraneus* (Perez Moreno et al., 2000), *Dibrachys affinis* (Babi et al., 1992), *Dibrachys boarmiae* (Vidal, 1997) and *Dibrachys cavus* (Haeselbarth, 1985, 1989; Perez Moreno et al., 2000). *Dibrachys affinis* and *D. cavus* attack larvae and pupae in Algeria, and some European countries (CAB International, 2002). Two pteromalids have been reared on grape berry moth in the northwest of Iran (Akbarzadeh-Shoukat et al., 2008b) (see Table 1).

DISCUSSION

List of the parasitoid families and their species on the grape berry moth in Iran was presented in the Table 1. Considering this wide range of native hymenopterous parasitoids that control *L. botrana* can be used in the biological control program against this important pest. Be advised please that the potential possibilities of the practical utilization of these parasitoids remain unrealized because their biology and their role in nature have not been sufficiently investigated.

These parasitoids attack to different life stages of *L. botrana*. Most of the known parasitoids (%50) are larval parsitoid (Fig. 1). Based on Akbarzadeh-Shoukat et al. (2008a), rate of larval parasitism of *L. botrana* varied 1% to 16.8% (average 6.33%). This parasitism was significantly different in other localities and the rest generations, but the maximum rate of parasitism was in the first generation of the pest.

1. Family Bethylidae (Hym.: Chrysidoidea)

The world fauna of Bethylidae (Hymenoptera, Chrysidoidea) is represented by 2,216 species distributed in 97 genera of seven subfamilies. This family is poorly known in Iran. In this family *Goniozus* Förster includes to Bethylinae and has 160 species worldwide. Two species of this genus have reared on larvae of *L. botrana* in the northeast of Iran (Alavi & Gholizadeh, 2008). Alavi & Gholizadeh (2008) reported *Goniozus audouinii* Westwood that is junior synonymy of *Goniozus claripennis* Förster.

Terayama (2003) presented following characters for distinguishing this genus: antenna with 13 segments; always fully winged, basal vein oblique, only slightly angled, leaving median vein at about the same point as the transverse median vein; transverse median vein near based of the apparent basal vein, prostigma large, forming a subtriangle, *Rs + m* vein shorter than *rs* vein; median carina of clypeus short, extending up to the frons at most for short distance.

2-Family Braconidae (Hym.: Ichneumonoidea)

The family Braconidae is one of the largest families in the Hymenoptera containing more than 15,000 valid species (Wharton, 1993). This family is among the foremost of these beneficial insects. *Habrobracon* is a specious genus of the family with wide range of the host but *H. hebetor* is a common parasitoid of moths (Lepidoptera). Two braconid species have been reared on pupal stage of *L. botrana* in the northwest of Iran (Akbarzadeh-Shoukat et al., 2008a).

3-Family Trichogrammatidae (Hym.: Chalcidoidea)

Trichogrammatidae represent minute size wasps that act as egg parasitoids of insects. Twelve trichogrammatids has been recorded on *L. botrana*: *Trichogramma agrotidis* (Fry, 1989), *Trichogramma brassicae* (Fry, 1989; Lozzia & Rigamonti, 1991; Ebrahimi et al., 1998) *Trichogramma cacaeciae* (Barnay et al., 1999; Castaneda Samayoa et al., 1993; Tavares et al., 1988; Zimmerman et al., 1997), *Trichogramma daumalae* (Dugast & Voegelé, 1984; Fry, 1989), *Trichogramma dendrolimi* (Castaneda Samayoa et al., 1993), *Trichogramma embryophagum* (Castaneda Samayoa et al., 1993; Fry, 1989), *Trichogramma euproctidis* (Sugonjaev & Sorokina, 1978), *Trichogramma evanescens* (Castaneda Samayoa et al., 1993; Fry, 1989; Hommay et al., 2002; Nasr et al., 1995), *Trichogramma principium* (Fry, 1989), *Trichogramma semblidis* (Sengonca et al., 1990; Sengonca et al., 1987), an unidentified *Trichogramma* and *Trichogrammatoidea brasiliensis* (Noyes, 2010). The latter is a species that distributed in Afrotropical, Neotropical and Oriental regions (Voegelé et al., 1974).

Within this list, *T. ingricum* has not been reported as parasitoid of *L. botrana*. It is widely distributed in the north and northwest of Iran as parasitoid of *L. botrana*, *Cydia pomonella* (L.) and *Chilo supressalis* Walker (Ebrahimi & Akbarzadeh-Shoukat, 2008). Biocontrol effect of *T. ingricum* on *L. botrana* was assessed about 60% in Urmia vineyards (Ebrahimi & Akbarzadeh-Shoukat, 2008). They reported its widely distribution in this region with the 40-50% parasitism in the first generation of *L. botrana*.

Regarding to the importance of grape berry moth as a key pest, it would be essential to control pest before entering in the host fruit. Therefore its egg parasitoids have most inhibitor role in decrease of damage. In Iran only two species (11%) have known as egg parasitoid. Akbarzadeh-Shoukat & Ebrahimi (2008) reported 6% to 42% egg parasitism of first generation in different localities of West-Azarbayjan province (Northwest of Iran). They mentioned presence of this parasitoid in most of vineyards (about 90%) of this area.

Recently seven parasitoid species have been reported on pupal stage of *L. botrana* (Akbarzadeh-Shoukat et al., 2008b). Mean of pupal parasitism was estimated 21% and it was ranged 12-42% in this study.

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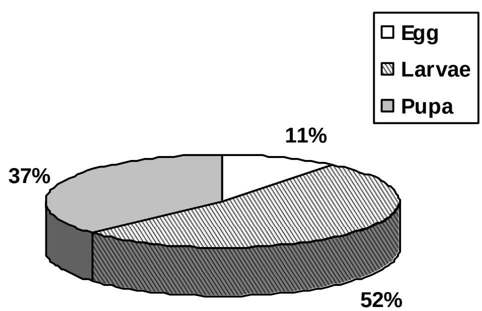

Figure 1. Percent of each life stage parasitoids of *Lobesia botrana* in Iran.

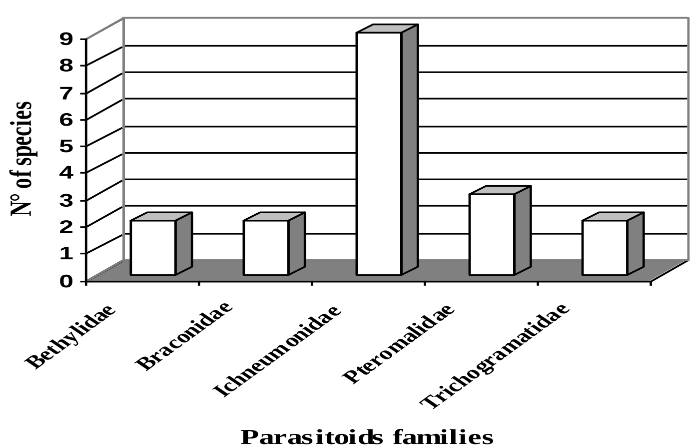

Figure 2. Quantitative distribution of Iranian hymenopterous parasitoid of *Lobesia botrana* in five families.

Table 1. Hymenpterous parasitoids of grape berry moth in Iran.

Parasitoids	Host stage	Distribution	References
Braconidae			
Habrobracon hebetor Say	pupae	**West-Azarbayjan**, Orumieh	AKBARZADEH-SHOUKAT et al. (2008b)
Habrobracon sp.	pupae	**West-Azarbayjan**, Orumieh	AKBARZADEH-SHOUKAT et al. (2008b)
Ichneumonidae			
Enytus apostata Gravenhorst	larvae, pupae	**West-Azarbayjan**, Orumieh **Ghazvin** **East-Azarbayjan**, Azarshahr	Akbarzadeh-Shoukat et al. (2008b); Sooudi et al. (2006) Present paper
Pristomerus vulnerator (Panzer)	pupae	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat et al. (2008b)
Temelucha sp.	pupae	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat et al. (2008b)
Itoplectis tunetana (Schmiedeknecht)	larvae	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat et al. (2008a)
Itoplectis alternans (Gravenhorst)	larvae	**Fars**, Shiraz, Ghasr-e Dasht	New record (Present paper)
Pimpla confinis Kasparyan	larvae	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat et al. (2008a)
Dicaelotus inflexus Thomson	larvae	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat et al. (2008a)
An unknown Labiinae	pupae	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat et al. (2008b)
Bethylidae			
Goniozus claripennis Förster	larvae	**North-Khorasan**	Alavi & Gholizadeh (2008)
Goniozus gallicola (Kiffer)	larvae	**North-Khorasan**	Alavi & Gholizadeh (2008)
Pteromalidae			
Dibrachys affinis Masi	pupae	**East-Azarbayjan**, Azarshahr	New record (Present paper)
Pteromalus puparum (L.)	larvae	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat et al. (2008b)
Homoporus sp.	larvae	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat et al. (2008b)
Trichogrammatidae			
Trichogramma embryophagum (Hartig)	egg	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat and Ebrahimi (2008)
Trichogramma ingricum Sorokin	egg	**West-Azarbayjan**, Orumieh	Akbarzadeh-Shoukat and Ebrahimi (2008), Ebrahimi & Akbarzadeh-Shoukat (2008)

SEASONAL OCCURRENCE OF THE ECTOPARASITIC MITE *HEMIPTEROSEIUS INDICUS* ON THE RED COTTON BUG *DYSDERCUS KOENIGII* (HEMIPTERA: PYRRHOCORIDAE) IN WEST BENGAL

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ABSTRACT: The present study indicates the population fluctuation of *Hemipteroseius indicus* an ectoparasitic mite infesting Pyrrhocorid bug, *Dysdercus koenigii* under field condition. The population was high during summer months. Temperature had direct influence on population showing positive correlation, while rainfall did not have much influence on population dynamics of mites. Regarding male-female population, the both the male and female population attended peak during March, gradually decrease during April to August and becoming very low during winter months. The present communication reports the results thereof.

KEY WORDS: *Dysdercus konigii*, *Hemipteroseius indicus*, red cotton bug, seasonal occurrence.

Mites inhabiting insects show a great variety and unique types of associations like predatory, parasitic, commensalisms and phoretic. Hunter and Rossanio (1988) opined that insect-mite association may be opportunistic, possibly accidental. Among those, many of the predatory and parasitic mite species can be exploited judiciously for biological control against agri-horticultural and household pests as well as insects of medical importance. Mites of the family Otopheidomenidae (Acari: Mesostigmata) are ectoparasites of insects, primarily Hemiptera, Orthoptera and Lepidoptera and closely related to the Phytoseiidae (Krantz & Khot, 1962; Evans, 1963) although phytoseiids are usually predators. Little is known about the seasonal occurrence of this parasitic family. Only information is available in this aspect is on *Hemipteroseius adleri* (Lewandowski & Szafranek, 2005).

Dysdercus koenigii commonly known as red cotton bug, is an important pest of a member of field crops including cotton, okra, kapok, sorghum etc. causing economic loss to the growers. This insect is often seen as infested with one Otopheidomenis mite *Hemipteroseius indicus*, (a new species is currently reported on this host from India is *H. vikrami* as reported by Menon et al., 2011) generally occurs on porter's body and is known to suck haemolymph causing weakening and in some cases even death. Since, the mite has importance in biological control of the important pest (Banerjee & Dutta, 1980) and as because nothing is known about the seasonal occurrence of the mite species it was thought desirable to study the present aspect. Since, association of *Hemipteroseius indicus* with *Dysdercus koenigii* was regularly found as because these mites appear to be a parasite of red cotton bug having potentiality in biological control, it was thought desirable to find out population fluctuation of *Hemipteroseius* *indicus* on red cotton bug as well as the population variation of different stages and variation if any in sex ratio.

MATERIAL AND METHODS

The experiment was carried out on cotton plant grown at the Ramakrishna Mission Ashrama garden, Narendrapur, South 24 Parganas, West Bengal. Monthly sampling was conducted on the cotton plant at the selected site between December 2008 and November 2009. The months were clubbed into four seasons *viz.* winter (December to February), summer (March to May), monsoon (January to August), post monsoon (September to November) to find out population fluctuation in different seasons. For counting of mite population, a total of 20 adult insects irrespective of sex were collected in a glass test tube from the cotton plant following which the insects were narcotized by placing a cotton ball soaked with Ether inside the test tube containing the insects. After narcotization the insects were taken out and examined under stereo binocular microscope (OLYMPUS, U-CMAD3, JAPAN) by placing those insects on Petri dish. All the stages of the mites (egg, immature and adult) were picked up with a fine brush soaked with alcohol and placed on a micro-slide in a drop of lactic acid. The collected stages of the mite were mounted irrespective of stages and sex and the species were confirmed according to Krantz & Knot (1962). Data on the number of stages of mites available and sexes along with meteorological data were recorded to find out seasonal fluctuation in the mite abundance vis-à-vis among the sexes.
Data obtained on the mite abundance, were subjected to one way factorial ANOVA using month as variable. The statistical analyses were performed following Zar (1999) using the SPSS ver. 10 software (Kinnear & Gray, 2000).

RESULTS AND DISCUSSION

Hemipteroseius indicus were found abundantly on Red cotton bugs (*Dysdercus koenigii*) and its population was found throughout the year with seasonal and monthly fluctuation. The present study revealed that the mites were always found on adult host insect, *Dysdercus koenigii* and could never be collected from immature ones. All the developmental stages of the mite were observed on the host insect. In most cases they were found under the wings. However, in case of heavy infestation (where population ranged > 100), the mites were found in other body region also, like, dorsal surface of thorax as well as near the head; but they are never on the ventral surface. It is observed that the abundance of *H. indicus* is positively correlated with temperature and negatively correlated with relative humidity (Table 1).

At the onset of winter (December) the mean abundance of *H. indicus* was noted as 1.85 ± 0.39. As the winter sets in, with the further fall of temperature the mean population of the mite decreased substantially to 1.5 ± 0.62. With the increase of temperature in February the mite population started increasing (3.5 ± 1.31) and this trend of increase was prominent in March, when the population increased unusually and rapidly to 53.2 ± 15.89 per insect. This increase may be attributed to the fact that increase in temperature does have an effect on the relative abundance of the mite as revealed from the correlation matrix (Table1). During April to June, the mite population maintained a moderate level of abundance (Table 2). Rainfall was found to be negatively correlated with abundance of the mite and did not appear to have any marked influence on the population of insects and in turn the mite abundance (Table 1 and 2). This is further confirmed from the fact that from July onwards, though rainfall increased further but that did not cause any substantial reduction in mite population. However, from August onwards, (September, October and November) the mite population per insects (3.6 ± 0.61, 3 ± 0.84, 2.7 ± 1.08 and 2 ± 0.39 respectively) reduced substantially with the reduction of mean temperature (28.55°C, 28.49°C, 27.92°C and 22.71 respectively). So it is comprehensible that temperature has a prominent effect on the mite abundance. One way ANOVA on mite abundance taking months and rainfall as variables revealed significant difference between abundance, months and rainfall (Table 3 and 4). During the entire period of observation the population mostly dominated by immature stages; the dominance hierarchy was noted of the order : immature> adults> eggs (Figure 1 and 2). There was a prominent variation of mite population in four different seasons (Figure 2). In most of the months the eggs were sporadic similar to the observation of Lewandowski and Szafranek (2005). The population of mite were reasonably low during the winter period and the different stages were in the order of egg (2.15 ± 1.03) > adult (1.79 ± 0.63) > immature (0.83 ± 0.44). During summer the population of all the stages increased substantially, where the adult population was maximum (25.4 ± 13.2) followed by immatures (21.1 ± 10.7) and eggs (14.3 ± 4). During the monsoon months generally due to drain away of the mite from the surface of the leaves or fruits of the host plant (Rajakumar et al., 2005; Dhooria et al., 2005; Karmakar & Dey, 2006; Yadav & Manjunatha, 2007; Patil & Nandihalli, 2009) the mite population tends to exhibit a lower level. But in case of insect associated mites owing to their phoretic nature (Hunter, 1993) and their position on the ventral surface of elytra (Ramaraju & Mohanasundaram, 1999), under the hind wing (Chmielewski, 2006), under the proboscis (Boggs & Gilbert, 1987), ventral side of the abdomen (Ramaraju & Mohanasundaram, 1998) the rain shower have negligible chance to drain them away and thereby lower the population. This fact was also noted in the present study where among all the stages the adult was maximum (7.23 ± 3.17) followed by immature (5.9 ± 3.48) and eggs (4.7 ± 1.46). During post monsoon period the population trend of different stages (adult 3 ± 1.6 > immature 1.65 ± 0.95 > egg 1.35 ± 0.72) was more or less similar with monsoon whereas the total population decrement in post monsoon period followed the same pattern as in winter.

Among the adults, male and female abundance was more or less same in all the months (Fig. 3). However, male population was always observed to be lower than the females. Male and female population attended peak during March but males were present in lower numbers than females. Their occurrence was lowered during winter (December to February) as the total population also got reduced during this time. Lewandowski and Szafranek (2005) reported that the sex ratio (Female: Male) of the closely related species *H. adleri*, was more female biased in summer period. But it is markedly different from *H. indicus* where the sex ratio was found to differ with the months. The sex ratio was noted to be female biased all throughout the season; only female was observed in September but at the commencement of winter the ratio became 2:1 (Table 2). This difference in the sex ratio needs to be further explored in the background of their varying geographical location, environmental regulations, nutritional input, and inter-specific competition.

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Table 1: Correlation matrix of abundance, month, temperature rainfall and relative humidity.

Correlation Matrix					
	MNTH	ABN	TEM	RF	RH
MNTH	1	-0.123	-0.014	**0.275**	**0.337**
ABN	-0.123	1	**0.197**	-0.113	**-0.141**
TEM	-0.014	**0.197**	1	**0.381**	**0.302**
RF	**0.275**	-0.113	**0.381**	1	**0.832**
RH	**0.337**	**-0.141**	**0.302**	**0.832**	1

Table 2. Mean abundance of in *Hepimteroseius indicus* on red cotton bug (*Dysdercus koenigii*) in different months along with other meteorological data.

Month	Mean abundance of mites + eggs per host ± SE	Mean Air Temperature	Mean R H(%)	Mean Rainfall	Sex ratio (Female: male)
December	1.85 ± 0.39	21.65	75.39	0.003	2:01
January	1.5 ± 0.62	16.33	70.5	0	3:01
February	3.5 ± 1.31	25.09	61.76	0	1:01
March	53.2 ± 15.89	28.86	61.34	0.019	2:01
April	12.1 ± 5.18	32.64	62.78	0.003	2:01
May	13.25 ± 2.94	31.05	74.45	6.56	3:01
June	10.7 ± 3.02	31.86	76.52	3.78	3:01
July	9.95 ± 1.98	29.46	82.22	12.18	5:01
August	3.6 ± 0.61	28.55	81.56	8.28	3:01
September	3 ± 0.84	28.49	77.58	13.46	Only female
October	2.7 ± 1.08	27.92	75.16	1.43	7:01
November	2 ± 0.39	22.71	64	1.95	3:01

Table 3. One way ANOVA on mite abundance, taking months as variable. The F- value was significant at P>0.005.

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**
Corrected Model	114573	11	10415.8	6.78182
Intercept	31579.2	1	31579.2	20.5616
MONTHS	114573	11	10415.8	**6.78182**
Error	350170	228	1535.84	
Total	464744	239		

Table 4. One way ANOVA on mite abundance, taking rainfall as variable. The F- value was significant at P>.005

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**
Corrected Model	51005.1	9	5667.23	3.15045
Intercept	18020	1	18020	10.0174
RAINFALL	51005.1	9	5667.23	**3.15045**
Error	413739	230	1798.86	
Total	464744	239		

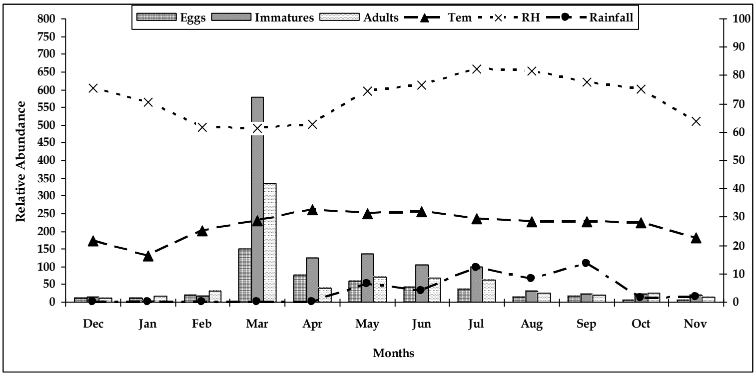

Figure 1. Monthly variation of *Hepimteroseius indicus* along with different environmental factors.

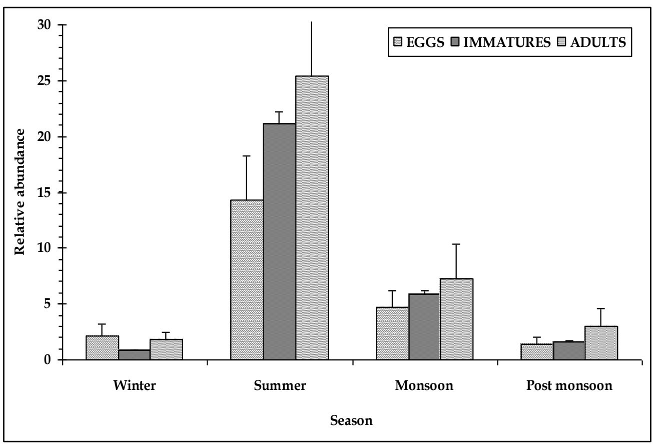

Figure 2. Seasonal variation of *Hepimteroseius indicus* population.

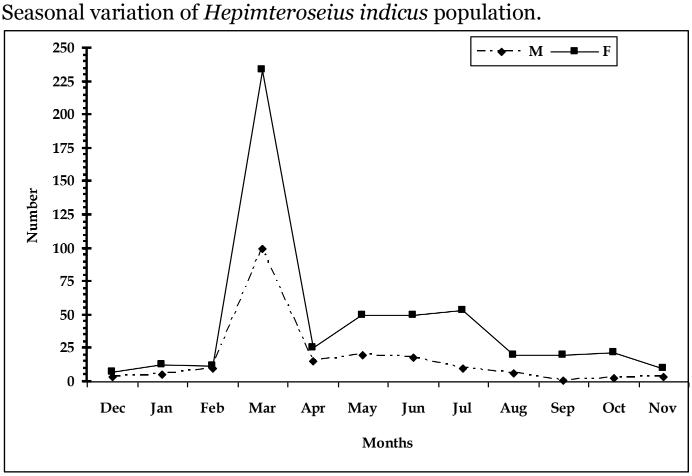

Figure 3. Variation in male and female population of *Hepimteroseius indicus*.

THE EFFECT OF HEAT TREATMENT ON LOSSES OF DIFFERENT LIFE STAGES FOR *TRIBOLIUM CONFUSUM* DUVAL (COLEOPTERA: TENEBRIONIDAE)

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ABSTRACT: *Tribolium confusum* Duval is an important pest of food processing technology in the world. The use of elevated temperatures or heat shock treatments is a very effective method for managing storage pests. In this study in order to evaluate the mortality of this insect by the use of elevated temperatures, effects of five constant temperatures including 35, 45, 50, 55 and 60°C for 5, 10, 15, 20 and 30 minutes have been studied on different developmental stages of this pest (5-day larvae, 15-day larvae, pupae and adult). After heating, the samples were kept under temperature of 28±1°C and relative humidity of 65±5%. Results indicated the most susceptive and the most heat-tolerant stage of the insect's growth were respectively related to the 15-day larvae and pupal stage. Furthermore, it was revealed that the minimum controlling temperature for the 5-day and 15-day larvae is 50°C and for pupae and adult insects is respectively 55°C and 50°C. These results provides, considering the possibility of pest's existence in different developmental stages in an infected mass, 55 °C for 15 minutes would be effective for managing and controlling life stages of *Tribolium confusum*.

KEY WORDS: *Tribolium confusum*, heat treatment, developmental stages.

Tribolium confusum Duval (Col., Tenebrionidae) is one of the pests of storage crops and attacks about 100 types of these crops. This pest mostly attacks the tropical and semi-tropical regions. Larval old cuticle and excreta of adult insects seriously decrease the quality of flour by entering poison into flour (Songa & Rono, 1998; Hollingworth et al., 2002).

Today, physical methods such as nuclear radiation and physical factors (sound, light, etc.) and chemical methods are being used for controlling *Tribolium confusum* (Bank & Fields, 1995). One of the prevalent methods of controlling storage pest is to use fumigants. Methyl bromide is one these pesticides used for controlling storage pests in food processing technology (Makhijani & Gurney, 1995).

Methyl bromide is one of the most significant chemical compounds with unfavorable effects on ozone layer (Anonymous, 1992; 1993). According to the Montreal Protocol, usage of methyl bromide is permitted in countries like Iran until 2015 (Makhijani & Gurney, 1995). Several methods can be replaced for methyl bromide (Dean, 1911). One of these methods is to use thermal treatments which are of the most important techniques used in food processing technology during the past 80 years (Fields, 1992; Dowdy, 1999; Wright et al., 2002; Mahroof et al., 2003; Roesli et al., 2003).

In some cases, heating treatment is done by exposing foods to 50-60°C temperature for 24 to 36 hours in order to kill all insects existing in the food (Dowdy, 1999; Mahroof et al., 2003). In heating, short period of time is considered for high temperature in order to avoid affecting the quality of crops (Evans, 1986; Tang et al., 2000; Wang et al., 2002). Besides, overheating in the environment causes damage to the processing equipment and machinery used in food processing technology. Moreover, less heating in this part would affect the pests' survival as well (Dowdy, 1999; Mahroof et al., 2003).

At present, economic importance of using these methods for controlling storage pests has been paid special attention (Oosthuizen, 1935; Wright et al., 2002), and many researchers have proved that if heating does not cause complete mortality of the pests, if may leave undesirable effect on reproduction, fertilization and development of the insects progeny (Arbogast, 1981; Gonen, 1977; Kawamoto et al., 1989; Lale & Vidal, 2003; Okasha et al., 1970; Proverbs & Newton, 1962; Saxena et al., 1992; Tikku & Saxena, 1985; Tikhu & Saxena, 1990). Being exposed to a sub lethal temperature (44°C) may cause complete or incomplete mortality of different species of *Tribolium castaneum* in the larvae or pupal stage.

For instance, only 1.3% of the eggs laid by female *Tribolium castaneum* are transformed into pupa when exposed to 44°C temperature and relative humidity of 75% for 8 hours (Oosthuizen, 1935).Mortality of *T. castaneum* in 50°C temperature and 15 to 30 minutes exposure time when the insects is not fed in post-treatment recovery period (for one day) is less than 29%. Prolongation of recovery period to 7 days results in 51-65% mortality. But in conditions when the amount of food is suddenly decreased or food is considered for insect at the time for recovery, survival of adult insects increases (Dowdy, 1999). High temperatures leave undesirable effects on reproduction of storage pests. When *Trogoderma granarium* Everts. , are exposed to 45°C temperature for 48 to 72 hours in pupal stage, adults made out of these pupae are not capable of regeneration (Saxena et al., 1992).When the 1-day, 2-day, 3-day and old pupae of *T. castaneum* are in 45°C temperature for 48 to 72 hours, development of the next generation would be completely stopped since survival of pupal stage is entirely disturbed. When the 2 or 3-day pupae of *T. castaneum* are kept in 45°C temperature for 48 hours, the produced female insects do not produce and larvae. But then the 1-day pupae are kept in 45°C temperature for 48 to 72 hours, they do not survive(Saxena *et al.*, 1992). In another research, when kept in 35°C temperature for 7 days and then in 26.5 °C temperature, the two-week female *Sitophilus granarius* (L.) resulted fewer adults in comparison with the females kept in 26.5 °C temperature (Gonen, 1977). According to the importance of the usage of non-chemical methods in controlling storage pests and role of temperature as a safe factor for environment, this research studies the effects of 35, 45, 50, 55 and 60°C temperature on mortality of *T. confusum* at different developmental stages.

MATERIALS AND METHODS

Insects Rearing

T. confusum was reared under laboratory conditions at 28±1°C and 65±5% relative humidity in darkness. For this purpose, pastry flour has been used in all tests as the food ration for the pest. 500g flour has poured in a plastic disposable dish with 13cm height and 15cm diameter and adult types of this pest were put in the dishes. After a while when the surface of the food area was being covered larvae's old cuticle, a new culturing environment was prepared and the adult insects and other life stages were transferred to the new environment from the previous one by a bolter.

Temperature treatment

Test was done on different developmental stages of the insect including 5-day larvae, 15-day old larvae, 3-4 day old pupae, and 7-day old adult insects. Thermal treatments included temperatures of 35, 45, 50, 55 and 60°C for 5, 10, 15, 20 and 30 minutes together with the experimental group. This test was done based upon factorial in the form of completely randomized design in 4 replications, and each unit of test included 25 insects. To conduct the studies, the first thing required was a population of the same age. To collect young larvae of the same age, the insect rearing dishes each contain 500gr flour were prepared and about 1000 male and female adult insects were released in them. After 24 hours and adults were collected by bolter and the dishes were put in an incubator until hatching of the eggs. After hatching in the sixth day and larvae's birth, the larvae were given five days for activity and then in the fifth day the 5-day old larvae were collected from the environment and put in the petri for being tested. 20gr flour was also given to the larvae for their nutrition. After performing thermal treatments, the samples were exposed to rearing condition and the mortality rate was recorded after collapse of this period. The case was done in regard to old larvae.

To study the effect of different temperatures on pupal stage of this pest, first we needed pupae of the same age. To collect pupae of the same age, all the pupae available in the rearing environment were collected first, so that even a single pupae was not left in the environment. Therefore, all the pupae appeared in the next day were almost of the same age.

Pupae of the same age were selected randomly from the environment and undergone thermal treatments. To achieve 3-4 day old insects, all the adult insects available in the rearing environment were collected by a bolter; therefore, the adult insects appeared in the next day were all of the same age. Then the 3-4 day old insects were collected randomly from the environment, and the samples' mortality was recorded after performing thermal treatments. Statistical data analysis was done using SAS and SPSS software.

RESULTS

The results achieved from the statistical analysis in all stages indicated that there was a significant difference of about 1% between different treatments in comparison with the experiment. Based on the obtained information, 60°C temperature has caused 100% mortality in all life stages of the pest for all durations. In 5-day larvae stage, 55°C temperature for 10 to 30 minutes and 50°C for 30 minutes caused 100% mortality and there was no significant difference between them. In 50°C for 20, 15 and 10 minutes the observed mortality was respectively 89, 80 and 72%.

At this stage, increase of time was effective on increase of mortality rate, so that by increasing the time from 5 minutes to 10 minutes in 50°C temperature, the mortality rate was increased from 29% to 72% (table 1-3). Therefore, the best controlling temperature for this stage is 50°C for 30 minutes.

In regard to 15-day larvae, also 55°C temperature for 5 to 30 minutes and 50°C temperature for 15 to 30 minutes caused 100% mortality. 50°C temperature in 5 minutes and 10 minutes respectively causes 86% and 97% mortality. The best controlling temperature for this stage is 50°C temperature for 10 minutes (table 1-3). The results related to pupal stage of the pest indicated that 55°C temperature causes 100% mortality for all durations. At this stage, increase of time from 20 to 30 minutes in 50°C temperature caused the increase of mortality from 11% to 87%. The best controlling temperature for this stage is 55°C temperature for 5 minutes (Table 1-3).

Results related to developmental stage of adult insects indicated that the thermal treatment of 55°C temperature for 5 to 30 minutes and the thermal treatment of 50°C temperature for 30 minutes caused 100% mortality. Increases of time from 15 to 20 minutes in 5°C temperature at this stage increased the mortality rate from 45% to 69%.

CONCLUSION

Based on the results, it has been indicated that increase of temperature decreases the time of reaching to the maximum mortality. It means that in a given period, the higher temperature causes the higher mortality. Therefore, in superheating or decontamination with high temperatures, not only the temperature but also the time has a special importance. According to the conducted tests and achieved results, it can be concluded that the developmental stage of 15-day larvae is the most susceptible and sensitive stage and the pupal stage is the most resistant life stage of *Tribolium confusum* against high temperatures.

According to the fact that in an environment contaminated with pest, all life stages of the pest are available and therefore, what is economically important is the control of harmful stages of the pest using controlling temperature appropriate for the pest's different developmental stage, so that it prevents regeneration. Larval stage of this insect has more significant in view of economy and has the capacity to cause intensive damage. Based on the achieved results, 50°C temperature for 30 minutes suffices for controlling this stage of the pest's life. 55°C temperature in 5 minutes also controls well the pupal stage which is the most resistant stage of pest's life.

15 minutes exposure time in 60°C temperature, control all life stages of *Tribolium castaneum* and *Oryzophilus surinamensis* Linnaeus and this fact accords with the results of the present study (Wilkin & Nelson, 1987). Besides, Boina and Subramanyam (2004) proved that young larvae of *Tribolium castaneum* are in the stage sensitive to increase of temperature. But results of the present research indicated that old larvae are the most sensitive stage. Exposure of one to a few days old pupae and 14-day or older larvae of *Tribolium castaneum* to 50°C for 39 and 60 minutes has harmful effects on reproduction and survival of egg stage to adult stage. Besides, young larvae of this pest tolerate temperatures over 50°C (Mahroof *et al.*, 2003) and this fact completely accords with the present research. Larvae and adult stages of *Tribolium confusum* Duval had 100% mortality when exposed to 47.5 °C temperature for 48 hours or 50°C temperature for 24 hours (Taheri, 1994). Considering the fact that the heating period in this study has been between 24 to 48 hours. Observation of 100% mortality is completely logical and confirms the results of this study.

In general results of this research indicate that heating has the capacity to be used for controlling storage pests , and designing and manufacturing the equipment for defusing equal heat in the mass or the product is of great importance. Furthermore , based upon the achieved results , 55 °C temperature for 15 minutes is recommendable for controlling all developmental stages of the pest.

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Table1-3. Ranking of the interacting between temperature and time in different developmental stages of *T. confusum*.

Average of mortality				Heat duration (min)	Temp. °C
Adult	**Pupae**	**15- days larvae**	**5-days larvae**		
A 100	A 100	A 100	A 100	30	60
A 100	A 100	A 100	A 100	20	60
A 100	A 100	A 100	A 100	15	60
A 100	A 100	A 100	A 100	10	60
A 100	A 100	A 100	A 100	5	60
A 100	A 100	A 100	A 100	30	55
A 100	A 100	A 100	A 100	20	55
A 100	A 100	A 100	A 100	15	55
A 100	A 100	A 100	A 100	10	55
A 100	A 100	A 100	A 95	5	55
A 100	B 87	A 100	A 100	30	50
C 69	C 11	A 100	B 89	20	50
D 54	D 0	A 100	C 80	15	50
E 0	D 0	B 97	D 72	10	50
E 0	D 0	C 86	E 29	5	50
E 10	D 0	D 12	F 2	30	45

Note: in the thermal treatments and in experiment when the mortality rate has been zero, they have not been mentioned in the table.

BIONOMICS OF *DIAPHORINA CITRI* KUWAYAMA (HEMIPTERA: PSYLLIDAE), ON *CITRUS SINENSIS* IN JAMMU REGION OF J & K STATE

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[Chhetry, M., Gupta, R. & Tara, J. S. 2012. Bionomics of *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae), on *Citrus sinensis* in Jammu Region of J & K State. Munis Entomology & Zoology, 7 (1): 304-308**]**

ABSTRACT: The objective of this work is to study the biology of Asian Citrus psyllids, *Diaphorina citri* Kuwayama on *Citrus sinensis* in Jammu and Kashmir, India having varied agro-climatic conditions ranging from tropical, sub-tropical to temperate conditions. *C. sinensis* (Sweet Orange) is a cherished and economically important fruit in Jammu region of J & K State which is severely attacked by Asian citrus psyllids, a very serious pest of citrus in India. Both adults and nymphs suck sap of citrus plants, reduce their vigour and kill tender shoots. Citrus psylla has also been established as a vector of the 'greening disease'. Thus, an attempt was made to study the biology of *D. citri* in Jammu. The insects were reared in the laboratory at room temperature (10.84°C-32.87°C) and relative humidity of 26%-80% on *C. sinensis* plantlets. Eggs were laid in clusters on the half opened tender leaves and tender twigs. There are five nymphal stages with length varying from 0.26-2.96 mm. The incubation, nymphal and adult longevity were 2.28±0.18, 14.86±1.07 and 10±1.23 days respectively. Thus, the psyllid has a total life span of 20 to 36.5 days (27.14±2.34 days). The present study is an important step in future to record the no. of generations of Asian Citrus psyllids on *C. sinensis* and for the timely management of the pest.

KEY WORDS: *Diaphorina citri*, biology, *Citrus sinensis,* Asian Citrus psyllid, morphometric measurements, life cycle.

Psyllids can cause damage to their host plants in various ways; the removal of large quantity of plant sap, when psyllid populations are high; it cause induction of leaf necrosis or abortive terminal buds by inserting their mouth parts into plant tissue; deformation of leaves, buds or flowers including induction of galls; soiling of leaves, flowers or fruits by secreting honeydew which may stimulate fungal growth. The most serious damage is caused by larvae or by adults transmitting plant diseases (Yana et al., 2010). Amongst different species of psyllids, *Diaphorina citri* Kuwayama is recorded to cause extensive damage to plants of family Rutaceae. The importance of the pest is due to its role in spreading Citrus greening disease (da Graca, 1991; Halbert and Manjunath 2004) which is one of the most devastating diseases of Citrus in the world. This insect is known to be the most efficient vector of phloem-inhabiting bacterium *Candidatus Liberobacter asiaticus* that causes Citrus greening disease known as 'Huanglongbing' throughout Asia and Far East (Pande, 1971). Symptoms of Citrus greening include yellowing of shoot, mottling and chlorosis of the leaves (Capoor et al., 1967). Infected trees are stunted, sparsely foliated and may bloom off-season. In addition, there is twig dieback, leaf and fruit drop, and production of small lopsided hard fruit with small, dark, aborted seeds. Given high reproductive potential of this vector during the period of favorable weather conditions and food availability (Tsai & Liu, 2000), this pest is expected to spread throughout citrus producing areas in Florida.

Biology of *Diaphorina citri* on *Citrus jambhiri* has been studied by Khan et al. (1989) in India. Tsai & Liu (2000) also studied the biology of *D. citri* on four commonly grown Citrus and related plants (*C. jambhiri*, *C. aurantium*, *C. paradisi* and *Murraya paniculata*) in laboratory conditions in Florida. Nava et al. (2007) studied the biology of *D. citri* in Brazil on different host plants namely *C. limonia* (Rangpur lime), *Murraya paniculata* (Orange Jessamine) and *C. sunki* (Sunki mandarin) in Brazil. The authors made an attempt to study the biology of the pest on *C. sinensis* cv. Jaffa, a commercially cultivated fruit in J & K, India.

MATERIALS AND METHODS

Adult psyllids were collected by hand-held aspirators from citrus groves located at Udheywalla (District Jammu). Potted *C. sinensis* cv. Jaffa plants were used for the oviposition by the adult females. The branches were regularly pruned whenever new shoots were required. After oviposition the adults were removed from the cage and eggs were counted by using the stereomicroscope. Eggs laid on the potted plants were allowed to hatch in situ and then the freshly hatched nymphs were transferred individually by the help of fine paint brush to young tender shoots. Nymphs were reared in normal room temperature and were checked daily for ecdysis. A single shoot was held in glass vial (8cm X 2.5cm) containing water, the mouth plugged with cotton. Vial was then placed in a disposable cup so as to collect the exuviae released by the developing instars which was finally placed inside a glass chimney, the mouth of which was covered by a muslin cloth. *D. citri* rearing system consisted of a nymphal development cage (60 X 60 X 60 cm). About 30 plantlets were placed in the cage.

Observations were recorded daily. Morphometric measurements of eggs, different instars and adults were recorded and analyzed statistically. Measurements of morphologically important body parts were recorded by using stage and ocular micrometer scales. Duration of different stages in the lifecycle was also calculated and analyzed statistically. During the period under observation, the average maximum and minimum temperature was 32.87°C and 10.84°C respectively, and morning and afternoon relative humidity of 80% and 26% respectively.

RESULTS

Newly emerged adults did not mate immediately and took 2-4 days for becoming sexually mature. During copulation, male approached female from side and held her with its leg of one side while balancing with the leg of other side with female slightly lifting its wings. Copulation lasted for 5-10 min. and a single male copulated with more than one female during its lifetime. The mean number of eggs was 17±0.56 eggs/10 cm twig laid by gravid females on the half opened tender leaves with a hatching rate was 56±1.46%. Eggs were elongate, almond-shaped with a round basal portion and a slender stalk for thrusting the egg into plant tissues. Light yellow when freshly laid, turned bright yellow and finally bright orange with transparent stalks. Average length of egg along with stalk was 0.28±0.02 mm (0.26-0.31 mm), width 0.13±0.02 mm (0.12-0.14 mm) and stalk length was 0.04±0.01 mm (0.04-0.05 mm). Incubation period lasted for 2.28±0.18 days.

Asian Citrus psyllid nymphs varied in length from 0.26–2.96 mm. Body generally yellowish orange with five nymphal stages with similar looks but increase in size after each moult. Except first instar, all other instars develop wing pads. Nymphs moved in a slow and steady manner. There was gradual increase in the body length from first to second instar but showed a steady increment from second to first instar stage. Antennae were two segmented in first three instars, and became three segmented afterwards. Antennal tip became black from third instar onwards. Survival rate from first to third instar was significantly lower 28±0.45% than the survival rate from third to fifth instar 68±0.47% ($t= 3.03$, $P\leq 0.01$, df= 47). Body of fifth instar was broadly oval, about 2.5 times as long as wide. General body color was yellow to yellowish brown, third antennal segment turned entirely black and eyes became deep red. The first, second, third, fourth and fifth instar stage lasted for 3.42±0.17days, 2.71±0.21days, 2.50±0.18days, 3.14±0.32days, and 3.07±0.31days respectively.

Adult psyllids were small insects with general color brown. Average body length (head to tip of forewing) was 3.02±0.17 mm (2.87mm-3.56mm). Average length of head, antennae, thorax and abdomen measured 0.40±0.04 mm, 0.42±0.03 mm, 0.79±0.09 mm and 1.21±0.17 mm respectively. Average length and width of forewing was 2.17±0.10 mm and 0.84±0.05 mm respectively. Average adult longevity was of 10.00±1.23 days (7 days-16 days). The survival rate from egg to adult stage was 46±1.02%. Thus, the average nymphal period was of 14.86±1.07 days (11-17.5 days) with a total life span of 27.14±2.34 days (20 days-36.5 days) in summer when the average maximum and minimum temperature recorded was 35.87°C and 10.84°C respectively, and morning and afternoon relative humidity of 90% and 26% respectively.

DISCUSSION

Pande (1971) observed that mating immediately occurred after emergence. Shivankar et al. (2000) observed that adults reached sexual maturity 2-6 days after emergence. Tsai & Liu (2000) recorded egg length of 0.31 mm and width of 0.15 mm in Florida. According to Hussain and Nath (1927) total nymphal period of the insect studied in Pakistan varied from 11 to 25 days, each instar lasting for 3 days in summer and 4 days in winter and the total life cycle was completed in 15-42 days, however, Khan et al. (1989) observed the incubation period of 2 to 4 days in July-August and 5 to 11 days in November and total life cycle of 15 to 18 days in September and 23 to 27 days in November in Maharashtra. Mathur (1975) observed body length in males as 1.7 mm and in female as 2.4 mm, width of head with eyes was 0.55 mm, length of forewings in male was 2.1 mm, in females it was 2.4 mm and length of abdomen was recorded as 0.58 mm. These variations in the life stage durations may be due to differential environmental factors.

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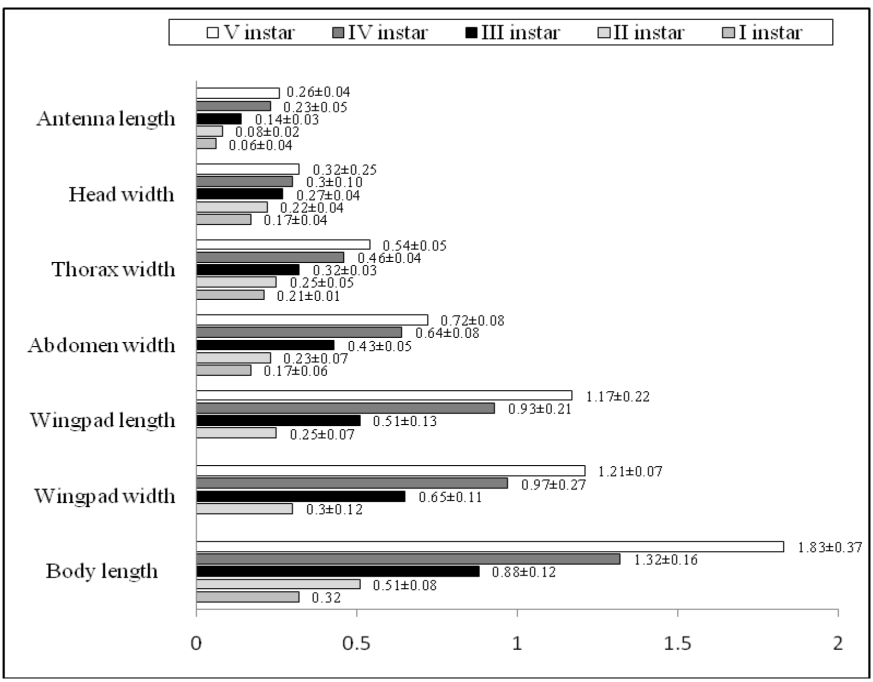

Figure 1. Measurements of body parts of different nymphal stages of *Diaphorina citri* Kuwayama.

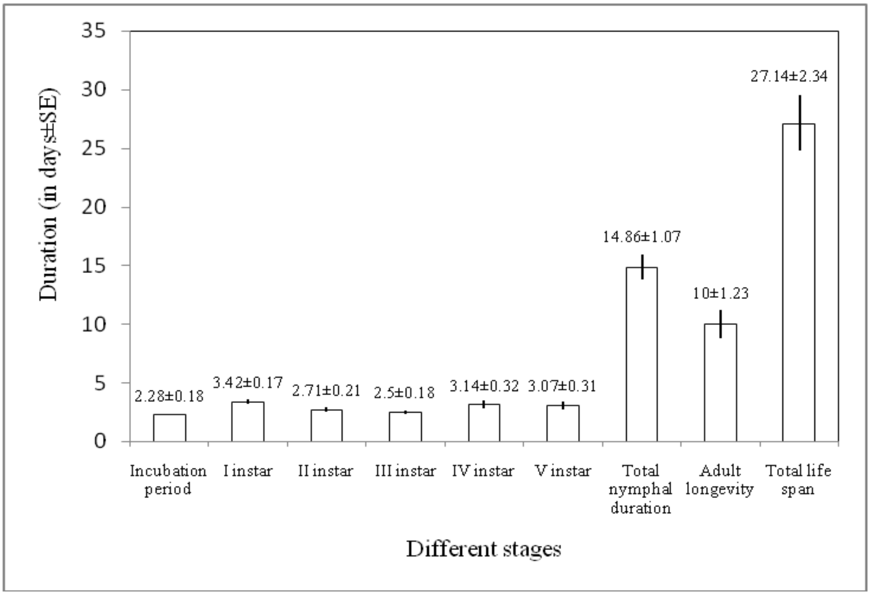

Figure 2. Duration (in days±SE) of different stages in the life cycle of *Diaphorina citri* Kuwayama.

REVIEW OF CHALCIDOID PARASITOIDS (HYMENOPTERA: CHALCIDOIDEA) OF XYLOPHAGOUS BEETLES

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ABSTRACT: Xylophagous beetles (XBs) are one of the economically important pests of woody plants especially in the forest ecosystems. Over 89 genera (4.2% of known genera) and 208 species of parasitoids (Hym.: Chalcidoidea) have been recorded from XBs worldwide. About 264 distinct parasitoid-host associations between Chalcidoidea and XBs were identify. It appears to provide effective control in many cases. XBs are mostly parasitized by species belonging to the chalcidoid families Chalcididae (6%), Encyrtidae (14%), Eulophidae (15%), Eurytomidae (10%), Eupelmidae (11%), Pteromalidae (41%), and rarely by species belonging to other families such as Leucospidae, Mymaridae, Torymidae and Trichogrammatidae. Most of the genera associated with XBs are widely distributed in the same zoogeographical region, while 14 are cosmopolitan. Fourthy genera have limited distributions to a zoogeographical region, of which 70% are found only in the Palaearctic, 17.5% in the Nearctic, and the rest in the Afrotropical, Australian, Neotropical and Oriental regions.

KEY WORDS: Xylophagous beetles, Coleoptera, parasitoids, association, Hymenoptera, Chalcidoidea.

Xylophagous insects are found in many insect orders such as Coleoptera, Lepidoptera, Hymenoptera and Diptera (Csóka & Kovács, 1999). Within these orders, insects belonging to several families of the order Coleoptera are well-known pests of woody plants including different families of trees in the orchards and forests. Severe infestations can kill trees directly or by the fungal disease (Lotfalizadeh & Khalghani, 2008). This group attack trees that are weakened or dying due to stress factors such as drought, disease, smog, mechanical injury and primary pests. Sometimes the mass outbreaks of different bark and wood boring insects can cause enormous economic losses in the forests e.g. the Hungarian coniferous forests (Lakatos & Thuroczy, 2002). Some of xylophagous beetles (XBs) are vectors of plant pathogens such as the elm bark beetles that transport Dutch elm disease. Faccoli et al. (2005) mentioned pine forests growing decrease in Europe and Northern Africa by the bark beetles feeding and pathogen transmitting.

Coleoptera with mutualistic relationships with bacteria, fungi and protists are generally considered beneficial insects in the forest ecosystems because of decomposition of dead woody plants, whether alive or dead.

XBs are large and cosmopolitan families such as Anobiidae, Bostrichidae, Cerambycidae, Buprestidae and Scolytidae (Williams & Langor, 2002; Lotfalizadeh & Khalghani, 2008). However, some xylophagous are found within the families Lucanidae, Scarabaeidae, Eucnemidae, Elateridae, Lymexylonidae, Anthribidae and Curculionidae (Williams & Langor, 2002). "Bark beetles of the world" (http://www.barkbeetles.org/) is a web site that concentrates on the biology of Scolytidae, with a large searchable database. Another database (http://www.fond4beetles.com/Buprestidae/index.html) is focused on Jewel beetles (Buprestidae).

The natural enemies of this group of pests are pathogens, predators and parasitoids. In the present work the focal point is the chalcidoid parasitoids. Several families of the superfamily Chalcidoidea are potential parasitoids of Coleoptera including xylophagous groups. Chalcidoid wasps (Hymenoptera: Chalcidoidea)- representing about 22,000 species in 19 families- are an interesting group of insects, which show exquisite life histories and diverse types of host relationships. Although chalcidoids are generally considered beneficial insects in agricultural situations, they can also be pests when their populations attack on XBs of ecological importance, e.g. beetles used for decomposition of dead woody plants. Also some of them are hyperparasitoid of XBs through their primary parasitoids such as Ichneumonidae and Braconidae. Lakatos & Thuroczy (2002) mentioned a great number of various parasitoid species found in the Hungarian coniferous forests including the families Pteromalidae, Eurytomidae, Encyrtidae, Eulophidae, Mymaridae from Chalcidoidea and further species of families Platygastridae from Proctotrupoidea, Braconidae, Ichneumonidae from Ichneumonoidea and Bethylidae from Chrysidoidea.

Considering the importance of this group of pest, their biocontrol agents can be very important, and within these natural enemies, chalcidoid hymenopterous as parasitoid of XBs are very impotent group in controlling these pests. No works have focused especially on a broad assessment of XBs-Chalcidoidea associations world widely. The Chalcidoidea Database (http://www.nhm.ac.uk/entomology/chalcidoids/index.html) is a searchable electronic databases web site with useful data on biology, associations, distribution and taxonomy of Chalcidoidea.

Several general references contain synoptic information about the parasitism of chalcidoids species in different countries or regions (Austin et al., 1994; Andrianova and Makhmadzieev, 1980; Bakke, 1956; Balazy, 1968; Beaver, 1967; Berisford, 1969; 1974; Bickel, 1985; Bosman and Meijeraan, 1969; Buhroo et al., 2002; Hedqvist, 1967; Kamijo, 1981; Lakatos and Thuroczy, 2002; Loerch and Cameron, 1983; Lotfalizadeh and Khalghani, 2008; Lozano and Campos, 1993; Markovic and Stojanovic, 2003; Mendel, 1985, 1986; Mendel and Halperin, 1982; Mendel and Gurevitz, 1985; Parihar and Kampantzov, 1997; Pettersen, 1976; Reid, 1957; Stojanovic and Markovic, 2007; Weslien, 1992; Williams and Langor, 2002; Yanovskii, 1986; Yang, 1987, 1996; Yunap, 1986; Zhang et al., 2005). Because of the importance of this group of parasitoids in XBs complex control, further researches should be carried out. Further study can increase our knowledge on these benefit groups of insects that in the most case all of collected species have not been identified. On the other hand, little information is available in the literature concerning the parasitoid-host associations of chalcidoids and XBs in natural or near-natural settings, the fact that influences our perception of the true diversity of such associations and diminishes our ability to draw from the full range of these associations for use in biological control efforts. Such studies could be aided by tools to help in identifying the complex fauna of benefit species. Therefore, this review was made because of necessity of more correct evaluation of importance of the superfamily in natural control, and also for evaluation of their potential importance in the control of density of XBs. The objectives of this study are (1) to provide an extensive, referenced, tabulation of XBs-parasitoids associations worldwide; and (2) to review these data for patterns of biological and/or biological control interest.

MATERIALS AND METHODS

Approximately 138 literatures were searched and the data related to parasitoids of xylophaous beetles were extracted to identify references that cited XBs-chalcidoid parasitoids association. A list of parasitic chalcidoids has been developed according to literature records. Biological information on the association of each species with XBs is summarized. For species with taxonomic and biological literature, a brief summary and key reference are given here (see Table 1).

The families Anobiidae, Bostrichidae, Cerambycidae, Buprestidae and Scolytidae that may be named as xylophagous, phloeophagous, woodborers and bark beetles in the literatures are considered as XBs in this review.

The following data on associations were recorded from the literature: (1) scientific name and family of chalcidoid parasitoid species, and (2) bibliographic citation information.

Associations were recorded only if parasitoid taxa were identified i.e., associations in which either the parasitoid taxon was identified only to family or order rank were excluded. Only in the family Mymaridae two unknown species are included because of conserve this family in the associated fauna to XBs.

After the initial compilation of parasitoid-host associations, the scientific names and family associations of all nominal taxa were checked in Noyes (2010) for accuracy, and available taxonomic and most recent nomenclatural changes were considered. The known distributions of geographically restriction of each parasitoid were presented. The abbreviations of zoogeographic regions are as follow: AFT, Afrotropical region; AUS, Australian region; NEA, Nearctic; NET, Neotropical region; ORL, Oriental region; PAL, Palaearctic region. Associated species or genera with XBs that present in three or more zoographical regions have been considered as a cosmopolitan species or genera.

RESULTS AND DISCUSSION

This review indicates various number of chalcidoid species living in or from XBs and identify 264 distinct parasitoid-host associations between Chalcidoidea and XBs (Table 1). These associations involve 89 genera and 208 identified parasitoid species on five families of XBs.

The number of world species of Chalcidoidea associated with XBs and their distribution are presented. In summarizing known data on parasitoids of XBs, I establish ten families of the chalcidoid wasps as the associated ones. Within the chalcidoids wasps, the families that have been known as parasitoids of XBs include Chalcididae, Encyrtidae, Eulophidae, Eurytomidae, Eupelmidae, Leucospidae, Mymaridae Pteromalidae, Torymidae and Trichogrammatidae. Lakatos and Thuroczy (2002) mentioned some other groups of parasitoids such as Braconidae, Ichneumonidae (Ichneumonoidea), Platygastridae, Diapriidae (Proctotrupoidea) and Bethylidae (Chrysidoidea) as associated to XBs that their host relations are still not clarified.

Out of 2100 or so valid chalcidoid genera, 4.2% of them are reliably known to contain species that are parasitic on XBs. These 89 genera contain about 208 described species. It seems that the Chalcidoidea is the largest group of natural insect enemies of XBs. In Mymaridae the precise numbers of species have not been identified (Lakatos and Thuroczy 2002).

Taxa in three families predominate: Pteromalidae 47 genera (53% of Chalcidoidea genera) and 83 species (40% of chalcidoid species); Eulophidae 10 genera (11%) and 31 species (15%); and Eupelmidae 6 genera (6%) and 23 species (11%). According to this investigation, Pteromalids (41%) and Eulophids (15%) are the dominant parasitoids (Fig. 4), nevertheless, undoubtedly a large number of various parasitoid species haven't been determined yet.

Grouped by chalcidoid family, 41% of all associations involve the family Pteromalidae, 6% the Chalcididae, 14% the Encyrtidae, 15% the Eulophidae, 10% the Eurytomidae, 11% the Eupelmidae, and 1% each of the families: Mymaridae, Torymidae and Trichogrammatidae (Fig. 3).

Grouped by XB family, 40% of all associations involve the Scolytidae, 27% the Buprestidae, 18% the Cerambycidae, 10% the Anobiidae and 6% the Bostrychidae (Fig. 1). Two chalcidoid families show a clear majority of associations with a single XB family: Pteromalidae with Scolytidae (75% of pteromalid associations) and Eulophidae with Scolytidae (48% of eulophid associations). The bostrychid family has not reported as host of Torymidae.

Chalcidoid parasitoids diversity of each XBs families are summarized in Fig. 5. In addition to the number of chalcidoid species recorded for various XBs families, the number of chalcidoid species (and genera) known for those XB species within their respective family is also recorded (Fig. 6). Among XBs families, the greatest parasitoid diversity was recorded for the family Scolytidae (Fig. 6). The highest number of recorded parasitoids genera and species is found in the Palaearctic region (72-148), followed by the Nearctic (33-50), Oriental (28-35), Neotropical (18-19), Afrotropical (11-13) and Australian (12-13) regions (Fig. 6). Fourthy-one genera have limited distributions to a zoogeographical region, of which 70% are found only in the Palaearctic, 17.5% in the Nearctic, and the rest in the Afrotropical, Australian, Neotropical and Oriental regions.

Table 1 includes the entire chalcidoid hymenopterous parasitoid genera and species recorded on XBs families world widely.

Given this reality that some of XBs (e.g. Bark beetles) are economically important pest, hence, it is important to be able to distinguish which parasitoid species may be useful in combating those threats. This study broadly documents the current knowledge of global chalciodid-XB parasitoid-host associations as a preliminary step for assessing the use of chalcidoid parasitod as targeted parasitoids to control XBs.

PARASITOID ASSOCIATIONS

Chalcidid association- Chalcididae currently includes 89 genera and approximately 1500 species placed in five subfamilies in the world (Noyes, 2010). Only 13 species in four genera are reported from XBs. The number of associations between Chalcididae and XBs, at first glance, seems disproportionately highly relative to the small species diversity of the families Cerambycidae, Buprestidae, Bostrichidae and Scolytidae (Figs 3-5). Part of this may be suggested the possibility of entrance of the chalcidid parasitoids -with relatively large and stout body- into the large galleries of these families. However, there are some small species belong to the family of Scolytidae have been reported as host of this group of parasitoids, that I also suggest the possibility of a broader role for the Chalcididae in the suppression of XBs populations. It includes four genera and 13 species (6%) of the family Chalcididae which attack XBs worldwide (Fig. 4). These species are widely distributed in the tropical regions.

The strong majority of chalcidid associations with XBs in the family Buprestidae (67%) bears further study for the possible discovery of additional parasitoids for buprestid beetles biological control efforts. This family was not recovered on Anobiidae.

Encyrtid association- Encyrtidae currently includes 483 genera and aproximatly 4000 species placed in two subfamilies in the world (Noyes, 2010). Thirteen genera including 28 species have been recorded on different families of XBs (see Table 1). Most of them are distributed in the Palaearctic region and about 60% of them associated with Cerambycidae. It belongs 14% of total parasitoids associated to XBs (Fig. 3).

These microhymenoptera have relatively minute size that permites them to entrance all of XB's galleries. The encyrtidae is one of the most useful families in biological control mostly on Hemiptera and Coleoptera. It seems that their associations need furthers attention because only 2.7% of know genera are associated with XBs.

In this family *Oobius agrili* as a solitary and parthenogenic egg parasitoid, was introduced from China to use as a biocontrol agent in USA to control of *Agrilus planipennis* (Col.: Buprestidae) (Bauer et al., 2008).

Eulophid association- Eulophidae is one of the large families of chalcidoids. It currently includes 332 genera and more than 4500 species (Noyes, 2010) arranged in four subfamilies. Parasitic eulophids on XBs belong 31 species in ten genera (Fig. 4). Among these, only five genera of Tetrastichinae (*Aprostocetus* Westwood, *Baryscapus* Förster, *Tetrastichus* Haliday, *Planotetrastichus* Yang, *Phymastichus* LaSalle), two genera of Euderinae (*Boučekastichus* Andriescu, *Wichmannia* Ruschka), one genus of Eulophinae (*Pnigalio* Schrank) and one genus of Entedoninae (*Entedon* Dalman) include parasitoids of XBs. It is mostly associated with Scolytidae (44%) and Buprestidae (29%) (Table 1). Eulophidae are second specious group of parasitoid community associated with XBs (Fig. 4). Such as latter family they are small wasps that may be simplify to access in the XB's galleries.

Bauer et al. (2008) mentioned *Tetrastichus planipennisi* as a classical biological control of *Agrilus planipennis* (Col.: Buprestidae) in USA (introduced from China).

Eupelmid association- This family includes 48 genera and approximately 1000 species placed in three subfamilies (Calosotinae, Eupelminae and Neanastatinae) in the world (Noyes, 2010). Some these genera that attack insects in plant stems or wood. Out of 48 so valid eupelmid genera, six (*Balcha* Walker, *Calosota* Curtis, *Eusandalum* Ratzeburg and *Pentacladia* Westwood from Calosotinae *Eupelmus* Dalman from Eupelminae and *Metapelma* Westwood from Neanastatinae) are reliably known to contain species that are parasitic on XBs. These six genera have 23 described species, mostly associated with Scolytidae (39%) and Buprestidae (39%).

This relatively large family is widely distributed through the world but most of the genera associated with XBs are not widely distributed and occur in one zoogeographical region (mostly Palearctic) of the world (Table 1), while there is not any cosmopolitan eupelmid species. It seems that this family is not studied sufficiently in the other regions. One of the reasons of this problem may be the difficulty of their collection by known methods *e.g*. sweeping. Because there are brachypterous and apterous forms in this family, therefore rearing on dead twigs with exit holes can be a recommended method.

Eurytomid association- Classification of Eurytomidae followed here is that of Lotfalizadeh et al. (2007). Eurytominae is the largest subfamily that contains species, which exhibit a range of biologies and includes all the XBs parasitoids species in the family. Within this subfamily, *Eurytoma* is a specious genus with remarkably varied biology, including organisms that are parasitic, inquilinous, phytophagous, entomophagous and gall inducing. Many of the species of *Eurytoma* occur as parasitic in XBs.

All of XBs parasitoids species (20 species) include in this family belong to the genus *Eurytoma* (except *Endobia donacis*) (Fig. 4). These species are from two species groups, *morio*-group and *nodularis* (Lotfalizadeh et al., 2007) or *robusta*-group (Zerova and Seryogina, 2006). Lotfalizadeh et al. (2007) believe that *morio* group is not good placed in the genus *Eurytoma* because of lacking postgenal depression. But these species have hairy metacoxa, relatively inflated marginal vein and distinctive costal cell bearing numerous white hairs on its ventral surface. On the contrary the *nodularis* group has a conspicuous mesopleural ventral shelf, carinate fore coxae and the petiolate female gaster (Lotfalizadeh et al., 2007).

In summary, the adults of those eurytomid taxa parasitoids of XBs can be separated from other chalcidoid families by typical characters of the family Eurytomidae (mostly black coloration, quadrate pronotum and punctuate notum). After Pteromalidae, Eulophidae and Eupelmidae, this family includes a large part (10%) of parasitoids of XBs (Fig. 3). Its association with the families Scolytidae and Buprestidae with 36% is dominant. In this family, *Endobia donacis* is a cosmopolitan species.

Pteromalid association- Pteromalidae, one of the large families of Chalcidoidea, currently includes 587 genera and approximately 3500 species placed in 30 subfamilies throughout the world (Noyes, 2010). Several groups of pteromalid are parasitoids of XBs that belong to Pteromalinae, Cerocephalinae, Cleonyminae, Louriciinae, Macromesinae and Euderinae (Fig. 2). Of which Pteromalinae is most specious group. Also most cleonymines are parasitoids or supposed parasitoids of XBs (Bouček, 1988; Gibson, 2003). Therefore, it seems that the Cleonyminae may be need more attention as XBs parasitoids. But biology of the Cleonyminae genera is mostly unknown; therefore these genera are excluded in this review. According to literatures 1) some of them have unknown biology but they are probably parasitoids of XBs such as *Lycisca* Spinola, *Westwoodiana* Girault, *Striatacanthus* Gibson (Gibson, 2003) or they are parasitoids of XBs larvae probably mainly of Buprestidae and Cerambycidae such as *Thaumasura* Westwood (Bouček, 1988); 2) some others are parasitoids of the larvae of unknown XBs in dead tree trunks and logs such as *Mesamotura* Girault, *Parepistenia* Dodd (Bouček, 1988); 3) some genera are apparently parasitoids of XBs such as *Neboissia* Bouček (Bouček, 1988).

The Pteromalidae are the well known generalists parasitoids of XBs and form a very large part of chalciodid fauna associated with XBs (Fig. 3). Within the recovered families approximately 41% of reared species belongs to Pteromalidae. They outshine the Chalcididae, Encyrtidae, Eulophidae, Eurytomidae, Eupelmidae and Torymidae in both species richness and spectrum of XBs hosts that they attack (Fig. 5 and Table 1). About 80% of them are widely distributed in the Palaearctic region (Table 1). This family show the broadest range of associations with XB families, but a distinct plurality (55%) of its associations were with the family Scolytidae. Also their association with other families were calculated as follow: 17% with Buprestidae, 13% with Anobiidae, 8% with Cerambycidae and 7% with Bostrychidae.

The pteromalid parasitoid fauna of XBs comprise 83 of described species in 47 genera. Dzhanokmen (1991) reviewing trophic association of the family Pteromalidae, listed 14 genera for Anobiidae, eight genera for Buprestidae and 17 genera for Scolytidae within five subfamilies (Pteromalinae, Cerocephalinae, Cleonyminae, Miscogasterinae and Macromesinae) that attach XBs. She did not mention the families Cerambycidae and Bostrychidae as hosts of Pteromalidae.

The preponderance of pteromalid associations with XBs in the family Scolytidae, suggests that additional taxa in this family might be good targets for further study for control of this group of agricultural pests. Solitary parasite is predominant in this family. They can be the primary or secondary parasite of Coleoptera (Dzhanokmen, 1991).

They are potentially important natural enemies of many pest insects and there are some successful utilization in biological control programs. Bouček and Rasplus (1994) listed some of them such as *Perniphora robusta* (L.) and *Cheiropachus quqdrum* (F.) that were introduced from Europe respectively to New Zealand and North America against Scolytidae. The pteromalids associated with XBs are mostly ectoparasite that acts predominantly as larval parasite. These wasps are rarely associated with adult such as *Tomicobia seitneri* (Ruschka, 1924) on several species of *Ips* (Col.: Scolytidae) (Dzhanokmen, 1991). This family has ten species in nine genera that were widely distributed and are cosmopolitan (see Table 1).

Mymaridae association- Mymaridae currently includes 99 genera and more than 1400 species in the world (Noyes, 2010). All of the members of the family so far known are parasitic in habit and develop in the eggs of different insect orders (Lin et al., 2007). Very few reliable host records exist for more than 1400 mymarid taxa. Although members of this family are almost exclusively egg parasitoids, Lakatos and Thuroczy (2002) and Lin et al. (2007) reported two unknown species of *Anaphes* Haliday and *Prionaphes* Hincks respectively develop as parasitoids of the XBs in the Palaearctic and Australian regions.

Trichogrammatid association-They are tiny wasps that are egg parasitoid of different orders of insects. World Trichogrammatid currently includes 96 genera and approximately 900 species in the world (Noyes, 2010) of which two species have so far been reported as XB associates. They are found on XBs of the families Scolytidae and Cerambycidae and include 1% of XB's parasitoids (Fig. 3). It seems that these minute wasps (smaller than 1 mm) can enter easily in the XB's galleries but our knowledge of their controlling task of XBs is rudimentary. Two listed species in this research are widely distributed (see Table 1).

Torymid association- This family contains about 1000 species placed in 73 genera in the world (Noyes, 2010). Much useful information on the biology of Torymidae is available in summarized forms in Grissell (1995). He discussed in detail the subfamily systematics of torymids and accordingly, the family includes Megastigminae and Toryminae. Only three species in two genera (*Ecdamua* and *Microdontomerus*) was reported on XBs families (except Bostrychidae).

This family with its characteristic morphology (long ovipositor) should have an important task in XBs control, because of their sheltered habitat. Hence, it seems its importance as the biocontrol agent of XBs needs to be reviewed in the world fauna.

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Table 1. Chalcidoid parasitoids of xylophagous beetles worldwide with their geographical distribution, host families and literature cited.

Parasitods	Zoogeographical distribution*	Hosts family	Reference
Chalcididae			
Acanthochalcis			
nigricans Cameron, 1884	NEA, NET	Buprestidae	Halstead and Haines (1985)
Phasgonophora			
sulcata Westwood, 1832	NEA	Buprestidae	Peck (1963), Haack et al. (1981)
Tanycoryphus			
conglobatus Steffan, 1950	AFT	Bostrychidae	Herting (1973)
criniger Steffan, 1950	AFT	Bostrychidae	Herting (1973)
occultus Steffan, 1957	AFT	Buprestidae	Herting (1973)
tibialis (Nikol'skaya, 1960)	PAL	Buprestidae	Nikol'skaya (1960), Lotfalizadeh & Khalghani, (2008), Lotfalizadeh et al. (2009)
Trigonura			
californica Rohwer, 1917	NEA	Buprestidae	Peck (1963)
elegans (Provancher, 1887)	NEA	Buprestidae	Peck (1963)
chrysobathra Yang, 1994	PAL	Buprestidae	Yang et al. (1994)
ruficaudis (Cameron, 1913)	ORL, PAL	Buprestidae, Cerambycidae	Lotfalizadeh & Khalghani (2008)
sphenoptera Nikol'skaya, 1960	PAL	Buprestidae	Nikol'skaya (1960), Lotfalizadeh & Khalghani (2008)
tenuicaudis Waterston, 1922	ORL	Buprestidae, Cerambycidae	Narendran (1986)
ulmi Burks, 1959	NEA	Scolytidae	Peck (1963), Herting (1973)
Encyrtidae			
Austroencyrtus			
ceresii (Liao & Tachikawa, 1984)	ORL	Cerambycidae	Trjapitzin (1989)
Amauroencyrtus			
micans De Santis, 1985	NEO	Cerambycidae	De Santis (1985)
Avetianella			
ambigua Zhang & Huang, 2004	PAL	Cerambycidae	Zhang & Huang (2004), Zhang et al. (2005)
batocerae (Ferrière, 1936)	ORL	Cerambycidae	Noyes, 2008
buprestidis Gordh and Trjapitzin, 1981	NEA	Buprestidae	Gordh & Trjapitzin (1981), Zhang et al. (2005)
capnodiobia Trjapitzin, 1968	PAL	Buprestidae	Trjapitzin (1963), Trjapitzin, (1989), Zhang et al. (2005)
coombsi Schmidt and Noyes, 2003	AUS	Cerambycidae	Schmidt & Noyes (2003), Zhang et al. (2005)
depressa (Girault,1916)	NEA	Cerambycidae	Gordh (1979), Gordh & Trjapitzin (1981), Zhang et al. (2005)
longoi Siscaro, 1992	PAL	Cerambycidae	Austin et al. (1994)
xystrocerae Zhang & Huang, 2005	PAL	Cerambycidae	Zhang et al. (2005)
Baeoanusia			
xanthopleuron Schmidt & Noyes, 2003	AUS	Cerambycidae	Schmidt & Noyes (2003)
Cerchysiella			
togashii Tachikawa, 1988	PAL	Cerambycidae	Tachikawa (1988)
Dionencyrtus			
cordylomerae (Risbec, 1951)	AFT	Cerambycidae	Herting (1973)
fiorentinoi De Santis, 1985	NEO	Cerambycidae	De Santis (1985)

Heterococcidoxenus *schlechtendali* (Mayr, 1876)	PAL	Scolytidae	Lotfalizadeh & Khalghani (2008)
Oobius			
abditus Annecke, 1967	AFT	Buprestidae	Annecke (1967), Zhang et al. (2005)
agrili Zhang & Huang, 2005	PAL	Buprestidae	Zhang et al. (2005)
funestus Annecke, 1967		Buprestidae	Annecke (1967), Zhang et al. (2005)
rudnevi (Novicky, 1928)	PAL	Cerambycidae	Trjapitzin (1963), Trjapitzin (1989)
taybekovi Myartseva & Trjapitzin,1979	PAL	Buprestidae	Myartseva (1979), Trjapitzin (1989), Zhang et al. (2005)
zahaikevitshi Trjapitzin, 1963	PAL	Buprestidae	Trjapitzin (1989), Zhang et al. (2005)
Ooencyrtus			
moneilemae Gahan, 1925	NEA	Cerambycidae	Peck (1963)
ovidivorus (Girault, 1925)	AUS	Cerambycidae	Girault (1925)
Orianos *brazai* Noyes, 1990	ORL	Buprestidae	Noyes (1990)
Protyndarichoides			
aligarhensis (Fatma & Shafee, 1985)	ORL, PAL	Scolytidae	Springat & Noyes (1990), Fatma & Shafee (1985)
Tineophoctonus			
armatus (Ashmead, 1888)	NEA, PAL	Anobiidae	Trjapitzin (1989)
Zaommoencyrtus			
brachytarsus Xu & He, 1998	ORL	Cerambycidae	Xu & He (1998)
emetzi Khlopunov, 1981	PAL	Cerambycidae	Khlopunov (1981)
Zdenekiella			
deon Guerrieri & Noyes, 2005	PAL	Bostrychidae	Guerrieri & Noyes (2005)
Eulophidae			
Aprostocetus			
crypturgus Yang, 1996	PAL	Scolytidae	Yang (1996)
dendroctoni Yang, 1996	ORL	Cerambycidae	Yang (1996)
lamiicidus Kerrich, 1963	AFT	Cerambycidae	Herting (1973)
Baryscapus			
agrilorum (Ratzeburg, 1844)	PAL	Buprestidae	Graham, 1991
holbeini (Girault, 1917)	PAL	Buprestidae	Herting (1973), Peck (1963)
nordi (Burks, 1963)	NEA	Buprestidae	Burks (1963)
Boučekastichus			
leileri (Hedqvist, 1974)	PAL	Anobiidae	Hedqvist (1974a)
Entedon		Scolytidae	
broussonetiae Yang, 1996	PAL		Yang (1996)
confinis Ratzeburg, 1848	PAL	Anobiidae	Bouček & Askew (1968)
ergias Walker, 1839	NEA, PAL	Cerambycidae, Scolytidae	Gumovsky (1999), Lotfalizadeh & Khalghani (2008)
methion Walker, 1839	NEA, PAL	Anobiidae	Thampson (1955)
tibialis (Nees, 1834)	PAL	Anobiidae, Scolytidae	Markovic & Stojanovic (1996)
stephanopachi Heqvist, 1959	NEA, PAL	Bostrychidae	Schauff (1988)
zanara Walker, 1839	PAL	Buprestidae	Bouček & Askew (1968)
Euderus			
agrili Bouček, 1963	PAL	Buprestidae	Bouček & Askew (1968)
caudatus Thomson, 1878	NEA, PAL	Cerambycidae	Bouček & Askew (1968)
regiae Yang,1996	PAL	Scolytidae	Yang (1996)
jezoensis Ishii, 1938	PAL	Scolytidae	Herting (1973)
Tetrastichus			
agrilocidus Graham, 1991	PAL	Buprestidae	Graham, 1991
heeringi Delucchi, 1954	PAL	Buprestidae	Herting (1973), Graham

			(1991)
telon (Graham, 1961)	PAL	Buprestidae	Graham (1991)
clavicornis Yang, 1996	PAL	Scolytidae	Yang (1996)
clavatus Yang, 1996	PAL	Scolytidae	Yang (1996)
xylebororum Domenichini, 1960	ORL	Scolytidae	Herting (1973)
taibaishanensis Yang, 1996	PAL	Scolytidae	Yang (1996)
ulmi Erdös, 1954	PAL	Buprestidae, Scolytidae, Cerambycidae	Herting (1973), Graham, (1991), Stojanovic & Markovic (2007)
Planotetrastichus			
scolyti Yang, 1996	PAL	Scolytidae	Yang (1996)
Pnigalio			
minio (Walker, 1847)	NEA	Buprestidae	Burks (1979)
Phymastichus			
coffea LaSalle, 1990	AFT, NET	Scolytidae	Lopez Vaamonde & Moore (1998)
Wichmannia			
pictipennis Bouček , 1972	PAL	Scolytidae	Bouček (1972)
decorata Ruschka, 1916	PAL	Scolytidae	Bouček (1972)
Eurytomidae			
Endobia			
donacis Erdös, 1964	NEA, ORL, PAL	Bostrychidae	Farooqi & Subba Rao (1986)
Eurytoma			
arctica Thomson, 1876	PAL	Scolytidae	Lotfalizadeh & Khalghani (2008)
blastophagi Hedqvist, 1963	PAL	Scolytidae	Lotfalizadeh & Khalghani (2008)
conica Provancher, 1887	NEA	Scolytidae	Berisford et al. (1970)
elistae Zerova, 1995	PAL	Buprestidae	Zerova & Seryogina (2006)
flaviventris Zerova, 1977	PAL	Buprestidae	Zerova & Seryogina (2006)
gyorfii Erdös, 1957	PAL	Anobiidae	Zerova & Seryogina (2006)
graminicola Zerova, 1981	PAL	Buprestidae	Zerova & Seryogina (2006)
iranicola Zerova, 2007	PAL	Cerambycidae	Zerova & Seryogina (2006), Lotfalizadeh & Khalghani (2008)
kondarica Zerova, 1994	PAL	Buprestidae	Zerova & Seryogina (2006)
morio Boheman, 1836	PAL	Scolytidae	Stojanovic & Markovic (2007), Lotfalizadeh & Khalghani (2008)
nova Zerova, 2001	PAL	Anobiidae	Zerova & Seryogina (2006)
pedicellata Yang, 1996	PAL	Scolytidae	Yang (1996)
pini Bugbee, 1958	NEA, NET	Scolytidae	Herting (1973)
polygraphi (Ashmead, 1894)	NEA, PAL	Scolytidae	Zerova, 1978
pyrrhidii Erdös, 1969	PAL	Buprestidae, Cerambycidae	Zerova & Seryogina (2006)
tilicola Hedqvist, 1966	PAL	Buprestidae, Cerambycidae	Zerova & Seryogina (2006)
tomici Ashmead, 1894	NEA	Scolytidae	Peck (1963)
turkomanica Zerova, 1995	PAL	Buprestidae	Zerova & Seryogina (2006)
wachtli Mayr, 1878	PAL	Cerambycidae	Zerova & Seryogina (2006); Zerova,1978
zykovi Zerova, 1995	PAL	Buprestidae	Zerova & Seryogina (2006)
Eupelmidae			
Balcha			
indica (Mani & Kaul, 1973)	NEA, ORL	Scolytidae, Cerambycidae	Gibson (2005)
levicollis (Cameron, 1908)	ORL	Buprestidae	Gibson (2005)
Calosota			
aestivalis Curtis,1836	PAL	Scolytidae, Buprestidae, Anobiidae	Trjapitzin (1978), Mendel (1986)

agrili Nikol'skaya, 1952	PAL	Buprestidae	Trjapitzin (1978)
yanglingensis Yang, 1996	PAL	Scolytidae	Yang (1996)
qilianshanensis Yang, 1996	PAL	Scolytidae	Yang (1996)
Eusandalum			
acmaeoderae Rohwer, 1917	NEA	Buprestidae	Peck (1963)
alfierii (Bolivar y Pieltain, 1925)	PAL	Buprestidae	Bouček (1967)
coronatum (Thomson, 1876)	PAL	Buprestidae	Trjapitzin (1978)
inerme (Ratzeburg, 1848)	PAL	Anobiidae, Bostrichidae, Buprestidae, Cerambycidae, Scolytidae	Lotfalizadeh & Khalghani (2008)
flavipenne Ruschka, 1921	PAL	Buprestidae	Trjapitzin (1978)
lindemani Kalina, 1984	PAL	Buprestidae	Kalina (1984)
Eupelmus			
carinifrons Yang, 1996	ORL, PAL	Scolytidae	Yang (1996)
kashmiricus Narendran, 2001	ORL	Scolytidae	Narendran et al. (2001)
sculpturatus Nikol'skaya, 1952	PAL	Scolytidae	Herting (1973), Markovic & Stojanovic (2003)
muellneri Ruschka, 1921	PAL	Buprestidae, Scolytidae	Lotfalizadeh & Khalghani (2008)
valsus Narendran, 2001	ORL	Scolytidae	Narendran et al. (2001)
vindex Erdös, 1955	PAL	Scolytidae	Narendran et al. (2001)
Metapelma			
compressipes Cameron, 1909	ORL	Cerambycidae	Herting (1973)
indica (Girault, 1920)	ORL	Bostrychidae	Thompson (1955)
zhangi Yang, 1996	PAL	Scolytidae	Yang (1996)
Pentacladia			
eques (Haliday, 1862)	AFT, PAL	Buprestidae	Delvare (2001)
mateui Delvare, 2001	PAL	Buprestidae	Delvare (2001)
Leucospidae			
Leucospis			
dorsigera Fabricius, 1775	PAL	Bostrichidae, Cerambycidae	Herting (1973), Baur (2005)
Mymaridae			
Anaphes sp.	PAL	Cerambycidae	Lakatos & Thuroczy (2002)
Prionaphes sp.	AUS	Cerambycidae	Lin et al. (2007)
Pteromalidae			
Ablaxia			
squamifera (Thomson, 1878)	PAL	Cerambycidae, Scolytidae	Bouček (1961), Meduna (1986)
Acerocephala			
atroviolacea (Crawford, 1913)	NEA	Scolytidae	Dzhanokmen (1991)
Acrocormus			
semifasciatus Thomson, 1878	PAL	Scolytidae	Bouček (1961), Graham (1969), Hertig (1973), Stojanovic & Markovic (2007)
Aggelma			
agrili Bouček, 1965	PAL	Buprestidae	Dzhanokmen (1991)
Agrilocida			
ferrierei Steffan, 1964	PAL	Buprestidae, Scolytidae	Steffan (1964), Mendel (1986), Gibson (2003)
Amotura			
caelata Grissell, 1991	NEA, NET	Buprestidae, Bostrychidae	Grissell (1991)
Anisopteromalus			
calandrae (Howard, 1881)	AFT, AUS, NEA, NET,	Anobiidae	Dzhanokmen (1991)

	ORL, PAL		
Callimomoides *ovivorus* (Ferrière, 1936)	ORL	Cerambycidae	Bouček (1988)
Callocleonymus *Bimaculae* Yang, 1996	PAL	Scolytidae, Buprestidae	Dzhanokmen (1991), Yang (1996)
pulcher Masi, 1940	AFT, PAL	Bostrychidae, Scolytidae, Buprestidae	Dzhanokmen (1991), Lotfalizadeh & Khalghani (2008)
Cerocephala *aquila* (Girault, 1920)	AUS, NET, ORL	Bostrychidae, Buprestidae, Scolytidae	Dzhanokmen (1991)
eccoptogastri Masi, 1921	AFT, PAL	Scolytidae	Herting (1973), Mendel (1986), Lozano & Campos (1993), Stojanovic & Markovic (2007)
rufa (Walker, 1833)	NEA, PAL	Buprestidae, Anobiidae, Scolytidae	Dzhanokmen (1991)
Chalcedectus *balachowskyi* Steffan, 1968	PAL	Bostrychidae, Buprestidae, Cerambycidae	Gibson (2003), Lotfalizadeh & Khalghani (2008)
Cheiropachus *obscuripes* Brues, 1910	NEA, PAL	Scolytidae, Buprestidae	Dzhanokmen (1991)
quadrum (Fabricius, 1787)	NEA, PAL, ORL, NET	Bostrychidae, Cerambycidae, Scolytidae	Dzhanokmen (1991), Lotfalizadeh & Khalghani (2008), Stojanovic & Markovic (2007)
Cleonymus *laticornis* Walker, 1837	PAL	Anobiidae, Bostrychidae, Buprestidae, Cerambycidae, Scolytidae	Dzhanokmen (1991), Gibson (2003)
Dibrachys *boarmiae* (Walker, 1863)	AUS, PAL, NET	Anobiidae	Dzhanokmen (1978)
Dinotiscus *aponius* (Walker, 1848)	PAL	Scolytidae	Dzhanokmen (1991), Stojanovic & Markovic (2007)
colon (Linnaeus, 1758)	NEA, PAL, NET	Scolytidae	Dzhanokmen (1991), Lakatos & Thuroczy (2002)
eupterus (Walker, 1836)	NEA, PAL	Scolytidae	Dzhanokmen (1991), Lakatos & Thuroczy (2002)
dendroctoni (Ashmead, 1894)	NEA	Scolytidae	Dzhanokmen (1991)
tenebricus Walker, 1834	PAL	Scolytidae, Cerambycidae	Graham (1969)
Dorcatomophaga *westi* Kryger, 1951	PAL	Anobiidae	Dzhanokmen (1991)
Euderus *lividus* (Ashmead, 1886)	ORL, NEA	Cerambycidae	Peck (1963), Grimble et al. (1971), Gibson (2003)
Habritys *brevocornis* (Ratzeburg, 1844)	NEA, PAL	Scolytidae	Thompson, 1958
Heydenia *pretiosa* Förster, 1856	PAL	Buprestidae, Scolytidae, Cerambycidae	Dzhanokmen (1991), Lotfalizadeh & Khalghani (2008), Lakatos & Thuroczy (2002), Gibson (2003)
indica Narendran, 2001	ORL	Scolytidae	Buhroo et al. (2002), Sureshan & Narendran (2003)

unica Cook & Davis,1891	NEA	Scolytidae	Dzhanokmen (1991)
Kaleva			
microps Bouček, 1993	NEA	Anobiidae	Bouček (1993)
Tomicobia	PAL	Scolytidae	Dzhanokmen (1991), Lakatos & Thuroczy (2002)
pityophthori (Bouček, 1955)			
Lariophagus			
puncticollis (Möller, 1882)	NET, PAL	Anobiidae	Dzhanokmen (1991)
Macromesus		Scolytidae	Dzhanokmen (1991), Stojanovic & Markovic (2007)
amphiretus Walker, 1848	PAL		
cryphali Yang, 1996	PAL	Scolytidae	Yang (1996)
huanglongnicus Yang, 1996		Scolytidae	Yang (1996)
harithus Narendran, 2001	ORL	Scolytidae	Narendran et al. (2001), Buhroo et al. (2002)
Mesopolobus			
typographi (Ruschka, 1924)	PAL	Scolytidae	Thompson (1958) Herting (1973), Stojanovic & Markovic (2007)
Metacolus			
azureus (Ratzeburg, 1844)	PAL	Scolytidae	Thompson (1958), Graham (1969), Herting (1973), Lakatos & Thuroczy (2002)
sinicus Yang, 1996	PAL	Scolytidae	Dzhanokmen (1991), Yang (1996)
unifasciatus Förster, 1856	PAL, ORL	Scolytidae	Thompson (1958), Graham (1969), Dzhanokmen (1991), Lakatos & Thuroczy (2002)
Nasonia	AFT, AUS, NEA, NET, ORL, PAL	Scolytidae	Pettersen (1976)
vitripennis (Walker, 1836)			
Nikolskayana			
mirabilis Bouček, 1965	PAL	Scolytidae	Graham (1969), Dzhanokmen (1991)
Norbanus	NEA, PAL	Cerambycidae	Bin (1973)
scabriculus (Nees, 1834)			
Notanisus			
oulmesiensis (Delucchi, 1962)	PAL	Buprestidae, Scolytidae	Delucchi (1962), Mitroiu & Andriescu (2008)
Oodera			
ahoma (Mani & Kaul, 1973)	ORL	Buprestidae	Farooqi et al. (1986), Dzhanokmen (1991)
formosa (Giraud, 1863)	PAL	Buprestidae, Scolytidae	Dzhanokmen (1991), Gibson (2003)
regiae Yang, 1996	PAL	Buprestidae	Dzhanokmen (1991), Yang (1996)
Oxysychus			
convexus Yang 1996	PAL	Scolytidae	Yang (1996)
grandis Yang, 1996	PAL	Scolytidae	Yang (1996)
pini Yang,1996	PAL	Scolytidae	Yang (1996)
mori Yang, 1996	PAL	Scolytidae	Yang (1996)
scolyti Yang, 1996	PAL	Scolytidae	Yang (1996)
Pandelus			
flavipes (Förster, 1841)	PAL	Anobiidae	Dzhanokmen (1991)
Perniphora			
robusta Ruschka, 1923	PAL	Scolytidae	Graham (1969); Dzhanokmen (1991)
Platygerrhus			
scutellatus Yang, 1996	PAL	Scolytidae	Dzhanokmen (1991), Yang (1996)
ductilis (Walker, 1836)	PAL	Anobiidae, Scolytidae	Dzhanokmen (1991)
Plutothrix			
coelius (Walker, 1839)	PAL	Anobiidae	Dzhanokmen (1991)
glareosa Heydon, 1997			Dzhanokmen (1991),

	NEA	Anobiidae	Heydon, 1997
Rhaphitelus *maculatus* Walker, 1834	PAL	Bostrychidae, Scolytidae	Dzhanokmen (1991), Stojanovic & Markovic (2007), Lotfalizadeh & Khalghani (2008)
Rhopalicus *brevicornis* (Thomson, 1878)	PAL	Scolytidae	Graham (1969), Herting (1973), Lakatos & Thuroczy (2002)
quadratus (Ratzeburg, 1844)	PAL	Scolytidae	Kamijo (1981), Dzhanokmen (1991)
guttatus (Ratzeburg, 1844)	PAL	Buprestidae, Scolytidae	Herting (1973), Dzhanokmen (1991), Yang (1996), Lakatos & Thuroczy (2002)
zolae Grissell, 1983	NEA	Scolytidae	Dzhanokmen (1991)
pulchripennis (Crawford, 1912)	NEA	Scolytidae	Dzhanokmen (1991)
tutela (Walker, 1836)	PAL, ORL, NEA	Bostrychidae, Scolytidae	Dzhanokmen (1991), Lakatos & Thuroczy (2002)
pulchripennis (Crawford, 1912)	NEA	Scolytidae	Dzhanokmen (1991)
Roptrocerus *brevicornis* (Thomson, 1878)	PAL	Scolytidae	Graham (1969), Herting (1973), Lakatos & Thuroczy (2002)
cryphalus Yang, 1996	PAL	Scolytidae	Dzhanokmen (1991), Bouček & Rasplus (1991), Yang (1996)
mirus (Walker, 1834)	PAL	Scolytidae	Graham (1969), Herting (1973), Lakatos & Thuroczy (2002)
xylophagorum (Ratzeburg, 1844)	AUS, NEA, NET, ORL, PAL	Scolytidae	Dzhanokmen (1991), Lakatos & Thuroczy (2002)
Rhaphitelus *maculatus* Walker, 1834	AUS, NEA, NET, ORL, PAL	Scolytidae	Dzhanokmen (1991)
Stenoselma *nigrum* Delucchi,1956	PAL	Buprestidae	Garrido Torres & Nieves-Aldrey (1999)
Solenura *ania* (Walker, 1846)	ORL, PAL	Buprestidae, Cerambycidae	Yang (1991)
Theocolax *elegans* (Westwood, 1874)	AFT, AUS, NEA, NET, ORL, PAL	Bostrychidae Scolytidae Anobiidae	Dzhanokmen (1991), Prinsloo (1980)
formiciformis Westwood, 1832	AUS, NEA, NET, PAL	Anobiidae	Dzhanokmen (1991)
Tomicobia *seitneri* (Ruschka, 1924)	PAL	Scolytidae	Dzhanokmen (1991), Lakatos & Thuroczy (2002)
tibialis Ashmead, 1904	NEA	Scolytidae	Peck (1963), Burks (1979), Dzhanokmen (1991)
Tricolas *xylocleptis* Bouček, 1967	PAL	Anobiidae	Graham (1969)
Trychnosoma *ernobii* Hedqvist, 1974	PAL	Anobiidae	Hedqvist (1974b), Dzhanokmen (1991)
Zdenekiana *plana* (Huggert, 1976)	PAL	Buprestidae	Bouček & Rasplus (1991)
yui Yang, 1996	PAL	Buprestidae, Scolytidae	Yang (1996)
Zolotarewskya *longicostalia* Yang, 1996	PAL	Anobiidae, Scolytidae	Yang (1996), Gibson (2003)
robusta Yang, 1996	PAL	Buprestidae, Scolytidae	Yang (1996)

Trichogrammatidae			
Trichogramma			
minutum Riley, 1871	AUS, NEA, NET, ORL, PAL	Cerambycidae Scolytidae	Hayat & Viggiani (1984)
semblidis (Aurivillius, 1898)	NEA, ORL, PAL	Scolytidae	Michalski & Seniczak (1974)
Torymidae			
Ecdamua			
nambui Kamijo, 1979	PAL	Anobiidae, Buprestidae, Scolytidae	Zavada (2005), Zerova & Seryogina (2007)
Microdontomerus			
mysticus Grissell, 2005	NET	Cerambycidae	Grissell (2005)
westcotti Grissell, 2005	NEA	Buprestidae	Grissell (2005)

The abbreviations of zoogeographic regions are as follow: AFT, Afrotropical region; AUS, Australian region; NEA, Nearctic; NET, Neotropical region; ORL, Oriental region; PAL, Palaearctic region.

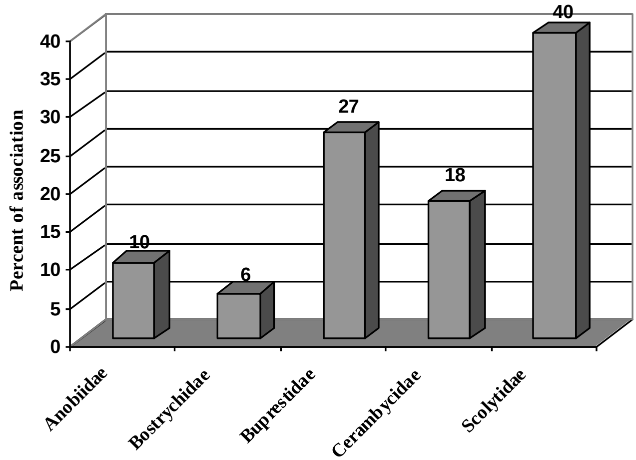

Figure 1. Percent of associations of each XB family with hymenopterous families.

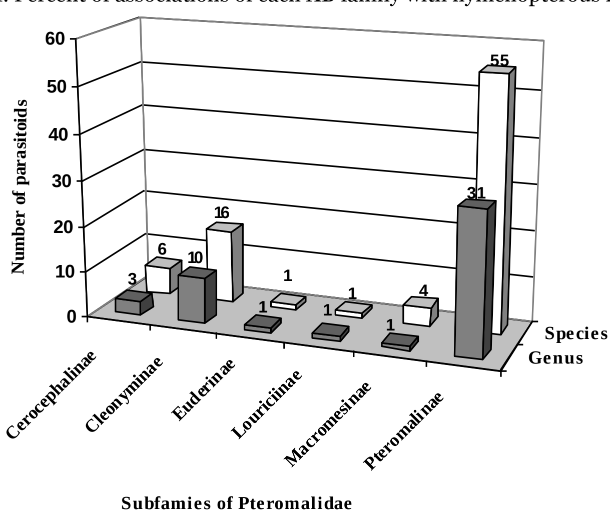

Figure 2. Numbers of the pteromalid's subfamilies taxa associated with XBs.

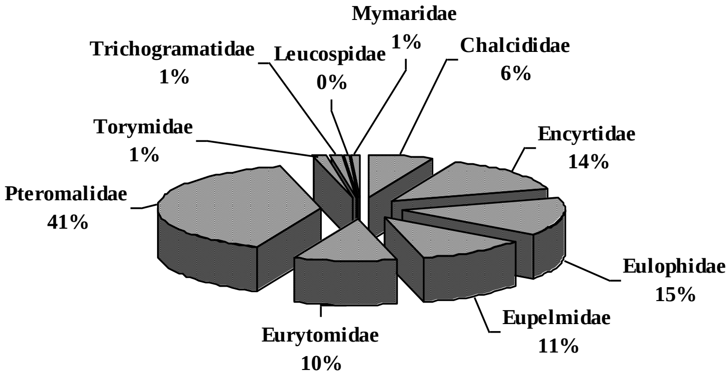

Figure 3. Percent of each chalcidoid parasitoid families reported XBs.

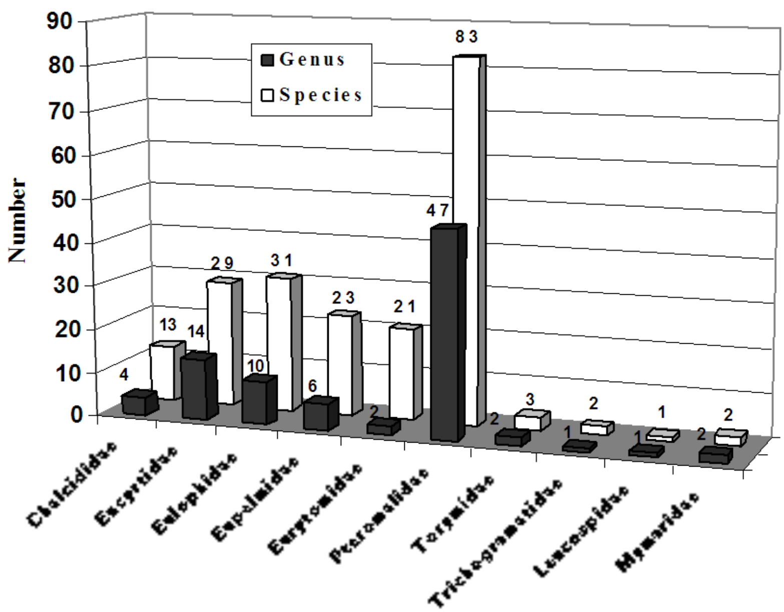

Figure 4. Numbers of chalcidoids taxa with known chalcidoid-XBs parasitoid-host associations.

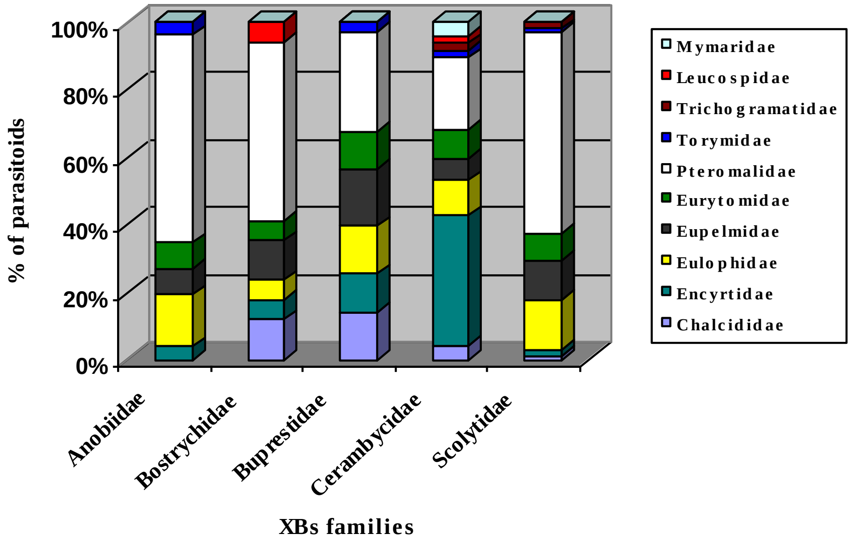

Figure 5. Percent of chalcidoids taxa on each XB families.

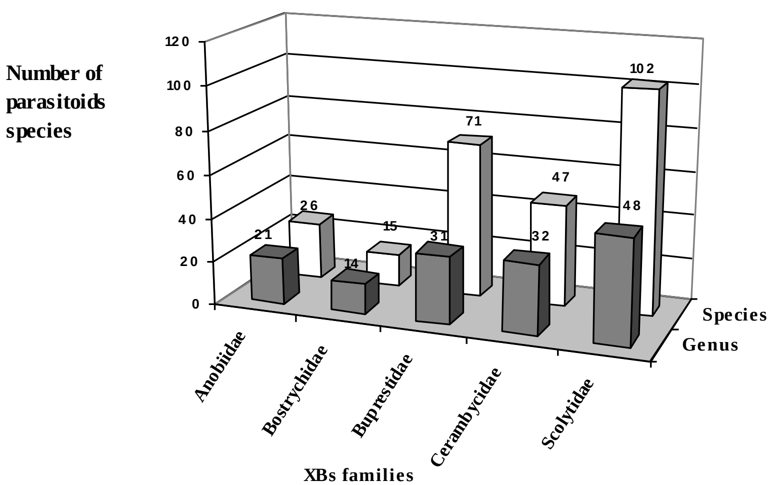

Figure 6. Numbers of chalcidoids genera and species on each XB families.

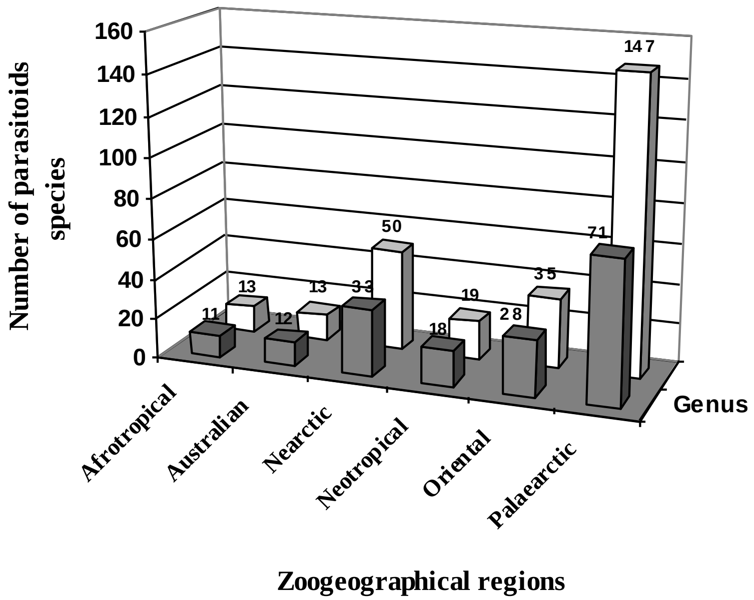

Figure 7. Numbers of chalcidoids genera and species associated with XB families in each zoogeographical regions.

ALEURODOTHRIPS FASCIAPENNIS FRANKLIN: A NEWLY RECORDED GENUS AND SPECIES FOR IRAN (THYSANOPTERA: PHLAEOTHRIPIDAE)

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[Mirab-balou, M. & Chen, X.-X. 2012. *Aleurodothrips fasciapennis* Franklin: A newly recorded genus and species for Iran (Thysanoptera: Phlaeothripidae). Munis Entomology & Zoology, 7 (1): 334-338**]**

ABSTRACT: During the study of Iranian thrips in 2008-2010, a male of the *Aleurodothrips fasciapennis* Franklin 1908, belong in tribe Aleurodothripini Han 1997 (Phlaeothripidae: Phlaeothripinae) was collected on the infected leaves of grape by *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae) from Zanjan province, which is represented as new records of the tribe, genus and species in Iran for the first time.

KEY WORDS: Thysanoptera, Phlaeothripidae, Aleurodothripini, new record, Iran, *Aleurodothrips fasciapennis*.

The Thysanoptera with more than 6000 known species is one of the orders of insects distributed through all parts of the world. This order is includes nine families for living species (plus three fossil families) belong in two suborders, of these family Phlaeothripidae is only family in suborder Tubulifera (Mound, 2011). This family is currently interpreted as comprising about 3500 known species in the world (Mound, 2011), of these 44 species in 16 genera have been reported from Iran (Bhatti et al., 2009). At least half of the species in this family are fungus-feeders, mostly on hyphae but with one major group, the Idolothripinae, feeding on spores. More than one-third of the species are phytophagous, including the *Haplothrips* lineage in flowers, and the much larger *Liothrips* lineage on leaves. Some leaf-feeding species include galls on their host plants (Mound, 1994). A few species are predatory on scale insects and mites (Palmer & Mound, 1991), and the members of one small lineage feed on mosses (Mound, 1989).

Most of Iranian phlaeothripids have been recorded from tribe Haplothripini; and amongst them, *Haplothrips* species have a diversity of biologies, with many described species apparently predatory including *Haplothrips* (*H.*) *andresi* Priesner, *H.* (*H.*) *flavitibia* Williams, *H.* (*H.*) *globiceps* Bagnall, *H.* (*H.*) *kurdjumovi* Karny, *H.* (*H.*) *longiceps* Bagnall, *H.* (*H.*) *maroccanus* Priesner, *H.* (*H.*) *minutus* (Uzel), *H.* (*H.*) *phyllophilus* Priesner, *H.* (*H.*) *rabinovitchi* Priesner and *H.* (*H.*) *subtilissimus* (Haliday), and others phytophagous, particularly in the flowers of Asteraceae and Poaceae (Minaei & Mound, 2008).

In this paper, the predatory thrips, *Aleurodothrips fasciapennis* Franklin 1908, is represented as new records of the tribe, genus and species in Iran for the first time.

MATERIALS AND METHODS

During the course of study on Iranian thrips in 2008-2010, we were collected one specimen from infected leaves of grape by citrus mealy bug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae), from Zanjan province, West of Iran. The thrips was mounted on slide using the method of Mirab-balou & Chen (2010). All descriptions, measurements and photos were made with a Leica DM IRB microscope, a Leica MZ APO microscope with a Leica Image 1000 system. The specimen is deposited in the Institute of Insect Sciences, Zhejiang University, Hangzhou, China (ZJUH).

***Aleurodothrips* Franklin**

Aleurodothrips Franklin, 1909: 228; Stannard, 1968: 399.
Microcanthothrips Bagnall, 1914: 295.

Generic diagnosis. Head quadrate, about as long as wide, weakly striate, not projecting much beyond anterior eye margin. Ocelli present. Eyes moderately large, not prolonged ventrally. Postocular setae small, pointed (Fig. 1). Antennae 8-segmented, segment II with dorsal sensorium, III and IV with short sense cones; segment VIII separate but closely joined to segment VII (Fig. 8). Mouth-cone short, broadly rounded. Maxillary stylets extended up to eyes, widely spaced within head. Pronotum shorter than head, smooth except for posterior margin. Only anterolateral and epimeral setae well developed, these dilated (Fig. 3). Praepectus (basantra) present (Fig. 3). Probasisternal plates (ferna) large (Fig. 3). Metascutum smooth. Mesospinasternum fully formed. Females with fore legs unarmed; males bearing a large tooth-like projection on each of the fore femora, 3 or 4 setae bearing warts on each of the fore tibiae, and a moderate-sized tooth on each fore tarsus (Fig. 2). Mid and hind femora without differentiated setae. All tarsi one-segmented. Forewings slightly narrowed in the middle, lacking duplicated cilia (Fig. 9). Pelta divided into three parts. Abdominal terga II-IV more or less with anastomosing, transverse striate, terga V-VIII more or less hexagonally reticulate, tergum VIII and IX nearly smooth. Abdominal terga II-VII each with one pair of sigmoidal wing-retaining setae (Fig. 7); lateral setae dilated.

Males with abdominal sternum V with several pairs of differentiated median setae, abdominal sternum VIII with glandular area. Abdominal tergum IX with major dorsal, posterior setae shorter than tube, dilated; lateral pair in males as long as in females, not shorter as in males of many species in the Phlaeothripinae. Tube much shorter than head, terminal setae shorter than tube (Fig. 4) (Stannard, 1968).

Remarks. *Aleurodothrips* is easily distinguished from other related genera by the lack of epimeral sutures on the pronotum; the division of the pelta into three parts; and the shape of fore legs of male.

***Aleurodothrips fasciapennis* (Franklin)** (Figures 1-9)

Cryptothrips fasciapennis Franklin, 1908: 727; Stannard, 1968: 399, 400.
Cephalothrips spinosus Bagnall, 1909: 174.

This species was identified based on the descriptions by Stannard (1968), Han (1997) and Moritz et al. (2001).

Diagnosis. *Male macroptera.* Body bicolored, brown and yellow; antennal segments I-IV yellow (Fig. 8), head and pronotum faintly shaded; forewings pale, banded with light brown at base, medially and at apex (Fig. 9); Abdominal segments V-VI dark brown; major setae pale yellow. Head without long postocular setae (Fig. 1). Mouth cone short, bluntly rounded. Maxillary stylets widely spaced. Maxillary bridge not discernible. Antennae 8-segmented, III with 1 sense cone, IV with 2 sense cones (Fig. 8). Pronotum shorter than head, with only 2 pairs of major setae (anterolateral and epimeral setae) (Fig. 3); prosternal ferna large (Fig. 3). Fore femur with stout spur on inner margin, fore tarsus with small pointed tooth, fore tibia with about 3 small tubercles on inner margin (Fig. 2). Mesonotum sculpture; metanotum smooth (Fig. 6). Forewing narrow but swollen at base, without duplicated cilia (Fig. 9). Pelta weakly sclerotised. Abdominal terga II-VII each with 1 pair of sigmoid wing-retaining setae (Fig. 7); tergum IX setae B1 & B2 capitate; tube shorter than head (Fig. 4). Abdominal sternum VIII without glandular area; sernum V with three pairs of enlarged median setae; and latero-ventral setae spine-like (Fig. 5).

Measurements of male in µm; Length (width). Body 1600(330); head 160(185); pronotum 120(250); forewing 660(32); hind wing 570(30); abdominal tergum X (tube) 130(65); tergum IX setae B1 80, B2 90, B3 105. Antennal segments I-VIII as follows: I 28(37); II 30(37), III 54(26), IV 53(30), V 55(28), VI 50(27), VII 37(20), and VIII 34(15).

Material examined. **IRAN**: **Zanjan Province**, Yenjigeh (51° 424' N, 35° 672' E, 1149 m), 1♂ from grape (infected by mealy bug), 25.vi.2009, coll. M. Mirab-balou; (ZJUH).

Host plants. Grape (Family Vinifera).

Distribution. Iran (Zanjan province); China (Including Taiwan), Vietnam, Japan, India, Sri Lanka, Indonesia, Barbados (West Indies), Reunion Island (Indian Ocean), Fiji (Pacific), Borneo (Kalimantan), Micronesia (Oceania), Polynesia , Australia, Bermuda, the United States, Jamaica, Cuba, Nassau, Puerto Rico, and Belgium (Mirab-balou et al., 2011).

Remarks. This species is predator of scale insects. The bicolored body and banded forewings are characteristic of this species (Mound & Marullo, 1996). In this study, we have collected this predatory thrips on the infected leaves of grape by *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae).

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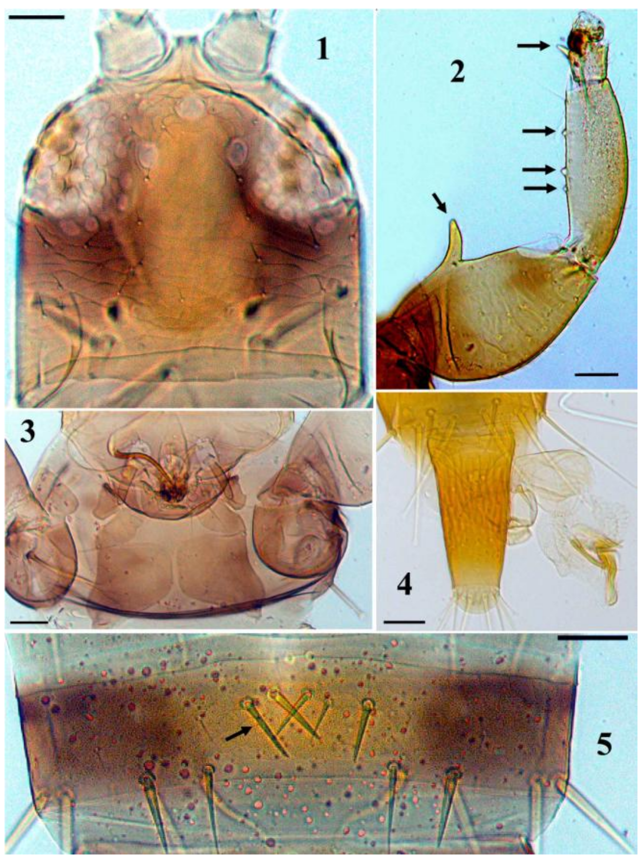
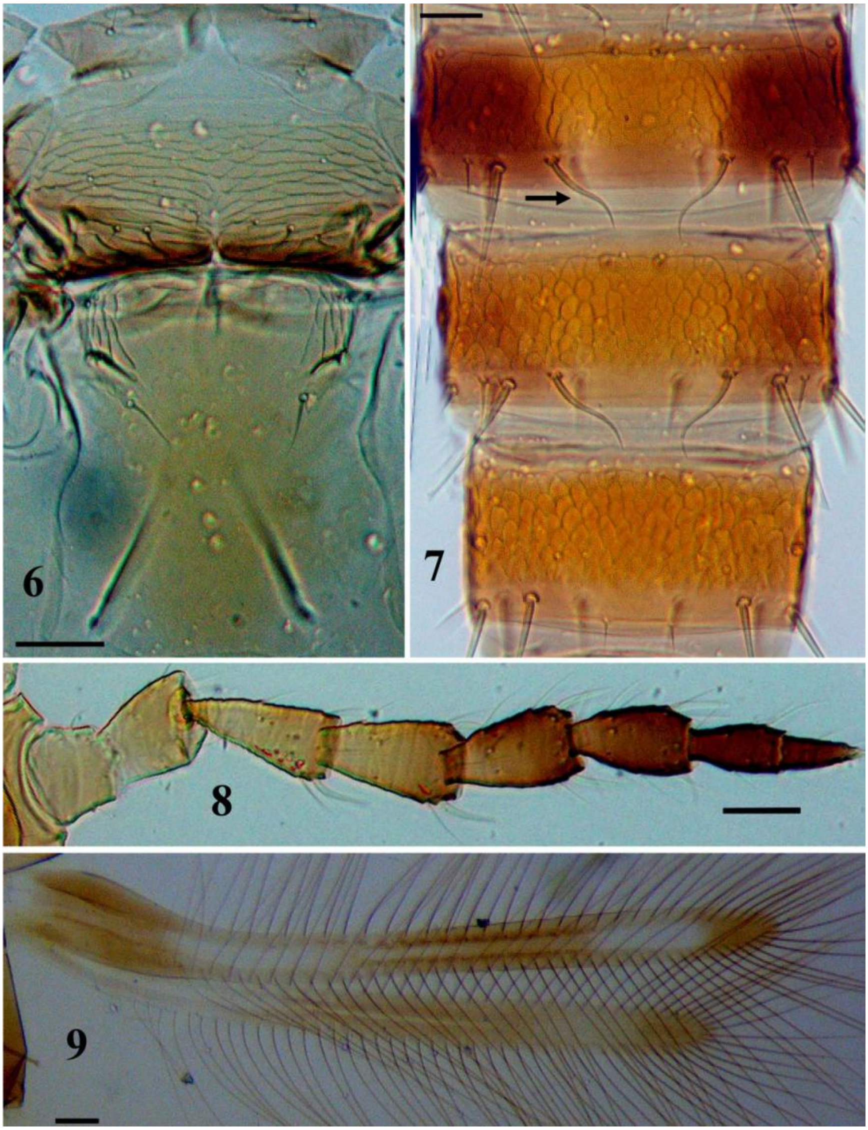


Figures 1-5. *Aleurodothrips fasciapennis* (♂): (1) head, (2) fore leg, (3) prosternum, (4) tube, (5) sternum V. (Scale bar=30 microns).



Figures 6-9. *Aleurodothrips fasciapennis* (♂): (6) meso- and metanotum, (7) terga VI-VIII, (8) antennae, (9) wing. (Scale bar=30 microns).

