This volume is dedicated to the chief-editor Hüseyin Özdikmen’s older brother

AHMET COŞAR

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NEW TAXA AND NOTES ON THE SYSTEMATIC OF PALEARTIC LONGHORN-BEETLES (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT: Fifteen new taxa of Cerambycidae (Coleoptera) are described from the Paleartic region, mainly from the Mediterranean region and from Middle East. One from Pakistan is described as well. New combination for Akimerus berchmansi ssp. ariannae Pesarini & Sabbadini 2007 is proposed. Turanoclytus sieversi ssp. deyrollei (Pic, 1897) and Herophila veluchianum (Breuning, 1943) are reevaluated as valid subspecies and species respectively. New status for Isotomus speciosus ssp. comptus Mannerheim, 1825, Isotomus speciosus ssp. syriacus Pic, 1902, Isotomus speciosus ssp. gilanus Pic, 1911, Isotomus speciosus ssp. barbara Sama, 1977 and Isotomus speciosus ssp. jarmlae Sláma, 1982 are proposed. New synonym is proposed for Isotomus speciosus ssp. syriacus Pic, 1902 = Isotomus comptus ssp. meridionalis Ozdikmen & Aytar, 2012. We confirm the following synonymy recently revalidated Isotomus speciosus ssp. speciosus (Schneider, 1787) = Isotomus speciosus ssp. ganglabueri (Pic, 1900).

KEY WORDS: Coleoptera, Cerambycidae, Rhamnusium, Xylosteus, Cortodera, Molorchus, Isotomus, Turanoclytus, Plagionotus, Dorcadion, Herophila, Phytoecia, new species, new subspecies, new combination, new status, new synonym, Bulgaria, Greece, Albania, Cyprus, Turkey, Iraq, Pakistan

In this paper, we describe 15 new taxa of Cerambycidae from the Paleartic region. The majority of them come from the Mediterranean Region: Xylosteus bartoni ssp. migliacci n. ssp. (Bulgaria and Greece), Rhamnusium bicolor ssp. pesarinii n. ssp. (Turkey), Cortodera cartini n. sp. (Turkey), Cortodera pseudoholosericea n. sp. (Albania and Greece), Molorchus (Caenoptera) akbesianus n. sp. (Turkey), Molorchnis (s. str.) sabatinelli n. sp. (Pakistan), Turanoclytus sieversi ssp. baiocchi n. ssp. (Turkey), Turanoclytus ilamensis n. ssp. magnani n. ssp. (Turkey), Turanoclytus ilamensis ssp. ozdikmeni n. ssp. (Turkey), Plagionotus detritus ssp. cecbci n. ssp. (Turkey), Isotomus speciosus ssp. eggeri n. ssp. (Greece), Dorcadion (Cribidodicrion) ringenbachi n. sp. (Iraq), Herophila moreana n. sp. (Greece), Phytoecia (s. str.) viridipes n. sp. (Turkey) and Phytoecia (Metallidia) lissae n. sp. (Cyprus). Herophila veluchianum (Breuning, 1943) is rehabilitated from a junior synonym of H. tristis (Linnaeus, 1767) and Turanoclytus sieversi ssp. deyrollei (Pic, 1897) is rehabilitated from a junior synonym of T. sieversi (Ganglbauer, 1890). Akimerus berchmansi ssp. ariannae Pesarini & Sabbadini, 2007 is proposed as new combination. New status for Isotomus speciosus ssp. comptus Mannerheim, 1825, Isotomus speciosus ssp. syriacus Pic, 1902, Isotomus speciosus ssp. gilanus Pic, 1911, Isotomus speciosus ssp. barbara Sama, 1977 are proposed. New synonym is proposed as well for Isotomus speciosus ssp. syriacus Pic, 1902 = Isotomus comptus ssp. meridionalis Ozdikmen & Aytar, 2012 n. syn. We confirm the synonymy for the recent reevaluated subspecies: Isotomus speciosus ssp. speciosus (Schneider, 1787) = Isotomus speciosus ssp. ganglabueri (Pic, 1900). Some of the new taxa described were collected by the authors during several expeditions in Bulgaria and Turkey.
Others belong to the material that our colleagues (Enrico Migliaccio, Roma, Italy; Jean Claude Ringhenbach, Pardies Pietat, France; Manfred Egger, Lienz, Austria; Claudio Sola, Guiglia, Modena, Italy; Mauro Malmusi, Modena, Italy) have given us to study.

SYSTEMATIC PART

*Xylosteus bartoni* ssp. *migliaccioi* *n. ssp.* (Bulgaria, Greece)  
*Rhamnusium bicolor* ssp. *parinii* Rapuzzi, Sama & Sabbadini *n. ssp.* (Turkey)  
*Cortodera cartinii* *n. sp.* (Turkey)  
*Cortodera pseudoholosericea* *n. sp.* (Albania, Greece)  
*Akimerus berchmansi* ssp. *ariannae* Pesarini & Sabbadini, 2007 *n. comb.* (Greece)  
*Molorchus* (*Caenoptera*) *akbesianus* *n. sp.* (Turkey)  
*Molorchus* (s. str.) *sabatinelli* *n. sp.* (Pakistan)  
*Turanoclytus sieversi* ssp. *baiocchii* *n. ssp.* (Turkey)  
*Turanoclytus sieversi* ssp. *deyrollei* (Pic, 1897) *stat. res.* (Turkey)  
*Turanoclytus ilamensis* ssp. *magnanii* *n. ssp.* (Turkey)  
*Plagionotus detritus* ssp. *cebecii* *n. ssp.* (Turkey)  
*Plagionotus detritus* ssp. *africae septentrionalis* Tippmann, 1952 *stat. res.* (Turkey, Syria)  
*Isotomus speciosus* (Schneider, 1787) = *Isotomus speciosus ssp. ganglbaueri* (Pic, 1900)  
*Isotomus speciosus* ssp. *eggeri* *n. ssp.* (Greece)  
*Isotomus speciosus* ssp. *comptus* Mannerheim, 1825 *n. comb.* (Turkey, Caucasus)  
*Isotomus speciosus* ssp. *syriacus* Pic, 1902 *n. comb.* (Turkey)  
*Isotomus speciosus* ssp. *gilanus* Pic, 1911 *n. comb.* (Iran)  
*Isotomus speciosus* ssp. *barbarae* Sama, 1977 *n. comb.* (Italy)  
*Isotomus speciosus* ssp. *jarmilae* Sláma, 1982 *n. comb.* (Greece, Crete)  
*Dorcadion* (*Cribridorcadion*) *ringenbachi* *n. sp.* (Iraq)  
*Herophila moreana* *n. sp.* (Greece)  
*Herophila veluchiana* (Breuning, 1943) *n. stat.* (Greece)  
*Phytoecia* (s. str.) *viridipes* *n. sp.* (Turkey)  
*Phytoecia* (*Metallidia*) *lisae* *n. sp.* (Cyprus)

Subfamily Lepturinae Latreille, 1802

Tribe Xylosteini Reitter, 1913

*Xylosteus bartoni migliaccioi* *n. ssp.*  
(Figs. 1A,B)


**Description of the Holotypus**

Length 17.5 mm, width 4 mm. The body is pitchy-brown. Head is deeply punctured. Front is flat, antennal tubercles are very prominent, deeply divided by a deep furrow between them. Occiput is with a small shining line between eyes. Front is dense punctured, occiput is denser punctured, cheeks are long with many deep points, denser between eyes and antennae. Pronotum is longer than width, it is strictly constricted after the apex and just before the base. On each side there is a large, acuminate tooth. Disk has two smoothed callosities on each side, in the middle of them there is a small shiny line. Pronotum is deeply punctured with several small, recumbent light hairs, denser on each side. Scutellum is triangular, with a dense and very fine sculpture, glabrous. Elytra are long, parallel sided. Deeply punctured. The points are denser on the first two third and sparser towards the apex. From each dimple starts a short, thin, recumbent, light setae. Elytra are darker than the rest of the body, with three yellow spots. The first two spots are on the lateral margin side and draw a half moon facing outward. The third is situated just before the apex and its outline is not clear. Legs are long, tibiae have dense short erect setae, sparser on the forelegs. Antennas are long as body, scape is stout and densely punctured, from the second segment till the half of the fifth segment they are deeply punctured, sparser and smaller than the scape, from the second half of the fifth segment till the last one they are knurled, with many very small and very dense points. From the scape until the first half of the fifth segment they have several short erect light hairs, from the second half of the fifth segment till the apex they have a very dense and short light fluff. Fourth segment is long half than the third and the fifth. Third and fifth are similar length.

**Female**
The females show the typical sexual difference of the genus. The body is larger and stouter than in the males; elytra are oval elongate instead parallel sided; antennas are evidently shorter and legs are shorter and stouter than the males.

**Discussion**
The new subspecies is easy to distinguishes from the nominal form according the darker color of the body, the punctuation evidently deeper and denser toward the elytral apex. In *Xylosteus bartoni* the punctuation is sparser and quite evanescent in the elytral apical third. In the new subspecies from each point starts a medium recumbent golden seta that is very short and difficult to appreciate in the nominal form. The elytral pattern in *X. b. migliacci* n. ssp. is almost always made by three spots on each elytron. The first two are inclined, the first one from the margin to the disk of each elytron and the second one from the disk toward the lateral side, in this way they form a sort of “half-moon” to the lateral margin of each elytron. The third spot is situated in the apical region ant it is more or less rectangular shaped.
Pic firstly described a new *Xylosteus* from Bulgaria (Rhilo Dagh) as *Leptorhabdium illyricum* var. *merkli* Pic, 1913 ([Figs. 2A,B](#)) but it is homonym of *Xylosteus spinolae* var. *merkli* Pic, 1910 ([Figs. 3A,B,C-4A,B](#)) described for a drawing variation of *Xylosteus spinolae* Frivaldsky, 1838 from Romania (Szemenik Mts.). Later (1933) Obenberger and Mařan changed its name in *Xylosteus merkli*.


**Original description:**

"Elongatus, postice modice dilatatus, mediocre pubescens, rufus, fere opacus, elytris nitidis, brunnescentibus ad medium et lateraliter luteo maculatis. Allongé, un peu élargi postérieurement, finement et médiocrement pubescent de jaune, presque mat sur l'avant corps, élytres brillants, très éparsement et peu distinctement pubescent, roux, élytres rembrunis et ornés chacun, sur le milieu et sur les côtés, de deux macules allongées jaunes, un peu obliques. Tête large, à tempes marquées, sillonnées sur le milieu; antennes atteignant le milieu des élytres, 3e article long, plus grand que 4e; prothorax plus long que large, impressionné et carené longitudinalement sur le disque, à forts tubercules latéraux; élytres un peu plus larges que le prothorax, longs, subarrondis séparément au sommet, à punctuation médiocre et irrégulière avec des traces de plis transversaux; pattes relativement grêles. Long. 16 mill. Rhilo Dagh, 1898 (Merkl in coll.Pic).

Très distinct de *X.spinolae* Friv. ♀ par la forme plus allongée du corps, les 2 macules claires des élytres, le prothorax carené au milieu".

**Note**

The new subspecies for its particular drawing resembles *X. spinolae* Frivaldsky, 1838 and probably part of the records for *X. spinolae* from Bulgaria and from Rodopi Mountains and Sofia region should be referred to the new taxon.

**Variability of the paratypes**

The paratypes males show similar drawing, more or less developed, typical for the genus. Females are quite similar with the elytral pattern reduced in one female from Greece (Drama) that is made by only two lateral spots on each side of the elytral middle. The size range is between 14 to 18 mm for the males and between 15 to 18 mm for the females.

**Derivatio nominis**

We dedicate this new *Xylosteus bartoni* subspecies to Enrico Migliaccio (Roma, Italy) as thanksgiving for his friendship and suggestions during our journey to Bulgaria.

**Tribe Rhamnusiini Sama, 2009**

*Rhamnusium bicolor* spp. *pesarinii* Rapuzzi, Sama & Sabbadini n. ssp.

(Figs. 5A,B)

**Type material:** *Holotypus* ♀: **Turkey**: Tunceli prov., 40 Km NW Tunceli (Ovacik), 11-14.VI.2012, ex larva *Populus nigra* sfarf. 20.VI.2012, P. Rapuzzi lgt. (Coll. P. Rapuzzi); *Paratypus*: 1♂ and 1♀: **Turkey**: Tunceli prov., 40 Km NW
Description of the Holotypus

Length 18.0 mm, width 6.0 mm. The head, pronotum, antennae and legs are reddish, apex of the mandibles and scutellum are black, elytra yellowish except for the apex that is darkened. Ventral surface is black, abdomen is black in the median portion and reddish at the apex and at the base. Head is deep punctured on the vertex, quite impunctate on the front. Antennal tubercles are very prominent and close one to the other that remains only a deep thin line between them. Temples are long and rounded posteriorly. Sides of the head have many erect golden hairs, they are denser around eyes and close to the mandibles. Pronotum is little wider than longer, there are two big callosities on the disk. Sides have a large and obtuse tooth just behind the middle. Pronotum is quite impunctate, only few very small points on the disk, sides have dense erect golden hairs, they are shorter and very sparser on the disk. Scutellum is rounded, impunctate, glabrous and black. Elytra are parallel sided, they are just a little restricted on the side at the middle. Apex is rounded. Elytral punctuation is dense and deep, made by large points that are denser on first two third of their length, sparser and smaller towards the apex. On apical third there are many short and semi-erect golden hairs. Apex is darkened, this area starts with dark brown colored and ends at the apex where it is black.

Legs are long, totally yellow except for the basal third of the hind femora that is black. Legs pubescence is made by short brown erect hairs. Antennae are long, reaching the middle of the elytral length. They are totally reddish. Fourth segment is little shorter than third, fifth is longer than the scape.

Female

The females are similar to the males, same type of color, the only differences are the typical sexual differences of this genus.

Discussion

*Rhamnusium bicolor* ssp. *pesarinii* n. ssp. is well characterized according the stability of the color and the same color between males and females. For these reason, it can be related to *Rhamnusium bicolor* ssp. *testaceipenne* Pic, 1897 know from Caucasus, but it is easy to distinguish according the shape of prothoracic tubercles that are really very smooth and for the presence of the black spot on the elytral apex. According this last character it is similar to *Rhamnusium bicolor* ssp. *praestum* Reitter, 1895 known from SE Turkey (Hatay province) and from NW Syria. Anyway, this subspecies is characterized by a great individual variability (we have collected about ten specimens of this taxon on Amanos Mountains and there aren’t one specimens identic to the other) the shape of the lateral tubercles in *R. b. praestum* is very similar than in *R. b. testaceipenne* and consequently different from the new subspecies. In *R. b. praestum* antennae are evidently bi-colored and they are uniformly reddish in *R. b. pesarinii* n. ssp.
Variability of the paratypes

The type series is quite similar, only two males show a very reduced black spot on the elytral apex. For the rest only the size change and the range is between 15 to 20 mm. for the males and between 14 to 21 mm. for the females.

Note

In Rapuzzi’s collection is preserved one specimens of *Rhamnusium bicolor* ssp. *praestum* Reitter, 1895 collected in Malatya provinces (Turkey), Akçatoprak, 38°30’N 37°32’E, 1020 m., 20.V.2010, Marco Uliana lgt. This record enlarges the range of this subspecies that previously was known in Turkey only from Hatay province (Danilevsky, 2012).

Derivatio nominis

We dedicate the new subspecies to Carlo Pesarini (Milano, Italy) as thanksgiving for his great friendship and for sharing with us his big competence in Entomology.

Tribe Rhagiini Kirby, 1837

*Cortodera cartinii* n. sp.

(Fig. 6)

**Type material:** Holotypus ♀: Turkey: Bolu prov., Abant lake, 1600 m., 1.VI.2008, A. Cartini lgt. (Coll. P. Rapuzzi); Paratypus: 2♀♀: idem (Coll. L. Saltini).

Description of the Holotypus

Length 11,0 mm, width 3,5 mm. Body is black, elytra, anterior tibiae, labrum, mandibles, first and second antennal segments only partially as well the antennal segments from the seventh to the eleventh are reddish brown. Head is large, front is transverse with a deep furrow on the middle. Labrum is brown and quite not punctured. Mandibles are long deeply punctured on the external side, they are brown toward the apex. Vertex is deeply punctured, temples are strongly angulated. Head is covered with long semi-erect thin light setae. Pronotum is as long as large, it is deeply punctured with dense points. The single point is not combined with any of the others. In the middle of the vertex there is a longitudinal shiny short line. Pronotum is gibbous. Pronotum is covered by long semi-erect light hairs. Elytra are parallel sided, reddish-brown colored, rounded toward the apex. There is a very thin black stripe along the suture on the first quarter of the elytra length. Basal half of elytra have dense and deep points, from each of them starts a long semi-erect setae dark in the central portion and lighter toward the lateral margin. Toward the apex this punctuation becomes lighter and sparser. Apex is very shortly truncated. Legs are long, black except for the anterior tibiae that are lighter. All legs are covered by long erect light hairs. These hairs are denser on the tibiae than femora. Antennae are slender, they are reaching the middle of the elytral length. The third segment is longer than fourth. Fourth segment is long as long the scape. All antennae are covered by short, recumbent silvery hairs.

Male

Unknown.
Discussion

The new species is related with *Cortodera pseudomophlus* Reitter, 1889 (from Easter Turkey, Armenia, Georgia, Iran and Turkmenistan). It is easy to distinguish according the longer and denser pubescence on the whole body. This pubescence is light in *Cortodera cartinii* n. sp. and dark in *C. pseudomophlus*. The elytra in the new species are longer and more parallel side. Moreover, we never seen any specimen of *C. pseudomophlus* with lighter anterior tibiae and partly light antennae that are evident in all the known specimens of the new species. *C. cartinii* n. sp. has pronotum with lateral side regular instead angulate on the middle.

Variability of the paratypes

The know specimens have the same pattern of color. The range of size is from 11 to 12 mm.

Derivatio nominis

We dedicate the new species to Arnaldo (Dodo) Cartini (Reggio Emilia, Italy) as recognition for the collecting of the type series of this species.

*Cortodera pseudoholosericea* n. sp. 
(Figs. 7A,B)

**Type material:** Holotypus ♀: Albania: Berat pref., Mount Tomorri, 40°37’32”N 20°10’15”E, 2140 m., 5.VII.2015, J.C. Ringenbach lgt. (Coll. P. Rapuzzi); Paratypus: 1♂ 5♀♀: same data (Coll. J.C. Ringenbach & P. Rapuzzi); 1♂: Greece: Macedonia: 4 Km NW of Deskati, 39°56’59.82”N 21°46’09.03”E, 1500 m., 1.VI.2016, O. Konvicka lgt. (Coll. O. Konvicka, Zlin, Czech Republic); 3♀♀: idem (Coll. O. Konvicka, Zlin, Czech Republic; Coll. P. Rapuzzi); 3♂♂: idem, E. Ezer lgt. (E. Ezer, Zlin, Czech Republic; Coll. P. Rapuzzi).

**Description of the Holotypus**

Length 12,0 mm, width 3,0 mm. Body is totally black except for the front tibias that are reddish. Head is long, deep punctured. Temples are long and angulate. Front is rectangular with a groove in the middle. Pubescence is made by long golden erect hairs. The pubescence is denser on the front and around the eyes. Pronotum is globular, little larger than long. Apical margin is impunctate, the rest is covered by dense and deep points except for a thin median glossy line. Sides of pronotum angulate just up to the middle. Scutellum is rounded at apex, mat, with several deep points. Elytra are relatively short, restricted towards the apex. Elytral punctuation is deep and dense, made by regular points that are deeper and denser on the first half of the elytral length and sparser and thinner towards the apex. From each point starts a long golden semi-erect hair. Elytral apex is rounded. Legs are long, covered by silver erect hairs, denser on the tibias. Front tibias are reddish except for the apical third that is black. Tarsi are long and slender. Antennae are long, reaching the apical third of elytral length. Third segment is little longer than the fourth and the fifth that are of the same length. Ventral surface is totally black.

**Female**

The females show the typical character of the genus. Shorter antennae, wider body, shorter legs. The females of *Cortodera pseudoholosericea* n. sp. have light elytra, brown colored. The legs are often totally black except in one specimen that
the front tibias are reddish as in the males and in another specimen that all the legs are totally reddish except for the black knees. The ventral surface is always black.

Discussion

The new species is related with *Cortodera holosericea* (Fabricius, 1801) (from Central Europe, Italy, Balcan southward Greece). It is easy to distinguish according the dimorphism with the females often with brown elytra. The legs and antennae are totally black (except the Holotype that has front tibiae reddish and in 1 female with all the legs light), in *C. holosericea* the first 3 or 4 antennal segments are more or less reddish. The legs in the females are generally reddish (in the southern population the males have black legs except for the front tibia that are more or less reddish; in Central Europe populations, the legs in the males are sometimes light). Abdomen is totally black in both sexes. Last segment is always red in *C. holosericea*. In both the sexes the body shape is stouter, elytral rate between length and width in the males is 3,3 instead 4 in *C. holosericea*. In the females, this rate is 3,3 instead 3,7. In both sexes pronotum is less globular and shorter. Its pubescence is longer and denser. The temples are evidently more prominent and angulate, gradually curved in *C. holosericea*.

Variability of the paratypes

The known specimens have the same pattern of color (male totally black and females black with brown elytra) except for one female from Albania with the legs reddish except for the apex of the tibia and femora (in this case the abdomen is still totally black); another female from Albania is totally black. The range of size is from 11 to 12 mm.

Derivatio nominis

The name of the new species remembers its affinity with *Cortodera holosericea* (Fabricius, 1801).

**Akimerus berchmansi** ssp. ariannae Pesarini & Sabbadini, 2007 n. comb.


_Akimerus schaefleri* ssp. ariannae was described to distinguish the population of _Akimerus_ that inhabits the continental part of Greece. The main character used for the description was the length of the apical teeth of the hind legs, that was really shorter than the _Akimerus_ from the rest of Europe. Moreover the population from Greece often shows the female with a dark elytral color that is really rare in the rest of Europe.

After a deep check of several specimens from Greece we discover that this taxon doesn’t belong to _Akimerus schaefleri_ (Laicharting, 1784) but it is closely related with _Akimerus berchmansi_ Breit, 1915 till now known only from South East Turkey. This affinity is very evident on the base of the apex of aedeagus that shows a simple apex in _A. schaefleri_ (Fig. 8A) and enlarged in “romboid-shape” in _A. berchmansi_ (Fig. 8B). _A. b. ariannae_ has the apex very similar to _A. berchmansi_ (Fig. 8C). This character was already highlited by Pesarini and Sabbadini (2007) but curiously overlooked.
For this reason we suggest the following new combination: *Akimerus berchmansi ssp. ariannae* Pesarini and Sabbadini 2007 *n. comb.*

It will be interesting to investigate deeper *Akimerus* populations from South Balkans (Bulgaria, Former Yugoslavia and Albania) to individuate the border between the distribution areas of these two species.

**Subfamily Cerambycinae Latreille, 1802**
**Tribe Molochini Gistel, 1848**

*Molorchus (Caenoptera) akbesianus n. sp.*

(Fig. 9)

*Type material: Holotypus* ♀: *Turkey*, Hatay prov., Dortyol area, env. of Topaktas, VI.2013, ex larva *Juglans regia* sfarf. 20.IV-1.VI.2014, P. Rapuzzi lgt. (Coll. P. Rapuzzi); *Paratypus*: 1♂ and 9♀♀ sama data as Holotypus (Coll. P. Rapuzzi).

**Description of the Holotypus**

Length 10,3 mm, width 2 mm. Body is black except for the appendix and elytra that are pitchy brown. Head is deeply punctured with a deep furrow between eyes. Antennal tubercles are strong and acuminate. There are several long thin erect hairs on the whole head, denser around eyes. Pronotum is twice long as wide, it is deep punctured on whole surface, denser on the disk. Apical and basal margins show an area of thin folds. On the disk there are two areas with very flat callosities. Each one is situated on the side of the middle and a third in located in the middle just up the base. These callosities are smoothed and densely punctured with the same kind of punctuation of the rest of pronotum. Pronotum have long erect hairs, denser at the sides, light and dark hairs are mixed. Scutellum is small, it is rounded at apex with few recumbent golden small hairs denser on the middle portion. Elytra are short, they cover about the middle of the wings length; apical is rounded and dehiscent towards the apex. Each elytron has a yellow transverse carina on the disk in the apical middle. These carinas are inclined from the margin to the sutural region. Elytral punctuation is dense, it is made by deep points, with the same density on the whole surface. Few erect hairs are only on the shoulders and on the basal region; these hairs are long, thin and silvery. Legs are long, with several erect, silvery, long hairs on tibiae and femora. Claws of femora are slightly darkened. Antennae are long, exceeding the apex of abdomen with the last seven joints. All antennae are pitchy-brown colored. Scape is long, it is deeply punctured with many erect, silvery, long hairs on both sides; from the second to the fourth segments there are several erect hairs on the outer and inner sides, from the fifth to the sixth segments only on the inner side. All antennal joints, except for the scape that is deeply punctured, have dense and very small punctures.

**Female**

Similar to males with shorter antennae. Antennae exceeding the abdominal apex with the last two segments.

**Variability of paratypes**

The length range is between 10,2 and 10,3 mm for the males and 8,2 and 11,0 mm for the females. The other characters follow inside the specific variation or sexual variation (antennal length).
Discussion

The new species is related with *Molorchus* (*Caenoptera*) *juglandis* Sama, 1982 described from Çamlıyayla (Mersin province, Turkey) and diffuse in Southern Turkey, Western Syria and Lebanon. It is possible to distinguish according the pronotum that is lacking the shining callosities on the disk. In place of these callosities there are three small elevated areas densely and finely punctured. *Molorchus* (*Caenoptera*) *akbesianus* n. sp. is evidently darker, elytra are entirely pitchy brown and not reddish with the apex darkened. Elytral punctuation is denser and deeper in the new species than in *M. juglandis*. According the other species of *Molorchus* (*Caenoptera*) from southern Turkey (*M. abieticola* Holzschuh, 2007) it is very easy to distinguish according the pronotum that is missing the large and shining callosities on the disk; the new species is missing the golden pubescence at the sides of pronotum that is peculiar in *M. abieticola*.

Biology

The specimens of the type series were reared from dead branches of walnut (*Juglans regia* L., 1753).

Derivatio nominis

The name of the new species is dedicated to the region of the famous entomological site, Akbes, where the collecting place follows.

*Molorchus* (*s. str.*) *sabatinellii* n. sp.  
(Fig. 10)

**Type material:** **Holotypus** ♂: **Pakistan**: NWFP, Bhurban, 2060 m., 33°56'54"N73°27'17"E, ex larva Pinus sp., D. Baiocchi lgt. (Coll. P. Rapuzzi).

**Description of the Holotypus**

Length 6 mm, width 1,3 mm. Body is black except for labrum, palpi, antennae, part of femora and disk of elytra that are lighter. Head is deep punctured with a small furrow just behind eyes. Pubescence on the head is made by several silvery small erect hairs and few longer erect hairs denser close to the eyes. Pronotum is evidently longer than wide, it is densely punctured with three not very defined shiny areas, two placed on the sides in the apical half and one in the middle of the basal portion. Between these flat callosities there is a dense punctuation, on the callosities the punctuation is thinner and sparser. Apical and basal margin of pronotum is made by few small transverse folds. Pubescence on pronotum is made by erect hairs. These hairs are denser on the disk and on the sides and they are longer, silvery and thin and partially inclined towards the apex. Scutellum is triangular, long, a little depressed in the middle with the central portion covered by silvery short recumbent hairs; the rest is more or less glabrous. Elytra are short, little longer than pronotum, they are dehiscent towards the apex, this latter is rounded. Punctuations made by deep and rather sparse points on the first two thirds of their length, denser and thinner towards the apex where they give to elytra a mat appearance. Elytra are black except for the central area that is dark brown. Elytral pubescence is made by long silvery erect hairs, denser at the sides and shorter and sparser toward the apex and in the central portion. Legs are long and thin; pitchy-black except for the base of femora that is yellow. All the legs have long erect dark hairs, denser on the femora than on the tibiae. Tarsi are very slender and long. Antennae are long, they exceed the apex of abdomen with the last four joints. Antennae are pitchy-brown colored and very dense punctured.
with very thin points that give to the antennae a mat appearance. Scape is deeper punctured than the rest of antennae. Third joint is shorter than fourth and it is as long as the scape. Scape has erected hairs on its whole surface, the next four only on the inner side, from the sixth segment to the apex without erect hairs.

**Female**

Unknown.

**Discussion**

The closest species (and only one *Molorchus* known from Pakistan) is *Molorchus hederae* (Gardner, 1936). The new species can be distinguished according the shape of pronotum with the lateral margins sinuate, more rounded in *M. hederae*. The pronotum shows only flat and vague callosities, well developed and shining in *M. hederae*. Antennae and legs are evidently thinner and longer, elytral punctuation is little deeper and sparser in *M. sabatinellii* n. sp. The color of elytra is darker, with a pitchy-brown portion in the middle of each elytra, in *M. hederae* this area is lighter and wider.

From the same area (NWFP, Gharial env.) Daniele Baiocchi (Rome, Italy) reared several specimens of *Molorchus* (s. str.) *hederae* (Gardner, 1936) from *Rosa* sp. (Figs. 11A,B). These specimens differ from the type specimens (Figs. 12A,B,C,D) mainly in the smaller size of body (5 to 8 mm against 7 to 10 mm) of the type series preserved in National History Museum (London, England).

**Derivatio nominis**

We dedicate the new species to Guido Sabatinelli (Rome, Italy) as thanksgiving for his help to organize the Daniele Baiocchi’s journey in Pakistan in 2011 that collected, among other interesting Cerambycidae, this new species.

**Tribe Clytini Mulsant, 1839**

*Turanoctylus sieversi* ssp. *baiocchii* n. ssp.  
(Figs. 13A,B,C)


**Description of the Holotypus**

Length 14,0 mm, width 5 mm. The body is black except for elytra and antennae that are light brown and all tibiae that are dark brown. Head is strongly punctured. This punctuation is divided in two distinct areas, one made by only deep and strong punctures that shows a shiny surface, the other is made by double kind of point, one deep and strong and the other made by very small and dense points, in this case the surface appears matt. The shiny areas are around eyes and in a median line between eyes; the matt portions are concentrated between the shiny portions on the front and in two spots behind each eye. Head has several erect silvery hairs, denser close to the mandibles and scattered on the front. Around eyes, mainly in the lower part, there is a short and recumbent pubescence made by whitish short hairs. The pronotum is slightly transverse, globular, with two small impressions just at the side of the middle on the disk. Sides are rounded with the larger part just in front of the middle, basal portion slightly constricted. Pronotum is very dense punctured, matt. Pronotum has spars light pubescence, denser at the sides and on the base. Scutellum is short, round
and glabrous except for a fringe of whitish short setae on the marginal side. Elytra are parallel sided, slightly acuminate toward the apex. They are hazelnut colored except for the lateral margin and briefly on the apex that are blackish. They are very fine and densely punctured on the whole surface. Elytra show dense pubescence made by semi-erect dark hairs mixed with few light longer hairs. Drawings is made by small spots of white pubescence: the first spot is very small in the humeral portion, other two spots are positioned one on each elytron in the middle of the disk. On the apical quarter of the elytra length there is a transverse thin band. This band is not complete but it is made by two distinct spots forming an arcuate band down. On the apex there are only few light hairs. Apex is truncates. Legs are long, strong. Femora are black and tibiae are little lighter. All the legs are covered by mixed black and light erect long hairs. Antennae are short, reaching the basal quarter of elytral length. Completely light brown. Scape shiny with several deep points, following segments matt, with very dense punctuation made by thin and small point. All antennae covered by very short brownish small recumbent setae.

Discussion
The new subspecies is very easy to distinguish from the nominative subspecies according the absence of light spots on pronotum, longer elytra, stouter in *Turanoclytus sieversi* (Ganglbauer, 1890). Moreover, about one third of the whole type series is made by specimens with light colored elytra both in males and females. This kind of color is not known in any population of *Turanoclytus sieversi* but it is known in *Turanoclytus ilamensis* (Holzschuh, 1979). *T. ilamensis* differs from *T. sieversi*, among other characters, for the median spot that is perfectly rounded in *T. sieversi* (as well in *T. s. baiocchii*) and made by a transverse line in *T. ilamensis*.

Variability of the paratypes
The elytra of the males are narrower toward the apex as in the other species of the Genus *Turanoclytus*. The length range is between 8 to 17 mm for the males and 7 to 16 mm for the females. The ground color of the elytra can be totally black or more or less reddish in both the sex. The percentage of light specimens is around 20% in both the sex (9 males on 45 specimens and 5 females on 26 specimens). The white strips can be more or less interrupted. Sometimes the postmedian transverse band is made by isolated spots. One male is totally black except for one small white spot on each elytron in the basal region.

Biology
All the known specimens were reared from dead branches, drums and roots of *Astragalus cfr. gummifer* (Fabaceae). Often the plants were previously killed by the larvae of *Sphenoptera* sp. (Coleoptera, Buprestidae).

Derivatio nominis
We dedicate this new taxon to Daniele Baiocchi (Rome, Italy) great specialist of *Anthaxia* Eschscholtz, 1829 (Coleoptera, Buprestidae) as thanksgiving for his friendship and help in research during many entomological trips in the Near East.
SYSTEMATIC NOTE

Turanoclytus sieversi (Ganglbauer, 1890)
Clytus (Xylotrechus) sieversi, 1890, Ganglbauer, Hor. Soc. ent. Ross., 25: 429
Type loc.: Kasikoporan (Armenia).

Original description

The specimens that we checked from Armenia and Georgia well fit with the original description. But the specimens that we have seen from Turkey differ in a clear manner from the Caucasian specimens, firstly for the absence of light spots on pronotum (seldom pronotum shows few white pubescent areas on the disk). Moreover, the Turkish populations have less punctured elytra and sparser elytral pubescence. For these reasons, we believe that the Turkish populations of Turanoclytus sieversi belong to a different subspecies. The oldest name available for this subspecies is:

Turanoclytus sieversi ssp. deyrollei (Pic, 1897) stat. res.
Xylotrechus sieversi v. akbesianus Pic, 1902, Mat. Long., 4, 1: 17. Type loc.: Syrie, Akbés (Turkey, Hatay).

Original description
"Forme très voisine de C. antilope, mais dessin bien différents; noir, un peu brillant aux élytres, ceux-ci marqués de quatre taches de duvet jaunâtre avec l'extrémité apicale marquée de même. Antennes presque cylindriques, fortes, roussâtres, atteignant le milieu du corps, à 3e article un peu plus long que le 4e. Prothorax assez globuleux, mat, dilaté et bien arrondi sur le milieu, non bordé de duvet jaunâtre (peyut être à cause de dépilation), à ponctuation granuleuse peu forte, très dense. Écusson très large, court, semi-circulaire, pubescent de jaunâtre. Élytres assez courts, larges aux épaules, très peu atténués en arrière, obliquement arrondis à l'extrémité, à ponctuation fine rapprochée; ils sont d'un noir terne un peu brillant, avec chacun une apicale et quatre taches de duvet jaunâtre; sur chaque élytre la première externe et oblique vers les épaules, la deuxième transversale et assez grosse avant le milieu, les deux autres petites obliquement placées après le milieu. Pattes assez robustes, d'un roussâtre un peu brillant, peu pubescent. Long. 14 mill."
**Type loc.:** Syrie, Akbés  

**Original description**  
"Forme plus courte; pas de macule apicale distincte aux élytres; élytres avec une fascie post médiane courte (forme type) ou avec des macules isolées (var. akbesiana) Syrie, Akbés. . sieversi Gglb".

We have collected specimens with the postmedian white strip interrupted and divided in several smaller spots all over Turkey. For this reason we believe that it must be considered simply a synonym of *T. sieversi* ssp. *deyrollei*.

We have studied many specimens of *T. sieversi* ssp. *deyrollei* from the following Turkish localities:

5♂♂ 8♀♀: Turkey, Tunceli prov., 15 Km N Pülümür, 10.V.2011, ex larva Astragalus sp., P. Rapuzzi lgt. (Coll. P. Rapuzzi).  
2♂♂ 1♀: Turkey, Bingöl prov., Kuruça Geç., 1900 m., ex larva Astragalus sp., P. Rapuzzi & G. Sama lgt. (Coll. P. Rapuzzi).  

**Turanoclytus ilamensis ssp. magnanii** n. ssp.  
(Fig. 14)  

**Type material:** Holotypus ♂: Turkey: Hakkari prov., Yuksekoval, 1 Km S of Karabey, 1899 m., 37°26′10″N 44°25′41″E, 13.V.2014, ex larva Astragalus sp. sfarf. 20-31.V.2014, P. Rapuzzi lgt. (Coll. P. Rapuzzi); **Paratypes:** 3♂♂ 1♀♀: idem (Coll. P. Rapuzzi).
Description of the Holotypus

Length 15.0 mm, width 5 mm. The body is totally black except for antennae, tarsi and palpi that are dark brown. Front is square, with a deep carina in the middle. Punctuations is made by sparsely and deep points. On the vertex there are two distinct areas, just behind eyes, made by dense and small points that show a mat aspect. Base of the head and a median line are sparsely punctured and shining. Pubescence is quite absent, only few erect dark hairs just behind eyes. Pronotum is as long as wide, with rounded sides. The largest portion is just behind the middle. Pronotum is very dense and heavy punctured, the sculpture is regular on whole surface. Just before the base, on the middle, there is a small area made by denser punctures that is relieved than the other areas. Pubescence made by very short and sparse dark hairs, concentrated mainly on the sides. Elytra are long, with parallel side, apex rounded. All the elytral surface is covered by a dense and not very deep points. The density of this punctuation is similar on the whole elytral surface. Pubescence made by dense, recumbent, light hairs. On the apical third there is a very small area made by white dense recumbent pubescence positioned on the middle of each elytron that is the vestiges of the elytral drawing. Legs long, stout, completely black except for the last two tarsal segments that are dark brownish colored. Femora and tibia have dense, stout, semi-recumbent, black hairs. Antennas are short, dark brown except for the first and the second segments that are reddish. Scape and second are segment shiny, glabrous and sparsely punctured; the punctuation is made by sparse deep points. From the third segment till the apex the single joint is covered by very short and dense lying light hairs.

Variability of the paratypes

The paratypes are very similar, only the length is quite variable. The range in males is between 10 to 15 mm. The only one known female is long 10 mm. Two paratypes males show totally black elytra without any track of the white small spot on the apical third.

Discussion

The new taxon is very easy to distinguish from all other Turanoclytus known according the totally black colour without evident stripes or spots. Only sometimes (1 male and 1 female) there is a very small track of white spot. We ascribe this insect to Turanoclytus ilamensis Holzschuh, 1979 according the geographical position. In fact, all around this locality is known only T. ilamensis that is easy to recognize according the median band that is made by a transverse line (spot in T. sieversi).

Biology

All the known specimens were reared from dead branches, drums and roots of Astragalus cfr. gummifer (Fabaceae). Often the plants were previously killed by the larvae of Sphenoptera sp. (Coleoptera, Buprestidae).

Derivatio nominis

We want to dedicate this insect to Gianluca Magnani (Cesena, Italy), specialist in Buprestidae family, great friend and member of many expeditions involved in the study of the Mediterranean Fauna.
**Turanoclytus ilamensis ssp. ozdikmeni n. ssp.**

(Fig. 15)

**Type material:** Holotypus ♂: Turkey: Hakkari prov., Kolbasi, 1900 m., VI.2010, ex larva Astragalus sp. sfrf. 16.VIII. 2010, P. Rapuzzi and G. Sama lgt. (Coll. P. Rapuzzi); Paratypes: 9♂♂ and 27 ♀♀: same data of the holotype (Coll. P. Rapuzzi).

**Description of the Holotypus**

Length 11,0 mm, width 3 mm. The body is totally black except for antennae, tarsi and palpi that are dark brown. Front is square, with an indistinct carina in the middle. The typical carina between antennae and in the middle of the front, that is a character of the Genus, in this taxon is quite absent. Punctuations is made by sparse and very large and deep punctures. On the vertex there are two distinct areas, just behind eyes, made by dense and small points that show a mat aspect. Cheek, labrum and front covered by dense white, recumbent short hairs. This pubescence is well developed between antennae as well. Head vertex shows only with few and very sparse white hairs. Pronotum is little longer than wider, globoids, sides well rounded. It is very strong and densely punctured. The points are stronger and denser on the anterior third. On the surface of pronotum there are six white spots made by short and recumbent white hairs: two of them are on the anterior side close to the margin and laterally positioned, two just before the base and at the side of the middle and the last two are ovoid and positioned at the side of the base.

Scutellum is rounded and covered by white short and recumbent pubescence. Elytra are relatively short, deep punctured, the points are denser on the first two third and sparser and smaller on the third towards the apex. Whole elytra are covered by brown semi-erect short hairs. White pattern is made by short recumbent white hairs and it is made by a small transverse line positioned behind the shoulder on each elytron, one arcuate line opened toward the elytral base just before the middle and a post median white band divided in two small spots on each elytron before the apex. Apex covered by sparser grey pubescence. Legs long, pubescence is made by a mix of black and white erect hairs. Antennae are short, reaching the elytral base, dark brown with the first four segments with several white erect hairs, the following segments with dense but very short light hairs. Whole ventral surface is with recumbent white stout hairs.

**Variability of the paratypes**

Several paratypes show a lighter color on elytra that are not black but dark brown (male and female). The arcuate band [typical of *T. ilamensis* (Holzschuh, 1979)] sometimes is shorter and in one case is made by a single rounded spot [typical of *T. sieversi* (Ganglbauer, 1890)]. In one male the ground drawing is partially covered by a long light brown pubescence. The length range is between 8 to 15 mm for the males and the females too.

**Discussion**

*Turanoclytus ilamensis ssp. ozdikmeni n. ssp.* represents the most northwestern population of the species. It is surely closer with *T. i. campadelli* (Sama & Rapuzzi, 2003) but it is easy to distinguish according the presence of lighter forms that are totally missing in *T. i. campadelli*. The sculpture of pronotum is similar to the sculpture of *T. i. hadullai* Danilevsky, 2010 made by small and thin sculpture without evident granules. It is easy to distinguish from this latter according the white scattered hairs on elytral surface. *T. i. zuwandiense* Lazarev,
2016 in my opinion is hardly to distinguish from *T. i. hadullai* and anyway the new subspecies is easy to distinguish from the latter according the presence of the brown elytral pubescence that is totally missing in both Caucasian subspecies. Moreover, it is distinguishing from each other species of this group (*sieversi* and *ilamensis*) for the quite missing carina on the front.

**Biology**

All the known specimens were reared from dead branches, drums and roots of *Astragalus cfr. gummifer* (Fabaceae). Often the plants were previously killed by the larvae of *Sphenoptera* sp. (Coleoptera, Buprestidae).

**Derivatio nominis**

We want to dedicate this interesting Cerambycidae to our friend and colleague Hüseyin Özdkimen (Gazi University, Ankara, Turkey) as thanksgiving for his precious help during many survey in Turkey to study its incredible interesting and rich Fauna.

*Plagionotus detritus* ssp. *cebecii* n. ssp.

(Figs. 16A,B)

**Type material:** Holotypus ♂: Turkey: Egridir prov., Yukangökdere, 37°44’15”N 30°49’53”E, 1479 m., 26.IV.2015, ex larva *Quercus sp.* sfarf. 2.V-1.VI.2015, P. Rapuzzi (Coll. P. Rapuzzi); Paratypes: 9♂ and 8 ♀: same data as Holotype (Coll. P. Rapuzzi).

**Description of the Holotypus**

Length 16,0 mm, width 6 mm. Body is dark brown except for partly of the head, partly of elytra and abdomen that are black. Head is covered by yellow dense pubescence except for the space between the antennae that is hairless, brown and sparsely punctured. Labrum is hairless as well and it is shining. Pronotum is globular, larger than wider and it is covered on the first two-thirds by dense yellow pubescence. On the disk remains only one thin transverse band just in the middle. Basal portion is hairless with dense and thin punctures. Scutellum is rounded, black and it is covered by dense white recumbent setae. Elytra are acuminated towards the apex, they are black except for the basal portion and a thin sutural stripe that reaches the middle of the elytral length that are reddish. Elytra are very densely and thinner punctured, covered by dense, recumbent black hairs. The drawing is made by yellow bands and yellows areas made by short, dense, recumbent hairs. The first band is just before the middle, it is made on each elytron by a rectangular spot little projected toward the base. The apical half is covered by this yellow pubescence and there are several black spots. The first black spot is just behind the apical third and it is rectangular shaped, it is starting close to the lateral margin and not reaching the suture. The last one is placed in the fourth apical portion and it is smaller, little arched toward the elytral base. Apex is truncated with a very small tooth on the external side. Antennae are long, reaching the apical fourth, totally reddish with segments 3-6 with a little tooth on the internal side. Antennae are very dense and thin punctured, covered by short and recumbent gold hairs. Legs are long, strong covered by scattered white small recumbent white hairs.

**Variability of paratypes**

The type series is very similar in the drawing. In one specimen (female) pronotum is totally covered by yellow pubescence except for the basal portion that
is always black. The last black spot, close to the elytral apex, sometimes is divided in two small black spots on each elytron instead a small transverse black line. The size range is between 16 to 18 mm in the males and between 15 to 18 mm for the females.

Discussion

Plagionotus detritus ssp. cebecii n. ssp. belongs to Plgionotus detritus ssp. caucasicola Plavilstshikov, 1940 group (very likely the latter can be considered a distinct species). P. d. caucasicola (Figs. 17A,B) is described from Caucasus and it is easy to distinguish from Plagionotus detritus detritus (Linnaeus, 1758) for the pronotum that is quite totally covered by yellow pubescence, for the missing of the first basal transverse yellow stripe, for the often-larger post-basal yellow stripe. To the same group belongs Plagionotus detritus ssp. africaseptentrionalis Tippmann, 1952 stat. res. (Fig. 18) wrongly synonymized by Vitali (2016) to P. d. caucasicola. (see note). The new subspecies is easy to distinguish from P. d. caucasicola according the dark ground elytral colour (lighter in cebecii), for the wider post-basal yellow stripe. From P. d. africaseptentrionalis the new subspecies is easy to distinguish for the ground colour that is totally reddish in P. d. africaseptentrionalis and black except for a small basal portion in P. d. cebecii n. ssp. and for the pronotum that is evidently long as large in P. d. africaseptentrionalis, wider in the new subspecies.

Note

Plagionotus detritus ssp. caucasicola Plavilstshikov, 1940 was described from Caucasus. Danilevsky (2010a) and Vitali (2016) correctly considered it as a valid subspecies of Plagionotus detritus (Linnaeus, 1758) but wrongly synonymized P. d. africaseptentrionalis Tippmann, 1952 to it. According the original description and on the base of several specimens preserved in our collections, we have stated that it is a valid geographic population, diffuses from Turkey (Hatay province, Dortyol area, env. Topaktas vill., 28.VI.2013, P. Rapuzzi lgt.) (new record for Turkey) to Syrian Costal Region (Ali & Rapuzzi, 2016). Plagionotus detritus ssp. africaseptentrionalis Tippmann, 1952 was described from Egypt (Alexandria). Several species described or recorded from that area are due, very likely, to introduction by timber at the beginning of the last century. It is very likely that this animal was introduced from some place of the Middle East with oak timber. Anyway, it is a valid subspecies according its particular features. P. d. africaseptentrionalis is easy to separate from P. d. caucasicola according the totally light brown body colour, from the wider post-basal spot. From all the known subspecies of Plagionotus detritus it shows a longer pronotum, long as wide instead wider. So far Plagionotus detritus ssp. africaseptentrionalis Tippmann, 1952 stat. res.

Biology

All the known specimens were reared from larvae and pupae collected under the bark or few millimetres inside the wood of big dead trunks of oak (Quercus sp.).

Derivatio nominis

We want to dedicate this insect to Hüseyin Cebeci (İstanbul Üniversitesi, Orman Fakültesi, İstanbul, Turkey) as thanksgiving for his support and help in studying Turkish fauna of Saproxylic insects.
Isotomus speciosus ssp. eggeri n. ssp.

(Fig. 19)


Description of the Holotypus

Length 21,0 mm, width 4,5 mm. Body is black except for the antennae and tarsi that are partly reddish-brown. Head is small, front is square with a long carina in the middle that continues till on the head vertex. Antennal tubercles are small, not prominent. Head is densely punctured, the points are denser and deeper close to the base. All the surface is covered by short, recumbent, whitish hairs. Pronotum is globose, little longer than wider, sides are perfectly rounded with the maximum width on the middle. Disk is convex with two deep hollows in the middle, one on each side respect the middle. In the middle of the basal half of pronotum there is a small depressed line. Both, hollows and depressed line, are covered by short, dense, recumbent, whitish hairs showing two spots and one line of white pubescence. The surface of pronotum is covered by short, recumbent light hairs, denser on the sides and near the base. Scutellum is triangular, rounded toward the apex, covered by dense, recumbent white hairs. Elytra are long, constricted toward the apex. Apex is shortly truncated with a small tooth on the outer margin. Elytra are covered by a dark brown (coffee-colored) short, recumbent pubescence. Drawing is made by spots and bands of whitish pubescence. The first one is on the shoulders and it is made by a single spot inside the short basal carina. The second is made by one small spot very close to the suture just behind the scutellum. The third is a band in comma-shape facing the outer edge of elytra. Fourth is a transverse band, curved toward the base of elytra. Fifth is a small band that cover the elytral apex. The elytral punctuation is made by small and dense points all over the elytral surface. Legs are very long, blackish-brown colored except for the last tarsal segments that are little lighter. All femora are covered with scattered short, whitish, semi-erect hairs; on all the legs there are several erect longer dark setae. Antennae are long, reaching quite the elytral apex; segments from third to seventh show the basal half lighter than the apex that is dark brown. On the segments three and four and partly five there is a dense fringe made by golden erect hairs on the inner side.

Discussion

The new subspecies is distinguishing from the nominal form according the dark legs, partly or totally light in Isotomus speciosus speciosus (Schneider, 1787). The ground color on elytra is dark-brown instead black (when not covered by more or less uniform whitish pubescence, form “ganglbaueri (Pic, 1900)”). According these characters it is close to Isotomus jarmilae Sláma, 1982, endemic from Crete; anyway it is easy to separate from this latter according the presence of the white spot just behind the scutellum in the middle of elytra, missing in the Cretan species. I. speciosus eggeri n. ssp. share with I. jarmilae the dense
pubescence of light hairs on pronotum that is very sparse and rare in *I. speciosus* typ.; moreover the sculpture on pronotum is very similar to *I. jarmilae*. The females of the new subspecies are sometimes, according the legs color and the ground elytral color, very similar to *I. speciosus speciosus*.

**Note**

In our opinion this population shows that *Isotomus* from Mediterranean belong to one species only where is possible to identify several subspecies. Very likely *Isotomus barbarae* Sama, 1977, *Isotomus jarmilae* Sáma, 1982, *Isotomus speciosus eggeri* n. ssp., *Isotomus comptus comptus* Mannerhein, 1825, *Isotomus comptus gilianus* Pic, 1911 and *Isotomus syriacus* Pic, 1902 are subspecies of the same species. It is confirmed by the hybrids that we have obtained crossing the different species and the subsequent generations obtained crossing these hybrids by themselves.

*Isotomus theresae* Pic, 1897 (from Algeria and Tunisia) can be separate as distinct species according the particular features.

Recently Danilevsky (2017) considered the populations from the West Balcans as a distinct subspecies [*ganglbaueri* (Pic, 1900)]. It was described on the base of specimens from “Hong.” (Hungary) very likely somewhere in the Austro-Hungarian empire. This form is characterized by the males more or less covered by light pubescence. This form is known only for the males, mixed with the nominal form, on the east coast of the Adriatic and Ionian Sea. We have studied several hundreds of male specimens from that area (Slovenia, Istria, Croatia from the northern Kvarner till the southern Dalmatia, Albania and Greece) and we find everywhere specimens perfectly dark with white spots (typical form) and specimens totally covered by light pubescence (*ganglbaueri*). We find all the transitions from these two extreme forms. According our opinion it should be considered simply a form of *Isotomus speciosus* without any systematic value. So far, we propose the following synonymy:

*Isotomus speciosus* (Schneider, 1787) = *Isotomus speciosus ssp. ganglbaueri* (Pic, 1900)

*Isotomus comptus meridionalis* Özdkmen & Aytar, 2012, described from Turkey (Osmaniye prov.; Karatepe, Gündoğan) is a synonym of *Isotomus speciosus* ssp. *syriacus* Pic, 1902 after checking the type specimens by Pierpaolo Rapuzzi; now these specimens are preserved in Entomology Department of Eastern Mediterranean Forestry Research Institute (İçel province, TURKEY).

For these reasons, we propose:

*Isotomus speciosus* ssp. *speciosus* (Schneider, 1787) = *Isotomus speciosus ssp. ganglbaueri* (Pic, 1900)

*Isotomus speciosus* ssp. *comptus* Mannerheim, 1825 nov. comb.

*Isotomus speciosus* ssp. *syriacus* Pic, 1902 nov. comb.

*Isotomus speciosus* ssp. *gilianus* Pic, 1911 nov. comb.

*Isotomus speciosus* ssp. *barbarae* Sama, 1977 nov. comb.

*Isotomus speciosus* ssp. *jarmilae* Sláma, 1982 nov. comb.

Variability of the Paratypes

The type series shows a range of size between 21.0 to 16.0 mm in the males and from 22.0 to 17.5 mm in the females. The drawing is quite stable, only in two males the comma-shaped whitish spot is more rounded. Sometimes the arched white band is interrupted close to the suture. The ground color of elytra is always dark coffee-brown except in two specimens (one male and one female) that is a little darker. The legs and the antennae in females are lighter, often totally reddish, instead dark-brown as in all the known males.

Biology

Part of the specimens were reared from larvae collected inside dead branches of oak (Quercus sp.).

Derivatio nominis

We dedicate the new subspecies to our friend Manfred Egger (Wattens, Austria) as thanks for giving us the opportunity to study part of the interesting material collected in Greece.

Subfamily Lamiinae Latreille, 1825
Tribe Dorcadioniini Swainson & Shuckard, 1840
Dorcadion (Cribridorcadion) ringenbachi n. sp.
(Fig. 20)

Type material: Holotypus ♂: Iraq, Arbil, North of Galala, 36°39'53"N 44°47'47"E, 2560 m., Jean Claude Ringenbach lgt. (coll. P. Rapuzzi); Paratypus 1♂: same data as the Holotype (coll. J.C. Ringenbach, Pardies Pietat, France).

Description of the Holotypus

Length 15.5 mm, width 6 mm. Body is black except for the legs, the first antennal joint and the extreme elytral apex that are dark reddish. Head is large, with sparse small punctuation and with a long thin furrow in the middle of the front. This furrow finishes behind the eyes just before the pronotum. The median line is covered by white pubescence from the area between the antennal tubercles backwards the pronotum; on the fronts it is glabrous. There are few white small recumbent hairs on the head, denser around the eyes, the mandibles and the cheeks. Pronotum is as long as large, largest just before the middle in correspondence of the two lateral teeth. These teeth are acuminate and slightly reward facing. Pronotum has sparse medium-size points, denser at the sides. The middle of the disk shows a longitudinal area slightly depressed. Pubescence is made by black short recumbent hairs and three white longitudinal bands that are made by the same structure pubescence, one on the middle and other two on each side. Scutellum is long, triangular shaped with the apex rounded; it is entirely covered by short white pubescence. Elytra are long, oval shaped, convex with the apex that is rounded. Each elytron has two complete longitudinal white strips. The humeral one starts from the humeri and reaches the apex; in the median portion of its length it is partially interrupted by small irregular spots of black pubescence. The sutural strip starts from the scutellum and reaches the apex without join the humeral band. On the disk of each elytra there is a small longitudinal glabrous band, situated just in the middle between the humeral and the sutural bands. Legs are long and stout, apex of hind tibiae has a couple of long teeth, apex of tibiae is enlarged. Outward side of all the legs is reddish, inner side is dark brown to black. Tarsi are reddish. All the legs are covered by sparse white short pubescence, denser on tibiae than femora. Antennae are of medium length,
with the first antennal joint dark reddish. All the joints are covered by very short black hairs. Underside is completely covered by short white hairs.

**Discussion**

The new species can be placed close to *Dorcadion (Cribridorcadion) serouense* Kadlec, 2005 from Serou (Iran, West Azerbaijan). Anyway, it differs for many characters. First of all, the new species is missing the portion of the discal longitudinal white band, the humeral one is interrupted by several small black spots in the Iraqi species and complete in *D. serouense* and so on. Both have the same shape of head, pronotum and legs.

**Variability of the Paratypus**

The only Paratypus known is of the same size of the Holotype. The only difference appreciable is the little darker color of the legs and the whole black antennas.

**Derivatio nominis**

The new species is dedicated to its discoverer (Jean Claude Ringhenbach, Pardise Pietat, France) who has been lucky enough to play entomological researches in this area very interesting and still little investigated.

**Tribe Lamiini Latreille, 1825**

*Herophila* moreana n. sp.

(Fig. 21)


**Description of the Holotypes**

Length 24 mm, width 9 mm. Totally black, the body is covered with a reddish-brown pubescence sparse that leaves large denuded areas all over the body. This pubescence is more concentrated in the apical half of the elytra.

The head has thick and deep punctuation, antennal tubercles are pronounced. Pronotum is slightly wider than long, with coarse and more dense irregular marks denser on the sides than on the disk. The disk in the middle has three swelling, one toward the base and two toward the front side, these callosities are very blunt; on the sides of the two front there are two dimples that make the same callosity more obvious. The lateral tubercles are stout and acute, placed just above the middle. Pubescence is sparse, coffee colored and consisting of very short hairs lying, that are denser at the sides than on the disc.

Scutellum is triangular with the edge covered with robust and very clear short bristles.

Elytra are convex, with strong granules denser especially in the basal third, towards the apex the punctuation tends to shrink and thin. The pubescence in the basal half is mainly present in areas between granules and toward the apex becomes more dense on until completely cover the elytra in the apical third. The two apical spots of black pubescence are obvious while, the two basal have just mentioned. Legs with very short and black pubescence. At the inner side of the hind tibiae the pubescence assumes the coloring reddish-brown. Antennas are stout, densely and heavily punctured with pubescence similar to that of the legs, only the latest articles have a clearer pubescence.

**Variability of the paratype**

The paratypes show the typical sexual difference of the Genus. Males are stouter with longer and stouter legs and antenna. Females show shorter and thinner appendix. The size range is 27 to 15 mm for the males and 26 to 16 for the females. The fresher specimens show denser coffee-brown pubescence that appears sparser on the older one.

**Discussion**

The new species is close to *Herophila fairmairei* (Thomson, 1857) described from Parnassos (Greece) but it is easy to distinguish according the elytral pubescence (denser on the third apical portion of elytral length) that is quite completely missing in *H. fairmairei* (only in several very fresh specimens is possible to distinguish few areas with brown pubescence). From *Herophila tristis*
(Linnaeus, 1767) it is distinguishing according the mostly glabrous part of body, the stouter antenna, shorter than body as in *H. fairmarei* and longer than body in *H. tristis*. The shape of elytra is stouter and shorter than the other known species of the Genera.