ODONATA FAUNA OF TOKAT PROVINCE (TURKEY)

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[Salur, A., Miroğlu, A. & Okçu, B. 2012. Odonata fauna of Tokat province (Turkey). Munis Entomology & Zoology, 7 (1): 339-343**]**

ABSTRACT: In this study, odonatan specimens collected from the Tokat province in central part of Black Sea Region of Anatolia in 2005 and 2010 have been established faunistically. 30 species belonging to 8 families are found to be distributed in Tokat province. Among these, 2 species belong to Calopterygidae, 1 species to Euphaeidae, 3 species to Lestidae, 1 species to Platycnemididae, 7 species to Coenagrionidae, 3 species to Aeshnidae, 2 species to Gomphidae, 11 species to Libellulidae. All species were stated as the first records for Tokat province.

KEY WORDS: Odonata, Fauna, Tokat, Turkey.

Tokat is located in the Black Sea Region of Turkey. It borders Samsun province to the north, Ordu province to the northeast, Sivas province to the east and south. It also borders Yozgat province to the southwest and Amasya province to the west. Tokat province has the features of a gateway between climates of Central Anatolia, Central-Eastern Anatolia, the Black Sea and Central Black Sea.

There have been many studies reported about the Odonata fauna of Turkey until now. But when literature is scanned, it is noticed that there is not any study about odonatan fauna of Tokat province (Demirsoy, 1995; Kalkman et al., 2006). Field trips were made in 2005 and 2010 to Tokat province to supply this information deficiency. Furthermore, the records of samples which were collected from Tokat province in 2005 is ordered and this article is created.

Field study was carried out in different periods between June 2005 and June to September 2010 in Tokat province. Odonata species were collected with aeriol net. specimens were put into killing jars and then softened and pinned. All the specimens were deposited in Hitit University Zoology Museum.

Family Calopterygidae

***Calopteryx splendens amasina* Bartenef, 1911**

Materials: *Niksar:* 1♂, 1♀, 27/06/2005, Kümbetli, 258 m, 40°37'N 36°48'E; *Erbaa:* 2♂♂, 1♀, 27/06/2005, Ağcaalan, 227 m, 40°39'N 36°42'E; 4♂♂, 1♀, 23/06/2010, Kozlu - Gavur tarlası, 850 m, 40° 36' 956" N 36° 29' 570"E; 5♂♂, 1♀, 23/06/2010, Gölönü - Gölönü Lake, 1066m, 40° 34' 230" N 36° 29' 277" E; 7♂♂, 25/07/2010, near Alacabal - Bostanlık, 330m, 40° 38' 383" N 36° 31' 944"E; 3♂♂, 25/07/2010, near Alacabal - Yürük içi, 331 m, 40° 38' 706" N 36° 31'778"E; 6♂♂, 1♀, 25/07/2010, Koçak village - Körgova, 445 m, 40° 39' 090" N 36° 31'760"E; 2♂♂, 1♀, 25/07/2010, Koçak village - Çilçilin pınar, 416 m, 400 39' 455" N 36° 32'231"E; 2♂♂, 1♀, 25/07/2010, Koçak village –Entry of industry, 443 m, 40° 39' 914" N 36° 31'551"E; 12♂♂, 26/07/2010, Keçeçi - Özündere, 1019 m, 400 30' 103" N 36° 28' 648"E; 3♂♂, 1♀, 26/07/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 10♂♂, 4♀♀, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 7♂♂ 26/07/2010, Kozlu - Gavur tarlası, 850 m, 40° 36' 956" N 36° 29' 570"E; 9♀♀, 26/07/2010, Keçeçi - Özündere, 1019 m, 400 30' 103" N 36° 28' 648"E; 2♂♂, 3♀♀, 04/09/2010, Tosunlar village -canal, 135 m, 40° 42'837"N 36° 32'749"E; 2♂♂, 04/09/2010, Kale village - Kale bridge, 195 m, 40°45'271"N 36°30'600"E. **Phenology and Habitat:** June, July and September. Coast of canal, coast of marsh, coast of small stream.

Calopteryx virgo festiva **(Brullé, 1832)**

Materials: *Erbaa:* 1♀, 23/06/2010, Kozlu - Gavur tarlası, 850 m, 40º 36' 956" N 36º 29' 570"E; 1♂, 1♀, 23/06/2010, Gölönü - Gölönü Lake, 1066 m, 40º 34' 230" N 36º 29' 277" E; 5♂♂, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40º 38' 383" N 36º 31' 944"E; 1♂, 25/07/2010, near Alacabal - Yürük içi, 331 m, 40º 38' 706" N 36º 31'778"E; 2♂♂, 25/07/2010, Koçak village - Körgova, 445 m, 40º 39' 090" N 36º 31'760"E; 3♀♀, 25/07/2010, Koçak village - Entry of industry, 443 m, 40º 39' 914" N 36º 31'551"E; 2♂♂, 1♀, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40º 34' 230" N 36º 29' 277" E; 4♂♂, 2 ♀♀, 26/07/2010, Keçeçi - Özündere, 1019 m, 40º 30' 103" N 36º 28' 648"E. **Phenology and Habitat:** June and July. Pool of near the spring, pool of near the spring, coast of marsh.

Family Euphaeidae

Epallage fatime **(Charpentier, 1840)**

Materials: *Erbaa*: 2♂♂, 1♀ , 27/06/2005, Ağcaalan, 227 m, 40º39'N 36º42'E; *Niksar*: 1♂, 28/06/2005, Muhtardüzü, 352 m, 40º27'N 37º02'E; *Reşadiye*: 1♂, 1♀, 29.06.2005, Kışlaoğlu, 566 m, 40º21'N 37º27'E. **Phenology and Habitat:** June. Coast of stream.

Family Lestidae

Lestes barbarus **(Fabricius, 1798)**

Materials: *Reşadiye*: 1♂, 29/06/2005, Altıparmak, 507 m, 40º22'N 37º22'E; *Erbaa*: 1♀, 25/07/2010, Koçak village - Entry of industry, 443 m, 40º 39' 914" N 36º 31'551"E; 19♂♂, 14♀♀, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40º 34' 230" N 36º 29' 277" E; 1♂, 26/07/2010, Kozlu - Gavur tarlasi, 850 m, 40º 36' 956" N 36º 29' 570"E; 3♂♂, 26/07/2010, Meydandüzü - Küçük Yuvak, 840 m, 40º 35' 974" N 36º 30' 603" E. **Phenology and Habitat:** June and July. Coast of lake, coast of marsh, near the small stream.

Lestes dryas **Kirby, 1890**

Materials: *Erbaa*: 2♂♂, 23/06/2010, Gölönü - Gölönü Lake, 1066 m, 40º 34' 230" N 36º 29' 277" E; 7♂♂, 26/07/2010, Gölönü - Gölönü Lake 1066 m, 40º 34' 230" N 36º 29' 277" E. **Phenology and Habitat:** June and July. Coast of lake.

Sympecma fusca **(Vander Linden, 1820)**

Materials: *Erbaa*: 1♂, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40º 34' 230" N 36º 29' 277" E . **Phenology and Habitat:** July. Coast of lake.

Family Platycnemididae

Platycnemis pennipes **(Pallas, 1771)**

Materials: *Niksar*: 1♂, 2♀♀, 27/06/2005, Kümbetli, 258 m, 40º37'N 36º48'E; 2♂♂, 2♀♀, 27/06/2005; *Erbaa*: Tepekışla, 220 m, 40º40'N 36º40'E; 8♂♂, 4♀♀, 23/06/2010, Kozlu - Gavur tarlası, 850 m, 40º 36' 956" N 36º 29' 570"E; 4♂♂, 2♀♀, 23/06/2010, Gölönü - Gölönü Lake, 1066 m, 40º 34' 230" N 36º 29' 277" E; 6♂♂, 3♀♀, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40º 38' 383" N 36º 31' 944"E; 17♂♂, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40º 34' 230" N 36º 29' 277" E; 6♂♂, 26/07/2010, Kozlu - Gavur tarlası, 850 m, 40º 36' 956" N 36º 29' 570"E; 85♂♂, 14♀♀, 26/07/2010, Keçeci - Özün dere, 1019 m, 40º 30' 103" N 36º 28'648"E. **Phenology and Habitat:** June and July. Coast of lake, coast of marsh, near the stream.

Family Coenagrionidae

Coenagrion ornatum **(Sélys, 1850)**

Material: *Niksar*: 1♂, 28/06/2005, Ormancık, 342 m, 40º30'N 36º54'E. **Phenology and Habitat:** June. Pool of near the spring.

Coenagrion puella **(Linnaeus, 1758)**

Materials: *Reşadiye*: 1♀, 29/06/2005, Altıparmak, 507 m, 40º22'N 37º22'E; *Niksar*: 7♂♂, 28/06/2005, Ormancık, 342 m, 40º30'N 36º54'E; *Erbaa*: 18♂♂, 3♀♀, 23/06/2010, Kozlu - Gavur tarlası, 850 m, 40º 36' 956" N 36º 29' 570"E; 99♂♂, 13♀♀, 23/06/2010, Gölönü - Gölönü Lake, 1066 m, 40º 34' 230" N 36º 29' 277" E; 3 ♂♂, 23/06/2010, Meydandüzü - Büyükyuvak, 911 m, 40º 35'939" N 36º 29' 632" E; 2♂♂, 3♀♀, 25/07/2010, near Alacabal -

Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 1♂, 26/07/2010 Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 3♂♂, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 6♂♂, 2♀♀, 26/07/2010, Kozlu - Gavur tarlası, 850 m, 40° 36' 956" N 36° 29' 570"E. **Phenology and Habitat:** June and July. coast of marsh, lake, near the small stream.

***Coenagrion scitulum* (Rambur, 1842)**

Materials: *Erbaa*: 1♂, 23/06/2010, Meydandüzü - Küçük Yuvak, 911m, 40° 35' 974" N 36° 30' 603" E; 1♂, 23/06/2010, Gölönü - Gölönü Lake, 1066m, 40° 34' 230" N 36° 29' 277" E; 2♀♀, 04/09/2010, Kale village - Kale bridge, 195m, 40°45'271"N 36°30'600"E. **Phenology and Habitat :** June and September. Pool of near the spring, coast of lake.

***Enallagma cyathigerum* (Charpentier, 1840)**

Materials: *Erbaa*: 1♀, 25/07/2010, Koçak village - Çilçilin pınar, 416 m, 400 39' 455" N 36° 32'231"E; 1♂, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 1♂, 1♀, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E. **Phenology and Habitat:** July. Pool of near the spring, coast of lake.

***Ischnura elegans ebneri* Schmidt, 1938**

Materials: *Reşadiye*: 1♂, 4♀♀, 29/06/2005, Altıparmak, 507 m, 40°22'N 37°22'E; *Niksar*: 2♂,1♀, 28/06/2005, Ormancık, 342 m, 40°30'N 36°54'E; *Erbaa*: 67♂♂, 18♀♀, 23/06/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 11♂♂, 1♀, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 1♂, 26/07/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 6♂♂, 6♀♀, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 4♂♂, 1♀, 04/09/2010, Tosunlar village -canal, 135 m, 40° 42'837"N 36° 32'749"E. **Phenology and Habitat:** June, July and September. Coast of lake, coast of marsh, pool of near the spring, near the small stream.

***Ischnura pumilio* (Charpentier, 1825)**

Materials: *Reşadiye*: 1♀, 29/06/2005, Altıparmak, 507 m, 40°22'N 37°22'E; *Erbaa*: 1♂, 23/06/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 1♂, 23/06/2010, Kozlu - Gavur tarlası, 850 m, 40° 36' 956" N 36° 29' 570"E; 1♂, 4♀♀, 23/06/2010, , Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 15♂♂, 10♀♀, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 4♂♂, 4♀♀, 25/07/2010, Koçak village - Körgova, 445 m, 40° 39' 090" N 36° 31'760"E; 1♂, 26/07/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 3♂♂, 26/07/2010, Gölönü - Gölönü Lake (lake), 1066 m, 40° 34' 230" N 36° 29' 277" E. **Phenology and Habitat:** June, July. Coast of lake, coast of marsh, pool of near the spring, near the small stream.

***Pyrrhosoma nymphula* (Sulzer, 1776)**

Materials: *Erbaa*: 1♂, 1♀, 23/06/2010, Kozlu - Gavur tarlası, 850 m, 40° 36' 956" N 36° 29' 570"E. **Phenology and Habitat :** June. Coast of marsh.

Family Aeshnidae

***Aeshna affinis* Vander Linden, 1820**

Materials: *Erbaa*: 8♂♂, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E. **Phenology and Habitat:** July. Lake.

***Aeshna isosceles antehumeralis* (Schmidt, 1954)**

Materials: *Erbaa*: 7♂♂, 23/06/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 1♀, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E. **Phenology and Habitat:** June and July. Lake.

***Caliaeshna microstigma* (Schneider, 1845)**

Materials: *Erbaa*: 4♂♂, 27/06/2005, Ağcaalan, 227 m. 40°39'N 36°42'E; 1♂, 23/06/2010, Kozlu - Gavur tarlası, 850 m, 40° 36' 956" N 36° 29' 570"E; *Reşadiye*: 1♂, 29.06.2005, Karaağaç, 615 m, 40°20'N 37°32'E. **Phenology and Habitat:** June. Coast of marsh.

Family Gomphidae
***Gomphus schneideri* Sélys, 1850**

Materials: *Erbaa*: 1♀, 27/06/2005, Tepekışla, 220 m, 40°40'N 36°40'E. **Phenology and Habitat:** June. Near the small stream.

***Onychogomphus forcipatus albotibialis* Schmidt, 1954**

Materials: *Erbaa*: 1♂, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 1♂, 26/07/2010, Keçeci - Özün dere, 1019 m, 40° 30' 103" N 36° 28'648"E . **Phenology and Habitat:** July. Coast of small stream.

Family Libellulidae
***Libellula depressa* Linnaeus, 1758**

Materials: *Erbaa*: 1♂, 23/06/2010, Meydandüzü -Büyük yuvak, 911 m, 40° 35' 939" N 36° 29' 632" E; 2♂♂, 23/06/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 2♂♂, 23/06/2010, Kozlu - Gavur tarlası, 850 m, 40° 36' 956" N 36° 29' 570"E; 1♀, 23/06/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 1♀, 23/06/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 2♂♂, 26/07/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 1♀, 1♂, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E. **Phenology and Habitat:** June and July. Lake, coast of marsh.

***Orthetrum albistylum* (Sélys, 1848)**

Materials: *Erbaa*: 3♂♂, 04/09/2010, Tosunlar village - canal, 135 m, 40° 42'837"N 36° 32'749"E. **Phenology and Habitat:** Sepember. Cast of marsh.

***Orthetrum brunneum* (Fonscolombe, 1837)**

Materials: Niksar: 2♂♂, 27/06/2005, Kümbetli, 258 m, 40°37'N 36°48'E; *Erbaa*: 3♂♂, 1♀, 23/06/2010, Kozlu - Gavur tarlası, 850 m, 40° 36' 956" N 36° 29' 570"E; 5♂♂, 23/06/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 2♂♂, 2♀♀, 25/07/2010, Koçak village - Çilçilin pınar, 416 m, 40° 39' 455" N 36° 32'231"E; 11♂♂, 2♀♀, 25/07/2010, Koçak village - Körgova, 445 m, 40° 39' 090" N 36° 31'760"E; 6♂♂, 25/07/2010, near Alacabal - Yürük içi, 331 m, 40° 38' 706" N 36° 31'778"E; 27 ♂♂, 5♀♀, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 2♂♂, 26/07/2010, Kozlu - Gavur tarlası, 850 m, 40° 36' 956" N 36° 29' 570"E; 1♂, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 3♂♂, 26/07/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 3♂♂, 2♀♀, 04/09/2010, Kale village - Kale bridge, 195 m, 40° 45' 271" N 36° 30' 600"E; 3♂♂, 04/09/2010, Tosunlar village - canal, 135 m, 40° 42'837"N 36° 32'749"E. **Phenology and Habitat:** June, July and September. Pool of near the spring, coast of lake.

***Orthetrum cancellatum* (Linnaeus, 1758)**

Materials: *Erbaa*: 1♂, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 1♂, 25/07/2010, near Alacabal - Yürük içi, 331 m, 40° 38' 706" N 36° 31'778"E; 2♂♂, 1♀, 25/07/2010, Koçak village - Körgova, 445 m, 40° 39' 090" N 36° 31'760"E; 1♀, 25/07/2010, Koçak village - Çilçilin pınar, 416 m, 40° 39' 455" N 36° 32'231"E. **Phenology and Habitat:** July. Coast of small stream.

***Orthetrum coerulescens anceps* (Schneider, 1845)**

Materials: *Niksar*: 3♂♂,1♀, 28/06/2005, Ormancık, 342 m, 40°30'N 36°54'E; *Erbaa*: 1♂, 27/06/2005, Ağcaalan, 227 m, 40°39'N 36°42'E; 1♂, 1♀, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 6♂♂, 25/07/2010, near Alacabal - Yürük içi, 331 m, 40° 38' 706" N 36° 31'778"E; 22♂♂, 1♀, 25/07/2010, Koçak village - Körgova, 445 m, 40° 39' 090" N 36° 31'760"E; 4♂♂, 25/07/2010, Koçak village - Çilçilin pınar, 416 m, 40° 39' 455" N 36° 32'231"E; 1♂, 5♀♀, 25/07/2010, Koçak village - Entry of industry, 443 m, 40° 39' 914" N 36° 31'551"E; 1♂, 26/07/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E. **Phenology and Habitat:** June and July. Coast of small stream, pool of near the spring.

Crocothemis erythraea (Brullé, 1832)

Materials: *Niksar*: 1♂, 27/06/2005, Kümbetli, 258 m, 40°37'N 36°48'E; *Erbaa*: 2♀♀, 23/06/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 3♂♂, 25.07.2010, near Alacabal - Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 1♂, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 4♂♂, 9♀♀, 04/09/2010, Tosunlar village, 135 m, 40° 42'837"N 36° 32'749"E; 2♀♀, 04/09/2010, Kale village - Kale bridge, 195 m, 40°45'271"N 36°30'600"E. **Phenology and Habitat:** June, July and September. Canal, coast of small stream pool of near the spring.

Sympetrum fonscolombii (Sélys, 1840)

Materials: *Erbaa*: 3♂♂, 7♀♀, 25/07/2010, Koçak village - Entry of industry, 443 m, 40° 39' 914" N 36° 31'551"E; 1♀, 25/07/2010, Koçak village - Çilçilin pınar, 416 m, 40° 39' 455" N 36° 32'231"E; 5♂♂, 2♀♀, 26/07/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 3♂♂, 5♀♀, , 26/07/2010, Gölönü - Gölönü Lake (lake), 1066 m, 40° 34' 230" N 36° 29' 277" E; 1♂, 5♀♀, 04/09/2010, Tosunlar village -canal, 135 m, 40° 42'837"N 36° 32'749"E; 1♀, 04/09/2010, Kale village - Kale bridge, 195 m, , 40° 45' 271" N 36° 30' 600"E. **Phenology and Habitat:** July and September. Coast of small stream, coast of lake, coast of canal.

Sympetrum meridionale (Sélys, 1841)

Materials: *Erbaa*: 1♀, 25/07/2010, Koçak village - Entry of industry, 443 m, 40° 39' 914" N 36° 31'551"E. **Phenology and Habitat:** July. Pool.

Sympetrum sanguineum (O.F. Müller, 1764)

Materials: *Reşadiye*: 2♂♂, 29/06/2005, Altıparmak, 507 m, 40°22'N 37°22'E; *Erbaa*: 1♂, 23/06/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E; 1♀, 25/07/2010, near Alacabal - Bostanlık, 330 m, 40° 38' 383" N 36° 31' 944"E; 2♂♂, 25/07/2010, Koçak village - Entry of industry, 443 m, 40° 39' 914" N 36° 31'551"E; 13♂♂, 8♀♀, 26/07/2010, Gölönü - Gölönü Lake, 1066 m, 40° 34' 230" N 36° 29' 277" E. **Phenology and Habitat:** June and July. Coast of lake, pool.

Sympetrum striolatum (Charpentier, 1840)

Materials: *Niksar*: 1♂, 27/06/2005, Dalkaya, 272 m, 40°33'N 36°52'E. **Phenology and Habitat:** June. Edge of the way.

Pantala flavescens (Fabricius, 1798)

Materials: *Erbaa*:1♂, 1♀, 26/07/2010, Meydandüzü - Küçük Yuvak, 840 m, 40° 35' 974" N 36° 30' 603" E; 6♂♂, 6♀♀, 25/07/2010, Koçak village - Çilçilin pınar, 416 m, 40° 39' 455" N 36° 32'231"E. **Phenology and Habitat:** July. Pool of near the spring.

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COMPARING CARBOHYDRATE ENZYMES ACTIVITY IN *EURYGASTER INTEGRICEPS* PUTTON (HEMIPTERA: SCUTELLERIDAE), *RHOPALOSIPHUM PADI* L. (HOMOPTERA: APHIDIDAE) AND *HAPLOTHRIPS TRITICI* KURD. (PHLAEOTHRIPIDAE: THYSANOPTERA) AS A COMPLEX PEST ON WHEAT

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[Seddigh, S., Masoudi-Nejad, A., Tafaghodinia, B. & Imani, S. 2012. Comparing carbohydrate enzymes activity in *Eurygaster integriceps* Putton (Hemiptera: Scutelleridae), *Rhopalosiphum padi* L. (Homoptera: Aphididae) and *Haplothrips tritici* Kurd. (Phlaeothripidae: Thysanoptera) as a complex pest on wheat. Munis Entomology & Zoology, 7 (1): 344-351**]**

ABSTRACT: Sunn pest (*Eurygaster integriceps* Putton), Bird cherry-oat aphid (*Ropalosiphum padi* L.) and wheat thrips (*Haplothrips tritici* Kurd.) are the most important pests which damage on wheat. They are dependent on their carbohydrate enzymes because of their nutrition diet. The weakness of wheat is caused because of their feeding on plant's carbohydrate materials. In this study the activity of three enzymes including: α-amylase, α and β-glucosidase were assayed in the midgut, salivary glands of sunn pest, the gut of wheat aphid and wheat thrips. Levels of these enzymes activities were different. In sunn pest's midgut the highest activity was found for β-glucosidase and the lowest was for α-amylase whereas in sunn pest salivary gland the highest activity was detected for α-glucosidase and the lowest in α-amylase. In the Aphid gut enzyme activity was different so that the highest activity was detected in α-amylase but the lowest in β-glucosidase. In wheat thrips the highest enzyme activity was detected in β-glucosidase and no α-amylase activity was observed. Comparing these four samples, the alpha amylase activity had the highest level in sunn pest's midgut and the lowest in wheat thrips. The highest activity of α, β-glucosidase enzyme was as the same as α-amylase and in sunn pest midgut was the highest. The lowest activity of α, β- glucosidase was found in wheat thrips and wheat aphid, respectively. So the most important pest is *E.integriceps* because of its carbohydrate enzymes.

KEY WORDS: α-Amylase, α-Glucosidase, β-Glucosidase, Enzyme assay, *Eurygaster integriceps, Ropalosiphum padi, Haplothrips tritici.*

Sunn pest, *Eurygaster integriceps* Putton (Hemiptera: Scutelleridae), is the key pest of wheat and barley in the wide area of the Near and Middle East to Eastern and South Europe and South Africa, which causes extreme damage to the vegetative growth stage of wheat in the early season (Popov et al. 1996; Paulin & Popov, 1980). Sunn pest feeding is like other heteropteran, which penetrates and cuts tissues with its stylets in piercing-sucking mouthparts while injecting amylases and proteases through the salivary canal in order to liquefy the tissues into a nutrient-rich slurry. The liquefied food is ingested through the food canal and passed into the gut where it is digested and engrossed later (Cohen, 2000; Boyed et al., 2002). Sunn pest feeds on different stages of developing grains and sucks milky nutrients from immature grains. Its enzymes, which are injected into the grains degrade gluten proteins, cause rapid relaxation of dough and poor volume and texture of bread (Rajabi, 2000).

Aphids are also one of the principal pests of cereal crops (Minks & Harrewijn, 1987; Leszczynski et al., 1994; Yu, 1992; 1996; Roditakis et al., 2000). In summer, aphid populations on wheat can reach damaging levels, particularly in clement regions of the world (Carter et al.,1980; Leather et al.,1989). The Bird cherry-oat aphid (*R. padi* L.) is one of the most important pests in cereal fields and the infestation of *R. padi* in cereal fields varies greatly between years (Leather et al., 1989). Heavy aphid infestation in earlier growth stages can kill the young wheat plants, but normally, aphid feeding results in a poor root growth and ultimately reduction in cultivator number and grain yield (Russell, 1978).

Thrips (Thysanoptera: Thripidae) are serious pests of ornamental, vegetable, and fruit crops both in the open field and greenhouses throughout the world (Tommasini and Maini, 1995). They belong to Hemimetabola, and are considered as the sister group of Hemiptera that includes bugs, plant hoppers and aphids (Heming, 1973). Feeding by thrips can cause deformity, discoloration, silvering and bronzing of leaves and fruits on vegetable crops reducing their market value.

In Italy *Eurygaster integriceps* like other grain pests live on a polysaccharide-rich diet and are dependent on their α-amylases and glucosidases for survival (Mendiola-Olaya et al., 2000; Boyed et al. 2002). As many species of insect depend on the effectiveness of their amylases for survival, characterization studies of insect amylases are not only of interest for comparative investigations, but they can also contribute to clarify the compatibility of some natural diets with insect development (Buonocore et al., 1976).

α-Amylases (α-1,4-glucan-4-glucanohydrolases; EC 3.2.1.1) are one group of the hydrolytic enzymes which are widespread in animals, plants and microorganisms. These enzymes are purified from different origins including bacteria, nematodes and insects because of their important biochemical role in growth and development, also their physical and chemical properties have been characterized (Mendiola-Olaya et al., 2000; Oliveira-Neto et al., 2003; Mohamed, 2004; Erthal et al., 2007).

High activities of α-glucosidases (EC 3.2.1.20) are common in many insect species and are probably involved in the intermediate and final digestion of starch and glycogen (Terra, 1988). Insects secrete many types of α-amylases enzymes which catalyze the degradation of starch and glycogen, which can be characterized by the type of residue generated (Terra and Ferreira, 2005). α-Amylase converts starch to maltose which is then hydrolyzed to glucose by an α-glucosidase. In insects, only α-amylase has been found to hydrolyze long α-1,4-glucan chains such as starch or glycogen (Terra et al.,1996).

The α-amylase and glucosidases activity of salivary glands and gut of the sunn pest and other pests were undertaken to gain a better understanding of their digestive physiology, which we hope will lead to new strategies of control.

MATERIAL AND METHODS

Insects Samples:

Adult insects (*Eurygaster integriceps* Putton, *Rhopalosiphum padi* L. and *Haplothrips tritici* Kurd.) were collected from the Pakdasht wheat farm of Tehran Province, Iran and maintained on wheat plants in the laboratory at 27±2 c under a 14^{th} light: 10h dark (LD 14:10) photoperiod but wheat thrips which were maintained in refrigerator for further usages.

Sample preparation:

Enzyme samples from the salivary glands and midguts of adults of sunn pest and aphid were prepared by the method of Cohen (1993), with slight modification. Transiently, adults were randomly selected and their midguts and salivary glands complexes were took off by dissection under a light microscope in ice-cold distilled water. We used the whole body of wheat thrips. Samples were then placed in a pre-cooled homogenizer and ground in 1 ml of distilled water. The homogenates from each preparation (midguts, salivary glands complexes and wheat thrips) were transferred separately to 1.5 ml centrifuge tubes and centrifuged at 15000 x g for 20 min at 4 c. The supernatants were pulled and stored at -20 c for following analysis.

Amylase activity assay:

The alpha amylase activity was assayed by the dinitrosalicylic acid (DNS) procedure (Bernfeld,1955) using %1 soluble starch (Merck, Darmstadt, Germany) as the substrate. Ten micro liters of enzyme were incubated for 30 min at 35 c with 500 µl universal buffer containing succinate, glycin and 2-morpholinoethanesulfonic acid (PH 6.5) (Hosseinkhani & Nemat Gorgani, 2003) and 40 µl soluble starch. The reaction was stopped by addition of 100 µl DNS and heated in boiling water for 10 min. DNS is a color reagent: the reducing group released from starch by α-amylase action are measured by the reduction of DNS. Boiling water stops the activity of α-amylase and catalyzes the reaction between DNS and the reducing groups of starch. Reaction transferred into Elisa plates. The absorbance was read at 540nm with Elisa reader (Model ELX800) after cooling in ice for 5 min. One unite of α-amylase activity was defined as the amount of enzyme required to produce 1 mg maltose in 30 min at 35 c. A standard curve of absorbance against amount of maltose released was produced to enable calculation of the amount of maltose released during α-amylase assay. Serial dilutions of maltose (Merck) in the phosphate buffer PH (6.8) were made to give concentration of 1,2,3,4,5 mg ml^{-1}. They repeated four times.

A blank without substrate but with α-amylase extracts and a control containing no α-amylase extracts but with the substrate were run at the same time with the reaction mixtures. All assays were repeated two times. The procedure was repeated for each sample (midguts and salivary glands of sunn pest and wheat aphids).

α- and β- Glucosidase activity assays:

Glucosidases activity was evaluated from salivary glands of sunn pest extracts, midguts of both sunn pest and wheat aphid extracts and wheat thrips. α and β-glucosidase were assayed to estimate the hydrolysis of the P-nitrophenyl substrate (P-nitrophenyl-α-D- glucopyranoside and P-nitrophenyl-β-D-glucopyranoside for α- and β- glucosidase, respectively) by Elisa reader according to the method of Silva and Terra (1995) and Yu (1989). Assays were performed at 40 c in 0.04 m citric acid-phosphate (Na_2Hpo_4) buffer (PH=5.0) containing 10 mµ Nacl and 10 mµ $CaCl_2$. Reaction mixtures consisted of enzyme extract (10 µl) and substrate (10, 5 µl for α- and β-glucosidase, respectively) and buffer (Total mixture up to 50 µl). Reactions were terminated after 10 min by adding 150 µl 0.25 µ NaOH, as stop buffer. The production of p-nitrophenol was measured at 405 nm by Elisa reader (Model ELX800). All experiments were repeated at least two times in order to calculate mean activity. The procedure was repeated separately for midguts and salivary glands complexes for each pests.

Protein determination:

Protein concentration was measured according to the method of Bradford (1976), using bovin serum albumin (Bio-Rad, Germany) as a standard.

RESULTS

The amylolytic activity per milligram was almost identical in the midgut and salivary glands of sunn pest, *E. integriceps* Putton, wheat aphid, *R.padi* L. but not in *H. tritici* Kurd. The α-amylase specific activity of sun pest midgut and salivary gland complexes were detected 1.167 and 0.0028 mU mgProtein^{-1}, respectively, although the specific activity of the midgut of the wheat aphids was 0.037 mU mgProtein^{-1} and no α- amylase activity was detected in wheat thrips. So the alpha amylase activity was the highest in the midgut of sunn pest but very low in its salivary glands and midgut of wheat Aphid (Fig. 1).

The specific activity of α-glucosidase from midguts and salivary glands of sunn pest was found 0.28 and 0.0316 mU mgProtein^{-1}, respectively but that was 0.0065 and 0.0045 mU mgProtein^{-1} in the midgut of the wheat aphids and wheat thrips, respectively. This result showed α-glucosidase activity in the midgut of sunn pest was so higher than its activity in its salivary glands also higher than its activity in other samples (Fig. 1).

β-Glucosidase activity was disclosed from all samples. β-glucosidase specific activity from the midgut of sunn pest and wheat aphids was contemplated 2.4 and 0.00091 mU mgProtein^{-1} respectively, whereas it was 0.028 and 0.0081 mU mgProtein^{-1} in salivary gland complexes of sunn pest and wheat thrips, respectively. So we found that the β-glucosidase activity in the midgut of sunn pest was very high, whereas it was very low in other samples (Fig.1).

All results of comparing these enzymes activity among sunn pest, wheat thrips and wheat aphid are showed in Table 1.

Comparing enzymes activity in the sunn pest salivary gland complexes, wheat thrips and wheat aphid midgut showed α-amylase had the most activity in aphid midgut but was different in the others and no activity was observed in wheat thrips. The most activity of alpha and beta glucosidase was detected in salivary glands of sunn pest (Fig.2).

DISCUSSION

α-Amylases are one of the most important enzymes in *E. integriceps* which digest gluten of wheat. The presence of amylase activity in salivary glands of many phytophagous heteroptrans has also been reported (Boyed et al., 2002; Boyed, 2003). Insects secrete many types of α-amylases which catalyze the degradation of starch and glycogen. These can be characterized by the type of residue generated (Terra & Ferreira, 2005). This research indicated that the α-amylase activity is present in the salivary gland complexes and midgut of *E. integriceps* Putton and the midgut of *R. padi* L. but not in wheat thrips. Specific activity of this enzyme is high in the midgut, whereas its activity is very ignoble in salivary gland complexes. As Boyed et al. (2002) showed sunn pest can digest polysaccharides partially by salivary secretions, which would be ingested along with partially digested starches to be used in the midgut. But complete breakdown of starch should take place in the midgut where large amounts of amylases exist. The activity of this enzyme in salivary gland complexes and midgut of sunn pest confirmed that. Therefore when pest complexes attack wheat, their alpha amylase importance is different so that wheat thrips has no alpha amylase and doesn,t damage on gluten which it differs in other pests. Alpha amylase is one of the most of the active enzymes in the midgut of a wheat aphids but in contrasting with the midgut of sunn pest is not high. α- amylase of *R.padi* can damage on wheat but not as much as sunn pest midgut. However, this enzyme in *R. padi* is much more important than sunn pest salivary glands and can damage on wheat more.

High activities of α-glucosidase is common in many insect species and is probably involved in the digestion procedure of starch and glycogen (Terra, 1988). Comparing specific activity of the α-glucosidases of midgut and salivary glands of sunn pest, indicated both have this enzyme activity also this enzyme activity is present in the midgut of the wheat aphids and wheat thrips. Activity of α-glucosidase was very high in the midgut but low in salivary gland complexes of sunn pest and was the highest in the midgut of sunn pest but lowest in wheat thrips. We found that the damage of *R. padi* and *H.tritici* alpha glucosidase on wheat are the same because their enzyme activity has no significant differences with each other although it is lower in *H. tritici*.

Midgut of sunn pest and wheat aphid showed the highest and lowest activity of β-glucosidase, respectively. This enzyme activity in sunn pest salivary gland complexes is much more than wheat thrips and *R. padi*. So this enzyme damage on wheat is more important than wheat aphid and thrips.

Comparing enzymes activity in sunn pest salivary glands showed the lowest activity was in α-amylase, whereas α-glucosidase and β-glucosidase activity were high and the same.

Enzymes assay in the midgut of *E. integriceps* showed the highest activity was in β-glucosidase and the lowest in α-glucosidase. α-amylase activity was lower than β-glucosidase but more than α-glucosidase. Enzymes activity in *R. padi* proved that α-amylase activity was the highest in contrast with other enzymes. But in *H. tritici* the highest activity of enzymes was observe in β-glucosidase and no α- amylase activity was detected.

As a result we found that when complex of pests attack wheat field, the α-amylase which exist in salivary glands and midgut of sunn pest damage on wheat carbohydrates then wheat aphid α-amylase damage on it although wheat thrips doesn,t secret this carbohydrate enzyme. Then α, β-glucosidase enzymes degridate the production and damage on wheat.

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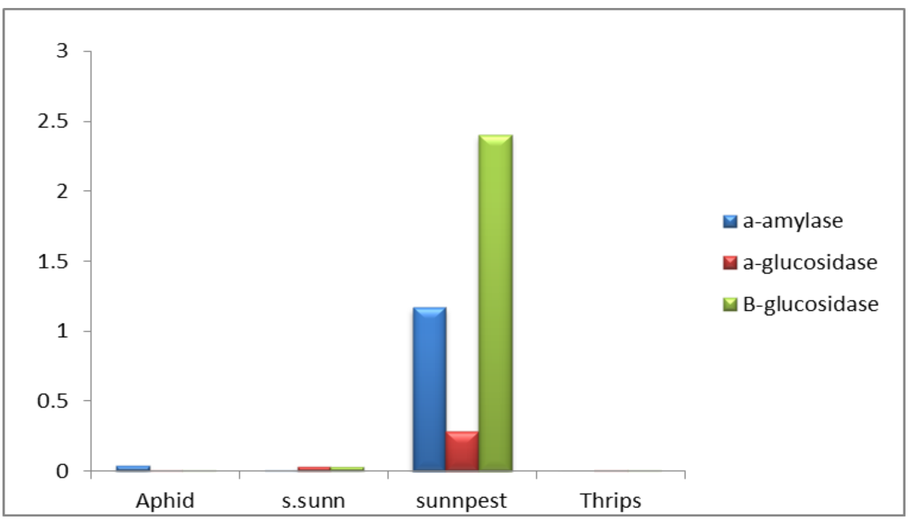

Figure 1. Comparing enzymes in the sunn pest midgut and salivary glands, wheat aphid midgut and wheat thrips showed all enzymes had the most activity in sunn pest midgut.

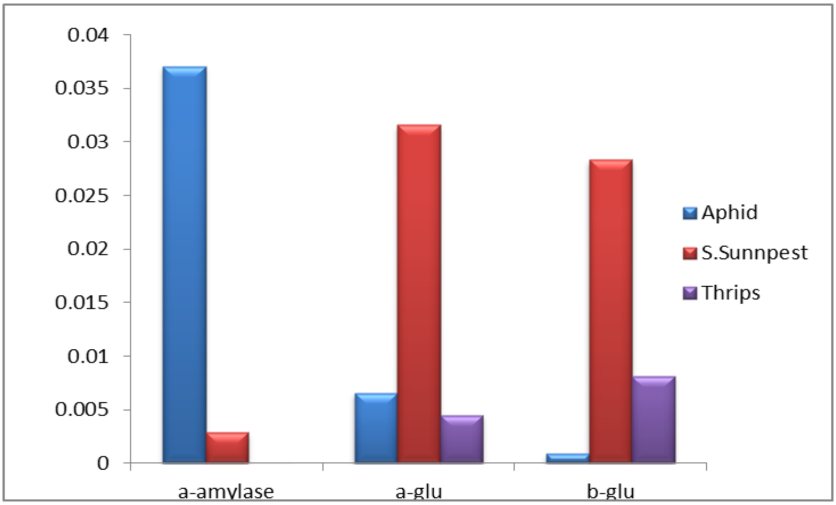

Figure 2- Comparing enzymes in the sunn pest salivary glands, wheat aphid midgut and wheat thrips.

Table 1. Specific activity of aphid midgut, sunn pest midgut and salivary glands and wheat thrips (mili Unit of activity/mgProtein).

Specific activity	**Aphid**	**Sunn pest salivary gland**	**Sunn pest midgut**	**Thrips**
α-amylase	0.037	0.0028	1.167	0
α-glucosidase	0.0065	0.0316	0.28	0.0045
β-glucosidase	0.00091	0.028	2.4	0.0081

EVALUATION OF FUMIGANT TOXICITY OF ORANGE PEEL *CITRUS SINENSIS* (L.) ESSENTIAL OIL AGAINST THREE STORED PRODUCT INSECTS IN LABORATORY CONDITION

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ABSTRACT: In search for alternatives of conventional pesticides, plant essential oils have been widely investigated. Essential oils from aromatic plants are recognized as proper alternatives to chemical fumigants. In this research fumigant toxicity of essential oil of citrus peels was studied against three most common stored-product insects*, Tribolium confusum, Callosobruchus maculatus* and *Rhyzopertha dominica*. Five concentrations of essential oil were tested with four replicated at 24 and 48 h times with 30 adult insect in each replication. The citrus peels have medicinal and insecticide properties. The essential oil was obtained from the fruit peels using hydro distillation that were dried naturally at room temperature (23–27°C). After 24 h of exposure, the LC_{50} values were estimated to be 259, 158 and 118 μl/l air and after 48 h were 134, 106 and 86 respectively for each insect. It was found that *R. dominica* adults were more susceptible to the oil than others and *T. confusum* adults were less susceptible. Increasing the essential oil concentration and exposed time increased the fumigant toxicity of essential oils on insects. These results suggest that citrus peel essential oil as potential fumigant and may be used as a safe pesticide for the management of stored-product insects.

KEY WORDS: Fumigant toxicity, Citrus peel Essential oil, *Tribulium confusum*, *Rhyzopertha dominica, Callosobruchus maculatus*.

Globally a minimum of 10% of cereals and legumes are lost after harvest (Boxall et al., 2002). Stored products of agricultural and animal origin are attacked by more than 600 species of beetle pests, 70 species of moths and about 355 species of mites causing quantitative and qualitative losses and insect contamination in food commodities is an important quality control problem of concern for food industries (Rajendran & Sriranjini, 2008). Currently, phosphine (from metal phosphide preparations, cylinderized formulations and on-site generators) and methyl bromide (available in cylinders and metal cans) are the two common fumigants used for stored-product protection world over. Insect resistance to phosphine is a global issue now and control failures have been reported in field situations in some countries (Taylor, 1989; Collins et al., 2002). Methyl bromide, a broad-spectrum fumigant, has been declared an ozone-depleting substance and therefore, is being phased out completely (Rajendran & Sriranjini, 2008).

During the past few decades, application of synthetic pesticides to control agricultural pests has been a standard practice. However, with growing evidence that many conventional pesticides can adversely affect the environment, requirements for safer means of pest management have become crucial. Therefore, the use of safe, low toxicity botanical pesticides is now emerging as one of the prime means to protect crops, their products and the environment from pesticide pollution, a global problem (Rozman et al., 2007).

Use of plant products as insecticide is one of the important approaches of insect pest management and it has many advantages over synthetic insecticides

(Weinzierl & Henn, 1992). Plant materials with insecticidal properties are one of the most important locally available, biodegradable and inexpensive methods for the biological control of pests (Zewde & Jembere, 2010). Essential oils are volatile natural complex secondary metabolites characterized by a strong odor and have a generally lower density than that of water (Bruneton, 1999; Bakkali et al., 2008). There are 17,500 aromatic plant species (Bruneton, 1999) among higher plants and approximately 3,000 essential oils are known out of which 300 are commercially important for pharmaceuticals, cosmetics and perfume industries apart from pesticidal potential (Tripathi et al., 2009).

The fruit peels of some citrus species have been reported to have insecticidal properties against insect pests (Don-Pedro, 1985; Onu and Sulyman, 1997; Elhag, 2000). Cow pea treated with the powdered sun-dried of orange peels is associated with LD_{50} of 4% (w/w) for *Callosobruchus maculates* (F.) exposed to it (Don Pedro, 1985). Essential oil derived from orange peels is known to have toxic, feeding deterrent, and poor development effects on lesser grain borer, *Rhyzopertha domonica* (F.), rice weevils, *Sitophilus oryzae* (L.) and red floor beetle, *Tribolum castaneum* (Herbst) (Tripathi et al., 2003).

In another studies, the essential oil of citrus peels powder to reduce oviposition or larvae emergence through parental adult mortality (Don-Pedro, 1996; Elhag, 2000); and the peel oil has fumigant action against fleas (Weinzierl and Henn, 1992) and house hold insects *Blatella germanica* (L.) and *Musca domestica* (L.) and stored product *Sitophilus oryzae* (Karr and Coats, 1988) and *callosobruchus maculatus* (F.) (Morawej and Abbar, 2008). The major active component of citrus oil is limonene. Insecticidal activity of limonene has been successfully applied for the control of insect parasitoids of pet animals (Morawej and Abbar, 2008). (+)-limonene was toxic to Malathion resistance fleas (Collart and Hink, 1986) and to all life stages of the cat flea, *Ctenocephalides felis* (Hink and Fee, 1986) and *Tribolium cunfusum* (Stamopoulos et al., 2007). The peel oil was also reported to have toxicity toward *Culex pipiens* (Mwaiko & Savaeli, 1992); and cow pea weevils, *Callosobruchus maculates* (F.) (El-Sayed & Abdel-Razik, 1991).

In the present study, the activities of volatile fractions of essential oils extracted from the fruit dried peels of *Citrus sinensis* on the three stored product beetles.

MATERIALS AND METHODS

Insect cultures

All the test insects were supplied from laboratory colonies maintained in the Entomology laboratory of the Department of Entomology, Urmia University. *Tribolium confusum* (Du Val) was reared in one liter glass container containing wheat flour mixed with yeast (20:1 w/w). *Rhyzopertha dominica* (F.) was reared in one liter glass container containing whole wheat grains and *Callosobruchus maculatus* (F.) was reared on a diet of bean. The cultures were maintained in continuous darkness at 29 ± 1°C and 60 ± 5% relative humidity (r.h.). The insects used in these experiments were 1–7 days old adults.

Plant materials

The fresh citrus fruits were collected from the central local market of Urmia, Iran during January and February 2010, were peeled. The fresh peels of C. sinensis fruits were dried naturally on laboratory benches at room temperature (23–27°C) until they were crisp. The dried peels were stored at 24°C until they were hydrodistilled to extract their essential oils. Ground materials were obtained by grinding the dry peels into a fine powder using mortal and pestle.

Extraction of essential oil

Dried peels were subjected to hydrodistillation using a modified Clevenger-type apparatus in order to obtain essential oil. Condition of extraction was: 50 g of ground materials, 600 ml distilled water and 2 h distillation. About 1.5 ml oil was extracted per 50 g ground materials. Extracted oil was stored in a refrigerator at 4°C until the onset of bioassays.

Fumigant toxicity

The fumigation toxicity of the essential oil was tested following the method of Wang et al. (2001) with some modification. Wide mouth bottles of 310 ml capacity with lids were used as exposure chamber. Filter papers of 3 cm diameter were treated with five different essential oil concentrations to give a range of 20-80% mortality. The range of concentrations had been chosen on the basis of a number of preliminary trials. The filter paper was attached to the undersurface of the screw cap of bottles. Thirty insects in small nylon mesh bag with 2g food substrate were hung at the center of the glass bottle (2 cm high) above. The bottles were then closed tightly with a lid. Each treatment with respective control was replicated four times. Mortality was checked after 24 and 48 h. The insects were considered to be dead as no leg or antennal movements were observed.

Data analysis

Mortality data were analyzed with SPSS software (SPSS Inc, 1993). Probit analysis was used to determinate LC50 and LC95 values. The values significance of $\chi 2$ was estimated according to Robertson and Preisler (1992). Data were analyzed using one-way analysis of variance (ANOVA) followed by Tukey's honestly significant difference (HSD) test to estimate statistical differences between means at $\alpha = 0.05$.

RESULTS

Chemical constituent of essential oil

The chemical constituents of the essential oil of *C. sinensis*, the retention indices and the percentage of the individual components are summarized in Table 1. The two major constituents, in order of decreasing amounts, were limonene (70%) and β-pinene (9.3%).

Fumigant toxicity

The essential oil vapors of the dried peels showed variable toxicity to adults of test insects, depending on concentration and exposure time. According to the results of ANOVA, the effect of doses and exposure time interactions of the essential oil obtained from *C. sinensis* fruit dried peels on beetles were significant at $P< 0.01$. The results showed there were positive and linear significant relationships between percent mortality of *T. confusum, C. maculatus* and *R. dominica* and duration of exposure to the essential oil vapors within all concentration levels. This indicates that higher dosage is more efficient in management of pests.

The 24-h LC_{50} values against the beetles were 259, 158 and 124 µl/l air and the 48-h LC_{50} values were 134, 106 and 93 µl/l air for *T. confusum, C. maculatus* and *R. dominica* respectively (Table 2 and 3). In general, mortality, increased as the doses of essential oil and exposure period increased. On the other hand, the LC50 decreased with the duration of exposure to the essential oil concentrations (Table 2 and 3).

The essentials oil caused the highest mortality in 53, 41 and 31 µlL-1 doses and at 48 h of exposure on *T. confusum, C. maculatus* and *R. dominica* respectively. In all of the times, it was found that *R. dominica* adults were more susceptible to the oil than others, and *T. confusum* adults were less susceptible.

The slops of the six probit mortality regressions for the essential oil were significantly different. The slope of the probit mortality line for the T. confusum in 48 h was significantly greater than those of C. maculatus and R. dominica (Table 3).

DISCUSSION

Over 120 plants and plant products have been showed to have insecticidal or deterrent activity against stored product pests (Dale, 1996). However, the number and quality of plants used by farmers is often limited by their availability (Dharmasena, 1995). Rotaceae is a large family containing 130 genera in seven subfamily, with many important fruits and essential oil product. Lemon essential oil has the highest value of all essential oils imported to the USA (Weiss, 1997).

The toxicity of *C. sinensis* peel oil may be attributed to d-limonene (Sharaby, 1988). Tripathi et al. (2003) reported the contact toxicity of d-limonene with LD_{50} 74.73, 85.37 and 79.78 for *R. dominica, S. oryzae* and *T. castaneum*. Analysis of the toxicity data in the present study showed that the essential oil vapors from citrus dried peels exhibited a variable toxic action against the adult of three beetles. The current findings are similar to the results of Morawej and Abbar (2008) who has also reported fumigant toxicity of orange peel oil against *C. maculatus*.

The orange peel oil has been reported to have fumigant toxicity 13 times more than that of methyl bromide (Tripathi et al., 2003). The studies also showed that orange peel has strong fumigant toxicity effect against the *Z. subfasciatus* (Zewde & Jembere, 2010). Keita *et al.* (2001) reported that the mode of the action of fumigant toxicity of essential oil against insects might be the inhibition of acetyl cholinesterase.

Studying on the effects of essential oil from various plant species on the bruchid, *A. obtectus*, Papachristos and Stamopoulos (2002) reported that fumigant LC_{50} values of *C. sinensis* at 24 h exposure for males and females were 11.4 and 19.5 µl/l air, respectively. These values were much lower than the LC_{50} values of the same plant source obtained in the present study for these beetles. The observed difference between our results and those of Papachristos and Stamopoulos (2002) seems to be reasonable because of different species and size of insects or/and methodology of oil extraction concerned (Morawej & Abbar, 2008).

The result of the current study suggested that materials derived from *Citrus sinensis,* may be used as pulse protectant against *pests* for small scale farmers. Therefore, investigation on incorporating, improving and adopting for the control of stored product insects need to be investigated.

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Table 1: Chemical components of the essential oil of *Citrus sinensis*.

Compounds	Retention index	Content (%)
β- pinene	*973*	*9.3*
Limonene	1040	70
Linalool	1104	3.8
Isopulegol	1156	0.56
Terpinen-4-ol	1185	0.59
Decanal	1208	4.92
Geranyl formate	1384	1.92
Citral	1159	0.89
Helminthogermacrene	1382	0.50
1,1-dodecanediol	1452	0.94
δ-murrolene	1480	1.58
Valencene	1495	3.81

Table 2. LC_{50} and LC_{95} values of *C. sinensis* essential oil to *Tribolium confusum, Callosobruchus maculatus* and *Rhyzopertha dominica* at 24 h.

Insects	LC_{50} (µl/l air) [a, b]	Slope (± SE)	Intercept (±SE)	*df*	χ^2
T. confusum	259(248-272)	5.6(±0.44)	-5.69(±0.85)	3	2.59
C. maculatus	158.5(147-171)	3.52(±0.26)	-0.96(±0.56)	3	4.44
R. dominica	124(116-134)	3.57(±0.30)	-0.67(±0.48)	3	2.90

Table 3. LC_{50} and LC_{95} values of *C. sinensis* essential oil to *Tribolium confusum, Callosobruchus maculatus* and *Rhyzopertha dominica* at 48 h.

Insects	LC_{50} (µl/l air) [a, b]	Slope (± SE)	Intercept (±SE)	*df*	χ^2
T. confusum	134(129-140)	6.52(±0.49)	-5.58(±0.80)	3	5.91
C. maculatus	106(98-114)	3.67(±0.28)	-0.56(±0.43)	3	4.47
R. dominica	93(86-100)	3.54(±0.31)	-0.18(±0.45)	3	1.91

ODONATA FAUNA OF PÜLÜMÜR (TURKEY: TUNCELİ PROV.)

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[Salur, A., Doğan, Ö. & Yağız, Y. 2012. Odonata Fauna of Pülümür (Turkey: Tunceli prov.). Munis Entomology & Zoology, 7 (1): 359-362**]**

ABSTRACT: A total of 470 samples were collected in the Pülümür district of Tunceli province located in East Anatolia region of Turkey by area studies and then identified between July and September 2010. 24 species were stated as first records for the Pülümür district and Tunceli province. The habitats and the phenologies of these species found in the studied area were given.

KEY WORDS: Odonata, Fauna, Pülümür, Tunceli, Turkey.

In this study which is purposed that determination of distribution of Odonata species; for this purpose samples are collected from lakes, ponds, streams and woodlands for setting up fauna composition of Pülümür district of Tunceli province. According to references it is found that there is no study about Pülümür district for Odonata fauna. This study is the first for Odonata fauna of Pülümür district.

It is known that there is about 6000 species in the world and 200 species in west palearctic for Odonata (Dumont, 1991). In Turkey, it has been determined that 35 genus in 10 family, 115 species and subspecies so far (Kalkman, 2006).

Pülümür district which has several types of woodlands, but there has been no study about inventory of Odonata fauna so far. For fullfilling the empitiness, field trips are carried out about July, August and September in 2010 and 470 samples are gathered from 14 different localities. During species identification, is 24 species in 11 genus belonging to 6 family were determined. These records are new for both of Pülümür district and Tunceli province.

Pülümür district (Fig. 1) which was selected as study region has an area of around 1505 km². For setting up Odonata fauna field studies were carried out in July, August and September and samples were collected from different phenologies and habitats. After killing the samples in killing jars; samples were softened and pinned by niddles. These 470 samples are saved in Hitit University Zoology Museum (HUZM).

Family Calopterygidae

***Calopteryx splendens amasina* Bartenef, 1911**

Materials: 3♂♂, 1♀, 26/07/2010, Kırmızı Köprü-Köprü Altı, 1248 m, 39° 23' 342" N 039° 49' 824"E. **Phenology and Habitat:** July. Coast of stream.

***Calopteryx virgo festiva* (Brulle, 1832)**

Materials: 5♂♂, 26/07/2010, Cumhuriyet district, 1255 m, 39° 29' 034" N 039° 54' 524"E. **Phenology and Habitat:** July. Coast of stream.

Family Euphaeidae

***Epallage fatime* (Charpentier, 1840)**

Materials: 1♀, 22/07/2010, Kırmızı Köprü-Köprü Altı, 1593 m, 39° 23' 261" N 039° 49' 535"E; 3♂♂, 1♀, 26/07/2010, Kırmızı Köprü-Köprü Altı, 1248 m, 39° 23' 342" N 039° 49' 824"E. **Phenology and Habitat:** July. Coast of stream.

Family Coenagrionidae
***Coenagrion puella* (Linnaeus, 1758)**

Materials: 4♂♂, 22/07/2010, Komlar District, 1602 m, 39° 29' 558" N 039° 54' 307"E; 5♂♂, 23/07/2010, Kırklar-Golarapiye, 2111 m, 39° 27' 562" N 040° 33' 243"E; 2♂♂, 23/07/2010, Kırklar-Golarapiye , 2093 m , 39° 27' 592" N 040° 03' 249"E; 1♂, 23/07/2010, Kırklar-Golarapiye , 2449 m , 39° 27' 682" N 040° 03' 265"E; 1♂, 23/07/2010, Kırklar-Anuh Stream , 2197 m , 39° 27' 383" N 040° 03' 678"E. **Phenology and Habitat:** July. Marsh and coast of lake, on the pragmites.

***Enallagma cyathigerum* (Charpentier, 1840)**

Materials: 3♂♂, 1♀, 23/07/2010, Kırklar-Golarapiye , 2093 m , 39° 27' 592" N 040° 03' 249"E; 2♂♂, 23/07/2010, Kırklar-Golarapiye, 2111 m, 39° 27' 562" N 040° 33' 243"E . **Phenology and Habitat:** July. Coast of lake.

***Ischnura elegans ebneri* Schmidt, 1938**

Materials: 6♂♂, 4♀♀, 02/09/2010, Kırklar-Kırklar Stream, 1954 m, 39° 28' 226" N 040° 02' 514"E; 1♀, 22/07/2010, Komlar District, 1602 m, 39° 29' 558" N 039° 54' 307"E. **Phenology and Habitat:** July and September. Coast of stream and marsh.

***Ischnura pumilio* (Charpentier, 1825)**

Materials: 1♀, 22/07/2010, Kırmızı Köprü-Köprü Altı, 1593 m, 39° 23' 261" N 039° 49' 535"E; 6 ♂♂, 7♀♀, 19/08/2010, Mountain way, 1863 m, 39° 31' 290" N 039° 52' 662"E; 1♂, 1♀, 20/08/2010, Atatürk District, 1555 m, 39° 29' 815" N 039° 52' 690"E; 1♂, 1♀, 02/09/2010, Kırklar-Kırklar Stream, 1954 m, 39° 28' 226" N 040° 02' 514"E; 1♀, 01/09/2010, Kırklar-Ferhat Stream, 2246 m, 39° 26' 874" N 040° 05' 389"E. **Phenology and Habitat:** July to September. Coast of stream, Roadside, on the gramineous vegetation and pragmites.

Family Lestidae
***Lestes barbarus* (Fabricius, 1798)**

Materials: 6♂♂, 5♀♀, 19/08/2010, Baş Kalecik, 1500 m, 39° 33' 479" N 039° 52' 967"E; 9♂♂, 3♀♀, 20/08/2010, Atatürk District, 1555 m, 39° 29' 815" N 039° 52' 690"E; 2♀♀, 02/09/2010, Kırklar-Kırklar Stream, 1954 m, 39° 28' 226" N 040° 02' 514"E. **Phenology and Habitat:** August and September. Coast of stream, marsh and pragmites vegetation.

***Lestes dryas* Kirby, 1890**

Materials: 17♂♂, 3♀♀, 23/07/2010, Kırklar-Anuh Stream , 2197 m , 39° 27' 383" N 040° 03' 678"E; 3♂♂, 3♀♀, 23/07/2010, Kırklar-Golarapiye, 2111 m, 39° 27' 562" N 040° 33' 243"E; 7♂♂, 2♀♀, 23/07/2010, Kırklar-Golarapiye, 2449 m, 39° 27' 682" N 040° 03' 265"E; 6♀♀, 02/09/2010, Kırklar-Kırklar Stream, 1954 m, 39° 28' 226" N 040° 02' 514"E; 1♀, 01/09/2010, Kırklar-Ferhat Stream, 2246 m, 39° 26' 874" N 040° 05' 389"E; 5♂♂, 22/07/2010, Komlar District, 1602 m, 39° 29' 558" N 039° 54' 307"E; 1♀, 26/07/2010, Cumhuriyet district,, 1255 m, 39° 29' 034" N 039° 54' 524"E. **Phenology and Habitat:** July and September. Lake, marsh and pragmites vegetation.

***Lestes sponsa* (Hansemann, 1823)**

Materials: 6♂♂, 23/07/2010, Kırklar-Anuh Stream , 2197 m , 39° 27' 383" N 040° 03' 678"E; 48♂♂, 2♀♀, 23/07/2010, Kırklar-Golarapiye, 2111 m, 39° 27' 562" N 040° 33' 243"E; 20♂♂, 3♀♀, 23/07/2010, Kırklar-Golarapiye , 2093 m , 39° 27' 592" N 040° 03' 249"E; 1♂, 26/07/2010, Cumhuriyet district,, 1251 m, 39° 29' 325" N 039° 54' 590"E; 6♂♂, 1♀, 23/07/2010, Kırklar-Golarapiye, 2449 m, 39° 27' 682" N 040° 03' 265"E; 1♂, 1♀, 22/07/2010, Komlar District, 1602 m, 39° 29' 558" N 039° 54' 307"E; 1♂, 1♀, 22/07/2010, Kırmızı Köprü-Köprü Altı, 1593 m, 39° 23' 261" N 039° 49' 535"E; 1♂, 01/09/2010, Kırklar-Ferhat Stream, 2246 m, 39° 26' 874" N 040° 05' 389"E; 1♂, 4♀♀, 02/09/2010, Kırklar-Kırklar Stream, 1954 m, 39° 28' 226" N 040° 02' 514"E. **Phenology and Habitat:** July and September. Lake, marsh and pragmites vegetation.

***Lestes virens* (Charpentier, 1825)**

Materials: 9♂♂, 6♀♀, 19/08/2010, Baş Kalecik, 1500 m, 39° 33' 479" N 039° 52' 967"E; 9♂♂, 30♀♀, 20/08/2010, Atatürk District, 1555 m, 39° 29' 815" N 039° 52' 690"E; 1♀, 23/07/2010, Kırklar-Golarapiye, 2449 m, 39° 27' 682" N 040° 03' 265"E; 4♂♂, 02/09/2010, Kırklar-Kırklar Stream, 1954 m, 39° 28' 226" N 040° 02' 514"E; 1♀, 19/08/2010, Mountain way, 1863 m, 39° 31' 290" N 039° 52' 662"E; 1♂, 23/07/2010, Kırklar-Golarapiye , 2093 m , 39° 27' 592" N 040° 03' 249"E. **Phenology and Habitat:** July to September. Lake, marsh, coast of stream and gramineous and pragmites vegetation.

***Sympecma fusca* (Vander Linden, 1820)**

Materials: 1♂, 24/08/2010, Kırklar-Çiftlik(Kırkgöze), 1861 m, 39° 27' 536" N 040° 01' 679"E; 3♂♂, 1♀, 19/08/2010, Baş Kalecik, 1500 m, 39° 33' 479" N 039° 52' 967"E. **Phenology and Habitat:** July. Marsh, Roadside, gramineous and pragmites vegetations.

Family Aeshnidae

***Aeshna affinis* Vander Linden, 1820**

Materials: 2♂♂, 1♀, 21/07/2010, Cumhuriyet district,, 1603 m, 39° 29' 258" N 039° 54' 577"E; 2♂♂, 22/07/2010, Komlar District, 1602 m, 39° 29' 558" N 039° 54' 307"E; 6♂♂, 26/07/2010, Cumhuriyet district,, 1251 m, 39° 29' 325" N 039° 54' 590"E. **Phenology and Habitat:** July. Marsh.

***Aeshna juncea* (Linnaeus, 1758)**

Materials: 1♂, 1♀, 23/07/2010, Kırklar-Anuh Stream, 2197 m, 390 27' 383" N 040° 03' 678"E. **Phenology and Habitat:** July. Lake.

Family Libellulidae

***Libellula depressa* Linnaeus, 1758**

Materials: 3♂♂, 1♀, 22/07/2010, Komlar District, 1602 m, 39° 29' 558" N 039° 54' 307"E. **Phenology and Habitat:** July. Marsh.

***Orthetrum anceps* (Schneider, 1845)**

Materials: 1♂, 19/08/2010, Baş Kalecik, 1500 m, 39° 33' 479" N 039° 52' 967"E; 1♀, 23/07/2010, Kırklar-Golarapiye, 2111 m, 39° 27' 562" N 040° 33' 243"E; 6♀♀, 26/07/2010, Kırmızı Köprü-Köprü Altı, 1248 m, 39° 23' 342" N 039° 49' 824"E; 4♀♀, 22/07/2010, Kırmızı Köprü-Köprü Altı, 1593 m , 39° 23' 261" N 039° 49' 535"E. **Phenology and Habitat:** July and August. Pragmites vegetation, near the lake and stream.

***Orthetrum brunneum* (Fonscolombe, 1837)**

Materials: 2♂♂, 20/07/2010, Karagöl-Viran Şehir, 1932 m, 39° 26' 754" N 040° 09' 726"E; 3♂♂, 3♀♀, 26/07/2010, Kırmızı Köprü-Köprü Altı, 1248 m, 39° 23' 342" N 039° 49' 824"E; 1♀, 26/07/2010, Cumhuriyet district,, 1255 m, 39° 29' 034" N 039° 54' 524"E; 1♂, 19/08/2010, Baş Kalecik, 1500 m, 39° 33' 479" N 039° 52' 967"E. **Phenology and Habitat:** July and August. Pragmites vegetation, near the lake, marsh and stream.

***Orthetrum cancellatum* (Linnaeus, 1758)**

Materials: 1♀, 19/08/2010, Baş Kalecik, 1500 m, 39° 33' 479" N 039° 52' 967"E. **Phenology and Habitat:** August. Roadside.

***Sympetrum flaveolum* (Linnaeus, 1758)**

Materials: 56♂♂, 5♀♀, 23/07/2010, Kırklar-Golarapiye, 2449 m, 39° 27' 682" N 040° 03' 265"E; 1♀, 20/08/2010, Atatürk District, 1555 m, 39° 29' 815" N 039° 52' 690"E; 20♂♂, 7♀♀, 23/07/2010, Kırklar-Anuh Stream , 2197 m, 39° 27' 383" N 040° 03' 678"E; 6♂♂, 2♀♀, 23/07/2010, Kırklar-Golarapiye, 2111 m, 39° 27' 562" N 040° 33' 243"E;

5♂♂, 4♀♀, 22/07/2010, Komlar District, 1602 m, 39° 29' 558" N 039° 54' 307"E; 2♀♀, 19/08/2010, Kırmeşe-Village way, 1580 m, 39° 34' 075" N 039° 50' 716"E; 3♂♂, 1♀, 21/07/2010, Cumhuriyet district,, 1603 m, 39° 29' 258" N 039° 54' 577"E; 3♂♂, 21/07/2010, Cumhuriyet district,, 1598 m, 39° 29' 274" N 039° 54' 575"E. **Phenology and Habitat:** July. Coast of stream, coast of lake, canalet and marsh.

***Sympetrum fonscolombei* (Sélys, 1840)**

Materials: 1♂, 22/07/2010, Kırmızı Köprü–Köprü Altı, 1593 m, 39° 23' 261" N 039° 49' 535"E. **Phenology and Habitat:** July. Coast of stream.

***Sympetrum sanguineum* (Müller, 1764)**

Materials: 3♂♂, 19/08/2010, Baş Kalecik, 1500 m, 39° 33' 479" N 039° 52' 967"E. **Phenology and Habitat:** August. Roadside, gramineous vegetation.

***Sympetrum striolatum (*Charpentier, 1840)**

Materials: 1♂, 23/08/2010, Hacılı-Çevirme, 1588 m, 39° 27' 841" N 039° 57' 579"E . **Phenology and Habitat:** August. Marsh, Pragmites vegetation.

***Sympetrum vulgatum decolaratum* (Sélys, 1884)**

Materials: 3♂♂, 23/08/2010, Hacılı-Çevirme, 1588 m, 39° 27' 841" N 039 °57' 579"E; 1♂, 1♀, 24/08/2010, Kırklar-Çiftlik(Kırkgöze), 1861 m, 39° 27' 536" N 040° 01' 679"E; 1♂, 1♀, 02/09/2010, Kırklar-Kırklar Stream, 1954 m, 39° 28' 226" N 040° 02' 514"E. **Phenology and Habitat:** August and September. Coast of stream, marsh and pragmites vegetation.

***Sympetrum meridionale* (Selys, 1841)**

Materials: 3♂♂, 23/08/2010, Hacılı-Çevirme, 1588 m, 39° 27' 841" N 039° 57'579"E . **Phenology and Habitat:** August. Marsh and pragmites vegetation.

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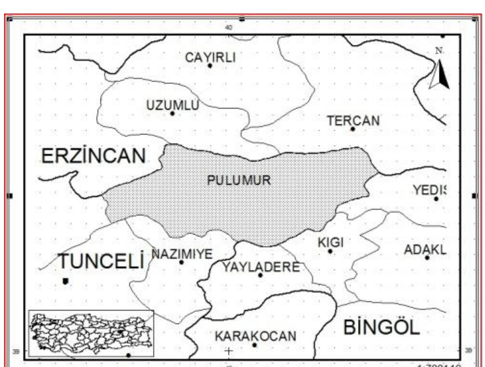

Figure 1. Pülümür and nearest districts.

SYNOPSIS OF THE GENUS *CHRYSOGASTER* LOEW, 1857 (DIPTERA: SYRPHIDAE) IN IRAN

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[**Khaghaninia, S., Shakeryari, A. & Gharaei, B.** 2012. Synopsis of the genus *Chrysogaster* Loew, 1857 (Diptera: Syrphidae) in Iran. Munis Entomology & Zoology, 7 (1): 363-367]

ABSTRACT: Based on specimens collected in the northern parts of Iran, species of the genus *Chrysogaster* occurring in Iran is reviewed. *Chrysogaster coemiteriorum* Linnaeus, 1758 and *C. rondanii* Maibach & Goeldlin, 1995, are newly reported for the Iran insect fauna and a key to five species of the genus in Iran is presented.

KEY WORDS: *Chrysogaster*, Milesiinae, Syrphidae, Flowerflies, Iran.

Hoverflies belong to one of the most diverse fly families which include about 200 genera and more than 6000 species worldwide. Flowerflies of the subfamily Milesiinae are the most common and conspicuous which contain about two thirds of hoverfly fauna. Many species, being regular visitors of flowers, are important pollinators of various plants including vegetables, fruit trees (Asteraceae, Brassicaceae, and Rosaceae) and flowering plants (Kevan & Baker, 1983).

Most of Milesiinae larvae are filter feeders in all kinds of aquatic media and are commonly called rat-tailed maggots. It is usually found where bushes or trees, hogweed, angelica and water-dropworts are very attractive (Stubbs & Falk, 2002). The adults mainly feed on nectar or pollen for proteins, lipids and vitamins (Saribiyik, 2003).

The males in genus *Chrysogaster* are rather more slender than the females, the latter usually having an exceptionally broad oval abdomen. The abdomen is normally dull on top but rather shining in some specimens, especially females. Confusion is most likely with *Cheilosia*, especially *Cheilosia vernalis* whose famales have an abdomen of similar shape (Stubbs & Falk, 2002).

The males of *Chrysogaster* and *Melanogaster* have eyes which meet on top of the head and there is a facial knob. The flatted area on top of the abdomen is normally dull although a problem can arise with some female specimens where the black abdomen is somewhat shining, but the furrows on the frons may help avoid the assumption that such specimens belong to *Cheilosia*. The females have transverse furrow across the frons (Maibach et al., 1994).

Dusti & Hayat (2006) presented the first checklist of flower flies of Iran which contain only a single species, *Chrysogaster viduata*. Then few species of the genus were added to the fauna of Iran by some taxonomists (Gharaei & Lotfalizadeh, 2001; Khaghaninia et al., 2010; Khaghaninia et al., 2011). Here we record as new two species of the genus from Iran and present a key to all species occurring in this area.

MATERIAL AND METHODS

The specimens were identified using the keys, Stubbs and Falk (2002) and Speight (2010). The distribution records and visited flowers of species are provided mostly from Speight (2010). Materials were deposited in the collection of agricultural faculty, Tabriz University.

RESULTS

Genus Chrysogaster (Meigen, 1803)

The genus *Chrysogaster* is distinguished from other genera of Milesiinae by the following characters:

Body black, metallic, lustrous; abdomen in middle and upper parts usually matt; eyes in male contiguous; face in male with short median tubercle; third segment of antennae short.

Key[1] to species of *Chrysogaster* in Iran

1- Male (eyes holoptic) 2
- Female (eyes dichoptic) 6

2- Side of thorax above front coxa with extensive area strongly gray dusted..***cemiteriorum***
- Side of thorax above front coxa shining black..3

3- Top of thorax matt black; angle of frons where eyes meet not exceeding 90 ....***basalis***
- Top of thorax shining; angle of frons where eyes meet greater than 90 4

4- Mouth margin protruding longer than median facial tubercle..***viduata***
- Mouth margin protruding shorter than median facial tubercle..5

5- Face with developed knob; top of thorax with most hairs inclined at about 45 ....***virescens***
- Face with knob less developed; top of thorax with most hairs much more erect..***rondanii***

6- Pleura heavily gray dusted above front coxaebasal veins and often sub-costal cell strongly yellow-tinged.. ***cemiteriorum***
- Pleura glossy black above front coxae; basal veins and often sub-costal cell brownish.....7

7- Wing at most brownish in front face wide..8
- Wing strongly black; face narrow..9

8- Top of thorax virtually bald; sternite 1 with hairs shorter than width of hind femur..***virescens***
- Top of thorax with shorter pale hairs; sternite 1with hairs as long as width of hind femur ....***rondanii***

9- Mesonotum almost glabrous; abdomen with long dense hairs .... ***viduata***
- Mesonotum almost hairy; abdomen with short dense hairs..***basalis***

Chrysogaster basalis (Loew, 1857)

Material examined: 2 specimens (1♂, 1♀): Qaradag forests; 38°51' N 46°72' E, 1360 m, 19 August 2009 (collected by S. Khaghaninia, deposited at Insect Museum of Tabriz University).

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[1] Adapted from Bei- Bienko (1988) and Stubbs and Falk (2002)

Diagnostic characters: Wing darkened (black-brown). Antennae black. Abdomen in upper and middle parts usually matt. Median tubercle of face in male well developed, with sharp outline. Body 6.0 to 8.0 mm (Bei- Bienko, 1988).
Flowers visited: White umbellifers, *Chrysanthemum leucanthemum, Potentilla*.
Range: from northern France and southern Germany south to Spain and Portugal and in N Africa, Switzerland, Roumania and much of the Balkan Peninsula (Bosnia-Herzegovina, Croatia, Greece, Macedonia, Serbia), Ukraine, Kazakhstan and Tajikistan.

***Chrysogaster coemiteriorum* (Linnaeus, 1758)** (Fig. 1)
Material examined: 1 specimens (1♀): kendovan Valley; 37°46' N 46°16' E, 2496 m, 27 May 2010 (collected by A. Shakeryari, deposited at Insect Museum of Tabriz University).
Diagnostic characters: The unique character within the genus is the presence of grey dusting on the pleura just above the front coxae. Whilst dusting is obvious in some specimens, this is not always so and care is necessary lest the legs mask the area concerned (Stubbs and Fulk, 2002).
Flowers visited: White umbellifers, *Sambucus ebulus*.
Range: Fennoscandia south to North Africa, from Ireland eastwards through most of Europe (though extremely localized in the Alps) into Russia and on to the Pacific coast.

***Chrysogaster rondanii* (Maibach & Goeldlin, 1995)** (Fig. 2)
Material examined: 1 specimens (1♂): kendovan Valley; 37°46' N 46°17' E, 2338 m, 11 Jun 2011 (collected by A. Shakeryari, deposited at Insect Museum of Tabriz University).
Diagnostic characters: A very species small. The male has a broader face with the knob and the top thorax has long black hairs. The antennae are usually dark. The female thorax and scutellum with pale hairs at the margins (Miabach& Geoldlin, 1995).
Flowers visited: *Cytisus, Ilex, Crataegus, Prunus spinosa*.
Range: Netherlands, France, Germany and Switzerland.

***Chrysogaster viduata* (Linnaeus, 1758)**
Diagnostic characters: Abdomen, on upper side entirely lustrous, Bases of wing not yellow, Wing strongly black, Face no wide, visits stream margins to drink during hot weather (Speight 2010).
Flowers visited: White umbellifers; *Cornus, Filipendula, Galium, Sambucus*.
Range: From Fennoscandia south to Iberia and the Mediterranean, including North Africa; from Ireland eastwards through much of Europe into European parts of Russia as far as the Ukraine and the Caucasus mountains.
Note: This species was firstly recorded from East Azerbaijan province, in the North-West of Iran (Gharali, 2001).

***Chrysogaster virescens* (Loew, 1854)**
Material examined: 9 specimens (5♂♂, 4♀♀): (4♀♀) Mekidi village (on bogs); 38°50' N 46°54' E, 1656 m , 19 Aug. 2008, (5♂♂): Varzghan (on reed beds near to Varzghan dam ; 38°30' N 46°37' E, 1689 m , 7 July 2010 (collected by S. Khaghaninia, deposited at Insect Museum of Tabriz University).
Diagnostic characters: The thorax and scutellum have a greenish reflection which is strongly developed in some females but less obvious in many specimens.

The antennae are usually orange but it is not uncommon to find specimens with very dark antennae, so care needs to be taken to check other key features (Stubbs and Fulk, 2002).

Flowers visited: White umbellifers, *Filipendula, Ilex, Iris, Ranunculus.*

Range: Southern Finland, Ireland, Britain and the Atlantic seaboard of Europe from Denmark to the Pyrenees and northern Spain, Switzerland and central Europe.

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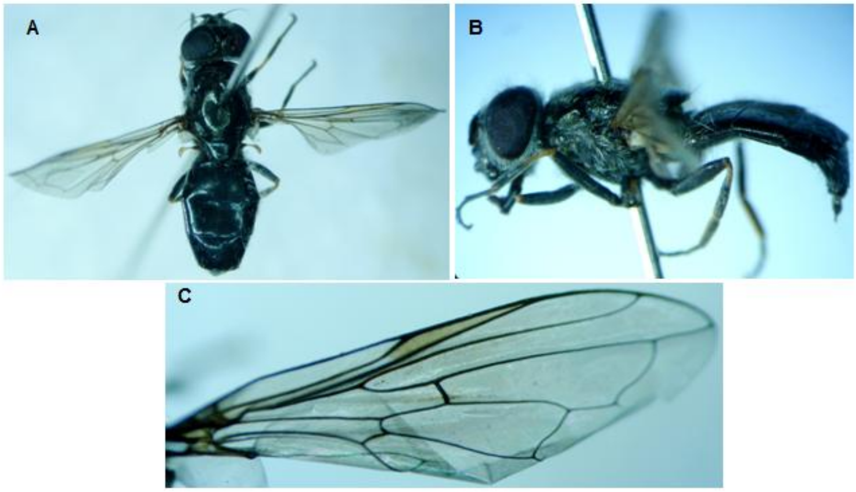

Figure 1. *Chrysogaster coemiteriorum*, a- Female, dorsal view, b- lateral view, c- sub-costal cell (Original).

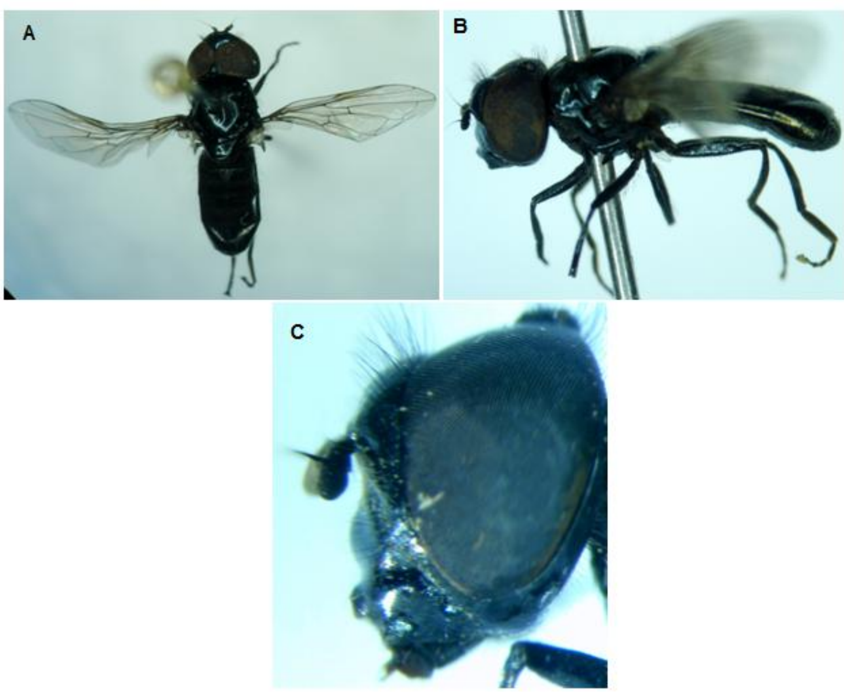

Figure 2. *Chrysogaster rondanii*, a- Male, dorsal view, b- lateral view, c- Face with knob (Original).

ATTRACTION OF *SIMULIUM DAMNOSUM* COMPLEX TO *PTEROCARPUS SANTALINOIDES*: A PRELIMINARY STUDY

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ABSTRACT: Insects generally respond to varieties of cues but little is known on the attraction of *Simulium damnosum* sensu lato to plants. The present study investigates the attraction of *Simulium damnosum* s.l. to *Pterocarpus santalinoides* along Osun River in South Western Nigeria. Two consented fly capturers were positioned under *Pterocarpus santalinoides* and a plant of comparable size at Osun Budepo and Osun Eleja both located along Osun river between October to December, 2008. The number of the flies caught under *P. santalinoides* was statistically higher than the control at both sites with *P. santalinoides* accounting for 63.86% and 59.39% of the flies collected at Osun Budepo and Osun Eleja respectively (Osun Budepo, F= 218.4, $P<0.05$; Osun Eleja, F= 147.2, $P>0.05$). The results therefore demonstrate that the identification of the compounds possibly responsible for the attraction could be used to develop lures for the trapping and control of *S. damnosum*.

KEY WORDS: *Simulium damnosum* s.l., *Pterocarpus santalinoides*, attraction.

In West Africa, human onchocerciasis is transmitted by members of *Simulium damnosum* sensu lato which differ in their epidemiological significance in different ecological zones (Ibeh et al., 2008). Human onchocerciasis caused by *Onchocerca volvulus* is a severely debilitating disease. It constitutes one of the major public health problems in many riverine communities of Africa in which it serves as an obstacle to their social and economic development (Post et al., 2003; Adeleke et al., 2011). The disease affects 18 million people worldwide, with 350,000 blind and 6 million cases of skin diseases. The global incidence of new cases of blindness is 40,000 annually, with 120 million people at risk and 1.09 million Disability Adjusted Life Years (DALYs) host annually (CDC, 2006; Idowu et al., 2008; Maikaje et al., 2008; Oyibo et al., 2004). The disease is prevalent in 35 countries of the world of which 28 are in Africa and Nigeria accounts for one quarter of the global infection (Hassan et al., 1994; Opara et al., 2008).

Generally, insects respond to the various cues emanating from pherohormones, auditory, olfactory, visual and other chemical sources. The recent discoveries of the attraction of the insect vectors and pests to semio-chemicals; either chemical volatiles or pherohormones have elicited renewed interest in utilization of such chemicals for studying insect populations and control (Hassan, et al., 1994; Idowu & Akinsele, 2000; Manda et al., 2007). Jiang et al. (2008) reported the attraction of *Musca autumnali* (Diptera: Muscidae) a veterinary pest to ornamental plants *Euonymus europaeus* and *E. kiautschovicus* in China. Torr et al. (1995) had earlier reported the attraction of tse-tse fly to the plant. However, there is little or no information on the attraction of *Simulium damnosum* s.l. to plants. The present study therefore presents the reports of preliminary investigation on attraction of *Simulium damnosum* s.l. to *Pterocarpus santalinoides* along Osun river, South west Nigeria.

MATERIALS AND METHODS

The study was conducted along Osun river system, South Western Nigeria. River Osun lies on the latitude $8^{o} 20^{1}$ and $6^{o} 30^{1}$ N and longitude $5^{o}10^{1}$ and $3^{o} 25^{1}$ E in the forest zone of Nigeria. Based on the information gathered at Osun Eleja (latitude $7^{o}16^{1}$ N and longitude $4^{o}08^{1}$ E) during focus group discussion with the villagers on their knowledge on bioecology of *S. damnosum* complex (the results presented elsewhere), *Pterocarpus santalinoides* ('Gbena') was identified to be harbouring adults of *S. damnosum* s.l. by the villagers.

To investigate the role of the plant in fly attraction, two consented fly catchers were positioned along the river between 7.00AM to 6.00PM. One fly catcher was positioned under *P. santalinoides* and the other one sat under a plant of comparable size and shade as a control. The two fly catchers were rotated hourly to eliminate the effect of individual attractant to the flies. The investigation was also replicated at Osun Budepo (latitude $7^{o}04^{1}$ N and longitude $4^{o}08^{1}$ E).

During the course of the experiment, the potential breeding sites were identified and their distances to the two plants under investigation were recorded. The study was conducted between October and December, 2008. The results were subjected to statistical analysis using Analysis of variance (ANOVA).

RESULTS

The results of the fly attraction of *P. santalinoides* in the study area are presented in tables 1 and 2. The results show significant difference in the number of flies caught under *P.santalinoides* and the control at both sites (Osun Budepo, F= 218.4, $P<0.05$; Osun Eleja, F= 147.2, $P>0.05$). Of the 202 flies caught at Osun Eleja, the flies caught under *P. santalinoides* accounted for 63.86% while the flies caught under the control plant constituted 36.14%. The distance of *P. santalinoides* (110m) was farther to the identified breeding site than the control plant (80m). At Osun Budepo, 165 flies were caught, out of which 98 flies (59.39%) were captured under *P. santalinoides* while 67 (40.61) flies were caught under the control plant. The distance of the potential breeding sites to *P. santalinoides* and the control plant was 90m and 101m respectively.

DISCUSSION

The results obtained from the studies at Osun Budepo and Osun Eleja showed the attractiveness of the adult of *S. damnosum* s.l. to *P. santalinoides*. The factors regulating the attraction of the biting adults of *S. damnosum* s.l. to *P. santalinoides* could not be specifically explained in this study, two factors are suggested to be likely responsible for the mechanism of attraction. Firstly, it could be that the plant exhibits certain odours which orientate the females (biting adults) of the flies towards the plant since dipterans are equipped with very sensitive antennae (Jang et al., 2008). *S. damnosum* s.l. may be attracted to saponnin which is one of the principal phytochemical constituents of *P. santalinoides* (Osuagwu et al., 2007) as observed in other insects (Adeleke et al., 2009). Though, the insecticidal properties of the seed oil of the plant had been reported against mosquito larvae (Service, 1999), the plant is a multi-purpose plant with wider benefits (Osagwu et al., 2007). Secondly, since the males of the flies feed on plant juices and nectars, the males may show preference for feeding on the juices produced by *P. santalinoides* as the leaves and seeds of the plant have been reported to be nutritious and medicinal (Osagwu et al., 2007). The orientation of the females towards the plants may be initiated by mate location, but the females could become appetitive for blood meals after mating (Service, 1999). Therefore a high biting rate is expected where the females of the flies congregate. These two reasons are subject of further studies.

The relatively far distance of *P. santalinoides* to the identified breeding site as compared with the control plants at the two catching points possibly removed the influence of the breeding site distance as a contributing factor to the higher number of flies caught under *P. santalinoides*. The discovery of factors mediating the orientation of *S. damosum* s.l. to *P. santalinoides* would provide opportunities towards controlling the insect. Such compounds could be used to develop lures for *S. damnosum* traps therefore stemming the use of human beings as baits for trapping insect vectors, most importantly now that there are strong criticisms in scientific circle over the use of human subjects as baits because of the risk of drug resistant parasites.

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Table 1. Summmary of the black fly attraction of *Pterocarpus santalinoides* at Osun Eleja during the period of study.

Months of study	*P. santalinoides*	Control	Total
October	103 (60.59%)	67 (39.41%)	170
November	18 (78.26%)	5 (21.74%)	23
December	8 (88.88%)	1 (11.11%)	9
Total	129 (63.86%)	73 (36.14%)	202

F= 147.2 $p<0.05$

Table 2. Summmary of the black fly attraction of *Pterocarpus santalinoides* at Osun Budepo during the period of study.

Months of study	*P. santalinoides*	Control	Total
October	81 (56.64%)	62 (43.36%)	143
November	10 (66.66%)	5 (33.54%)	15
December	7 (100%)	(0%)	7
Total	98 (59.39%)	67 (40.60%)	165

$p<0.05$

A LABORATORY STUDY OF SUSCEPTIBILITY OF *HELICOVERPA ARMIGERA* (HUBNER) TO THREE SPECIES OF ENTOMOPATHOGENIC NEMATODES

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ABSTRACT: The insecticidal effect of *Heterorhabditis bacteriophora* Poinar (Rhabditida: Nematoda: Heterorhabditidae), *Steinernema carpocapsae* (Weiser) and *Steinernema feltiae* (Filipjev) (Rhabditida: Nematoda: Steinernematidae), was examined against *Helicoverpa armigera* under laboratory conditions. The nematodes were used in the following doses: 0 (control), 1, 10, 50, 100 and 500 infective juveniles (IJs) per insect, and their infectivity was tested at 22° C after 72, 96 and 120 h. of exposure using three methods of filter paper assay, food assay and soil assay. In all trials, *H. bacteriophora* IRA10 had the highest toxicity and *S. carpocapsae IRA18* the lowest. There were no significant differences between strains at the lowest concentration in all exposure times. In filter paper assay, a dose of 500IJ/Larvae of *H. bacteriophora* IRA10 after 120h of exposure time caused 83% mortality, whereas *S. feltiae* IRA24 and *S. carpocapsae* IRA18 caused 71.67%and 30% mortality, respectively. In food and soil assay, similar results were found and *H. bacteriophora* IRA10 was *more pathogenic* against cotton bollworm compared to *S. feltiae* and *S. carpocapsae*.

KEY WORDS: Entomopathogenic nematodes, *Helicoverpa armigera*, *Heterorhabditis bacteriophora*, *Steinernema carpocapsae*, *Steinernema feltiae*.

The American Bollworm *Helicoverpa armigera* Hubber (Lepidoptera: Noctuidae) is extremely polyphagous and one of the major pests of cotton in almost all of the cotton growing areas in Iran, causing quantitative and qualitative losses. It has been reported as a major pest of cotton, sorghum, maize, sunflower and tomato. The infestation by *H. armigera* on these crops is largely restricted to one stage in host-plant development. On cotton, the damage is characterized by feeding activity on flower buds, flowers and cotton bolls.

Entomopathogenic nematodes (EPNs) are used to control several agriculturally important insect pests of different orders. Several species of EPNs are used worldwide against a variety of pests. Some important EPN species of *Steinernema* and *Heterorhabditis* are obligate pathogens and are characterized by their association with symbiotic bacteria present in the digestive tract; *Xenorhabdus* in steinernematids and *Photorhabdus* in heterorhabditids (Boemare et al., 1996). With the aim of determining virulence of different EPNs species, we investigated the ability of EPNs in control of *Helicoverpa armigera* in laboratory conditions.

MATERIALS AND METHODS

Nematode sources

A preliminary test was conducted to compare the pathogenicity of different entomopathogenic nematodes against last instar larvae of cotton bollworm by the same methods used for the filter-paper-substrate Petri dish assay. *Steinernema carpocapsae* (strain IRA18) (Weiser, 1955), *S. feltiae* (strain IRA24) and *Heterorhabditis bacteriophora* (IRA10) recently isolated from north-west of Iran by Eivazian Kary et al. (2009) were used in experiments.

One last instar cotton bollworm larva was placed in each of 30 Petri dishes (35×12 mm) containing 150 µl of 100 IJs suspended in water and evenly distributed on a filter paper (Wattman No. 1) in the dish. The dishes were incubated in the dark at 25°C in a plastic bag containing a moist paper towel to maintain humidity. After 120 h, the infected cadavers were transferred to White traps (White, 1927) for harvesting IJs. The IJs were collected in Ringer's solution and stored in the dark at 10°C. Nematode viability was 100%. IJs within two weeks of harvest were used in all experiments.

Insect sources

Early instar larvae of *H. armigera* were collected from cotton field and reared on artificial diets based on cowpea (Shorey & Hall, 1965) in controlled conditions of 26±2°C, 50±5% relative humidity and a photoperiod of 16:8 (L: D) h. until they reached the life stage to be tested.

Effect of dose and nematode species on infection of cotton bollworm on filter paper

The efficacy of EPNs was tested at five concentrations including 1, 10, 50, 100 and 500 infective juvenile (IJs) against cotton bollworm larvae. Individual last instar larvae were placed in each of 24 wells of plate as the first replicate containing 100µl of IJs suspended in water evenly distributed on a filter paper (Wattman No.1). The plates were incubated in the dark at 22°C in a plastic bag containing a moist paper towel to maintain humidity. Control insects were treated with water only. Three days after treatment, insect mortality was recorded on a daily basis. Dead larvae were collected every 24 h, held at the same temperature for another 48 h, and then were dissected to verify that mortality occurred as a result of parasitism by nematodes.

Effect of dose rate and nematode species on infection of cotton bollworm via feeding

This experiment was done with the same conditions as above. Last instar larvae were fed with 5 g of arterial diet incorporated with the same concentration of EPNs. Three days after treatment, insect mortality was recorded on a daily basis and dead insects were examined for nematode presence by dissection.

Statistical analysis

Data were submitted to analysis of variance and the means were compared by the Tukey test, using SPSS 14.0 software (SPSS, 2004). The data were transformed into $\sqrt{(x+0.5)}$ before statistical analysis as necessary.

RESULTS

Effect of three different nematode species against larvae of cotton bollworm in filter paper assay

The effect of three species of entomopathogenic nematodes on cotton bollworm larvae in different exposure times is presented in Tables 1 to 3 and Figure 1. The tested nematodes did not show any mortality in two concentrations

(1 and 10 IJ/larvae) during all exposure times, except *H. bacteriophora* that showed little mortality in 10 IJ/larvae concentration after 72 h exposure time. Mortality rate was increased by increasing exposure time and pathogen concentration. There was a positive correlation between concentrations and mortality rates. Three tested nematodes showed the highest mortality at 500 IJ/larvae concentration. Mortality rates were significantly different between three other concentrations (50, 100, 500 IJ/larvae) after all exposure times (P < 0.001). The tested nematodes differed from each other significantly in pathogenicity (Table 1), and *H. bacteriophora* and *S. feltiae* were more pathogenic than *S. carpocapsae* in higher concentrations (P < 0.05). The descending trend of pathogenicity effects of nematodes in higher concentration after 24 and 72 h exposure times was *H. bacteriophora*, *S. feltiae* and *S. carpocapsae*, respectively.

Effect of three nematode species against larva of cotton bollworm in food assay

The mortality effect of mixed food with three entomopathogenic nematodes after three different times is presented in Table 4 to 6 and Figure 1. According to Table 4, there was no mortality in three first concentrations after 24 h exposure time. With increasing exposure time, mortality occurred in lower concentrations. Mortality was observed in 50 IJ/larvae concentration after 48 h and in 10 and 50 IJ/larvae concentrations after 72 h exposure time. Similar to filter paper assay, pathogenicity effect was increased by increasing exposure time and pathogen concentration, and all three used nematodes caused higher mortality at higher concentrations (Tables 4-6) (P < 0.001). However, *S. carpocapsae* showed no significant difference between five concentrations after 24 and 48 h exposures time (P > 0.05). Mortality rates after 72 h exposure time were significantly different between the given five concentrations (P < 0.001). The pathogenicity effect of *S. carpocapsae* especially in the highest nematode dose (500 IJ/larvae) was significantly different from the two other pathogens (Table 1), and *S. carpocapsae* caused lower mortality rate against cotton bollworm larvae (P < 0.01) after all three exposure times. The descending order of pathogenicity effect of three nematodes was similar to filter paper assay; however, no significant differences was observed between *H. bacteriophora* and *S. feltiae* in the two higher concentrations during different exposure times.

Effect of three different nematode species against larva of cotton bollworm through soil assay

All nematode species showed pathogenic effects on cotton bollworm larva in soil application assay (Tables 7 to 9; Fig. 1). No infection or larva mortality occurred by the tested nematodes in the first concentration of (1 IJ/larvae) treatments. Pathogenic effect by *H. bacteriophora* was observed in four higher concentrations after all three exposure times. Moreover, *S. feltiae* and *S. carpocapsae* showed no pathogenic effect in 10 IJ/larvae concentration after 24 and 48 h and 24 h exposure times, respectively. The infection level of cotton bollworm larva was increased as pathogen concentration increased and there was significant difference between concentrations (P < 0.001). Similar to filter paper and food assays, the highest mortality was observed in 500 IJ/larvae concentration after all three exposure times. Three nematode species differed from each other in pathogenicity in some concentrations. *H. bacteriophora* and *S. feltiae* were more pathogenic than *S. carpocapsae* in two higher concentrations (P < 0.001).

DISCUSSION

The efficacy of various nematode species or strains for controlling a particular insect pest may differ significantly (Bedding et al., 1983; Forschler et al., 1988; Kondo et al., 1988). Efficacy is influenced by the rate of IJ penetration into the insect, the time it takes to release the symbiotic bacteria, and the virulence of the latter (Glazer & Navon, 1990).

In the present study, when cotton bollworm was exposed to various dosages of nematodes in the laboratory for 120 h, *H. bacteriophora* IRA10 killed the greatest number of larvae and direct relationships were found between results obtained in dose-response and exposure-time assays. Similar results were obtained in studies of the effect of nematodes on other lepidopteran pests (Glazer, 1992; Ricci et al., 1996). In all treatments, there was a positive correlation between concentrations and mortality rates. A linear relationship between the number of nematodes applied to insects and the number of infecting nematodes has been established for several insect species (Fan & Hominick, 1991).

Application of three species of these biological agents (*S. feltiae*, *S. carpocapsae*, and *H. bacteriophora*) at studied temperatures (22°C) resulted in mortality in different levels. An optimal biological activity of *S. carpocapsae* was determined in the temperature range from 22 to 24°C (Choo HoYul et al., 2002), *H. bacteriophora* from 22 to 26 °C (Doucet et al., 1996), and S. feltiae at 25°C (Belair et al., 2003). Under the conditions of this study, it appears that all species of entomopathogenic nematodes were able to kill last instar larvae of cotton bollworm within six days of application. *Heterorhabditis bacteriophora* had a greater effect on last instar larvae of cotton bollworm than *S. feltiae* and *S. carpocapsae* in all experiments and it appears that under the conditions of this study, the *H. bacteriophora* nematode is most likely to be an effective biocontrol agent for cotton bollworm.

In our experiments, low mortality caused by *S. feltiae* and *S. carpocapsae* could be attributed to the foraging strategies of the nematode species. *Steinernema carpocapsae* displays a "nictation" or ambusher foraging strategy in which it stays on the soil surface waiting for its host, whereas *S. feltiae* displays an intermediate ambusher–cruiser foraging strategy in which it waits for or seeks its host (Lewis, 2002).

Although laboratory screening of entomopathogenic nematodes for infectivity can be an important component of developing a biological control program for a particular pest (Ricci et al., 1996), relative infectivity among nematodes in the laboratory may not be consistent with what is observed in the field (Grewal & Georgis, 1998). Once the biological candidates are defined based on characteristics tested in the laboratory, the ultimate test of efficacy must be conducted under field conditions. For any biocontrol agent to be effective in the field, it must be able to function under realistic climatic conditions.

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Table 1. Mean mortality percentages of *Helicoverpa armigera* larva infected with EPNs at different concentration (mean number of died larva ± SE) after 72 hours exposure time (filter assay).

Nematode species	Concentration				
	1	10	50	100	500
H. bacteriophora	0Ac	0Ac	5.83 ± 1.78Abc	12.50 ± 2.63Ab	30.83 ± 6.09Aa
S. feltiae	0Ac	0Ac	1.25 ± 0.89Bc	16.25 ± 2.81Ab	25.83 ± 2.55Aa
S. carpocapsae	0Ab	0Ab	0.42 ± 0.42Bb	3.75 ± 1.70Bab	4.58 ± 1.15Ba

Table 2. Mean mortality percentages of *Helicoverpa armigera* larva infected with EPNs at different concentration (mean number of died larva ± SE) after 96 hours exposure time (filter assay).

Nematode species	Concentration				
	1	10	50	100	500
H. bacteriophora	0Ac	0Ac	12.92 ± 2.44Abc	26.67 ± 4.36Ab	50.42 ± 8.82Aa
S. feltiae	0Ac	0Ac	7.08 ± 2.98ABc	31.25 ± 4.08Ab	50.42 ± 2.59Aa
S. carpocapsae	0Ab	0Ab	2.08 ± 1.28Bb	12.08 ± 1.81Ba	15.00 ± 3.12Ba

Table 3. Mean mortality percentages of *Helicoverpa armigera* larva infected with EPNs at different concentration (mean number of died larva ± SE) at after 120 hours exposure time (filter assay).

Nematode species	Concentration				
	1	10	50	100	500
H. bacteriophora	0Ad	0.83 ± 0.83Ad	21.67 ± 3.39Ac	48.33 ± 5.28Ab	83.33 ± 5.56Aa
S. feltiae	0Ad	0Ad	15.00 ± 2.79ABc	51.25 ± 4.03Ab	71.67 ± 2.39Aa
S. carpocapsae	0Ac	0Ac	11.25 ± 2.33Bb	23.75 ± 1.97Ba	30.00 ± 1.94Ba

Table 4. Mean mortality percentages of *Helicoverpa armigera* larva infected with EPNs at different concentration (mean number of died larva ± SE) after 72 hours exposure time (food assay).

Nematode species	Concentration				
	1	10	50	100	500
H. bacteriophora	0Ab	0Ab	0Ab	2.50 ± 1.27Ab	9.17 ± 2.31Aa
S. feltiae	0Ab	0Ab	0Ab	1.67 ± 0.68Ab	6.67 ± 1.55Aa
S. carpocapsae	0Aa	0Aa	0Aa	0.42 ± 0.42Aa	0.42 ± 0.42Ba

Table 5. Mean mortality percentages of *Helicoverpa armigera* larva infected with EPNs at different concentration (mean number of died larva ± SE) after 96 hours exposure time (food assay).

Nematode species	Concentration				
	1	10	50	100	500
H. bacteriophora	0Ac	0Ac	1.25 ± 0.64ABc	14.58 ± 3.18Ab	27.08 ± 2.26Aa
S. feltiae	0Ac	0Ac	4.17 ± 1.64Ac	10.42 ± 2.43Ab	22.08 ± 1.65Aa
S. carpocapsae	0Aa	0Aa	0Ba	0.42 ± 0.42Ba	2.92 ± 1.76Ba

Table 6. Mean mortality percentages of *Helicoverpa armigera* larva infected with EPNs at different concentration (mean number of died larva ± SE) after 120 hours exposure time (food assay).

Nematode species	Concentration				
	1	10	50	100	500
H. bacteriophora	0Ad	0.83 ± 0.83Acd	7.50 ± 1.36Ac	23.33 ± 2.86Ab	36.67 ± 2.39Aa
S. feltiae	0Ad	0Ad	8.33 ± 1.86Ac	18.33 ± 2.08Ab	31.25 ± 1.67Aa
S. carpocapsae	0Ac	0Ac	5.42 ± 1.25Abc	10.42 ± 1.42Bb	18.75 ± 2.80Ba

Table 7. Mean mortality percentages of *Helicoverpa armigera* larva infected with EPNs at different concentration (mean number of died larva ± SE) after 120 hours exposure time (soil assay).

Nematode species	Concentration				
	1	10	50	100	500
H. bacteriophora	0Ad	0.42 ± 0.42Ad	9.17 ± 1.73Ac	25.83 ± 3.09Ab	34.58 ± 1.17Aa
S. feltiae	0Ac	0Ac	8.33 ± 1.52ABb	27.08 ± 3.53Aa	30.42 ± 2.16Aa
S. carpocapsae	0Ac	0Ac	4.17 ± 0.88Bbc	7.50 ± 2.22Bb	17.92 ± 2.24Ba

Table 8. Mean mortality percentages of *Helicoverpa armigera* larva infected with EPNs at different concentration (mean number of died larva ± SE) after 120 hours exposure time (soil assay).

Nematode species	Concentration				
	1	10	50	100	500
H. bacteriophora	0Ad	2.92 ± 1.53Ad	23.75 ± 2.41Ac	48.75 ± 5.73Ab	62.08 ± 3.59Aa
S. feltiae	0Ad	0Ad	13.33 ± 1.94Bc	46.67 ± 4.47Ab	62.08 ± 2.44Aa
S. carpocapsae	0Ad	1.67 ± 1.27Ad	9.17 ± 1.36Bc	20.00 ± 2.04Bb	30.83 ± 3.06Ba

Table 9. Mean mortality percentages of *Helicoverpa armigera* larva infected with EPNs at different concentration (mean number of died larva ± SE) after 120 hours exposure time (soil assay).

Nematode species	Concentration				
	1	10	50	100	500
H. bacteriophora	0Ad	5.83 ± 2.08Ad	32.50 ± 2.76Ac	60.83 ± 4.57Ab	89.58 ± 3.30Aa
S. feltiae	0Ad	1.67 ± 1.11Ad	23.33 ± 2.58Bc	61.25 ± 4.35Ab	81.25 ± 3.64Aa
S. carpocapsae	0Ad	5.00 ± 1.94Ad	20.42 ± 2.10Bc	30.83 ± 1.42Bb	41.25 ± 2.81Ba

For all tables, the means followed by the same lowercase letter within the same row or the means followed by the same capital letter within the same column are not significantly different (P>0.05; Tukey).

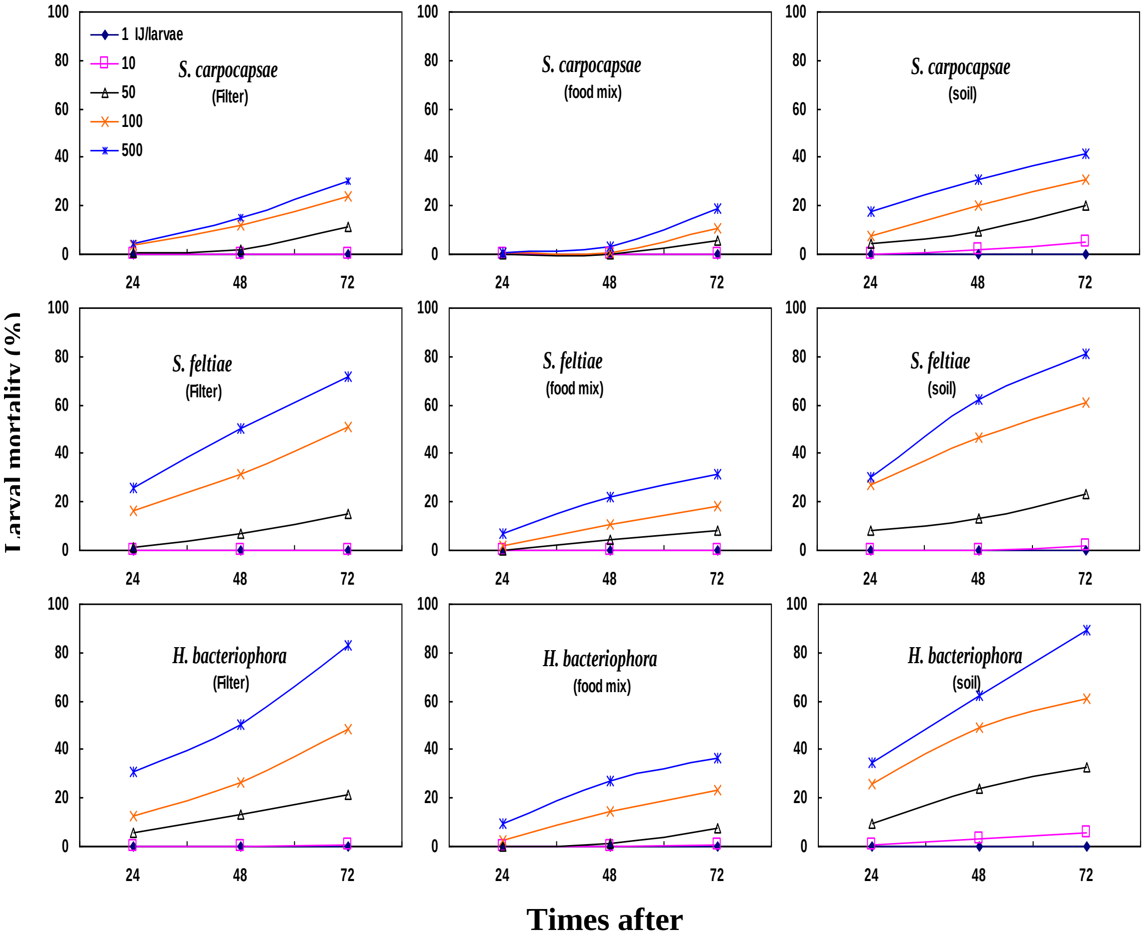

Figure 1. The effects of three species of entomopathogenic nematodes on *Helicoverpa armigera* larva at five concentrations in different treatment way.

TRICHOMONIASIS AMONG ANTE-NATAL ATTENDEES IN A TERTIARY HEALTH FACILITY, ABEOKUTA, NIGERIA

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ABSTRACT: The prevalence of trichomoniasis was carried out among ante-natal attendees at the State Hospital Ijaiye Abeokuta. 200 pregnant women systematically selected were examined. Vaginal swab were collected with sterile swab stick and urine samples were collected into universal container from each respondent of age 16 to 50 years and parasitological examination carried out. Results showed that (19.5%) 39 out of 200 had infection. Highest prevalence was seen among age group (21-25) and the least among age groups (41-45) and (46-50). 1-3 months stage of pregnancy has the highest prevalence of 12.19% for both samples and the least among 7-9months having 6.38% prevalence. Primigravid had higher prevalence of 31-25% than multigravid having 9.67% in both samples. The occupational related prevalence showed that traders have the highest prevalence of (15.38 %) HVS samples (14.28 %) for urine samples and both HVS and urine samples while the least prevalence (0 %) was seen among the students for urine samples and both HVS and urine samples and (6.25%) among the civil servants for HVS samples**.**

KEY WORDS: Trichomoniasis, ante-natal attendees, Abeokuta, Nigeria.

Trichomonas vaginalis is a cosmopolitan protozoan parasite which can be transmitted sexually causing trichomoniasis. *T. vaginalis* may be found in the vagina, cervix, urethra external genitalia, prostate, epididymis and semen (1). The prevalence of trichomoniasis Hhas also been known to correlate with sexual activity (2). The infection is common among sexually active adolescent especially where people do not practice safer sex (3).

Trichomoniasis is specifically an infection of the human genito-urinary tract, infecting both male and female where over 180 million women are thought to be infected worldwide (3). *T. vaginalis* infection is the most prevalent non viral sexually transmitted disease in the world (4) where an estimated 5 million women are infected in the United States (5). In Africa, Emarievcoe (6) observed that about 20% of women attending family planning, antenatal or other clinics were infected.

T. vaginalis may be emerging as one of the most important cofactors in amplifying HIV transmission, particularly in African-American communities of the United States, where they posited that in persons co-infected with HIV, the pathology induced by *T. vaginalis* infection can increase HIV shedding; and infection may also act to expand the portal of entry for HIV in an HIV-negative persons (1).

Higher prevalence of infection has been reported among women than men (3), which adduced that the reasons could be due to the biological configuration of women, violence against women, poverty and unemployment. Also the use of oral contraceptives which alter the normal environment of the vagina and reduce the normal lubricating secretions cause trauma or damage to the vaginal wall through which sexually transmitted pathogens like *T. vaginalis* can enter.

The infection is asymptomatic in 10-50% of women (7), however asymptomatic infections can suddenly become symptomatic due to emotional stress, general lowered resistance or changes in pH of the vagina. The common symptoms associated with the infection include, yellowish-white, this watery vaginal discharge which tends to be frothy, vulval itching, dysuria or offensive odour.

Complications of trichomonal vaginitis include premature rupture of membranes, premature labour, low birth weight and post- abortion or post-hysterectomy (6). This report provided the basis for the study in assessing trichomoniasis and its perception among ante-natal attendees in a tertiary health facility of Abeokuta, Southwestern Nigeria.

MATERIALS AND METHOD

Study Area

The study was carried out at the Ogun State Hospital Ijaiye Abeokuta, the capital city of Ogun State. Abeokuta is located on approximately 7°11'N and 3°21'E in the rainforest with an annual rainfall of 963.3mm.

Selection of Study Population

The study populations were systematically selected based on the number of pregnant women who visited the ante-natal clinic section of the hospital on clinic days.

Ethical Consent

Request and approval to use the hospital for the research study were obtained from the Medical Director and the Ethical Committee. Consent was also obtained from the pregnant women who participated in the study.

Collection and examination of Samples

High vaginal swab and urine samples were collected from each pregnant woman attending the antenatal clinic using the systematic sampling method. High vaginal swabs were collected using sterile swab sticks, while the urine samples were collected inside universal container with each respondent name written on it. The samples were examined using wet microscopy parasitological methods as described by (4).

Data analysis

Analyses into the assessment of the relationship between infection rate and status, in addition to test for significance were carried using SPSS version 16.0.

RESULTS

From table 1, 22 (11%) respondents are positive for HVS sample, 17 (8.5%) are positive for urine samples.

Age related prevalence of infection showed higher prevalence of 4.5% in HVS samples 3.5% in urine samples and 2.5% in both urine and HVS samples for age group (21-25). The least prevalence was 0.5% among age groups (41-45) and (46-50).

Gestational related prevalence has shown that 1 –3 months stage of pregnancy has the highest prevalence of 12.19% for both samples, 19.51% for HVS only and 17.03% for urine samples only. Least prevalence was seen among 7-9 months pregnancy stage with 6.38% for both samples and 4.25% for HVS and urine samples each.

Relating infection to gravid status of respondents, multigravid had higher prevalence of 9.67% in both samples than the primigravid having 6.58%. Primigravid has a greater prevalence of 13.16% in HVS sample and 9.21% in urine samples unlike the multigravid having a prevalence of 9.67% in HVS samples and 8.06% in urine samples.

The occupational related prevalence of infection showed that the highest prevalence of infection (15.38%) was among the traders for HVS sample result. It also had the highest for urine samples and for both HVS and urine samples (4.28%). The least prevalence was seen among students for urine samples and both HVS and urine samples (0%) while the least prevalence was among civil servant (6.25%) for HVS samples. Generally, the traders had the highest prevalence of infection followed by Artisan, civil servants then students.

DISCUSSION

The findings of this study showed that Trichomoniasis is prevalent among the pregnant women attending antenatal clinic at the State Hospital Ijaiye Abeokuta. Out of the 200 samples examined, 39 samples were found positive with 19.5% prevalence rate while 161 (80.5%) were negative. The infection was higher in high vaginal swab samples 11% than urine samples 8.5%. From the laboratory examination, it was observed that respondents with heavy infection in their HVS sample also have infection in their urine sample i.e. all positive urine samples also have infection in the HVS sample. The high prevalence of trichomoniasis among the respondent may constitute major health risk to the unborn babies. Maternity homes and antenatal clinics should incorporate diagnosis of trichomoniasis in the routine check up of pregnant women to ensure a timely detection of infection and adequate treatment as a measure to prevent neo-natal infection of trichomoniasis (8).

Age group (21-25) were found to be the highest infected group with prevalence rate of 4.5%, 3.5% and 2.5% for HVS, urine and both samples respectively. While age group (41-45) and (46-50) had the lowest prevalence of 0.5% for all samples. The high prevalence corroborates the findings reported by (3) that trichomoniasis is more prevalent among the more sexually active young people. Generally, increase in the rate of sexually transmitted disease in Nigeria has been obtained on increased poverty, unemployment and violence amongst women and children amongst other factors (9).

The traders have the highest prevalence of trichomoniasis (15.38%) in HVS samples and (14.28%) for urine samples and both samples. The least prevalence (0%) was seen among the students for urine samples and both samples while it is seen among the civil servants for the HVS samples. The high rate of infection amongst the trader may be associated with their active social life with little or no personal preventive measures. The major problem of this class of people may not necessarily be poor personal hygiene (9), although the vegetative trophozoites of *T. vaginalis* could be transmitted through vaginal contamination of toilet seats, the water of toilet bowls, sharing of panties and towel. Finally, sexual permissiveness associated with affluence, lack of awareness, poverty and ignorance of the public health implication, poor sanitary and poor personal hygiene may likely be upper most in the list of risks factors of Trichomoniasis. It is hoped that public enlightenment to people will aid the prevention and eradication of Trichomoniasis along side with AIDs and other sexually transmitted diseases.

The study has shown a high prevalence of trichomoniasis among the pregnant women attending antenatal clinic at the State Hospital Ijaiye Abeokuta. Sex partners should be treated at the same time to reduce possibility of further transmission. Government should sponsor public health education to enlighten people on the public health implication of the infection Antenatal clinics should incorporate diagnosis of trichomoniasis in the routine check up for pregnant women.

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Table 1. Overall prevalence.

	HVS	%	URINE	%
Positive	22	(11%)	17	(8.5%)
Negative	178	(89 %)	183	(91.5 %)

Table 2. Age Related Prevalence of *T. vaginalis*.

Age group	**No examined**	**Prevalence of**		**Infection**			
		HVS	**%**	**Urine**	**%**	**Both**	**%**
16-20	14	2	1	3	1.5	1	0.5
21-25	53	9	4.5	7	3.5	5	2.5
26-30	78	3	1.5	2	1.0	3	1.5
31-35	36	4	2.0	3	1.5	4	2.0
36-40	17	2	1.0	0	-	2	1.0
41-45	1	1	0.5	1	0.5	1	0.5
46-50	1	1	0.5	1	0.5	1	0.5
Total	**200**	**22**	**11**	**17**	**8.5**	**17**	**8.5**

Table 3: Prevalence of *T. vaginalis* with respect to gestational period.

Stage of Pregnancy	**No Examined**	**HVS**	**%**	**Urine**	**%**	**Both**	**%**
1 –3 months	41	8	19.51	7	17.03	5	12.19
4 –6 months	111	12	10.81	8	7.21	9	8.11
7 –9 months	47	2	4.25	2	4.25	3	6.38

Table 4. Prevalence with respect to gravid status of respondents.