**Note 1**
Breuning (1943: 96) described his *Dorcadion veluchianum* that was synonymized with *Herophila tristis* by Sama (Sama, 2010: 50-51). After check several specimens from the type area (Pindos mountains, Greece) we resurrect it as a distinct species.

*Herophila veluchiana* (Breuning, 1943) **nom. res.** (Figs. 22A,B).
We studied specimens from the following localities:
Greece, Pindos, Perister, 2000 m., 12.VII.1984, Osella lgt. (1 female and 1 dead specimen, elytra).
Greece, Epiro, M.te Tymphristos (Carpenissi), 1800-2000 m., 13.VI.1999 Osella lgt. (1 male); idem 6.VII.1998 (1 male); idem, 8.VII.1982 (1 female); idem, VII.1984 (1 male).

*Herophila veluchiana* (Breuning, 1943) is distinguished from all other species of the genera for the small size of the body, for the long legs and antennae and the light color of the elytral pubescence. The pubescence is not uniform but it is made by scattered areas between more all less glabrous zones.

From *Herophila veluchiana* the new species is distinguished according the larger body size: from 27 to 15 mm against 16 to 14 mm. The new species is distinguished also according the elytral shape that is shorter and stouter, longer and less convex in *H. veluchiana*. The new species shows a similar elytral pattern as *H. veluchiana* made by scattered pubescence and not evident dark spots. Anyway, legs and antennae are shorter and stouter in *Herophila moreana* n. sp. than *H. veluchiana* that shows thin and long appendix.

**Note 2**
From Arkadia, Vytina env. (28.V.2015, Claudio Sola leg. and coll.) we have seen *Herophila tristis* and *Herophila moreana* collected in the same biotope.

**Note 3**
We have studied many specimens belong to Genus *Herophila* from Greece and we found out that also *Herophila tristis* ssp. *martinascoi* (Contarini & Garagnani, 1983), previously considered endemic from Southern Italy, is represented in this Country: Patras, Valle Stige, 23-24.VII.1983, S. Bruno lgt. New record for Greece.

**Derivatio nominis**
The name of the new species shows the origin: Morea, the old name for Peloponnese region.

**Tribe Phytoeciini Mulsant, 1839**

*Phytoecia (s. str.) viridipes* n. sp.
(FIG. 23)

**Type material:** **Holotypos** ♀: **Turkey:** Erzincan prov., 30 Km W Refahiye, 2300/2500 m., 14.VI.1999, Kizildagi Geç., near Gemencik, Benedikt lgt. (Coll. P.Rapuzzi); Paratypus: 1♂ **Turkey:** Bayburt prov., 5-8 Km NW str. For Gümüş.(ane), 13.VI.2009, F. Angelini lgt. (Coll. P. Rapuzzi); 1♂ **Turkey:** Sivas prov., Zara, NE Kuruköprü, 39°32'N37°31E, 2000 m., 29.V.2013, Jean Claude Ringenbach lgt. (Coll. J.C. Ringenbach, Pardies Pietat, France).
Description of the Holotypus

Length 12 mm, width 2.5 mm. Body is metallic, green with golden reflexes on the head and the pronotum. The head is strongly punctured with a thin groove in the middle of the front and the vertex. Mandibles are black, single-spired, with the external part of base metallic. Labrum is metallic green. Head is covered by dense, thin erect brown hairs. Pronotum is as long as wide; it is deeply punctured; each point is separate from the others by a space less than the diameter of the point. Pronotum is little narrower toward the base than the apex. All pronotum is covered by long erect light brown hairs. Scutellum is rounded, finely punctured and surrounded by short white recumbent setae. Elytra are long, moderately narrower toward the apex. On the disk of each elytra there are two thin, but quite well developed, costae. The costa closest to the suture is in some parts evanescent. Elytra are deeply punctured, the points are large and deep. The space between each point shows a micro-sculpture that give to the elytra a matter appearance than head and pronotum where this micro-sculpture is absent. All the elytral surface is covered by long, semi-erect, thin, white hairs. Apex of elytra are emarginated. Antennae are long, reaching elytral apex. The first five antennal segments have metallic reflex, more evident in the first three that are perfectly metallic, from the fourth to the fifth the metallic reflexes are less noticeable. From the sixth segment to the apex antennae are totally black. All antennae have very short white hairs. Legs are completely green metallic, they are covered with dense pubescence. This pubescence is white except for all the tibiae that in the apical half where the pubescence is denser and golden. Tarsi are green metallic as well. Ventral surface is completely golden metallic, covered with long semi-erect whitish hairs. Prosternum and sternum heavily punctured with dense and large points, abdomen with very dense and fine punctuation.

Female
Unknown.

Variability of the paratype
The two paratypes are long 9 and 10 mm respectively. The color is similar, head and pronotum are golden and elytra are green. One specimen has blue metallic antennae instead green.

Discussion
The new species is close to Phytoecia (s. str.) caerulea (Scopoli, 1772) and mainly with its subspecies bethseba Reiche & Saulcy, 1858 according the whole metallic legs. It can be distinguished according the denser and longer erect hairs, shorter in all the subspecies of P. caerulea. In Phytoecia caerulea caerulea and Phytoecia caerulea baccueti (Brullé, 1832) pronotum is longer than wider, as long as wide in P. viridipes n. sp. and in P. caerulea ssp. bethseba (for this reason and for other features bethseba can be regarded as a distinct species, closely related with the new one that can be considered its northern subspecies). P. caerulea caerulea and P. caerulea ssp. baccueti (that shows a red spot on the disk of the pronotum) have front legs reddish instead metallic green. The elytral sculpture is denser in P. viridipes n. sp. than in all the known subspecies of P. caerulea.

Derivatio nominis
The name remembers the legs that are totally green.
Phytoecia (Metallidia) lisae n. sp.
(Fig. 24)


Description of the Holotypus
Length 11 mm, width 2.6 mm. The body, legs and antennae have green metallic sheen. Head is long, front is large. Mandibles are long, with the lateral side deep punctured and green metallic sheen, the rest is black. Head is deep and densely punctured, the points are thinner and denser on the front, larger, deeper and sparser on the vertex. The pubescence is made by two different kind of setae, one long, thin, erect and silvery colored and the second one is made by denser, shorter, recumbent brownish setae. The last once are not homogenous but quite scattered. Eyes are large, deeply incised. The two lobes of the eyes are joined by a very thin structure. Pronotum is little transverse, with rounded sides. Pronotum is deeply punctured, the sculpture is made by two different kind of points, one large, deeper and sparser, the second one is made by thinner, denser and smaller points between of the larger ones. Pubescence is made by very long and light thin erect hairs, it is denser at the sides of pronotum and sparser on the disk. There is also a scattered brownish pubescence made by very dense, recumbent hairs. These spots of pubescence are distributed everywhere on the pronotum, but they are denser at the sides. Scutellum is rounded, densely punctured with many short, recumbent silvery hairs. Elytra are long, slightly acuminate towards the apex. Apex is obtusely acuminate. Elytral sculpture is regular, made by deep and dense punctures organized in quite regular rows parallel to the suture. In the middle of each elytra there is a long carina that starts just behind the humeri and reaches the apical area. Elytral pubescence is made by long semi-erect dark hairs, evidently shorter and sparser than the pronotal setae; all the elytral surface is covered by dense golden, very short and recumbent hairs. On the lateral sides, in the first third of elytral length, there are dense, very long, erect silvery hairs. Legs are long, with a dense silvery pubescence and scattered semi-erect longer hairs. Antennae are long as the body, very densely punctured and covered by dense, short, adherent silvery hairs. Ventral side of the body covered with long, dense silvery hairs. These hairs are semi-erected and projected toward the back. From the first to the third abdominal segments has one short distinct teeth in the middle of the base.

Female
Unknown.

Discussion
Phytoecia lisae n. sp. belongs surely to the recently described subgenus Metallidia Kasatkin, 2011 according the character highlighted in its description (apex of mandible simplex, ground color metallic, teeth on sternites). The new species is very interesting firstly for the locality that enlarge a great deal the area of the subgenus. In fact, Metallidia Kasatkin, 2011 was described based on a single specie (alinae Kasatkin, 2011) from Eastern Turkey (Buglan pass, Muş province) and known only after few specimens from the type locality only.

P. (Metallidia) lisae n. sp. is very easy to distinguish from P. alinae for many characters. The pubescence on head and pronotum is really less dense and made by sparser erect hair that are denser at the side of both of this organ, denser and not regular oriented in P. alinae. The short and adherent pubescence is brownish
colored in the new species instead whitish grey in *P. ainaea*. The metallic color of the whole body in *P. lisae* is yellowish-green instead blue-green. In the new species elytra show several erect hairs that are quite absent in the Turkish species.

**Derivatio nominis**

We dedicate the new species to Lisa, the younger daughter of Pierpaolo Rapuzzi.

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We are grateful to Gérard Tawakilian (Muséum Nationale d’Histoire Naturelle, Paris, France), Maxwell Barclay (Natural History Museum, London, Great Britain), Jiri Hajek and Lukas Sekerka (National Museum, Prague, Czech Republic), Luca Bartolozzi (Museo di Storia Naturale “La Specola” – UniFi, Firenze, Italy) for the help to provide us the specimens and the pictures of the type material preserved in their Museums. We are also grateful to our colleagues Marco Ulina (Museo Civico di Storia Naturale di Venezia, Italy), Enrico Migliaccio (Roma, Italy), Jean Claude Ringhenbach (Pardies Pietat, France), Manfred Egger (Wattens, Austria), Robert Borek (Aeropolis, Greece), Lucio Saltini (Modena, Italy); Mauro Malmusi (Modena, Italy); Michele Carraretto (Morgano, Treviso, Italy); Claudio Sola (Guiglia, Modena, Italy); Ondrej Konvicka (Zlin, Czech Republic) and Eduard Ezer (Zlin, Czech Republic) that have given us to study part of the material collected during their entomological expeditions. A special thanks to our friend prof. Hüseyin Özdikmen (Gazi University, Ankara, Turkey) to help us during our entomological investigations in Turkey.

**LITERATURE CITED**


Figure 6. *Cortodera cartinii* n. sp. Holotypus. Turkey: Bolu prov., Abant lake, 1600 m., 1.VI.2008, A. Cartini lgt. (Coll. P. Rapuzzi).

Figure 9. *Molorchus* (*Caenoptera*) *akbasianus* n. sp. Holotypus. Turkey, Hatay prov., Dortyol area, env. of Topaktas, VI.2013, ex larva *Juglans regia* sfar. 20.IV-1.VI.2014, P. Rapuzzi lgt. (Coll. P. Rapuzzi).

Figure 10. *Molorchus* (s. str.) *sabatinelli* n. sp. Holotypus. Pakistan: NWFP, Bhurban, 2060 m., 33°56'54"N73°27'17"E, ex larva Pinus sp., D. Baiocchi lgt. (Coll. P. Rapuzzi).


Figure 20. *Dorcadion* (*Cribridorcadion*) *ringenbachi* n. sp. Holotypus. Iraq, Arbil, North of Galala, 36°39’53”N 44°47’47”E, 2560 m., Jean Claude Ringenbach lgt. (coll. P. Rapuzzi).


A NEW SUBSPECIES OF PURPURICENUS KAELHERI (LINNAEUS, 1758) (COLEOPTERA: CERAMBYCIDAE) FROM CORSICA ISLAND, FRANCE

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ABSTRACT: The new subspecies Purpuricenus kaehleri corsicus ssp. nov. comes from the northern part of the Corsica Island (France). For the time being, it is endemic to Corsica. It was compared with specimens of taxa known within its group: Purpuricenus kaehleri (Linnaeus, 1758) and Purpuricenus kaehleri menetriesi Motschulsky, 1845.

KEY WORDS: Coleoptera, Cerambycidae, Cerambycinae, Purpuricenus kaehleri, new subspecies, France, Palearctic region

Purpuricenus kaehleri corsicus ssp. nov.

Body: Quite black including the legs and antennae. Ventral side of abdomen sparsely pubescent, punctuation very sparse and fine.

Elytra: Cinnabar red, almost parallel, about 2.3 times as long as wide at base. With very short and very sparse black pubescence. Punctures of elytra very coarse and deep, intervals between punctures being larger than puncture diameter. Elytral apex slightly emarginate, with small spine at suture. The large common black spot begins at end of anterior half of elytra and is extended to end of elytra. It is pear-shaped, very wide anteriorly, stepwise narrowing toward end and touching elytral apex. It reminds of pear situated upside down.

Scutellum: Black, triangular, with straight sides and acute angles.

Pronotum: Black, but partially red laterally, where small red circular spots are present. Pronotum with well developed lateral calli, spines. On disk more vaulted, with very coarse and very dense punctuation. Punctures diameter larger than intervals between punctures. Pronotum pubescence very sparse and short on disk, longer and denser on lateral surfaces.

Head: Anterior part of head short and wide, with rather dense, erect setae.

Antennae: Black, seemingly consisting of 12 antennomeres in males, but having antennomere 11 strongly appendiculate. Antennae very short compared to body length, at most one antennomere (or sometimes even none antennomere) exceeds beyond end of elytra. All males of other known subspecies (including the nominotypical form), have very long antennae exceeding at least beyond twice elytral length.

Legs: Black, femora and tibiae with black, decumbent pubescence. Ratios of leg length to body length considerably smaller than those in nominotypical form. Male metatarsi with decumbent, long setation. Basal metatarsomere as long as metatarsomeres 2 and 3 combined.

Body size: Males – 12-13 mm, female – 13 mm.

Ecology: It develops in oaks (Quercus L.), observed flying in oak forests, in the twilight. The main swarming period, late June and early July.

Differential diagnosis: Among the group considered here, the new subspecies Purpuricenus kaehleri corsicus ssp. nov., belongs to a principally different taxa. Its features are very characteristic and very different from the nominotypical form of Purpuricenus kaehleri (Linnaeus, 1758), as well as from the known subspecies Purpuricenus kaehleri menetriesi Motschulsky, 1845. Within its subgroup, the new subspecies Purpuricenus kaehleri corsicus ssp. nov. is a small subspecies, whose males reach their body length of at most 13cm, and in addition, have very short antennae exceeding beyond the elytral apex by not whole ultimate antennomere, contrastingly to the subspecies Purpuricenus kaehleri (Linnaeus, 1758) and Purpuricenus kaehleri menetriesi Motschulsky, 1845, the antennae of which are very long, at least 1.75 times longer than the body. In addition, the new species has a very different black spot on the elytra, which begins as far as at the elytra midlength, is very wide anteriorly, and from there, it is stepwise narrowed toward elytra end in such a way that elytra apices are also black. In general comparison with all the taxa in the group, the new subspecies Purpuricenus kaehleri corsicus ssp. nov. is obviously and essentially different as to the body shape and length, shape of the black spot, length and widths of legs, and coarser punctuation of the elytra. For the time being, the subspecies is endemic to theCorsica Island (France).

Distribution of particular Purpuricenus kaehleri subspecies in Palaearctic region.

Purpuricenus kaehleri corsicus ssp. nov. – Corsica Island (France).
Purpuricenus kaehleri kaehleri (Linnaeus, 1758) – Europe, northern Turkey, Transcaucasia.
Purpuricenus kaehleri menetriesi Motschulsky, 1845 – Iran.

Etymology: The new subspecies Purpuricenus kaehleri corsicus ssp. nov. was described and named after the Mediterranean island Corsica.

ACKNOWLEDGEMENTS

I would like to thank M. Sláma (Praha, Czech Republic), M. Danilevsky (Moscow, Russia), J. Klícha (Praha, Czech Republic) for important data. My thanks are extended to Prof. Ing. Miloslav Rakovič (Dobřichovice, Czech Republic) for professional translation into English language.

LITERATURE CITED

Figure 1. *Purpuricenus kaehleri corsicus* ssp. nov., A. Male, B. Female.

Figure 3. Corsica Island.
A NEW SPECIES OF GENUS EUSCELIMENA GÜNTHER, 1938
(ORTHOPTERA: TETRIGIDAE: SCELIMENINAE)
FROM CENTRAL INDIA

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ABSTRACT: A new species of genus Euscelimena hardi sp. nov. is described from Chhattisgarh, India. A Key to the genus Euscelimena is provided.

KEY WORDS: Tetridoidea, Taxonomy, new species, Raipur, Hardi nala

The genus Euscelimena was erected by Gunther in 1938. Here it is consider a member of family Tetrigidae. This genus currently includes 3 species namely Scelymena gavialis Saussure, 1862 with type locality Sri Lanka later Gunther, 1838 synonyms with E. gavialis (Saussure, 1862); Tetrīx harpago Serville, 1838 with type locality India, Maharashtra: Mumbai; Bolivar 1887, synonyms with Scelimena harpago later on Gunther synonyms with the species E. harpago (Serville, 1838) and Hancock, 1904 describe species Scelimena logani with type locality from Sri Lanka later on Blackth, 1992 synonyms with the species E. logani (Hancock, 1904) (Eades et al., 2016). Only two species E. harpago and E. gavialis from India (Shishodia et al., 2010).

MATERIAL AND METHODS

Study area. The survey were carried out in Chhattisgarh state, covering two protected areas. Barnawapara Wildlife Sanctuary is situated in Raipur, covering an area of about 244.66 sq. km., lies between 21°18’45” to 21°30’N and 88°22’30”to 82°37’30”E. Udanti Wildlife Sanctuary is situated in Gariyaband district of Chhattisgarh state, which lies between 20°0’N to 20°15’N, 82°30’E to 82°0’E with an area of about 4240.17 km².

The specimens were collected by sweeping over pebbles on the banks of Hardi nala and Bijakhera Nala, by using an insect net and killed by benzene vapor in killing jar. The specimens were preserved dry and pinned. The specimens were studied under a Leica stereozoom Microscope (Leica M205 A) and photographs were taken using the software Leica Application Suite (LAS V3.8). All the measurements are given in millimetres. The type specimen was deposited the Central Entomological Laboratory (CEL) of the Zoological Survey of India in Kolkata.

TAXONOMY

Order Orthoptera Olivier, 1789
Suborder Caelifera Ander, 1939
Superfamily Tetrigoidea Rambur, 1838
Family Tetrigidae Rambur, 1838
Subfamily Scelimeninae Bolivar, 1887
Genus Euscelimena Günther, 1938

Diagnosis: Body elongated and slender, head not exserted; vertex usually wider than an eye, a little oblique or inclined anteriorly, extend up to the eyes in front, slightly depressed anteriorly, median carinula visible only in front; frontal costa bifurcate between the paired ocelli, protuberant between antennae, depressed in front, narrowly sulcate between paired ocelli and a little widely forked between antennae; antennae filiform and located below the inferior margin of eyes. Pronotum transverse or truncated anteriorly, subulate posteriorly and usually extend beyond the apex of hind femora; dorsum rugose, granulose, tubercles present on the anterior margin below the eyes and also in between, generally distinct tubercles present on the shoulders and lateral margins; prozonal carinae distinct and parallel; posterior angle of lateral lobes of pronotum with a strong spine projecting outwards with its apex more or less directed forwards. Elytra usually elongate, punctuate, apex narrowly rounded. Wings usually extend up to the apex of pronotum; anterior and middle femora elongate, lobate with serrulate margins; hind femora elongate, crassate, inferior margin frequently dentate; hind tibiae and first joint of hind tarsi strongly lamellate; pulvilli of first segment of hind tarsi usually subequal.

Euscelimena hardi sp. nov.
(Figs. 1-10)

Holotype: Chhattisgarh, Raipur, Barnawapara WLS; Hardi nala, 26.xii.2011, 1 (♂, DC); 21°24′6.20″N, 82°25′764″E, 283 m, Reg. No. 18825/H5, coll. S. K. Gupta & party.
Paratypes: 3 (1♂, 2♀, DC) same data as Holotype, Reg. No. 18826-28/H5; Gariyaband, Udanti WLS; Baji Nala, 30.vi.2014, 5 (5♀, DC); 22°12′ 58.2″N, 82°11′ 16.5″E, 591 m, Reg. No. 18829-18833/H5, coll. S. K. Gupta & party.

Description: Male. Head in dorsal view vertex is below of the distal margin of compound eyes, Median carina of vertex present in the distal half of the length of the vertex, vertex smaller than a compound eye. Median ocellus situated far below the level of the lower margin of compound eyes, in the place where facial carinae end. Lateral ocelli situated in the level of the lower margins of the compound eyes. Frontal costa in lateral view not produced from the level of the distal margin of the compound eyes. Frontal costa bifurcate into facial carinae between the lateral ocelli and facial carinae run parallel to the median ocelli forming a very broad scutellum. Antennal grooves situated below the lateral ocelli, below the lower margin of the compound eyes. Antennal grooves length subequal to the scutellum width. Eyes in frontal view sub-globular, in lateral view sub-globular with margin above to the pronotum. Antennae 11-12 segmented.

Pronotum. Pronotum disc with 7 large tubercles. Anterior margin truncated, posterior margin subulated extend slightly apex of posterior femora. Prozonal carinae well developed, Humero-apical carinae forming with external lateral carinae obtuse angle. Interhumeral carinae distinct.

Wings: Tegmina reduced, not visible, covered by pronotum. Alae present, visible under pronotum, do not reach the apex of the pronotum.

Legs. Fore legs: femora 1.9 times as long as wide, laterally compressed, dorsal and ventral margin with 2 strongly projected teeth; tibia clothed with bristles
and large spines; second tarsal segments 2.6 times longer than first. **Mid legs:** femora 2.6 times as long as wide, serrated carina on external face distinct, ventral margin with 2 strongly projected teeth. Tibiae clothed with bristles, dorsal and ventral margin serrated; second tarsal segments 5.9 times longer than first. **Hind legs:** hind femora robust – 2.3 times as long as wide, ventral margin with 5 strongly projected teeth; genicular and antigenicular teeth visible; posterior tibiae and first segment of posterior tarsi lamellated; first tarsal segments 1.6 times longer than third; tip of pulvilli I, II and III spinulately produced, pulvilli II distinctly shorter than length of I, III pulvilli together. Epiproct triangular, with pointed apex. Subgenital plate as long as wide, apex with V-shaped incision; cerci nearly triangular with slightly pointed tip.

**Coloration.** Body color from brown to dark blackish. Pronotal tubercles usually dark black. Lamellae of hind tibiae and first joint of hind tarsus sub-hyaline. Teeth of all legs yellowish.

**Differentiated Characters:**
Comparison of *Euscelimena hardi* sp. nov. and *Euscelimena harpago* is below:

<table>
<thead>
<tr>
<th>Characters</th>
<th>Euscelimena hardi sp. nov.</th>
<th>E. harpago</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontal costa</td>
<td>Frontal costa bifurcation start in about lower ¼ of the compound eye height. Facial carinae are undulated. Scutellum very broad.</td>
<td>Frontal costa bifurcation start in about middle of the compound eye height. Facial carinae are almost parallel. Scutellum narrow.</td>
</tr>
<tr>
<td>Lateral spine of Pronotum</td>
<td>Lateral spine of pronotum broad at the base and directed transversely.</td>
<td>Lateral spine of pronotum narrow at the base and almost straight.</td>
</tr>
<tr>
<td>Pronotum</td>
<td>Pronotum disc convex and extend up to only hind femur apex</td>
<td>Pronotum disc depressed and extend above tip of hind tibia</td>
</tr>
<tr>
<td>Tegmena and wings</td>
<td>Tegmina unvisible and hind wings up to only 4&lt;sup&gt;th&lt;/sup&gt; or 5&lt;sup&gt;th&lt;/sup&gt; abdominal segment.</td>
<td>Tegmina visible and hind wings up to pronotum.</td>
</tr>
</tbody>
</table>

**Keys to the genus Euscelimena**

1. Lateral lobe of pronotum with two spines, curving forwards……………………………*E. logani*  
   - Lateral lobe of pronotum with only one spine……………………………………………………………2

2. Lamellae of hind tibiae and first joint of hind tarsi very wide, subhyaline…………………..3  
   - Lamellae of hind tibiae and first joint of hind tarsi narrower……………………………*E. gavialis*

3. Frontal costa bifurcation start in about lower ¼ of the compound eye height. Facial carinae are undulated. Scutellum very broad……………………………………*E. hardi* sp. nov.  
   - Frontal costa bifurcation start in about middle of the compound eye height. Facial carinae are almost parallel. Scutellum narrow………………………………………*E. harpago*

**Measurements** (all in millimetres). **Male:** **Body length** (from the tip of the vertex to the end of the abdomen): 8.557; Head length 0.892; Vertex: 0.519. compound eye length: 0.610, width: 0.517. Antennal grooves length: 0.194, scutellum width: 0.195, Antenna length: 1.678. **Pronotum** length: 8.391, shoulder width: 2.607. **Fore leg**: femur length: 1.364, width: 0.715; tibia length:
1.812, width: 0.255; tarsus length (by segments): I: 0.273, II: 0.737; claw length: 0.359. **Mid leg:** femur length 1.806, width 0.675; tibial length 1.961, width 0.288; tarsus length: I: 0.117, II: 0.698; claw length 0.093. **Hind leg:** femur length: 4.685, width: 1.974; tibia length: 3.689, width: 0.364; tarsus length: I: 1.060, II: 0.112, III: 0.660; pulvilli length: I: 0.124, II: 0.204, III: 0.172; claw length 0.208. cerci length: 0.504. Subgenital plate length 0.799; width 0.773.

**Measurements** (all in millimetres). **Female. Body length** (from the tip of the vertex to the end of the abdomen): 11.662; Head length: 1.450; Vertex: 0.530. compound eye length: 0.852, width: 0.651. **Pronotum** length: 10.565, width: 2.937. **Fore leg:** femur length: 1.819, width: 0.741; tibia length: 1.990, width: 0.271; tarsus length (by segments): I: 0.269, II: 0.736; claw length: 0.196. **Mid leg:** femur length 2.262, width 0.595; tibial length 2.248, width 0.438; tarsus length: I: 0.282, II: 0.629; claw length 0.183. **Hind leg:** femur length: 5.97, width: 2.166; tibia length: 4.097, width: 0.672; tarsus length: I: 1.128, II: 0.237, III: 0.687; pulvilli length: I: 0.209, II: 0.207, III: 0.239; claw length 0.287. Abdomen length: 6.636; Dorsal ovipositor valves length: 1.480, ventral ovipositor valves length: 1.092, cerci length: 0.344.

**Etymology.** The name of the species has been given after the collection locality of the species.

**ACKNOWLEDGEMENTS**

The authors are grateful to the officer-in-Charge and staff of Orthoptera section for the necessary facilities. The authors are thankful to CAMPA (Compensatory Afforestation Fund Management and Planning Authority) for the funding.

**LITERATURE CITED**


Figure 11. Collection localities in Chhattisgarh, India.
A PROPOSE TO ACCEPTATION OF CALCHAENESTHES PRIMIS ÖZDİKMEN (COLEOPTERA: CERAMBYCIDAE: CERAMBYCINAE) AS A THREATENED LONG-HORNED SPECIES AT THE EUROPEAN AND EUROPEAN UNION LEVEL

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ABSTRACT: Calchaenesthes primis Özdikmen (Coleoptera: Cerambycidae: Cerambycinae) has not been classified on the European Red List of Saproxylic Beetles yet, is reported from Cyprus and Turkey in Eastern Mediterranean Region. In Cyprus, it exists in Paphos and Larnaca districts. In Turkey, it occurs in Adıyaman, Amasya, Burdur, Gaziantep, Hatay, İçel, Mardin, Niğde and Siirt provinces. Known host plants include kermes oak (Quercus coccifera L.) probably also other Quercus species (Fagaceae).

KEY WORDS: Calchaenesthes primis, longhorned beetle, distribution, host plant

Calchaenesthes primis (Coleoptera: Cerambycidae: Cerambycinae) was described by Özdikmen (2013 in Özdikmen et al., 2013) from İçel province of Turkey. This species, therefore, has not been classified on the European Red List of Saproxylic Beetles until now (Nieto and Alexander 2010). Information on this species is critical to efforts to protect this species from extinction in the Eastern Mediterranean basin.

The Eastern Mediterranean denotes the countries geographically to the east of the Mediterranean Sea (Levantine Sea basin). This is commonly interpreted in two ways: the region of Syria plus the Cyprus (also known as the Levant), and Turkey, or the Levant plus Greece, and Egypt, thereby including European and African components to the definition. The Levantine Sea is bordered by Turkey in the north, Syria, Lebanon, Israel and the Gaza Strip in the east, Egypt and Libya in the south, and the Aegean Sea in the northwest. The largest Island in the Levantine Sea is Cyprus. The greatest depth of 4384 meters is found in the Pliny Trench, about 80 km south of Crete. The Levantine Sea stretches over an area of 320 000 km². The countries and territories of the Eastern Mediterranean include Cyprus, Greece (mainland and Aegean Islands), Lebanon, Syria, Palestine, Israel, Turkey, Egypt, Jordan and Libya. The Eastern Mediterranean Region encompasses only two countries as Greece and Cyprus within the European Union (Sundseth & Brussels, 2009).

The Mediterranean basin is recognised as a biodiversity hotspot. About one-third of the Mediterranean fauna is endemic. According to the International Union for Conservation of Nature Red List of Threatened Species, 19% of faunal species (amphibians, birds, cartilaginous fishes, endemic freshwater fishes, crabs and crayfish, mammals, dragonflies, and reptiles) are threatened with extinction (5% Critically Endangered, 7% Endangered, 7% Vulnerable) in the Mediterranean Region. In addition, at least 16 irreplaceable species are already extinct, including some endemics (Vlachogianni et al., 2012; Avgın et al., 2015). With most representatives in the Order Coleoptera, insect diversity in the region is also high.
Within borders of region as well as in neighboring countries and regions, Turkey is surrounded on 3 sides by large water bodies, it has continental properties including exceptionally diverse topographical features. The latter have provided refugia in which many species have survived in spite of harsh geological and climatic changes. Turkey is located at an intersection of geographical regions with large climatic and geographical gradients as well as a diversity of ecosystems and habitats (Kahraman et al., 2011; International Union for Conservation of Nature, 2012; Avgın et al., 2015). The great biological importance of Turkey is evident from the remarkable variety of arthropods in Turkey. The coleopteran fauna of Turkey is estimated to include 25 000 species (Koçak & Kemal, 2009). As a result of this, Turkey plays an important geographic and ecological role in safeguarding biodiversity.

*Calchaenesthes primis* is among the saproxylic beetles in Europe and Turkey, has not been classified on the European Red List of Saproxylic Beetles until now (Nieto & Alexander, 2010). Thus, the primary objective of this paper is to propose for acceptance of this beetle as a threatened long-horned species at the European and European Union level and is to define the known distribution of this insect along with information on its ecological habits and host plants. In addition, a bibliography of previous studies related to this species is included.

**MATERIALS AND METHODS**

The material of this work is a comprehensive review of the scientific literature that was conducted to delineate the known distribution of *Calchaenesthes primis*. Host plants and ecological habits were recorded when available. Additional surveys for this insect were conducted by many researchers and are reported herein. We included information and data that are important in assessing the level of threat to the species. These protocols included geographic range, population data, and habitat preferences (Nieto & Alexander, 2010; International Union for Conservation of Nature, 2012). Information and data of this species are presented under the title Taxonomic history, Reported occurrence in Turkey, Reported occurrence outside Turkey, Host plants, Life cycle and biology and Status and conservation of threatened species. Moreover, a distribution map of *Calchaenesthes primis* in the Eastern Mediterranean Region is also given (Fig. 1). Reported global occurrence of *Calchaenesthes primis* with bibliographic citations is also provided (Table 1).

**RESULTS AND DISCUSSION**

**Taxonomic history.** The cerambycid genus *Calchaenesthes* was erected by Kraatz (1863) with the type species *Callidium oblongomaculatum* Guérin-Méneville, 1844. *Callidium nogelii* Frivaldszky, 1845, *Calchaenesthes oblongomaculatus* var. *subjunctus* Pic, 1945 and *Calchaenesthes oblongomaculata* var. *quadrimaculata* Pic, 1912 are known synonyms of the type species. *Calchaenesthes oblongomaculata* (Guérin-Méneville, 1844) is distributed in Balkan Peninsula (Bulgaria, Greece and Romania), European Turkey, ?Jordan and ?Cyprus.

The other senior species, *Calchaenesthes sexmaculata* was described by Reiche (1861) from Algeria (Kabylia) as *Anoplistes oblongomaculatum* var. *sexmaculatum*. This species occurs also in Europe (Spain) and North Africa (Morocco and Tunisia). *Calchaenesthes 6-maculatus* var. *junctus* Pic, 1922 and
Purpuricenus (Calchaenesthes) sexmaculatus var. parvimaculatus Rungs, 1947 are known synonyms of the species.

Calchaenesthes diversicollis was described by Holzschuh (1977) from Iran (Luristan) as a subspecies of Calchaenesthes oblongomaculatus. This species is also distributed in Iraq and Turkey.

Calchaenesthes pistacivora was described by Holzschuh (2003) from Iran (Kerman). This species is endemic to Iran.

Calchaenesthes primis was described by Özdikmen (2013 in Özdikmen et al. 2013) from Turkey (İçel). This species occurs also in Cyprus.

Consequently, the Western Palaearctic genus Calchaenesthes Kraatz, 1863 is included 5 species.

**Reported occurrence in Turkey.** Calchaenesthes primis is reported as occurring in 9 of Turkey’s 81 provinces (Fig. 1). These are Adıyaman, Amasya, Burdur, Gaziantep, Hatay, İçel, Mardin, Niğde and Siirt provinces. All reports before 2013 from Anatolia are given as Calchaenesthes oblongomaculata (Özdikmen et al., 2013). Location reports along with specific citation(s) of those reports are listed in Table 1.

**Reported occurrence outside Turkey.** Calchaenesthes primis is recorded from the Western Palaearctic Region, from Turkey (Anatolia) and Cyprus. Citations of confirmed occurrence of Calchaenesthes primis are listed in Table 1, and the recorded distribution is shown in Fig. 1.

**Host plants.** Calchaenesthes primis is apparently monophagous in deciduous trees in the plant family Fagaceae, e.g. Quercus coccifera (Özdikmen et al., 2013; Özbek et al., 2015; Hoskovec et al., 2016) and probably also other Quercus species (Rejzek & Hoskovec, 1999; Malmusi & Saltini, 2005; Sama et al., 2011; Hoskovec et al., 2016).

**Life cycle and biology.** Calchaenesthes primis is a very rare species. Adults and larvae can be collected only from the host plants growing in lowland and foothill habitats up to 1,000 m above sea level. Adults can usually be found sitting on the leaves or flying around of their host, especially from early April to early June. Duration of the life cycle is at least 2-3 years. Larvae develop in living twigs of the host plant. The overwintering stage is most likely the larval stage. Pupation takes place in the autumn and adults overwinter in the pupal cells. Interestingly, the beetles tend to gather on selected living trees showing a strong preference for stunted oaks growing on poor stony grounds. This behaviour implies that an infochemical (aggregation or sex pheromone) mediated communication might be used by this species (Demelt, 1963; Rejzek & Hoskovec, 1999; Malmusi & Saltini, 2005; Sama et al., 2011; Özdikmen et al., 2013; Ambrus et al., 2014; Özbek et al., 2015; Hoskovec et al., 2016).

**Status and conservation of threatened species.** Calchaenesthes primis is among the saproxylic beetles in Europe and Turkey, however, has not been classified on the European Red List of Saproxylic Beetles until now (Nieto & Alexander, 2010). Since this species was described by Özdikmen (2013 in Özdikmen et al., 2013) from Turkey and was firstly reported by Ambrus et al. (2014) from Cyprus. We included information and data that are important in assessing the level of threat to the species. These protocols included geographic range, population data, and habitat preferences (Nieto & Alexander, 2010; International Union for Conservation of Nature, 2012). Subsequently, we propose that this beetle should be classified in the category of Endangered on the European Red List at the European and European Union level. Besides, we suggested that the species should be listed in the category of Vulnerable in the
LITERATURE CITED


Table 1. Reported global occurrence of *Calchaenesthes primis*, with bibliographic citations.

<table>
<thead>
<tr>
<th>Country</th>
<th>Province</th>
<th>Locality</th>
<th>Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkey</td>
<td>Adıyaman</td>
<td>Kahta (Karadut)</td>
<td>Rejzek &amp; Hoskovec, 1999; Özdkimen et al., 2013; Hoskovec et al., 2016</td>
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<td>Turkey</td>
<td>Amasya</td>
<td>Gümüşhacıköy (İnegöl Mt.)</td>
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<td>Gölhisar</td>
<td>Sama et al., 2011</td>
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<td>Gaziantep</td>
<td>Islahiye</td>
<td>Demelt, 1963; Özdkimen et al., 2013</td>
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<td>Hatay</td>
<td>Hassa (Akbez)</td>
<td>Pic, 1897</td>
</tr>
<tr>
<td>Turkey</td>
<td>Içel</td>
<td>Erdemli (Güzeloluk)</td>
<td>Malmusi &amp; Saltini, 2005; Özdkimen et al., 2013; Hoskovec et al., 2016</td>
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<tr>
<td>Turkey</td>
<td>Içel</td>
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<td>Ambrus et al., 2014; Özdkimen et al., 2013; Özbek et al., 2015</td>
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<tr>
<td>Turkey</td>
<td>Mardin</td>
<td>Midyat (Haberli)</td>
<td>Hoskovec et al., 2016</td>
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<td>Ulukışla (Çiftehan)</td>
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<td>Şirvan</td>
<td>Holzschuh, 1977; Özdkimen et al., 2013</td>
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<td></td>
<td>Lodos, 1998; Ambrus et al., 2014; Danilevsky, 2016</td>
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</tr>
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<td>Cyprus</td>
<td>Larnaca</td>
<td>Pano Lefkara</td>
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</tr>
<tr>
<td>Cyprus</td>
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</table>

Figure 1. Distribution of *Calchaenesthes primis* Özdkimen in provinces of Turkey and Cyprus in Eastern Mediterranean basin.
A NEW SUBSPECIES OF *ROPALOPUS INSUBRICUS* GERMAR, 1824 (COLEOPTERA: CERAMBYCIDAЕ) FROM AIGUINES, FRANCE

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ABSTRACT: A new subspecies, *Ropalopus insubricus gallicus* ssp. nov., comes from southeast France, from the range Aiguines at an altitude of 1000 m, location situated east of the lake Sainte-Croix. At the time being, it is a subspecies endemic to the French range Aiguines. Its specimens were compared with all members of the genus: *Ropalopus insubricus insubricus* Germar, 1824, *Ropalopus ungaricus* Herbst, 1784 and *Ropalopus siculus* Stierlin, 1864.

KEY WORDS: Coleoptera, Cerambycidae, Cerambycinae, *Ropalopus insubricus* new subspecies, France, Palaearctic region

*Ropalopus insubricus gallicus* ssp. nov.

**Body:** Quite black including legs and antennae; only abdominal ventrites dark red. Body underside with very long and grey pubescence. Prosternum, mesosternum, metasternum and abdominal ventrites covered with erect setae. Punctation of ventral surface very dense and fine.

**Elytra:** Metallic green; fresh green colour in the basal half, stepwise changing into rather violet-green tinge towards elytral apex. Elytra punctation very coarse and dense in basal half, becoming stepwise finer towards elytral apices. Elytra very short in relation to body length, only 2.15 times as long as wide at humeri. Pubescence very sparse throughout elytral surface (elytra rather glabrous with exception of few erect setae on sides of humeri. Ends of elytra regularly arcuate, without any outward directed spine or process.

**Scutellum:** Not sharply triangular, with rather rounded apex, at least twice as wide at base as long.

**Head:** Very wide and short, relatively densely, evenly, flatly wrinkled-punctate; head vertex with a deep longitudinal furrow.

**Pronotum:** Distinctly transversal, arcuate dilated on sides in males, strongly edged angularly dilated in females, more strongly narrowed towards base. Moderately vaulted on its top surface, but without smooth area. Whole surface evenly punctate. Pronotum pubescence longer, but still very sparse on sides only.

**Antennae:** Black, not reaching to elytral apices in males; achieving ¾ elytra length in females. First antennomere relatively more coarsely punctate, punctation of remaining antennomeres finer and denser. Antennomeres 1 to 6 with long, semierect, black setae. Antennomeres 3 and 4 with rather short but distinct spines.

**Legs:** Black, with black, decumbent setae on femora and with long, erect setae on tibiae. Legs shorter and more robust compared to body dimensions. Basal metatarsomere of males as long as metatarsomeres 2 and 3 combined.

**Body size:** Males 17-18 mm, females 19-20 mm.

Development: Most adult individuals were caught on the host plant Acer sp. Smaller number of individuals were reared (ex larvae) from wood of Acer sp.

Differential diagnosis: The new subspecies Ropalopus insubricus gallicus ssp. nov., exemplifies differences encountered in the group studied. It exerts very characteristic features different from those of the nominotypical form Ropalopus insubricus insubricus Germar, 1824, thus justifying the definition of a new subspecies. Among taxa of the group, it belongs to smaller insects, where body lengths vary between 17 and 18 mm in males and between 19 and 20 mm in females, whereas in the nominotypical form, the body lengths are of 18 to 28 mm in males and 20- 30 mm in females.

Further important differences between the new subspecies described here and the nominotypical form are as follows: in the new subspecies, the males have distinctly shorter antennae, by far not reaching to the elytral apex; only antennomeres 3 and 4 bear observable spines; the pronotum surface is punctate throughout, without any distinct glossy area on its top; elytra are more metallic bright and shorter – only 2.15 times as long as wide at humeri;the ventral side of the body including prosternum, mesosternum, metasternum and abdominal ventrites is covered with very long, grey pubescence; the abdominal ventrites are dark red.

Contrastingly to these characteristics of the new subspecies, the nominotypical form Ropalopus insubricus insubricus Germar, 1824 is rather larger and more robust; the metallic shine of the elytra is less considerable, rather obsolete; male antennae are much longer, exceeding beyond the elytral apex by a number of antennomeres; antennomeres 3 to 9 are distinctly extended to produce spines; the ratio of the elytra length to the body length is larger, the elytra being 2.25 times longer than wide at humeri; the top part of the pronotum surface has a glossy, prevalently impunctate area; the body underside (prosternum, mesosternum, metasternum and an abdominal ventrites) bears very sparse and black pubescence; the abdominal ventrites are black.

Etymology: The infraspecific name of the new taxon Ropalopus insubricus gallicus ssp. nov. is based on the historical, ancient name Gallia, corresponding to the contemporary territory of France.

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LITERATURE CITED


Figure 1. Ropalopus insubricus gallicus ssp. nov., A. Male, B. Female.
RESEARCH OF AQUATIC COLEOPTERA FAUNA OF THE INNER WESTERN ANATOLIA, PART - II (COLEOPTERA: HELORPHORIDAE, HYDROCHIDAE AND HYDROPHILIDAE)

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ABSTRACT: 5185 specimens belonging to the superfamilies of the Hydrophiloidea were collected by area studies between April-September in 2007-2009 in provinces of Afyon, Denizli, Kütahya and Uşak located in the Inner Western Anatolia. As a result of identification of these specimens, 66 species group taxa (65 species and one subspecies) of 18 genera of three families belong to the order Coleoptera were determined (Helophoridae 20 species; Hydrochidae 3 species; Hydrophilidae 42 species and one subspecies).

KEY WORDS: Aquatic Coleoptera, fauna, Inner Western Anatolia, Turkey

Many field surveys were carried out between 2007-2009 with the purpose of discovering the Inner Western Anatolia aquatic Coleoptera fauna. As a result of these studies 145 species taxonomy, belonging to 7 families of Adephaga and Polyphaga (Adephaga: Gyrinidae, Haliplidae, Noteridae, and Dytiscidae; Polyphaga: Helophoridae, Hydrochidae and Hydrophilidae), have been identified. The 1st Part of this study was published with the title “Research of aquatic Coleoptera fauna of the Inner Western Anatolia, Part - I” (Darilmaz & Kiyak, 2015). In the 2nd Part of this study some species related to Helophoridae, Hydrochidae and Hydrophilidae families that have been discovered in the Inner Western Anatolia region will be presented.

This study is a part of PhD thesis of the first author (Darilmaz, 2010).

MATERIAL AND METHODS

Samples were collected from various water bodies with sieve, ladle and net having a mesh size of one millimeter. The specimens were preserved with 70 % alcohol, and in the laboratory they were cleaned off from clayey and muddy substances with a small paintbrush.

The list of localities is shown in Fig. 1.

List of localities of recorded species from the research area

BE1: AFYON: Emirdağ (Eskişehir road 5 th km, under bridge), 39°03′610″K 31°09′854″D, 933 m, 23.04.2007
BE2: AFYON: İsehisar (Seydiler, roadside pond), 38°53′846″K 30°50′142″D, 1201 m, 23.04.2007
BE3: KÜTAHYA: Altıntaş (Oluklu stream-under bridge), 39°04′869″K 30°07′557″D, 1018 m, 24.04.2007
BE4: KÜTAHYA: Between Altıntaş-Dumlupınar (exit of Genişler village-Oluklu stream), 38°58′749″K 30°06′800″D, 1064 m, 24.04.2007
BE5: AFYON: Hocalar (Devlethan village-Gümü stream), 38°31′764″K 29°58′608″D, 1011 m, 24.04.2007
BE6: DENİZLİ: Çivril (Akdağ-Kiû stream), 38°21′633″K 29°51′107″D, 896 m, 25.04.2007
BE7: DENİZLİ: Çivril (Işıklı Lake, 1st station), 38°16′077″K 29°55′498″D, 827 m, 25.04.2007
BE8: DENIZIL: Buldan (Süleymanlı Lake), 38°03′035″K 28°46′291″D, 1157 m, 26.04.2007
BE9: DENIZIL: Çal (Karapınar village-Karapınar pond), 37°46′104″K 29°07′715″D, 350 m, 26.04.2007
Between the pond of irrigation canal, 38°58′194″K 30°53′394″D, 1138 m, 18.06.2007

BE24: KÜTAHYA: Between Tavşanlı-Domaniç (Karasu stream), 39°34′921″K 29°27′852″D, 817 m, 21.05.2007

BE25: KÜTAHYA: Between Tavşanlı-Domaniç (Karaköy-Kocasu stream), 39°43′665″K 29°31′457″D, 708 m, 21.05.2007

BE26: KÜTAHYA: Tavşanlı (Güzelýurt pond), 39°29′007″K 29°34′480″D, 850 m, 21.05.2007

BE27: KÜTAHYA: Simav (Gölçük Plateau Lake), 39°09′975″K 29°05′108″D, 1309 m, 22.05.2007

BE28: KÜTAHYA: Simav (Demirciköy, puddle), 39°06′94″K 28°55′457″D, 825 m, 22.05.2007

BE29: KÜTAHYA: Şaphane (exit of Karamanca village, roadside stream), 39°00′905″K 29°09′531″D, 899 m, 22.05.2007

BE30: USAK: Ulubey (Güney road-Hamam stream), 38°17′910″K 29°08′479″D, 528 m, 23.05.2007

BE32: USAK: Esme (Isalar pond), 38°28′316″K 29°01′503″D, 800 m, 23.05.2007

BE34: AFYON: Kütahya (Çakıl dam), 39°51′823″K 29°28′057″D, 203 m, 23.05.2007

BE35: UŞAK: Eşme (İsalar pond), 38°17′910″K 29°08′479″D, 528 m, 23.05.2007

BE36: KÜTAHYA: Ihsaniye (Çeşme, pond), 39°04′785″K 30°25′553″D, 1136 m, 19.06.2007

BE37: KÜTAHYA: Ihsaniye (Doğer village, Emre pond), 39°06′507″K 30°26′403″D, 1154 m, 19.06.2007

BE38: KÜTAHYA: Söğüt (Söğüt Dam), 39°25′264″K 30°31′380″D, 1134 m, 19.06.2007

BE39: KÜTAHYA: Söğüt (Söğüt stream), 39°26′896″K 30°10′212″D, 1069 m, 19.06.2007

BE40: KÜTAHYA: Hocalar-Banaz 10th km (puddle of irrigation canal), 38°39′04″K 29°48′955″D, 997 m, 23.05.2007

BE41: KÜTAHYA: Hocalar (Devlethan village, Belağ Plateau, Aylan fountain), 38°32′444″K 29°54′556″D, 1200 m, 24.05.2007

BE42: KÜTAHYA: Hocalar (Bayat pond), 38°58′536″K 30°53′970″D, 1145 m, 18.06.2007

BE43: KÜTAHYA: Ihsaniye (Avşar stream), 38°47′393″K 30°48′221″D, 1044 m, 19.06.2007

BE44: KÜTAHYA: Ihsaniye (Ihsaniye Dam), 38°47′393″K 30°48′221″D, 1044 m, 19.06.2007

BE45: KÜTAHYA: Ihsaniye (collected on the fly), 39°03′805″K 30°24′056″D, 1110 m, 19.06.2007

BE46: KÜTAHYA: Ihsaniye (Üçlerkaya pond), 39°04′785″K 30°25′553″D, 1136 m, 19.06.2007

BE47: KÜTAHYA: Ihsaniye (Doğer village, Emre pond), 39°06′507″K 30°26′403″D, 1154 m, 19.06.2007

BE48: KÜTAHYA: Söğüt (Söğüt Dam), 39°25′264″K 30°31′380″D, 1134 m, 19.06.2007

BE49: KÜTAHYA: Söğüt (Söğüt stream), 39°26′896″K 30°10′212″D, 1069 m, 19.06.2007

BE50: KÜTAHYA: Tavşanlı (Kuruçay village-Kuruçay pond), 38°28′660″K 29°30′358″D, 1162 m, 18.06.2007

BE51: KÜTAHYA: Domaniç (Domaniç-İneğöl road 5th km, Çakıl stream), 39°50′709″K 29°38′34″D, 1126 m, 20.06.2007

BE52: KÜTAHYA: Domaniç (Domaniç-Bursa road, Çeşme), 39°50′709″K 29°38′34″D, 1126 m, 20.06.2007

BE53: KÜTAHYA: Domaniç (Domaniç-Bursa road 8th km, pond of Palazoğlu Fish facility), 39°51′823″K 29°38′393″D, 1333 m, 20.06.2007

BE54: KÜTAHYA: Çavdarhisar (Çavdarhisar Dam), 39°10′728″K 29°35′377″D, 1023 m, 20.06.2007

BE55: KÜTAHYA: Gediz (Gümeleköy Dam), 38°55′385″K 29°28′411″D, 796 m, 21.06.2007
| BE218: DENİZLİ: Çardak (Acıgöl-1st station), 37°47'759''K 29°05'329''D, 899 m, 21.05.2009 |
| BE219: DENİZLİ: Çardak (Acıgöl-2nd station), 37°49'054''K 29°55'619''D, 826 m, 30.04.2009 |
| BE220: AFYON: Dinar (Karakuyu Lake), 38°04'587''K 30°16'505''D, 1020 m, 30.04.2009 |
| BE221: AFYON: Emirdağ (Pınarbaşı Pond), 39°02'877''K 31°19'605''D, 899 m, 19.05.2009 |
| BE222: AFYON: Sultandağı (Yakasenek Village Fountain), 38°32'370''K 31°09'695''D, 1542 m, 19.05.2009 |
| BE223: AFYON: Sultandağı (Gököl-Akşehir Lake), 38°29'200''K 31°20'746''D, 953 m, 19.05.2009 |
| BE224: AFYON: Çay (Eber Lake-1st station), 38°36'828''K 31°08'467''D, 968 m, 19.05.2009 |
| BE225: AFYON: Çay (Eber Lake-2nd station), 38°36'875''K 31°09'611''D, 973 m, 19.05.2009 |
| BE226: AFYON: Çay (Karamik marshy place-1st station), 38°25'271''K 30°53'690''D, 1014 m, 20.05.2009 |
| BE227: AFYON: Çay (Karamik marshy place-2nd station), 38°26'936''K 30°50'248''D, 1009 m, 20.05.2009 |
| BE228: AFYON: İhsaniye (Döğer Village, Emre Pond 2nd station), 39°06'607''K 30°26'403''D, 1154 m, 20.05.2009 |
| BE229: KÜTAHYA: Simav (between Söğüt Village-Gökçeler Village 4th km, roadside stream), 39°05'332''K 29°03'129''D, 898 m, 21.05.2009 |
| BE230: KÜTAHYA: Simav (Gökçeler Village-irrigation Pond), 39°06'124''K 29°02'179''D, 834 m, 21.05.2009 |
| BE231: KÜTAHYA: Simav (Örenli Village-Örenli Pond), 39°11'741''K 28°53'882''D, 819 m, 21.05.2009 |
| BE232: DENİZLİ: Çivril (Gökğöl Village-Işıklı Lake 2nd station), 38°12'375''K 30°02'332''D, 1118 m, 21.05.2009 |
| BE233: DENİZLİ: Çivril (Gökğöl Village-Işıklı Lake 3rd station), 38°11'656''K 30°03'523''D, 830 m, 21.05.2009 |
| BE234: DENİZLİ: Honaz (Kzalyer Town, roadside stream), 37°45'842''K 29°22'108''D, 804 m, 22.05.2009 |
| BE235: AFYON: Dinar (Karakuyu Lake-1st station), 38°04'587''K 30°16'505''D, 1020 m, 22.05.2009 |
| BE236: AFYON: Dinar (Karakuyu Lake-Karakuyu Lake-2nd station), 38°03'999''K 30°14'776''D, 1004 m, 22.05.2009 |
| BE237: AFYON: Emirdağ (Pınarbaşı Pond), 39°02'877''K 31°19'605''D, 899 m, 17.06.2009 |
| BE238: AFYON: Emirdağ (Kemerkaya Town, Pancarlı Stream), 38°51'874''K 31°10'088''D, 1435 m, 17.06.2009 |
| BE239: AFYON: Emirdağ (Kemerkaya Town-Yapraçlı district, roadside stream), 38°54'040''K 31°07'468''D, 1236 m, 17.06.2009 |
| BE240: AFYON: Çay (Pazarağaç Town-Dervendöğü farm district, roadside puddle), 38°36'867''K 30°51'268''D, 996 m, 17.06.2009 |
| BE241: AFYON: Çay (Eber Lake-1st station), 38°36'875''K 31°09'611''D, 973 m, 17.06.2009 |
| BE242: AFYON: Çay (Karamik marshy place-1st station), 38°25'271''K 30°53'090''D, 1014 m, 18.06.2009 |
| BE243: AFYON: Çay (Karamik marshy place-2nd station), 38°26'936''K 30°50'248''D, 1009 m, 18.06.2009 |
| BE244: AFYON: İhsaniye (Döğer Village, Emre Pond), 39°06'607''K 30°26'403''D, 1154 m, 18.06.2009 |
| BE245: AFYON: İhsaniye (Döğer Village, Emre Pond, 2nd station), 39°06'607''K 30°26'403''D, 1154 m, 18.06.2009 |
| BE246: KÜTAHYA: Türkmen Mt. (Söğüt Plateau-stream), 39°23'713''K 30°19'218''D, 1373 m, 18.06.2009 |
| BE247: KÜTAHYA: Tavşanlı (entry Dereli Village-roadside pond), 39°29'283''K 29°14'820''D, 603 m, 19.06.2009 |
| BE248: KÜTAHYA: Tavşanlı (Ormanlı Village-Emet Stream), 39°29'234''K 29°11'633''D, 498 m, 19.06.2009 |
| BE249: USAK: Ulubey (stream in Ulubey canyons), 38°24'306''K 29°18'487''D, 563 m, 20.06.2009 |
| BE250: DENİZLİ: Çivril (Gökğöl Village-Işıklı Lake 2nd station), 38°12'375''K 30°02'332''D, 1118 m, 20.06.2009 |
RESULTS

Helophoridae Leach, 1815

Helophorus (Empelurus) nubilus Fabricius, 1777

Helophorus (Empelurus) micans Faldermann, 1835

Helophorus (Helophorus) aquaticus (Linnaeus, 1758)

Helophorus (Helophorus) liguricus Angus, 1970
Material examined: BE206: 1 ex.

Helophorus (Helophorus) syriacus Kuwert, 1885

Helophorus (Rhopalohelophorus) abeilii Guillebeau, 1896
Material examined: BE40: 12 ex.; BE96: 3 ex.

Helophorus (Rhopalohelophorus) brevipalpis Bedel, 1881

Helophorus (Rhopalohelophorus) daedalus d’Orchymont, 1932

Helophorus (Rhopalohelophorus) discrepans Rey, 1885
Helophorus (Rhopalohelophorus) flavipes Fabricius, 1792
Material examined: BE240: 8 ex.

Helophorus (Rhopalohelophorus) griseus Herbst, 1793

Helophorus (Rhopalohelophorus) helenae Angus, 1998

Helophorus (Rhopalohelophorus) illustris Sharp, 1916
Material examined: BE8: 5 ex.; BE70: 5 ex.; BE162: 27 ex.

Helophorus (Rhopalohelophorus) lapponicus Thomson, 1853

Helophorus (Rhopalohelophorus) lewisi Angus, 1985
Material examined: BE3: 5 ex.; BE130: 8 ex.

Helophorus (Rhopalohelophorus) longitarsis Wollaston, 1864

Helophorus (Rhopalohelophorus) montenegrinus Kuwert, 1885
Material examined: BE166: 2 ex.

Helophorus (Rhopalohelophorus) nanus Sturm, 1836
Material examined: BE245: 8 ex.

Helophorus (Rhopalohelophorus) obscurus Mulsant, 1844

Helophorus (Rhopalohelophorus) pallidipennis Mulsant & Wachanru, 1852
Material examined: BE3: 1 ex.

Helophorus (Rhopalohelophorus) subcarinatus Angus, 1985

Hydrochidae Thomson, 1859
Hydrochus elongatus (Schaller, 1783)

Remarks: This species has been published as a new record for the fauna of Turkey (Darialmaz & Kiyak, 2008).

Hydrochus flavipennis Kuster, 1852

Hydrochus ignicollis Motschulsky, 1860
Material examined: BE157: 17 ex.; BE241: 1 ex.

Hydrophilidae Latreille, 1802
Anacaena limbata (Fabricius, 1792)

Anacaena lutescens (Stephens, 1829)

Paracymus aeneus (Germar, 1824)
Paracymus relaxus Rey, 1884
Material examined: BE70: 1 ex.
Remarks: This species has been published as an exact locality for the fauna of Turkey (Darilmaz & Kıyak, 2009a).

Berosus (Berosus) affinis Brullé, 1835

Berosus (Berosus) luridus (Linnaeus, 1760)

Berosus (Berosus) signaticollis (Charpentier, 1825)

Berosus (Enoplurus) frontifoveatus Kuwert, 1888

Chaetarthria seminulum (Herbst, 1797)
Material examined: BE63: 1 ex.; BE70: 1 ex.

Chasmogenus livornicus (Kuwert, 1890)
Remarks: This species has been published as an exact locality for the fauna of Turkey (Darilmaz & Kıyak, 2009a).

Cymbiodyta marginella (Fabricius, 1792)

Enochrus (Enochrus) melanocephalus (Olivier, 1792)

Enochrus (Lumetus) ater (Kuwert, 1888)
Material examined: BE169: 8 ex.

Enochrus (Lumetus) bicolor (Fabricius, 1792)

Enochrus (Lumetus) fuscipennis (Thomson, 1884)

Enochrus (Lumetus) halophilus (Bedel, 1878)
Material examined: BE240: 57 ex.
Remarks: This species has been published as a new record for the fauna of Turkey (Darilmaz & Kıyak, 2009b).