Gravid status	**No examined**	**HVS samples positive with *T. vaginalis* (%)**	**Urine samples positive with *T. vaginalis* (%)**	**HVS and Urine samples positive with *T. vaginalis* (%)**
Primigravid	76	10 (13.16)	7 (9.21)	5 (6.58)
Multigravid	124	12 (9.67)	10 (8.06)	12 (9.67)
Total	200	22 (22.83)	17 (17.27)	17 (16.25)

FOUR SPECIES AS NEW RECORDS OF TRIBE CHRYSOGASTERINI (DIPTERA: SYRPHIDAE) FROM IRAN

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[Shakeryari, A., Khaghaninia, S. & Irani Nejad, K. H. 2012. Four species as new records of tribe Chrysogasterini (Diptera: Syrphidae) from Iran. Munis Entomology & Zoology, 7 (1): 385-390**]**

ABSTRACT: In order to study the hoverflies fauna of the subfamily Milesiinae (Dip.: Syrphidae) in Kandovan region (East Azerbayjan province) a survey was conducted during 2010-2011. Totally, 4 species belonging to the tribe Chrysogasterini were identified which all are new records for the insect fauna of Iran and listed as follow: *Melanogaster hirtella* Loew, 1843, *Melanogaster parumplicata* Loew, 1840, *Orthonevra brevicornis* Loew, 1840 and *Orthonevra nobilis* Fallen, 1817.

KEY WORDS: Chrysogasterini, Fauna, Syrphidae, Kandovan, Iran.

Hoverflies is one of the largest and most diverse families of the order Diptera which include about 200 genera and more than 6000 described species over the world. Flower flies of the subfamily Milesiinae are the most common and conspicuous which contain about two thirds of hoverfly fauna. Many species, being regular visitors of flowers, are important pollinators of various plants including vegetables, fruit trees (Asteraceae, Brassicaceae, and Rosaceae) and flowering plants (Kevan & Baker, 1983).

In this subfamily, humeri is hairy and head naturally sits well forward so that the humeri is clearly visible. Most of Milesiinae larvae are filter feeders in all kinds of aquatic media and are commonly called rat-tailed maggots (Stabbs & Falk, 2002).

One of the significant character of these flies is the ability of them to keep the body motionless in the air for quite a period of time during flight. The adults mainly feed on nectar or pollen for proteins, lipids and vitamins (Saribiyik, 2003).

The presence of a concave face, smoothly leading to a projecting mouth margin, is characteristic of the tribe Chrysogasterini. The only exceptions are males of the genus *Chrysogaster,* which has a knob like *Cheilosia*, although no distinct eye rim is present at the side of the face beside the eye. The genus *Melanogaster* is smaller and darker with less evidence of iridescence than the remaining species of *Chrysogast*er (Maibach et al., 1994). The hind femur has small spines on the ventral surface, but these are very difficult to observe in some species. The males of *Chrysogaster* and *Melanogaster* have eyes which meet on top of the head and there is a facial knob. The top of the abdomen is particularly flat in *Chrysogaster, Lejogaster, Melanogaster, Orthonevra* and *Myolepta* (Stabbs & Falk, 2002).

Recently the hoverflies fauna of Iran were studied by some taxonomists (Dousti & Hayat, 2006; Gharali & Reemer, 2008, 2010; Khaghaninia et al., 2010ab; Khaghaninia & Bashiri, 2011). Unfortunately the Syrphids of the Kandovan region have not been yet studied so it subjected for present study.

MATERIAL AND METHODS

The adult specimens were collected from Kandovan valley using common entomological net during 2010-2011(Fig. 1). Kandovan valley is one of the longest Sahand chain mauntains' valleys with about 12 km length, located in southern east of East Azerbayjan province, Iran. This biosphere reserve situated in the south of Sultan mountain, one of the Sahand's summits, with about 35.5 km distance of Tabriz city with UTM (Universal Transfer Mercator) coordinate system, X from 609181.42 to 617583.55 E; Y from 4177170.42 to 4183938.80 N and varying latitude from 1860 m to 3110 m a.s.l. This area has rich grass lands with various species of Astraceae, Umblifera, Legominaceae and Ronunculaceae. The specimens were killed in a killing jar containing potassium cyanide and the voucher specimens were deposited at Insect Museum of Tabriz University. The specimens were identified based on valid keys such as Stubbs & Falk (2002) and Speight (2008). The range and flower visited of the recorded species are provided mostly from Speight (2010).

RESULTS

Chrysogasterini

Diagnostic characters: The members of this tribe mostly has a concave face and with very different appearance. In *Chraysogaster* group, the abdomen is entirely black, blackish, metallic green, blue or blackish-gray with faint gray spotes. Also tergites in *Orthonevra* and *Melanogaster*, tergites are dull or semi-shining black on dorsal surface (Stabbs & Falk, 2002).

Key for the studied genera
(Adapted from Bei- Bienko 1988 and Stubbs and Falk, 2002)

- Body metallic green or bronzy. 3rd segment of antennae usually elongate. Face of male without median tubercle. Tergite 1 with metallic margin as on other tergites..***Orthonevra***

- Tergite 1 dull at margin, contrasting with metallic margins of other tergites. antennae with third segment completely black. hairs on sternite 2 as long as those on thoracic dorsum..***Melanogaster***

Key for the studied species of *Melanogaster*

1- Eyes meet on top of the head (Males) 2

- Eyes separated (Females) 3

2- Thoracic dorsum (viewed from front) with hairs partly yellowish-brown, face without knob only slightly developed ....***hirtella***

- Thoracic dorsum (viewed from in front) with hairs entirely black, face with knob only slightly developed .... ***parumplicata***

3- Thoracic dorsum with hairs yellow (or grayish) and upstanding (view from side), Lip sharply angled .... ***hirtella***

- Thoracic dorsum with sparse golden hair lying almost flat on surface, Lip not sharply angled.. ***parumplicata***

Key for the studied species of *Orthonevra*

1- Third antennal segment about as long as deep, frons in male is in form of broad unequal-sided triangle. upper margin of tergite 5 is dark colored, body length is 5.0 to 7.0 mm, surstyli greatly broadened in basal half..***brevicornis***

- Third antennal segment twice as long as deep. frons in male is in form of equilateral triangle, upper margin of tergite 5 entirely black, body length is 5.5 to 6.0 mm, surstyli moderately broad, with sharply defined angle on ventral margin............................... ***nobilis***

***Melanogaster hirtella* (Loew, 1843)** (Fig. 2)
Material examined: 2 specimens (2♂♂): Kandovan; 37°46.95' N 46°15' E, 2341 m, 13 July 2010.
Diagnostic characters: Smallish very black specimens with black antennae, the wings clear or only slightly brownish, females often have a shining abdomen. Wing length 5-6 mm (Speight 2010).
Flowers visited: White umbellifers; *Caltha*, *Euphorbia*, *Iris pseudacorus, Menyanthes, Mimulus guttatus, Potentilla erecta, Pyrus communis, Ranunculus, Sorbus aucuparia, Taraxacum, Viburnum opulus*.
Range: Denmark south to the Pyrenees and Portugal; Ireland eastwards to the Alps (Switzerland, Liechtenstein); Britain.

***Melanogaster parumplicata* (Loew, 1840)** (Fig. 3)
Material examined: 1 specimens (1♂): Kandovan; 37°46' N 46°15' E, 2358 m, 5 August 2010.
Diagnostic characters: Legs are entirely black. Face profile gently curved. Wing length 5.5-7 mm. The male has a weak facial knob (very pronounced in aerosa) and the female facial profile is gently curved (very angular in aerosa) between the antennae and the lip (Stabbs & Falk, 2002).
Flowers visited: Umbellifers, *Caltha*, *Crataegus*, *Prunus spinosa*, *Ranunculus*, *Rhamnus cathartica*, *Taraxacum*.
Range: Norway, Sweden, Southern Finland, Poland, northern, central and south-west Germany, the Swiss Jura and the Balkans (Bosnia-Herzegovina and Montenegro).

***Orthonevra brevicornis* (Loew, 1840)** (Fig. 4)
Material examined: 3 specimens (3♀♀): Kandovan; 37°45' N 46°18' E, 2705 m, 5 August 2010.
Diagnostic characters: The stigma has a tiny dark spot at the base. The third antennal segment is usually dark above and orange below. The male resembles *Chrysogaster* except that the face is concave. The female has erect pale hairs on the thoracic dorsum, a feature otherwise only found in combination with black antennae in *Melanogaste* (Stabbs & Falk, 2002).
Flowers visited: Umbellifers; *Cornus*, *Crateagus*, *Malus*, *Pyrus communis*, *Ranunculus*, *Rorippa*, *Salix*.
Range: Southern Finland and Denmark south to northern France (Brittany); from Britain (England) eastwards through parts of central Europe (Netherlands, Belgium, Germany, Poland) into European parts of Russia, the Caucasus and western Siberia.

***Orthonevra nobilis* (Fallen, 1817)** (Fig. 5)
Material examined: 8 specimens (8♀♀): Kandovan; 37°45' N 46°17' E, 2621 m, 20 July 2011.
Diagnostic character: The stigma is dark and there is often slight darkening of the center of the wing, in combination giving a clue to identification in the field.

The third antennal segment is rather pointed at the apex. Females have a small tubercle at the apex of tergite 4. Wing length 4-5.75 mm (Stabbs & Falk, 2002).
Flowers visited: White umbellifers; *Fragaria*, *Galium*, *Potentilla erecta*, *Ranunculus.*
Range: From central Norway south to Pyrenees and central Spain; from Ireland eastwards through northern and central Europe into European parts of Russia; also in mountainous parts of Italy, the former Yugoslavia, Greece and Turkey; the Caucasus; through Siberia to the far east; China.

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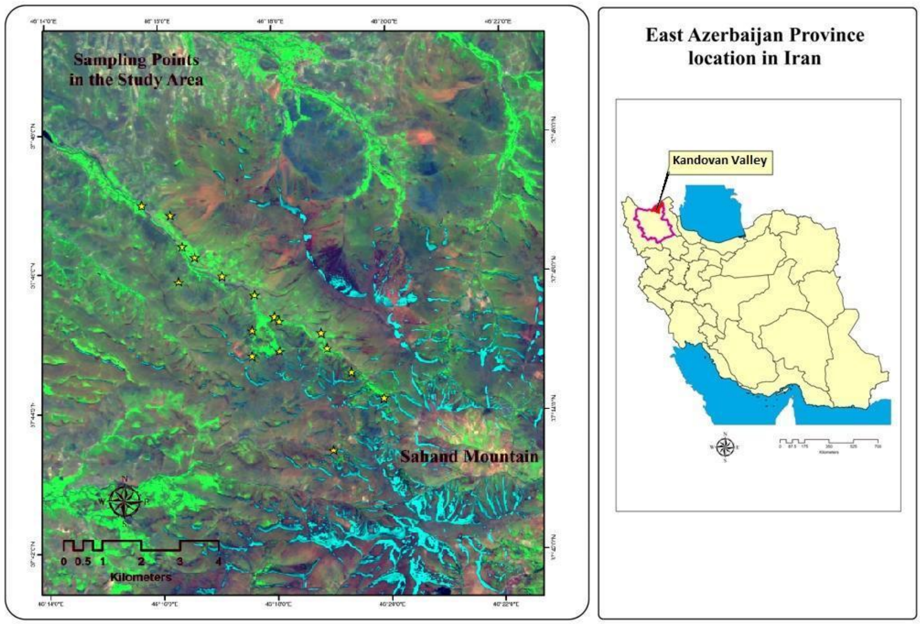

Figure 1. Location of sampling points in Kandovan valley, based on satellite image (SPOT).

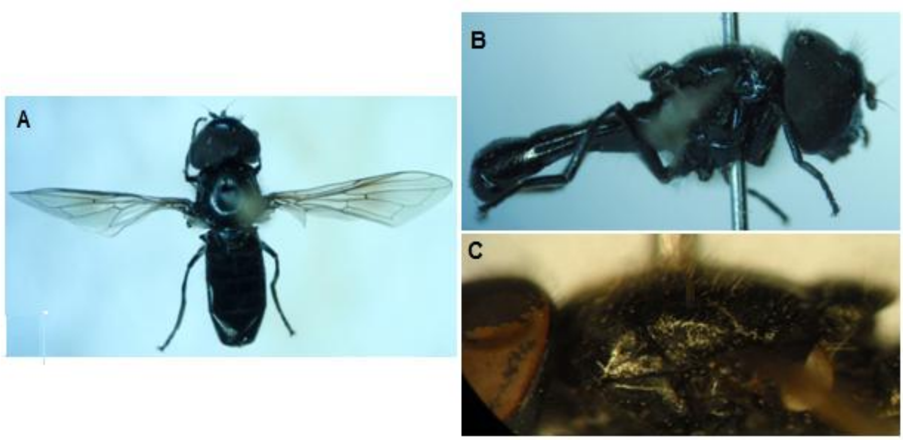

Figure 2. *Melanogaster hirtella*: a- male, dorsal view, b- lateral view, c- thoracic dorsum (Original).

Figure 3. *Melanogaster parumplicata*: a- male, dorsal view, b- lateral view, c- face with knob (Original).

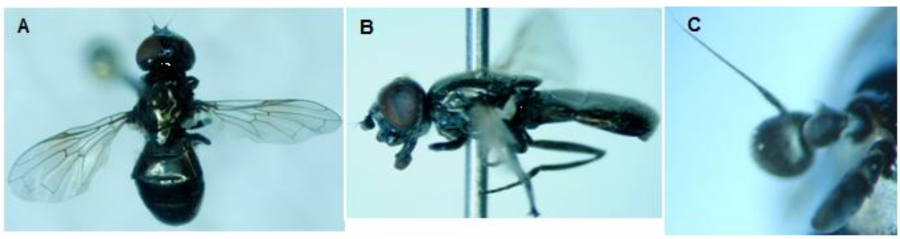

Figure 4. *Orthonevra brevicornis*: a-Female, dorsal view, b- lateral view, c- antennae (Original).

Figure 5. *Orthonevra nobilis*: a- Female, dorsal view, b- lateral view, c- antennae (Original).

TAXONOMY AND FIELD OBSERVATIONS OF GRASSHOPPER AND LOCUST FAUNA (ORTHOPTERA: ACRIDOIDEA) OF JHARKHAND, INDIA

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[Nayeem, R. & Usmani, K. 2012. Taxonomy and field observations of grasshopper and locust fauna (Orthoptera: Acridoidea) of Jharkhand, India. Munis Entomology & Zoology, 7 (1): 391-417**]**

ABSTRACT: The state of Jharkhand (India) is a biodiversity hotspot owing to its topography and geographical features and is blessed with tropical zone dry and wet forests. The mainstay of tribal communities is agriculture. Acridoids have long been credited as forest and crop pest and till date there is no consolidated work dealing with the distribution of locusts and grasshoppers from the state. Keeping this in view the area was surveyed and acridoid fauna has been listed in addition to worked out taxonomy. Keys to subfamilies and genera have been provided. The interaction of concerned samples with their natural habitat was observed very closely and has been listed wherever required. Collection of 421 samples has been worked out that comprised 41 species belonging to 28 genera of 10 subfamilies, 3 families and 4 tribes.

KEY WORDS: Observation, Taxonomy, Acridoidea, Jharkhand (India).

Orthoptera is one of the most diverse orders of class Insecta with superfamily Acridoidea being most noted pest of agriculture and forest areas. It is because of this reason that attempt has been made to work out the taxonomy of the same alongwith some ecological or field observations that help us to understand the interaction and behavior of this fauna. The order orthoptera consists of insects with incomplete metamorphosis, including the grasshoppers, crickets and locusts. Many insects in this order produce sound (known as a "stridulation") by rubbing their wings against each other or their legs. They are also well adapted for flight since both direct and indirect muscles work together during flight movements and thus explains the reason for these insects to cover long distances during swarming conditions that mainly results from overcrowding and scarcity of food. Grasshoppers are beneficial to a healthy, vigorous, grassland ecosystem when they are at low to moderate (noneconomic) densities. This family of insects preceded today's rangeland plant species and vertebrate animal life by millions of years (Carpenter, 1953). Grasshoppers developed in the rangeland ecosystem during a long period of coevolution with other flora and fauna. Grasshoppers' ecologic role (Van Hook, 1971) of providing food for wildlife, stimulating plant growth, creating plant litter for the soil, and cycling elements and nutrients was developed as a functional part of the whole ecosystem.

Acridoidea is one of the important superfamilies of suborder Caelifera (Short-horned grasshoppers with three segmented tarsi and a short ovipositor), rest being Tridactyloidea, Tetrigoidea and Eumastacoidea. Tetrigoidea is easily distinguishable from Acridoidea by the elongate pronotum, usually extending beyond the end of the body, by the absence of an arolium between the claws and the two-segmented tarsi of the fore and middle legs. The other Superfamilies of Caelifera are easily recognizable at sight and are not frequently encountered. Superfamily Acridoidea has shown maximum diversity and divided into various families of which family Acrididae, Catantopidae and Pyrgomorphidae are widely distributed in India. Members of Superfamily Acridoidea harm chiefly by defoliation, that on the other hand drastically affect the produce by decreasing the overall photosynthetic area or we can say that they are capable enough to affect the green cover (forest and wetlands) negatively.

Since earlier days to present time locusts are the main pests in countries bordering deserts as for example Africa, where swarms of locusts have resulted in famine like conditions many a times. A notable taxonomical work on Acrididae was made by Kirby (1914) in the series 'Fauna of British India' and he divided the family Acrididae into eight subfamilies. Uvarov (1921, 1924, 1927, 1942) studied in detail Indian Acrididae. Agarwala (1952) contributed some studies on female copulatory structures in relation to oviposition sites while Roonwal (1956) contributed some studies on the nymphal structures and ecology on Acrididae. Dirsh (1965, 1975), Tandon (1976), Shishodia (1987, 1997, 1999), Tandon & Shishodia (1969-1989), Usmani & Shafee (1980-1990), Kumar & Virktamath (1991a,b), Murlirangan & Srinivasan (1992), Hazra et al. (1993), Priya & Narendran (2003), Kulkarni & Shishodia (2004, 2005) and Usmani (2005) have contributed works on the taxonomy of this group. More recently, Tandon & Khera (1978), Julka et al. (1982), Shishodia & Hazra (1986) and Dey & Hazra (2003) have done work on the taxonomy as well as on the ecology of this group.

The state of Jharkhand was formed on 15 November 2000 with 18 districts, which were formerly part of south Bihar. Most of the state lies on the Chota Nagpur Plateau, which is the source of the Koel, Damodar, Brahmani, Kharkai and Subarnarekha rivers, whose upper watersheds lie within Jharkhand. Much of the state is still covered by forest. Jharkhand has a rich variety of flora and fauna. Soil content of Jharkhand state mainly consist of soil formed from disintegration of rocks and stones, and soil composition is further divided into Red Soil, found mostly in the Damodar valley and Rajmahal area; Micacious soil (containing particles of mica), found in Koderma, Jhumeritilaiya, Barkagaon and areas around the Mandar hill; Sandy soil, generally found in Hazaribagh and Dhanbad; Black soil, found in Rajmahal area and finally Laterite soil, found in western part of Ranchi, Palamu, and parts of Santhal Parganas and Singbhum.

Although the territory of Jharkhand holds a rich store of minerals; yet agriculture in Jharkhand is the mainstay for most of the tribal communities. In fact, about 80% of the total population practices agriculture in Jharkhand. It is noteworthy that the total area of agricultural lands in Jharkhand is about 2.57 hectares, which produces a total of 37.85 tonnes of food grains. Among the important crops that form an important part of agriculture of Jharkhand are Paddy, Wheat, Pulses, Oilseeds, Maize, Til, Sugarcane, Bajra, etc. These crops largely support the socio-economic condition of the people of Jharkhand. It is noteworthy that climate in Jharkhand largely support the cultivation of crops within the territory.

Brief descriptions of the species spotted in this region have been provided with notes on their colouration. In the present study the authors uphold recent workers in classifying Acridoidea with a few generally accepted changes. The Superfamily Acridoidea is here understood in the same sense as by Uvarov (1966). No survey work so far has been done exclusively for this group from the state of Jharkhand. There are very few reports on the taxonomy of Acridoidea from this region. There is no systematic study on the locusts and grasshoppers belonging to the Superfamily Acridoidea from Jharkhand, a hot spot of Biodiversity. Keeping in view the above fact, the present work is aimed at studying one of the Superfamilies of Orthoptera which is most widely distributed and show a very high degree of biological diversity in this land of forest.

MATERIAL AND METHODS

About 421 specimens of grasshoppers were collected from various agricultural and pasture areas along with forest habitat of Jharkhand which served the basis for the present critical study. A complete record was also maintained indicating the reference number, locality, date of collection and name of host plants etc.

I) Collection of adult grasshoppers

The authors surveyed various agricultural areas of Jharkhand during the period 2010-2011 for the collection of grasshoppers and locusts. They were caught by hands and by the ordinary aerial insect net. The net was used for catching insects individually or by sweeping on grasses, bushes and other vegetables. Since some Acridoidea live on trees, it is sometimes highly rewarding to investigate the branches of trees. Attempts were made to collect the specimens from their host plants. Different parts of crops were examined. Attention was also given to fruits and vegetables. The collected specimens were killed in cyanide bottles.

II) Field Observations during the period of collection

The concerned insects were closely studied in their natural habitat. Their interaction with the particular host plant, mode of damage caused, response to predator, camouflage pattern, activity during different phases of day, mode of flight in response to some approaching danger, their natural enemies were some of the common points of interest that have been worked upon.

III) Preparations for morphological studies

Dry mounts were also prepared for better understanding of certain characters like size, colour, texture etc. For this purpose, the specimens were first relaxed, stretched and later, they were pinned and labeled. Permanent collections of pinned specimens were kept in store boxes and cabinets for further studies on their morphological structures.

IV) Preparations for genitalic studies

For a detailed study of the various components of genitalia, the permanent slides were prepared and examined under the microscope in order to make a detailed study of the genitalic structures. Drawings were initially made with the help of a camera lucida. Details were filled in by conventional microscope examination.

Key to subfamilies and genera of Acridoidea MacLeay based on Indian specimens

1. Prosternal process present; hind tibia with or without external apical spine; epiphallus disc or bridge shaped, bridge divided or undivided; spermatheca with apical and pre-apical diverticula tubular...**2**

--- Prosternal process usually absent, if present, body strongly elongate and antennae ensiform; hind tibia without external apical spine; epiphallus bridge shaped, bridge undivided; spermatheca with apical diverticulum short or rudimentary, pre-apical diverticulum sac like...**10**

2. Lower knee lobe of hind femur spined; valves of ovipositor serrate or spined; hind tibia flattened...**OXYINAE** BRUNNER, 1893..... ***Oxya*** Serville, 1831

--- Lower knee lobe of hind femur never spined; valves of ovipositor never serrate or spined; hind tibia never flattened...**3**

3. Hind femur much robust, never reaching beyond apex of abdomen; epiphallus disc shaped, ancorae finger shaped, articulated in the middle of the disc, lophi absent; male circus large, strong, curved and toothed apically...
....**CALLIPTAMINAE** TINKHAM, 1940...... ***Acorypha*** Krauss, 1877
--- Hind femur never much robust, usually reaching beyond apex of abdomen; epiphallus bridge shaped, ancorae usually curved, articulated with bridge, lophi present; male circus never toothed apically...**4**

4. Radial area of tegmen with a series of regular, parallel, thickened, transverse stridulatory veinlets; valves of aedeagus divided or connected by small or indistinct flexure; arolium large... **HEMIACRIDINAE** DIRSH, 1956 **..............13**
--- Radial area of tegmen without transverse stridulatory veinlets; valves of aedeagus flexure; arolium of variable size **5**

5. Hind femur with lower basal lobe as long as upper one; tegmino-alar stridulatory mechanism present .... **ROMALEINAE** BRUNNER 1893....... ***Teratodes*** Gray, 1832
--- Hind femur with lower basal lobe shorter than upper one; tegmino-alar stridulatory mechanism absent **6**

6. Mesosternal interspace closed; hind femur with dorsal carina smooth; external apical spine of hind tibia present...
.............................**TROPIDOPOLINAE** JACOBSON, 1905....................***Tristria*** Stal, 1873
--- Mesosternal interspace open; hind femur with dorsal carina finely denticulate, sometimes smooth; external apical spine of hind tibia usually absent.................................. **7**

7. Mesosternal lobes rectangular; ancorae small or indistinct; pronotum with median carina slightly raised; spermatheca with apical diverticulum very long and slender...........................
.... **CYRTACANTHACRIDINAE** KIRBY, 1902........**20**
--- Mesosternal lobes rounded; ancorae well developed and curved; pronotum with median carina never raised; spermatheca with apical diverticulum moderately long......................... **8**

8. Body small to medium size; integument rough; last abdominal tergite in male with well developed furcula; male subgenital plate with transverse fold; bridge of epiphallus divided medially.. **COPTACRIDINAE** BRUNNER, 1893..............**23**
--- Body medium to large size; integument smooth; last abdominal tergite in male without well developed furcula; male subgenital plate without transverse fold; bridge of epiphallus usually undivided medially.. **9**

9. Pronotum with lateral carinae linear; male circus strongly compressed, apex downcurved.
.... **EYPREPOCNEMIDINAE** BRUNNER, 1893..............**26**
--- Pronotum without lateral carinae, if present, never linear; male circus variable, never strongly compressed, apex normal .... **CATANTOPINAE** BRUNNER, 1893..........**31**

10. Stridulatory serration on inner side of hind femur absent... **11**
--- Stridulatory serration on inner side of hind femur present... **12**

11. Body usually slender; frons oblique; medial area of tegmen usually without intercalary vein, if present, never serrated in both sexes............... **ACRIDINAE** MAC LEAY, 1821......**33**
--- Body rather sturdy; frons usually vertical; medial area of tegmen with intercalary vein usually serrated... **OEDIPODINAE** WALKER, 1871..........**38**

12. Body very slender; antennae flattened, ensiform; eyes nearer to apex of head than to its base; hind femur long and narrow, its stridulatory file represented by closely set rigid tubercles and articulated bristles... **TRUXALINAE** WALKER, 1870
--- Body moderately slender; antennae normally filiform but tend to be compressed and ensiform in species with elongated body; eyes never nearer to apex of head than to its base; hind femur never extremely narrow, its stridulatory file with articulated pegs........................
.... **GOMPHOCERINAE** FIEBER, 1853.......**47**

13. HEMIACRIDINAE: Prosternal process antero-posteriorly compressed; elytra or wings fully developed, much longer than pronotum; dorsum of pronotum flattened, lateral carina present ....***Spathosternum*** Krauss, 1877
--- Prosternal process conical, never compressed, elytra or wings fully developed or shortened, dorsum of pronotum rounded or flattned, lateral carinae present or absent.. ***Hieroglyphus*** Krauss, 1877

14. CYRTACANTHACRIDINAE: Prosternal process vertical or slightly bent towards mesosternum, but not touching it, usually laterally compressed..... ***Schistocerca*** Stal, 1873
--- Prosternal process strongly bent towards mesosternum, touching or nearly touching it, necer laterally compressed **24**

15. Integument slightly granulose and punctuate-dotted; pronotum with median carina low, weakly interrupted by the transverse sulci; epiphallus with lophi long and narrow..................
....***Cyrtacanthacris*** Walker, 1870
--- Integument strongly granulose; pronotum with median carina high, crest like, distinctly interrupted by transverse sulci; epiphallus with lophi broadly triangular.....................
....***Chondracris*** Uvarov, 1923

16. COPTACRIDINAE: Pronotum with median carina well raised, crossed by posterior transverse sulcus only, aedeagus with apical valve less than half the length of basal valve ......
....***Epistaurus*** I. Bolivar, 1889
--- Pronotum with median carina low; crossed by three transverse sulci; aedeagus with apical valves more than half the length of basal valve, frontal ridge between antennae much wider than vertex between the eyes; prosternal process cylindrical.......................................
.... ***Eucoptacra*** I. Bolivar, 1902

17. EYPREPOCNEMIDINAE: Hind tibia with dense spines; prosternal process with apex bilobate.. ....***Tylotropidius*** Stal, 1873
--- Hind tibia with sparse spines; prosternal process with apex never bilobate **27**

18. Fastigium of vertex without depression; male subgenital plate excised at apex................
.... ***Cataloipus*** I. Bolivar, 1890
--- Fastigium of vertex with depression; male subgenital plate never excised at apex, male cercus narrow, weakly compressed, apex acute .... ***Eyprepocnemis*** Fieber, 1853

19. CATANTOPINAE: Pronotum at least slightly constricted in middle; prosternal process conical............. ....***Xenocatantops*** Dirsh, 1953
--- Pronotum never constricted in middle...**29**

20. Frontal ridge sulcate; prosternal process laterally compressed...
....***Stenocatantops*** Thunberg, 1815
--- Frontal ridge flat or slightly depressed; prosternal process cylindrical or slightly antero-posteriorly compressed with rounded apex...........................***Diabolocatantops*** Jago, 1984

21. ACRIDINAE: Head elongate; hind femur very long and slender.....................................
....***Acrida*** Linnaeus, 1758
--- Head never elongate; Hind femur never very long and slender..**31**

22. Pronotum with lateral carinae straight, nearly parallel.................... ***Phlaeoba*** Stal, 1861
--- Pronotum with lateral carinae diverging in metazona............. ***Orthochtha*** Karsch, 1891

23. OEDIPODINAE: Dorsum of pronotum with numerous longitudinal parallel ridges.......
....***Morphacris*** Walker, 1870
--- Dorsum of pronotum without longitudinal ridges..**33**

24. Dorsum of pronotum with X-shaped pattern...............................***Oedaleus*** Fieber, 1853
--- Dorsum of pronotum without X-shaped pattern **34**

25. Pronotum with median carina crossed by two transverse sulci.....................................**35**
--- Pronotum with median carina crossed by one transverse sulcus or not crossed at all.....**36**

26. Pronotum with median carina strongly raised in prozona forming two tooth like projections, sharp in metazona..***Trilophidia*** Stal, 1873
--- Pronotum with median carina equally raised in prozona and metazona, not forming tooth like projection, lateral carinae irregular, tuberculate, sometimes absent in metazoan.... .... ***Acrotylus*** Fieber, 1853

27. Pronotum with median carina weak...***Aiolopus*** Fieber, 1853
--- Pronotum with median carina well developed...**37**

28. Median carina of pronotum, in profile, not excised at posterior sulcus, pronotum strongly crest-like, anteriorly projecting above vertex; frontal ridge flat............................... .... ***Gastrimargus*** Saussure, 1884
--- Median carina of pronotum, in profile, excised at posterior sulcus.................................**38**

29. Median carina of pronotum strongly raised in prozona and moderately in metazona; deeply excised by posterior transverse sulcus; frontal ridge sulcate... ....***Oedipoda*** Latreille, 1829
--- Median carina of pronotum equally raised in prozona and metazona; slightly excised by posterior transverse sulcus; frontal ridge flat...**39**

30. Pronotum strongly tectiform; mesosternal interspace as long as wide.............................. ....***Locusta*** Linnaeus, 1758
--- Pronotum slightly tectiform; mesosternal interspace much wider than long.................... ....***Chloebora*** Saussure, 1884

31. GOMPHOCERINAE: Fastigial foveolae weak, hardly visible from above; fastigium of vertex without median carinula; pronotum with lateral carinae angularly incurved; arolium of small size..**41**
--- Fastigial foveolae deep, visible from above; fastigium of vertex with median carinula; pronotum with lateral carinae straight, slightly diverging in metazoan; arolium of medium size...**42**

32. Body of small size; vertex without lateral carinulae; frontal ridge sulcate; hind tibia with inner spur of inner side about as long as external one............................***Leva*** I. Bolivar, 1909
--- Body of medium size; vertex with lateral carinulae; frontal ridge flat; hind tibia with inner spur of inner side slightly longer than external one........... ***Stenohippus*** Uvarov, 1926

33. Valvulae of ovipositor covered by supra anal plate .... ***Dociostaurus*** Fieber, 1853
--- Valvulae of ovipositor exserted, free **43**

34. Pronotum not constricted; lateral carinae entirely dorsal... .... ***Aulacobothrus*** Bolivar, 1902
--- Pronotum constricted .... ***Chorthippus*** Fieber, 1852

TAXONOMIC ACCOUNT

Superfamily Acridoidea MacLeay, 1821
Family Acrididae MacLeay, 1821
Subfamily Oxyinae Brunner von Wattenwyl, 1893
Tribe Oxyini Brunner von Wattenwyl, 1893

Oxya japonica japonica (Thunberg, 1815)

Diagnostic characters: Antennae as long as or slightly longer than head and pronotum together. Lateral longitudinal ridges on ventral surface of female sub genital plate without spines except at apices. Ovipositor valves with short dents. Posterior ventral basivalvular sclerite with a large spine on its inner ventral margin, male cercus with sub-acute or truncate apex.
Material examined: 1♂, 14-V-2010, on underlying grasses in vegetable field, Dhab, Koderma; 1♀, 5-VII-2010, on paddy, Balu, Latehar.
Morphometry: (Length in mm)
Male : Body 11.7, Tegmina 19.9, Hind femur 10.7, Pronotum 7.8
Female: Body 14.9, Tegmina 23.5, Hind femur 14.9, Pronotum 9.0
Field observations: Spotted feeding on the upper half portion of cereal crops usually paddy. It is a major pest of paddy crop.
Natural enemies: No natural enemies are recorded.
Distribution: Uttar Pradesh, Rajasthan, Tamil Nadu, Tripura, West Bengal, Gujarat, Bihar, Jharkhand, Assam, Manipur, Karnataka, Kerala, Punjab.

Oxya hyla hyla (Serville, 1831)

Diagnostic characters: Body of medium size, antennae filiform, longer than, as long as, or shorter than head and pronotum together; fastigium of vertex short, without mid-longitudinal carinula, frontal ridge sulcate, dorsum of pronotum slightly flattened, crossed by three transverse sulci, median carina weak, lateral carinae absent, metazona shorter than prozona, posterior margin rounded or obtusely angular. Ovipositor valves with long hook like dents posterior ventral basivalvular sclerites with very small spinelets on its inner ventral margin. Male circus with subacute or truncate apex.
Material examined: 1♀, 13-V-2010, on paddy, Sarabh, Hazaribagh; 2♀, 24-V-2010, on paddy, Baramasia, Dumka.
Morphometry: (length in mm)
Female: Body 13.8, Tegmina 22.2, Hind femur 13.4, Pronotum 8.2
Field observations: Spotted feeding on the upper half portion of cereal crops usually paddy. Voraciously feeds on the leaf tips that are comparatively soft. Reputed pest of paddy.
Natural enemies: No natural enemies recorded.
Distribution: Punjab, Haryana, Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, Tamil nadu, West Bengal, Assam, Meghalaya, Manipur.

Oxya velox (Fabricius, 1787)

Diagnostic characters: Posterior ventral basivalvular sclerites of ovipositor without any well defined spines on its lower inner margin. Median pair of spines on posterior margin of subgenital plate set wider apart. Male circus conical with subacute apex.
Material examined: 1♀, 15-V-2010, on grasses, Ramgarh; 1♀, 24-VII-2010, on paddy saplings, Namkum, Ranchi; 1♀, 25-V-2010, on gourd, Amarpur, Godda.
Morphometry: (length in mm)
Female: Body 13.7, Tegmina 23.05, Hind femur 14.65, Pronotum 8.85
Field observations: Camouflages easily and mostly encountered in the saplings of paddy plant feeding on nearly all plant parts. Commonly spotted in paddy saplings rather than the crop.
Natural enemies: Red mite *Eutrombidium trigonum* also observed parasitizing this species.

Distribution: Bihar, Jharkhand, Uttar Pradesh, Arunachal Pradesh, Haryana.

Subfamily Hemiacridinae Dirsh,1956
Tribe Hieroglyphini

Hieroglyphus banian (Fabricius, 1798)

Diagnostic characters: Green including the antennae. Pronotum smooth with four sulci, narrowly lined with black, the first obsolete above, the second on the sides and the last two continuous. Tegmina subhyaline, densely reticulated and greenish at the base, with green nervures, wings as long as the tegmina, greenish hyaline. The three sub-terminal ventral segments with silky tufts of hair on the middle. Hind tibiae blue with black tipped spines. Antennae with the basal joint yellowish green, the rest dark green tipped with yellow.
Material examined: 1♀, 4-VII-2010, on sugarcane, Kobna, Chatra.
Morphometry: (length in mm)
Female: Body 49.0, Tegmina 33.1, Hind femur 23.9, Pronotum 9.4
Field observations: Feeds on entire leaf and jumps off large distances when disturbed because of strong wings.
Natural enemies: The authors found small reddish mites possibly *Trombidium* sp. on adults but doubted whether they caused any mortality. 15% of egg pods dug up near Bangalore was parasitized by *Scelio hieroglyphi* (Channa Basa, 1953). Many vertebrates including frogs, snakes, lizards, birds and mammals occasionally feed on *H. banian* but none is regarded as an important predator.
Distribution: West Bengal, Andhra Pradesh, Sikkim, Himachal Pradesh, Bihar, Jharkhand, Orissa, Rajasthan, Maharashtra, Tamil Nadu, Uttar Pradesh.

Hieroglyphus nigrorepletus (Bolivar, I., 1912)

Diagnostic characters: Body medium to large; antennae filiform, longer than head and pronotum together, fastigium of vertex rounded or trapezoidal, flat, with obtuse lateral carinulae, frons oblique, frontal ridge sulcate, dorsum of pronotum cylindrical, crossed by three deep transverse sulci, median carina weak, lateral carinae absent,Dorsum of pronotum with two broad black parallel bands connecting all sulci.
Material examined: 1♂,12-VII-2010, on paddy, Patia, Gumla.
Morphometry: (length in mm)
Male: Body 42.0, Tegmina 26.9, Hind femur 17.4, Pronotum 6.0
Field observations: Feeds on entire leaf and jumps off large distances when disturbed because of strong wings. Possesses comparatively low camouflage potential and can be spotted easily on the crops.
Natural enemies: Myna perched on the trees surrounding the plot preyed upon it very efficiently.
Distribution: Uttar Pradesh, Jharkhand, Punjab.

Tribe Spathosternini Krauss, 1877

Spathosternum prasiniferum (Krauss, 1877)

Diagnostic characters: Small, green, integument finely rugose almost smooth. Head conical, fastigium of vertex obtusely angular or parabolic. Filiform antennae, frontal ridge narrow and sulcated. Two broad blackish band or dark greenish band running behind the lower part of the eyes and below the lateral carinae of the pronotum which is banded above by a narrow pale yellow line and lateral carinae present, Prosternal process large, strongly, antero–posteriorly compressed, spatulated, inclined backwards.
Material examined: 2♀, 16-VII-2010, on moong, 1♀1♂, 1-VII-2010, on grasses, Ketar, Garhwa; 2♂, 2-VII-2010, on grasses, Shahpur, Daltonganj Palamu; 2♀3♂, 9-VII-2010, on grasses, Kisko, Lohardaga; 6♀, 15-VII-2010, on paddy, Malsara, Simdega; 1♀2♂,16-VII-2010, on grasses, Kutipi, West Singbhum; 4♀, 18-VII-2010, on grasses, Maluka, West Singhbhum; 2♀, 21-VII-2010, on grasses, Khunti; 3♀, 24-VII-2010, on grasses, Namkom,

Ranchi; 1♂3♀, 25-VII-2010, on grasses, Sonahata, Ranchi; 1♀, 13-V-2010, on grasses of brinjal field, Sarabh, Hazaribagh; 1♂, 14-V-2010, on grasses, Dhab, Koderma; 2♀, 15-V-2010, on grasses, Ramgarh; 12♀4♂, 16-V-2010, on grasses, Birni, Giridih; 8♀4♂, 19-V-2010, on grasses, Gomoh, Dhanbad; 2♀1♂, 21-V-2010, on grasses, Mohanpur, Jamtara; 4♀1♂, 22-V-2010, on grasses, Sarawan, Deogarh; 2♂, 24-V-2010, on grasses, Baramasia, Dumka; 8♀, 25-V-2010, on grasses, Amarpur, Godda; 2♂, 26-V-2010, on grasses, Maharajpur, Sahibganj; 2♀1♂, 28-V-2010, on grasses, Pakur; 12♀, 31-V-2010, on grasses, Bhalki, East Singbhum.
Morphometry: (length in mm)
Male: Body 17.5, Tegmina 12.8, Hind femur 8.65, Pronotum 2.85
Female: Body 19.2, Tegmina 14.5, Hind femur 9.65, Pronotum 3.0
Field observations: Predominantly present on roadside grasses, grassy patches along the periphery of crop field, even in wild vegetation but on the grass present here and there. One can comment that this genus is cosmopolitan in distribution.
Natural enemies: No natural enemies recorded.
Distribution: West Bengal, Andhra Pradesh, Arunachal Pradesh, Bihar, Jharkhand, Goa, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh.

Subfamily Teratodinae Brunner von Wattenwyl, 1893

Teratodes monticollis (Gray, 1832)

Diagnostic characters: Body of medium size; antennae filiform, much shorter than head and pronotum together, head broad, fastigium of vertex rounded, frontal ridge sulcate, much widened between antennae, pronotum much compressed, forming a high crest, covering the head anteriorly and half of abdomen posteriorly, never crossed by transverse sulci, lateral carinae absent, prosternal process short, straight, apex pointed, mesosternal interspace open, tegmina and wings developed, tegmino-alar stridulatory mechanism present, hind femur short, stout, tuberculate, lower basal lobe about as long as upper one, hind tibia without external apical spine.
Material examined: 1♀, 13-V-2010, on dry leaves, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Female: Body 28.15, Hind femur 12.15, Pronotum 17.15.
Remarks: Exceptionally high, raised collar like pronotum. The sample is light brown in colour.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Uttar Pradesh, Maharashtra, Gujarat, Tamil Nadu.

Subfamily Tropidopolinae Jacobson, 1902
Tribe Tristriini Mishchenko, 1945

Tristria pulvinata (Uvarov, 1921)

Diagnostic characters: Prosternal tubercle is strongly bent backward, Lower surface very broad, concave, trapezoidal with lateral margins raised and hind margin lying on mesosternum. Elytra not reaching the apex of abdomen, wings fully developed.
Material Examined: 1♀1♂, on grasses, 28-V-2010, Pakur; 1♀1♂, on grasses, 16-VII-2010, Kutipi, West Singbhum; 2♀6♂, on grasses, 4-VII-2010, Kobna, Chatra; 2♀, on sugarcane, 12-VII-2010, Patia, Gumla; 4♀, on grasses, 21-VII-2010, Khunti; 6♂, 2-VII-2010, on grasses, Shahpur, Daltonganj Palamu, 12♀, on grasses, 24-VII-2010, Namkom, Ranchi.
Morphometry: (length in mm)
Male: Body 29.75, Tegmina 18.55, Hind femur 15.25, Pronotum 4.35
Female: Body 48.0, Tegmina 25.1, Hind femur 19.8, Pronotum 5.5
Field observations: The species is graminivorous. It is a grassland species and is found in many species of grasses. At some of the sites the species was present in abundance.
Natural enemies: No natural enemies recorded.

Distribution: West Bengal, Andhra Pradesh, Assam, Bihar, Jharkhand, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh.

Subfamily Cyrtacanthacridinae Uvarov, 1923
Tribe Cyrtacanthacridini Kirby, 1902

Schistocerca gregaria gregaria (Forskal, 1775)

Diagnostic characters: Body of large size, integument finely punctuate, antennae filiform, shorter than head and pronotum together, fastigium of vertex trapezoidal, with shallow longitudinal depression, frontal ridge low, narrower than interocular distance, pronotum constricted, crossed by three transverse sulci, median carina low, sometimes indistinct in prozona, lateral carinae absent, metazona about as long as prozona, posterior margin rounded, prosternal process cylindrical, moderately bent towards mesosternum but not touching it, tegmina fully developed, apex obliquely rounded, veinlets in the apical part more or less perpendicular to the veins, hind femur with lower basal lobe shorter than upper, external apical spine of hind tibia absent.
Material Examined: 1♀1♂, 16-V-2010, on shrubs, Birni, Giridih.
Morphometry: (length in mm)
Male: Body 47.15, Tegmina 38.5, Hind femur 21.15, Pronotum 9.0
Female: Body 67.0, Tegmina 52.8, Hind femur 30.65, Pronotum 13.4
Field observations: Well reputed for gregarisation in superfamily Acridoidea and was sampled from shrubs bordering wheat crop. Jumps over long distances when disturbed and spotted easily owing to its size. Body being dull yellowish with brown patterns perfectly merges with the surroundings.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Uttar Pradesh, Jharkhand.

Chondacris rosea (De Geer, 1773)

Diagnostic characters: Body of large size, integument strongly granulose, antennae filiform, longer than head and pronotum together, fastigium of vertex trapezoidal, frontal ridge slightly narrowed at apex, Pronotum tectiform, crossed by three transverse sulci, median carina raised, lateral carinae absent, Prosternal process large, strongly bent towards mesosternum, nearly touching it, mesosternal interspace open, lobes rectangular. Supra anal plate weakly trilobite, cercus compressed, apex slightly attenuate and incurved, subgenital plate elongate, acutely conical, Epiphallus bridge undivided, ancorae absent, lophi broadly triangular. Ovipositor valves comparatively slender, with curved apices, ventral valve with angular lateral projection on outerside.
Material Examined: 1♀1♂, 25-V-2010, on pigeon pea, Amarpur, Godda.
Morphometry: (length in mm)
Male: Body 67.7, Tegmina 51.75, Hind femur 32.7, Pronotum 16.2
Female: Body 91.3, Tegmina 69.45, Hind femur 43.85, Pronotum 22.6
Field observations: Sampled from pigeon pea field, exceptionally large in size and flies over large distances. Found feeding on upper portions of the plant that is tough as compared to other parts, may be because of the presence of strong mandibles.
Natural enemies: No natural enemies recorded.
Distribution: Meghalaya, Bihar, Jharkhand.

Cyrtacanthacris tatarica tatarica (Linnaeus, 1758)

Diagnostic characters: Body large, integument slightly granulose and punctuate-dotted, antennae filiform, about as long as head and pronotum together, pronotum moderately tectiform and slightly constricted, crossed by three transverse sulci, median carina low, lateral carinae absent, prosternal process large, widened in middle and gradually narrowing towards subacute apex. Supra anal plate slightly trilobite, with angular apical lobes, cercus compressed, subconical, apex subacute. Subgenital plate elongate, acutely conical, Female subgenital plate with posterior margin having a conical projection medially.

Material Examined: 1♀1♂, 25-V-2010, on pigeon pea, Amarpur, Godda; 3♀, 29-V-2010, on wheat, Murkum, Saraikela; 2♀, 22-V-2010, on shrubs surrounding wheat field, Sarawan, Deogarh; 4♀1♂, 13-V-2010,on pigeon pea, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Male: Body 52.0, Tegmina 41.25, Hind femur 25.75, Pronotum 9.7
Female: Body 61.7, Tegmina 45.6, Hind femur 29.65, Pronotum 12.5
Field observations: The specimen was sampled from the stubbles of pigeon pea and wheat during morning hours and from the dense wild vegetation surrounding the same field during early evening hours. The observed activity was high during morning while below moderate activity was noticed during evening hours.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Jharkhand.

Subfamily Coptacridinae Brunner Von Wattenwyl, 1893

Epistaurus sinetyi (Bolivar, I., 1902)

Diagnostic characters: Body pale reddish, wings with borders hyaline, outer side of hind femur obliquely trifasciate, abdomen red, spotted dorsally,antennae slightly widened apically, as long as or longer than head and pronotum together, fastigium of vertex narrow, concave with sharp lateral carinulae, frons almost vertical, frontal ridge flat, narrowed at the fastigium.
Material Examined: 1♀1♂, 25-V-2010, on pigeon pea, Amarpur, Godda.
Morphometry: (length in mm)
Male: Body 14.4, Tegmina 10.9, Hind femur 7.54, Pronotum 2.87
Female: Body 17.80, Tegmina 12.49, Hind femur 8.15, Pronotum 4.17
Field observations: The specimen was sampled from the stubbles of pigeon pea and wheat during morning hours. The insects exhibited moderate activity and hovered around spiny bushes bodering the crop field.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Jharkhand

Eucoptacra praemorsa (Stal, 1861)

Diagnostic characters: Tegmina with few irregular oblique dark spots; pronotum with posterior transverse sulcus placed a little before the middle, ovipositor with dorsal valve much longer than lateral apodeme, preapical diverticulum of spermatheca with a long protuberance basally.
Material Examined: 1♀1♂, 25-V-2010, on pigeon pea
Morphometry: (length in mm)
Male: Body 21.21, Tegmina 16.03, Hind femur 10.26, Pronotum 3.61
Female: Body 27.41, Tegmina 22.03, Hind femur 13.65, Pronotum 4.64
Field observations: The specimen was sampled from the stubbles of pigeon pea and wheat during morning hours and from the dense wild vegetation surrounding the same field during early evening hours. The observed activity was high during morning while below moderate activity was noticed during evening hours.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Jharkhand.

Subfamily Eyprepocnemidinae Brunner Von Wattenwyl, 1893
Tribe Eyprepocnemidini Brunner Von Wattenwyl, 1893

Tylotropidius varicornis (Walker, 1870)

Diagnostic Characters: Body of medium size; antennae filiform, slightly shorter than head and pronotum together, fastigium of vertex almost parabolic, apex slightly truncate, frons oblique, frontal ridge flat, moderately wide, dorsum of pronotum slightly tectiform, median carina sharp, lateral carinae obtuse, excurved and slightly divergent backwards, metazona

shorter than prozona, posterior margin rounded or widely obtuse-angular, prosternal process antero-posteriorly compressed, with bifid apex, tegmina fully developed or shortened, hind femur very slender, elongate, hind tibia with dense spines, external apical spine absent, arolium of medium size.
Material examined: 2♂, 5-VII-2010, on sugarcane, Balu, Latehar.
Morphometry: (length in mm)
Female: Body 33.16, Tegmina 25.68, Hind femur 22.14, Pronotum 5.12
Field observations: It is a polyphagous species.
Natural enemies: No natural enemies are recorded.
Distribution: Bihar, Jharkhand, Uttar Pradesh, Assam, Manipur, Meghalaya, Kerala, Andhra Pradesh.

Cataloipus indicus (Uvarov, 1942)

Diagnostic Characters: Body of large size, antennae filiform, slightly widened in apical half, longer than head and pronotum together, fastigium of vertex parabolic, globular without concavity and median carinula, frons oblique, frontal ridge wide, flat, dorsum of pronotum weakly tectiform, crossed by three deep transverse sulci, prosternal process almost tongue shaped, externo-median area of hind femur along upper edge with a black stripe reaching middle of length, hind tibia light blue.
Material examined: 1♂, 5-VII-2010, on sugarcane, Balu, Latehar.
Morphometry: (length in mm)
Female: Body 30.30, Tegmina 18.55, Hind femur 22.44, Pronotum 5.56
Field observations: It is a polyphagous species.
Natural enemies: No natural enemies are recorded.
Distribution: Tamil Nadu, Uttar Pradesh, Kerala, Andhra Pradesh, Bihar, Jharkhand.

Eyprepocnemis alacris alacris (Serville, 1838)

Diagnostic characters: This is a typical species of the genus. It can easily be separated from other members of genus in having bluish grey hind tibia with two whitish signs at the base and reddish apex and tarsus, male cercus gradually narrowing towards apex incurved and down curved. Fastigium of vertex round, frontal ridge with characteristic dark brown markings on lateral carinae, prosternal process cylindrical and antero-posteriorly compressed. Elytra and wings fully developed, elytra with numerous brown spots, bluish grey hind tibiae.
Material examined: 2♀, 5-VII-2010, on sugarcane, Balu, Latehar.
Morphometry: (length in mm)
Female: Body 51.55, Tegmina 37.39, Hind femur 28.25, Pronotum 8.65
Field observations: It is a polyphagous species.
Natural enemies: No natural enemies are recorded.
Distribution: Tamil Nadu, Uttar Pradesh, Assam, Manipur, Meghalaya, Kerala, Andhra Pradesh, Bihar, Jharkhand.

Subfamily Catantopinae Brunner Von Wattenwyl, 1893

Stenocatantops splendens (Thunberg, 1815)

Diagnostic Characters: Frontal ridge sulcate; prosternal process laterally compressed Body of medium size, antennae filiform, longer than head and pronotum together, fastigium of vertex parabolic, slightly depressed with median and lateral carinulae, apex obtuse, frons oblique; frontal ridge flat and of medium width, dorsum of pronotum flattened or weakly tectiform, with sharp median and lateral carinae, lateral carinae straight, sometimes diverging backwards or weakly incurved, metazona slightly shorter than prozona, posterior margin broadly rounded, prosternal process subcylindrical or slightly antero-posteriorly compressed, slightly inclined backwards, tegmina fully developed or shortened, hind femur slender, hind tibia with sparse spines, external apical spine absent.

Material examined: 4♀, 18-VII-2010, Maluka, on maize, West Singhbhum; 2♀, 13-V-2010, on pigeon pea, Sarabh, Hazaribagh; 1♀, 21-V-2010, on pigeon pea, Mohanpur, Jamtara; 2♀,22-V-2010, on pigeon pea, Sarawan, Deogarh; 1♀1♂,24-V-2010, on pigeon pea Baramasia, Dumka; 4♀, 29-V-2010, on pigeon pea, Murkum, Saraikela; 6♀,12-VII-2010, on sugarcane, Patia, Gumla; 12♀, 25-VII-2010, on shrubs, Sonahata, Ranchi.
Morphometry: (length in mm)
Male: Body 29.9, Tegmina 24.1, Hind tibia 13.0, Pronotum 5.65
Female: Body 32.7, Tegmina 25.8, Hind tibia 14.8, Pronotum 7.01
Field observations: *C. pinguis innotablis* is widely distributed in pulse crop and is commonly found in shrubs and herbs (wild vegetations).
Natural enemies: In Thailand adults are affected by the fungus *Entomophthora grylli* Fres. (Roffey, 1965). Red mite *Eutrombidium trigonum* also observed parasitizing this species.
Distribution: Orissa, Goa, Uttar Pradesh, Tamil Nadu, Bihar, Jharkhand.

Tribe Catantopini Brunner von Wattenwyl, 1893

Diabolocantops pinguis (Stal, 1861)

Diagnostic characters: Reddish brown, rather stout. Frontal ridge finely punctured, slightly expanded between the antennae, lateral carinae, distinct, slightly divergent, antennae filiform, Pronotum closely punctured, obtusely angulated behind, carina slight, continuous, with the sulci well marked. Abdomen with a short narrow dorsal stripe behind. Hind femora stout, with two transverse black spots above, the first extending into the externo–median area, the lower outer area blackish brown and the upper carinae slightly serrated, hind tibiae and tarsi red, the former with black tipped spines. Cerci of the male slightly expanded at the tips. The species is easily identified by the cercus which is upcurved, more broadened apex and projecting, upper apical angle is more projecting. The species is also easily identified by the character of the hind femur.
Material examined: 4♀, 18-VII-2010, Maluka, on maize, West Singhbhum; 2♀, 13-V-2010, on pigeon pea, Sarabh, Hazaribagh; 1♀, 21-V-2010, on pigeon pea, Mohanpur, Jamtara; 2♀,22-V-2010, on pigeon pea, Sarawan, Deogarh; 1♀1♂,24-V-2010, on pigeon pea Baramasia, Dumka; 4♀, 29-V-2010, on pigeon pea, Murkum, Saraikela; 6♀,12-VII-2010, on sugarcane, Patia, Gumla; 12♀, 25-VII-2010, on shrubs, Sonahata, Ranchi.
Morphometry: (length in mm)
Male: Body 29.9, Tegmina 24.1, Hind tibia 13.0, Pronotum 5.65
Female: Body 32.7, Tegmina 25.8, Hind tibia 14.8, Pronotum 7.01
Field observations: *C. pinguis innotablis* is widely distributed in pulse crop and is commonly found in shrubs and herbs (wild vegetations).
Natural enemies: In Thailand adults are affected by the fungus *Entomophthora grylli* Fres. (Roffey, 1965). Red mite *Eutrombidium trigonum* also observed parasitizing this species.
Distribution: Orissa, Goa, Uttar Pradesh, Tamil Nadu, Bihar, Jharkhand.

Xenocatantops karnyi (Kirby, 1910)

Diagnosis: Body of medium size, antennae slightly longer or shorter than head and pronotum together, fastigium of vertex with slightly raised carinulae between eyes, median carina never strongly raised, frontal ridge never projecting between antennae, tegmina reaching beyond apex of abdomen, tegmina and wings fully developed, pronotum at least slightly constricted in middle, prosternal process conical.
Material examined: 1♂,24-V-2010, on pigeon pea Baramasia, Dumka; 1♀, 21-V-2010, on pigeon pea, Mohanpur, Jamtara; 2♀, 13-V-2010, on pigeon pea, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Female: Body 31.45, Tegmina 25.65, Hind femur 14.1, Pronotum 5.9
Male: Body 29.6, Tegmina 23.25, Hind femur 11.78, Pronotum 4.2
Field observations: Somewhat less active as compared to *Catantops pinguis innotabilis*. May be spotted in pigeon pea and ripe sugarcane crop easily.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Jharkhand.

Subfamily Acridinae MacLeay, 1821

Orthochtha indica (Uvarov, 1942)

Diagnostic characters: Body of median size, antennae ensiform, much longer than head and pronotum together; head conical, never elongate, fastigium of vertex depressed, with lateral carinulae, fastigial foveolae absent, frontal ridge sulcate, pronotum elongate, constricted in middle, median carina crossed by posterior transverse sulcus only.
Material examined: 1♀, 15-VII-2010, on paddy, Malsara, Simdega; 1♀, 25-VII-2010, on grasses, Sonahata, Ranchi.
Morphometry: (length in mm)
Female: Body 29.90, Tegmina 21.40, Hind femur 15.31, Pronotum 3.79
Field observations: Female member is much active as compared to males.
Natural enemies: No natural enemies have been recorded.
Distribution: Jharkhand, Punjab.

Tribe Acridini MacLeay, 1821

Acrida exaltata (Walker, 1859)

Diagnostic characters: Head conically ascending. Fastigium broad, laminate and truncate at apex.Transverse sulcus of pronotum present about the middle of pronotal disc. Male subgenital plate comparatively long. Tegmina a little produced beyond the hind knee and wings slightly shorter than tegmina.
Materials examined: 4♀, 1-VII-2010, on paddy, Ketar, Garhwa; 2♂, 2-VII-2010, on grasses, Shahpur, Daltonganj Palamu, 1♀4♂,4-VII-2010, on grasses, Kobna, Chatra; 2♀6♂, 5-VII-2010, on paddy, Balu, Latehar; 1♀2♂, 9-VII-2010, on paddy, Kisko, Lohardaga; 6♀,12-VII-2010, on paddy, Patia, Gumla; 2♀,15-VII-2010, on grasses, Malsara, Simdega; 3♀,24-VII-2010, on grasses, Namkom, Ranchi; 2♂, 13-V-2010, on lentil, Sarabh, Hazaribagh; 1♀,15-V-2010, on grasses, Ramgarh; 2♂, 25-V-2010, on grasses, Amarpur, Godda; 6♀, 26-V-2010, on grasses present in gourd field, Maharajpur, Sahibganj; 4♀1♂, 31-V-2010, on grasses, Bhalki, East Singbhum.
Morphometry: (length in mm)
Male: Body 52.8, Tegmina 44.8, Hind femur 31.4, Pronotum 6.8
Female: Body 48.25, Tegmina 30.0, Hind femur 24.55, Pronotum 8.2
Field observations: It is abundantly found on grasses and paddy fields. Females very sluggish and can be sampled with bare hands while male members show moderate to good activity. This species indicates its presence through stridulatory sounds that are very prominent and can be heard clearly. The females are much larger in size than males.
Natural enemies: This species was found to be parasitized by *Eutrombidium trigonum*. Very common and known from many localities in India
Distribution: Jharkhand, Punjab, Haryana, Uttarakhand, Madhya Pradesh, Sikkim, Kashmir, Assam, Uttar Pradesh, Bihar.

Acrida gigantea (Herbst, 1786)

Diagnostic characters: Head conically ascending. Fastigium broad, laminate and truncate at apex. Transverse sulcus of pronotum present about the middle of pronotal disc. Male subgenital plate comparatively long. Tegmina a little produced beyond the hind knee and wings slightly shorter than tegmina. Lateral carinae with black inner margins.
Material examined: 1♀, 1-VII-2010, on paddy, Ketar, Garhwa; 2♀, 5-VII-2010, on paddy, Balu, Latehar; 2♂, 9-VII-2010, on paddy, Kisko, Lohardaga; 6♀, 26-V-2010, on grasses present in gourd field, Maharajpur, Sahibganj; 4♀1♂, 31-V-2010, on grasses, Bhalki, East Singbhum.
Morphometry: (length in mm)
Male: Body 31.45, Tegmina 22.0, Hind femur 17.3, Pronotum 4.3
Female: Body 50.1, Tegmina 45.65, Hind femur 31.4, Pronotum 9.65

Field observations: Usually found in paddy and grasses and produces very striking stridulatory sound. Rest observations same as that of *Acrida exaltata*. Its camouflage potential is low as compared to *Acrida exaltata* and colour changes according to the surroundings.
Natural enemies: This species was found to be parasitized by *Eutrombidium trigonum*.
Distribution: Bihar, Uttar Pradesh, Punjab, Haryana, Himachal Pradesh, Rajasthan, Jharkhand, Uttarakhand.

Tribe Phlaeobini Brunner von Wattenwyl, 1893

Phlaeoba infumata (Brunner von Wattenwyl, 1893)

Diagnostic characters: Antennae ensiform. Lateral carinae of pronotum straight, disc of pronotum rugose. Wings fusco-hyaline, infumated towards the apex. Subgenital plate of male acute.
Material examined: 1♀, 24-V-2010, on dead vegetation, Baramasia, Dumka; 4♀, 24-VII-2010, on dead vegetation, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 32.1, Tegmina 23.5, Hind femur 16.4, Pronotum 5.0
Field observations: This species occur in sugarcane fields and widely encountered in dead and decaying vegetations. The samples are usually uniformly brown and very active. Sometimes can also be located in rice crop.
Natural enemies: No natural enemies have been recorded.
Distribution: Arunachal Pradesh, Assam, Bihar, Jharkhand, Haryana, Himachal Pradesh, Manipur, Tamil Nadu, Uttar Pradesh, West Bengal.

Phlaeoba panteli (Bolivar. I., 1902)

Diagnostic characters: Body slender and of moderate size, antennae ensiform, median carinula present, frons oblique, frontal ridge sulcate, median carina excised by anterior and posterior sulcus each, hind wings hyaline, lateral carinae linear.
Material examined: 2♀, 15-VII-2010, on dead vegetation, Malsara, Simdega; 1♀, 25-VII-2010, on grasses, Sonahata, Ranchi.
Morphometry: (length in mm)
Female: Body 29.6, Tegmina 24.0, Hind femur 16.5, Pronotum 5.6
Field observations: Usually spotted on dead and decaying plant material lying on ground. Differs from *Phlaeoba infumata* in having striped patterns on upper half of the body usually along lateral sides of head and pronotum.
Natural enemies: No natural enemies have been recorded.
Distribution: Uttar Pradesh, Jharkhand, Punjab.

Subfamily Oedipodinae Walker, 1871

Morphacris fasciata (Thunberg, 1815)

Diagnostic characters: Body of medium size; antennae filiform, longer than head and pronotum together, fastigium of vertex angular, strongly concave, with high lateral carinulae, frontal ridge moderately narrow, sulcate, dorsum of pronotum tectiform, with sharp parallel longitudinal ridges, median carina raised, crossed by posterior transverse sulcus only, lateral carinae absent, dorsum of pronotum with numerous longitudinal parallel ridges
Material examined: 1♀,16-VII-2010, on paddy, Kutipi, West Singbhum
Morphometry: (length in mm)
Female: Body 29.58, Tegmina 22.81, Hind femur 13.51, Pronotum 5.75
Field observations: Pronotum is unique with many parallel ridges, body is comparatively soft and the insect usually feeds on the distal or rather apical part of the leaves.
Natural enemies: No natural enemies observed.
Distribution: Punjab, Haryana, Rajasthan, Bihar, Jharkhand, Uttarakhand, Himachal.

Chloebora grossa (Saussure, 1884)

Diagnostic characters: Large sized insect with nearly round eyes, Median carina well developed but lateral carinae show slight presence in metazona, tegmina membranous at apical one third part, hindwing membranous and bears a complete fascia midway, hind tibia is markedly shorter than femur.
Material examined: 1♂, 13-V-2010, on grasses, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Male: Body 35.6, Tegmina 27.45, Hind femur 14.2, Pronotum 6.55
Field observations: It shows its presence in forest areas in and around bushes and exhibits good camouflage with the surrounding rocks.
Natural enemies: No natural enemies have been recorded.
Distribution: Bihar, Jharkhand, Tamil Nadu.

Chloebora marshalli (Henry, G. M., 1933)

Diagnostic characters: Large sized insect with nearly round eyes, Median carina well developed but lateral carinae show slight presence in metazona, Pronotum indistinctly tuberculate, wings in female, without fascia if present very diffuse; hind tibia carmine red.
Material examined: 1♀, 13-V-2010, on grasses, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Female: Body 50.13, Tegmina 37.98, Hind femur 22.55, Pronotum 8.46
Field observations: Jumps to great distances when sensed any disturbance and had colour pattern that matched perfectly with the surrounding rocks so, is very tough to notice unless shows some eye catching movement.
Natural enemies: No natural enemies have been recorded.
Distribution: Uttar Pradesh, Jharkhand.

Tribe Trilophidiini Shumakov, 1963

Trilophidia annulata (Thunberg, 1815)

Diagnostic characters: Small insect, antennae filiform with black yellow bands, eyes somewhat bulging, pronotum saddle shaped, median carina forming tooth like projections in prozona, apex of tegmina truncated, hind femur with a yellow band just above the basal lobe.
Material examined: 2♀1♂,16-VII-2010, on paddy, Kutipi, West Singbhum; 1♀, 24-VII-2010, on grasses, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 22.8, Tegmina 18.6, Hind femur 9.8, Pronotum 3.85
Male: Body 19.48, Tegmina 16.4, Hind femur 7.6, Pronotum 2.25
Field observations: Commonly found in paddy and ploughed wheat fields the body is broader in the upper half. Colour pattern differs considerably with changing surroundings and the ones that were light brown to brownish yellow were covered with dense fine hairs. These exhibit moderate activity throughout the day.
Natural enemies: Red mite *Eutrombidium trigonum* was observed parasitizing this species.
Distribution: Punjab, Haryana, Rajasthan, Bihar, Jharkhand, Uttarakhand, Himachal, Arunachal Pradesh, Tripura, Meghalaya.

Trilophidia repleta (Walker, F., 1870)

Diagnostic characters: Body of medium size; inner side of hind femur with two pale bands; basal disc of wings yellow; hind tibia with two broad ochraceous rings.
Material examined: 1♀, 13-V-2010, on grasses, Sarabh, Hazaribagh; 1♀,22-V-2010, on grasses, Sarawan, Deogarh.
Morphometry: (length in mm)
Female: Body 21.6, Tegmina 17.2, Hind femur 9.0, Pronotum 3.2

Field observations: Usually encountered in brownish colour but rare in the concerned area when compared to *Trilophidia annulata*.
Natural enemies: Red mite *Eutrombidium trigonum* was observed parasitizing this species.
Distribution: Punjab, Bihar, Jharkhand, Meghalaya.

Tribe Epacromiini Brunner Von Wattenwyl, 1893

Aiolopus simulatrix (Walker, 1870)

Diagnostic characters: It is popularly known as Sudan Plague locust and is a serious pest of grain and many other crops. The species is variable in general coloration, size, relative length of tegmina and width of hind femur. It can easily be distinguished by its broad hind femur which is longer than hind tibia and by the form of frontal ridge and pronotum.
Material examined: 4♀2♂, 1-VII-2010, on paddy, Ketar, Garhwa; 2♀, 2-VII-2010,on paddy, Shahpur, Daltonganj Palamu; 2♂, 4-VII-2010, on paddy, Kobna, Chatra; 6♀4♂, on paddy, 7-VII-2010, Dhangtartola, Latehar; 1♀, 25-VII-2010, on paddy, Sonahata, Ranchi; 3♂, 13-V-2010, on paddy, Sarabh, Hazaribagh; 2♀, 16-V-2010, on brinjal, Birni, Giridih; 2♂, 25-V-2010, on paddy, Amarpur, Godda.
Mophometry: (length in mm)
Male: Body 11.2–11.7, Pronotum 6.4–7.1, Tegmina 17.3–17.7 Hind femur 7.3–7.8
Female: Body 13.3–13.9, Pronotum 7.1–8.3, Tegmina –22.3–23.1, Hind Femur 11.3 – 11.7
Field observations: A common pest of agricultural crops. Observed in paddy and brinjal, as well as grasslands.
Natural enemies: No natural enemies recorded.
Distribution: Andaman & Nikobar Islands, Bihar, Jharkhand, Delhi, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Punjab, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal.

Aiolopus thalassinus thalassinus (Fabricius, 1781)

Diagnostic characters: Medium sized insect, tegmina and wings fully developed, head acutely conical, antennae filiform, as long as or longer than head and pronotum together, fastigium of vertex elongate-angular, slightly concave, with well developed lateral carinulae, frons oblique; frontal ridge flat, pronotum slightly tectiform and slightly constricted in prozona, median carina weak, medial area of tegmen with intercalary vein well developed and finely serrated, hind femur slender, hind tibia with inner pair of spines longer than external one, external apical spine absent, arolium of small size, Frontal ridge of uniform width with nearly parallel margins, foveolae shorter, hind tibia coloured as in *tumulus* but with a dark ring before the middle and without the bluish median part.
Material examined: 4♀, 5-VII-2010, on paddy, Balu, Latehar; 2♂, 7-VII-2010, on paddy, Dhangtartola, Latehar; 1♂, 12-VII-2010, on paddy, Patia, Gumla.
Morphometry: (length in mm)
Male: Body 25.8, Tegmina 20.05, Hind femur 11.85, Pronotum 3.75
Female: Body 33.1, Tegmina 26.75, Hind femur 16.2, Pronotum 5.15
Field observations: Commonly found in vegetable fields of brinjal, lady finger, tomato and also in paddy fields.
Natural enemies: Red mite identified as *Eutrombidium trigonum* was found to infect the insect.
Distribution: West Bengal, Bihar, Uttar Pradesh, Uttarakhand, Jharkhand, Haryana, Punjab.

Aiolopus thalassinus tamulus (Fabricius, 1798)

Diagnostic characters: Very commonly found in paddy fields and coloured in combination of black and green. Frontal ridge gradually tapered towards the fastigium, foveolae longer, hind tibia in the basal third with a straw-coloured band, in the median part usually bluish, the apical part reddish.

Material examined: 1♀, 4-VII-2010, on paddy, Kobna, Chatra; 1♂, 9-VII-2010, on grasses, Kisko, Lohardaga; 3♀, 15-VII-2010, on paddy, Malsara, Simdega; 4♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Male: 24.4, Tegmina 18.2, Hind femur 8.2, Pronotum 3.4
Female: 33.5, Tegmina 26.9, Hind femur 15.2, Pronotum 4.75
Field observations: Many of the paddy fields were heavily infested but may also be encountered in wheat, maize, and grassland areas surrounding the fields.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Uttar Pradesh, Uttarakhand, Jharkhand, Haryana, West Bengal.

Tribe Acrotylini Shumakov, 1963

Acrotylus insubricus insubricus (Scopoli, 1786)

Diagnostic characters: Body of medium size, pronotum saddle shaped and shorter than width, eyes somewhat bulging, tegmina with infuscated spots beyond middle, hind wings with lunate incomplete fascia.
Material examined: 4♀, 15-VII-2010, on paddy, Malsara, Simdega; 2♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 26.0, Tegmina 20.35, Hind femur 7.7. Pronotum 2.8
Field observations: It has been found damaging rice crop and the bulging pattern of eyes can be noticed with much ease. The observed activity was moderate throughout the day.
Natural enemies: No natural enemies have been recorded.
Distribution: Andhra Pradesh, Bihar, Goa, Maharashtra, Rajasthan, Tamil Nadu, Uttar Pradesh, Jharkhand.

Tribe Locustini Kirby, 1825

Oedaleus abruptus (Thunberg, 1815)

Diagnostic characters: Body small to medium size, antennae filiform, longer than head and pronotum together, fastigium of vertex angular, flat or slightly concave, with obtuse lateral carinulae, hind wings fascia broadly interrupted anterior termination of hind wing fascia flattened, reaching or just surpassing second anal vein, pronotum with posterior transverse sulcus placed much before the middle.
Material examined: 4♀1♂, 5-VII-2010, on grasses, Balu, Latehar; 8♀, 15-VII-2010, on grasses, Malsara, Simdega; 3♀, 15-V-2010, on grasses, Ramgarh; 3♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Male: Body 20.45, Tegmina 15.7, Hind femur 10.2, Pronotum 3.4
Female: Body 25.8, Tegmina 19.6, Hind femur 13.2, Pronotum 4.25
Field observations: commonly encountered in areas close to some water source or if the soil showed good signs of moisture. Thriving population was observed on grasses in such plots and these were even present in shadowed areas of orchards or tree plantations.
Natural enemies: No natural enemies recorded.
Distribution: Andhra Pradesh, Jharkhand, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Meghalaya, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal.

Locusta migratoria migratoria (Linnaeus, 1758)

Diagnostic characters: It occurs in green and brown form in the solitary phase. The species can easily be identified from other Locusts by the absence of prosternal process, the slight yellow tinting of the wings and the black anal veins are distinctive features of the species.
Material Examined: 4♀2♂, 4-VII-2010, on maize, Kobna, Chatra
Morphometry: (length in mm)

Male: Body 44.85, Tegmina 37.65, Hind femur 20.15, Pronotum 7.77
Female: Body 60.4, Tegmina 48.8, Hind femur 25.6, Pronotum 10.0
Field observations: Though quite strict graminivorous and capable of causing considerable damage to grain crops, very many plants belonging to different families have been recorded as food.
Natural enemies: It is sometimes heavily infested with mites.
Distribution: Assam, Bengal, Kashmir, Jharkhand, Bihar, Uttar Pradesh, Himachal Pradesh, West Bengal, Maharashtra.

Gastrimargus africanus africanus (Saussure, 1888)

Diagnostic characters: Body medium to large size, antennae filiform, as long as or shorter than head and pronotum together, fastigium of vertex slightly concave with weak median and well developed lateral carinulae, frontal ridge flat, pronotum tectiform, constricted in prozona, anteriorly projecting above vertex, median carina almost crest-shaped, crossed by posterior transverse sulcus only, lateral carinae absent.
Material examined: 1♂, 4-VII-2010, on wild vegetation, Kobna, Chatra.
Morphometry: (length in mm)
Male: Body 32.92, Pronotum 5.81, Tegmina 27.47, Hind Femur 16.75.
Field observations: This species is very active and jumps great distances. Mostly female members are encountered.
Natural enemies: No natural enemies have been recorded.
Distribution: West Bengal, Assam, Jharkhand, Himachal Pradesh, Madhya Pradesh, Maharashtra, Sikkim, Karnataka and Uttar Pradesh.

Tribe Oedipodini Walker, 1871

Oedipoda miniata miniata (Pallas, 1771)

Diagnostic characters: Wings mostly rugose so the dark band often pale brown, strongly bowed reaching upto IXth or Xth section of anal fan and not touching hind margin (Harz, 1975). Integument often less rugose and less callous. Facial carinula mostly without projections. Dark fasciae of wings extending towards the base by one longitudinal band into the anterior field.
Material examined: 4♀, 25-VII-2010, on paddy, Sonahata, Ranchi; 5♀, 15-V-2010, on wheat stubbles, Ramgarh; 6♀, 22-V-2010, on wheat stubbles, Sarawan, Deogarh; 3♀, 24-V-2010, on wheat stubbles, Baramasia, Dumka; 4♀2♂, 29-V-2010, on wheat stubbles, Murkum, Saraikela.
Morphometry: (length in mm)
Female: Body 45.55, Tegmina, 36.0, Hind femur, 20.7, Pronotum 9.6
Male: Body 42.5, Tegmina 33.65, Hind femur 18.8, Pronotum 8.2
Field observations: This species was abundantly present in harvested wheat fields with stubbles, hiding in them. Exhibited good flight response.
Natural enemies: No natural enemies recorded.
Distribution: Uttar Pradesh, Bihar, Punjab, Himachal pradesh, Rajasthan, Jharkhand.

Subfamily Calliptaminae Tinkham, 1940

Acorypha glaucopsis (Walker, F., 1870)

Diagnostic characters: Body of medium size; integument finely dotted, antennae filiform, shorter than head and pronotum together, fastigium of vertex moderately long, with longitudinal concavity and strong lateral carinulae, frons vertical, frontal ridge flat, Lower inner spur of hind tibia with the apex simply recurved bearing sparse hairs, Pronotum with metazona slightly longer than prozona; prosternal process slightly transverse.
Material Examined: 1♀1♂,12-VII-2010, on lentil, Patia, Gumla; 2♀1♂,21-VII-2010, on wild vegetations, Khunti; 1♀, 16-V-2010, on shrubs, Birni, Giridih; 4♀, 22-V-2010, on shrubs, Sarawan, Deogarh, 1♂, 2-VII-2010, on grasses, Shahpur, Daltonganj Palamu.tristria

Morphometry: (length in mm)
Male: Body 16.0, Tegmina 12.5, Hind femur 9.35, Pronotum 3.3
Female: Body 24.0, Tegmina 20.7, Hind femur 14.4, Pronotum 5.65
Field observations: Very active and has exceptionally robust hind femur.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Rajasthan, Tamil Nadu, Jharkhand.

Acorypha insignis (Walker, F., 1870)

Diagnostic characters: Body of medium size; integument finely dotted, antennae filiform, shorter than head and pronotum together, lower inner spur of hind tibia with the apex prominent beyond the base of the claw, in the shape of obtuse tubercle bearing dense and long hairs, pronotum with metazoan much longer than prozona, prosternal process strongly cylindrical.
Material examined: 1♂, 26-V-2010, on shrubs, Maharajpur, Sahibganj.
Morphometry: (length in mm)
Male: Body 17.76, Tegmina 13.17, Hind femur 10.20, Pronotum 3.31
Field observations: Mostly present in wild greens that have comparatively low human interference. Exhibits high activity and jumps over short distances.
Natural enemies: No natural enemies recorded.
Distribution: Jharkhand, Bihar, Haryana.

Subfamily Gomphocerinae Fieber, 1853
Tribe Gomphocerini Fieber, 1853

Leva indica (Bolivar, I., 1902)

Diagnostic characters: Body of small size, antennae filiform, longer than head and pronotum together, head subconical, shorter than pronotum, vertex without lateral carinulae, frontal ridge sulcate, hind tibia with inner spur of inner side about as long as external on, fastigium of vertex elongate-angular, concave, without median carinula, shorter than eye length, fastigial foveolae not visible from above; frontal ridge shallowly sulcate, pronotum subcylindrical, slightly constricted.
Material examined: 1♀, 5-VII-2010, on grasses, Balu, Latehar.
Morphometry: (length in mm)
Female: Body 16.84, Tegmina 12.68, Hind femur 8.73, Pronotum 1.83
Field observations: It is a large species of Gomphocerinae other than those already recorded. It may well become minor pests at times.
Natural enemies: No natural enemies have been recorded.
Distribution: Jammu & Kashmir, Uttar Pradesh, Punjab, Jharkhand.

Chorthippus indus (Uvarov, 1942)

Diagnostic characters: Colour variable, green, testacious or brown. Antennae sub depressed, longer than the head and pronotum together. Pronotum with transverse sulcus placed about the middle, the head not carinated above, the pronotum strongly tricarinate, the median carina slightly raised, the lateral carinae slightly incurved before the middle and then diverging. Tegmina longer than abdomen in a male usually shorter in the female, sometimes with longitudinal yellow scapular lines. Wings hyaline with brown nervures. Pectus and front leg pilose, legs not spotted, hind tibia with twelve small spines, decreasing in size towards the base. Subgenital plate in the male is curved, pubescent, valves of the ovipositor unarmed.
Material examined: 1♂, 5-VII-2010, on grasses, Balu, Latehar.
Morphometry: (length in mm)
Male: Body 17.15, Tegmina11.7, Hind femur 10.6, Pronotum 3.7
Field observations: It is a large species of Gomphocerinae other than those already recorded. It may well become minor pests at times.
Natural enemies: No natural enemies have been recorded.

Distribution: Jammu & Kashmir, Uttar Pradesh, Punjab, Jharkhand.

Stenohippus mundus (Walker, F., 1871)

Diagnostic characters: Body of small size, antennae filiform, longer than head and pronotum together, head subconical, shorter than pronotum, vertex without lateral carinulae, frontal ridge between antennae flat, tegmina much longer than abdomen.
Material examined: 1♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 18.53, Tegmina 12.87, Hind femur 9.14, Pronotum 2.91.
Remarks: It is very small species. Abundantly found on grasses and paddy crops. The samples were very active and rested usually on ground or lower portions of the crop but not noticed feeding on paddy.
Natural enemies: No natural enemies are recorded.
Distribution: West Bengal, Delhi, Tamil Nadu, Tripura, Uttar Pradesh.

Tribe Dociostaurini

Dociostaurus apicalis (Walker, F., 1871)

Diagnostic characters: Body of small size, antennae filiform, longer than head and pronotum together, head subconical, shorter than pronotum, vertex without lateral carinulae, frontal ridge between antennae flat, tegmina shorter than abdomen.
Material examined: 1♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 16.4, Tegmina 10.95, Hind femur 7.8, Pronotum 2.5.
Remarks: It is very small species. Abundantly found on grasses and paddy crops. The samples were very active and rested usually on ground or lower portions of the crop but not noticed feeding on paddy.
Natural enemies: No natural enemies are recorded.
Distribution: West Bengal, Delhi, Uttar Pradesh, Jharkhand.

Tribe Arcypterini Shumakov, 1963

Aulacobothrus luteipes luteipes (Walker, F., 1871)

Diagnostic characters: Frontal ridge convex; fastigial foveolae elongate rhomboidal, dorsum of head and pronotum with a pale stripe extending from anterior margin of fastigium to posterior margin of pronotum with posterior transverse sulcus placed in the middle, frontal ridge sulcate, tegmina without dark spots on radial area .
Material examined: 1♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 12.8, Pronotum 6.8, Tegmina 17.2, Hind Femur 12.4.
Field observations: This species can be recognized in field because of pale yellow stripe present dorsally but much less active as compared to *Leva* sp.
Natural enemies: No natural enemies have been recorded.
Distribution: West Bengal, Assam, Bihar, Jharkhand, Himachal Pradesh, Madhya Pradesh, Maharashtra, Sikkim, Karnataka and Uttar Pradesh.

RESULTS AND DISCUSSION

Survey of the state yielded many interesting results as per field observations. The behavior or rather response of the concerned group to habitat factors, when observed in detail, lead to interesting conclusions. Many of them are summarized as under:

- Grasshoppers were observed to rest on upper half or on top portion of vegetation in morning hours but shifted to lower portions by noon. In the morning hours the inolation (Sunlight) has low intensity and the grasshoppers being cold blooded warm up their bodies and this explains the behavior.
- The disturbed insect changes its body orientation away from the approaching person and jumps off, may be because it senses the currents of movement and tries to move away from the approaching danger.
- In early morning hours the insects were very lethargic while in late afternoons they exhibited mild activity. The same insects showed maximum activity during noon and afternoon, roughly from 1100 hrs to 1500 hrs. This is so because the insect is cold blooded and thereby its activity frequency fluctuates according to sunlight intensity and duration.
- Many a times the behavioral response exhibited by the grasshoppers indicated some thought oriented responses e.g. jumping in thorny bushes nearby upon disturbance.
- Leguminous crops showed maximum infestation of members of subfamily Catantopinae and to some extent by Oedipodinae. The members of the two groups are blessed with strong mandibles and this explains the activity.
- Paddy was infested mostly by *Aiolopus* sp. followed by *Oxya* sp.
- Wheat showed very minor infestation, the samples were mostly collected from the tracts around the field and when these tracts were walked over, the grasshoppers jumped into the sown area. Leaves of paddy when compared to wheat are more subtle may be because of more water content and so it is commonly infested by acridoids.
- In case of vegetables, lady finger tops the list while gourd showed some signs of infestation. Other vegetables in the area were nearly free of Acridoid pest infestation.
- Mites such as *Eutrombidium trigonum* were found adhering to the body parts such as legs, wings and lower abdomen in many of the samples.
- Myna and sparrow were seen feeding efficiently on the grasshoppers that had low camouflage potential i.e. those species that had some color other than the surrounding vegetation were easily spotted.
- Frogs, toads and praying mantis were also spotted feeding on the grasshoppers.
- The area surrounding any plot that had chilies, onion or garlic plantations were very much free from acridoid infestation. These crops act as biocontrol agents and help to repel insects because of their pungent odour.
- The plots that were treated with oil based pesticides were nearly free form grasshopper infestation while those that were subjected to dust or water based formulations exhibited fair presence of the pest. Oil based formulations adhere to the parts on which they are applied while dust or water based formulations are not able to withstand climatic disturbances and fall off to the ground.
- Absence or very rare occurance was observed in the Industrial cities like Bokaro Steel City, Dhanbad etc. The state of Jharkhand (India) is very rich in mineral and coal deposits and therefore supports Iron and Steel industry, Chemical industry, Coal based industries and these all liberate

many noxious substances in mediums such as air, water and soil. Many of the air pollutants ultimately fall off to the ground and this explains the absence of these insects from the concerned area.

- In the morning hours, patches of crop field that had been harvested had fairly good population of grasshoppers as compared to the plots that had standing crops. The harvested area is more appropriate for the insects to warm up their bodies in sun as compared to the plots with standing crops and hence the insects migrate to the harvested plots in the morning hours.

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Table I. Showing host and habitat of Indian species represented in Jharkhand region.

Species	Host and Habitat
1. *Oxya japonica japonica* (Thunberg, 1815)	Underlying grasses in vegetable field and paddy
2. *Oxya hyla hyla* (Serville, 1831)	Present along the upper half of Paddy plantations but as per observation it is not a voracious feeder.
3. *Oxya velox* (Fabricius, 1787)	Can be easily encountered in grasses surrounding crop fields, paddy saplings and gourd.
4. *Hieroglyphus banian* (Fabricius, 1798)	Sugarcane
5. *Hieroglyphus nigrorepletus* (Bolivar, 1912)	Sampled from paddy crop and can easily be traced in the crop owing to its black stripes along the pronotum.
6. *Spathosternum prasiniferum prasiniferum* (Walker, 1871)	This species is very much cosmopolitan in terms of distribution and may be present in a wide variety of crops and vegetations like lentil, grasses, paddy, underlying grasses of brinjal field.
7. *Teratodes monticollis* (Gray, 1832)	The species was sampled from dead leaves underlying dense vegetation.
8. *Eyprepocnemis alacris alacris* (Serville, 1838)	Present in cultivated grounds and. Chiefly sampled from sugarcane crop resting on the leaves in the morning hours. Its strong mandibles aid its feeding on such rough leaves of concerned crop.
9. *Cataloipus indicus* (Uvarov, 1942)	Jumps very effectively may be because of presence of elongated hind legs. The movement was very fast and restricted over the top potions of the plant. Sampled from sugarcane.
10. *Tylotropidius varicornis* (Walker, 1870)	Same as above.
11. *Eucoptacra praemorsa* (Stal, 1861)	The insect exhibits moderate activity and the population was concentrated in the shadowed portion of crop field of pigeon pea that was surrounded by mango plantations.
12. *Epistaurus sinetyi* (Bolivar, 1902)	Same as above.
13. *Acorypha glaucopsis* (Walker, F., 1870)	This is very active genus and very common in rocky areas but was also sampled from lentil. Its thick hind femur assist its powerful jumps over long distances. The thrust was sometimes felt on fingers during sampling and surely it can jump off if loosely held.
14. *Acorypha insignis* (Walker, F., 1870)	Same as above but was only sampled from wild vegetation Sampled from shrubs.
15. *Diabolocantops pinguis* (Stal, 1861)	This species has also been gifted with strong hind femur and very strong mandibles. Usually seen feeding on leguminous crops and jumps off great distances. Its body colour pattern perfectly matches with the surrounding vegetation and may only be spotted once the vegetation is disturbed. Sampled from maize, pigeon pea, sugarcane, shrubs.

16. *Xenocatantops karnyi* (Kirby, 1910)	This species is not so active as above one and also the hind femur is moderately thick. Was sampled from pigeon pea.
17. *Stenocatantops splendens* (Thunberg, 1815)	Same as *Diabolocatantops pinguis*.
18. *Schistocerca gregaria gregaria* (Forskal, 1775)	Present in arid and semi-arid conditions. It is polyphagous pest that damages both cultivated and non-cultivated crops. Sampled from shrubs.
19. *Chondacris rosea* (De Geer, 1773)	Large in size and sampled from pigeon pea.
20. *Cyrtacanthacris tatarica tatarica* (Linnaeus, 1758)	The insects are present in the fields for short time period and usually present in the tall grasses around the field. When disturbed these insects shifted more inside the grasses. Sampled from pigeon pea, wheat and shrubs.
21. *Tristria pulvinata* (Uvarov, 1921)	This is predominantly a grassland species and was even sampled from the same. The crop field around the grassland had some of the members may be those that migrated from grassland when disturbed. Sampled from grasses and sugarcane.
22. *Acrida exaltata* (Walker, 1859)	Chiefly grassland pest and colouration perfectly matches with the vegetation. Females of the genus are very lazy while the males are much active. The males produce a striking stridulatory sound that indicate the presence of species in the particular area. Sampled from paddy, grasses, bottle gourd, lentil.
23. *Acrida gigantea* (Herbst, 1786)	Grassland species but can be easily identified because of the presence of a pair of black linings along lateral carinae of the pronotum. Sometimes polymorphism may be observed in same field. Two polymorphic forms are green and brown in colour. Sampled from paddy and grasses in bottle gourd field.
24. *Phlaeoba infumata* (Brunner von Wattenwyl, 1893)	Mainly inhabits plots having dead and decaying vegetations. Upon disturbance it moves more inside the vegetation rather than jumping away from disturbed site. Integument is much rough and hardy as compared to *Acrida* sp. Sampled from dead vegetation.
25. *Phlaeoba panteli* (Bolivar, 1902)	Same as above but lateral sides of pronotum with striped wooden markings and sampled from dead vegetation and grasses.
26. *Orthochtha indica* (Uvarov, 1942)	Sampled from paddy.
27. *Trilophidia annulata* (Thunberg, 1815)	The sample has strikingly bulging eyes and the median carina forms tooth like projections. More commonly found as compared to other species of the genus. Sampled from paddy and grasses.
28. *Trilophidia repleta* (Walker, 1870)	Less common than *T.* annulata. Sampled from grasses.
29. *Aiolopus simulatrix* (Walker, 1870)	This is a grassland species usually found in moist grassland, irrigated land. Has been recorded as a serious pest of foodgrains and other crops. Sampled from paddy and brinjal.
30. *Aiolopus thalassinus thalassinus* (Fabricius, 1781)	Chiefly graminivorous. May be present in grasslands both extensive and in patches. This species has been observed to get attracted to night light. Sampled from paddy.
31. *Aiolopus thalassinus tamulus* (Fabricius, 1798)	Same as above.
32. *Chloebora grossa* (Saussure, 1884)	Large size insect. Mostly brown in colour. Present in rocky areas with somewhat arid conditions. Sampled from grasses.
33. *Chloebora marshalli* (Henry, G.M., 1933)	Same as above.
34. *Acrotylus insubricus insubricus* (Scopoli, 1786)	Present in sparsely vegetated places and has been observed feeding on cabbage, cauliflower, wheat. Sampled from paddy.

35. *Oedaleus abruptus* (Thunberg, 1815)	Prefers to inhabit moist areas and not very dry ones. Abundantly present in grasses along some ditches filled with water. Sampled from grasses and paddy.
36. *Morphacris fasciata* (Thunberg, 1815)	The insect is moderately active and has been observed feeding on apical part of leaves. Sampled from paddy.
37. *Oedipoda miniata miniata* (Pallas, 1771)	Chiefly present in the abandoned crop fields. Females fly long distances and the insects have been observed to move into the crevices in the ground may be to avoid sunlight. Sampled from paddy and wheat stubbles.
38. *Locusta migratoria migratoria* (Linnaeus, 1758)	Sampled from maize.
39. *Gastrimargus africanus africanus* (Saussure, 1888)	Mobile member of Acridoidea. Sampled from wild vegetation.
40. *Leva indica* (Bolicar, 1902)	Very small sized insect sampled from grasses.
41. *Chorthippus indus* (Uvarov, 1942)	Abundantly present in paddy and grasses. Is a big insect as compared to other members of the subfamily Gomphocerinae. Sampled from grasses.
42. *Stenohippus mundus* (Walker, 1871)	Very small in size. Present mostly in crop fields. Near about absent from wild vegetations and leguminous crops. Sampled from paddy.
43. *Dociostaurus apicalis* (Walker, 1871)	Same as above.
44. *Aulacobothrus luteips luteips* (Walker, 1871)	Same as above.

Figure I. Map of India depicting state's geographic position.

Figure II. Map of Jharkhand.

APHID PARASITOIDS ASSOCIATIONS ON STONE FRUIT TREES IN KHORASAN RAZAVI PROVINCE (IRAN) (HYMENOPTERA: BRACONIDAE: APHIDIINAE)

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[Ahmadabadi, N. J. & Awal, M. M. 2012. Aphid parasitoids associations on stone fruit trees in Khorasan Razavi Province (Iran) (Hymenoptera: Braconidae: Aphidiinae). Munis Entomology & Zoology, 7 (1): 418-423**]**

ABSTRACT: During 2009-2010, Aphid parasitoids wasps (Hymenoptera: Braconidae: Aphidiinae) were studied in Khorasan Razavi province, North East of Iran. Eight species from six genus, including *Aphidius matricariae* Haliday, *A transcaspicus* Telenga, *Binodoxys acalephae* Marshall, *B angelicae* Haliday, *Diaeratiella rapae* M'Intosh, *Ephedrus persicae* Froggatt, *Lysiphlebus fabarum* Marshall and *Praon volucre* Haliday were reared from 26 associations in different location in Khorasan Razavi province in North East of Iran. *Aphidius transcaspicus* was the most abundant parasitoid species with 62% in our survey. The activity of hyperparasitoids was including, *Alloxysta castanea* Hartig, *Asaphes suspensus* Nees, *Dendrocerus carpenteri* Curits, *Pachyneuron aphidis* Bouche, *Phaenoglyphus vilosa* Hartig and *Syrphophagus aphidovorus* Mayr.

KEY WORDS: stone fruit trees, aphid parasitoids, *Aphidius transcaspicus*, Iran.

In Iran, stone fruit trees are including peach, apricot, plum, almond, cherry and black-cherry that are cultivated in the most areas (Esmaili, 1983). According to the statistics of the year 2008, the state of Khorasan Razavi, with 668447 hectares of stone fruit trees, is in the second rank in Iran (Radmehr, 2010). Aphids on stone fruit trees are an important group of plant insect pests which show a high biological potential in reducing the quality and quantity of ornamental plants (Rajabi, 1989). The most usual control method of pests is spraying the plants with insecticides that cause some problems, such as danger of poison residue, increase of second pest population and decrease of useful insects (Rajabi, 1989). Parasitoids have a critical impact on reduction of the population of aphids and 80% of parasitoid species belong to the Hymenoptera (Quicke, 1997). Aphid parasitoids of Aphidiinae play the most important role (Aphidiinae are solitary obli-gatory endoparasitoids of aphids (Stary & Schlinger, 1967). So many species of which have been considered as potential biocontrol agents (Stary & Schlinger, 1967; Lozier et al., 2008; Lathman & Mills, 2010). Stary et al. (2000) reviewed the Aphidiine species of Iran and listed 49 species. Since then this number has increased to a total of 59 recognized species (Rakhshani et al., 2005-2008; Stary et al., 2005; Tomanovic et al., 2007). Importance of integrated pest management, the lack of information about diversity of parasitoid wasps associations to invasive aphids on stone fruit trees in Khorasan Razavi-Iran and also the importance of stone fruit trees, lead us to study on aphid parasitoids.

MATERIAL AND METHODS

Sampling on stone fruit trees was carried out during 2009 – 2010 in five different location of Khorasan Razavi-Iran. Samples from the host trees bearing aphid colonies consisting of live and mummified aphids and host plants were collected. Branches with leaves from each tree were carefully cut off and 15 branches with 8-10 cm were transported to plastic boxes which were labeled with date of sampling, host plants and location and covered with mesh for ventilation (Figure 1). Boxes were held at room temperature for 2-3 weeks till the adult parasitoids emerged. The emerged wasps were clipped daily using an aspirator and dropped into 96% ethanol. Selected fresh specimens of aphids were immersed in 75% ethanol (Rezwani, 2001) and preserved there for later identification. The collected specimens were deposited in the Insect Collection of Agriculture Faculty, Ferdowsi University of Mashhad, Mashhad-Iran.

RESULTS

We have determined the presence of eight parasitoid species from six genus reared in associations of aphids on stone fruit trees at different locations of Khorasan Razavi province, North East of Iran.

Aphid, parasitoids and plant association

Aphidius matricariae Haliday, 1834 (Fig. 2a)

Brachycaudus divericata Shaposhnikov on plum: Khorasan Razavi-Kardeh, 3 May 2010, (2♀).

Brachycaudus helichrysi Kaltenbach on apricot: Khorasan Razavi-Mashhad, 5 May 2010, (2♀); Khorasan Razavi-Torghabe, 12 May 2010, (32♀, 11♂); on plum: Khorasan Razavi-Torghabe, 5 May 2010, (2♀).

Hyalopterus amygdali Blanchard on apricot: Khorasan Razavi-Torghabe, 12 May 2010, (5♀, 2♂).

Myzus persicae Sulzer on apricot: Khorasan Razavi-Mashhad, 27 April 2010, (2♀, 1♂); on Peach: Khorasan Razavi-Torghabe, 20 April 2010, (4♀, 2♂); 12 May 2010, (8♀, 3♂).

Aphidius transcaspicus Telenga, 1958 (Fig. 2b)

Hyalopterus amygdali Blanchard on almond: Khorasan Razavi-Golmakan, 29 May 2010, (2♀,1♂); khorasan Razavi-Torghabe, 20 April 2010, (11♀, 5♂); 9 May 2010, (12♀, 6♂); 12 May 2010, (9♀, 5♂); 19 May 2010, (17♀, 8♂); on apricot: Khorasan Razavi-Mashhad, 5 May 2010, (8♀, 6♂); on peach: Khorasan Razavi-Faragard, 30 April 2010, (5♀, 3♂).

Hyalopterus pruni Geoffroy on apricot: Khorasan Razavi-Faragard, 20 September 2009, (12♀, 5♂); Khorasan Razavi-Mashhad, 25 April 2010, (6♀, 2♂); 27 April 2010, (6♀, 11♂); 3 May 2010, (4♀, 3♂); 5 May 2010, (3♀, 2♂); 11 May 2010, (30♀, 26♂); 18 May 2010, (127♀, 79♂); 20 May 2010, (17♀, 9♂); 23 May 2010, (15♀, 12♂); khorasan Razavi-Torghabe, 5 May 2010, (9♀, 7♂); 11May 2010, (4♀, 4♂); 18 May 2010, (3♀, 1♂); on peach: Khorasan Razavi-Faragard, 23 October 2009, (6♀); 30 April 2010, (19♀, 10♂); Khorasan Razavi-Golmakan, 29 May 2010, (2♀, 1♂); on plum: Khorasan Razavi-Faragard, 10 September 2009, (5♀, 1♂); 25 October 2009, (8♀, 3♂); 9 May 2010, (6♀, 2♂); Khorasan Razavi-Kardeh, 29 October 2009, (2♀); Khorasan Razavi-Mashhad, 5 May 2010, (13♀, 7♂); 18 May 2010, (1♀, 1♂).

Binodoxys acalephae Marshall, 1896 (Fig. 2c)

Brachycaudus helichrysi Kaltenbach on plum: Khorasan Razavi-Mashhad, 3 May 2010, (7♀, 6 ♂); 5 May 2010, (9♀, 5 ♂).

Binodoxys angelicae Haliday, 1833 (Fig. 2d)

Brachycaudus helichrysi Kaltenbach on plum: Khorasan Razavi-Mashhad, 3 May 2010, (3♀, 2 ♂); 5 May 2010, (5♀, 4 ♂).

Diaeratiella rapae M'Intosh, 1855 (Fig. 2e)

Hyalopterus pruni Geoffroy on apricot: Khorasan Razavi-Mashhad, 27 April 2010, (1♀, 1♂); on plum: 5 May 2009, (2♀, 1♂).

Myzus persicae Sulzer on peach: Khorasan Razavi-Faragard, 30 April 2010, (2♀).

Ephedrus persicae Froggatt, 1904 (Fig. 2f)

Hyalopterus amygdali Blanchard on almond: Khorasan Razavi-Torghabe, 3 May 2010, (9♀, 4♂); 5 May 2010, (18♀, 9♂); 9 May 2010, (13♀, 6♂); 11 May 2010, (20♀, 11♂); 12 May 2010, (7♀, 1♂); 17 May 2010, (6♀, 3♂); 18 May 2010, (10♀, 8♂); 19 May 2010, (10♀, 6♂).

Brachycaudus amygdalinus Schout on almond: Khorasan Razavi-Torghabe, 9 May 2010, (5♀, 3♂); 11 May 2010, (5♀, 4♂); 12 May 2010, (19♀, 11♂); 17 May 2010, (6♀, 3♂); 18 May 2010, (3♀, 1♂); 19 May 2010, (4♀, 2♂).

Lysiphlebus fabarum Marshall, 1896 (Fig. 2g)

Hyalopterus pruni Geoffroy on apricot: Khorasan Razavi-Mashhad, 5 May 2010, (1♀, 1♂); on plum: Khorasan Razavi-Mohamadabad, 27 April 2010, (3♀, 1♂); 5 May 2010, (4♀, 2 ♂).

Brachycaudus helichrysi Kaltenbach on plum: Khorasan Razavi-Mashhad, 10 May 2009, (2♀, 1 ♂).

Praon volucre Haliday, 1833 (Fig. 2h)

Myzus persicae Sulzer on peach: Khorasan Razavi-Faragard, 30 April 2010, (2♀, 1♂).

Hyalopterus pruni Geoffroy on apricot: Khorasan Razavi-Mashhad, 25 April 2010, (3♀, 2♂); 27 April 2010, (2♀, 1♂).

Brachycaudus helichrysi Kaltenbach on apricot: Khorasan Razavi-Mashhad, 5 May 2010, (5♀, 6♂); on plum: Khorasan Razavi-Mashhad, 5 May 2010, (1♀, 1♂); on peach: Khorasan Razavi-Kardeh, 30 April 2010, (2♀, 1♂).

In this survey the most abundant aphid was *Hyalopterus pruni* (Hom: Aphididae) on plum and apricot in all places of sampling and this species was also the most frequently parasitized. From the parasitoids, *Aphidius transcaspicus*, with 62%, was the most abundant parasitoid (Figure 3a). In our survey *Pterochlorus persicae* Chold (Hom: Aphididae) was free of parasitoid in all places of sampling (Khorasan Razavi-Faragard on plum, Khorasan Razavi-Mashhad on almond, and plum). Female parasitoids, with 63%, were more numerous than the male parasitoids with 37% (Figure 3b). Also, in this survey among hyperparasitoids, *Pachyneuron aphidis* Bouche, with 86%, was the most abundant hyperparasitoid (Fig. 3c).

DISCUSSION

We have observed that different species of parasitoids attack different species of aphids on different plant hosts such as *Aphidius matricariae, Lysiphlebus fabarum* and *Praon volucre*. However we have observed that *Aphidius transcaspicus*, as a specialized endo-parasitoid restricted to the genus *Hyalopterus* spp. (Kavallieratos et al., 2001; Rakh-shani et al., 2008). This species has a good biological potential since, as we have seen in Khorasan Razavi-Mashhad, this species parasitized all of the *Hyalopterus pruni* species on a plum tree (data unpublished). In fact, it has been shown that this species can be used as a powerful biological control agent against the mealy plum aphid, *Hyalopterus pruni* in plum orchards (Lozier et al., 2006, 2008; Lathman & Mills, 2010). *Ephedrus persicae* Froggatt only found in Khorasan Razavi-Torghabe on almond, probably, because of that many of association are limited to their host plants and respective habitats in the biocorridors (Rhakhshani et al., 2007). In addition, among aphid parasitoids, *Diaeratiella rapae* M'Intosh was found rarely. It has been recorded from a limited host rang from Iran (Stary et al., 2000; Rakhshani et al., 2005, 2006). The abundance of aphid parasitoids primarily depends on associated aphid abundance and other factors such as plant communities (Stary, 1968), altitude, geographical area and year of sam-pling (Rhakhshani et al., 2008). The activity of hyperparasitoids seems to impair the efficacy of parasitoids since they destroy colonies of the mummified aphids. Our col-lected hyperparasitoids were including, *Alloxysta castanea* Hartig, *Asaphes suspensus* Nees, *Dendrocerus carpenteri* Curits, *Pachyneuron aphidis* Bouche, *Phaenoglyphus villosa* Hartig and *Syrphophagus aphidovorus* Mayr.

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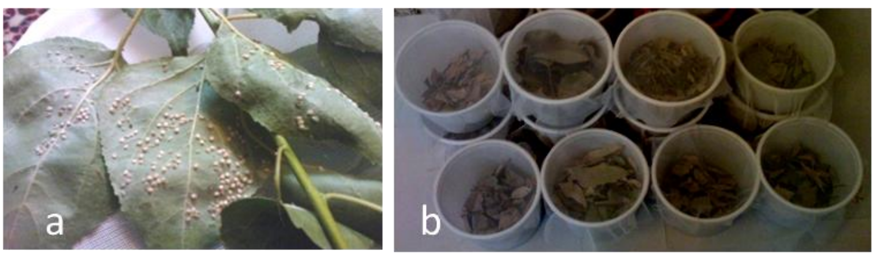

Figure 1- a- Apricot leaves with mummified aphids of *Hyalopterus pruni* Geoffroy, b- Plastic boxes covered with mesh.

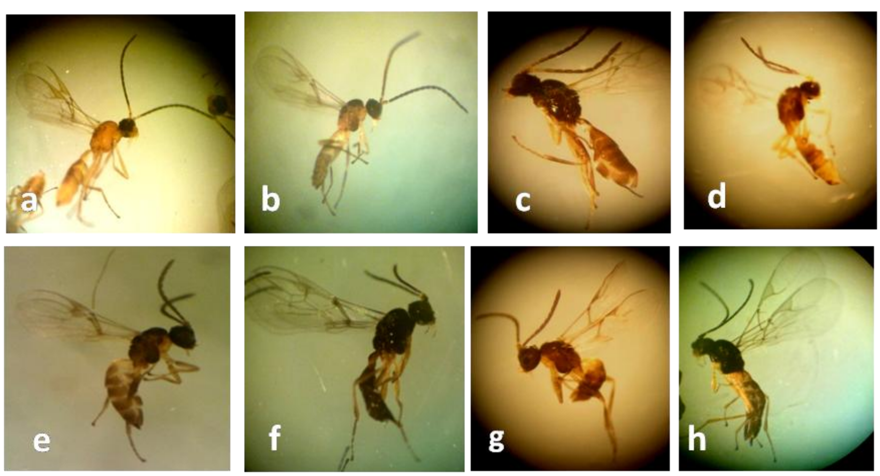

Figure 2. Female parasitoids: a- *Aphidius matricariae* Haliday, b- *A transcaspicus* Telenga, c- *Binodoxys acalephae* Marshall, d- *B. angelicae* Haliday, e- *Diaeratiella rapae* M'Intosh., f- *Ephedrus persicae* Froggatt, g- *Lysiphlebus fabarum* Marshall, h- *Praon volucre* Haliday.

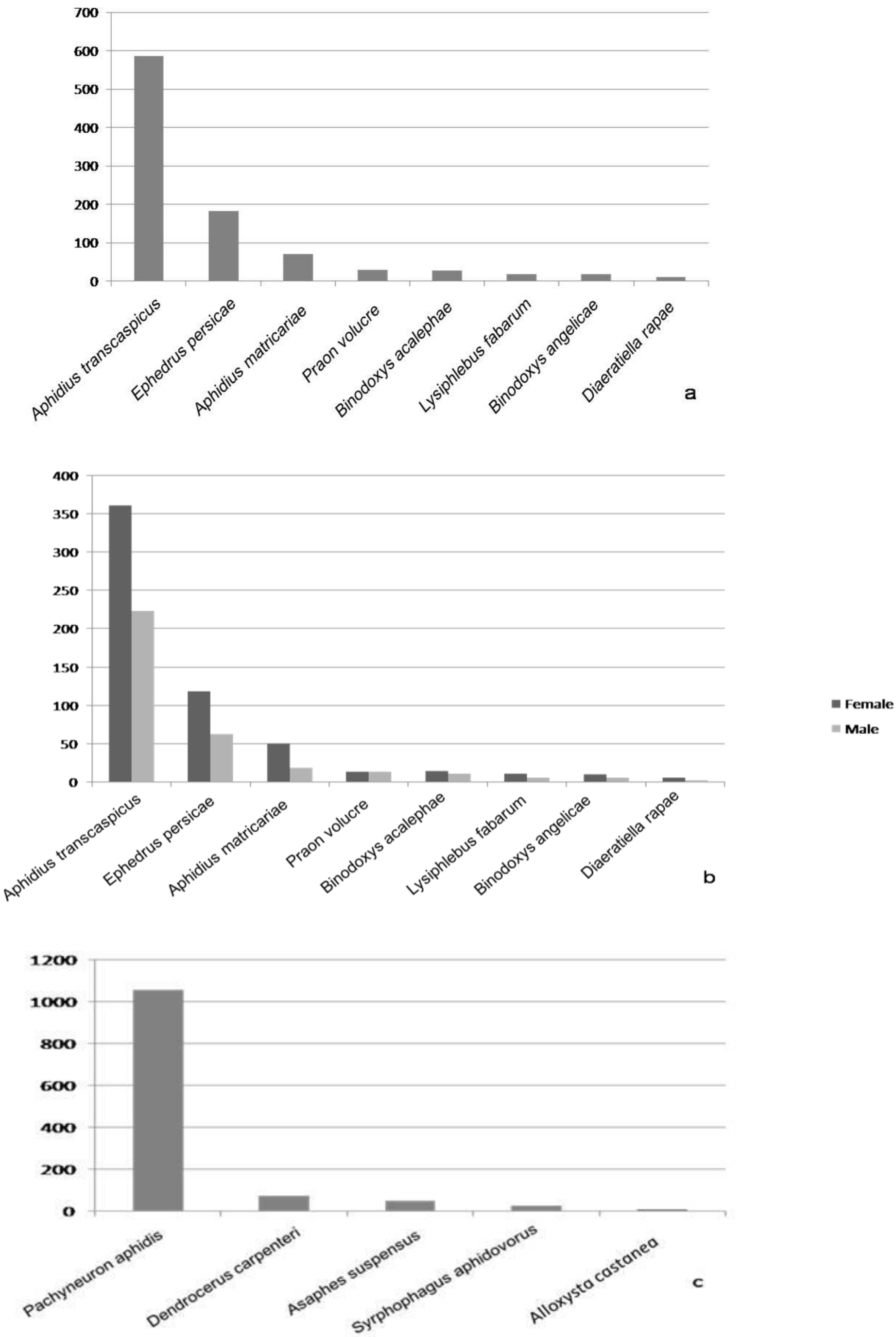

Figure3- Total numbers of aphid parasitoids (a), total numbers of sexes (b) and total numbers of hyperparasitoids on stone fruit trees in Khorasan Razavi, Iran.

THE SPIDER FAUNA OF MALDIVE ISLANDS IN INDIAN OCEAN (ARANEAE)

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[Sunil, J. K. 2012. The spider fauna of Maldive Islands in Indian Ocean (Araneae). Munis Entomology & Zoology, 7 (1): 424-431**]**

ABSTRACT: The present study documents the diversity and characteristics of spider families occurring in the coral islands of Maldives in Indian Ocean. The faunistic survey yielded 57 species of spiders belonging to 35 genera and 17 families. Araneidae was the most dominant family recording 12 species belonging to 7 genera. On species level, *Tetragnatha mandibulata* Walckenaer, 1842 was the dominant species. Guild structure analysis revealed six feeding guilds, namely orb weavers, stalkers, ground hunters, foliage runners, scattered line weavers and ambushers. Orb weavers and stalkers were the dominant feeding guilds representing 35% and 22% respectively of the total collection. 12 genera namely *Artema, Crossopriza, Argyrodes, Latrodectus, Linyphia, Neoscona, Pardosa, Clubiona, Martensopoda*, *Thanatus*, *Bavia*, *Myrmarachne* are reported for the first time from Maldives.

KEY WORDS: Maldives, spiders, diversity, oceanic islands.

Maldives is a small island nation, but the tropical environment supports a rich biodiversity of invertebrates. Although many reports were made on the terrestrial and aquatic animals the spider fauna is totally neglected by the workers. Because of its proximity to several lands masses like India, Seychelles, Australia and Madagascar the fauna exhibit several unique features not seen in other parts of the world. In his pioneering work on spiders in Maldives, Pocock (1904) recorded 19 species from these islands. For more than century after that no work on spiders in Maldives has been conducted by anyone till now. The aim of the present paper is to provide a preliminary checklist about the spiders of these coral islands. Though the study of spiders from Maldives islands is still far from complete, the present study forms a basis for further investigations on this group.

MATERIALS AND METHODS

Checklist is based on an examination of specimens collected by the author while he was in Maldives, during the period from January 2007 to November 2008 and on reviews of published literature like Pocock, 1904 and Platnick, 2006. The checklist is presented in a taxonomic order: suborder, family, genus and species. The classification of araneae follows Platnick 2010. For each species presented in the checklist information is provided in the following sequence: name of the species, author, material examined guild structure, affinities and the distribution. specimens were placed directly into 75% alcohol for preservation. Global Positioning System hand unit (GPS) was used to determine the exact geographical locations. The identification of spiders was done following Pocock (1900, 1904), Tikader (1980, 1982), Koh (1989), Murphy & Murphy (2000) and Dippenaar (2002). The specimens used in the present study are deposited in the Arachnological Collections of Deva Matha College, Kuravilangad, Kerala.

Study area: The Maldives consists of a chain of coral atolls, 80-120km wide, stretching 860 kms from latitude 7°6'35"N to 0°42'24"S, and lying between longitude 72°33'19"E to 73°46'13"E. These coral atolls are located on the 1600 kms long Laccadives-Chagos submarine ridge extending into the central Indian Ocean from the south-west coast of the Indian sub-continent. It is believed that the Maldives was formed about 65-225 million years ago in the Mesozoic Era (Maniku, 1990). The 26 geographic atolls in the Maldives vary enormously in shape and size. A total of 1192 islands are found in the chain of 26 geographic atolls, and the islands differ depending on location, form and topography. The islands vary in size from 0.5 km^2 to around 5.0 km^2 and in shape from small sandbanks with sparse vegetation to elongated strip islands. The maximum height of land above mean sea level within the Maldives is around 3 meters and around 80% of the land area is less than 1 meter above mean high tide level (MHAHE, 1999). Out of the 1192 islands 199 are inhabited and 87 have been developed as tourist resorts. The largest island is Gan (1°55'N and 73°32'5"E) in Laamu Atoll with an area 5.16 km^2 and most of the present study was conducted in this island during the period January 2007-November 2008. The relative humidity ranges from 73% to 85%. Daily temperatures vary little throughout the year with a mean annual temperature of 28°C. Average annual rainfall varies from 1,407mm to 2,707mm between different atolls.

RESULTS

Family Diversity: 17 families are recorded from Maldives during the study (Table. I & VI). Families like Araneidae (12 species), Salticidae (10 species), Tetragnathidae (7 species) and Sparassidae (7 species) exhibit highest species diversity. Theridiidae (2 species), Pholicidae (2 species) are also widely present in the islands. Families like Barychelidae, Hersilidae, Desidae, Scytodidae, Thomisidae and Uloboridae are represented by one species only.

Generic Diversity: 35 genera are found in 17 families (Table II). Maximum generic diversity is found in families like Araneidae (7), Salticidae (5), Tetragnathidae (2), Pholicidae (2) and Sparassidae (2). Most genera discovered show affinities with oriental region and are widely present in the Indian mainland. Genera like *Cyclosa, Cyrtophora* (Fam: Araneidae), *Hersilia* (Fam: Hersilidae), *Pardosa* (Fam: Lycosidae), *Artema*, *Crossopriza* (Fam: Pholidae), *Bavia*, *Myrmarachne*, *Plexippus* (Fam: Salticidae), *Tylorida* (Fam: Tetragnathidae) and *Linyphia* (Fam: Linyphiidae) are first records from Maldives.