Enochrus (Lumetus) politus (Küster, 1849)
Material examined: BE196: 8 ex.
Remarks: This species has been published as a new record for the fauna of Turkey (Darilmaz & Kıyak, 2009b).

Enochrus (Lumetus) quadruplicatus (Herbst, 1797)
Material examined: BE34: 7 ex.; BE137: 6 ex.
Enochrus (Lumatetis) testaceus (Fabricius, 1801)

Enochrus (Methydrus) coarctatus (Gredler, 1863)

Enochrus (Methydrus) nigritus (Sharp, 1872)

Helochares (Helochares) lividus (Forster, 1771)

Helochares obscurus (O. F. Müller, 1776)

Helochares punctatus Sharp, 1869

Hydrobius fuscipes (Linnaeus, 1758)

Limnoxenus niger (Gmelin, 1790)

Hydrochara caraboides (Linnaeus, 1758)

Hydrochara dichroma (Fairmaire, 1892)

Hydrochara flavipes (Steven, 1808)
Material examined: BE87: 3 ex.; BE197: 2 ex.; BE219: 1 ex.; BE224: 2 ex.

Brownephilus major (İncekara, Mart, Polat & Karaca, 2009)
Material examined: BE235: 5 ex.; BE251: 2 ex.
Remarks: This species has been published as a new combination and first female description (Darilmaz et al., 2010).

Hydrophilus (Hydrophilus) piceus (Linnaeus, 1758)

Laccobius (Dimorpholaccobius) bipunctatus (Fabricius, 1775)
**Laccobius** (*Dimorpholaccobius*) obscuratus aegaeus Gentili, 1974

**Laccobius** (*Dimorpholaccobius*) scutellaris Motschulsky, 1855
Material examined: BE256: 6 ex.

**Laccobius** (*Dimorpholaccobius*) simulatrix d'Orchymont, 1932

**Laccobius** (*Dimorpholaccobius*) striatulus (Fabricius, 1801)

**Laccobius** (*Dimorpholaccobius*) sulcatulus Reitter, 1909

**Laccobius** (*Dimorpholaccobius*) syriacus Guillebeau, 1896

**Laccobius** (*Microlaccobius*) gracilis Motschulsky, 1855

**Coelostoma** (*Coelostoma*) orbiculare (Fabricius, 1775)

**Cercyon** (*Cercyon*) circumcinctus Reitter, 1889

LITERATURE CITED


Figure 1. Map of study area showing sample localities (black dot).
DISTRIBUTION OF CALLERGATES GAILLARDOTI (CHEVROLAT) (COLEOPTERA: CERAMBYCIDAE: PRIONINAE) IN THE EASTERN MEDITERRANEAN REGION

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ABSTRACT: Callergates gaillardoti (Chevrolat) (Coleoptera: Cerambycidae: Prioninae), an endangered species on the European Red List of Saproxylic Beetles, is reported from Greece (Rhodes, Samos and Lesbos Islands), Cyprus, Lebanon, Syria and Turkey. It also has been introduced into Egypt (North Africa). In Turkey, it occurs in Adana, Antalya, Aydın, Hatay, İçel, Konya, Muğla and Osmaniye provinces. Known host plants include the species of Pinus (Pinaceae), e.g. Pinus brutia, Pinus halepensis, Pinus nigra, Pinus pinea, Pinus sylvestris.

KEY WORDS: Callergates gaillardoti, longhorned beetle, distribution, host plants
and climatic changes. Turkey is located at an intersection of geographical regions with large climatic and geographical gradients as well as a diversity of ecosystems and habitats (Kahraman et al., 2011; International Union for Conservation of Nature, 2012; Avgın et al., 2015). The great biological importance of Turkey is evident from the remarkable variety of arthropods in Turkey. The coleopteran fauna of Turkey is estimated to include 25,000 species (Koçak & Kemal, 2009). As a result of this, Turkey plays an important geographic and ecological role in safeguarding biodiversity.

Biodiversity is under severe pressure in Turkey, and region-wide conservation efforts must be implemented to avoid extinction of threatened species. Such conservation efforts can be aided by identification of emblematic umbrella species to help market, advertise, and generate public support (Avgın et al., 2015). The deadwood habitat of native tree species is under severe pressure among the many habitats and species threatened in Turkey (Avcı et al., 2010; Coşkun et al., 2010; Gürkan et al., 2010; Avgın et al., 2015). Callergates gaillardoti is among the saproxylic beetles of that habitat and, in Europe, is considered “Endangered” (Nieto & Alexander, 2010). Thus, the primary objective of this paper is to define the known distribution of this insect along with information on its ecological habits and host plants. In addition, a bibliography of previous studies related to this species is included.

MATERIALS AND METHODS

The material of this work is a comprehensive review of the scientific literature that was conducted to delineate the known distribution of Callergates gaillardoti. Host plants and ecological habits were recorded when available. Additional surveys for this insect were conducted by many researchers and are reported herein. We included information and data that are important in assessing the level of threat to the species. These protocols included geographic range, population data, and habitat preferences (Nieto & Alexander, 2010; International Union for Conservation of Nature, 2012). Information and data of this species are presented under the title Taxonomic history, Reported occurrence in Turkey, Reported occurrence outside Turkey, Host plants, Life cycle and biology and Status and conservation of threatened species. Moreover, a distribution map of Callergates gaillardoti in the Eastern Mediterranean Region is also given (Fig. 1). Reported occurrences in Turkey and World with bibliographic citations are also provided (Tables 1 and 2).

RESULTS AND DISCUSSION

Taxonomic history. The prionine genus Callergates was erected by Lameere (1904) as a subgenus of the genus Ergates Audinet-Serville, 1832 with the type species Ergates gaillardoti Chevrolat, 1854. Earlier authors considered Callergates a subgenus of Ergates (Lameere 1904, Nishio 1956). More recent authors consider it as a separate genus (Villiers, 1978; Jeniš, 2001, 2008; Löbl & Smetana, 2010; Özdikmen, 2013, 2014; Danilevsky, 2016).

The Palearctic genus Callergates includes only 2 described taxa as Ergates gaillardoti and Ergates akbesianus. The type species, Ergates gaillardoti, was described by Chevrolat (1854) from Saida (Lebanon). And Ergates akbesianus was described by Pic (1900) from “Haute Syrie: Akbès” that is in Hatay province of Turkey, not Syria. This taxon is a synonym of Callergates gaillardoti (Chevrolat, 1854). Thus, Callergates is still a monotypic genus.
Reported occurrence in Turkey. *Callergates gaillardoti* is reported as occurring in 8 of Turkey’s 81 provinces (Fig. 1). These are Adana, Antalya, Aydn, Hatay, Icel, Konya, Mugla and Osmaniye provinces. Location reports along with specific citation(s) of those reports are listed in Table 1.

Reported occurrence outside Turkey. *Callergates gaillardoti* is recorded from the Western Palaearctic Region from Greece to Lebanon, Southeast Europe (Greece and Cyprus), Turkey (Anatolia), Middle East (Syria, Lebanon). It also has been introduced into Egypt (Alfieri, 1916; Löbl & Smetana, 2010; Özdikmen, 2016; Danilevsky, 2016). Citations of confirmed occurrence of *Callergates gaillardoti* are listed in Table 2, and the recorded distribution is shown in Fig. 1.

Host plants. *Callergates gaillardoti* is apparently monophagous in conifers (*Pinus* spp.) and develops in dead decaying trunk and in dead stumps of the host plants such as *Pinus pinea* (Demelt, 1963), *Pinus sylvestris* (Welnicki & Przewoźny, 2007), *Pinus brutia* (Sama et al., 2012), *Pinus nigra* and *Pinus brutia* (Cihan et al., 2013), *Pinus halepensis* (Hoskovec et al., 2016). Specimens from Turkey were found on or in the conifer species *Pinus brutia*, *Pinus nigra* and *Pinus pinea* either as adults or larvae (Demelt, 1963; Svacha & Danilevsky, 1987; Adlbauer, 1988; Sama et al., 2012; Cihan et al., 2013).

Life cycle and biology. *Callergates gaillardoti* larvae live in dead decaying trunk and in dead stumps of the host plants (Sama et al., 2012; Özdikmen, 2013; Hoskovec et al., 2016). Adults and larvae can be collected only from the host plants growing in lowland and foothill habitats between 150 and 1,467 m above sea level. Duration of the life cycle is at least 3 years. The overwintering stage is most likely the larval stage. Larvae live in dead decaying trunk and in dead stumps of the host plants. Pupation occurs in the wood (in pupal cell) in the spring and summer. Adults probably are crepuscular, nocturnal, and are attracted to light. They actively fly in spring and summer (between May and August) (Demelt, 1963; Svacha & Danilevsky, 1987; Adlbauer, 1988; Sama et al., 2012; Özdikmen, 2013; Hoskovec et al., 2016).

Status and conservation of threatened species. Nieto & Alexander (2010) report that 6% of the species of saproxylic beetles are considered Endangered in Europe. *Callergates gaillardoti* is included in those 26 species. According to Özdikmen (2016), *C. gaillardoti* is probably rather widely distributed in SW Turkey and suggested that the species be listed in the category of Vulnerable in the Turkish Red List. Based on its distribution, collection dates, and records from Turkey, we concur with that placement.

LITERATURE CITED


Atay, E., Jansson, N. & Gürkan, T. 2012. Saproxylic beetles on old hollow oaks (*Quercus* spp.) in a small isolated area in southern Turkey (Insecta: Coleoptera). Zoology in the Middle East, 57: 105-114.


Table 1. Distribution of *Callergates gaillardoti* in Turkey by province, with bibliographic citation of occurrence.

<table>
<thead>
<tr>
<th>Province</th>
<th>Locality</th>
<th>Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adana</td>
<td>Çukurova Univ. (Campus of Balçalı)</td>
<td>Özdikmen, 2006</td>
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<tr>
<td>Adana</td>
<td>Feke</td>
<td>Adlbauer, 1988</td>
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<tr>
<td>Adana</td>
<td>Karaisah (Yenigözleğen)</td>
<td>Cihan et al., 2013</td>
</tr>
<tr>
<td>Adana</td>
<td>Karataş</td>
<td>Demelt, 1963</td>
</tr>
<tr>
<td>Adana</td>
<td>Kozan</td>
<td>Atay et al., 2012</td>
</tr>
<tr>
<td>Adana</td>
<td>Unreported</td>
<td>Öymen, 1987</td>
</tr>
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<td>Antalya</td>
<td>Alanya (Çıralı bridge)</td>
<td>Özdikmen &amp; Çağlar, 2004</td>
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<tr>
<td>Antalya</td>
<td>Alanya (Güzelbağ)</td>
<td>Adlbauer, 1988</td>
</tr>
<tr>
<td>Antalya</td>
<td>Bey Mts.</td>
<td>Demelt, 1963</td>
</tr>
<tr>
<td>Antalya</td>
<td>Çayarası-Alanya (Sarmut bridge env.)</td>
<td>Özdikmen &amp; Turgut, 2009; Turgut &amp; Özdikmen, 2010</td>
</tr>
<tr>
<td>Antalya</td>
<td>Manavgat (Kumköy)</td>
<td>Demelt, 1963</td>
</tr>
<tr>
<td>Antalya</td>
<td>Manavgat</td>
<td>Özdikmen &amp; Demir, 2006</td>
</tr>
<tr>
<td>Antalya</td>
<td>Unreported</td>
<td>Öymen, 1987</td>
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<tr>
<td>Aydın</td>
<td>Didim (Yenihisar)</td>
<td>Özdikmen, 2006</td>
</tr>
<tr>
<td>Hatay</td>
<td>Hassa (Akbez)</td>
<td>Pic, 1897, 1900</td>
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<tr>
<td>Hatay</td>
<td>Nur Mts. (E of Dörtyol)</td>
<td>Sama et al., 2012</td>
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<tr>
<td>İçel</td>
<td>Anamur (Sarıyayla)</td>
<td>Cihan et al., 2013</td>
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<tr>
<td>İçel</td>
<td>Çamlıyayla (İledin)</td>
<td>Cihan et al., 2013</td>
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<tr>
<td>İçel</td>
<td>Çamlıyayla (Namrun)</td>
<td>Svacha &amp; Danilevsky, 1987</td>
</tr>
<tr>
<td>İçel</td>
<td>Erdemili (Hacalari)</td>
<td>Cihan et al., 2013</td>
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<tr>
<td>İçel</td>
<td>Mezitli (Kuyuluk)</td>
<td>Cihan et al., 2013</td>
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<td>İçel</td>
<td>Mut (Alahan)</td>
<td>Cihan et al., 2013</td>
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<tr>
<td>İçel</td>
<td>Silifke</td>
<td>Cihan et al., 2013</td>
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<td>İçel</td>
<td>Silifke (Karakaya)</td>
<td>Cihan et al., 2013</td>
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<td>Tarsus (Ayvalı)</td>
<td>Cihan et al., 2013</td>
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<tr>
<td>Konya</td>
<td>Beyreli</td>
<td>Özdikmen &amp; Turgut, 2009; Turgut &amp; Özdikmen, 2010</td>
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<tr>
<td>Muğla</td>
<td>Köyceğiz</td>
<td>Özdikmen, 2006</td>
</tr>
<tr>
<td>Osmaniye</td>
<td>Zorkun (Plateau of Mitis)</td>
<td>Özdikmen &amp; Turgut, 2009</td>
</tr>
<tr>
<td>Turkey</td>
<td></td>
<td>Lodos, 1998; Sama &amp; Rapuzzi, 2000; Özdikmen, 2006; Swift et al., 2010; Löbl &amp; Smetana, 2010; Danilevsky, 2016</td>
</tr>
</tbody>
</table>

Table 2. Reported global occurrence of *Callergates gaillardoti*, with bibliographic citations.

<table>
<thead>
<tr>
<th>Reported Countries</th>
<th>Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyprus</td>
<td>Sama, 1994; Özdikmen &amp; Turgut, 2009; Löbl &amp; Smetana, 2010; Özdikmen, 2014, 2016; Hoskovec et al., 2016; Danilevsky, 2016</td>
</tr>
<tr>
<td>Greece (Lesbos Island)</td>
<td>Drumont &amp; Dauber, 2011</td>
</tr>
</tbody>
</table>
Figure 1. Distribution of *Callergates gaillardoti* in provinces of Turkey, Eastern Mediterranean basin, and other countries.
A NEW SUBSPECIES OF CERAMBYX CERDO LINNAEUS, 1758 FROM BULGARIA (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT: A new subspecies, Cerambyx cerdo masaryki ssp. nov. coming from southeast Bulgaria is described. The subspecies is still endemic to Bulgaria. The subspecies was compared with species of the genus Cerambyx L., and particularly with subspecies of Cerambyx cerdo Linnaeus, 1758, i.e. with C. cerdo acuminatus Motschulsky, 1852, C. cerdo pfisteri Stierlin, 1864, C. cerdo mirbecki Lucas, 1842, C. cerdo Linnaeus, 1758 and C. cerdo klinzigi Podaný, 1964.

KEY WORDS: Coleoptera, Cerambycidae, Cerambycinae, Cerambyx cerdo, new subspecies, Bulgaria

Cerambyx cerdo masaryki ssp. nov.

Body: Completely brown, including legs and antennae. Body underside bright, with short and very sparse setae, rather present on lateral areas of abdomen only.

Elytra: Brown, less converging backward from humeri, rather wider in posterior half. Elytra 2.4 times longer than wide at humeri. Apical thorns of elytra mostly blunter and shorter. Elytral sculpture very finely wrinkled in anterior half, nearly smooth apically.

Scutellum: Brown, narrower and blunter in general.

Pronotum: Brown, lateral thorn mostly blunter and shorter. Pronotum with relatively coarse and deep, fairly regular sculpture, usually with parallel transversal scratches.

Head: Brown, head vertex with finer punctures. Eyes larger, more dilated on inferior and anterior sides. Last palpmere more elongate.

Antennae: Dark brown, distinctly slimmer in males as well as females. Antennomeres less swollen, with coarser punctuation. Male antennae mostly shorter, exceeding body length by less than elytra length (by 0.8 elytra length on average). Female antennae reaching or slightly exceeding ends of elytra. Male ultimate antennomere considerably short.

Legs: Legs considerably shorter relatively to body size. Femora and tibiae shorter and slimmer. Underside of tibiae wrinkled at base of anterior legs only. Protarsomeres narrower, more wedge-shaped.

Body size: Males: 35-36 mm, females: 44-47 mm.

Ecology: It develops in oaks (Quercus L.); observed flying in oak forests, in the twilight. The main swarming period: late June and early July.

**Differential diagnosis:** The new subspecies *C. cerdo masaryki* ssp. nov. inhabits oak forests in surroundings of the seaside town Burgas on the Black Sea coast, in southeast Bulgaria. It was compared with all the species and subspecies of the genus *Cerambyx* L. kept in my collection, and particularly with all the subspecies of *Cerambyx cerdo* Linnaeus, 1758. It exerts a considerable difference in colour; it is the only entirely brown subspecies of the species *C. cerdo* Linnaeus, 1758. In addition, it can also be characterised by other different features, such as shorter antennae (particularly in males) and shape of antennomeres, which are narrower and not as much swollen as in other subspecies of *C. cerdo* Linnaeus, 1758. The elytra are not apically narrowed as in the nominotypical form; they are widened in posterior half. The elytral sculpture is finer compared to all other subspecies. Legs are shorter and thinner relatively to the body size compared to *C. cerdo* Linnaeus, 1758, in which the legs are distinctly longer and stronger. In addition, the nominotypical form has also markedly long antennae, which exceed the body length by the elytra length or even more. I thoroughly compared all males and females and found the new subspecies *C. cerdo masaryki* ssp. nov. to be considerably different from the nominotypical form as well as from all the subspecies of *C. cerdo* Linnaeus, 1758. The other subspecies compared were as follows: *C. cerdo klinzigi* Podaný, 1964, which is conspicuously different by having very wide and short elytra, stronger legs and bent tibiae; the subspecies *C. cerdo acuminatus* Motschulsky, 1852 has a very coarse elytral sculpture, stout body and very considerable, long thorns of the elytral apex; the subspecies *C. cerdo mirbecki* Lucas, 1842 has very characteristic pubescence of the elytra, which are covered with greyish white hairlike setae throughout.

**Etymology:** The new subspecies *C. cerdo masaryki* ssp. nov. was named in honour of T. G. Masaryk (1850–1973), a statesman, philosopher and pedagogue, and the first president of Czechoslovakia – in period of 1918 to 1935.

Distribution of particular *Cerambyx cerdo* subspecies in Palaearctic region:


**ACKNOWLEDGEMENTS**

I would like to thank M. Sláma (Praha, Czech Republic), M. Danilevsky (Moscow, Russia), J. Pumr (Praha, Czech Republic), D. Loupanec (Zlin, Czech Republic), for important data. My thanks are extended to Prof. Ing. Miloslav Raković (Dobřichovice, Czech Republic), for professional translation into English language.

**LITERATURE CITED**


Figure 1. *Cerambyx cerdo masaryki* ssp. nov., A. Male, B. Female.
CONTROL OF FLEA BEETLE *PODAGRICA* SPP. (COLEOPTERA: CHRYSOMELIDAE) WITH ENTOMOPATHOGENIC FUNGUS *BEAUVERIA BASSIANA* (BALSAMO) VUILLEMIN IN OKRA (*ABELMOSCHUS ESCULENTUS*) (L.) MOENCH

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** Department of Pure and Applied Zoology, Federal University of Agriculture, P.M.B 2240, Abeokuta, Ogun State, NIGERIA.


ABSTRACT: The effectiveness of entomopathogenic fungus, *Beauveria bassiana* at controlling infestation of *Podagrica* spp. in okra field was evaluated at a low-land farm (FADAMA) and University Farms site of Federal University of Agriculture, Abeokuta, Ogun State in 2014 late and 2015 early planting seasons respectively. The experiment was laid out in a split plot arrangement fitted into Randomized Complete Block Design. The main plot consisted of two flea beetle susceptible okra varieties (NH99/DA and LD88/1-8-5-2) and sub-treatment was the spray regime (*B. bassiana* and Lambda-cyhalothrin). The control was the unsprayed okra plots. The isolate of Botanigard 22WP-*Beauveria bassiana* strain GHA was mixed with water in a knapsack sprayer and applied to the leaves of okra plants from 2 WAP at 3.57g/1.5L of water and repeated at weekly interval for 6 weeks. Lambda-cyhalothrin, a synthetic insecticide which served as a check was mixed with water in a knapsack sprayer at 0.5ml/0.96L of water and repeated at weekly interval. The Na, Cu, Ca, Mg, P, Fe, K and proximate composition of *B. bassiana*-treated and untreated okra fruits were determined. Irrespective of season, number of flea beetles per plant, percentage of damaged leaves and pods in *B. bassiana*-treated okra plots were comparable to the ones from okra plants treated with lambda-cyhalothrin. They were however, significantly (P<0.05) lower to the ones from untreated okra plots. The fruit yield from plots treated with *B. bassiana* and lambda-cyhalothrin were comparable (P>0.05) and significantly (P<0.05) higher than the yield from the untreated plots. The proximate composition and minerals evaluated in *B. bassiana*-treated okra fruit were not significantly different (P>0.05) from the composition of untreated okra fruits The study concluded that entomopathogenic fungus, *B. bassiana* reduced the number of *Podagrica* spp. in treated okra plants and enhanced yield. The use of the treatment is therefore recommended for the control of *Podagrica* spp. in okra field.

KEY WORDS: Entomopathogenic fungus, *Beauveria bassiana*, *Podagrica* spp., lambda-cyhalothrin, proximate composition

Okra “*Abelmoschus esculentus*” is an important vegetable crop that supplies carbohydrate, protein, fat, minerals, fibre and other substances that enhance healthy growth of human being (Gopalan et al., 2007). The crop is an economically important vegetable crop grown in tropical and sub-tropical parts of the world as a garden crop as well as on large commercial farms (Thompson & Kelly, 1979). Okra is grown for its pods which are harvested while they are still immature and used in salads and soups, consumed raw, cooked or fried (Moniruzzaman et al., 2007). The crop is used in curing diseases such as genito-
urinary disorders, spermatorrhoea, chronic dysentery, ulcers and hemorrhoids (Adams, 1975).

Many pests have been reported to attack the crop at different stages of growth (Critchley, 1997; Praveen & Dhandapani, 2001; Dabire-Binso et al., 2009; Echezona et al., 2010). They include species that damage the foliage, shoots, flowers and pods. Hill (1987) identified nine insect species as serious pests of this crop worldwide: *Aphis gossypii* (Glov.), *Empoasca spp.*, *Ferrisia virgata* (Ckll.), *Dysdercus spp.*, *Oxyacrenus hyalipennis* (Costa), *Earias vittella* (Stoll.), *Earias boplaga* (Wlk.), *Earias insulana* (Boisd.) and *Helicoverpa armigera* (Hub.). The crop is also subject to attack by flea beetles, *Podagrica* spp that infest the seedlings and cause damage of economic importance by feeding on the leaves (Praveen & Dhandapani 2001, Seif & Varela 2004). Flea beetle is a general name applied to the small, jumping beetles of the leaf beetle family (Chrysomelidae) (Metcalf & Metcalf, 1993). The adult flea beetle is a very small to moderately sized Chrysomelidae that is difficult to control due to its high mobility ((Metcalf & Metcalf, 1993; Clark, 2005). Flea beetles cause the greatest damage by feeding on cotyledons, stems and foliage. The small round holes caused by an individual flea beetles feeding may coalesce into larger areas of damage under high infestation (Hines & Hutchinson, 1997; George, 2003). This extensive damage to leaves reduces the leaf area available for photosynthesis and the amount of food available for plant use, leading to yield reduction or complete loss in high infestations (Odebiyi, 1980; Ajibola, 1984; Indra & Kamini, 2003).

Koay & Chua (1978) reported that okra yield can be up to 30 t/ha, but could be constrained to 5–10 t/ha in most developing countries as a result of extensive damage by flea beetles. Echezona et al. (2010) reported that *Podagrica uniforma* and *Podagrica sjostedt* are the most destructive in West Africa. The larval and adult stages of the flea beetle have chewing mouthparts, which they use effectively below ground (larvae) and above ground (adults) to cause damage. In addition, scars on fruits and foliage from above-ground feeding may render produce unmarketable (Ambrosino, 2008). Severe damage to above-ground plant parts can kill seedlings, and in older plants can lead to crop stress, reduced growth, stunting, and eventual death (Caldwell et al., 2005). Some species are vector of serious diseases such as okra mosaic virus, potato blight and bacterial wilt of corn (Hill, 1987; Metcalf & Metcalf, 1993; George, 2003).

There are several commercial insecticides recommended to control flea beetles. However, these insecticides have broad-spectrum actions that kill beneficial insects in addition to the targeted pest. This has contributed to the environmental pollution through air or as residues in food. In the last few years, the use of environmentally friendly bio-pesticides that support sustainable crop production is being developed as alternative methods of pest control (Berry, 1998). *Microbial pesticides* consist of a microorganism (e.g., a bacterium, fungus, virus, or protozoan) as the active ingredient. Microbial pesticides can control many different kinds of pests, although each separate active ingredient is relatively specific for its target pest (Cranshaw & Baxendale, 2005).

*Beauveria bassiana* is a fungus commonly found in many soils, and it causes a disease in insects known as “white muscadine” (Parker et al., 2012). It grows naturally in the soil throughout the whole world and acts as parasite on various arthropods species causing white muscardine disease. It is being used as a biological insecticide to control a number of pests such as termites, thrips, whiteflies, aphids and different beetles. The specie is named after the Italian entomologist Agostino Bassi, who discovered it in 1835. It was formerly known as *Tritirachium shiota* while the name *Beauveria bassiana* has long been used to
describe a specie complex of morphologically similar and closely related isolates. The fungus, *B. bassiana* was reported to be highly virulent by producing more spores from the fungus that grows out of the cadaver of killed insect thus increasing the chance for other individuals to be killed. When the microscopic spores of the fungus is in contact with the body of an insect host, they germinate, penetrate the cuticle, and grow inside, killing the insect within a matter of days. Afterwards, a white mould emerges from the cadaver and produces new spores. A typical isolate of *B. bassiana* can attack a broad range of insects and various isolates differ in their host range (Mul et al., 2009; Kaoud, 2010).

*Beauveria bassiana* can be used as a biological insecticide to control a number of pests such as termites, whiteflies, and many other insects. The fungus rarely affects humans or other animals, so it is generally considered safe as an insecticide. This study therefore evaluates the effectiveness of entomopathogenic fungus for the control of flea beetles in okra plots.

**MATERIALS AND METHODS**

The study was conducted at the at low land and Directorate of University Farm sites of Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State in the late 2014 planting season and early 2015 planting season respectively. The areas are located in Latitude 7º 5’N and Longitude 3º 25’E (Altitude 108 m) in the Derived Savannah zone with mean annual rainfall of 1200 mm. The experiment was laid out in a split plot arranged in a Randomized Complete Block Design with three replicates. In both seasons, the main plot was 7 m X 7 m (49 m²) and 2m space between the plots. There were two okra varieties namely NH 99/DA and LD 88/1-8-5-2. The sub-treatments consisted of sprayed regime (*Beauveria bassiana* (Entomopathogenic fungus) and lambda cyhalothrin (Insecticides) and unsprayed regime which served as control. The sub plot was 2 m X 2 m with 0.5 m space between them.

The isolate of Botanigard 22WP- *Beauveria bassiana* strain GHA in wettable powder was mixed with water in a knapsack sprayer at 3.57g/1.5L of water and applied to the leaves of okra plants from 2WAP. Subsequent spraying was done on weekly basis according to the recommendation of the insecticide’s manufacturer. Lambda-cyhalothrin insecticide was mixed with water in a knapsack sprayer at 0.5ml/0.96L of water. Repeated spraying was done on weekly basis.

Data on plant height was taken at 3, 6 and 9 weeks After Planting (WAP). Number of flea beetles per plant was counted on the upper and lower surfaces of the leaves of fifteen tagged okra plants in the middle row as from 4WAP till 8WAP at weekly interval. The counting was done between the hours of 7.00am – 10.00am when the insects were still relatively inactive. The number of leaves per plant was noted at physiological maturity and the percentage leaf damaged was calculated as:

\[ \text{Percentage Leaf Damaged} = \frac{\text{Number of damaged leaves}}{\text{Total number of leaves}} \times 100 \]

Data on yield parameters were collected on number of pods per plant, pod weight per plots, number and weight of damage pods. Percentage of damaged pods was calculated as:

\[ \% \text{ pod damaged} = \frac{\text{Number of damaged pods}}{\text{Total number of pods}} \times 100 \]
The proximate and mineral composition of okra fruits from plots treated with entomopathogenic fungus *Beauveria bassiana* were determined using the method of AOAC (2000) and compared with the proximate and mineral composition of okra fruits from the untreated plots.

**Analysis of data**

Data on insect count were transformed using square root transformation method ($\sqrt{(\kappa + 0.5)}$, where $\kappa$ was the number of insect counted). Data obtained were subjected to Analysis of Variance (ANOVA) and significant means (P<0.05) were separated using Least Significant Difference (LSD).

**RESULTS**

**Number of Podagrica spp. and pod yield of okra plants treated with Beauveria bassiana and Lambda-cyhalothrin**

Table 1 shows the number of flea beetles per plant in both 2014 and 2015 planting seasons. In both seasons, okra plants treated with entomopathogenic fungus *Beauveria bassiana* and lambda-cyhalothrin had significantly (P<0.05) lower number of flea beetles relative to the unsprayed treatment. However, the number of flea beetles from *Beauveria bassiana*-treated okra plots were not significantly (P>0.05) different from the number in lambda-cyhalothrin treated okra plots in both years. The number of flea beetles on both okra varieties were not significantly (P>0.05) different from each other irrespective of planting season.

In 2004 planting season, the pod yield in the variety “NH 99/DA” was 517.2 g, 497.1 g and 366.62 g in plots treated with EPF, lambda-cyhalothrin and the untreated plots respectively. In the variety “LD 88/1-8-5-2”, it was 517.0 g, 508.2 g and 391.9 g in plots treated with EPF, lambda-cyhalothrin and the untreated plots respectively. Significantly (P<0.05) higher okra pods were obtained from plots treated with *B. bassiana* and lambda-cyhalothrin compared to the ones from plots treated with *B. bassiana* and lambda-cyhalothrin. The pod yield from okra plots treated with *B. bassiana* and lambda-cyhalothrin were comparable (P>0.05) (Table 1).

**Number of leaves and percentage of damaged leaves in okra plants treated with Beauveria bassiana and Lambda-cyhalothrin**

There was no significant difference (P>0.05) in the number of leaves per plant in the sprayed (entomopathogenic fungus *B. bassiana* and lambda-cyhalothrin) and the unsprayed okra plants in both 2014 and 2015 planting seasons. Irrespective of planting season, the number of leaves on the two okra varieties were comparable (P>0.05) (Table 2).

The okra plants sprayed with treatments of entomopathogenic fungus *Beauveria bassiana* and lambda-cyhalothrin had significantly (P<0.05) lower percentage of damaged leaves compared to the unsprayed okra plants in both planting seasons. The percentage of damaged leaves in okra plants sprayed with treatments of entomopathogenic fungus *Beauveria bassiana* and lambda-cyhalothrin were however, not significantly (P>0.05) different from each other. The influence of okra variety on damage to the okra leaves was insignificant (P>0.05) (Table 2).

**Plant height of okra plants treated with Beauveria bassiana and Lambda-cyhalothrin**

In both 2014 and 2015 planting seasons, there were no significant (P>0.05) difference in plant height of okra at 3, 6 and 9WAP in okra plants treated with *B.
bassiana, lambda-cyhalothrin and the untreated ones. Varietal influence on plant height of treated and untreated okra plants was also not significant (P>0.05) (Table 3).

**Number of pods and percentage of pods damaged in okra plants treated with Beauveria bassiana and Lambda-cyhalothrin**

There were no significant (P>0.05) difference in number of pods per plant on okra plants treated with B. bassiana, lambda-cyhalothrin and the untreated ones in 2014 and 2015 planting seasons irrespective of variety (Table 4).

The okra plots treated with B. bassiana and lambda-cyhalothrin had a significantly (P<0.05) lower number and percentage of damaged pods compared to the pods from unsprayed plots in 2014 and 2015 planting seasons. However, the number and percentage of damaged pods in B. bassiana-treated and lambda-cyhalothrin-treated okra plants were not significantly (P>0.05) different from each other in both planting seasons irrespective of variety (Table 4).

**Proximate and mineral composition of okra fruits**

The proximate compositions of okra from sprayed plots were not significantly (P>0.05) different from the proximate composition of okra from the unsprayed plots irrespective of the planting season or variety. However, higher dry matter, fiber, ash, crude protein and fat content were noted in okra from plots sprayed B. bassiana (Table 5). Similarly, the mineral composition of okra pods from the sprayed plots were not significantly (P>0.05) different from the pods from unsprayed plots irrespective of planting season or variety. However, the Na, Ca, Mg, P, Fe and K content of okra from plots sprayed with B. bassiana was lower. (Table 6).

**DISCUSSION**

In this study, two flea beetle species, Podagrica uniforma and Podagrica sjostedti were observed as feeding on okra leaves. This result is in consonance with the report of Echezona et al. (2010) which indicated P. uniforma and P. sjostedti as the most destructive insect pests of okra in West Africa. The presence of these insects in the two okra varieties evaluated in both 2014 and 2015 suggest that the insects are regular insect pest of okra. This agrees with the findings of Pitan and Olatunde (2006) who observed flea beetles Podagrica spp. as the most important insect pest of okra in Africa, accounting for as much as 90% of the total pest population found on the crop at vegetative stage.

The average pod damage to the two okra variety in 2014 planting season was 32.49% and 52.66% in 2015 planting season. The ability of the insect to cause damage to infested okra plants has been reported by many authors (Odebiyi, 1980; Parh et al., 1997; Cranshaw, 1998). Koay & Chua (1978) reported that Okra yield can be as high as 30 t/ha, but yield could be constrained to 5–10 t/ha in most developing countries as a result of extensive damage by flea beetles. The economic impact of flea beetles on crop production was reported to vary with population densities and yield losses of about 10% are possible where flea beetles are abundant even when the crop is protected. The average damage to the leaves was 49.31% in 2014 and 46.16% in 2015. This agrees with earlier report which indicated the ability of the insect to cause high damage to insect foliage and stem (Odebiyi 1980; Cranshaw 1998). Parh et al. (1997) reported P. uniforma and P. sjostedti as major okra defoliators capable of causing heavy defoliations of up to 80% on okra leaves. Cranshaw (1998) reported the ability of adult beetles to make small holes known as ‘shot holes’ on okra leaves. Odebiyi (1980) and Indra &
Kamini (2003) reported that leaf feeding by the insects reduces the leaf area available for photosynthesis and the amount of food available for plant use, leading to yield reduction or complete loss in high infestations.

In this study, the number of flea beetle in okra plots treated with the entomopathogenic fungus *B. bassiana* was significantly lower than the number of the insect in the untreated plots. This agrees with the reports of Hajek and St. Leger (1994), Inglis et al. (2001) and Wraight et al. (2001) which indicated that *B. bassiana* is widely used to control pests and provides a basis for the production of a large number of mycoinsecticides. Wright (1992), Carruthers et al. (1993), Lewis et al. (1996) and Poprawski et al. (1997) reported that foliar applications of *B. bassiana* have proven to be useful in suppressing population of several economically important insects, including *Bemisia tabaci* (Gennadius) *Leptinotarsa decem/ineata* (Say), *Ostrinia nubilalis* (Htib-ner), and may provide another important option for control of other insect pests. Tefera and Pringle (2003) also tested the entomopathogen efficiency of *B. bassiana* and reported significant reduction in the coleopteran population of *Chilo partellus* in the first four days after treatment with *B. bassiana*. Malarvannan et al. (2010) evaluated *B. bassiana* against the tobacco caterpillar, *Spodoptera litura* and concluded that biopesticides, particularly microbial pesticides can be used as an alternate control method in combating the pest.

There are conflicting reports on the impact of flea beetles on okra yield loss. Several studies reported that insecticide spraying enhance yield increase in okra (Obeng-Ofori & Sackey, 2003; Ahmed et al., 2007; Thul et al., 2009), while other reports showed no systematic evidence of yield enhancement due to control of flea beetle on okra (Odebiyi et al., 1981; Emosairue & Ukeh, 1997). In this study however, yield of okra was enhanced in the plots treated with *B. bassiana* and lambda-cyhalothrin. This is in consonance with the findings of Krishnareddy et al. (1995), Adesina & Idoko (2013) and Adesina & Afolabi (2014) which reported that okra plants treated with biopesticides had higher yield compared to the yield of okra plants in untreated plots. In this study, the comparability of *B. bassiana* with lambda-cyhalothrin in terms of reduction of flea beetle infestation and enhancement of yield is a good development and suggestive that *B. bassiana* could be used as mycoinsecticides that will provide biological alternatives to chemical insecticides as earlier reported by Luangsa-Ard et al. (2005).

The result of this study indicated that proximate composition (moisture, dry matter, fat, ash, crude fiber, crude protein and carbohydrate content and mineral composition (Na, Cu, Ca Mg, P, Fe and K in the pods of sprayed and unsprayed okra plants were comparable. This shows that *B. bassiana* has no negative effect on the pods of the treated okra plants and could be used without any deleterious effect on the nutritional composition of okra pods from treated okra plants. This suggests that okra fruits from treated plots could be consumed without any treatment effect on proximate and major mineral composition of the okra fruit. Moniruzzaman et al. (2007) reported okra as a nutritious vegetable with rich source of vitamins, calcium, potassium and other minerals through its young immature pods which are consumed raw, cooked or fried.

The result of this study reflected the effectiveness of *B. bassiana* at reducing flea beetle infestation of treated plots. Similarly, higher yield of okra fruits was obtained from *B. bassiana*-treated plots. The mineral and proximate composition of *B. bassiana*-treated okra fruits was comparable with the mineral and proximate composition of the untreated okra fruits. The use of the treatment is therefore recommended for the control of *Podagrica* spp. in okra field.
LITERATURE CITED


Table 1. Number of Podagrica spp. and yield of okra plants treated with Beauveria bassiana and Lambda-cyhalothrin.
Table 2. Number of leaves and percentage of damaged leaves in okra plants treated with *Beauveria bassiana* and Lambda-cyhalothrin.

<table>
<thead>
<tr>
<th>Varieties (V)</th>
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<th>Spraying (S)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
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<td>2015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EPF</td>
<td>L</td>
<td>C</td>
<td>Mean</td>
<td>EPF</td>
</tr>
<tr>
<td>Number of leaves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>V=NS; S=NS; V X S=NS</td>
</tr>
<tr>
<td>Percentage leaf damaged</td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>14.26</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>V=NS; S=6.05*; V X S=7.23*</td>
</tr>
</tbody>
</table>

EPF = Entomopathogenic fungus (*Beauveria bassiana*) sprayed treatment  
L = Lambda cyhalothrin sprayed treatment  
C = Control (unsprayed treatment)  
LSD = Least Significant Difference  
* = Significantly Different  
NS = Not Significantly Different  
S = Sprayed Treatments  
V = Varieties (NH 99/DA and LD 88/1-8-5-2)  
V X S = Interaction of sprayed treatment and variety

Table 3. Plant height of okra plants treated with *Beauveria bassiana* and Lambda-cyhalothrin.

<table>
<thead>
<tr>
<th>Varieties (V)</th>
<th>Spraying (S)</th>
<th>Spraying (S)</th>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>EPF</td>
<td>L</td>
<td>C</td>
<td>Mean</td>
<td>EPF</td>
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<td></td>
<td>V=NS; S=NS; V X S=NS</td>
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<td>6 WAP</td>
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<td></td>
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<td>9 WAP</td>
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<td>62.97</td>
<td>42.73</td>
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<td>62.26</td>
<td>60.50</td>
<td>62.80</td>
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<td>42.78</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>V=NS; S=NS; V X S=NS</td>
</tr>
</tbody>
</table>

EPF = Entomopathogenic fungus (*Beauveria bassiana*) sprayed treatment  
L = Lambda cyhalothrin sprayed treatment  
C = Control (unsprayed treatment)  
LSD = Least Significant Difference  
NS = Not Significantly Different  
S = Sprayed Treatments  
V = Varieties (NH 99/DA and LD 88/1-8-5-2)  
V X S = Interaction of sprayed treatment and variety
Table 4. Number of pods and percentage of okra pod damaged in okra plants treated with *Beauveria bassiana* and Lambda-cyhalothrin.

<table>
<thead>
<tr>
<th>Varieties (V)</th>
<th>Spraying (S)</th>
<th>Spraying (S)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>2014</td>
<td>2015</td>
</tr>
<tr>
<td></td>
<td>EPF</td>
<td>L</td>
</tr>
<tr>
<td>NH 99/DA</td>
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<td>4.76</td>
</tr>
<tr>
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<td><strong>Mean</strong></td>
<td><strong>5.07</strong></td>
<td><strong>5.12</strong></td>
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<tr>
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<td>V=NS; S=NS; V X S=NS</td>
<td>V=NS; S=NS; V X S=NS</td>
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<tr>
<td>NH 99/DA</td>
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<tr>
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<td><strong>Mean</strong></td>
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<td>V=NS; S=0.31*; V X S=0.33*</td>
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<td><strong>Mean</strong></td>
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</table>

**EPF** = Entomopathogenic fungus (*Beauveria bassiana*) sprayed treatment  
**L** = Lambda cyhalothrin sprayed treatment  
**C** = Control (unsprayed treatment)  
**LSD** = Least Significant Difference  
* = Significantly Different  
**NS** = Not Significantly Different  
**S** = Sprayed Treatments  
**V** = Varieties (NH 99/DA and LD 88/1-8-5-2)  
**V X S** = Interaction of sprayed treatment and variety
Table 5. Proximate composition (g/100g sample) of okra fruit from okra plant treated with *B. bassiana*.

<table>
<thead>
<tr>
<th>Treatments (S)</th>
<th>Varieties (V)</th>
<th>EPF</th>
<th>Control</th>
<th>Mean</th>
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<td>Moisture content</td>
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<td>NH 99/DA</td>
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<td>86.83</td>
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<td>86.29</td>
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<td><strong>86.49</strong></td>
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<tr>
<td>LSD(0.05)</td>
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<td>V = NS; S = NS; V X S = NS</td>
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<tr>
<td>Dry matter content</td>
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<td>V = NS; S = NS; V X S = NS</td>
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<tr>
<td>Crude fat content</td>
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</tbody>
</table>

EPF = Entomopathogenic fungus (*Beauveria bassiana*) sprayed treatment  
C = Control (unsprayed treatment)  
LSD = Least Significant Difference  
NS = Not Significantly Different  
S = Sprayed Treatment  
V = Varieties (NH 99/DA and LD 88/1-8-5-2)  
V X S = Interaction of sprayed treatment and variety
Table 6. Mineral composition (g/100g sample) of okra fruit from okra plant treated with *B. bassiana*.

<table>
<thead>
<tr>
<th>Treatments (S)</th>
<th>Varieties (V)</th>
<th>EPF</th>
<th>Control</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (Na)</td>
<td>NH 99/DA</td>
<td>7.94</td>
<td>8.14</td>
<td><strong>8.04</strong></td>
</tr>
<tr>
<td></td>
<td>LD 88/1-8-5-2</td>
<td>7.60</td>
<td>8.20</td>
<td><strong>7.90</strong></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>7.77</td>
<td>8.17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD (0.05)</td>
<td>V = NS; S = NS; V X S = NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>NH 99/DA</td>
<td>0.10</td>
<td>0.11</td>
<td><strong>0.11</strong></td>
</tr>
<tr>
<td></td>
<td>LD 88/1-8-5-2</td>
<td>0.10</td>
<td>0.10</td>
<td><strong>0.10</strong></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>0.10</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD (0.05)</td>
<td>V = NS; S = NS; V X S = NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium (Ca)</td>
<td>NH 99/DA</td>
<td>77.34</td>
<td>77.84</td>
<td><strong>77.60</strong></td>
</tr>
<tr>
<td></td>
<td>LD 88/1-8-5-2</td>
<td>75.81</td>
<td>78.27</td>
<td><strong>77.04</strong></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td><strong>76.58</strong></td>
<td><strong>78.06</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD (0.05)</td>
<td>V = NS; S = NS; V X S = NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>NH 99/DA</td>
<td>56.60</td>
<td>57.86</td>
<td><strong>57.23</strong></td>
</tr>
<tr>
<td></td>
<td>LD 88/1-8-5-2</td>
<td>56.91</td>
<td>58.67</td>
<td><strong>57.79</strong></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td><strong>56.76</strong></td>
<td><strong>58.27</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD (0.05)</td>
<td>V = NS; S = NS; V X S = NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphorus (P)</td>
<td>NH 99/DA</td>
<td>63.07</td>
<td>63.86</td>
<td><strong>63.47</strong></td>
</tr>
<tr>
<td></td>
<td>LD 88/1-8-5-2</td>
<td>63.86</td>
<td>64.63</td>
<td><strong>64.25</strong></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td><strong>63.47</strong></td>
<td><strong>64.25</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD (0.05)</td>
<td>V = NS; S = NS; V X S = NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>NH 99/DA</td>
<td>0.79</td>
<td>0.83</td>
<td><strong>0.81</strong></td>
</tr>
<tr>
<td></td>
<td>LD 88/1-8-5-2</td>
<td>0.79</td>
<td>0.85</td>
<td><strong>0.82</strong></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>0.79</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD (0.05)</td>
<td>V = NS; S = NS; V X S = NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium (K)</td>
<td>NH 99/DA</td>
<td>291.50</td>
<td>319.00</td>
<td><strong>305.25</strong></td>
</tr>
<tr>
<td></td>
<td>LD 88/1-8-5-2</td>
<td>308.50</td>
<td>319.50</td>
<td><strong>314.00</strong></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td><strong>300.00</strong></td>
<td><strong>319.50</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSD (0.05)</td>
<td>V = NS; S = NS; V X S = NS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EPF = Entomopathogenic fungus (*Beauveria bassiana*) sprayed treatment  
C = Control (unsprayed treatment)  
LSD = Least Significant Difference  
NS = Not Significantly Different  
S = Sprayed Treatment  
V = Varieties (NH 99/DA and LD 88/1-8-5-2)  
V X S = Interaction of sprayed treatment and variety
SUPPLEMENTARY CHECKLIST OF ORIBATID MITES (ACARI) FROM TURKEY

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ABSTRACT: In the present paper, a supplementary checklist of oribatid mites recorded between the years 2008-2016 is provided (the closing date for publications included in this list was 15 May 2016). The oribatid mite species described from Turkey as new to science have been highlighted.

KEY WORDS: Supplementary checklist, Oribatid mites, Acari, Turkey

Oribatids are the characteristic mites of the soil. About 11,000 species are known in about 1,300 genera and approximately 175 families (Subías, 2004, updated February 2016). A list of the acari fauna of Turkey was given by Özkan et al. (1988), which was updated by Özkan et al. (1994) and Erman et al. (2007). In those studies, 143 species and 1 subspecies included in 75 genera and 43 families belonging to oribatid mites were listed. Between the years 2008-2016, more studies have been done on the oribatid mite fauna of Turkey. In the present paper, a supplementary checklist of oribatid mites recorded between the years 2008-2016 is provided (the closing date for publications included in this list was 15 May 2016). The oribatid mite species described from Turkey as new to science have been highlighted.

Supplementary checklist of oribatid mites

Lohmanniidae Berlese, 1916
Papillacarus Kunst, 1959

Perlohmanniidae Grandjean, 1954
Perlohmannia Berlese, 1916
Perlohmannia (Perlohmannia) Berlese, 1916
Perlohmannia (Perlohmannia) turcica Ayyıldız et al., 2016; Ayyıldız et al., 2016

Epilohmanniidae Oudemans, 1923
Epilohmannia Berlese, 1910
Epilohmannia imreorum Bayoumi & Mahunka, 1976; Baran et al., 2015

Euphthiracaridae Jacot, 1930
Acrotritia Jacot, 1923
Acrotritia duplicata (Grandjean, 1953); Ayyıldız et al., 2011a

Phthiracaridae Perty, 1841
Phthiracarus (Phthiracarus) Perty, 1841
Phthiracarus (Phthiracarus) lentulus (C. L. Koch, 1841); Bayram & Çobanoğlu, 2009
Malaconothridae Berlese, 1916

Tyrphonothurus Knülle, 1957
Tyrphonothurus (Tyrphonothurus) Knülle, 1957
Tyrphonothurus (Tyrphonothurus) glaber (Michael, 1888); Toluk & Ayyıldız, 2008a

Notridae Berlese, 1896
Notrus Koch, 1836
Notrus silvestris Nicolet, 1855; Ayyıldız & Toluk, 2016

Crotoniidae Thorell, 1876

Heminothrus Berlese, 1913
Heminothrus (Platynothrus) Berlese, 1913
Heminothrus (Platynothrus) peltifer (C. L. Koch, 1839); Bayram & Çobanoğlu, 2009

Nanhermanniidae Sellnick, 1928

Nanhermanna Berlese, 1913
Nanhermanna (Nanhermanna) Berlese, 1913
Nanhermanna (Nanhermanna) nana (Nicolet, 1855); Sarial & Baran, 2013

Hermanniidae Sellnick, 1928

Hermanniella Berlese, 1908
Hermanniella multiforma Sitnikova, 1973; Ayyıldız & Toluk, 2016

Neoliodidae Sellnick, 1928

Neoliodes Berlese, 1888
Neoliodes theleproctus (Hermann, 1804); Per et al., 2015

Poroliodes Grandjean, 1934
Poroliodes farinosus (Koch, 1839); Yalçın et al., 2013

Plateremaeidae Trägårdh, 1926

Paralopheremaeus Paschoal, 1987
Paralopheremaeus hispanicus arifi Baran, 2010; Baran, 2010a

Licnodamaeidae Grandjean, 1954

Licnobelba Grandjean, 1931
Licnobelba caesarea (Berlese, 1910); Ayyıldız & Toluk, 2016

Gymnodamaeidae Grandjean, 1954

Gymnodamaeus Kulczynski, 1902
Gymnodamaeus barbarossa Weigmann, 2006; Toluk & Ayyıldız, 2014
Gymnodamaeus bicostatus (Koch,1835); Yalçın et al., 2013

Jacotella Banks, 1947
Jacotella frondeus (Kuljiev, 1979); Ayyıldız & Toluk, 2016

Compactozetidae Luxton, 1988

Cepheus Koch, 1835
Cepheus dentatus (Michael, 1888); Ayyıldız et al., 2011b

Ceratoppiidae Kunst, 1971

Parapyroppia Pérez-Íñigo & Subías, 1979
Parapyroppia cornuta (Berlese, 1910); Toluk & Ayyıldız, 2009a
**Liacaridae** Sellnick, 1928

*Adoristes* Hull, 1916

*Adoristes (Gordeeviella)* Shtanchaeva, Subías & Arillo, 2010

*Adoristes (Gordeeviella) krivolutskii* Shtanchaeva, Subías & Arillo, 2010; Ayyıldız & Toluk, 2016

**Zetorchestidae** Michael, 1898

*Zetorchestes* Berlese, 1888


**Ctenobelbidae** Grandjean, 1965

*Ctenobelba* Balogh, 1943

*Ctenobelba (Ctenobelba)* Balogh, 1943

*Ctenobelba (Ctenobiliab) berlesei* (Berlese, 1904); Baran et al., 2010

*Ctenobelba (Causiobelba) urhani* Baran, 2015; Baran, 2015

**Ctenobellidae** Grandjean, 1965

*Zetorchestes* Berlese, 1888


**Amerobelbidae** Grandjean, 1961

*Amerobelba* Berlese, 1908

*Amerobelba decedens* Berlese, 1908; Şimşek and Baran, 2012

**Damaeolidae** Grandjean, 1965

*Damaeolus* Paoli, 1908

*Damaeolus asperatus* (Berlese, 1904); Baran et al., 2010

*Damaeolus ornatissimus* Csiszár, 1962; Baran et al., 2010

**Eremobelbidae** Balogh, 1961

*Eremobelba* Berlese, 1908

*Eremobelba geographic* Berlese, 1908; Toluk et al., 2015

**Ameridae** Bulanova-Zachvatkina, 1957

*Amerus* Berlese, 1896

*Amerus (Amerus) polonicus* Kulczynski, 1902; Baran & Kılıç, 2013

**Caleremaecidae** Grandjean, 1965

*Calereamæus* Berlese, 1910

*Calereamæus monilipes* (Michael, 1882); Ayyıldız et al., 2011b

**Autognetidae** Grandjean, 1960

*Autogneta* Hull, 1916

*Autogneta (Autogneta)* Hull, 1916

*Autogneta (Autogneta) parva* Forsslund, 1947; Toluk & Ayyıldız, 2008b

*Autogneta (Rhaphigneta)* Grandjean, 1960

*Autogneta (Rhaphigneta) flagellata* (Mahunka, 1977); Ayyıldız & Toluk 2016

*Autogneta (Rhaphigneta) numidiana* (Grandjean, 1960); Toluk & Ayyıldız, 2009b

**Conchogneta** Grandjean, 1963

*Conchogneta dalecarlica* (Forsslund, 1947); Toluk & Ayyıldız, 2009b

**Thyrismidae** Grandjean, 1953

*Banksinoma* Oudemans, 1930

*Banksinoma lanceolata* (Michael, 1885); Toluk & Ayyıldız, 2011

**Oppiidae** Sellnick, 1937

*Lasiobelba* Aoki, 1959

*Lasiobelba (Lasiobelba)* Aoki, 1959

*Lasiobelba (Lasiobelba) kuehnelti* (Csiszár, 1961); Yaşa et al., 2015

**Multioppia** Hammer, 1961

**Multioppia (Multioppia)** Hammer, 1961

**Multioppia (Multioppia) turcica** Toluk et al., 2009; Toluk et al., 2009a
Ramusella Hammer, 1962
Ramusella (Ramusella) Hammer, 1962
Ramusella (Ramusella) sengbuschi Hammer, 1968; Toluk & Ayyıldız, 2008b

Ramusella (Insculptoppia) Subías, 1980
Ramusella (Insculptoppia) ermani Baran, 2010; Baran, 2010b
Ramusella (Insculptoppia) golbasiensis Baran, 2010; Baran, 2010b
Ramusella (Insculptoppia) neonominata Subías, 2004; Toluk & Ayyıldız, 2008c
Ramusella (Insculptoppia) pinarbasiensis Ayyıldız et al., 2010; Ayyıldız et al., 2010
Ramusella (Insculptoppia) salmani Toluk & Ayyıldız, 2008; Toluk & Ayyıldız, 2008b

Microoppia Balogh, 1983
Microoppia arcuata Gordeeva & Tarba, 1990; Toluk & Ayyıldız, 2008b

Rhinoppia Balogh, 1983

Rhinoppia (Rhinoppia) Balogh, 1983
Rhinoppia (Rhinoppia) artvinensis Toluk & Ayyıldız, 2008; Toluk & Ayyıldız, 2008d
Rhinoppia (Rhinoppia) eliafe Toluk et al., 2009; Toluk et al., 2009
Rhinoppia (Rhinoppia) exobothridialis Toluk & Ayyıldız, 2009; Toluk & Ayyıldız, 2009c
Rhinoppia (Rhinoppia) hygrophila (Mahunka, 1987); Yalçın et al., 2013
Rhinoppia (Rhinoppia) loksai (Schalk, 1966); Toluk & Ayyıldız, 2008c
Rhinoppia (Rhinoppia) mahunkai Toluk et al., 2009; Toluk et al., 2009
Rhinoppia (Rhinoppia) nasuta (Moritz, 1965); Toluk et al., 2010
Rhinoppia (Rhinoppia) parapectinata (Ryabinin, 1987); Toluk et al., 2010
Rhinoppia (Rhinoppia) trilobata (Khanbekjan & Gordeeva, 1991); Toluk & Ayyıldız, 2008b
Rhinoppia (Rhinoppia) alidagiensis Toluk, 2016; Toluk, 2016

Rhinoppia (Bipectinoppia) Subías and Shtanchaeva, 2011
Rhinoppia (Bipectinoppia) emarginata Toluk & Ayyıldız, 2009; Toluk & Ayyıldız, 2009c
Rhinoppia (Bipectinoppia) tasdemiri Toluk & Ayyıldız, 2008; Toluk & Ayyıldız, 2008d
Rhinoppia (Bipectinoppia) variopectinata Toluk & Ayyıldız, 2010; Toluk & Ayyıldız, 2010a

Berniniella Balogh, 1983

Berniniella (Berniniella) Balogh, 1983
Berniniella (Berniniella) parasigma Iturrondobeitia, 1987; Toluk & Ayyıldız, 2009b
Berniniella (Berniniella) serratirostris hauseri (Mahunka, 1974); Toluk & Ayyıldız, 2008b

Dissohina Hull, 1916
Dissohina uludagensis Ayyıldız et al., 2010; Ayyıldız et al., 2010a

Laurooppia Subías & Mínguez, 1986
Laurooppia maritima acuminata (Strenzke, 1951); Toluk & Ayyıldız, 2011
Laurooppia tenupectinata Subías & Rodríguez, 1988; Toluk & Ayyıldız, 2009b
Laurooppia tridentata (Forsslund, 1942); Toluk & Ayyıldız, 2011

Moritzoppia Subías & Rodríguez, 1988
Moritzoppia acuta Toluk & Ayyıldız, 2010; Toluk & Ayyıldız, 2010a
Moritzoppia escotata (Subías & Rodríguez, 1986); Toluk & Ayyıldız, 2008b
Moritzoppia keilbachi (Moritz, 1969); Toluk & Ayyıldız, 2008b
Moritzoppia problematica Mahunka & Mahunka-Papp, 2002; Toluk & Ayyıldız, 2008b
Moritzoppia turcica Toluk & Ayyıldız, 2010; Toluk & Ayyıldız, 2010a

Oppiella Jacot, 1937
Oppiella (Perspicuoppia) Pérez-Íñigo, 1971
Oppiella (Perspicuoppia) ozkani Baran et al., 2012; Baran et al., 2012
Oppiella (Perspicuoppia) turcica Toluk & Ayyıldız, 2009; Toluk & Ayyıldız, 2009c

Oxyoppia Balogh & Mahunka, 1969
Oxyoppia (Dzarogneta) Kulijev, 1978
Oxyoppia (Dzarogneta) baranae Toluk & Ayyıldız, 2008; Toluk & Ayyıldız, 2008b
Subiasella Balogh, 1983
Subiasella (Dividoppia) Mahunka, 1987
Subiasella (Dividoppia) aperta (Mahunka, 1987); Baran et al., 2012

Corynoppia Balogh, 1983
Corynoppia andalau sakaryaensis Mahunka, 2001; Baran & Gökyeşil, 2015
Corynoppia kosarovi (Jeleva, 1962); Baran et al., 2011

Epimerellidae Ayylidz and Luxton, 1989

Epimerella Kulijev, 1967
Epimerella ankaraensis Baran et al., 2012; Baran et al., 2012
Epimerella luxtoni Toluk et al., 2008; Toluk et al., 2008
Epimerella subiasi Toluk et al., 2008; Toluk et al., 2008

Quadropipiidae Balogh, 1983

Quadroppia Jacot, 1939
Quadroppia (Quadroppia) Jacot, 1939
Quadroppia (Quadroppia) squarrosa Toluk & Ayylidz, 2009; Toluk & Ayylidz, 2009d
Quadroppia (Quadroppia) maritalis Lions, 1982; Baran et al., 2009
Quadroppia (Coronoquadroppia) Ohkubo, 1995
Quadroppia (Coronoquadroppia) foveolata Toluk & Ayylidz, 2009; Toluk & Ayylidz, 2009d
Quadroppia (Coronoquadroppia) micheali turcica Baran et al., 2009; Baran et al., 2009
Quadroppia paolii (Woas, 1986); Baran & Ayylidz, 2008
Quadroppia (Coronoquadroppia) sezeki Baran & Ayylidz, 2009; Baran & Ayylidz, 2009

Suctobelbidae Jacot, 1938

Rynchobelba Willmann, 1953

Suctobelba Paoli, 1908
Suctobelba (Suctobelba) Paoli, 1908
Suctobelba (Suctobelba) atomaria Moritz, 1970; Toluk & Ayylidz, 2010b
Suctobelba (Suctobelba) beringiana Krivolutsky, 1974: Toluk & Ayylidz, 2010b

Suctobelbella Jacot, 1937
Suctobelbella (Suctobelbella) Jacot, 1937
Suctobelbella (Suctobelbella) acutidens (Forsslund, 1941): Toluk et al., 2010
Suctobelbella (Flagrosuctobelba) Hammer, 1979
Suctobelbella (Flagrosuctobelba) subtrigona (Oudemans, 1900): Yalçın et al., 2013

Carabodidae Koch, 1835
Carabodes (Flexa) Kulijev, 1977
Carabodes (Flexa) intermedius Willman, 1951: Yalçın et al., 2013

Tectocepheidae Grandjean, 1954

Tectocepheus Berlese, 1896
Tectocepheus alatus Berlese, 1913: Per et al., 2015

Licneremaecidae Grandjean, 1931
Licneremaecus Paoli, 1908
Licneremaecus licnophorus (Michael, 1882): Toluk & Ayylidz, 2011

Scutoverticidaridae Grandjean, 1954

Provertex Mihelčič, 1959
Provertex forsslundii Krivolutsky, 1969: Ayylidz et al., 2013
Achipteriidae Thor, 1929

Campachipteria Aoki, 1995
Campachipteria fancagoi (Jacot, 1929): Per & Ercan, 2015

Oribatellidae Jacot, 1925

Ophidiotrichus Grandjean, 1953
Ophidiotrichus tectus (Michael, 1884): Ayyıldız et al., 2013

Ceratozetidae Jacot, 1925

Lepidozetes Berlese, 1910
Lepidozetes singularis Berlese, 1910: Ayyıldız et al., 2011c

Oribatulidae Thor, 1929

Oribatula Berlese, 1896
Oribatula (Oribatula) Berlese, 1896
Oribatula (Oribatula) interrupta (Willmann, 1939): Yalçın et al., 2013

Phauloppia Berlese, 1908
Phauloppia lucorum (Koch, 1841): Ayyıldız & Toluk, 2016

Liebstadiidae J. and P. Balogh, 1984

Liebstadia Oudemans, 1906
Liebstadia (Liebstadia) Oudemans, 1906
Liebstadia (Liebstadia) humerata Sellnick, 1928: Yalçın et al., 2013

Scheloribatidae Grandjean, 1933

Scheloribates Berlese, 1908
Scheloribates (Scheloribates) Berlese, 1908
Scheloribates (Scheloribates) xylobatooides Mahunka, 1977: Toluk & Ayyıldız, 2009a

Between 1 January 2008 and 15 May 2016, totally 5 subspecies and 96 species, 45 genera and 17 families added to the Turkish oribatid fauna. 30 species and 3 subspecies of these have been described from Turkey as new to science and the rest of 66 species and 2 subspecies have been recorded as new records for the Turkish fauna. Up to 15 May 2016, the total number of families has increased to 60, genera has increased to 120, species has reached to 239 and subspecies has raised to 6.