Species Diversity: 57 species are collected from Maldives during the study. Genera like *Neoscona* (6 species), *Tetragnatha* (5 species), *Oxyopes* (3 species), *Heteropoda* (3 species) and *Olios* (3 species) show highest diversity of species in the collection. The analysis of species data with reference to the area of the country (Table III) shows that the Maldives islands exhibit comparatively higher species and generic level diversity compared with other south Asian countries in the area.

New records: The most striking feature of the spider fauna of Maldives islands is the high number of new records. About 30 species recorded during the study are new records to Maldives. Araneidae and Salticidae exhibit highest number of new records. Similarly 12 genera namely *Artema, Crossopriza* (Fam. Pholcidae);

Argyrodes, Latrodectus (Fam. Theridiidae); (*Linyphia*) Fam. Linyphiidae; *Neoscona* (Fam. Araneidae); *Pardosa* (Fam. Lycosidae); *Clubiona* (Fam. Clubionidae); *Martensopoda* (Fam. Sparassidae); *Thanatus* (Fam. Philodromidae); *Bavia*, *Myrmarachne* (Fam. Salticidae) recorded during the study are also new to Maldives.

Dominant species: The dominant species in each vegetation zone are shown in Table IV. The dominant species is calculated by counting the species number of collected specimens. The three top scorer species in the locality are *Tetragnatha mandibulata* Walckenaer, 1842, *Argiope anasuja* Thorell, 1887 and *Pardosa* sp. 1. The total number of top scorers (Table IV) was 20, of which six were araneids, four were salticids and three were tetragnathids. A general trend was the dominance of lycosid species among ground dwelling species and araneid species in web building species.

Functional groups: The collected spiders can be divided into six functional groups (guilds) (Table V) based on their foraging behaviour in the field (Uetz et al. 1999). The dominant guild was of the orb web builders and it comprised of 20 species of spiders. Spiders of the families Araneidae, Tetragnathidae and Uloboridae fall under this category. Spiders of the category Stalkers formed the next dominant guild comprising of 13 species of spiders. Ground runners (10 species), scattered line weavers (4 species), ambushers (3 species) and Foliage runners (1 species) are the other functional groups.

Endemism: A total of 57 species are discovered from Maldives so far. Among the collection *Heteropoda atollicola* is endemic to Maldives. *Desis gardineri*, and *Tetragnatha foveata* are also restricted to Laccadive and Srilankan region.

Affinities: The present study conducted in Maldives revealed that the spider fauna of these islands bears affinities with Oriental (21 spp), Australian (3 spp.), Palearctic (4 spp.) and Nearctic (1 sp.) regions. High number of Indian species suggests the arrival of majority of spiders here from the neighbouring Indian mainland.

Zoogeographic Analysis: About 29 species recorded in Maldives are widely distributed in South Asia; a few of these are found only in the Indo-srilankan region. Most of the widely distributed species in south Asia belong to Araneidae (11 species) and Salticidae (6). Because of bright colouration and large orb webs, spiders of the above mentioned families were easily observed. Species like *Crossopriza lyoni* (Blackwall, 1867); *Plexippus paykulli* (Audouin, 1826) are cosmopolitan in distribution; whereas species like *Artema atlanta* Walckenaer, 1837; *Zosis geniculata* (Olivier, 1789); *Heteropoda venatoria* (Linnaeus, 1767) are pantropical in distribution.

DISCUSSION

The spider fauna of Maldives is not rich compared with many other tropical islands. Around 1447 species are reported from the neighbouring Indian mainland and around 354 species are reported from Srilanka (Siliwal, 2007). The lack of high species diversity can be attributed to the limited diversity of habitats in these coral islands. The limited floral diversity is also a contributing factor in reducing the number of invertebrates. A notable feature in the diversity of spiders is the higher family and generic diversity. Except the common families like Araneidae and Salticidae most families are represented by a few species. Seven families are represented by only single species. Rare families like Desidae which are not found in neigbouring mainland are also recorded from these coral islands.

The spider fauna here is a chance assemblage of species arrived from neighboring lands. Most species found here are also found in Indian mainland and Srilanka, which shows the primary route of spider migration. The sub order Mygalamorphae is represented by only a Barychelid species, *Sason robustum*. The scarcity of mygalmorphs can be attributed to the vast separation of these coral islands from the niegbhouring land. Legendre (1979) suggested that in the case of *Sason,* its arboreal nest allowed for its transport as flotsam in ocean currents.

Only a few endemic species are recorded from Maldives which reflects the limited local character of the fauna. Another notable feature in the spider fauna is the high number of Tetragnathid spiders of the genus *Tetragnatha* observed during the study. These are common in most areas; the frequent equatorial rain also favours the abundance of moisture loving genera.

There are many environmental factors that affect species diversity. However, when spiders were divided according to their functional group there was a significant effect of habitat on the diversity of these groups. The web building and foliage running spiders rely on vegetation for some part of their lives, either for finding food, building retreats or for web building. The structure of the vegetation is therefore expected to influence the diversity of spiders found in the habitat. Studies have demonstrated that a correlation exists between the structural complexity of habitats and species diversity (Hawksworth, Kalin-Arroyo 1995). Diversity generally increases when a greater variety of habitat types are present (Ried, Miller 1989). Uetz (1991) suggests that structurally more complex shrubs can support a more diverse spider community. The lack of high diversity of spiders in Maldives has to be viewed in this context.

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Table I. Species diversity in different families found in Maldives.

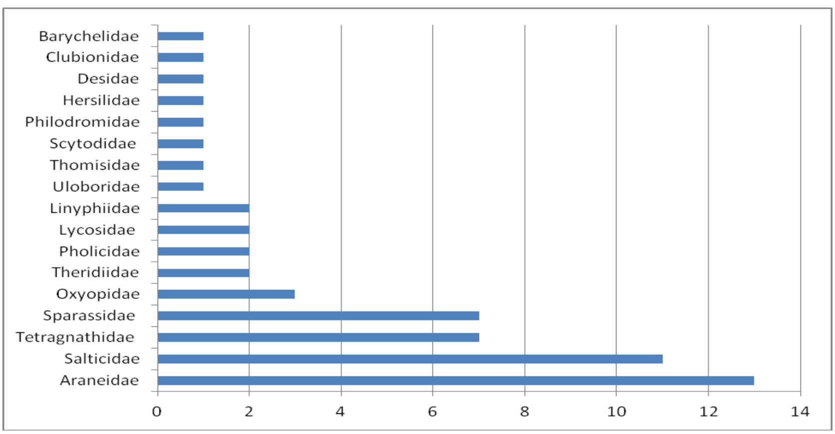

Table II. Diversity of genera found in different families.

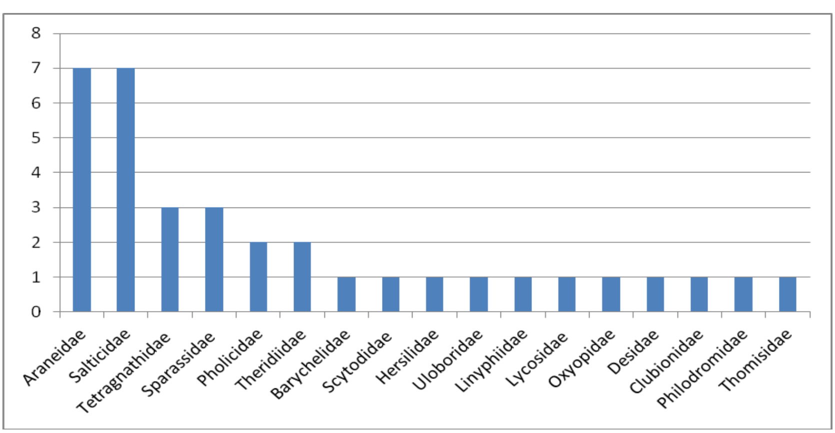

Table III. Comparison of area and spider species richness of some Asian countries.

Country	Area (km2)	Genera	Spider species	Sources
Afghanistan	652,090	65	113	Siliwal (2006)
Bangaladesh	143,998	24	50	Siliwal (2006)
Bhutan	38,394	51	105	Siliwal (2006)
India	3,201,446	365	1447	Siliwal (2006)
Malaysia	330,803	238	425	Rashid (2009)
Maldives	300 35	57		
Nepal	147,18179	221		Siliwal (2006)
Pakistan	796,095	79	138	Siliwal (2006)
Singapore	705	186	310	Song (2002)
Srilanka	65,610 213	354		Siliwal (2006)

Table IV. List of dominant species.

FAM. **PHOLCIDAE** C. L. Koch, 1850 *Artema atlanta* Walckenaer, 1837 *Crossopriza lyoni* (Blackwall, 1867) FAM. **HERSILIIDAE** Thorell, 1870 *Hersilia savignyi* Lucas, 1836 FAM. **ULOBORIDAE** Thorell, 1869 *Zosis geniculata* (Olivier, 1789) FAM. **TETRAGNATHIDAE** Menge, 1866 *Tetragnatha mandibulata* Walckenaer, 1842 *Tetragnatha viridorufa* Gravely, 1921 *Tylorida ventralis* (Thorell, 1877)	FAM. **ARANEIDAE** Clerck, 1757 *Argiope anasuja* Thorell, 1887 *Cylosa insulana* (Costa, 1834 *Cyrtophora cicatrosa* (Stoliczka, 1869) *Neoscona mukerjei* Tikader, 1980 *Neoscona theisi* (Walckenaer, 1842) *Thelacantha brevispina* (Doleschall, 1857) FAM. **LYCOSIDAE** Sundevall, 1833 *Pardosa* sp. 1 FAM. **SPARASSIDAE** Bertkau, 1872 *Heteropoda venatoria* (Linnaeus, 1767) *Olios* sp. 1 FAM. **SALTICIDAE** Blackwall, 1841 *Carrhotus decorata* Tikader, 1974 *Hyllus semicupreus* (Simon, 1885) *Plexippus paykulli* (Audouin, 1826) *Plexippus petersi* (Karsch, 1878)

Table V. Composition of different functional groups.

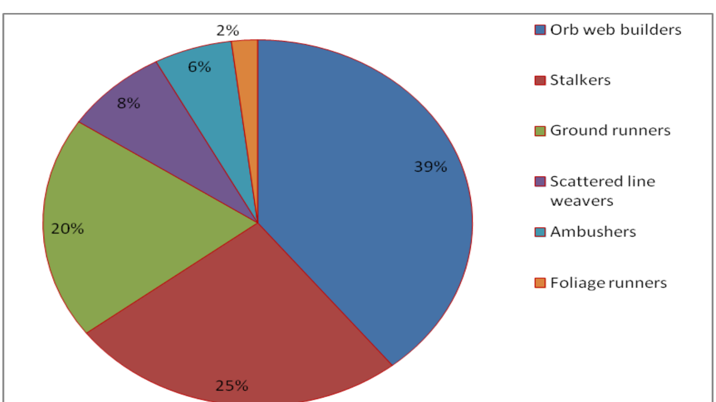

Table VI. Checklist of spiders in Maldive Islands.

Species	Material	Guild	Affinities	Distribution
FAM. **BARYCHELIDAE** Simon, 1889				
1. *Sason robustum* (O. P.-Cambridge, 1883)	--	Ambushers	Oriental	India, Sri Lanka, Seychelles
FAM. **SCYTODIDAE** Blackwall, 1864				
2. *Scytodes gilva* (Thorell, 1887)	--		Oriental	India, Myanmar
FAM. **PHOLCIDAE** C. L. Koch, 1850				
3. *Artema atlanta* Walckenaer, 1837	1 female	Scattered line weaver	Pantropical	Introduced in Belgium
4. *Crossopriza lyoni* (Blackwall, 1867)	2 females	Scattered line weaver	Cosmopolitan	
FAM. **HERSILIIDAE** Thorell, 1870				
5. *Hersilia savignyi* Lucas, 1836	2 females	Stalkers	Oriental	Sri Lanka, India to Phillipines
FAM. **ULOBORIDAE** Thorell, 1869				
6. *Zosis geniculata* (Olivier, 1789)	2 females	Orb weavers	Oriental	Pantropical
FAM. **THERIDIIDAE** Sundevall, 1833				
7. *Argyrodes sp. 1*	1 male	Sheet web builders		
8. *Latrodectus hasselti* Thorell, 1870		Sheet web builders	Oriental	Southeast Asia to Australia
FAM. **LINYPHIIDAE** Blackwall, 1859				
9. *Linyphia* sp. 1	1 male	Sheet web builders		
10. *Linyphia* sp. 2	1 female	Sheet web builders		
FAM. **TETRAGNATHIDAE** Menge, 1866				
11. *Leucauge* sp. 1	1 female	Orb weavers		
12. *Tetragnatha foveata* Karsch, 1891	--	Orb weavers	Oriental	Sri Lanka, Laksdweep, Maldive Is.
13. *Tetragnatha mandibulata* Walck, 1842	2 females	Orb weaver	Oriental, Australian	West Africa, Australia, Bangladesh, Philippines,
14. *Tetragnatha vermiformis* Emerton, 1884	3 females	Orb weavers	Oriental, Palearctic	Canada to Panama, Japan, Philippines
15. *Tetragnatha viridorufa* Gravely, 1921	1 female	Orb weavers	Oriental	India
16. *Tetragnatha* sp. 1	2 females	Orb weavers		
17. *Tylorida ventralis* (Thorell, 1877)	3 females	Orb weavers	Oriental	India to Taiwan, Japan, New Guinea
FAM. **ARANEIDAE** Clerck, 1757				
18. *Araneus* sp. 1	2 females	Orb weaver		
19. *Argiope anasuja* Thorell, 1887	3 females	Orb weavers	Oriental	Pakistan to Maldives
20. *Cylosa insulana* (Costa, 1834	2 females	Orb weavers	Palearctic, Oriental	Mediterranean to Philippines, Australia
21. *Cyrtophora cicatrosa* (Stoliczka, 1869)	3 females	Orb weavers	Oriental	Pakistan to Northern Territory
22. *Neoscona achine* (Simon, 1906)	4 females	Orb weavers	Oriental	India, China
23. *Neoscona mukerjei* Tikader, 1980	2 females	Orb weavers	Oriental	India
24. *Neoscona punctigera* (Doleschall, 1857)	2 females	Orb weavers	Palearctic	Réunion to Japan
25. *Neoscona scylla* (Karsch, 1879)	2 females	Orb weavers	Palearctic	Russia to Korea,
26. *Neoscona theisi* (Walckenaer, 1842)	2 females	Orb weavers	Palearctic	China to Pacific Is.
27. *Neoscona* sp. 1	2 females	Orb weavers		
28. *Neoscona* sp.2	2 females	Orb weavers		
29. *Poltys illepidus* C. L. Koch, 1843	2 females	Orb weavers	Oriental, Australian	Thailand to Australia,

30. *Thelacantha brevispina* (Doleschall 1857)	2 females	Orb weavers	Oriental, Australian	Madagascar, India to Philippines, Australia
FAM. **LYCOSIDAE** Sundevall, 1833		Orb weavers		
31. *Pardosa* sp. 1	2 females	Ground runners		
32. *Pardosa* sp. 2	2 females	Ground runners		
FAM. **OXYOPIDAE** Thorell, 1870				
33. *Oxyopes hindostanicus* Pocock, 1901	2 females	Stalkers	Oriental	Pakistan to Sri Lanka
34. *Oxyopes* sp. 1	2 females	Stalkers		
35. *Oxyopes* sp. 2	2 females	Stalkers		
FAM. **DESIDAE** Pocock, 1895				
36. *Desis gardineri* Pocock, 1904	--		Oriental	Laccadive Is.
FAM. **CLUBIONIDAE** Wagner, 1887				
37. *Clubiona* sp. 1	1 females	Foliage runner		
FAM. **SPARASSIDAE** Bertkau, 1872				
38. *Heteropoda atollicola* Pocock, 1904	--	Foliage runner	Oriental	Maldive Is
39. *Heteropoda nilgirina* Pocock, 1901	2 females	Foliage runner	Oriental	India
40. *Heteropoda venatoria* (Linnaeus, 1767)	2 females	Foliage runner	Oriental	Pantropical
41. *Martensopoda minuscula* (Reimoser,1934)	2 females	Foliage runner	Oriental	India
42. *Olios lamarcki* (Latreille, 1806)	--	Foliage runner	Oriental	Madagascar to India
43. *Olios* sp. 1	1 male	Foliage runner		
44. *Olios* sp. 2	1 female	Foliage runner		
FAM. **PHILODROMIDAE** Thorell, 1870				
45. *Thanatus* sp. 1	1 female	Ambushers		
FAM. **THOMISIDAE** Sundevall, 1833				
46. *Thomisus pugilis* Stoliczka, 1869	1 female	Ambushers	Oriental	India
FAM. **SALTICIDAE** Blackwall, 1841				
47. *Bavia* sp. 1	1 male	Stalkers		
48. *Carrhotus decorata* Tikader, 1974	1 female	Stalkers	Oriental	India
49. *Carrhotus viduus* (C. L. Koch, 1846	1 female	Stalkers	Oriental, Palearctic	India to China, Java
50. *Hyllus pudicus* Thorell, 1895	2 females	Stalkers	Oriental	India, Myanmar
51. *Hyllus semicupreus* (Simon, 1885)	2 females	Stalkers	Oriental	India, Sri Lanka
52. *Myrmarachne* sp. 1	2 females	Stalkers		
53. *Myrmarachne* sp. 2	2 females	Stalkers		
54. *Plexippus paykulli* (Audouin, 1826)	2 females	Stalkers	Cosmopolitan	
55. *Plexippus petersi* (Karsch, 1878)	1female, 1 male	Stalkers	Palearctic	Africa to Japan, Philippines, Hawaii
56. Genus 1, sp.1	1 female	Stalkers		
57. Genus 2, sp. 2	1 female	Stalkers		

IN OVO AND IN VITRO TOXICITY OF THIRAM, A COMMON BROAD SPECTRUM FUNGICIDE IN AGRICULTURE

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[Zahri, S., Dastjerdi, H. R. & Amirikia, M. 2012. In ovo and in vitro toxicity of Thiram, a common broad spectrum fungicide in agriculture. Munis Entomology & Zoology, 7 (1): 432-438**]**

ABSTRACT**:** At the recent years, thiram, a dithiocarbamate compound is used as a fungicide to protect crops against a wide variety of plant pathogens. In this work, Chicken embryos were studied for the screening of skeletal malformation caused after application of thiram. On the other hand, the toxicity of thiram to chicken liver cells culture was determined. The compound was dissolved in acetone, then a volume of 50 µl of different doses of it was injected into the yolk sac after 72 hours of incubation and the embryos were harvested after 19 day of incubation The results showed that exposure of the embryos to thiram increased mortality with a LD_{50} value of 3 5 µg egg and malformations including clubfoot and unossified caudal vertebrae No significant difference was observed in wet weight of the embryos. Thiram also exhibited the cytotoxic and antiproliferative effects against liver cells with an IC_{50} value of 5 2 µg ml The present study proposes that thiram can affect the growth and ossification of the chicken embryos, which are developed outside the mother.

KEY WORDS: Embryotoxicity, thiram, malformation, cytotoxicity, dithiocarbamate, Chicken embryos.

Thiram, a heavy metal chelator, has been considered as a fungicide in agriculture and is widely used for the control of plant diseases (Guitart et al., 1996; Marikovsky, 2002; Grosicka et al., 2005). The compound has been used in the treatment of human scabies, as an accelerator vulcanizing agent during rubber processes. The application of thiram as an ingredient in sunscreen and as a bacteriostatic in medical soaps and certain antiseptic sprays has also been reported (Dalvi, 1988; Ruijtenbeek et al., 2002). On the other hand, the oral administration of thiram to mice has caused a significant inhibition in the development of glioma tumor and reduced the metastatic growth of Lewis lung carcinoma (Marikovsky, 2002).

The chick embryo (*Gallus gallus*) is a general model for the developmental physiology and toxicological studies (Altimiras & Crossley, 2000; Ruijtenbeek et al., 2002). The chickens and its embryos are cost-effective and readily available, and present an alternative approach to the treatment of pregnant mammals. The chicken embryo develops outside the mother and therefore the effects of external stresses on embryonic development can be studied without interferences of the maternal hormonal and metabolic modifications. Due to the absence of maternal metabolism, considerably smaller amount of administered substances per embryo is needed, which is particularly useful for testing rare or expensive compounds, or when the maternal toxicity is of concern (Petrovova et al., 2009). The present study deals with the embryotoxic and cytotoxic effects of thiram on chicken embryo and liver cells culture, respectively

MATERIALS AND METHODS

Materials

Thiram, 98% purity (Guaranteed by supplier), was obtained as a gift from Giah co. (Iran- Tehran). Fertile eggs (*Gallus gallus*) were obtained from a local commercial poultry source and were checked for bacterial contamination. 3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyltetrazolium bromide (MTT) and alizarin red were purchased from Sigma and Merck (Germany), respectively.

Embryos preparation and treatment

The eggs were incubated at 37 7-38 C in incubators with a relative humidity of 70%. The eggs were turned three times daily to avoid the sticking of the embryo to the shell membranes. After three days, the eggs were candled and embryos of uniform size were selected randomly to be used in all experiments. Before injection, the large end of egg was wiped with a sterile cotton wool pad moistened with a 70 ethanol solution and drilled above the air cell.

A series of a fresh stock solution of thiram in minimum volume of acetone were prepared and injected aseptically into the yolk sac of the eggs in various doses (1, 2 5, 5 and 10 μg egg) after 72 hours of incubation All the tests were performed in three replications (n=10). Control eggs injected with 50 μl of acetone were run with each batch of treated eggs (Anwar, 2004). The eggs were candled at day 7 and 14 of incubation and the dead embryos were recorded before they were discarded. After 18th day of incubation, the embryos were taken out from the shells and subjected to detection of abnormalities (Natekar, 2007). Percentage of mortality was calculated using the following formula [(mortality $_{treatment}$ % - mortality $_{control}$ %) (100 – mortality $_{control}$ %)] ×100.

Skeletal study

In order to study of the skeletal elements, the specimens were prepared according to the method expressed by previous published data (Staples & Shnell, 1963). Briefly, the specimens were eviscerated and skinned. Then, they were placed into the 2 aqueous potassium hydroxide until the flesh was sufficiently clear to render the skeleton visible. The solution was changed whenever it became discolored. The specimens were then placed into 1 aqueous KOH solution to which a few drops of aqueous alizarin red solution was added. The stained specimens were stored in glycerin.

For the study of skeletal elements, The length of long bons and incidence of abnormalities of each embryo treated with various doses of thiram in all three experimental groups was measured and statistically analysed to see the degree of suppression of growth in the long bones as compared with their corresponding controls.

Liver tissue culture

The embryo livers were aseptically harvested from 12-day-old embryonated chicken eggs. The liver tissue was washed, minced and placed in a 50 ml flask containing 2-3 ml of phosphate buffered saline. The minced liver tissue was trypsinized at room temperature for 15 minutes and the undigested tissue was allowed to settle. In order to inactivation of the enzyme, the supernatant fraction was transferred to a tube containing RPMI1640 medium supplemented with 20% fetal bovine serum The remaining tissues were repeatedly trypsinized until all the tissue pieces were digested The embryo liver cells were cultured in RPMI1640 medium, supplemented with 10 FCS and pencillin streptomycine (100 u ml, 100 μg ml), at 37 C in a humidified, CO_2-controlled (5) incubator (Bissell & Tilles, 1971).

Cytotoxicity assay

The MTT colorimetric assay was used to evaluation of thiram cytotoxicity (Carmichael et al., 1987; Zahri et al., 2009). The freshly prepared cells were suspended in a fresh medium and dispensed into 24-well microplates at 3×10^5 cells/well. After 24h of incubation, the fungicide was dissolved in DMSO and added to the cells at different concentrations (0, 0.25, 0.5, 1, 2.5 and 5 μg/ml) in the volume of 500 μl/well. Cells in the control wells were treated with the same volume of medium containing DMSO. After 16h, the medium was removed and the cells were incubated with 50μl of sterile aqueous solution of MTT 5 mg ml) for 3 h. The blue formazan precipitation was dissolved in DMSO and the absorbances of resulting solutions were measured at 540 nm The 50% inhibition concentration (IC_{50}) values were defined as the concentration of an agent required to induce a 50% reduction in absorbance. Viability percentage was evaluated as "($OD_{treatment}$ / $OD_{control}$)×100".

Statistically analysis

One-way ANOVA was used to determine the difference between groups and controls. A P-value of < 0.05 indicated significance. The analysis was performed using SPSS V. 14.

RESULTS

The in-ovo embrotoxicity studies showed that treatment of the embryos with thiram at the concentrations of 2.5, 5 and 10 μg egg increased embryos mortality by 22%, 44% and 80%, respectively. However, no significant effect was observed at concentration of 1 μg egg. The results showed that thiram exhibited an embryo toxicity effect in a dose-dependent manner with a LD_{50} (lethal dose, 50%) value of 3 5 μg egg (Fig. 2). However, the wet weight of embryos was not significantly affected by thiram On the other hand, typical morphologic malformations were observed at the concentrations of 2 5 and 5 μg egg In the concentration of 2.5 and 5 μg egg, the reduced body size and clubfoots were detected in 12 5 and 20% of the embryos (Fig. 3A).

Detailed study of skeleton by alizarin red staining showed that the treatment of the eggs with a 2 5μg egg of thiram induces wavy pubis and retarded skeletal growth in 12 5 of the embryos, which were characterized by unossified vertebrae (Fig. 3B). Incidence of unossified vertebrates was increased to 60 by dose-dependent increament of the fungicide up to 5μg egg (Fig. 2C). Treatment with the 10 μg egg of thiram was not led to any abnormalities, due likely to the excess mortality of the embryos.

Liver tissue culture as a major detoxification organ was used to evaluate of cytotoxic effects of the fungicide. Treating of the embryos liver cell culture with the various concentrations of thiram showed a significant decrease in the cell viability in a time- and dose-dependent manner ($P < 0.05$) In the concentration of 5.2 μg/ml thiram, the viability of 50% (IC_{50}) of liver cells was inhibited (Fig. 4). The growth of treated cells was clearly inhibited and analyses of cell shapes showed significant alterations in the elevated concentrations of thiram. The treated liver cells reduced to the condensed form and intercellular connections were lost.

The difference of mortality rates between control and 1 and 2.5 μg/egg was not significant and the liver cell cytotoxicity assays showed that > 60% of the cells were alive after treatment with the 2.5 μg/ml of thiram.

DISCUSSION

Thiram is a broad spectrum agriculture fungicide that is widely used to control seed decay and seedling blights. Because the maternal metabolism degrades the compound, some previous data have not been shown any teratogenic effects of the fungicide against mammals and it did not present any genotoxic hazard to humans (Larsen, 1992). These experiments showed that the administration of thiram (2.5 and 5 μg/egg) extensively reduces the body size and retard skeletal growth. Previous reports have shown that thiram induces apoptosis and inhibits angiogenesis and DNA synthesis, leading to the cell death in rapidly proliferating embryonic tissue (Ritter et al., 1971; Izaguirre et al., 2000; Hammond et al., 2001; Marikovsky, 2002; Grosicka et al., 2005). The observed retardation of the growth and reduction in the size of body may occur by induced apoptosis in embryo by the fungicide. Anthrogryposis or clubfoot is the prevalent imperfection in the treated groups and the cause of this phenomenon was postulated as muscular hypoplasia (Landauer, 1975). It has been suggested that this substances probably compete with acetylcholine for the possession of the acetylcholine receptors resulting in a pronounced cholinergic effect (Forsyth et al., 1994; Paul et al., 1999).

Previous reports have been described that thiram is rapidly degraded to more polar products in the adult rats and some other mammals and the LD_{50} was very high (2000-4000 mg/kg bw) (Thouin, 1985; Larsen, 1992), however, our results showed that the chicken embryos, which develop outside of the mother, were sensitive to toxicity of thiram and their grows and ossification was affected by the fungicide. Liver tissue is a major site for detoxification and xenobiotic metabolism in animals and our results show that thiram also possess cytotoxic effect against the liver tissue culture.

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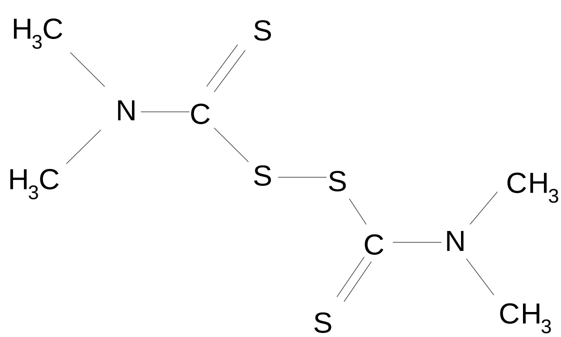

Figure 1. The structure of Thiram.

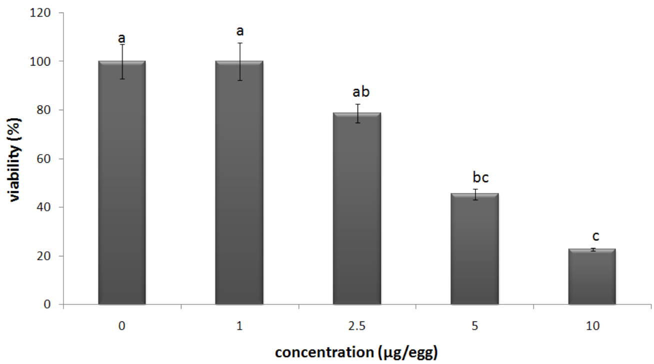

Figure 2 Effects of in ovo injection of various doses (1, 2 5, 5 and 10 µg egg) of thiram in vehicle (50µl of acetone) or vehicle alone in yolk sac of the fertile eggs prior to incubation Same letters indicates nonsignificant difference between groups.

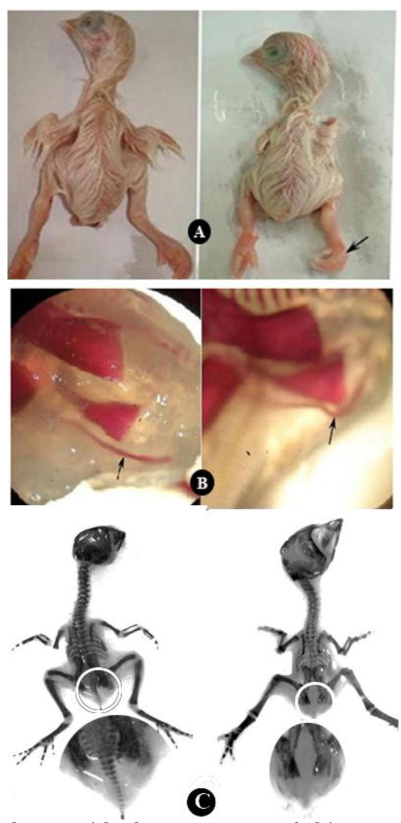

Figure 3. A: Treated embryos with the 2.5 µg egg of thiram prior to incubation which exhibits the reduced body size and clubfoot (right) and Control (left). (B) Control embryo (left) ant the embryo which was treated with the 2.5 µg egg displaying wavy pubis (right). (C) Control embryo (left) and the embryo which was treated with the 5µg egg showing unossified caudal vertebrae (right).

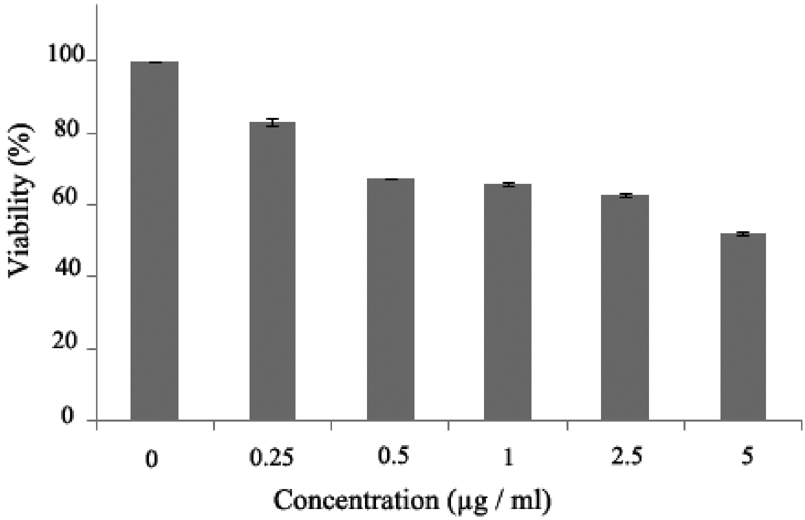

Figure 4. In vitro cytotoxic effects of the various doses (0 25, 0 5, 1, 2 5, 5 µg ml) of thiram against the liver cell culture after 16 h incubation.

EVALUATION OF PROXIMATE COMPOSITION OF MAIZE GRAINS INFESTED BY MAIZE WEEVIL (*SITOPHILUS ZEAMAIS* L.) (COLEOPTERA: CURCULIONIDAE)

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[**Osipitan, A. A., Olaifa, O. K. & Lawal, O. A.** 2012. Evaluation of proximate composition of maize grains infested by maize weevil (*Sitophilus zeamais* L.) (Coleoptera: Curculionidae). Munis Entomology & Zoology, 7 (1): 439-445]

ABSTRACT: The study examines change in the proximate composition of maize grains infested by varied population of maize weevil (*Sitophilus zeamais*). 50 gm maize grains (SUWAN-1) was weighed into 250 cm^3 Kilner glass jars and separately infested with 5pairs, 10 pairs and 15 pairs of *S. zeamais* for ninety days. A 250 cm^3 Kilner jar filled with 50 gm uninfested maize grains served as control. All treatments and control were replicated four times and arranged on the work-table in the laboratory using completely randomized design. At 90 day post-infestation of the maize grains, data were collected on damage indices such as % grain weight loss, % grain damage, weight of grain dust and final population of *S. zeamais*. The proximate composition of the damaged and undamaged maize grains was determined by analyzing the maize grains for total protein, fat, starch, sugar, moisture and ash contents using the standard analytical method (AOAC, 1970). The data on proximate analysis was correlated with final population of *S. zeamais*, weight of grain dust, % grain weight loss and % grain damage. The results indicated that *S. zeamais* infestation of maize grains had a significant ($P < 0.05$) effect on protein, starch and moisture content of the infested maize grains. The damage to maize grains and depletion of its proximate composition directly correlated with the population of *S. zeamais*. Adequate preservation of stored maize grains from infestation by *S. zeamais* is therefore essential to reduce loss during storage and depletion of nutritional composition of stored maize grains.

KEY WORDS: *S. zeamais,* proximate composition, infestation, damage indices.

Maize – *Zea mays* is the third most important cereal crop after rice and wheat (CIMMYT, 1994). It has the widest distribution and is primarily grown for its grains which is consumed as human food and animal feed. The crop is high yielding, mature early, easy to process, readily digestible, cost less than other cereals and can be grown across a range of agroecologocal zones (Enyong et al., 1999). In some developed countries, maize is also grown for industrial products such as oil, syrup and starch (CGIAR, 1996). The diverse usefulness of maize has led to increase in maize production and reversed the downward spiral of food production in Africa. The world maize output was 301 million tonnes in 1992, but increased to 589million tonnes in 2000. The United State of American produces 43%, Asia (25%), Latin America and Caribbean (13%) and Africa (7%) of the production in 2000.

The production of maize and yield is however threatened by insect pest that infest the crop on the field and in the store. *S. zeamais* are the major primary insect pest of stored maize grains throughout the warmer part of the world. Typical infestation of maize by *S. zeamais* starts on the field and transferred to the store where population builds up and cause greater damage to the maize grains (Howe, 1963; Hall et al., 1999). The growth and development of the insect in storage is favourably enhanced by suitable ambient temperature and relative humidity. Hall (1963) reported that 80% of stored maize grains are attacked on the field by *S. zeamais* and the infestation caused 10–15 % loss after 4-5 months due to build up of the insect. White (1953) estimated 20% loss in kernels of wheat after 5 weeks due to infestation by maize weevil larvae. *S. zeamai*s is highly destructive and could completely destroy grains in elevation, bins, ships and other places where physical conditions for growth are favourable. *S. zeamai*s feeds and lay eggs in the maize kernel; complete their larval and pupal stages within the kernels. These activities involve boring and generation of grain dust which may affect the nutritional composition of maize kernel. Adem and Bourges (1981) and Torreblanca et al. (1983) reported 30% changes in the concentration of the amino acids, lysine and tryptophan in maize grains infested by larger grain borer (LGB) - *Prostephanus truncatus*. Osipitan et al. (2009) also reported the ability of LGB to introduce fungi such *Aspergillus niger, A. tamari, A. parasiticus, A. ochraceus, Fusarium compacticum* and *F. oxysporium* and bacteria such *Bacillus cereus, B. macerans, Proteus mirabilis, P. morganic, P. rettgeri, Proteus* sp., *Pseud geniculatum, P. fragii, P. putela, Serratia marcences* into infested host through their frass This study therefore examines change in the proximate composition of maize grains infested by varied population of maize weevil (*Sitophilus zeamais*).

MATERIALS AND METHODS

The study was conducted at the Entomological Research Laboratory of the Department of Crop Protection, College of Plant Science and Crop Production, University of Agriculture Abeokuta (UNAAB). The maize weevil – *Sitophilus zeamais* used for the study was obtained from the culture maintained in the Department of Crop Protection, University of Agriculture, Abeokuta (UNAAB) and cultured in shelled maize grains in 500cm^3 capacity Kilner glass jars. Several adults of mixed sexes and unknown ages were introduced into the culture media. Frass generated by feeding activities of the insects was sieved out on weekly basis using sieve of mesh size 0.25 mm to prevent excessive grain moisture content and growth of mould. Culture media were rejuvenated monthly to replace depleted ones, and adults were sieved out to set up new culture to guarantee regular source of insect.

Experimental procedure

50 gm uninfested maize grains were weighed into 250 cm^3 Kilner jars using Mettler weighing balance. Varied population of 5-10 days old *S. zeamais* was introduced into the jars as follows:

50 gm maize grains + 5 pairs *S. zeamais*
50 gm maize grains + 10 pairs *S. zeamais*
50 gm maize grains + 15 pairs *S. zeamais*
50 gm maize grains + No *S. zeamais* (Control)

The insects were sexed using the methods of Haines (1991). Each treatment was replicated four times and arranged on work-table in the laboratory using Completely Randomized Design (CRD).

50 gm maize grains were weighed into 250 cm^3 Kilner jars to monitor change in weight of grains as a result of moisture loss or gain (Hurlock, 1967). At 90 day post-infestation, the insects and the grain dust they generated by their feeding activities were sieved out of the grains and they were separated into damaged and undamaged and the following data were taken:

(i) Number of adult *S. zeamais*
(ii) Number of adult mortality

(iii) Weight of dust (gm)
(iv) Weight of damaged and undamaged grains
(v) Final weight of grains

Insects that did not move or respond to three probing with a blunt probe were considered dead (Obeng-Ofori & Reichmuth, 1997). Percentage weight lost and percentage damage respectively were calculated using the formulae, according to Baba Tierto (1994).

$$\% \text{ GWL} = \frac{\text{WCS} - \text{FWG} \times 100}{\text{WCS}}$$

GWL = Grain weight loss,
WCS = Weight of control sample,
FWG = Final weight of grains

$$\% \text{ GD} = \frac{\text{WDG} \times 100}{\text{WDUG}}$$

GD = Grain damaged,
WDG = Weight of damaged grains,
WDUG = Weight of damaged and undamaged grains

Determination of proximate composition of damaged grains

Proximate composition of damaged grains in each of the treatments and the undamaged grains (control) was determined by analyzing them for total protein, fat, starch, sugar, moisture and ash using the standard analytical method (AOAC, 1970). The data on proximate composition were also correlated with final population of *S. zeamais*, weight of grain dust, percentage grain weight loss and % grain damage.

Statistical analysis

Statistical analysis of data was based on SAS's general linear models procedure (SAS Institute, 2001). The data were subjected to Analysis of Variance (ANOVA). Significant means were compared using Student's Newman-Keuls Test (SNK) at $P < 0.05$.

RESULTS

Grain damage parameters

The final population (145.75) of *S. zeamais* from maize grains infested with 15 pairs of the insect was significantly ($P < 0.05$) higher than insect population from maize grains infested with 5 pairs. It was however, not significantly ($P > 0.05$) different from 144.00 *S. zeamais* from maize grains infested with 10 pairs of *S. zeamais* (Table1). As shown on Table1, the weight of grain dust (0.43 gm) was significantly ($P < 0.05$) lower in maize grains infested with 5 pairs of *S. zeamais*. The weight of grain dust (0.88 gm) was highest in maize grains infested with 15 pairs of *S. zeamais*. It was however, significantly ($P > 0.05$) comparable with weight of grain dust (0.79 gm) from maize grains infested with 10 pairs of *S. zeamais*.

The lowest grain weight loss (5.94%) was from maize grains infested with 5 pairs of *S. zeamais* and it differed significantly (P < 0.05) from weight loss of 10.21% from maize grains infested with 15 pairs of *S. zeamais*. The weight losses of 5.94% and 10.21% from maize grains infested with 10pairs and 15 pairs of *S. zeamais* respectively were not significantly (P > 0.05) different from each other (Table 1). The maize grains infested with 5 pairs of *S. zeamais* had a significantly (P < 0.05) lower % grain damage (54.23). The % grain damage from maize grains infested with 10 and 15 pairs of S. *zeamais* was 70.19 and 79.60 respectively. They were however not significantly (P > 0.05) different from each other (Table 1).

Proximate composition of damaged grains

As shown in Table 2, the proximate compositions of the maize grains at the different population of *S. zeamais* varied. The protein content (10.73) in the uninfested maize grains (control) was highest, but compare significantly (P > 0.05) with protein contents of 10.55 and10.05 from maize grains infested with 5pairs and 10 pairs of *S. zeamais* respectively. The protein content (9.65) of maize grains infested with 15 pairs of *S. zeamais* was the lowest, but compare significantly (P > 0.05) with protein contents (10.05) in maize grains infested with 10 pairs of *S. zeamais*.

The Moisture content of infested and damaged maize grains at all the population levels of *S. zeamais* infestation differ significantly (P < 0.05) from the moisture content of uninfested maize grains (control). The moisture content (12.60) of maize grains infested with 15 pairs of *S. zeamais* was significantly (P < 0.05) higher than moisture content in other *S. zeamais*-infested maize grains. The moisture contents (10.50 and 10.88) of maize grains infested with 5 pairs and 10 pairs of *S. zeamais* respectively were not (P > 0.05) significantly different from each other. Table 2 shows some depletion in starch content of *S. zeamais*-infested maize grains. The starch content of the damaged maize grains at all population level of *S. zeamais* infestation was significantly (P < 0.05) lower than the starch content of the undamaged maize grains. The lowest starch content (67.77) was in maize grains infested with 15 pairs of *S. zeamais*. It however, compare significantly (P > 0.05) with starch contents of 70.50 and 69.50 in maize grains infested with 5 pairs and 10 pairs of *S. zeamais* respectively. Irrespective of the population level of *S. zeamais* infestation, the composition of ash, fat and sugar were not significantly (P > 0.05) different from each other and from the uninfested maize grains.

Correlation of proximate composition of damaged maize grains and damage indices

The correlation (0.981) between % grain weight loss and % grain damage was positive and significant. Likewise, the correlation between final population of *S. zeamais* and % grain damage (0.975), final population of *S. zeamais* and % grain weight loss (0.958), % grain weight loss and weight of grain dust (0.701) were positive and significant (Table 3). The correlation between final population of *S. zeamais* and protein content (-0.682), % grain damage and protein content (-0.690), % grain weight loss and protein content (-0.752) were negative and significant (Table3).

DISCUSSION

In this study, maize grains infested with the higher population of *S. zeamais* had the highest grain weight loss and grain damage. This result is similar to the results of Arnarson et al. (1994) that reported variation in the damage to some infested maize grains by *S. zeamais*. The significant reduction in protein and starch content of maize grains infested by *S. zeamais* suggest depletion of these nutrients as a result of infestation by the insect. Adem & Bourges (1981) and Torreblanca et al. (1983) studied changes in the nutritional composition of maize grains infested by the larger grain borer (LGB) – *Prostephanus truncatus*, a storage insect pest of maize and reported 30% decline in the concentration of amino acids, lysine and tryptophan. In a similar study on nutritional depletion of maize kernel by *S. zeamais*, Dobie & Kilminster (1978) reported protein as an important nutrient in the diet of insect pest. The significant negative correlation of grain damage with protein content of damaged grains suggests that protein is one of the nutrients affected by the insect feeding.

In this study, the moisture content of infested and damaged maize grains increased. This may be as a result of the boring and other metabolic activities of the insect in infested grains. These activities will generate heat required for chemical reactions that proceed more frequently and rapidly at higher temperature with release of moisture as one of the bi-products of reactions. The results of this study is in agreement with the findings of Hayward et al. (1955) which reported surface heating, dampness and increase in moisture content of wheat- *Triticum aestivum* infested by *S. zeamais*.

In this study, the weight of grain dust obtained from infested maize grains directly vary with the population level of *S. zeamais*, grain weight loss and grain damage. This suggests that damage was done to the maize grains was as a result of the boring activities of the insect and conversion of maize grains to dust.

The results of these studies shows that *S. zeamais* is a highly destructive storage insect pest that could cause grain weight loss of between 5.94%, and 10.21%, grain damage of between 54.23%, and 79.60% in infested maize grains within 3 months. The results also show the ability of the insect to increase the moisture content of infested maize grains and cause reduction of starch and protein content. Conscious and concerted effort should therefore be made at preserving stored maize grains from infestation by *S. zeamais* to reduce loss in quantity and quality.

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Table 1. Final population and damage indices of grains infested with *S. zeamais*.

	Final population and damage indices of grains±SE			
Initial insect Population level	Final insect population	Weight of grain dust (gm)	% Grain weight loss	% Grain damage
0	0.00^{c}	0.00^{c}	0.00^{c}	0.00^{b}
5 pairs	96.25±1.97^{b}	0.43±0.13^{b}	5.94±2.12^{b}	54.23±1.80c
10 pairs	144.00±2.00^{a}	0.79±0.11^{a}	8.79±0.09^{ab}	70.19±2.42a
15 pairs	145.76±2.00^{a}	0.88±0.01^{a}	10.21±0.11^{a}	79.60±3.10a

Mean values in the same column having the same superscript are not significantly different, P> 0.05(SNK).

Table 2. Proximate composition of maize grains infested with *S. zeamais*.

Initial insect Population level	% Grain damage	Proximate composition of maize grains±SE Ash	Fat	Moisture	Total Protein	Starch	Sugar
0	0.00^{b}	1.82 ± 0.08^{a}	4.31 ± 0.14^{a}	10.48 ± 0.18^{a}	10.73 ± 0.27^{a}	72.20 ± 0.31^{a}	4.86 ± 0.15^{a}
5 pairs	54.23 ± 1.80^{c}	2.15 ± 0.26^{a}	4.13 ± 0.03^{a}	10.50 ± 0.15^{b}	10.55 ± 0.22^{a}	70.50 ± 2.12^{b}	4.39 ± 0.22^{a}
10 pairs	70.19 ± 2.42^{a}	1.71 ± 0.86^{a}	4.29 ± 0.09^{a}	10.88 ± 0.24^{b}	10.05 ± 0.24^{ab}	67.50 ± 2.20^{b}	4.37 ± 0.2^{a}
15 pairs	79.60 ± 3.10^{a}	1.84 ± 0.54^{a}	4.19 ± 0.12^{a}	12.60 ± 1.10^{c}	9.65 ± 0.14^{b}	67.77 ± 0.86^{b}	4.23 ± 0.16^{a}

Mean values in the same column having the same superscript are not significantly different, P> 0.05(SNK).

Table 3. correlation of proximate composition of maize grains with damage indices.

	Proximate composition of maize grains and damage indices of maize grains Protein	Fat	Sugar	Starch	Ash	Moisture Content	Final population of insect	% damage	% Weight loss	Weight of grain dust
Protein	1.00									
Fat	-0.319	1.00								
Sugar	0.209	0.249	1.00							
Starch	0.066	-0.144	0.603	1.00						
Ash	0.144	-0.112	-0.061	-0.40	1.00					
Moisture content	0.174	-0.283	-0.449	-0.310	-0.192	1.00				
Final insect Population	-0.682	-0.072	-0.382	-0.159	-0.161	0.121	1.00			
% Damage	-0.690**	-0.99	-0.401	-0.105	-0.153	0.048	0.975**	1.00		
%Weight loss	-0.752**	-0.049	-0.398	-0.117	-0.236	0.016	0.958**	0.981	1.00	
Weight of Grain dust	-0.438	-0.142	-0.481	-0.200	-0.151	0.279	0.782**	0.740**	0.701**	1.00

** Correlation significant at 0.01 level (2 –tailed)
* Correlation significant at 0.05 level (2 –tailed)

A CONTRIBUTION TO THE PICTURE-WINGED FLIES (DIPTERA: ULIDIIDAE) FROM FARS PROVINCE, IRAN

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ABSTRACT: Fars province in the south of Iran was surveyed for Ulidiidae (Insecta: Diptera) during 2009–2010. Four species belonging to 4 genera and 2 subfamilies Otitinae and Ulidiinae were recorded. Of these, *Ceroxys hortulana* (Rossi 1790) and *Ulidia omani* Steyskal 1970 are new to the fauna of Iran.

KEY WORDS: Fars province, Iran, Fauna, New record, Ulidiidae, Diptera.

The picture-winged flies, Ulidiidae (= Otitidae), are a family of true flies belonging to the superfamily Tephritoidea within the suborder Brachycera. Over 700 valid species are known, and these are distributed predominantly in the New World and, to a lesser degree, in the Palaearctic region, with few species widespread into tropical Africa, Asia, and into Oceania (Kameneva, 2003; 2005). The Iranian fauna of Ulidiidae is very poorly known. Papers by Kameneva (2008) and Kameneva & Korneyev (2010) contain a few faunistic records for the Ulidiidae of Iran, but none of the studies focused specifically on the Ulidiidae of the area. The objectives of the present study were to provide detailed information on the distribution of Ulidiidae in Fars province and to contribute to the knowledge of the Iranian fauna.

MATERIALS AND METHODS

This paper is the result of some collection trips to different locations in Fars province during 2009¬2010. The Fars province is located in southern Iran between 27°01′ and 31°51′N and between 50°27′ and 55°45′E, covering an area of 125,000 km^2. The climate of the province is arid to semiarid. The specimens were captured selectively by hand net or sweeping (Also, the McPhail trap and light trap were used) by the first author. The materials are deposited in the Department of Entomology, College of Agriculture, Islamic Azad University, Jahrom branch. The taxonomic arrangement of Fauna Europaea (2010) for subfamilies, tribes, genera and species are followed in this paper. Collecting periods are arranged chronologically.

RESULTS

The Ulidiidae species collected and identified during this 2-year study period are listed as follows:

Subfamily Otitinae Aldrich, 1932
Tribe Otitini Aldrich, 1932

The tribe is distributed in the Old World and North America, and is absent in South America and the temperate part of the Australasian region. It includes the widespread genera *Herina* Robineau-Desvoidy; *Melieria* Robineau-Desvoidy and the holarctic genera *Otites* Latreille; *Tetanops* Fallén and *Ceroxys* Macquart. The tribe also includes the nearctic genus *Hiatus* Cresson and the strictly palaearctic genera *Dorycera* Meigen and *Ulidiopsis* Hennig (Kameneva & Korneyev, 2006).

Genus *Ceroxys* Macquart, 1835
***Ceroxys hortulana* (Rossi, 1790)**
Material examined: 4 ♂, 1 ♀: Fars Province, Shiraz; 29°36' N 52°31' E, Elevation: 5048ft, 2 Nov. 2009, Captured by: McPhail trap on *Punica granatum* L. (Punicaceae).
Distribution: Europe, Near East, **First record from Iran.**

Subfamily Ulidiinae Macquart, 1835
Tribe Ulidiini Macquart, 1835

The picture-winged fly tribe Ulidiini includes about 90 species of the genera *Physiphora* Fallén, 1810, *Timia* Wiedemann, 1824 and *Ulidia* Meigen, 1826 (Kameneva, 2010).

Genus *Physiphora* Fallen, 1810

Most diverse of the genus occur in the Afrotropical region (Kameneva, 2010).
***Physiphora alceae* (Preyssler, 1791)**
Material examined: 1♂, 3 ♀: Fars Province, Estahban-Eij Village; 29 °05´N 54 °10´ E, Elevation: 5792ft, 20 Nov. 2009; Captured by: McPhail trap on on *Punica granatum* L. (Punicaceae), 7 ♂, 13 ♀: Fars Province, Estahban; 29 °07´N 54 °01´ E, Elevation: 5788ft, 17 Oct. 2009; Captured by: McPhail trap on *Ficus carica* L. (Moraceae), 1 ♀: Fars Province, Darab; 28 °51´N 54 °18´ E, Elevation: 5511ft, 24 Mar. 2009.
Distribution: Subcosmopolitan, except subpolar regions (Kameneva and Korneyev, 2010).

Genus *Timia* Wiedemann, 1824

The genus occurring predominantly in the Middle East and Central Asia (Kameneva, 2010).
***Timia (Empyelocera) abstersa* (Loew, 1873)**
Material examined: 3 ♂, 6 ♀: Fars Province, Kharameh; 29°32' N 53°19 E, Elevation: 4921ft, 28 May. 2009, hand net on *Medicago sativa* L. (Fabaceae).
Distribution: Widespread in sub arid zones of the Palaearctic Region, from Southern Moldova and Ukraine, eastwards to Mongolia, and in steppes and semi-deserts of European Russia (Volgograd and Astrakhan Regions), Kazakhstan, states of Middle Asia and Iran (Kameneva, 2008).

Genus *Ulidia* Meigen, 1826

All known species occur in the Palearctic region, commonly occurring in dry meadows, wood-and-steppe and steppe grasslands or semi-deserts in late spring or early summer. Only one species, *Ulidia fulvifrons* Bigot, 1857, is found in the New World (Kameneva, 2008; Chen and Kameneva, 2009; Kameneva, 2010).
***Ulidia omani* Steyskal, 1970**
Material examined: 1 ♂: Fars Province, Shiraz; 30°27' N 53°37' E, Elevation: 5047ft, 5 Mar. 2010, hand net on *Armoracia rusticana* G. Gaertn., B. Mey. & Scherb. (Brassicaceae).
Distribution: Moldova, Near East, **First record from Iran.**

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AN EVALUTION ON COLEOPTERA (INSECTA) SPECIES COLLECTED BY PITFALL TRAPS IN KARABİGA (ÇANAKKALE PROVINCE) OF TURKEY

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[Surgut, H. & Varlı, S. V. 2012. An evalution on Coleoptera (Insecta) species collected by pitfall traps in Karabiga (Çanakkale province) of Turkey. Munis Entomology & Zoology, 7 (1): 449-461**]**

ABSTRACT: This study was carried out by pitfall traps to determine Coleoptera species on 10 sampling zones at different biotopes occupied by plantation, oak and meadow from May to December of 2009 and from March to October of 2010 in Karabiga (Çanakkale province). During field studies, the samples were collected by using 7 pieces of pitfall traps by random parcellation in each sampling zone and then determined in laboratuary. As a result of this study, 29 species and 1 subspecies belonging to five families of Coleoptera were determined. These were *Harpalus smaragdinus* Duftschmid, 1812; *H. distinguendus* Duftschmid, 1812; *Dixus obscurus* Dejean, 1825; *Ditomus calydonius* Rossi, 1790; *Brachinus explodens* Duftschmid, 1812; *B. crepitans* Linnaeus, 1758; *Nebria brevicollis* Fabricius, 1792; *Poecilus cupreus* Linnaeus, 1758; *Carabus coriaceus* Linnaeus, 1758; *C. graecus* Dejean, 1826; *Chlaenius festivus* Panzer, 1796; *Calathus libanensis* Putzeys, 1873; *C. longicollis* Motschulsky, 1864; *C. erythroderus* Gemminger & Harold, 1868; *Olisthopus fuscatus* Dejean, 1828; *Pristonychus conspicuus* Waltl, 1838; *Broscus nobilis* Dejean, 1828 (Carabidae); *Dailognatha quadricollis* Eschscholtz, 1829; *Cossyphus tauricus* Steven, 1829; *Pedinus strabonis* Seidlitz, 1893; *Gonocephalum costatum* Brullé, 1832; *Blaps tibialis* Reiche, 1857; *Probaticus tenebricosus* Brullé, 1832 (Tenebrionidae); *Pittonotus theseus* Germar, 1817; *Drasterius bimaculatus* Rossi, 1790; *Melanotus fusciceps* Gyllenhal, 1817 (Elateridae); *Silpha obscura orientalis* Brullé, 1832 (Silphidae); *Ocypus curtipennis* Motschulsky, 1864; *Quedius levicollis* Brullé, 1832; *Tasgius morsitans* Rossi, 1790 (Staphylinidae).

KEY WORDS: Coleoptera, pitfall trap, Karabiga, Çanakkale, Turkey.

Turkey has a very diverse faunistic structure in terms of geological, ecological and climate with a connection between Europae and Asia. Karabiga (40°40'12" N/27°30'13" E) is a peninsula with an altitude ranging from 0 m to 224 m. Pitfall trapping is a method used effectively in the sampling of insects living on soil surface or in soil and under stone. With this method, it is likely to catch species of useful, harmful and neutral insects in soil layers. So our understanding of insect biodiversity is increasing by being informed about the seasonal fluctuations of this species in ecosystems.

With this study, the specimens belonging to Carabidae, Tenebrionidae, Elateridae, Silphidae and Staphylinidae of Coleoptera were collected by pitfall traps for the first time in Karabiga, and were aimed to contribute to the basis for ecological and the faunistic studies in the future. Some of the studies made on this families by pitfall trap method before are reported by Tezcan et al. (2000), Mercan et al. (2004), Anlaş et al. (2004), Gülperçin (2006), Gülperçin & Tezcan (2006), Avgın (2006), Anlaş (2007), Tezcan et al. (2007), Aslan et al. (2008), Canpolat (2008), Uzüm et al. (2009), Tezcan et al. (2010), Tanyeri et al. (2010), Varlı et al. (2010).

MATERIALS AND METHODS

The studies were performed at 10 sampling zones in biotopes occupied by plantation, oak and meadow from May to December of 2009 and from March to October of 2010 in Karabiga (Çanakkale, 40°40'12" N - 27°30'13" E) province (Fig. 1). Information on these areas are given in Table 1.

Seven pieces of pitfall traps were placed that the mouth part of 100 ml traps at the top of the soil and not closer than 25 meters to each other in each of the selected fields by random parcellation and after adding a mixture of ethylen glycol-water (1:1) the mouth part of the traps was camouflageded. The materials were collected from the traps every fifteen days and were brought to the laboratory in 70% ethanol. After collecting the materials, the places of the traps were changed in the same area taking into account the number of specimen and ecological conditions.

After pinning the collected materials, being writed biotopes, collection date and the area of the research by their names for any specimens, for diagnosis was conducted to Prof. Dr. Serdar Tezcan (Aegean University, Faculty of Agriculture, Department of Plant Protection, Entomology Department, İzmir), Assistant. Prof. Dr. Bekir Keskin (Aegean University, Faculty of Science, Department of Biology, İzmir), Assistant Prof. Dr. Nilay Gülperçin (Aegean University, Faculty of Science, Department of Biology, İzmir) and Instructor Tuba Öncül Abacıgil (Balıkesir University, Edremit Vocational Schools).

The examined materials are protected in Biology Department Entomology laboratory of Balıkesir University, Faculty of Science And Literature.

RESULTS

As a result of this study, 29 species and 1 subspecies belonging to five families of Coleoptera were determined. The species, subspecies and their families based on the diagnosis of the specimens examined are given below along with their disribution in Turkey.

Family: Carabidae

Subfamily: Harpalinae

***Harpalus smaragdinus* Duftschmid, 1812**

Material: Karabiga, Meadow-1, 2 m, 07.06.2009, (1) specimen. 26.04.2010, (1) specimen. Plantation-7, 50 m, 27.03.2010, (3) specimens. Plantation-9, 135 m, 27.03.2010, (5) specimens. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Anatolia, Antalya (Finike, Olympos, Söğüt lake, Yarpuz), Ardahan, Artvin (Kaçkar Mt., Meretet, Şavşat, Yalnızçam Mt.), Bitlis (Süphan Mt.), Bolu (Akyarma pass, Gerede), Çankırı (Ilgaz), Erzurum (Central, Ispir road, Oltu, Tortum), Giresun (Kümbet, Yağlıdere), Gümüşhane (Vaudağı pass), Kars (Sarıkamış), Manisa, İzmir-Kemalpaşa (Armutlu- Oren) (Csiki, 1932; Casale & Taglianti 1999; Kesdek & Yıldırım, 2003; Tezcan et al., 2007; Tezcan et al., 2010).

***Harpalus distinguendus* Duftschmid, 1812**

Material: Karabiga, Meadow-2, 2 m, 15.05.2010, (9) specimens. Meadow-10, 58 m, (3) specimens. Plantation-9, 27.03.2010, 135 m, (2) specimens. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Anatolia, Içel (Erdemli), Konya (Ivriz), Ankara, Antalya (Alanya, Beşkonak, Kızıllot, Manavgat, Perge, Sağırın, Sinekçibeli pass, Söğüt Golü, Termessos, Yarpuz), Artvin (Borçka), Aydın (Kuşadası), Bayburt (Bayburt), Burdur (Kızılkaya), Erzincan, Erzurum (Çat, Ispir road, Kop pass, Tortum), Giresun (Şebinkarahisar), Gümüşhane (Vaudağı pass), Isparta (Egirdir, Keçili), Istanbul (Büyükdere), Izmir (Kemalpaşa (Armutlu-Oren), Bergama, Bozdağ, Efes), Kahramanmaraş (Gözecik), Tokat (Niksar), Trabzon (Bodemeyer, 1900; Csiki, 1932; Gadeau de Kerville, 1939; Casale & Taglianti, 1999; Kesdek & Yıldırım, 2003; Tezcan et al., 2007; Tezcan et al., 2010).

***Dixus obscurus* Dejean, 1825**

Material: Karabiga, Meadow-3, 1 m, 08.08.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Anatolia, Izmir, Karşıyaka (Yamanlar Mt.), Menderes (Casale & Taglianti, 1999; Tezcan et al., 2010).

***Ditomus calydonius* Rossi, 1790**

Material: Karabiga, Plantation-5, 40 m, 22.06.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Anatolia (Casale & Taglianti, 1999).

Subfamily: Brachininae

***Brachinus explodens* Duftschmid, 1812**

Material: Karabiga, Meadow-2, 2 m, 01.07.2009, (1) specimen. Meadow-3, 1 m, 27.05.2010, (1) specimen. Plantation-7, 50 m, 27.03.2010, (1) specimen. Plantation-8, 53 m, 27.03.2010, (1) specimen. **Distribution:** Anatolia, Izmir (Kemalpaşa (Armutlu-Oren), Çiçekli), Eskişehir, Denizli, Ankara, Amasya, Antalya (Akseki, Bakacakbeli pass, Demirtaş, Elmalı, Korkuteli, Murtiçi, Söğütçük, Topraktepe, Yarpuz), Aydın (Kuşadası), Bolu (Abant, Akyarma geçidi, Boludağı pass, Köroğlu pass), Çanakkale (Ortaca), Çankırı (Çubucuk pass, Ilgaz), Giresun (Şebinkarahisar), Içel (Erdemli, Gülnar, Ulaş), Istanbul, Konya (Bakaran, Ivriz, Yeşildağ), Kahramanmaraş (Göksun), Tokat, Trabzon (Maçka) (Sahlberg, 1912-1913; Gadeau de Kerville, 1939; Bytinski-Salz, 1956; Casale & Taglianti, 1999; Tezcan et al., 2007; Tezcan et al., 2010).

***Brachinus crepitans* Linnaeus, 1758**

Material: Karabiga, Meadow-2, 2 m, 15.05.2010, (3) specimens. Meadow-10, 58 m, 27.05.2010, (2) specimens. Plantation-9, 135 m, 27.03.2010, (2) specimens. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Anatolia, Izmir- Kemalpaşa (Oren), Antalya (Avlan lake, Seklik), Artvin (Şavşat), Bitlis (Süphan Mt.), Bolu (Abant, Bolu Mt. pass), Burdur (Kızılkaya, Söğüt lake), Çankırı (Çubucuk pass, Ilgaz), Erzurum (Yumaklı), Kastamonu (Ilgaz Mt.), Konya (Yelibel pass), Sinop (Csiki, 1933; Bytinski-Salz, 1956; Casale & Taglianti, 1999; Tezcan et al., 2007; Tezcan et al., 2010).

Subfamily: Nebriinae

***Nebria brevicollis* Fabricius, 1792**

Material: Karabiga, Meadow-1, 2 m, 07.06.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Anatolia, Izmir (Bornova, Bozdağ, Kemalpaşa (Armutlu-Oren), Somak, Torbalı), Bolu (Abant), Antalya (Alanya, Manavgat, Yarpuz), Artvin (Yalnızçam Mt.), Aydın (Germencik), Denizli (Bozkurt), Istanbul (Büyükdere), Kastamonu (Ilgaz Mt. pass), Ordu (Akkuş) (Csiki, 1933; Bytinski-Salz, 1956; Gül-Zümreoğlu, 1972; Casale & Taglianti, 1999; Tezcan et al., 2007; Tezcan et al., 2010).

Subfamily: Pterostichinae

***Poecilus cupreus* Linnaeus, 1758**

Material: Karabiga, Meadow-2, 2 m, 07.06.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Anatolia, Ankara, Izmir-Kemalpaşa (Armutlu-Oren), Antalya (Avlan lake), Ardahan, Artvin (Yalnızçam pass), Aydın (Güdüşlü), Balıkesir (Bandırma), Bolu (Mengen), Çankırı, Erzurum (Köprübaşı, Tortum, Uzundere), Kars (Arpaçay, Dağpınar, Ilgar pass, Susuz), Kastamonu, Konya (Yelibel pass), Ordu (Akkuş), Sinop (Dranoz Mt.) (Csiki, 1932; Gadeau de Kerville, 1939; Casale & Taglianti, 1999; Tezcan et al., 2007; Tezcan et al., 2010).

Subfamily: Carabinae

***Carabus coriaceus* Linnaeus, 1758**

Material: Karabiga, Meadow-2, 2 m, 07.06.2009, (2) specimens. Meadow-3, 1 m, 21.06.2009, (1) specimen. Oak-6, 101 m, 12.03.2010, (1) specimen. 26.04.2010, (1) specimen. 15.05.2010, (2) specimens. 27.05.2010, (3) specimens. 01.08.2010, (1) specimen. Plantation-7, 50 m, 15.05.2010, (5) specimens. Plantation-8, 53 m, 27.05.2010, (6) specimens. Plantation-9, 135 m, 01.08.2010, (4) specimens. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Western Mediterranean, Aegean and Marmara, Izmir (Bornova) (Casale et.al., 2003; Tezcan et al., 2010).

***Carabus graecus* Dejean, 1826**

Material: Karabiga, Oak-6, 101 m, 12.03.2010, (1) specimen. Plantation-7, 50 m, 15.05.2010, (2) specimens. Plantation-9, 135 m, 15.05.2010, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Western Mediterranean, Aegean, Marmara, Ankara (Casale et.al., 2003; Kocatepe & Mergen, 2004).

Subfamily: Chlaeniinae

***Chlaenius festivus* Panzer, 1796**

Material: Karabiga, Meadow-3, 1 m, 01.07.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Mediterranean, Norhteast Anatolia, Southeast Anatolia, Izmir (Bornova, Urla) (Casale & Taglianti, 1999; Tezcan et al., 2010).

Subfamily: Platyniinae

***Calathus libanensis* Putzeys, 1873**

Material: Karabiga, Meadow-2, 2 m, 07.06.2009, (1) specimen. 21.06.2009, (1) specimen. 22.08.2009, (1) specimen. 07.11.2009, (2) specimens. Plantation-8, 53 m, 12.09.2010, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Anatolia, Denizli (Güney, Kazıkbeli pass), Eskişehir (Inönü), Gaziantep (Nurdağı), Isparta (Eğirdir, Sultan Mt., Yukarıgökdere), İstanbul (Alemdağ), Izmir (Çiçekli, Muradiye), Kahramanmaraş (Göksun), Kayseri (Pınarbaşı), Konya (Engilli), Nevşehir (Topuz Mt.), Osmaniye (Zorkun, Gökbeli), Sivas (Bulucan) (Casale & Taglianti, 1999; Tezcan et al., 2007).

***Calathus longicollis* Motschulsky, 1864**

Material: Karabiga, Oak-6, 101 m, 27.05.2010, (1) specimen. Plantation-8, 53 m, 27.05.2010, (1) specimen. Plantation-9, 135 m, 27.05.2010, (1) specimen. **Distribution:** Anatolia, Izmir-Kemalpaşa (Armutlu-Oren), Balıkesir, Bingöl, Erzincan, Erzurum, Konya, Ardahan, Iğdır, Kars, Adana, Adapazarı, Amasya, Antalya, Aydın, Bolu, Burdur, Bursa, Çanakkale, Çorum, Edirne, Eskişehir, Giresun, Gümüşhane, Isparta, Içel, Istanbul, Kahramanmaraş, Kastamonu, Kayseri, Kütahya, Manisa, Muğla, Nevşehir, Niğde, Ordu, Rize, Samsun, Sinop, Tokat, Trabzon, Yozgat (Battoni and Vereschagina, 1984; Oncüer, 1991; Casale and Taglianti, 1999; Kesdek & Yıldırım, 2004; Kesdek & Yıldırım, 2007; Tezcan et al., 2007; Tezcan et al., 2010).

***Calathus erythroderus* Gemminger & Harold, 1868**

Material: Karabiga, Plantation-7, 50 m, 26.04.2010, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Bingöl, Elazığ, Erzincan, Erzurum, Kars, Konya, Ardahan (Kesdek & Yıldırım, 2004; Kesdek, 2007).

***Olisthopus fuscatus* Dejean, 1828**

Material: Karabiga, Meadow-2, 2 m, 07.11.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Anatolia, Antalya (Demirtaş, Geris, Murtiçi, Perge, Sağırın, Taşkesiği, Termessos, Yarpuz), Izmir, Kemalpaşa (Armutlu), Muradiye (Casale & Taglianti, 1999; Tezcan et al., 2007; Tezcan et al., 2010).

***Pristonychus conspicuus* Waltl, 1838**

Material: Karabiga, Plantation-8, 53 m, 12.03.2010, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Afyon (Sultan Mt.), Ankara (Elmadağ), Antalya (Akyay, Korkuteli), Denizli (Güney), Içel (Sertavul pass), Kırşehir (Çiçekdağı), Konya (Engilli), Izmir-Kemalpaşa (Armutlu, Oren), Muradiye, Manisa (Casale, 1988; Tezcan et al., 2007; Tezcan et al., 2010).

Subfamily: Broscinae

***Broscus nobilis* Dejean, 1828**

Material: Karabiga, Meadow-1, 2 m, 07.06.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Anatolia, Izmir, Menemen (The coast of the Gediz river) (Casale & Taglianti, 1999; Tezcan et al., 2010).

Family: Tenebrionidae
Subfamily: Pimeliinae
***Dailognatha quadricollis* Eschscholtz, 1829**

Material: Karabiga, Meadow-1, 2 m, 07.06.2009, (1) specimen. 27.05.2010, (1) specimen. Oak-6, 101 m, 01.08.2010, (3) specimens. 12.09.2010, (2) specimens. Plantation-8, 53 m, 12.09.2010, (2) specimens. Plantation-9, 135 m, 01.08.2010, (3) specimens. 15.05.2010, (1) specimen. **Distribution:** Izmir-Balçova (Central, Çatalkaya), Bornova, Çeşme, Kemalpaşa (Central, Armutlu-Oren), Gaziemir, Menderes, Odemiş (Central, Bozdağ), Karşıyaka (Şemikler,Yamanlar), Karaburun-Mordoğan, Menderes (Cumaovası, Gümüşsu), Narlıdere, Seferihisar, Urla, Osmaniye, Kayseri, Denizli, Antalya, Eskişehir, Manisa, Adana, Adıyaman, Ağrı, Aydın, Bitlis, Çanakkale, Gaziantep, Gümüşhane, Hakkari, Hatay, Kahramanmaraş, Karaman, Kırıkkale, Konya, Mersin, Muğla, Nevşehir, Niğde, Tunceli (Ferrer & Soldati, 1999; Tezcan et al., 2004a; Tezcan et al., 2010).

Subfamily: Lagriinae
***Cossyphus tauricus* Steven, 1829**

Material: Karabiga, Meadow-2, 2 m, 21.06.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Istanbul, Izmir, Bornova, Menemen (Hatundere), Manisa (Tezcan et al., 2004a; Háva, 2007; Tezcan et al., 2010).

Subfamily: Tenebrioninae
***Pedinus strabonis* Seidlitz, 1893**

Material: Karabiga, Meadow-4, 2 m, 03.10.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Eskişehir, Karaman, Adana, Ağrı, Ankara, Bursa, Çorum, Diyarbakır, Gümüşhane, Isparta, Istanbul, Kastamonu, Kayseri, Konya, Mersin, Kırıkkale, Muğla, Nevşehir, Niğde (Ferrer & Soldati, 1999; Tezcan et al., 2004a).

***Gonocephalum costatum* Brullé, 1832**

Material: Karabiga, Meadow-1, 2 m, 07.06.2009, (2) specimens. Meadow-2, 2 m, 21.06.2009, (8) specimens. 15.05.2010, (2) specimens. 27.05.2010, (2) specimens. **Distribution:** Izmir (Central, Bornova, Çeşme, Gaziemir, Kemalpaşa, Kınık), Adana, Ağrı, Aksaray, Ankara, Balıkesir, Çanakkale, Diyarbakır, Hakkari, Isparta, Istanbul, Kahramanmaraş, Kayseri, Konya, Nevşehir, Muğla (Tezcan et al., 2004a; Tezcan et al., 2010).

***Blaps tibialis* Reiche, 1857**

Material: Karabiga, Oak-6, 101 m, 01.08.2010, (1) specimen. Plantation-7, 50 m, 26.04.2010, (1) specimen. 15.05.2010, (2) specimens. 27.05.2010, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Izmir, Balçova, Bornova (Central, Pınarbaşı), Karşıyaka (Yamanlardağı), Kemalpaşa, Kınık, Konak (Gültepe, Kadifekale), Ödemiş (Bozdağ), Selçuk, Tire, Antalya, Kayseri, Isparta, Konya, Niğde, Sivas, Adana, Nevşehir, Aydın, Ağrı, Ankara, Burdur, Diyarbakır, Edirne, Eskişehir, Kahramanmaraş, Kırıkkale, Manisa, Osmaniye, Van (Soldati, 1999; Tezcan et al., 2004b; Ferrer & Canpolat, 2008; Tezcan et al., 2010).

***Probaticus tenebricosus* Brullé, 1832**

Material: Karabiga, Plantation-8, 53 m, 15.05.2010, (1) specimen. **Distribution:** Ağrı, Bursa, Çanakkale, Kocaeli, Kütahya, Mersin, Burdur, Izmir, Balçova (Central, Konak), Bornova (Central, Doğanlar), Kemalpaşa (Armutlu-Oren), Menderes (Gümüldür, Cumaovası), Odemiş (Bozdağ), Urla (Central, Çeşmealtı) (Tezcan et al., 2004b; Tezcan et al., 2010).

Family: Elateridae
Subfamily: Elaterinae
***Pittonotus theseus* Germar, 1817**

Material: Karabiga, Plantation-8, 53 m, 22.08.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Anatolia, Izmir (Bornova, Çeşme, Gümüldür, Kemalpaşa, Armutlu, Konak, Tire), Mersin (Çamlıyayla), Samsun (Akpınar), Adana (Pozantı), Denizli (Menderes Vadisi), Mersin (Derbent, Kızılen) (Winkler, 1924-1932; Schmitscheks, 1953; Tarnawski, 1984; Guglielmi & Platia, 1985; Preisse & Platia, 2003; Dusanek & Mertlik, 2004; Jansonn & Coşkun, 2008; Tezcan et al., 2010).

Subfamily: Pyrophorinae

***Drasterius bimaculatus* Rossi, 1790**

Material: Karabiga, Meadow-1, 2 m, 07.06.2009, (3) specimens. Meadow-2, 2 m, 08.08.2009, (6) specimens. 26.04.2010, (2) specimens. 15.05.2010, (7) specimens. Meadow-3, 1 m, 01.07.2009, (2) specimens. Oak-6, 101 m, 12.03.2010, (3) specimens. 15.05.2010, (13) specimens. Plantation-7, 50 m, 26.04.2010, (3) specimens. Plantation-8, 53 m, 26.04.2010, (2) specimens. 27.05.2010, (1) specimen. Meadow-10, 58 m, 15.05.2010, (8) specimens. **Distribution:** Anatolia, Adana (Bolkar Mt., Pozantı), Mersin (Tarsus, Çamlıyayla), Western Anatolia, Karaman, Çanakkale-Balıkesir (Kaz Dağları), Adapazarı, Istanbul, Izmir (Central, Bornova, Kemalpaşa-Armutlu, Kınık, Kiraz, Menderes, Gümüldür, Odemiş, Seferihisar, Sığacık, Urla), Amasya, Artvin (Borçka), Aydın (Selçuk-Efes), Bitlis, Bolu, Bursa (Inegöl), Düzce (Akçakoca, Konuralp), Isparta, Erzurum (Kopdağı pass), Eskişehir (Sivrihisar), Gaziantep (Islahiye), Kastamonu, Muğla (Yatağan), Samsun (Bafra), Trabzon (Maçka) (Sahlberg, 1912-1913; Schenkling, 1925-1927; Winkler, 1924-1932; Gül-Zümreoğlu, 1972; Guglielmi & Platia, 1985; Laibner, 2000; Cate et.al., 2002; Dusanek & Mertlik, 2004; Kovancı et al., 2004; Tezcan et al., 2010; Varlı et al., 2010).

Subfamily: Melanotinae

***Melanotus fusciceps* Gyllenhal, 1817**

Material: Karabiga, Oak-6, 101 m, 26.04.2010, (1) specimen. Plantation-8, 53 m, 01.08.2010, (2) specimens. **Distribution:** Izmir (Bornova, Karaburun-Mordoğan, Kemalpaşa, Menemen, Seferihisar), Western, Central, Eastern and South Anatolia, Çanakkale (Güzelyol, Intepe, Truva), Diyarbakır (Central), Şanlıurfa (Karacadağ), Mersin (Derbent, Kızılen), Bursa (Guglielmi & Platia, 1985; Lodos, 1998; Kaya & Kovancı, 2004; Jannson & Coşkun, 2008; Tezcan et al., 2010).

Family: Silphidae

Subfamily: Silphinae

***Silpha obscura orientalis* Brullé, 1832**

Material: Karabiga, Meadow-1, 2 m, 07.06.2009, (10) specimens. Meadow-2, 2 m, 21.06.2009, (56) specimens. 26.04.2010, (11) specimen. 15.05.2010, (29) specimens. Meadow-3, 1 m, 01.07.2009, (10) specimens. Meadow-10, 58 m, 15.05.2010, (9) specimens. 27.05.2010, (65) specimens. Oak-6, 101 m, 01.08.2010, (140) specimens. 27.05.2010, (55) specimens. Plantation-7, 50 m, 01.08.2010, (44) specimens. Plantation-8, 53 m, 27.03.2010, (10) specimen. 27.05.2010, (10) specimens. 01.08.2010, (38) specimens. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Izmir, Kemalpaşa (Armutlu-Oren), Dikili, Kocaeli (Gebze), Ankara (Kazan, Şereflikoçhisar), Antalya, Anatolia (Schawaller, 1980; Açar, 2008; Tezcan et al., 2010).

Family: Staphylinidae

Subfamily: Staphylininae

***Ocypus curtipennis* Motschulsky, 1864**

Material: Karabiga, Meadow-1, 2 m, 21.06.2009, (1) specimen. 07.11.2009, (5) specimens. Meadow-2, 2 m, 07.11.2009, (5) specimens. 24.10.2009, (3) specimens. Meadow-3, 1 m, 07.11.2009, (2) specimens. **Remarks:** New record for the local fauna of the province of Çanakkale. **Distribution:** Izmir (Bornova), Bursa, Istanbul, Hatay, Antalya (Kesdek et al., 2009; Anlaş, 2009; Anlaş & Rose, 2009; Tezcan et al., 2010).

***Quedius levicollis* Brullé, 1832**

Material: Karabiga, Meadow-1, 2 m, 21.06.2009, (1) specimen. Meadow-2, 2 m, 24.10.2009, (2) specimens. 07.11.2009, (2) specimens. Meadow-3, 1 m, 21.06.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Erzurum, Adana, Ankara, Manisa, Izmir (Kesdek et al., 2009; Anlaş, 2009; Anlaş & Rose, 2009).

***Tasgius morsitans* Rossi, 1790**

Material: Karabiga, Meadow-1, 2 m, 24.10.2009, (1) specimen. Meadow-2, 2 m, 07.11.2009, (4) specimens. Meadow-3, 1 m, 07.11.2009, (1) specimen. **Remarks:** New record for the local fauna of the province of Çanakkale and the fauna of the Marmara region. **Distribution:** Anatolia (Casale & Taglianti, 1999).

DISCUSSIONS

As a result of this study, 687 specimens belonging to 29 species and 1 subspecies of five families of Coleoptera were determined (Table 2). Of These families, Carabidae with 17 species took the first place and Tenebrionidae followed it with 6 species (Table 3). In terms of the number of captured specimens, Silphidae with a total of 487 (70.89%) specimens took the first place and then Carabidae followed it with a total of 83 (12.08%) specimens. Silphidae was represented with a single subspecies with numerous specimens.

As the captured specimens were evaluated according to species; *S. obscura orientalis* was found the most common with a total of 487 specimens (70.89%). *D. bimaculatus* followed it with a total of 50 (7.28%) specimens. 26 (3.78%) specimens of *C. coriaceus,* 16 (2.33%) specimens of *O. curtipennis*, 14 (4.08%) specimens of *H. distinguendus* and *G. costatum*, 13 (1.89%) specimens of *D. quadricollis,* 10 (1.46%) specimens of *H. smaragdinus*, 7 (1.02%) specimens of *B. crepitans*, 6 (2.62%) specimens of *C. libanensis*, *Q. levicollis* and *T. morsitans*, 5 (0.73%) specimens of *B. tibialis*, 4 (1.16%) specimens of *B. explodens* and *C. graecus*, 3 (0.87%) specimens of *C. longicollis* and *M. fusciceps*, 1 (1.89%) specimen of *D. obscurus*, *D. calydonius*, *N. brevicollis*, *P. cupreus*, *C. festivus*, *O. fuscatus*, *C. erythroderus*, *P. conspicuus*, *B. nobilis*, *P. theseus*, *C. tauricus*, *P. strabonis*, *P. tenebricosus* were caught.

As the field studies were evaluated according to biotopes; by 228 (33.19%) specimens of 7 species and 1 subspecies in biotop of oak samples, by 160 (23.29%) specimens of 16 species and 1 subspecies in biotop of plantation, by 299 specimens of 20 species and 1 subspecies in biotop of meadow were represented (Table 2). *S. obscura orientalis*, *D. bimaculatus* and *D. quadricollis* were found in 3 seperate biotopes. *H. distinguendus*, *H. smaragdinus*, *B. explodens*, *C. libanensis* were found in plantation and meadow biotopes. *C. graecus*, *C. longicollis*, *M. fusciceps* and *B. tibialis* were found in oak and plantation biotopes. *P. conspicuus*, *P. tenebricocus*, *C. erythroderus*, *P. theseus* and *D. calydonius* were found in plantation biotope. *O. curtipennis*, *Q. levicollis*, *T. morsitans*, *G. costatum*, *B. nobilis*, *O. fuscatus*, *P. strabonis*, *C. tauricus, C. festivus, P. cupreus, N. brevicollis, D. obscurus* were found in meadow biotope.

The distribution and the number of specimens belonging to the biotopes were given in Table 3.

As the number of species was evaluated according to families and subfamilies in the study area; the number of the maximum abundant species was Carabidae with 17 species (56.66%). The number of the maximum abundant species in Carabidae was Platyninae with 5 species (29.41%). Tenebrionidae was represented with 6 species (20%) and its richest subfamily was Tenebrioninae with 4 species (66.67%). Elateridae was represented with 3 species (10%) and also these species belonged to Elaterinae, Pyrophorinae and Melanotinae, respectively. *S. obscura orientalis* was the only species collected in Silphidae (3.34%). Staphylinidae was represented with 3 species (10%) and all species of this family belonged to Staphylininae (Table 4).

As we looked at the number of the species of biotopes; it is understood that the maximum diversity of species was in meadow biotope. It is thought that the cause of the diversity of species was origaneted from close to both sea and fresh water resources and a moist soil structure. *S. obscura orientalis* was represented with the maximum number of specimens. It is thought that the reason for this was because of the interest in animal husbandary. As a result of the faeces and debris brought by this activity, these species found in living areas and were caught more numerically in each biotopes.

In June of 2009, both the number of species (14) and samples reached the highest level. The number of species in following months, realized as July (7), August (4), October (3) and November (5). *O. curtipennis*, *Q. levicollis* and *T. morsitans* were only caught in November and was month experienced of the greatest increase in the number of species (5) and samples (22) after June (Table 3).

In 2010, when we looked at the number of the species and the samples; in May, the number of species (12) and the number of samples (247) reached the highest level. In August, the number of the samples was 236, while the number of the species was 5. In March, the number of the samples was 30, while the number of the species was 9. The majority of samples captured in May and August were *S. obscura orientalis*. Despite the decrease in the number of the samples caught in March, the increase in the number of the species was noteworthy (Table 3).

In addition, except a few species, changed from 1–10 of species numbers caught in zones, ıt could consider that was under pressure of biodiversiy of these species and as a indicator of their relations with the soil.

The species of Staphylinidae were generally caught in Autumn. The species of this family live at moist soils and near sources of fresh water. Espically, the increase in the species of Staphylinidae with the autumn rains was noteworthy. As a result of this study, all of these species were caught in meadow biotope which was close to sources of fresh water.

The species of Elateridae are found in agricultural and forest areas, and in mountains. In this study, in parallel with these life areas were found in plantation biotope of *P. theseus* (50 m), in oak biotope of *M. Fusciceps* (101 m) and also *D. bimaculatus* was found both in oak bitope and in plantaion biotope.

The samples of Carabidae, Tenebrionidae, Elateridae, Silphidae and Staphylinidae were first collected by pitfall trap method which used as an effective and widespread method for detection of insect fauna in the soil. With such a research made in this area, the additional records were given to the fauna of the province of Çanakkale and the fauna of the Marmara region. For the local fauna of the province of Çanakkale 22 species and 1 subspecies, to the fauna of the Marmara region 12 species were added as the first record (Table 3).

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Table 1. The altitude and the coordinates of the sampling zone.

SAMPLİNG ZONE NUMBER	**BIOTOPE**	**ALTITUDE (m)**	**COORDİNATES**
1	MEADOW	2	40°22'33"15 N 27°18'10"98 E
2	MEADOW	2	40°22'38"58 N 27°18'14"99 E
3	MEADOW	1	40°22'41"65 N 27°18'17"73 E
4	MEADOW	2	40°22'32"52 N 27°18'11"69 E
5	PLANTATION	40	40°22'37"22 N 27°17'48"92 E
6	OAK	101	40°24'56"91 N 27°16'14"05 E
7	PLANTATION	50	40°25'24"24 N 27°15'09"12 E
8	PLANTATION	53	40°25'19"42 N 27°15'09"56 E
9	PLANTATION	135	40°25'11"86 N 27°15'59"57 E
10	MEADOW	58	40°25'06"58 N 27°17'41"32 E

Table 2. The distribution and the rates of species belonging to biotopes.

BIOTOPES	**SPECIES/ SUBSPECIES**	**THE NUMBER OF SPECIES**	**RATE (%)**
OAK	8	228	33.19
PLANTATION	17	160	23.29
MEADOW	21	299	43.52

Table 3. The distribution and the number of specimens belonging to biotopes.

FAMILY	SUBFAMILY	SPECIES	1	2	3	4	5	6	7	8	9	10	THE NUMBER OF TOTAL SPECIMENS
CARABIDAE	Harpalinae	*Harpalus smaragdinus* * **	2						3		5		10
		Dixus obscurus * **			1								1
		Ditomus calydonius * **					1						1
		Harpalus distinguendus *		9							2	3	14
	Brachininae	*Brachinus explodens*		1	1				1	1			4
		Brachinus crepitans * **		3							2	2	7
	Nebriinae	*Nebria brevicollis* *	1										1
	Pterostichinae	*Poecilus cupreus* *			1								1
	Carabinae	*Carabus coriaceus* *		1	2			8	5	4	6		26
		Carabus graecus *						1	1		2		4
	Chlaeniinae	*Chlaenius festivus* * **			1								1
	Platyniinae	*Calathus libanensis* *		5						1			6
		Olisthopus fuscatus * **		1									1
		Calathus longicollis						1		1	1		3
		Calathus erythroderus * **							1				1
		Pristonychus conspicuus * **								1			1
	Broscinae	*Broscus nobilis* * **	1										1
ELATERIDAE	Elaterinae	*Pittonotus theseus* * **					1						1
	Pyrophorinae	*Drasterius bimaculatus*	3	15	2			16	3	3		8	50
	Melanotinae	*Melanotus fusciceps*						1		2			3
TENEBRIONIDAE	Pimeliinae	*Dailognatha quadricollis*	2					5		2	4		13
	Lagriinae	*Cossyphus tauricus* *		1									1
	Tenebrioninae	*Pedinus strabonis* *				1							1
		Gonocephalum costatum	2	12									14
		Blaps tibialis *						1	4				5
		Probaticus tenebricosus								1			1
SILPHIDAE	Silphinae	*Silpha obscura orientalis* *	10	96	10			195	44	58		74	487
STAPHYLINIDAE	Staphylininae	*Ocypus curtipennis* *	6	8	2								16
		Quedius levicollis * **	1	4	1								6
		Tasgius morsitans * **	1	4	1								6
The number of species in zones			10	13	10	1	2	8	8	10	7	4	73
The number of total specimens belonging to zones			29	160	22	1	2	228	62	74	22	87	687

Table 4. The distribution and the rates of species belonging to families.

FAMILY	SPECIES/SUBSPECIES	RATE (%)
CARABIDAE	17	56.66
TENEBRIONIDAE	6	20.00
ELATERIDAE	3	10.00
SILPHIDAE	1	3.34
STAPHYLINIDAE	3	10.00
TOTAL	30	100.00

Figure 1. The general view of the sampling zones.

FAUNISTIC STUDY ON PENTATOMID AND SCUTELLERID BUGS (HEM.: HETEROPTERA) FROM BIRJAND COUNTY AND SUBURBS IN SOUTH KHORASAN PROVINCE (IRAN)

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[Golestan, M. N. & Awal, M. M. 2012. Faunistic study on pentatomid and scutellerid bugs (Hem.: Heteroptera) from Birjand county and suburbs in South Khorasan province (Iran). Munis Entomology & Zoology, 7 (1): 462-466**]**

ABSTRACT: The faunistic study was carried out during 2005-2006 on Pentatomidae an Scutelleridae families of Birjand county in South Khorasan province. Totally 29 species belonging to 22 genera were collected. All species were identified based on male genitalia and some other morphological characters. All species were reported for the first time from South Khorasan province.

KEY WORDS: Pentatomidae, Faunistic, Birjand, South Khorasan province.

Pentatomids are with approximately 760 genera and 4100 species known and one of the largest Heteroptera families. The majority of economically important them belong to the subfamily Pentatominae.

The first faunistic studies on Iran's Pentatomids and Scutellerids started as early as last 1800s by foreign scientists. Jakovlev (1877), Signoret (1880), Oshanin (1906-1912), Kiritshenko (1911, 1938, 1949 & 1966), Lindberg (1938), china (1938), Siedenstucker (1957), Brown (1962-1966), Wagner (1968) and Hoberlandt (1970, 1973 & 1977) reported a great number of species from Iran (Hoberlandt, 1995). Safavi (1959, 1973, 1974 & 1976) and Modarres Awal (1981, 1985, 1997, 2008 & 2011) have performed the most native studies to discover pentatomids and Scutellerids fauna in Iran.

MATERIALS AND METHODS

South Khorasan province has an area of 102460 square kilometers. This province is located between 57 -1' and 60 - 57' degrees of east longitude and the 30 - 32' and 34 - 36' degrees of north latitude. Birjand is the east Iranian, provincial capital of South Khorasan and the centre of the county Birjand.

High mountains and vast open plains affect the climate of this area. Nearness to the Central Dessert and open plains gives this area an arid climate with hot summers. On the other hand the east-west Mountains gives a reprieve from heat and makes the general climate more moderate than adjoining areas. The annual rainfall is about 167 millimeters most which falls during the winter and spring seasons. The lack of permanent rivers, the little rainfall and the climatic conditions have limited the agricultural products. The important crops are saffron, jujube and barberry.

Sampling performed by the ways of common sampling, including net working, light trap and collecting by observation. Also the specimens mostly collected from intact regions including plains, desert. Genital organs of male (Pygophore and parameres) and female (spermtheca and genal plates) was sand out and was supplied constant preparation so important genital organs in identification were drawn.

All specimens are collected by author and preserved in the Depatment of Entomology of Islamic Azad University, Birjand Branch.

RESULTS

Family Pentatomidae Leach, 1815
Subfamily Pentatominae (Amyot & Serville, 1843)

Mustha spinosula **(Lefebvre, 1831)**
Ark road (33Km, West of Birjand): 1 Nymph of stage 3, 1585m., 11. III. 2006, On *Artemisia* Sp., Chahardeh-e-Bala (10Km, North of Birjand): 1male, 1820m., 4. VIII. 2006, On Juglans regia L.

Apodiphus amygdali **(Germar, 1817)**
Birjand: 1male, 1300m., 27. IX. 2006, On *Prunus armeniaca* L., Chah-e-Kalateh-Arab(74Km, South of Birjand): 1female, 1474m, 28. VI. 2006, On Prunus domestica L., Ark (80Km, West of Birjand): 1male, 1female, 10. VI. 2006, On Malus domestica Borkh., Ali-Abad (100Km, South of Birjand): 2males, 1462m, 9. VI. 2006, On *Pistaca* Sp., Noozad: 1male, 1female, 23. X. 2006, On fruits with low density.

Sciocoris sulcatus **Feiber, 1851**
Arian-Shahr (73Km, North East of Birjand): 1female, 13. V. 2006, Under *Artemisia* Sp.

Sciocoris helferi **(Fieber, 1851)**
Khoor plain (62Km West of Birjand): 1male, 1401m, 8. IV. 2006, Under *Artemisia* Sp., Arian-shahr: 1male, 1female, 17. IV. 2006, Under *Artemisia* Sp.

Sciocoris angusticollis **Puton, 1895**
Kooshk (30Km North of Birjand): 2females, 1836m, 16. III. 2006, Khoor plain: 1male, 1401m, 8. IV. 2006, Under *Artemisia* Sp., Arian-Shahr: 17. IV. 2006, Under *Artemisia* Sp.

Aelia melonata **Feiber, 1868**
Siujan (24Km West of Birjand): 2females, 1373m, 27. VII. 2006, On *Atriplex* Sp. and *Hordeum vulgare* L.

Aelia rostrata **Boheman, 1852**
Dorokhsh (67Km North East of Birjand): 1male, 1722m, 25. V. 2006, On *Pyrethrum* Sp.

Holcostethus vernalis **Wolft, 1804**
Majan plain (80Km South of Birjand): 1male, 1female, 1480m, 28. IV. 2006, On *Hordeum vulgare* L., Sar-Chah-e-Ammari (105Km South of Birjand): 1male, 1248m, 9. VI. 2006, On Cynodon dactylon (L.), Ark: 1female, 10. VI. 2006, On *Rubia* L., Tarogh (160Km South East of Birjand): 2males, 1820m, 25. VII. 2006, On *Mentha* Sp., Siujan: 1female, 1373m, 27. VII. 2006, On *Atriplex* Sp.

Carpocoris purpureipennis **(De Geer, 1773)**
Chahardeh-e-Bala: 3males, 1600m, 21. IV. 2006, On *Euphorbia* Sp., Giv and Mokhtaran plains (110Km South of Birjand): 2males, 1450m, 28. IV. 2006, On *Hordeum vulgare* L., Salm-Abad (67Km East of Birjand): 1female, 1784m, 16. V. 2006, On Triticum aestivum L., Roshnavand (45Km North of Birjand): 2males, 20. V. 2006, On Acroptilon repens (L.), Dorokhsh: 3females, 1722m, 25. V. 2006, On Triticum aestivum L. and *Hordeum vulgare* L., Kalateh-Molla (80Km North East of Birjand): 1female, 2005m, 25. V. 2006, On Berberis vulgaris L. and Scropholaria Sp., Khan (88Km North East of Birjand): 2males, 2066m, 25. V. 2006, On grasses, Bojd plain (15Km East of Birjand): 1male, 1600m, 8. VI. 2006, On *Alhagi* Sp., Sar-Chah-e-Ammari: 2female, 1248m, 9. VI. 2006, On grasses, Ark: 1male, 10. VI. 2006, *Allium Cepa* L., Chah-e-Kalateh-Arab: 1female, 1474m, 28. VI. 2006, On

Chenopodum Sp., Eilaki-e-Payen (83Km South of Birjand): 1male, 1female, 2101m, 15. VII. 2006, On Asteraceae specially *Scorzonera* Sp., Darmian (68Km North East of Birjand): 3females, 1935m, 19. VII. 2006, On *Kochia* Sp. and *Zygophyllum eurypterum* Boiss. & Buhse., Siujan: 1female, 1373m, 27. VII. 2006, On *Taraxacum* Sp. and *Atriplex* Sp., Saghi (34Km North of Birjand): 1female, 2035m, 28. VII. 2006, On *Kochia* Sp., *Alhagi* Sp., Prunus domestica L. and *Allium Cepa* L., Khong (46Km North of Birjand): 2males, 1839m, 28. VII. 2006, On *Zygophyllum eurypterum* Boiss. & Buhse., *Allium Cepa* L. and *Pimpinella anisum* L., Kalateh-Soleyman (67Km South East of Birjand): 4males, 1862m, 29. VII. 2006, On *Allium Cepa* L., *Solanum tuberosum* L. and *Lycopersicum esculentum* L., Fanood (54Km South East of Birjand): 2males, 2074m, 29. VII. 2006, On *Clematis* Sp. and *Melissa* Sp., Boorgan (133Km South East of Birjand): 1male, 2females, 1775m, 6. IX. 2006, *Kochia* Sp., Liski (140 Km South East of Birjand): 1male, 1907m, 6. IX. 2006, On *Kochia* Sp. Note: This species was cosmopolite in the region and its density on *Allium cepa* L. and grasses was more than others.

***Dolycois baccarum* (Linnaeus, 1758)**
Noferest (32Km East of Birjand): 2males, 24. IV. 2006, On grasses, Salm-Abad: 1female, 2males, 1784m, 16. V. 2006, On *Triticum aestivum* L., Roshnavand: 1male, 21. V. 2006, Acroptilon repens (L.), Dorokhsh: 2males, 1722m, 25. V. 2006, On grasses, Kalateh-Molla: 1male, 2005m, 25. V. 2006, On *Berberis vulgaris* L. and *Scropholaria* Sp., Khan: 2males, 2066m, 25. V. 2006, On grasses, Ark: 1female, 10. VI. 2006, On Cousinia Sp. and *Daucus carota* L., Chah-e-Kalateh-Arab: 3female, 1474m, 28. VI. 2006, On *Gossypium hirsutum* L., Darmian: 1male, 1935m, 19. VII. 2006, On *Kochia* Sp., Tarogh: 2males, 1820m, 25. VII, 2006, On *medicago* Sp. and *Erysimum hieraciifolium* L., Siujan: 1male, 1373m, 27.VII. 2006, On *Atriplex* Sp. and *Taraxacum* Sp., Saghi: 2males, 2035m, 28. VII. 2006, On *Kochia* Sp. and *Alhagi* Sp., Khong: 1male, 1female, 1839m, 28. VII. 2006, On *Kochia* Sp., Kalateh-Soleyman: 2males, 1862m, 29. VII. 2006, On *Solanum tuberosum* L., Fanood: 1male, 2074m, 29. VII. 2006, On *Melissa officinalis* L., *Clematis* Sp. and *Alangium* Sp.

***Antheminia pusio* Kolenati, 1846**
Gloon-Abad (47Km South East of Birjand): 3males, 1975m, 13. III. 2006, Under *Artemisia* Sp., Arian-Shahr: 1male, 17. IV. 2006, On *Artemisia* Sp., Majan plain: 1male, 1480m, 28. IV. 2006, On *Hordeum vulgare* L., Roshnavand: 1male, 20. V. 2006, On Acroptilon repens (L.), Chah-e-Kalateh-Arab: 2males, 1474m, 28. VI. 2006, On *Allium Cepa* L., Saghi: 2females, 2035m, 28. VII. 2006, On *Allium Cepa* L. and *Euphorbia* Sp.

***Codophila varia* Fabricius, 1787**
Kooshk (30Km North Birjand): 1male, 1836m, 5. V. 2006, On Berberis vulgaris L., Salm-Abad: 2males, 1784m, 16. V. 2006, On *Raphanus* Sp., Roshnavand: 1male, 20. V. 2006, On *Acroptilon repens* (L.), Kalateh-Molla: 2females, 2005m, 25. V. 2006, On *Marrubium Sp.,* Siujan: 1male, 1373m, 27. VII. 2006, *On Hordeum vulgare* L., *Taraxacum* Sp. and *Atriplex* Sp.

***Codophila maculicollis* (Dallas, 1851)**
Sfah-Rood (20Km East of birjand): 1female, 1950, 8. VI. 2006, On *Amygdalus scoparia* Spach.

***Chroantha ornatula* (Herrich-Schaeffer, 1842)**
Arian-Shahr: 1male, 17. IV. 2006, On *Artemisia* Sp., Ali-Abad (100Km South of Birjand): 1male, 2females, 14. V. 2006, Collected by light trapping, Ark: 1male, 17. V. 2006, Collected by light trapping.

***Pitedia juniperina* (Linnaeus, 1758)**
Ark: 1female, 17. V. 2006, Collected by light trapping, Amir-Abad (20Km West of Birjand): 13. V. 2006, On *Morus alba* L., Ali-Abad (100Km South of Birjand): 1male, 29. VIII. 2006, Collected by light trapping.

Brachynema germari **(Kolenati, 1846)**
Ark Road: 1male, 1585m 11. III. 2006, On *Ephedra major* Host., Arian-Shahr: 2males, 1706m, 17. IV. 2006, On *Artemisia* Sp. with high density, Giv and Mokhtaran plians: 2males, 1450m, 28. IV. 2006, On barley fields, Gloon-abad: 1male, 1975m, 13. III. 2006, On *Artemisia* Sp., Ali-abad: 2males, 1466m, 29. VI. 2006, Collected by light trapping. Boorgan: 1male, 1775m, 6. IX. 2006, On *Kochia* Sp.

Rhaphigaster nebulosa **Poda, 1761**
Mood: 1female, 1860m, 29. VII. 2006, On *Populus* sp. and *Prunus domestica* L.

Piezodorus lituratus **Fabricius, 1794**
Behdan (30Km East of Birjand): 1male, 12. IV. 2006, On *Elaeagnusan* sp., Birjand City: 1female, 1300m, 23. XI. 2006, Sarayan (150Km North West of Birjand): 1male, 18. XII. 2006.

Eurydema ornata **Linnaeus, 1758**
Noferest (32Km East of Birjand): 3males, 12. IV. 2006, On *Lepidium* Sp., *Eruca sativa* L.) and *Descurainia sophia* (L.), Giv and Mokhtaran plians: 3males, 1450m, 28. IV. 2006, On *Medicago sativa* L., Salm-Abad: 4males, 1784m, 16. V. 2006, On *Raphanus* Sp., Sar-Chah-e-Ammari: 2males, 1248m, 9. VI. 2006, On *Veronica* Sp., Darmian: 3males, 2females, 1935m, 19. VII. 2006, On *Erysimum hieraciifolium* L., Tarogh: 1male, 2females, 1820m, 25. VII. 2006, On *Erysimum hieraciifolium* L. with high density.

Subfamily Podopinae Amyot & Serville, 1843

Ventocoris fischeri **(Herrich-Schaeffer, 1851)**
Mokhtaran plian: 1male, 1490m, 23. V. 2006, On *Bunium persicum* Bioss.

Ventocoris oblongus **(Horváth, 1889)**
Khoor plain: 1male, 1female, 1401m, 8. IV. 2006, Under *Euphorbia* Sp.

Tholagmus flavolineatus **(Fabricius, 1798)**
Saghi: 2males, 2035m, 28. VII. 2006, On *Pimpinella anisum* L., Khong: 3males, 1839m, 28. VII. 2006, On *Carum copticum* Heirn.

Graphosoma semipunctatum **(Fabricius, 1775)**
Saghi: 4males, 2females, 2035m, 28, VII, 2006, On *Pimpinella anisum* L.

Graphosoma consimile **Horváth, 1903**
Saghi: 1male, 2035m, 28. VII. 2006, On *Pimpinella anisum* L., Chahkand (34Km North of Birjand): 1male, 1female, 20. V. 2006, On *Alhagi* Sp.

Tarisa fraudatrix **Horvath, 1891**
Sar-Chah-e-Ammari: 2males, 1female, 1248m, 9. VI. 2008, On *Kochia* Sp., Saghi: 2males, 2035m, 28. VII. 2006, On *Kochia* Sp., Khong: 2males, 1839m, 28. VII. 2008, On *Kochia* Sp.,
Note: This species was collected only on the *Kochia* in Birjand region in this study and seem the Kochia is specific host it. Also all of specimens were collected from cluster part of plant.

Family Scutelleridae Leach, 1815

Eurygaster integriceps **Puton, 1881**
Arish (51Km West of Birjand): 3males, 1319m, 8. IV. 2006, On *Hordeum vulgare* L., Mokhtaran plain: 2males, 3females, 1490m, 15. IV. 2006, On grasses, Salm-abad: 1male, 1784m, 16. V. 2006, On *Triticum aestivum* L., Dorokhsh: 4males, 1722m, 25. V. 2006, On grasses.

***Odontotarsus impictus* Jakovlev, 1886**
Roshnavand and Chahkand: 2males, 20. V. 2006, On *Acroptilon repens* (L.), Khong: 3males, 1839m, 28. VII. 2006, On *Carum copticum* Heirn

***Odontotarsus plicatulus* Horváth, 1906**
Roshnavand: 1male, 20. V. 2006, On *Acroptilon repens* (L.).

***Odontotarsus* sp.**
Chahkand: 1male, 20. V. 2006, On *Acroptilon repens* (L.).

***Psacasta exanthematica* (Scopoli, 1763)**
Kooshk: 2males, 1836m, 5. V. 2006, On *Berberis vulgaris* L.

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EVALUATION OF *EMBLICA OFFICINALIS* RASAYANA ON FITNESS PARAMETERS AND LIFE SPAN OF NEMATODE: *CAENORHABDITIS ELEGANS*

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ABSTRACT: For the first time nematode *C. elegans* is exposed to test Ayurvedic medicine *Emblica officinalis* rasayana (herbal formulations). The objective of our study was to explore the potential of *Emblica officinalis* drug on reproductive fitness, longevity of *C. elegans*. Our results shows increase in brood size (number of progeny), lifespan was observed in rasayana fed worms, compare to control one according to the one way ANOVA.

KEY WORDS: *Caenorhabditis elegans*, Rasayana, *Emblica officinalis*.

Ayurveda is one of the ancient Indian medical sciences and oldest available classic of the world. which can be traced back to the Vedas, Vedas are the ancient books of knowledge or science from India. They contain practical and scientific information on various subjects beneficial to health, philosophy, engineering, astrology etc; Ayurveda combines physical, psycological and spiritual therapies in an approach to health that has addressed itself to the fundamental principles of good health and longevity. Ayurveda is precisely about maintaining or preserving good health as it about treating disorders–*"Swaasthasya Rakshanam*" is one of the goals of Ayurveda (Charaka Samhita Sutrasthana, 2000a).

The branch of *rasayana* or rejuvenation is one of the eight specialized branches of Ayurveda that primarily deals with the maintenance of health (Sushrutha Samhita Sutrasthana, 1972a). *Rasayana* is defined as any herb, food, or activity which confers youthfulness and cures diseases. If taken in a proper way the *rasayana* prevents early aging and keeps person young and active both physically and mentally (Charaka Samhita Chikitsasthana, 2000b). The literal meaning of *rasayana* is "augmentation of *rasa*", the vital fluid produced by the digestion of food. Rasa provides nutrition, enhances the vigor, vitality and Longevity of life (Pankaj et al., 2010; Priyadarshini et al., 2010). *Rasayana* is the method of treatment through which the *rasa* is maintained in the body. The purpose of *rasayana* is to give strength, immunity, *ojus,* vitality, will power and determination, and to strengthen the sense faculties, so that you are not exposed to sickness and disease as long as you live (Charaka Samhita Chikitsasthana, 2000b). *Emblica officinalis* is such herb used as rasayana in treatment of diseases. However effect of this drug on normal life activities has not been significantly validated. Therefore the present study was carried out with an *objective* to explore the potential of *Emblica officinalis* drug, on fitness of *C. elegans*. We have *C. elegans* as the test system which proved to be an excellent organism to test the effect of many drugs and other chemicals.

Valiathan has recognized the opportunity to create "Ayurvedic Biology" (Valiathan et al., 2006). His visionary perspective suggests that programs to create an evidence-base for Ayurveda should include clinical *rasayana* evaluations. He has since been quoted by Mashelkar (2006) as saying that *rasayana* should be tested on animal models. This rasayana is commonly used as rasayana therapy in Ayurveda medicine system but, possibly due to complexity and expense, only few trials have been conducted to test the rasayana formulations. There is urgent need to evaluate the influence of ancient herbal formulations of rasayana. According Pankaj et al. (2010); Priyadarshini et al. (2010); Guru Prasad et al. (2011) to literature there are few preliminary results where appropriately modified Ayurvedic *rasayana* enhance the fertility and life span of *Drosophila melanogaster*. After this there is no report on influence of rasayana on life span on any other model organisms, therefore we have selected *Caenorhabditis elegans* (nematode) for the present study as model. We have used *C. elegans* to study effect of herbal rasayana of *Emblica officinalis* fruits at endpoints of fitness parameters such as number of progeny (brood size), developmental time and also life span (Longevity).

Caenorhabditis elegans is a small free living, nematode naturally found in soil environments. It was chosen in 1963 by Sydney Brenner as a model organism to study the genetics of development and reproductive system. Today, this nematode *C. elegans* being simple, multicellular metazoan organism, transparent, free living nematode with a nervous digestive and reproductive system and specialized muscles (Riddle et al., 1997). It has been extensively used in biomedical research. *C. elegans* has a short life span (3 weeks at 22°C under optimal conditions), small size (1mm in length) easy to cultivate, and quick generation time, self fertilization, ability to frozon, measurable behavior genetic tractability and relevance to mammalian due to the high degree of conservation of gene sequence (Hope, 1999).

C. elegans occurs in two sexes: self-fertilizing hermaphrodites and males. Adult hermaphrodites contain 959 somatic cells, while the males have 1031 cells (Hodgkin, 1988). Although there is limited number of cells in this novel animal, *C. elegans* has highly differentiated digestive muscular nervous system and reproductive system. *C. elegans* develops from a fertilized egg to a gravid adult in about 3 days at 20°C by Hali & Altun (2008). A single hermaphrodite has ability to produce approximately 300 offspring. Offspring mature through four larval stages, L1-L4, growing in spurts between stages after molting old cuticles. The life cycle is short that its take 3 days eggs to L4 and next gravid (adult) will alive for 15 days in the bacterial diet (OP-50 strain) on agar or K media lawn (Byerly et al. 1976; Knight et al., 2002). At two points in the life cycle, if food is not available, nematode growth will arrest. Animals will survive for several hatchlings that arrest, as L1s or for several months starved L2s develop into dauer larvae (Lewis & Fleming, 1995). There is a wealth of knowledge available on *C. elegans* including its complete genomic sequence. There is a technology to quickly produce transgenic nematodes by Mello & Fire (1995) and the ability to observe all the cells in the living nematode by microscopy (Hali & Altun, 2008). The available microscopy techniques in *C. elegans* have led to the development of an exceptionally detailed in *C. elegans* reproductive and development biology. In addition, *C. elegans* is an ideal organism for assessing toxicity of heavy metals and detergents as well as organophosphate–induced mammalian neurotoxicity. A considerable amount of toxicity testing has been performed using *C. elegans* including lethality by Anderson and Boyd William (2008) and behavioral tests in aquatic media by Dhawan et al. (2008). Most of the studies have focused on the effects of metals or agricultural chemicals. But little is known about the influence of the drugs, phyto-chemicals and man made chemicals on *C. elegans*. The objective of the study is to evaluate the rasayana which is formulated as a new *rasayana* using (*Emblica officinalis* fruits) and maintaining traditional principles, precisely altered to reflect intrinsic differences between mammals and nematode.

MATERIALS AND METHODS

Preparation of the *Emblica officinalis* Rasayana

The dried fruits of *Emblica officinalis* were grinded into powder and 5 gm of the powder was added to a bottle and extracted by reflux in 50 ml. 60% aqueous methnol for 2h. The mixture was filtered, and the filtrate was collected. The extract was then concentrated to dryness by rotary vapourization at 50°C under reduced pressure according to Quanbin et al. (2006) and a light brown powder (3.0 g) was obtained. This powder (300 mg) was directly dissolved in 25 ml distilled water.

Strains

Ceanorhabditis elegans, wild-type strain (N2), was obtained from the *Caenorhabditis* Genetics Center (CGC, Minniepolis, MN, USA), which is funded by the NIH National Center for Research Resources (NCRR). This is borrowed from the east west college, Udayapura, Maharastra.

Preparation of nematode cultures

The worms were cultivated on NGM plates (3 g l^{-1} NaCl, 2.5 g l^{-1} proteose peptone, 5 mg l^{-1} cholesterol, 1 mmol $l^{-1}CaCl_2$, 1 mmol l^{-1} $MgSo_4$, 25 mmol l^{-1}Potassium phosphate, p^H 6.0,17g l^{-1} agar) on an established lawn of *Escherichia coli* strain OP50 (Brenner, 1974) and maintained at 20°C. To obtain synchronized culture, gravid hermaphrodites were lysed in an alkaline hypochlorite solution (Sultson et al., 1980) and the eggs were transferred to fresh NGM plates. The culture was grown for 3 days at 20°C until the newly hatched worms reached adulthood. The L4 stage worms / gravid worms were washed with K-medium (53 mM NaCl, 32 mM KCl) according to Williams & Dusenbery (1990) and peleted by centrifugation (3000 rpm, 5 min), washed again thrice with cold K-medium and finally suspended in K-medium to obtain 30-50 nematodes per 10 µl.

Procedure

Experiments were performed in 12–well sterile tissue culture plates. Approximately 100 early gravid animals which is considered as animal pool were transferred in 500µl of K-medium, adjusted to O.D 1.0 with OP-50 *E. coli* bacteria strain (diet of *C. elegans*) at 55O nm containing 10 µl of rasayana, this is designated as experiment I and control plates were also maintained without rasayana which is named as experiment II. All experiments were carried out at 22°C for 4 hours. The end points such as brood size (number of progeny), developmental time, and life span (number of survival rate) were evaluated.

Brood size (number of progeny) and Developmental time

To evaluate the effect of rasayana (*Emblica officinalis*) single worm was picked from pool exposed for 4h in above experiments and transfer to 500 µl of K-medium, adjusted to O.D 1.0 with OP-50 at 550 nm 72 hours after incubation. The number of progeny produced by single worm was counted by staining with 0.1% Methylene blue under stereomicroscope (35x). This was screened for both experiment I and II. The developmental time refers to the time taken for development from eggs to L1. Developmental time is observed in the terms of hours, at least 3 replicates for each experiment and five times were performed for statistical purposes.

Lifespan assay

Age synchronized adult worm (L4 stage of *C.elegans*) were exposed to *Emblica officinalis* rasayana (experiment I) and control without rasayana (experiment II) for four hours at 22°C. After the exposure period, worms were washed thrice with K-medium and 50 L4 worms (designated as day 0 of life span estimated) were placed in a well of 15 mm flat bottomed 16–well plates, each well containing 500 µl of K-medium (OD at 550 nm adjusted to 1.0 with *E. coli* cells) and FudR (5-fluro-2-deoxyuridine) at a final concentration of 50 µm (Keaney et al., 2004). Worms were raised and maintained at 20°C. The survivability was scored every day by gentle touching with platinum wire. The worms which failed to move in response to touch were considered as dead. Mean, standard deviation and One way ANOVA was applied to all parameters using SPSS 11.0.