LITERATURE CITED


Baran, Ş. 2012. First record of the mite family Ctenobelidae (Acari, Oribatida) from Turkey: Ctenobelba (Ctenobelba) ayyıldız sp. nov. Turkish Journal of Zoology, 36: 739-744.


NEW DATA ON THE DISTRIBUTION OF PSEUDAPLEMONUS ARTEMISIAE (F. MORAWITZ, 1861) (COLEOPTERA: APIONIDAE) IN UKRAINE AND THE PALEARCTIC REGION

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ABSTRACT: New record of Pseudaplemonus artemisiae (F. Morawitz, 1861) (Coleoptera, Apionidae) in Ukraine is represented and an updated information regarding distribution of this species in Ukraine and the Palearctic Region is given. Notes on geographical distribution and biology of the genus Pseudaplemonus Wagner, 1930 are represented.

KEY WORDS: Apionidae, Coleoptera, Pseudaplemonus artemisiae, Palearctic Region, Ukraine

The genus Pseudaplemonus Wagner, 1930 (= Cypriapion Ehret, 1997) belongs to the tribe Aplemonini Kissinger, 1968 of the subfamily Apioninae Schoenherr, 1823 and the family Apionidae Schoenherr, 1823. The genus comprises 9 species distributed in the Palearctic Region: P. aeneicollis (Gerstaecker, 1854); albanicus (Formânek, 1925); artemisiae (F. Moravitz, 1861); bermani Korotyaev, 1997; chevrolati (Gyllenhal, 1833); externepunctatus (Desbrochers des Loges, 1875); limonii (Kirby, 1808); martjanovi (Faust, 1891); prasolovi (Korotyaev, 1991) (Alonso-Zarazaga, 2011). Only one species of the genus, P. artemisiae, is presented in the territory of Ukraine. The aim of this paper is to document new data regarding distribution of P. artemisiae in Ukraine and the Palearctic.

MATERIALS AND METHODS

The insects were collected manually in the daytime. Photographs were taken by the Photographs were taken by Nikon D90 camera with Sigma EX 150mm 1:2.8 APO Macro DG HSM + Raynox DCR MacroScan Conversion lens. The material examined is deposited in the following collections: KIV: Kizub I. V. private collection, Kiev, Ukraine; SAI: Slutsky A. I. private collection, Kharkov, Ukraine.

RESULTS AND DISCUSSION

Pseudaplemonus artemisiae (F. Morawitz, 1861) (Fig. 1)

Material examined: 5 males and 5 females, Southern Ukraine, Kherson reg., Genichesk distr., Schasliveco vill. env., Azov Sea coast, 46°06'59.77"N 34°48'56.42"E, 09.08.2014, Shehovcov A.A. leg. and det. (KIV); 1 male and 1 female, Ukraine, Dnepropetrovsk reg., Pavlograd distr., near Bulakhovka vill., h =

Geographical distribution: *P. artemisiae* has been reported from Rostov Region (Arzanov, 2015; Arzanov et al., 2016), Volgograd Region (Becker, 1869; Schilsky, 1901; Makarov et al., 2009), Stavropol Territory (Arzanov, 2001), Astrakhan Region (Arzanov, 2013), The Republic of Kalmykia (Arzanov, 2015), The Republic of Dagestan (Korotyaev et al., 1993; Efendieva, 2009; Arsanov et al., 2014; Ismailova et al., 2015), Orenburg Region (Shapovalov, 2012), Novosibirsk Region (Krivets & Korotyaev, 1998; Legalov & Opanassenko, 2000; Legalov, 2010); Altai Territory (Krivets & Korotyaev, 1998; Legalov, 2010); and Omsk Region (Legalov et al., 2015) of **Russia**; Northern **Kazakhstan** (Arnoldi, 1969; Baytenov, 1974; Kazenas & Bayzhanov, 2009; Arsanov et al., 2014); Northern **Turkmenistan** (Arsanov et al., 2014), South-Eastern **Romania** (Kresl, 2010), and **Ukraine** (Schilsky, 1901; Solodovnikova, 1963; 1968; Arsanov et al., 2014).

So far, in Ukraine *P. artemisiae* is known from Odessa Region (Arsanov et al., 2014), Kherson Region (Solodovnikova, 1963; 1968), the Crimea (Schilsky, 1901; Solodovnikova, 1968), and Dnipropetrovsk Region. In the territory of Ukraine the species is distributed on the coasts of the Black (except the Southern coast of the Crimea) (Solodovnikova, 1968) and the Azov Sea (Solodovnikova, 1963; 1968; Arsanov et al., 2014), as well as on saline continental river areas. Based on our new data and published records, maps of *P. artemisiae* geographical distribution in the Palearctic Region are presented in Figs. 2 and 3.

It is important to note that until now *P. artemisiae* has not been indicated for the territory of Ukraine, Kazakhstan, Turkmenistan and Romania neither in the Catalogue of Palaearctic Coleoptera (Catalogue…, Alonso-Zarazaga, 2011) nor in the Fauna Europaea database (Alonso-Zarazaga & Vit, 2017). It should also be noted that in the Southern Territories of Russia the species is more widespread than the Caucasus region only as indicated in the Catalogue... (Alonso-Zarazaga, 2011). Moreover, in the Caucasus, areal of *P. artemisiae* is limited only by the Pre-Caucasus territory of The Republic of Dagestan (Korotyaev et al., 1993; Efendieva, 2009; Ismailova et al., 2015), where southern boundary of the species passes (Korotyaev et al., 1993). The presented data allow us to suggest the following changes to the Catalogue... (Alonso-Zarazaga, 2011):

**PAGE 152**

PRINTED:

*artemisiae* Moravitz, 1861: 292 (*Apion*) **E:** ST "Caucasus" **A:** WS

MUST BE:

*artemisiae* Moravitz, 1861: 292 (*Apion*) **E:** RO ST UK **A:** KZ TM WS

**Biology:** *P. artemisiae* belongs to the Mediterranean chorotype and is a stenotopic and xerophilic semi-desert species inhabiting solonetz soils and steppe (Solodovnikova, 1963; 1968; Korotyaev et al., 1993; Efendieva, 2009; Arzanov, 2013). The species is a monophagous and feeds on a matted sea-lavender (*Limonium bellidifolium* (Gouan) Dumort (= *caspium* (Willd.) Gams), Plumbaginaceae Juss., Fig. 4) (Moysiyenko, 2008; Efendieva, 2009; Arzanov, 2013; Arsanov et al., 2014).


**P. albanicus** Formânek, 1925 is known from Albania exceptually (Fig. 3) and its biology stiil is poorly investigated (Formânek, 1925).

**P. aeneicollis** (Gerstaeker, 1854) (= *aereirostre* (Desbrochers des Loges, 1901); *laudabile* (Faust, 1891)) is a semi-desert xerophilic Turano-Arabian species inhabiting solonetz soils and steppe. The species is known from Azerbaijan (Alonso-Zarazaga, 2011), Georgia (Alonso-Zarazaga, 2011), Southern Dagestan in Russia (Solodovnikova, 1974; Korotyaev et al., 1993; Mukhtarova et al., 2009; Efendieva, 2009; Ismailova et al., 2015), Northern Iran (Legalov et al., 2010; Alonso-Zarazaga, 2011; Ghahari & Colonelli, 2012), Saudi Arabia (Wanat, 1990; Alonso-Zarazaga, 2011), Western Tajikistan (Baytenov, 1974; Korotyaev, 1987; Nikulina, 1989), Iraq (Zumpt, 1938; Alonso-Zarazaga, 2011), Syria (Alonso-Zarazaga, 2011), Mongolia (Alonso-Zarazaga, 2011), Turkey (Alonso-Zarazaga, 2011), Uzbekistan (Baytenov, 1974; Alonso-Zarazaga, 2011), Turkmenistan (Schilsky, 1901; Wagner, 1906; Baytenov, 1974; Alonso-Zarazaga, 2011; Legalov, 2017), Southern Kazakhstan (Baytenov, 1974), Kirgizstan (Baytenov, 1974); Israel (Schilsky, 1901; Alonso-Zarazaga, 2011) (Fig. 3). The host plants of *P. aeneicollis* are *Psylliostachys leptostachya* (Boiss.) Roshk. and *P. suvorowii* (Regel) Roshk.
of Plumbaginaceae Juss. (Korotyaev, 1987; Nikulina, 1989; Mukhtarova et al., 2009; Legalov et al., 2010). *P. aeneicollis* has not been indicated for the territory of Tajikistan, Kazakhstan, and Kirgizstan in the Catalogue... (Alonso-Zarazaga, 2011) and existing data allow us to suggest the following changes to the Catalogue... (Alonso-Zarazaga, 2011):

**PAGE 152**

**PRINTED:**

*aeneicollis* Gerstaecker, 1854b: 277 (*Apion*) **N:** AB GG ST A: IN IQ IS MG SA SY TM TR UZ "Siberia"

**MUST BE:**

*aeneicollis* Gerstaecker, 1854b: 277 (*Apion*) **E:** AB GG ST A: IN IQ IS KG KZ MG SA SY TD TM TR UZ "Siberia"

**P. externepunctatus** Desbrochers des Loges, 1875 is distributed in the lower Volga basin (the Republic of Kalmykia) of Russia (Korotyaev, 1991; Arzanov, 2015), and Romania according to Alonso-Zarazaga, 2011 (Fig. 3).

**P. martjanovi** (Faust, 1891) inhabites in dry and desert-steppe depressions of Asian part of Russia (Alonso-Zarazaga, 2011): the Altai Republic, Krasnoyarsk Krai and the Tyva Republic (Korotyaev, 1991; Legalov, 2010), and Mongolia (Alonso-Zarazaga, 2011) (Fig. 3).

**P. prasolovi** (Korotyaev, 1991) is close to *P. externepunctatus* and *P. martjanovi*, and is known from the type locality only on Ili River in Almaty (formerly Taldy-Kurgan) Region in South-Eastern Kazakhstan (Korotyaev, 1991; Alonso-Zarazaga, 2011) (Fig. 3). The species feeds on *Limonium sp.* (Korotyaev, 1991).

**P. bermani** Korotyaev, 1997 is an East-Beringian species and is known from the type locality in Chukchi Autonomous District of Russia (Korotyaev, 1997; Berman et al., 2002; Chernyshev, 2008; Legalov, 2010; Berman et al., 2011; Alonso-Zarazaga, 2011). The species is a Pleistocene relict (Berman et al., 2011) and connected with *Armeria scabra* Pall. et Schult., the only species of Plumbaginaceae Juss, growing in the North-East of Asia (Berman et al., 2002). *P. bermani* is included in the Red data book of the Chukchi Autonomous District (Chernyshev, 2008) and is very closely related to *P. martjanovi* and *P. externepunctatus* comprising a group of related allopatric species (Berman et al., 2002).

**ACKNOWLEDGEMENTS**

The author thanks Marek Wanat (Museum of Natural History, Wroclaw, Poland) for kind contribution to preparing of the paper.

**LITERATURE CITED**


Figure 1. The habitus of *Pseudaplemonus artemisiae* (F. Morawitz, 1861): female (left) and male (right). Scale bar = 1 mm.

Figure 2. A map of *Pseudaplemonus artemisiae* (F. Morawitz, 1861) geographical distribution.
Figure 3. A map of the genus *Pseudaplemonus* Wagner, 1930 geographical distribution. 1 - *P. chevrolati* Gyllenhal, 1833; 2 - *P. limonii* Kirby, 1808; 3 - *P. albanicus* Formánek, 1925; 4 - *P. externepunctatus* Desbrochers des Loges, 1875; 5 - *P. artemisiae* (F. Morawitz, 1861); 6 - *P. aeneicollis* (Gerstaecker, 1854); 7 - *P. prasolovi* (Korotyaev, 1991); 8 - *P. martjanovii* (Faust, 1891); 9 - *P. bermani* Korotyaev, 1997.

Figure 4. *Limonium bellidifolium* (Gouan) Dumort, the only known host plant of *Pseudaplemonus artemisiae* (F. Morawitz, 1861).
DISTRIBUTION OF CALCHAENESTHES SPECIES (COLEOPTERA: CERAMBYCIDAE: CERAMBYCINAЕ) IN THE MEDITERRANEAN REGION

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ABSTRACT: Three of five species of Calchaenesthes Kraatz are distributed in the Mediterranean Region. Calchaenesthes oblongomaculata (Guérin-Méneville), a data deficient species on the European Red List of Saproxylic Beetles, is reported from Bulgaria, Greece, Romania, Cyprus, Jordan and Turkey in the Eastern Mediterranean Region. In Turkey, it occurs only in Istanbul province. Known host plants include the species of oak (Fagaceae: Quercus) and blossoming hawthorn (Rosaceae: Crataegus). Calchaenesthes sexmaculata (Reiche), an endangered species on the European Red List of Saproxylic Beetles, is reported from Spain, Morocco, Algeria and Tunisia in the Western Mediterranean Region. Known host plants include the species of oak (Fagaceae: Quercus). In addition, Calchaenesthes primis Özdkimen (Coleoptera: Cerambycidae: Cerambycinae) has not been classified on the European Red List of Saproxylic Beetles yet, is reported from Cyprus and Turkey in the Eastern Mediterranean Region. In Cyprus, it exists in Paphos and Larnaca Districts. In Turkey, it occurs in Adıyaman, Amasya, Burdur, Gaziantep, Hatay, İçel, Mardin, Niğde and Siirt provinces. Known host plants include kermes oak (Quercus coccifera L.), probably also other Quercus species (Fagaceae).

KEY WORDS: Calchaenesthes, longhorned beetles, distribution, host plants

The family of longhorn beetles (Cerambycidae) is one of the most speciose and well-known group of beetles with approximately 35,000 described species (Švácha & Lawrence, 2014). More than 600 species and 700 species occur in Europe and Turkey respectively.


Calchaenesthes oblongomaculata (Guérin-Méneville) and C. sexmaculata (Reiche) are classified as “Data Deficient” and “Endangered” on the European Red List of Saproxylic Beetles respectively (Nieto & Alexander, 2010). C. primis was described by Özdikmen (2013 in Özdikmen et al., 2013) from İçel province of Turkey. This species, therefore, has not been classified on the European Red List of Saproxylic Beetles (Nieto & Alexander, 2010). Information on these species is critical to efforts to protect these species from extinction in the Mediterranean basin.

The Mediterranean basin extends approximately 3,800 km east to west from the tip of Portugal to the shores of Lebanon and approximately 1,000 km north to south from Italy to Morocco and Libya. Within the European Union, the
Mediterranean Region encompasses seven countries, either partially (France, Portugal, Italy, Spain) or completely (Greece, Malta, Cyprus) (Sundseth & Brussels, 2009).

The Eastern Mediterranean denotes the countries geographically to the east of the Mediterranean Sea (Levantine Sea basin). This is commonly interpreted in two ways: the region of Syria plus the Cyprus (also known as the Levant), and Turkey, or the Levant plus Greece, and Egypt, thereby including European and African components to the definition. The countries and territories of the Eastern Mediterranean include Cyprus, Greece (mainland and Aegean Islands), Lebanon, Syria, Palestine, Israel, Turkey, Egypt, Jordan and Libya. The Eastern Mediterranean Region encompasses only two countries as Greece and Cyprus within the European Union.

The Western Mediterranean denotes the countries geographically to the west of the Mediterranean Sea. The countries and territories of the Western Mediterranean include Italy, France, Spain, Portugal, Morocco, Algeria and Tunisia. The Western Mediterranean Region encompasses four countries as Italy, France, Spain and Portugal within the European Union.

The Mediterranean basin is recognised as a biodiversity hotspot. About one-third of the Mediterranean fauna is endemic. According to the International Union for Conservation of Nature Red List of Threatened Species, 19% of faunal species (amphibians, birds, cartilaginous fishes, endemic freshwater fishes, crabs and crayfish, mammals, dragonflies, and reptiles) are threatened with extinction (5% Critically Endangered, 7% Endangered, 7% Vulnerable) in the Mediterranean Region. In addition, at least 16 irreplaceable species are already extinct, including some endemics (Vlachogianni et al., 2012; Avgın et al., 2015).

The Mediterranean basin is the richest biogeographic region for invertebrates; 75% of the total European insect fauna are found there (Balletto & Casale, 1991). With most representatives in the Order Coleoptera, insect diversity in the region is also high. In addition, the number of Cerambycidae in countries of the Mediterranean basin is higher than in countries situated farther to the north. For example, the number of cerambycids of Italy equals 296 (Sama & Rapuzzi, 2011), of Greece about 330 (Danilevsky, 2014), whereas in Poland there are only 192 species (Gutowski et al., 2012).

Within borders of region as well as in neighboring countries and regions, Turkey is surrounded on 3 sides by large water bodies, it has continental properties including exceptionally diverse topographical features. The latter have provided refugia in which many species have survived in spite of harsh geological and climatic changes. Turkey is located at an intersection of geographical regions with large climatic and geographical gradients as well as a diversity of ecosystems and habitats (Kahraman et al., 2011; International Union for Conservation of Nature, 2012; Avgın et al., 2015). The great biological importance of Turkey is evident from the remarkable variety of arthropods in Turkey. The coleopteran fauna of Turkey is estimated to include 25 000 species (Koçak & Kemal, 2009). More than 700 cerambycid species occur in Turkey. As a result of this, Turkey plays an important geographic and ecological role in safeguarding biodiversity.

*C. oblongomaculata*, *C. primis* and *C. sexmaculata* are among the saproxylic beetles in Europe. *C. oblongomaculata* and *C. sexmaculata* are considered “Data Deficient” and “Endangered” respectively, *C. primis* that described in 2013, however, has not been considered until now (Nieto & Alexander, 2010). Thus, the primary objective of this paper is to propose for acceptance of *C. primis* as a threatened long-horned species at the European and European Union level and is to define the known distribution of these insects along with information on their
ecological habits and host plants. In addition, a bibliography of previous studies related to these species is included.

**MATERIALS AND METHODS**

The material of this work is a comprehensive review of the scientific literature that was conducted to delineate the known distribution of *Calchaenesthes* species in the Mediterranean Region. Host plants and ecological habits were recorded when available. Additional surveys for these insects were conducted by many researchers and are reported herein. We included information and data that are important in assessing the level of threat to the species. These protocols included geographic range, population data, and habitat preferences (Nieto & Alexander, 2010; International Union for Conservation of Nature, 2012.). Information and data of these species are presented under the title Taxonomic history, Reported occurrence in Turkey, Reported occurrence outside Turkey, Host plants, Life cycle and biology and Status and conservation of threatened species. Moreover, a distribution map of *Calchaenesthes* species in the Mediterranean Region is also given (Fig. 1). Reported global occurrences of *Calchaenesthes* species with bibliographic citations are also provided (Tables 1, 2 and 3).

**RESULTS AND DISCUSSION**

**Taxonomic history.** The cerambycid genus *Calchaenesthes* was erected by Kraatz (1863) with the type species *Callidium oblongomaculatum* Guérin-Méneville, 1844. *Callidium nogelii* Frivaldszky, 1845, *Calchaenesthes oblongomaculatus* var. *subjunctus* Pic, 1945 and *Calchaenesthes oblongomaculata* var. *quadrimaculata* Pic, 1912 are known synonyms of the type species. *Calchaenesthes oblongomaculata* (Guérin-Méneville, 1844) is distributed in Balkan Peninsula (Bulgaria, Greece and Romania), European Turkey, ?Jordan and ?Cyprus.

The other senior species, *Calchaenesthes sexmaculata* was described by Reiche (1861) from Algeria (Kabylia) as *Anoplistes oblongomaculatum* var. *sexmaculatum*. This species occurs also in Europe (Spain) and North Africa (Morocco and Tunisia). *Calchaenesthes 6-maculatus* var. *junctus* Pic, 1922 and *Purpuricenus* (*Calchaenesthes*) *sexmaculatus* var. *parvimaculatus* Rungs, 1947 are known synonyms of the species.

*Calchaenesthes diversicollis* was described by Holzschuh (1977) from Iran (Luristan) as a subspecies of *Calchaenesthes oblongomaculatum*. It was upgraded by Holzschuh (2003) to the species level. This species is also distributed in Iraq and Turkey.

*Calchaenesthes pistaciivora* was described by Holzschuh (2003) from Iran (Kerman). This species is endemic to Iran.

*Calchaenesthes primis* was described by Özdikmen (2013 in Özdikmen et al. 2013) from Turkey (İçel). This species occurs also in Cyprus.

Consequently, the Western Palaearctic genus *Calchaenesthes* Kraatz, 1863 is included 5 species.

**An identification key for adults of *Calchaenesthes* species.**

1. Pronotum without any medio-lateral extension; postmedian spots on elytra large and oblong; Eastern Mediterranean species.........*C. oblongomaculata* (Guérin-Méneville, 1844)
2. Pronotum with more or less distinct, medio-lateral dental extensions; postmedian spots on elytra small..................................................
2. Elytra with six black spots at least in males; Western Mediterranean species. .................................................................C. sexmaculata (Reiche, 1861)  
--- Elytra with four black spots in both sexes. .....................................................................................................................3

3. Pronotum almost completely black (except reddish anterior angles); Iranian species. ..............................................................C. pistacivora Holzschuh, 2003  
--- Pronotum with reddish edges at least in anterior half. ........................................................................................................4

4. Basal black spots on elytra always reaching the suture; Western Asiatic species. .................................................................C. diversicolor Holzschuh, 1977  
--- Basal black spots on elytra never reaching the suture; Eastern Mediterranean species. .................................................................C. primis Özdikmen, 2013

**Reported occurrence in Turkey.** *Calchaenesthes oblongomaculata* and *Calchaenesthes primis* occur in Turkey. *Calchaenesthes oblongomaculata* is reported as occurring only in 1 of Turkey’s 81 provinces (Fig. 1). This is İstanbul province in European Turkey. Location reports along with specific citation(s) of those reports are listed in Table 1. Özdikmen et al. (2013) stated that the species is very likely distributed only in European Turkey for Turkey. Since, the synonym taxon *Callidium nogelii* was described by Frivaldszky (1845) from İstanbul province. *C. oblongomaculata*, however, is not distributed in Anatolia for Turkey. Since old records of this species from Anatolia should be belong to *C. primis*.

*Calchaenesthes primis* is reported as occurring in 9 of Turkey’s 81 provinces (Fig. 1). These are Adıyaman, Amasya, Burdur, Gaziantep, Hatay, İçel, Mardin, Niğde and Siirt provinces. Location reports along with specific citation(s) of those reports are listed in Table 2.

**Reported occurrence outside Turkey.** *Calchaenesthes oblongomaculata* is recorded from the Eastern Mediterranean Region, from Balkan Peninsula to Jordan, Bulgaria, Greece, Romania, European Turkey, Cyprus and Jordan. Citations of confirmed occurrence of *C. oblongomaculata* are listed in Table 1, and the recorded distribution is shown in Fig. 1. However, Özdikmen et al. (2013) stated that the records of Cyprus and Jordan of *C. oblongomaculata* need to be confirmed. As a matter of fact, Ambrus et al. (2014) reported only *C. primis* from Cyprus and did not mention another species of *Calchaenesthes* from Cyprus in their article. In addition, *C. oblongomaculata* was reported by Sama et al. (2002) from Jordan on *Quercus* spp. including *Quercus coccifera* and *Quercus alnifolia*. As known, *Calchaenesthes primis* prefers *Quercus coccifera* as its host plant. Thus, the record from Jordan is very likely belonging to *C. primis*.

*Calchaenesthes primis* is recorded from the Western Palaearctic Region, from Turkey (Anatolia) and Cyprus. Citations of confirmed occurrence of *Calchaenesthes primis* are listed in Table 2, and the recorded distribution is shown in Fig. 1.

*Calchaenesthes sexmaculata* is recorded only from the Western Mediterranean Region, from Iberian Peninsula to Tunisia, Spain, Morocco, Algeria and Tunisia. Citations of confirmed occurrence of *C. sexmaculata* are listed in Table 3, and the recorded distribution is shown in Fig. 1.

**Host plants.** *Calchaenesthes oblongomaculata* is apparently polyphagous in deciduous trees in the plant families Fagaceae (*Quercus* spp. including *Quercus macrolepis*, *Quercus coccifera* and *Quercus alnifolia*) and Rosaceae (*Crataegus* spp.) (Sama et al., 2002; Walczak et al., 2014; Hoskovec et al., 2017).

*Calchaenesthes primis* is apparently polyphagous in deciduous trees in the plant family Fagaceae, e.g. *Quercus coccifera* (Özdikmen et al., 2013; Özbek et al., 2015; Hoskovec et al., 2016) and probably also other *Quercus* species (Rejzek &
Hoskovec, 1999; Malmusi & Saltini, 2005; HSama et al., 2011; oskovec et al.,
2017).

Calchaenesthes sexmaculata is apparently polyphagous in deciduous trees in
the plant family Fagaceae, Quercus species (Vives, 2000, 2001; Verdugo, 2004;
Plaza, 2011; Verdugo & Coello, 2015), e.g. Quercus mirbeckii (Villiers, 1946;
Plaza, 2011; Verdugo & Coello, 2015), Quercus suber (Plaza & Ferrer, 1988; Plaza,
1989, 2011), Quercus pubescens, Quercus pyrenaica, Quercus lusitanica
(Verdugo, 2008), Quercus faginea (Plaza, 2011), Quercus canariensis (Verdugo &
Coello, 2015; Hoskovec et al., 2017).

Life cycle and biology. Adults and larvae of Calchaenesthes oblongomaculata can be collected only from the host plants growing in lowland and foothill habitats up to 1,000 m above sea level. Adults can usually be found sitting on the leaves or flying around of their host, especially from April to June. Authors’ observations show high activity of imagines starting at 20 °C, especially in the environment of flowering oaks and hawthorns. Duration of the life cycle is at least 2-3 years. Eggs are laid on living twigs. Larvae develop in living twigs of the host plant. Pupation takes place in the autumn and adults overwinter in the pupal cells (Sama et al., 2002; Walczak et al., 2014; Hoskovec et al., 2017).

Adults and larvae of Calchaenesthes sexmaculata can be collected only from
the host plants growing in lowland and foothill habitats up to 1,000 m above sea
level. Adults can usually be found sitting on the leaves or flying around of their
host, especially from April to June. Duration of the life cycle is at least 2-3 years.
Larvae develop in living twigs of the host plant. The overwintering stage is most
likely the larval stage. Pupation takes place in the autumn and adults overwinter

Adults and larvae of Calchaenesthes primis can be collected only from the
host plants growing in lowland and foothill habitats up to 1,000 m above sea
level. Adults can usually be found sitting on the leaves or flying around of their
host, especially from early April to late June. Duration of the life cycle is at least 2-3
years. Larvae develop in living twigs of the host plant. Pupation takes place in the
autumn and adults overwinter in the pupal cells. Interestingly, the beetles tend to
gather on selected living trees showing a strong preference for stunted oaks
growing on poor stony grounds. This behaviour implies that a infochemical
(aggregation or sex pheromone) mediated communication might be used by this
species (Demelt, 1963; Rejzek & Hoskovec, 1999; Malmusi & Saltini, 2005; Sama
et al., 2011; Özbek et al., 2013; Ambrus et al., 2014; Özbek et al., 2015;
Hoskovec et al., 2017).

Status and conservation of threatened species. These members of Calchaenesthes are more or less rare species.

Calchaenesthes oblongomaculata is among the saproxylic beetles in Europe
and Turkey. It is classified in the category of “Data Deficient” in the European Red
List of Saproxylic Beetles (Nieto & Alexander, 2010). We included information
and data that are important in assessing the level of threat to the species. These
protocols included geographic range, population data, and habitat preferences
Subsequently, we propose that this beetle should be classified in the category of
“Vulnerable” on the European Red List at the European and European Union
level. Besides, Özdikmen (2014) suggested that the species should be listed in the
category of “Data Deficient” in the Turkish Red List. Based on its distribution,
collection dates, and records from Turkey, we concur with that placement.
Calchaenesthes sexmaculata is among the saproxylic beetles in Europe and North Africa. It is classified in the category of “Endangered” in the European Red List of Saproxylic Beetles (Nieto & Alexander, 2010). We included information and data that are important in assessing the level of threat to the species. These protocols included geographic range, population data, and habitat preferences (Nieto & Alexander, 2010; International Union for Conservation of Nature, 2012). Based on its very restricted distribution (only in Andalusia, has ben cited only several times), the known small number of populations with a high degree of fragmentation and, apparently, by the very reduced population density in the Iberian Peninsula, we concur with that placement. In addition, this species is classified in the category of “Vulnerable” because it is an north-africano-betico endemism in the Western Mediterranean Region in the Red Book of the invertebrates of Andalusia (Verdugo, 2008) and the Atlas of threatened invertebrates of Spain (Plaza, 2011), we also concur with that placement for its worldwide distribution.

Calchaenesthes primis is among the saproxylic beetles in Europe and Turkey, however, has not been classified on the European Red List of Saproxylic Beetles until now (Nieto & Alexander, 2010). Since this species was described by Özdkikmen (2013 in Özdkikmen et al., 2013) from Turkey and was firstly reported by Ambrus et al. (2014) from Cyprus. We included information and data that are important in assessing the level of threat to the species. These protocols included geographic range, population data, and habitat preferences (Nieto & Alexander, 2010; International Union for Conservation of Nature, 2012). Subsequently, we propose that this beetle should be classified in the category of “Endangered” on the European Red List at the European and European Union level. Besides, we suggested that the species should be listed in the category of “Vulnerable” in the Turkish Red List based on its distribution, collection dates, and records from Turkey.

**LITERATURE CITED**


Figure 1. Distribution of Calchaenesthes species in the Mediterranean basin (■ C. oblongomaculata, □ C. primis, ▪ C. sexmaculata).
Table 1. Reported global occurrence of *Calchaenesthes oblongomaculata*, with bibliographic citations.

<table>
<thead>
<tr>
<th>Country</th>
<th>Regional Unit</th>
<th>Locality</th>
<th>Citations</th>
</tr>
</thead>
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<td>Turkey</td>
<td></td>
<td></td>
<td>Ganglbauer, 1881; Löbl &amp; Smetana, 2010; Özdikmen et al., 2013; Hoskovec et al., 2017; Danilevsky, 2017</td>
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<tr>
<td>Turkey</td>
<td>İstanbul</td>
<td></td>
<td>Frivaldszky, 1845; Kraatz, 1863; Ganglbauer, 1881; Özdikmen et al., 2013</td>
</tr>
<tr>
<td>Greece</td>
<td></td>
<td></td>
<td>Guérin-Méneville, 1844; Ganglbauer, 1881; Serafim, 2009; Löbl &amp; Smetana, 2010; Maican &amp; Serafim, 2012; Özdikmen et al., 2013; Hoskovec et al., 2017; Danilevsky, 2017</td>
</tr>
<tr>
<td>Greece</td>
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<td>Pessani Forest</td>
<td>Berger, 2005</td>
</tr>
<tr>
<td>Greece</td>
<td>Mainland: Ioannina</td>
<td>Vrosina</td>
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<td>Greece</td>
<td>Peloponnesse</td>
<td>Taygetus</td>
<td>Pic, 1945</td>
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<td>Greece</td>
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<td>Alpochori</td>
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<td>Kalogria</td>
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<td>Peloponnesse: Arcadia</td>
<td>Agios Petros</td>
<td>Walczak et al., 2014</td>
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<td>Tripoli</td>
<td>Hoskovec et al., 2017</td>
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<td>Greece</td>
<td>Peloponnesse: Elis</td>
<td>Ilida: Andritsaina</td>
<td>Berger, 2005</td>
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<td>Kraatz, 1863; Serafim, 2009; Löbl &amp; Smetana, 2010; Maican &amp; Serafim, 2012; Özdikmen et al., 2013; Hoskovec et al., 2017; Danilevsky, 2017</td>
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<td>Esechioi</td>
<td>Panin &amp; Săvulescu, 1961; Serafim, 2009; Maican &amp; Serafim, 2012</td>
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<td>Serafim, 2009; Löbl &amp; Smetana, 2010; Maican &amp; Serafim, 2012; Özdikmen et al., 2013; Hoskovec et al., 2017; Danilevsky, 2017</td>
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<td>Jordan</td>
<td>Ajloun</td>
<td>Sakib</td>
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Table 2. Reported global occurrence of *Calchaenesthes primis*, with bibliographic citations.

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<th>Locality</th>
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<td>Turkey</td>
<td>Adıyaman</td>
<td>Kahta (Karadut)</td>
<td>Rejzek &amp; Hoskovec, 1999; Öz dikmen et al., 2013; Hoskovec et al., 2017</td>
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<td>Gümüşhacıköy (İnegöl Mt.)</td>
<td>Malmusi &amp; Saltini, 2005; Öz dikmen et al., 2013</td>
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<td>Altinayla env.</td>
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<td>Islahiye</td>
<td>Demelt, 1963; Öz dikmen et al., 2013</td>
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<td>Hatay</td>
<td>Hassa (Akbez)</td>
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<td>Kovada Lake National Park</td>
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<td>İçel</td>
<td>Erdemli (Güzeloluk)</td>
<td>Malmusi &amp; Saltini, 2005; Öz dikmen et al., 2013; Hoskovec et al., 2017</td>
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<td>Erdemli (Arslanlı)</td>
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<td>İçel</td>
<td>Mut</td>
<td>Öz dikmen et al., 2013; Özbek et al., 2015</td>
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<td>Turkey</td>
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<td>Midyat (Haberli)</td>
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<td>Turkey</td>
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<td>Ulukışla (Çiftehan)</td>
<td>Holzschuh, 1977; Öz dikmen et al., 2013</td>
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<td>Turkey</td>
<td>Siirt</td>
<td>Şirvan</td>
<td>Holzschuh, 1977; Öz dikmen et al., 2013</td>
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<td>Ganglbauer, 1881; Lodos, 1998; Ambrus et al., 2014; Danilevsky, 2017</td>
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<td>Cyprus</td>
<td>Larnaca</td>
<td>Pano Lefkara</td>
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Table 3. Reported global occurrence of *Calchaenesthes sexmaculata*, with bibliographic citations.

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<td>Yakouren and Akfadou forests</td>
<td>Pic, 1896; Villiers, 1946</td>
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<td>Algeria</td>
<td>Skikda</td>
<td>Philippeville</td>
<td>Villiers, 1946</td>
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<td>Species/Cork</td>
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<td>Morocco</td>
<td>Fès-Boulemane</td>
<td>Daiet Achlef</td>
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<td>Arahou, 2008; Hoskovee et al., 2017</td>
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<td>Villiers, 1946; Rungs, 1947</td>
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<td>Lacordaire, 1869; Vives, 2000, 2001</td>
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<td>Posada del Ahogado, Sierra de Ojén (Tarifa)</td>
<td>Plaza &amp; Ferrer, 1988; Verdugo, 2004; Plaza, 2011</td>
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<td>Andalusia: Cádiz</td>
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<td>Plaza, 1989, 2011; Verdugo, 2004</td>
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<td>La Almoraima (Castelar de La Frontera)</td>
<td>Plaza, 2011</td>
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<td>Spain</td>
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<td>Sláma &amp; Simón Sorli, 2001; Verdugo, 2008; Plaza, 2011</td>
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<td>Andalusia: Málaga</td>
<td>Puerto de los Pilones (Junquera)</td>
<td>Verdugo, 2004; Plaza, 2011</td>
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<td>Sierra de las Nieves</td>
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FAUNA OF TEPHRITINAE (DIPTERA: TEPHRITIDAE) IN KAHRAMANMARAŞ PROVINCE OF TURKEY

Vedat Görmez* and Murat Küütük**

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ABSTRACT: This study is based on the Tephritinae (Diptera: Tephritidae) materials collected from Kahramanmaraş province during 2009 and 2010. During this study, 29 species belonging to 14 genera were determined from research region. Location information of the specimens examined, zoogeographical distributions and wing figures of all species were given.

KEY WORDS: Fruit flies, Tephritinae, Tephritidae, Diptera, fauna, Kahramanmaraş, Turkey

The fruit flies family are represented by 6 subfamilies, 500 genera and about 4500 species in the world (Freidberg, 2006). Faunistic studies on the fruit flies began with Giray (1966) in Turkey. Koçak & Kemal (2013) reported the largest list for Turkey Tephritidae fauna. According to this list, the Turkey Tephritidae fauna was represented with 156 species. In the studies done later, Yaran & Küütük (2014) described as a new species Urophora turkeyensis from Niğde. Yaran (2014) recorded Dioxyna sororcula, Terellia ivannikovi and Urophora trinervii species for the first time from Turkey in his PhD thesis. Thus, the Turkey Tephritidae fauna has reached to 160 species. The Tephritinae subfamily has the highest number of genera and species in the family of fruit flies in Turkey.

In this study, fauna of Tephritinae (Diptera: Tephritidae) were determined in Kahramanmaraş province. During this study, 29 species belonging to 14 genera were identified from research region. Location information of the identified specimens, Zoogeographic distributions and wing figures of all species were given in this paper.

MATERIALS AND METHODS

Adult materials were collected randomly from host plants by using an insect net in Kahramanmaraş province during 2009 and 2010. In the research region, fruit flies specimens were collected from elevations ranging from 400 m to 2000 m. Species were identified using the keys of Giray (1979), Foote (1984), White (1988), Freidberg & Kugler (1989), Merz (1994), Küütük (2003a), Küütük & Özgür (2003a), Özgür & Küütük (2003), Pakyürek (2006), Küütük (2006b) and Yaran (2009). Specimens were deposited in the insect laboratory of Gaziantep University.

RESULTS

In this study, 390 (203 male, 187 female) specimens of Tephritinae subfamily were collected in Kahramanmaraş province. During the study, 29 species within
the Tephritinae were identified. Figures of wing patterns of all specimens were given and species listed alphabetically in this paper.

**Acanthiophilus helianthi (Rossi, 1794)**

Material examined: 2 ♂♂, 5 ♀♀, Göksun, 38° 00' N, 36° 29' E, 1339 m, 18.07.2009; 4 ♂♂, 2 ♀♀, Düğünüryurd, 38° 08' N, 36° 41' E, 1389 m, 19.07.2009; 8 ♀♀, Aşın, 38° 12' N, 36° 58' E, 1165 m, 19.07.2009; 4 ♂♂, Narlı, 37° 20' N, 37° 09' E, 619 m, 13.05.2010; 1 ♂, 1 ♀, Türküoğlu, Aksu, 37° 30' N, 36° 53' E, 456 m, 13.05.2010; 2 ♂♂, 3 ♀♀, Kılıh, 37° 23' N, 36° 52' E, 516 m, 13.05.2010; 6 ♂♂, 2 ♀♀, Gökcük, 37° 27' N, 37° 35' E, 525 m, 15.05.2010; 5 ♂♂, 2 ♀♀, Çağlayancerit, 37° 44' N, 37° 14' E, 1461 m, 15.06.2010; 2 ♂♂, 2 ♀♀, Hasancık, 37° 37' N, 36° 46' E, 478 m, 02.07.2010; 2 ♂♂, 1 ♂, Andırın, Yenicekale, 37° 35' N, 36° 35' E, 1226 m, 02.07.2010; 2 ♂♂, 6 ♀♀, Andırın, 37° 34' N, 36° 20' E, 1074 m, 02.07.2010; 6 ♂♂, 4 ♀♀, Torlar, 37° 32' N, 36° 25' E, 1071 m, 02.07.2010; 1 ♂, Elbistan, Büyük yapalak, 38° 18' N, 37° 18' E, 1300 m, 24.07.2010; 4 ♀♀, Kuzucak, 37° 35' N, 37° 10' E, 980 m, 25.07.2010; 2 ♂♂, 1 ♂, Bozlar, 37° 41' N, 37° 26' E, 941 m, 25.07.2010. **Distribution:** Albania, Andorra, Austria, Balearic Is., Belgium, Britain I., Bulgaria, Canary Is., Corsica, Crete, Cyclades Is., Cyprus, Czech Republic, Dodecanese Is., French mainland, Germany, Greek mainland, Hungary, Italian mainland, Madeira, Malta, Moldova, Netherlands, Norwegian mainland, Poland, Portuguese mainland, Romania, Russia Central, Russia East, Sardinia, Sicily, Slovakia, Spanish mainland, Switzerland, Turkey, Ukraine (Kütük, 2003a; Yaran, 2014; Fauna Europaea, 2017).

**Actinoptera discoidea (Fallen, 1814)**

Material examined: 1 ♂, 1 ♀, Kahramanmaraş, Göksun, Değirmendere, 37° 55' N, 36° 27' E, 1401 m, 17.07.2010; 1 ♀, Göksun, Kırksu Plateau, 37° 46' N, 36° 21' E, 1525 m, 22.07.2010. **Distribution:** Armenia, Azerbaijan, Caucasian, Czech Republic, Danish mainland, Estonia, France, French mainland, Georgia, Germany, Hungary, Kazakhstan, Latvia, Lithuania, Moldavia, Poland, Russia, Sweden, Switzerland, Turkey, Ukraine, Yugoslavia (Foote, 1984; Merz, 1994; Kütük, 2003a; Fauna Europaea, 2017).

**Campiglossa producta (Loew, 1844)**

Material examined: 1 ♂, 1 ♀, Kahramanmaraş, Göksun, Püren Gateway, 37° 57' N, 36° 32' E, 1500 m, 18.07.2009; 2 ♀♀, Çağlayancerit, 37° 44' N, 37° 14' E, 1461 m, 15.06.2010; 2 ♀♀, Andırın, Yenicekale, 37° 35' N, 36° 35' E, 1226 m, 02.07.2010; 1 ♂, 1 ♀, Göksun, Kirikkilise, 37° 58' N, 36° 17' E, 1542 m, 08.07.2010; 2 ♀♀, Göksun, Yiricek, 37° 59' N, 36° 26' E, 1407 m, 23.07.2010. **Distribution:** Albania, Arabian Peninsula, Armenia, Austria, Azerbaijan, Azores, Balearic Is., Belgium, Britain I., Bulgaria, Canada, Canary Is., Channel Is., Corsica, Crete, Cyclades Is., Cyprus, Czech Republic, Denmark, Dodecanese Is., Egypt, Finland, French mainland, France, Germany, Greece, Greek mainland, Hungary, Iran, Iraq, Ireland, Israel, Italy, Italian mainland, Lebanon, Madeira, Malta, Moldova, Netherlands, North Aegean Is., Poland, Portugal, Portuguese mainland, Romania, Sardinia, Sicily, Slovakia, Spanish mainland, Switzerland, Syria, Turkey, Ukraine (Kütük, 2003a; Merz & Korneyev, 2004; Fauna Europaea, 2017).

**Capitetes ramulosus (Loew, 1844)**

Material examined: 1 ♀, Kahramanmaraş, Çağlayancerit, 37° 44' N, 37° 14' E, 1461 m, 15.06.2010. **Distribution:** Albania, Canary Islands, Cyprus, Egypt, France, Greece, Israel, Italy, Portugal, Syria, Turkey, Yugoslavia (Foote, 1984; Freidberg & Kugler, 1989; Kütük, 1998; Fauna Europaea, 2017).

**Dioxyna bidentis (Robineau-Desvoidy, 1830)**

Material examined: 1 ♀, Kahramanmaraş, Andırın, 37° 34' N, 36° 20' E, 1074 m, 02.07.2010. **Distribution:** Albania, Austria, Belgium, Britain I., Bulgaria, China, Crete, Czech Republic, Danish mainland, Finland, French mainland, Germany, Hungary, Ireland,
Italian mainland, Lithuania, Malta, Netherlands, North Aegean Is., North Africa, Norway, Poland, Romania, Russia Central, Russia East, Sicily, Slovakia, Spain, Sweden, Switzerland, Turkey (Foote, 1984; Freidberg & Kugler, 1989; Küttük, 1998; Fauna Europaea, 2017).

**Euaresta bullans** (Wiedemann, 1830)

**Material examined:** 1 ♂, Kahramanmaraş, Göksun, Beli Plateau, 37° 51' N, 36° 24' E, 1606 m, 18.07.2009; 1 ♂, Göksun, 38° 01' N, 36° 29' E, 1430 m, 19.07.2009; 1 ♀, Çağlayancerit, 37° 37' N, 37° 29' E, 960 m, 15.06.2010; 3 ♂♂, 3 ♀♀, Bozlar, 37° 41' N, 37° 26' E, 958 m, 30.06.2010; 1 ♀, Çağlayancerit, 37° 37' N, 37° 29' E, 960 m, 15.06.2010; 3 ♂♂, 3 ♀♀, Bozlar, 37° 41' N, 37° 26' E, 958 m, 30.06.2010; 1 ♀, Çağlayancerit, 37° 44' N, 37° 14' E, 1461 m, 30.06.2010; 1 ♂, Andirın, 37° 33' N, 36° 21' E, 935 m, 02.07.2010; 1 ♂, 1 ♂, Andirın, 37° 33' N, 36° 21' E, 940 m, 08.07.2010; 1 ♂, 4 ♀♀, Bozlar, 37° 41' N, 37° 26' E, 930 m, 16.07.2010; 1 ♀, Göksun, Kızılöz, 38° 01' N, 36° 40' E, 1700 m, 18.07.2010; 1 ♂, Göksun, Doğankonak, 38° 15' N, 36° 26' E, 1600 m, 23.07.2010; 1 ♂, Göksun, Kmkkoz, 38° 02' N, 36° 50' E, 1723 m, 24.07.2010; 1 ♀, Göksun, Kanlkavak, 38° 06' N, 36° 38' E, 1416 m, 24.07.2010; 1 ♂, Bozlar, 37° 41' N, 37° 26' E, 941 m, 25.07.2010. **Distribution:** Argentina, Australia, Azores, Balearic Is., Bulgaria, China, Crete, France, French mainland, Greece, Hungary, Israel, Italian mainland, Italy, Kaliningrad Region, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Madeira, Malta, Moldova, Monaco, Peru, Romania, Russia, Slovakia, South Africa, Spain, Spanish mainland, Turkey, Ukraine, United States, Uruguay (Hendel, 1927; Giray, 1969; Giray, 1979; Foote, 1984; Freidberg & Kugler, 1989; Norrbom & et al., 1999; Küttük, 2003a; Fauna Europaea, 2017).

**Goniurella longicauda** Freidberg, 1980

**Material examined:** 1 ♂, Kahramanmaraş, Narlı, Böltürkçe, 37° 26' N, 37° 10' E, 638 m, 15.06.2010; 1 ♂, Çağlayancerit, 37° 37' N, 37° 29' E, 960 m, 15.06.2010; 2 ♀♀, Çağlayancerit, 37° 37' N, 37° 29' E, 960 m, 15.06.2010; 1 ♂, Çağlayancerit, 37° 44' N, 37° 14' E, 1461 m, 15.06.2010; 1 ♂, Çağlayancerit, 37° 44' N, 37° 14' E, 1461 m, 15.06.2010; 1 ♂, Göksun, Keklikolu, 38° 11' N, 36° 27' E, 1660 m, 17.07.2010. **Distribution:** Canary Is., Albania, Canary Islands, China, Cyprus, Egypt, France, French mainland, Israel, Lebanon, Libya, Morocco, Syria, Tunisia, Turkey (Foote, 1984; Freidberg & Kugler, 1989; Küttük, 2003a; Fauna Europaea, 2017).

**Heringina guttata** (Fallen, 1814)

**Material examined:** 1 ♂, 1 ♂, Kahramanmaraş, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 07.07.2010; 4 ♂♂, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 17.07.2010; 1 ♂, Göksun, Kanlkavak, 38° 06' N, 36° 38' E, 1416 m, 24.07.2010. **Distribution:** Armenia, Austria, Azerbaijan, Czech Republic, Czechoslovakia, Danish mainland, Estonia, Finland, Georgia, Germany, Hungary, Iran, Kazakhstan, Latvia, Lithuania, Moldova, Netherlands, Poland, Russia, Sweden, Switzerland, Turkey, Ukraine (Foote, 1984; Merz, 1994; Küttük, 2003a; Fauna Europaea, 2017).

**Oxyna flavipennis** (Loew, 1844)

**Material examined:** 1 ♂, 1 ♂, Kahramanmaraş, Göksun, Yiricek, 37° 59' N, 36° 26' E, 1407 m, 23.07.2010; 4 ♂♂, 2 ♀♀, Göksun, 38° 03' N, 36° 28' E, 1375 m, 23.07.2010. **Distribution:** Albania, Andorra, Austria, Belgium, Britain I., Bulgaria, Central and South Europe, Channel Is., Czech Republic, Estonia, Finland, France, French mainland, Germany, Greek mainland, Hungary, Israel, Italian mainland, Latvia, Lithuania, Macedonia, Moldavia, Netherlands, Norwegian mainland, Poland, Romania, Russia Central, Russia East, Sicily, Slovakia, Spanish mainland, Sweden, Switzerland, Turkey, Ukraine, UK (Foote, 1984; White, 1988; Freidberg & Kugler, 1989; Merz, 1994; Küttük, 2003a; Fauna Europaea, 2017).

**Sphenella marginata** (Fallen, 1814)

**Material examined:** 1 ♂, Kahramanmaraş, Göksun, Geben, 37° 44' N, 36° 27' E, 1255 m, 18.07.2009; 3 ♂♂, 3 ♀♀, Göksun, 38° 01' N, 36° 29' E, 1340 m, 19.07.2009; 1 ♂, Narlı, 37° 20' N, 37° 09' E, 619 m, 13.05.2010; 1♂, Kılıh, 37° 23' N, 36° 52' E, 516 m, 13.05.2010; 1 ♀,
Göksun, Kabaağaç, 38° 08' N, 37° 02' E, 1119 m, 07.07.2010; 1 ♂, Göksun, Kirikkılise, 37° 58' N, 36° 17' E, 1542 m, 08.07.2010; 1 ♂, Göksun, Yiricek, 37° 59' N, 36° 26' E, 1407 m, 23.07.2010; 2 ♀♂, 1 ♂, Göksun, Acıömer, 38° 02' N, 36° 36' E, 1342 m, 24.07.2010.

**Distribution:** Afro-Tropical Region, Albania, Arabian Peninsula, Armenia, Austria, Azerbaijan, Azores, Balearic Is., Belgium, Britain I., Bulgaria, Canary Is., Caucasus, Channel Is., Corsica, Crete, Croatia, Cyclades Is., Cyprus, Czech Republic, Danish mainland, Denmark, Dodecanese Is., East Paleartic, Egypt, France, French mainland, Finland, Georgia, , Germany, Greece, Greek mainland, Hungary, Iran, Iraq, Ireland, Israel, Italian mainland, Italy, Lebanon, Lithuania, Madeira, Malta, Moldova, Netherlands, North Aegean Is North Africa., Northern Ireland, Norway, Norwegian mainland, Poland, Portugal, Portuguese mainland, Romania, Russia East, Sardinia, Sicily, Slovakia, Spain, Spanish mainland, Sweden, Syria, Switzerland, Turkey, (Hendel, 1927; Foote, 1984; White, 1988; Freidberg & Kugler, 1989; Merz, 1994; Kütk, 2003a; Merz & Korneyev, 2004; Fauna Europaea, 2017).

**Tephritis carmen** Hering, 1937

**Material examined:** 1 ♂, Kahramanmaraş, Göksun, Acıelma, 38° 00' N, 36° 25' E, 1650 m, 23.07.2010; 1 ♂, 1 ♀, Göksun, Kuğtaş, 37° 58' N, 36° 20' E, 1652 m, 23.07.2010.

**Distribution:** Albania, Austria, Bulgaria, Belgium, France, French mainland, Greek mainland, Italian mainland, Italy, Spain, Spanish mainland, Switzerland, Turkey, Ukraine (Foote, 1984, Merz, 1994; Özgür & Kütk, 2003; Fauna Europaea, 2017).

**Tephritis cometa (Loew, 1840)**

**Material examined:** 1 ♂, Kahramanmaraş, Göksun, 38° 01' N, 36° 29' E, 1340 m, 19.07.2009; 1 ♂, Göksun, Kuğtaş, 37° 58' N, 36° 20' E, 1652 m, 23.07.2010. **Distribution:** Afghanistan, Armenia, Austria, Azerbaijan, Belgium, Britain I., Bulgaria, Central European Russia Czech Republic, Danish mainland, East Europe European Russia, East Paleartic, England, Estonia, Finland, French mainland, Georgia, Germany, Greek mainland, Hungary, Israel, Italian mainland, Kazakhstan, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Moldova, Near East, Netherlands, Norwegian mainland, Poland, Romania, Russia, Slovakia, Spanish mainland, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan (Hendel, 1927; Foote, 1984; White, 1988; Freidberg & Kugler, 1989; Merz, 1994; Kütk, 2003a; Fauna Europaea, 2017).

**Tephritis dioscorea (Loew, 1856)**

**Material examined:** 1 ♂, Kahramanmaraş, Çağlayanerit, 37° 44' N, 37° 14' E, 1461 m, 15.06.2010; 1 ♂, Göksun, Kirikkılise, 37° 58' N, 36° 17' E, 1542 m, 08.07.2010; 3 ♂♂, 1 ♂, Göksun, Kuğtaş, 37° 58' N, 36° 20' E, 1658 m, 17.07.2010; 1 ♂, 1 ♀, Göksun, Değirmendere, 37° 55' N, 36° 27' E, 1401 m, 17.07.2010; 1 ♂, Göksun, Beli Plateau, 37° 51' N, 36° 24' E, 1623 m, 17.07.2010; 2 ♀♀, Göksun, Kızılöz, 38° 01' N, 36° 40' E, 1700 m, 18.07.2010; 1 ♂, Göksun, Değirmendere, 37° 55' N, 36° 26' E, 1393 m, 22.07.2010; 1 ♂, 2 ♀♀, Göksun, Kuğtaş, 37° 58' N, 36° 20' E, 1652 m, 23.07.2010; 1 ♂, Göksun, 38° 03' N, 36° 28' E, 1375 m, 23.07.2010; 1 ♂, Göksun, Kınıkkoz, 38° 02' N, 36° 50' E, 1723 m, 24.07.2010. **Distribution:** Andorra, Armenia, Austria, Azerbaijan, Bulgaria, Central European Russia, Corsica, Czech Republic, East European Russia, East Paleartic, Estonia, Finland, France, French mainland, Georgia, Germany, Hungary, Italian mainland, Kazakhstan, Latvia, Lithuania, Moldova, Near East, Netherlands, Poland, Romania, Sicily, Slovakia, Spanish mainland, Sweden, Switzerland, Turkey, Ukraine, (Hendel, 1927; Foote, 1984; Merz, 1994; Thompson, 1998; Küttik, 2005b; Yaran, 2009; Fauna Europaea, 2017).

**Tephritis divisa** Rondani, 1871

**Material examined:** 4 ♂♂, 1 ♀, Kahramanmaraş, Çağlayanerit, 37° 37' N, 37° 29' E, 960 m, 15.06.2010; 1 ♂, Bozlar, 37° 43' N, 37° 24' E, 931 m, 15.06.2010; 3 ♂♂, 2 ♀♀, Çağlayanerit, 37° 44' N, 37° 14' E, 1461 m, 15.06.2010; 1 ♀, Türköğlu, Önsen, 37° 32' N, 36° 49' E, 700 m, 15.06.2010; 1 ♂, Pazarcık, 37° 27' N, 37° 13' E, 707 m, 16.06.2010; 5 ♂♂, 3 ♀♀,
Çağlayancerit, 37° 44' N, 37° 14' E, 1461 m, 30.06.2010; 1 ♂, Andırın, Yenicakale, 37° 35' N, 36° 35' E, 1226 m, 02.07.2010; 2 ♀, Andırın, 37° 34' N, 36° 20' E, 1074 m, 02.07.2010; 3♂♂, 1 ♀, Göksun, Ahmetçik, 38° 01' N, 36° 40' E, 1578 m, 06.07.2010; 1 ♂, 2 ♀, Diğünyuru, 38° 08' N, 36° 41' E, 1400 m, 07.07.2010; 1 ♂, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 07.07.2010; 2 ♂♂, Göksun, Kirikkilise, 37° 58' N, 36° 17' E, 1542 m, 08.07.2010; 1 ♂, Andırın, 37° 33' N, 36° 21' E, 940 m, 08.07.2010; 1 ♂, Çağlayancerit, 37° 43' N, 37° 13' E, 1612 m, 16.07.2010. **Distribution:** Balearic Is., Crete, Croatia, Cyprus, France, French mainland, Greek mainland, Hungary, Israel, Italian mainland, Italy, Near East, North Aegean Island, Sardinia, Sicily, Spain, Spanish mainland, Switzerland, Turkey (Thompson, 1998; Küttük, 2005b; Pakyürek, 2006; Fauna Europaea, 2017).

**Tephritis erdemlii Küttük, 2008b**

**Material examined:** 3 ♀♀, Kahramanmaraş, Göksun, Kumkkoz, 38° 01' N, 36° 49' E, 1915 m, 18.07.2010; 1 ♂, Göksun, Kumkkoz, 38° 02' N, 36° 50' E, 1723 m, 24.07.2010. **Distribution:** Turkey (Küttük, 2008b).

**Tephritis fallax (Loew, 1844)**

**Material examined:** 1 ♂, Kahramanmaraş, Andırın, Yenicakale, 37° 35' N, 36° 35' E, 1226 m, 02.07.2010; 1 ♂, Andırın, Yenicakale, 37° 35' N, 36° 35' E, 1226 m, 08.07.2010; 1 ♂, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 17.07.2010; 1 ♂, Göksun, Hügtaş, 37° 58' N, 36° 20' E, 1652 m, 23.07.2010; 1 ♂, Çağlayancerit, Kaleköy, 37° 45' N, 37° 11' E, 1560 m, 25.07.2010. **Distribution:** Andorra, Austria, Bulgaria, Czech Republic, East European Russia, Estonia, French mainland, Germany, Hungary, Italian mainland, Kazakhstan, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Spanish mainland, Sweden, Switzerland, Turkey, Ukraine (Foote, 1984; Merz, 1994; Thompson, 1998; Özgür & Küttük, 2003; Fauna Europaea, 2017).

**Tephritis formosa (Loew, 1844)**

**Material examined:** 1 ♂, Kahramanmaraş, Andırın, 37° 34' N, 36° 20' E, 1074 m, 02.07.2010; 1 ♂, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 08.07.2010; 1 ♂, 1 ♀, Göksun, Kirikkilise, 37° 58' N, 36° 17' E, 1542 m, 08.07.2010; 1 ♂, 2 ♀♀, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 17.07.2010; 1 ♂, Göksun, Beli Plateau, 37° 51' N, 36° 24' E, 1623 m, 17.07.2010; 1 ♂, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 23.07.2010; 1 ♂, Göksun, 38° 03' N, 36° 28' E, 1375 m, 23.07.2010; 1 ♂, Göksun, Doğankonak, 38° 15' N, 36° 26' E, 1600 m, 23.07.2010. **Distribution:** Albania, Andorra, Armenia, Austria, Azerbaijan, Balearic Is., Belgium, Britain Is., Bulgaria, Caucacus, Channel Is., Corsica, Crete, Czech Republic, Europe, French mainland, Georgia, Germany, Greek mainland, Hungary, Iran, Israel, Italian mainland, Malta, Moldova, Near East, Netherlands, Poland, Portuguese mainland, Romania, Russia, Sicily, Slovakia, Spanish mainland, Switzerland, Turkey, Ukraine, United Kingdom (Hendel, 1927; Foote, 1984; White, 1988; Freidberg & Kugler, 1989; Merz, 1994; Küttük, 2003a; Fauna Europaea, 2017).

**Tephritis frauenfeldi Hendel, 1927**

**Material examined:** 1 ♂, Kahramanmaraş, Andırın, Yenicakale, 37° 35' N, 36° 35' E, 1226 m, 02.07.2010; 1 ♂, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 17.07.2010; 1 ♂, Göksun, Hügtaş, 37° 58' N, 36° 20 E, 1652 m, 23.07.2010. **Distribution:** Albania, Austria, Estonia, Greek mainland, Hungary, Italian mainland, Italy, Latvia, Lithuania, Moldova, Near East, Romania, Russia, Slovakia, Switzerland, Turkey, Ukraine (Foote, 1984; Merz, 1994; Thompson, 1998; Özgür & Küttük 2003; Fauna Europaea, 2017).

**Tephritis hurvitzi Freidberg, 1981**

**Material examined:** 1 ♂, Kahramanmaraş, Narh, Bölükçam, 37° 26' N, 37° 10' E, 638 m, 15.06.2010; 1 ♂, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 17.07.2010; 1 ♂, Andırın, Suluyayla, 37° 34' N, 36° 31' E, 1145 m, 22.07.2010; 1 ♂, Göksun, Acelma, 38° 00 N, 36° 25
E, 1650 m, 23.07.2010; 1 ♂, Göksun, 38° 03' N, 36° 28' E, 1375 m, 23.07.2010. **Distribution:** Cyprus, East Palearctic, Greek mainland, Iran, Iraq, Israel, Kazakhstan, Kyrgyzstan, Near East, Russia, Syria, Turkey, Uzbekistan (Foote, 1984; Freidberg & Kugler, 1989; Freidberg & Küttük, 2002; Merz & Korneyev, 2004; Fauna Europaea, 2017).

**Tephritis hyoscyami** (Linnaeus, 1758)

**Material examined:** 1♂, Kahramanmaraş, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 07.07.2010; 1♂, 1♀, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 08.07.2010; 2♂♂, 1♀, Göksun, Kirikkilise, 37° 58' N, 36° 17' E, 1542 m, 08.07.2010; 1♂, 1♀, Göksun, Yiricek, 37° 59' N, 36° 26' E, 1407 m, 17.07.2010; 3♂♂, 5♀♀, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 17.07.2010; 3♂♂, 4♀♀, Göksun, Huştaş, 37° 58' N, 36° 20' E, 1658 m, 17.07.2010; 1♂, 2♀♀, Göksun, Beli Plateau, 37° 51' N, 36° 24' E, 1623 m, 17.07.2010; 2♂♂, Göksun, Acelma, 38° 00' N, 36° 25' E, 1650 m, 23.07.2010; 5♂♂, Göksun, Huştaş, 37° 58' N, 36° 20' E, 1652 m, 23.07.2010; 1♂, 1♀, Göksun, Fındıklıoyak, 37° 56' N, 36° 24' E, 1590 m, 23.07.2010. **Distribution:** Albania, Armenia, Austria, Azerbaijan, Belgium, Britain I., China, Czech Republic, Danish mainland, East European Russia, East Palearctic, Estonia, Finland, French mainland, Georgia, Germany, Hungary, Ireland, Italian mainland, Latvia, Lithuania, Moldova, Near East, Netherlands, Northern and Central Europe, Norwegian mainland, Poland, Portuguese mainland, Romania, Russia, Slovakia, Sweden, Switzerland, Turkey, Ukraine (Foote, 1984; Merz, 1994; Küttük, 2003a; Fauna Europaea, 2017).

**Tephritis mariannae** Merz, 1992

**Material examined:** 1♂, Kahramanmaraş, Çağlayancerit, 37° 44' N, 37° 14' E, 1461 m, 30.06.2010; 1♂, Andırın, 37° 34' N, 36° 20' E, 1074 m, 02.07.2010; 2♀♀, Çağlayancerit, 37° 43' N, 37° 13' E, 1612 m, 16.07.2010; 2♀♀, Göksun, Yiricek, 37° 59' N, 36° 26' E, 1407 m, 23.07.2010. **Distribution:** French mainland, Switzerland, Turkey (Merz, 1994; Küttük 2006a; Fauna Europaea, 2017).

**Tephritis nigricauda** (Loew, 1856)

**Material examined:** 1♂, Kahramanmaraş, Göksun, Huştaş, 37° 58' N, 36° 20' E, 1658 m, 07.07.2010; 1♂, Göksun, Kirikkilise, 37° 58' N, 36° 17' E, 1542 m, 08.07.2010; 2♀♀, Göksun, Keklikoluk, 38° 11' N, 36° 27' E, 1660 m, 17.07.2010; 2♂♂, Göksun, Huştaş, 37° 58' N, 36° 20' E, 1658 m, 17.07.2010; 1♂, Göksun, Kırksu Plateau, 37° 46' N, 36° 21' E, 1525 m, 22.07.2010; 1♀, Göksun, Değirmendere, 37° 55' N, 36° 26' E, 1393 m, 22.07.2010; 1♂, Göksun, Yiricek, 37° 59' N, 36° 26' E, 1407 m, 23.07.2010; 2♂♂, Göksun, Huştaş, 37° 58' N, 36° 20' E, 1652 m, 23.07.2010; 1♀, Göksun, Doğankonak, 38° 15' N, 36° 26' E, 1600 m, 23.07.2010; 1♂, Çağlayancerit, Kakeköy, 37° 45' N, 37° 11' E, 1560 m, 25.07.2010. **Distribution:** Afghanistan, Albania, Austria, Balearic Is., Bulgaria, Corsica, Crete, Czech Republic, East European Russia, East Palearctic, Estonia, Far East, France, Germany, Greek mainland, Hungary, Italian mainland, Latvia, Lithuania, Malta, Moldova, Near East, North Aegean Is., North Africa, North European, Poland, Portuguese mainland, Romania, Russia, Sardinia, Sicily, Spanish mainland, Switzerland, Syria, Turkey, Ukraine (Foote, 1984; Merz, 1994; Küttük & Özgür, 2003a; Merz & Korneyev, 2004; Fauna Europaea, 2017).

**Tephritis postica** (Loew, 1844)

**Material examined:** 2♂♂, Kahramanmaraş, Çağlayancerit, 37° 37' N, 37° 29' E, 960 m, 15.06.2010; 1♀, Çağlayancerit, 37° 44' N, 37° 14' E, 1461 m, 15.06.2010; 2♂♂, 1♀, Göksun, Mehmetbey, 38° 04' N, 36° 27' E, 1480 m, 17.07.2010; 1♀, Göksun, Kimikkoz, 38° 02' N, 36° 50' E, 1723 m, 24.07.2010; 1♂, Göksun, Kabaağaç, 38° 10' N, 37° 01' E, 1120 m, 24.07.2010; 5♂♂, 4♀♀, Elbistan, Büyükykapalak, 38° 18' N, 37° 18' E, 1300 m, 24.07.2010. **Distribution:** Albania, Austria, Balearic Is., China, Corsica, Crete, Cyprus, Czech Republic, East Palearctic, France, Georgia, Germany, Greece, Hungary, Iran, Israel, Italian mainland, Kazakhstan, Kyrgyzstan, Moldova, Near East, North Africa, Poland, Romania, Sicily, Slovakia, Spanish mainland, Switzerland, Turkey, West Asia (Hendel, 1927; Zaitzev, 1947;
**Tephritis praeox (Loew, 1844)**

Material examined: 1 ♂, 1 ♀, Kahramanmaraş, Andırın, 37° 34' N, 36° 20' E, 1074 m, 02.07.2010; 1 ♂, Diğünıurdyu, 38° 08' N, 36° 41' E, 1400 m, 07.07.2010; 1 ♂, Göksun, Keklikoluk, 38° 11' N, 36° 27' E, 1660 m, 17.07.2010; 1 ♂, Göksun, Yiricek, 37° 59' N, 36° 26' E, 1407 m, 17.07.2010; 1 ♂, Göksun, Kızlıöz, 38° 01' N, 36° 40' E, 1700 m, 18.07.2010; 1 ♂, Göksun, Kmkkoz, 38° 01' N, 36° 49' E, 1915 m, 18.07.2010; 1 ♂, Göksun, Yiricek, 37° 59' N, 36° 26' E, 1407 m, 23.07.2010; 1 ♂, Göksun, Huğutaş, 37° 58' N, 36° 20' E, 1652 m, 23.07.2010; 2 ♂♂, Göksun, Fundikhoyak, 37° 56' N, 36° 24' E, 1590 m, 23.07.2010; 1 ♂, Göksun, Kanhkavak, 38° 06' N, 36° 38' E, 1416 m, 24.07.2010. **Distribution:** Afghanistan, Albania, Austria, Balearic Is., Belgium, Britain I., Bulgaria, Canary Is., China, Corsica, Crete, Cyprus, Dodecanese Is., French mainland, Greek mainland, Hungary, Iraq, Israel, Italian mainland, Lebanon, Madeira Is., Malta, Near East, Netherlands, North Africa, Portuguese mainland, Romania, Sardinia, Sicily, Spanish mainland, Switzerland, Syria, Turkey, United Kingdom (Hendel, 1927, Foote, 1984, Freidberg & Kugler, 1989, Merz, 1994; Merz & Korneyev, 2004; Fauna Europaea, 2017).

**Tephritis sauterina Merz, 1994**

Material examined: 1 ♂, Kahramanmaraş, Göksun, Acemla, 38° 00' N, 36° 25' E, 1650 m, 23.07.2010. **Distribution:** Greece, Switzerland, Turkey (Merz, 1994; Kütük, 2003a; Fauna Europaea, 2017).

**Tephrityomia lauta (Loew, 1869)**

Material examined: 3 ♂♂, 1 ♀, Kahramanmaraş, Göksun, Püren Gateway, 37° 57' N, 36° 32' E, 1500 m, 18.07.2009; 1 ♂, Göksun, Beli Plateau, 37° 51' N, 36° 24' E, 1606 m, 18.07.2009; 1 ♂, Göksun, Geben, 37° 44' N, 36° 27' E, 1255 m, 18.07.2009; 1 ♂, Pazarçuk, Akçalar, 37° 30' N, 37° 25' E, 918 m, 15.06.2010; 8 ♂♂, Çağlayançerit, 37° 44' N, 37° 14' E, 1461 m, 15.06.2010; 5 ♂♂, 7 ♀♀, Andırın, 37° 33' N, 36° 21' E, 935 m, 02.07.2010; 1 ♂, 2 ♀♀, Elbistan, Akpınar, 38° 04' N, 37° 12' E, 1323 m, 07.07.2010; 1 ♂, Çağlayançerit, Közanlıpinar, 37° 36' N, 37° 11' E, 980 m, 16.07.2010; 3 ♂♂, Kuzučak, 37° 35' N, 37° 10' E, 980 m, 25.07.2010. **Distribution:** Crete, Cyclades Is., Cyprus, Dodecanese Is., Egypt, Greece, Iran, Israel, Morocco, Near East, North Africa, Tunisia, Turkey (Hendel, 1927; Giray, 1979; Foote, 1984; Freidberg & Kugler, 1989; Merz & Korneyev, 2004; Fauna Europaea, 2017).

**Trupanea amoena (Frauenfeld, 1857)**

Material examined: 1 ♂, Kahramanmaraş, Göksun, Püren Gateway, 37° 57' N, 36° 32' E, 1500 m, 18.07.2009; 1 ♂, Diğünıurdyu, 38° 08' N, 36° 41' E, 1389 m, 19.07.2009; 1 ♂, Narlı, 37° 20' N, 37° 09' E, 619 m, 15.06.2010; 1 ♂, Pazarçuk, 37° 37' N, 37° 29' E, 929 m, 30.06.2010; 1 ♂, Elbistan, Erçene, 38° 12' N, 36° 58' E, 1285 m, 07.07.2010; 1 ♂, Andırın, 37° 33' N, 36° 21' E, 940 m, 08.07.2010; 2 ♀♀, Çağlayançerit, 37° 43' N, 37° 13' E, 1612 m, 16.07.2010; 1 ♂, 2 ♀♀, Göksun, Değirmendere, 37° 55' N, 36° 27' E, 1401 m, 17.07.2010; 1 ♂, Elbistan, Büyükyapalak, 38° 18' N, 37° 18' E, 1300 m, 24.07.2010; 1 ♂, Kuzučak, 37° 35' N, 37° 10' E, 980 m, 25.07.2010; 1 ♂, Bozlar, 37° 41' N, 37° 26' E, 941 m, 25.07.2010. **Distribution:** Afro-tropical region, Albania, Andorra, Australian region, Austria, Balearic Is., Belgium, Britain I., Bulgaria, Canary Is., Central and Northern Europe, Central Asia, Corsica, Crete, Croatia, Cyprus, Czech Republic, Dodecanese Is., East Palearctic, Ethiopia, Flip Flops, French mainland, Germany, Greek mainland, Hungary, India, Iran, Israel, Italian mainland, Madeira Is., Malta, Moldova, Near East, Netherlands, North Africa, Oriental region, Poland, Portuguese mainland, Romania, Sardinia, Sicily, Sri Lanka, Switzerland, Taiwan, Turkey, United Kingdom (Hendel, 1927; Giray, 1969; Foote, 1984;
White, 1988; Freidberg & Kugler, 1989; Merz, 1994; Merz & Korneyev, 2004; Fauna Europaea, 2017).

**Trupanea stellata** (Fuesslin, 1775)

**Material examined:** 1 ♀, Kahramanmaraş, Pazarlık, 37° 27’ N, 37° 13’ E, 707 m, 16.06.2010; 1 ♀, Göksun, Kabağaç, 38° 08’ N, 37° 02’ E, 1119 m, 07.07.2010; 1♂, Düğünyurdur, 38° 08’ N, 36° 41’ E, 1400 m, 07.07.2010; 2♂♀, Göksun, Keklikoluk, 38° 11’ N, 36° 27’ E, 1660 m, 17.07.2010. **Distribution:** Afghanistan, Albania, Andorra, Austria, Azores Is., Balearic Is., Belgium, Britain I., Bulgaria, Canary Is., Central and Northern Russia, Channel Is., China, Corsica, Crete, Cyclades Is., Cyprus, Czech Republic, Danish mainland, Dodecanese Is., East European Russia, East Palearctic, Finland, French mainland, Germany, Greek mainland, Hungary, Iran, Ireland, Israel, Italian mainland, Lithuania, Madeira Is., Malta, Moldova, Near East, Netherlands, North Africa, North and East Africa, Northern Ireland, Norwegian mainland, Oriental region, Poland, Romania, Sardinia, Sicily, Slovakia, Spanish mainland, Sweden, Switzerland, Turkey, UK, Western and Central Asia (Hendel, 1927; Kerville 1939; Foote, 1984; White, 1988; Freidberg & Kugler, 1989; Merz, 1992, 1994; Norrbom & et al., 1999; Merz & Korneyev, 2004; Fauna Europaea, 2017).

**Xyphosia miliaria** (Schrank, 1781)

**Material examined:** 1♂, Kahramanmaraş, Göksun, Huğtaş, 37° 58’ N, 36° 20’ E, 1658 m, 07.07.2010; 1♂, Göksun, Kırkuş Plateau, 37° 46’ N, 36° 21’ E, 1525 m, 22.07.2010; 1♀, Göksun, 38° 03’ N, 36° 28’ E, 1375 m, 23.07.2010; 2♂♂, Göksun, Doğankonak, 38° 15’ N, 36° 26’ E, 1600 m, 23.07.2010. **Distribution:** Albania, Andorra, Armenia, Austria, Azerbaijan, Belgium, Britain I., Bulgaria, Central European Russia, Channel Is., Crete, Czech Republic, Danish mainland, East European Russia, East Palearctic, Eastern and Western Siberia, Estonia, Far East, Finland, French mainland, Georgia, Germany, Greek mainland, Hungary, Ireland, Italian mainland, Latvia, Lithuania, Moldova, Mongolia, Near East, Netherlands, Northern Ireland, Norwegian mainland, Poland, Romania, Sardinia, Sicily, Slovakia, Spanish mainland, Sweden, Switzerland, Turkey, Ukraine (Foote, 1984; Merz, 1994; Kütük, 2003a; Fauna Europaea, 2017).

**DISCUSSION**

Kahramanmaraş province is neighbor to Central Anatolia, Mediterranean, Eastern Anatolia and Southeast Anatolia regions. Therefore it is located in a transitional zone. This situation has also increased the faunistic and floristic diversity of the province. Especially, the widespread distribution of the Asteraceae family has made it possible for fruit flies to spread to this area as well.

Tephritinae is the subfamily with the largest number of species in the Palearctic region. The Turkey fauna is similarly that. 71 of the 160 species within the Tephritinae in Turkey. 29 species belonging to 14 genera of Tephritinae subfamily were determined in this study conducted in Kahramanmaraş. According to literatures, 17 species in Adana, 11 species in Adıyaman, 16 species in Aksaray, 10 species in Gaziantep, 16 species in Kayseri, 13 species in Kırşehir, 6 species in Kilis, 9 species in Nevşehir, 25 species in Niğde, 12 species in Sivas and 13 species in Şanlıurfa were identified which were located in around Kahramanmaraş province (Özgür & Kütük, 2003; Kütük, 2008a; Yaran & Kütük, 2012; Kütük & et al., 2013; Yaran & Kütük, 2015; Yaran & Kütük, 2016; Avşar & Kütük, 2017). When these literatures are compared, it is seen that Kahramanmaraş fauna is the richest fauna.

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LITERATURE CITED


SEASONAL ABUNDANCE AND DIVERSITY INDICES OF SPIDER’S WEB IN THE YEAR 2013 TO 2016 WITH SPECIAL REFERENCES OF WEB PATTERN AND ARCHITECTURE FROM DIFFERENT HABITATS OF EASTERN REGION OF RAJASTHAN, INDIA

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ABSTRACT: Spiders attract special attention to the zoologist on account of their unique weaving capability of constructing webs with geometrical precision. Web weaving habit of spiders are unique because few of others insects like (silk worm) produce silk, yet the survival value of silk spinning or web weaving has never been discovered by any observers. According to their web building ability, generally the spiders are considered as weavers or non-weavers Present paper describes the web architecture and patterns of spiders with respect to their diversity and distribution in the habitat of Eastern Rajasthan. There are more than 30,000 documented species of spider in the world. These species can be broken in to two categories: web builders and ground dwellers. The type of web spider spins depends entirely on the spider’s way of life. The pattern and architecture of webs varies family to family. During the study 6 types of web patterns Viz. Irregular web, Sheet webs, Funnel web, Orb web, Single-line web, Dome shaped horizontal webs were identified and analyzed between July 2012 to June 2015. These webs are thought to produce patterns that resemble patterns reflected by many flowers in U.V. light. Thus insect who are searching for their favorite type of flower see the decorated web in U.V. light and fly in to the trap. Spider web can take a variety of forms, but the most common type is the Orb web. The gradations of the web patterns can be written in the following order: Orb web > Sheet web > Irregular web > Funnel web > Sheet web > Irregular web > Funnel web > Single line snare web > Horizontal dome shape web. The orb web and Sheet web were very commonly observed during this study. The study focused on the spider’s web behavior and their survival strategy, which will help in their conservation.

KEY WORDS: Spiders (Araneae), web architecture and web patterns, conservation

Animals in various taxa build some kinds of nest. Nests are built to protect the owner from predators, moderate harsh environmental conditions, trap food for consumption or attract females to mate. Spiders also make a nest its called web. Spiders are the most diverse and abundant invertebrate predators in terrestrial ecosystems (Wise, 1993; Sebastian, 2009). They regulate the terrestrial arthropod population (Anonymous, 2000). The global list of spider fauna is approximately 39,882 species belonging to 3676 genera and 108 families (Platnick, 2011). Tikader (1987) published the first comprehensive list of Indian spiders which included 1067 species belonging to 249 genera in 43 families. The parental care is the most interesting event among spiders. The eggs never lay singly, but are laid in one or more clusters and each cluster is protected by a covering of silk and the egg sac or cocoon. All spiders are carnivorous, spider mainly feed on large population of Insects and also feed on other spider. The spiders daily construct a new web with the help of energy help accumulated from the food they get. The
spiders specially orb weaver spiders make their webs at night time and usually take them down in the morning Blackledge et al. (2001, 2004). They eat the silk, leaving only the base line to rebuild on. Constructing the web uses a lot of the spider’s energy does to the large amount of protein required, in the form of silk and after a time the silk will lose its stickiness and becomes inefficient at capturing prey. Eating their web is a way for the spider to recoup some of the energy used in spinning, the silk protein are thus recycled. The survey was conducted at Eastern Region of Rajasthan. Present survey is an attempt to revise and standardize spider fauna and their web weaving behavior and web patterns and architecture.

MATERIAL AND METHODS

Study area- The present work has been carried out in forest and agriculture fields of Eastern region of Rajasthan (India). The Eastern region of Rajasthan (Map-1) covers mainly Bharatpur district and some micro habitat areas of Dholpur and Karoli district (27.2170°N 77.4895°E) in Rajasthan. It was earlier known as “Braj”. This dense forest region has wide diversity of habitats ranging from marshes, grasslands, woodlands, scrublands. South-West monsoon brings rainfall during the month of June to September. The average monthly temperature is 4°C in December and 42°C in June. The humidity in winter season is as low as 42% in the month of February and as high as 89% in the month of August. Eastern Region of Rajasthan lies at the confluence of the Gambhir and Banganga rivers. The area lies between 27°21°C North Latitude and 77° 49°C East Longitude. It is a low lying area in the floodplains of river Banganga and Gambhir which are tributaries of river Yamuna covering an area of about 5099 sq. km. It is situated 180 km from Delhi, along the Delhi – Jaipur Highway, 50 km from Agra.

Methodology- Firstly the site identification is done, in this the site where the spiders and their webs are present are selected to do further study on their different web patterns.

1. Site identification: Spider build webs in shrubs, trees, along rock walls, storage rooms and corners. Many spiders live in retreat area off the web. Burrowing spiders may be found under rocks, logs in debris or old litter under plants and under sheets of wood or cardboard.

2. Spider webs identification: The different web patterns are then identified by taking their photographs and comparing them with photographs and reports on the spider’s web pattern, which were done earlier.

3. Study of Spider activities and designing web patterns: Different activities of spiders are studied which includes foraging, egg laying and ecology of the spiders, simultaneously different web patterns are also studied by taking their pictures and comparing and analyzing them with the of previous work has been done on the same and different web patterns of spiders are prepared.

4. Photography: To know each web pattern, photograph were taken by using super –macro lens of Canon camera.

RESULT AND DISCUSSION

The study was performed on 24 study sites of the said region. Spiders were collected and counted by most of the two quantitative methods viz- Transect method (with two transects per site and 50 m x 10 m transects,) and quadrate method (20 m x 10 m quadrates, with 5-5 quadrate per site and 10-10 quadrates
in 15th & 16th site. These transect and quadrates were treated as our basic sampling units. Transects and quadrates were placed randomly within stratified habitat types. Sampling was carried out between July 2013 – Dec. 2016. Spiders were sampled along these transects and quadrates using six sampling techniques (semi-quantitative sampling and pitfall traps). The main purpose of this sampling design was to produce a relatively complete species list and associated abundance data for a representative example of each habitat type in the region, and of the region as a whole.

**Different web architectures of different spiders**

Spiders attract special attention to the zoologist on account of their unique weaving capability of constructing webs with geometrical precision. Web weaving habit of spiders are unique because few of others insects like (silk worm) produce silk, yet the survival value of silk spinning or web weaving has never been discovered by any observers. According to their web building 'ability, generally the spiders are considered as weavers or non-weavers. The weavers make the snares to trap insects for food viz. pholcidae family, while the non weavers hunt the prey by chasing viz. families’ Lycosidae, Gnaphosidae, Salticidae, Oxyopidae. The spiders wait at the center or at the corner of web for capture the prey.

During the study 6 different web pattern and architectures were found in the study area. These are following types:

1. **Irregular web (Space web):** The other name of this web is Space web. In these irregular webs, here threads are extending in all direction. Irregular web mostly built by the *Pholcus* spiders and some other spiders. These types of webs are mostly found on ceiling the roof and corner of wall. Families show the irregular type of web pattern formation like Theridiidae (*Tylorida ventralis*), Pholcidae (*Artema Atlanta, Crossopryza lyoni, Pholcus phalangiodes*).

2. **Sheet web/ Tangle web:** Sheet web/ Tangle web: - A sheet web is flat with main lines running down the center. Sometimes it’s called a triangular web. The spider shakes it when any insect lands on sheet web, causing the insect to struggle and get caught in the strands. This type of web pattern formation shows by some Families like Lyniphidae and Filistatidae (*Pritha* sp.).

   Principal part of the web of a more or less closely woven sheet extended in a single plane and consisting of threads extending in all direction in that plane. These webs are found on two adjacent walls. Linyphiidae family shows the sheet type of web formation.

3. **Funnel web:** A funnel web is built in the grassland and woodland areas. The spider hides in the small end and rushes out and grabs the insects as they come down the web. Spider (Funnel web weaver) is a group of spiders that make funnel-shaped webs, which the use to trap insects. They are among the most abundant and conspicuous spiders in temperate grassland area. They are also known as grass spiders. Worldwide there are about 700 known species of funnel web spiders.

   The principal part of a funnel web is sheet like in structure, but webs of this type different from sheet web in having a tube extending from one edge these found near water cooler.

   Families like Agelenidae and Lyniphidae show funnel type of web pattern formation.

4. **Orb webs:** An orb web is shaped like a circle. An orb-web the characteristics feature is that the center portion, the part laying within the supporting frame work, the web of Aranidae consist of a series of radiating lines an excellent illustration of orb web.
A spider (family Araneidae) is typical orb-weaver, the most common group of builders of spiral wheel-shaped web weaver, this web often found in gardens, forests and fields. Spiders common name is reference from the round shape of this typical web, and the taxon was formerly also referred to as the Orbiculariae.

Orb-weavers have eight similar eyes, hairy or spiny legs, and no stridulating organs. The Araneidae family is cosmopolitan, including many well-known large or brightly colored garden spiders. The 3,006 species in 168 genera worldwide make Araneidae the third-largest family of spiders known (behind Salticidae and Linyphiidae). The orb-weavers include over 10,000 species and make up about 25% of spider diversity.

However, orb-webs are also produced by members of other families. The large golden orb-weavers (Nephilidae) and long-jawed orb weavers (Tetragnathidae) were formerly included in the Araneidae; they are indeed closely related to them, being part of super family Araneoidea. Their webs are similar to those of the typical orb-weavers, but tend to be less sophisticated and often have an irregular instead of a neat spiral arrangement of the prey-capturing threads. The cribellate or hackled orb-weavers (Uloboridae) belong to a distinct superfamily of the suborder Araneomorphae; their webs are often very sophisticated, but Uloboridae use neither venom to kill their prey, nor sticky threads in their web, and probably evolved the orb structure independently. Uloboridae are cribellate, and their threads can be recognized by the fuzzy and dull appearance, which captures prey by a velcro-like mechanism.

This type of web were recorded in four different families –

(a) Wheel-shaped orb webs- (Family- Aranidae)
(b) Large golden orb-web (Family- Nephilidae)
(c) Long-jawed orb weavers (Family- Tetragnathidae)
(d) Cribellate or hackled orb-web (Family- Uloboridae)

(5) The single - line snare: There is a single horizontal line, attached at both ends to branches that stretch about four feet across open spaces in the forest. Some species of families like Theridiidae, Uloboridae shows single-line snare type of web pattern formation.

(6) Horizontal dome shaped web: Some garden spiders like Cyrtophora Cicatrosa and Cyrtophora cicatrosa weaves a horizontal dome shape web with many radial and spiral and them raises its center to form a dome, spider builds a flat mesh under this dome. It was found on Ccycas plant. Lyniphidae and Aranidae families also build three-dimensional horizontal dome shape webs which work differently from flat orb webs. Orb webs depend on sticky silk to entangle the prey which flies horizontally into the invisible trap. In three-dimensional webs, the silk is not sticky, in which flying insects are knocked down by the vertical silk lines onto the horizontal platform, the spider then runs out of its hiding place to grab them. Another type the Tent Spiders has various ingenious hiding places. The horizontal platform is often dome shaped. Which are not rebuilt regularly and can last for a long time (several weeks). The study suggests that orb webs are not waterproof (water droplets remain on the web) while three-dimensional webs are, and may thus be more durable in wet habitats.
Dominance of web-
Orb web > Sheet web > Irregular web > Funnel web > Single line snare web > Horizontal dome shape web

In the present study the seasonal abundance of spider’s web was studied. We studied web pattern and architecture of 9 families in the study area. During the study six types of web pattern formation are identified and analyzed by comparing with the studies and reports related to the same topic. Web formation by the spiders was also been studied during this study. The dominance of Web pattern was this manner- Orb web > Sheet web > Irregular web > Funnel web > Single line snare web > Horizontal dome shape web. The orb web and Sheet web were very commonly observed during this study.

These results indicated that web’s diversity in Eastern Region of Rajasthan is mostly dependant on the presence of food and paste species in the said area. Due to presence of ample food and paste diversity the Monsoon season represented high diversity of spider’s web in this region. In the present investigation, the important observation is hunters or and ground dweller spiders dominated the study area over the web builders irrespective of the said area. This could possibly be due to the agricultural practices used in different crop fields. During the crop season, workers work in the field and their movements disturb the webs. Therefore, only those web constructing spiders were reported, which could construct their webs in a limited space and secondly most of them are nocturnal. During evening, they construct the web, prey whole the night on the pests caught in the web and by dawn, they eat their webs (Neoscona). Among web builder, Argiope and Cyclosa dominated all the three seasons. Cyclosa is thus the most successful web builder as they require a small space to construct mostly the basal webs.

The webs built by the spiders are used mainly for three purposes: for capturing the prey, for egg laying and their development, and for defense.

Spider’s web richness was estimated in each Season. Similarity of spider species among different seasons was examined using the diversity indices including, Simpson index, Shannon – weiner index and Margalef richness index. The diversity, richness, and evenness indices for spiders were calculated using the Biodiversity calculator (www. Alyoung.com/labs/biodiversity calculator_html).

Spider web diversity indices were calculated and are shown in table- 11. The dominance index (1-Simpson index) of spider’s web calculated for the year 2013-14 is 0.7594 and the Shannon index as 2.323. The Shannon indices of webs calculated for 2014-15 and 2014-15 years were 2.195 and 2.28 respectively. Margalef richness index is the highest (0.6391) for spider web diversity in year 2015-16. The Margalef richness indices are in the order year 2015-16 (0.6391) > 2013-14 (0.6062) > 2014-15 (0.6038).

Web spinning behaviour
How to spider make web: In spiders spinnerets are present at the base of abdomen. These glands produce a thread like material for making a web. There are seven different types of glands. Generally a spider has three pairs of spinnerets, but the no. of web may vary with species from one to four pair. Each spinneret has its own special function. The orb weavers make their webs during night time and usually take them down in the morning times. They eat the silk thread, leaving only the base line to re-build on. The large amount of protein required at the time of constructing the web. After some time silk becomes inefficient at capturing prey and will lose its stickiness. Eating own web is a
process for the spider to regain some of the energy it’s used in spinning. The silk proteins are thus ‘recycled’.

The process of web making start by creating an initial base line where spider uses air to carry its sticky thread. The silk which is produced by the spinnerats, sticks to a surface area then the spider slowly and carefully walk over the thread and strengthen it with a second thread. The same process is repeated until the primary thread is strong enough to support the rest of the netting. After strengthening the primary thread, the spider will continue to make Y shaped netting. The first three radials of web are now constructed. More others radials are added making sure that the distance between each radial is short enough to cross.

Then spiral of non-sticky, evenly spaced, circular threads are helpful for the spider to easily move around its own web during construction. After this, beginning from the outside in, spider will methodically create the spiral and adhesive threads. It will use initial radiating lines as well as the non-sticky spirals as guide lines. The spaces between each spiral thread will be directly proportional to the distance from the tip of its back legs to its spinners. Spider uses its own body as a measuring or spacing device. While the sticky spirals threads are formed, the non-adhesive spirals are removed as they are not needed any more.

After completed its web, the spider will chew off the initial three centre spiral threads then wait with its head down, in the web for prey to come along. If the web and its thread are broken without any structural damage during the construction, the spider does not try to repair it as this would use up too much energy and it will probably be taken down in the morning or repaired the next night.

CONCLUSION

The spider constitutes a very interesting group of primitive animal. Which are cosmopolitan in nature. Spiders attract special attention to the zoologist on account of their unique weaving capability of constructing webs with geometrical precision. They are best friends of mankind as they feed on insects, which are generally harmful to mankind. In the present study the seasonal abundance of spider’s web was studied. We studied web pattern and architecture of 9 families in the study area. During the study six types of web pattern formation are identified and analyzed by comparing with the studies and reports related to the same topic. Web formation by the spiders was also been studied during this study. The gradations of the web patterns can be written in the following order: Orb web > Sheet web > Irregular web > Funnel web > Single line snare web > Horizontal dome shape web. The orb web and Sheet web were very commonly observed during this study. These results indicated that web's diversity in Eastern Region of Rajasthan is mostly dependant on the presence of food and paste species in the said area. Due to presence of ample food and paste diversity the Monsoon season represented high diversity of spider’s web in this region. In the present investigation, the important observation is hunters or and ground dweller spiders dominate the study area over the web builders irrespective of the said area. This could possibly be due to the agricultural practices used in different crop fields. During the crop season, workers work in the field and their movements disturb the webs. Therefore, only those web constructing spiders were reported, which could construct their webs in a limited space and secondly most of them are nocturnal. During evening, they construct the web, prey whole the night on the pests caught in the web and by dawn, they eat their webs (Neoscona). Among web
builder, *Argiope* and *Cyclosa* dominated all the three seasons. Cyclosa is thus the most successful web builder as they require a small space to construct mostly the basal webs. The webs built by the spiders are used mainly for three purposes: for capturing the prey, for egg laying and their development, and for defense. It was concluded that a long-term study is needed to know more about spiders and their webs. This helps in their conservation.

ACKNOWLEDGEMENTS

We would like to thank Prof. G.N. Vankhede, Ex- Professor and Head, P.G. Dept. of Zoology, S.G.B. Amravati University, for supporting us during the past 3 years. Our deep sense of gratitude goes to Dr. M.S. Malhotra, Senior Deputy Director, ICMR, New Delhi, who had supported us continuously with all kinds of his moral support.

LITERATURE CITED


Map 1. Location Map of Eastern region of Rajasthan.
Map 2. High value biodiversity areas (HVBA) of Eastern region of Rajasthan.

Figure 1. Irregular web of spiders of Theridiidae family.
Figure 2. Sheet web of spiders of Lyniphidae family.

Figure 3. Funnel web of spiders of Lycosidae family.
Figure 4. Orb web of spiders of Aranidae family.
Figure 5. Single line snare web of spiders of Uloboridae family.

Figure 6. Horizontal dome shape web of Cyrtophora genus of family Aranidae.
Figure 7. Process of spider web formation.

Table 1. Number and percentage of Irregular web of different families in different seasons of 2013-2016.

<table>
<thead>
<tr>
<th>Family</th>
<th>No. of Irregular/Space webs in 2013-2016</th>
<th>Percentage of Irregular/Space webs in 2013-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monsoon</td>
<td>Winter</td>
</tr>
<tr>
<td>Pholcidae</td>
<td>433</td>
<td>356</td>
</tr>
<tr>
<td>Theridiidae</td>
<td>128</td>
<td>146</td>
</tr>
<tr>
<td>Total</td>
<td>561</td>
<td>502</td>
</tr>
</tbody>
</table>
Table 2. Number and percentage of Sheet web of different families in different seasons of 2013-2016.

<table>
<thead>
<tr>
<th>Family</th>
<th>No. of Sheet webs in 2013-2016</th>
<th>Percentage of Sheet webs in 2013-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monsoon</td>
<td>Winter</td>
</tr>
<tr>
<td>Filistatidae</td>
<td>127</td>
<td>213</td>
</tr>
<tr>
<td>Lyniphiidae</td>
<td>218</td>
<td>412</td>
</tr>
<tr>
<td>Total</td>
<td>345</td>
<td>625</td>
</tr>
</tbody>
</table>

Table 3. Number and percentage of Funnel webs of different families in different seasons of 2013-2016.

<table>
<thead>
<tr>
<th>Family</th>
<th>No. of Funnel webs in 2013-2016</th>
<th>Percentage of Funnel webs in 2013-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monsoon</td>
<td>Winter</td>
</tr>
<tr>
<td>Agelenidae</td>
<td>68</td>
<td>201</td>
</tr>
<tr>
<td>Lyniphiidae</td>
<td>166</td>
<td>272</td>
</tr>
<tr>
<td>Total</td>
<td>234</td>
<td>473</td>
</tr>
</tbody>
</table>

Table 4. Number and percentage of Orb webs of different families in different seasons of 2013-2016.

<table>
<thead>
<tr>
<th>Family</th>
<th>No. of Orb webs in 2013-2016</th>
<th>Percentage of Orb webs in 2013-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monsoon</td>
<td>Winter</td>
</tr>
<tr>
<td>Aranidae</td>
<td>639</td>
<td>875</td>
</tr>
<tr>
<td>Nephilidae</td>
<td>112</td>
<td>170</td>
</tr>
<tr>
<td>Tetragnathidae</td>
<td>392</td>
<td>503</td>
</tr>
<tr>
<td>Uloboridae</td>
<td>209</td>
<td>323</td>
</tr>
<tr>
<td>Total</td>
<td>1352</td>
<td>1871</td>
</tr>
</tbody>
</table>

Table 5. Number and percentage of Single line - snare webs of different families in different seasons of 2013-2016.

<table>
<thead>
<tr>
<th>Family</th>
<th>No. of The single - line snare web in 2013-2016</th>
<th>Percentage of The single - line snare web in 2013-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monsoon</td>
<td>Winter</td>
</tr>
<tr>
<td>Theridiidae</td>
<td>69</td>
<td>156</td>
</tr>
<tr>
<td>Uloboridae</td>
<td>117</td>
<td>209</td>
</tr>
<tr>
<td>Total</td>
<td>186</td>
<td>365</td>
</tr>
</tbody>
</table>

Table 6. Number and percentage of Horizontal dome shaped webs of different families in different seasons of 2013-2016.

<table>
<thead>
<tr>
<th>Family</th>
<th>No. of Horizontal dome shaped webs in 2013-2016</th>
<th>Percentage of Horizontal dome shaped webs in 2013-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monsoon</td>
<td>Winter</td>
</tr>
<tr>
<td>Aranidae</td>
<td>142</td>
<td>194</td>
</tr>
<tr>
<td>Lyniphiidae</td>
<td>106</td>
<td>218</td>
</tr>
<tr>
<td>Total</td>
<td>248</td>
<td>412</td>
</tr>
</tbody>
</table>
Table 7. Month wise abundance of spiders web (Randomly search method, Quadrate method, line-transect method and other methods were used for searching and collection) in the year 2013-2014 from different habitats in Eastern Region of Rajasthan.

<table>
<thead>
<tr>
<th>Types of webs</th>
<th>Families</th>
<th>Month wise abundance of webs in the year of 2013-14 in Eastern Region of Rajasthan</th>
<th>Sp. wise total Count of web</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>JL</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monsoon</td>
<td>Winter</td>
</tr>
<tr>
<td>Irregular Web</td>
<td>Pholcididae</td>
<td>44</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Theridiidae</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Filistatidae</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Short web</td>
<td>Linyphiidae</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Funnel Web</td>
<td>Argelenidae</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Linyphiidae</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>Orb web</td>
<td>Araneidae</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Nephilidae</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Tetragnathidae</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Uloboridae</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Single line Web</td>
<td>Araneidae</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Linyphiidae</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Horizontal Dome-shape Web</td>
<td>Argelenidae</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Uloboridae</td>
<td>11</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 8. Month wise abundance of spiders web (Randomly search method, Quadrate method, line-transect method and other methods were used for searching and collection) in the year 2014-2015 from different habitats in Eastern Region of Rajasthan.

<table>
<thead>
<tr>
<th>Types of webs</th>
<th>Families</th>
<th>Month wise abundance of webs in the year of 2014-15 in Eastern Region of Rajasthan</th>
<th>Sp. wise total Count of web</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>JL</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monsoon</td>
<td>Winter</td>
</tr>
<tr>
<td>Irregular Web</td>
<td>Pholcididae</td>
<td>30</td>
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</tr>
<tr>
<td></td>
<td>Theridiidae</td>
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<td>9</td>
</tr>
<tr>
<td></td>
<td>Filistatidae</td>
<td>10</td>
<td>8</td>
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<tr>
<td>Short web</td>
<td>Linyphiidae</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Funnel Web</td>
<td>Argelenidae</td>
<td>7</td>
<td>3</td>
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<td></td>
<td>Linyphiidae</td>
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<tr>
<td>Orb web</td>
<td>Araneidae</td>
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<td>12</td>
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<td></td>
<td>Nephilidae</td>
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<td>14</td>
</tr>
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<td></td>
<td>Tetragnathidae</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Uloboridae</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Single line Web</td>
<td>Araneidae</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Linyphiidae</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Horizontal Dome-shape web</td>
<td>Araneidae</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Uloboridae</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>
Table-9- Month wise abundance of spiders web (Randomly search method, Quadrate method, line-transect method and other methods were used for searching and collection) in the year 2015-2016 from different habitats in Eastern Region of Rajasthan.

<table>
<thead>
<tr>
<th>Types of webs</th>
<th>Families</th>
<th>JU</th>
<th>A</th>
<th>O</th>
<th>N</th>
<th>D</th>
<th>JN</th>
<th>F</th>
<th>MA</th>
<th>A</th>
<th>Total Count of web</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>36</td>
<td>20</td>
<td>15</td>
<td>12</td>
<td>19</td>
<td>25</td>
<td>6</td>
<td>28</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Irregular web</td>
<td>Theridiidae</td>
<td>8</td>
<td>5</td>
<td>11</td>
<td>7</td>
<td>11</td>
<td>14</td>
<td>19</td>
<td>10</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Araneidae</td>
<td>18</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>19</td>
<td>15</td>
<td>7</td>
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<tr>
<td>Sheet web</td>
<td>Tetragnathidae</td>
<td>19</td>
<td>20</td>
<td>18</td>
<td>17</td>
<td>44</td>
<td>26</td>
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<td>47</td>
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</tr>
<tr>
<td></td>
<td>Agelenidae</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>23</td>
<td>24</td>
<td>17</td>
<td>21</td>
<td>11</td>
<td>5</td>
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<tr>
<td>Funnel web</td>
<td>Linyphiidae</td>
<td>12</td>
<td>8</td>
<td>10</td>
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<td>9</td>
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<td>16</td>
<td>14</td>
<td>25</td>
<td>9</td>
<td>6</td>
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<tr>
<td>Orb web</td>
<td>Araneidae</td>
<td>37</td>
<td>25</td>
<td>30</td>
<td>78</td>
<td>82</td>
<td>77</td>
<td>38</td>
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<td>27</td>
<td>26</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Uloboridae</td>
<td>19</td>
<td>17</td>
<td>13</td>
<td>10</td>
<td>24</td>
<td>20</td>
<td>23</td>
<td>20</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td></td>
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<td>8</td>
<td>3</td>
<td>2</td>
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<td>Single-line web</td>
<td>Linyphiidae</td>
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<td>5</td>
<td>4</td>
<td>5</td>
<td>16</td>
<td>14</td>
<td>9</td>
<td>19</td>
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<td>6</td>
<td>4</td>
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<td>18</td>
<td>13</td>
<td>7</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Horizontal web</td>
<td>Uloboridae</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>14</td>
<td>16</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Dome-shape web</td>
<td>Uloboridae</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>14</td>
<td>16</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 10. Total web counts of webs in spiders families.

<table>
<thead>
<tr>
<th>Family</th>
<th>Irregular web</th>
<th>Sheet web</th>
<th>Funnel web</th>
<th>Orb web</th>
<th>Single-line web</th>
<th>Horizontal dome-shaped web</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Agelenidae</td>
<td>88</td>
<td>120</td>
<td>44</td>
<td>52</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Araneidae</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>3.</td>
<td>Tetragnathidae</td>
<td>37</td>
<td>25</td>
<td>30</td>
<td>78</td>
<td>82</td>
</tr>
<tr>
<td>4.</td>
<td>Linyphiidae</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>5.</td>
<td>Nephilidae</td>
<td>13</td>
<td>9</td>
<td>9</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>6.</td>
<td>Tetragnathidae</td>
<td>27</td>
<td>23</td>
<td>12</td>
<td>34</td>
<td>30</td>
</tr>
<tr>
<td>7.</td>
<td>Uloboridae</td>
<td>19</td>
<td>17</td>
<td>13</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>8.</td>
<td>Theridiidae</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>9.</td>
<td>Uloboridae</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Season wise total count of web</td>
<td>364</td>
<td>391</td>
<td>306</td>
<td>343</td>
<td>303</td>
<td>406</td>
</tr>
<tr>
<td>Total</td>
<td>1289</td>
<td>1302</td>
<td>1099</td>
<td>1098</td>
<td>4496</td>
<td>563</td>
</tr>
</tbody>
</table>
Table 11. Diversity indices of spider webs in Eastern Region of Rajasthan.

<table>
<thead>
<tr>
<th>Diversity Indices</th>
<th>Formula for calculation</th>
<th>Diversity indices of webs in Eastern Region of Rajasthan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Year 2013-14</td>
</tr>
<tr>
<td>Total no. of Webs</td>
<td>3882</td>
<td></td>
</tr>
<tr>
<td>Total types of Web</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Average population size</td>
<td>697</td>
<td></td>
</tr>
<tr>
<td>Simpson Index</td>
<td>$\frac{\sum h_i(n_i - 1)}{N(N - 1)}$</td>
<td>0.2406</td>
</tr>
<tr>
<td>Simpson Index Approximation</td>
<td>$\frac{\sum h_i^2}{N^2}$</td>
<td>0.2406</td>
</tr>
<tr>
<td>Reciprocal Simpson Index</td>
<td>$\frac{1}{N}$</td>
<td>4.4596</td>
</tr>
<tr>
<td>Alternate Reciprocal Simpson Index</td>
<td>$\frac{1}{\sqrt{N}}$</td>
<td>4.4596</td>
</tr>
<tr>
<td>Dominance index</td>
<td>$1 - \frac{\sum h_i(n_i - 1)}{N(N - 1)}$</td>
<td>0.7394</td>
</tr>
<tr>
<td>Dominance Index Approximation</td>
<td>$1 - \frac{\sum h_i^2}{N^2}$</td>
<td>0.7394</td>
</tr>
<tr>
<td>Shannon Index</td>
<td>$-\sum \frac{h_i}{N} \log_2 \left( \frac{h_i}{N} \right)$</td>
<td>2.343</td>
</tr>
<tr>
<td>Shannon Index</td>
<td>$-\sum \frac{h_i}{N} \log_10 \left( \frac{h_i}{N} \right)$</td>
<td>1.31</td>
</tr>
<tr>
<td>Berger-Parker Diversity</td>
<td>$\frac{N}{N_{max}}$</td>
<td>0.4936</td>
</tr>
<tr>
<td>Inverted Berger-Parker Diversity Index</td>
<td>$\frac{n}{N_{max}}$</td>
<td>2.453</td>
</tr>
<tr>
<td>Margolish Richness Index</td>
<td>$S = \ln N$</td>
<td>6.6966</td>
</tr>
<tr>
<td>Menhinick Index</td>
<td>$\frac{1}{N} \sum h_i$</td>
<td>0.9979</td>
</tr>
<tr>
<td>Rarefied/ Bill Numbers ($&lt;0.01\alpha$)</td>
<td>$1 - \frac{1}{r} \ln \left( \sum k_i \right)$</td>
<td>6.5005, 1.4152, 200</td>
</tr>
<tr>
<td>In (1) of Bill Numbers ($&lt;0.01\alpha$)</td>
<td>$1.720, 1.514, 1.312, 1.1$</td>
<td>0.8941</td>
</tr>
<tr>
<td>Gini Coefficient</td>
<td>$\frac{1}{S} \sum \frac{n_i}{S}$</td>
<td>2.077</td>
</tr>
<tr>
<td>Equitability Index</td>
<td>$\frac{1}{S} \sum \left( \frac{n_i}{S} \right)$</td>
<td>2.8367</td>
</tr>
<tr>
<td>Beta diversity of webs</td>
<td>$\frac{(S+N, S)}{S}$</td>
<td>5</td>
</tr>
<tr>
<td>Whittaker’s Index</td>
<td>$\frac{S}{S+N}$</td>
<td>4</td>
</tr>
<tr>
<td>Alternate Whittaker’s Index</td>
<td>$\frac{S}{S+N}$</td>
<td>0</td>
</tr>
<tr>
<td>Sorensen’s Similarity Index</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sorensen’s Similarity Index (%)</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Jaccard Index</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Jaccard Index (%)</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Evenness Index</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Evenness Index (%)</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>species Density</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of common webs</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gamma diversity of webs</td>
<td>$\frac{(S+N, S)}{S}$</td>
<td>5</td>
</tr>
<tr>
<td>Absolute gamma</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Graph 1. Number and percentage of Irregular web of different families in different seasons of 2013-2016.

Graph 2. Number and percentage of Sheet web of different families in different seasons of 2013-2016.
Graph 3. Number and percentage of Funnel web of different families in different seasons of 2013-2016.

Graph 4. Number and percentage of Orb web of different families in different seasons of 2013-2016.
Graph 5. Number and percentage of ISingle line snare web of different families in different seasons of 2013-2016.

Graph 6. Number and percentage of Dome shape horizontal web of different families in different seasons of 2013-2016.
NOTES ON THE DISTRIBUTION OF THE RARE FUNGUS WEEVIL ANTHRIBUS SCAPULARIS GEBLER, 1833 (COLEOPTERA: ANTHRIBIDAE) IN UKRAINE

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ABSTRACT: The paper presents new faunistic information regarding the Anthribus scapularis Gebler, 1833 species (Coleoptera, Anthribidae) distribution in Ukraine and the Palearctic Region. An updated map of A. scapularis distribution in the Palearctic Region is proposed.

KEY WORDS: Anthribus scapularis, Anthribidae, Coleoptera, Palearctic Region, Ukraine

The genus Anthribus Geoffroy, 1762 belongs to the tribe Anthribini Billberg, 1820 of the subfamily Anthribinae Billberg, 1820 and comprises 6 species distributed in the Palearctic Region: A. fasciatus Forster, 1770; A. kawanai (Yuasa, 1931); A. nebulosus Forster, 1770; A. niveouvariegatus (Roelofs, 1879); A. scapularis Gebler, 1833 and subrosex Reitter, 1916 (Tryzna & Valenti, 2011). Until recently, A. scapularis had not been known from Ukraine. In this paper, we report occurrence of this species in the southern part of Ukraine (Mykolaiv region).

MATERIALS AND METHODS

The specimens of A. scapularis were collected by Kizub I.V. and Krivosheev R.E. and deposited in the Kizub I.V. private collection (KI, Kyiv, Ukraine) and the collection of the I.I. Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine (SIZ, Kyiv, Ukraine). The following keys were used for the identification of the specimens: Jacobson, 1932; Cmoluch Z. 1989; Egorov, 1996. Photographs were taken by the Canon EOS 5D Mark III camera with the Canon Macro Lens EF 100 mm 1:2.8 L IS USM and the flash Nissin MF18 Macro.

RESULTS AND DISCUSSION

Anthribus scapularis Gebler, 1833 (Fig. 1)

= constrictus Stierlin, 1867 (Brachytarsus)
= gebleri Reitter, 1916 (Brachytarsus)
= roseus Reitter, 1916 (Brachytarsus)

Material examined: 1 ex., Southern Ukraine, the Mykolaiv region, [Voznesensk district], Aktovskiy Canyon, [Aktovo village environs, the Mertvovod river valley, 47°42'13"N 31°25'05"E], 01-02.05.2016, Kizub I.V. leg. et det. (KI). 2 ex., Ukraine, the Mykolaiv region, the Southern Bug river valley, 47°59' N, 31°00' E, 11.04.2016, Krivosheev R.E. leg., Nazarenko V.Yu. det. (SIZ).
Geographical distribution: *A. scapularis* is widely but fragmentally distributed in the Palearctic Region. So far, the species has been reported from southern parts of Norway (Strand, 1946; Silfverberg, 1992; Zachariassen, 1990; Gonget, 2003; Silfverberg, 2004; Olsen, 2007; Ødegaard et al., 2009; 2010; Tryzna & Valenti, 2011; Mikalsen, 2012; Henriksen & Hilmo, 2015; Alonso-Zarazaga, 2017), Sweden (Palm, 1951; Silfverberg, 1992; Lundberg, 1994; Gonget, 2003; Silfverberg, 2004; Tryzna & Valenti, 2011; Alonso-Zarazaga, 2017), Finland (Silfverberg, 1992; Gonget, 2003; Silfverberg, 2004; Hyvärinen, 2006; Albrect, 2010; Tryzna & Valenti, 2011; Alonso-Zarazaga, 2017), Denmark (Silfverberg, 1992; Hansen, 1996; Mahler et al., 1996; Stoltze & Pihl, 1998; Gonget, 2003; Tryzna & Valenti, 2011; Jørum et al., 2012; Alonso-Zarazaga, 2017), France (Guillebeau, 1895; Hoffmann, 1945; Dajos, 1965), Germany (Gonget, 2003; Heinz & Bense, 2003; Rote Listen Bayerns, 2010; Gürlich et al., 2011; Tryzna & Valenti, 2011; Alonso-Zarazaga, 2017), Poland (Burakowski et al., 1992; Kubisz et al., 1998; Cmoluch Z. 1989; Pawłowski et al. 2002; Glowaciński Z., 2002; Stachowiak, 2002; Wanat & Mokrzycki, 2005; Tryzna & Valenti, 2011; Greń et al. 2012; Parusel, 2012; Szoltyś et al., 2015; Alonso-Zarazaga, 2017), Czech Republic (Benedikt et al., 2010; Tryzna & Valenti, 2011), Slovakia (Tryzna & Valenti, 2011), Latvia (Silfverberg, 1992; Telnov, 2004; Silfverberg, 2004; Tryzna & Valenti, 2011; Alonso-Zarazaga, 2017), Lithuania (Pileckis, 1968; Pileckis, 1976; Silfverberg, 1992; Monsevičius, 1997; Pileckis & Monsevičius, 1997; Silfverberg, 2004; Tamutis et al., 2011; Tryzna & Valenti, 2011; Alonso-Zarazaga, 2017), Estonia (Silfverberg, 1992; Silfverberg, 2004; Tryzna & Valenti, 2011; Alonso-Zarazaga, 2017), Belarus (Alexandrovitch et al., 1996; Tryzna & Valenti, 2011; Alonso-Zarazaga, 2017), Moldova (Poiras, 2006; Munteanu, 2008; Bacal et al., 2013), Bulgaria (Angelov, 1981; Gueorguiev et al., 1998; Tryzna & Valenti, 2011; Alonso-Zarazaga, 2017), European part of Turkey (Tryzna & Valenti, 2011), Sicily in Italy (Abbazzi & Osella, 1992; Abbazzi et al., 1999; Colonelli, 2003; Audisio et al., 2014; Alonso-Zarazaga, 2017), Algeria (Tryzna & Valenti, 2011), European parts of Russia (Stierlin, 1867; Lindeman, 1871; Dwigubsky, 1892; Lebedev, 1912; Plavilstshikov, 1913; Jacobson, 1932; Frieser, 1981; Gönget, 2003; Vlasov, 2003; Silfverberg, 2004; Legalov, 2011; Tryzna & Valenti, 2011; Nikitisky & Legalov, 2016; Alonso-Zarazaga, 2017) and Asian (Frieser, 1981; Legalov & Opanassenko, 2000; Dedyukyin et al., 2005; Tshernyshev & Legalov, 2008; Legalov, 2010; Dedyukyin, 2012) including the Far East (Eropov, 1996; Legalov, 2010), and from Eastern Kazakhstan (Matesova, 1966; Legalov, 2010; Dedyukyin, 2012). In the present study, we report records of *A. scapularis* from southern parts of Ukraine. 3 specimens of the species were collected in the Mykolaiv region in the Spring of 2016. One female of *A. scapularis* has previously been found in the Kherson region of Ukraine (Ivano-Rybaltschansky district of the Chernomorskiy Biosphere Reserve, 46°26'55"N 32°07'51"E) in 1999 by Gorbunov V. Yu. and deposited in the Museum of Nature of Kharkiv National University (Loboda, 2017). Based on the information from literature and our new data, a map of *A. scapularis* distribution in the Palearctic Region is presented in Figs. 2 and 3. Fig. 4 shows the locality of *A. scapularis* in Ukraine.