RESULTS

The data (Table1) on the brood size and developmental time is represented in mean and standard deviation. The brood size of *C. elegans* was very high in case of rasayana fed *C. elegans* (380.6±10.40) than the control one (313.6 ± 4.50) in the experiment II (Table 1). According to One way ANOVA there is a significant difference between the brood size between the experiment I and II (F value= 124.10; $P < 0.001$). But in case the developmental time of the *C. elegans* from egg to L1 stage does not have such difference between both experiments I and II (12.24 hours and 14.36 hours) where there is no such difference according to the One way ANOVA (F value= 11.92).

The life span of *C. elegans* data is depicted in the form of the figure1 where its shows the percentage of survivability of the *C. elegans* which is fed in rasayana (*Emblica officinalis)* and control one. According to the figure life span of the rasayana fed animals was high and it went more than 30th of day the percentage of the *C. elegans* of the control group was nil at almost on the 25th day.

DISCUSSION

In the present study an effort is made to study the effect rasayana of *Emblica officinalis* of rasayana on fitness parameters and life span. Our results confirm there is an influence of *Emblica officinalis* rasayana which is mixed in experimental culture (experiment I). These results were similar to some workers (Charaka Samhita Sutrasthana, 2000a). Sexually reproducing animals are endowed with special features, first to produce fertile offspring and second to adapt to a particular environment. From our studies, rasayana shows high numbers of progeny (Table 1). Our finding agrees with the observation of Grawes et al. (1971) where they noticed oviposition rhythm in *Drosophila melanogaster* and Vogel (1972) has demonstrated that certain aziridine analogous have discernible effect on fecundity in *Drosophila*. Several workers have made studies on the effect of different chemicals on fertility in *Drosophila melanogaster* (Vasudeva & Krishnamurthy, 1983). The present study of the author agrees with them that influence of the chemicals will alter the fertility in *C. elegans*. Moreover (Pankaj et al., 2010; Guru Prasad et al., 2011) showed the influence of the rasayana of *Emblica officinalis* on the fertility of *Drosophila*.

The estimation of fitness is the first step in understanding the adaptive evolution of a population. The rate of development is another parameter, which is used to analyze the some chemicals clinically. In the present investigations the genetic constitution, amount of the food, temperature, and space were kept constant. Obviously the differences in the developmental must have been determined by the chemical used or not by the other factors. This type of effect on the developmental time by different chemicals in *Drosophila melanogaster* has been shown by Jafari et al. (2007). Contrast to the above studies our results suggest that there is no such influence of rasayana on developmental time of *C. elegans* according to the mean value of both experiment I and II (Table1).

Jafari et al. (2008) emphasizes the importance of the phyto-chemicals on aging is an inherently *complex* process: no single *chemical drug* targeting a single enzyme is going to be effective against it. Along with this his group is also suggested that failure to find pharmaceuticals significantly helping to slow or reverse human ageing processes reflects the number of genes and biochemical pathways involved; He suggests "mass screening of pharmaceuticals and botanicals to produce effective therapeutics for human aging is essential in increase in life span. His group's subsequent research investigated the effects of single plant extracts, clear examples of complexity, on *D. melanogaster* lifespan. Extracts of three Chinese mushrooms yielded no effects, while *Rhodiola* (Hong Jing Tian) extended lifespan (Jafari et al., 2008). According to (Priyadarshini et al., 2010; Guru Prasad et al., 2011) there is a extension of life span in *Drosophila* which is fed by the rasayana compare to non fed flies. These results are similar to our results where worms in the experiment I which is treated with rasayana show more long life span compare to the experiment II (control one). We authors confirm the developmental time is not early in case of the *Emblica officinalis* rasayana fed worms. This suggests the time taken to the completion of the life cycle is normal and there is effect of *Emblica officinalis* rasayana on prolong life span and normal developmental time.

CONCLUSION

Like *Drosophila, C. elegans* is also one of the important model organisms in field of testing some of the plant products. Our data shows there is influence of rasayana on brood size number of the progeny and extension of lifespan of nematode worms. This is contrast to the developmental time where there is no early development of the egg into L1 stage according to the statistics.

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Table 1. Fitness parameters of *Emblica officinalis rasayana*-fed and Control one of *C. elegans*.

Batch	N	Number of progeny	Developmental time (in hours)
Rasayana (Experiment I)	25	380.6 ± 10.40	12.24 ±1.09
Control (Experiment II)	25	313.6 ± 4.50	14.36 ± 0.99
F value		124.10	11.92
P value		0.000**	0.686

Values are in M ± SE, **P<0.001.

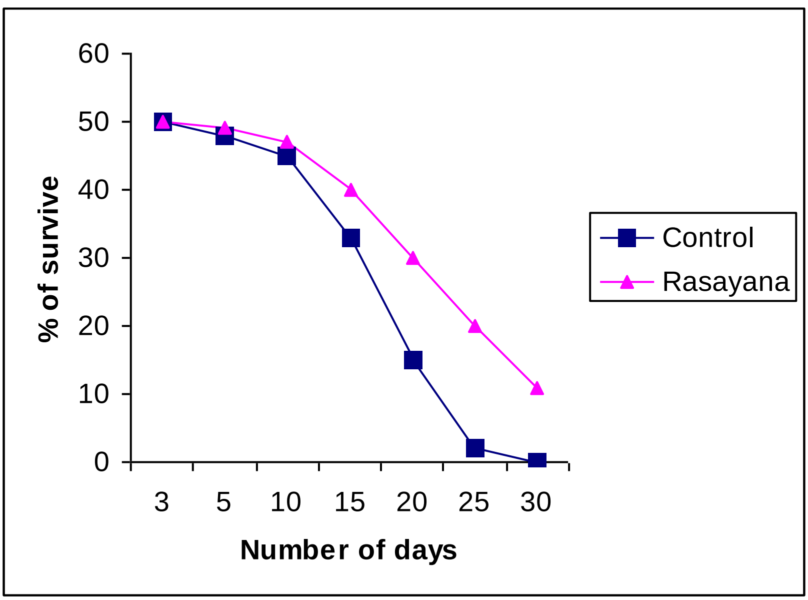

Figure 1. Lifespan of *C. elegans* in *Emblica officinalis* rasayana (experiment I) and control plates (experiment II).

STUDY ON BIOLOGY AND POPULATION FLUCTUATIONS OF LEAF MINER *AGROMYZA* SP. ON CHICKPEA IN KHOMEYN REGION (IRAN)

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[Changizi, S., Goldasteh, Sh., Shoushtari, R. V., Changizi, M. & Najafabadi, S. S. M. 2012. Study on biology and population fluctuations of leaf miner *Agromyza* sp. on chickpea in Khomeyn Region (Iran). Munis Entomology & Zoology, 7 (1): 474-480**]**

ABSTRACT: The population fluctuations of leaf miner *Agromyza* sp. was selected on chickpea. It was from last decade of May until the end of July 2010 in chickpea farm in the National Center of Bean researching in Khomeyn-Iran. The larvae, pupa and adult stages were surveyed. The sampling of larvae was done for three times a week in two leaves period. The sampling of pupa was done two times a week. For determining of adults population was used from yellow sticky card. The sampling was performed three times a week and were changed the cards at the end of two week. The highest population density was recorded for larvae, pupa and adult leaf miner population in the first decade of June 2010. The egg stage takes 6 days, larval stage usually takes 4 days with 3 instars, pupa stage takes 2-7 days till 2 months depending on environmental conditions. The adult insect life long is 8 days. The duration of each generation is 18-25 days. This pest lives on chickpea for three generations. The highest altitude of adult insect population was in the first decade of June.

KEY WORDS: Chickpea, Leaf miner, *Agromyza* sp., Population fluctuations.

The leaf miner is one of the most important pests of vegetables and chickpea in Iran. The larvae produce mine that start from apex and finish in the base of leaflet. When the larvae reach in the base of leaflet, move to different sides and produce a thread route that is wide in terminal. The mature larvae stays in terminal part of mine for some hours and fall down in the ground finally. The chickpea leaf has 12-14 leaflets. The tunnels become dry because of the sun and leaflet will be scald.

This insect lives from May to second decade of August and it has 4 generations in Karaj province of Iran (Sadri, 1964; Baghdar, 1980). There are some factors that effect on comparative seasonal of leaf miner like pesticides (Parrella, 1987). The chickpea is one of important crops in Iran. There are some pests that attack it and produce damage on its foliage. The Agromyzid flies attack chickpea, flowers and vegetables in Iran. The sampling methods are different but the most important methods are based on counting the larvae in the mines (Wolfenbarger & Wolfenbarger, 1966). The other methods are counting the number of pupa and adults (Zhender & Trumble, 1985). The sticky cards were suggested to survey the adult population (Musgrave et al., 1975). The yellow sticky cards are effective for catching leaf miners (Chandler, 1981).

MATERIAL AND METHODS

The chickpea seeds were planted in the end of March 2010 in chickpea farm in National Center of Bean researching in Khomeyn-Iran. The fluctuations of larvae population was surveyed in 3 stages:
1. The larval stage
2. The pupa stage
3. The adult stage

1. The sampling of larval stage was done for three times a week in two leaves period. The sampling of larval stage was done for three times a week in two leaves period. It was estimated 1 meter for margin the farm. Then was selected 1 plant and picked up 2 leaves of it randomly. The sampling method was continued like crosswise. The 60 leaves were selected from the farm and they were collected in plastic packet and were transferred to the laboratory. In laboratory were counted the number of leaflet and larvae in per leaf. It was continued 8 weeks until harvest time. The Relative Variation (RV) was calculated in first sampling. Our samples were more than number of samples that was calculated with sample size formula.
2. We used traps that were made of pasteboard (37×29 cm) to estimate the fluctuations of pupa population. The40 traps were provided and we cut them in 2 parts. They were transferred to farm and were located around 40 chickpea plants that were selected randomly. Two parts of each trap were joined together with flat tape around plants. Thus each plant was located in the center of trap. The sampling of pupa stage was done for two times a week in two leaves period. This space was necessary form the pupa in the field. The pupas were counted two times a week. The first time was on Thursday and second time was on Sunday. Then were located traps on other plants that were selected on Sunday randomly. This method was performed in 8 weeks until harvest time.
3. After were counted the larvae in laboratory, they were held in plastic vials and were surveyed every day. The leaf miner flies in vials were transferred to identify. For determining of adult population fluctuations we used yellow and sticky cards (9.8 × 24.8 cm, Russell IPM Cards). The 45 cards were installed up in the farm randomly. The used cards were located vertical (Parrella & Jones, 1981). The adult counting was done three times a week and the cards replaced after two weeks. This method was continued until harvest time.

We calculated the mean No. of larvae, pupa and adult. The first sampling time for larvae and adult was in 30 May to end of July 2010. The data for temperature and relative humidity (RH) were gave from weathering office in Khomeyn.

RESULTS AND DISCUSSION

1. **Leaf miner Biology**:
The diagrams show that each generation takes 18-25 days in this region conditions. The growth occurs in 18.8 °C. The adults spent their life on chickpea or weeds. The leaf miner has 3 generations on chickpea plants in these conditions.
Egg:

The first eggs were observed in second decade of May. The eggs were transparent and some times white and very tiny. From egg lying to complete the larval body takes 4-6 days. The egg lying is occurs on the upper surface of leaflet apex some times swept into the side of main leaflet vein. The female damage is observed in parallel of main leaf vein. It is similar tiny holes with yellow color that is caused for entry ovipositor and eating plant juice (Fig. 1). The females prefer low leaves in each plant for laying the eggs. When these leaves drop on the ground, the infestation was observed in upper leaves gradually.

Larvae:

The larvae instar 3 is about 2.4-2.9 mm long. It is vermiform and white-yellow in color that changes to yellow (Fig. 2). It has 3 instars (Fig. 3). The mine is similar to question mark and the mature larvae locate in the base of leaflet (Fig. 4 and 5). There are discontinuous excrements of larvae in the mine. It was estimated that each larvae move in 4-5 mm for 44 hours. At first the mining is white and then becomes light yellow (Fig. 6). The larval stage usually takes 4 days and fall down and changes pupa in the ground. We were observed the first group of larvae in the last decade of May (Fig. 7).

Pupa:

The leaf miner spends the winter in shape pupa. The pupa body is about 1.4-3 mm long and is articulate absolutely. The pupa is light yellow and then becomes chromatic (Fig. 8). The pupa stage takes 2-7 days till 2 months depending on environmental conditions. We were observed the first group of pupa in the first decade of June in pupa traps (Fig. 9 and 10).

Adult:

The adult body is about 1.7-2.2 mm long. The body is some black that there are some black lines on the tergits. The head and plural parts of abdomen are yellow (Fig. 11). The females lay the eggs on one line in parallel of main vein of the leaflet. The mine is forming in the over surface of leaflet and was sawed in one sample under the leaflet surface. The adult insect life long is 8 days depending on weather conditions. This insect lives from last decade of May until middle of July in Khomeyn region.

2. **Population fluctuations**:

Larvae:

The mean No. of larvae was increased in the end of May and the first of June 2010 and there was a population peak in May 3rd. There was second peak in June eighth. The population was decreased in second decade of June until the end of June. In July 1st, there was third peak of population and after that was decreased until harvest time. It was not observed any larvae in July eighteenth (Fig. 12).

Pupa:

The one peak of population was occurred in June tenth. There were two other peaks in June 27th and July 4th. After that was not observed any pupa until harvest time (Fig. 13).

Adult:

There were 3 peaks for adult populations in 3rd and 1st June and July 1st. The population was decreased after July 2nd until harvest time (Fig. 14).

The results show that life cycle is start in 18.8-22 ^{o}C in Khomeyn region. This temperature degree was expressed in 15 ^{o}C in Karaj-Iran (Sadri, 1964; Baghdar, 1980). The larval stage in Khomeyn (4-6 days) is shorter than Karaj (6-8 days). This pest takes 3 generations in chickpea and has more generation in Khomeyn in other seasons in every year. It is necessary to do more studies about it. This pest has highest damage on chickpea in 22.8 ^{o}C and %30 RH. The highest peak of population was in second decade of June. This damage was occurred by second generation of leaf miner *Agromyza* sp. in Khomeyn region. Thus this time is suitable to control this pest. Some suggested methods like collect the pupas and use the yellow sticky cards are useful. But it is better to decrease using insecticides in vegetable and chickpea fields in this region.

The linear regression equation of larvae, pupa and adult density and Standard Error (SE) of the mean is showed. The regression equation is positive in 3 figures and "r" is high. The "r" value for pupa is less than larvae and adult (Fig. 15, 16 and 17).

ACKNOWLEDGEMENTS

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Figure 1. Egg.

Figure 2. Larvae.

Figure 3. Larval instars.

Figure 4. Larval mining.

Figure 5. Larvae in mine.

Figure 6. Leaf damage.

Figure 7. Plant damage.

Figure 8. Pupa.

Figure 9. Pupa in vial.

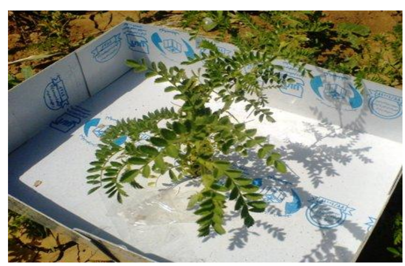

Figure 10. Pupa trap.

Figure 11. Adult on a yellow trap.

(All photos take by simin changizi, May-July 2010)

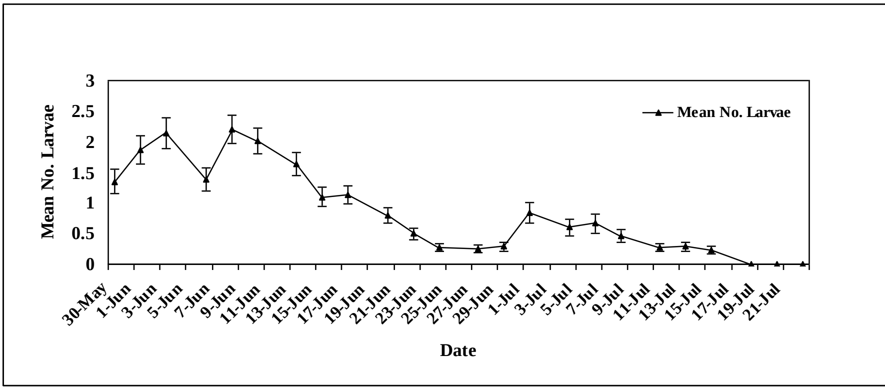

Figure 12. Mean No. of Larvae in sampling dates.

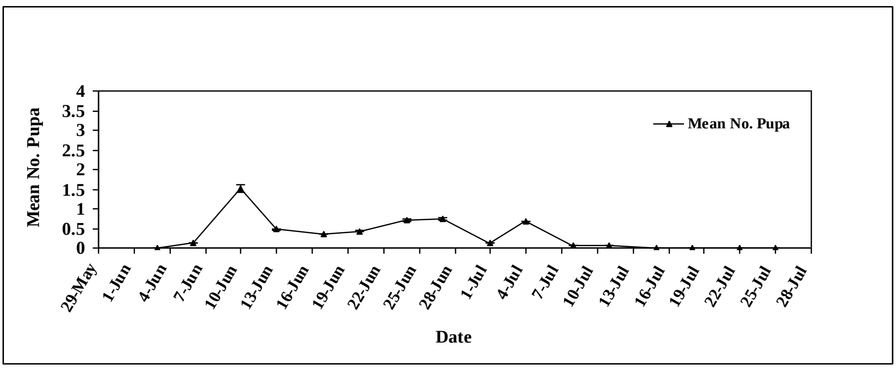

Figure 13. Mean No. of Pupa in sampling dates.

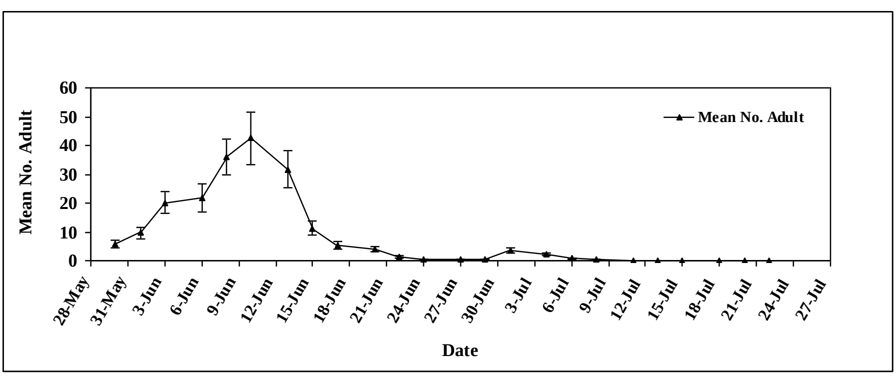

Figure 14. Mean No. of Adult in sampling dates.

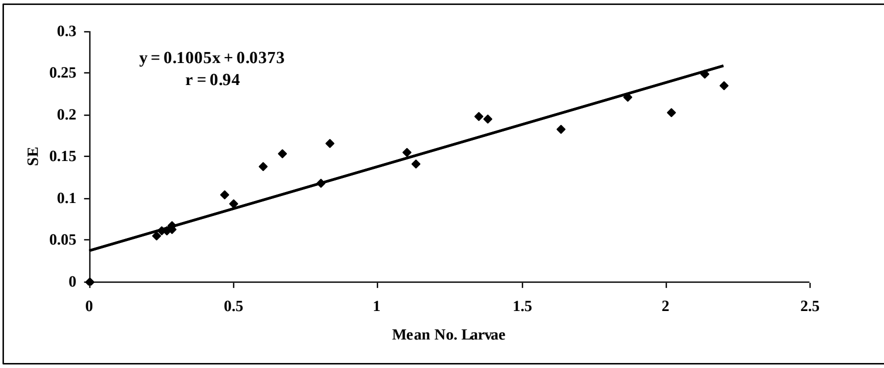

Figure 15. The linear regression equation of mean No. of larvae and SE (Standard Error).

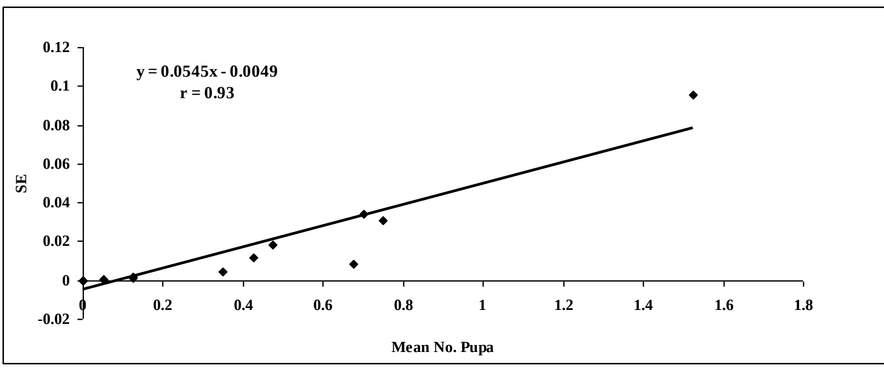

Figure 16. The linear regression equation of mean No. of pupa and SE (Standard Error).

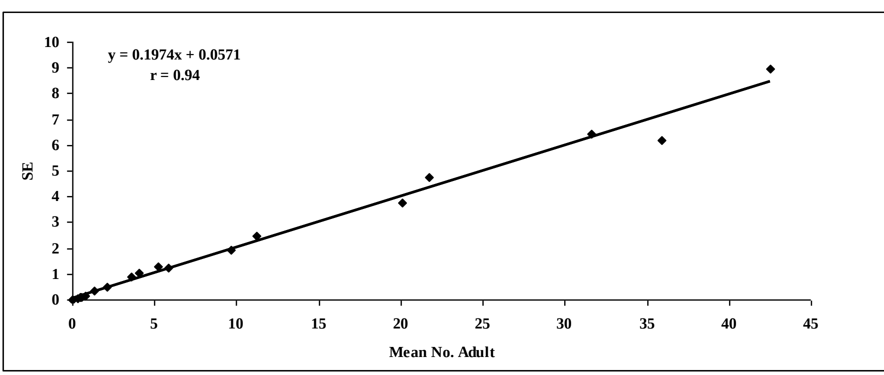

Figure 17. The linear regression equation of mean No. of adult and SE (Standard Error)

EVALUATION OF THE EFFECT OF INTERSPECIFIC COMPETITION BY LARGER GRAIN BORER, *PROSTEPHANUS TRUNCATUS* (HORN) (COLEOPTERA: BOSTRICHIDAE) AND MAIZE WEEVIL, *SITOPHILUS ZEAMAIS* (MOTS.) (COLEOPTERA: CURCULIONIDAE) ON DAMAGE TO MAIZE GRAINS

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[Osipitan, A. A., Adebowale, T. J., Mohemmed, I. G. & Adekanmbi, D. I. 2012. Evaluation of the effect of interspecific competition by larger grain borer, *Prostephanus truncatus* (Horn) (Coleoptera: Bostrichidae) and maize weevil, *Sitophilus zeamais* (Mots.) (Coleoptera: Curculionidae) on damage to maize grains. Munis Entomology & Zoology, 7 (1): 481-488**]**

ABSTRACT: This study evaluated the effect of interspecific competition between the larger grain borer – *Prostephanus truncatus* and maize weevil - *Sitophilus zeamais* on damage by the insects to infested maize grains. 50 g maize grains was weighed into 250 cm^3 kliner jars and infested with adult LGB and S. *zeamais* of between 1 – 10 days old as follows: 50 g maize + 6 pairs of LGB, 50 g maize + 6 pairs of *S. zeamais*, 50 g maize + 3 pairs of LGB + 3 pairs of *S. zeamais,* 50 g maize + 4 pairs of LGB + 2 pairs of *S. zeamais,* 50 g maize + 2 pairs of LGB + 4 pairs of *S. zeamais,* 50 g maize + No LGB + No *S. zeamais*. At 90 days post-infestation, the following data were taken: weight of grain dust (g), final weight of grains (g), weight of damage and undamaged grains (g), number of living adults and number of adult mortality. The result indicated a significantly ($p < 0.05$) higher % grain damage (91.33) and grain dust (2.42 gm) in maize grains solely infested with *S. zeamais*. In treatments with mixed insect infestation, treatment with higher population of *S. zeamais* (50 g maize grains + 2 pairs of LGB + 4 pairs of *S. zeamais*) had a significantly ($p < 0.05$) higher % damage (42.90) than other treatments of mixed insects infestation. However, a significantly ($p < 0.05$) higher % weight loss (5.01) and weight of grain dust (2.51 gm) was obtained in treatment with higher population of LGB (50g maize grains + 4 pairs LGB + 2 pairs *S. zeamais*). Mortality of adult LGB (7.3) was significantly ($p < 0.05$) higher in treatment with higher population of LGB (50 g maize grains + 4 pairs LGB + 2 pairs *S. zeamais*). In two of the treatments with mixed insect infestation, (3 pairs LGB + 3 pairs *S. zeamais*) and (2 pairs LGB + 4 pairs *S. zeamais*), all the introduced LGB died and no larvae nor pupae was seen in the treatments. The study indicated the ability of *S. zeamais* to suppress the activities of LGB in interspecific competition.

KEY WORDS: *P. truncatus*, *S. zeamais, Z. mays,* Interspecific competition, infestation.

Maize (*Zea mays* L.) also known as corn is widely grown throughout the world and a greater weight of the crop is produced each year than any other grain ((CIMMYT, 1994). The crop is high yielding, early maturing, easy to process, readily digestible and cost less than others. It is a stable human food and good source of energy for man through direct consumption of grains (CGIAR, 1997). Maize is the 3rd most important grain after rice and wheat and also serves as source of raw materials for industry and as a feed, forage and silage for livestock (CIMMYT, 1994). The crop is however affected by some pests in store; notably larger grain borer (LGB) - *Prostephanus truncatus,* Maize weevil - *Sitophilus zeamais,* Auguimous grain moth – *Sitotroga cereallela* (Oliv.) and lesser grain borer - *Rhyzopertha dominica* (Throne, 1994; Markham et al., 1994).

The Larger grain borer (Coleoptera: Bostrichidae), a pest of farm stored maize and dried cassava chips was accidentally introduced from Central America into Tanzania in the late 1970's and spread to the other countries in the region. In West Africa, it was first found in Togo in the early 1980's and is now becoming the most destructive pest of stored maize grains in many Africa countries including Benin, Burkina Faso, Burundi, Ghana, Guinea, Kenya, Malawi, Mozambique, Zambia and Nigeria (Dunstan & Magazini, 1981; Harnisch & Krall, 1984; Anonymous, 1986; Kalivogui & Muck, 1990; Bosque-Perez et al., 1991; Pike et al., 1992; Opolot & Odong, 1999). Adult LGB will attack maize in the cob both before and after harvest; they bore into the maize husks, cob or grain making neat round holes. They produce large quantities of grain dust as they tunnel within the grains and more damage is done to infested grains due to conversion of maize grains to maize dust by boring activities (Hodges et al., 1983). The LGB was reported to create enabling environment for infestation of damaged grains by fungi and bacteria (Osipitan et al., 2009).The adults prefer grains on cobs to shelled grains; thus damage to unshelled maize grain is greater than on loose shelled maize. LGB is tolerant of dry conditions so that development is possible in grains at equilibrium with a relative humidity as low as 40% (10% moisture content for maize). The insect develops best at fairly high temperatures of about 30°C and relatively high humidity of about 70% (13% grain moisture content), when it completes its life cycle in 25 days (Bell & Watters, 1982). LGB causes considerable losses in stored maize and weight loss as high as 41.2% and 44.8% have been reported in Tanzania and Togo respectively after six months storage (Keil, 1988; Pantenius, 1988) Adults often live for 7-8 months, and may survive for 2 years and under favourable conditions. A generation may be completed in less than 4 weeks; so there may be 12-13 generations a year.

Maize weevil *(Sitophilus zeamais)* is another serious insect pest of maize that belongs to the family Curculionidae and order Coleoptera. It is a pest of stored maize and cob maize prior to harvest. The infestation initiated in the standing maize crop further develop in storage as the grain dries as stored cobs or bulk grains. It may also infest other cereals if the moisture content is moderate or high (e.g. >15%) (CIMMYT, 2001). A consequence of the above fact is that maize weevil is a greater problem in developing countries than in developed countries. Studies have reported that over 20% weight loss caused by weevils for untreated grains of maize hybrids stored in traditional structures may occur in on-farm stores in tropical countries. Maize weevil is perhaps the most destructive pest of stored grains in the world, capable of destroying grains in elevators, bins, ships, and anywhere else where physical conditions for growth are favourable and the grain is left undisturbed for some time (Markham et al., 1994). Attack is evidenced by the presence of numerous adults, surface heating of the grain and dampness sometimes to the extent that germination occurs. Damage by the insect results in direct loss of food and may also reduce future maize production for farmers who use store grains as seed; a practice that accounts for 70% of all maize planted in Eastern and Southern Africa (CIMMYT, 1994). Apart from indirect effect arising from production of heat by maize weevil and larger grain borer; the major effect of the infestation by the insects is the damage to grains by the feeding activities of the adults and larvae within the grain. This not only reduces the grain quality but also produce a considerable amount of grain dust and eventual reduction in the quality of grain (Adem & Bourges, 1981; Longstaff, 1981).

Singly, maize weevil and LGB cause substantial damage to maize grains. The present study however, investigates their influence on each other in inter-specific competition for food and space in mixed infestation of maize grains.

MATERIALS AND METHODS

This study was conducted at the Entomological Research Laboratory of Department of Crop Protection, College of Plant Science, University of Agriculture, Abeokuta. The maize weevil *Sitophilus zeamais* used for the study was obtained from the Department of Crop Protection, University of Agriculture, Abeokuta and cultured in glass jars in the laboratory using clean maize grains (*Zea mays*). Larger Grain Borer (LGB) was obtained from the Department of Zoology, University of Ibadan, Ibadan and cultured in glass jars in the laboratory of Crop Protection Department, University of Agriculture, Abeokuta using maize grains and cassava chips. The maize grains used for the study were conditioned to 13% moisture content and disinfected using Force toxin tablets. Fifty grammes each of the maize grains was weighed into 250 cm^3 kliner jars and infested with adult LGB and S. *zeamais* as stated below:

The maize grains were diversely infested with LGB and S. *zeamais* as follows.

- 50 g maize+6 pairs of LGB
- 50 g maize+6 pairs of *S. zeamais*
- 50 g maize+3 pairs of LGB+3 pairs of *S. zeamais*
- 50 g maize+4 pairs of LGB+2 pairs of *S. zeamais*
- 50 g maize+2 pairs of LGB+ 4 pairs of *S. zeamais*
- 50 g maize + No LGB +No *S. Zeamais*

Each treatment was replicated four times and the treatment jars were arranged randomly on the work benches in the laboratory using Complete Randomized Design.

One of jar containing 50 grammes of the maize grains was kept free of insects and this serves to measure moisture gain or loss as result of environmental factors.

The introduced insects were allowed to feed on the grains and left undisturbed for 90 days, and then sieved out. Thereafter, the following data were taken:

- Weight of grain dust (gm)
- Final weight of grains (gm)
- Weight of damage and undamaged grains
- No of living adult (LGB)
- No of living adult (Maize weevil)
- No of adult mortality (LGB)
- No of adult mortality (Maize weevil)

Assessment of final population of insects

At 90 days post-infestation, the insects were sieved out of the grains and separated into living and dead.

The number of living and dead adults for each of the insect species was noted.

Assessment of percentage Grain Damage

The grains in each sample were separated into damaged and undamaged and weight of each was noted.

Percentage damage was calculated using the formulae:

$$\% \text{ Grain Damage} = \frac{\text{Weight of damaged grains}}{\text{Total weight of grains}} \times \frac{100}{1}$$

Assessment of percentage weight loss

The final weight of the grains was determined after sieving out the insects and grain dust. The uninfected samples were also weighed and the observed changes in weight were used to correct the changes in the weight of corresponding trial samples (Hurlock 1967). Percentage weight loss was calculated using the formulae:

$$\% \text{ weight loss} = \frac{\text{Weight of control Sample - final weight} \quad \text{x} \quad 100}{\text{Weight of Control sample}}$$

Assessment of grain dust

The grain dust was sieved out of the infested and damaged grains and weighed using Mettler weighing balance.

Data Analysis

Statistical Analysis of data was based on SAS general statistical linear models procedure (SAS Institute, 2001). Analysis of variance (ANOVA) table was generated for all the variable and treatments at $P \leq 0.05$ and Student's Newman-Keuls Test (SNK) was used to separate significant means.

RESULTS

Assessment of percentage grain damage

The mean percentage grain damage is shown in Table 1. The % grain damage (91.3) in treatment of maize grains singly infested with 6 pairs of *S. zeamais* was significantly ($P < 0.05$) higher than % grain damage in other treatments. Conversely, the % grain damage in treatment of maize grains singly infested with 6 pairs of LGB was significantly ($P < 0.05$) lower than % grain damage in other treatments. In the treatments of mixed insects of LGB and *S. zeamais*, a significantly ($P < 0.05$) higher % grain damage (42.9) was caused by the combination of 2 pairs of LGB + 4 pairs of *S. zeamais*. The % grain damage (27.7) caused by the combinations of (3 pairs of LGB + 3 pairs of *S. zeamais*) and (4 pairs of LGB + 2 pairs of *S. zeamais*) (31.0) were not significantly ($P > 0.05$) different from each other.

Assessment of percentage grain weight loss

As shown on Table 1, the % weight loss (4.8) caused by single infestation of LGB was significantly ($P < 0.05$) higher than % weight loss (1.5) caused by single infestation of *S. zeamais*. In the treatments of mixed insects of LGB and *S. zeamais*, insect combination of 4 pairs of LGB + 2 pairs of *S. zeamais* caused a significantly ($P < 0.05$) higher % grain weight loss (5.0) relative to weight losses caused by other insect combinations. The % weight losses of 0.6 and 1.0 respectively caused by insect combinations of 3 pairs of LGB + 3 pairs of *S. zeamais* and 2 pairs of LGB + 4 pairs of *S. zeamais* were not significantly ($P > 0.05$) different from each other.

Assessment of grain dust

As shown on Table 1, maize grains singly infested by LGB caused a significantly ($P < 0.05$) higher grain dust (2.4) than grain dust (0.8) from maize grains singly infested with *S. zeamais*. In the treatments of mixed insects of LGB and *S. zeamais,* a significantly ($P < 0.05$) higher grain dust (2.5) was caused to maize grains infested with insect combination of 4 pairs of LGB + 2 pairs of *S.*

zeamais. The % weight of grain dust (0.3 and 0.5 respectively) from maize grains infested with insect combinations of 3 pairs of LGB + 3 pairs of *S. zeamais* and 2 pairs of LGB + 4 pairs of *S. zeamais* were not significantly (P >0.05) different from each other.

Assessment of mortality of adult *Sitophilus zeamais* and LGB

Mortality of maize weevil and LGB in the treatments is shown in Table 2. In mono-specie insect infestation, higher insect mortality (6) was recorded in LGB infested treatment relative to insect mortality (2) in maize weevil infested treatment. In the mixed infestation of LGB and *S. zeamais,* the LGB mortality (8.0) in treatment of 4 pairs of LGB + 2 pairs of *S. zeamais* was not significantly (P > 0.05) different from LGB mortalities of 6 at a piece in treatments of 3 pairs of LGB + 3 pairs of *S. zeamais* and 6 pairs of LGB. The mortality of maize weevil (5.0) was highest in treatment of 3 pairs of LGB + 3 pairs of *S. zeamais*. The mortality was however, not significantly (P > 0.05) different from LGB mortality (4.3) in treatment of 2 pairs of LGB + 4 pairs of *S. zeamais*. The lowest *S. zeamais* mortality was in treatment of 6 pairs of *S. zeamais*. It was however, not significantly (P > 0.05) different from *S. zeamais* mortality (2.7) in treatment of 4 pairs of LGB + 2 pairs of *S. zeamais*.

Assessment of final population of Adult LGB and *Sitophilus zeamais*

The population of adult LGB and *S. zeamais* in the treatments is shown in Table 3. A significantly (P < 0.05) higher number of LGB (34.0) was recorded in treatment of 6 pairs of LGB. No living LGB adult was seen in treatments of 3 pairs of LGB + 3 pairs of *S. zeamais* and 2 pairs of LGB + 4 pairs of *S. zeamais*. The number of *S. zeamais* (121.3) in mono-specie infestation of the maize grains by the insect was significantly (P < 0.05) higher than number of the insect in other treatments. The number of *S. zeamais* (63.0 and 61.3 respectively) in 3 pairs of LGB + 3 pairs of *S. zeamais* and 4 pairs of LGB + 2 pairs of *S. zeamais* were not significant (P > 0.05) difference from each other.

DISCUSSION

Competition for food, space and other requisites by store product insects plays a major role in regulating the population size at any point in time. It often results into fighting, predation and mutual disturbances that lead to adverse influences such as elongation of developmental and reproductive processes, death or emigration by insects. In this study, the mixed infestation of LGB and maize weevil in maize grains, the major host of the insects created inter-specific competition that created scramble competition for food and shelter since their needs coincides. Apart from sharing the same host diet, LGB and maize weevil lays their eggs in the grains and complete their entire life cycle within the grain (Hodges, 1982). In this study, all the LGB in the treatments of equal number of the two insect species died. This shows that *S. zeamais* have competitive advantage over LGB in the scramble for food that eventual result into exclusion of LGB in the treatment. This may be as a result of the voraciousness of *S. zeamais* in loose grains relative to LGB that thrives well on unshelled maize on cob rather than loose maize grains (Golob et al., 1983). This in consonance with the results of studies by Hodges et al. (1983) that reported LGB as major pest of maize, infesting both the stored and standing crop in the ear rather than shelled corn. Likewise, Golob et al. (1985) reported that maize stored on the cob suffered considerably more damage than shelled grains.

In this study, higher % of damage was caused by *S. zeamais* in monospecie infestation of maize grains compared to damage caused by monospecie infestation by LGB. This shows the ability of *S. zeamais* to cause higher damage in monospecie infestation of maize grains relative to damage cause by LGB. However, the percentage weight losses caused by monospecie infestation of LGB and *S. zeamais* showed that though lesser % of the infested grains were damaged by LGB, the damage elicited higher weight loss than weight loss in grains damaged by *S. zeamais*. This indicated that though, higher % of the grains infested by *S. zeamais* were damaged; the damage was paltry, while LGB caused substantial damage to the relatively fewer grains damaged. Giles and Leon (1975) reported LGB as a highly voracious insect pest capable of causing up to 40% yield loss in stored maize grains within six months. The insect was reported to cause losses that exceeded those of other insects under similar condition (Giles & Leon, 1975; GASGA, 1993). Booth et al. (1990) and Espinal et al. (1996) reported that the adult LGB and its larval stage cause damage to a wide range of commodities. Similarly, higher grain dust was generated from grains infested by monospecie infestation of LGB relative to maize grains infested with maize weevil. Hodges et al. (1983) reported that much grain dust is generated by the boring activities of LGB that gradually converts maize grains into grain dust.

In the treatments of mixed insects, *S. zeamais* thrive better than LGB when one considers the final population. In the treatments, the population of LGB was either totally repressed or reduced, suggesting the ability of *S. zeamais* to suppress the activities of LGB in interspecific competition. This study also shows that mixed infestation of maize grains by LGB and maize weevil would constitute additional damage to infested maize grains, especially in terms of weight loss since LGB has the ability to bore into any single maize grain infested and cause substantial weight loss, while maize weevil has the potential to damage higher percentage of infested maize grains. The effect of the damage of the insects on the nutritional quality of the infested maize grains is severe (Adem & Bourges, 1981; Torreblanca et al., 1983). Similarly, Osipitan et al. (2009) evaluated damage caused to some food commodities by LGB and microbial composition of frass induced by the insect and reported fungi such as *Aspergillus niger, A. tamari, A. parasiticus, A. ochraceus, Fusarium compacticum* and *F. oxysporium* and bacteria such as *Bacillus cereus, B. macerans, Proteus mirabilis, P. morganic, P. rettgeri, Proteus* sp., *Pseud geniculatum, Pseud fragii, Pseud putela* and *Serratia marcences* in the commodities. It therefore becomes more imperative to protect stored maize grains from infestation by LGB and maize weevil. Conscious efforts should be explored at using environmental and ecologically friendly methods of preserving our stored maize grains from infestation by the insects.

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Table 1. Percentage grain damage, Percentage grain weight loss and weight of grain dust in maize infested with LGB and *Sitophilus zeamais*.

Treatment	% Grain Damage	% Grain weight loss (gm)	Weight of grain dust (gm)
6 pairs of LGB	13.3[d]	4.8[a]	2.4[a]
6 pairs *Sitophilus zeamais*	91.3[a]	1.5[b]	0.8[b]
3 pairs LGB + 3 pairs *Sitophilus zeamais*	27.7[c]	0.6[c]	0.3[c]
4 pairs LGB +2 pairs *Sitophilus zeamais*	31.0[c]	5.0[a]	2.5[a]
2 pairs LGB + 4 pairs *Sitophilus zeamais*	42.9[b]	1.0[c]	0.5[c]

Means with the same letter are not significantly different from each other at P < 0.05 based on Student's Newman-Keuls Test (SNK).

Table 2. Mortality of LGB and *Sitophilus zeamais* in maize grains infested with the insects.

Treatments	Insect Mortality.	
	LGB	Maize weevil
6 pairs of LGB	6.0[ab]	0.0[d]
6 pairs *Sitophilus zeamais*	0.0[c]	2.0[b]
3 pairs LGB + 3 pairs *Sitophilus zeamais*	6.0[ab]	5.0[a]
4 pairs LGB +2 pairs *Sitophilus zeamais*	8.0[a]	2.7[b]
2 pairs LGB + 4 pairs *Sitophilus zeamais*	4.0[b]	4.3[a]

Means with the same letter are not significantly different from each other at P < 0.05 based on Student's Newman-Keuls Test (SNK).

Table 3. Final population of LGB and *Sitophilus zeamais* in maize grains.

Treatments	Number of adult insects	
	LGB	*Sitophilus zeamais*
6 pairs of LGB	34.0[a]	0.0[d]
6 pairs *Sitophilus zeamais*	0.0[c]	121.3[a]
3 pairs LGB + 3 pairs *Sitophilus zeamais*	0.0[c]	63.0[c]
4 pairs LGB +2 pairs *Sitophilus zeamais*	19.3[b]	61.3[c]
2 pairs LGB + 4 pairs *Sitophilus zeamais*	0.0[c]	76.7[b]

Means with the same letter are not significantly different from each other at P < 0.05 based on Student's Newman-Keuls Test (SNK).

BIOMONITORING OF THE GENOTOXIC AND OXIDATIVE THE EFFECT OF NEEMON MORTALITY AND PHYSIOLOGICAL INDICES OF *HYPHANTRIA CUNEA* DRURY (LEPIDOPTERA)

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ABSTRACT: The fall web worm, *Hyphantria cunea* Drury (Lepidoptera: Arctiidae) native insect to North America has recently been introduced into Iran resulting in severe damage to trees and agricultural production. An experiment was conducted to examine insecticidal effect of a commercial product of neem extract, Achook® (Godrej india) containing 0.03% of effective material,Azadirachtin, against third instar larva of this pest. The first instar larvae were collected from *Platanus orientalis* hosts and reared on fresh mulberry leaves in growth chambers (28± 2 ºC, RH 75± 5 and 14:10 LD). Third instar larvae of next generation were used in the present study. The dipping method was used where mulberry leaves of similar sizes were dipped in the solution of neem and provided to the larvae. About 70 percent mortality was observed in treated insects after 48 h. The controls fed 51.93 more than treated larvae. The measurement of physiological factors (cholestrol, uric acid, urea urea, protein, glucose) showed reduction in treated larvae in comparison to control insects. The possible significance of these changes is discussed.

KEY WORDS: Neem, Azadirachta indica, fall web worm, *Hyphantria cunea*, physiology.

The fall web worm, *Hyphantria cunea* Drury (Lepidoptera: Arctiidae) is an insect native to North America that is presently distributed in many areas in the northern hemisphere (Warren & Tadic, 1970) and New Zealand (Kean & Kumarasinghe, 2007). It has been introduced to different areas of Europe and Asia (Li et al., 2001). Since, 2002, *H. cunea* established itself in northern areas of Iran, causing severe damage to trees. It is a multivoltine pest feeding on leaves of trees and hibernates as pupa in soils around the damaged forest and shade trees. Research has been conducted to look for natural plant protection compounds such as botanical insecticides, antifeedants and microorganisms (Zibaee et al., 2010).

The compounds from the neem tree have a number of properties useful for insect pest management. These include toxicity, repellence, feeding and oviposition deterrence, insect growth regulatory activity, etc. (Ascher & Meisner, 1989; Schmutterer, 1990; Mordue & Blackwell, 1993; Mordue, 2004) and more than 140 active compounds have been identified in the neem tree (Koul, 2004). The key insecticidal ingredient is azadirachtin, a steroid-like tetranortriterpenoid, responsible for both antifeedant and toxic effects in insects (Govindachari et al., 2000; Koul, 2004). Furthermore, azadirachtin blocks the synthesis and release of moulting hormones from the prothoracic glands, leading to incomplete ecdysis in immature insects (Isman, 2006). Different insect species show varying degrees of sensitivity to various extracts and components. Naumann & Isman (1995) used three concentrations of an oil-free neem seed extract to deter oviposition in noctuid moths and found that these neem-based products were not effective. According to Turcani (2001), the neem seed kernel suspension reduced the damage by *Pieris brassicae* L. larvae but failed to give any significant protection to castor, *Ricinus communis* L. leaves against the red hairy caterpillars, *Amsacta albistriga* Walker. Neem preparation showed a positive effect in controlling the turnip root fly, *Delia floralis* (Fall.) and the cabbage moth, *Mamestra. brassicae* (Karelina et al., 1992; Meadow & Seljasen, 2000; Seljasen & Meadow, 2006), However Pats & Isman (1998) found no effect on hatching or larval development for the cabbage root fly, *D. radicum* (L.) and Neemix, which kills and repels a variety of insects, had no effect on populations of the beet armyworm, *Spodoptera exigua* (Hübner) larvae. These controversial results suggest that the efficacy of any neem-based insecticides on pests should be investigated before widespread use in the field.

This research addresses the need for finding effective options for managing the insect pest *Hyphantria cunea* in Guilan province in the face of the declining popularity of conventional chemical insecticides. In this study, we have been interested in the effects of Neem EC, on deterrence and some physiological aspects of this lepidopteran pest.

MATERIAL AND METHODS

First instar larvae of *Hyphantria cunea* were collected from *Platanus orientalis* host and reared separately on mulberry leaves to reach 3th instar larvae in the laboratory at 28 ± 2 °C under a 14 h light:10 h dark photoperiod and relative humidity of 65 ± 5 percent. The third instar larvae of next generation were used to initiate the experiments.

The neem (Achook®, Godrej company, India) was procured. Bioassays were performed with 3^{th} instar larvae of *Hyphantria cunea* (<24 h) using the suggested concentration of the company, 0.03 % of effective material (Azadirachtin). Leaf discs of 6cm diameter were dipped for 10 seconds and air dried leaves were provided to the larvae. Control leaves were treated with distilled water and air-dried in the same way. Three replicates of 10 larvae each were used for the bioassays with one control of 10 insects. Larvae were starved 4-5h prior to each bioassay. After 48h post-treatment the number of dead larvae was counted and the area of eaten leaves was measured by leaf area meter. For physiological indices the live larvae were randomly selected and were placed in 2 ml of distilled water or buffer related to each test and then samples were homogenized.

Protein was measured based on the Biuret's method as was described by Reinhold (1953) using a protein assay kit (Pars Azmon Co, Iran) and measuring the absorbance at 540 nm. Glucose was analyzed as described by Siegert (1987) and total cholesterol as was described by Richmonds (1973) hydrolyzing cholesterol esters with cholesterol oxidase, cholesterol esterase and peroxidase. Uric acid contents in the medium were determined using uricase as described by Valovage and Brooks (1979) at 500 nm. Urea was measured with urease-GDH kit (Biochem. Co, Iran) at 340 nm following the manufacturer's protocol.

All data were analyzed using SAS software and Tukey's studentized range (HSD) test in a complete randomized design (SAS, 1997).

RESULTS

Results showed that the mortality rate of treated larvae were 70% while no mortality was recorded for controls. The area of leaf consumed in treated leaves was 51.93 times lesser compared with the controls (Table 1).

The level of cholesterol, protein, glucose, uric acid and urea in treated larvae were reduced in the order of 0.68, 0.53, 0.92, 0.64 and 0.70 times than controls (Fig. 1).

DISCUSSION

Secondary organic compounds synthesized by plants have an important role in protecting plants against insect herbivory by way of delay in larval growth and metamorphosis or antifeedants (Isman et al., 2006). The neem in the present study clearly showed insecticidal and antifeedant effects on *Hyphantria cunea*.

Larval mortality, impaired antifeedant effect and reduced plant damage were all substantial enough to suggest that neem could be considered in the management of this insect. Yoshida & Toscano (1994) found that the relative consumption rate of *Heliothis viridescens* (Fabricius) larvae treated with neem extract was 25% that of the control. Greenberg et al. (2006) found that neem-based insecticides deterred feeding by beet armyworm (*S. exigua*). The neem tree contains different substances in its tissues, many of which are biologically active against insects as antifeedants (Jacobson, 1987; Mordue, 2004). The primary active ingredient of neem-based pesticides is azadirachtin. Inhibition of feeding behaviour by azadirachtin results from blockage of input receptors for phagostimulants or by the stimulation of deterrent receptor cells or both (Mordue & Blackwell, 1993). The Neem EC did not produce a rapid mortality. No larvae perished within the first days of the experiment; mortality began on second day, when moulting to the 4th growth stage began. Coudriet et al. (1985) detected that neem seed extract prolonged larval development, and induced larval mortality of *Bemisia tabaci* (Gennadius) on cotton foliage. In our experiments the treated larvae perished directly before moulting or in the process of moulting as they were unable to shed the old integument. The mortality observed during the molting process; support the proposition that the action of neem ingredients is connected with endocrine events in the insects. To be successful, metamorphosis requires a careful synchrony of many hormones and other physiological changes. Metamorphosis occurs when the corpora allata stops secreting juvenile hormone (Gilbert et al., 1980). It can occur only when the insect has reached a certain minimum mass characteristic of the growth stage. Neem EC caused lethal failure of larval-larval and larval-pupal ecdysis, which is typical for insecticides possessing morphogenetic activity, commonly referred to as IGR-activity. It is possible that azadirachtin, because of its similarity to ecdysone, which controls the process of metamorphosis as the insects pass from larva to pupa, will block off these vital hormones and interrupt their life cycle (Sridharan, 2007). The defects occurred in moulting into the 4th instar. Therefore it may be concluded that a higher than normal juvenile hormone level persisted in the organism, allowing growth but inhibiting metamorphosis. It is known that neem may act as an exogenous juvenile hormone or its analogue (Schmutterer, 1987). However, it is also possible that, as a result of intoxication, histopathological changes may occur in the corpora cardiaca of the insect, causing disorders in the secretion of hormones (Mordue, 2004).

Different factors may affect enzymatic and non-enzymatic processes in insects such as: climate, diet, chemicals, etc. Our results show that Achook® significantly affected biochemical process in the fall web worm larvae.

Many insecticides have an antifeedant effect and decrease insect feeding efficiency which affects protein biosynthesis and accumulation (Etebari et al., 2007). Present result shows that the amount of total protein decreased in larvae treated with Achook® after 48 treatments. This phenomenon is probably due to breakdown of proteins into free amino acids which are shunted into the TCA cycle as keto acids (Bizhannia et al., 2005).

Mukherjee et al. showed that higher concentrations of azadirachtin increased the amount of protein in the hemolymph of *Tribolium castaneum* and this is probably due to the increase in the activity of detoxifying enzymes. Schmidt et al. showed that treatment of *Spodoptera littoralis* and *Agrotis ipsilon* Rottenburg (Lepidoptera: Noctuidae) with azadirachtin decreased protein in the hemolymph. Zibaee et al. reported that the amount of protein decreased in mid-gut of rice stripped stem borer due to diazinon treatment.

Urea and uric acid are excreted end product of insects and their amount is correlated with the amount of protein in the insect's body. Dungern & Briegel (2001) reported that the activity level of xanthin dehydrogenase increased due to Presence of higher protein in the hemolymph. After 48 h, the amount of uric acid decreased in the hemolymph of treated larvae. This result indicates that the decrease in uric acid in the hemolymph is probably due to altered metabolic pathway after treatment that prevented the natural excretion of uric acid from the insect body (Etebari & Matindoost, 2004a).

Etebari & Matindoost (2004b) reported that if the feeding activity is normal, glucose and cholesterol amounts in the hemolymph of silkworms increases. When the feeding of larvae, however, is interrupted the amount of these metabolites are severely decreased (Etebari & Matindoost, 2004c). Several activities of insects depend on carbohydrates metabolism. The amount of glucose demonstrates the availability of this sugar for carbohydrates metabolism in insect cells (Satake et al., 2000). Our results show that the amount of glucose and cholesterol decreased in larvae that were treated with neem after 48 h. Radhakrishna and Devi showed that treatment of silkworm larvae with organophosphorus compounds decreased the amount of glucose. Nath (2003) reported that lethal and sublethal doses of ethion and fenitrothion increased the amount of glucose and trehalose in silkworm. This could be due to imbalance in the homeostasis of the silkworm. Our results similarly point to this.

In conclusion, our results demonstrates that Achook® has toxic, as well as growth regulatory, antifeedant and biochemical effects that caused 70% of mortality in treated larvae and results are promising in developing effective approaches to control insect pests, but more studies are needed to evaluate the field efficacy of Neem EC for this particular pest of economic importance.

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Table 1. Mean (± standard error) measurement of leaf area size (cm^2).

Treatments	*0.03%*	*Control*
	250±40.32a*	***4.14±0.04b***
	131.81±40.32a	***4±0.04b***
	255.39±40.32a	***4.13±0.04b***

*Data with similar letters in each column are not significantly different (α≥5%).

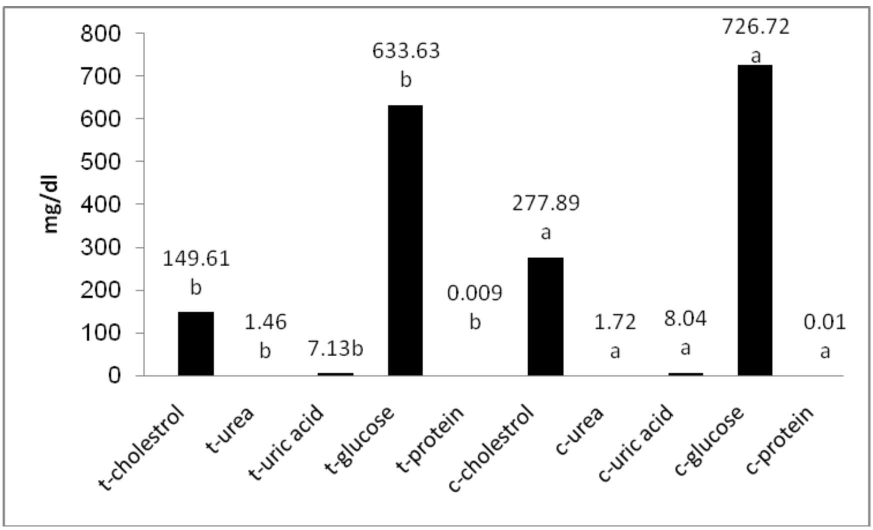

Figure 1. Comparison of mean number of physiological parameters between treatment and control.

Data with similar letters in each column are not significantly different (α≥5%) (t= Treated , c= Control).

EFFECTS POTENTIALS OF COMMERCIAL EDIBLE *HETEROMETRUS SPINIFER* IN VITRO

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[Koç, K., Memiş, E., Polat, H., Türkez, H. & İncekara, Ü. 2012. Biomonitoring of the genotoxic and oxidative effects potentials of commercial edible *Heterometrus spinifer* in vitro. Munis Entomology & Zoology, 7 (1): 496-501**]**

ABSTRACT: In this investigation, the genotoxic and oxidative effects of water soluble extracts of *Heterometrus spinifer* (Malaysian Forest Scorpion) has been assessed on cultured human blood cells. The extract was added to the cultures at 12 different concentrations (0-2000 mg/L). Micronucleus (MN) test was used to monitor the DNA and chromosomal damage produced by scorpion extracts in vitro. In addition, to assess the oxidative effects, total antioxidant capacity (TAC) and total oxidant status (TOS) levels were measured. Our results indicated that these extracts did not show genotoxic effects at the tested concentrations. However, the extracts caused dose dependent alterations in both TAC and TOS levels. Based on the findings, it was concluded that the studied scorpion can be consumed safely, but it is necessary to consider the cellular damages which are likely to appear depending on oxidative stress at higher concentrations. It has been also suggested that this in vitro approach for oxidative and genotoxicity assessments may be useful to evaluate the potential health risks of edible scorpion.

KEY WORDS: Genotoxicity, *Heterometrus spinifer* scorpion, human blood culture, micronucleus test, oxidative status.

Scorpions and other arthropods are consumed as food supplements in many parts of the world. Scorpions are commonly eaten in China, Thailand, Cambodia and Bangkok. Scorpions same as insects are high in protein and apparently consist of important fatty acids and vitamins (Mayor, 2009). Having commercial importance, the edible scorpion *Heterometrus spinifer*, is quite large, averaging around 15 cm. As its name suggests the Malaysian Forest Scorpion is native to Malaysia though it is also seen in some other areas in Asia. For example, this species is common to Thailand and is one of a few species that is known to be edible. But many of the arthropods have venom and other defensive chemicals which are biologically active. So eating of these invertebrates may cause serious harmful effects on humans. In this context, the potential toxic effects of these popular arthropods need to be investigated in more detail. For this aim, we used sensitive and reliable short term genotoxicity (MN) and oxidative stress (TAC and TOS) screening tests (performed in five replicates) on human whole blood cultures. This research will also serve to improve the pharmaceuticals because it is well known that animal toxins may become important in curing diseases like cancer**.** The genotoxic and oxidative effects of edible scorpion extracts exposure have not yet been reported. In this study, we aimed to elucidate whether the water soluble extracts of *Heterometrus spinifer* scorpion have the genotoxic and oxidative effects in vitro or not.

MATERIAL AND METHODS

Scorpion extracts

Heterometrus spinifer scorpion was supplied from internet address (http://www.thailandunique.com/). A stock solution of aqueous extract was prepared by mixing 1,4 g of processed scorpion powder with 200 ml of water (boiled and cooled tap water) with constant stirring on a magnetic stirrer. The suspension of scorpion powder in water was left for 4 h, and filtered through filter paper No.1 (Whatman). The filtrate was stored in amber colored air tight bottle at room temperature till use. Then, stock solutions were diluted and added to cell culture tubes at different concentrations (0, 5, 10, 15, 25, 40, 75, 100, 200, 500, 1000 and 2000 ppm).

Cell cultures

The heparinized blood samples from five healthy male non-smoking donors with no history of exposure to any toxic agent were used in our experiments. From all volunteers involved in this study, hematological and biochemical parameters were analyzed, and no pathology was detected. Human peripheral blood lymphocyte cultures were set up according to a slight modification of the protocol described by Evans & O'Riordan (1975). A 0.5 mL aliquot of heparinized blood was cultured in 6 mL of culture medium (Chromosome Medium B; Biochrom, Berlin) with 5 mg/mL of phytohemagglutinin (Biochrom). The cultures were incubated in complete darkness for 72 h at 37°C. Experiments were conformed to the guidelines of the World Medical Assembly (Declaration of Helsinki). The MN test was carried out on lymphocytes 72 h after treatment. The TAC and TOS assays were carried out on plasma samples 2 h after treatment. Each individual lymphocyte culture without insect extract was studied as a control group.

MN assay

The MN test was performed by adding cytochalasin B (Sigma®; final concentration 6 mg/mL) after 44 h of culture. At the end of the 72-h incubation period, the lymphocytes were fixed with ice-cold methanol/acetic acid (1:1, v/v). The fixed cells were put directly on slides, using a cytospin, and stained with Giemsa solution. All slides were coded before scoring. The criteria for scoring micronuclei were as described by Fenech (1993). At least 1000 binucleated lymphocytes were examined per concentration for the presence of one, two or more micronuclei.

TAC and TOS analysis

The automated Trolox equivalent antioxidant capacity (TAC) and total oxidant status (TOS) assays were carried out in plasma samples obtained from blood cultures for 2h by commercially available kits (Rel Assay Diagnostics®, Gaziantep, Turkey) (Erel, 2004).

Statistical analysis

Statistical analysis was performed using SPSS software (version 13.0, SPSS, Chicago, IL, USA). The Duncan's was used to determine whether any treatment significantly differed from controls or each other. Statistical decisions were made with a significance level of 0.05.

RESULTS

The results of the present study clearly indicated that the aqueous extracts of scorpion did not alter MN/1000 cell frequencies in cultured human lymphocytes (Figure 2). Nevertheless, the human blood cultures were found to be sterile after the applications of the extracts of scorpion at concentrations of 1000 and 2000 ppm. The cytotoxic effects observed at increasing concentrations might cause the sterility. Scorpion extract at 10 ppm caused significant increases of TAC level when compared to control value. However, different concentrations of scorpion (200, 500, 1000 and 2000 ppm) lead to significant decreases of TAC level when compared to control value (Figure 3). As shown from the results presented in Figure 4, the TOS levels increased at higher concentrations of scorpion (100, 200, 500, 1000 and 2000 ppm).

DISCUSSION

Edible arthropods are consumed as food supplements in many parts of the world. But many of them have venom and other defensive chemicals which are biologically active. So eating of these invertebrates may cause serious harmful effects on humans. Very few studies have been reported in relation to the genotoxic and oxidative effects of edible insect extracts but not scorpions. In the study by Incekara and Turkez (2009), three aquatic edible insect species, *Hydrophilus piceus* (Linnaeus, 1758) (Coleoptera: Hydrophilidae), *Dytiscus marginalis* Linnaeus, 1758 (Coleoptera: Dytiscidae) and *Cybister* sp., (Coleoptera: Dytiscidae) were evaluated and found to be non genotoxic. In Incekara et al. (2010), the in vitro genetic and oxidative effects of different *Callimenus latipes* Stal, 1875 (Orthoptera: Tettigoniidae: Bradyporinae) extracts (acetone, ethanol and diethyl ether) on human lymphocytes were investigated. In Turkez et al. (2010) the genotoxic potentials of water soluble extracts of grasshoppers, *Saga ephippigera ephippigera* Fischer de Waldheim, 1846 and *Callimenus dilatatus* (Stal, 1876) (Orthoptera) on cultured human blood cells were evaluated and found to be non genotoxic. Again, recently Turkez et al. (2011) reported non-mutagenic properties of migratory locust (*Locusta migratoria*) on cultured human blood cells by using the chromosome aberration (CA) and MN tests in vitro. In addition, Adamolekun (1993) reported a seasonal ataxic syndrome associated with the consumption of the edible larva of *Anaphe venata* (Butler) in south-west Nigeria. Akinnawo et al. (2002) studied toxicity of the aqueous extracts of raw and processed larva of *Cirina forda* (Westwood) administered orally in white albino mice and albino rats. They suggested that the processed larva of *Cirina forda* (Westwood) is neither neurotoxic nor hepatotoxic to mice and rats; however, the neurotoxic nature of the raw extract needs further investigation. MacEvilly (2000) suggested that insects should not be eaten with nuts or shellfish as both have been shown to trigger allergic responses in hypersensitive individuals. There are also very few reports of human death caused by eating insect (Blum, 1994; Steyn, 1962).

Our present results clearly indicated that water extracts of *Heterometrus spinifer* scorpion have no mutagenic potential. Basic toxicity information often provides a valuable perspective for predicting the potential risk to humans. As a matter of fact, it was reported identification and subsequent lowering of exposure to genotoxic agents would remain one of the main goals for primary cancer prevention in man (Bartsch & Malaveille, 1989). According to the results of the present study, it is suggested that scorpion can be consumed safely; however, it will also be useful to take into consideration the cytotoxicity at increasing doses. The safe concentrations of edible scorpion extracts in human blood as prescribed here are valid only for in vitro conditions. In order to generalize this suggest, further in vivo studies are required on the absorption kinetics of these extracts from the gastrointestinal track into blood. The results of the present study revealed that the scorpion extract caused significant increases of TAC levels at 10 ppm in vitro. Our results also revealed that aqueous extracts of scorpion caused decreases of TAC levels, at higher concentrations than 200 ppm. And the scorpion extracts caused increases of oxidative stress at the concentrations higher than these concentrations. The cytotoxic effects of overdoses applications of scorpion extracts could be explained by the increases of TOS levels. Eating arthropods have become more popular day by day around the world (Memorial University, 2010) and therefore further investigations on the potential genotoxic effects of these commercial arthropods should be conducted. We also offer that this in vitro approach which includes the collaborative use of genetic endpoints and oxidative stress markers will serve to compare the potential health risks of edible insects related with mutagenesis or carcinogenesis.

Based on the findings, it was concluded that the scorpion can be consumed safely, but it is necessary to consider the cellular damages which are likely to appear depending on oxidative stress. It has been also suggested that this in vitro approach for oxidative and genotoxicity assessments may be useful to evaluate the potential health risks of edible arthropods.

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Figure 1. Commercial *Heterometrus spinifer* scorpion in sale.

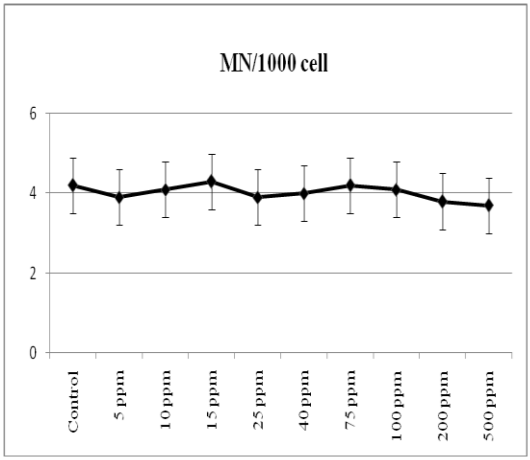

Figure 2. The effects of aqueous extracts from *Heterometrus spinifer* scorpion on MN/1000 cell values in human blood cultures.

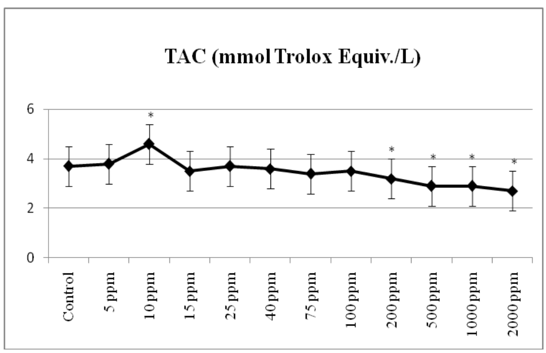

Figure 3. The effects of aqueous extracts from *Heterometrus spinifer* scorpion on TAC levels in human blood cultures (Values are means ± standart deviation, * symbol means statistically significant differences from control).

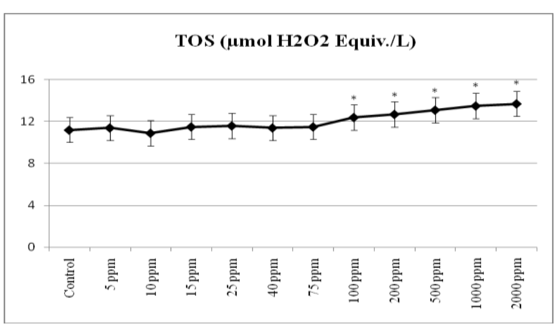

Figure 4. The effects of aqueous extracts from *Heterometrus spinifer* scorpion on TOS levels in human blood cultures (Values are means ± standart deviation, * symbol means statistically significant differences from control).

OCCURRENCE OF SPONTANEOUS LARVAL MUTANT IN THE POLYVOLTINE SILKWORM, *BOMBYX MORI* L.

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[Rajanna, K. L., Ravindra Singh & Jayappa, T. 2012. Occurrence of spontaneous larval mutant in the polyvoltine silkworm, *Bombyx mori* L.. Munis Entomology & Zoology, 7 (1): 502-505**]**

ABSTRACT: A recessive mutation was found during the course of basic stock maintenance in December 2009. Some spontaneous marked mutant larvae (0.20%) were observed in a polyvoltine silkworm race "Pure Mysore" of the mulberry silkworm, *Bombyx mori* L. The mutant larvae were dark brown body color and characterized by prominent crescent and star spots when compared to normal cream-white larvae. The performance of mutant larvae was inferior to the normal and the comparative performance of mutant x CSR2 and normal x CSR2 has also been discussed.

KEY WORDS: *Bombyx mori* L.*,* Mutant larvae, Performance, Pure Mysore.

The polyvoltine silkworm race Pure Mysore (PM) plays a vital role in the production of PM x CSR2 hybrid, a ruling hybrid in southern India contributing maximum silk production. Systematic maintenance and multiplication of Pure Mysore breed is followed at different levels both at the Research Institutes and Basic Seed Farms. However, certain spontaneous mutant larvae/pupae have been observed in Pure Mysore such as black striped pupal wing, (Yamamoto et al., 1984), oily larval mutant (Rama Mohana Rao et al., 1989). Majority of the mutants are caused due to chromosomal aberrations (Tazima, 1964). It has been reported that generally mutants are inferior to the normal in several characters such as fecundity, hatching, larval weight, effective rate of rearing, cocoon weight, cocoon shell weight and cocoon shell percentage with an exception to oily larval mutant (Rama Mohan Rao et al, 1989). In this paper, the characters of mutant larvae, comparative performance of mutant and normal and their hybrids are presented.

MATERIALS AND METHODS

During the course of basic stock maintenance of Pure Mysore, some spontaneous larvae (0.20%) were observed in December, 2009.The mutant larval characters are very conspicuous and the mutant larvae can be easily separated from the normal batch. These larvae were separated and stabilized following line breeding and directional selection. Presently, the line is breeding true and characterized by light yellow non-diapausing eggs, prominent crescent and star spots on second and fifth abdominal segments, respectively. The mutant line was designated as "Pure Mysore Mutant" [PM (M)]. Photographs of PM (M) and normal Pure Mysore (PM) have been depicted in Figure 1. Both mutant and normal Pure Mysore were used for this study and maintained up to ten generations (Jan-Feb'2010 to Jul-Aug'2011) by following standard rearing technique (Krishnaswami, 1978). Data were collected for nine characters viz., fecundity, hatchability, larval span, larval weight, effective rate of rearing(ERR) by No., ERR by weight, cocoon weight, cocoon shell weight and cocoon shell percentage. During 6th, 7th and 8th generation, the mutant and normal Pure

Mysore were crossed with bivoltine breed CSR2 and prepared the cross breed eggs of PM (M) x CSR2 and PM x CSR2. These hybrids were reared thrice and their performance was assessed with respect to important rearing and reeling parameters.

RESULTS AND DISCUSSION

Generation-wise performance of PM (M) and normal Pure Mysore for nine characters has been presented in Table 1. The performance of mutant was inferior to normal with respect to all important rearing characters. In all the generations, the characters of the mutant strain were consistent; hence it is breeding true. The reduction noticed in the mutant was 16% in fecundity, 0.70% in hatching,11% each in larval weight and ERR by No., 27% in ERR by Wt, 20% in cocoon weight, 23% in cocoon shell weight and 4% in cocoon shell percentage.

When the mutant individuals were crossed with CSR2 breed, it is observed that neither larval colour nor larval markings were appeared in F1 i e., PM (M) x CSR2 and its reciprocal cross indicating the recessive character of the mutant. It is evident from the Table 2 that the mean values of the rearing parameters also revealed reduction even with hybrid involving the mutant to the tune of 15% in fecundity, 1% in hatching, 6% in larval weight, 0.20% in ERR by No., 6% each in ERR by weight, and cocoon weight and 7% in cocoon shell weight.

The resultant cocoons of PM (M) x CSR2 and PM x CSR2 were subjected for reeling test and collected the data for six characters namely, average filament length, non breakable filament length, filament size, renditta, reelability and waste on silk weight and presented in Table 3. The reduction observed in important reeling parameters of mutant was 7.2% in average filament length (AFL), 4% in average non-breakable filament length (NBFL), -0.37% in filament size and -2.20% in renditta. In case of both filament size (denier) and renditta, negative trend measures quality of the silk. However, increased reelability (3%) was recorded in case of PM (M) x CSR2.

Genetical studies on spontaneous mutants in the mulberry silkworm, *Bombyx mori* L. like polyphagous mutant strains Si and Brd with regard to dominant feeding habit (Tazima, 1994), "non-moulting k" mutant with retarded growth (Banno et al., 1995), sex linked "non-moulting nm-s" (Banno et al., 1997), a recessive translucent-15 mutant with moderately translucent or oily larval skin (Kawaguchi et al., 1997), a mutant expressing extra legs and wings at adult stage (Hirokawa, 1998) have been carried out.

In the present study, the mutant PM (M) was found recessive in nature as no mutant larvae were observed when crossed with another bivoltine silkworm breed CSR2. In F1 hybrid involved one spontaneous larval mutant with reddish brown larvae at hatching pure Mysore chocolate and one polyvoltine breed MW1 with normal dark brown larvae, all the larvae were dark brown in colour indicating the recessive nature of the mutant (Ravindra Singh, et al., 1992). The findings of this study can be useful to the silkworm breeders who are involved in maintenance of the basic stocks. As the several characters of mutant and its hybrid have shown deterioration, this type of mutant should be eliminated from the stock to avoid greater affect on the important breed characters during basic stock maintenance and also to avoid reduction in economic characters in the cross breed combination.

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NORMAL **MUTANT**

Figure 1. Normal and mutant larvae of silkworm.

Table 1. Performance of mutant PM (M) and normal Pure Mysore.

	Generation	Fecun-dity (No.)	Hatching (%)	Larval span (h)	Larval Wt.(g)	ERR No.	ERR Wt. (Kg)	Cocoon Wt. (g)	Cocoon shell Wt. (g)	Cocoon shell (%)
Mutant PM (M)	Jan-Feb'10	383	98.69	672	21.037	7333	6.333	0.763	0.109	14.30
	Mar-Apr'10	386	78.46	552	18.307	8766	6.666	0.832	0.096	11.54
	May-Jun'10	321	93.83	600	21.037	8756	8.750	1.082	0.151	13.95
	Jul-Aug,10	445	94.74	600	22.268	7400	6.000	0.948	0.142	14.98
	Sept-Oct'10	453	90.92	600	20.153	7133	6.903	0.981	0.134	13.66
	Nov-Dec '10	402	90.10	696	21.308	9866	9.333	1.014	0.145	14.23
	Jan-Feb '11	473	89.38	696	23.215	8400	7.140	0.870	0.131	15.05
	Mar-Apr'11	413	90.75	576	23.372	9666	7.833	0.894	0.124	13.81
	May-Jun'11	367	93.25	624	21.678	8333	7.000	0.953	0.142	14.90
	Jul-Aug,11	452	89.25	624	18.285	7800	6.000	0.882	0.128	14.51
	Mean	**410**	**90.94**	**624**	**21.066**	**8345**	**7.196**	**0.922**	**0.130**	**14.09**
	SD	**47**	**5.27**	**49**	**1.764**	**948**	**1.126**	**0.093**	**0.017**	**1.02**
Normal PM	Jan-Feb'10	374	98.40	648	24.153	9933	11.333	1.070	0.156	14.58
	Mar-Apr'10	474	88.44	552	23.291	9666	9.500	0.995	0.137	13.77
	May-Jun'10	427	92.13	600	23.203	9866	11.000	1.173	0.179	15.26
	Jul-Aug,10	552	92.74	600	24.723	9850	11.000	1.156	0.175	15.14
	Sept-Oct'10	567	91.92	600	24.523	9000	7.333	1.343	0.176	13.10
	Nov-Dec '10	498	91.38	696	25.596	9900	10.667	1.223	0.189	15.45
	Jan-Feb '11	524	91.59	744	21.396	9500	9.833	1.118	0.176	15.74
	Mar-Apr'11	464	92.06	576	26.341	9733	11.166	1.216	0.181	14.88
	May-Jun'11	501	90.43	600	21.706	9024	8.960	1.099	0.170	15.47
	Jul-Aug,11	526	86.79	600	21.788	7366	8.167	1.108	0.157	14.16
	Mean	**491**	**91.59**	**622**	**23.672**	**9384**	**9.896**	**1.150**	**0.170**	**14.76**
	SD	**58**	**3.03**	**58**	**1.695**	**787**	**1.387**	**0.096**	**0.015**	**0.85**

Table 2. Rearing performance of hybrids of mutant PM (M) and normal Pure Mysore.

Crossbreed combination	Generation	Fecun-dity (No.)	Hatch-ing (%)	Larval span (h)	Larval Wt.(g)	ERR No.	ERR Wt. (Kg)	Cocoon Wt. (g)	Cocoon shell Wt. (g)	Cocoon shell (%)
PM(M) x CSR2	Nov-Dec '10	396	90.76	576	42.126	9840	20.000	1.920	0.354	18.44
	Jan-Feb '11	473	89.38	624	33.297	9840	16.400	1.645	0.339	20.60
	Mar-Apr'11	438	90.31	552	45.575	9920	17.800	1.745	0.312	17.88
	Mean	**436**	**90.15**	**584**	**40.33**	**9867**	**18.067**	**1.770**	**0.335**	**18.97**
	SD	**39**	**0.70**	**37**	**6.33**	**46**	**1.815**	**0.139**	**0.021**	**1.44**
PM x CSR2	Nov-Dec '10	501	93.53	576	44.160	9880	19.000	1.884	0.346	18.37
	Jan-Feb '11	542	91.62	672	42.218	9880	19.200	2.000	0.419	20.95
	Mar-Apr'11	503	88.54	552	41.756	9900	19.200	1.776	0.324	18.24
	Mean	**515**	**91.23**	**600**	**42.71**	**9887**	**19.133**	**1.887**	**0.363**	**19.19**
	SD	**23**	**2.52**	**63**	**1.28**	**12**	**0.115**	**0.112**	**0.050**	**1.53**

Table 3.Reeling performance of hybrids of mutant PM (M) and normal Pure Mysore.

Crossbreed combination	Generation	AFL (m)	NBFL (m)	Filament size(d)	Renditta	Reelability (%)	Waste on silk wt (%)
PM(M) x CSR2	Nov-Dec '10	828	759	2.97	7.70	91.65	19.05
	Jan-Feb '11	794	668	2.52	7.60	83.00	30.00
	Mar-Apr'11	735	668	2.62	8.30	90.00	28.60
	Mean	**786**	**698**	**2.70**	**7.87**	**88.22**	**25.88**
	SD	**47**	**53**	**0.24**	**0.38**	**4.59**	**5.96**
PM x CSR2	Nov-Dec '10	729	627	3.02	8.00	86.25	22.11
	Jan-Feb '11	1004	827	2.50	7.30	80.00	30.70
	Mar-Apr'11	808	738	2.56	7.80	89.00	25.00
	Mean	**847**	**731**	**2.69**	**7.70**	**85.08**	**25.94**
	SD	**142**	**100**	**0.28**	**0.36**	**4.61**	**4.37**

EVALUATION OF OVIPOSITION-SITE PREFERENCE BEHAVIOR IN PREDATORY BUG *DERAEOCORIS LUTESCENS* SCHILLING (HEMIPTERA: MIRIDAE)

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ABSTRACT: The present research aimed to study the oviposition site preference of the predatory bug *Deraeocoris lutescens* Schilling (Hemiptera: Miridae) at 25±1°C temperature, relative humidity of 60±10% and a photoperiod of 16:8 h (L:D). The experiments on different plant species were investigated among four groups of plants, six crop plant species, three greenhouse plant species, five orchard plant species and five ornamental plant species. Among different plant species, most oviposition was on broad bean leaves with a total of 41.7±3.7, sweet pepper with 31.1±3.4, grape leave with 13.9±2.8 and begonia with 39.3±3.0 eggs in each group. In order to determine preference of *D. lutescens* for oviposition, broad bean leaves which infested with different nutritional sources, *Aphis gossypii, Aphis fabae, Myzus persicae,* eggs of *Sitotroga cerealella,* 10% honey emulsion and 10% honey emulsion + yeast extract were used. Among these leaves as substrates of oviposition, the adult females showed higher preference for leaves infested with *M. persicae* than with other nutritional sources. The preferred site for egg deposition at light and dark area by *D. lutescens* females was tested. The adult females showed significantly higher preference for the leaves as substrates of oviposition in the dark area than in the light area.

KEY WORDS: Predatory bug, *Deraeocoris lutescens,* oviposition site preference, plant species, nutritional sources.

Primarily through the study of many insects, it has become clear that oviposition behaviour, and choice of oviposition sites in particular, can increase the performance and survival of insect progeny. Such oviposition behavior is largely driven by variation in the environment. Choice of oviposition sites and dispersion of eggs by adult insects can vary among host species, among individuals within a host population, and within an individual of a particular host population.

A positive correlation between female preference for oviposition sites and offspring performance was detected in many studies, primarily for herbivorous insects (Craig et al., 1989; Craig et al., 2000; Craig & Ohgushi, 2002; Jaenike, 1978; Kanno & Harris, 2002; Scheirs et al., 2000; Stein & Price, 1995; Thompson, 1988). Females of the gall aphid *Pemphigus betae* indeed maximise their overall fitness; stem mothers prefer to establish galls at sites on the leaves that support more offspring (Whitham, 1978, 1980). Determinants of oviposition choice by phytophagous insects include allelochemicals, quantity and/or quality of resources, plant morphology and natural enemies (Thompson & Pellmyr, 1991). Such factors can lead to variation in performance and survival of insect progeny for eggs deposited in different locations (Craig et al., 1989; Mayhew, 1997;

Rausher, 1979; Resetarits, 1996; Simberloff & Stiling, 1987; Stamps & Linit, 2002). Because variation in oviposition behaviour can be genetic and heritable (Jaenike, 1990; Jaenike & Holt, 1991; Thompson & Pellmyr, 1991), natural selection may favour the choice of oviposition sites that facilitate growth and survival of offspring.

Moreover, oviposition site selection by predatory bugs to be correlated positively with offspring performance at the substrate of oviposition. This is supported by the significantly higher hatching success of eggs deposited at the preferred vein origin site as compared with those deposited on other parts of the leaf (Groenteman et al., 2006). When selecting an oviposition site, omnivores are expected to respond to both prey availability and, even more strongly, to plant traits that affect both females and their offspring (Groenteman et al., 2006). The relation between omnivore oviposition preference and offspring performance was tested on two spatial scales, between plants of different nutritional value, and between areas within a leaf (Groenteman et al., 2006). Some predators deposit their eggs where prey is concentrated (Hagen et al., 1999). Others oviposit away from prey (Schellhorn & Andow, 1999), possibly relying on the high mobility of the hatching young. However, a rigorous exploration of the relationship between offspring mobility and oviposition strategy in predators has not yet been attempted. Even less is known about the oviposition preference–offspring performance relationship in omnivorous insects that feed on both prey and plant food sources (Coll, 1996). Omnivory is widespread in nature, and may be exhibited by most consumers during at least one of their life stages (Coll & Guershon, 2002; Pimm & Lawton, 1978; Whitman et al., 1994). These consumers are therefore expected to respond to both plant characteristics and prey availability when choosing an oviposition site.

Deraeocoris lutescens Schilling (Hemiptera: Miridae) is a predatory bug found commonly on a wide variety of plants across Middle East and Europe, that feeds on a wide range of arthropod pests such as aphids, small caterpillars, mites and insect eggs (Lamine et al., 2005). Females insert their eggs in leaf tissue. The females' choice of oviposition site is important for the subsequent distribution of nymphs on prey's host plants. Oviposition behaviour of many insects has been investigated by others on anthocorids (Armer et al., 1998; Evans, 1976; Groenteman et al., 2006; Sigsgaard, 2004; Thompson & Pellmyr, 1991). Oviposition behaviour of this predator and others of the genus *Deraeocoris* is not well known. This research investigates the acceptability and preferences of a range of plants for oviposition by the predatory bug *D. lutescens* in the laboratory. Moreover, we examined oviposition preference on the same plant with different nutritional sources and places of light and dark on the leaves.

MATERIAL AND METHODS

Insect rearing

The stock cultures of *Aphis fabae* Scopoli on broad bean, *Aphis gossypii* Glover on cotton and *Myzus persicae* (Sulzer) on cabbage plants were established with individuals obtained from stock cultures available at the Shahid Bahonar University of Kerman. For obtaining of individuals in the desired age, aphid species was kept in a climatically controlled chamber at 25±1°C temperature, relative humidity of 60±10% and a photoperiod of 16:8 h (L:D) on broad bean leaves in the round plastic Petri dishes (6 cm diameter) that were filled with 2 cm-thick-layer of 0.7% agar gel.

The predatory bug, *D. lutescens* were originally obtained from the experimental teaching garden of Shahid Bahonar University of Kerman, Iran. This species was identified by department of insect taxonomy research, Iranian research institute of plant protection, Tehran, Iran. The predatory bugs were reared on freshly excised broad bean leaf discs 5 cm in diameter (as substrate of oviposition) which were placed in the abovementioned round Petri dishes. Broad bean leaves were infested with more than 40 nymphs of aphids mentioned above as prey. The cages were held in a controlled climate and adults were transferred to new cages every two days. Broad bean leaves with eggs were incubated until egg hatching. These leaves and first nymphs were placed into new Plexiglas cages (7.5 × 15 × 4.5 cm), with a mesh-covered hole in the lid, to start the pre-imaginal rearing. Food and water were supplied up to adult emergence.

Experimental conditions

The preference oviposition of *D. lutescens* was determined by multiple-choice experiments in a Plexiglas cages (21×12×9 cm), with three mesh-covered holes in the lid in a climatically controlled chamber at 25±1°C temperature, relative humidity of 60±10% and a photoperiod of 16:8 h (L:D).

Preference to different substrates

The oviposition preference by *D. lutescens* on different plant species was investigated among four groups of plants. During each experiment, leaf discs (5 cm in diameter) of six crop plant species (bean, potato, broad bean, sugar beet, tobacco and cabbage), three greenhouse plant species (cucumber, tomato and sweet pepper), five orchard plant species (grape, walnut, cherry, peach and pear) and five ornamental plant species (geranium, coleus, Begonia, Stonecrop and giant dumb cane) were placed upside down onto, the round Petri dishes 6 cm in diameter were partially filled with 2 cm thick layer of 0.7% Agar gel. The round plastic Petri dishes containing different leaves of each group were randomly positioned in the abovementioned Plexiglas cages during a trial. The adult females and males of *D. lutescens* (1-day-old) were transferred for 7 days into the Plexiglas cages, containing leaves of different plant species of each group infested with eggs of *Sitotroga cerealella* (Olivier) (Lepidoptera: Gelechiidae) as food. This step was necessary in order to reduce the possibility that *D. lutescens* might get adapted to a certain plant species and to give the adult females and males the chance to mate. After 8 days, three mated females were transferred together into another Plexiglas cage with different leaves and offered eggs of *S. cerealella* as food. The oviposition substrates were daily replaced by new ones and the numbers of laid eggs on the leaves were recorded. A trial lasted seven days from 9th till 15th days of longevity and replicated 12 times.

Preference to different nutritional sources

In order to determine preference of *D. lutescens* for oviposition on broad bean leaves, which infested with different nutritional sources, six freshly excised broad bean leaf discs (5 cm diameter) placed in the abovementioned round plastic Petri dishes were used. The round plastic Petri dishes containing *A. gossypii* (3-4-days-old), *M. persicae* (3-4-days-old), *A. fabae* (3-4-days-old), 10% honey emulsion, 10% honey emulsion + yeast extract and eggs of *S. cerealella* on broad bean leaves were randomly positioned in the Plexiglas cages. Three *D. lutescens* females (mated, 9-days-old) were kept together in each Plexiglas cage. After that, the females were transferred to another Plexiglas cage containing new leaves every 24 hours. The leaves in the old Plexiglas cage were checked under a binocular for recording of the eggs. The experiment was continued for one week and replicated 12 times.

Preference to light and dark area

The preferred site for egg deposition by *D. lutescens* females at different light and dark area was tested in the laboratory. In order to prepare the dark and light area in each Plexiglas cage, half part of each Plexiglas cages mentioned above was covered with black watercolour from all sides. For each Plexiglas cage, four freshly excised broad bean leaf discs (5 cm diameter) placed in the round plastic Petri dishes (6 cm diameter) without lids were used. Leaf discs infested with eggs of *S. cerealella* as food were placed in the opposite corners of each Plexiglas cages. Three mated females of the predatory bug (9-days-old) were confined simultaneously in the Plexiglas cages for 24 hours. After that, the females transferred together into another Plexiglas cage, similar to the one described above, and the number of laid eggs into each leaf was recorded. The experiment was continued for 7 days and replicated 12 times.

Statistical analysis

For statistical comparison among several means, all the data from the laboratory studies on egg laying of the predatory bug were subjected to a one-way analysis of variance (ANOVA) followed by a Tukey Test (StatPlus 4.9, 2007).

RESULTS

Egg-laying preferences of *D. lutescens* on greenhouse plants

The daily and total number of eggs laid by three *D. lutescens* females from the 9th till the 15th days of longevity on three species of greenhouse plants, cucumber (*Cucumis sativus*), tomato (*Lycopersicon esculentum*) and sweet pepper (*Capsicum annuum*) with eggs of *S. cerealella* as food at 25±1°C are summarized in Table1. The predatory bug was not able to lay eggs on greenhouse plant species used in the experiment equally.

The adult females showed most oviposition preference on Sweet pepper leaves with a total of 31.1±3.4 eggs and least oviposition preference on Cucumber with 7.1±1.5 eggs. However, among the three greenhouse plant species used, Sweet pepper had significantly the highest counts of the predator eggs ($P<0.01$).

Egg-laying preferences of *D. lutescens* on crop plants

The Broad bean leaves with a total of 41.7±3.7 eggs showed significantly ($P<0.05$) the highest number of *D. lutescens* eggs among the crop plant species. No clear tendency in oviposition substrate preference of the predator females was to be distinguished among the other crop plant species that are showed in Table 2.

Egg-laying preferences of *D. lutescens* on orchard plants

Among five species of orchard plant, pear, walnut and peach leaves were not as a suitable substrate for oviposition. Although among these leaves, cherry leaves (with a total of 1.0±0.5 eggs) were observed significant difference in total eggs laid by the predator. But the adult females showed significantly higher oviposition preference for grape leaves (with a total of 13.9±2.8 eggs) than other orchard plant species ($P<0.005$) (Table 3).

Egg-laying preferences of *D. lutescens* on ornamental plants

Begonia leaves with a total of 39.3±3.0 eggs showed significantly (P<0.005) the highest number of *D. lutescens* eggs among the ornamental plant species (except geranium) were used (Table 4).

Among stonecrop, giant dumb cane and coleus leaves as substrate of oviposition, no significant difference in egg-laying preferences was observed (P<0.01). No clear tendency in oviposition preference of the predator females was to be observed between coleus and geranium (P<0.005).

Oviposition preference of *D. lutescens* to different nutritional sources

Table 5 represents the daily and total number of eggs laid by three *D. lutescens* females on the leaves from the 9th to 15th days of longevity. Among these leaves as substrates of oviposition, the adult females showed higher preference for leaves infested with *M. persicae* than with other nutritional sources with a total of 27.2±1.6 eggs (P<0.05). Except *M. persicae* treatment, no significant tendency in oviposition substrate preference of the predator females was to be distinguished among the nutritional sources (P<0.01).

Egg-laying preferences of *D. lutescens* to light and dark area

Fig.1 shows the daily and total number of eggs laid by three *D. lutescens* females from the 9th till the 15th days of longevity on broad bean leaves at light and dark area with eggs of *S. cerealella* as food at 25±1°C. The adult females showed significantly higher preference for the leaves as substrates of oviposition in the dark area with a total of 102.2±3.5 eggs than in the light area with a total of 18.5±2.0 eggs (P<0.005).

DISCUSSION

Oviposition preference is a way of maternal investing; the females spend time and energy in such activity, which may result or not in providing the offspring development (Krainacker et al., 1987). The oviposition site preference of *D. lutescens* on Greenhouse, crop, ornamental plants is higher than orchard plants. The current study showed that the predator bug between plant groups has distinctive preference for different species. It dependent to physical and chemical structure of leaves, so oviposition-preference patterns of *D. lutescens* are supposed to correspond to host suitability for egg hatching and offspring development because females are assumed to maximize their fitness by oviposition on high-quality hosts. The major hypothesis of the evolution of oviposition behavior is that the females would choose species of plants that could maximize offspring survival and growth (Thompson & Pellmyr, 1991). The predators and their herbivorous prey may respond in similar ways to variations in plant quality, resulting in a spatial or temporal overlap in their distributions (Groenteman et al., 2006). *Anthocoris confusus* Reuter (Hemiptera: Anthocoridae) females insert their rostrum into plant tissue to determine the suitability of the plant for oviposition (Evans, 1976). Moreover, *Orius insidiosus* (say) (Hemiptera: Anthocoridae) can obtain water from the xylem, and may ingest small amount of starches, sugars and amino acids from the mesophyll of plants (Armer et al., 1998). Both moisture and nutrient levels could be detected by the females. Therefore, the females of the predator could detect both moisture and nutrient levels. The females select oviposition sites that maximize the hatch rate of deposited eggs rather than to optimize nymph performance may be related to the high mobility of the neonates and their ability to search for food away from the egg-hatching site. A similar oviposition strategy is probably exhibited by at least some of the predators that were found to lay egg near prey aggregations (Groenteman et al., 2006). Microhabitat selection for oviposition by *Anthocoris nemorum* is affected by plant quality and prey availability as well as exudates from prey (Sigsgaard, 2005). The abilities of *D. lutescens* females to distinguish between different nutritional sources and preferentially deposit their eggs into leaves with *A. gossypii, M. persicae* and eggs of *S. cerealella* appears to be correlated with nymphal development success. The predators may therefore respond primarily to variations in food or prey quality, which may be a better predictor of nymph performance. In choice oviposition experiments by *Anthocoris nemoralis* and *A. nemorum*, honeydew-treated pear leaves attracted more oviposition than honeydew free leaves (Sigsgaard, 2005). The predators rely on a nitrogen-rich prey diet, and oviposition of females may therefore respond to prey availability. In many cases, however, prey availability varies greatly in space and time, making it difficult for oviposition of females to predict prey availability for their offspring (Groenteman et al., 2006).

Detectable cues to assess microhabitat quality are a selective advantage for oviposition of females (Meyling & Pell, 2006). There was no evidence for photo-preference of *D. lutescens* studied between light and dark areas within the habitat. This result suggests that the dark area is a significant predictor of oviposition site selection by *D. lutescens* females.

Several recent studies have illustrated that habitat selection may commonly reflect a combination of direct effects on adult females and indirect fitness effects via future offspring performance (Doumbia et al., 1998; Groenteman et al. 2006; Krainacker et al., 1987; Thompson & Pellmyr, 1991). According to these results, the choice for oviposition sites by *D. lutescens* females is influenced by different factors of mentioned above. The preference of this predator to oviposit on different plant species and with different nutrition source is one of the major factors in determining its ability to successfully control the pests of these plants.

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Table 1. Mean daily and total number of eggs laid by tree *Deraeocoris lutescens* females on different leaf of greenhouse plant species by feeding on eggs of *Sitotroga cerealella* as prey for seven days from 9th till 15th days of longevity at 25±1°C.

Host plant	n	Mean number of laid eggs on the day							
		9th	10th	11th	12th	13th	14th	15th	Total
Cucumber	12	0.9±0.3	1.2±0.8	0.6±0.3	0.3±0.2	1.6±0.8	1.2±0.8	1.3±0.5	7.1±1.5 a
Tomato	12	3.7±1.4	1.7±0.8	2.2±1.1	2.7±1.5	4.0±1.1	3.5±1.6	1.4±0.5	19.3±3.3 b
Sweet pepper	12	8.1±2.7	4.9±1.8	6.9±1.9	2.7±1.0	4.2±1.3	2.3±1.1	2.0±0.6	31.1±3.4 c

Table 2. Mean daily and total number of eggs laid by tree *Deraeocoris lutescens* females on different leaf of crop plant species by feeding on eggs of *Sitotroga cerealella* as prey for seven days from 9th till 15th days of longevity at 25±1°C.

Host plant	n	Mean number of laid eggs on the day							
		9th	10th	11th	12th	13th	14th	15th	Total
Bean	12	3.3±1.6	0.4±0.3	1.1±0.9	1.1±0.7	1.1±0.9	0.6±0.3	0.0±0.0	8.2±2.3 a
Tobacco	12	1.5±1.0	0.9±0.5	2.5±1.3	1.2±0.9	0.3±0.2	0.2±0.2	0.0±0.0	6.7±2.2 a
Cabbage	12	1.2±0.7	1.5±1.0	0.5±0.5	0.2±0.2	0.2±0.2	0.4±0.3	0.1±0.1	4.2±1.1 a
Broad bean	12	5.8±2.2	8.8±1.8	6.6±1.8	3.2±1.5	8.2±2.1	5.8±2.0	3.2±1.2	41.7±3.7 b
Sugar beet	12	2.2±1.0	2.9±1.0	1.2±0.8	2.0±1.0	1.7±0.6	1.0±0.7	0.2±0.1	11.2±1.7 a
Potato	12	1.0±0.7	2.7±1.2	4.3±1.4	2.6±1.1	0.9±0.7	1.2±0.5	0.1±0.1	12.6±2.5 a

Table 3. Mean daily and total number of eggs laid by tree *Deraeocoris lutescens* females on different leaf of orchard plant species by feeding on eggs of *Sitotroga cerealella* as prey for seven days from 9th till 15th days of longevity at 25±1°C.

Host plant	n	Mean number of laid eggs on the day							
		9th	10th	11th	12th	13th	14th	15th	Total
Cherry	12	0.2±0.2	0.2±0.2	0.0±0.0	0.0±0.0	0.2±0.2	0.2±0.1	0.0±0.0	1.0±0.5 b
Pear	12	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0 a
Grape	12	2.2±1.5	4.0±1.5	2.2±1.4	1.6±1.0	1.7±0.9	0.6±0.3	0.3±0.2	13.9±2.8 c
Walnut	12	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0 a
Peach	12	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0 a

Table 4. Mean daily and total number of eggs laid by tree *Deraeocoris lutescens* females on different leaf of ornamental plant species by feeding on eggs of *Sitotroga cerealella* as prey for seven days from 9th till 15th days of longevity at 25±1°C.

Host plant	n	Mean number of laid eggs on the day							
		9th	10th	11th	12th	13th	14th	15th	Total
Begonia	12	3.6±1.5	8.4±1.7	7.2±1.8	6.4±2.9	4.7±1.3	5.7±1.0	3.2±0.7	39.3±3.0 c
Geranium	12	2.2±1.0	5.4±2.2	2.2±0.9	5.7±1.4	5.4±1.8	5.2±2.0	5.2±2.0	33.2±4.2 bc
Stonecrop	12	0.0±0.0	0.0±0.0	0.2±0.2	0.4±0.4	0.1±0.1	0.0±0.0	0.0±0.0	0.7±0.6 a
Giant Dumb Cane	12	0.2±0.1	0.8±0.6	0.8±0.7	0.0±0.0	1.2±0.7	1.1±0.8	0.7±0.6	4.8±1.9 a
Coleus	12	0.7±0.3	0.9±0.7	1.4±1.1	3.3±1.6	2.3±1.3	1.5±0.7	0.7±0.2	10.9±2.0 ab

Table 5. Mean daily and total number of eggs laid by three *Deraeocoris lutescens* females on broad bean leaves infested with different nutritional source portions for seven days from 9th till 15th days of longevity at 25 ±1°C.

Nutritional source	n	Mean number of laid eggs on the day							
		9th	10th	11th	12th	13th	14th	15th	Total
M. persicae	12	6.2±2.2	6.2±2.0	6.5±2.4	2.1±1.1	2.1±1.4	3.2±1.1	0.7±0.5	27.2±1.6 b
A. fabae	12	0.6±0.5	2.7±1.2	0.6±0.6	1.0±0.9	1.6±0.9	3.7±1.5	1.3±1.1	11.6±2.6 a
A. gossypii	12	3.2±1.3	1.0±0.8	0.6±0.6	6.7±3.4	5.7±2.6	0.4±0.3	1.7±0.7	19.3±5.0 ab
Sitotroga cerealella (egg)	12	1.2±1.2	3.9±1.9	1.3±1.1	2.0±1.0	4.2±1.6	1.1±0.7	5.9±2.6	19.3±3.3 ab
10% Honey emulsion	12	0.0±0.0	2.0±1.4	0.8±0.4	0.9±0.6	2.3±1.4	1.4±0.7	1.4±0.6	8.9±2.4 a
10% Honey emulsion +yeast extract	12	1.2±1.2	5.6±3.0	0.9±0.5	0.7±0.4	1.7±1.0	1.3±0.8	1.0±1.0	12.6±3.9 a

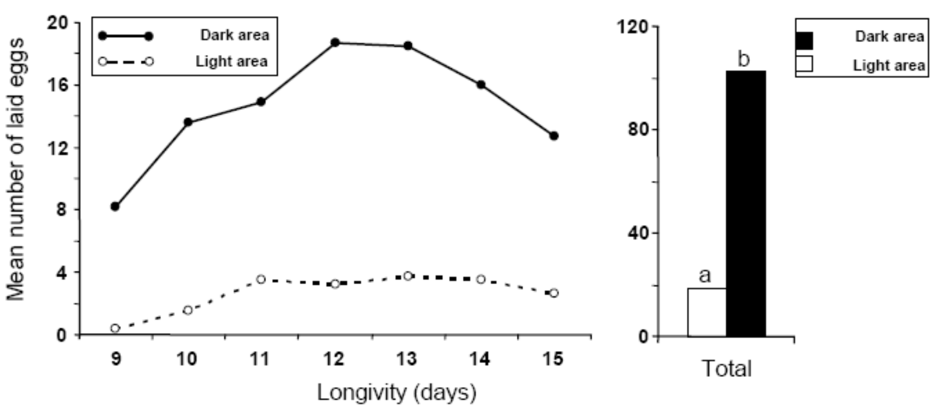

Figure 1. Mean daily and total number of eggs laid by three *Deraeocoris lutescens* females on broad bean leaves with eggs of *Sitotroga cerealella* as prey at light and dark area for 7 days from 9th till 15th days of longevity at 25±1°C temperature and 16:8h (L:D) photoperiod.

SUBSPECIFIC STATUS OF *RUTPELA MACULATA* (PODA, 1761)(COLEOPTERA: CERAMBYCIDAE: LEPTURINAE)

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ABSTRACT: The subspecific status of *Rutpela maculata* (Poda, 1761) is discussed. So a new subspecies, *Rutpela maculata nigricornis* (Stierlin, 1864), is added for the fauna of Turkey.

KEY WORDS: *Rutpela maculata,* Lepturini, Lepturinae, Cerambycidae, Coleoptera, Turkey.

Rutpela maculata (Poda, 1761) has European chorotype in the world fauna. It is very variable. For this reason, it has been described many different color forms that have been described by various authors as different taxa: *Leptura fasciata* Scopoli, 1763; *Leptura elongata* DeGeer, 1775; *Leptura armata* Herbst, 1784; *Leptura scopoliana* Laicharting, 1784; *Stenocorus rubea* Geoffroy, 1785; *Leptura calcarata* Olivier, 1790; *Leptura quinquemaculata* Gmelin, 1790; *Leptura nigrofasciata* V. Petagna, 1792; *Leptura sinuata* Fabricius, 1792; *Leptura subspinosa* Fabricius, 1792; *Strangalia binotata* Mulsant, 1839; *Strangalia externepunctata* Mulsant, 1839; *Strangalia impunctata* Mulsant, 1839; *Strangalia punctatofasciata* Mulsant, 1839; *Strangalia undulata* Mulsant, 1839; *Strangalia manca* Schaufuss, 1863; *Strangalia armata var. nigricornis* Stierlin, 1864; *Strangalia dayremi* Pic, 1904; *Leptura alsatica* Pic, 1906; *Leptura disconotata* Pic, 1908; *Leptura kricheldorffi* Wagner, 1928; *Strangalia bifenestrata* Pic, 1933; *Strangalia nicodi* Pic, 1933; *Strangalia discoininterrupta* Pic, 1945; *Strangalia dromensis* Pic, 1945; *Strangalia pacifica* Pic, 1945; *Rutpela maculata irmasanica* Sama, 1996.

Among them, only *Strangalia armata var. nigricornis* Stierlin, 1864 [as *Rutpela maculata nigricornis* (Stierlin, 1864)] and *Rutpela maculata irmasanica* Sama, 1996 are accepted the geographical races as subspecies of *Rutpela maculata* (Poda, 1761) according to Löbl & Smetana (2010). In the same reference, the remaining taxa are accepted as synonyms of the nominotypical subspecies.

Until 1996 the species, *Rutpela maculata* (Poda, 1761) was knowing as only one taxon. That year Gianfranco Sama described a new subspecies as *Rutpela maculata irmasanica* Sama, 1996 from Antalya province (Irmasan pass) in Southern Turkey. So the species has been represented by only two subspecies in the world fauna as the nominotypical subspecies and *Rutpela maculata irmasanica* Sama, 1996 which described on the base of red colored abdomen of males. The later has still been known as a local taxon in Southern Turkey yet.

On the other side, *Strangalia armata* var. *nigricornis* was described by Stierlin (1864) from Sicily. In 2006, Rapuzzi & Sama accepted it as a valid name for a subspecies of *Rutpela maculata* (Poda, 1761) from Sicilia and Calabria because of black antennae (with the exception of articles 4 to 7 which have a narrow yellowish basal ring) and totally black hind tibiae in males. So they given it as *Rutpela maculata* ssp. *nigricornis* (Stierlin, 1864) **status novus** in their publication. They also stated that this form was already identified by Stierlin (1864). On the contrary the their subtitle, *Rutpela maculata* ssp. *nigricornis* (Stierlin, 1864) **status novus,** they considered the description of Stierlin as infrasubspecific status and the taxon not available under the International Code of Nomenclature (1999), art. 45.6.4.

The subspecific status of the taxon was also published by Löbl & Smetana (2010) as *Rutpela maculata nigricornis* (Stierlin, 1864) from Italia (Sicily) only. Rapuzzi & Sama (2010), however, stated *Strangalia armata* var. *nigricornis* Stierlin, 1864 is an unavailable name. So they used *Rutpela maculata nigricornis* Rapuzzi & Sama (2006) as the taxon name in their publication.

Rutpela maculata nigricornis Rapuzzi & Sama (2006) can not accept as an available name under the International Code of Nomenclature (1999), art. 16.1. Since the name was not introduced by the authors as new. This approach is also shared by Danilevsky (2011).

We studied the fauna of Bolu, Düzce and Kırıkkale provinces of Turkey in 2011 and collected *Rutpela maculata* (Poda, 1761) from Bolu and Düzce provinces (except Kırıkkale province). During the works, we detected an important serie of males which are different from the nominotypical subspecies. Then, we compared the new series with the old series that were collected by H. Özdikmen et al. from different parts of Turkey.

After the works, we saw that the species, *Rutpela maculata* (Poda, 1761), is represented by all subspecies (3 subspecies) in Turkey in real.

As seen above, *Rutpela maculata irmasanica* Sama, 1996 occurs only in Antalya provinces in Southern Turkey.

The nominotypical subspecies, *Rutpela maculata maculata* (Poda, 1761) occurs Northwestern Anatolia (e.g. Balıkesir province) and probably European Turkey.

Rutpela maculata nigricornis (Stierlin, 1864) occurs the remaining parts of Turkey (e.g. all territories of Western Black Sea Region including Düzce and Bolu provinces in Northern Turkey and Osmaniye province in South Turkey) (Fig 1, 4).

The later subspecies is probably distributed Turkey to Caucasus and Iran. We see some specimens from Georgia and Armenia. Moreover, Danilevsky (2011) stated that "*According to Lazarev (2008) all populations of Rutpela maculata from Caucasus and Crimea must be regarded as R. m. nigricornis because of black hind tibiae in males*".

This subspecies does not occur only in Italy (Sicily) for Southern Europe, but also at least in France. Since we saw some specimens from France on web page (e.g. www.galerie-insecte.org). Moreover, Danilevsky (2011) mentioned that the subspecies seems to be distributed in Spain evidently. Interestingly, it absolutely occurs in Great Britain. Since we also saw some specimens from Great Britain on web page (http://www.thewcg.org.uk/Cerambycidae/0140G.htm).

On the other side, we must state that the shape of parameres of *Rutpela maculata nigricornis* (Stierlin, 1864) is the same that of *Rutpela maculata maculata* (Poda, 1761).

According to the description of Rapuzzi & Sama (2006), *Rutpela maculata nigricornis* (Stierlin, 1864) is a color form of *Rutpela maculata* (Poda, 1761). It differs from the nominotypical subspecies by black antennae (with the exception of segments 4 to 7 which have a narrow yellowish basal ring) and totally black hind tibiae in males. However, we observed some variations in the populations in terms of these diagnostic characters. With this respect, coloring of antennae very variable (totally black to segments 3-11 which have a yellowish basal ring). The coloring of hind tibiae has only one variation. The articulation area between femora and tibiae and / or a small parts of tibial bases is colored yellowish. However, that area mostly is completely black.

As a result of the present work, the distributional areas of the subspecies of *Rutpela maculata* (Poda, 1761) for Turkish and World fauna are presented as follows:

FOR TURKISH FAUNA

Old records from Turkey: Sinop prov.: around Ayancık (Schimitschek, 1944); Zigana Mountains (?Trabzon prov.) (Villiers, 1959); İstanbul prov.: Polonez village as *Strangalia maculata* (Demelt & Alkan, 1962; Demelt, 1963); Balıkesir prov.: Gönen, Çanakkale prov.: Biga (Gfeller, 1972); Turkey (Lobanov et al., 1981; Danilevsky & Miroshnikov, 1985; Svacha & Danilevsky, 1988; Sama, 2002); Trabzon prov.: Maçka (Sümela), Kastamonu prov., Sivas prov.: Çamlıbel pass (Sama, 1982); İstanbul prov.: Bahçeköy as *Strangalia maculata* (Öymen, 1987); Tokat prov.: Mezra, Amasya prov.: Merzifon (Ortaköy, Suluova), Kastamonu prov.: Masruf pass (Küre), Tunceli prov.: Pülümür, Rize prov.: Ovitdağı pass (İkizdere) (Adlbauer, 1992); Holotype: Antalya prov.: Irmasan pass as type locality of *R. maculata irmasanica* Sama, 1996 and Akseki (Sama, 1996); Hatay prov.: Akbez, İçel prov.: Namrun (Bolkar Mountains) (Sama, 1996); İstanbul prov., Artvin prov., North parts of Van prov., East Anatolian Region (Lodos, 1998); Artvin prov.: Şavşat (Karagöl) / Yusufeli, Balıkesir prov.: Erdek, Bingöl prov.: Central, Trabzon prov.: Beşikdüzü (Türkelli) (Tozlu et al., 2002); Artvin prov.: Şavşat, Bolu prov.: Abant, Bursa prov.: Uludağ, Çanakkale prov.: Kirazlı, Kırklareli prov.: Demirkoy, Malatya prov.: Reşadiye pass, Muş prov.: Buğlan pass, Rize prov.: İkizdere / Şavşat-Çam pass, Samsun prov.: Kavak (Hacılar pass) (Malmusi & Saltini, 2005); Çankırı prov., Kastamonu prov. (Özdikmen et al., 2005); Artvin prov.: Yusufeli (Barhal road), Kocaeli prov.: İzmit (Beşkayalar Natural Park), Osmaniye prov.: Zorkun plateau road (Olukbaşı place) / Yarpuz road (Karataş place), Hatay prov.: Dörtyol (Topaktaş plateau) (Özdikmen & Demirel, 2005); Kocaeli prov.: İzmit (Özdikmen & Şahin, 2006); Adana prov.: Pozantı (Karataş), Rize prov.: Central (Özdikmen & Demir, 2006); Rize prov.: Çamlıhemşin (Çat village env., entry of Verçenik Atmeydanı), Elevit plateau, Meydan village, Kastamonu prov.: between Azdavay–Pınarbaşı, Pınarbaşı–Azdavay road (Karafasıl village, Suğla plateau), Azdavay (Ballıdağ Wild Life Protection District), Küre–Seydiler road (Masruf pass), Yaralıgöz pass, Daday (Daday–Araç road), Karabük prov.: Safranbolu (Gürleyik National Park), Akçakese–Pınarbaşı road (Özdikmen, 2007); Konya prov.: Derebucak (Tekebeli pass env.) (Turgut & Özdikmen, 2010); Osmaniye prov.: Küllü-Islahiye road (Hınzırlı plateau), Zorkun road (Çiftmazı Gölyeri), Yarpuz road (Yukarı Haraz plateau) (Özdikmen et al., 2010); Bolu prov.: Gerede-Mengen, İkizler plateau road, Bolu-Seben road, Yeniçağa-Mengen road, Abant (Dereceören env.), Gölcük road, 500 m to Dereceören (Özdikmen, 2011); Düzce prov. (unpublished data) (Fig. 2).

According to the subspecies, probable dispersition of these records is like that:

For the subspecies, *Rutpela maculata maculata* (Poda, 1761):

İstanbul prov.: Polonez village as *Strangalia maculata* (Demelt & Alkan, 1962; Demelt, 1963); Balıkesir prov.: Gönen, Çanakkale prov.: Biga (Gfeller, 1972); İstanbul prov.: Bahçeköy as *Strangalia maculata* (Öymen, 1987); İstanbul prov. (Lodos, 1998); Balıkesir prov.: Erdek (Tozlu et al., 2002); Bursa prov.:

Uludağ, Çanakkale prov.: Kirazlı, Kırklareli prov.: Demirkoy (Malmusi & Saltini, 2005); Kocaeli prov.: İzmit (Beşkayalar Natural Park) (Özdikmen & Demirel, 2005); Kocaeli prov.: İzmit (Özdikmen & Şahin, 2006) (Fig. 3).

For the subspecies, *Rutpela maculata nigricornis* (Stierlin, 1864):

Sinop prov.: around Ayancık (Schimitschek, 1944); Zigana Mountains (?Trabzon prov.) (Villiers, 1959); Turkey (Lobanov et al., 1981; Danilevsky & Miroshnikov, 1985; Svacha & Danilevsky, 1988; Sama, 2002); Trabzon prov.: Maçka (Sümela), Kastamonu prov., Sivas prov.: Çamlıbel pass (Sama, 1982); Tokat prov.: Mezra, Amasya prov.: Merzifon (Ortaköy, Suluova), Kastamonu prov.: Masruf pass (Küre), Tunceli prov.: Pülümür, Rize prov.: Ovitdağı pass (İkizdere) (Adlbauer, 1992); Hatay prov.: Akbez, İçel prov.: Namrun (Bolkar Mountains) (Sama, 1996); Artvin prov., North parts of Van prov., East Anatolian Region (Lodos, 1998); Artvin prov.: Şavşat (Karagöl) / Yusufeli, Bingöl prov.: Central, Trabzon prov.: Beşikdüzü (Türkelli) (Tozlu et al., 2002); Artvin prov.: Şavşat, Bolu prov.: Abant, Malatya prov.: Reşadiye pass, Muş prov.: Buğlan pass, Rize prov.: İkizdere / Şavşat-Çam pass, Samsun prov.: Kavak (Hacılar pass) (Malmusi & Saltini, 2005); Çankırı prov., Kastamonu prov. (Özdikmen et al., 2005); Artvin prov.: Yusufeli (Barhal road), Osmaniye prov.: Zorkun plateau road (Olukbaşı place) / Yarpuz road (Karataş place), Hatay prov.: Dörtyol (Topaktaş plateau) (Özdikmen & Demirel, 2005); Adana prov.: Pozantı (Karataş), Rize prov.: Central (Özdikmen & Demir, 2006); Rize prov.: Çamlıhemşin (Çat village env., entry of Verçenik Atmeydanı), Elevit plateau, Meydan village, Kastamonu prov.: between Azdavay–Pınarbaşı, Pınarbaşı–Azdavay road (Karafasıl village, Suğla plateau), Azdavay (Ballıdağ Wild Life Protection District), Küre–Seydiler road (Masruf pass), Yaralıgöz pass, Daday (Daday–Araç road), Karabük prov.: Safranbolu (Gürleyik National Park), Akçakese–Pınarbaşı road (Özdikmen, 2007); Konya prov.: Derebucak (Tekebeli pass env.) (Turgut & Özdikmen, 2010); Osmaniye prov.: Küllü-Islahiye road (Hınzırlı plateau), Zorkun road (Çiftmazı Gölyeri), Yarpuz road (Yukarı Haraz plateau) (Özdikmen et al., 2010); Bolu prov.: Gerede-Mengen, İkizler plateau road, Bolu-Seben road, Yeniçağa-Mengen road, Abant (Dereceören env.), Gölcük road, 500 m to Dereceören (Özdikmen, 2011); Düzce prov. (unpublished data) (Fig. 4).

For the subspecies, *Rutpela maculata irmasanica* Sama, 1996:

Antalya prov.: Irmasan pass as type locality of *R. maculata irmasanica* Sama, 1996 and Akseki (Sama, 1996) (Fig. 5).