*A. scapularis* is a relict species and is extremely rare throughout its entire range. In Norway, it is known from only a few locations in southern parts of the country (Zachariassen, 1990; Ødegaard et al., 2010; Henriksen & Hilmo, 2015) and is in the Red List of Norway (Ødegaard et al., 2009; 2010; Mikalsen, 2012; Henriksen & Hilmo, 2015). Recently, in the Red List of Norway changed the species’ category from species with deficient data (Ødegaard et al., 2009) to a
vulnerable species (Ødegaard et al., 2010; Mikalsen, 2012; Henriksen & Hilmo, 2015). In Poland, *A. scapularis* is known from single location (Cmoluch, 1989; Burakowski et al., 1992; Kubisz et al., 1998; Stachowiak, 2002; Greń et al. 2012; Szoltys et al., 2015) and is included in the Red List of Poland in the category of a species with deficient data (Pawłowski et al. 2002 Greń et al. 2012; Parusel, 2012; Szoltys et al., 2015). Solitary findings of *A. scapularis* have also been reported from Moldova (Poiras, 2006), Bulgaria (Gueorguiev et al., 1998) and Czech Republic (Benedikt et al., 2010). *A. scapularis* is also included as a vulnerable species in the Red List of Denmark (Mahler et al., 1996; Stoltze & Pihl, 1998) and as a species with deficient data in the Red List of Italy (Audisio et al., 2014). In Italy, this species has been reported only once from Sicilia in 1932 (Abbazzi et al., 1999). In Germany, *A. scapularis* is known from the Schleswig-Holstein Land, where its last collected in 1928, and Southern Bavaria, and is included in the Red Lists of these regions as an extinct (Gürlich et al., 2011) and endangered species (Heinz & Bense, 2003; Rote Listen Bayerns, 2010), respectively. Presence of *A. scapularis* in some southern regions of the European part of Russia is documented mostly by old reports. For example, the species was reported from the Volgograd region in 1867 (Stierlin, 1867), from the Saratov region in 1903 (Sakharov, 1903), and Tatarstan in 1910 (Lebedev, 1912). In the Moscow region, the species has also been reported up to 1913 (Nikitsky & Legalov, 2016). Therefore, *A. scapularis* might be already extinct form some parts of its known range.

**Biology:** *A. scapularis* is an entomophagous species that is quite an exceptional case among curculionoid Coleoptera. The biology and trophic relations of the species are very poorly studied. It is know that *A. scapularis* larvae develop on insects of the family Coccidae Fallen, 1814 (called soft scales), in particular of the genera *Rhodococcus* Borchsenius, 1953 and *Eulecanium* Cockerell, 1900 (Opanassenko, 1966; Poiras, 2006) and the family Diaspididae Targioni, 1868 (called armored scales) leaving on the *Pinus silvestris* Linnaeus, 1753 trees (Burakowski et al., 1992; Dedyukyin, 2012). The larvae of *A. scapularis* feed on the eggs and larvae of these hosts (Matesova, 1966; Poiras, 2006). In Europe, *A. scapularis* also feed on soft scales species associated with the introduced plant *Myrica gale* Linnaeus, 1753 (Koch, 1992; Burakowski et al., 1992) and the genus *Caragana* Fabricius, 1763 in East Siberian steppe (Tshernyshev & Legalov, 2008). The species hibernates in the adult stage (Gonget, 2003).

**Comparative notes:** *A. scapularis* can be distinguished from *A. nebulosus*, another species of the genus *Anthribus* distributed in Ukraine, by the lateral border of the pronotum which is marked and sharp throughout from its base to the apex, and elytra colored brick-red with black parquet spots. From *A. fasciatus*, which also occurs in Ukraine, *A. scapularis* can be distinguished by the pronotum not narrowing from the base towards its front end, its sharp-cornered posterior angles with a deep notch at the base of the pronotum, and by the elytra interstices being of similar width and convexity.

**ACKNOWLEDGEMENTS**

The authors thank Vitaliy Yu. Nazarenko (I.I. Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine, Kyiv, Ukraine) for consultation and Andrii Rozhok (The University of Colorado, Denver, USA) for editing the paper draft.
LITERATURE CITED


Figure 1. The habitus of *Anthribus scapularis* Gebler, 1833: A) dorsal view; B) frontal view. Scale bar = 1 mm.

Figure 2. A map of *Anthribus scapularis* Gebler, 1833 distribution: A) entire range; B) distribution in the Western Palearctic Region.
Figure 3. A map of some known localities of *Anthribus scapularis* Geble, 1833 in the Western Palearctic Region: 1 – Lyngdal, Vest-Agder, Norway (Zachariassen, 1990; Ødegaard et al., 2010); 2 – Farsund, Vest-Agder, Norway (Zachariassen, 1990; Ødegaard et al., 2009; Henriksen & Hilmo, 2015); 3 – Budalssås, Larvik, Norway (Mikalsen, 2012); 4 – Kirkøy, Østfold, Norway (Zachariassen, 1990; Olsen, 2007; Ødegaard et al., 2010; Henriksen & Hilmo, 2015); 5 – Odal, Hedmark, Norway (Zachariassen, 1990; Ødegaard et al., 2010; Henriksen & Hilmo, 2015); 6 – Bohuslän, Sweden (Gønget, 2003); 7 – Västergötland, Sweden (Gønget, 2003); 8 – Halland, Sweden (Gønget, 2003); 9 – Skåne, Sweden (Gønget, 2003); 10 – Gotland, Sweden (Gønget, 2003); 11 – Härjedalen, Sweden (Gønget, 2003); 12 – Dalarna, Sweden (Gønget, 2003); 13 – Uppland, Sweden (Gønget, 2003); 14 – Hälsingland, Sweden (Gønget, 2003); 15 – Jämtland, Sweden (Gønget, 2003); 16 – Ångermanland, Sweden (Gønget, 2003); 17 – Västerbotten, Sweden (Gønget, 2003); 18 – Lulea, Sweden (Gønget, 2003); 19 – Norrbotten, Sweden (Gønget, 2003); 20 – Päkkem, Sweden (Palm, 1951); 21, 23 – Finland Proper, Finland (Albrecht, 2010); 22 – Satakunta, Finland (Albrecht, 2010); 24, 26 – Pirkanmaa, Finland (Albrecht, 2010); 25 – Kouvol, Finland (Albrecht, 2010); 26 – Central Finland, Finland (Albrecht, 2010); 27 – Southern Ostrobothnia, Finland (Albrecht, 2010); 28, 29 – Northern Ostrobothnia, Finland (Albrecht, 2010); 30 – Rovaniemi, Finland (Albrecht, 2010); 31 – Northern Karelia, Finland (Albrecht, 2010); 32 – Lieksa and Ilomantsi, Finland (Hyvärinen, 2006); 33 – Kainuu, Finland; 34 – Tofte Skov, North Jutland, Denmark (Jørum et al., 2012); 35 – North-West Jutland, Denmark (Gønget, 2003); 36 – West Jutland, Denmark (Hansen, 1996; Gønget, 2003); 37 – The Wadden Sea Area, South Jutland, Denmark (Mahler et al., 1996; Gønget, 2003); 38 – Schleswig-Holstein, Germany (Gürlich et al., 2011); 39 – Sorø, Tarn, France (Hoffmann, 1945; Dajos, 1965); 40 – France: Mont-Aigoual, Cévennes, France (Hoffmann, 1945; Dajos, 1965); 41 – Mont-Ventoux, Vaucluse, France (Hoffmann, 1945; Dajos, 1965); 42 – Villebois, de l’Ain, France, (Guillebeau, 1895; Hoffmann, 1945; Dajos, 1965); 43 – Southern Bavaria, Germany (Heinz & Bense, 2003; Rote Listen Bayerns, 2010); 44 – Načeratický kopeček, Načeratice, Czech Republic (Benedikt et al., 2010); 45 – Bytom, Górny Śląsk, Poland (Cmoluch, 1989); 46 – Orshansko-Mogilevskij Geobotanical dist., Belarus (Alexandrovitch et al., 1996); 47 – Moscow region, Russia (Nikitsky & Legalov, 2016); 48 – Yaroslavl region, Russia (Vlasov, 2003); 49 – Kazan, Tatarstan, Russia (Lebedev, 1912); 50 – Bratky, Pernskiy Kray, Russia (Dedyukyin, 2012); 51 – Sholnia, Udmurtia, Russia (Dedyukyin, 2012); 52 – Sokol, Udmurtia, Russia (Dedyukyin, 2012); 53 – Oktiabrskskiy Gorodok, Tatishchevskij dist., the Saratov region, Russia (Sakharov, 1903); 54 – Volgograd (Sarepta), Russia (Stierlin, 1867); 55 – Golo Burdo Mt., Bulgaria (Georgeuev et al., 1998); 56 – Chişinău, Moldova (Poiras, 2006); 57 – the Southern Bug valley, the Mykolaiv region, Ukraine; 58 – Aktovskiy Canion, Voznesensk district, the Mykolaiv region, Ukraine; 59 – Ivanovo-Rybaltschansky dist. of the Chernomorskiy Biosphere Reserve, Kherson region, Ukraine (Loboda, 2017).
Figure 4. A map of *Anthribus scapularis* Gebler, 1833 known localities in Ukraine: 1 – the Southern Bug valley, the Mykolaiv region, Ukraine; 2 – Aktovskiy Canion, Voznesensk district, the Mykolaiv region, Ukraine; 3 – Ivano-Rybalshansky district of the Chernomorskiy Biosphere Reserve, the Kherson region, Ukraine (Loboda, 2017).
DISTRIBUTION OF CALCHAENESTHES SPECIES
(COLEOPTERA: CERAMBYCIDA: CERAMBYCINAE)
IN THE SOUTH-WESTERN ASIA

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ABSTRACT: Two of five species of Calchaenesthes Kraatz (Coleoptera: Cerambycidae: Cerambycinae) are distributed in the South-Western Asia. Calchaenesthes pistacivora Holzschuh, an endangered species, is reported only from Iran in the South-Western Asia. Known host plants include the species of pistachio (Anacardiaceae: Pistacia), e.g. Pistacia vera, Pistacia atlantica mutica and Pistacia khinjuk. Calchaenesthes diversicollis Holzschuh, an endangered species, is reported from Iraq, ?Iraq and ?Turkey in the South-Western Asia. In Turkey, if present, it probably occurs only in South-Eastern Anatolia. Known host plants include Brant’s oak or Persian oak (Quercus brantii), and probably also other Quercus species (Fagaceae).

KEY WORDS: Calchaenesthes, longhorned beetles, distribution, host plants

The family of longhorn beetles (Cerambycidae) is one of the most speciose and well-known group of beetles with approximately 35,000 described species (Švácha & Lawrence, 2014). More than 600 species and 700 species occur in Europe and Turkey respectively.


South-Western Asia or Western Asia is the westernmost subregion of Asia (Figs. 1 and 2). It significantly overlaps with the Middle East (or Near East), the main difference being the exclusion of Egypt. As a geographic concept, it includes Anatolia, Iran, Armenian Highlands, South Caucasus, the Levant, Mesopotamia, the Arabian peninsula and the Sinai Peninsula.

South-Western Asia is located directly south of Eastern Europe. To the north, the region is delimited from Europe by the Caucasus Mountains, to the southwest, it is delimited from Africa by the Isthmus of Suez, while to the east, the region adjoins Central Asia and South Asia. The Dasht-e Kavir and Dasht-e Lut deserts in eastern Iran naturally delimit the region somewhat from Asia itself. In addition, the region is surrounded by seven major seas as the Aegean Sea, the Black Sea, the Caspian Sea, the Persian Gulf, the Arabian Sea, the Red Sea, and the Mediterranean Sea.

The countries and territories of Western Asia can be listed below:
Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Iran, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, Turkey (Anatolia), United Arab Emirates and Yemen (Figs. 1 and 2).

*Calchaenesthes oblongomaculata* (Guérin-Méneville) and *C. sexmaculata* (Reiche) are classified as “Data Deficient” and “Endangered” on the European Red List of Saproxylic Beetles respectively (Nieto & Alexander, 2010). *C. primis* was described by Özdikmen (2013 in Özdikmen et al., 2013) from İçel province of Turkey. This species, therefore, has not been classified on the European Red List of Saproxylic Beetles (Nieto & Alexander, 2010).

*C. diversicollis* Holzschuh, 1977 and *C. pistacivora* Holzschuh, 2003 are among the saproxylic beetles in the South-Western Asia. Unfortunately, threat categories of *C. diversicollis* Holzschuh, 1977 and *C. pistacivora* Holzschuh, 2003 has not been determined up to now. Information on these species is critical to efforts to protect these species from extinction in the South-Western Asia. Thus, the primary objective of this paper is to propose for acceptance of *C. diversicollis* Holzschuh, 1977 and *C. pistacivora* Holzschuh, 2003 as threatened long-horned species in the South-Western Asia and is to define the known distribution of these insects along with information on their ecological habits and host plants. In addition, a bibliography of previous studies related to these species is included.

**MATERIALS AND METHODS**

The material of this work is a comprehensive review of the scientific literature that was conducted to delineate the known distribution of *Calchaenesthes* species in the South-Western Asia. Host plants and ecological habits were recorded when available. Additional surveys for these insects were conducted by many researchers and are reported herein. We included information and data that are important in assessing the level of threat to the species. These protocols included geographic range, population data, and habitat preferences (Nieto & Alexander, 2010; International Union for Conservation of Nature, 2012). Information and data of these species are presented under the title Taxonomic history, Reported occurrence in the South-Western Asia, Host plants, Life cycle and biology and Status and conservation of threatened species. Moreover, a distribution map of *Calchaenesthes* species in the South-Western Asia is also given (Figs. 1 and 2). Reported global occurrences of *Calchaenesthes* species with bibliographic citations are also provided (Tables 1 and 2).

**RESULTS AND DISCUSSION**

**Taxonomic history.** The cerambycid genus *Calchaenesthes* was erected by Kraatz (1863) with the type species *Callidium oblongomaculatum* Guérin-Méneville, 1844. *Callidium nogelii* Frivaldszky, 1845, *Calchaenesthes oblongomaculatus* var. *subjunctus* Pic, 1945 and *Calchaenesthes oblongomaculata* var. *quadrimaculata* Pic, 1912 are known synonyms of the type species. *Calchaenesthes oblongomaculata* (Guérin-Méneville, 1844) is distributed in Balkan Peninsula (Bulgaria, Greece and Romania), European Turkey, ?Jordan and ?Cyprus.

The other senior species, *Calchaenesthes sexmaculata* was described by Reiche (1861) from Algeria (Kabylia) as *Anoplistes oblongomaculatum* var. *sexmaculatum*. This species occurs also in Europe (Spain) and North Africa (Morocco and Tunisia). *Calchaenesthes 6-maculatus* var. *junctus* Pic, 1922 and
Purpuricenus (Calchaenesthes) sexmaculatus var. parvimaculatus Rungs, 1947 are known synonyms of the species.

Calchaenesthes diversicollis was described by Holzschuh (1977) from Iran (Luristan) as a subspecies of Calchaenesthes oblongomaculatus. It was upgraded by Holzschuh (2003) to the species level. This species is also distributed in Iraq and Turkey (Löbl & Smetana 2010 and Danilevsky 2017). G. Sama is the real author for the genus in Löbl & Smetana (2010). According to the catalogue, the species is distributed in Iran, Iraq and Turkey. However, it has not been any published record from Iraq in real. So the record of Iraq based on the unpublished data of G. Sama. In addition to this, the records of Turkey should be belong to new species C. primis Özdkikmen, 2013. Consequently, the species is not known from Turkey. Moreover, the record of Iraq need to be confirmed.

Calchaenesthes pistacivora was described by Holzschuh (2003) from Iran (Kerman). This species is endemic to Iran.

Calchaenesthes primis was described by Özdkikmen (2013 in Özdkikmen et al. 2013) from Turkey (İçel). This species occurs also in Cyprus.

Consequently, the Western Palearctic genus Calchaenesthes Kraatz, 1863 is included 5 species.

An identification key for adults of Calchaenesthes species.

1. Pronotum without any medio-lateral extension; postmedian spots on elytra large and oblong; Eastern Mediterranean species..............C. oblongomaculata (Guérin-Méneville, 1844)
   --- Pronotum with more or less distinct, medio-lateral dental extensions; postmedian spots on elytra small.................................................................2

2. Elytra with six black spots at least in males; Western Mediterranean species......................C. sexismaculata (Reiche, 1861)
   --- Elytra with four black spots in both sexes...........................................................3

3. Pronotum almost completely black (except reddish anterior angles); Iranian species...........
   ........................................................................................................................................C. pistacivora Holzschuh, 2003
   --- Pronotum with reddish edges at least in anterior half.......................................................4

4. Basal black spots on elytra always reaching the suture; Western Asiatic species............
   ........................................................................................................................................C. diversicollis Holzschuh, 1977
   --- Basal black spots on elytra never reaching the suture; Eastern Mediterranean species......
   ........................................................................................................................................C. primis Özdkikmen, 2013

Reported occurrence in Turkey. Only Calchaenesthes diversicollis was reported by Löbl & Smetana (2010) and Danilevsky (2017) from Turkey. As mentioned above, the Turkish records of these catalogues should be belong to C. primis Özdkikmen, 2013 (Özdikmen et al., 2013). So this species is not known from Turkey.

Reported occurrence outside Turkey. Calchaenesthes diversicollis is recorded from Iran and Iraq. The Turkish records of this species should be belong to C. primis Özdkikmen, 2013 (Özdikmen et al., 2013). Citations of confirmed occurrence of C. diversicollis are listed in Table 1, and the recorded distribution is shown in Fig. 1.

Calchaenesthes pistacivora is recorded only from SE Iran. This species is endemic to Iran. Citations of confirmed occurrence of Calchaenesthes pistacivora are listed in Table 2, and the recorded distribution is shown in Fig. 2.

Host plants. Calchaenesthes diversicollis is apparently polyphagous in deciduous trees in the plant families Fagaceae (Quercus spp. including Quercus...
brantii). Known host plants for *Calchaenesthes pistacivora* include the species of pistachio (Anacardiaceae: *Pistacia*), e.g. *Pistacia vera*, *Pistacia atlantica mutica* and *Pistacia khinjuk* (Hashemi-Rad, 2006; Achterberg & Mehrnejad, 2011).

**Life cycle and biology.** Adults and larvae of *Calchaenesthes diversicollis* can be collected only from the host plants growing in lowland and foothill habitats up to 2,000 m above sea level. Adults can usually be found sitting on the leaves or flying around of their host, especially from April to June. Duration of the life cycle is probably at least 2-3 years. Eggs are probably laid on living twigs. Larvae probably develop in living twigs of the host plant. Pupation probably takes place in the autumn and adults overwinter in the pupal cells (Awal, 1997; Hashemi-Rad et al., 2000; Ambrus & Grosser, 2013).

Adult beetles of *Calchaenesthes pistacivora* appear in the early April and feed upon pistachio leaves. Eggs are ovoid, 1 mm diameter and two mm length. The female usually laid eggs on the young twigs or on the pruned branches sites. She laid 40- 45 eggs in her life span. The incubation period for eggs lasts two weeks (approximately) in the natural condition. New hatched larvae penetrate inside the branches and make a tunnel there. The tunnel length is about 15 cm (approximately). Larval period takes 16 to 18 months (in the natural condition) and full-developed larvae pupated in the base of tunnels. Pupa period takes 45 days (approximately). Adults remain five to six months inside the tunnels. Then they emerge at early April. Thus, this insect has one generation over two years. (Hashemi-Rad, 2006; Ahterberg & Mhrnejad, 2011).

**Status and conservation of threatened species.** These members of *Calchaenesthes* are more or less rare species.

*C. diversicollis* Holzschuh, 1977 and *C. pistacivora* Holzschuh, 2003 are among the saproxylic beetles in the South-Western Asia. Unfortunately, threat categories of *C. diversicollis* Holzschuh, 1977 and *C. pistacivora* Holzschuh, 2003 has not been determined up to now. Information on these species is critical to efforts to protect these species from extinction in the South-Western Asia. We included information and data that are important in assessing the level of threat to these species. These protocols included geographic range, population data, and habitat preferences (International Union for Conservation of Nature, 2012). Subsequently, we propose that *C. diversicollis* should be classified in the category of “Vulnerable” on the South-Western Asian Red List. Similarly, we propose that *C. pistacivora* should be classified in the category of “Endangered” on the South-Western Asian Red List.

**LITERATURE CITED**


Abai, M. 2004. Introducing of eight species and one subspecies of Cerambycidae (Coleoptera) for the world from Iran. Entomological News of Iran No. 21: p. 1.


Figure 1. Distribution of Calchaenesthes diversicollis in South-Western Asia.
Table 1. Reported global occurrence of *Calchaenesthes diversicollis*, with bibliographic citations.

<table>
<thead>
<tr>
<th>Country</th>
<th>Regional Unit</th>
<th>Locality</th>
<th>Citations</th>
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<tr>
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<td>Ilam</td>
<td>Hashemi-Rad et al., 2000; Borumand, 2004; Özdkmen et al., 2013</td>
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<td>Abai, 1969; Awal, 1997; Özdkmen et al., 2013</td>
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<td>Iran</td>
<td>Kohgiluyeh and Boyer Ahmad</td>
<td>Sisakht env.</td>
<td>Ambrus &amp; Grosser, 2013</td>
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<td>Kordestan</td>
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<td>Holzschuh, 2003</td>
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<td>Iran</td>
<td>Lorestan</td>
<td>Sama, 2012; Özdkmen et al., 2013</td>
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<td>Khorramabad</td>
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<td>?Turkey</td>
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<td>Holzschuh, 2003; Löbl &amp; Smetana, 2010; Ambrus &amp; Grosser, 2013; Özdkmen, 2014; Danilevsky, 2017</td>
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Figure 2. Distribution of *Calchaenesthes pistacivora* in South-Western Asia.
Table 2. Reported global occurrence of *Calchaenesthes pistacivora*, with bibliographic citations.

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<tr>
<td>Iran</td>
<td></td>
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<td>Löbl &amp; Smetana, 2010; Danilevsky, 2017</td>
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ENVIRONMENTAL AND ECOLOGICAL SURVEY ESPECIALLY FOR SPIDER RESEARCH IN EASTERN REGION OF RAJASTHAN AND ITS CATCHMENT AREA

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ABSTRACT: Spiders have been regarded as good indicators of habitat quality due to higher sensitivity to change in their environment. Spiders are attractive because of their intriguing biology and they can be easily collected and maintained in laboratory. This survey research was carried out between July 2012 – Dec.2016 in Eastern Region of Rajasthan lies between 27°21'70 North Latitude and 77° 48'95 East Longitude. The present study was attempted to accomplish the following objectives: The major objective of the present Survey research was to make a situation analysis and review of the Environmental and Arachnological studies undertaken in and around the Eastern Region of Rajasthan, explore the research gaps, and plan futuristic strategy. This included reviewing the present scenario in and around the Eastern Region of Rajasthan, revisiting the completed Arachnological investigation on Eastern Region of Rajasthan and its catchment, collecting and collating the findings of published and unpublished documents, and analyzing the data for examining decadal changes in several ecological variables.

KEY WORDS: Survey research, Research Gap, Eastern Rajasthan

Spiders can survive in most environments and are polygamous; therefore, they have great biodiversity. Although spider diversity in temperate regions has been well studied, tropical areas however, have received relatively little attention. Spiders are the most diverse and abundant invertebrate predators in terrestrial ecosystems (Wise, 1993; Nyffeler, 2000). They regulate the terrestrial arthropod population (Riechrt & Bishop, 1990; Coddington & Levi, 1991). The global list of spider fauna is approximately 39,882 species belonging to 3676 genera and 108 families. (Platnick, 2011). Tikader (1987) published the first comprehensive list of Indian spiders which included 1067 species belonging to 249 genera in 43 families. Rajasthan state has not been studied extensively for its spider diversity, fragmentary reports however, are available (Bastawade & Khandal, 2006; Saini et al., 2012). Scanty reports are available on spider and its diversity in and around this region. (Lawania et al., 2013a,b,c,d,e,f). This study is focused on the neglected diversity of spider fauna and providing base line information for further studies. The present work was carried out in forest and agriculture fields from Eastern region of Rajasthan (India). This Region locally known as Braj, is a mosaic of grasslands, woodlands, woodland swamps and wetlands. These diverse habitats are home to approximately 375 avian species including 140 species of waterfowl, 372 species of plants, 34 species of mammals, 57 species of fish, 14 species of snakes, 5 species of lizards, 3 species of Geckos, 7 species of turtles, 8 species of amphibians, 71 species of butterflies, more than 16 species of dragonflies and 51 species of spiders. The said area assumes ornithological significance in two respects - firstly because of its strategic location as a staging ground for migratory
waterfowl arriving in the Indian subcontinent before dispersing to various regions. It is also a site where waterfowl converge before departing to breeding grounds in the western Palaearctic region. In addition, the wetland is a wintering area for massive congregations of waterfowl. Secondly it used to be the only regular wintering area in India for the central population of the rare and endangered Siberian crane. This region has been considered as a structural entity on the basis of topography and socio-cultural profile. The forest and vegetation of Eastern Rajasthan has been broadly classified and categorised in to three types depending upon three major zones: Semi-arid type, Subtropical humid type, and Tropical savana (Summer-dry type forest). These forests provide sufficient vegetation diversity and rich environment conditions for the spider fauna.

**MATERIAL AND METHODS**

**Study area-** The present work has been carried out in forest and agriculture fields of Eastern region of Rajasthan (India). The Eastern region of Rajasthan (Map-1) covers mainly Bharatpur district and some micro habitat areas of Dholpur and Karoli district (27.2170°N 77.4895°E) in Rajasthan. It was earlier known as “Braj”. This dense forest region has wide diversity of habitats ranging from marshes, grasslands, woodlands, scrublands. South-West monsoon brings rainfall during the month of June to September. The average monthly temperature is 4°C in December and 42°C in June. The humidity in winter season is as low as 42% in the month of February and as high as 89% in the month of August. Eastern Region of Rajasthan lies at the confluence of the Gambhir and Banganga rivers. The area lies between 27°2170 North Latitude and 77° 4895 East Longitude. It is a low lying area in the floodplains of river Banganga and Gambhir which are tributaries of river Yamuna covering an area of about 5099 sq. km. It is situated 180 km from Delhi, along the Delhi – Jaipur Highway, 50 km from Agra.

**Approaches-** Macro level approach- Details of the research works undertaken in and around Eastern Region of Rajasthan was collected; Efforts were made to collect the available information from the following sources:

- Newspaper reports/articles, Research articles published in scientific journals, Research reports and dissertations from academic and research institutions, Information available online, Records from various line departments of Government of Rajasthan, Government of India and other relevant sources such as Department of Forest and Wildlife, Agriculture, Irrigation, Rural Development, State Pollution Control, Board, Directorate of Economics and Statistics, State Ground Water Board, and Regional Census Office, Jaipur, India Meteorology Department (IMD), Jaipur. The collected information were collated and sorted out into a temporal scale of 5 years and as appropriate based on the availability of datasets to analyze the annual/decadal changes.

- Micro level approach- To gain basic understanding about the perception and opinion about ground scenario and the changes occurring over time, discussions were held with stakeholders.

Following approaches were adopted: Customized questionnaire survey and interaction with naturalists, armature bird watcher and Arachnologists.

**Methods of collection (Especially spiders)**

In total 24 study sites were chosen. Spiders were collected and counted by the two quantitative methods viz- Transect method (50 m x 10 m transects, with two
transects per site) and quadrate method (20 m x 10 m quadrates, with 5-5 quadrates in per site and 10-10 quadrates in 15th & 16th sites.

(a) Field Methods: Well standard sampling protocols were adopted for spider collection in different sites of sampling. The detailed descriptions of this collection techniques are:

(i) Sweep Netting- this method is used to collect the foliage spiders is collated by this sampling method from herbs shrubs and low level vegetation (up to 2 m in height). The sweep net consists of a 90 cm handle; 40 cm ring.

(ii) Ground Hand Collecting- Knee level spider samples collected from this collection method. This method of sampling is used to collect the spiders, in the ground, litter, in broken logs, rocks which are found to be visible.

(iii) Aerial Hand Collecting- This collection method involved the collection of species of spiders from knee level to arm length level. This method accessed free-living and web-building spiders on the stems of living or dead shrubs, high herbs, foliage and tree trunks etc.

(iv) Vegetation Beating- This method is used to accesses spiders living in the shrub, high herb vegetation, bushes, branches and small trees. In this method spiders were collected on a cloth (1 m by 1.2 m) by beating high herbs vegetation, dead shrubs and high herbs with a stick.

(v) Litter sampling- Specimen were collected by hand. Litter sampling involved sorting of spiders from the litter collection tray.

(vi) Pitfall sampling- Wet pitfall trap method was used to study the ground dwelling spiders. The pitfall traps consisted of a 9 cm wide by 16 cm deep plastic jar, two-third filled with 70% ethyl alcohol and a few drops of liquid soap/detergent. The pitfall traps were left open for a period of three days. The distance between two adjacent jars was 5 meter.

RESULT AND DISCUSSION

The study was performed on 24 study sites of the said region. Spiders were collected and counted by most of the two quantitative methods viz- Transect method (with two transects per site and 50 m x 10 m transects,) and quadrate method (20 m x 10 m quadrates, with 5-5 quadrates per site and 10-10 quadrates in 15th & 16th site. These transect and quadrates were treated as our basic sampling units. Transects and quadrates were placed randomly within stratified habitat types. Sampling was carried out between July 2012 – Dec.2016. Spiders were sampled along these transects and quadrates using six sampling techniques (semi-quantitative sampling and pitfall traps). The main purpose of this sampling design was to produce a relatively complete species list and associated abundance data for a representative example of each habitat type in the region, and of the region as a whole.

RECOMMENDATIONS

Present compilation – A bibliography with 456 reports (both published and unpublished), research articles, conference proceedings, dissertations and theses, and books and booklets, Helped in identifying spider and other Environmental research gaps and priority areas that need to be studied to help maintaining the ecological integrity of Eastern region of Rajasthan, its surrounding ecosystems, and catchment areas. Research matrix was prepared, and accordingly, the research areas are divided in two major heads: those required to be undertaken
for the first time and those that require a revisit and comparison with earlier reported findings.

1. Research gaps: initial assessments
   i. Seed-bank for Eastern region of Rajasthan: Investigate the carrying capacity and minimum ecological requirement of seeds of both flora and fauna (especially spiders) of the region.
   ii. Assessment of health of satellite wood lands, grasslands and wetlands in Eastern region of Rajasthan and their suitability as alternate habitats for both resident and migratory spiders.
   iii. Flow regime and Environmental flow: Examine the flow regime of rivers supplying water to Eastern region of Rajasthan, and assess the environmental flow as an aid in decision-making process.
   iv. Nutrient and contaminant budgeting in the upstream areas of Eastern region of Rajasthan especially in the catchment areas of the rivers need to be examined. It is expected that sub-surface flow must be inducing the spatial movement of agro-chemical residues in the region.
   v. Assessment of quality of inflow water from alternate sources such as Chambal river and Govardhan drain.
   vi. Investigate the co-existence and resources partitioning of major herbivores such as nilgai, sambar, chital, and feral cattle that would provide information which could help the management of habitat and population of these species in Eastern region of Rajasthan in the present context.
   vii. Examine the changes in vegetation pattern and soil quality due to ongoing invasive species eradication programme. Investigate the role of Eastern region of Rajasthan in carbon sequestration.
   viii. Cumulative Impact Assessment on land use changes, intensification of agriculture, hydrology and water regime, infrastructure development, ground water extraction, increase in visitors, etc.
   ix. Identification of indicator spider species and its ecology needs to be studied for the long term conservation of the region.
   x. Assessment of Ecosystem services of Eastern region of Rajasthan and its economic evaluation.
   xi. Creation of research database and analysis on research-management interface.

2. Research gaps: revisit and comparison
   i. Study the land use changes in the region focusing on both urbanization and agriculture.
   ii. Revisit the vegetation cover of Eastern region of Rajasthan and prepare a revised vegetation map for the region.
   iii. Review the scenario on agriculture: intensification of agriculture, and use of organic fertilizers.
   iv. Assessment of levels of agrochemical residues in various environmental compartments across trophic levels.
   v. Regular monitoring of water quality and pollutants levels in the region is to be carried out to monitor the health of aquatic ecosystem.
   vi. Assessment of ground water quality and impact of agrochemical inputs on aquifers and around Eastern region of Rajasthan.
   vii. Comprehensive Environmental Assessment and Monitoring for the Eastern region of Rajasthan ecosystem and the adjoining areas with respect to
biophysical and socioeconomic aspects. This would help the PA Management to take corrective measures.

viii. Periodic monitoring of status of spider population and their habitats for their long term conservation in the region.

ix. Bird migration study: Since thousands of migratory birds visit Eastern region of Rajasthan, it provides ample opportunity for bird ringing and monitoring. Through such attempt it would be easy to examine spatial movement of contaminants through organisms such as birds.

x. Climate change and avian influenza: Study the impact of global climate change, avian influenza etc. on global bird communities and their migration to and from Eastern region of Rajasthan. This also provides an opportunity to study the epidemiology of avian influenza in India.

xi. Aquatic-terrestrial habitat relationship: Due to changing climate and land use pattern the habitat relationship between aquatic and terrestrial ecosystems of the region needs to be studied.

xii. Evaluation of the catchment area to understand the land use pattern and its impact on the region environment.

xiii. Socio-economic assessments and economic evaluation need to be undertaken for the surrounding areas of Eastern region of Rajasthan.

ACKNOWLEDGEMENTS

We would like to thank Prof. G.N. Vankhede, Ex- Professor and Head, P.G. Dept. of Zoology, S.G.B. Amravati University, for supporting us during the past 3 years. Our deep sense of gratitude goes to Dr. M.S. Malhotra, Senior Deputy Director, ICMR, New Delhi, who had supported us continuously with all kinds of his moral support.

LITERATURE CITED


Map 1. Location Map of Eastern region of Rajasthan.

Map 2. High value biodiversity areas (HVBA) of Eastern region of Rajasthan.
Table 1. Area of the site Compartments of Eastern Region of Rajasthan.

<table>
<thead>
<tr>
<th>Site.No.</th>
<th>Area (km²)</th>
<th>Perimeter (km)</th>
<th>Habitat type</th>
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<tr>
<td>2</td>
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Table 2. Showing no. of sampling method & sampling site with GPS range with special references to habitat type of Eastern Region.

<table>
<thead>
<tr>
<th>S.N of Site</th>
<th>Sampling Methods</th>
<th>No. of sampling points</th>
<th>Habitat type</th>
<th>GPS range</th>
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<td>Pitfall (P)</td>
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| Total sampling points | 230 |
SEASONAL ABUNDANCE AND POPULATION INDICES OF SPIDER FAUNA IN MONSOON SEASONS OF THE YEARS 2013 TO 2016 FROM DIFFERENT HABITATS OF EASTERN REGION OF RAJASTHAN, INDIA

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ABSTRACT: The spiders of Eastern region of Rajasthan were studied in Monsoon seasons from 2013 to 2016. July, August, September and October months were included in this season. Monthly Collections were made in three year’s Monsoon season. During the present investigation we have recorded 43 species from 35 genera 16 families from monsoon Seasons of the year 2013 to 2016. Most species of spider found belonged to family Araneidae followed by Salticidae. Spiders were collected by using different methods and techniques. Higher abundance of spider was recorded during the month of October. The relative abundance of spiders in the season was in the order of: October> July> August> September. The high species diversity of spiders in said area can be attributed to the high diversity of plants and insects. This is the first report of the spider fauna from eastern region of Rajasthan.

KEY WORDS: Spiders, Monsoon, seasonal abundance, population indices

In India the conservation efforts have focused on higher vertebrates and invertebrates have largely been ignored. The Arachnids are one such important group. Spider can regulate large population of insect and other invertebrate in most ecosystems (Russell-Smith, 1999). Therefore, there is a growing need to study this group. Spiders are interesting, intelligent and elegant creatures having predatory lifestyle. Most of the spiders have cannibalistic activity during courtship behaviour. These carnivorous animals can run and jump very fast whenever required. Hence these are treated as cursorial creatures. These are pest in houses but boost the crops, by killing the harmful insects. Garden spiders are treated as friends of farmers, but farmers killing the spiders by spraying the pesticides. Spiders are an important part of food chain Dayal (1935), getting rid of unwanted insects and being food themselves for birds and other large insects and reptiles Bastawade (2002). Some of these having poisonous glands are called tarantulas. A total of 44,540 species, 3,924 genera belonging to 58 families are present in the world Platnick (2014). Pocock (1900a,b) and Tikader (1980a,b, 1981, 1982, 1987) provided major contributions to the Indian Arachnology. Pocock (1900) described 112 species of spiders from India. His book gave the earlier list of spiders’ families, in India. Tikader (1987) also studied Indian Spider and published first comprehensive list of Indian spiders, which included 43 families belonging to 249 genera 1067 species. Eastern area of Rajasthan with its varied geographic, climatic, and ecological features exhibits a rich assemblage of different types of spiders’ species. However, no studies on their diversity have ever been undertaken here; with the result that many of the species remain unnamed and unrecorded. Some studies taken by Lawania (2013a,b,c,d,e,f). During the recent
faunal studies in Eastern region of Rajasthan, authors could collect an interesting specimen of spiders, which are not described earlier from study area. Further, environmental pollution and deforestation have led many spider species to the verge of extinction. Hence the present work is conducted with a goal to find the objectives envisaged in the proposal mentioned below.

**MATERIAL AND METHODS**

**Study area** - The present work has been carried out in forest and agriculture fields of Eastern region of Rajasthan (India). The Eastern region of Rajasthan (Map-1) covers mainly Bharatpur district and some micro habitat areas of Dholpur and Karoli district (27.2170°N 77.4895°E) in Rajasthan. It was earlier known as “Braj”. This dense forest region has wide diversity of habitats ranging from marshes, grasslands, woodlands, scrublands. South-West monsoon brings rainfall during the month of June to September. The average monthly temperature is 4°C in December and 42°C in June. The humidity in winter season is as low as 42% in the month of February and as high as 89% in the month of August. Eastern Region of Rajasthan lies at the confluence of the Gambhir and Banganga rivers. The area lies between 27°2170 North Latitude and 77° 4895 East Longitude. It is a low lying area in the floodplains of river Banganga and Gambhir which are tributaries of river Yamuna covering an area of about 5099 sq. km. It is situated 180 km from Delhi, along the Delhi – Jaipur Highway, 50 km from Agra.

**Methods of collection** - In total 24 study sites were chosen. Spiders were collected and counted by the two quantitative methods viz- Transect method (50 m x 10 m transects, with two transects per site) and quadrat method (20 m x 10 m quadrat, with 5-5 quadrat in per site and 10-10 quadrates in 15th & 16th sites.

(a) **Field Methods:** Well standard sampling protocols were adopted for spider collection in different sites of sampling. The detailed descriptions of this collection techniques are-

(i) **Sweep Netting** - this method is used to collect the foliage spiders is collated by this sampling method from herbs shrubs and low level vegetation (up to 2 m in height). The sweep net consists of a 90 cm handle; 40 cm ring.

(ii) **Ground Hand Collecting** - Knee level spider samples collected from this collection method. This method of sampling is used to collect the spiders, in the ground, litter, in broken logs, rocks which are found to be visible.

(iii) **Aerial Hand Collecting** - This collection method involved the collection of species of spiders from knee level to arm length level. This method accessed free-living and web-building spiders on the stems of living or dead shrubs, high herbs, foliage and tree trunks etc.

(iv) **Vegetation Beating** - This method is used to accesses spiders living in the shrub, high herb vegetation, bushes, branches and small trees. In this method spiders were collected on a cloth (1 m by 1.2 m) by beating high herbs vegetation, dead shrubs and high herbs with a stick.

(v) **Litter sampling** - Specimens were collected by hand. Litter sampling involves sorting of spiders from the litter collection tray.

(vi) **Pitfall sampling** - Wet pitfall trap method was used to study the ground dwelling spiders. The pitfall traps consisted of a 9 cm wide by 16 cm deep plastic jar, two-third filled with 70% ethyl alcohol and a few drops of liquid soap/detergent. The pitfall traps were left open for a period of three days. The distance between two adjacent jars was 5 meter.
Post collection work:

1. **Taking photographs:** After coming to the laboratory, the animals were sorted according to the family and then photographs were taken by using supermacro lens of Fuji fine pix S2950 camera model No. 1TU83456. For each spider, photographs were taken from dorsal, ventral and lateral view—after slightly narcotizing them with 70% alcohol. A brush dipped in 70% ethyl alcohol was touched at pedicel of spider which slowed down their movements.

2. **Preserving the specimen:** After taking the habitats photographs, the legs and palps of the spiders were manipulated and made straight by dipping them in warm water to make their legs straight and after this they were transferred immediately in a petridish with 70% ethyl alcohol. Legs and palps were again made straight and properly oriented. Plastic U-pins were kept on spider legs and palps as weight, due to weight they are unable to fold back. Spider was kept properly oriented petridish and covered for 24 hours, to prevent the evaporation of alcohol.

3. **Studies under stereozoom microscope:** After 24 hours of proper fixation, after this spiders specimen were stored in plastic bottles/glass of proper size in legs spread condition, properly labelled or taken for further study. Initially the measurements of cephalothorax, abdomen, whole body (from dorsal side), leg segments and palp segments (from ventral side) were taken in mm by digital microscope.

   Then the specimen was cleaned gently by brush to remove any dust particles trapped in between the body hairs. Chelicerae were made straight and then photographs of eye arrangements, cephalothorax, and abdomen were taken from dorsal side. From ventral side photographs of sternum, labium and endites (maxillae), chelicerae showing the teeth on pro and retro margins, abdomen, external epigyne, spinnerates etc. were taken. Photographs of leg segments were also taken showing trichobothria, hairs/spines, calamistrum, claws, etc. All these photographs were used for spider identification.

4. **Dissection:** After taking necessary photographs with MIPS (Magnus Image Processing System), the female spiders were dissected for genetilia to show internal epigyne. After its proper removal, it was made clear by using 10% KOH later it was washed with absolute alcohol and then kept it in 70% alcohol overnight. After this, photographs of internal epigyne were taken using MIPS. The same procedure is repeated for male spiders wherein preferably pedipalp of left side was made clear and transparent either removing it or in situ and then photographs were taken from its dorsal, ventral and lateral sides for proper identification of a species.

5. **Identification of spiders:** Up to family, genus and species level all adult specimens were identified. The identification of spiders on the basis of morphometric characters the detail structure of pedipalp of male spiders and epigyne of female.

**RESULT AND DISCUSSION**

The study was performed on 24 study sites of the said region. Spiders were collected and counted by most of the two quantitative methods viz- Transect method (with two transects per site and 50 m x 10 m transects,) and quadrat method (20 m x 10 m quadrates, with 5-5 quadrate per site and 10-10 quadrates in 15th & 16th site. These transect and quadrates were treated as our basic sampling units. Transects and quadrates were placed randomly within stratified habitat types. Sampling was carried out between July 2013 – Dec.2016. Spiders
were sampled along these transects and quadrates using six sampling techniques (semi-quantitative sampling and pitfall traps). The main purpose of this sampling design was to produce a relatively complete species list and associated abundance data for a representative example of each habitat type in the region, and of the region as a whole.

In the present study the seasonal abundance of spiders was studied. 16 families 35 genera and 43 species were recorded in Monsoon season. These results indicated that spider’s diversity in Eastern region of Rajasthan is mostly dependant on the presence of food and pest species in the said area. Due to presence of ample food and pest diversity the monsoon season represented high diversity of spider in this region. In the present investigation, the important observation is hunters or and ground dweller spiders dominated the study area over the web builders irrespective of the said area. This could possibly be due to the agricultural practices used in different crop fields. During the crop season, workers work in the field and their movements disturb the web. Therefore, only those web constructing spiders were recorded, which could construct their webs in a limited space and secondly most of them are nocturnal.

Species richness was estimated in Monsoon Season. Similarity of spider species among different seasons was examined using the diversity indices including, Simpson index, Shannon – weiner index and Margalef richness index. The diversity, richness, and evenness indices for spiders were calculated using the Biodiversity calculator (www. Alyoung.com/labs/biodiversity calculator.html). Diversity indices were calculated and are shown in table- 2. The dominance index (1-Simpson index) calculated for Monsoon season is 0.9756 and the Shannon index as 5.487. The Simpson was calculated for all monsoon seasons were 0.02438 and Margalef richness index is the highest (7.11) for spider diversity in Monsoon season.

CONCLUSION

During the Present investigation we have recorded 43 species from 35 genera and 16 families from selected habitats from Eastern region of Rajasthan, during the Monsoon seasons of the year 2013 to 2016. Diversity wise spider species recorded in the present investigation are in the order as- Salticidae > Araneidae > Oxyopidae > Lycosidae ≈ Pholcidae ≈ Thomisidae > Gnaphosidae ≈ Pisauridae ≈ Scytodidae ≈ Sparassidae ≈ Uloboridae > Clubionidae ≈ Filistatidae ≈ Hersiliidae ≈ Selenophidae. During the study we have recorded some observation about their feeding habits. Jumping spiders are found to rely much more on sight. Web builders from Araneidae and Tetragnathidae have advantages of catching pray in the web. All the observation included that they are keeping the insect population in control and thus helping human being from getting protected from vector borne diseases.

ACKNOWLEDGEMENTS

We would like to thank Prof. G.N. Vankhede, Ex- Professor and Head, P.G. Dept. of Zoology, S.G.B. Amravati University, for supporting us during the past 3 years. Our deep sense of gratitude goes to Dr. M.S. Malhotra, Senior Deputy Director, ICMR, New Delhi, who had supported us continuously with all kinds of his moral support.
LITERATURE CITED


Map 1. High value biodiversity areas (HVBA) of Eastern region of Rajasthan.
Map 2. Location Map of Eastern region of Rajasthan.

Graph 1. Lorenz graph showing diversity richness in Monsoon season in the year 2013-2016 (Note- Lorenz graph representing cumulative % population of Spiders).

The Lorenz curve shows the reality of the species distribution.
Graph 2. Linear graph showing diversity richness in Monsoon season in the year 2013-2016. (Note- Lorenz graph representing cumulative % population of Spiders).

Table 1. Seasonal abundance and population indices of spiders (Randomly search method, Quadrate method, line-transect method and other methods were used for searching and collection) in monsoon season 2013-2016 from different habitats in Eastern Region of Rajasthan.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species (Female &amp; M-Male)</th>
<th>Habits</th>
<th>Habits</th>
<th>Month wise abundance in Monsoon season in Eastern Rajasthan</th>
<th>Total Count</th>
<th>Mean ± S.E</th>
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<tbody>
<tr>
<td>Araneida</td>
<td>Atrax sp. F</td>
<td>Web builder</td>
<td>Woodland</td>
<td>July Aug Sep Oct</td>
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<tr>
<td></td>
<td>Araneis argentei F</td>
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<td>Woodland</td>
<td>2 1 4 1</td>
<td>9</td>
<td>2.33 ± 0.62</td>
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<td>Araneis lunulatus F</td>
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<td>6 9 11 16</td>
<td>42</td>
<td>10.33 ± 2.40</td>
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<td>Ctenidae</td>
<td>Ctena menidae F</td>
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<td>Woodland</td>
<td>5 3 11 9</td>
<td>26</td>
<td>3.63 ± 1.92</td>
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<td>2.93 ± 1.10</td>
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<td>34</td>
<td>8.23 ± 1.01</td>
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<td>Eriophora</td>
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<td>10.00 ± 1.58</td>
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<td>Woodland &amp; Grassland</td>
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<td>54</td>
<td>8.5 ± 2.10</td>
</tr>
<tr>
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<td>Woodland &amp; Grassland</td>
<td>7 3 7 13</td>
<td>36</td>
<td>9.5 ± 1.5</td>
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**Total**

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Dominance of family: Salticidae > Araneidae > Oxyopidae > Lycosidae > Pholcidae > Theridiidae > Selenophasidae

Three dominant species: Pholcops pankuli F > Oxyopes pankui F > Hygroopes semicinctus F

Three rare species: Zosis fuevadae M < Hersilia savagyi F = Hygroopes sp. F = Tenuicauda sp. M
Table 2. Representing diversity indices of spiders in The Monsoon seasons of the years of 2013-2016 in Eastern Region of Rajasthan.

<table>
<thead>
<tr>
<th>Diversity Indices</th>
<th>Formula for calculation</th>
<th>Diversity indices of spider fauna in Monsoon seasons of the years of 2013-2016 from Eastern Region of Rajasthan</th>
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<td>Total no. of species</td>
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<td>Simpson Index</td>
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<td>39.8</td>
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<td>Dominance index</td>
<td>( 1 - \frac{\sum n_i(n_i-1)}{N(N-1)} )</td>
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<tr>
<td>Dominance index Approximation</td>
<td>( 1 - \frac{\sum n_i^2}{N^2} )</td>
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<td>Absolute gamma</td>
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TWO NEW RECORDS OF THE GENUS AGROECA WESTRING, 1861 (ARANEAE: LIOCRANIDAE) FROM TURKEY

Gökhan Gündüz* and Hüseyin Allahverdi**

* Biology Department, Institution of Science, Uludağ University, Görükle/ Bursa, TURKEY. E mail: gokhangunduz@yahoo.com.tr
** Biology Department, Science and Art Faculty, Muş Alparslan University, Centrum/ Muş, TURKEY.


ABSTRACT: A short history of the genus Agroeca Westring, 1861 for Turkey is given and two species of the genus are recorded for the first time from Turkey: A. dentigera Kulczyński, 1913 and A. brunnea (Blackwall, 1833). After these records, the number of species of genus Agroeca for Turkey increases to six.

KEY WORDS: Spider; Turkey; Agroeca Westring, 1861; spiny-legged sac spiders

Liocranids are free-living and ground-dwelling hunters. They usually prefer to live in leaf litters on the forest floor. Some members of the family are known as in symbiotic relation with termites and ants. They are called spiny-legged sac spiders. Especially metatarsi and tibia of the first two pairs of legs bear ventrally several pairs of spines. They have two tarsal claws, eight eyes in two rows, anterior row straight, posterior row procurred or recurved. The prosoma and abdomen ovoid slightly widening toward posterior end (Jocqué & Dippenaar-Schoeman, 2006). Family is represented by 31 genus and 271 species around the world (World Spider Catalog, 2017) and 7 genus and 12 species in Turkey (Bayram et al., 2016).

The genus Agroeca consists of 28 valid species and has holarctic distribution. Although two species (ones from India and Peru) are considered most likely misplaced in this genus, Agroeca is the second most species-rich genus in the family according to Zonstein et al. (2015). Agroeca can be distinguished from the other genera in the family by having three pair of spines on ventral side of metatarsi I- II and two pairs on ventral side of tibia I- II. Additionally, tegulum of male palp has generally longitudinal grooves (Roberts, 1995).

This short paper gives a brief history of the genus Agroeca in Turkey and the report of two new records for the genus with distributional information.

MATERIAL AND METHODS

The specimens which are considered in this paper are part of the master thesis collection of the first author. All specimens were collected by hand aspirator and pitfall traps in 2012-2014 years. They are preserved in 70% ethanol at the first author’s personal collection.

RESULTS

Agroeca brunnea (Blackwall, 1833) (Figs. 2A-B)

Agelena brunnea Blackwall, 1833: 351 (Description female).
Philoica linotina Grube, 1859: 467 (Description male).
Agroeca brunnea Jocqué, 1977d: 80, f. 6-7 (male).
Material examined: 1 male, Yedipınar Village, Korkut District, Muş Province (38°49'13.9"N; 41°42'46.3"E), 04.04.2014, leg: G. Gündüz. 1 male, Dagdibi Village, Hasköy District, Muş Province (38°41'03.8"N; 41°39'34.6"E), 19.06.2014, leg: G. Gündüz. The specimens were collected under the stones on an open area by means of hand aspirator.

Diagnosis: Prosoma has some irregular patterns on pale yellow ground in dorsally. Carapace surrounded by dark margins. Abdomen with dark chevrons. The length between posterior median eyes equals the length between posterior lateral eyes and posterior median eyes. There are very light brown bants on ventral side of femora. Retrolateral tibial apophysis long, slender, pointed upward and has a small tubercule distally. A. brunnea can be distinguished from other species in Turkey with the shape of retrolateral tibial apophysis, tegulum and tegular apophysis. This species is new to Turkey.


Agroeca dentigera Kulczyński, 1913 (Figs. 2C-D)

Agroeca dentigera Kulczyński, 1913a: 26, pl. 1, f. 10 (Description female).
Agroeca dentigera Wunderlich, 1975b: 44, f. 6-10 (female, Description male).
Agroeca dentigera Jonsson, 2005: 49, f. 1-6 (male and female).

Material examined: 1 female, Bögürdelen Village, Hasköy District, Muş Province (38°37'35.4"N; 41°48'18.9"E), 12.05.2012, leg: G. Gündüz. 2 female, Yedipınar Village, Korkut District, Muş Province (38°49'10.9"N; 41°42'41.4"E), 01.09.2013-15.10.2013 (from pitfall trap), leg: G. Gündüz.

Diagnosis: This species is smaller than A. brunnea. Prosoma pale yellow with dark dentated striae, while eye region much darker. Carapace is enclosed by thin dark border. Abdomen brownish and has dorsally marked chevrons. Legs without any stripe or ring. Femora have dorsally 3 fine and robust spines. Epigyne has heart-shaped chitinous wall and two eyelid-like structure near the anterior part. This species is recorded for the first time for Turkey.

Distribution: Europa, Russia (World Spider Catalog, 2017).

DISCUSSIONS

Agroeca is a holarctic genus and has 28 valid species now. The genus is represented by four species in Turkey until now: Agroeca cuprea Menge, 1873 (Özkütük et al., 2013), A. inopina O. P. Cambridge, 1886 (Topçu et al., 2007), A. parva Bosmans, 2011 (Elverici et al., 2013) and A. proxima (O. P.-Cambridge, 1871) (Özkütük et al., 2011) (Figure 1). The first record of the genus was reported in 2007 (Topçu et al., 2007). However, some members of the genus is very common, there are several rare representatives, too. Two of them is reported in this short paper. By this study, the situation of the genus Agroeca in Turkey changed, as well. The number of the species raised from 4 to 6. And the distribution of genus is widened through the east. It is also considered that the presence of the other species for Agroeca in Turkey, A. maculata, is very probable as mentioned in previous studies (Özkütük et al., 2013).

ACKNOWLEDGMENT

We are thankful to Rahşen Kaya and Ersen Aydin Yağmur for their valuable comments on the manuscript.
LITERATURE CITED


Figure 1. Distribution map of genus Agroeca in Turkey based on current knowledge. 1: A. inopina, 2: A. proxima, 3: A. parva, 4: A. cuprea, 5: A. brunnea, 6: A. dentigera.
Figure 2. *Agroeca brunnea* (Blackwall, 1833), male. (A) Palp, ventral. (B) Palp, lateral. *Agroeca dentigera* Kulczyński, 1913, female. (C) epigyne, (D) vulva, ventral. **Diagnostic abbreviations**: E: embolus, T: tegulum, TA: tegular apophysis, MA: median apophysis, RTA: retrolateral tibial apophysis, CD: copulatory duct, F: fertilisation duct, R: receptacle. Scale bar: 0.1 mm.
PREDATOR-PREY INTERACTIONS BETWEEN PREDATORY BUG ORIUS SPP. (HEMIPTERA: ANTHOCORIDAE) AND WESTERN FLOWER THRIPS, FRANKLINIELLA OCCIDENTALIS (PERGANDE) (THYSANOPTERA: THRIPIDAE) ON FABA BEAN IN TWO DIVERSE HABITATS

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ABSTRACT: Field experiments were established in two ecologically diverse areas (polyculture and triculture) in the same agricultural landscape in the Research and Application Farm of the Faculty of Agriculture, University of Çukurova, Balcak in seasons; 2005 and 2006 in which prey-predator interactions between predatory bugs, Orius spp. and their prey, western flower thrips, Frankliniella occidentalis (Pergande) on faba bean was evaluated. Orius niger (Wollf) was found to be the most prevalent predatory insect species in both habitats. F.occidentalis and Orius species were mainly collected from the flowers of faba bean in both location and years. Densities of both insect species were relatively greater in polyculture area than those numbers found in triculture. Numbers of F. occidentalis and Orius spp. were greater in polyculture in both years. Population trends of Orius spp in abundance were significantly related to the population patterns of F. occidentalis in both habitats in both years (P<0.05). Ratios of prey: predator (thrips: Orius) were found to be lower as less than 0.25 thrips per Orius on faba bean in both habitats, indicating that Orius was an effective predator of pest thrips species. Furthermore, faba bean were found to be more useful in conservation and augmentation of Orius spp. in winter time.

KEY WORDS: Prey-predator interactions, Orius spp., Frankliniella occidentalis, abundance, faba bean

Faba bean (Vicia faba L.) is an important nutritious food crop containing high protein levels as human food. This crop is cultivated widely together with other winter vegetable crops in the eastern Mediterranean region of Turkey. Faba bean is also a good rotational crop fixing nitrogen and thus enhancing soil fertility. This crop is rank fourth among the other leguminous crops in Turkey in term of production. Faba bean is consumed as green vegetable or dried pods in the Aegean and Mediterranean Regions of Turkey (Anonymous, 2001).

Polyphagous anthocorid Orius spp. (Hemiptera: Anthocoridae) are often considered as important predators of thrips (Riudavets 1995). In Turkey, O. niger suppress effectively population increase of Frankliniella flower thrips in the non-insecticide treated cotton fields in Çukurova region (Atakan, 2006; Atakan & Gençer, 2008) also Orius spp. are recorded on various vegetable crops grown in different parts of Turkey (Yaşarakıcı & Hınçal, 2000; Bulut & Göçmen, 2000). Orius spp. are an important biological control agent regulating the populations of the serious pestiferous thrips, the western flower thrips (WFT), Frankliniella occidentalis (Pergande) especially in the greenhouse crops (Tommasini, 2004; van de Veire & Degheele, 1992; Tavella et al., 2000). O. niger has been well
established to manage *F. occidentalis* in glasshouse cultivation of sweet pepper (van de Veire & Degheele, 1992).

Habitats represented by different plant biodiversity can affect differently richness of harmful and beneficial arthropod species insect species and their densities on host plant crops (Root, 1973; Sheehan, 1986; Russell, 1989; Andow, 1991). There are numerous studies dealing with effects of the crop diversification on abundance of the pestiferous and of beneficial insects (Letourneau & Altieri, 1983; Letourneau, 1990; Helenius, 1991; Coll & Bottrell, 1994, 1995; Nampala et al., 1999). However, in the additive intercropping experimental design, there is inter-specific plant competition that hampers crop development that may indirectly affect abundance of herbivore species (Bukovinszky et al., 2004). Greater availability of alternative foods in a mixed experimental design in the same experimental area may reduce predation risk of a target pest insect due to habitat complexity interfering with the movement and host searching behaviors of the natural enemies of pest insects (Ables et al., 1978; Andow & Prokryn, 1990).

Though, *Orius* species are common predators of thrips species on various crops, their winter activity and predatory ability particularly on *F. occidentalis* on winter crops such as faba bean or wild plants in the vegetationally different agricultural areas is not well understood in the Mediterranean region.

Considering the possible mixed effects of intercropping (i.e., different plant architecture, plant volatiles and cues) on accumulations of the thrips and the predatory insect, two field experiments were established in two ecologically diverse areas in the same agricultural landscape. Faba bean, cultivated as winter crop in a large scale, flowering through early-winter and-spring in the eastern Mediterranean region of Turkey, may have various ecological impacts on the *F. occidentalis*-*Orius* population dynamics. This may allow well-understanding of the predation abilities of *Orius* species on pestiferous insects on subsequent arable crops in the region.

In this work, we aimed to assess (a) abundance patterns of *F. occidentalis* and *Orius* spp. on faba bean in diversified two habitats (b) species composition of *Orius* spp. on faba bean and (c) preference of faba bean parts by *F. occidentalis* and *O. niger*.

### MATERIAL AND METHODS

#### Study Sites

This work was carried out in the Research and Application Farm (RAF) of Faculty of Agriculture, University of Çukurova in seasons; 2005 and 2006. The area of the RAF is 12 ha and has different topographical features of landscapes. For instance, winter wheat is the predominant crop in the non-irrigated area, while in the irrigated lands various agricultural crops including alfalfa, temperate fruit crops, vegetables and field crops such as cotton, maize, sesame and soybean are grown either experimentally or commercially.

The first experimental area (N: 37° 01.809´; E: 35° 21.694´) is represented by high plant biodiversity, i.e., polyculture area which included winter vegetables (onion, broccoli, lettuce and red cabbage), wheat and annual summer crops (cotton and maize) grown in small acreage. Additionally, various citrus species (lemon, orange, mandarin and grapefruit) olive trees are also grown commercially. Winter or annual summer crops were grown in an area of 1.5 ha, while citrus and olive are grown in an area of 2.2 ha and 1.5 ha, respectively. Another experiment of an area of 8.0 ha established in Cotton Research and Application Centre (CRAC) (N: 37° 00.795´; E: 35° 21.119´). In this area, wheat
(6.5 ha) and lettuce (1.0 ha) had been grown commercially. This experimental area is described as triculture. Two habitats were isolated from each other by nearly 2 km, and they have the same ecological features excluding plant biodiversity.

**Experimental procedure**

The experimental area of faba bean (cv. Lara) was established nearby the citrus (mandarin and orange) and olive trees, while wheat and lettuce plots (50 or 100 m$^2$) in polyculture area. This area included various winter vegetable crops which established in separate plots of 200 m$^2$ and they were nearly 200 m away from the experimental area.

Faba bean was planted on 5 October, 2004 and 15 October, 2005. The size of the experimental area was 500 m$^2$ (25 m-length and 20 m-width). Experimental area was divided into five replications. No pesticides were applied during the course of the experiment.

**Sampling of insects on faba bean**

A beating method was performed to extract thrips or *Orius* populations from the plants. For this aim in each sub-plots, five plants were randomly selected, bent down and vigorously shaken into a white plastic container for about 5 sec. The extracted thrips and predators were collected by a fine brush and stored in plastic vials (2 ml) contained 60% ethyl alcohol. In the laboratory, the thrips samples were transferred to vials containing AGA solution (i.e., 10 parts of 60% ethyl alcohol, one part glacial acetic acid and one part glycerine) and kept for one day. Thrips species were slide-mounted and identified under a binocular microscope. Larval thrips were grouped into one category due to difficulty of their identification. The same sampling method was also applied to identify other beneficial and harmful insect species inhabiting faba bean plants.

**Sampling of thrips and *Orius* on various plant parts of faba bean**

Five plants were randomly selected from each sub-plots of faba bean and a total of 6 leaflet and flowers (two leaflets or flowers from each three sections, upper, middle and lower) sampled for numbers of *F. occidentalis* and *Orius* in both years. Leaflets and flower samples of each plant were separately kept in plastic bags and the samples were stored in an insulated cooler and transmitted to the laboratory. In order to extract the populations of thrips or beneficial insects, flowers and leaf samples were kept for one or two hour in a deep-freezer and then, tapped onto white plastic sheet. The extracted thrips and predators were collected by fine brush and kept in plastic tubes (2 ml) containing 60% ethyl alcohol for further identification processes. Flowers were dissected carefully to expose any remained thrips or predators in flower parts and rinsed in a detergented solution 2% for 25 sec then sieved. Thrips extracted from the solution were transferred to plastic tubes contained 60% ethyl alcohol. *Orius* species were identified by guidance of Önder method (1992) and Tommasini (2004). Thrips species were identified by the first author. Identified insect samples were counted separately under steromicroscope with x45 magnification.

**Data analyzes**

Other thrips species: *Thrips tabaci* Lind, *Thrips major* Uzel, *Thrips meridionalis* (Priesner), *Thrips angusticeps* Uzel and predatory thrips *Aeolothrips collaris* Priesner, were collected mainly in polyculture area and their abundance was not evaluated because their numbers were few in most sampling dates. Numbers of larval thrips were not subjected to analysis due to their very low numbers. Numbers of the most common predators, *Orius* spp. (pooled) adults and *Orius* spp nymphs (pooled). Numbers of *F. occidentalis* and *Orius* spp. on two plant parts (i.e., leaves and flowers) were pooled for each sampling location
and for sampling years. Seasonal comparisons of the numbers of thrips and *Orius* on plant parts i.e., leaves and flowers in the two habitats, were quantified by using the simple t-test at P < 0.05. Relationships between numbers of thrips and *Orius* on faba bean plants were done by using Quadratic regression analysis at P < 0.05. All analyzes were performed by SPSS 13.0. Microsoft statistics programs (SPSS, 2000).

**RESULTS**

**Species composition of *Orius* on faba bean**

*Orius niger* was the most prevalent predatory insect species on both habitats, except those in March which were dominated by *O. laevigatus*. Overall, proportions of *O. niger* on faba bean in polyculture were 71 and 74% in 2005 and 2006; and in triculture, 73 and 55% in 2005 and 2006, respectively (Fig. 1).

**Abundance of thrips and *Orius* on two plant parts of faba bean**

*Frankliniella occidentalis* (adult) and adults of *O. niger* were mainly collected from the flowers of faba bean on most sampling dates in both location and years (Table 1). Overall, seasonal mean numbers of both insects were significantly higher in flowers than in leaves in both locations in both years (P < 0.05) (Table 1). *Orius* nymphs were always found in flowers’ samples, but their numbers were very few on most sampling dates in both locations.

**Abundance of thrips and *Orius* populations on faba bean**

Early colonization of *F. occidentalis* in faba bean was detected in polyculture area. Population densities of thrips in both habitats were lower in 2005 than numbers in 2006 (Fig. 2). Numbers of thrips peaked in 28 March 2005 and 16 March 2006 in polyculture area. Mean numbers of thrips in polyculture were highly greater on most sampling dates as compared to mean numbers of thrips in triculture in both years (Figure 2). Colonization’s time of both *Orius* species to faba bean plants was similar in polyculture, but was two weeks earlier than those of triculture in both years (Fig. 2). Populations of total *Orius* adults fluctuated with some increases and decreases throughout the samplings in both habitats in 2005 (Fig. 2). In 2005, mean numbers of adult *Orius* spp. increased to peak on 21 February and 28 March in polyculture and 28 March in triculture. Mean numbers of *Orius* adults were greater on most sampling dates in the period between January and February than numbers found in triculture area in 2005. In 2006, mean numbers of adult *Orius* spp. increased to peak on 2 February, 16 March and 6 April in polyculture and 23 February and 30 March in triculture. Similarly, previous year, in 2006, by excluding 16 February and 30 March the mean numbers of *Orius* spp. in polyculture area were more abundant on most sampling dates than numbers found in triculture (Fig. 2).

Population trends of *Orius* spp. in abundance followed the population patterns of *F. occidentalis* in both habitats in both years. There were significantly positive relationships between numbers of thrips and *Orius* spp. in both habitats in both years (Table 2). Populations of *Orius* were greater than those of thrips in all sampling dates in both years and numbers of thrips were very low or negligible at the presence of high numbers of *Orius* populations in both habitats.

Most of the nymphs probably belonged to *O. niger* because this predator was widely-spread on faba bean on most sampling periods in both area and years. First nymphs of *Orius* were detected on faba bean in the first or second week of March in both habitats (unpublished data).

Overall, relatively greater numbers of *F. occidentalis* and *Orius* spp. were detected in polyculture in both years (Fig. 3).
Prey: predator ratio

Ratios of prey: predator (thrips: Orius) were found to be relatively greater in polyculture than triculture in both years (2005-polyculture = 0.15; 2005-triculture = 0.06; 2006-polyculture = 0.21; 2006-triculture = 0.13 (Fig. 4).

Other insect species

A total of 14 pest insect species were identified on faba bean during the samplings in both habitat (Table 3). Among these insect species, leafhoppers were more abundant during the sampling period. Other insect species, excluding aphid Acyrthosiphon pisum (Haris), were rarely found and their cumulative numbers were low in both years. A. pisum numbers were relatively greater in 2006 than that found in previous study-year. However no damage on plants due to aphid or leafhopper feedings was recorded in both years. In general, identified pestiferous insect numbers were greater in polyculture habitat than those found in triculture habitat.

A total of 11 predatory insect species were identified on faba bean during the sampling (Table 4). Among these insect species, Orius niger were more abundant during the sampling periods. Other beneficial arthropods were rarely found and their cumulative numbers were low in both years. In general, identified predacious insect numbers were greater in polyculture habitat than those found in triculture habitat. Predators Satphylinus and Campylomma nicolosi were detected only in polyculture habitat in both years.

DISCUSSION

The results show that Orius niger was the main Orius species on both faba bean. Here, O. niger appeared to be the more active predator in the hard winter months in the region (Fig. 1). This may be a result of both year round availability of its thrips prey (Atakan & Uygur, 2004). O. niger is commonly found anthocorid species in Italy, while O. laevigatus is the most abundant species in the warmest locations of Italy (Tommasini, 2004).

The flowers of faba bean mainly colonized by F. occidentalis and Orius species during winter and early spring time (Table 1). It is well-known that Orius species benefit from the plant nectars and pollens (Dick & Jarvis 1962, Salas-Aguilar & Ehler 1977, Kiman & Yeargan 1985). Though, the flowers of faba bean might be important as pollen and nectar sources for the survival of Orius species beside other predators and parasitoids during unavailability or scarcity of arthropod preys. This case is more likely due to the greater availability of extra floral nectars found in faba bean plants (Anonymous, 2008). Nuessly et al. (2004) indicated that numerous beneficial insect species visited the faba bean plants grown in southern Florida (USA). Additionally, large and closed structure of those flowers might be a good hibernation and shelter site for protection of Orius species from unfavorable climatic conditions.

In both habitats, population densities of the thrips on plants were lower than those of Orius spp. (Fig. 2). Faba bean flowers were found to be good host especially for Orius spp. in winter time. Low densities of thrips throughout the winter-spring season may indicate that thrips have high predation risks due to Orius attacks. This suppression of thrips effectively by a predator depends upon several factors comprising the initial population densities of the prey and predator, their fecundity, and morphological structure of host plant (Osekre et al., 2008). Previous studies done in the region reported capability of O. niger to effectively suppress Frankliniella flower thrips on untreated crop plant such as cotton (Atakan & Özgür, 2001 ) and wild plants (Atakan & Tunç, 2010). There
were consistent suppressions of *F. occidentalis* populations overtime in faba bean. Prey - predator ratios in most of sampling weeks were very lower (less than 0.25 thrips per predator) than 217 thrips per *Orius*, which this ratio is critical capability ratio for *O. insidiosus* to effectively control populations of *F. occidentalis* (Sabelis & van Rijn, 1997). In current study, significant correlations obtained between numbers of thrips and *Orius* in both habitats may be an evident of *Orius* species mainly *O. niger* becoming an important natural enemy of pest thrips.

In this work, *F. occidentalis* and both *Orius* species were more abundant on faba bean grown in polyculture than their abundance found in triculture. Additionally some pest insect species such as leafhoppers were more abundant in polyculture area. This issue is probably due to great availability of different crop plant species in polyculture area. Additionally, in the polyculture, multi-flowering weed species might enhance the reproductive capacity of *Orius* species, providing nectars, pollens and also alternative preys (Atakan, 2010). Generalist natural enemies such as anthocorids are particularly assumed to benefit of plant diversification because of the great availability of food sources (Root, 1973; Sheehan, 1986; Russell, 1989). Numbers of *Orius* were lower on the intercropped cowpea + sorghum than numbers in cowpea as sole crop and cowpea + green gram mixture (Nampala et al., 1999). Population densities of *Orius* sp. were not significantly different when cowpea had grown alone or intercropped in Kenya (Kyamanyawa et al., 1993). The above findings obtained from other studies differ, probably, due to variation in microclimatic conditions, while different suitability of preferred niches and insect meals recorded within the mixed cropping system (Altieri et al., 1978; Andow, 1983; Letourneau & Altieri, 1983; Ogenga-Latigo, 1988).

The quick colonization of adult *Orius* species to faba bean in polyculture ecosystem may have resulted in the nearly two weeks earlier appearance of *Orius* nymphs than happened in triculture. The first *Orius* nymphs on faba bean were recorded in the first or second week of March in both years. We recorded both male and female of *O. niger* during the study. However, *O. niger* produced nymphs on *S. arvensis* in the mild winter period (December and January) in the same experimental area (Atakan, 2010). Tommasini & Nicoli (1996) revealed that North Italy strains of *O. laevigatus* inclined to go into diapause while the strain from the southern Italy could give offspring in the autumn and winter time. Bahşi & Tunç (2008) commented that *O. niger* would have an ability to survive and produce nymphs under unheated greenhouses conditions in Mediterranean region of Turkey, based upon the laboratory results. A reason of no nymphs dwelling the faba bean throughout the winter time (January and February) in our study was attributed to unfavorable climatic conditions for nymphal survival, resulting in death of the nymphs.

In conclusion, faba bean is a more attractive plant species hosting considerable numbers of the *Orius* species and other beneficial insects in winter time. Cultivation of faba bean, especially in monoculture area could be useful for conservation and augmentation of the beneficial insects including *Orius* spp. Overwintering biology of *O. niger* is not clearly understood. Therefore, further study should be planned for this issue.

**ACKNOWLEDGEMENTS**

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LITERATURE CITED


Atakan, E. 2010 Influence of weedy field margins on abundance patterns of the predatory bugs Orius spp. and their prey, the western flower thrips (Frankliniella occidentalis), on faba bean. Phytoparasitica, 38: 313-325.


Figure 1. Proportions of adults of two *Orius* species in faba bean with polyculture (a) and (b) triculture areas in 2005-2006.

Table 1. Seasonal abundance of *Frankliniella occidentalis* and *Orius* spp. adults on leaves and flowers of faba bean in Adana province, Turkey in 2005-2006.

<table>
<thead>
<tr>
<th>Years</th>
<th>Habitat types</th>
<th>Insect species</th>
<th>Plant parts</th>
<th>Mean numbers (±SE)/plant parts</th>
<th>ANOVA results</th>
</tr>
</thead>
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<td></td>
<td></td>
<td><em>Orius</em> spp.</td>
<td>Leaves</td>
<td>0.35±0.15</td>
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<td>2005</td>
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<td>Flowers</td>
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<td>Flowers</td>
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</table>
Figure 2. Mean numbers of *Frankliniella occidentalis* and *Orius* populations on faba bean in two diverse habitats in 2005-2006.

Table 2. Relationships between numbers of *Orius* spp. and *Frankliniella* thrips on faba bean plants in two diverse habitats in 2005-2006, Adana province, Turkey.

<table>
<thead>
<tr>
<th>Years</th>
<th>Habitat type</th>
<th>Associations</th>
<th>df</th>
<th>R²</th>
<th>F</th>
<th>P</th>
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<td><em>Orius</em>-thrips</td>
<td>2.12</td>
<td>0.65</td>
<td>10.174</td>
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<td>Tricrate</td>
<td><em>Orius</em>-thrips</td>
<td>2.12</td>
<td>0.69</td>
<td>6.722</td>
<td>0.011</td>
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<td>10.564</td>
<td>0.002</td>
<td>$Y = 0.137x - 0.0842 + 0.0577$</td>
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Figure 3. Seasonal mean numbers of *Frankliniella occidentalis* and *Orius* populations on faba bean in two diverse habitats in 2005-2006.

Figure 4. Seasonal prey:predator (Thrips: *Orius*) ratios in two diverse habitats in 2005-2006.
Table 3. List and cumulative numbers of harmful insect species detected on faba bean in Adana province, Turkey during 2005-2006.

<table>
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<tr>
<th>Insect species</th>
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<th>2005 TC</th>
<th>2006 PC</th>
<th>2006 TC</th>
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<td>0</td>
<td>14</td>
<td>4</td>
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<tr>
<td><em>Epistomis (Tropinota) hirta</em> Poda</td>
<td>Coleoptera/Scarabaeidae</td>
<td>8</td>
<td>0</td>
<td>3</td>
<td>0</td>
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<td><em>Oxythrea cinetella</em> (Schaum)</td>
<td>Coleoptera/Scarabaeidae</td>
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<td>0</td>
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<td>0</td>
<td>5</td>
<td>0</td>
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<tr>
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<td>0</td>
<td>6</td>
<td>0</td>
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<td><em>Asymmetrusa decedens</em> (Pauli)-<em>Euphasca decipiens</em> Paoli</td>
<td>Hemiptera/Coccidae</td>
<td>321</td>
<td>240</td>
<td>968</td>
<td>340</td>
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<td><em>Acrystosiphon pisum</em> (Harris)</td>
<td>Hemiptera/Aphididae</td>
<td>10</td>
<td>5</td>
<td>197</td>
<td>13</td>
</tr>
<tr>
<td><em>Thrips major</em> (Priesner)</td>
<td>Thysanoptera/Thripidae</td>
<td>18</td>
<td>1</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td><em>Franklinia occidentalis</em> (Pergande)</td>
<td>Thysanoptera/Thripidae</td>
<td>26</td>
<td>16</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td><em>Thrips meridionalis</em> Uzel</td>
<td>Thysanoptera/Thripidae</td>
<td>13</td>
<td>3</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td><em>Thrips tabaci</em> Lin.</td>
<td>Thysanoptera/Thripidae</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><em>Thrips angusticeps</em> Uzel</td>
<td>Thysanoptera/Thripidae</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><em>Melanthrips pallidior</em> Priesner</td>
<td>Thysanoptera/Aelenothripidae</td>
<td>12</td>
<td>10</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

PC: Polyculture, TC: Triculture

Table 4. List and cumulative numbers of beneficial insect species detected on faba bean in Adana province, Turkey during 2005-2006.

<table>
<thead>
<tr>
<th>Böcek türleri</th>
<th>Order/Family</th>
<th>2005 PC</th>
<th>2005 TC</th>
<th>2006 PC</th>
<th>2006 TC</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Coccinella septempunctata</em> L.</td>
<td>Coleoptera/Coccidae</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>0</td>
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<tr>
<td><em>Hippodamia variegata</em> Goeze</td>
<td>Coleoptera/Coccidae</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><em>Seconus levallanti</em> Mulsant</td>
<td>Coleoptera/Coccidae</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><em>Seconus pallidipredormis</em> Günther</td>
<td>Coleoptera/Coccidae</td>
<td>8</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td><em>Staphylinus sp.</em></td>
<td>Coleoptera/Staphylinidae</td>
<td>10</td>
<td>0</td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td><em>Orius niger</em> (Wolff)</td>
<td>Hemiptera/Anchocorids</td>
<td>58</td>
<td>49</td>
<td>102</td>
<td>90</td>
</tr>
<tr>
<td><em>Orius laevigatus</em> (Fieber)</td>
<td>Hemiptera/Anchocoris</td>
<td>10</td>
<td>10</td>
<td>37</td>
<td>5</td>
</tr>
<tr>
<td><em>Orius majuscus</em> (Reuter)</td>
<td>Hemiptera/Anchocorids</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><em>Campylosoma nicolasi</em> (Reuter)</td>
<td>Hemiptera/Miridae</td>
<td>15</td>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td><em>Chrysoperla carnea</em> (Stephens)</td>
<td>Neuroptera/Chrysoptidae</td>
<td>14</td>
<td>3</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td><em>Aelothrips collaris</em> Priesner</td>
<td>Thysanoptera/Aelenothripidae</td>
<td>17</td>
<td>14</td>
<td>19</td>
<td>11</td>
</tr>
</tbody>
</table>

PC: Polyculture, TC: Triculture
FIRST REPORT OF *BRACHYMERIA CARBONARIA* (ZEHNTNER), *MEGACHALCIS TIMORENSIS* BOUCEK AND *TROPIMERIS EXCAVATA* STEFFAN (HYMENOPTERA: CHALCIDOIDEA) FROM INDIA

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ABSTRACT: Three chalcidid pupal parasitoids, *Brachymeria carbonaria* (Zehntner), *Megachalcis timorensis* Boucek and *Tropimeris excavata* Steffan are recorded for the first time from India and a new host record for *Brachymeria albicrus* (Klug) is also reported.

KEY WORDS: Chalcidinae, Haltichellinae, first report, India

*Brachymeria* Westwood and *Megachalcis* Cameron belong to the subfamily Chalcidinae that includes four tribes. The genus *Brachymeria* belongs to the tribe Brachymerini and is highly diversified with 310 species known globally, 118 in Oriental region and 74 in India. *Megachalcis* belongs to the tribe Cratocentrini and was erected by Cameron with *M. fumipennis* as the type species (Cameron, 1903). This genus is represented by seven species globally and all of them are known from Oriental region also. However, only two (*M. fumipennis* Cameron and *M. malabarica* Narendran) are known from India. There is no further report of this genus from India after Narendran (1989), where he described *M. malabarica*. *Tropimeris* belongs to the subfamily Haltichellinae, tribe Tropimeridini and was erected with *T. excavata* as the type species (Steffan, 1948). Globally it is represented by three species and two are known from India (Noyes, 2016). The genus *Brachymeria* is highly speciose among the members of Chalcididae and also has a wider host range, attacking the pupae of most Lepidoptera, Diptera and Coleoptera and rarely as hyperparasitoids of Hymenoptera (Boucek, 1952; Masi, 1951; Ruschka, 1922). *Tropimeris* was reported from *Exelastis atomosa* Walshm, *Spilosoma obliqua* Walker (Hussain & Agarwal, 1981) and *Sphenarches caffer* Zell. (Steffan, 1948). The host of *Megachalcis* is unknown.

MATERIALS AND METHODS

Parasitoids were collected from Karnataka, Mizoram and Tamil Nadu states using yellow pan, malaise trap and host rearing. Collected specimens were processed, dried using hexamethyldisilazane as described by Brown (1993) and card/slide mounted using the standard procedure adopted by Noyes (1982). Left antenna of *T. monodon* Boucek and *T. excavata* Steffan were slide mounted. Images were captured using Leica stereo zoom microscope M205C and DMC 2900 camera whereas for slide mounted antenna, the same was done using Leica...
DM750 phase contrast microscope and DFC 295 camera. Finally the images were stacked using montage and pyramided using Combined ZP software. The acquired images were then processed using Adobe Photoshop 7.0. Voucher specimens are deposited with EDAU, Parasitoid Taxonomy and Biocontrol laboratory.

Abbreviations: ATREE- Ashoka Trust for Research in Ecology and the Environment, Bengaluru; EDAU – Entomology Department, Annamalai University, Chidambaram; GKVK- Gandhi Krishi Vigyan Kendra; UAS – University of Agricultural Sciences, Bengaluru; ICAR- Indian Council of Agricultural Research; NBAIR- National Bureau of Agricultural Insect Resources, Bengaluru; T1- First gastral tergite.

Brachymeria carbonaria (Zehntner, 1906) (Fig. 1a)

Brief diagnosis: This species can be diagnosed with the following characters: T1 smooth and shiny (Fig. 1b), hind femora black with a very narrow yellow apical spot, hind tibia black from base to beyond middle, the apical part yellow (Joseph et al., 1973) (Fig. 1c).

Specimens examined: One female, India, Mizoram, ICAR, Kolasib, 23.50°N, 92.30°E, 16.v.2016, NBAIR Team; one male, Tamil Nadu, MGR thittu, Pichavaram, 11.25°N, 79.46° E, 12.ix.2010, malaise trap, S. Manickavasagam; one female, Tamil Nadu, Kanyakumari, 8.08°N, 77.54°E, 1.ix.2005, ATREE team.

Distribution: Indonesia (Deventer, 1906), India (new record).

Variation: Tegula color varies from yellow with brown base (2 of 3) to dark brown (1 of 3).

Megachalcis timorensis Boucek, 1988 (Fig. 2a)

Brief diagnosis: This species can be diagnosed by the presence of subinfumate wings, with more infumation just at veins; propodeum with an angulate transverse costula, raised in middle in a reversed V shape (Fig. 2b), first tergite with denser punctures at the postero-lateral corners and epipygium in lateral view accuminate.

Specimens examined: One female, India, Karnataka, Bengaluru, GKVK campus, UAS, from Syzygium cumini ecosystem, 13.03° N, 77.57° E, 30.xii.2009, Yeshwanth; one female, Tamil Nadu, Sivapuri, 11.38°N, 79.71° E, 12.iii.2013, yellow pan trap, S. Manickavasagam.

Distribution: Indonesia (Boucek, 1988), India (new record).

Variation: Both the specimens match each other except color variation in the first gastral tergite (T1 rufous with apex black in Karnataka specimen whereas it is completely rufous in Tamil Nadu specimen) and wing infuscation (Figs. 2c & 2d).

Tropimeris excavata Steffan, 1948 (Fig. 3a)

Brief diagnosis: Hind femur with two sharp teeth (Fig. 3b) and the funicle of female slightly transverse. This is closer to T. monodon but can be differentiated by the presence of single sharp teeth in hind femur (Fig. 3d).

Specimen examined: one female, India, Tamil Nadu, Annamalainagar, orchard ecosystem, 11.23° N, 79.43° E, 2.ix.2015, yellow pan trap, R. Jayanthi.

Distribution: Senegal (Steffan, 1948), India (new record).

Comments: In the original generic diagnosis (Steffan, 1948, in French), he mentioned as two segmented clava. Husain and Agarwal (1981) while describing T. indicus, also mentioned as clava 2-segmented. However, later Boucek (1988) and Narendran (1989) reported clava as 3-segmented. To confirm this, the
antenna was dissected and slide mounted and it is confirmed that the clava is two segmented (Fig.3c) in both *T. excavata* and *T. monodon*. However, variation exists in the general body color from reddish brown to black.

**New host record for Brachymeria albicrus (Klug, 1834)**

**Specimen examined:** One female, India, Karnataka, Kanakapura, 12.54° N, 77.41° E, 22.vi.2016, ex. *Colotis amata* (Fabricius), NBAIR team.

**Host:** *Earias* sp., *Anaphaesis aurata* Fabricius (Narendran, 1989), *Colotis amata* (Fabricius) (Pieridae: Lepidoptera) (new record).

**ACKNOWLEDGEMENTS**

The authors are thankful to Dr. John S. Noyes (Natural History Museum, London, England, UK) for providing literatures on Tropimeris, Dr. C.A. Virakthamath and Dr. H.M. Yeshwanth of UAS, GKVK, Bengaluru for providing Megachalcis on loan and Dr. Priyadharshan and the ATREE team for providing Chalcididae specimens on loan. The help rendered by Ms. R. Jayanthi (PG scholar 2014-2016) in collecting the lone specimen of *Tropimeris excavata* is gratefully acknowledged. We thank ICAR for partly funding this work through Network Project on Insect Biosystematics.

**LITERATURE CITED**


Figure 1. *Brachymeria carbonaria*. a & b - habitus–lateral & dorsal; c- hind leg.

Figure 2. *Megachalicis timorensis*. a-habitus; b-propodeum; c & d-fore wing color variation of specimens from Karnataka (c); Tamil Nadu (d).
Figure 3. *Tropimeris excavata*. a-habitus; b-hind leg; c. *Tropimeris monodon* left antenna; d-hind leg.
SOME ADDITIONAL NOTES CARABIDAE AND TENEBRIONIDAE (COLEOPTERA) FAUNA IN ÇANAKKALE PROVINCE OF TURKEY

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ABSTRACT: In this study, some additional faunistic notes are given on seven species belonging to Carabidae and one species belonging to Tenebrionidae (Coleoptera) collected by pitfall traps in Çanakkale province of Western Turkey. All of them, eight species were evaluated as the first record for Marmara region and the local fauna of Çanakkale province.

KEY WORDS: Carabidae, Tenebrionidae, first record, fauna, Çanakkale, Turkey

The family Carabidae, known as ground beetles, is one of the largest and widespread families of Coleoptera, with over 40,000 species which more than 30% of species are arboreal, though in general temperate species are terrestrial, most are flightless and predatory, and also the taxonomically and ecologically best known groups in all insects. More than 1100 species of the Carabidae have been recorded in Turkey (Casale & Taglianti, 1999) and new species are still being added to the list. Some of the studies made on Turkish Carabidae fauna; Casale & Taglianti (1999), Kocatepe & Mergen (2004), Kesdek & Yıldırım (2004, 2007a,b, 2008, 2010a,b), Avgın (2006), Avgın & Özüdiken (2007), Kesdek (2012, 2013), Anlaş & Tezcan (2010), Tezcan et al. (2011), Avgın & Cavazutti (2011), Surgut & Varlı (2012), Avgın (2014), Fidan et al. (2014).

The Tenebrionidae, named as Darkling beetles, is a big family, distributed in all parts of the world and comprising species over with 15 000 (Bouchard et al., 2005). They occur in many terrestrial ecosystems, mostly in decaying vegetation matter, under stones and bark, or in desert or semidesert habitats. So far, more than 310 species and subspecies of Tenebrionidae have been recorded from Turkey (Tezcan et al., 2004). Some of the studies made on Turkish Tenebrionidae fauna; Ferrer & Soldati (1999), Keskin (1999, 2004, 2005), Leo & Fattorini (2000), Tezcan et al. (2000, 2004a,b), Mercan et al. (2004), Lillig & Aydin (2006), Keskin & Ferrer (2006), Nabozhenko & Keskin, (2009, 2010), Keskin & Nabozhenko (2010, 2011), Ferrer & Avgın (2011).

This paper has been prepared in order to give some additional information as a result of master thesis of the first author on the fauna of Çanakkale (Karabiga) province.

RESULTS

As a result of this study, for each species, information on the name of locality, date of collection, place on which the material collected, and the number of species have been given in brackets. The material evaluated in this study is given in systematical order in the following.
CARABIDAE

Carabinae Latreille, 1802

*Carabus (Archicarabus) victor* Fischer von Waldheim, 1836

**Material examined:** Çanakkale (Karabiga), 15.V.2010, meadow, (1). Totally 1 specimen, leg. Sürgüt.

**Remarks:** First record for Marmara Region and local fauna of Çanakkale province.

**Distribution in Turkey:** Turkey (Löbl & Smetana, 2003).

Harpalinae Bonelli, 1810

*Acinopus (Acinopus) picipes* (Olivier, 1795)

**Material examined:** Çanakkale (Karabiga), 15.V.2010, meadow, (1). Totally 1 specimen, leg. Sürgüt.

**Remarks:** First record for Marmara Region and local fauna of Çanakkale province.

**Distribution in Turkey:** Anatolia (no locality) (Casale & Taglianti, 1999); Eskisehir, Ankara (Avgın & Emre, 2007).

Harpalus (Harpalus) attenuatus Stephens, 1828

**Material examined:** Çanakkale (Karabiga), 27.V.2010, meadow, (1). Totally 1 specimen, leg. Sürgüt.

**Remarks:** First record for Marmara Region and local fauna of Çanakkale province.

**Distribution in Turkey:** Anatolia (no locality) (Casale & Taglianti, 1999); Artvin, Bayburt, Erzurum, Bingöl, Sinop, Kahramanmaraş, İzmir (Bozdağlar), Türkmen Dağı (Eskişehir-Kütahya) (Kesdek & Yıldırım, 2003; Avgın, 2006; Avgın & Emre, 2007; Anlaş & Tezcan, 2010; Tezcan et al., 2011; Kesdek, 2013; Küçükkayki, 2013).

Platyninae Bonelli, 1810

*Calathus (Calathus) syriacus* Chaudoir, 1863

**Material examined:** Çanakkale (Karabiga), 26.IV.2010, meadow, (1). Totally 1 specimen, leg. Sürgüt.

**Remarks:** First record for Marmara Region and local fauna of Çanakkale province.


*Synuchus nivalis* (Panzer, 1797)

**Material examined:** Çanakkale (Karabiga), 26.IV.2010, meadow, (1). Totally 1 specimen, leg. Sürgüt.

**Remarks:** First record for Marmara Region and local fauna of Çanakkale province.

**Distribution in Turkey:** Ardahan, Artvin, Erzurum, Kars (Kesdek & Yıldırım, 2010a).

Pterostichinae Bonelli, 1810

*Amara (Amara) aenea* (De Geer, 1774)

**Material examined:** Çanakkale (Karabiga), 26.IV.2010, meadow, (1). Totally 1 specimen, leg. Sürgüt.

**Remarks:** First record for Marmara Region and local fauna of Çanakkale province.

**Distribution in Turkey:** Ardahan, Artvin, Burdur, Erzincan, Erzurum, Iğdır, Isparta, Karaman, Kars, Konya, Muğla, Şırnak (Kesdek & Yıldırım 2010b; Kesdek, 2012); İzmir (Bozdağlar) (Tezcan et al., 2011).

Scaritinae Bonelli, 1810

*Distichus (Distichus) planus* (Bonelli, 1813)

**Material examined:** Çanakkale (Karabiga), 26.IV.2010, meadow, (1). Totally 1 specimen, leg. Sürgüt.

**Remarks:** First record for Marmara Region and local fauna of Çanakkale province.

**Distribution in Turkey:** İzmir, Muğla (Öncüer, 1991); Bingöl, Erzurum, Iğdır, Kars, Tunceli (Kesdek, 2012).
TENEBRIONIDAE

Tenebrioninae Latreille, 1802

Raiboscelis syriacus (Reiche, 1861)

Material examined: Çanakkale (Karabiga), 27.V.2010, meadow, (1). Totally 1 specimen, leg. Sıtkı M. Kesdek.

Remarks: First record for Marmara Region and local fauna of Çanakkale province.

Distribution in Turkey: Ankara, Antalya, Aydın, İzmir, Konya, Manisa, Muğla (Tezcan et al., 2004b).

ACKNOWLEDGEMENTS

I would like to thank to Pof. Dr. Serdar TEZCAN (Aegean University, Faculty of Agriculture, Department of Plant Protection, Entomology Department, İzmir) and Ass. Prof. Dr. Memiş KESDEK (Muğla Sıtkı Koçman University, Fethiye Ali Şitki Mehfaret Koçman Vocational School, Muğla) who kindly help in identification of the species and in preparing of the article.

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A NEW RECORD FOR THE TURKISH BLOW FLY FAUNA (DIPTERA: CALLIPHORIDAE)

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ABSTRACT: Due to, blowflies (Calliphoridae) are usually the first insects to colonize a body after death, often within hours, they have greatest value to forensic investigations. The age of the oldest blowflies gives the most accurate evidence of the Post Mortem Interval (PMI) and habitat preferences ensure us the determination of crime scene. This family is a wide spread calyptrate family all over the World and Turkey. In this study Pollenia rudis (Fabricius, 1794) was collected from Eskişehir and reported first time in Turkey. Seasonal activity and succession of this species on the decaying pig carcasses were given and interpreted. The variation of taxonomical characters and distribution on the world briefly discussed.

KEY WORDS: Pollenia rudis, new record, Turkish fauna, forensic entomology, blow flies

Diptera are one of the three largest and most diverse animal groups in the world comprised of over 160,000 named species in about 150 families (Symank et al., 2008) and the Calliphoridae is a large and cosmopolitan family of Diptera that belong to the Calyptrata family group. Calliphoridae contains over 1000 described species (Smith, 1986), of which about 115 are present in Europe (Oosterbroek, 2006). The genus Pollenia Robineau-Desvoidy 1830 is represented by 42 known species in Palaearctic, and the Western Palaearctic being much more species rich than the Eastern Palaearctic (Rognes, 1998).

Members of the genus Pollenia are commonly referred to as cluster flies. Taxonomy of some species groups and their life history are well documented (Rognes, 1991a; Thomas & Davies, 1973). They are Calliphorids that have very diverse habits, especially the larvae. While the adults generally visit flowers, faeces and carrion, there are species whose larvae feed on dead animals, faeces or other decaying organic matter. Larvae usually infest living vertebrate animals (Zumpt, 1965; Rognes, 1998). These maggots quickly invade the areas of the corpse and grow in size and weight. Information about the size, weight and age of blowfly larvae and adults on a corpse can be used to identify the time, and sometimes place, of death (Sharma et al., 2013).

This work provides the first country record for Pollenia rudis (Fabricius, 1794), collected on different days of pig decomposition during a forensic entomology research in Eskişehir, extending the known range of the species and taxonomic characters were given in details, variability and distribution of species were briefly discussed.

MATERIAL AND METHODS

The first sampling process occurred on bloat and early active decaying stage of forensic research at decomposition field, the adult samples were collected by nets within 30 cm diameter and preserved in ethyl acetate jars. The study was conducted in oak forest on 39°56’07.12”N, 30°29’34.11”E, Eskişehir, near the Tekeciler village. The specimens were collected between 15 June 2012 and 15 June
2013. The species were identified by literature and keys (Rognes, 1987; 1991b; Szpila, 2010 and Jewiss-Gaines et al., 2012). The taxonomical characteristics were photographed by Leica microscope MZ12.5 donated with DFC 480 camera.

RESULTS

Totally 28 specimens, belonging to the Polleninae subfamily, was determined as a new record; Pollenia rudis (Fabricius, 1794).

Family Calliphoridae
Subfamily Polleninae
Genus Pollenia Robineau-Desvoidy 1830
Species Pollenia rudis (Fabricius, 1794)


Distribution: Canada, United States, United Kingdom, Netherlands, Germany, Switzerland, Norway, Sweden, Finland, Russia, Albania, Andorra, Austria, Belarus, Belgium, Cyprus, Czech Republic, Finland, French mainland, Greek mainland, Hungary, Ireland, Italian mainland, Lithuania, Madeira, northern Ireland, Poland, Portuguese mainland, Romania, Sicily, Slovakia, Spanish mainland, Ukraine, Australian region, East Palaearctic, Nearctic region, North Africa, Oriental region (www.fau 나라.org; www.globalspecies.org).

Comments: General distribution of this species is North America, North Africa and North Europe. This species is also distributing in Russia, Greek mainland and Cyprus. Due to near distribution to Turkey (Greek mainland, Cyprus and East Palaearctic) and habitat preferences explain the being P. rudis in Turkey, especially with the human race. This species can be distinguished from closely related species with anterodorsal setae of mid-tibia and dark brown or black setulae of mid- and hind femur. This species are not so variable but, variabilities in coloration of antennae and in abdominal pattern were seen. The other variabilities are body size, coloration of posterior thoracic spiracle, basicosta and coloration of mid- and hind femur setulae on posteroventral surfaces.

The taxonomical characters were described by photos within the quotes of identification keys;

1. Underside of wing without tuft of pale setulae at intersection of subcosta and humeral crossvein (Fig. 1).
2. Presutural area with only 1 anterior intra-alar seta (Figure 2), thorax without mid-dorsal stripe (Figs. 2, 3).
3. Lappets of posterior thoracic spiracle (anterior to halter) tan, yellow, or orange in colour (Fig. 4), basicosta brown, light brown or tan (Fig. 5).
4. Facial carina between antennae prominent, not reduced (Fig. 6).
5. Mid-tibia with 2-3 anterodorsal setae (Fig. 7), mid- and hind femur with only dark brown or black setulae on posteroventral surface (Fig. 8).
DISCUSSION

Comparing with the other Pterygot orders in Turkey, Diptera is the fourth richest order in Turkey after Lepidoptera, Coleoptera and Hymenoptera, according to the total number of the species (Anonymous, 2012). Unfortunately, there are still many undiscovered new species to the science, and unrecorded species to the fauna of Turkey. Potential of the dipteran fauna of Turkey may be estimated more than 10,000 species (Koçak & Kemal, 2013).

The preference of Calliphorids for a fresh corpse makes them a high priority at crime scenes whenever they are encountered (Sharma et al., 2013). Blow flies are the first organisms to arrive on a dead body. Their offspring can give a good estimate of the time a body has been exposed to insects. We expect that *P. rudis* also have great forensic importance due to the specimens were collected in early stages of decomposition, lay their eggs same time with the other species that forensically very important, larvae grow up with the other larva and habitat preference.

The distribution area of this species is known pine-oak forest that colonized on dead body at this location. As a reported at recent study that species live in forest near the urban sites (Fremdt & Amendt, 2013). Specific habitat preferences of this species possibly use as evidence about corpse is moved or not.

This species shown their intensive activity at dead body at spring and autumn before other species (Table 1). This species use to determine PMI (Post mortal interval) cause of that earlier comes to corpse than other Calliphorids. Therefore, succession and development stages of this species can be useful as reference for the crime investigations.

In this study, *P. rudis* was reported as new record for Turkish Calliphoridae fauna. The variety of lifestyle, diverse habits, feeding on several foods show us the way to conclude that the actual diversity of this family in Turkey can be higher than currently known. In the future, we expect that more new Turkish cluster fly records will be found for this family.

ACKNOWLEDGEMENTS

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LITERATURE CITED


http://www.globalspecies.org/ntaxa/508525. 17.03.2014.


Table 1. Activity of specimen during a year.

<table>
<thead>
<tr>
<th>Month</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
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Figure 1. Underside of wing without tuft of pale setulae at intersection of subcosta and humeral cross vein.

Figure 2. Presutural area with only 1 anterior intra-alar seta.
Figure 3. Thorax without mid-dorsal stripe.

Figure 4. Lappets of posterior thoracic spiracle (anterior to halter) tan, yellow, or orange in colour.

Figure 5. Basicosta brown, light brown or tan.
Figure 6. Facial carina between antennae prominent, not reduced.

Figure 7. Mid-tibia with 2-3 anterodorsal seta.

Figure 8. Mid- and hind femur with only dark brown or black setulae on posteroventral surface.
FIRST REPORT OF HYPTIOTES AFFinis BÖSEnBERG & STRAND, 1906 (ARANEAE: ULOBORIDAE) FROM INDIA

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ABSTRACT: Hyptiotes affinis Bösenberg & Strand, 1906 is reported from India for the first time. Illustrations of the habitus, male palp and distribution map are provided. DNA barcode data obtained for this species is available at BOLD.

KEY WORDS: Uloboridae, Hyptiotes affinis, India, new record

The family Uloboridae is represented by 281 species under 18 genera worldwide. Of which, 22 species under 5 genera are known from India (World Spider Catalog, 2017). These araneomorph entelegyne spiders are small to medium size with cribellum and calamistrum. The genus Hyptiotes Walckenaer, 1837 was erected from the type species Hyptiotes paradoxus (C. L. Koch, 1834) and is represented by 16 species worldwide, of which two species were reported from India; Hyptiotes himalayensis Tikader, 1981 and Hyptiotes indicus Simon, 1905 (World Spider Catalog, 2017). The members of the genus can be distinguished by the posterior eyes placed on tubercles and triangular carapace.

While studying the spiders from Sikkim state of India, we recognized this triangular web spider previously unknown in the country. This species was previously known from China, Korea, Taiwan, and Japan. The objective of the present study is to provide the first record of Hyptiotes affinis Bösenberg & Strand, 1906 from India along with DNA barcode data.

MATERIAL AND METHODS

The specimen was handpicked and stored in 70% alcohol. It was later examined and photographed by the Leica EZ4 HD stereomicroscope. All images were then processed with the aid of LAS core software (LAS EZ 3.0). Species was identified using diagnostic keys provided by Kim & Lee (2013). All measurements are in millimeters. The studied specimen has been deposited in the NZC (National Zoological Collections) at the Zoological Survey of India, Kolkata. Legs were used for isolation of genomic DNA. Amplification of the cytochrome C oxidase subunit I (mtCOI) gene was performed following Barrett & Hebert (2005). The sequencing was carried out on 3730 DNA Analyzer (Applied BioSystems) in the in-house sequencing facility of Zoological Survey of India. The resulting sequence was submitted to BOLD (Barcode of Life Data Systems) under the project titled “Barcoding Spiders of India”.
TAXONOMY

*Hyptiotes affinis* Bösenberg & Strand, 1906
(Figs. 1-4)

**Material Examined:** 1 male, 15 September 2016, Rongli, East Sikkim, India, (27°12′13″N, 88°42′7″E, 877m), ZSI-AA-543, leg. Rushati Dey.

**Diagnosis:** The species can be recognized by the thin sinuous embolus and curved basal part with tiny and sharp median apophysis (Fig. 3).

**Comments:** The DNA barcode data of *H. affinis* was evaluated in the similarity search engine of NCBI (National Centre for Biotechnology Information). The sequence developed in our study showed 90% similarity with sequences of same genus and closely related to *H. gertschi* Chamberlin & Ivie, 1935.

**Distribution:** China, Korea, Taiwan, Japan, India (New Record).

ACKNOWLEDGEMENTS

The authors are grateful to Director, Zoological Survey of India for his encouragement and moral support and for providing necessary facilities to carry out the work. This work is a part of the Ph. D thesis of the first author.

LITERATURE CITED


Figures 1-4. *Hyptiotes affinis*, male. 1, dorsal view; 2, ventral view; 3, male left palp, ventral view; 4, same, retrolateral view. Abbreviations: E – embolus, E – embolus, O – origin of embolus. Scales: 1–2, 1 mm; 3, 0.5mm.
SPECIES OF _COLOTRECHNUS_ THOMSON, 1878
(HYMENOPTERA: PTEROMALIDAE, COLOTREHNINAE)
FROM TURKEY, WITH DESCRIPTION OF NEW SPECIES

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ABSTRACT: The species of _Colotrechnus_ Thomson, 1878 (Hymenoptera: Pteromalidae, Colotrehninae) from Turkey were studied. From Turkey 10 species of _Colotrechnus_, 8 of them as new species, _C_. _karatasensis_ n. sp., _C_. _bekiralkani_ n. sp., _C_. _kemaliyenensis_ n. sp., _C_. _mustafaoezeri_ n. sp., _C_. _zduzgunesae_ n. sp., _C_. _hasangirayi_ n. sp., _C_. _birecikensis_ n. sp., _C_. _akifkansui_ n. sp. and 2 known species, _C_. _subcoeruleus_ Thomson 1878, _C_. _viridis_ (Masi, 1921), were described from several parts of Turkey. An identification key was provided for the world species.

KEY WORDS: _Colotrechnus_ spp., Hymenoptera, Pteromalidae, Turkey

The subfamily Colotrechninae was established in the Pteromalidae, and _Colotrechnus_ and its type species _C_. _subcoeruleus_ was described by Thomson (1876). Masi (1921) described _Zanonia_ and its type species, _Z_. _viridis_. Delucchi, (1956) discussed the status of _Colotrechnus_ compared with characters of _Zanonia_ (Masi), and synonymized _Zanonia_ under _Colotrechnus_, gave the diagnostic characters of the genus and provided an identification key for two known species, _C_. _subcoeruleus_ Thomson and _C_. _viridis_ (Masi). It was placed as a tribe under Pteromalidae (Bouček, 1958) and later upgraded to a subfamily (Peck et al., 1964). The subfamily is now divided into five tribes by Bouček (1988) such as: Hetreulophini, Amerostenini, Divnini, Colotrechnini and Uzkini. This whole group can be simply characterized by the presence of large axillae separated from the scutellum by (mostly) out-curving grooves or lines visible dorsally, and by the absence of an occipital carina (Bouček, 1988). Up to date, 19 valid genera have been described in this subfamily (Noyes, 2016). They are widely distributed in the world (Noyes, 2016). Among them, _Colotrechnus_ is the best known genus of Colotrechninae. Until now, 6 species have been described in this genus, _C_. _ignotus_ from nearctic, and _C_. _subcoeruleus_ from the Palearctic Region and _C_. _viridis_ from Euroasan region and Africa were recorded. Two species, _C_. _agromyzae_ and _C_. _melghatlea_, were reported from Oriental Region, and _C_. _notaularis_ from the Australasian Region. From Turkey 2 species, _C_. _subcoeruleus_ and _C_. _viridis_, were recorded (Doğanlar, 1985; Öncüer, 1991), but the first one was described as new species by this work.

The species of _Colotrechnus_ were reported as parasitoids of Diptera (Tephritidae, Agromyzidae) on associated plant (Asteraceae, Fabaceae, Myrtaceae) (Noyes, 2016; Bouček, 1988; Burks, 1979). Apparently these wasps are potential enemies of some species of Diptera. Li et al. (2014) recorded _Colotrechnus_ from China, described _C_. _viridis_ from the specimens collected from the Junggar Basin in north of Xinjiang.
In this work morphological characters of the Colotrechnus species from Turkey were studied and the new species was described and compared with the similar species and an identification key was provided for the World species.

**MATERIAL AND METHODS**

This study is based upon examination and identification of the specimens collected from several parts of Turkey. The examined specimens and types of the new species were deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC). Specimens were collected by sweeping net and putting the whole contents of the swept materials directly in 96 % ethanol. After sorting the material, individuals were mounted on cards, and, whole body or antenna and/or forewings of some species were slide mounted in Canada balsam for further morphological studies.

The species were identified by following the keys of Li et al. (2014) and Graham (1969). Photographs of diagnostic characters of the genera were taken by using of Leica DM 500 microscopes with a digital Leica ICC 50 camera attached to it.

Terminology and abbreviations

Morphological terminology follows that of Bouček (1988), Gibson et al. (1997) and Li et al. (2014). Abbreviations used in the key and descriptions are: F1-7 = funicular segments; C1-C3= Club segments; a= distance between tip of post marginal vein and base of costal cell; b= distance between tip of post marginal vein and tip of forewing; MSt1, MSt2= basal segments of metasoma.

**RESULTS AND DISCUSSION**

*Colotrechnus* Thomson, 1878


**Diagnosis.** Body long and slightly slender, metallic dark green. Head and mesosoma finely reticulate, head without occipital carina. Face with antennal scrobes deep and broad or very shallow; lower face with a slight depression below toruli; clypeus flat and small, (delimited by distinct Groove in *C. mustafaoezeri* n. sp., and anterior margin of clypeus slightly emarginated medially, with a distinct impression above the emargination in *C. karatasensis* n. sp.). Antennae inserted slightly below centre of face, above lower ocular line (except in *C. karatasensis* n. sp. inserted at centre of face); antennal formula 11263 (11353 in males and in some small females of Australian spp. (Bouček, 1988), and in females of *Colotrechnus bekiralkani* n. sp. from Turkey); flagellum with dense hairs. Pronotum rounded, with distinct neck and collar, anterior margin of collar not margined, posterior margin finely reticulate, with short pale hairs; notauli very shallow and incomplete, sometimes complete in *Colotrechnus notaularis* Bouček (Bouček, 1988). Scutellum dorsally with conspicuous sublateral grooves. In females, propodeum very short, almost reduced to a point, median area smooth and bare, forming an acute triangle area, submedian area with white dense hairs; plica absent; propodeal spiracles large and subcircular, touching anterior propodeal margin. In males propodeum much longer and median carina complete. Fore wing with 3 usually distinct folds, sometimes marked by
conspicuous hairlines, radiating from the short clavate stigma (Bouček, 1988); costal cell bare on upper side, with several setal patterns on lower side; speculum broad, open; basal cell open without any hairs. Hind tibia with 2 spurs. Metasoma sessile and lanceolate, much longer or slightly longer than mesosoma; basal tergites often slightly produced in middle; ovipositor either produced or not produced.

**Biology.** Bouček (1988) stated that one species was reared from pods of *Glaucinia flava* (Papaverales: Papaveraceae) in France, and another species, *C. agromyzae* Subba Rao, was allegedly reared in Indonesia from *Agromyza* sp. (Diptera: Agromyzidae). A North American species has been found to emerge from the heads of some Asteraceae (Dicotyledones: Asterales) (Noyes, 2016).

**Distribution.** All regions in the world.

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**Key to World species of Colotrechnus Thomson**

1- Notauli complete; head in facial view short, transverse-oval, lower face distinctly reticulate; 6 funicular segments slightly transverse. Head in frontal view distinctly wider than height (36:29.5), and 1.8x as wide as length, POL 2.5 OOL, eye 1.4x as long as width; 20:5:14.5, malar space 0.34x eye height, scape 10, pedicel plus flagellum 36, mesosoma in dorsal view slightly narrower than head width (0.92x), 1.25x as long as width; mesoscutum 1.27x as wide as length; scutellum length 1.48x minimum distance between axillary grooves, with 2 pairs of bristles laterally. Metasoma 1.84x as long as mesosoma, and 3.68x as long as width; last tergite (epipygium) about twice as long as broad........................................................................................................... *C. notaularis* Bouček

- Notauli incomplete, only distinct anteriorly..................................................................................................................2

2-Anterior margin of clypeus slightly emarginated medially, with a distinct impression above the emargination (Fig. 1c); metasoma 1.54x as long as mesosoma, the latter 0.68x as long as width (Figs. 1a,b); Antenna (Fig. 1g) with combined length of flagellum 2.54x as long as length of club, and 3.33x as long as scape; club 1.9x as long as wide; C1 1.15x as long as C2; forewing (Fig. 2a) 2.42x as long as wide; a/b 1.73x; costal cell (Fig. 2b) 8.6x as long as wide, with one complete row along margin, 2 at base, 3 rows setae in apical half. Head (Fig. 1c) in frontal view slightly wider than high (40:36), and 2.2x as wide as length, POL 2.8 OOL; eye about 2.2x as long as width; malar space about 0.36x eye height; scape short, 0.45x eye height, not reaching lower edge of anterior ocellus, about 4.0x as long as width; antenna (Fig. 3c) with pedicel in lateral view about 1.3x as long as width; F1–F3 distinctly transverse, equal in length and width, 2.14x as wide as long; F4 twice as wide as long; F5 slightly wider than F4, 2.2x as wide as long; club 1.9x as long as wide; C1 0.92x as long as C2; club as long as pedicel plus anelli and F1+F2 together. Combined length of flagellum 2.4x as long as club, and 2.3x as long as scape. Forewing (Fig. 4a) 1.75x as long as wide; a/b 2.15x; costal cell 8.7x as long as wide, with one complete row along margin, 2 at base, 3 rows setae in apical half; post marginal vein longer than stigmal vein. Mesosoma (Figs. 3a,d) in profile slightly convex dorsally, length about 1.34x wide in dorsal view, slightly broader than head width (1.1x); mesoscutum, about 1.9x as wide as long; scutellum (Figs. 3a,d) 1.3x as long as space between sublateral grooves, with 3 pairs of bristles laterally; metasoma (Figs. 3a,e) 1.32x as long as mesosoma, and 2.1x as long as width; last tergite (epipygium) about 1.4x as long as broad........................................................................................................... *C. karatasensis* n. sp.