FOR WORLD FAUNA

Range of *Rutpela maculata maculata* (Poda, 1761):

Europe (France, Corsica, Italy, Sardinia, Albania, Slovenia, Croatia, Bosnia-Herzegovina, Serbia, Montenegro, Macedonia, Greece, Bulgaria, Romania, Hungary, Austria, Switzerland, Belgium, Netherlands, Denmark, Germany, Luxembourg, Great Britain, Ireland, Czechia, Slovakia, Norway, Poland, Sweden, Finland, Estonia, Latvia, Lithuania, Belorussia, Ukraine, Moldova, European Russia, European Kazakhstan), Caucasus, Turkey, Iran.

Range of *Rutpela maculata nigricornis* (Stierlin, 1864):

S Europe (Portugal, Spain, France, Italy, Sicily, Crimea, Great Britain), Caucasus (Georgia, Armenia), Turkey, Iran.

Range of *Rutpela maculata irmasanica* Sama, 1996:
S Turkey.

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Figure 1. A male of *Rutpela maculata nigricornis* (Stierlin, 1864) from Bolu province in NW Anatolia.

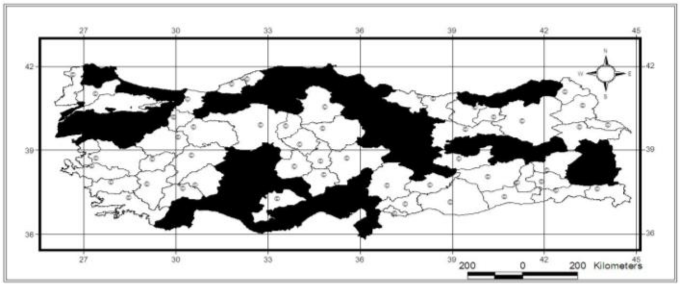

Figure 2. Old records from Turkey of *Rutpela maculata* (Poda, 1761).

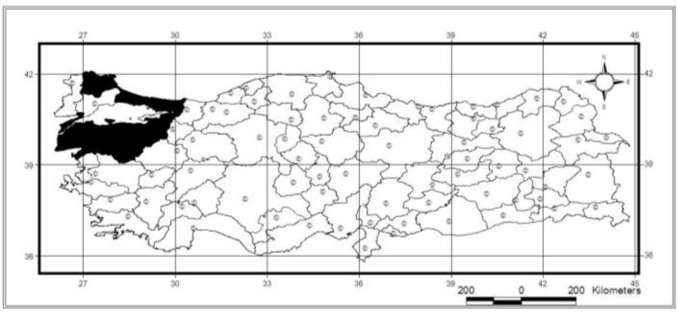

Figure 3. The distribution in Turkey of *Rutpela maculata maculata* (Poda, 1761).

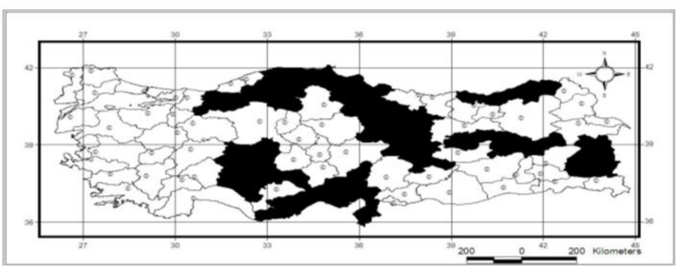

Figure 4. The distribution in Turkey of *Rutpela maculata nigricornis* (Stierlin, 1864).

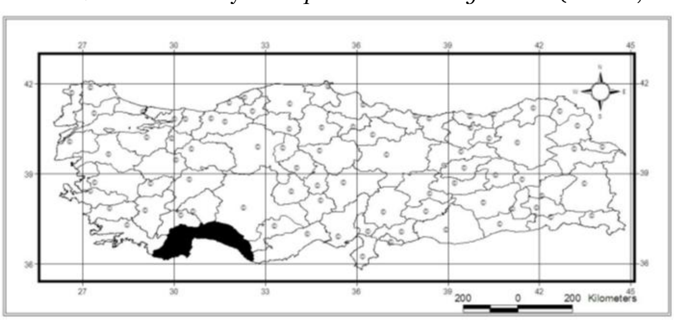

Figure 5. The distribution in Turkey of *Rutpela maculata irmasanica* Sama, 1996.

TEMNORHYCHUS BAAL REICHE & SAULCY, 1856, A NEW SPECIES FOR TURKISH FAUNA (COLEOPTERA, SCARABAEIDAE, DYNASTINAE)

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[Uliana, M. & Yıldırım, E. 2012. *Temnorhychus baal* Reiche & Saulcy, 1856, a new species for Turkish fauna (Coleoptera: Scarabaeidae: Dynastinae). Munis Entomology & Zoology, 7 (1): 523-525**]**

ABSTRACT: *Temnorhychus baal* Reiche & Saulcy (Coleoptera: Scarabaeidae: Dynastinae) is recorded for the first time for Turkish fauna from provinces of Erzurum and İzmir. Hypothesis explaining its presence in Turkey are discussed, based on the known biogeographical history of the species.

KEY WORDS: *Temnorhynchus baal*, distribution, Turkey, new record.

The genus *Temnorhynchus* Hope counts 31 species-level taxa, mostly distributed in the Ethiopic region (including Malagasy subregion) (Krell, 1996). Only two species, closely related, reach the Palearctic region, where they are spread in the Eastern Mediterranean area and in the Arabian Peninsula.

Of these, *T. baal* Reiche & Saulcy is the species more widespread in the considered area, its occurrence being recorded from North Africa, the Levant, some Aegean Islands and Greece (Krell 1993, 1994a,b; Gillett & Gillett, 2009).

This paper present the first records of *T. baal* from Turkey, based on specimens recently collected during field research and one specimen preserved in the collection of the Erzurum University.

RESULTS

Material examined: Turkey: Erzurum, 4.VII.1997, leg. E. Dane, 1 specimen (coll. Entomology Museum, Erzurum, Turkey (EMET)); Izmir, 8 KM W Selçuk, Pamucak beach, 24.V.2011, leg. M. Uliana & R. Rattu, 51 specimens (coll. M. Uliana and R. Rattu).

Specimens from Pamucak beach were picked among several others, all of them found dead on the sand surface, in the area going from pioneer vegetation (*Cakiletum*) to the beginning of the dune (*Ammophiletum*) (fig.1). Most of them were well preserved, some being still fresh and relaxed, making us suspect that they had died the night before. Of a few specimens were found only remains, mostly missing the abdomen, apparently due to predation or to the action of scavenger animals (rodents?) feeding on dead specimens.

DISCUSSION

Temnorhynchus baal is spread in both the Ethiopic and the Palearctic regions, where it is most often observed in coastal localities, in accordance to the psammophilous habits generally recognized for the members of this genus (Krell, 1996) and for this species in particular (Krell, 1993: 283).

Krell (1996) proposed a thorough analysis of the biogeography of the genus

Temonrhynchus, where the origin and history of Mediterranean populations of *T. baal* are discussed in detail. *T. baal* is presumed to have recently originated in the area corresponding to Southern Egypt/Sudan, in a time range comprised between 28.000 and 18.000 years before present. While it is likely to have autonomously spread to the Levant coasts taking advantage of the ecological corridor represented by the Nile valley (where this species is still present) and of the periods of favorable environmental conditions, its arrival in the Aegean Islands and Macedonia was putatively put in relation to the expansion of sugar cane cultivation, occurred in these areas since the 14^{th} century. *Temnorhynchus* beetles are known to feed on sugar canes, and a record for *T. baal* as a pest of this cultivation is also known.

Given the known occurrence of *T. baal* in the neighbouring Naxos island (Krell, 1994a; Gillett & Gillett, 2009), the presence of *T. baal* on the western coast of Turkey is not suprising: the distance between Naxos and Pamucak beach is about 170 Km, and is interspersed with other Islands. The longer distance between two of these is about 45 Km, between Donousa and Ikaria.

Considering the massive population observed in 2011, together with the absence of previous records, it seems a reasonable hypothesis that its presence in this area may be of recent origin, either due to active or passive dispersion. *Temnorhynchus* beetles are good fliers and are considered capable to colonize new habitats in short time (Krell, 1996: 212), as suggested also by the recent establishment of *T. retusus* in Australia (Krell & Hangay, 1998).

On the other hand, the record from Erzurum is difficult to interpret, since it comes from a continental area at a quite high altitude, far away from known areas of occurrence. In the Mediterranean part of its distributional range its presence in continental areas is known only from one pair collected in Greece at (Doiran [=Dojran?]) in 1921, which represent the northernmost known collecting place.

Therefore the specimen from Erzurum is most likely deriving from a passive introduction: further field investigations may ascertain whether a established population is existing or not.

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We thank dr. Frank-T. Krell (Denver Museum of Nature and Science) for revising and commenting the first draft of this paper. Marco Uliana wish to acknowledge the World Biodiversity Association for financial support of the field expedition in Turkey by M. Uliana and R. Rattu.

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Figure 1. Pamucak Beach (İzmir), may 24, 2011: area where dead adults of *Temnorhynchus baal* were collected.

SOME OF THE FRUIT FLIES FAUNA OF CHICHEKLI REGION WITH A NEW REPORT FOR IRAN (DIPTERA: TEPHRITIDAE)

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[**Khaghaninia, S., Gharajedaghi, Y., Zarghani, E. & Pour Abad, R. F.** 2012. Some of the fruit flies fauna of Chichekli region with a new report for Iran (Diptera: Tephritidae). Munis Entomology & Zoology, 7 (1): 526-535]

ABSTRACT: Based on specimens collected from Chichekli region, located in East Azerbaijan province, during 2009-2011, eighteen species of nine genera were recognized. Identification key to the species is provided. The locality, host plants and figures of wing pattern of each species are given. *Urophora jaceana* (Hering, 1935) is being newly reported for the Iran insect fauna.

KEY WORDS: Tephritidae, Chichekli, East Azerbaijan province, Iran, New record.

There are more than 4000 described species of Tephritidae over the world. This family differs from other Tephritoidea by the following character: costal vein with two interruptions, one before humeral vein and the other at place of ending of subcostal vein (Rikhter, 1989). Most species of tephritids are phytophagous. Most tephritid larvae develop in fruit or within the flower heads of Asteraceus plants. A few tephritids are leaf miners; some species are stem borers and some others live in roots (White, 1988).

Chichekli region is located in west of Qaradag forests, a registered biosphere in world heritages by UNESCO since 1976 in East Azarbaijan province, Iran. This biosphere reserve situated in the north eastern Tabriz city with a distance of 64.8 km and UTM (Universal Transfer Mercator) coordinate system, X from 654517.66 to 655110.71 E; Y from 4306958.17 to 4308226.18 N and varying latitude from 1271 m to 1336 m. This area has rich grass lands with various species of Astraceae (*Achillea*, *Anthemis*, *Artemisia, Carthamus*, *Centaurea*, *Cirsium*, *Echinops*, *Helichrysum*, *Onopordum*, *Senecio*, *Sonchus* and *Tanacetum*), Apiaceae and Legominaceae.

The tephritids of this area have not been verified so it subjected for the present study.

MATERIALS AND METHODS

Adult specimens were swept on flowers head of Asteraceus plants in twenty-nine localities which situated through the working area during 2009- 2011 (Fig. 1). The samples were killed in a killing jar containing potassium cyanide and the voucher specimens were deposited at Insect Museum of Tabriz University. The terminology primarily follows White et al. (2000).

RESULTS

Eighteen species belonged to nine genera of the family Tephritidae were identified which infested the head of Astraceus plants. All of them are as new records for the region and *Urophora jaceana* (Hering, 1935) is being newly record for the Iran insect fauna. The subfamilies, tribes and species are listed in alphabetic order.

Key to studied species of the family Tephritidae

1. Wings hyaline, without distinct pattern (Fig. 2) .... *Terellia serratulae*
- Wings with distinct pattern or crossbands (Fig. 3 to 19) 2

2. Wings with crossbands (Fig.3 to 11) 3
- Wings pattern anather forms (Fig. 12 to 19) 11

3. Abdomen in black color 4
- Abdomen in yellow color 7

4. Aculeus without subapical steps (Fig. 20) .... *Urophora quadrifasciata*
- Aculeus with subapical steps (Fig. 21 to 23) 6

5. Aculeus with two subapical steps (Fig. 21) .... *U. solstotoalis*
- Aculeus with one subapical steps (Fig. 22, 23) 7

6. Preapical and discal crossbands parallel (Fig. 5) .... *U. mauritanica*
- Preapical and discal crossbands not parallel (Fig. 6) .... *U. jaceana*

7. Presutural dorsocentral setae present (Fig. 24) .... *Chaetorallia jaceae*
- Presutural dorsocentral setae absent (Fig. 25 to 27) 8

8. Extension of cell cup extending well beyond bm-cu crossvein (Fig. 8) .... *Orellia falcate*
- Extension of cell cup ending approximately in line with bm-cu crossvein (Fig. 9, 10) 9

9. Scutum with a black apical spot and pair of the base of each setae black basal spots (Fig. 26) .... *Chaetostomella cylindrica*
- Scutum usually without a black spot, at most with narrow basal-lateral basal spots (Fig. 27) 11

10. Dark transverse bands of wings between R_{4+5} and M displaced over apex of wings (Fig. 10) .... *Terellia quadratula*
- Pattern of wings not displaced over apex of wings (Fig. 11) .... *Ter. gynaecochroma*

11. Abdomen in yellow color .... *Ter. ruficauda*
- Abdomen in black color 13

12. Cell dm completely hyaline (Fig. 13) .... *Acanthiophilus helianthi*
- Cell dm not completely hyaline (Fig. 14 to 19) 14

13. With three pair of frontal setae (Fig. 28) .... *Acinia biflexa*
- With two pair of frontal setae (Fig. 29, 30) 14

14. With one pair of scutellar setae (Fig. 31) 15
- With two pair of scutellar setae (Fig. 32) 16

15. Vein CuA_1 with a brown stripe along it from dm-cu to hind margin of wing (Fig. 15) .... *Trupanea amoena*
- Vein CuA_1 entirely with a hyaline area (Fig. 16) .... *Tru. stellata*

16. Apical fork of wing absent, anly isolated brown spots present at end of vein R_{4+5} and M (Fig. 17) .... *Tephritis formosa*
- Apical fork of wing present (Fig. 18, 19) 17

17. Hyaline area in cell dm not separate (Fig. 18) .... *Tep. cometa*
- Hyaline area in cell dm separate (Fig. 19) .... *Tep. hurvitzi*

Subfamily Tephritinae
Tribe Myopitini
***Urophora jaceana* (Hering, 1935)**
Material examined: (1♂): Chichakli, 38°39' N, 46°31' E, 2140 m, 1 April 2009 (Gharajedaghi); (1♂): Chichakli, 38°40 N, 46°31 E, 2168 m, 24 March 2010 (Zarghani).
Host plants: *Centaurea jacea* L., and *C. nigra* L. (White and Korneyev, 1989).

Distribution: Most of Europe; from Ireland and France in the West and Norway and Northern Russia (Kola Peninsula) in the North to the Pyrenees, Alps, Caucasus, and Turkey in the South and Ural Mountains in the East; introduced into Eastern America (Korneyev and White, 1999; Kutuk, 2003). **New record for the Iran insect fauna.**

***Urophora mauritanica* Macquart, 1851**
Material examined: (1♂): Chichakli, 38°40' N, 46°31' E, 2148 m, 15 February 2009 (Gharajedaghi).
Host plants: *Carthamus arborescens* M.Bieb., *C. glaucus* M.Bieb., *C. tinctorius* L., *C. lanatus* L., and *C. tenuis* (Boiss.) Bornm. (Fraunfeld, 1857; White and Korneyev, 1989; Freidberg and Kugler, 1989).
Distribution: Albania, Algeria, Bulgaria, Crete, Cyprus, Czech Republic, French mainland, Greek mainland, Italian mainland, Sardinia, FYR Macedonia, Malta, Moldova, Morocco, south of European Russia, Spain, Ukraine, Turkey, Azerbaijan, Kazakhstan, Uzbekistan, Israel, Algeria, Libya (White and Korneyev, 1989; Merz and Korneyev, 2004) and Iran (Gharali et al., 2005).

***Urophora quadrifasciata* (Meigen, 1826)**
Material examined: (1♂, 1♀): Chichakli, 38°41' N, 46°31' E, 2163 m, 15 February 2009 (Gharajedaghi).
Host plants: The larvae develop in flowerhead galls on *Centaurea iberica* Trev. ex Spreng, *C. solstitialis* L., *C. aspera* L., *C. sterilis* L., *C. breviceps* Trev. ex Spreng., *C. nicaeensis* Trev. ex Spreng., *C. procurrens* Sieb., *C. jacea* L., *C. maculosa* Lam., *C. splendens* Sieb., *C. nigrescens* L., *C. cyanus* L, *C. calpitropa* L., *C. nigra* L., and *Serratula tinctoria* L. (Giray, 1979; White, 1988; White and Korneyev, 1989; Freidberg and Kugler, 1989; Merz, 1994; Korneyev and White et al., 1999; Kutuk, 2003).
Distribution: Most of Europe, Turkey, Kazakhstan, Israel, Iran, East Palaearctic and Nearctic region, and North Africa (Kutuk and Ozgur, 2003; Merz and Korneyev, 2004) and Iran (Karimpoor and Merz, 2006).

***Urophora solstitialis* (Linnaeus, 1758)**
Material examined: (1♀): Chichakli, 38°40' N, 46°31' E, 2168 m, 1 January 2010 (Khaghaninia).
Hostplants: *Carduus defloratus* L., *C. nutans* L., *C. personata* (L.) Jacq., *C. acanthoides* L., *C. crispus* L., *Cirsium vulgare* (Savi) Ten., and *C. heterophyllum* (L.) Hill. (White, 1988; Merz, 1994; Kutuk, 2003).
Distribution: Most of Europe, except Spain and Mediterranean region (Merz and Korneyev, 2004), North Caucasus, Armenia, Turkey, Kazakhstan, Western China (Xingjian), Far East Russia (Magadan) (Korneyev and White, 1999), North America, Australia, and New Zealand (Norrbom et al., 1999), and Iran (Gharajedaghi et al, 2011b).

Tribe Tephritini
***Acanthiophilus helianthi* (Rossi, 1794)**
Material examined: (2♂♂, 4♀♀): Chichakli, 38°39' N, 46°31' E, 2140 m, 20 February 2009 (Gharajedaghi); (5♂♂, 1♀): Chichakli, 38°39 N, 46°31 E, 2243 m, 10 July 2010 (Khaghaninia).
Host plants: The larvae develop in flower heads of various species of *Carthamus*, *Centaurea* and related genera of the family Asteraceae (Hendel, 1927; Freidberg, Kugler, 1989; Merz, 1994).
Distribution: North and East Africa; Central and South Europe; Kazakhstan, Kyrgyzstan, China, Transcaucasia, Turkey, Near and Middle East including Iran; Saudi Arabia, UAE, Pakistan, India and Thailand (Norrbom et al., 1999; Korneyev and Dirlbek, 2000; Merz and Dawah, 2005; Merz, 2008).

***Acinia biflexa* (Loew, 1844)**
Material examined: (2♂♂): Chichakli, 38°39' N 46°31' E, 2243 m, 15 February 2010 (Zarghani).
Host plants: *Inula britanica* (Baugnee, 2006).
Distribution: Belgique (Baugnee, 2006) and Iran (Gharajedaghi et al., in press).

***Tephritis cometa* (Loew, 1840)**
Material examined: (2♂♂): Chichakli, 38°39' N, 46°31' E, 2239 m, 20 February 2010 (Khaghaninia).
Host plants: *Circium gaillardotii, C. vulgare, C. arvense,* and *C. palustre* (Giray, 1979; White, 1988; Freidberg and Kugler, 1989; Merz, 1994).
Distribution: West and Middle Asia, Israel, Afghanistan, Russia, Estonia, Latvia, Lithuania, Ukraine, Moldova, Azerbaijan, Georgia, Armenia, Kazakhstan, Uzbek, Tajikistan, Kirghis, Turkomanas, Switzerland, England, Germany and Turkey (Foote, 1984; White, 1988; Freidberg and Kugler, 1989; Merz, 1994; Kutuk and Ozgur, 2003), and Iran (Mohamadzade et al. 2010b).

***Tephritis formosa* (Loew, 1844)**
Material examined: (1♀): Chichakli, 38°41' N, 46°31' E, 1788 m, 21 July 2011 (Gharajedaghi).
Host plants: *Sonchus oleraceus*, *S. aspera, S. arvensis, Hypochaeris radicata*, and *Crepis virens* (White, 1988; Freidberg and Kugler, 1989; Merz, 1994).
Distribution: Europe, except Scandinavia, to Israel and Iran (Norrbom et al., 1999).

***Tephritis hurvitzi* Freidberg, 1758**
Material examined: (3♂♂, 3♀♀): Chichakli, 38°39' N, 46°31' E, 2229 m, 20 February 2009 (Khaghaninia).
Host plants: *Scorzonera syrica* and *Tragopogon longirostris* (Freidberg and Kugler, 1989).
Distribution: Europe, Middle Asia, Israel, Syria, Jordan, Lebanon, Iraq and Iran (Norrbom et al., 1999; Korneyev and Dirlbek, 2000, and Mohammadzade et al. 2010b).

***Trupanea amoena* (Frauenfeld, 1857)**
Material examined: (1♂, 1♀): Chichakli, 38°39' N, 46°31' E, 2229 m, 31 December 2010 (Khaghaninia).
Host plants: *Lactuca* sp.*, Picris hieracioides* and *Sonchus* sp. (Merz, 1994).
Distribution: Iran: East Azerbaijan (Zaitzev, 1947), Khorasan Jonubi, Sistan and Baluchestan (Hering, 1956), Tehran (Gilasian et al., 2008); Europe, Israel, Syria, Iraq, Saudi Arabia and UAE (Norrbom et al., 1999; Korneyev and Dirlbek, 2000; Merz and Dawah, 2005; Merz, 2008).

***Trupanea stellata* (Fuesslin, 1775)**
Material examined: (1♀): Chichakli, 38°41' N, 46°31' E, 1788 m, 5 July 2011 (Gharajedaghi).
Host plants: *Senecio* spp., *Artemisia judaica*, *Inula graveolens* and *I. viscosa* in Israel (Freidberg and Kugler, 1989). In Europe reared from *Anthemis* spp., *Aster* sp., *Bidens* sp., *Centaurea* spp., *Crepis* spp., *Inula* sp.,*Picris* sp, *Senecio* sp. and *Serratula* sp. (Merz, 1994).
Distribution: Iran: Kerman, Sistan and Baluchestan (Dirlbek, 1980), Europe, Israel, Iraq, Armenia, Saudi Arabia, India, Mongolia and Africa (Norrbom et al., 1999; Korneyev and Dirlbek, 2000; Merz and Dawah, 2005).

Tribe Terelliini
***Chaetorellia jaceae* (Robineau-Desvoidy, 1830)**
Material examined: (1♂, 1♀): Chichakli, 38°39' N, 46°31' E, 2140 m, 1 January 2009 (Gharajedaghi).
Host plants: *Centaurea nigra* and *Cirsium spp.* (Korneyev and Konovalov, 2010; Richter, 1970; White, 1988).
Distribution: Western and central England (White, 1988), Norhwest, central belt, south, Crimea. Central belt and south of Western Europe, Asia Minor (Richter, 1970) and Iran (Gharajedaghi et al., 2011a).

***Chaetostomella cylindrica* (Robineau-Desvoidy, 1830)**
Material examined: (1♀): Chichakli, 38°41' N, 46°31' E, 1788 m, 12 July 2011 (Gharajedaghi).
Host plants: *Centaurea nigra* and many species of Cardueae (White, 1988).

Distribution: Southern England, Europe, Norh Africa, Asia as far east as Mongolia (White, 1988), and Iran (Mohamadzade, 2010b).

***Orellia falcata* (Scopoli, 1763)**
Material examined: (2♀♀, 1♂): Chichakli, 38°39' N, 46°31' E, 2140 m, 24 March 2009 (Gharajedaghi).
Host plants: Larvae bore into the stem base and root of *Tragopogon pratensis* (White, 1988; Richter, 1970).
Distribution: England, Scotland, Europe (White, 1988), and Iran (Gilasian and Merz, 2008).

***Terellia gynaecochroma* (Hering, 1937)**
Material examined: (2♀♀): Chichakli, 38°39' N, 46°31' E, 2229 m, 1 January 2010 (Khaghaninia).
Host plants: *Carduus acanthoides* L., *Onopordom acanthium* L. (Hendel, 1927; kutuk, 2006; Mohamadzade, 2010, b), *O. anisacanthum* Boiss, *O. illyricum* L. (Khouzama et al., 2002) and *O. heteracanthum* (Mohamadzade, 2010, b).
Distribution: North West, South, Crimea, Trans-caucasus, Central belt, Erope (Richter, 1970), Cyprus, Israel, Jordan, Syria (Freidberg, Kugler, 1989; Norrbom et al., 1999; Korneyev and Dirlbek, 2000) and Iran (Mohamadzade, 2010a and b).

***Terellia quadratula* (Loew, 1869)**
Material examined: (1♂, 2♀♀): Chichakli, 38°40' N, 46°31' E, 2168 m, 13 February 2010 (Khaghaninia).
Host plants: *Echinops viscosus* (Freidberg and Kugler, 1989).
Distribution: Israel, Lebanon, Caucasus (Norrbom et al., 1999; Korneyev and Dirlbek, 2000; Korneyev, 2006) and Iran (Mohamadzade, 2010b).

***Terellia ruficauda* (Fabricius, 1794)**
Material examined: (1♂, 1♀): Chichakli, 38°41' N, 46°31' E, 1788 m, 20 March 2011 (Gharajedaghi).
Host plants: *Cirsium arvense* (Mohamadzade, 2010, b), *C. palustre* (L.) Scop., *C. arvense* (L.) Scop.,*C. eriophorum* (L.) Scop., and *C. dissectum* (L.) Scop.(White, 1988; Merz, 1994; Kutuk and Ozgur, 2003).
Distribution: North America, Europe, Russia, Kazakhstan, Kyrgyzstan, Mongolia, China; (Norrbom et al., 1999) and Iran (Mohamadzade, 2010, b).

***Terellia serratulae* (Linnaeus, 1758)**
Material examined: (2♂♂, 2♀♀): Chichakli, 38°41' N, 46°31' E, 2163 m, 15 March 2009 (Gharajedaghi).
Host plants: *Cirsium arvense,* (Mohamadzade, 2010, b), *Carduus acanthoides* L., *Card. defloratus* L., *Card. nutans* L., *Cirsium alatum* (Gmel.) Bobr.,*Cirs. erisithales* (Jacq.) Scop.,*Cirs. oleraceum* (L.) Scop., *Cirs. tuberosum* (L.), and *Cirs. vulgare* (Ten.) Savi are recorded (Zwolfer, 1965; White, 1988; Merz, 1994). References of *Cirs.arvense* (L.) Scop.,*Cirs. Phyllocephalum* Boiss., (Kugler and Freidberg, 1975), *Galactites tomentosa* Moench., *Lamyropsis cynaroides* (Lam.) Dittrich, and *Card. pycnocephalus* L., (Neuenschwander and Freidberg, 1983).
Distribution: British Is., Scandinavia, Kazakhstan, Israel, Syria, Iraq and Africa (Norrbom et al., 1999; Korneyev and Dirlbek, 2000), and Iran (Mohamadzade et. al., 2010b).

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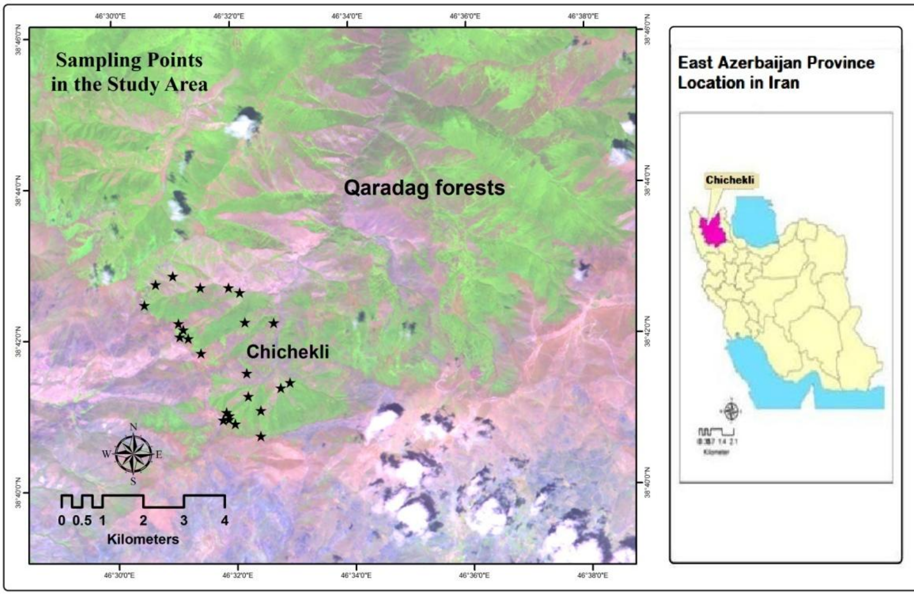
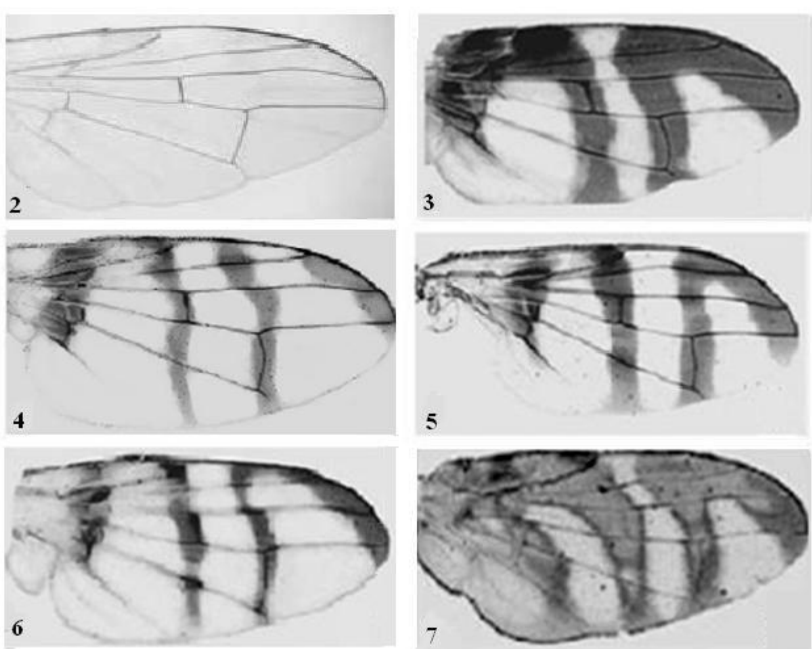
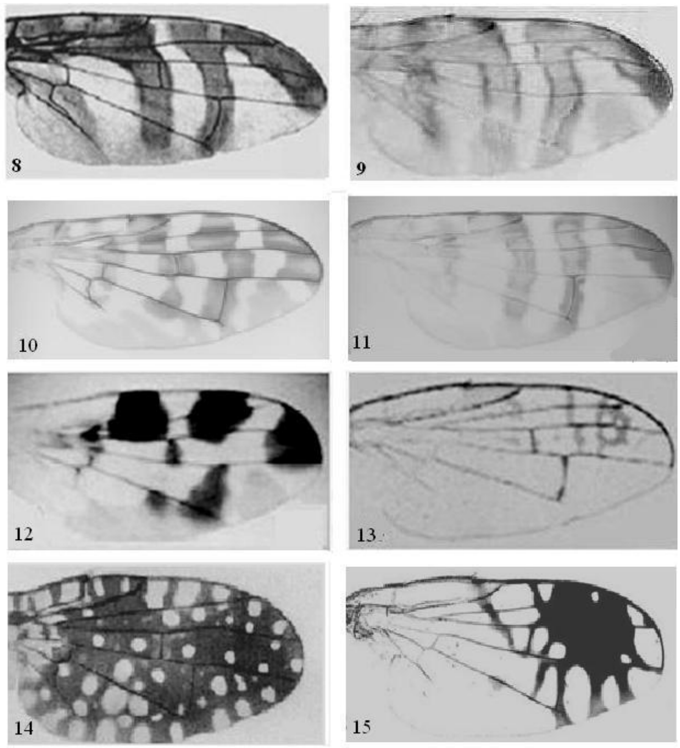


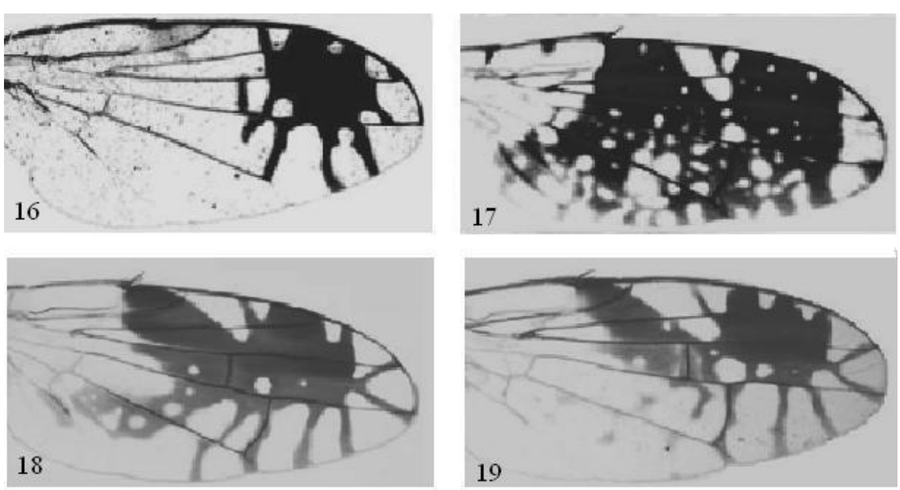
Figure 1. Location of sampling points on satellite image (SPOT) of Chichekli region.



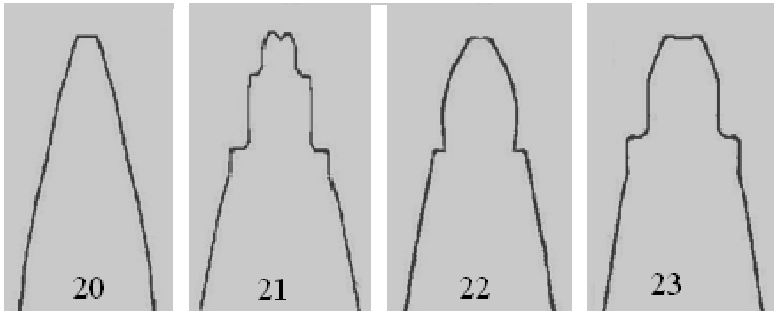
Figures 2-9. Right wings of fruit flies: 2- *Terellia serratulae*, 3- *Urophora quadrifasciata*, 4- *U. solstitialis*, 5- *U. mauritanica*, 6- *U. jaceana*, 7- *Chaetorellia jaceae*.



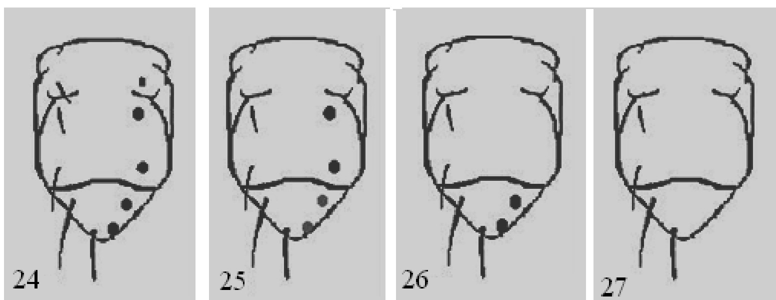
Figures 8-15. Right wings of fruit flies: 8- *Orellia falcata*, 9- *Chaetorellia cylindrica* 10- *Terellia quadratula*, 11- *Ter. gynaecochroma*, 12- *Ter. ruficauda*, 13- *Acanthiophilus helianthi*, 14- *Acinia biflexa*, 15- *Trupanea amoena*.



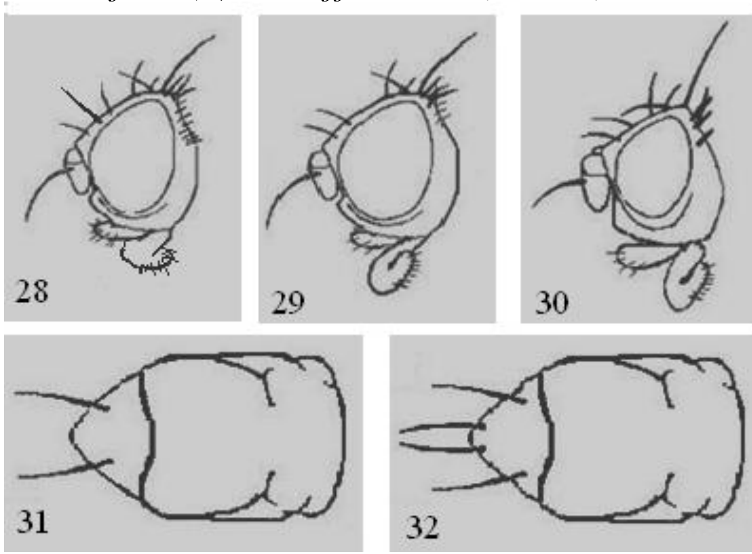
Figures 16-19. Righht wings of fruit flies: 16- *Trupanea stellata,* 17- *Tephritis formosa*, 18- *Tep. hurvitzi*, 19- *Tep. cometa*.



Figures 20-23. Aculeus of fruit flies: 20- *Urophora quadrifasciata*, 21- *U. solstitialis*, 22- *U. mauritanica*, 23- *U. jaceana* (dorsal view).



Figures 24-27: Tergum of fruit flies: 24- *Chaetorella jaceae*, 25- *Orellia falcata*, 26- *Chaetostomella cylindrica,* 27- *Terellia gynaecochroma* (dorsal view).



Figures 28-30. Head of fruit flies: 28- *Acinia* spp., 29- *Trupanea* spp., 30- *Tephritis* spp. (lateral view); 31-32: Scutellum setae of fruit flies. *Trupanea spp.,* 32- *Tephritis spp.* (dorsal view).

ABUNDANCE NEUROPTERA SPECIES RECORDED IN PISTACHIO AND CHERRY ORCHARDS OF SOUTHEASTERN ANATOLIA OF TURKEY

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ABSTRACT: This study which is entitled the Neuroptera fauna of Pistachio and Cherry Orchards in Southeastern Anatolia Region was carried out during 2006–2009. Samples were taken from the orchards in Batman, Diyarbakır, Mardin and Siirt provinces. The samples were identified and listed. Recommendations were made on the species which can be prey of harmful insects for crops. In a total of 20 species of 15 genera and 4 families (Chrysopidae, Mantispidae, , Myrmeleontidae and Nemopteridae) were collected from different localities of the southeastern region of Turkey. *Acanthaclisis mesopotamica* Hölzel, 1972 is new record Anatolian fauna.

KEY WORDS: Neuroptera, Pistachio, Cherry Orchards, fauna, Turkey.

Neuroptera is one of the oldest insect orders. The order is with 6000 species distributed among 17 families, the order is relatively small. Its member occupy a wide variety of habitats and display an array of life styles (Anonymous, 2009). Also, Turkey Neuroptera fauna has 11 families, 195 species and 6 subspecies now (Berber & Canbulat, 2009). In this region, the abundance of species of the insect order Neuroptera was studied in the traditionally cultivated landscape of southeastern Turkey. Result of study was determined 29 species, 10 genera, 5 families of the order (Satar & Özbay, 2004). But, this was only faunistic study. In this study, two important cultivated plants in general for the region in recent years, the cherry and pistachio orchards are considered the fauna of Neuroptera.

The specimens were collected in different localities of the southeastern region of Turkey (Fig. 1) between 2006 and 2009 by use light traps. Trees selected for sampling were inspected once week between March and November. Generally eudominant species were of the family Chyrosopidae and Myrmeleontidae.

MATERIALS AND METHODS

Several sampling methods were used for collecting Neuroptera species, differing on the activity patterns of the different species. The species were captured individually using net trap during the morning period. One light trap on the ground was used at each area from the mid June to the mid September. A 20 watt Philips energy saver white day light bulb was used at each trap and traps were cleared at two weeks interval. The collected material was deposited in Plant Protection, Agriculture Faculty laboratory of Dicle University.

RESULTS

In a total of 20 species of 15 genera and 4 families (Chrysopidae, Mantispidae, Myrmeleontidae and Nemopteridae) were collected from different localities of the southeastern region of Turkey. *Acanthaclisis mesopotamica* Hölzel, 1972 is new record Anatolian fauna (Fig 2).

In this study, list of species is below.

Family Chrysopidae Schneider, 1851

Chrysoperla carnea Stephens, 1836 *sensu lato*

Host Plant Arae: Cherry

Material examined: 2♀, 5♂, 13.06.2007, Batman-Beşiri; 2♀, 1♂, 20.6.2007, Diyarbakır-Kocaköy; 3♀, 2♂, 16.08.2009, Mardin-Yeşilli; 2♀, 1♂, 09.06.2009. **Totally:** 18 exs.

Distribution in Turkey: Konya (Esben-Petersen, 1933); Turkey (locality unknown) (Hölzel, 1967a); Niğde, Nevşehir (Tuatay et al., 1972); Antalya, Van (Gepp, 1974); Adana (Popov, 1977); Adana, Adıyaman, Ağrı, Amasya, Mersin, Tokat, Trabzon, Şanlıurfa, Van, Samsum, Siirt, Şırnak, Ankara, Artvin, Aydın, Bitlis, Burdur, Çanakkale, Diyarbakır, Erzurum, Gaziantep, Hakkâri, İstanbul, İzmir, Kahramanmaraş, Malatya, Mardin (Şengonca, 1980a); Aydın, İstanbul, Konya (Monserrat & Hölzel, 1987); Ankara (Kıyak & Ozdikmen, 1993); Çanakkale (Canbulat & Kıyak, 2000**)**; Adana (Arı & Kıyak, 2000); Kahramanmaraş (Bahadıroğlu & Daymaz, 2001); Kayseri (Canbulat, 2002); Edirne (Onar & Aktaç, 2002); Adıyaman, Şanlıurfa, Batman, Diyarbakır, Mardin, Şırnak, Siirt (Satar & Özbay, 2004); Kars, Arhadan, Iğdır (Arı, 2004); Kırşehir (Canbulat & Özsaraç, 2004); Elazığ (Özbay et al., 2005); Antalya, Burdur, Isparta, Denizli, Aydın, Muğla (Canbulat & Kıyak, 2005b).

Chrysopa dubitans McLachlan, 1887

Host Plant Area: Cherry

Material examined: : 1♀, 2♂, 19.09.2006, Mardin-Yeşilli; 2♀, 2♂, 02.07.2006, Mardin-Savur. **Totally:** 7 exs.

Distribution in Turkey: Mersin **(**Hölzel, 1965, 1967a); Adana (Popov, 1977); İzmir (Şengonca, 1979); Mersin, Antalya, Denizli, Hatay, İzmir, Mardin, Siirt (Şengonca, 1980a, 1981a); Çanakkale (Canbulat & Kıyak, 2000); Kahramanmaraş (Bahadıroğlu & Daymaz, 2001); Mardin (Satar & Özbay, 2004a).

Dichochrysa flavifrons flavifrons Brauer, 1850

Host Plant Area : Cherry

Material examined: 1♀, 2♂, 16.08.2006, Mardin-Yeşilli; 2♀, 1♂, 19.09.2006, Mardin-Savur; 3♀, 2♂, 08.06.2009, Mardin-Sultan köy. **Totally:** 11 exs.

Distribution in Turkey: Middle Anatolia (locality unknown) (Aspöck & Aspöck, 1969a); Adana, Mardin, Mersin, Ankara (Şengonca, 1980a, 1981a); Çanakkale (Canbulat & Kıyak, 2000); Adana (Arı & Kıyak, 2000); Kahramanmaraş (Bahadıroğlu & Daymaz, 2001); Kayseri (Canbulat, 2002); Edirne (Onar & Aktaç, 2002); Adıyaman, Diyarbakır, Mardin, Şırnak, Siirt (Satar & Özbay, 2004a); Kars, Arhadan (Arı, 2004); Elazığ (Özbay et al., 2005); Antalya, Burdur, Isparta, Denizli, Aydın, Muğla (Canbulat & Kıyak, 2005b).

Family Mantispidae Leach in Brewster, 1815

Mantispa scabricollis McLachlan, 1875

Host Plant Area: Cherry

Material examined: 1♂, 2♂ 01.07.2009, Mardin-Yeşilli.

Distribution in Turkey: İzmir, Mersin (Şengonca, 1979, 1980b); Aydın (Monserrat & Hölzel, 1987); Adana (Arı & Kıyak, 2000); Elazığ, Mardin (Satar & Özbay, 2004a); Arhadan, Kars (Arı, 2004); Antalya, Isparta, Aydın, Muğla (Canbulat & Kıyak, 2005b).

Family: Myrmeleontidae Latreille, 1802

Neuroleon* (*Neuroleon*) *assimilis Navás, 1914

Host Plant Area: Cherry

Material examined: Mardin: Central, 19.VIII.2009, 2♀, 2♂, 17. IX. 2009, 1♀, **Totally:** 5 exs.

Host Plant Area: Pistachio
Material examined: Siirt: Central, 07.VIII. 2009, 1♀, Aydınlar, 02. VII. 2009, 1♀, 07.VII.2009, 1♀, 13. VIII, 2009, 4♀, 1♂, **Totally**: 8 exs.
Distribution in Turkey: İzmir (Şengonca, 1979); İstanbul (Monserrat & Hölzel, 1987); Mersin (Kacirek, 1998); Çanakkale (Canbulat & Kıyak, 2002a); Batman, Diyarbakır, Mardin (Satar & Özbay, 2004a); Arhadan, Iğdır (Arı, 2004); Antalya, Burdur, Isparta, Denizli, Muğla (Canbulat & Kıyak, 2005b).

Echthromyrmex sehitlerolmez Koçak & Kemal, 2008
Host Plant Area: Pistachio
Material examined: Siirt: Aydınlar, 01.VII.2009, 1♀, 30.IX.2009, 2♀, 07.VIII.2009, 10♀, **Totally:** 13 exs.
Distribution in Turkey: Hakkari (Koçak & Koçak 2008); Diyarbakır (Koçak & Koçak, 2008).

Mymeleon inconspicuus Rambur, 1842
Host Plant Area: Pistachio
Material examined: Siirt: Merkez, 01.VII.2009, 1♀, 30.VII.2009, 1♂, **Totally**: 2 exs.
Distribution in Turkey: Antalya (Gepp, 1974**;** Canbulat & Kıyak, 2005b); Kars (Arı, 2004); Adıyaman, Diyarbakır (Satar & Özbay, 2004a); Elazığ (Özbay et al., 2005).

Palpares libelluloides Linnaeus, 1764
Host Plant Area: Pistachio
Material examined: Mardin: 06.VI.2007, 1♂, Siirt, 23.VIII.2009, 2♀, **Totally**: 3 exs.
Distribution in Turkey: Konya (Esben-Petersen, 1933); Antalya (Gepp, 1974); Ankara, Adana (Popov, 1977); Mersin, Adana, İzmir, İstanbul, Muğla, Ankara (Şengonca, 1979); Adana, Mersin, Şanlıurfa, Kahramanmaraş, Burdur (Kacirek, 1998); Kayseri (Canbulat, 2002); Çanakkale (Canbulat & Kıyak, 2002a); Adıyaman, Şanlıurfa, Batman, Diyarbakır, Siirt (Satar & Özbay, 2004a); Iğdır (Arı, 2004); Kırşehir (Canbulat & Özsaraç, 2004); Elazığ (Özbay et al., 2005); Antalya, Burdur, Isparta, Denizli, Aydın, Muğla (Canbulat & Kıyak, 2005b).

Solter ledereri Navás, 1912
Host Plant Area: Cherry, Pistachio
Material examined: Mardin: Midyat: 24.V.2006, 2♀, Ömerli, 19. VIII. 2009, 3♀, 17.IX.2009, 1♀, Siirt: Merkez, 13. IX. 2008, 2♀, 1♂, **Totally**: 9 exs.
Distribution in Turkey: Denizli (Monserrat & Hölzel, 1987); Adıyaman, Diyarbakır, Mardin (Satar & Özbay, 2004a); Iğdır (Arı, 2004); Antalya (Canbulat & Kıyak, 2005b).

Acanthaclisis mesopotamica Hölzel, 1972
Host Plant Area: Pistachio
Material examined: Siirt: Aydınlar, 25.VI.2009, 2♀. **Totally**: 2 exs.
Distribution in World: Saudi Arabia, Iraq (Hölzel,1982). This species is new record for Turkish fauna.

Distoleon kabulensis Hölzel, 1972
Host Plant Area: Pistachio
Material examined: Siirt: Aydınlar, 25.VI.2009, 2♀. **Totally:** 2 exs.
Distribution in Turkey: Elazığ (Hölzel, 1972a); Kayseri (Canbulat, 2007). Remarks: *Distoleon kabulensis* Hölzel, 1972 were previously recorded from by Hölzel (1972a) in the part of type series from Elazığ.

Distoleon tetragrammicus Fabricius, 1798
Host Plant Area: Cherry
Material examined: 1♀, 1♂, 10.05.2008, Diyarbakır-Merkez, 700m; 1♂, 25.05.2008, Diyarbakır-Kulp, 1200m; 2♀, 1♂, 25.05.2008, Diyarbakır-Eski Lice; 1♀, 15.09.2008, Mardin-Merkez; 1♀, 2♂, 13.06.2008, Mardin-Yeşilli; 2♀, 1♂, 08.06.2009, **Totally:** 13 exs.
Distribution in Turkey: Konya (Esben-Petersen, 1933); Mersin, Adana, İzmir, Aydın (Şengonca, 1979); Adana (Arı & Kıyak, 2000); Mersin, Hatay (Kacirek, 1998); Kayseri

(Canbulat, 2002); Çanakkale (Canbulat & Kıyak, 2002a); Diyarbakır, Şırnak (Satar & Özbay, 2004a); Arhadan (Arı, 2004); Antalya, Burdur, Isparta, Denizli, Aydın, Muğla (Canbulat & Kıyak, 2005b).

Cueta lineosa Rambur, 1842

Host Plant Area: Cheery
Material examined: Mardin: Ömerli, 19. VIII. 2009, 3♀, 2♂, 17. IX. 2009, 2♀, 2♂. **Totally**: 9 exs.
Distribution in Turkey: Malatya (Hölzel, 1969); Turkey (locality unknown) (Hölzel, 1972a); Antalya (Gepp, 1974); Denizli (Monserrat & Hölzel, 1987); Mersin, Antalya (Şengonca, 1979); Mersin (Aspöck et al., 1980); Elazığ (Özbay et al., 2005); Adıyaman, Diyarbakır (Satar & Özbay, 2004a); Kırşehir (Canbulat & Özsaraç, 2004); Kayseri (Canbulat, 2002); Antalya, Denizli, Aydın (Canbulat & Kıyak, 2005b).

Neuroleon* (*Neuroleon*) *microstenus McLachlan, 1898

Host Plant Area: Cherry
Material examined: Mardin: Ömerli, 19.VIII.2009, 7♀, 2♂. **Totally**: 9 exs.
Distribution in Turkey: Nevşehir (Gepp, 1974); Ankara (Hölzel, 1972a); Adana (Şengonca, 1979); Çanakkale (Canbulat & Kıyak, 2002a); Diyarbakır, Mardin (Satar & Özbay, 2004a); Iğdır (Arı, 2004).

Myrmecaelurus trigrammus Pallas, 1771

Host Plant Area: Cherry
Material examined: Mardin: Ömerli, 19. VIII.2009, 2♀, 1♂. **Totally:** 3 exs.
Distribution in Turkey: Antalya (Schneider, 1845); Konya (Esben-Petersen, 1933); Konya, Van, Eskişehir, Ankara (Hölzel, 1972a); Edirne, Ankara, Adana (Popov, 1977); Adana, Mersin, Antalya, Aydın, İzmir (Şengonca, 1979); Ankara, Antalya, İstanbul, Aydın (Monserrat & Hölzel, 1987); Hatay, Mersin, Adana, Denizli, Aydın, Burdur (Kacirek, 1998); Adana (Arı & Kıyak, 2000); Kayseri (Canbulat, 2002); Çanakkale (Canbulat & Kıyak, 2002a); Kırşehir (Canbulat & Özsaraç, 2004); Kars, Arhadan, Iğdır (Arı, 2004); Batman, Diyarbakır, Mardin, Şırnak (Satar & Özbay, 2004a); Elazığ (Özbay et al., 2005); Antalya, Burdur, Isparta, Denizli, Aydın, Muğla (Canbulat & Kıyak, 2005b).

Neuroleon* (*Ganussa*) *tenellus Klug, 1834

Host Plant Area: Cherry
Material examined: Mardin (Ömerli), 19.VIII.2009, 2♀. Totally: 2 exs.
Distribution in Turkey: Adana, Siirt (Şengonca, 1979); Mersin (Aspöck et al., 1980); Antalya (Monserrat & Hölzel, 1987); Adana (Kacirek, 1998); Kayseri (Canbulat, 2002); Batman, Diyarbakır, Mardin (Satar & Özbay, 2004a) Antalya, Aydın, Muğla (Canbulat & Kıyak, 2005b).

Family: Nemopteridae Burmeister, 1839

Dielocroce ephemera Gerstaecker, [1894]

Host Plant Area: Cherry
Material examined: Mardin: Savur, 19. VIII. 2009, 7♀, 5♂, Totally: 12 exs.
Distribution in Turkey: Mardin (Gerstaecker, 1894; Şengonca, 1981b); Batman (Satar et al., 2004).

Lertha extensa Olivier, 1811

Host Plant Area: Cherry
Material examined: 5 ♀, 7 ♂, 9.6.2006, Diyarbakır; 3 ♀, 2 ♀, 13.6.2006, Lice, Diyarbakır prov., 1100 m; 4 ♀, 3 ♂, 14.6.2007, Nusaybin, Mardin.; 5 ♀, 11 ♂, 19.6.2007, Kozluk, Siirt prov., 5 ♀, 3 ♂, 19.6.2007, Eruh, Siirt.
Distribution in Turkey: Şanlıurfa, Hakkari (Şengonca, 1979, 1981b); Hatay (Tjeder, 1970); Kahramanmaraş, Malatya (Hölzel, 1968); Şanlıurfa (Kacirek, 1998**);** Van **(**Koçak & Kemal, 2002)**;** Diyarbakır, Mardin, Siirt (Satar & Özbay, 2004 b); Iğdır, Kars (Arı, 2004).

Lertha sheppardi Kirby, 1904

Host Plant Area: Cherry
Material examined: 1 ♀, 7 ♂, 17.6.2009, Bismil, Diyarbakır. 10 ♀, 7 ♂, 9.6.2009,Yeşilli, Mardin.
Distribution in Turkey: Amanos mountains (Navás, 1912; Hölzel, 1968); Denizli (Şengonca, 1979); Mersin (Şengonca, 1981b); Diyarbakır, Şanlıurfa (Satar & Özbay, 2004 b).

DISCUSSION

As result of this study 20 species spread areas and abundance belonging to 4 families in neuropteran order was determined. 18 insects species which were determined in three administrative provinces and on only a culture plant are very important for insects potential in pistachio and cherry areas with this study. This study is very important to be a base to integred pest management and biological control studies which will be made in the future.

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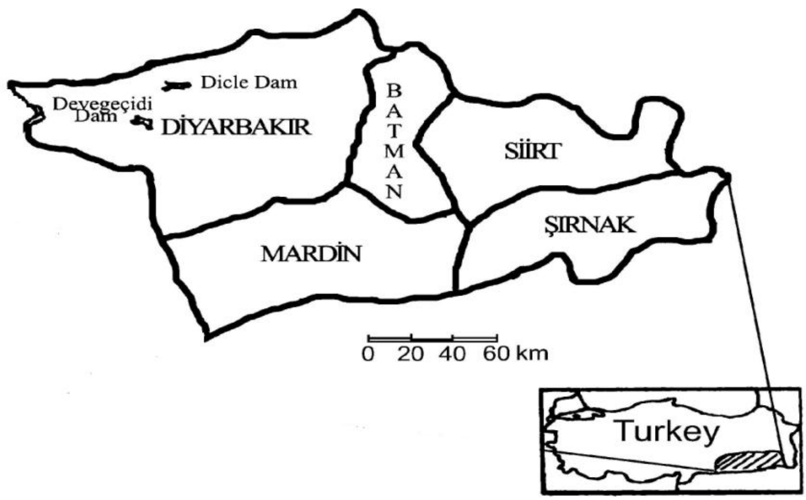

Figure 1. The collecting sites.

Figure 2. The adult of *Acanthaclisis mesopotamica* Hölzel, 1972.

A NEW SPECIES OF THE GENUS *NEOCUCULLANUS* (NEMATODA: CUCULLANIDAE) IN *SALMINUS BRASILIENSIS* (PISCES: CHARACIDAE) FROM ARGENTINA

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[Ramallo, G. 2012. A new species of the genus *Neocucullanus* (Nematoda: Cucullanidae) in *Salminus brasiliensis* (Pisces: Characidae) from Argentina. Munis Entomology & Zoology, 7 (1): 543-549**]**

ABSTRACT: During a parasitological survey of *Salminus brasiliensis* (Cuvier, 1816) from Juramento River, specimens of a new species of nematode were collected from the intestine, piloryc caeca and liver of fish and studied by light and scanning electron microscopy. *Neocucullanus marcelae* sp. nov. is described as the third species of the genus *Neocucullanus* by in both sexes the excretory pore is anterior to nerve ring, spicules in males very long, over 1.60-1.90 mm long, possess 32 caudal papillae; females with very prominent vulva. *Neocucullanus marcelae* n. sp. is the first species of the genus from Argentina.

KEY WORDS: *Neocucullanus* sp. nov., Nematodes parasites, freshwater fishes, Argentina.

The Argentinian continental ichthyofauna is very well represented, 450 species, with the absence of the families Osteoglossidae and Nandidae. This number represents less than 10% of the total fish species occurring in the Neotropical Region (López, 2001; López et al., 2002).

In Argentina, the Family Characidae is represented by 61 species distributed in 30 genera. Likewise, in the country, genus *Salminus* Agassiz, 1829 two valid species (*Salminus brasiliensis* (=*Salminus maxillosus*) (Cuvier, 1816) and *Salminus hilarii* Valenciennes, 1849) were recorded (López et al., 2003).

Salminus brasiliensis is distributed in South America: Paraná (Argentina), Paraguay, and Uruguay River basins; Laguna dos Patos drainage, upper Chaparé and Mamoré River basin in Bolivia, and Brazil. Occurrence in the remaining Amazon River highly doubtful (Froese & Pauly, 2011).

In Argentina, *S. brasiliensis* is recorded in the basin paranoplatensean ecoregion. This ecoregion combines elements of "yungas" (cloud forest irregularly distributed in the Provinces of Salta, Jujuy, Tucumán and Catamarca). Include the major part of course of Pilcomayo River in Argentina, Bermejo River, San Francisco, Salado del Norte or Juramento River, and in its southern portion rivers Tercero, Cuarto and Carcarañá. Except for Pilcomayo River, which merges with Paraguay River, the rest of these watercourses flow into Paraná River along different parts of it (López et al., 2002).

Salminus brasiliensis are fishes benthopelagic and potamodromous (Riede, 2004). Occurs in ponds (Cordiviola & Pignalberi, 1985); carnivorous, feeds on fish and crustaceans (Baensch & Riehl 1997; Zaniboni Filho et al., 2004).

A study to quantify the fish conservation state of the Family Characidae in an area of the Plata basin, taking into account the biological, ecological and distribution variables was performed. In this it was concluded that *S. brasiliensis* is a vulnerable species of maximum priority (Zayas & Cordiviola, 2007).

Many species of neotropical fish nematodes belong to Seuratoidea and Dracunculoidea. Out of five families of Seuratoidea superfamily, only the families Quimperiidae and Cucullanidae involve species parasitic in Neotropical freshwater fishes. Three genera (*Cucullanus*, *Dichelyne*, *Paraseuratum*) which are also found in other zoogeographical regions, but other three genera (*Neocucullanus*, *Neoparaseuratum*, *Procamallanus*) are restricted to South America (Moravec, 1998).

In the Neotropical freshwater fishes, Cucullanidae family encompasses three genus (*Dichelyne* Jägerskiöld, 1902, *Neocucullanus* Travassos, Artigas et Pereira, 1928, and *Cucullanus* Müller, 1777 (Moravec, 1998). *Neocucullanus* genus no occurs in Argentina.

Neocucullanus Travassos, Artigas et Pereira, 1928, is characterized by the caudal end in both sexes short and rounded, spicules short and thick and at least 9 pairs of preanal papillae in male (Moravec, 1998).

The aim of this paper was to describe the first species of the genus *Neocucullanus* in *Salminus brasiliensis* from Argentina and the third species of genus from South America.

MATERIAL AND METHODS

In September 2010 and May 2011, 14 specimens of *Salminus brasiliensis* (sex not specified; Lst = 25-43 cm) from Juramento River, (25º13'35,19"S; 64º28'30,82"W), Salta, Argentina were collected and examined for helminths. Fishes were 10% formalin fixed before preservation in 70% ethanol. Body cavity was opened by a mid-ventral incision and the digestive tract was removed. Nematodes were cleared in lactophenol and examined under light microscope. Drawings were made with the aid of LEICA microscope. Quantitative descriptors of parasite populations were estimated based on definitions of Bush et al. (1997). Measurements are given in millimeters unless otherwise stated. For SEM (scanning electronic microscopy) examination specimens were dehydrated throughout an ethanol series, acetone and ether, coated with gold and examined in a Jeol JSM-35CF SEM.

Type specimens were deposited in the Colección Helmintológica Fundación Miguel Lillo (CH-N-FML), Miguel Lillo 251, (4000) San Miguel de Tucumán, Argentina.

RESULTS

Cucullanidae Railliet & Henry, 1915

Neocucullanus marcelae sp. nov.
(Figures 1-19)

General: Large sized nematodes with transversaly striated cuticle. Mouth dorsoventrally elongated, surrounded by membranous collarette with denticles. Four large double papillae, 2 small deirids and 6 small papillae present (Fig.3). Esophagus expanded at its anterior end to form well developed pseudobuccal capsule (oesophastome); posterior part of esophagus also somewhat expanded (Figs. 1,2). Intestinal caecum absent. Caudal end of adults very short and rounded, with a mucron. Precloacal sucker present. Preanal papillae numerous. Vulva postequatorial.

Diagnosis. In both sexes the excretory pore is anterior to nerve ring (Figs. 10, 11), spicules in males very long, over 1.60 mm long, 32 caudal papillae: 9 pairs preanal and one ventral media, 1 pair adanal and 5 pairs postanal and one media ventral; females with prominent vulva.

Male (n=9) measurements of holotype in parentheses. Body 17.1-22.04 (19.08) long, 0.64-0.74 (0.70) wide. Esophagus 1.52-1.67 (1.60) long and 0.36-0.42 (0.40) wide. Distance from anterior end deirids, nerve ring and excretory pore 0.65-0.82 (0.74), 0.63-0.83 (0.80) and 0.40-0.48 (0.48), respectively. Caudal end short and blunt with hemicircular subventral alae. Caudal papillae: 9 pairs preanal and one media ventral, 1 pair adanal and 5 pairs postanal and one media ventral (Figs. 7,8,16,17,18,19). Precloacal sucker from posterior end 0.91-1.13 (0.92). Spicules well sclerotized, large, equally long 1.62-1.90 (1.62) (Fig.9). Gubernaculum absent. Phasmids not observed. Tail very short and rounded, 0.28-0.33 (0.32) long, with terminal mucron.

Female (n=9 gravid specimens) measurements of alllotype in parentheses. Body 22.00-27.00 (27.00) long, 0.66-0.89 (0.72) wide. Esophagus 1.62-1.81 (1.80) long and 0.37-0.44 (0.40) wide. Distance from anterior end of deirids, nerve ring, and excretory pore 0.66-0.80 (0.78), 0.63-0.77 (0.68) and 0.36-0.49 (0.36), respectively. Vulva postequatorial, vulvar lips very elevated, 9.4-12.2 (12.0) from posterior end (Fig. 5, 12, 13). Uterus opposed, containing numerous eggs. Eggs thin-walled, size 0.063-0.086 (0.083) x 0.050-0.056 (0.050). (Fig. 6). Short tail bluntly, 0.20-0.28 (0.28), with cuticular spike 0.020-0.030 (0.022) long at tip. Two small phasmids observed (Figs. 4, 14, 15).

***Type specimens*:** Holotype: male CH-N-FML # 07488; allotype: female CH-N-FML # 07489, and paratypes (10 males, and 14 females) CH-N-FML # 07490.

Type host: *Salminus brasiliensis* (Cuvier, 1816) (Pisces, Characidae), CI-FML # 5190, collected in 2010.

***Type locality*:** El Chorro (25º13'35,19"S; 64º28'30,82"W), Juramento River, Department Metán, Province of Salta, Argentina.

Prevalence: 43% (6/14). *Salminus brasiliensis* harbored 42 specimens of *Neocucullanus marcelae* sp. nov.

Site of infection: Intestine, piloryc caeca and liver.

Mean intensity: 8.4 nematodes per fish.

Etymology: The specific name is given in honor to Marcela Peralta, collegue, friend, and godmother.

Remarks*:* Of the three species of *Neocucullanus* (*N. neocucullanus, N. multipapillatus* and *N. marcelae* n. sp.), *N. marcelae* sp. nov. is the only that presents the excretory pore anterior to nerve ring.

Neocucullanus marcelae is more similar to *N. neocucullanus* because both lack gobernaculum and possess hemicircular subventral caudal alae, observed with light microscope. It differs from *N. neocucullanus* by preanal papillae (9 pairs vs. 10 pairs), unpaired preanal papilla (present vs. absent), spicules (1.60-

1.90 mm vs. 0.38 mm), papillae adanal (present vs. absent), papillae postanal (5 pairs and unpaired media ventral vs. 3 pairs).

Neocucullanus marcelae n. sp. shares with *N. multipapillatus* 15 pairs of caudal papillae and unpaired preanal papilla. Differ by adanal papillae (present vs. absent), gobernaculum (absent vs. present), caudal alae (present vs. absent) and unpaired media ventral postanal papilla (present vs. absent).

In this paper, we describe the first species of the genus *Neocucullanus* from Argentina and the third species of the same in South America.

ACKNOWLEDGEMENTS

Thanks to members of the Project "Dorados, los tigres del río"specially Eduardo Armanini and Juanjo Lomascolo; members of "Juramento Fly Fishing Group"; to the authorities of Ministerio de Medio Ambiente y Desarrollo Sustentable de la Provincia de Salta for their collaboration; to Fabiana Cancino for the determination of the hosts; to Dr. Moravec for their valuable and disinterested comments; to Andrés Ortiz for his technical support in figures digitalization; and to the Laboratory of Electron Microscopy staff, especially to Alberto Andrada Barone for their assistance.

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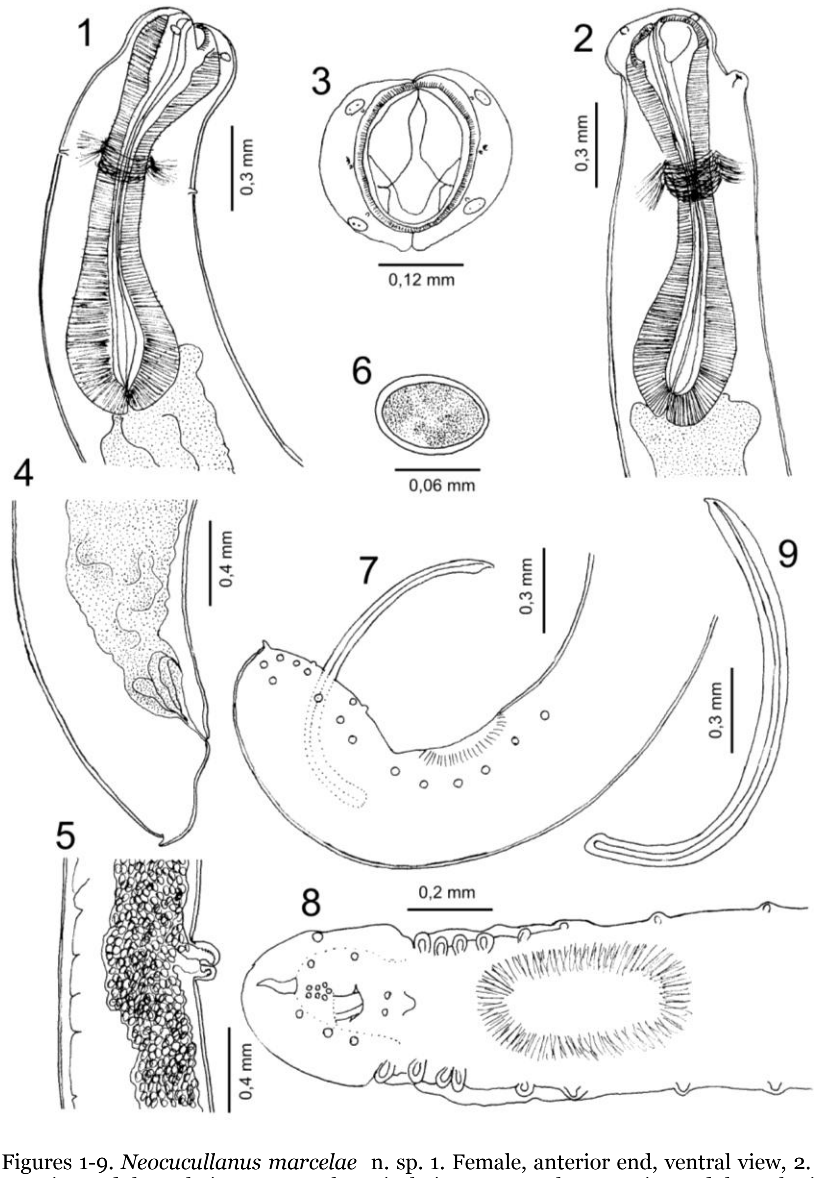
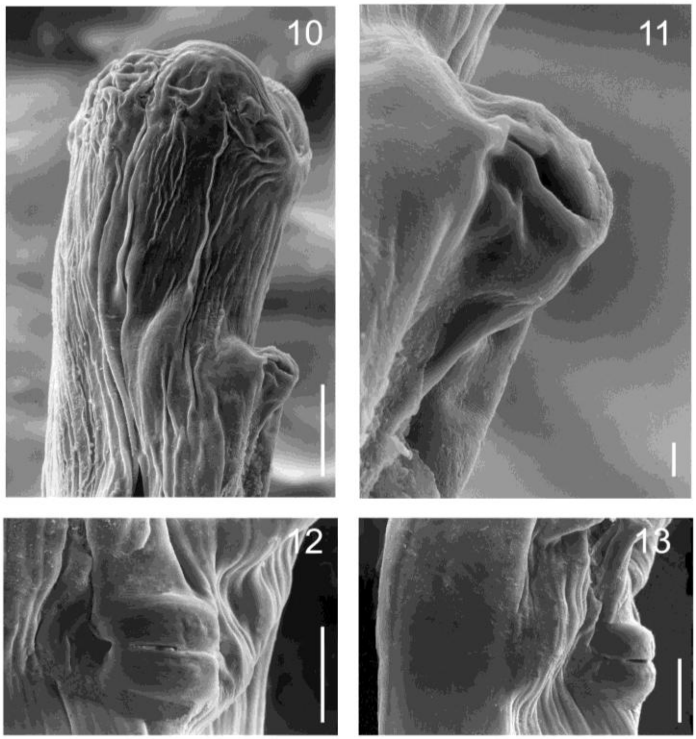
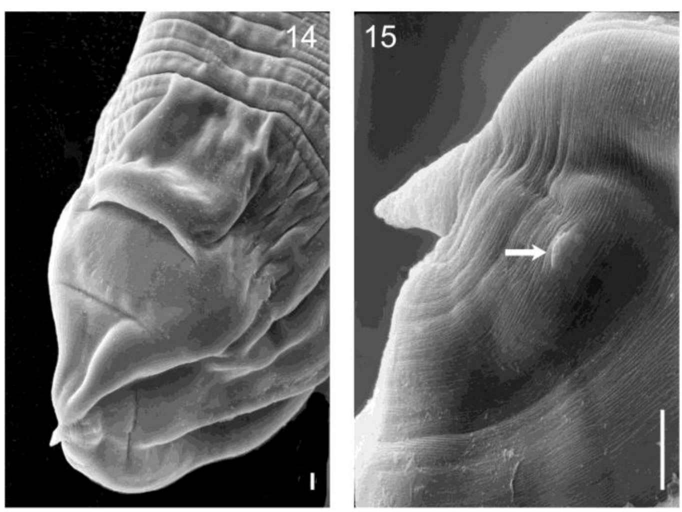


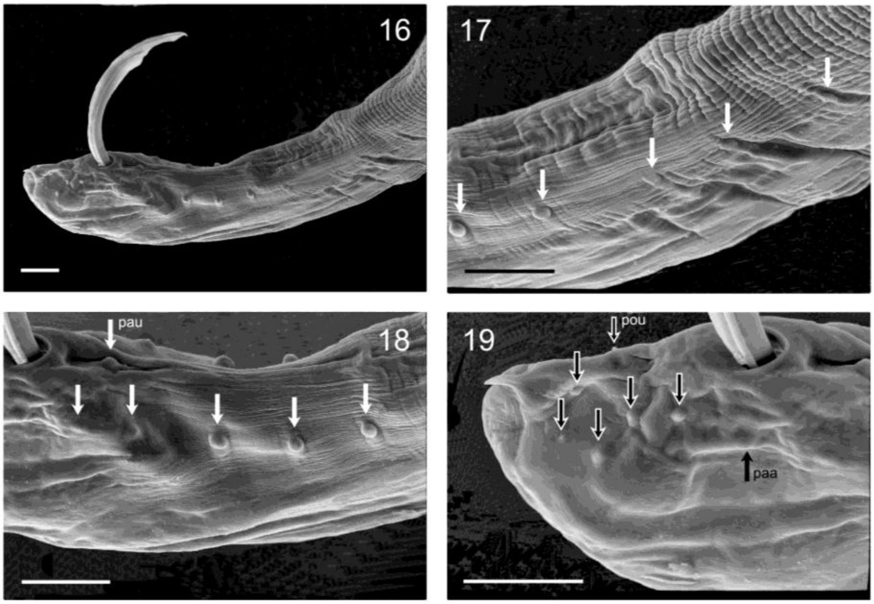
Figures 1-9. *Neocucullanus marcelae* n. sp. 1. Female, anterior end, ventral view, 2. Male, anterior end, lateral view, 3. Female, apical view, 4. Female, posterior end, lateral view, 5. Female, vulva, 6. Egg, 7. Male, posterior end, lateral view, 8. Male, posterior end, ventral view, 9. Spicules.



Figures 10-13. *Neocucullanus marcelae* n. sp. 10. Female, anterior end. Scale = 100 μ, 11. Detail of excretory pore. Scale= 10 μ, 12-13. Vulva. Scale=100 μ.



Figures 14-15. *Neocucullanus marcelae* n. sp. 14. Female, posterior end, 15. Female, phasmid (white arrow).Scales=10 μ .



Figures 16-19. *Neocucullanus marcelae* n. sp. 16. Male, posterior end, ventro-lateral view, 17-18. Preanal papillae (white arrows), 19. Adanal (black arrow) and postanal papillae (highlighted arrows). Scales=100 µ . pau: unpaired preanal papilla; pou: unpaired postanal papilla; paa: adanal papilla.

A NEW SPECIES OF *DORCADION* DALMAN, 1817 FROM TURKEY (COLEOPTERA: CERAMBYCIDAE)

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[Özdikmen, H., Mercan, N. & Cihan, N. 2012. A new species of *Dorcadion* Dalman, 1817 from Turkey (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 7 (1): 550-554**]**

ABSTRACT: The following new taxon is described: *Dorcadion* (*Cribridorcadion*) *narlianum* sp. n. from Turkey, close to *D. complanatum* Ganglbauer, 1884. A short key to the identification of -*cingulatum* species-group is proposed. On the other side, a discussion on taxonomic status of -*cingulatum* species-group is realized.

KEY WORDS: Cerambycidae, Dorcadioninae, *Dorcadion*, new species, Turkey.

During the study of the Cerambycidae from Kahramanmaraş province in Southern Turkey, we have identified a female specimen belonging to a new species of *Dorcadion* Dalman, 1817 which will be described in this paper.

Dorcadion (*Cribridorcadion*) *narlianum* sp. n.

(Fig. 1)

Type serie. Holotype ♀: Turkey, Kahramanmaraş prov.: 5 km S of Narlı, N 37 19 E 37 10, 07.III.2008.

Male unknown.

Description:

Body length: 14 mm.

Body black, covered with rather dense, recumbent, short yellowish-white pubescence. Also head (especially on sides of frons) with stronger, rather long, erect, reddish-brown hairs. The same hairs present on the first antennal segment as semi-recumbent.

Head with fine regular punctuation, with recognizable 2 triangular dark parts on vertex. Antennae totally black or dark reddish-brown. Pronotum with 2 lateral and 1 median longitudinal hairy band. Median band complete and clear. Each medio-lateral part on pronotum (between lateral and median hairy bands) with distinct longitudinal dark part. Punctuation of pronotum coarser on the sides. Also, median longitudinal hairy band with a distinct area that comprise of coarse punctuations, in just in front of the middle. Scutellum small and triangular. Elytra with brownish ground pubescence, each elytron with complete and unmottled 1 lateral band and 1 humeral band, and mottled with dark brown hairs 1 dorsal band (even this band from place to place interrupted with dark brown hairs), short 1 presutural band, and distinct, rather wide 1 sutural band. Also a distinct row of dark brown hairs beside the sutural band. The dorsal band do not reach the humeral band at the apical part of elytron. Pygidium can see above. Legs (especially femora and tibiae) dark reddish-brown. Tarsi black.

Differential diagnosis. The new species is in *-cingulatum* species-group definitely. This group includes 4 species as *D. cingulatum, D. complanatum, D. cingulatoides* and *D. narlianum* sp. n.. Except the later, all species was described from Iran. Only *D. cingulatum* has been recorded from SE Turkey (Özdikmen, 2010; Löbl & Smetana, 2010).

D. complanatum Ganglbauer, 1884 is closely related species to the new species. It is easily distinguished from *D. complanatum* by different design of pronotum, and narrower humeral band and shorter dorsal band that do not reach the humeral band at the apical part of elytron, on elytra (Figs. 1, 2). It is more different from the remaining species (Figs. 3, 4).

The original description of *D. complanatum* Ganglbauer, 1884:

D. complanatum, n. sp.

Mit *D. cingulatum* nahe verwandt, aber in beiden Geschlechtern viel grosser und flacher und dadurch an *D. striatum* erinnernd, von dem es sich durch den Mangel einer Rückenrippe leicht unterscheidet, ♂ schwarz, das erste Fühlerglied und die Beine rothbraun. Kopf mit weisser Mittelbinde und weissgrau pubescenten Seiten, zwei kurze Längslinien auf der Stirne und zwei dreieckige Scheitelmakeln braun seidenschimmernd tomentirt. Halsschild mit spitzigen Seitendornen, an den Seiten grob und dicht punktirt, sehr spärlich grau und braun behaart, auf der Scheibe braun seidenschimmernd tomentirt, zu beiden Seiten der weissen Mittelbinde nach hinten erhoben. Flügeldecken auf dem Rücken ziemlich flach, mit stumpfer, aber fast bis zur Spitze deutlicher Schulterrippe, hellbraun seidenschimmernd tomentirt, die Naht, ein schmaler Seitensaum und eine breitere Schulterbinde schneeweiss, zwei breite, etwas unregelmässige Rückenstreifen, ein Seitenstreifen und einige kleine Makeln auf der Schulterbinde schwarzsammtig. ♀ breiter und flacher, mit stärker vortretender Schulterrippe und deutlich vertiefter ungefleckter Schulterbinde, heller braun tomentirt, die schwarzsammtigen Rückenstreifen scharf gezeichnet, schmal, nach hinten spitzig auslaufend.

Long. 145—17 mm. — Persien.

Von Dr. V. Pias on zur Beschreibung mitgetheilt.

The original description of *D. cingulatum* Ganglbauer, 1884:

D. cingulatum n. sp.

♂schwarz, die Fühler und Beine heller oder dunkler rothbraun. Kopf und Halsschild mit weisser Mittelbinde und dicht weissgrau behaarten Seiten, zwei dreieckige Scheitelmakeln und zwei massig breite Längsbinden auf dem Halsschilde schwarzbraunsammtig tomentirt. Halsschild mit mehr oder minder spitzigen Seitendornen, an den Seiten massig grob punktirt. Flügeldecken mit braunem Grundtoment, die Naht-, eine massig breite, scharfgezeichnete Schulterbinde und eine breite, auf der Innenseite von einem schwarzsammtigen Tomentstreifen gedeckte Seitenbinde weiss. Das braune Grundtoment wird auf dem Rücken ebenfalls zum grössten Theile durch schwarzsammtiges Toment gedeckt und ist oft nur an der Spitze der Flügeldecken erkennbar. Bisweilen ist das schwarzsammtige Toment mehr oder weniger vollständig in zwei Rückenstreifen aufgelöst.

♀auf der ganzen Oberseite mit hell graubräunlichem Toment bekleidet, zwei dreieckige Scheitelmakeln und zwei Längsbinden auf dem Halsschilde dunkler, die Mittelbinde des Halsschildes, sowie die Naht-, Seiten- und Schulterbinde der Flügeldecken weisslich. Flügeldecken neben der Naht, auf dem Rücken und längs der Seitenbinde mit schwarzsammtigen, oft in Makeln aufgelösten, mehr oder minder verkürzten Tomentstreifen. Der Rückenstreifen setzt sich oft nach hinten in eine hellere Rückenbinde fort. Die schwarzsammtigen Streifen können aber auch vollständig fehlen.

Long. 11—135 mm. — Persien.

Von Dr. G. Kraatz und Dr. V. Pias on zur Beschreibung mitgetheilt.

The description of *D. cingulatoides* Breuning, 1946 (ex Breuning, 1962):
Female. Dem male von *cingulatum* GNGLB. und speziell dessen m. *persianum* BREUN. nahestehend, aber außer den normalen Geschlechtsunterschieden durch eine weniger feine Punktierung auf der Stirn, eine gröbere Punktierung des Halsschildes, dessen Seitenhöcker an seinem Vorderrand stärker konvex ist und sich durch die samtschwarze Deckenlängsbinde auf der Scheibenmitte, die die Deckenmitte nicht erreicht, unterscheidet.
Male. Unbekannt.
Von mir nach einem Stück aus Persien: Masenderan beschrieben.

Etymology. From the type locality "Narlı" (Turkey: Kahramanmaraş prov.: Pazarcık).

A short key for *-cingulatum* species-group on the base of females

1. Pronotum with 1 median band and 2 lateral bands of hairy areas.......................**2**

- Pronotal design not suchlike...**3**

2. Humeral band wide, dorsal band reach humeral band at the apical part.............. ....***D. complanatum*** Ganglbauer, 1884

- Humeral band narrower, dorsal band do not reach humeral band at the apical part...***D. narlianum* sp. n.**

3. The velvety-black longitudinal band on elytral disc reach the middle of elytra (not interrupted in the middle of elytra)...........***D. cingulatum*** Ganglbauer, 1884

- Punctuation on the forehead less fine, punctuation of the pronotum coarser, projection on side is in its front edge stronger convex, and the velvety-black longitudinal band on elytral disc do not reach the middle of elytra (interrupted in the middle of elytra)...***D. cingulatoides*** Breuning, 1946

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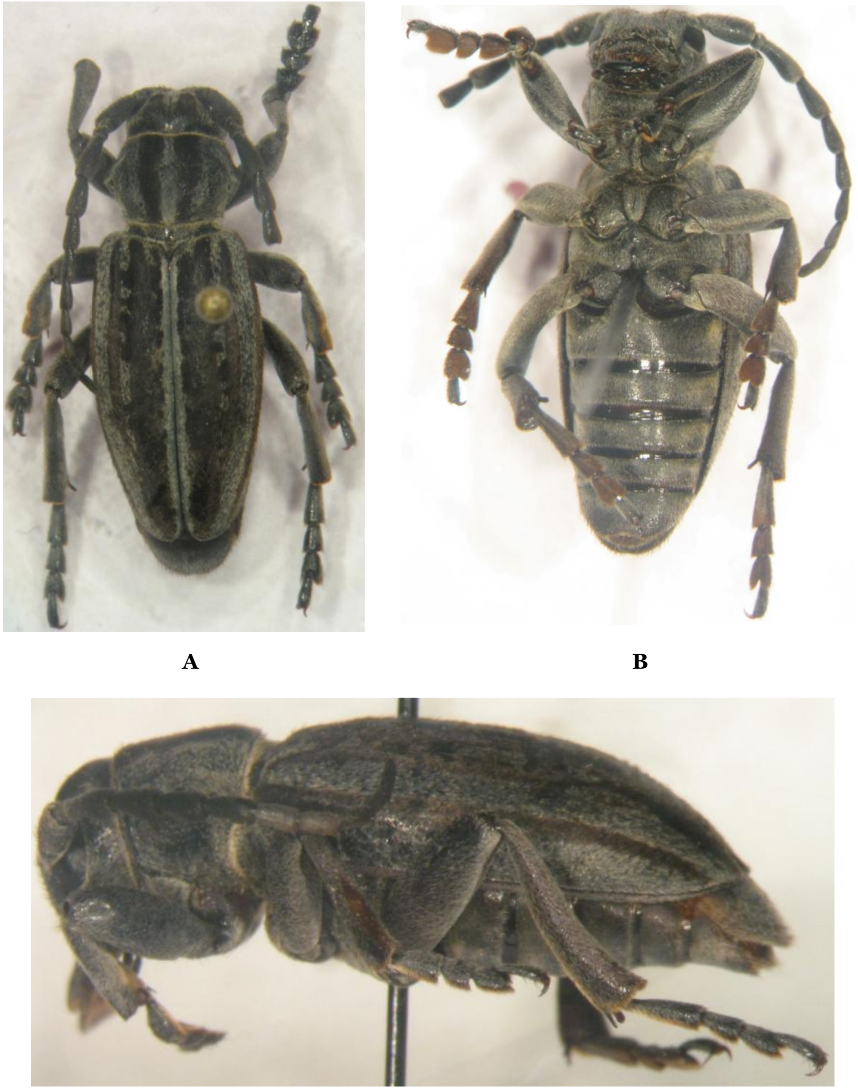

A B

C

Figure 1. *D. narlianum* sp. n. (holotype ♀), A. Dorsal view, B. Ventral view, C. Lateral view.

Figure 2. *D. complanatum* Ganglbauer, 1884.

Figure 3. *D. cingulatum* Ganglbauer, 1884.

Figure 4. *D. cingulatoides* Breuning, 1946.

All photos in this page by M. L. Danilevsky from http://www.zin.ru/ANIMALIA/COLEOPTERA/eng/pedestdn.htm

DEVELEOPMENT OF INTEGRATED PEST MANAGMENT STRATEGIES AGAINST LETTUCE APHID (HEM.: APHIDIDAE)

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[Satar, S., Sangün, O. & Özdemir, I. 2012. Develeopment of integrated pest managment strategies against lettuce aphid (Hem.: Aphididae). Munis EntomologyZoology, 7 (1): 555-567**]**

ABSTRACT**:** This study was carried out to reveal the reasons of extreme insecticide usage for aphid management at lettuce production areas in East Mediterranean Region of Turkey and to develop solution for this problem. While there are seven different aphid species that were determined in lettuce field of the region *Hyperomyzus lactucae* (L.), *Myzus (N.) persicae* (Sulzer), and *Nasonovia ribisnigri* (Mosley), (Hemiptera: Aphididae) is most importanat ones among them. The field surveys of biological control agent in lettuce fields show us that *Metasyrphus corollae* (F.) (Diptera: Sryphidae) and *Sphaerophoria scripta* (L.) were determined as important biological control agents on lettuce aphids, but the most important and hopefull agent was *Fusarium subglutinans*, entomopathogen fungi. Chemical control methods to suppress lettuce aphids populations revealed that among active ingredients named Thiomethoxam, Spirotetramat, Pymetrozine used against lettuce aphids, the first two ones have to be applied before closing heart of the lettuce plant. Thus, pest population can be limited under the economic loss threshold.

KEY WORDS: *Nasonovia ribisnigri*, *Myzus (N.) persicae*, IPM, thiomethoxam, spirotetramat, pymetrozine, lettuce.

With its advantages for agriculture, climate, soil and ecological conditions, East Mediterranean region enables the intensive fruit and vegetable production. Among the vegetables, especially lettuce can be grown both in plain and mountainous areas for four seasons. The size of lettuce production fields could vary from a house garden to large lands of around 100 da size. Total lettuce production in the region accounts for 34% of all production in Turkey, and Mersin (17%) and Hatay (10%) provinces have the largest shares in regional production, which are followed by Adana (6%) and Osmaniye (1%) (Anonymous, 2008).

Lettuce requires relatively less irrigation on account of its growing seasons (Autumn-Spring) compared to other vegetables. Furthermore, lettuce is quite rich in mineral salts like iron, calcium and phosphor as well as A, B, C, D, and E vitamins. For these properties and its fresh consumption, it is a highly economic product widely consumed in Turkey. This economic and healthy vegetable has many harmful pests, of which the most important one is aphids due to direct nutrition and viruses it transfers. Zeren (1989) carried out a study to determine harmful aphids for this vegetable in Cukurova Region, and reported four species including *Aphis craccivora* Koch, *Acyrthosiphum lactucae* (Passerini), *Macrosiphum euphorbia* Thomas and *Myzus (N.) persicae* Sulzer; on the other hand, Toros et al. (2002) performed a study to determine general aphid flora in East Mediterranean Region and reported three aphid species for lettuce including *Acyrthosiphon lactucae* (Passerini), *M. (N.) persicae* (Sulzer) and *Nasonovia ribisnigri* (Mosley). *N. ribisnigri* is accepted as one of the most harmful pest for lettuce in East Mediterranean Region, USA, Europe and Canada (Mackenzie &

Vernon, 1988; Martin et al., 1995; Rufinger et al., 1997; Chaney, 1999; Palumbo, 2000; Palumbo & Hannan, 2002).

Liu (2004) stated that *N. ribisnigri* prefers to live in the heart of lettuce and its chemical combat with contact effective insecticides is quite difficult. Besides, Davis et al. (1997) reported that *N. ribisnigri* is also an important vector for cucumber mosaic and lettuce mosaic viruses. Rufingier et al. carried out a study to determine the resistance of two different *N. ribisnigri* populations to five different insecticides, and reported that aphids showed resistance to all insecticides. On the other hand, other studies stated that chemical combat of this pest is performed with enduring insecticides in general (Eenink & Dieleman, 1982; Van Helden et al., 1992).

In this study prepared with respect to abovementioned points, three different pesticides were applied to lettuce planted on 2 da area of Circulating Capital Enterprise of Cukurova University in three different periods, and a convenient method is developed for the integrated pest management program used on the control plot; in addition, the points to take into consideration for a successful management program and the role of biological combat in this integrated management are emphasized. Consequently, basic information is provided to develop management methods that give particular importance to human health and environment suitable to integrated management as an alternative to current intensive use of insecticides on lettuce fields in Cukurova Region.

MATERIAL AND METHOD

Development of chemical management methods suitable to integrated management with different pesticides against aphid in lettuce

The study carried out to determine the variations in aphid populations on lettuce was performed on Research and Study plot of plant production department of Faculty of Agriculture in Çukurova University. For this purpose, thinning process was repeated for three times on lettuce seedlings (*Lactuca sativa* L. var. Velvet®) on 10 September 2009, 5 January 2010 and 19 April 2010. Seedlings were thinned on soil as double-row in back and 5000 lettuce plants per acre. Prior to each thinning period, 20 kg/acre of bottom fertilizer (15-15-15) was used. 10 kg/acre ammonium nitrate fertilizer was used near the bolting stage of lettuce. During the management of weeds on lettuce field, management was performed by hand pulling over rows and hoeing between rows. Planted lettuce seedlings were obtained from seedling firm by giving lettuce seeds. Special attention was given for seedlings to be free of insecticides while receiving the seedlings obtained from the seeds provided to firm. Thinning process was applied to form four plots in each plantation period. Plot size was kept at 15 X 20 m, and a 2.5 m safety strip was created between plots.

The success rates of three different insecticides (2 certificated and 1 uncertificated) on production field were evaluated in terms of pest management by comparing to control plot. For this purpose, a total of 16 plots were created for four different applications on production field according to randomized blocks experiment pattern (3 insecticides + 1 control plot). The number of aphids on leaves in the center part of randomly selected 10 lettuces plants was counted every week from plantation to harvest. Population development of aphids on plants was followed, and chemical management was decided considering the time before harvest when the development of aphid population reached economic loss threshold (20 individual/plant). The application number was limited to one considering the development of aphid population density and harvest time (Table 1). Lettuce habitus had an important part in insecticide application. Especially, because no or inadequate amount of insecticides can reach aphids in growing cone when head formation stage of lettuce starts, special attention was paid to apply insecticide before the head formation stage.

Aphid species on lettuce plants in the study were taken directly into tubes by means of a fine-lead brush. Preparations were prepared for the sample in tubes, and their exact identifications were made through analysis under microscope.

Determining the natural enemies fed on aphids in lettuce plants

Natural enemies fed on aphid on lettuce plants were investigated on the lettuce field composed of 16 plots in the study for all the periods including the 1st, 2nd and 3rd plantation. For this purpose, it was tried to take parasitoid, hunter and entomopathogens detected during weekly population follow-ups, and consequently, parasitoids are taken into culture, while minor hunters were given aphids to allow them reach puberty and entomopathogens were directly sent to an expert for identification.

Hunter Coccinellidae species were diagnosed by Prof. Dr. Nedim Uygun, Sryphidae species by Prof. Dr. Faruk Özgür and Entomopathogen fungus species by Assist. Prof. Dr. Evrim Arıcı. A limited number of parasitoid mummies were encountered in the study, and these parasitoids were not identified.

Statistical analyses

The study was performed in accordance with the randomized block experiment pattern, and the differences between applications were observed on weekly basis as of insecticide use date. The differences between study results and control group were tested by variance analysis. A multiple comparison test was applied to detect the different application when a difference was found between applications and control group.

Mortality rates (%) of insecticides were calculated with respect to control by Henderson Tilton equation (Karman, 1971). The equation is as follows:

$$\text{Correted Mor. (\%)} = \left\{1 - \frac{\text{n in Co before treatment} \quad \text{X} \quad \text{n in T after treatment}}{\text{n in Co after treatment} \quad \text{X} \quad \text{n in T before treatment}}\right\} \text{x } 100$$

Mortality rates (%) of insecticides were calculated with respect to control by Henderson Tilton equation (Karman, 1971). The equation is as follows:

Where n: number of living aphids in parcel, T: insecticide treated parcel, and Co:control parcel.

Arcsin transformation was applied to percentage effects obtained from the equation, and then they were subjected to statistical analysis (Duncan Multiple Comparison Test) at 5% significance level by means of Totemstat Package Software.

STUDY RESULTS AND DISCUSSION

Development of chemical management methods suitable to integrated management with different pesticides for aphids on lettuce

The identification of samples taken during population follow-ups from the plots in Circulating Capital Enterprise of Agriculture Faculty of Cukurova University revealed that samples were composed of *N. ribisnigri*, *M. (N.) persicae* and *H. lactucae* species. Considering the frequency rates of species, the first species was determined at 68% and the second species was determined at 24%. On the other hand, the frequency rate of *Hyperomyzus lactucae* was found as 8%.

For this reason, studies performed both in insecticide experiments and other experiments were accepted to be carried out on *N. ribisnigri* and *M. (N.) persicae* constituting over 90% of the population.

Lettuce cultivation was performed in three different times, the first of which occurred on 9 October 2009. Experiments were prepared with four repetitions according to randomized block design. Thiomethoxam (Actara 240 SC), Spirotetramat (Movento SC 100) and Pymetrozine (Plenum WG50) preparations were used in the experiments, control plots were taken into account for comparison purposes.

Following the preliminary count of aphid, count was repeated on the 3rd, 7th and 14th days after insecticide application (Table 2).

In the study, biological activity percentages were evaluated in the table formed by Actara counts on the 3rd, 7th and 14th days, and consequently, the biological activity levels were found as 98.6%, 97.93% and 97.09%, respectively, while the biological activity level of Movento was determined as 98.87%, 99.96% and 99.71%, respectively (Table 2). The evaluation of biological activity levels revealed that both insecticides had very high biological activity. On the other hand, biological activity of Plenum was determined rather low as 33.35%, 44.67% and 41.34%, respectively (Table 2). The reason of this situation is attributed to the low activity of Plenumun against aphid on lettuce, which has antifeedant characteristic and no systemic effect. It is more useful to apply and retry this insecticide before the formation of aphid population. However, in this case, pestiide should be used more frequently for the control of aphid on growth cone of rapidly and actively growing lettuce plants. In the comparison of biological effects of three inseticides, no statistically significant difference was detected between Actara and Movento for all the three days, while a significant difference was detected between these two insecticides and Plenum (Table 2).

The second lettuce cultivation was performed on 10 January 2010, and biologic effect of Actara was determined as 92.96%, 98.87% and 82.57%, respectively, while the biologic effect of Movento was 91.96%, 98.51% and 95.23%, respectively (Table 3). Plenum demonstrated higher effects compared to its performance in the first cultivation, but its effects were lower than those of Actara and Movento. In the statistical evaluation, no significant difference was detected between Plenum and other pesticides (Tables 4,5). As a result of this study, the results in Table 2 and 3 were found parallel.

The third lettuce cultivation was performed on 30 April 2010, but the insecticide experiment could not be made as the aphid population did not form at the time. The reason for the absence of aphid population was attributed to negative effects of increasing temperatures as of May and aphid did not prefer lettuce and could not develop on lettuce on account of the rancidity of lettuce with milk formation.

In the study, it was determined that pesticide application time had no significant effect on biologic activity of insecticide used on lettuce. Near the harvest of lettuce, a habitus bolting and covering the developing bolt formed. This structure appearing in the last stage of lettuce corresponds with the period when pest approaches the economic loss threshold. In the integrated management, spending time on the economic loss threshold without using chemical management methods could cause not to obtain the desired success in lettuce plant. For this reason, it is required to establish an early warning system in the pest management method for this plant, and based on this system, a management threshold should be formed without spending time on pest population in the field. In the early warning system trapping winged animals, water traps or siphon traps with certain height are widely used in Europe and America to control aphids on potato and fodder plants and epidemic virus carried by aphids (Tatchell, 1985).

Satar et al. (2011) reported that the number of aphids falling into water trap for 8 months was 191, and the number of species was 12 in their study carried out on lettuce lands to follow up population with water traps. In addition, the species of *H. lactucae* (41%), *N. ribisnigri* (16%) ve *M. (N.) periscae* (24%) accounted for 81% of the total population captured on lettuce and *N. ribisnigri*, an important pest of lettuce, was reported to fall into traps in October and February months when the 1^{st} and 2^{nd} product lettuce cultivation was performed and started to grow. This is one of the findings suggesting that this pest is identified with lettuce. In this study, the population of aphids on lettuce was observed to increase in lettuce cultivation period or at 18-23°C.

Table 4 and 5 demonstrate the weekly changes in aphids, insecticies and control group data on the 1^{st} lettuce cultivation field which was planted on 10 October 2009 by randomized block design. As can be seen in the tables, pest population was low for all the four characters until October, while an increase was noted in population at the end of October and beginning of November. As a result of the pesticide application made after this increase, population was found near zero on fields subjected to Actara and Movento plots; however, it started to increase in Plenum and Control plots. The initial weeks of November during which the population started to increase corresponded with period when the mean temperature declined to 20°C (Figure 2). This increase lasted until lettuce harvest.

The results of the statistical analysis performed according to randomized block design of the first experiment are given in Table 4.

In the investigation of Table 4, the effect of interaction was found significant for four experiments. DUNCAN multiple comparison test was applied to determine the significant ones, and the results are given in Table 5.

When the columns in Table 5 are investigated in order, an increase is noted for Actara as of the 5^{th} week and a considerable decrease is observed in the mean value as of the 6^{th} week. Similarly, in the investigation of Movento, a considerable decrease is noted beginning on the 6^{th} week when the pesticide was applied. On the other hand, in the investigation of Plenum, no effect is determined and the increase continued after the 6^{th} week when the pesticide was applied. Lastly, there was also a constant increase observed in the control group.

The results of DUNCAN test performed for three insecticides and their differences with control group for each week revealed no significant difference between these four groups during the initial three weeks. Flowing the 5^{th} week, Actara and Movento was considered in the same group, while Plenum and Control remained in the same group, and this grouping became definite as of the 6^{th} week, and maintained this situation until the last measurement week. In this case, Actara and Movento formed a group, and Plenum and Control formed another group (Table 5).

Seedlings on the second cultivation plot were thinned on 5 January 2010.about one week later than this cultivation time, population follow-up was started. Population followed a course lower than economic loss threshold for all characteristics until the end of March. This low population was observed especially from February to the end of March. Climate records during these months demonstrated that humid atmosphere resulting from the rain showers starting at 11 February and lasting until the last week of March was one of the main reasons for low population of *Fusarium subglutinans* (Wollenw & Reinking) which develops well in the humid weather. Both in population follow-up studies performed in field and surveys, there were many populations killed by entomopathogen in rainy seasons. For this reason, this supported the idea that the fungus has a natural enemy which should be investigated. Similar results were reported by some researchers studying in Cukurova Region and also by some laboratory studies (Biçer 1998, Erkılıç et al. 1999, Satar 2004). The situation of the population on the second plot increased between the beginning and end of March with no specific rainfall (Table 7 and Figure 2). Population reached its maximum in all plots especially at the end of March. The mean temperature changed between 15-22 °C for the same period. This is the most suitable air temperature for the development of *N. ribisnigri* (Pulambo and Hannan 2002). A decrease was also noted in control group plots in April due to the increasing temperature similar to plots subjected to pesticide applications (Table 7 and Figure 2).

The results of the analysis performed by randomized block design of the second experiment are given in Table 6.

Table 6 indicates the important effect of interaction for four experiments. DUNCAN multiple comparison test was applied to determine the important ones, and the results are given in Table 7.

There is a significant increase for Actara in the second experiment starting from the 10^{th} week when the columns in Table 7 are separately investigated; however, a significant decrease is noted as of the 12^{th} week when the pesticide application was performed. An increase was observed for Movento starting from the 11^{th} week, and similarly, a significant decrease was noted as of the 12^{th} week. Similar decreases were also observed for Plenum and control groups starting from the 12^{th} week, but the population number was determined high. The results of DUNCAN test performed to determine the difference in three insecticides and their differences with control group demonstrated that there was no significant difference between four groups for nearly the initial 6 weeks, and especially Actara and Movento were determined in the same group, while Plenum and Control were characterized in the same group as of the 14^{th} week. In this case, Actara - Movento and Plenum – Control formed two separate groups.

The last lettuce cultivated field was subjected to thinning process on 19 April 2010. Subsequently, aphid population on lettuce leaves was followed. No evident aphid population occurred on the third cultivation plot, and with the increasing air temperature, it grew rapidly and milky formation (rancidity) was observed on lettuce in bolting stage. As a result of the increasing temperature and milky formation, no population could develop on lettuce (Figure 2).

Natural enemies of aphids observed in lettuce fields in East Mediterranean Region

In the field studies performed on areas of Circulating Capital Enterprise of Agriculture Faculty of Cukurova University between October 2009 and May 2010, some natural enemies were detected for aphid species; however, their occurrence frequencies were quite low (Table 8). Pest activity is generally low between October and March, which is also the period of lettuce cultivation, due to the low air temperature.

Species in Sryphidae family of Entomoafag pests was the most frequent species, followed by Coccinella septempunctata L. in Coccinellidae family (Table 8). All of these snatural enemies in Insecta class were collected from lettuce experiment plots in Balcalı Campus of Cukurova University. In the fields studies performed in lettuce lands in the region, no natural enemy was detected from Insecta class. In addition, *F. subglutinans* of Entomopathogen fungus was a natural enemy observed in all lettuce fields in the region. Similarly, Erkılıc et al.

(1999) detected 7 species of Hyphomycetes class in aphids in East Mediterranean Region and determined the highest mortality rate for *F. subglutinans* under climate room conditions. Bicer (1998) reported that *F. subglutinans* was isolated from *N. ribisnigri* aphid on lettuce. Satar (2004) performed a study to determine the biologic activity of *F. subglutinans* under greenhouse conditions, and reported that aphid population was completely suppressed after two weeks of fungus application. In the field studies, the aphid populations observed in the second lettuce cultivation demonstrated an evident decrease especially after rainfall.

CONCLUSION

The present study performed on lettuce cultivation fields between 2009 and 2010 determined that *N. ribisnigri* and*M. Persicae* populations could exceed the economic loss threshold. Furthermore, producers and consumers demand that there should be no pest on lettuce, and thus the market price of lettuce with aphid damage decreases. Consequently, produces do not comply with the economic loss threshold or the criteria of other integrated management methods in insecticide application. On the other hand, pests on lettuce plants with 8-10 weeks of production period and fresh consumed should be suppressed in a way that poses no threat to human and environment health. In addition, habitus differences of the plant like leaves bound to main body, overlapping leaves, heading in the later seasons and closing growth cone limit the use of contact and systemic insecticides on this culture plant. *M. corollae* and *S. scripta* are important hunters and natural enemies of aphids on lettuce, but they are inadequate in number, while F. *subglutinans* has a chance in combat against these pests and should be further investigated in field studies. It was concluded that thiomethoxam (Actara) and spirotetramatnun tried in chemical management could reduce the level of pest under economic loss threshold with correct applications on correct times contrary to its previous 4-5 applications in lettuce production. For this reason, establishing an early warning system which determines the population through water or siphon traps that can capture the winged creatures for aphid management on lettuce and enables the management before reaching the economic loss threshold will increase the success rate of insecticide applications and protect human and environment health by avoiding unnecessary insecticide use.

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Table 1. Commercial names, application doses and waiting periods of insecticides to be used in lettuce cultivation fields.

Product	Effective agent	Application dose	Waiting period
Actara 240SC	Thiomethoxam	20ml/da	7 days
Movento SC100	Spirotetramat	75ml/da	3 days
Plenum 50WG*	Pymetrozine	25gr/da	7 days
Kontrol	Water	-	-

*uncertificated for lettuce. However, it is a suitable insecticide with antifeedant effect for the management of aphids.

Table 2. Biological activity was measured based on the Handerson-Tilton Equation of three different insecticides on the first lettuce product.

Insecticide (dose/ decare)	Repetition	Preliminary count	3rd day	7th day	14th day	Efficiency %*		
						3rd day	7th day	14th day
Actara 240 SC 20ml/hl	I	12	19	1	51	96.43	99.84	9397
	II	16	2	0	0	98.88	100.00	100.00
	III	25	4	25	0	96.95	91.88	100.00
	IV	26	0	0	8	100.00	100.00	94.38
	Mean	19.8	6.3	6.5	14.8	98.06 a**	97.93 a	97.09 a
Movento SC 100 75 ml/hl		4	3	0	29	99.81	100.00	98.86
		4	3	0	0	99.58	100.00	100.00
	III	38	2	0	0	97.68	100.00	100.00
	IV	22	2	2	0	98.40	99.15	100.00
	Mean	17.0	2.5	0.5	7.3	98.87 a	99.79 a	99.71 a
Plenum WG 50 15 g/hl	I	36	156	94	141	12.03	54.68	49.97
	II	20	121	82	113	15.38	18.08	20.98
	III	25	41	112	264	68.71	63.62	41.78
	IV	24	72	124	73	37.25	42.29	52.64
	Mean	26.3	97.5	103.0	147.8	33.35 b	44.67 b	41.34 b
Control	I	57	112	131	178			
	II	22	130	91	130			
	III	52	63	148	218			
	IV	27	102	191	137			
	Mean	39.5	101.8	140.3	165.8			

*Biological activity averages were subjected to arcsin transformation before the statistical analyses. **When the average values were observed from top to down, the difference was concluded statistically significant by Duncan test if it did not contain the same value on condition that it should be separately investigated for each day (α=0.05).

Table 3. Biologic activities of three different insecticides on the second product lettuce plants by Handerson-Tilton equation.

Insecticide (dose/ decare)	Repetition	Preliminary count	3rd day	7th day	14th day	Efficiency %* 3rd day	Efficiency %* 7th day	Efficiency %* 14th day
Actara 240 SC 20ml/hl	I	268	3	1	2	89.44	97.12	92.59
	II	283	20	2	17	85.26	98.36	50.20
	III	199	3	0	0	97.14	100.00	100.00
	IV	390	0	0	1	100.00	100.00	87.30
	Ort.	285.0	6.5	0.8	5.0	92.96 a**	98.87 a	82.52 a
Movento SC 100 75 ml/hl	I	222	7	2	0	79.59	95.23	100.00
	II	205	5	2	9	97.33	98.81	80.90
	III	134	10	0	0	93.59	100.00	100.00
	IV	284	1	0	0	97.31	100.00	100.00
	Ort.	211.3	5.8	1.0	2.3	91.96 a	9.51 a	95.23 a
Plenum WG 50 15 g/hl	I	359	11	11	31	48.14	57.57	-53.76
	II	375	16	21	29	84.38	77.17	-12.58
	III	380	12	7	30	78.18	79.85	-48.05
	IV	354	10	10	10	66.48	66.48	-15.23
	Ort.	367.0	12.3	12.3	25.0	69.29 b	70.27 b	-32.41 b
Control	I	94	81	99	77			
	II	230	167	150	42			
	III	220	95	60	35			
	IV	96	110	110	32			
	Ort.	160.0	113.3	104.8	46.5			

*The mean biologic activities were subjected to arcsin transformation before statistical analysis. ** When the average values were observed from top to down, the difference was found statistically significant if it did not contain the same letter when separately investigated for each day (α=0.05).

Table 4. Variance analysis table for Actara, Movento, Plenum and Control groups included in the first lettuce cultivation plot.

Sources	Degrees of freedom	Actara	Movento	Plenum	Control
		Sum of squares	Sum of squares	Sum of squares	Sum of squares
Interaction	1	149.511**	152.100**	5848.336**	8084.544**
week	8	146.389**	128.400**	7903.739**	10110.056**
repetition	3	120.000	12.456	554.697**	481.656**
week*repetition	24	271.300**	101.644**	3883.328**	3519.544**
error	324	844.800	695.400	10076.900	16954.200

**P<0.05 significance level

Table 5. Population development of *Nasanovia ribisnigri* in Actara, Movento, Planum and Control groups experimented in the first lettuce cultivation plot .

Weeks	n	Actara	Movent	Plenum	Control
		$\overline{X} \mp SH$	$\overline{X} \mp SH$	$\overline{X} \mp SH$	$\overline{X} \mp SH$
02.10.20099	40	0.02±0.023^{aA}	0.10±0.05^{aA}	0.05±0.03^{aA}	0.27±0.10^{aB}
14.10.20099	40	0.05±0.03^{aA}	0.67±0.17^{abA}	0.45±0.16^{aA}	0.37±0.14^{aA}
21.10.2009	40	0.07±0.04^{aA}	0.42±0.11^{aA}	0.50±0.21^{aA}	0.40±0.11^{aA}
28.10.2009	40	0.17±0.06^{aA}	0.27±0.08^{aA}	1.50±0.24^{aB}	0.25±0.08^{aA}
11.11.2009	40	0.67±0.22^{bA}	1.15±0.32^{bcAB}	2.45±0.60^{aBC}	2.85±0.57^{aC}
18.11.2009*	40	1.97±0.39^{cA}	1.70±0.54^{cA}	2.62±0.73^{aB}	3.95±0.60^{aB}
02.12.2009	40	0.62±0.23^{abA}	0.25±0.08^{aA}	9.75±2.34^{bB}	10.17±1.92^{bB}
09.12.2009	40	0.65±0.25^{abA}	0.05±0.03^{aA}	10.30±2.48^{bB}	14.02±2.26^{cC}
21.12.2009	40	1.48±0.62^{bcA}	0.72±0.16^{abA}	14.77±2.34^{cB}	16.57±2.41^{cB}

[a] When the average values were observed from top to down, the difference was found statistically significant by DUNCAN test if it did not contain the same letter when separately investigated for each day. [A] When the average values were observed from left to right, the difference was found statistically significant by DUNCAN test if it did not contain the same letter when separately investigated for each day. *insecticide application date

Table 6. Variance analysis table for Actara, Movento, Plenum and Control groups taken in the experiment on the second lettuce cultivation plot.

Sources	Degrees of freedom	Actara	Plenum	Movento	Control
		Sum of squares	Sum of squares	Sum of squares	Sum of squares
Interaction Week	1	9408.960**	6706.727**	8573.357**	7259.282**
Repetition	14	28678.240**	15658.023**	9764.183**	4594.093**
Week*repetition	3	100.333	55.473	487.510	18.645
Error	42	2505.067	1665.777	14428.947**	5695.680**
	540	25745.400	21454.000	45678.367	19901.300

**P<0.05 significance level

Table 7. Population development in Actara, Movento, Plenum and Control groups experimented on the second lettuce cultivation plot.

Weeks	n	Actara	Movento	Plenum	Control
		$\overline{X} \mp SH$	$\overline{X} \mp SH$	$\overline{X} \mp SH$	$\overline{X} \mp SH$
14.01.2010	40	1.37 ± 0.27^{aA}	1.87 ± 0.40^{abA}	1.85 ± 0.36^{aA}	1.45 ± 0.29^{abA}
21.01.2010	40	1.45 ± 0.71^{aA}	1.85 ± 0.86^{abA}	2.07 ± 0.32^{aA}	1.47 ± 0.37^{abA}
28.01.2010	40	1.12 ± 0.51^{aA}	1.57 ± 0.61^{abA}	1.80 ± 0.34^{aA}	1.52 ± 0.29^{abA}
04.02.2010	40	1.57 ± 0.57^{aA}	1.87 ± 0.82^{abA}	1.17 ± 0.31^{aA}	1.35 ± 0.29^{abA}
11.02.2010	40	1.62 ± 0.62^{aA}	1.70 ± 0.94^{abA}	1.77 ± 0.52^{aA}	1.17 ± 0.28^{abA}
18.02.2010	40	3.17 ± 1.11^{aA}	2.80 ± 1.04^{abcA}	3.10 ± 0.49^{aA}	4.05 ± 2.51^{abcA}
25.02.2010	40	3.27 ± 1.60^{aAB}	5.62 ± 2.30^{cA}	3.00 ± 0.62^{aB}	3.70 ± 0.72^{abcAB}
04.03.2010	40	3.27 ± 1.46^{aA}	2.82 ± 1.92^{abcA}	4.15 ± 1.38^{aA}	3.65 ± 1.09^{abcA}
11.03.2010	40	1.30 ± 0.77^{aAB}	1.02 ± 0.62^{abB}	2.82 ± 1.23^{aBC}	0.65 ± 0.26^{aA}
18.03.2010	40	2.27 ± 1.18^{aAB}	2.40 ± 1.14^{aA}	1.92 ± 0.45^{aAB}	4.27 ± 1.17^{bcB}
25.03.2010	40	8.55 ± 3.91^{bB}	3.80 ± 1.28^{bcAB}	5.77 ± 1.02^{aA}	5.97 ± 2.72^{cAB}
01.04.2010*	40	28.50 ± 6.08^{cB}	21.12 ± 6.49^{dB}	36.70 ± 6.55^{bC}	12.25 ± 2.13^{dA}
08.04.2010	40	0.65 ± 0.32^{aA}	0.57 ± 0.41^{abA}	1.22 ± 0.81^{aB}	4.30 ± 0.46^{bcC}
15.04.2010	40	0.07 ± 0.42^{aA}	0.10 ± 0.09^{aA}	1.22 ± 0.81^{aB}	3.17 ± 0.43^{abcB}
22.04.2010	40	0.50 ± 0.31^{aA}	0.22 ± 0.31^{aA}	2.50 ± 1.31^{aB}	3.17 ± 0.43^{abcB}

[a] When the average values were observed from top to down, the difference was found statistically significant by DUNCAN test if it did not contain the same letter when separately investigated for each day. When the average values were observed from left to right, the difference was found statistically significant by DUNCAN test if it did not contain the same letter when separately investigated for each day *Insecticide application date

Figure 8. Natural enemies detected on lettuce plants in Circulating Capital Enterprise of Agriculture faculty of Cukurova University between October 2009 and May 2010.

Order	**Family**	**Number**	**Species**
Diptera	Syrphidae	15	*Metasyrphus corollae* (Fabr.)
		9	*Sphaerophoria scripta* (L.)
Neuroptera	Chrysopidae	2	*Chrysoperla carnea* (Stephens)
Coloptera	Coccinellidae	12	*Coccinella septempunctata* L.
Hypomycetes*		-	*Fusarium subglutinans* (Wol. & Rein.)

*Entomopathogen fungus

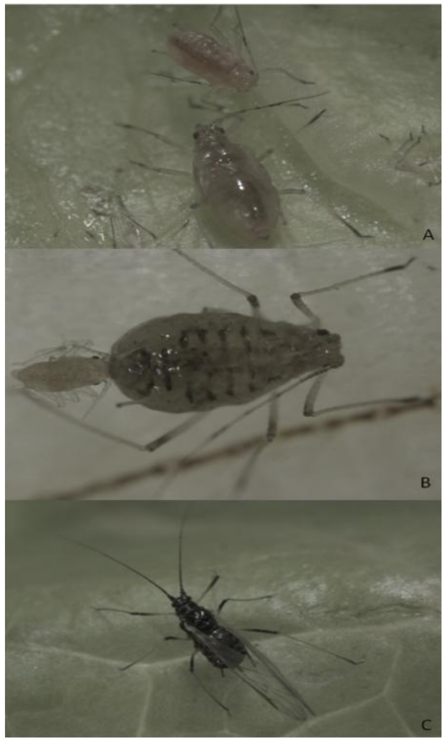

Figure 1. Winged and wingless nympha (A) of *Nasonovia ribisnigri* (Mosley), adult spawning wingless creatures (B) and winged adult (C).

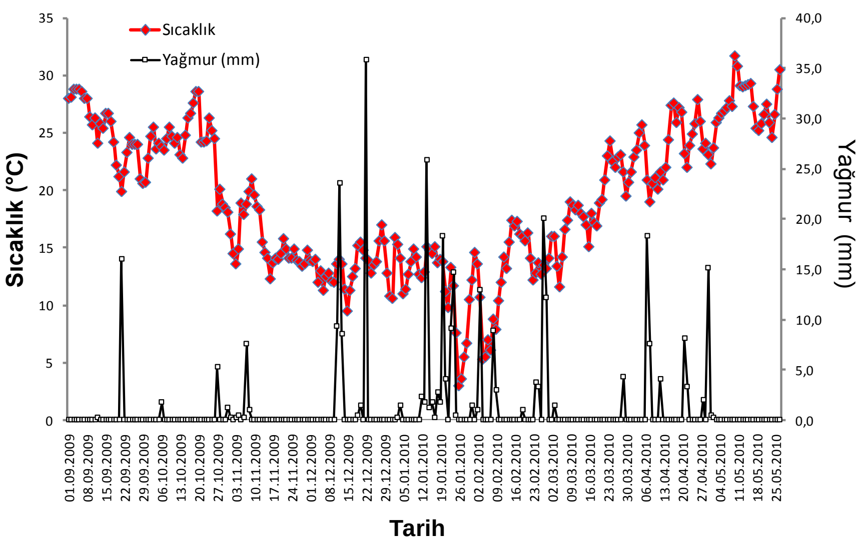

Figure 2. Daily temperature and rainfall values between 1 September 2009 – 25 May 2010 for Balcalı Campus, Faculty of Agriculture, Çukurova University (Anonymous, 2010).

LONGHORNED BEETLES OF KIRIKKALE PROVINCE IN TURKEY (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT: This work is the first attempt for entire longhorned beetles fauna of Kırıkkale. All known taxa from Kırıkkale province are given with new faunistical data in the present text. 31 species are new records for Kırıkkale province. *Pedostrangalia verticenigra* (Pic, 1892) is also the first record for Central Anatolian Region of Turkey. Moreover, *Phytoecia rufipes rufipes* (Olivier, 1795) is also the first report for the northern half of Turkey.

KEY WORDS: Cerambycidae, Coleoptera, fauna, new records, Kırıkkale, Turkey.

The research area of the present work covers Kırıkkale province. Kırıkkale is located at 39°51' North, 33°30' East coordinates. It is placed in Central Kızılırmak part of Central Anatolian Region. It is bounded by Çankırı province in the North, Çorum province in the North-East, Yozgat province in the East, Kırşehir province in the South-East, Ankara province in the West and South. Kırıkkale province has 8 counties as Bahşılı, Balışeyh, Çelebi, Delice, Karakeçili, Keskin, Sulakyurt and Yahşihan. (Map 1).

Its Mountains are placed on slope in which Çamlıca, Karakaya ve Kırıkkale hills in north of the provincial territories descend to the plain level. The elevation of province is about 700 m. Koçu Mt. that extends direction in Northwest-Southeast, has 4 km width and 7 km length. Its highest point is Yığlıtepe (1278 m). Denek mountain range in South and Souteast of the province that extends between Keskin and İzzettin village in South of Çoruhözü valley, has 30 km width and 44 km length. Its highest points are Gavur hill (1742 m) and Bozkaya hill (1577 m). Küre Mt. extends direction in Northeast-Southwest. Its highest point is Küre hill (1450 m).

The areas which contains plains, are too few in the province. The most important plain is Kırıkkale plain.

Plateaus of which elevations change 1200 and 1600 m., occur in Kırıkkale province. These are: Hodar, Bedesten, Kamışlı, Sarıkaya in Küre Mt.; Koçu in Koçu Mt.; Gümüşpınar, Pehlivanlı, Suludere, Yeşilkaya, Azgın in Denek Mt..

Kırıkkale has two different types of vegetation, namely "Step vegetation" and "Forest vegetation". Dominant vegetation in the province is step formation. The forestal areas that forms from dwarf oaks and partly junipers, are in Koçubaba Mt. in North and Denek Mt. in South.

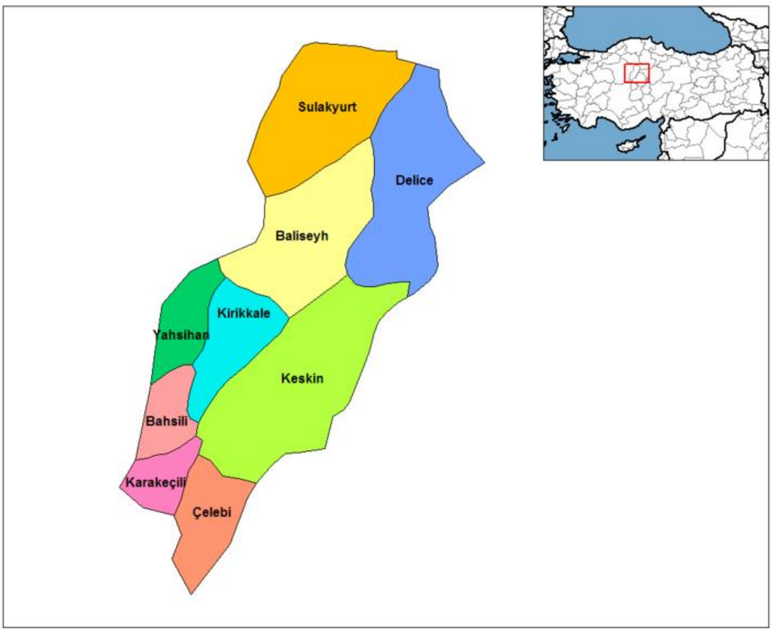
The territory is in massif of Kırşehir that extends along the Keskin, Hirfanlı, Kesikköprü, Kırıkkale and Kızılırmak.

Kırıkkale has a continental climate (Köppen climate classification *Dsa*) and semi-arid climate (Köppen climate classification *BSk*), with cold and snowy winters and hot and dry summers. Rainfall occurs mostly during the spring and autumn. In the province, the direction of prevailling wind is North-East. Relative humidity is 63%. Pressure is 929.8 hPa.

This fauna is known too few. Only 8 species have been recorded from Kırıkkale province until the present work. So the longhorned beetles fauna of

Kırıkkale has not been studied completely until now. More detailed information of most evaluated species in the text can obtain in the works of Özdikmen (2007, 2008a,b and 2011) and Sama et al. (2012).

In this work, new faunistical data are presented. Besides, according to cited literatures, all known taxa from Kırıkkale province are also given in the text. So I determined that the longhorned beetles fauna of Kırıkkale province consists of 40 species (belong to 6 subfamilies, 22 genera). However, it must be suppose that the fauna is richer from determining fauna now. Since some known taxa in Turkish fauna should be presented in this region. But the taxa which can be supposed in this area are not mentioned in the present text. Consequently it would be expected that a number of additional species and new records are to be expected to occur in Kırıkkale.



Map 1. Kırıkkale province and its counties.

ARRANGEMENT OF INFORMATION

Information in the present text is given in the following order:

The subfamily and the tribe names are given simply.

For the genus and subgenus names, the type species are provided under the taxon names.

For each species, the whole subspecies are provided under the taxon names.

The data, **Material examined, Old records in Kırıkkale, Records in Turkey, Remarks** and **Chorotype** under the title for each taxon is given.

Material examined. Material examined that is provided for some taxons covers the original records for Kırıkkale province in Turkey. The most materials were collected from various localities in Kırıkkale. They are deposited in Gazi University (Ankara).

The data under the title of Material examined are given according to the following outline as possible as:
Kırıkkale[1]: Yahşihan[2], Küçükalan[3], 14.VI.2009[4], 2 specimens[5] ([1] Administrative district (Province); [2] Town; [3] Village; [4] Collecting date (day/month/year); [5] Number of specimens).
Old records in Bolu. These parts include previous records that have been given by various authors in different literatures from Kırıkkale. The whole records are evaluated with localities in related references. Each record is accompanied by the author's name and publication date of the related reference.
Records in Turkey. The abbreviations of the provinces and lands in Turkey are given in paranthesis. These parts include previous records that have been given by various authors in different literatures.
Remarks. In these parts, taxonomical and nomenclatural problems are discussed for some taxons and are given regional and general distribution range in Turkey chiefly.
Chorotype. The present zoogeographical characterization is based on the chorotype classification of Anatolian fauna, recently proposed by Vigna Taglianti et al. (1999). In the text, a possible chorotype description can be identified for each taxon. But this kind of description cannot be possible for some taxons, so two or more chorotypes are used for them.

ABREVIATIONS OF THE PROVINCES AND LANDS IN TURKEY

ADANA (AD)	ELAZIĞ (EL)	MANİSA (MN)
ADIYAMAN (ADY)	ERZİNCAN (ER)	MARDİN (MR)
AFYON (AF)	ERZURUM (EZ)	MUĞLA (MG)
AĞRI (AG)	ESKİŞEHİR (ES)	MUŞ (MU)
AKSARAY (AK)	GAZİANTEP (GA)	NEVŞEHİR (NE)
AMASYA (AM)	GİRESUN (GI)	NİĞDE (NI)
ANKARA (AN)	GÜMÜŞHANE (GU)	ORDU (OR)
ANTALYA (ANT)	HAKKARİ (HA)	OSMANİYE (OS)
ARDAHAN (AR)	HATAY (HT)	RİZE (RI)
ARTVİN (ART)	IĞDIR (IG)	SAKARYA (SA)
AYDIN (AY)	ISPARTA (IP)	SAMSUN (SM)
BALIKESİR (BL)	İÇEL (IC)	SİİRT (SI)
BARTIN (BR)	İSTANBUL (IS)	SİNOP (SN)
BATMAN (BA)	İZMİR (IZ)	SİVAS (SV)
BAYBURT (BY)	KAHRAMANMARAŞ (KA)	ŞANLIURFA (SU)
BİLECİK (BI)	KARABÜK (KR)	ŞIRNAK (SK)
BİNGÖL (BN)	KARAMAN (KM)	TEKİRDAĞ (TE)
BİTLİS (BT)	KARS (KAR)	TOKAT (TO)
BOLU (BO)	KASTAMONU (KS)	TRABZON (TB)
BURDUR (BU)	KAYSERİ (KY)	TUNCELİ (TU)
BURSA (BS)	KIRIKKALE (KI)	UŞAK (US)
ÇANAKKALE (CA)	KIRKLARELİ (KK)	VAN (VA)
ÇANKIRI (CN)	KIRŞEHİR (KIR)	YALOVA (YA)
ÇORUM (CO)	KİLİS (KL)	YOZGAT (YO)
DENİZLİ (DE)	KOCAELİ (KO)	ZONGULDAK (ZO)
DİYARBAKIR (DI)	KONYA (KN)	THRACIA (=EUROPEAN TUR.) (TRA)
DÜZCE (DU)	KÜTAHYA (KU)	TURKEY (TUR)
EDİRNE (ED)	MALATYA (MA)	

Family CERAMBYCIDAE
Subfamily PRIONINAE
Tribe PRIONINI

***Mesoprionus besikanus* (Fairmaire, 1855)**
Old records in Kırıkkale prov.: Sulakyurt (Özdere) (Özdikmen & Demir, 2006).
Records in Turkey: AD-AN-ANT-BI-BS-BU-CA-DE-ER-EZ-IC-IS-IZ-KI-KL-KN-KU-KY-MG-NE-US-TRA-TUR
Remarks: The species distributes mostly in W half of Turkey. As seen above, it has been recorded only by Özdikmen & Demir (2006) from Kırıkkale province until now. Unfortunately, any specimen of the species did not obtain from Kırıkkale.
Chorotype: Turano-Mediterranean (Balkano-Anatolian).

***Prionus coriarius* (Linnaeus, 1758)**
Old records in Kırıkkale prov.: Sulakyurt (Özdere) (Özdikmen & Demir, 2006).
Records in Turkey: AN-ANT-ART-AY-BL-BO-BU-HT-KA-KI-KK-KO-KS-RI-SN-TB-TUR
Remarks: The species distributes rather widely in Turkey. As seen above, it has been recorded only by Özdikmen & Demir (2006) from Kırıkkale province until now. Unfortunately, any specimen of the species did not obtain from Kırıkkale.
Chorotype: Sibero-European + Turano-Europeo-Mediterranean.

Subfamily LEPTURINAE
Tribe RHAGIINI

***Cortodera flavimana* (Waltl, 1838)**
Material examined: Kırıkkale: Bedesten village, N 39 47 E 33 21, 21.V.2011, 1 specimen.
Records in Turkey: AD-AF-AK-AN-ANT-ART-BO-BS-BY-CN-EZ-GU-IC-IP-IS-IZ-KA-KAR-KN-KO-KR-KS-KY-NI-RI-SM-SN-SV-TO-YO-TUR
Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Turano-Mediterranean (Balkano-Anatolian).

Tribe LEPTURINI

***Vadonia unipunctata unipunctata* (Fabricius, 1787)**
Material examined: Kırıkkale: Kulaksız-Sulakyurt road, 5 km to Sulakyurt, N 40 6 E 33 43, 07.VI.2011, 34 specimens; Yahşihan cemetery, N 39 50 E 33 25, 25.VI.2011, 1 specimen; 3 km to Sulakyurt, N 40 5 E 33 42, 25.VI.2011, 1 specimen; Kırıkkale-Balışeyh road, 15 km to Balışeyh, 16.VI.2011, 1 specimen; Sulakyurt-Balışeyh road, 1 km to Sulakyurt, N 40 6 E 33 43, 26.VI.2011, 5 specimens.
Records in Turkey: AF-AK-AM-AN-ANT-ART-BI-BN-BO-BT-BU-BY-CN-EL-EZ-IP-İZ-KA-KAR-KIR-KN-KO-KR-KS-KY-MA-NE-NI-OS-RI-SV-TO-TU-US-VA-TUR
Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Turano-European or Turano-Europeo-Mediterranean.

***Pseudovadonia livida livida* (Fabricius, 1776)**
Material examined: Kırıkkale: Between Balışeyh-Sulakyurt, 6 km past of Balışeyh, N 39 54 E 33 43, 19.V.2011, 1 specimen; Kulaksız-Sulakyurt road, 10 km to Sulakyurt, N 40 4 E 33 42, 07.VI.2011, 1 specimen; Kulaksız-Sulakyurt road, 15 km to Sulakyurt, 25.VI.2011, 1 specimen; Sulakyurt-Balışeyh road, 3 km to Sulakyurt, 26.VI.2011, 2 specimens.
Records in Turkey: ADY-AM-AN-ANT-ART-BI-BO-BR-BS-BT-BY-CN-ER-EZ-GA-GI-GU-HT-IC-IP-IS-IZ-KAR-KK-KN-KO-KR-KS-MN-NI-OR-OS-RI-SM-US-TUR **Records in Turkey for the subspecies:** AM-AN-BI-BO-BR-BS-CN-IS-KK-KN-KO-KR-KS-OR
Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Sibero-European + E-Mediterranean (Palaestino-Taurian).

***Stictoleptura cordigera cordigera* (Füsslins, 1775)**

Material examined: Kırıkkale: Elmadağ-Kırıkkale road, Kalecik-Çankırı return, N 39 55 E 33 24, 25.VI.2011, 1 specimen; Kulaksız-Sulakyurt road, 8 km past to Kulaksız, N 40 5 E 33 42, 23.VII.2011, 1 specimen; Kulaksız-Sulakyurt road, 5 km to Sulakyurt, N 40 50 E 33 42, 23.VII.2011, 14 specimens; Çelebi-Tatık road, 5 km past to Çelebi, N 39 31 E 33 38, 24.VII.2011, 7 specimens; Kösedurak-Sulakyurt road, 5 km to Sulakyurt, N 39 29 E 33 43, 24.VII.2011, 1 specimen; Kulaksız-Sulakyurt road, 8 km to Sulakyurt, N 40 51 E 33 42, 06.VIII.2011, 1 specimen.

Records in Turkey: ADY-AK-AN-ANT-ART-BL-BN-BO-BS-BT-CA-DE-ED-EZ-GA-GU-HT-IC-IS-IZ-KA-KK-KN-KO-MG-MU-NE-NI-OS-TE-TU-YA-TUR

Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.

Chorotype: Turano-European.

***Pedostrangalia* (*Neosphenalia*) *verticenigra* (Pic, 1892)**

Material examined: Kırıkkale: Sulakyurt-Balışeyh road, 3 km to Sulakyurt, 26.VI.2011, 2 specimens; Kulaksız-Sulakyurt road, 8 km past to Kulaksız, N 40 5 E 33 42, 23.VII.2011, 1 specimen; entry of Sulakyurt, 23.VII.2011, 3 specimens.

Records in Turkey: ART-EZ-RI-TUR

Remarks: The species probably distributes wider than the known in Turkey. This is the first record for Kırıkkale province and thereby to Central Anatolian Region of Turkey.

Chorotype: SW-Asiatic (Anatolo-Caucasian).

***Pachytodes erraticus erraticus* (Dalman, 1817)**

Material examined: Kırıkkale: 3 km to Sulakyurt, N 40 5 E 33 42, 25.VI.2011, 9 specimens; Sulakyurt-Balışeyh road, 3 km to Sulakyurt, 26.VI.2011, 16 specimens; entry of Sulakyurt, 23.VII.2011, 26 specimens; Kösedurak-Sulakyurt road, 5 km to Sulakyurt, N 39 29 E 33 43, 24.VII.2011, 1 specimen.

Records in Turkey: AF-AM-AN-ANT-ART-BI-BO-BR-BS-BT-CN-CO-EL-ER-EZ-GA-GU-HT-IP-IS-IZ-KAR-KK-KN-KO-KR-KS-MN-MU-RI-SM-SN-SV-TB-TO-TU-YO-ZO-TRA-TUR

Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.

Chorotype: Sibero-European.

***Stenurella bifasciata nigrosuturalis* (Reitter, 1895)**

Material examined: Kırıkkale: 3 km to Sulakyurt, N 40 5 E 33 42, 25.VI.2011, 1 specimen; Sulakyurt-Balışeyh road, 3 km to Sulakyurt, 26.VI.2011, 1 specimen; Sofular-Sarıkız road, 5 km past to Sofular, 26.VI.2011, 1 specimen; Kulaksız-Sulakyurt road, 8 km past to Kulaksız, N 40 5 E 33 42, 23.VII.2011, 3 specimens; Kulaksız-Sulakyurt road, 5 km to Sulakyurt, N 40 50 E 33 42, 23.VII.2011, 65 specimens; entry of Sulakyurt, 23.VII.2011, 2 specimens; Çelebi-Tatık road, 5 km past to Çelebi, N 39 31 E 33 38, 24.VII.2011, 1 specimen; Kösedurak-Sulakyurt road, 5 km to Sulakyurt, N 39 29 E 33 43, 24.VII.2011, 2 specimens; Kulaksız-Sulakyurt road, 8 km to Sulakyurt, N 40 51 E 33 42, 06.VIII.2011, 1 specimen.

Records in Turkey: AD-AF-AK-AM-AN-ANT-ART-BI-BN-BO-BR-BS-BT-BU-CA-CN-CO-ER-EZ-GA-GU-HT-IC-IZ-KA-KK-KN-KO-KR-KS-KY-MG-MN-NE-OS-RI-SM-TB-US-YA-YO-ZO-TUR **Records in Turkey for the subspecies:** ART-BI-BO-BR-BS-CA-CN-CO-ER-EZ-GU-KK-KO-KR-KS-RI-SM-TB-YA-YO-ZO-TUR

Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.

Chorotype: Sibero-European + SW-Asiatic.

***Stenurella septempunctata latenigra* (Pic, 1915)**

Material examined: Kırıkkale: entry of Sulakyurt, 23.VII.2011, 1 specimen.

Records in Turkey: AF-AM-AN-ART-BI-BO-BS-CA-EZ-GU-IS-IZ-KK-KO-KR-KS-OR-RI-SM-TO-TB-YA-YO-ZO-TUR

Remarks: The species distributes widely in N Turkey. However, this is the first record for Kırıkkale province.

Chorotype: Turano-European (Ponto-Pannonian + Turano-Sarmato-Pannonian) + Turano-Mediterranean (Turano-Apenninian).

Subfamily CERAMBYCINAE
Tribe TRACHYDERINI

***Purpuricenus budensis* (Götz, 1783)**
Material examined: Kırıkkale: Entry of Sulakyurt, 23.VII.2011, 4 specimens.
Old records in Kırıkkale prov.: Sulakyurt (Özdikmen & Demir, 2006).
Records in Turkey: AD-ADY-AF-AM-AN-ANT-ART-AY-BL-BN-BO-BS-BU-CA-CO-DE-ED-EZ-GA-GU-HT-IC-IP-IS-IZ-KA-KI-KN-KO-MG-MN-MU-NI-OS-RI-SI-SM-SN-TO-TU-YO-TUR
Remarks: The species distributes widely in Turkey.
Chorotype: Turano-Europeo-Mediterranean.

Tribe GRACILIINI

***Penichroa fasciata* (Stephens, 1831)**
Material examined: Kırıkkale: Border of Kırıkkale-Ankara, VII.2011, 27 specimens.
Records in Turkey: AM-ANT-AN-IC-SM-TO-YO-TRA-TUR
Remarks: The species probably distributes rather widely in Turkey. This is the first record for Kırıkkale province.
Chorotype: Turano-Europeo-Mediterranean + Nearctic.

Tribe CERTALLINI

***Certallum ebulinum* (Linnaeus, 1767)**
Material examined: Kırıkkale: 10 km to Yahşihan, 26.IV.2011, 5 specimens; 500 m past to the border of Kırıkkale-Ankara, N 39 55 E 33 19 59, 19.V.2011, 6 specimens; Kalecik-Çankırı return, Kırıkkale-Elmadağ road, N 39 55, E 33 24, 19.V.2011, 23 specimens, 06.VI.2011, 10 specimnens, N 39 55 E 33 25, 19.V.2011, 25 specimens; Balışeyh-Kırıkkale road, 15 km to Balışeyh, N 39 51 E 33 34, 19.V.2011, 90 specimens; Entry of Sulakyurt, N 40 9 E 33 43, 19.V.2011, 6 specimens; Sulakyurt-Balışeyh road, 10 km past to Sulakyurt, N 40 6 E 33 43, 19.V.2011, 6 specimens; Bahşılı-Çorum road, 2 km past to Bahşılı, N 39 56 E 33 44, 19.V.2011, 8 specimens; Balışeyh-Yozgat road, 10 km to Balışeyh, N 39 56 E 33 56, 19.V.2011, 3 specimens; Refinery, N 39 46 E 33 30, 20.V.2011, 16 specimens; Kopullukaya env., N 39 46 E 33 39, 20.V.2011, 8 specimens; 2 km past to Çerikli, Çerikli-Balışeyh road, N 39 57 E 33 58, 20.V.2011, 17 specimens; Central, 21.V.2011, 6 specimens; Yahşihan cemetery, N 39 50 E 33 26, 21.V.2011, 11 specimens; Yahşihan-Bedesten road, 10 km past to Yahşihan, N 39 48 E 33 21, 21.V.2011, 15 specimens; Hacılar-Karaahmetler road, 5 km past to Hacılar, N 39 42 E 33 19, 21.V.2011, 2 specimens; Karakeçili, Central, N 39 36 E 33 20, 21.V.2011, 29 specimens; 500 m past to the border of Kırıkkale-Ankara, 06.VI.2011, 1 specimen; Yahşihan-Bedesten road, 4 km to Bedesten, N 39 49 E 33 22, 06.VI.2011, 2 specimens; 1 km to entry of Bedesten, N 39 48 E 33 21, 06.VI.2011, 8 specimens; Konur town, N 39 34 E 33 45, 06.VI.2011, 3 specimens; Kulaksız-Sulakyurt road, 10 km to Sulakyurt, N 40 4 E 33 42, 07.VI.2011, 2 specimens, 5 km to Sulakyurt, N 40 6 E 33 43, 07.VII.2011, 3 specimens.
Records in Turkey: AD-ADY-AK-AM-AN-ANT-AY-BI-BL-BS-CA-CN-DE-DI-ER-GA-HT-IC-IP-IS-IZ-KA-KN-KY-MG-MN-MR-NE-NI-OS-SN-SU-TB-YO-TRA-TUR
Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Turano-Europeo-Mediterranean.

Tribe HYLOTRUPINI

***Hylotrupes bajulus* (Linnaeus, 1758)**
Material examined: Kırıkkale: Border of Kırıkkale-Ankara, VII.2011, 1 specimen.
Records in Turkey: AD-AM-AN-ANT-ART-AY-BI-BO-BR-BS-CA-DE-DU-ER-EZ-GI-GU-HT-IC-IP-IS-IZ-KA-KAR-KN-KR-KS-KU-KY-OS-RI-SN-SV-TB-US-ZO-TRA-TUR

Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Subcosmopolitan.

Tribe CALLIDIINI

***Phymatodes testaceus* (Linnaeus, 1758)**
Material examined: Kırıkkale: Kırıkkale: Sulakyurt-Kızılırmak road, 2 km past to Sulakyurt, N 40 10 E 33 44, 26.VI.2011, 1 specimen.
Records in Turkey: ADY-ANT-ART-BN-BO-CA-GU-HT-IC-IS-NI-OS-TRA-TUR
Remarks: The species probably distributes rather widely in Turkey. This is the first record for Kırıkkale province.
Chorotype: Holarctic.

Tribe CLYTINI

***Plagionotus* (*Neoplagionotus*) *bobelayei* (Brullé, 1832)**
Material examined: Kırıkkale: Kırıkkale-Balışeyh road, 15 km to Balışeyh, N 39 51 E 33 33, 07.VI.2011, 2 specimens, N 39 51 E 33 23, 25.VI.2011, 1 specimen; Sulakyurt-Balışeyh road, 1 km to Sulakyurt, N 40 6 E 33 43, 26.VI.2011, 1 specimen.
Old records in Kırıkkale prov.: Kılınçlar (Özdikmen & Demir, 2006).
Records in Turkey: ADY-AG-ANT-ART-BN-EZ-GU-HT-IC-IP-IZ-KAR-KI-KN-MA-MU-SM-TU-YO-TRA-TUR
Remarks: The species distributes rather widely in Turkey.
Chorotype: Turano-European (Turano-Sarmato-Pannonian).

***Plagionotus* (*Echinocerus*) *floralis* (Pallas, 1773)**
Material examined: Kırıkkale: Kırıkkale-Balışey road, 15 km to Balışeyh, N 39 51 E 33 33, 07.VI.2011, 1 specimen; Kulaksız-Sulakyurt road, 5 km to Sulakyurt, N 40 6 E 33 43, 25.VI.2011, 4 specimens, 07.VII.2011, 1 specimen; Elmadağ-Kırıkkale road, Kalecik-Çankırı return, N 39 55 E 33 24, 25.VI.2011, 3 specimens; Sulakyurt-Balışeyh road, 3 km to Sulakyurt, 26.VI.2011, 7 specimens, 1 km to Sulakyurt, N 40 6 E 33 43, 26.VI.2011, 90 specimens; Balışeyh-Kulaksız road, 3 km past to Balışeyh, N 39 56 E 33 43, 23.VII.2011, 1 specimen; Kulaksız-Sulakyurt road, 8 km past to Kulaksız, N 40 5 E 33 42, 23.VII.2011, 1 specimen; Entry of Sulakyurt, 23.VII.2011, 4 specimens.
Records in Turkey: AD-ADY-AF-AG-AM-AN-ANT-AR-ART-BI-BO-BS-BU-BY-CA-CN-CO-DE-EL-ER-ES-EZ-GI-GU-IC-IG-IP-IZ-KA-KAR-KIR-KK-KM-KN-KO-KR-KS-KY-MA-MN-MU-NI-OS-SM-SN-SV-TB-TO-TU-US-YO-ZO-TRA-TUR
Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Sibero-European.

***Chlorophorus* (*Perderomaculatus*) *sartor* (Müller, 1766)**
Material examined: Kırıkkale: Kulaksız-Sulakyurt road, 8 km past to Kulaksız, N 40 5 E 33 42, 23.VII.2011, 2 specimens; Kulaksız-Sulakyurt road, 5 km to Sulakyurt, N 40 50 E 33 42, 23.VII.2011, 39 specimens; Entry of Sulakyurt, 23.VII.2011, 5 specimens; Kösedurak-Sulakyurt road, 5 km to Sulakyurt, N 39 29 E 33 43, 24.VII.2011, 4 specimens, 8 km to Sulakyurt, N 40 51 E 33 42, 06.VIII.2011, 1 specimen.
Records in Turkey: AD-AM-AN-ANT-ART-AY-BI-BL-BR-BS-BU-CA-CN-DE-EL-ES-EZ-GA-GU-HT-IC-IP-IS-IZ-KA-KK-KN-KR-KS-KY-MG-MN-OS-RI-SM-SN-TE-TO-YO-TRA-TUR
Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Turano-European.

***Chlorophorus* (*Crassofasciatus*) *trifasciatus* (Fabricius, 1781)**
Material examined: Kırıkkale: Entry of Sulakyurt, 23.VII.2011, 1 specimen.
Records in Turkey: AN-ANT-BI-IC-IS-KN-KO-KR-KS-KU-OS-TUR

Remarks: The species probably distributes widely in especially W half of Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Mediterranean.

***Chlorophorus* (s.str.) *varius varius* (Müller, 1766)**
Material examined: Kırıkkale: Elmadağ-Kırıkkale road, Kalecik-Çankırı return, 7 km to Kırıkkale, N 39 55 E 33 24, 23.VII.2011, 4 specimens; Balışeyh-Kırıkkale road, 5 km past to Kırıkkale, 23.VII.2011, 1 specimen; Entry of Sulakyurt, 23.VII.2011, 6 specimens; Exit of Kırıkkale, Ankara-Samsun return, Aşağı Mahmutlar village, N 39 52 E 33 37, 24.VII.2011, 2 specimens; Osmangazi, N 39 51 E 33 32, 24.VII.2011, 3 specimens; Kösedurak-Sulakyurt road, 5 km to Sulakyurt, N 39 29 E 33 43, 24.VII.2011, 5 specimens, 8 km to Sulakyurt, N 40 51 E 33 42, 06.VIII.2011, 6 specimens; Hasandede town, 06.VIII.2011, 4 specimens; Çamlıca village, 07.VII.2011, 7 specimens.
Old records in Kırıkkale prov.: Kırıkkale (Sama, 1982).
Records in Turkey: AD-ADY-AK-AM-AN-ANT-ART-AY-BI-BL-BO-BR-BU-CA-CN-DE-ER-ES-EZ-GA-GU-HA-HT-IC-IG-IP-IS-IZ-KA-KI-KIR-KK-KM-KN-KO-KR-KS-KY-MA-MG-MN-MR-MU-NE-NI-OS-SU-TB-TO-TU-US-VA-ZO-TRA-TUR **Records in Turkey for the subspecies:** ADY-AK-AM-AN-ANT-ART-AY-BI-BL-BO-BR-BU-CA-CN-DE-ER-ES-EZ-GA-GU-HA-IG-IP-IS-IZ-KA-KI-KIR-KK-KM-KN-KO-KR-KS-KY-MA-MG-MN-MR-MU-NE-NI-SU-TB-TO-US-VA-ZO-TRA-TUR
Remarks: The species distributes rather widely in Turkey.
Chorotype: Palearctic.

Subfamily STENOPTERINAE
Tribe STENOPTERINI

***Stenopterus rufus geniculatus* Kraatz, 1863**
Material examined: Kırıkkale: 3 km to Sulakyurt, N 40 5 E 33 42, 25.VI.2011, 2 specimens; Sulakyurt-Balışeyh road, 3 km to Sulakyurt, 26.VI.2011, 8 specimens; Entry of Sulakyurt, 23.VII.2011, 33 specimens.
Records in Turkey: ADY-AM-AN-ANT-ART-BI-BO-BR-BS-CA-CN-CO-EZ-GA-GU-HT-IC-IS-IZ-KA-KK-KN-KO-KR-KS-KY-MN-NI-OS-RI-SM-SN-TB-TO-TU-YO-TRA-TUR
Records in Turkey for the subspecies: AM-AN-ART-BI-BO-BR-BS-CA-CN-CO-EZ-GU-IS-KK-KO-KR-KS-RI-SM-SN-TB-TO-YO-TRA
Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Turano-European.

Tribe HYBODERINI

***Callimus* (*Lampropterus*) *femoratus* (Germar, 1824)**
Material examined: Kırıkkale: Kulaksız-Sulakyurt road, 10 km to Sulakyurt, N 40 4 E 33 42, 07.VI.2011, 5 specimens, 20 km to Sulakyurt, 25.VI.2011, 1 specimen, 5 km to Sulakyurt, 25.VI.2011, 1 specimen, 3 km to Sulakyurt, N 40 5 E 33 42, 25.VI.2011, 2 specimens; Sulakyurt-Balışeyh road, 3 km to Sulakyurt, 26.VI.2011, 1 specimen; Entry of Sulakyurt, 23.VII.2011, 1 specimen.
Old records in Kırıkkale prov.: Central (Sama, 1982).
Records in Turkey: ADY-AD-AM-AN-ANT-ART-BL-BN-BS-BT-BU-CA-DI-ED-EZ-GA-HA-HT-IC-IS-IZ-KA-KI-KK-KN-MA-MG-MN-MR-MU-NI-OS-TO-TU-YO-TRA-TUR
Remarks: The species distributes rather widely in Turkey.
Chorotype: Turano-Mediterranean (Turano-E-Mediterranean).

Subfamily DORCADIONINAE
Tribe DORCADIONINI

***Dorcadion cinerarium cinerarium* (Fabricius, 1787)**
Material examined: Kırıkkale: Keskin-Çelebi road 10th km, N 39 31 E 33 33, 28.III.2011, 4 specimens; Balışeyh-Sulakyurt road, 25 km to Sulakyurt, N 40 15 E 33 42,

27.IV.2011, 2 specimens; Kulaksız-Sulakyurt road, 10 km to Sulakyurt, N 40 4 E 33 42, 19.V.2011, 1 specimen.
Old records in Kırıkkale prov.: Keskin (Braun, 1978).
Records in Turkey: AN-BS-CN-CO-ES-GA-IC-KA-KI-KS-KY-OR-SM-SV-TO-YO-TUR
Remarks: The species probably distributes rather widely in Turkey.
Chorotype: E-Mediterranean (NE-Mediterranean).

Subfamily LAMIINAE
Tribe PHYTOECIINI

***Oxylia argentata* (Ménetries, 1832)**
Old records in Kırıkkale prov.: Central (Adlbauer, 1988).
Records in Turkey: ADY-AG-AN-ANT-ART-BN-BT-BY-CO-DI-EL-ER-EZ-GI-GU-HT-IC-IP-IZ-KAR-KI-KN-KS-NI-SI-SN-TU-YO-TUR
Remarks: The species distributes rather widely in Turkey. As seen above, it has been recorded only by Adlbauer (1988) from Kırıkkale province until now. Unfortunately, any specimen of the species did not obtain from Kırıkkale.
Chorotype: SW-Asiatic (Anatolo-Caucasian + Irano-Caucasian + Irano-Anatolian) + Turanian (Ponto-Caspian).

***Oxylia duponcheli* (Brullé, 1832)**
Material examined: Kırıkkale: Kulaksız-Sulakyurt road, 5 km to Sulakyurt, N 40 6 E 33 43, 07.VII.2011, 1 specimen.
Records in Turkey: AK-AN-ANT-ART-ES-IC-KA-KM-KN-MA-MN-OS-TUR
Remarks: The species probably distributes rather widely in Turkey. This is the first record for Kırıkkale province.
Chorotype: Turano-Mediterranean (Balkano-Anatolian).

***Phytoecia* (*Cardoria*) *scutellata* (Fabricius, 1792)**
Material examined: Kırıkkale: Balışeyh-Sulakyurt road, 25 km to Sulakyurt, N 40 15 E 33 42, 27.IV.2011, 1 specimen.
Records in Turkey: ADY-AR-ES-EZ-KAR-KN-TUR
Remarks: The species probably distributes rather widely in Turkey. This is the first record for Kırıkkale province.
Chorotype: Turano-Mediterranean (Turano-E-Mediterranean).

***Phytoecia* (*Helladia*) *humeralis humeralis* (Waltl, 1838)**
Material examined: Kırıkkale: Kalecik-Çankırı return, Kırıkkale-Elmadağ road, N 39 55 52, E 33 24 34, 19.V.2011, 2 specimens; Entry of Sulakyurt, N 40 9 E 33 43, 19.V.2011, 2 specimens; Sulakyurt-Balışeyh road, 10 km past to Sulakyurt, N 40 6 E 33 43, 19.V.2011, 1 specimen; Balışeyh-Yozgat road, 10 km to Balışeyh, N 39 56 E 33 56, 19.V.2011, 1 specimen; Refinery, N 39 46 E 33 30, 20.V.2011, 1 specimen; Çerikli-Balışeyh road, 2 km past to Çerikli, N 39 57 E 33 58, 20.V.2011, 2 specimens; Bedesten village, N 39 47 E 33 21, 21.V.2011, 1 specimen.
Records in Turkey: AD-ADY-AK-AM-AN-ANT-AY-BU-DE-DI-ED-ES-GA-HA-HT-IC-IP-IZ-KA-KN-MA-MN-NI-OS-SI-US-YO-TUR **Records in Turkey for the subspecies:** AD-ADY-AK-AM-AN-ANT-AY-BU-DE-DI-ED-ES-GA-HA-HT-IC-IP-IZ-KA-KN-MA-MN-NI-SI-US-YO-TUR
Remarks: The species distributes rather widely in Turkey. This is the first record for Kırıkkale province.
Chorotype: E-Mediterranean (Palaestino-Cyprioto-Taurian + NE-Mediterranean).

***Phytoecia* (s.str.) *caerulea caerulea* (Scopoli, 1772)**
Material examined: Kırıkkale: 10 km to Yahşihan, 26.IV.2011, 3 specimens; 500 m past to the border of Kırıkkale-Ankara, N 39 55 E 33 19, 19.V.2011, 4 specimens, 06.VI.2011, 1 specimen; Kalecik-Çankırı return, Kırıkkale-Elmadağ road, N 39 55 52, E 33 24 34, 19.V.2011, 4 specimens, N 39 55 E 33 25, 19.V.2011, 7 specimens, 06.VI.2011, 3 specimens; Balışeyh-Kırıkkale road, 15 km to Balışeyh, N 39 51 E 33 34, 19.V.2011, 7 specimens; Entry of Sulakyurt, N 40 9 E 33 43, 19.V.2011, 2 specimens; Sulakyurt-Balışeyh road, 10 km past

to Sulakyurt, N 40 06 E 33 43, 19.V.2011, 2 specimens; Balışeyh-Yozgat road, 10 km to Balışeyh, N 39 56 E 33 56, 19.V.2011, 1 specimen; Çerikli-Balışeyh road, 2 km past to Çerikli, N 39 57 E 33 58, 20.V.2011, 1 specimen; Central, 21.V.2011, 1 specimen; Yahşihan cemetery, N 39 50 E 33 26, 21.V.2011, 2 specimens; Yahşihan-Bedesten road, 10 km past to Yahşihan, N 39 48 E 33 21, 21.V.2011, 1 specimen; Karakeçili, Central, N 39 36 E 33 20, 21.V.2011, 2 specimens; Yahşihan-Bedesten road, 4 km to Bedesten, N 39 49 E 33 22, 06.VI.2011, 3 specimens; 1 km to entry of Bedesten, N 39 48 E 33 21, 06.VI.2011, 1 specimen.
Records in Turkey: AD-AF-AK-AN-ANT-AY-BI-BO-BS-BU-DE-DU-ER-ES-EZ-GA-HT-IC-IP-IS-IZ-KA-KM-KN-KR-KS-KU-KY-MG-MN-NE-NI-OS-SM-SN-SV-TE-YO-TRA-TUR
Records in Turkey for the subspecies: AF-AK-AN-AY-BO-BU-DU-ER-ES-EZ-IP-KA-KM-KN-KR-KS-KY-NE-NI-SM-SN-SV-TE-YO-TRA-TUR
Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Turano-European.

Phytoecia (s.str.) *cylindrica* (Linnaeus, 1758)

Material examined: Kırıkkale: Balışeyh-Kırıkkale road, 15 km to Balışeyh, N 39 51 E 33 34, 19.V.2011, 1 specimen; Entry of Sulakyurt, N 40 9 E 33 43, 19.V.2011, 2 specimens; Balışeyh-Yozgat road, 10 km to Balışeyh, N 39 56 E 33 56, 19.V.2011, 1 specimen.
Records in Turkey: AN-IS-IZ-KA-KO-KS-KY-NI-TU-TRA-TUR
Remarks: The species probably distributes widely in Turkey. This is the first record for Kırıkkale province.
Chorotype: Sibero-European.

Phytoecia (s.str.) *geniculata* Mulsant, 1862

Material examined: Kırıkkale: Entry of Sulakyurt, N 40 9 E 33 43, 19.V.2011, 1 specimen; Sulakyurt-Balışeyh road, 10 km past to Sulakyurt, N 40 6 E 33 43, 19.V.2011, 5 specimens.
Records in Turkey: AD-AF-AN-ANT-AY-BI-BL-BS-BU-DE-ED-GA-HT-IC- IS-IZ-KA-KS-MN-OS-SI-TRA-TUR
Remarks: The species probably distributes widely in especially W half of Turkey. This is the first record for Kırıkkale province.
Chorotype: E-Mediterranean (Aegean + NE-Mediterranean + Palaestino-Cyprioto-Taurian).

Phytoecia (s.str.) *manicata* Reiche et Saulcy, 1858

Material examined: Kırıkkale: Kırıkkale-Balışey road, 15 km to Balışeyh, N 39 51 E 33 33, 07.VI.2011, 1 specimen.
Records in Turkey: AD-DI-HT-IP-IZ-KA-KN-OS-SI-TUR
Remarks: The species distributes widely in especially S half of Turkey. This is the first record for Kırıkkale province.
Chorotype: E-Mediterranean (Palestino-Taurian).

Phytoecia (s.str.) *pustulata pustulata* (Schrank, 1776)

Material examined: Kırıkkale: Kopullukaya ENV., N 39 46 E 33 39, 20.V.2011, 1 specimen; 1 km to entry of Bedesten, N 39 48 E 33 21, 06.VI.2011, 1 specimen; Konur town, N 39 34 E 33 45, 06.VI.2011, 2 specimens; Kırıkkale-Balışey road, 15 km to Balışeyh, N 39 51 E 33 33, 07.VI.2011, 1 specimen.
Records in Turkey: AM-BI-BO-BU-DU-GU-IS-KA-KAR-KN-MG-OS-SM-SV-TRA-TUR
Remarks: The species probably distributes widely in Turkey. This is the first record for Kırıkkale province. It is represented only by the nominotypical subspecies in Turkey.
Chorotype: Turano-European.

Phytoecia (s.str.) *rufipes rufipes* (Olivier, 1795)

Material examined: Kırıkkale: Balışeyh-Yozgat road, 10 km to Balışeyh, N 39 56 E 33 56, 19.V.2011, 1 specimen.
Records in Turkey: AD-ADY-AK-HT-IC-KA-MA-NI-TUR **Records in Turkey for the subspecies:** ADY-AK-IC-KA-MA-NI-TUR

Remarks: The species distributes widely in Southern parts of Turkey. So, this is the first record for Kırıkkale province and thereby N half of Turkey. It is represented by 2 subspecies in Turkey as the nominotypical subspecies and *P. rufipes latior* that distributes only in S Turkey and Syria.
Chorotype: Sibero-European or Turano-European.

***Phytoecia* (s.str.) *virgula* (Charpentier, 1825)**
Material examined: Kırıkkale: Kalecik-Çankırı return, Kırıkkale-Elmadağ road, N 39 55 52, E 33 24 34, 19.V.2011, 2 specimens; Yahşihan cemetery, N 39 50 E 33 26, 21.V.2011, 2 specimens; Karakeçili, Central, N 39 36 E 33 20, 21.V.2011, 1 specimen; Konur town, N 39 34 E 33 45, 06.VI.2011, 2 specimens; Kulaksız-Sulakyurt road, 10 km to Sulakyurt, N 40 4 E 33 42, 07.VI.2011, 3 specimens; Kulaksız-Sulakyurt road, 5 km to Sulakyurt, N 40 6 E 33 43, 07.VII.2011, 1 specimen.
Records in Turkey: ADY-AK-AN-AM-BI-BN-BO-BR-BU-BY-DE-ER-ES-EZ-GU-HT-IP-IS-IZ-KA-KAR-KN-KR-KS-KU-MN-NE-NI-OS-SM-TU-VA-TRA-TUR
Remarks: The species probably distributes widely in Turkey. This is the first record for Kırıkkale province.
Chorotype: Turano-European.

***Phytoecia* (*Opsilia*) *coerulescens* (Scopoli, 1763)**
Material examined: Kırıkkale: Balışeyh-Kırıkkale road, 15 km to Balışeyh, N 39 51 E 33 34, 19.V.2011, 3 specimens; Sulakyurt-Balışeyh road, 10 km past to Sulakyurt, N 40 6 E 33 43, 19.V.2011, 1 specimen; Refinery, N 39 46 E 33 30, 20.V.2011, 1 specimen; Kopullukaya env., N 39 46 E 33 39, 20.V.2011, 6 specimens; Çerikli-Balışeyh road, 2 km past to Çerikli, N 39 57 E 33 58, 20.V.2011, 1 specimen; 5 km past to Delice, N 39 56 E 34 1, 20.V.2011, 1 specimen; 1 km to entry of Bedesten, N 39 48 E 33 21, 06.VI.2011, 2 specimens; Kulaksız-Sulakyurt road, 5 km to Sulakyurt, N 40 6 E 33 43, 07.VII.2011, 1 specimen; Sulakyurt-Balışeyh road, 3 km to Sulakyurt, 26.VI.2011, 1 specimen.
Records in Turkey: AD-ADY-AK-AM-AN-ANT-AR-ART-AY-BO-BS-BU-BY-CN-CO-DE-DI-ER-ES-EZ-GA-GU-IC-IP-IS-IZ-KA-KAR-KIR-KK-KM-KN-KS-KY-MA-MG-MN-NE-NI-OS-SM-SN-SV-TB-YO-ZO-TRA-TUR
Remarks: The species distributes very widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Sibero-European + Mediterranean.

Tribe AGAPANTHIINI

***Agapanthia* (*Synthapsia*) *kirbyi* (Gyllenhal, 1817)**
Material examined: Kırıkkale: 5 km past to Delice, N 39 56 E 34 1, 20.V.2011, 1 specimen; Hacılar-Küreboğazı village road, 1 km to Küreboğazı, N 39 41 E 33 19, 25.VI.2011, 1 specimen.
Records in Turkey: AD-AF-AK-AM-AN-ANT-BI-BN-BS-BT-BU-CO-ED-ER-ES-EZ-IC-IP-IZ-KA-KAR-KIR-KN-KO-KY-MN-NI-OS-SI-TO-TU-VA-TRA-TUR
Remarks: The species distributes rather widely in Turkey. This is the first record for Kırıkkale province.
Chorotype: Turano-European.

***Agapanthia* (*Epoptes*) *lateralis* Ganglbauer, 1884**
Material examined: Kırıkkale: Border of Kırıkkale, Elmadağ-Kırıkkale road, N 39 55 E 33 25 , 19.V.2011, 1 specimen; Refinery, N 39 46 E 33 30, 20.V.2011, 1 specimen; Kalecik-Çankırı return, Elmadağ-Kırıkkale road, N 39 55 E 33 24, 06.VI.2011, 1 specimen; 1 km to entry of Bedesten, N 39 48 E 33 21, 06.VI.2011, 1 specimen; Hacılar-Küreboğazı village road, 1 km to Küreboğazı, N 39 41 E 33 19, 25.VI.2011, 1 specimen.
Records in Turkey: AF-AG-AK-AM-AN-ANT-BI-BO-CA-CN-CO-ER-ES-GA-IC-IP-IS-IZ-KA-KIR-KM-KN-KR-KS-MN-MG-NE-NI-OS-SV-TE-TO-ZO-TRA-TUR
Remarks: The species distributes widely in Turkey (especially W half of Turkey). This is the first record for Kırıkkale province.
Chorotype: E-Mediterranean.

Agapanthia (s.str.) *cardui* (Linnaeus, 1767)

Material examined: Kırıkkale: Kalecik-Çankırı return, Kırıkkale-Elmadağ road, N 39 55 52, E 33 24 34, 19.V.2011, 4 specimens; Balışeyh-Kırıkkale road, 15 km to Balışeyh, N 39 51 E 33 34, 19.V.2011, 12 specimens; Balışeyh-Yozgat road, 10 km to Balışeyh, N 39 56 E 33 56, 19.V.2011, 2 specimens; Refinery, N 39 46 E 33 30, 20.V.2011, 1 specimen; Çerikli-Balışeyh road, 2 km past to Çerikli, N 39 57 E 33 58, 20.V.2011, 4 specimens; Yahşihan-Bedesten road, 10 km past to Yahşihan, N 39 48 E 33 21, 21.V.2011, 3 specimens; Hacılar-Karaahmetler road, 5 km past to Hacılar, N 39 42 E 33 19, 21.V.2011, 1 specimen; 1 km to entry of Bedesten, N 39 48 E 33 21, 06.VI.2011, 4 specimens; Kırıkkale-Balışey road, 15 km to Balışeyh, N 39 51 E 33 33, 07.VI.2011, 1 specimen; Kulaksız-Sulakyurt road, 5 km to Sulakyurt, N 40 6 E 33 43, 07.VII.2011, 2 specimens, 20 km to Sulakyurt, 25.VI.2011, 36 specimens; Sofular-Sarıkız road, 5 km past to Sofular, 26.VI.2011, 7 specimens.
Records in Turkey: AN-ART-BI-BS-BY-CA-CN-ED-ER-ES-EZ-GU-IS-KAR-KIR-KK-KN-KO-KS-RI-SV- TRA-TUR
Remarks: The species distributes widely in N Turkey. So, the old records from S Turkey should be belong to *A. suturalis*. This is the first record for Kırıkkale province.
Chorotype: S, C and E European.

Agapanthia (s.str.) *suturalis* (Fabricius, 1787)

Material examined: Kırıkkale: Kalecik-Çankırı return, Elmadağ-Kırıkkale road, N 39 55 E 33 24, 06.VI.2011, 1 specimen; 1 km to entry of Bedesten, N 39 48 E 33 21, 06.VI.2011, 1 specimen; Konur town, N 39 34 E 33 45, 06.VI.2011, 1 specimen; Kırıkkale-Balışeyh road, 15 km to Balışeyh, N 39 51 E 33 33, 07.VI.2011, 1 specimen; Kulaksız-Sulakyurt road, 10 km to Sulakyurt, N 40 4 E 33 42, 07.VI.2011, 1 specimen, 5 km to Sulakyurt, 25.VI.2011, 3 specimens, 3 km to Sulakyurt, N 40 5 E 33 42, 25.VI.2011, 4 specimens; Exit of Kulaksız, Sulakyurt road, 20 km to Sulakyurt, N 40 14 E 33 43, 26.VI.2011, 10 specimens; Sulakyurt-Balışeyh road, 3 km to Sulakyurt, 26.VI.2011, 3 specimens; entry of Kıyıhalil-İnce village, border of Çankırı, N 40 17 E 33 43, 26.VI.2011, 1 specimen.
Records in Turkey: AD-ANT-AY-BN-BU-DE-DI-EL-ER-GA-HA-HT-IC-IP-IZ-KA-KL-KN-MA-MG-MN-OS-SI-TU
Remarks: The species distributes widely in S Turkey. This is the first record for Kırıkkale province.
Chorotype: Mediterranean.

Agapanthia (*Smaragdula*) *violacea* (Fabricius, 1775)

Material examined: Kırıkkale: 5 km past to Delice, N 39 56 E 34 1, 20.V.2011, 1 specimen; Kulaksız-Sulakyurt road, 10 km to Sulakyurt, N 40 4 E 33 42, 07.VI.2011, 1 specimen; 3 km to Sulakyurt, N 40 5 E 33 42, 25.VI.2011, 2 specimens.
Records in Turkey: AD-AF-AK-AN-BI-BO-BS-CO-DE-DU-ED-ER-EZ-GA-HT-IC-IP-IS-IZ-KA-KIR-KK-KN-KO-KR-KS-KY-MG-MN-NE-NI-OS-SA-ZO-TRA-TUR
Remarks: The species distributes widely in Turkey. However, this is the first record for Kırıkkale province.
Chorotype: Turano-European and Sibero-European. Since, according to Sama (2002), the records from Middle East and Central Asia may be different species. These records should be confirmed.

Consequently, according to old references, the longhorned beetles fauna of Bolu province included only 8 species of 8 genera of 5 subfamilies: **Prioninae:** 2 species as *Mesoprionus besikanus* and *Prionus coriarius*; **Cerambycinae:** 3 species as *Purpuricenus budensis, Plagionotus bobelayei* and *Chlorophorus varius*; **Stenopterinae:** 1 species as *Callimus* (*Lampropterus*) *femoratus*; **Dorcadioninae:** 1 species as *Dorcadion cinerarium* and **Lamiinae:** 1 species as *Oxylia argentata*.

With the present work, 37 species of 20 genera of 5 subfamilies among the collected specimens from Kırıkkale province were determined: **Lepturinae:** 8 species as *Cortodera flavimana, Vadonia unipunctata, Pseudovadonia livida, Stictoleptura cordigera, Pedostrangalia verticenigra, Judolia erratica, Stenurella bifasciata* and *Stenurella septempunctata*; **Cerambycinae:** 10 species as *Purpuricenus budensis, Penichroa fasciata, Certallum ebulinum, Hylotrupes bajulus, Phymatodes testaceus, Plagionotus bobelayei, Plagionotus floralis, Chlorophorus varius, Chlorophorus trifasciatus* and

Chlorophorus sartor; **Stenopterinae:** 2 species as *Stenopterus rufus* and *Callimus femoratus*; **Dorcadioninae:** 1 species as *Dorcadion cinerarium*; **Lamiinae:** 16 species as *Oxylia duponcheli, Phytoecia scutellata, Phytoecia humeralis, Phytoecia caerulea, Phytoecia cylindrica, Phytoecia geniculata, Phytoecia manicata, Phytoecia pustulata, Phytoecia rufipes, Phytoecia virgula, Phytoecia coerulescens, Agapanthia kirbyi, Agapanthia lateralis, Agapanthia cardui, Agapanthia suturalis* and *Agapanthia violacea*.

Therefore, 3 species of 3 genera of 2 subfamilies for Kırıkkale province are known only the records from references: **Prioninae:** 2 species as *Mesoprionus besikanus* and *Prionus coriarius*; and **Lamiinae:** 1 species as *Oxylia argentata*.

A total of 32 species are new records for Kırıkkale province. Moreover, *Pedostrangalia verticenigra* (Pic, 1892) is the first record for Central Anatolian Region of Turkey and also *Phytoecia rufipes rufipes* (Olivier, 1795) is the first record for N half of Turkey.

Finally, Longhorned Beetles Fauna of Kırıkkale province comprises of 40 species of 22 genera of 6 subfamilies with the newly recorded species in the present work. Number of known species from Kırıkkale province was increased from 8 species to 40 species.

A faunistic list are presented as follows:

In the list, the sign of (*) is used for known taxa both references and the present work, (**) is used for new records to Kırıkkale prov., (***) is used for new record to Central Anatolian Region, (****) is used for new records to N half of Turkey. Any sign is not used for the known species only from old references.

LONGHORNED BEETLES FAUNA OF KIRIKKALE PROVINCE (COLEOPTERA: CERAMBYCIDAE)

FAMILY CERAMBYCIDAE Latreille, 1802: 211
SUBFAMILY PRIONINAE Latreille, 1802: 212
TRIBE PRIONINI Latreille, 1802: 212
GENUS *MESOPRIONUS* Jakovlev, 1887: 323
SPECIES *M. besikanus* (Fairmaire, 1855: 318)
GENUS *PRIONUS* Geoffroy, 1762: 198
SPECIES *P. coriarius* (Linnaeus, 1758: 389)
SUBFAMILY LEPTURINAE Latreille, 1802: 218
TRIBE RHAGIINI Kirby, 1837: 178
GENUS *CORTODERA* Mulsant, 1863: 572
SPECIES *C. flavimana* (Waltl, 1838: 471) (**)
TRIBE LEPTURINI Latreille, 1802: 218
GENUS *VADONIA* Mulsant, 1863: 559
SPECIES *V. unipunctata* (Fabricius, 1787: 157)
SUBSPECIES *V. u. unipunctata* (Fabricius, 1787: 157) (**)
GENUS *PSEUDOVADONIA* Lobanov, Danilevsky & Murzin, 1981: 787
SPECIES *P. livida* (Fabricius, 1777: 233)
SUBSPECIES *P. l. livida* (Fabricius, 1777: 233) (**)
GENUS *STICTOLEPTURA* Casey, 1924: 280
SUBGENUS *STICTOLEPTURA* Casey, 1924: 280
SPECIES *S. cordigera* (Fuessly, 1775: 14)
SUBSPECIES *S. c. cordigera* (Fuessly, 1775: 14) (**)
GENUS *PEDOSTRANGALIA* Sokolov, 1897: 461
SUBGENUS *NEOSPHENALIA* Löbl, 2010: 110
SPECIES *P. verticenigra* (Pic, 1892: 416) (**) (***)
GENUS *JUDOLIA* Mulsant, 1863: 496
SPECIES *J. erratica* (Dalman, 1817: 490)
SUBSPECIES *J. e. erratica* (Dalman, 1817: 490) (**)
GENUS *STENURELLA* Villiers, 1974: 217
SPECIES *S. bifasciata* (Müller, 1776: 93)
SUBSPECIES *S. b. nigrosuturalis* (Reitter, 1895) (**)
SPECIES *S. septempunctata* (Fabricius, 1792: 346) (**)
SUBSPECIES *S. s. latenigra* (Pic, 1915: 5)

SUBFAMILY CERAMBYCINAE Latreille, 1802: 211
TRIBE TRACHYDERINI Dupont, 1836: 1
SUBTRIBE TRACHIDERINA Dupont, 1836: 1
GENUS *PURPURICENUS* Dejean, 1821: 105
SPECIES *P. budensis* (Götz, 1783: 70) (*)
TRIBE GRACILIINI Mulsant, 1839: 99
GENUS *PENICHROA* Stephens, 1839: 270
SPECIES *P. fasciata* (Stephens, 1831: 250) (**)
TRIBE CERTALLINI Fairmaire, 1864: 149
GENUS *CERTALLUM* Dejean, 1821: 111
SPECIES *C. ebulinum* (Linnaeus, 1767: 637) (**)
TRIBE HYLOTRUPINI Zagajkevich, 1991: 67
GENUS *HYLOTRUPES* Audinet-Serville, 1834: 77
SPECIES *H. bajulus* (Linnaeus, 1758: 396) (**)
TRIBE CALLIDIINI Kirby, 1837: 170
GENUS *PHYMATODES* Mulsant, 1839: 47
SUBGENUS *PHYMATODES* Mulsant, 1839: 47
SPECIES *P. testaceus* (Linnaeus, 1758: 396) (**)
TRIBE CLYTINI Mulsant, 1839: 70
GENUS *PLAGIONOTUS* Mulsant, 1842: 1
SUBGENUS *ECHINOCERUS* Mulsant, 1862: 143
SPECIES *P. floralis* (Pallas, 1773: 724) (**)
SUBGENUS *NEOPLAGIONOTUS* Kasatkin, 2005: 51
SPECIES *P. bobelayei* (Brullé, 1832: 253) (*)
GENUS *CHLOROPHORUS* Chevrolat, 186: 290
SUBGENUS *CHLOROPHORUS* Chevrolat, 1863: 290
SPECIES *C. varius* (Müller, 1766: 188)
SUBSPECIES *C. v. varius* (Müller, 1766: 188) (*)
SUBGENUS *CRASSOFASCIATUS* Özdikmen, 2011: 538
SPECIES *C. trifasciatus* (Fabricius, 1781: 244) (**)
SUBGENUS *PERDEROMACULATUS* Özdikmen, 2011: 537
SPECIES *C. sartor* (Müller, 1766: 188) (**)
SUBFAMILY STENOPTERINAE Gistel, 1848: [9] (unnumbered section)
TRIBE STENOPTERINI Gistel, 1848: [9]
GENUS *STENOPTERUS* Illiger, 1804: 120
SPECIES *S. rufus* (Linnaeus, 1767: 642)
SUBSPECIES *S. r. geniculatus* Kraatz, 1863: 104 (**)
TRIBE HYBODERINI Linsley, 1840: 367
GENUS *CALLIMUS* Mulsant, 1846: [5]
SUBGENUS *LAMPROPTERUS* Mulsant, 1862: 214
SPECIES *C. femoratus* (Germar, 1824: 519) (*)
SUBFAMILY DORCADIONINAE Swainson, 1840: 290
TRIBE DORCADIONINI Swainson, 1840: 290
GENUS *DORCADION* Dalman, 1817: 397
SUBGENUS *CRIBRIDORCADION* Pic, 1901: 12
SPECIES *D. cinerarium* (Fabricius, 1787: 140) (*)
SUBFAMILY LAMIINAE Latreille, 1825: 401
TRIBE PHYTOECIINI Mulsant, 1839: 191
GENUS *OXYLIA* Mulsant, 1862: 398
SPECIES *O. argentata* (Ménétriés, 1832: 227)
SPECIES *O. duponcheli* (Brullé, 1832: 260) (**)
GENUS *PHYTOECIA* Dejean, 1835: 351
SUBGENUS *CARDORIA* Mulsant, 1862: 436
SPECIES *P. scutellata* (Fabricius, 1792: 317) (**)
SUBGENUS *HELLADIA* Fairmaire, 1864: 176
SPECIES *P. humeralis* (Waltl, 1838: 471)
SUBSPECIES *P. h. humeralis* (Waltl, 1838: 471) (**)
SUBGENUS *PHYTOECIA* Dejean, 1835: 351
SPECIES *P. caerulea* (Scopoli, 1772: 102)

SUBSPECIES *P. c. caerulea* (Scopoli, 1772: 102) (**)
SPECIES *P. cylindrica* (Linnaeus, 1758: 394) (**)
SPECIES *P. geniculata* Mulsant, 1862: 420 (**)
SPECIES *P. manicata* Reiche & Saulcy, 1858: 17 (**)
SPECIES *P. pustulata* (Schrank, 1776: 66)
SUBSPECIES *P. p. pustulata* (Schrank, 1776: 66) (**)
SPECIES *P. rufipes* (Olivier, 1795: 25)
SUBSPECIES *P. r. rufipes* (Olivier, 1795: 25) (**) (****)
SPECIES *P. virgula* (Charpentier, 1825: 225) (**)
SUBGENUS *OPSILIA* Mulsant, 1862: 387
SPECIES *P. coerulescens* (Scopoli, 1763: 49) (**)
TRIBE AGAPANTHIINI Mulsant, 1839: 172
GENUS *AGAPANTHIA* Audinet-Serville, 1835: 35
SUBGENUS *SYNTHAPSIA* Pesarini & Sabbadini, 2004: 121
SPECIES *A. kirbyi* (Gyllenhal, 1817: 186) (**)
SUBGENUS *EPOPTES* Gistel, 1857: 93
SPECIES *A. lateralis* Ganglbauer, 1884: 541 (**)
SUBGENUS *AGAPANTHIA* Audinet-Serville, 1835: 35
SPECIES *A. cardui* (Linnaeus, 1767: 632) (**)
SPECIES *A. suturalis* (Fabricius, 1787: 149) (**)
SUBGENUS *SMARAGDUL*A Pesarini & Sabbadini, 2004: 128
SPECIES *A. violacea* (Fabricius, 1775: 187) (**)

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NOTES ON THE TENEBRIONIDAE (COLEOPTERA) FAUNA COLLECTED BY HIBERNATION TRAP-BANDS AND PITFALL TRAPS IN BOZDAĞLAR MOUNTAIN, WESTERN TURKEY*

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ABSTRACT: Tenebrionidae specimens collected by pitfall traps and hibernation trap-bands in Bozdağlar Mountain, western Turkey during the years of 2003-2007 have been evaluated. A total of 14 species belonging to two subfamilies and some ecological considerations on those species were given. The species are (alphabetic order): *Blaps jeannei* Ferrer & Soldati 1999; *Dailognatha quadricollis* Brullé 1832; *Graecopachys quadricollis* (Brullé 1836); *Idastrandiella mucoreus* (Waltl 1838); *Pachyscelis villosa* (Drapiez 1820); *Pimelia subglobosa polita* Soliér 1836; *Tentyria rotundata mittrei* Soliér 1835; *Zophosis punctata* Brullé 1832 in the subfamily Pimeliinae; *Dendarus messenius* Brullé 1832; *Euboeus mimonti* Boieldieu 1865; *Gonocephalum granulatum pusillum* (Fabricius 1791); *Odocnemis crenatostriatus* (Allard 1877); *Opatroides punctulatus* Brullé 1832; *Probaticus tenebricosus* (Brullé 1832) in the subfamily Tenebrioninae. *Dailognatha quadricollis* and *Pimelia subglobosa polita* were the most abundant species in the study with percentages of 39,7 % and 26,8 %, respectively.

KEY WORDS: Ecology, faunistics, hibernation trap-bands, pitfall trap, Turkey, Tenebrionidae.

The Tenebrionidae, also known as Darkling beetles, is a big family, distributed in all parts of the world and comprising more than 15.000 species belonging to 96 tribes of 10 subfamilies (Bouchard et al., 2005). They occur in many terrestrial ecosystems, mostly in decaying vegetation matter, under stones or bark. They can be found in desert or semidesert habitats. Relatively only a few Tenebrionidae species are of great economic importance.

So far, more than 310 species and subspecies of Tenebrionidae have been recorded from Turkey (Tezcan et al., 2004). The publications of Mercan et al. (2004) and Aslan et al. (2008) are the studies focusing on ecology of Tenebrionidae of Turkey, while all other contributions e.g. Fairmaire (1866) and Anlaş et al. (2004) for the Turkish Tenebrionids are concerned with taxonomic or faunistic problems.

The aim of this study is to evaluate the Tenebrionidae fauna in Bozdağlar mountain in Western Turkey. The results of this study also provide some ecological and faunistic data of Tenebrionids in Turkey.

MATERIAL AND METHOD

Study Area

Studies have been conducted at four counties (Dağmarmara and Çıkrıkçı counties by pitfall traps; Kuşlar, Ovacık and Çıkrıkçı counties by hibernation trap-bands) at Bozdağlar Mountain (2157 m), Western Turkey (Fig. 1), (also see Anlaş et al., 2010). Type of vegetation and agricultural practices determination the environment found in the counties:

1. Natural areas (chestnuts, pines and oaks forest):

Chestnuts biotopes: Aged 40 to 70 years *Castanea sativa* Miller is the common plant species. There are also *Trifolium bocconei* Savi, *Salvia fruticosa* Miller, *Anthemis tinctoria* L., *Rubia tinctorum* L., *Medicago xvaria* Martyn, *Prunella vulgaris* L., *Juniperus oxycedrus* L., *Spartium junceum* L., *Rosa canina* L., *Rubus canescens* Dc., *Polypodium vulgare* L., *Cistus salviifolius* L. and *Styrax* sp. as they are rarely seen in the study area.

Pines biotopes: *Pinus brutia* Ten. and *Pinus nigra* (Arnold) are the common plant species in the biotopes. There are also occur *Cistus laurifolius* L. and *Polypodium* sp.

Oaks biotopes: Being the abundant plant species aged 10-35 years is *Quercus ithaburensis* Dacne. subsp. *macrolepis* (Kotschy) and *Quercus infectoria* Olivier. There are also rare ones as *Cistus creticus* L., *Stacbys cretica* L. ssp. *smyrnaea* Rech., *J. oxycedrus*, *Pyrus amygdaliformis* Vill., *R. canina* and *Astragalus* sp.

2. Seminatural areas (near edges of running water, various types of unforested habitats such as meadows and other grassland, burnt forest, maquis forest):

Meadow biotopes: *Euphorbia anacampseros* Boiss, *Coridothymus capitatus* (L.), *P. vulgare*, and *J. oxycedrus*, are the common plant species in meadow biotopes.

Maquis biotopes: *Q. infectoria*, *C. salviifolius*, *R. canina*, *J. oxycedrus*, *Sarcopoterium spinosum* L., and *C. capitatus*, are the common plant species in the biotopes.

Fire-influenced biotopes: Once being an oak forest, this habitat that was burnt in July 2000. *J. oxycedrus*, *P. amygdaliformis*, *R. canina*, *Cistus laurifolius* L., *Thymus longicaule* C. Presl and *Verbascum sp.* are common plant species. In the biotope, there are also occur burnt wood pieces and trees.

3. Cultivated landscapes (orchards of cherries, walnuts, apples, figs, pears and olives):

In the gardens which have only occur the related trees (each orchard has only one tree species).

The material referred to in this study is deposited in the Lodos Entomological Museum (LEMT), Department of Plant Protection, Ege University (Izmir, Turkey), Entomological Museum of Zoology Department, Ege University (ZDEU-Ent) and in the private collection of S. Anlaş. Material were identified by B. Keskin and S. Anlaş. Classification and nomenclature of darkling beetles suggested by Lawrence & Newton (1995), Iwan (2001), Soldati & Soldati (2003) and Bouchard et al. (2005) have been followed. Material have been collected by two methods. Those were pitfall traps method and using hibernation trap bands.

Sampling

a) Pitfall traps:

A total of 6 pitfall traps were placed in each biotope. Pitfall traps consisted of 200 ml cups buried in the soil in such a way that the lip of the trap would be at ground level. They were half filled with ethylen glycol and water mixture at 1:1 ratio. Traps were cleared in two weeks intervals from beginning of April to end of October and then collected material were determined.

Detailed information on the biotopes of pitfall trapping is given in Table 1.

b) Hibernation trap-bands:

At each biotope hibernation trap bands in 70 x 250 m size made of hemp sack were rounded to the trunk of six trees in the beginning of October and removed in next February and collected material were determined. A total of 18 hibernation trap-bands were placed in each biotope.

Detailed information on the biotopes of hibernation trap-bands is given in Table 2.

RESULTS

In total, 1174 specimens of 14 species belonging to two subfamilies of Tenebrionidae have been recorded by pitfall traps and hibernation trap-bands in Bozdağlar Mountain, western Turkey during the years of 2003-2007 have been evaluated. Those species are *Blaps jeannei* Ferrer & Soldati, 1999; *Dailognatha quadricollis* Brullé, 1832; *Graecopachys quadricollis* (Brullé, 1836); *Idastrandiella mucoreus* (Waltl, 1838); *Pachyscelis villosa* (Drapiez, 1820); *Pimelia subglobosa polita* Soliér, 1836; *Tentyria rotundata mittrei* Soliér, 1835; *Zophosis punctata* Brullé, 1832 (Pimeliinae); *Dendarus messenius* Brullé, 1832; *Euboeus mimonti* Boieldieu, 1865; *Gonocephalum granulatum pusillum* (Fabricius, 1791); *Odocnemis crenatostriatus* (Allard, 1877); *Opatroides punctulatus* Brullé, 1832; *Probaticus tenebricosus* (Brullé, 1832) (Tenebrioninae).

Pitfall trap studies

A total of 845 specimens representing 12 species of Tenebrionidae were collected at two counties between the years of 2003-2006 (Table 3). Among these, eight species belonged to Pimeliinae, while the other four species are members of Tenebrioninae.

The most abundant species is *D. quadricollis* with 429 specimens and percent dominance value of 50.77 %. *P. subglobosa polita* and *D. messenius* followed it with percent dominance values of 37.16 % and 6.04 %, respectively. Those three species were found in all two counties during collecting period. The species of *B. jeannei*, *G. quadricollis*, *P. villosa T. rotundata mittrei Z. punctata E. mimonti* and *G. granulatum pusillum* were collected only occasionally, with the abundance being less than 1 %.

The total number of the specimens collected during two years' collection in Dağmarmara was 386 (45.68 %) and in Çıkrıkçı was 459 (54.32 %). The number of collected specimens and species by pitfall traps at each biotope is given in Table 4.

Among the biotopes, the majority of the specimens were collected from oaks biotope (253), meadow (198) and fire-influenced biotopes (185); the least specimens were collected from semiaquatic biotopes (7) and chestnuts biotopes (49). The number of species was 9 at oak biotopes; 8 at meadow; 6 at pines; 5 at chestnuts and maquis, 4 at fire-influenced biotopes; only 1 species at semiaquatic biotopes.

Seasonal dynamics

Of 12 species recorded during this study, only *Dailiognatha quadricollis*, *Pimelia subglobosa polita* and *Dendarus messenius* were collected in higher number of specimens that allows us to evaluate their seasonal dynamics on the localities (Fig. 2).

D. quadricollis, and *P. subglobosa polita* sampled during the period from April to October. The number of specimens of *D. quadricollis*, and *P. subglobosa* *polita* increased from April to June and reached peak level in June. *D. quadricollis,* in the period of July-October it decreased and in October the number decreased up to 28. *P. subglobosa polita,* showing low abundance in July with number of 26 and increased in August. In the period of September-October it decreased again and October the number decreased up to 11. *D. messenius* was not recorded April and October, the peaks were recorded in June and August.

Hibernation trap-band studies

Totally 329 specimens representing seven species of Tenebrionidae were collected at three counties during the autumn and winter periods of the years of 2005-2007 (Table 5). Among these, three species (*B. jeannei, D. quadricollis* and *P. villosa*) belong to Pimeliinae, while four species (*D. messenius, O. crenatostriatus, O. punctulatus* and *P. tenebricosus*) belong to Tenebrioninae.

The most frequently collected species in three counties was *O. crenatostriatus*, with percent dominance value of 73.86 %; and also *D. quadricollis* and *O. punctulatus* with percent dominance value of 11.25 % and 11.25 %, respectively.

The total number of specimens collected during two years in Çıkrıkcı was 75 (22.80 %) and in Ovacık 87 (26.44 %). It was 167 (50.76 %) in Kuşlar during three years collection period.

The number of collected specimens and species of each biotope is given in Table 6.

The number of specimens at chestnuts was 90 and apple was 64 among eight biotopes. Their numbers changed between 8 and 54 in other biotopes. Number of species was 4 at fig and it was 3 at pear and chestnut biotopes. The number of species was one at the biotope of olive, it was 2 at the rest of biotopes.

DISCUSSION

The first study on the fauna of Bozdağ have been conducted by Fairmaire (1866) and in this study a total of 23 species recorded. In this study to determine the Tenebrionidae fauna of west and northwest Bozdağlar Mountain, pitfall traps and hibernating trap bands were used to collect material. Using pitfall traps is a standard method to collect tenebrionids. But hibernation trap-bands were used for the second time with respect to Tenebrionidae. This method previously was used in ecological cherry orchards in Izmir and Manisa by Tezcan & Keskin (2004). Artificial hibernation trap-bands have great importance in both the protection of fauna and also in extending their life-span. In this study, the artificial hibernation places that have been used as hibernation trap-bands, are utilized for the evaluation of fauna of different biotopes.

In total, 1174 specimens of the Tenebrionidae were collected at all location by different methods. 845 of which were collected by pitfall traps and 329 by hibernation trap-bands. *D. quadricollis* is the most abundant species with 466 specimens (39,7 %), 429 of which were collected by pitfall traps and 37 by hibernation trap-bands. *P. subglobosa polita* other dominant species with 314 specimens (26,8 %), all of them were collected by pitfall traps. *O. crenatostriatus* is collected with 243 specimens (20,7 %), only by hibernation trap-bands. Collecting of more adults of *O. crenatostriatus* probably overlapping of the activation period of this species and the collection of hibernation trap-bands. Detailed information on the biology, damage etc. of the collected species in ecosystems is not available in Turkey. It is expected that knowledge on darkling beetles will rise with further studies.

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Table 1. Detailed information on biotopes of pitfall trap methods.

Region	Prov.	County	Period	Biotopes	Coordinate	Altitude (m)
1	Manisa	Dağmarmara	2003 & 2006	Oak forest	38°22'14''N/ 27°50'39''E	980
				Fire-influenced biotopes	38°22'07''N/ 27°50'16''E	960
				Pine forest	38°22'49''N/ 27°52'12''E	930
				Meadow	38°22'39''N/ 28°04'56''E	880
				Chestnut forest	38°23'37''N/ 27°49'09''E	620
2	Manisa	Çıkrıkçı	2005 & 2006	Oak forest	38°28'19''N/ 27°49'44''E	220
				Meadow	38°28'19''N/ 27°49'38''E	200
				Pine forest	38°28'23''N/ 27°49'47''E	180
				Semiaquatic biotopes	38°28'24''N/ 27°49'17''E	110
				Maqui forest	38°28'24''N/ 27°49'20''E	150

Table 2. Detailed information on biotopes of hibernation trap-band methods (*setting period of trap-bands (October), collected February the following year).

Region	Prov.	County	Years*	Biotopes	Coordinate	Altitude (m)
1	Manisa	Çıkrıkçı	2005 & 2006	Fig	38°28'24''N/ 27°49'30''E	120
				Olive	38°28'22''N/ 27°49'28''E	120
				Pear	38°28'21''N/ 27°49'31''E	120
2	Manisa	Kuşlar	2004, 2005 & 2006	Cherry	38°21'44''N/ 27°49'58''E	820
				Chestnut	38°21'48''N/ 27°49'57''E	820
				Walnut	38°21'41''N/ 27°49'56''E	820
3	Manisa	Ovacık	2005 & 2006	Apple	38°22'45''N/ 27°51'06''E	930
				Cherry	38°22'45''N/ 27°51'06''E	930
				Pine	38°22'45''N/ 27°51'06''E	930

Table 3. Number of specimens collected by pitfall traps in different counties and their percent dominance values.

Subfamilies	Location and year	Dağmarmara		Çıkrıkçı		Sum	Dominance Value (%)
	Species	2003	2006	2005	2006		
Pimeliinae	*B. jeannei*		1	1		2	0.24
	D. quadricollis	84	52	131	162	429	50.77
	G. quadricollis				1	1	0.12
	I. mucoreus	2	1	5	4	12	1.42
	P. villosa			3	4	7	0.83
	P. subglobosa polita	79	118	23	94	314	37.16
	T. rotundata mittrei		1		1	2	0.24
	Z. punctata	2	2		1	5	0.59
Tenebrioninae	*D. messenius*	16	7	6	22	51	6.04
	E. mimonti				1	1	0.12
	G. granulatum pusillum	2	1			3	0.36
	P. tenebricosus	3	15			18	2.13
	Totally	**188**	**198**	**169**	**290**	**845**	**100**
		386		**459**		**845**	

Table 4. The number of collected specimens and species by pitfall traps at each biotope in Western Turkey [Ch (Chestnuts), Ma (Maquis), Me (Meadow), Oa (Oaks), Sa (Semiaquatic), Pi (Pines), Fi (fire-influenced)]

Biotopes	Ch	Ma	Me	Oa	Sa	Pi	Fi	Total
B. jeannei				2				2
D. quadricollis	11	57	98	156	7	16	84	429
G. quadricollis				1				1
I. mucoreus		1	9	1		1		12
P. villosa		1	3	3				7
P. subglobosa polita	29	27	75	64		31	88	314
T. rotundata mittrei			1			1		2
Z. punctata				3			2	5
D. messenius	6	9	10	22		4		51
E. mrmonti			1					1
G. granulatum pusillum	1		1	1				3
P. tenebricosus	2					5	11	18
Number of specimens	**49**	**95**	**198**	**253**	**7**	**58**	**185**	**845**
Number of species	**5**	**5**	**8**	**9**	**1**	**6**	**4**	**12**

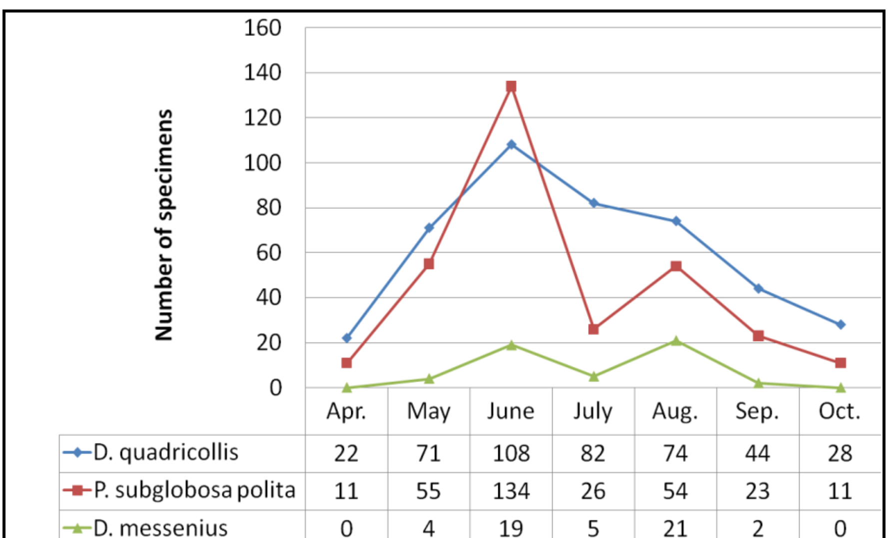
Table 5. Number of specimens collected by hibernation trap-bands at different counties and their percent dominance values.

Location and year	Ovacık		Kuşlar			Çıkrıkçı		Sum	Dominance Value (%)
Species	2006	2007	2005	2006	2007	2006	2007		
B. jeannei		1		1				2	0.61
D. quadricollis			3	2		13	19	37	11.25
P. villosa						2	1	3	0.91
D. messenius						2	1	3	0.91
O. crenatostriatus	36	47	96	20	44			243	73.86
O. punctulatus						16	21	37	11.25
P. tenebricosus	1	2			1			4	1.21
Totally	**37**	**50**	**99**	**23**	**45**	**33**	**42**	**329**	**100**
	87		**167**			**75**		**329**	

Table 6. Biotopes of Tenebrionidae species collected by hibernation trap-bands in Western Turkey [Ol (Olive), Ap (Apple), Fg (Fig), Pe (Pear), Ce (Cherry), Wl (Walnut), Pi (Pine), Ch (Chestnut)].

Biotopes	Ol	Ap	Fg	Pe	Ce	Wl	Pi	Ch	Total
B. jeannei						1	1		2
D. quadricollis	8		10	14	2			3	37
P. villosa			3						3
D. messenius			2	1					3
O. crenatostriatus		61			52	33	11	86	243
O. punctulatus			12	25					37
P. tenebricosus		3						1	4
Number of specimens	**8**	**64**	**27**	**40**	**54**	**34**	**12**	**90**	**329**
Number of species	**1**	**2**	**4**	**3**	**2**	**2**	**2**	**3**	**7**

Figure 1. Study areas at Bozdağlar Mountain, western Turkey.



	Apr.	May	June	July	Aug.	Sep.	Oct.
D. quadricollis	22	71	108	82	74	44	28
P. subglobosa polita	11	55	134	26	54	23	11
D. messenius	0	4	19	5	21	2	0

Figure 2. Seasonal dynamics of specimens of *Dailognatha quadricollis, Pimelia subglobosa polita* and *Dendarus messenius* during sampling period, April to October, by pitfall traps.

THE LONGHORNED BEETLES THAT ORIGINALLY DESCRIBED FROM WHOLE TERRITORIES OF TURKEY (COLEOPTERA: CERAMBYCOIDEA) PART I – VESPERIDAE AND CERAMBYCIDAE (PRIONINAE, LEPTURINAE, NECYDALINAE, ASEMINAE, SAPHANINAE AND DORCASOMINAE)

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ABSTRACT. The paper is the first part of a planned serial work. It gives an annotated list of the Cerambycoidea [Vesperidae and Cerambycidae (Prioninae, Lepturinae, Necydalinae, Aseminae, Saphaninae and Dorcasominae)] that originally described from Turkey, with some important synonyms.

KEY WORDS: Prioninae, Lepturinae, Cerambycidae, Vesperidae, Cerambycoidea, Coleoptera, Turkey.

As known, Turkey that has continental properties, is origin of many taxa and is a refigium (an area where conditions have enabled a species or a community of species to survive after extinction in surrounding areas) for effected living creatures from geological and climatical changes has more biological importance than any land in the World. As seen the whole World, an incredible variations have also been seen among the insects which are the most influenced living creatures from these changes occurred in the past in Turkey. Turkey appears a continental property changeable in very short distances in terms of climatical features and field structures.

Hence, a series work is planned that is aim to expose the Turkish Cerambycoidea described from Turkey originally as possible as detailed and entirely by beginning from Vesperidae to Cerambycidae (Prioninae and Lepturinae). The present study is attempted as the first step of this aim.

According to Özdikmen (2012), the ratio of endemism for Turkish longhorned beetles is approximately 40 %. This status is proved that Turkey is in a position of the origin for many taxa among the longhorned beetles.For this reason, it is clear that to know the type locality of each species group taxa described from Turkey will be very useful for many objectives. However, there is no any work on this subject clearly.

Information in the present text is given in following order:

All taxa are accompanied by the author's name and description date. For each species, subspecies or important synonym, the original combination and type locality are provided under the taxon names. The status of endemism for Turkey is also indicated under these information.

In this paper, classification and nomenclature of the longhorn beetles suggested by Özdikmen (2012) is followed chiefly. Within the genera and subgenera, the species are listed alphabetically.

Please see Löbl & Smetana (2010) for cited references in the text.

SUPERFAMILY CERAMBYCOIDEA Latreille, 1802

FAMILY VESPERIDAE Mulsant, 1839: 214

SUBFAMILY VESPERINAE Mulsant, 1839: 214

TRIBE VESPERINI Mulsant, 1839

GENUS *VESPERUS* Dejean, 1821: 111

SPECIES *V. ocularis* Mulsant & Rey, 1863: 172

Orig. comb.: *Vesperus ocularis*

Type loc.: "Smyrne" (Turkey: İzmir prov.)

Endemic species to Turkey.

FAMILY CERAMBYCIDAE Latreille, 1802: 211

SUBFAMILY PRIONINAE Latreille, 1802: 212

TRIBE ERGATINI Fairmaire, 1864: 117

GENUS *CALLERGATES* Lameere, 1904: 47

SUBGENUS -

SPECIES *C. gaillardoti* (Chevrolat, 1854: 481)

Orig. comb.: *Ergates gaillardoti*

Type loc.: "Saida" (Israel)

SYNONYM

akbesianus Pic, 1900: 81

Orig. comb.: *Ergates akbesianus*

Type loc.: Akbez (Turkey: Hatay prov.)

GENUS *ERGATES* Audinet-Serville, 1832: 143

SPECIES *E. faber* (Linnaeus, 1760: 187)

Orig. comb.: *Cerambyx faber*

Type loc.: "Suecia" (Sweden)

SUBSPECIES *E. faber faber* (Linnaeus, 1760: 187)

SYNONYM

alkani Demelt, 1968: 28

Orig. comb.: *Ergates faber alkani*

Type loc.: Murgul (Turkey: Artvin prov.)

TRIBE PRIONINI Latreille, 1802: 212

GENUS *MESOPRIONUS* Jakovlev, 1887: 323

SPECIES *M. besikanus* (Fairmaire, 1855: 318)

Orig. comb.: *Prionus besikanus*

Type loc.: "Baie de Bésika dans le Bosphore" (Turkey: İstanbul prov.: Bosphorus)

SUBFAMILY LEPTURINAE Latreille, 1802: 218

TRIBE XYLOSTEINI Reitter, 1913: 5

GENUS *XYLOSTEUS* Frivaldszky, 1837: 180

SPECIES *X. kadleci* Miroshnikov, 2000: 38

Orig. comb.: *Xylosteus kadleci*

Type loc.: Abant Lake env. (Turkey: Bolu prov.)

Endemic species to Turkey.

TRIBE RHAMNUSIINI Sama [in Sama and Sudre], 2009: 383

GENUS *RHAMNUSIUM* Latreille, 1829: 130

SPECIES *R. graecum* Schaufuss, 1862: 311

Orig. comb.: *Rhamnusium graecum*

Type loc.: Graecia (Greece)

SUBSPECIES *R. g. graecum* Schaufuss, 1862: 311

SYNONYMS

juglandis Fairmaire, 1866: 276

Orig. comb.: *Rhamnusium juglandis*

Type loc.: Turkey (?İzmir prov.: Boz Mt.)

delagrangei Pic, 1901: 10
Orig. comb.: *Rhamnusium delagrangei*
Type loc.: "Smyrna" (Turkey: İzmir prov.)

SPECIES *R. testaceipenne* Pic, 1897: 299
Orig. comb.: *Rhamnusium testaceipenne*
Type loc.: Caucasus

SYNONYMS
anatolicum Pic, 1901: 10
Orig. comb.: *Rhamnusium testaceipenne* v. *anatolicum*
Type loc.: Amasya prov. (Turkey)

obscuripes Pic, 1903: 163
Orig. comb.: *Rhamnusium testaceipenne* v. *obscuripes*
Type loc.: European Turkey

rufotibiale Pic, 1917: 3
Orig. comb.: *Rhamnusium testaceipenne* v. *rufotibiale*
Type loc.: Taurus Mts. (Turkey)

TRIBE RHAGIINI Kirby, 1837: 178
GENUS *RHAGIUM* Fabricius, 1775: 182
SUBGENUS *HAGRIUM* Villiers, 1978: 85
SPECIES *R. bifasciatum* Fabricius, 1775: 183
Orig. comb.: *Rhagium bifasciatum*
Type loc.: Anglia (England), Gallia (France)

SYNONYM
deyrollei Pic, 1909: 123
Orig. comb.: *Rhamnusium bifasciatum* ab. *deyrollei*
Type loc.: "Trapezunt" (Turkey: Trabzon prov.)

SUBGENUS *MEGARHAGIUM* Reitter, 1913: 6
SPECIES *R. elmaliense* Schmid, 1999: 157
Orig. comb.: *Rhagium elmaliense*
Type loc.: Elmalı (Turkey: Antalya prov.)
Endemic species to Turkey.

SPECIES *R. phyrigium* K. Daniel, 1906: 176
Orig. comb.: *Rhagium phyrigium*
Type loc.: Akşehir (Turkey: Konya prov.)
Endemic species to Turkey.

SPECIES *R. syriacum* Pic, 1892: CXI [1893: 414]
Orig. comb.: *Rhagium mordax* var. *syriacum*
Type loc.: Akbez (Turkey: Hatay prov.)

SUBGENUS *RHAGIUM* Fabricius, 1775: 182
SPECIES *R. inquisitor* (Linnaeus, 1758: 393)
Orig. comb.: *Cerambyx inquisitor*
Type loc.: Europa

SUBSPECIES *R. i. fortipes* Reitter, 1898: 357
Orig. comb.: *Rhagium fortipes*
Type loc.: Akbez (Turkey: Hatay prov.)
Endemic subspecies to Turkey.

GENUS *AKIMERUS* Audinet-Serville, 1835: 212
SPECIES *A. berchmansi* Breit, 1915: 353
Orig. comb.: *Rhagium fortipes*
Type loc.: Akbez (Turkey: Hatay prov.)
Endemic species to Turkey.

GENUS *STENOCORUS* Geoffroy, 1762: 221
SUBGENUS *ANISORUS* Mulsant, 1862: 467
SPECIES *S. brunnescens* (Holzschuh, 1991: 5)
Orig. comb.: *Anisorus brunnescens*
Type loc.: Şemdinli (Turkey: Hakkari prov.)
Endemic species to Turkey.

SPECIES *S. heterocerus* (Ganglbauer, 1882: 139)
Orig. comb.: *Toxotus heterocerus*
Type loc.: "Cilicia: Gülek (Bulgar-dagh)" [Turkey: İçel prov.: Gülek]

SPECIES *S. homocerus* (K. Daniel, 1900: 139)
Orig. comb.: *Toxotus homocerus*
Type loc.: Asia minor (Turkey)
Endemic species to Turkey.

SUBGENUS *STENOCORUS* Geoffroy, 1762: 221
SPECIES *S. auricomus* (Reitter, 1890: 250)
Orig. comb.: *Toxotus auricomus*
Type loc.: "Külek (Silicischer Taurus)" [Turkey: İçel prov.: Gülek]
Endemic species to Turkey.

SPECIES *S. insitivus* (Germar, 1824: 520)
Orig. comb.: *Leptura insitivus*
Type loc.: Caucasus

SUBSPECIES *S. i. insitivus* (Germar, 1824: 520)
SYNONYM
latus Pic, 1892s: cxi [= 1893d: 414]
Orig. comb.: *Toxotus insitivus* var. *latus*
Type loc.: "monts Amanus, pays d'Akbès" (Turkey: Hatay prov.: Akbez)

SPECIES *S. serratus* Holzschuh, 1974: 86
Orig. comb.: *Stenocorus serratus*
Type loc.: Buğlan pass (Turkey: Muş prov.)
Endemic species to Turkey.

SPECIES *S. vittidorsum* (Reitter, 1890: 250)
Orig. comb.: *Toxotus persicus* v. *vittidorsum*
Type loc.: "not stated", probably "Araxesthal" (Caucasus and ?Turkey)

GENUS *BRACHYTA* Fairmaire, 1864: 185
SUBGENUS -
SPECIES *B. delagrangei* Pic, 1891: 102
Orig. comb.: *Brachyta delagrangei*
Type loc.: "not stated" [but undoubtedly Turkey: Hatay prov.: Akbez from Pic (1892: 414)]
Endemic species to Turkey.

GENUS *CORTODERA* Mulsant, 1863: 572
SUBGENUS -
SPECIES *C. aestiva* Sama & Rapuzzi, 1999: 466
Orig. comb.: *Cortodera aestiva*
Type loc.: Sarıkamış (Turkey: Kars prov.)
Endemic species to Turkey.

SPECIES *C. alpina* (Ménétries, 1832: 230)
Orig. comb.: *Pachyta alpina*
Type loc.: Alpes du Caucase (Caucasus)

SUBSPECIES *C. a. xanthoptera* Pic, 1898: 115
Orig. comb.: *Cortodera aestiva*
Type loc.: "Angora" (Turkey: Ankara prov.)

SPECIES *C. cirsii* Holzschuh, 1975: 82
Orig. comb.: *Cortodera cirsii*
Type loc.: Nurdağı pass (Turkey: Adana prov.)
Endemic species to Turkey.

SPECIES *C. colchica* Reitter, 1890: 246
SUBSPECIES *C. c. colchica* Reitter, 1890: 246
Orig. comb.: *Cartodera colchica*
Type loc.: "Kaukasus, Araxesthal" (Caucasus and ?Turkey)

SPECIES *C. discolor* Fairmaire, 1866: 277
Orig. comb.: *Cortodera discolor*
Type loc.: Bosz-Dagh (Turkey: ?İzmir prov.)

SPECIES *C. flavimana* (Waltl, 1838: 471)
Orig. comb.: *Leptura flavimana*
Type loc.: Turcia (Turkey), Hungaria (Hungary)

SPECIES *C. imrasanica* Sama & Rapuzzi, 1999: 464
Orig. comb.: *Cortodera imrasanica*
Type loc.: Çakıllı pass (Irmasan pass) (Turkey: Antalya prov.)
Endemic species to Turkey.

SPECIES *C. longipilis* Pic, 1898: 50
Orig. comb.: *Cortodera longipilis*
Type loc.: Akbez (Turkey: Hatay prov.)
Endemic species to Turkey.

SPECIES *C. obscurans* Pic, 1892: CXI
Orig. comb.: *Cortodera semilivida* v. *obscurans*
Type loc.: Akbez (Turkey: Hatay prov.)
Endemic species to Turkey.

SYNONYMS
flavescens Pic, 1894: 116
Orig. comb.: *Cortodera obscurans* v. *flavescens*
Type loc.: Akbez (Turkey: Hatay prov.)

fulvipennis Pic, 1898: 50
Orig. comb.: *Cortodera obscurans* v. *fulvipennis*
Type loc.: Akbez (Turkey: Hatay prov.)

SPECIES *C. omophloides* Holzschuh, 1975: 77
Orig. comb.: *Cortodera omophloides*
Type loc.: "Kilik. Taurus, Namrun (Prov. Mersin)" (Turkey: İçel prov.)
Endemic species to Turkey.

SPECIES *C. orientalis* Adlbauer, 1988: 264
Orig. comb.: *Cortodera humeralis orientalis*
Type loc.: Nurdağı pass (Turkey: Osmaniye prov.)
Endemic species to Turkey.

SPECIES *C. pseudomophlus* Reitter, 1889: 40
Orig. comb.: *Cartodera pseudomophlus*
Type loc.: "Araxesthal" (Caucasus and ?Turkey)

SPECIES *C. ranunculi* Holzschuh, 1975: 80
Orig. comb.: *Cortodera ranunculi*
Type loc.: Varto (Turkey: Muş prov.)
Endemic species to Turkey.

SPECIES *C. rubripennis* Pic, 1891: 102
Orig. comb.: *Cortodera discolor* var. *rubripennis*
Type loc.: Akbez (Turkey: Hatay prov.)
Endemic species to Turkey.

SYNONYM
obscura Pic, 1898: 49
Orig. comb.: *Cortodera rubripennis* var. *obscura*
Type loc.: Akbez (Turkey: Hatay prov.)

SPECIES *C. semilivida* Pic, 1892: CXCIII
Orig. comb.: *Cortodera semilivida*
Type loc.: Akbez (Turkey: Hatay prov.)

SPECIES *C. simulatrix* Holzschuh, 1975: 83
Orig. comb.: *Cortodera simulatrix*
Type loc.: Şavşat (Turkey: Artvin prov.)
Endemic species to Turkey.

SPECIES *C. syriaca* Pic, 1901: 90
Orig. comb.: *Cortodera syriaca*
Type loc.: Syria

SUBSPECIES *C. s. nigroapicalis* Holzschuh, 1981: 95
Orig. comb.: *Cortodera syriaca nigroapicalis*
Type loc.: Uludere, Tanin pass (Turkey: Hakkari prov.)

SPECIES *C. uniformis* Holzschuh, 1975: 79
Orig. comb.: *Cortodera uniformis*
Type loc.: Gümüşhane prov. (Turkey)
Endemic species to Turkey.

SPECIES *C. wewalkai* Holzschuh, 1995: 9
Orig. comb.: *Cortodera wewalkai*
Type loc.: Turkey
Endemic species to Turkey.

SPECIES *C. wittmeri* Holzschuh, 1995: 9
Orig. comb.: *Cortodera wittmeri*
Type loc.: Gümüşhane prov. (Turkey)
Endemic species to Turkey.

TRIBE LEPTURINI Latreille, 1802: 218
GENUS *GRAMMOPTERA* Audinet-Serville, 1835: 215
SUBGENUS *GRAMMOPTERA* Audinet-Serville, 1835: 215
SPECIES *G. merkli* Frivaldszky, 1884: 4
Orig. comb.: *Grammoptera merkli*
Type loc.: "Achu-Dagh Asiae minoris" (Turkey)
Endemic species to Turkey.

GENUS *ALOSTERNA* Mulsant, 1863: 576
SUBGENUS *ALOSTERNA* Mulsant, 1863: 576
SPECIES *A. anatolica* Adlbauer, 1992: 490
Orig. comb.: *Alosterna anatolica*
Type loc.: Elmalı (Turkey: Antalya prov.)
Endemic species to Turkey.

SPECIES *A. tabacicolor* (DeGeer, 1775: 139)
Orig. comb.: *Leptura tabacicolor*
Type loc.: not stated, but undoubtedly Europe

SUBSPECIES *A. t. tokatensis* Pic, 1901: 59
Orig. comb.: *Alosterna tabacicolor* var. *tokatensis*
Type loc.: Tokat prov. (Turkey)
Endemic subspecies to Turkey.

GENUS *VADONIA* Mulsant, 1863: 559
SPECIES *V. bisignata* (Brullé, 1832: 264)
Orig. comb.: *Leptura bisignata*
Type loc.: Greece

SUBSPECIES *V. b. bisignata* (Brullé, 1832: 264)
SYNONYM
grandicollis Mulsant & Rey, 1863: 182
Orig. comb.: *Vadonia grandicollis*
Type loc.: "Smyrne" (Turkey: İzmir prov.)

SPECIES *V. bitlisiensis* Chevrolat, 1882: 59
Orig. comb.: *Vadonia bittisiensis*
Type loc.: Bitlis prov. (Turkey)

SYNONYM
cribricollis Pic, 1889: 20 [mispaginated: 5]
Orig. comb.: *Leptura cribricollis*
Type loc.: Bitlis prov. (Turkey)

SPECIES *V. bolognai* Sama, 1982: 207
Orig. comb.: *Vadonia bolognai*
Type loc.: Kavak (Turkey: Samsun prov.)
Endemic species to Turkey.

SPECIES *V. ciliciensis* (Daniel & Daniel, 1891: 13)
Orig. comb.: *Vadonia ciliciensis*
Type loc.: Cilician Taurus (Turkey: ?İçel prov.)
Endemic species to Turkey.

SPECIES *V. danielorum* Holzschuh, 1984: 142
Orig. comb.: *Vadonia danielorum*
Type loc.: Termessos (Turkey: Antalya prov.)
Endemic species to Turkey.

SPECIES *V. frater* Holzschuh, 1981: 96
Orig. comb.: *Vadonia frater*
Type loc.: Nurdağı pass (Turkey: Adana prov.)
Endemic species to Turkey.

SPECIES *V. instigmata* Pic, 1890: CLXXVI
Orig. comb.: *Vadonia bitlisiensis* var. *instigmata*
Type loc.: Bitlis prov. (Turkey)
Endemic species to Turkey.

SPECIES *V. ispirensis* Holzschuh, 1993: 14
Orig. comb.: *Vadonia ispirensis*
Type loc.: İspir (Turkey: Erzurum prov.)
Endemic species to Turkey.

SPECIES *V. moesiaca* (Daniel & Daniel, 1891: 6)
Orig. comb.: *Leptura moesiaca*
Type loc.: Serbia, Turkey

SPECIES *V. monostigma* (Ganglbauer, 1882: 29)
Orig. comb.: *Leptura monostigma*
Type loc.: Amasya prov. (Turkey)
Endemic species to Turkey.

SPECIES *V. soror* Holzschuh, 1981: 95
SUBSPECIES *V. s. soror* Holzschuh, 1981: 95
Orig. comb.: *Vadonia soror*
Type loc.: Pamukkale (Turkey: Denizli prov.)
Endemic subspecies to Turkey.

SUBSPECIES *V. s. tauricola* Holzschuh, 1993: 14
Orig. comb.: *Vadonia soror tauricola*
Type loc.: Aydıncık (Turkey: İçel prov.)
Endemic subspecies to Turkey.

GENUS *PSEUDOVADONIA* Lobanov, Danilevsky & Murzin, 1981: 787
SPECIES *P. livida* (Fabricius, 1777: 233)
Orig. comb.: *Leptura livida*
Type loc.: Kiel (Germany)

SUBSPECIES *P. l. desbrochersi* (Pic, 1891: XVI)
Orig. comb.: *Vadonia livida* var. *desbrochersi*
Type loc.: Bitlis prov. (Turkey)

GENUS *ANOPLODERA* Mulsant, 1839: 285
SUBGENUS *ANOPLODERA* Mulsant, 1839: 285
SPECIES *A. rufipes* (Schaller, 1783: 296)
Orig. comb.: *Leptura rufipes*
Type loc.: Germany

SUBSPECIES *A. r. lucidipes* Sama, 1999: 46
Orig. comb.: *Anoplodera rufipes lucidipes*
Type loc.: Erdemli (Turkey: İçel prov.)
Endemic subspecies to Turkey.

GENUS *STICTOLEPTURA* Casey, 1924: 280
SUBGENUS *STICTOLEPTURA* Casey, 1924: 280
SPECIES *S. deyrollei* (Pic, 1895: 40)
Orig. comb.: *Leptura deyrollei*
Type loc.: "Trébizonde" (Turkey: Trabzon prov.)

SPECIES *S. excisipes* (Daniel & Daniel, 1891: 6)
Orig. comb.: *Leptura excisipes*
Type loc.: Cilician Taurus (Turkey: ?İçel prov.)

SPECIES *S. gevneensis* Özdikmen & Turgut, 2008: 549
Orig. comb.: *Stictoleptura gevneensis*
Type loc.: Alanya, Gevne valley (Turkey: Antalya prov.)
Endemic species to Turkey.

SPECIES *S. heydeni* (Ganglbauer, 1889: 469)
Orig. comb.: *Leptura heydeni*
Type loc.: "Caramanien" (Turkey: Karaman prov.).

SPECIES *S. rufa* (Brullé, 1832: 263)
Orig. comb.: *Leptura rufa*
Type loc.: Greece

SUBSPECIES *S. r. rufa* (Brullé, 1832: 263)
SYNONYM
nigropicta Fairmaire, 1866: 278
Orig. comb.: *Leptura nigropicta*
Type loc.: "Bosz-Dagh" (Turkey: ?İzmir prov.)

SUBSPECIES *S. r. dimidiata* (Daniel & Daniel, 1891: 11)
Orig. comb.: *Leptura rufa dimidiata*
Type loc.: "Nordpersien" (Iran)

SYNONYM
attaliensis Daniel & Daniel, 1891: 11
Orig. comb.: *Leptura attaliensis*
Type loc.: Antalya prov. (Turkey)

SPECIES *S. sambucicola* (Holzschuh, 1982: 65)
Orig. comb.: *Brachyleptura sambucicola*
Type loc.: "Kilik. Taurus, Vili. Mersin, Namrun" (Turkey: İçel prov.: Namrun)

SPECIES *S. scutellata* (Fabricius, 1781: 247)
Orig. comb.: *Leptura scutellata*
Type loc.: Italy

SUBSPECIES *S. s. inscutellata* (Pic, 1892: 415)
Orig. comb.: *Leptura scutellata* var. *inscutellata*
Type loc.: Akbez (Turkey: Hatay prov.)
Endemic subspecies to Turkey.

SPECIES *S. tripartita* (Heyden, 1889: 329)
Orig. comb.: *Leptura tripartita*
Type loc.: Syria (?Turkey)

GENUS *ANASTRANGALIA* Casey, 1924: 280
SPECIES *A. montana* (Mulsant & Rey, 1863: 179)
Orig. comb.: *Leptura montana*
Type loc.: Cyprus

SUBSPECIES *A. m. montana* (Mulsant & Rey, 1863: 179)
SYNONYM
leuthneri Ganglbauer, 1886: 516
Orig. comb.: *Leptura montana* var. *leuthneri*
Type loc.: Gülek (Turkey: İçel prov.)

nigerrima Pic, 1892: 415
Orig. comb.: *Leptura montana* var. *nigerrima*
Type loc.: Akbez (Turkey: Hatay prov.)

pernigra Reitter, 1898: 193
Orig. comb.: *Leptura montana* var. *pernigra*
Type loc.: Akbez (Turkey: Hatay prov.)

semisanguinea Reitter, 1898: 193
Orig. comb.: *Leptura montana* var. *semisanguinea*
Type loc.: Akbez (Turkey: Hatay prov.)

GENUS *PEDOSTRANGALIA* Sokolov, 1897: 461
SUBGENUS *PEDOSTRANGALIA* Sokolov, 1897: 461
SPECIES *P. tokatensis* Sama, 1996: 103
Orig. comb.: *Pedostrangalia tokatensis*
Type loc.: Almus, Alanköy (Turkey: Tokat prov.)
Endemic species to Turkey.

SUBGENUS *NEOSPHENALIA* Löbl, 2010: 110
SPECIES *P. adaliae* (Reitter, 1885: 390)
Orig. comb.: *Strangalia verticalis* var. *adaliae*
Type loc.: Adalia, Lycian Taurus (Turkey: ?Antalya prov.)

SPECIES *P. emmipoda* (Mulsant, 1863: 531)
Orig. comb.: *Strangalia emmipoda*
Type loc.: Turkey

SYNONYM
joegeri Fairmaire, 1866: 279
Orig. comb.: *Leptura joegeri*
Type loc.: Bosz-Dagh (Turkey: ?İzmir)

adanensis Pic, 1917: 6
Orig. comb.: *Strangalia adanensis*
Type loc.: Adana prov. (Turkey)

SPECIES *P. kurda* Sama, 1996: 104
Orig. comb.: *Pedostrangalia kurda*
Type loc.: Pülümür (Turkey: Tunceli prov.)
Endemic species to Turkey.

SPECIES *P. verticenigra* (Pic, 1892: 416)
Orig. comb.: *Leptura* (*Strangalia*) *verticalis* var. *verticenigra*
Pedostrangalia verticenigra was originally described by Fairmaire (1866) from "Ovatschik" without name as a variation of *Pedostrangalia*

verticalis. Then, Pic (1892) proposed the name "*verticenigra*" for the variation.
Type loc.: "Ovatschik" (Turkey: İzmir prov.: Bozdağ, Ovacık)

GENUS *RUTPELA* Nakani & Ohbayashi, 1957: 242
SUBGENUS -
SPECIES *R. maculata* (Poda, 1761: 37)
Orig. comb.: *Leptura maculata*
Type loc.: Graz (Austria)

SUBSPECIES *R. m. irmasanica* Sama, 1996: 105
Orig. comb.: *Rutpela maculata irmasanica*
Type loc.: Irmasan pass (Turkey: Antalya prov.)
Endemic subspecies to Turkey.

GENUS *SOLAIA* Sama, 2003: 69
SPECIES *S. antonellae* Sama, 2003: 71
Orig. comb.: *Solaia antonellae*
Type loc.: Abant (Turkey: Bolu prov.)
Endemic species to Turkey.

GENUS *CARLANDREA* Sama & Rapuzzi, 1999: 467
SPECIES *C. syriaca* (Pic, 1891: 1)
Orig. comb.: *Leptura* (*Strangalia*) *syriaca*
Type loc.: Akbez (Turkey: Hatay prov.)
Endemic species to Turkey.

GENUS *STENURELLA* Villiers, 1974: 217
SPECIES *S. bifasciata* (Müller, 1776: 93)
Orig. comb.: *Leptura bifasciata*
Type loc.: Denmark

SUBSPECIES *S. b. ferruginipes* (Pic, 1895: 76)
Orig. comb.: *Strangalia bifasciata* var. *ferruginipes*
Type loc.: Taurus (Turkey)
Endemic subspecies to Turkey.

SUBSPECIES *S. b. nigrosuturalis* (Reitter, 1895: 88)
Orig. comb.: *Strangalia nigrosuturalis*
Type loc.: Akbez (Turkey: Hatay prov.)

SUBSPECIES *S. b. safronovi* Danilevsky, 2011: 2
Orig. comb.: *Stenurella bifasciata safronovi*
Type loc.: Kemer, Beldibi (Turkey: Antalya prov.)
Endemic subspecies to Turkey.

SPECIES *S. pamphyliae* Rapuzzi & Sama, 2009: 182
Orig. comb.: *Stenurella pamphyliae*
Type loc.: Gündoğmuş (Turkey: Antalya prov.)
Endemic species to Turkey.

SPECIES *S. samai* Rapuzzi, 1995: 618
Orig. comb.: *Stenurella samai*
Type loc.: Demirköy, Yıldız Mts. (Turkey: Kırklareli prov.)

SPECIES *S. septempunctata* (Fabricius, 1792: 346)
Orig. comb.: *Leptura septempunctata*
Type loc.: Hungary

SUBSPECIES *S. s. latenigra* (Pic, 1915: 5)
Orig. comb.: *Strangalia septempunctata* var. *latenigra*
Type loc.: "Asie Mineure" (Turkey)

SPECIES *S. zehrae* Özdikmen, Mercan & Cihan, 2012: 18
Orig. comb.: *Stenurella zehrae*
Type loc.: Hacı Yakup village (Turkey: Düzce prov.)
Endemic species to Turkey.

SUBFAMILY NECYDALINAE Latreille, 1825: 401
TRIBE NECYDALINI Latreille, 1825: 401
GENUS *NECYDALIS* Linnaeus, 1758: 421
SUBGENUS *NECYDALIS* Linnaeus, 1758: 421
SPECIES *N. sabatinelli* Sama, 1994: 10
Orig. comb.: *Necydalis sabatinelli*
Type loc.: Abant (Turkey: Bolu prov.)
Endemic species to Turkey.

SUBFAMILY ASEMINAE Thomson, 1861: 139
TRIBE ASEMINI Thomson, 1861
GENUS *ARHOPALUS* Audinet-Serville, 1834: 77
SPECIES *A. syriacus* (Reitter, 1895: 86)
Orig. comb.: *Criocephalus syriacus*
Type loc.: Haifa (Israel), Akbez (Turkey: Hatay prov.)

SUBFAMILY SAPHANINAE Gistel, 1848: [1]
TRIBE SAPHANINI Gistel, 1848: [1]
GENUS *DRYMOCHARES* Mulsant, 1847: 518
SPECIES *D. starcki* Ganglbauer, 1888: 398
Orig. comb.: *Drymochares starcki*
Type loc.: Caucasus

SUBSPECIES *D. s. cavazzutii* Sama & Rapuzzi, 1993: 288
Orig. comb.: *Drymochares starcki cavazzutii*
Type loc.: Borçka and Hopa (Turkey: Artvin prov.)

SUBSPECIES *D. s. ivani* Sama & Rapuzzi, 1993: 287
Orig. comb.: *Drymochares starcki ivani*
Type loc.: Abant (Turkey: Bolu prov.)
Endemic subspecies to Turkey.

SUBFAMILY DORCASOMINAE Lacordaire, 1868: 456
TRIBE DORCASOMINI Lacordaire, 1868: 456
GENUS *APATOPHYSIS* Chevrolat, 1860: 95
SUBGENUS *APATOPHYSIS* Chevrolat, 1860: 95
SPECIES *A. anatolica* Heyrovsky, 1938: 93
Orig. comb.: *Apatophysis anatolica*
Type loc.: Akşehir (Turkey: Konya prov.)
Endemic species to Turkey.

SPECIES *A. kadleci* Danilevsky, 2008: 29
Orig. comb.: *Apatophysis kadleci*
Type loc.: Namrun (Turkey: İçel prov.)
Endemic species to Turkey.

SPECIES *A. karsica* Danilevsky, 2008: 28
Orig. comb.: *Apatophysis karsica*
Type loc.: Yusufeli (Turkey: Artvin prov.)
Endemic species to Turkey.

SPECIES *A. vedica* Danilevsky, 2008: 26
Orig. comb.: *Apatophysis vedica*
Type loc.: Ararat (Turkey: Kars prov.)
Endemic species to Turkey.

As a result of the present work, a total of 81 species group taxa (64 species and 17 subspecies) of Vesperidae [1 sp.] and Cerambycidae [Prioninae (1 sp.), Lepturinae (56 sp. and 15 ssp.), Necydalinae (1 sp.), Aseminae (1 sp.), Saphaninae (2 ssp.) and Dorcasominae (4 sp.)] are determined.

Among of them, 54 species group taxa (44 species and 10 subspecies) are endemic to Turkey now. So, endemism ratio of the longhorned beetles that originally described from whole territories of Turkey, is approximately 67 %

[Vesperidae (1 sp.) and Cerambycidae [Lepturinae (38 sp. and 9 ssp.), Necydalinae (1 sp.), Saphaninae (1 ssp.) and Dorcasominae (4 sp.)]].

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A NEW SUBSPECIES OF *DORCADION HALEPENSE* (KRAATZ, 1873) FROM SOUTH TURKEY (COLEOPTERA: CERAMBYCIDAE)

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[Özdikmen, H., Mercan, N. & Cihan, N. 2012. A new subspecies of *Dorcadion halepense* (Kraatz, 1873) from South Turkey (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 7 (1): 604-606**]**

ABSTRACT: The following new subspecies is described: *Dorcadion* (*Cribridorcadion*) *halepense sehitkamilense* ssp. n. from South Turkey. Also, *Dorcadion* (*Cribridorcadion*) *halepense* and *Dorcadion* (*Cribridorcadion*) *saulcyi* which are very close, are discussed. Moreover, a short key to the identification of both species and their subspecies is proposed.

KEY WORDS: *Dorcadion, Cribridorcadion,* Cerambycidae, Dorcadioninae, Dorcadionini, new subspecies, Turkey.

Dorcadion halepense sehitkamilense ssp. n.

(Fig. 1A)

Material examined. Holotype ♂: Turkey, Gaziantep prov.: Şehitkamil, N 37 05 E 36 57, 28.III.2008. Allotype ♀: Turkey, Kilis prov.: Kesmelik district, N 36 44 E 37 07, 01.III.2008 (Map 1).

Description. Length: 10 mm - 12 mm.
Same as the nominotypical subspecies, *Dorcadion* (*Cribridorcadion*) *halepense halepense* (Kraatz, 1873). So redescription of the taxon is unnecessary.

> The description of *D. halepense* (ex Breuning, 1962)
> "♂. Langoval. Fühler viel kürzer als der Körper, die ersten Glieder mit kurzen, abstehenden Haaren besetzt, das dritte Glied etwas kürzer als das erste. Kopf und Halsschild dicht und sehr fein punktiert mit Ausnahme einiger gröberer Punkte auf den Halsschildseiten. Halsschild quer, gewölbt, mit schmalem spitzigem Seitenhöcker. Schildken klein, dreieckig. Decken mäßig lang, seitlich verbreitert, apikal stumpf verrumdet, dicht und fein punktiert, die Punkte apikalwärts sehr fein werdend; eine Humeralkante ist kaum angedeutet. Schwarz, Beine und Fühler mehr weniger dunkelrot. Kopf, die umgeschlagenen Halsschildseitenteile, die Seitenteile der Halsschildscheibe, die Körperunterseite und die Beine gelbgrau tomentiert. Je eine rotbraune bis dunkelbraune, dreieckige Makel im oberen Teil der Stirn. Scheitel und Halsschild mit schmaler hellgelber Mittellängsbinde, die auf dem Halsschild jederseits von einer breiten rotbraunen bis dunkelbraunen Längsbinde begleitet wird. Je eine ebenso gefärbte dreieckige Makel auf dem Scheitel. Schildchen hellgelb tomentiert. Decken rotbraun bis dunkelbraun tomentiert mit hellgelben Längsbinden: eine breite laterale, eine breite humerale, eine schmälere, basale und ab etwas hinter der Deckenmitte mit der Humeralbinde vereinigte dorsale und eine sehr schmale suturale. Das Humero-dorsale Intervall schmäler als die Dorsalbinde; zuweilen eine kleine, hellgelbe Basalmakel zwischen Dorsal- und Suturalbinde, den Beginn einer Praesuturalbinde andeutend. Fühler dunkelrotbraun tomentiert.
> Female. Die normalen Geshlechtsunterschiede aufweisend; die Kopfmakeln, die dunklen Halsschildlängsbinden und die Deckengrundtomentierung heler, rotbraun bis gelbbraun; eine Längsreihe dunkelbrauner Makeln neben der Suturalbinde.
> Länge: 9-11 mm; Breite 3 ¼ - 4 ½ mm."

Differential diagnosis. The subspecies is a geographical race of *D. halepense* definitely. It is very close the nominotypical subspecies. It differs from only by absence of interval between humeral and dorsal bands, and thereby each other of them joined completely.

Amanos Mountain range is generated a geographical barrier between the populations of nominotypical subspecies and *D. halepense sehitkamilense* ssp. n.. And so, the nominotypical subspecies (southern population) distributes in South of Turkey (Amanos Mountains, especially Hatay province) and North of Syria (Aleppo) [southwards from Amanos Mts.]. *D. halepense sehitkamilense* (northern population) distributes also in South Turkey (Gaziantep and Kilis provinces) [Eastwards from Amanos Mts.].

A short discussion on the status of *D. halepense* and *D. saulcyi*:

Both taxa are closely related. In fact, *D. halepense* was described by Kraatz (1873) from Aleppo (Syria) as a variety of *D. saulcyi* with the original combination *D. saulcyi* var. *halepense* Kraatz, 1873. They, however, are separate species as in Breuning (1962). Unfortunately, collected specimens of the taxa are wrongly identified by some authors even today. Whereas *D. saulcyi* can easily be distinguished from *D. halepense* by absence of dorsal band on elytra.

Consequently, each species includes 2 subspecies with the present work.

A short key for *D. halepense* and *D. saulcyi*

1. Dorsal band on elytra present..**2**
- Dorsal band on elytra absent..**3**

2. The interval between humeral and dorsal bands on elytra present.....................
....***D. halepense halepense*** (Kraatz, 1873)(Fig. 2)
- The interval between humeral and dorsal bands on elytra absent...........................
....***D. halepense sehitkamilense* ssp. n.** (Fig. 1A,B)

3. Humeral band on elytra not wide; body relatively big (11-14 mm).......................
....***D. saulcyi saulcyi*** Thomson, 1865
- Humeral band on elytra relatively a little wider; body smaller (7-12 mm)............
....***D. saulcyi javeti*** Kraatz, 1873 (Fig. 3)

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A **B**

Figure 1. A. *D. halepense sehitkamilense* ssp. n. (holotype ♂), B. *D. halepense sehitkamilense* ssp. n. (allotype ♀).

A **B**

Figure 1. A. *D. halepense halepense* (Kraatz, 1873) (Jiří Mička's photo from http://www.biolib.cz/en/image/id132220/), B. *D. saulcyi javeti* Kraatz, 1873 (from Breuning, 1962).

A CONTRIBUTION TO THE STINK BUGS FROM KHODAFARIN, NW IRAN (HETEROPTERA: PENTATOMIDAE: PENTATOMINAE)

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[Havaskary, M., Pour Abad, R. F., Kazemi, M. H. & Rafeii, A. 2012. A contribution to the stink bugs from Khodafarin, NW Iran (Heteroptera: Pentatomidae: Pentatominae). Munis Entomology & Zoology, 7 (1): 607-616**]**

ABSTRACT: During 2008-2010 several sampling was conducted to survey Stink Bugs (Heteroptera: Pentatomidae: Pentatominae) from Khodafarin county at North Western of Iran. Tottaly 22 species belonged to 11 genera and 6 tribes were determined. In additional to the faunistic study, distribution of all the studied species is reviewed and determination comments are specified for them.

KEY WORDS: Stink Bugs, Pentatomidae, Pentatominae, Heteroptera, Khodafarin, Iran.

Khodafarin region with the location of 38° ' to 39° 'N; 46°3 ' to 7° 'E is situated in littorals of Aras River at East Azarbaijan province. Aras is main branch of "Kura River" with most significant is located in North West of Iran. Total length of the river is about 1072 kilometers which 410 kilometers made as join border between Iran and Azerbaijan. Aras occupants around 2,100,000 km^2 of area which 39% situate in Iranian territory, 38% at Armenia & Azerbaijan soils and 23% from Turkeys land. Aras is flows from "Minghuldag" mountains of Turkey with peak altitude of 3650 a.s.l. and by coursed Armenian highlands, is arrived in Iranian northern borders and afterwards comers with "Kura River" at Saber Abad of Azerbaijan and ultimately strews in Caspian Sea (Fig. 1).

The family of Pentatomidae is the largest in the Pentatomoidea, presently having more than 4700 species in nearly 900 genera (Rider, 2006). Stink bugs (Heteroptera: Pentatomidae) are easily recognized from other true bugs by their round or ovoid shape and five - segmented antenna, three tarsal segmented, Scutellum narrowed behind, more or less triangular in shape, rarely almost covering the abdomen (Borror et al., 1989). Although a few species have 4-3 antennal segments and scutellum covered specially Asopniae and Podopinae (Rider, 2006). The most of Pentatomids discharge a disagreeable scent which includes unsaturated aldehydes as the characteristic component, this scent has considered as a "defensive substance" (Waterhouse et al., 1961; Remold, 1962), "alarm pheromone" (Calam & Youdeowel, 1968; Ishiwatari, 1974) and also "aggregation pheromone" (Ishiwatari, 1976).

The fauna of Pentatomidae from North West of Iran was so far studied and published by Askari et al. (2009), Farshbaf (2000), Gharaat et al. (2009), Hassanzadeh et al. (2009 a,b), Khalilzadeh et al. (2005), Modarres (1987 & 1996), Nateq Golestan et al. (2010), Nikdel et al. (2011), Sadeghi (2004), Sadaghian et al. (2004). The true bugs of Aras river littorals have not been studied so far, thus the present research focused to identification of Stink bugs (subfamily Pentatominae) in the mentioned area.

MATERIAL AND METHOD

The sampling of the material was conducted by sweeping net, light trap and some of them captured by hand directly from various grass lands and trees. Specimens were collected from different localities of Khodafarin county contain MarzAbad, Mardanaghum, Ebrahim sami, Ashegloo, Tatar, Toali, Jananloo, Khomarloo, Vinag, Bastamloo Aynaloo, Larijan, Gholibaghloo and some parts in highland expanse in Kaleybar region. The collected specimens were put into jars filled with 70% ethanol. Their identification was based on morphological structures and male genitalia examinations. For determining the materials, the following papers by Anufriev et al. (1988), Kment & Jindra (2008), Borror (1989), Carapezza & Jindra (2008), Lodos (1959), Thomas (1994), Ribes et al. (2007, 2008), Rider (1989) were used. The system, nomenclature, synonymy, and Palaearctic distribution followed from Aukema, B. & Rieger Ch. (2006). Determination Notes are Mostly based on Rider's useful Web Site [http://www.ndsu.edu/ndsu/rider/Pentatomoidea/]. Distributional data dependent in Iran based on Modarres (2002), Havaskary et al., (2010) Hoberlandt (1995) and Linnavuori (2008).

Subfamily Pentatominae Leach, 1815
Tribe Aelini Douglas & Scott, 1865

***Aelia acuminata* Linnaeus,1758**
Synonyms: *Cimex acuminatus* Linnaeus, 1758; *C. tessarophthalmus* Dallas, 1851; *Aelia turanica* Horvath, 1895; *A. punctiventris* Horvath, 1911; *A. baluchistanensis* Ahmad & Zaidi, 1988. **Material examined**: Khomarloo; 20 May. 2009 & 4 June. 2010., Ashegloo & Ebrahim sami, 20.August. 2010., Bastamlu, 14. June. 2008. **Distribution in Iran**: East & West Azarbaijan, Tehran, Kermanshah, Esfahan, Khorasan, Fars, Markazi, Hamedan, zanjan, Lorestan, Mazandaran, Gorgan. **Distribution out of Iran**: HoloPalaearctic. **Determination Note**: in male species, dorsoposterior margin of pygophores always with only a middle emargination or completely without recesses, Third antennal segment more than twice as long as second and somewhat longer than fourth; front chest plates everywhere evenly rounded (Wagner, 1960).

***Aelia furcula* Fieber, 1868**
Synonym: *Aelia simillima* Reuter, 1900. **Material examined**: Khomarloo; 16, 18 & 25. May. 2009. 18 &19. June. 2008., Ashegloo & Ebrahim sami; 25. June. 2008., Bastamlu; 17. June. 2008. **Distribution in Iran**: East & West Azarbaijan, Kermanshah, Tehran, Khorasan, Fars, markazi, Hamedan, Zanjan, Lorestan, Manazdaran, Gorgan. **Distribution out of Iran**: EUROPE; Kazakhstan, Greec, Russia, Ukraine. ASIA; Azerbaijan, Afghnistan, kazakhstan (asian part), Armenia, Turkey, China, Turkmenistsn, Uzbekistan. **Determination Note**: in male species, Hind surface of genital segment just ventrad of central recess with two distinct teeth; apex of head rounded apically, with clearly protruding corners (Wagner, 1960).

***Aelia melonata* Fiber, 1868**
Synonym: *Aelia abtusa* Fieber,1868. **Material examined**: Vinag; 4 & 5. June. 2009. **Distribution in Iran:** East Azarbaijan, Markazi, Tehran, Mazandaran, Khorasan, Blouchestan. **Distribution out of Iran**: EUROPE; France, Russia (ST: Caucasus), Spain, Uzbekistan. ASIA; Azerbaijan, Afghanistan, Kazakhstan, Armenia, Turkey, Georgia, Kirgizia, Tadzhikistan, Turkmenistan, Uzbekistan. **Determination Note:** Hind surface of male genital segment without teeth; apex of head diagonally angled, without protruding corners (Wagner, 1960).

***Aelia virgata* Herrich-Schäffer, 1841**
Synonym: *Cimex virgatus* Herrich-Schäffer, 1841. **Material examined**: Tatar & Toalii; 28. July. 2009. **Distribution in Iran;** Kermanshah, Fars, Lorestan, Markazi, Hamedan, Zanjan, Khorasan and other northern provinces. **Distribution out of Iran**: EUROPE; Bulgaria, Turkey, Greec, Macedonia, Uzbekistan. ASIA; Azerbaijan, Armenia, Turkey (Asian part), Israel, lebanon, Syria. **Determination Note:** abdomen not broader than pronotum; bucculae without embossments, sloping evenly to the rear; abdomen ground color pale, with dark marks (Wagner, 1960).

***Neottiglossa leporina* Herrich-Schäffer, 1830**
Synonym: *Pentatoma leporina* Herrich-Schäffer, 1830; *Neottiglossa calva* Jakovlev, 1903; *N. irana* Wagner, 1963. **Material examined**: Aynaloo; 2. Agust. 2010**.** **Distribution in Iran;** Khorasan, West Azarbaijan. **Distribution out of Iran**: EUROPE & ASIA **Determination Note:** Abdominal venter pale with dark punctures, punctures laterad of spiracles concolorous with sternite; each spiracle surrounded by small black spot; punctures on exocorium concolorous with surface, Scutellum distinctly longer than coria, lateral margins just beyond apex of frena subparallel for short distance, apex broadly rounded (Stichel, 1961; Wagner, 1966).

Tribe Carpocorini Mulsant & Rey, 1865

***Brachynema germari* Kolenati, 1846**
Synonyms: *Cimex virens* Klug, 1845; *Raphigaster germari* Kolenati, 1846; *Pentatoma anabasis* Becker, 1867; *Pentatoma tetrastigment* Walker, 1867; *Raphigaster biplaga* Walker, 1867; *Onocoma germari* var. *flavomarginatus* Jakovlev, 1871; *Onocoma germari* var. *grisea* Jakovlev, 1871; *Brachynema melanota* Jakovlev, 1874; *Brachynema virens* var. *alternatum* Horvath, 1899. **Material examined**: Khomarloo; 12. Junly. 2009, Tatar & Toalii; 6. August. 2010. **Distribution in Iran**: Khorasan, West Azarbaijan, Tehran. **Distribution out of Iran:** HoloPalaearctic **Determination Note:** Scutellum lacking whitish-yellow spots along base, body Longer (11-14 mm); form more elongate; rostrum clearly surpassing hind margin of middle coxae; scutellum almost twice as long as broad, apex pointed; humeral angles lacking black spots; posterolateral angles of pygophore acute **(**Ribes & Schmitz, 1992)**.**

***Carpocoris coreanus* Distant, 1899**
Synonyms: *Carpocoris iranus* Tamanini, 1958. **Material examined**: Khomarloo; 12, 13, 15 June. 2010. Jananloo; 18. June. 2010. Tatar & Toalii; 6. August. 2010. Ashegloo; 14. Septamber. 2009. Mardanaghum; 7. September 2010. MarzAbad & Mardanaghum; 20. August. 2009. **Distribution in Iran**: East Azarbaijan, Khorasan. **Distribution out of Iran:** EUROPE; Russia. ASIA; Azerbaijan, Afghanistan, Kazakhstan, Armenia, Turkey, China, Greece, Iraq, Israel, Jordan, Kirgizia, Mongolia, Russia, EG Sinai, Syria, Tadzhikistan, Turkmenistan, Uzbekistan. EXTRALIMITAL; Pakistan. **Determination Note:** Humeral angles of pronotum short and usually sharply pointed; generally one elongated, black spot, always parallel to the posterolateral free margin; parameres with the superior (= outer) tooth of the hypophysis well separated from the anterior and superior margins (Ribes, 2008).

***Carpocoris fuscispinus* Boheman, 1851**
Synonym: *Cimex fuscispinus* Boheman, 1851; *Pentatoma hahni* Flor, 1856. **Material examined**: Khomarloo; 12, 13, 15 June. 2010, Jananloo; 18. June. 2010, Tatar & Toalii; 6. August. 2010, Ashegloo; 14. Septamber. 2009., Mardanaghum; 7. September 2010. MarzAbad; Mardanaghum; 20. August. 2009, Larijan; 28. July. 2009. **Distribution in Iran**: East Azarbaijan, Mazandaran, Zanjan, Tehran, Markazi, Esfahan, Khorasan, Lorestan, Ardabil. **Distribution out of Iran:** HoloPalaearctic**.** **Determination Note:** Humeral angles of pronotum sharply pointed or rounded, protruding more or less; black spot on them, massive, with its internal edge convex; parameres with superior (= outer) tooth of the hypophysis near to the anterior edge and very near to the superior edge (Ribes, 2008).

***Carpocoris pudicus* Poda, 1761**
Synonym: *Cimex pudicus* Poda, 1761; *Cimex cinctus* Schrank, 1776; *Cimex carnus* Gmelin,1790; *Pentatoma wilkinsonii* Westwood,1837; *Pentatoma Pallida* Dallas, 1851. **Material examined**: Ashegloo; 14. Septamber. 2009., Mardanaghum; 20. August. 2009**.** **Distribution in Iran**: Mazandaran, Gorgan, Tehran, Semnan, Khorasan **Distribution out of Iran:** EUROPE, ASIA & Egypt from North African Regions. **Determination Note**: Humeral angles of pronotum rounded, with black spot; abdomen usually narrower than pronotum; scutellum weakly convex, without depression; parameres much smaller, rounded apically; aedeagus of medium size, with small ventrolateral process of conjunctiva; vesica shorter than 1mm (Rider, 2011).

***Carpocoris purpureipennis* De Geer, 1773**
Synonym: *Cimex purpureipennis* DeGeer, 1773; *Cimex nigricornis* Fabricius, 1775; *Cimex porphyropterus* Gmelin, 1790; *Carpocoris nigricornis* var. *pyromosa* Westhoff, 1884. **Material examined**: Aynaloo; 2. Agust. 2010., MarzAbad & Mardanaghum; 15. Sptamber. 2009. **Distribution in Iran**: Khorasan, East Azrabajan **Distribution out of Iran:** HoloPalaearctic. **Determination Note:** The black spot on the humeral angles of pronotum with its internal edge concave, semilunar, or near semilunar; anterolateral margins of pronotum more largely covered by the black spots than posterolateral ones; inflated conjunctiva of aedeagus with ventro-lateral lobes very long (Ribes, 2008). parameres with the superior (= outer) tooth of the hypophysis near to the anterior edge and very near to the superior edge (Rider , 2011).

***Dolycois baccarum* Linnaeus, 1758**
Synonym: *Cimex baccarum* Linnaeus, 1758**;** *Cimex verbasci* De Geer,1773; *Cimex* subater Harris, 1780; *Cimex albidus* Gmelin, 1790; *Aelia depressa* Westwood, 1837; *Pentatoma confusa* Westwood, 1837; *Pentatoma inconcisa* Walker, 1867. **Material examined**: Khomarloo; 25. April. 2008., 20. May &12, 13, 15. June. 2010., Jananloo; 18 &19 June. 2010., Tatar & Toalii; 28. July. 2009., Ashegloo; 20. August. 2010. **Distribution in Iran**: West & East Azarbaijan, Fars, Khorasan, Tehran, Esfahan **Distribution out of Iran:** HoloPalaearctic**. Determination Note:** Lateral lobe on each side of posteroventral pygophoral surface devoid of long hairs**;** Lateral lobe on each side of posteroventral pygophoral surface quite large, projecting posteriorly nearly as far as lateral angle of pygophore(Rider, 2011)**.**

***Holcostethus strictus vernalis* Wolf, 1804**
Synonym: *Cimex vernalis* Wolf, 1804. **Material examined**: Vinag; 5. June. 2009. **Distribution in Iran**: Tehran **Distribution out of Iran:** HoloPalaearctic**. Determination Note:** head in dorsal view, not black. Ocular index=4.25 - 5.5 Rostrum not suppressing posterior coxae. Scutellum with concave margin on the middle region (Ribes et al., 2007).

Tribe Eysarcorini, Mulsant & Rey, 1866

***Eysarcoris ventralis* Westwood, 1837**
Synonyms: *Pentatoma ventralis* Westwood, 1837; *Pentatoma inconspicuum* Herrich-Schaeffer, 1844; *Pentatoma pusillus* Costa,1847; *Eysarcoris distactus* Dallas, 1851; *Eysarcoris misellus* Stal, 1854; *Eusarcoris helferi* Fieber,1861; *Stollia rectipes*, Ellenrieder, 1862; *Eysarcoris epistomalis* Mulsant & Rey, 1866; *Eysarcoris mayeti* Mulsant & Rey, 1872; *Eusarcoris pseudoaeneus* Jakovlev,1869; *Eysarcoris inconspicuous* var. *simplex* Puton, 1881; *Eusarcoris scutellaris* Jakovlev, 1885; *Eusarcoris egenus* Jakovlev, 1900; *Eusarcoris sindellus* Distant,1902; *Eusarcoris schmidti* Jakovlev, 1902; *Eysarcoris tangens* Stichel,1961; *Eysarcoris confuses* Fuente, 1972; *Eysarcoris uniformis* Fuente, 1972; *Eysarcoris hispalensis* Fuente, 1972; *Eysarcoris luisae* Fuente, 1972. **Material examined**: Khomarloo; 12 & 13 August. 2010., Jananloo; 20. Septamber. 2009., Tatar & Toalii; 10. Septamber. 2009., Ashegloo; 20.August. 2010., MarzAbad & Mardanaghum; 15. Sptamber.2008., Larijan; 27.July. 2009., Gholibaghloo; 8 & 9 Septamber. 2010. **Distribution in Iran**: Markazi, Khorasan Ardabil, Guilan, Golestan, Kerman, Markazi, Mazandaran, Semnan, Tehran, Zanjan. **Distribution out of Iran:** HoloPalaearctic.

Tribe Halyini Amyot & Serville, 1843

***Mustha spinosula* Lefebvre, 1831**
Synonyms; *Halys spinosula* Lefebvre, 1831; *Mustha serrata* Amyot & Serville, 1843. **Material examined**: Ayanloo; 1. Septamber. 2010. **Distribution in Iran**: East & west Azarbaijan, Fars, Gilan, Golestan, Khorasan Razavi, Khorasan Shomali, Mazandaran, Semnan and Tehran provinces. **Distribution out of Iran**: EUROPE; Albania, Bosnia Herzegovina, Turkey, Greece, Macedonia, Russia (St; Caucasus), Yugoslavia. NORTH AFRICA; Egypt. ASIA; Azerbaijan, Armenia, Turkey (Asian part), Cyprus, Georgia, Iraq, Israel, Syria, Turkmenistan. **Determination Note:** Body dark brown; pronotum with 16 regularly arranged spines; coriurn without dentine; male pygophore with lateral lobes a little produced with apex convex, ventero median cavity narrow and v-shaped; paramere F-shaped, stem relatively thick with well-developed thumb-like inner projection, blade acutely tapering towards apex with outer upper margin hump-like and a sub-round projection near apex (Memon & Ahmad, 2008).

***Apodiphus amygdali* Germar, 1817**
Synonym: Halys *amygdali* Germar, 1817; *Halys hellenica* Lefebvre, 1831; *Halys exsculpta* Burmeister, 1835. **Material examined**: Khomarloo; 18 & 24 July. 2009., Mardanaghum; 15. April .2010., Larijan; 8. July. 2009. MarzAbad & Mardanaghum; 20. August. 2009. **Distribution in Iran**: East Azarbaijan Fars, Tehran, Markazi, Kerman, Hormozgan, Semnan, Balouchestan**,** Esfahan, Khorasan**. Distribution out of Iran**: EUROPE; Albania, Bosnia Herzegovina, Bulgaria, Croatia, Turkey, Greece, Italy, Macedonia, Yugoslavia. ASIA; Azerbaijan, Armenia, Turkey (Asian Part) Georgia, Iraq, Israel, Lebanon, Syria, Turkmenistan. **Determination Note:** Outer angles of paraclypei, protruded forwarded; metathoracic scent gland complex with posterior margin of evaporating area folded in males; postero- lateral margin of paramere toothed; in females 2nd gonocoxae highly convex, 9th paratergites divided by transverse suture, Spermathecal bulb with longer tubules branched (Memon, 2002).

***Apodiphus integriceps* Horváth, 1888**
Synonym: *Neonevisanus rugosus* Distant, 1918. **Material examined**: MarzAbad & Mardanaghum; 20. August. 2009. **Distribution in Iran**: Tehran, Ghazvin, Hormozgan, Southern Khorasan , Khorasan Razavi, Kerman, Kermanshah. **Distribution out of Iran**: Afghanistan, Kazakhstan, Kirgizia, Tadzhikistan, Turkmenistan, Uzbekistan and Yemen. **Extralimital**: India & Pakistan. **Determination Note:** Head without median orchraceous line; scutellum with prominent ochraceous spots; apex of paraclypei slightly sinuate, with outer lobe slanting labium reaching to base of 3rd sternum; dorsoposterior margin of pygophore without projection; 2nd gonocoxae medially notched at posterior margin.(Memon, 2002).

Tribe Pentatomini Leach, 1815

***Acrosternum breviceps* Jakovlev, 1889**
Synonyms: *Nezara breviceps* Jakovlev, **1889***; Nezara sahlbergi* Reuter, 1900; *Nezara satunini* Jakovlev, 1903; *Nezara bactriana* Kiritshenko, 1912. **Material examined**: Vinag; 4 & 5. June. 2009**. Distribution in Iran**: Khorasan, Ardabil **Distribution out of Iran:** ASIA; Azerbaijan, Armenia, Afghanistan, Turkey, Georgia, Iraq, Kirgizia, Kuwait, Saudi Arabia, Tadzhikistan, Turkmenistan and Uzbekistan **Distribution out of Iran**: HoloPalaearctic**.Determination Note:** Juga extending distinctly beyond apex of tylus; caudoventral margin of pygophore with a deep U-shaped median incision, delimited on each side by a sharply triangular lobe (Linnavuori & Al-Safadi, 1993).

***Acrosternum heegeri* Fieber, 1861**
Synonym: *Rhaphygaster incerta* Signoret, 1861; *Rhaphygaster submarginatus* Stål, 1861**. Material examined**: Mardanaghum; 20. August. 2009., Khomarloo; 8. August. 2010. **Distribution in Iran**: Widspread. **Distribution out of Iran:** HoloPalaearctic**. Determination Note:** Tylus free apically, not enclosed by juga**;** Apex of rostrum reaching to or beyond middle of second abdominal segment; margins of head in front of eyes only

slightly recessed; Emargination in posterior margin of male pygophore relatively deep, nearly rectangular, posterolateral angles of pygophore very broad and rounded; head before eyes clearly less than twice as broad as long (Wagner, 1959).

***Acrosternum millieri* Mulsant & Rey, 1866**
Synonyms: *Nezara millierei* Mulsant & Rey, 1866; *Aethemenes forbesi* Distant, 1884 *Acrosternum putoni* Vidal, 1949**. Material examined**: Ashegloo; 20. August. 2010**.,** Aynaloo; 2. Agust. 2008. **Distribution in Iran**: Widspread. **Distribution out of Iran:** HoloPalaearctic**. Determination Note:** Posterolateral angles of male pygophore broad, angular, nearly rectangular in dorsal view; emargination in posterior margin of pygophore deep, nearly rectangular **(**Wagner, 1959).

Tribe Strachini Mulsant & Rey, 1866

***Eurydema ornatum* Linnaeus, 1758**
Synonyms: *Cimex festivus* Linnaeus, 1767; *Cimex pictum* Herrich-Schäffer, 1833 *Pentatoma decoratum* Herrich-Schäffer, 1833; *Strachia pustulata* Fieber, 1837 *Eurydema pictum* var. *conjuncta* Kolenati, 1846; *Cimex fallax* Scholtz, 1847 *Pentatoma ornata* var. *falleni* Gorski, 1852; *Cimex umbralis* Gistel, 1857. **Material examined**: Khomarloo; 6. Agugust. 2008., 12, 13, 15 June. 2010., Jananloo; 20. Septamber. 2009., Tatar & Toalii; 6. August. 2010., Larijan; 27. July. 2009. Ayanloo; 1. Septamber. 2010. **Distribution in Iran**: Ardabil, Azarbaijan, Sistan and Balouchestan, Esfahan, Gilan, Golestan, Kerman, Kermanshah, Khorasan Razavi, Northern Khorasan, Khuzestan, Lorestan, Mazandaran, Tehran and Zanjan provinces **Distribution out of Iran:** HoloPalaearctic. **Determination Note:** Anterior angeles of pronoyum toothed, connexiva slightly exposed at repose. In males tips of dorsal membranous conjunctival lobes without sclerotized plate. In females 2nd gonocoxae meaidally convex. Pygopgore about 1.5x broader than long, dorso median surface concave, medially notched, dorso-lateral lobes much prominent lobe- like sub-raundly protected, later continuous with sub roundly protected ventro lateral lobes. Ventro posterior margin medially concave, dorso-inner process prominent triangular, proctiger rectangular, posteromedially deeply concave, paramere F-shaped pex of blade narrow, pointed thorn like, outer margin humped, aedeagus bilobed, distal lobe somewhat quadrangular, inner lobe large, rod like, visica elongated dorsal membrane conjunctival appendage bilobed without sclerotized apices(Siddiqui, 2000).

***Eurydema putoni* Jakovlev, 1877**
Synonyms: *Strachia adusta* Jakovlev, 1877; *Strachia distinct* Jakovlev, 1879; *Strachia colorata* Jakovlev, 1882; *Eurydema formosum* Puton, 1895**. Material examined**: Khomarloo; 20 & 24 July. 2009., Vinag; 4 & 5. June. 2009. **Distribution in Iran**: East Azarbaijan, **Distribution out of Iran:** EUROPE; Russia. ASIA; Azerbaijan, Afghanistan, Armenia, Turkey, Iraq, Israel, Syria. **Determination Note:** Posterior and posterolateral pronotal margins at least partly black or blackish blue, sometimes with short pale color along margin; anterior margin pale colored with, on each side, one often very short black or blackish blue interruption**;** Dorsal dark areas shining blackish blue or blackish green; mesocorium black with only one pale stripe distally, or the entire distal part of the corium pale; no pale pattern near middle of cubital vein (Derjanschi & Péricart, 2005).

***Eurydema ventralis* Kolenati, 1846**
Synonyms: *Eurydema ornata hoffmanseggi* Gorski, 1852; *Strachia ornata* Fieber, 1861; *Eurydema ventralis* Tamanini, 1957; *Eurydema ventrale* Tamanini, 1961. **Material examined**: Khomarloo; 20. July. 2009., Mardanaghum; 7. September. 2010. **Distribution in Iran**: East Azarbaijan, Khorasan. **Distribution out of Iran:** Palaearctic contain Asia, Europe & Extralimital regions. **Determination Note**: Ventral surface of abdomen lacking median rows of black spots; second antennal segment usually less than 1.3 times the length of segment III; dorsal surface of abdomen mostly red in both males and females; each paratergite anteriorly with a wide black patch reaching from outer margin of paratergite to mediotergite (Rider, 2011).

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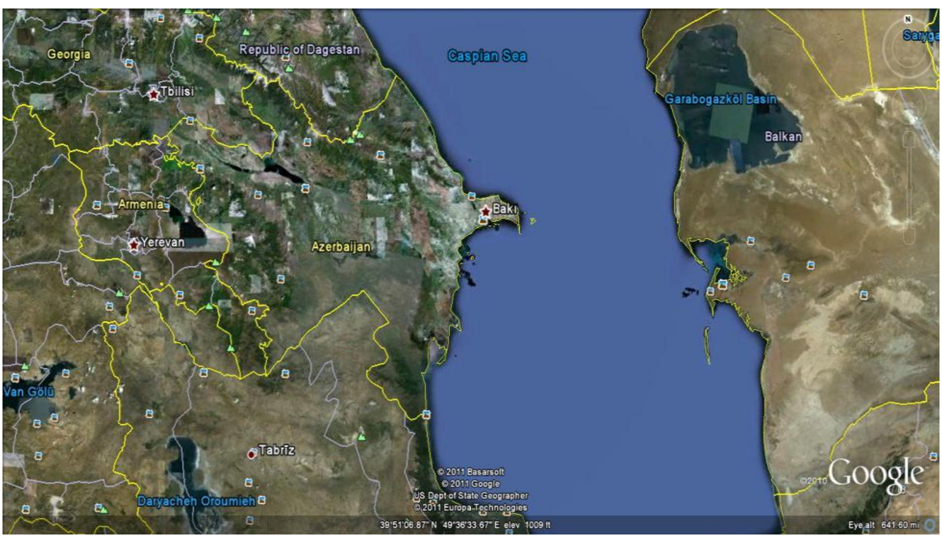

Figure 1. Map of Aras River as the boundary between Iran, Armenia, Azerbaijan & Turkey which flowed from turkey and strews in Caspian Sea (Google earth map, 2011).

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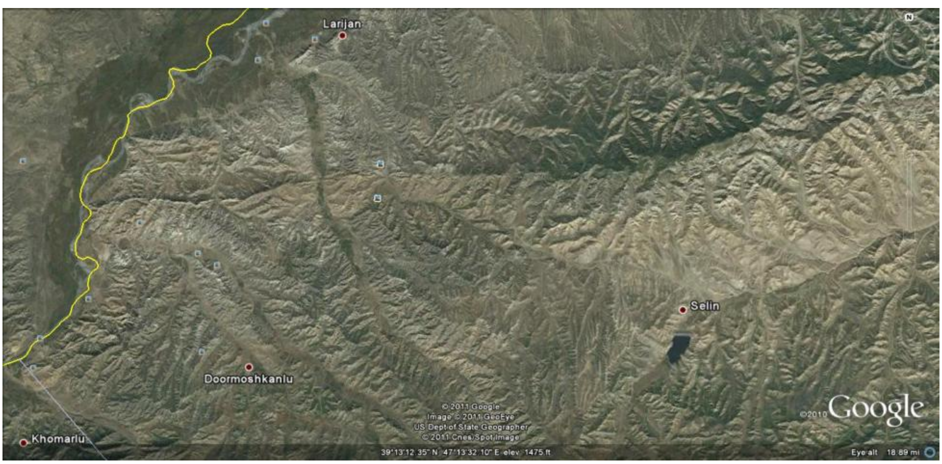

3

Figures 2-3. Maps from the sampled regions from in the Khodafarin County, Aras River is showed by yellow line. (Google earth map, 2011).

AN INVESTIGATION OF THE FRUIT FLIES (DIPTERA: TEPHRITIDAE) FAUNA IN AJABSHIR REGION (EAST AZERBAIJAN PROVINCE) WITH THE NEW RECORD FROM IRAN (PART 1)

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[**Gharajedaghi, Y., Khaghaninia, S. & Pour Abad, R. F.** 2012. An investigation of the fruit flies (Diptera: Tephritidae) fauna in Ajabshir region (East Azerbaijan province) with the new record from Iran (part 1). Munis Entomology & Zoology, 7 (1): 617-625]

ABSTRACT: Based on specimens collected from Ajabshir region during 2009-2010, forty nine species of sixteen genera were recognized which *Orellia distans* Loew, 1847 is being newly reported for the Iran insect fauna. At the first part of this study, identification key and photos of the studied species are prepared. At the second part of this study, the locality, host plants, distribution of the studied species and references are prepared.

KEY WORDS: Tephritidae, Fruit flies, Ajabshir region, Iran, New record.

Tephritidae (true fruit flies) is a large family of the order Diptera with more than 4400 described species over the world. Considering their damage on fruit plantations, they are important insects from the agricultural point of view as well as forest entomology (Merz, 2001). Other species are important agents in biological control programs against weeds (White et al., 1992).

This family is recognized by the following characters: medium or small sized flies; vertical plate usually does not reach midpoint of frons and carries one or more orbital bristles; antennae with glabrous or plumose arista; wings usually with a pattern consisting of brown strips and spots, costal vein with two interruptions, one before humeral vein and one at place of ending of subcostal vein; abdomen in males with five and in females with six segments visible externally (Richter, 1989).

Ajabshir region is located in south west of East Azerbaijan province, close to eastern beach of the Urumiyeh Lake with UTM (Universal Transfer Mercator) coordinate system, X from 572964.47 to 599802.25 E; Y from 4147773.18 to 4161843.04 N and varying latitude from 1350 m to 2113 m. This area has rich grass lands with various species of Asteraceae, Apiaceae, Fabaceae and Ronunculaceae.

Before this study, Garajedaghi et al. (unpublished data) and Garajedaghi et al. (2011a,b,c), added sixteen genera and thirty nine species of fruit flies to the list of this region.

MATERIALS AND METHODS

Materials collected by sweeping net on flowers heads of Asteraceus plants in twenty-three localities which situated through the working area during 2009-2010 (Fig. 1).

The samples were killed in a killing jar containing potassium cyanide and specimens were deposited at Insect Museum of Tabriz University (IMTU). The terminology primarily follows White et al. (1999).

RESULTS

In this study, forty nine species of sixteen genera were collected in Ajabshir region. Of them, *Orellia distans* (Loew, 1847) is being newly record from Iran fauna. In addition, ten species are recorded for the first time from this region. The subfamilies, tribes and species are listed in alphabetic order.

Key to studied species of the family Tephritidae

1. Wing completely hyaline except pterostigma (Fig. 2 to 8) 2
- Wings with pattern or crossbands (Fig. 8 to 50) 8

2. With one pair of orbital bristles (Fig. 51) 3
- With two pairs of orbital bristles (Fig. similar to 52) 4

3. Whith darkned forefemora and midfemora .... *Urophora hermonis*
- Whith undarkned forefemora and midfemora .... *U. İmpicta*

4. Without dark spots on abdominal tergites .... *Terellia luteola*
- Without dark spots on abdominal tergites 5

5. Mesonotum as long as wide and convex .... *Ter. virens*
- Mesonotum flat and distinctly longer than wide 6

6. Palpi not protruding beyond anterior oral margin (Fig. 52) .... *Ter. uncinata*
- Palpi protruding beyond anterior oral margin (Fig. 53, 54) 7

7. Length of basal segment of ovipositor equal to length of abdomen .... *Ter. fuscicornis*
- Basal segment of ovipositor shorter than abdomen .... *Ter. serratulae*

8. Wing with inconspicuous pattern (Fig. 9 to 12) 9
- Wings with distinct pattern or crossbands (Fig. 13 to 50) 12

9. Base of wing not completely hyaline (Fig. 9) .... *Tephritomyia lauta*
- Base of wing completely hyaline (Fig. 10, 11, 12) 10

10. Body in blackish color .... *Acanthiophilus helianthi*
- Body in yellowish color 11

11. With one pair of orbital bristles (Fig. 55) .... *Ensina sonchi*
- With two pairs of orbital bristles (Fig. similar to 52) .... *Ter. colon*

12. Wings with crossbands (Fig. 13 to 33) 13
- Wings with another form of pattern (Fig. 34 to 50) 33

13. Wing with one crossband (Fig. 13) .... *Sphenella marginata*
- Wing with three or four crossbands (Fig. 14 to 33) 14

14. Body in blackish color 15
- Body in yellowish color 24

15. Wing with 3 crossbands (Fig. 14, 15, 16) 16
- Wing with 4 crossbands (Fig. 17 to 23) 18

16. Mesonotum with brown stripes and spots .... *U. solaris*
- Mesonotum without brown stripes and spots 17

17. Aculeus apex with ill-defined secondary steps (Fig. 61) .... *U. affinis*
- Aculeus apex without secondary steps (Fig. 62) .... *U. stylata*

18. Aculeus apex without steps (Fig. 63, 64) 19
- Aculeus apex with steps (Fig. 65 to 69) 20

19. Subasal band of wing ending on hand margin of cell AN (Fig. 17) .... *U. doganlari*
- Subasal band of wing not ending on hand margin of cell AN (Fig. 18) ...... *U. quadrifasciata*

20. Aculeus apex with one pair of subapical steps (Fig. 65, 66) 21
- Aculeus apex with two pairs of subapical steps (Fig. 67, 68, 69) 22

21. Wing with limber preapical and discal crossbands (Fig. 19) .... *U. jaceana*
- Wing with right preapical and discal crossbands (Fig. 20) .... *U. mauritanica*

22. Aculeus apex with smoothed out steps (Fig. 67) .... *U. stalker*
- Aculeus apex with distinctly developed steps (Fig. 68, 69) 23

23. With greater length of interval between the primary and secondary steps of aculeus (Fig. 68) .... *U. solstitialis*
- Without greater length of interval between the primary and secondary steps of aculeus (Fig. 69) .... *U. terebrans*

24. Presutural dorsocentral setae present (Fig. 70) 25
- Presutural dorsocentral setae absent (Fig. 71, 72, 73) 26

25. Discal crossband arrive to beneath margin of wing (Fig. 24) .... *Chaetorellia jaceae*
- Discal crossband not arrive to beneath margin of wing (Fig. 25) .... *Chaetorellia australis*

26. Extension of cell cup extending well beyond bm-cu crossvein (Fig. 26, 27, 28) 27
- Extension of cell cup ending approximately in line with bm-cu crossvein (Fig. 29 to 33)..29

27. In along of Sc vein, all crossbands are blended (Fig. 26) .... *Orellia stictica*
- In along of Sc vein, all crossbands are not blended (Fig. 27, 28) 28

28. Preapical and apical crossbands not separate (Fig. 27) .... *Or. falcate*
- Preapical and apical crossbands separate (Fig. 28) .... *Or. distans*

29. Scutum with a black apical spot and pair of the base of each setae black basal spots (Fig. 72) .... *Chaetostomella cylindrica*
- Scutum usually without a black spot, at most with narrow basal-lateral basal spots (Fig. 73) 30

30. Wing with 4 inconspicuous crossbands (Fig. 30) .... *Ter. nigronota*
- Wing with distinct pattern or crossbands (Fig. 31, 32, 33) 31

31. Wings pattern not linear projection (Fig. 31) .... *Ter. ruficauda*
- Wings pattern linear projection (Fig. 32, 33) 32

32. Dark transverse bands of wings between R_{4+5} and M displaced over apex of wings (Fig. 32) .... *Ter. quadratula*
- Pattern of wings not displaced over apex of wings (Fig. 33) .... *Ter. gynaecochroma*

33. Body in yellowish color .... *Xyphosia miliaria*
- Body in blackish color 34

34. Apical of wings completely black (Fig. 35) .... *Oxyaciura tibialis*
- Apical of wings not completely black and with hyaline areas (Fig. 36 to 50) 35

35. With three pairs of frontal setae (Fig. 56) .... *Heringina gutatta*
- With two pairs of frontal setae (Fig. 57 to 60) 4

36. Proboscis geniculate (Fig. 57) .... *Campiglossa loewiana*
- Proboscis not geniculate (Fig. 58, 59, 60) 5

37. With one pairs of scutellar setae (Fig. 74) 6
- With two pairs of scutellar setae (Fig. 75, 76) 7

38. Vein CuA_1 with a brown stripe along it from dm-cu to hind margin of wing (Fig. 38).........
.... *Trupanea amoena*
- Vein CuA_1 entirely with a hyaline areas (Fig. 39) .... *Tr. Stellata*

39. Frons convex above eyes (Fig. 59) .... *Euaresta bullans*
- Frons not convex above eyes (Fig. 60) 8

40. Apical fork of wing absent, anly isolated brown or black spots present at end of vein R_{4+5} and M (Fig. 41 to 44) 41
- Apical fork of wing present (Fig. 45 to 50) 44

41. Hyaline areas in cell dm small than black areas (Fig. 41) .... *Tephritis formosa*
- Hyaline areas in cell dm more than black areas (Fig. 42, 43, 44) 10

42. Hyaline areas in cell r_{4+5} small than black areas (Fig. 42) .... *Tephritis bardanae*
- Hyaline areas in cell r_{4+5} more than black areas (Fig. 43, 44) 11

43. With three separate hyaline areas in cell r_{4+5} (Fig. 43) .... *Tephritis postica*
- With more than three separate hyaline areas in cell r_{4+5} (Fig. 44) .... *Tephritis hyoscyami*

44. Hyaline areas not pent in black areas (Fig. 45) .... *Tephritis cometa*
- Hyaline areas pent in black areas (Fig. 46 to 50) 13

45. Cell m of wing with three separate hyaline areas (Fig. 46) .... *Tephritis hurvitzi*
- Cell m of wing with more than three separate hyaline areas (Fig. 47 to 50) 14

46. With four separate hyaline areas in cell r_{4+5} (Fig. 47) .... *Tephritis oedipus*
- With more than four separate hyaline areas in cell r_{4+5} (Fig. 48, 49, 50) 15

47. Hyaline areas in cell dm not wide (Fig. 48) .... *Tephritis praecox*
- Hyaline areas in cell dm wide (Fig. 49, 50) 16

48. Cell cup completely hyaline, except in tension to apical of wings (Fig. 49) ....
.... *Tephritis dioscurea*
- Cell cup not completely hyaline (Fig. 50) .... *Tephritis nigricauda*

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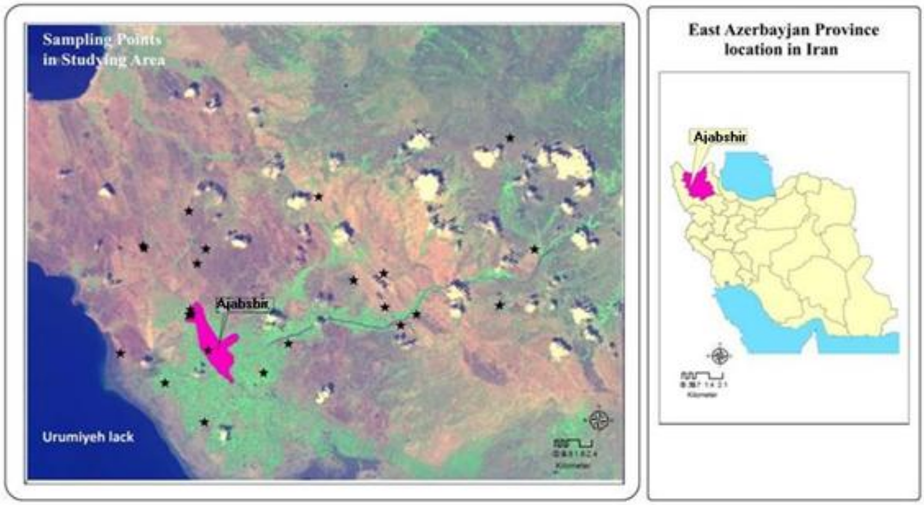
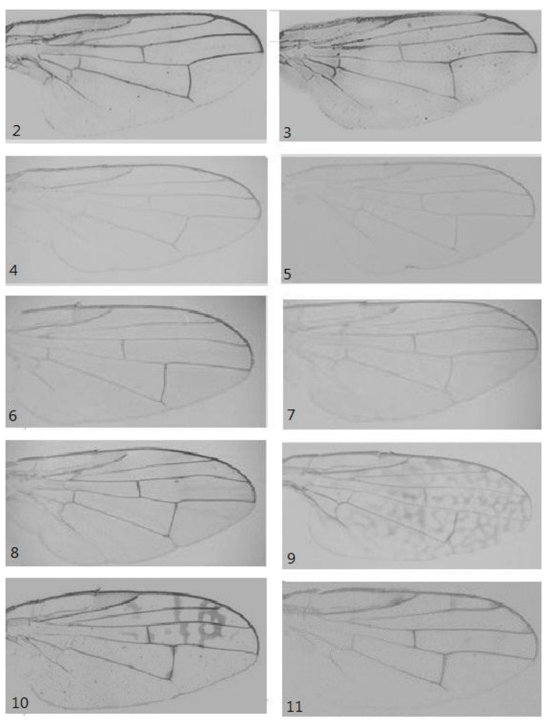
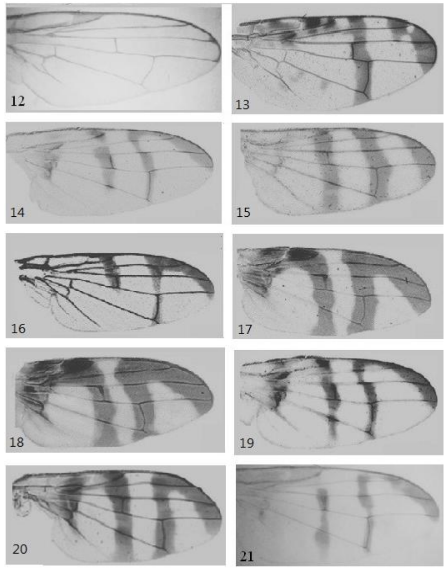


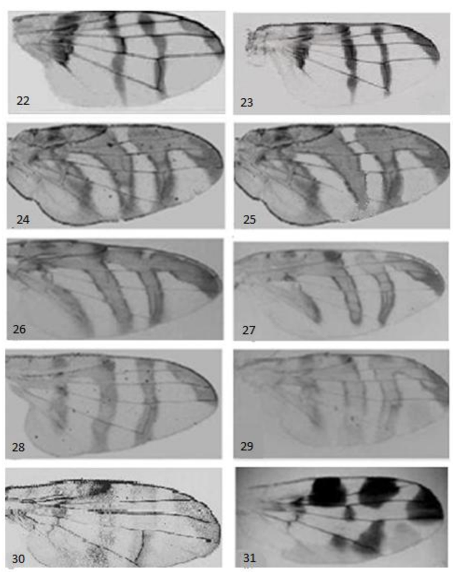
Figure 1. Location of sampling points on satellite image (SPOT) of Ajabshir region.



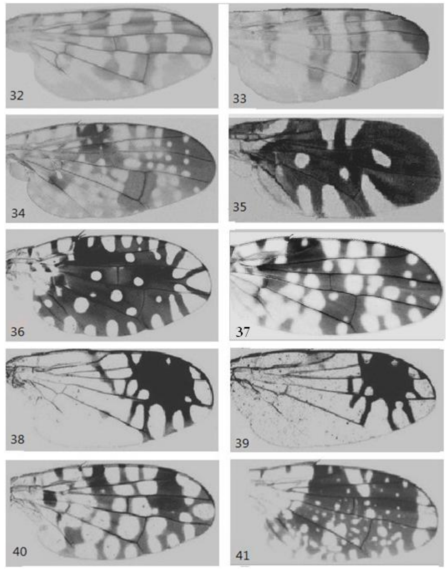
Figures 2-11. Wings of fruit flies: 2- *Urophora hermonis*, 3- *U. impicta*, 4- *Terellia luteola*, 5- *T. virens*, 6- *Ter. uncinata*, 7- *Ter. foscicornis*, 8- *Terellia serratulae*, 9- *Tephritomyia lauta*, 10- *Acanthiophilus helianthi*, 11- *Ensina sonchi* (Original).



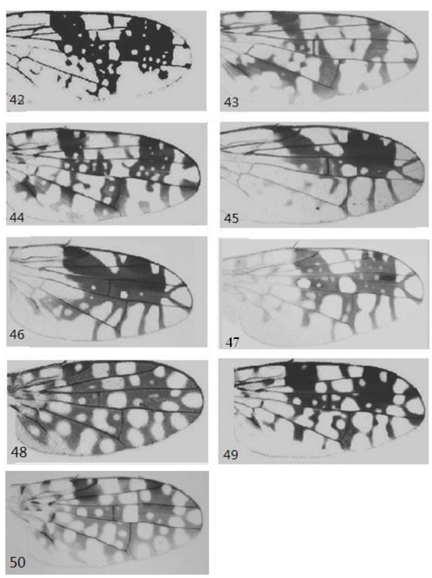
Figures 12-21. Wings of fruit flies: 12- *Terellia colon*, 13- *Sphenella marginata*, 14- *Urophora solaris*, 15- *U. affinis*, 16- *U. stylata*, 17- *U. doganlari*, 18- *U. quadrifasciata*, 19- *U. jaceana*, 20- *U. mauritanica*, 21- *U. stalker* (Original).



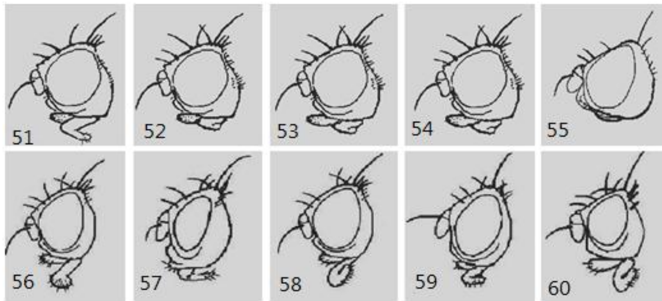
Figures 22-31. Wings of fruit flies: 22- *Urophora solstitialis*, 23- *U. terebrans*, 24- *Chaetorellia jaceae,* 25- *Chaetorellia australis*, 26- *Orellia stictica*, 27- *O. falcata*, 28- *O. distans*, 29- *Chaetostomella cylindrica*, 30- *Terellia nigronota*, 31- *Ter. ruficauda* (Original).



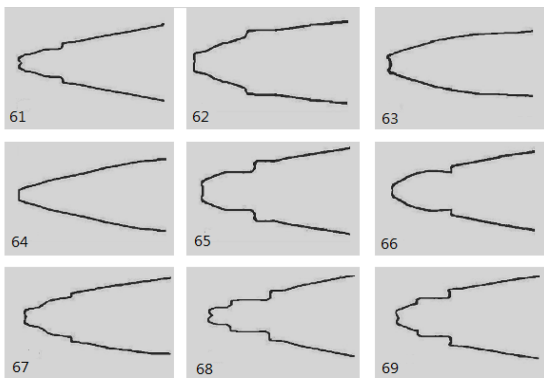
Figures 32-41. Wings of fruit flies: 32- *Terellia quadratula*, 33- *Ter. gynaecochroma*, 34- *Xyphosia miliaria*, 35- *Oxyaciura tibialis*, 36- *Heringina gutatta*, 37- *Compiglossa loewiana*, 38- *Trupanea amoena*, 39- *Tru. Stellata*, 40- *Euaresta bullans*, 41- *Tephritis formosa* (Original).



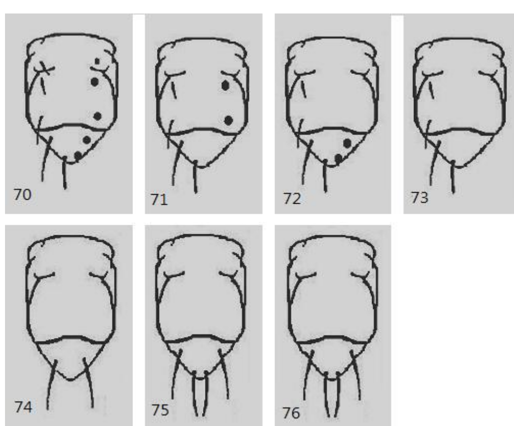
Figures 42-50. Wings of fruit flies: 42- *Tephritis bardanae*, 43- *T. postica*, 44- *T. hyoscyami*, 45- *T. cometa*, 46- *T. hurvitzi*, 47- *T. oedipus*, 48- *T. praecox*, 49- *T. dioscurea*, 50- *T. nigricauda* (Original).



Figures 51-60. Head of fruit flies: 51- *Urophora* spp., 52- *Terellia uncinata,* 53- *Ter. fuscicornis*, 54- *Ter. serratulae*, 55- *Ensina sonchi* : 56- *Heringina* spp., 57- *Compiglossa* spp., 58- *Trupanea* spp., 59- *Euaresta* spp., 60- *Tephritis* spp. (Lateral view; drawing).



Figures 61-69. Aculeus of genus *Urophota*: 61- *U. affinis*, 62- *U. stylata*, 63- *U. doganlari*, 64- *U. quadrifasciata*, 65- *U. jaceana*, 66- *U. mauritanica*, 67- *U. stalker*, 68- *U. solatitialis* 69- *U. terebrans* (dorsal view; drawing).



Figures 70-76: Tergum of fruit flies: 70- *Chaetorella* spp., 71- *Orellia* spp., 72- *Chaetostomella cylindrica,* 73- *Terellia* spp.*,* 74- *Trupanea* spp., 75- *Euaresta bullans* 76- *Tephritis* spp., (dorsal view; drawing).

CONTRIBUTIONS TO THE ELATERIDAE (COLEOPTERA) FAUNA OF EDREMIT BAY AREA AND IDA MOUNTAIN OF WESTERN TURKEY

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[**Öncül Abacıgil, T., Varlı, S. V., Tezcan, S. & Gülperçin, N.** 2012. Contributions to the Elateridae (Coleoptera) fauna of Edremit Bay area and Ida Mountain of Western Turkey. Munis Entomology & Zoology, 7 (1): 626-628**]**

ABSTRACT: Elateridae specimens collected from Edremit Bay area and Ida Mountain of western Turkey have been evaluated. A total of 11 species belonging to six genera have been recorded. Among the collected species *Ampedus cardinalis* is the first record for Turkey.

KEY WORDS: Elateridae, faunistics, pitfall trap, hibernation trap band, Turkey.

Some faunistical data on Elateridae (Coleoptera) fauna of oak biotopes of Ida Mountain, Western Turkey has been given by Varlı et al. (2010). There is not any detailed study on Elateridae fauna of neither Edremit Bay area nor Ida Mountain of Turkey. In this paper Elateridae species occurring in this area were given.

MATERIAL AND METHODS

Elateridae species were collected by using hibernation trap bands at five olive orchards located near Edremit Bay area (Abacıgil et al., 2010) and also by using sweeping net, pitfall traps and collecting under barks and under stones at 11 locations from Ida Mountain (Fig. 1).

RESULTS

Ampedus cardinalis (Schiodte, 1865)

Material: Ayıderesi, 12.IV.2008, *Pinus brutia* (Pinaceae), under bark, (1). Yedikardeşler, 1.V.2008, *Heracleum platytaenium* Boiss. (Apiaceae), (1). Totally 2 specimens. First record for Turkey.

Cardiophorus nigratissimus Buysson, 1891

Material: Avcılar, 25.II.2006, *Olea europaea* (Oleaceae), hibernation trap-bands, (2). Taylıeli, 25.II.2006, *O.europaea*, hibernation trap-band, (1). Yedikardeşler, 31.V.2008, *Heracleum platytaenium* Boiss., (1). Totally 4 specimens. First record for local fauna of Balıkesir.

Cardiophorus sacratus (Erichson, 1840)

Material: Narlı, 25.II.2006, *O.europaea*, hibernation trap-band, (1). Totally 1 specimen. First record for local fauna of Balıkesir.

Cardiophorus vestigialis (Erichson, 1840)
Material: Beypınarı, 05.VII.2008, pitfall trap, (1). Karayaprak Stream location, 16.X.2010, under stone, (1). Nanekırı, 04.VII.2009, pitfall trap, (3). Zeytinli, 09.V.2005, hibernation trap-band, (1). Totally 6 specimens. First record for local fauna of Balıkesir.

Dicronychus cinereus (Herbst, 1784)
Material: Nanekırı, 04.VII.2009, pitfall trap, (1). Totally 1 specimen. Previously reported from oak biotopes of Ida Mountain, Balıkesir (Varlı et al., 2010).

Dicronychus rubripes (Germar, 1824)
Material: Yedikardeşler, 31.V.2008, *Heracleum platytaenium* Boiss., (1). Totally 1 specimen. Previously reported from oak biotopes of Ida Mountain, Balıkesir (Varlı et al., 2010).

Dicronychus senaci (Desbrochers, 1869)
Material: Edremit, Central province 30.V.2005, hibernation trap-band, (1). Totally 1 specimen. Previously reported from oak biotopes of Ida Mountain, Balıkesir (Varlı et al., 2010).

Drasterius bimaculatus (Rossi, 1790)
Material: Avcılar, 09.V.2005, *O.europaea*, hibernation trap-band, (1). Ayvalık, 5.II.2006, *O.europaea*, hibernation trap-band, (1). Narlı, 25.II.2006, *O.europaea*, hibernation trap-band, (1). Totally 3 specimens. Previously reported from oak biotopes of Ida Mountain, Balıkesir (Varlı et al., 2010).

Peripontius dentatus Platia & Schimmel, 1991
Material: Altıparmak, 21.VI.2009, under stone, (1). Ayıderesi, 19.VII.2009, pitfall trap, (1). Beypınarı, 19.VII.2008, *Vicia villosa* Roth. (Fabaceae), (5); 06.IX.2009, pitfall trap, (2). Koçere, 19.VII.2009, pitfall trap, (2); 06.IX.2009, pitfall trap, (2). Totally 13 specimens. First record for local fauna of Balıkesir.

Peripontius ingridae Schimmel, 1996
Material: Gıldırdak Stream location, 27.VI.2010, under stone, (1). Pelitköy, 25.II.2006, *O.europaea*, hibernation trap-band, (1). Taylıeli, 25.II.2006, *O.europaea*, hibernation trap-band, (1). Zeytinli, 25.II.2006, *O.europaea*, hibernation trap-band, (1). Totally 4 specimens. First record for local fauna of Balıkesir and Çanakkale.

Prosternon tesellatum (Linnaeus, 1758)
Material: Çeyiz Stream location, 05.VII.2008, *Abies nordmanniana* ssp. *equi-trojani* (Asch. & Sint.) (Pinaceae), hibernation trap-band, (1); IX.2008-V.2009, *Abies nordmanniana* ssp. *equi-trojani* (Asch. & Sint.), hibernation trap-band, (1). Kırlangıç Stream location, 17.VII.2010, pitfall trap, (1). Koçere, 06.IX.2009, pitfall trap, (1). Söbüyurt, 16.VIII.2008, pitfall trap, (1). Totally 5 specimens. Previously reported from oak biotopes of Ida Mountain, Balıkesir (Varlı et al., 2010).

DISCUSSION

In this study a total of 11 species belonging to six genera recorded. Of these species five (*Dicronychus cinereus*, *D.rubripes*, *D.senaci*, *D.bimaculatus*, *P.tesellatum*) were recorded previously from this area. Among the collected species *A.cardinalis* is the first record for Turkey. Five of them (*Cardiophorus nigratissimus*, *C.sacratus, C.vestigialis, Peripontius dentatus*, *P.ingridae*) were recorded for the first time from Balıkesir province and one (*P.ingridae*) from Çanakkale province. 36.59% of material were collected by pitfall traps while 34.15% of material were collected by hibernation trap bands. Among those *P. dentatus* was common species.

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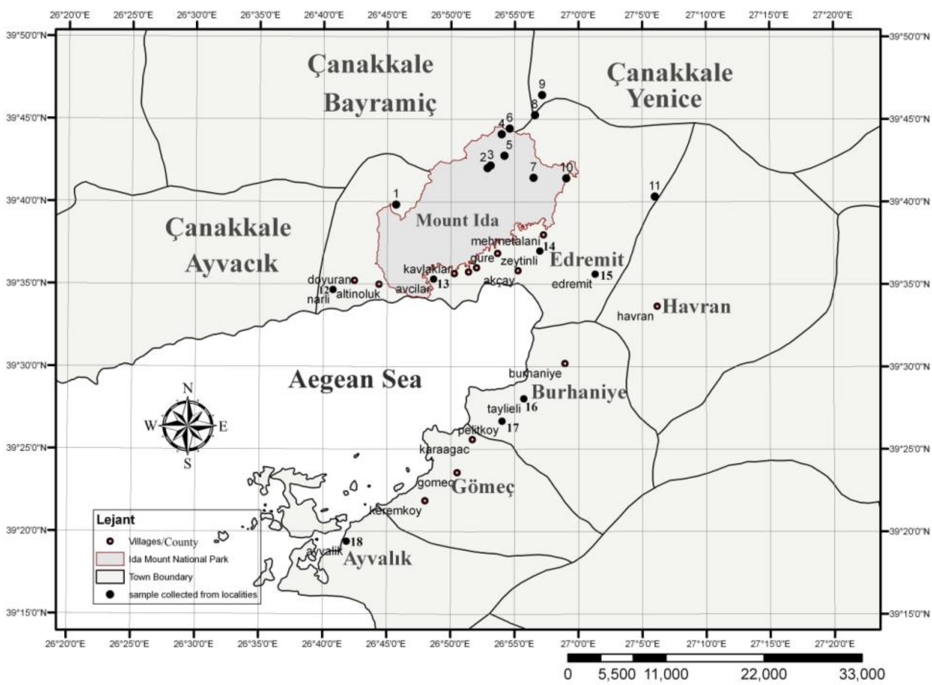

Figure 1. Localities of samples collected from the Ida Mountain and Edremit Bay area. 1. Nanekırı 2. Çeyiz Stream 3. Beypınarı 4. Koçere 5. Altıparmak 6. Kırlangıç Stream 7. Ayıderesi 8. Söbüyurt 9. Gıldırdak Stream 10. Yedikardeşler 11. Karayaprak Stream 12. Narlı 13. Avcılar 14. Zeytinli 15. Edremit, Central Province 16. Taylıeli 17. Pelitköy 18. Ayvalık.

ICHNEUMONIDAE (HYMENOPTERA) FROM NORTH-EASTERN TURKEY. III.

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[Çoruh, S. & Kolarov, J. 2012. Ichneumonidae (Hymenoptera) from North- Eastern Turkey. III. Munis Entomology & Zoology, 7 (1): 629-633**]**

ABSTRACT: Faunistic data of 24 species from Turkey are reported. Five species marked in the text by asterisk are new records for Turkish fauna. A zoogeographic characterisation for each species is proposed.

KEY WORDS: Ichneumonidae, Metopiinae, fauna, Turkey, new record, zoogeographic characterisation.

The Ichneumonidae fauna of Turkey is not well studied. In the catalogue of Kolarov (1995) 383 species were listed fromTurkey. Later many authors (Kolarov et al., 1997a,b; Kolarov et al., 1999; Kolarov et al., 2002; Çoruh et al., 2002; Kolarov & Gürbüz, 2004; Gürbüz, 2005; Yurtcan & Beyarslan, 2005; Yurtcan & Beyarslan, 2006; Çoruh & Özbek, 2008; Riedel et al., 2010; Kolarov & Çalmaşur, 2011 etc.) have made contributions to the Turkish fauna. In the present paper unpublish data for 24 species from subfamily Metopiinae from North Eastern Turkey are listed. Five species are new record for Turkish fauna. A zoogeographic characterisation for each species is proposed.

MATERIAL AND METHODS

Materials were collected by sweeping with a hand net and Malayse traps. The stuffing and taxonomocal identification of collected material was carried out in the Atatürk University of Erzurum. Generally the taxonomical works of Tolkanitz (1987 and 2007) were used. The materials are preserved in the Entomology Museum of Atatürk University of Erzurum, Turkey.

RESULTS

Subfamily Metopiinae

Colpotrochia cincta (Scopoli, 1763)

Material examined: Artvin: Çoruh valley near Oltu Road, 16.VI.2001, 1 male.
Distribution: Palaearctic region.

Colpotrochia triclistor (Aubert, 1979)

Material examined: Kars: Sarıkamış, Karakurt, TCK Fountain, 1500 m, 10-19.VI.2003, 1 female (from Malasia trap), 22.VI.2010, 1 females, 2 males.
Distribution: Turkey.

Drepanoctonus tricoloratus (Sedivy, 1971)

Material examined: Kars: Sarıkamış, Karakurt, TCK Fountain, 1500 m, 16-23.VIII. 2002, 9 females, 11 males, 23-29.VIII.2002, 2 females, 2 males, 8-14.IX.2002, 2 females, 5 males, 10-19.VI.2003, 7 females, 11 males, 29.VII-08.VIII.2003, 1 female, 1 male,

08.VIII.2003, 1 males, 08-19.VIII.2003, 2 females, 3 males (from Malasia trap), 19.VIII.2003, 1 male, 17.VIII.2005, 1 female.
Distribution: Ukraine, Georgia, Turkey, Russia-Chita oblast and Mongolia.

Exochus albicinctus Holmgren, 1873
Material examined:Erzurum: Arıbahce, 2000-2400 m, 20.VII.2001, 1 male; Hınıs 40 km SE, 1800 m, 14.IX.2002, 1 male; Narman, Kireçli, 2000 m, 02.VII.2000 m, 1 male; Pasinler, Küprüköy, Kayabaşı, 1600 m, 14.VI.2004, 1 male.
Distribution: Palaearctic region.

**Exochus bolivari* Seyrig, 1927
Material examined: Artvin: Yusufeli 2-8 km SW Altıparmak, 1300 m, 25-27.VII.2005, 1 female.
Distribution: Spain, France, Corsica and Moldova.

Exochus britannicus Morley, 1911
Material examined: Kars: Sarıkamış, Karakurt, TCK Fountain, 1500 m, 09-27.VIII.2004, 1 female (from Malasia trap). **Konya:** Güneysınır, Gürağaç, 1020 m, 08.VIII.2002, 1 female.
Distribution: United Kingdom, Poland, Hungary, Romania, Moldova, Turkey, Kazakhstan and Russia-Chita oblast.

Exochus castaniventris Brauns, 1896
Material examined: Konya: Güneysınır, Gürağaç, 1020 m, 16.VII.2000 m, 1 male. **Erzurum:** University Campus, 1850 m, 08-11.VII.1999, 3 females, 1 male.
Distribution: Spain, France, Malta, Poland, Hungary, Romania, Greece, Bulgaria, Moldova, Georgia, Turkey, Russia-Volgograd oblast, Kazakhstan, Uzbekistan and Egypt.

Exochus consimilis Holmgren, 1858
Material examined: Erzurum: Çat, Çirişli, 2000 m, 01.VII.2002, 1 male; Oltu, Tutmaç-Başaklı, 1900 m, 01.VII.2000, 1 male. **Rize:** Ovit Mt., 2400 m, 29.VII.2003, 1 male; Ikizdere, Çamlık, 1600-2000 m, 29.VII.2000 m, 1 male.
Distribution: Holarctic region.

Exochus erythronotus (Gravenhorst, 1820)
Material examined: Kars: Sarıkamış, Karakurt, TCK Fountain, 1500 m, 27.V.2003, 1 male.
Distribution: Madeira Islands, Europe, Georgia, Turkey and Armenia.

**Exochus ferus* Tolkanitz, 1993
Material examined: Rize: Ayder, Çamlıhemşin, 1200-1550 m, 30.VII.2000, 1 male.
Distribution: Hungary, Eastern Europe, Armenia, Kazakhstan, Siberia and Sakhalin.

**Exochus flavifrons* Boheman, 1863
Material examined: Erzurum: Oltu-Başaklı, 2100 m, 24.VII.2005, 1 male.
Distribution: Sweden, Finland, Germany, Poland, late Czechoslovakia, Hungary, Bulgaria, Moldova and Ukraine.

Exochus lictor Haliday, 1838
Material examined: Kars: Sarıkamış, Karakurt, TCK Fountain, 1500 m, 02.V.2000 m, 1 male. **Rize:** Ayder Çamlıhemşin, 1200-1550 m, 30.VII.2000 m, 1 male.
Distribution: Holarctic region.

Exochus mitratus Gravenhorst, 1829
Material examined: Artvin: 300 m, 16.V.2006, 1 male; Yusufeli Morkaya, 1300 m, 27.VII.2003, 1 male. **Bayburt:** Aydıntepe, Arpalı, 17.VI.2010, 1 male; Yoncalık, 2800-2900 m, 5.VII.2000, 2 males. **Bingöl:** Karlıova, Çobantaşı, 1455 m, 10.VIII.2004, 1 male. **Erzurum:** University Campus, 1850 m, 8.VI.2005, 1 female, 12.VI-2.VII.2004, 1 female, 10.VIII.2000 m, 1 male, 23.VII.2005, 1 female; Konaklı, 2000-2400 m, 22.VII.2000 m, 3

males, 2 females; Gölet, 22.VII.2006, 1960 m, 1 male; Aşkale, 1950 m, 28.V.2001, 2 females; 28.VI.2000, 1 female; 14.VII.2000 m, 2 females, 1 male, Ilıca, Gülyurt, Bakımevi, 2100 m, 16.VI.2002, 2 males; Narman Kireçli, 2000 m, 2.VII.2000 m, 1 male; Oltu-Başaklı, 2100 m, 24.VII.2005, 1 male, Kaleboğazı, 8.VIII.2000, 1 female, Sarısaz, 1450 m, 18.V.2000 m, 1 female, Tutmaç-Başaklı, 1700-2000 m, 1-2.VII.2000 m, 3 females, 3 males; Tortum, Petrol Ist. Karşısı, 1700 m, 24.V.2005, 1 male; Uzundere, 1200 m, 16.V.2003, 1 male; 21.VII.2000 m, 1 male; Balkalı, 1040 m, 29.VI.2003, 1 male; 10.VII.2003, 1 male. **Kars:** Aras Valley, 1500-1600 m, 23.V.2001, 1 male; Arpaçay Küçükpirveli, 1800 m, 27.VII.2000 m, 1 male;. Il Sınırı, 1470 m, 14.VI.2004, 1 female; Sarıkamış, Karakurt, TCK Fountain, 1500 m, 2.V.2000, 1 male; 8-14.0.2002, 1 female. **Rize:** Ikizdere, Ovit Mt., 2400-2600 m, 11.VII.2000, 1 male; Çamlık, 1600 m, 29.VIII.2000 m, 1 male.
Distribution: Holarctic region.

Exochus protuberans Kolarov & Çoruh, 2009
Material examined: Erzurum: Ispir, Maden Köprübaşı, 1450 m, 17.VII.2003, 1 female.
Distribution: Turkey.

Exochus suborbitalis Schmiedeknecht, 1924
Material examined: Ağrı: Eleşkirt, Alkuşak, 2100 m, 22.VI.2002, 1 male. **Ardahan:** Göle Ormanlık Alan, 2160 m, 25.VII.2005, 1 male. **Artvin:** Yusufeli, 21.IX.2000, 1 female. **Bayburt:** Maden, 1050 m, 16.VI.2000, 1 female. **Bingöl:** Yenibağlar, 3.VI.2003, 1400 m, 1 male. **Erzincan:** Mercan Yollarüstü, 1360 m, 4.VIII.2003, 1 male. **Erzurum:** University Campus, 1850 m, 4.VII.2000, 1 male, 20-28.VII.2003, 1 male (from malasia trap); 10.VIII.2000, 2 males; Söğütlü, 1900 m, 15.VI.2002, 1 male; 8-11.VIII.1999, 4 males (from malasia trap); Horasan, 1750 m, 4.V.2000, 1 male; Oltu Inanmış, 1700 m, 26.VII.2000, 1 male, Sarısaz, 21.IX.2000, 1 female, Tutmaç-Başaklı, 1700-2100 m, 31.VII.2001, 1 female; Olur Süngübayır, 1850 m, 30.VII.1999, 2 males; Uzundere, 27.VI.2000, 2 males. **Kars:** Sarıkamış, Karakurt, TCK Fountain, 1500 m, 6-20.VIII.2003, 1 male.
Distribution: Europe, Caucasus, Turkey, Kazakhstan and Siberia.

***_Exochus thomsoni_ Schmiedeknecht, 1924**
Material examined: Erzurum: University Campus, 1850 m, 26.IX.2000 m, 1 female; Oltu, Inanmış, 1700 m, 27.VII.2000 m, 1 male.
Distribution: Europe, Caucasus, Kazakhstan, Middle Asia, Siberia and Far East of Russia.

Exochus vafer Holmgren, 1873
Material examined: Erzincan: Çağlayan Road Side, 1100 m, 6.VII.2001, 1 male. **Erzurum:** Ilıca, Ağzıaçık Geçidi, 2000 m, 19.VII.2003, 1 male; Tortum, Kazandere, 1190 m, 3.VIII.2004, 1 male.
Distribution: Europe, Caucasus, Turkey, Kazakhstan and Siberia (Chita oblast of Russia).

Hypsicera femoralis (Geoffroy, 1785)
Material examined: Ağrı: Doğubeyazıt, 15.VI.2001, 1 male. **Erzurum:** Cat, 2000 m, 11.VII.1994, 1 male.
Distribution: Cosmopolitan species, introduced into South Africa.

Metopius (_Peltastes_) _pinatorius_ Brullé, 1846
Material examined: Erzurum: Arıbahçe, 2000-2400 m, 20.VII.2001, 1 female.
Distribution: Europe, Turkey, Turkmenistan, Siberia and Pacific coast of Russia.

Metopius (_Peltocarus_) _dentatus_ (Fabricius, 1779)
Material examined: Bayburt: Maden, 1650 m, 16.VI.2000 m, 1 male. **Erzurum:** Pasinler, Çalıyazı, 2400 m, 10.VII.1997, 1 female.
Distribution: Libya, Europe, Georgia, Turkey, Cyprus, Israel, Turkmenistan, Uzbekistan and Pacific coast of Russia.

Spudaeus scaber (Gravenhorst, 1829)
Material examined: Bayburt: Kop. Mt., 2300 m, 25.VI.2004, 1 male.
Distribution: Europe, Turkey, Kazakhstan and North America.

***Triclistus longicalcar* Thomson, 1887**

Material examined: Artvin: Genya Mt., 1900 m, 14.VII.2003, 1 female. **Erzurum:** University Campus, 1850 m, 7.VI.2003, 1 male; 9.VI.2005, 1 male; 14.VI.2004, 1 male; Palandöken DSİ Göleti, 2000 m, 12.X.2002, 1 male; Ispir, Gülyurt Mt., 2400 m, 7.VII.2004, 1 female; Oltu Inanmış, 1700 m, 26.VII.2000 m, 1 male; Olur Yeşilbağlar, 1000 m, 29.VI.2003, 1 female; Tekman Yaylası, 2450 m, 19.VII.2005, 1 female.
Distribution: Europe.

***Triclistus podagricus* (Gravenhorst, 1829)**

Material examined: Erzurum: Ilıca Atlıkonak, 2100 m, 21.VI.2004, 1 female; Olur, Yeşilbağlar, 1200 m, 25.VI.2001, 1 male.
Distribution: Holarctic region.

***Trieces tricarinatus* (Holmgren, 1858)**

Material examined: Erzurum: Dadaşköy, 9.VII.2004, 2 males, 1 female; Uzundere, Balıklı, 1040 m, 29.VI.2003, 1 male.
Distribution: Europe and Turkey.

Zoogeographical characterisation

The zoogeographic characterisation follows mainly the chorotype classification of the Near East fauna, proposed by Taglianti et al. (1999). After investigation of the recent geographic distribution of the species listed above, they can be divided into the following groups:

1. Cosmopolitan range: *Hypsicera femoralis*.
2. Holarctic chorotypes: *Exochus consimilis*, *E. lictor*, *E. mitratus*, *Spudaeus scaber* and *Triclistus podagricus*.
3. Palaearctic ranges: *Colpotrochia cincta*, *Exochus albicinctus*, *E. ferus*, *E. thomsoni*, *E. vafer*, *Metopius* (*Peltastes*) *pinatorius* and *M.* (*Peltocarus*) *dentatus*.
4. Sibero-European chorotypes: *Drepanoctonus tricoloratus* (Sibero-Eastern European chorotype), *Exochus britannicus* and *E. suborbitalis*.
5. Europeo-Mediterranean range: *Exochus castaniventris*.
6. European chorotypes: *Exochus bolivari*, *E. erythronotus*, *E. flavifrons*, *Triclistus longicalcar* and *Trieces tricarinatus*.
7. Eastern Anatolian endemic ranges: *Colpotrochia triclistor* and *Exochus protuberans*.

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IMPACT OF HIVE DIMENSION AND FIGHT ENTRANCE ON HIVE COLONIZATION, PEST INFESTATION AND HIVE WEIGHT GAIN IN *APIS MELLIFERA ADANSONII* (HYMENOPTERA: APIDAE)

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[Babarinde, S. A., Odewole, A. F., Oyegoke, O. O. & Amao, O. B. 2012. Impact of hive dimension and fight entrance on hive colonization, pest infestation and hive weight gain in *Apis mellifera adansonii* (Hymenoptera: Apidae). Munis Entomology & Zoology, 7 (1): 634-641**]**

ABSTRACT: Four hive types [Kenya top bars hive with flight entrance on the floor (KF), Kenya top bars hive with flight entrance on the wall (KW), Kenya top bars hive with flight entrance on the floor and the wall (KFW) and Tanzania top bars with flight entrance on the floor and the wall (TFW)] were constructed and baited by smearing 30 g bee wax on their flight entrance, top bars, inner surface of the wall and floor on 17th April 2008. Colonization, colony development and pest infestation were monitored over a period of 16 weeks. Hive type did not significantly (P>0.05) affect colonization period. All hive types were colonized with 100% colonization in TFW and KF. KW and KFW had 66.67% colonization. The least mean colonization period was 3.67 days after hive installation and was observed in KF, while the longest colonization period of 7 days was observed in KFW. Hive type did not affect weight gain ranged from 0.3 kg (TFW at 2 weeks after colonization) to 2.5 kg (KF at 8 weeks after colonization). Bee population was significantly affected by hive type and was lowest in TFW which was the only hive type that was heavily (2/3 of the replicates) infested by *Galleria mellonella,* hence the reason for its lowest weight and bee population. *Aethina tumida* was encountered in KT and KF. Both pests were observed in colonized hives. The only intruder that was observed in uncolonized hive was *Gryllus bimaculatus* and was encountered in KFW. With 100% colonization and least mean colonization period of 3.67 days post installation of baited hives in Kenya top bar with flight entrance on the floor (KF), KF is recommended for areas where the risk of accidental rain water into hive is not paramount.

KEY WORDS: Top bar hive, hive type, hive colonization, fight entrance, hive dimension, honey bee pests, colony weight gain.

Colonization is artificial means of catching a colony or a swarm of bees into hives. Ordinarily, colonization does not suppose to be a problem in West Africa, a region which is full of wild bees colonies. In most cases if an apiary is sited on a virgin land where there is no competition and appropriate baits are used, colonization can begin within the first day installation of hives. However there have bee reported cases of colonization problems in South western and South Eastern Nigeria (Babarinde pers. comm.; Ojating & Ojating, 2004).

Several baiting materials have been listed with performance based on different factors. Bee wax is considered to be the best bait to attract swarm and the started strips on the top bar may be enough to do this (Eaton, 2006). Alternatively, smearing bee wax on inner surface of the hive, the top bars and the flight entrance will attract the bee colony. The baited hive could then be installed on a stand and covered with corrugated materials to provide shade. Though, there are several designs of hives, the top bar hives are comparatively predominant amidst tropical beekeepers (Sageren, 1997; Gregory, 2003; Romet, 2005; Eaton, 2006; Emery, 2006). Top bar hives have many of the advantages of movable frame hives and their use can lead to 3-fold increases in yields of honey and can be very profitable because of low input costs (Wilson, 2006). Okwee-Achai et al.(2010) reported that the top bar hives had significantly higher colonization rate than the log hives in the North-western agro-ecological zone of Uganda.

Although, several designs of top bar hives have been reported (Sakho, 1999; Magnum, 2001), the need for further research on their designs are paramount, since they form an intermediate technology which is an improvement over the traditional honey hunting. In south western Nigeria, the conventional top bar hive used for beekeeping is the Kenya top bar with flight entrances on the wall and floor. This is presented as sample hive type in most private and institution-based beekeeping trainings or workshops. Though the Tanzania top bar hive seems easier to construct due to its shape, it is not common amidst the beekeepers in the area of this study. The technical knowledge required to construct some of the modern hive types is a major discouragement to rural farmers who have interest in beekeeping (Caron, 2007). As a way to eliminate this discouragement, Kenya top bars and Tanzania bars hive were constructed and experimented for beekeeping, with the aim of investigating the effect of hive dimensions and flight entrance on hive colonization, pest infestation and colony weight gain.

MATERIALS AND METHODS

Experimental Site

The apiary site was located at Ayekale Village, Surulere Local Government, which is about 12 km from the Campus of Ladoke Akintola University of Technology, Ogbomoso, Nigeria. The apiary was about 4 m to the stream.

Hive specifications

The Kenya top bars hives used for the experiment were constructed using Sageren (1997) and Gregory (2003) models with little modifications. Each hives had 15 top bars of 3 cm width. Each entrance on the floor was 12 x 1 cm and positioned around the centre of the hive length. Entrances on the wall were 3, each having 12 mm diameter and were aligned towards an edge of the hive. Details of each hive type are presented in Figures 1 to 4.

Installation of the hives

Each hive was baited with 30 g bee wax and installed 56 x 31 cm surface area and 30 cm height metallic stand. A total of 12 hives were baited, three replicates each of Kenya top bars hive with flight entrance on the floor (KF), Kenya top bar hive with flight entrance on the wall (KW), Kenya top bars hive with flight entrance on the floor and the wall (KFW) and rectangular top bars hive with flight entrance on the floor and the wall (TFW). The experiment was set up on 17th April 2008. Corrugated roofing sheets were used as roofing material to prevent adverse weather conditions. The flight entrance of each hive faced the east. The baited hives were placed under cashew (*Anacardium occidentalis)* trees which was the only available tree species grass (*Pannisetum purpureum)* and spear grass (*Imperata cylindrica)*. During the experimental period, arable farmers around the apiary had maize (*Zea mays)* and cassava (*Manihot spp)* grown on their plots.

Data collection and analysis

Data were collected on colonization date, pest infestation, hive weight gain and bees population. Colonization date was recorded as number of days post installation of hives that bees colonized the hive. Pest type and date of its infestation were also recorded. This was determined by daily inspection of the hives. Pests encountered were collected and preserved for identification at Insect Collection Museum, Crop Protection and Environmental Biology Department, University of Ibadan, Ibadan, Nigeria. Hive weight was determined immediately after baiting before installation and on bi-weekly interval with the aid of a top loading weighing machine, Camry®. Hive weight gain was calculated as the difference between the previous weight and the weight at bi-weekly interval. Number of bees at flight entrance (s) was recorded on inspection of colonized hives at bi-weekly interval. The number of bees at flight entrance was determined by visual count and bees population was determined by ERLS formula. Data collected were subjected to one way analysis of variance (ANOVA). The experiment was set up in completely randomized design.

RESULTS

Effect of hive dimension and flight entrance on hive colonization

Hive type did not significantly affect colonization period. All hive were colonized but Kenya top bars with flight entrance on the floor (KF) and rectangular top bars with flight entrance on the floor and the wall (TFW) had 100% colonization. The other two types (Kenya top bars with flight entrance on the wall (KW) and Kenya top bars with flight entrance on the floor and the wall (KFW) had 66.67% colonization. Kenya top bars with flight entrance on the floor (KF) had the shortest mean colonization period (3.67 days after hive installation). The longest mean colonization period was 7 days after hive installation and was recorded in Kenya top bars with flight entrance on the floor and wall (KFW) (Fig. 5).

Effect of hive dimension and flight entrance on hive weight gain

Hive type did not affect weight gain throughout the experimental period and ranged from 0.3 kg-2.5 kg. Hive weight fluctuated but was consistently least (0.3-0.7 kg) in TFW and highest (1.5-2.5 kg) in KF. At 12 weeks after colonization (WAC), weight loss was recorded in TFW (Fig. 6).

Effect of hive dimension and flight entrance on bee population

Population of bee colony in KF was significantly higher than population of bee in other hive types. Population in TFW was throughout the experimental period. Bee population did not progressively increase with experimental duration but rather fluctuated (Fig. 7).

Occurrence of pests in different hive types

Two pests and one intruder were recorded in the different hive types. KF and KW had highest number of hive beetle, *Aethina tumida*, and a replicate each was affected by the pest on 1st June 2008 and 5th July 2008 respectively. An intruder, *Gryllus bimaculatus,* was recorded in KFW. Two replicates of TFW were infested by large wax moth, *G. mellonella,* on 19th July 2008 and 22nd August 2008 respectively. KFW was infested by the intruder before hive colonization while the pests attacked hives after the hive had been colonizes (Table 1).

DISCUSSION

Top bar hives are almost becoming most popular among educated trainers who are interested in modern bee keeping in some developing counties. As simple as the technology of top bar hives is, construction details are not fully understood by local farmers who have no access to documented sketches. In South Western Nigeria, the common model has two flight entrances. The first set of entrances is on the wall, while the second is on the floor. The floor entrance is often presumed to be useful to drain off water from hives when there is accidental water drain into the hives practically in Nigeria variations of flight entrances have not been studied.

In this research, attempt was made to compare three types with the Gregory model (Gregory, 2003). A rectangular hive was included because its specification was simpler than the standard Kenya models. The result indicates that hive type did not affect hive colonization and weight gain. Primarily, choice of hive type by bees keeper should depend on a number of apicultural factors such as colonization, yield and vulnerability to pests. TFW and KF performed equally in terms of colonization periods. This results recommends a reduction of flight entrance to just one especially in areas where pests can utilize extra flight entrance to attack the colony. However this can only be adopted where there is no tendency of water draining into the hive.

The initial population of bees could not have been affected by hive types. This is because the scout worker bees look for a convenient accommodation and communicate to the colony. This would lead to colonization (Segeren, 1997). Also population of bee colony in KF was significantly higher than population of bees in other hive types and the reason for these could be as a result of pest infestation in the other hive types. Several authors (Adjare, 1990; Segeren, 1997, Ojating & Ojating, 2004, Ande et al., 2008; Babarinde et al., 2010) have reported that *G. mellonella* can cause absconding of established colony. Although *Aethina tumida* could be a nuisance to honey bees, it may not be associated with absconding (Adjare, 1990). So, in this study, TFW that had highest incidence of *G. mellonella* had the least bee population.

As simple as the specification of TFW was, a major deterrence that hinders its recommendation for practical use was its vulnerability to the wax moth, *G. mellonella*. Though, it had 100% colonization, yield was greatly affected by the pest infestation. It was not however certain whether pest incidence was catalyzed by the double flight entrance or not. It is therefore recommended that rectangular hive with single flight entrance be compared with those studied in this work, before final recommendation of rectangular hive can be made.

Since KF had 100% colonization and shortest mean colonization period which was 3.67 days after hive installation, it appears better than other two types of Kenya top bars hive. It has been observed in Ogbomoso, south western Nigeria that bees sometimes used the floor entrance for their foraging activities and abandoned the conventional wall flight entrance. Hence, single flight entrance on the floor will not have a negative impact on apicultural activities, especially when hives are placed securely to avoid water drain.

The result of this study will help bee keepers in solving the problem of getting standard hive sample for their apicultural activities. This study has shown that KF could be more preferable for it had least number of pests, higher number of bees population, and significant weight gain on bi-weekly basis. It is also important that baited hive installation should be done during the time of floral blossom. This is because seasonal productivity of honey bee colonies depend on the seasonal availability of nectar and pollen of flowering plants (Ikedobi et al., 1985).

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Table 1. Occurrence of pests and intruders in different hive types.

Pest	Order	Category	Hive type	Date of occurrence
Aethina tumida	Coleoptera	Pest	KF	1st June, 2008 & 5th July, 2008
Gryllus bimaculatus	Orthoptera	Intruder	KFW	5th July, 2008
Galleria melonella	Lepidoptera	Pest	TFW	19th July, 2008 & 2nd August, 2008

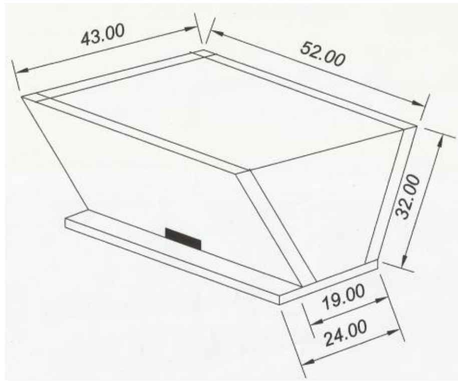

Figure 1. Kenya top bar hive with flight entrance on the floor (All dimensions are in centimeters).

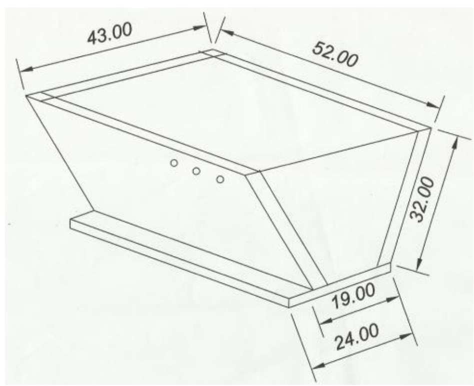

Figure 2. Kenya top bar hive with flight entrance on the wall (All dimensions are in centimeters).

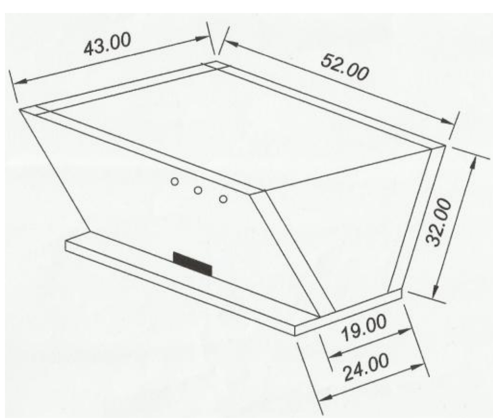

Figure 3. Kenya top bar hive with flight entrance on the floor and wall (All dimensions are in centimeters).

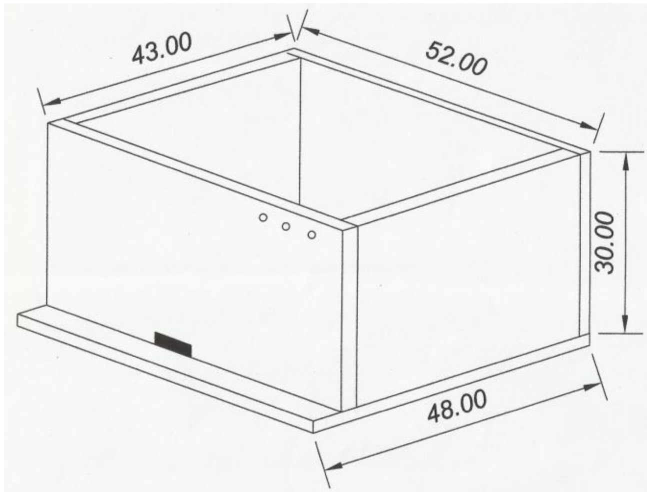

Figure 4. Tanzania top bar hive with flight entrance on the floor and wall (All dimensions are in centimeters).

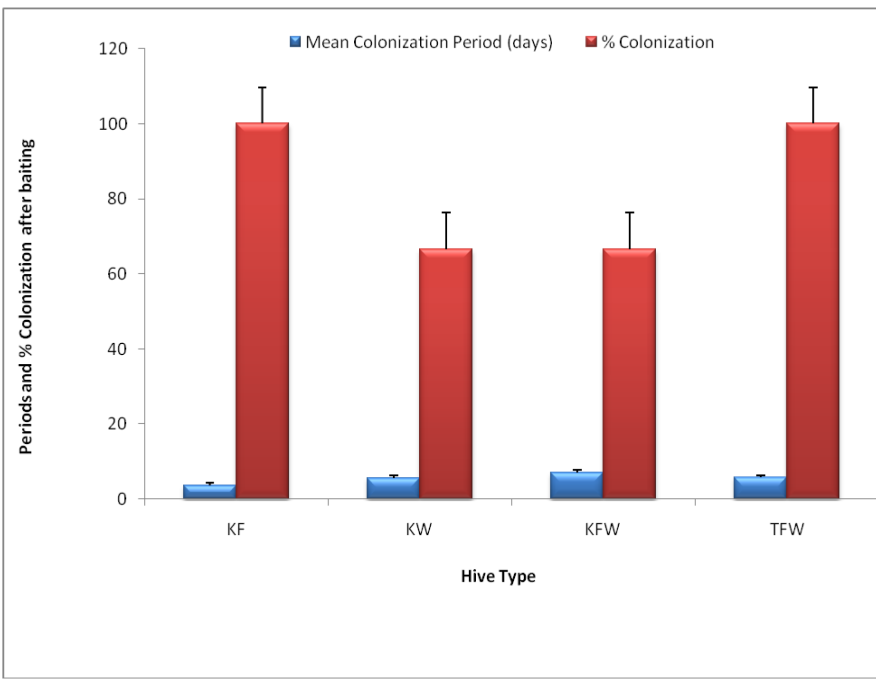

Fig. 5. Effect of hive dimension and flight entrance on colonization
KF: Kenya top bar hive with flight entrance on the floor
KW: Kenya top bar hive with flight entrance on the wall
KFW: Kenya top bar hive with flight entrances on the floor and wall
TFW: Tanzania top bar hive with flight entrances on the floor and wall

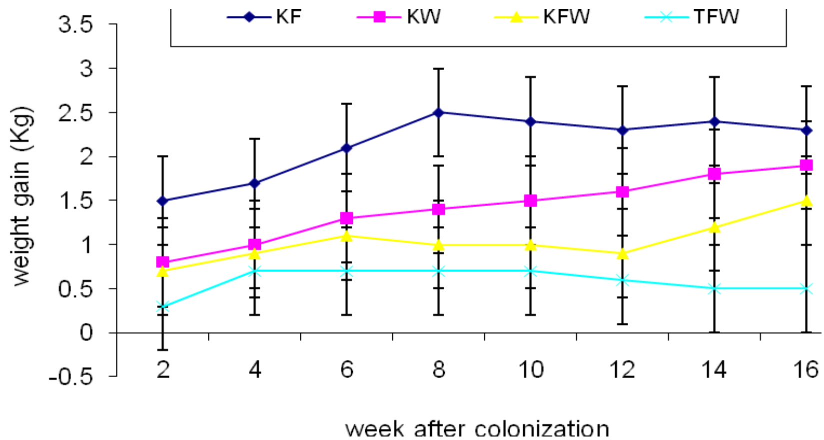

Fig. 6. Effect of hive dimension and flight entrance on hive weight gain.
KF: Kenya top bar hive with flight entrance on the floor
KW: Kenya top bar hive with flight entrance on the wall
KFW: Kenya top bar hive with flight entrances on the floor and wall
TFW: Tanzania top bar hive with flight entrances on the floor and wall

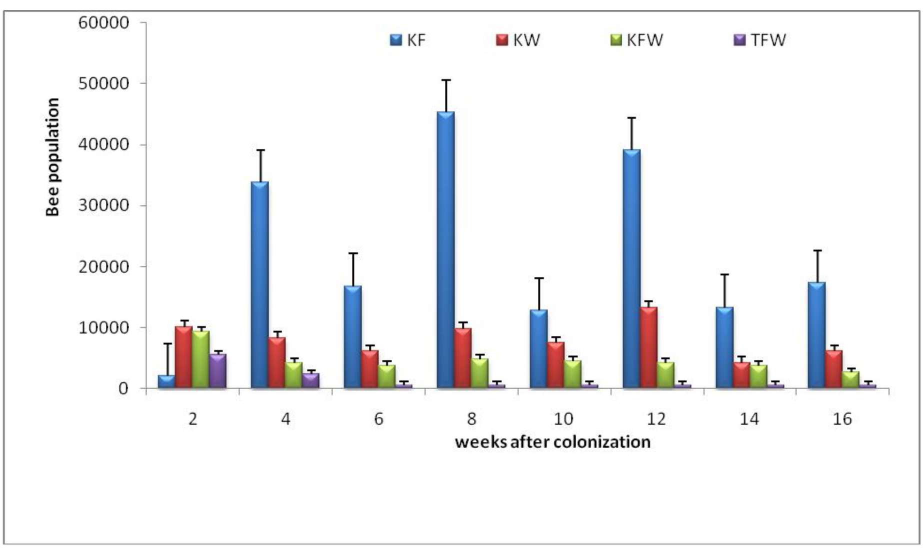

Fig. 7. Effect of hive dimension and flight entrance on bee population.
KF: Kenya top bar hive with flight entrance on the floor
KW: Kenya top bar hive with flight entrance on the wall
KFW: Kenya top bar hive with flight entrances on the floor and wall
TFW: Tanzania top bar hive with flight entrances on the floor and wall

SCIENTIFIC NOTES

SALVIA SCLAREA L. (LAMIALES: LAMIACEAE) - A NEW HOST RECORD FOR *HELICOVERPA ARMIGERA* (HÜBNER) (LEPIDOPTERA: NOCTUIDAE)

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[**Nadda, G., Tewary, D. K., Shanker, A. & Singh, V.** 2012. *Salvia sclarea* L. (Lamiales: Lamiaceae) - A new host record for *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae). Munis Entomology & Zoology, 7 (1): 642-645]

American bollworm, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) is a widespread pest species of world-wide economic importance on many agricultural and horticultural crops. It is highly polyphagous, causes severe damage and loss to a wide range of food, fibre, oil, fodder, vegetable, horticultural, ornamental, aromatic and medicinal plants as well as wild hosts. In India alone, it is reported to cause annual crop damage of ca. $1 billion (Gujar et al., 2004). Due to its polyphagous nature of feeding, it is quite difficult to control and is known to attack more than 200 host plants all over the world (Bharti et al., 2007) and number of hosts are still increasing. The most important crop hosts of which *H. armigera* is a major pest are tomato, cotton, pigeon pea, chickpea, sorghum and cowpea. Other hosts include *Dianthus*, *Rosa*, *Pelargonium*, *Chrysanthemum*, groundnut, okra, peas, field beans, soybeans, lucerne, *Phaseolus* spp., other Leguminosae, tobacco, potatoes, maize, flax, a number of fruits (*Prunus*, *Citrus*), forest trees and a range of vegetable crops. The specificity of ovipositing females in selecting plants makes lepidopterons potentially powerful agents of natural selection on plant species.

Though a large number of plants belonging to different taxonomic groups have been reported as hosts for this pest, *H. armigera*, to the best of our knowledge no report is available on Clary sage, *Salvia sclarea* (Lamiales: Lamiaceae) as a potential host for this insect pest. *S. sclarea* is of economical importance as flavoring agent in the food industry, perfumery and cosmetic industries. It is an aromatic perennial plant which can be cultivated as annual crop also. Its stems are square, brownish and hairy with few branches. The leaves are large, oblong, heart-shaped, arranged in pairs, wrinkled, irregularly toothed at the margins and covered with velvety hairs. The flowers are set in whorls in a long, loose, terminal spike. Recent studies have shown that the clary sage oil has some interesting biological properties (Farkas et al., 2005). Herb and roots of *S. sclarea* are used for stomachache, diarrhoea, sore throat, swellings and headaches. *S. sclarea* contain flavonoids, monoterpenoids, sesquiterpenoids and diterpenoids. The essential oil, known as clary sage oil or muscatel sage, contains l-linalyl acetate, linalool, and nerol as major compounds. The concrete and absolute of clary sage include linalyl acetate, linalool, sclareol, and sesquiterpenes.

S. sclarea is considered native to Southern Europe. It has been additionally brought into Middle Europe, where it is cultivated nowadays for industrial use (Pešić & Banković, 2003). In 2002 this crop has been introduced by Institute of

Himalayan Bioresource Technology, Palampur, India at its Chandpur Farm (Latitude, 76°33′29″ East; Longitude, 32°6′20″ North; Elevation, 1356 m amsl) (Fig. 1A.). During the course of surveying insect pests in the month of June-July 2006, it was observed for the first time on *S. sclarea* causing a great deal of damage to the flowers of (Fig. 1B). Thereafter, this pest is found to attack *S. sclarea* crop every year in the month of March-April onward. Due to the pinkish color of flowers and their arrangement in whorls on a green spike, it was quite difficult to see the damaging insects on this crop. There were holes in the flowers and frass pellets on the leaves and flowers. When observed carefully, this damage was found to be due to the attack of *H. armigera* larvae feeding on the flowers (Fig. 1C,D,E & F). No damages or feeding of leaves were observed which may be due to the presence of velvety hairs on the leaves and availability of large number of flowers for the developing larvae. All the larvae observed were of different stages. All the stages (second instar onward) were collected from the flowers which indicated that females of *H. armigera* laid eggs on multiple occasions. All the larval instars stages collected from this crop suggesting *S. sclerea* can support development of *H. armigera*. 3-6 larvae per plant were recorded. Larvae bore holes in the flowers and one larva damaged many flowers. This is the first report of *H. armigera* attacking *S. sclarea*. Some of the collected larvae were brought into the laboratory and reared individually in plastic cups on semi-synthetic diet at a temperature 25±2°C and 14:10 (L: D) hours photoperiod for further studies. Attack of this pest on the flowers resulted in reduction of flower production which may ultimately lead to decline in seed and essential oil production. *H. armigera* activity in farm understudy was evident from the succeeding year study based on the male moth captured with sex pheromone traps.

In the same farm there was 6 hectares of *Rosa damascena* (Damask rose) plantation. Flowering and flush of this crop is attacked by *H. armigera*. Flowering starts in April and ends in May. *H. armigera* only attacks buds and flowers of roses; it is possible that after rose crop is over, moth population utilizes *S. sclerea* as its potential alternative host. Information regarding the impact of *S. sclerea* on the *H. armigera* populations is currently unavailable and further studies are required to understand the ecology and evolution of interactions between *H. armigera* and new identified host, *S. sclarea*.

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Figure 1A. *Salvia sclarea* crop.

Figure 1B. Damaged *S. sclarea* plant with frass.

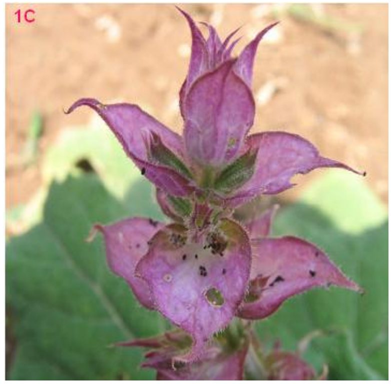

Figure 1C. Damaged *S. sclarea* flowers.

Figures 1D,E,F. *H. armigera* larvae on flowers of *S. sclarea* with damage and frass.

SCIENTIFIC NOTES

FABRICATION OF SUITABLE LOW COST BAMBOO MOUNTAGES FOR ERI SILKWORM, *SAMIA RICINI* DONOVAN

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[Deberaj, Y., Singh, N. I., Sarmah, M. C. & Singh, R. 2012. Fabrication of suitable low cost bamboo mountages for Eri Silkworm, *Samia ricini* Donovan. Munis Entomology & Zoology, 7 (1): 646-649**]**

Spinning is the last stage of rearing. It requires suitable mounting device to get good quality cocoon for reeling. This is the most important step in silkworm rearing wherein the mature worms will be mounted on proper cocooning device. If care is not taken in this stage, the quality as well as quantity of the cocoon may get affected adversely. In north eastern India, most of the farmers used bundle of dried leaves called 'JALI' for cocooning in ericulture as a common practice since long back. Till recently, a few farmers have started using bamboo *Chandrike* as mountage just like in mulberry silkworm. Many workers have studied the different types of mountages in mulberry silkworm (Geetha Devi et al., 1990; Singh et al., 1994, 1998; Himantharaj, 1995; Singh, 1995; Rajan et al., 2000; Kumaresan et al., 2007) and muga silkworm (Barah & Samson, 1990; Sahu et al., 1998) in different parts of the country. However, in ericulture no detail work has been undertaken for fabrication or performance of mounting devices except the preliminary studies of Debaraj & Brahma (2003); Patil & Savanurmath (1994). Considering the availability of huge potential of bamboo in north eastern India, bamboo can be used as a good raw material for fabrication of low cost mounting devices for eri silkworm. Therefore an attempt was made to fabricate low cost bamboo mountages for eri silkworm in the present study. The data on the comparative performance of the bamboo mountages with other devices are discussed and presented in this write-up.

MATERIALS AND METHODS

The experiment on comparative performance of different cocoon mountages was conducted in five seasons with four treatments including control at Regional Eri Research Station, Mendipathar, Meghalaya. The eri silkworm, Borduar race was reared following standard rearing method (Tray rearing). After completion of rearing, the matured worms were mounted in different mountages @ 50 worms per square feet. Cocoons were harvested after complete pupation. Two new devices of cocoon mountage were fabricated, which are made up of bamboo strips. The first device, BSM-1 is made up of bamboo strips comprising 15 numbers (85 x 3 cm) fixed in parallel on two bamboo strips (60 x 4 cm) making grooves in both ends and tied with binding wire. The distance between two strips is 3 cm. A bamboo sieve fixed on one side supports the whole structure. This type of mountage is single layered and ideal size of each device is 85 x 60 x 4 cm.

The second device, BSM-2 is also made up of bamboo strips comprising 12 numbers (80 x 2.5 cm) fixed in parallel on two bamboo strips or wooden reapers (60 x 3 cm) in both ends tied with nails or binding wire. The distance between two strips is 2 cm. Such complete set of bamboo strip frames are placed one above the other up to 5 frames to make it a multiple layered mountage. The ideal size of each device is 80 x 60 x 22 cm. The third treatment is the traditional method of cocoon mountage called 'JALI', which is made up of bundle of dried leaves of mango, jack fruit, sal, etc. The performance of these devices was compared with bamboo *Chandrike* (1 m dia) as control. The mean data on the comparative performance of different cocoon mountages were collected and analyzed considering all the cocoon characters like good cocoon percentage, inferior cocoon percentage, cocooning percentage, pupation percentage, cocoon weight, cocoon shell weight, cocoon shell percentage, space occupied by each mountage, harvesting time, durability, etc.

RESULTS AND DISCUSSION

Results indicated that good cocoon recovery percentage was recorded maximum in BSM-1 (95.62%) followed by BSM-2 (94.72%) and minimum in Jali (92.66%). Inferior cocoon percentage was maximum (6.93%) in Jali followed by Chandrike (5.61%) and the same was minimum in BSM-2 (4.56%). The cocoon weight, cocoon shell weight and cocoon shell percentage were recorded maximum in BSM-1 (Table 1). The percentage of cocooning and pupation were also higher in newly fabricated bamboo mountages (BSM-1 & BSM-2) than Jali and Chandrike (Table 2). These bamboo mountages occupied less space compared to Jali and Chandrike. The harvesting time of each mountage was calculated and found that the new bamboo mountages took less time for harvesting (7-10 min) whereas the Jali took more time (18-23 min). In mulberry silkworm, the rotatory mountage was found significantly superior than others in all the economic characters (Singh et al., 1998). Similarly, the rotary mountage was found more advantageous and profitable than plastic collapsible mountage and traditional bamboo mountage in mulberry silkworm (Kumaresan et al., 2007; Rajan et al., 2000). In muga silkworm, the box type mountage was recommended for cocooning considering the overall better performance than chandrike and jali (Sahu et al., 1998). In the present finding, the new bamboo mountages may be recommended for large scale utilization in eri silkworm rearing by the farmers considering the better performance compared to other mountages.

Advantages of bamboo strip mountages:

- Cocoons are uniform in size and shape, harvesting is easy as cocoons are made in parallel/ horizontally. Harvesting time is comparatively less in both the bamboo strip mountages.
- Good cocoon recovery and pupation percentages are more. Less number of defective cocoons.
- In an area of 5.32 sq. ft. up to 295 worms can be accommodated in the case of bamboo strip mountage No.1 (BSM-1) (single layered), whereas bamboo strip mountage No. 2 (BSM-2) (multiple layered) can accommodate up to 290 worms in 5.66 sq. ft.
- The mountages are more durable and can last up to 7-8 years (3-4 crops per year).
- Any farmer can prepare themselves with their own material, as bamboo is commonly available in every houses of north eastern India and easy to

handle, cost-effective. The costs of these mountages are more than 50 % less than the chandrike.

- It occupies less space as compared to jali and chandrikes which occupy more space both in use and storing.

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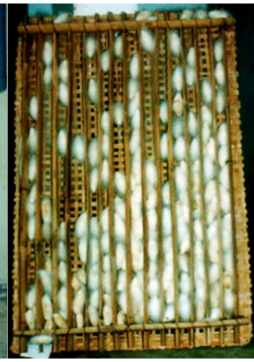
Table 1. Comparative performance of different cocoon mountages of eri silkworm. (Mean±SD)

Mountages	Good Cocoon (%)	Inferior Cocoon (%)	Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell percentage
BSM-1	95.62±5.12	5.04±4.64	3.35±0.56	0.44±0.08	13.29±0.79
BSM-2	94.72±3.92	4.56±3.50	3.28±0.56	0.42±0.09	12.70±1.13
JALI	92.66±4.43	6.93±3.91	3.19±0.79	0.41±0.12	12.85±0.93
Chandrike	93.87±4.03	5.61±3.18	3.21±0.68	0.40±0.11	12.35±0.94

Table 2. Performance of different types of mountages of eri silkworm.

Mounta	Cocooning (%)	Pupation (%)	Space occupied by each mountage (sq. ft.)	Harvesting time (min)
BSM-	98.32	97.54	5.32	7 to 9
BSM-	96.76	96.23	5.66	8 to 10
JALI	93.58	91.35	6.25	18 to 23
Chandr	94.57	95.14	9.00	10 to 13


1 2 3

Figures 1-3. 1) Bamboo strip mountage (large size), 2) Bamboo strip mountage (normal size), 3) Bamboo chandrike mountage.


4 5

Figures 4-5. 4) Jali mountage (bundle of dry leaves), 5) Jali mountage (dry banana leaves).


6 7

Figures 6-7. 6) Eri cocoons (white & brick red colour), 7) A heap of eri cocoons.

SCIENTIFIC NOTES

NEW REPORT OF SYONAKA (*OROXYLUM INDICUM* (L.) BENTH. EX KURZ.) AS A FOOD PLANT OF ERI SILKWORM, *SAMIA RICINI* DONOVAN (LEPIDOPTERA: SATURNIIDAE) IN ASSAM, INDIA

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[Ahmed, S. A., Sarmah, M. C. & Rajan, R. K. 2012. New report of Syonaka (*Oroxylum indicum* (L.) Benth. ex Kurz.) as a food plant of Eri Silkworm, *Samia ricini* Donovan (Lepidoptera: Saturniidae) in Assam, India. Munis Entomology & Zoology, 7 (1): 650-652**]**

The Eri silk (*Samia ricini* Danovan) under the family Saturniidae is the only completely domesticated polyphagous silkworm among the vanya silks in North Eastern region of India. India is the largest producer of Eri silk in the world as 96% of total eri silk is produced in India (Rajesh Kumar & S. K. Gangwar, 2010). Assam province alone produces more than 65 per cent of total eri silk production of India providing livelihood to 1.83 lakh farm families. Of late eri culture has been introduced to many non-traditional states of India such as Andhra Pradesh, Orissa, Gujarat, Karnataka and Uttar Pradesh. Out of four promising types of vany silks, eri silk is considered as comparatively hardy, tolerant to disease and pest attacks and easy to rear in indoor condition that contributes in assured crop. Besides these, the silk is having unique thermal properties for which eri silk garments are best suited during both summer and winter seasons. In tribal dominated states of India, eri pupa is considered as delicious protein food.

The eri silk worm is polyphagous in nature and feeds on leaves of many food plants Castor (*Ricinus coummunis*), Kesseru (*Heteropanax fragrans)* Tapioca (*Monihot esculenta*), Barkesseru (*Ailanthus excelsa*), Payam (*Evodia flaxinifolia* Hook.), Barpat (*Ailanthus grandis*), Jatropha, Papaya, *Ailanthus altissima*, Gulanch, Gamari etc. The type of host plant influences the rearing performance of eri silk into a greater extent. During the process of collection , characterization and exploration of perennial host plants for rearing of eri silkworm at Germplasm Conservation Centre, Central Muga Eri Research & Training Institute, Chenijan, India, the eri silkworm has been reared on Syonaka (*Oroxylum indicum*) locally known as "*Bhatgila*". The eri silkworm feeding on *O. indicum* is reported for the first time in India. The eri silkworm reared at Germplasm Conservation, CMER&TI, Chenijan, Jorhat during August-September 2011 and observed the average larval period (23 days) and effective rate of rearing (45 per cent).

Oroxylum indicum is native to the Indian subcontinent, in the Himalayan foothills with a part extending to Bhutan and southern China, in Indo-China and the Malaysia ecozone. It is visible in the forest biome of Manas National Park in Assam, India. It is also reported from Sri Lanka (Ceylon) (Theobald, W. L., 1981). The plant grows all over India in deciduous forests and in moist areas. It is a medium sized deciduous tree growing 8-12 meters in height. The bark is grayish brown in color with corky lenticels. The leaves are very large, 2-3 pinnate, leaflets 12 cm long and 8 cm broad. The flowers are reddish-purple outside and pale, spinkish-yellow within, numerous, in large erect racemes. The fruits are flat capsules, 0.33-1 meter long and 5-10 cm broad, sword-shaped. The plant flowers in June-July and bears fruits in November.

The detail studies on rearing performance of eri silkworm feeding on syonaka will be useful to explore the perennial host plant of the silkworm which is need of the hour among farming communities.

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Fig. 1(a)

Fig. 1(b)

Figure 1 (a & b). *Oroxylum indicum* plant.

Figure 2. Early stage rearing of *Samia ricini* Donovan on Syonaka.

Figure 3. Late stage rearing of *Samia ricini* Donovan on Syonaka.