- Female antenna with 2 anelli; other characters variable...............................................................................................4
4- Antenna (Fig. 5a) with all funicular segments longer than wide, mesosoma with dense long fine setae.................................................................5
-Antenna with all funicular segments transvers, at most quadrate; mesosoma with sparse long or short fine setae.......................................................9
5- Female. Antennal formula 11263 (Fig. 5e)..............................................................................................................................6
- Male. Antennal formula 11353..............................................................8
6- Forewing (Fig. 4b) with distinct infumation below marginal vein; 2.06x as long as wide; a/b 1.57x; marginal vein 2.38x as long as post marginal vein; post marginal vein 1.6x as long as stigmatic vein; costal cell 8.5x as long as wide, with 3 rows setae. Antenna (Fig. 5e) with scape long, 0.7x eye height, not reaching lower edge of anterior ocellus, about 8.0x as long as width; POL 2.6 OOL; pedicel in lateral view about 7.9x as long as width; funicular segments longer than wide, almost in same width, F2 (Fig. 5g) with 3 sensillae in a row from base to tip and 3 sensillae in apical part, F2 with 5 linear sensillae almost in 3 rows, other segments with 2 rows sensillae; F1 2.0x, F2 1.5x, F3 1.33x, F4-F5 1.25x, F6 1.15x as long as wide; club (Fig. 5g) 2.5x as long as wide; C1 1.14x as long as C2; club as long as pedicel plus anelli and 1/2 F1 together; combined length of flagellum 4.1x as long as length of club, and 2.1x as long as scape; Mesosoma (Fig. 5d) about 4.3x as long as wide in dorsal view, slightly narrower than head width (0.93x); mesoscutum with fine about 1.55x as wide as length; scutellum 1.2x as long as space between sublateral groves, with at least 5 rows of setae; hind femur 1.76x as long as hind coxa. Metasoma (Figs. 5a,b) about 3.2x as long as wide, about 2.0x as long as mesosoma length; last tergite (epipygium) about 1.4x as long as broad; ovipositor 0.4x as long as last tergite..............................................................9...
7- Ovipositor not produced and 0.64x as long as last tergite; mesosoma 1.77x as long as mesosoma; Pronotum much shorter than half length of mesoscutum in dorsal view; antennal insertion well lower than centre of face; scape (Fig. 5 of Subba Rao, 1981) about 2.55x as long as F1. Forewing (Figs. 2, 3 of Subba Rao, 1981) 2.39x as long as broad; MV 2.75x as long as PMV; PMV 1.46x as long as STV; Head (Fig. 1 of Subba Rao, 1981) width in anterior view 1.56x distance between front ocellus and lower clypeal margin.........................C. subcoeruleus Thomson
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8- Antenna (Fig. 5h) with combined length of flagellum 4.25x as long as length of club and 5.2x as long as scape; F1 and F2 (Fig. 5i) with 3 linear sensillae in a row; club (Fig. 5i) 3.9-4.3x as long as wide; C1 0.72x as long as C2+C3........................................C. subcoeruleus Thomson
- Antenna (Fig. 6d) with combined length of flagellum 4.7x as long as length of club and 5.4x as long as scape; F1 and F2 with one linear sensillae; club 3.3-3.5x as long as wide; C1 0.93x as long as C2+C3; Head in frontal view 1.42x as wide as high, and twice as wide as length; Eye in frontal view about 1.5x as long as width. Malar space about 0.3x eye height, POL 2.3x OOL. Forewing (Fig. 4c) 1.9x as long as wide; a/b 1.9x; costal cell 6.25x as long as wide, with one complete row, and a half row at setae. Mesosoma (Figs. 6a,b) in profile slightly convex dorsally, about 1.6x as long as wide in dorsal view, as wide as head; mesoscutum about 1.34x as wide as long; scutellum 1.3x as long as space between sublateral groves, with at least 6 rows of setae; Metasoma (Fig. 6a) short, about 1.85x as long as wide, about 0.86x as long as mesosoma..............................................................C. kemaliyenensis n. sp.
9- Ovipositor produced (7a,c; 8a,b; 9a)..............................................................................................................................10
- Ovipositor not produced (10a; 11a; 12a)..............................................................................................................................13
10- Mesosoma (7c,e) bicoloured: pronotum, scutellum and propodeum pale yellow; female club with distinct spicula; clypeus (7d) delimited by distinct groove and with apical margin entire; antenna (7d) having club with distinct spicula, 1.9x as long as wide; C1 1.31x as long as C2; combined length of flagellum 2.7x as long as length of club, 2.7x as long as scape; forewing (4d) 2.42x as long as wide; a/b 2.8x; costal cell 8.6x as long as...
wide, with one complete row, and a half row at setae. Head (7d) in frontal view slightly wider than high (38:35) and 1.9x as wide as length; POL 3x OOL; Eye in frontal view about 2.2x as long as width. Malar space about 0.31x eye height, mesosoma 1.44x as long as width in dorsal view, distinctly narrower than head width (0.66x); mesoscutum about 1.5x as wide as long; scutellum 1.18x as long as minimum distance between axillary grooves, with 4 pairs of setae laterally; metasoma (7a-c) 4.35x as long as width, and 2.5x as long as mesosoma. last tergit (epipygium) about 1.33x as long as broad; ovipositor sheath 0.47x as long as  last tergit………………..C. mustufaezeri n. sp.
- Body uniformly coloured, black with bluish reflections; sides of clypeus not delimited by carina; female club without spicula.................................................................11

11- Antenna (Fig. of Burks, 1958) with combined length of flagellum 2.7x as long as club, and 2.1x as long as scape; Forewing 2.33x as long as wide, and a/b 2.7x; costal cell 6.0x as long as wide; mesoscutum with sparse, short and appressed pubescence; POL 2x OOL; club 1.8x as long as wide; C1 1.54x as long as C2; costal cell with upper side bare, lower side 1 comp, apical half 2nd row long bristles; stigmal vein not petiolate, stigmal vein almost as long as wide, stigma as long as wide; metasoma twice as long as mesosoma...... .................................C. ignotus Burks

- Antenna (Fig. 8e) with combined length of flagellum at least 3.2x as long as club; costal cell at least 7.9x as long as wide; mesoscutum with sparse, long and appressed pubescence; forewing at most 2.21x as long as wide; a/b 2.0x………………………………………………...12

12- Antenna (Fig. 8e) with combined length of flagellum 3.5-3.7x as long as club, and 2.64x as long as scape; metasoma 2.34x as long as mesosoma; costal cell 7.9x as long as wide; Club 1.8x as long as wide, C1 1.67x as long as C2; Forewing (Fig. 4e) 2.21x as long as wide; costal cell with upper side bare, lower side medially bare, at base 3-4 rows, in apical 2 rows of setae; stigma petiolate, stigmal vein more than twice as long as wide, stigma slightly wider than long; Head (Fig. 8c,d) in frontal view 1.25x as wide as high, and 2.3x as wide as length; POL 2.67x OOL; eye in frontal view about 1.7x as long as width. Malar space about 0.35x eye height; mesosoma (Fig. 8f) 1.4x as long as wide in dorsal view, slightly wider than head; mesoscutum about 1.52x as wide as long; scutellum (Fig. 8g) 1.4x as long as space minimum distance between axilllar grooves, with 3 pairs of setae laterally, 4 setae basally; metasoma (Fig. 8a,b) about 2.48x as long as wide, about 1.82x as long as mesosoma length; last tergit 1.5x as long as wide; ovipositor sheath 0.47x as long as last tergit..........................C. zduzgunesae n. sp.

- Antenna (Fig. 9e) with combined length of flagellum 3.2x as long as club and 2.1x as long as scape; mesosoma 1.93x as long as mesosoma; costal cell 8.6x as long as wide Club 1.56x as long as wide, C1 1.5x as long as C2; forewing (Fig. 4f) 2.15x as long as wide; a/b 2.0x; costal cell with upper side bare, lower side with 1 complete row, at base 2 rows, in apical 3 rows of setae; stigmal vein not petiolate, wider than long, stigma longer than wide; head (Fig. 9e) in frontal view 1.13x as wide as high, and 2.25x as wide as length POL 3.0x OOL; eye in frontal view about 3.0x as long as width; malar space about 0.34x eye height; mesosoma (Fig. 9a) about 1.32x as long as wide in dorsal view, slightly wider than head; mesoscutum (Fig. 9f) about 1.37x as wide as long; scutellum 1.33x as long as minimum distance between axillary grooves, with 3 pairs of setae laterally, 4 pairs in 2 rows medially; metasoma (Fig. 9a) about 2.6x as long as wide, about 1.93x as long as mesosoma length; last tergit (epipygium) about 0.8x as long as broad; ovipositor sheath 1.64x as long as last tergit……………………………C. hasangirayi n. sp.

13-Antenna (Fig. 10e) with F1 almost quadrate; combined length of flagellum about 3.1x (3.7) as long as length of club, and 2.9-3.1 x as long as scape; F1 0.75-0.93x as wide as long; with 5 linear sensilla; F2-F4 almost same length and width, 1.3-1.5x as wide as long; F5-F6 slightly widening, F5 1.5x, F6 1.67x as wide as long; F6 1.1-1.43x wider than F2; Club 1.74x (2.25) as long as wide; C1 1.25x as long as C2; Forewing (Fig. 4g) 2.1x as long as wide; a/b 2.0x; costal cell 7x as long as wide, with 2-3 complete rows of setae. Head (Fig. 10c) in frontal view 1.5x as wide as high, and 2.67x as wide as length; POL 2.6x OOL; eye in frontal view about 3.33x as long as width; malar space about 0.31x eye height, mesosoma (Figs. 10a,b) about 1.33x as long as wide in dorsal view, slightly narrower than head; mesoscutum (Fig. 10f) about 1.43x as wide as long; scutellum (Fig. 10g) 1.22x as long as minimum distance between axillary grooves, with 2 pair setae laterally, 1-2 setae basally; metasoma (Figs. 10a,b) about 3.0x as long as wide, about
1.52x as long as mesosoma length; last tergit (epipygium) about 1.6x as long as broad; ovipositor sheath 0.15x as long as last tergit.

- Antenna (Fig. 11c; 12d) with F1 distinctly transverse; combined length of flagellum at most 2.7x as long as club.

- Antenna (Fig. 11d) with F1 with at least 4 linear sensillae, F2-F6 at least 5-6 linear sensillae; club 1.3-1.5x as long as wide; Cl 1.14-1.36x as long as C2; combined length of flagellum 2.1-2.55x as long as club; 3.22-3.7x as long as scape; forewing (Fig. 4h) 2.02-2.55x as long as wide; a/b 1.7-2.5x; costal cell 7.5-8.0x as long as wide, with 1 complete rows, at base and apical about 2-3 rows of setae; Head (Fig. 11c) in frontal view 1.16-1.2x as wide as high, and 2.28x as wide as length, POL 2.25x OOL; eye in frontal view about 2.75x as long as width. malar space about 0.4x eye height; mesosoma (Figs. 11a,b) about 1.6x as long as wide in dorsal view, almost as wide as head; mesoscutum (Fig. 11f) about 1.3x as wide as long, with 4-5 rows, sparse, fine, long, pale setae; scutellum (Fig. 11g) 1.2x as long as minimum distance between axillary grooves, scutellum with 3 pair setae laterally, 3 setae basally; metasoma(Figs. 11a,b) about 2.83-3.2x as long as wide, about 1.6x as long as mesosoma length; last tergit (epipygium) about 1.5x as long as broad; ovipositor sheath 0.33x as long as last tergit.

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- Antenna (Fig. 12d) with F1 with at most 2 linear sensillae, F2-F6 at most 3-4 linear sensillae; club at least 1.74x as long as wide; combined length of flagellum at least 2.6x as long as club; combined length of flagellum about 2.03-2.31x as long as scape, 2.6-2.7 as long as club; F1 1.6-2.1x as wide as long; F2-F6 distinctly transverse, slightly widening towards tip, F2 2.0-2.3x as wide as long; F6 1.2-1.5x wider than F2, 2.2-2.4x as wide as long; club 1.74-1.8x as long as wide; C1 1.4-1.5x as wide as long, 1.25-1.31x as long as C2; forewing (Fig. 4i) 2.1-2.21x as long as wide; a/b 2.0-2.32x; costal cell 8.0-8.33x as long as wide, with 1 complete row, at base and apical 2 rows of setae. Head (Fig. 12c) in frontal view 1.1-1.2x as wide as high, and 2.5x as wide as length; POL 2.75x OOL; eye in frontal view about 2.4-2.8x as long as width; malar space about 0.26x eye height; mesosoma (Fig. 12a,b) about 1.2x as long as wide in dorsal view, almost as wide as head (42:35); mesoscutum (Fig. 12e) about 1.3-1.46x as wide as long, with 4-5 rows, sparse, fine, short, pale setae; scutellum 1.15x as long as minimum distance between axillary grooves, with 3 pair setae laterally; metasoma(Fig. 12a) about 2.6-2.0x as long as wide, about 1.4-1.6x as long as mesosoma length; last tergit (epipygium) (Fig. 12f) about 1.33-1.4x as long as broad; ovipositor sheath 0.3-0.14x as long as last tergit.

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**Colotrechnus notaularis** Bouček, 1988

(Figs. 454, 455 of Boucek, 1988)


**Diagnosis:** Body (Fig. 455 of Boucek, 1988) with mesosoma notaali complete; head in facial view short, transverse-oval, lower face distinctly reticulate; 6 funicular segments slightly transverse. Head in frontal view distinctly wider than height (36:29.5), and 1.8x as wide as length, POL 2.5 OOL, eye 1.4x as long as width; 20.5:14.5, malar space 0.34x eye height, scape 10, pedicel plus flagellum 36, mesosoma (Fig. 455 of Boucek, 1988) in dorsal view slightly narrower than head width (0.92x), 1.25x as long as width; mesoscutum 1.27x as wide as length; scutellum length 1.48x minimum distance between axillary grooves, with 2 pairs of bristles laterally. Metasoma 1.84x as long as mesosoma, and 3.7x as long as width; last tergit (epipygium) about twice as long as broad.

**Distribution:** Australia; New South Wales; Queensland; South Australia (Boucek, 1988).
Colotrechnus karataensis n. sp.
(Figs. 1a-g, 2a-c)

**Etymology.** The name is derived from the name of Karataş, Adana from which the types were collected.

**Diagnosis.** Anterior margin of clypeus slightly emarginated medially, with a distinct impression above the emargination; metasoma 1.54x as long as mesosoma, the latter 0.68x as long as width; combined length of flagellum 2.54x as long as length of club, and 3.33x as long as scape; club 1.9x as long as wide; C1 1.15x as long as C2; forewing 2.42x as long as wide; a/b 1.73x; costal cell 8.6x as long as wide, with one complete row along margin, 2 at base, 3 rows setae in apical half. Head in frontal view slightly wider than high (40:36), and 2.2x as wide as length, POL 2,8 OOL; eye about 2.2x as long as width; malar space about 0.36x eye height. Mesosoma in profile almost flat dorsally, length about 2.0x height, in dorsal view slightly broader than head width (1.08×), 1.25x as long as width; mesoscutum 30:44, scutellum 1.6x as long as minimum distance between axillary grooves, with 3 pairs of bristles laterally; metasoma 1.54x as long as wide; last tergite (epipygium) about 1.55x as long as wide.

**Description. Female:** Body length 2.0-2.2 mm.

**Colour.** Body black with metallic blue reflection, antenna black, scape and pedicel with metallic blue reflection; legs almost same colour with body, except hind tibiae medially brown, tarsi pale-brown. Wings hyaline, with pale venation and setae.

Head in frontal view slightly wider than high (40:36), face smooth with reticulation on malar area; antennal scrobe broad and deep, smooth and bare on the bottom, finely reticulate on both sides, with white densely appressed pubescence; lower face faintly concave, bare; clypeal margin (Fig. 1c) slightly emarginated medially, with a distinct impression above the emargination; eye about 2.2x as long as width; malar space about 0.36x eye height, malar sulcus developed finely, genal carina absent. Antennae (Fig. 1g) inserted at about centre of face, well above lower ocular line; flagellum with white dense hairs; scape short, 0.53x eye height, reaching lower edge of anterior ocellus, about 5.0x as long as width; pedicel in lateral view about 1.7x as long as width; F1–F2 slightly transverse, equal in length and width, 1.5-1.4x as wide as long; F3- F6 slightly widening and shortening towards tip, F3 1.13x, F6 1.5x as wide as long; club 1.9x as long as wide; C1 1.15x as long as C2; club somewhat longer than pedicel plus anelli and F1 together; combined length of flagellum 2.54x as long as club, and 3.33x as long as scape.

Mesosoma (Figs. 1a,b,d) in profile almost flat dorsally, length about 2.0x height, in dorsal view slightly broader than head width (1.08×); pronotum rounded, with distinct neck and collar, anterior margin of collar not margined, posterior margin reticulate, with long pale hairs; mesoscutum with raised-reticulate, about 1.5x as wide as long; notauli very shallow and incomplete, with fine, long pale setae; scutellum (Fig. 1e) almost smooth with delicate reticulation, with conspicuously sublateral grooves, axilla with obviously longitudinal carina; 1.6x as long as minimum distance between axillary grooves; frenal area absent, with 3 pairs of setae laterally; propodeum (Fig. 1f) medially very short, almost reduced to a point, median area smooth and bare, forming an acute triangle area, sub-median area with white dense hairs; plica absent; propodeal spiracles large and subcircular, touching anterior propodeal margin. Forewing (Fig. 2a) 2.42x as long as wide; a/b 1.73x; costal cell (Figs. 2b,c) 8.6x as long as wide, with one complete row along margin, 2 at base, 3 rows setae in apical half; marginal vein 2.2x post marginal vein; post marginal vein 1.43x stigmoid vein; stigma petiolate, 1.67x as long as
wide. Legs stout, hind coxae obviously enlarged and lengthened and approximately triangular in cross-section; both fore and hind femora enlarged, sub-flattened, but hind femora much larger than fore femora; all tibia with densely silvery hairs, hind tibia with 2 spurs.

Metasoma (Figs. 1a,b) elongate-acuminate, without petiole, about 2.43x as long as wide, about 1.54x as long as mesosoma length; MSt1 and MSt2 each with hind margins in middle portion roundly produced; last tergite (epipygium) about 1.55x as long as broad.

Male: unknown.

Materials studied: Holotype ♀, Turkey: Adana, Karataş, 08. viii. 2006, right antenna and forewing in slide, swept from pasture, M. Doğanlar, deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC). Paratype: 1 ♀, same data as the holotype.

Comments: Colotrechnus karatasensis n. sp. is an unique species in the genus, but it may similar to Uriellopteromalus spp. in having clypeal margin slightly emarginated medially, with a distinct impression above the emargination and body distinctly depressed dorsally, with both thorax and gaster broad and short, and marginal vein with but it differs from the species of Uriellopteromalus in having antennae attached in the middle of face, pronotum narrow, without any edge or carina, propodeum with a distinct median carina (in the species of Uriellopteromalus antennae attached below middle of face, propodeum rather broader and dorsally either with blunt transverse edge or a carina, propodeum without a distinct median carina (Boucek, 1988).

Colotrechnus bekiralkani n. sp.

(Figs. 3a-e, 4a)

Etymology. The name is derived from the name of Prof. Dr. Bekir Alkan who is the first Turkish entomology in Turkey.

Diagnosis. Clypeal margin entire, Female with antennal formula 11353; Head in frontal view slightly wider than high (40:34) and 1.73x as wide as length; POL 2.2 OOL; eye in frontal view about 2.7x as long as width. Malar space about 0.36x eye height; scape short, 0.45x eye height, not reaching lower edge of anterior ocellus, about 4.0x as long as width; pedicel in lateral view about 1.3x as long as width; F1–F3 distinctly transverse, equal in length and width, 2.14x as wide as long; F4 twice as wide as long; F5 slightly wider than F4, 2.2x as wide as long; club 1.9x as long as wide; C1 0.92x as long as C2; club as long as pedicel plus anelli and F1+F2 together. Combined length of flagellum 2.4x as long as club, and 2.3x as long as scape. Forewing 1.75x as long as wide; a/b 2.15x; costal cell 8.7x as long as wide, with one complete row along margin, 2 at base, 3 rows setae in apical half. Mesosoma (Fig. 3) in profile slightly convex dorsally, length about 1.34x wide in dorsal view, slightly broader than head width (1.1x); mesoscutum, about 1.9x as wide as long; scutellum 1.3x as long as space between sublateral groves, with 3 pairs of bristles laterally; metasoma 37:18 (2.05x metasoma 1.32x as long as mesosoma, and 2.1x as long as width; last tergit (epipygium) about 1.4x as long as broad.

Description. Female: Body length. 1.3 mm.

Colour. Body black with metallic green reflection, antenna black, scape and pedicel with metallic green reflection; legs almost same colour with body, except tarsi white, except tips of pretarsi black. Wings hyaline, with pale venation and setae.

Head (Fig. 3b) in frontal view slightly wider than high (40:34), face smooth with fine reticulation; antennal scrobe broad, smooth, frontal area finely reticulate,
with white sparsely appressed pubescence; lower face faintly concave, bare; clypeal margin entire, mouth broad, about twice as wide as malar space. Eye in frontal view about 2.7x as long as width. Malar space about 0.36x eye height, malar sulcus developed finely, genal carina absent. Antennae (Fig. 3c) antennal formula 11353; inserted distinctly below centre of face, well above lower ocular line; flagellum with black dense hairs; scape short, 0.45x eye height, not reaching lower edge of anterior ocellus, about 4.0x as long as width; pedicel in lateral view about 1.3x as long as width; F1–F3 distinctly transverse, equal in length and width, 2.14x as wide as long; F4 twice as wide as long; F5 slightly wider than F4, 2.2x as wide as long; club 1.9x as long as wide; C1 0.92x as long as C2; club as long as pedicel plus anelli and F1+F2 together. Combined length of flagellum 2.4x as long as club, and 2.3x as long as scape.

Mesosoma (Figs. 3a,d) in profile slightly convex dorsally, length about 1.34x wide in dorsal view, slightly broader than head width (1.1x); pronotum rounded, with distinct neck and collar, anterior margin of collar not margined, posterior margin reticulate, with long pale hairs; mesoscutum (Fig. 3d) with engraved reticulation, about 1.9x as wide as long; with sparsely fine, long pale setae; notauli very shallow and incomplete; scutellum 1.23x as long as space between sublateral groves, with fine reticulation, with conspicuous sublateral grooves, axilla with obviously longitudinal carina (Fig. 3d); frenal area absent, with 3 pairs of setae laterally; Forewing (Fig. 4a) densely hairy on both sides, 1.75x as long as wide; a/b 2.15x; costal cell 8.7x as long as wide, with one complete row along margin, 2 at base, 3 rows setae in apical half.; marginal vein 3.0x post marginal vein; post marginal vein 1.4x stigmatic vein; stigma capitate, 2.3x as long as wide.

Metasoma (Figs. 3a,e) elongate-acuminate, without petiole, about 2.1x as long as wide, about 1.24x as long as mesosoma length; MSt1 and MSt2each with hind margins in middle portion roundedly produced; last tergite (epipygium) about 1.4x as long as broad.

**Male:** unknown.

**Material studied:** Holotype ♀, Turkey: Kahramanmaraş, Pazarcık, Salluşağı village 37°30′41″N, 37°25′31″E, 1180 m (junction of Araban-Pazarcık road and highway Gaziantep-Kahramanmaraş road (D3609), 02. viii. 2008, antennae and forewing in slide, swept from pasture, M. Doğanlar, deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC).

**Comments:** *Colotrechnus bekiralkani* n. sp. is a unique species in the genus, in having antennae with 3-segmented anelli. Beside this character it is similar to *Colotrechnus karataensis* n. sp. in having body slightly depressed dorsally, and gaster broad and short but *C. bekiralkani* n. sp. differs from *C. karataensis* n. sp. in having antennae attached distinctly below middle of face, anterior margin of clypeus entire, combined length of flagellum 2.4x as long as club, and 2.3x as long as scape. (in *C. karataensis* n. sp antennae attached in the middle of face, anterior margin of clypeus slightly emarginated medially, with a distinct impression above the emargination, combined length of flagellum 2.54x as long as length of club and 3.33x as long as scape).

**Colotrechnus agromyzae Subba Rao, 1981**


**Diagnosis.** Ovipositor not produced and 0.64x as long as last tergite; metasoma 1.77x as long as mesosoma; Pronotum much shorter than half length of mesoscutum in dorsal view; antennal insertion well lower than centre of face;
scape 2.55x as long as F1. Forewing 2.39x as long as broad; marginal vein 2.75x as long as post marginal vein; post marginal vein 1.46x as long as stigmal vein; head width in anterior view 1.56x distance between front ocellus and lower clypeal margin.

**Distribution.** Indonesia.

**Host.** Agromyza sp.

*Colotrechnus melghatlicus* Narendran & Girish Kumar, 2009


**Diagnosis.** Ovipositor produced; metasoma 1.86x as long as mesosoma; Pronotum equal to half length of mesoscutum in dorsal view; antennal insertion almost near centre of face; scape 2.35x as long as F1; Forewing 2.1x as long as broad; marginal vein 3x as long as post marginal vein; post marginal vein 2.1x as long as stigmal vein; Ovipositor sheath not exserted. Head width in anterior view 1.36x distance between front ocellus and lower clypeal margin. Forewing 2.39x as long as wide; Hind femur 1.5x as long as hind coxa.

**Distribution.** India, Maharashtra; Amaravathi Dt.; Melghat Wild Life sanctuary, Semodah.

**Host.** Unknown.

*Colotrechnus subcoeruleus* Thomson, 1878

(Figs. 5a-j, 4b)

*Colotrechnus subcoeruleus* Thomson 1878: 46. Female and male were described, types not designated, Syntypes: Öland, Gottland and Skane.


**Diagnosis.** Antenna with all funicular segments longer than wide, mesosoma with dense long fine setae. Fore wing with distinct infumation below marginal vein; marginal vein 2.38x as long as post marginal vein; post marginal vein 1.6x as long as stigmal vein; antennal formula 11263; scape long, 0.7x eye height, not reaching lower edge of anterior ocellus, about 7.0x as long as width; POL 2.6 OOL; pedicel in lateral view about 1.9x as long as width; funicular segments longer than wide, almost in same width, F1 with 3 sensillae in a row from base to tip and 3 sensillae in apical part, F2 with 5 linear sensillae almost in 3 rows, other segments with 2 rows sensillae; F1 2.0x, F2 1.5x, F3 1.33x, F4-F5 1.25x, F6 1.15x as long as wide; club 2.5x as long as wide; C1 1.14x as long as C2; club as long as pedicel plus anelli and ½ F1 together; combined length of flagellum 4.1x as long as length of club, and 2.1x as long as scape; Forewing 2.06x as long as wide; a/b 1.57x; costal cell 8.5x as long as wide, with 3 rows setae. Mesosoma about 1.43x as long as wide in dorsal view, slightly narrower than head width (0.93x); mesoscutum with fine about 1.55x as wide as length; scutellum 1.2x as long as space between sublateral groves, with at least 5 rows of setae; hind femur 1.76x as long as hind coxa. Metasoma about 3.2x as long as wide, about 2.0x as long as mesosoma length; last tergite (epipygium) about 1.4x as long as broad; ovipositor 0.4x as long as last tergit.
Description from the specimens of Turkey

Female: Body (Figs. 5a,b) length 3.2-3.9 mm.

Colour. Body dark blue to violet, with metallic greenish reflection, antenna black, scape, pedicel and last segments of club testaceous; legs almost same colour with body, except tarsi with metatarsi white, except hind tarsi with 1-2. segments white, other segments pale brown, all of pretarsi black. Wings with pale brown cloud below marginal vein, venation brown, setae black.

Head (Fig. 5e) in frontal view slightly wider than high (45:40), face smooth with fine reticulation; antennal scrobe broad, smooth, frontal area finely reticulate, with white sparsely appressed pubescence; lower face faintly concave, bare; clypeal margin entire, mouth 1.2x as wide as malar space. Eye in frontal view about 2.75x as long as width. Malar space about 0.36x eye height, malar sulcus developed finely, genal carina absent. Antennae (Fig. 5e) inserted distinctly below centre of face, well above lower ocular line; flagellum with white dense hairs; antennal formula 11263; scape long, 0.7x eye height, not reaching lower edge of anterior ocellus, about 7.0x as long as width; pedicel in lateral view about 1.9x as long as width; funicular segments longer than wide, almost in same width, F1 (Fig. 5f) with 3 sensillae in a row from base to tip and 3 sensillae in apical part, F2 with 5 linear sensillae almost in 3 rows, other segments with 2 rows sensillae; F1 2.0x, F2 1.5x, F3 1.33x, F4-F5 1.25x, F6 1.15x as long as wide; club 2.5x as long as wide; C1 1.14x as long as C2; club as long as pedicel plus anelli and ½ F1 together. Combined length of flagellum 4.1x as long as club, and 2.1x as long as scape.

Mesosoma (Fig. 5d) in profile slightly convex dorsally, about 1.43x as long as wide in dorsal view; slightly narrower than head width (0.93x); pronotum rounded, with distinct neck and collar, anterior margin of collar not margined, posterior margin reticulate, with long pale dense hairs; mesoscutum with fine, engraved reticulation, about 1.55x as wide as long; with dense fine, long pale setae; notaulli very shallow and incomplete; scutellum 1.2x as long as space between sublateral grooves, with fine reticulation, with conspicuous sublateral grooves, axilla with obviously longitudinal carina (Figs. 1, 4); frenal area absent, with at least 5 rows of setae.

Forewing (Fig. 4b) densely hairy on both sides, 2.1x as long as wide; a/b 1.57x; costal cell 8.5x as long as wide, with one complete row along margin, at least 3 rows setae in apical half; marginal vein 3.2x post marginal vein; post marginal vein, 3.2x stigma vein; stigma petiolate, as long as wide.

Metasoma (Figs. 5a,b) elongate-acuminate, without petiole, about 3.2x as long as wide, about 2.0x as long as mesosoma length; MSt1 and MSt2each with hind margins in middle portion roundly produced; last tergite (epipygium) about 1.4x as long as broad; ovipositor 0.4x as long as last tergite.

Male: Body length. 3.0 mm. Similar to female accept as follows: eye 1.75x as long as wide; antennal formula 11353. Scape 3.6x as long as wide; pedicel 1.5x as long as wide; Combined length of flagellum 3.36x as long as length of club and 4.4x as long as scape; funicular segments with 3 linear sensillae in a row apically; F1 1.93x; F2-F5 1.3-1.2x as long as wide; club 3.9-4.3x as long as wide; C1 0.72x as long as C2+C3; Forewing without cloud. Mesosoma 1.5x as long as wide; mesoscutum 0.7x as long as wide; scutellum almost as long as wide; metasoma 0.86x as long as mesosoma, and 1.85x as long as wide.

Material studied: Turkey: Tokat, 1♀, 08. vi. 1986, antennae and forewing in slide, H. Çam. 1♀, 28. v. 1989, 1♂ 17.vii. 1989, H. Çam; Teknepınar, 1♂, 06.viii. 1986, M. Doğanlar, all of the specimens were swept from pasture, and deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC).
Comments: *Colotrechnus subcoeruleus* is similar to *Colotrechnus melghatlicus* Narendran & Girish and *Colotrechnus agromyzae* Subba Rao in having antennae with all funicular segments longer than wide, but it differs from both of them in having forewing with brownish cloud below marginal vein.

**Biology.** *Melanagromyza* sp. (Diptera: Agromyzidae) in India; reared from pods of *Glaucinia flava* (Papaveraceae) in France (Andriescu & Mitroiu, 2001).

**Distribution.** Britain, Sweden, Austria, Italy, Czechoslovakia (Graham, 1969); Europe as far as Transkaukazia, Romania, (Andriescu & Mitroiu, 2001), Spain (Li et al., 2014).

### Colotrechnus kemaliyenensis n. sp.

(Figs. 6a-g; 4c)

**Etymology.** The name is derived from the name of Kemaliye, Erzincan from which the types were collected.

**Diagnosis.** Antennal formula 11353; Combined length of flagellum 4.7x as long as length of club, and 5.45x as long as scape.; F1 and F2 with one linear sensillae; club 3.3-3.5x as long as wide; C1 0.93x as long as C2+C3; Head in frontal view 1.42x as wide as high, and twice as wide as length, Eye in frontal view about 1.5x as long as width. Malar space about 0.3x eye height, POL 2.3x OOL. Forewing 1.9x as long as wide; a/b 1.9x; costal cell 6.25x as long as wide, with one complete row, and a half row at setae. Mesosoma in profile slightly convex dorsally, about 1.64x as long as wide in dorsal view, as wide as head; mesoscutum about 1.34x as wide as long; scutellum 1.3x as long as space between sublateral groves, with at least 6 rows of setae; Metasoma short, about 1.85x as long as wide, about 0.86x as long as mesosoma.

**Description. Male:** Body (Fig. 6a) length. 1.53 mm.

Colour. Body dark blue to violet, with metallic greenish reflection, antenna black, last segments of club testaceous; legs almost same colour with body, except tarsi with 1-4 segments testaceous, pretarsi black. Wings with venation and setae black. Head in frontal view 1.42x as wide as high, and twice as wide as length. Face smooth with fine reticulation; antennal scrobe broad, smooth, frontal area finely reticulate, with white sparsely appressed pubescence; lower face faintly concave, bare; clypeal margin entire, mouth almost 2x as wide as malar space. Eye in frontal view about 1.5x as long as width. Malar space about 0.3x eye height, malar sulcus developed finely, genal carina absent. POL 2.3x OOL. Antennae (Fig. 6d) inserted distinctly below centre of face, well above lower ocular line; flagellum with black dense hairs; antennal formula 11353; scape 3.33x as long as wide, 0.5x eye height, not reaching lower edge of anterior ocellus; pedicel (Fig. 6e) in lateral view about 1.1x as long as wide; funicular segments longer than wide, almost in same width, F1 and F2 with one linear sensillae (Fig. 6e), F3-F5 with 2 sensillae apically; F1 2.36x; F2-F4 1.5-1.6x; F5 1.75x as long as wide; club (Figs. 6f-g) 3.3-3.5x as long as wide; C1 0.8-0.9x as long as C2+C3; combined length of flagellum 3.95-4.7x as long as length of club, and 5.45-5.53x as long as scape.

Mesosoma (Fig. 6b) in profile slightly convex dorsally, about 1.64x as long as wide in dorsal view, as wide as head; pronotum rounded, with distinct neck and collar, anterior margin of collar not margined, posterior margin reticulate, with long pale dense hairs; mesoscutum with fine, engraved reticulation, about 1.34x as wide as long; with dense fine, long pale setae; notauli very shallow and incomplete; scutellum (Fig. 6c) 1.3x as long as space between sublateral groves, with fine reticulation, with conspicuous sublateral grooves, axilla with obviously longitudinal carina; frenal area absent, with at least 6 rows of setae; Forewing densely hairy on both sides, 1.9x as long as wide; a/b 1.9x; marginal vein 2.45x
post marginal vein; post marginal vein 1.4x stigmal vein; stigma petiolate, as long as wide costal cell 6.25x as long as wide, with one complete row, and a half row at setae (Fig. 7).

Metasoma (Fig. 6a) short, without petiole, about 1.85x as long as wide, about 0.86x as long as mesosoma length.

**Material studied:** Holotype male. Turkey: Erzincan, Kemaliye, Yuva village, 18. vi. 1982, antennae and forewing in slide, swept from pasture, M. Doğanlar, deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC).

**Comments:** *Colotrechnus kemaliyenensis* n. sp. is similar to *Colotrechnus subcoeruleus* Thomson in having antennae with all funicular segments longer than wide, but it differs from *C. subcoeruleus* in having combined length of flagellum 3.95-4.7x as long as length of club, and 5.45-5.53x as long as scape; scape 3.33x as long as wide; pedicel 1.1x as long as wide; F1 and F2 with one linear sensillae, F3-F5 with 2 sensillae apically; F1 2.36x; F2-F4 1.5-1.6x; F5 1.75x as long as wide; club 3.3-3.5x as long as wide; C1 0.8-0.9x as long as C2+C3; Forewing 1.9x as long as wide; a/b 1.9x; costal cell 6.25x as long as wide, with one complete row, and a half row at setae; mesosoma 1.64x as long as wide; (in male of *C. subcoeruleus* combined length of flagellum 3.36x as long as length of club and 4.4x as long as scape; funicular segments with 3 linear sensillae in a row apically; scape 3.6x as long as wide; pedicel 1.5x as long as wide; F1 1.93x; F2-F5 1.3-1.2x as long as wide; club 3.9-4.3x as long as wide; C1 0.72x as long as C2+C3; mesosoma 1.5x as long as wide; mesoscutum 0.7x as long as wide; scutellum almost as long as wide; metasoma 0.86x as long as mesosoma, and 1.85x as long as wide).

*Colotrechnus mustafaoezeri* n. sp. (Figs. 7a-i, 4d)

**Etymology**. The name is derived from the name of Prof. Dr. Mustafa Özer who was a Turkish entomologist in the Ankara University.

**Diagnosis.** Mesosoma bicoloured: pronotum, scutellum and propodeum pale yellow; female club with distinct spicula; clypeus delimited by distinct groove and with apical margin entire; combined length of flagellum 2.7x as long as length of club; club 1.9x as long as wide; C1 1.31x as long as C2; combined length of flagellum 2.7x as long as scape, Forewing 2.42x as long as wide; a/b 2.8x; costal cell 8.6x as long as wide, with one complete row, and a half row at setae. Head in frontal view slightly wider than high (38:35) and 1.9x as wide as length; POL 3x OOL; Eye in frontal view about 2.2x as long as width. Malar space about 0.31x eye height, mesosoma 1.44x as long as width in dorsal view, distinctly narrower than head width (0.66x); mesoscutum about 1.5x as wide as long; scutellum 1.18x as long as minimum distance between axillary grooves, with 4 pairs of setae laterally; metasoma 4.35x as long as width, and 2.5x as long as mesosoma. Last tergit (epipygium) about 1.33x as long as broad; ovipositor almost 0.5x as long as the last tergite.

**Description. Female:** Body (Figs. 7a-c) length 1.4 mm.

Colour. Body mainly testaceous, with weak metallic green reflection, head and mesosoma (Figs. 7c-e) bicoloured: head in lower half, pronotum, scutellum and propodeum pale yellow, antenna with scape and pedicel darker with metallic green reflection, flagellum pale; legs pale yellow, metasoma fuscos with some fuscous areas. Wings hyaline, with pale venation and setae.

Head (Fig. 7d) in frontal view slightly wider than high (38:35), face with fine reticulation; antennal scrobe broad, smooth, frontal area finely reticulate, with
white appressed pubescence; lower face faintly concave, bare; clypeus delimited by distinct groove and with apical margin entire; mouth broad, about 2.35 times as wide as malar space. Eye in frontal view about 2.2 times as long as width. Malar space about 0.31 times eye height, malar sulcus finely developed, genal carina absent. POL 3 times OOL. OOL almost equal to diameter of ocellus. Antennae (Fig. 7g) inserted distinctly below centre of face, well above lower ocular line; flagellum with pale long hairs; antennal formula 11263; scape short, 0.34 times eye height, not reaching lower edge of anterior ocellus, about 4.3 times as long as width; pedicel (Fig. 7h) in lateral view about 1.25 times as long as width; F1–F2 (Fig. 7h) distinctly transverse, equal in length and width, 1.9 times as wide as long; F3–F5 equal in length and width, 1.4 times as wide as long; F6 (Fig. 7i) slightly wider and longer than F5, 1.43 times as wide as long; club (Fig. 7 g, i) plus spicula 2.14 times as long as wide; C1–C3 almost in same length; club as long as pedicel plus anelli and F1+F2 together. Combined length of flagellum 2.7 times as long as club, and 2.7 times as long as scape.

Mesosoma (Figs. 7a,e) in profile slightly convex dorsally, length about 1.44 times wider in dorsal view, distinctly narrower than head width (0.66 times); pronotum rounded, with distinct neck and collar, 2.25 times as wide as long, reticulated, anterior margin of collar not margined, with long pale setae; mesoscutum (Figs. 7e,f) with engraved, broad reticulation, about 1.5 times as wide as long; with sparse, fine, long pale setae; notaulli very shallow and incomplete; scutellum 1.18 times as long as space between sublateral groves, almost smooth, with conspicuous sublateral grooves, axilla with obviously longitudinal carina; frenal area absent, with 4 pairs of setae laterally; propodeum broad, median area finely reticulated, median carina weak, forming an acute triangle area, submedian area with white hairs; plica absent; propodeal spiracles large and subcircular, touching anterior propodeal margin.

Forewing (Fig. 4d) with pale setae, upper side sparse, lower side densely hairy, 2.42 times as long as wide; a/b 2.8; costal cell 8.6 times as long as wide, with one complete row along margin, 2 rows setae in apical half; marginal vein 2.3 times post marginal vein, and 3.75 times as long as stigmal vein; post marginal vein 1.6 times stigmal vein; stigma shortly petiolate, as long as wide.

Metasoma (Figs. 7a-c) long, without petiole, about 4.35 times as long as wide, about 2.4 times as long as mesosoma length; MSt1 and MSt2 each with hind margins in middle portion roundly produced; last tergite (epipygium) about 1.33 times as long as broad; ovipositor almost 0.5 times as long as the last tergite.

**Male:** unknown.

**Material studied:** Holotype ♀, Turkey: Konya, Karatay, Sakyatan village, 40 km from Konya to Karapınar, 23. vi. 2011, antennae and forewing in slide, swept from pasture, M. Doğanlar, deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC).

**Comments:** *Colotrechnus mustafaoezeri* n. sp. is a unique species in the genus, in having female club with distinct spicula; clypeus delimited by distinct groove and with apical margin entire; body testaceous, except head and mesosoma bicoloured: head in lower half, pronotum, scutellum, propodeum and legs pale yellow.

**Colotrechnus ignotus** Burks, 1958

(Fig. 1. of Burks, 1958 and figs given by CNCHYM)

Diagnosis. Combined length of flagellum 2.7x as long as club, and 2.1x as long as scape; Forewing 2.33x as long as wide, and a/b 2.7x; costal cell 6.0x as long as wide; mesoscutum with sparse, short and appressed pubescence; POL 2x OOL; club 1.8x as long as wide; C1 1.54x as long as C2; costal cell with lower side one complete row, and in apical half with 2nd row long bristles; stigmal vein not petiolate, stigmal vein almost as long as wide, stigma as long as wide; metasoma twice as long as mesosoma.

Host. Unknown. Some specimens taken by sweeping *Erigeron quercifolius*, and from *Melilotus alba, Bidens pilosa; Flaveria linearis* by R. A. Morse and other collectors (Burks, 1958).

Distribution. U.S.A.

*Colotrechnus zduezguenesae* n. sp. (Figs. 8a-h; 4e)

Etymology. The name is derived from the name of Prof. Dr. Zeliha Düzgüneş who was a Turkish entomologist in the Ankara University.

Diagnosis. Combined length of flagellum 3.5-3.7x as long as club, and 2.64x as long as scape; metasoma 2.34x as long as mesosoma; costal cell 7.9x as long as wide; club 1.8x as long as wide, C1 1.67x as long as C2; forewing 2.21x as long as wide; costal cell with upper side bare, lower side medially bare, at base 3-4 rows, in apical 2 rows of setae; stigma petiolate, stigmal vein more than twice as long as wide, stigmal vein slightly wider than long; Head in frontal view 1.25x as wide as high, and 2.3x as wide as length; POL 2.67x OOL; eye in frontal view about 1.7x as long as width; malar space about 0.35x eye height; mesosoma 1.4x as long as wide in dorsal view, slightly wider than head; mesoscutum about 1.52x as wide as long; scutellum 1.4x as long as space minimum distance between axillary grooves, with 3 pairs of setae laterally, 4 setae basally; metasoma about 2.48x as long as wide, about 1.82x as long as mesosoma length; last tergit 1.5x as long as wide; ovipositor sheath 0.47x as long as last tergit.

Description. Female: Body (Figs. 8a,b) length 2.45 mm.

Colour. Body dark blue to violet, with metallic greenish reflection, antenna brown, last segments of club testaceous; legs almost same colour with body, except tarsi with 1-4 segments testaceous, pretarsi black. Wings with venation and setae pale.

Head (Figs. 8c,d) in frontal view 1.25x as wide as high, and 2.3x as wide as length. Face with fine reticulation; antennal scrobe broad, smooth, frontal area finely reticulate, with white sparsely placed, appressed pubescence; lower face faintly concave, with fine white pubescence; clypeal margin entire, mouth broad, almost 2.8x as wide as malar space. Eye in frontal view about 1.7x as long as width. Malar space about 0.35x eye height, malar sulcus finely developed, genal carina absent. POL 2.67x OOL. Antennae (Figs. 8c,e) inserted distinctly below centre of face, well above lower ocular line; flagellum with white, dense hairs; antennal formula 11263; scape 3.1x as long as wide; scape long, 0.42x eye height, its tip well below lower edge of anterior ocellus; pedicel in lateral view 1.5x as long as wide; funicular segments transverse, almost in same width and length, except F1 almost quadrate, F2-F5 1.6x, F6 2.2x as long as wide, with 5-6 linear sensillae in a row; club 1.8x as long as wide; C1 1.7x as long as C2; combined length of flagellum 3.56x as long as length of club, and 2.64x as long as scape.

Mesosoma (Figs. 8a,f) in profile mesoscutum almost flat, especially scutellum distinctly convex dorsally, about 1.4x as long as wide in dorsal view, slightly wider than head; pronotum rounded, with distinct neck and collar, anterior margin of collar not margined, posterior margin finely reticulate, with short pale hairs; mesoscutum (Fig. 8f) with fine, reticulation, about 1.52x as wide as long; with
sparse fine, short pale setae; notauli very shallow and incomplete; scutellum (Fig. 8g) 1.4x as long as space between sublateral groves, with fine reticulation, with conspicuous sublateral grooves, axilla with obviously longitudinal carina; frenal area absent, with 3 pairs lateral of setae, and 4 basal long setae.

Forewing (Fig. 4e) densely hairy on both sides, 2.2x as long as wide; a/b 2.0x; marginal vein 2.5x post marginal vein, and 4.2x stigmal vein; post marginal vein 1.7x stigmal vein; stigma petiolate, as long as wide; costal cell 7.9x as long as wide, hair rows broken medially, apically 2 rows, basally 4 rows setae. Metasoma (Figs. 8a,b) short, without petiole, about 2.48x as long as wide, about 1.82x as long as mesosoma length; last tergit 1.5x as long as wide; ovipositor sheath 0.47x as long as last tergit.

**Male:** Similar to female except as follows: antennal formula 11353 (Fig. 8h). scape 2.73x as long as wide; pedicel in lateral view 1.25x as long as wide; funicular segments transverse, F1-F2 1.33x, F3-F5 1.55x, as long as wide, with 3-4 linear sensillae in a row; club 1.5x as long as wide; C1 as long as C2; combined length of flagellum 3.2x as long as length of club, and 3.0x as long as scape. Metasoma 1.2x as long as mesosoma, 2.3x as long as wide.

**Material studied:** Holotype female. Turkey: Adana, 25. vii. 1987, swept from *Cetauria iberica*, M. Doğanlar, deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC). Paratypes: 12 females, 7 males, same data as the holotype, antennae and forewings of female and male of them were slide mounted in Canada Balsam.

**Comments:** *Colotrechnum zduezguenesae* n. sp. is similar to *Colotrechnum ignotus* Burks and *Colotrechnum hasangirayi* n.sp. in having ovipositor sheath distinctly excerted. But *C. zduezguenesae* n.sp. differs from *C. ignotus* in having combined length of flagellum 3.5-3.7x as long as club, and 2.64x as long as scape; forewing 2.21x as long as wide; a/b 2.0x; costal cell 7.86x as long as wide (in *C. ignotus* combined length of flagellum 2.7x as long as club, and 2.1x as long as scape; forewing 2.33x as long as wide, and a/b 2.7x; costal cell 6.0x as long as wide). *C. zduezguenesae* n. sp. also differs from *C. hasangirayi* n.sp. in having combined length of flagellum 3.5-3.7x as long as club, and 2.64x as long as scape; Club 1.8x as long as wide, C1 1.67x as long as C2; Forewing 2.21x as long as wide; costal cell with upper side bare, lower side medially bare, at base 3-4 rows, in apical 2 rows of setae; scutellum with 3 pairs of setae laterally, 4 setae basally; last tergit (epipygium) about 1.5x as long as broad; ovipositor sheath 0.47x as long as last tergit. (in *C. hasangirayi* n.sp. combined length of flagellum 3.2x as long as club and 2.1x as long as scape; Club 1.56x as long as wide, C1 1.5x as long as C2; Forewing 2.15x as long as wide; a/b 2.0x; costal cell with upper side bare, lower side with 1 complete row, at base 2 rows, in apical 3 rows of setae; Scutellum with 3 pairs of setae laterally, 4 pairs in 2 rows medially; last tergit (epipygium) about 0.8x as long as broad; ovipositor sheath 1.64x as long as last tergit.). In male *C. zduezguenesae* n. sp. also differs from *C. hasangirayi* n.sp. in having scape 2.73x as long as wide; pedicel in lateral view 1.25x as long as wide; F1-F2 1.33x, F3-F5 1.55x, as long as wide, with 3-4 linear sensillae in a row; club 1.5x as long as wide; C1 as long as C2; combined length of flagellum 3.0x as long as scape. Metasoma 1.2x as long as mesosoma, 2.3x as long as wide (in *C. hasangirayi* n.sp. scape 4.3x as long as wide; pedicel in lateral view as long as wide; Fialmost quadrate; F2-F3 1.5x as long as wide, with 2-3 linear sensillae in a row; club 1.74x as long as wide; C1 1.8x as long as C2; combined length of flagellum 2.56x as long as scape. Metasoma 0.8x as long as mesosoma, 1.5x as long as wide).
Colotrechmus hasangirayi n. sp.
(Figs. 9a-g, 4f)

**Etymology.** The name is derived from the name of Prof. Dr. Hasan Giray who was a Turkish entomologist in the Ege University.

**Diagnosis.** Combined length of flagellum 3.2x as long as club and 2.1x as long as scape; metasoma 1.93x as long as mesosoma; costal cell 8.6x as long as wide; club 1.56x as long as wide, C1 1.5x as long as C2; forewing 2.15x as long as wide; a/b 2.0x; costal cell with upper side bare, lower side with 1 complete row, at base 2 rows, in apical 3 rows of setae; stigmal vein not petiolate, wider than long, stigma longer than wide; head in frontal view 1.13x as wide as high, and 2.25x as wide as length POL 3.0x OOL; eye in frontal view about 3.0x as long as width; malar space about 0.34x eye height; mesosoma about 1.32x as long as wide in dorsal view, slightly wider than head; mesoscutum about 1.37x as wide as long; scutellum 1.33x as long as minimum distance between axillary grooves, with 3 pairs of setae laterally, 4 pairs in 2 rows medially; metasoma about 2.6x as long as wide, about 1.93x as long as mesosoma length; last tergit (epipygium) about 0.8x as long as broad; ovipositor sheath 1.64x as long as last tergit.

**Description.** Female: Body (Fig. 9a) length. 2.5 mm.

Colour. Body dark blue to violet, with metallic greenish reflection, antenna brown, last segments of club testaceous; legs almost same colour with body, except tarsi pale yellow, except pretarsi testaceous. Wings with venation and setae pale yellow. Head (Figs. 9c,d) in frontal view 1.13x as wide as high, and 2.25x as wide as length. Face with fine reticulation; antennal scrobe broad, smooth, frontal area finely reticulate, with white sparsely placed, appressed pubescence; lower face faintly concave, with fine white pubescence; clypeal margin entire, mouth broad, almost 3.0x as wide as malar space. Eye in frontal view about 3.0x as long as width. Malar space about 0.34x eye height, malar sulcus finely developed, genal carina absent. POL 3.0x OOL. Antennae (Fig. 9e) inserted distinctly below centre of face, well above lower ocular line; flagellum with white, dense hairs; antennal formula 11263; scape 4.2x as long as wide; scape long, 0.56x eye height, its tip well below lower edge of anterior ocellus; pedicel in lateral view 1.8x as long as wide; funicular segments transverse, almost in same length, slightly widening towards tip, F1-F2 1.8x, F6 1.9x as long as wide, with 4-5 linear sensillae in a row; club 1.56x as long as wide; C1 1.5x as long as C2; combined length of flagellum 3.2x as long as length of club, and 2.1x as long as scape.

Mesosoma (Figs. 9b,f) in profile mesoscutum distinctly convex dorsally, especially scutellum almost flat, about 1.32x as long as wide in dorsal view, slightly wider than head; mesoscutum (Fig. 9f) with fine, reticulation, about 1.37x as wide as long, with sparse, fine, short, pale setae; notauli very shallow and incomplete; scutellum 1.33x as long as space between sublateral grooves, having fine reticulation, with conspicuous sublateral grooves, axillula with obviously longitudinal carina; frenal area absent, with 3 pairs of setae laterally, 4 pairs in 2 rows medially.

Forewing (Fig. 4f) densely hairy on both sides, 2.15x as long as wide; a/b 2.0x; marginal vein 2.9x post marginal vein, and 3.63x stigmal vein; post marginal vein 1.25x stigmal vein; stigma petiolate, as long as wide; costal cell 8.6x as long as wide, with 1 complete row. 2 rows basally, 3 rows apically setae.

Metasoma (Fig. 9a) long, without petiole, about 2.6x as long as wide, about 1.93x as long as mesosoma length; last tergit (epipygium) about 0.8x as long as broad; ovipositor sheath 1.64x as long as last tergit.

**Male:** Similar to female except as follows: antennal formula 11353 (Fig. 9g). Scape 4.3x as long as wide; pedicel in lateral view as long as wide; funicular
segments transverse, except F1 almost quadrate; F2-F3 1.5x as long as wide, with 2-3 linear sensillae in a row; club 1.74x as long as wide; C1 1.8x as long as C2; combined length of flagellum 3.3x as long as length of club, and 2.56x as long as scape. Metasoma 0.8x as long as mesosoma, 1.5x as long as wide.

**Material studied:** Holotype female. Turkey: Erzurum, Horasan, Karacuha, 30. v. 1980, swept from pasture, M. Doğanlar, deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC). Paratypes: 3 females, 1 male, same data as the holotype, antennae and forewings of holotype and paratype male were slide mounted in Canada Balsam.

**Comments:** *Colotrechnus hasangirayi* n. sp. is similar to *C. zduezguenesae* n. sp. The species was discussed before.

**Colotrechnus birecikensis** n. sp. (Figs. 10a-g, 4g)

**Etymology.** The name is derived from the name of Birecik, Şanlıurfa from which the types were collected.

**Diagnosis.** Antenna with F1 almost quadrate; combined length of flagellum about 3.1-3.7 x as long as length of club, and 2.9-3.1 x as long as scape; F1 0.75-0.93x as wide as long, with 5 linear sensillae; F2-F4 almost same length and width, 1.3-1.5x as wide as long; F5-F6 slightly widening, F5 1.5x, F6 1.67x as wide as long; F6 1.1-1.43x wider than F2; club 1.74x (2.25) as long as wide; C1 1.25x as long as C2; forewing 2.1x as long as wide; a/b 2.0x; costal cell 7x as long as wide, with 2-3 complete rows of setae. Head in frontal view 1.5x as wide as high, and 2.67x as wide as length; POL 2.6x OOL; eye in frontal view about 3.33x as long as width; malar space about 0.31x eye height, mesosoma about 1.33x as long as wide in dorsal view, slightly narrower than head; mesoscutum about 1.43x as wide as long; scutellum 1.22x as long as minimum distance between axillary grooves, with 2 pair setae laterally, 1-2 setae basally; metasoma about 3.0x as long as wide, about 1.52x as long as mesosoma length; last tergit (epipygium) about 1.6x as long as broad; ovipositor sheath 0.15x as long as last tergit.

**Description. Female:** Body (Figs. 10a,b) length 2.3 mm. Colour. Body dark blue to violet, with metallic greenish reflection, antenna brown; legs almost same colour with body, except tarsi pale yellow, pretarsi testaceous. Wings with venation testaceous, setae pale yellow. Head (Figs. 10c,d) in frontal view 1.5x as wide as high, and 2.67x as wide as length. Face with fine reticulation; antennal scrobe broad, smooth, frontal area finely reticulate, with white sparsely placed, appressed pubescence; lower face faintly concave, with fine white pubescence; clypeal margin entire, mouth narrow, almost 2.3x as wide as malar space. Eye in frontal view about 3.33x as long as width. Malar space about 0.31x eye height, malar sulcus finely developed, genal carina absent. POL 2.6x OOL. Antennae (Fig. 10e) inserted distinctly below centre of face, well above lower ocular line; flagellum with white, dense hairs; antennal formula 11263; scape 3.3x as long as wide; scape long, 0.45x eye height, its tip well below lower edge of anterior ocellus; pedicel in lateral view 1.6x as long as wide; funicular segments distinctly transverse, except F1 slightly, almost in same length, and width, F1 1.2x; F2 1.6x, F3-F6 1.4x as long as wide, with 4-5 linear sensillae in a row; club 2.1x as long as wide; C1 1.15x as long as C2; combined length of flagellum 3.2x as long as length of club, and 2.85x as long as scape. Mesosoma (Fig. 10f) in profile distinctly convex dorsally, about 1.33x as long as wide in dorsal view, slightly narrower than head; pronotum rounded, with distinct neck and collar, anterior margin of collar not margined, posterior margin finely reticulate, with short pale hairs; mesoscutum with fine reticulation, about 1.43x as...
wide as long, with sparse, fine, long, pale setae; notauli very shallow and incomplete; scutellum (Figs. 10f,g) 1.22x as long as space between sublateral groves, having fine reticulation, with conspicuous sublateral grooves, axilla with obviously longitudinal carina; frenal area absent, with 3 pairs of long setae laterally, 4 setae basally; propodeum (Fig. 10g) short, almost reduced to a point medially, median area finely reticulated, median carina distinct, forming an acute triangle area, submedian area finely reticulated; plica absent; propodeal spiracles large and subcircular, almost a diameter far from anterior propodeal margin. Forewing (Fig. 4g) densely hairy on both sides, 2.2x as long as wide; a/b 2.0x; marginal vein 2.5x post marginal vein, and 3.6x stigmal vein; post marginal vein 1.43x stigmal vein; stigma petiolate, almost as long as wide; costal cell 6.9x as long as wide, with 3-4 complete rows setae.

Metasoma (Figs. 10a,b) long, without petiole, about 3.0x as long as wide, about 1.52x as long as mesosoma length; last tergit (epipygium) about 1.6x as long as broad; ovipositor sheath 0.15x as long as last tergit.

**Male:** similar to female except as follows: antennal formula 11353 (Fig. 10h). Scape 3.7x as long as wide; pedicel in lateral view 1.33x as long as wide; funicular segments transverse, except F1 1.3x, F2-F5 1.6x, as long as wide, with 3-5 linear sensillae in a row; club 1.35x as long as wide; C1 0.9x as long as C2; combined length of flagellum 3.1x as long as length of club, and 2.9x as long as scape. Metasoma 0.8x as long as mesosoma, 1.4x as long as wide.

**Material studied:** Holotype female. Turkey: Şanlıurfa, Birecik, İnnaplı, 30. v. 1980, swept from pasture, M. Doğanlar, deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC). Paratypes: 1 female, Kahramanmaraş, Pazarçık, Salluşağı village 37°30’ 41” N, 37°25’ 31” E, 1180 m (junction of Araban-Pazarçık road and highway Gaziantep-Kahramanmaraş road (D3609), 02. viii. 2008, M. Doğanlar, 25 females, 8 males, Adana, 25. vii. 1987, swept from Cetauria iberica, M. Doğanlar, 1 female, Hatay, Reyhanlı, Atçana, swept from pasture, M. Doğanlar; 1 female, Taynat, swept from pasture, M. Doğanlar, antennae and forewings of holotype were slide mounted in Canada Balsam, deposited in (IMBC).

**Comments:** Colotrechnus birecikensis n. sp. is similar to Colotrechnus viridis (Masi), Colotrechnus akifkansui n. sp. and Colotrechnus taşlıçayensis n. sp. in having ovipositor not produced. But it differs from all of them in having antenna with F1 quadrate, at most slightly transverse; combined length of flagellum 3.2x as long as length of club (in the similar species mentioned above antenna with F1 distinctly transverse; combined length of flagellum at most 2.7x as long as club).

**Colotrechnus viridis (Masi, 1921)**
(Figs. 11a-g; 4h)


**Diagnosis.** F1 with at least 4 linear sensillae, F2-F6 at least 5-6 linear sensillae; club 1.3-1.5x as long as wide; C1 1.14-1.36x as long as C2; combined length of flagellum 2.1-2.55x as long as club; 3.2-3.7x as long as scape; forewing 2.02-2.55x as long as wide; a/b 1.7-2.5x; costal cell 7.5-8.0x as long as wide, with 1 complete rows, at base and apical about 2-3 rows of setae; head in frontal view 1.16-1.2x as wide as high, and 2.28x as wide as length, POL 2.25x OOL; eye in frontal view about 2.75x as long as width. malar space about 0.4x eye height; mesosoma about 1.6x as long as wide in dorsal view, almost as wide as head;
mesoscutum, about 1.3x as wide as long, with 4-5 rows, sparse, fine, long, pale setae; scutellum 1.2x as long as minimum distance between axillary grooves, scutellum with 3 pair setae laterally, 3 setae basally; metasoma about 2.83-3.2x as long as wide, about 1.6x as long as mesosoma length; last tergit (epipygium) about 1.5x as long as broad; ovipositor sheath 0.33x as long as last tergit.

**Description from the specimens of Turkey**

**Description.** Female: Body (Figs. 11a,b) length 2.3 mm.

**Colour.** Body dark blue to violet, with metallic greenish reflection, setae on dorsum pale yellow, on lateral areas and metasoma and paired setae laterally black; antenna black, with pale setae; legs almost same colour with body, except tarsi pale yellow, pretarsi testaceous. Wings with venation testaceous, setae pale yellow.

Head (Fig. 11c) in frontal view 1.16-1.2x as wide as high, and 2.28x as wide as length. Face with fine reticulation; antennal scrobe broad, smooth, frontal area finely reticulate, with white sparsely placed, appressed pubescence; lower face faintly concave, with fine white pubescence; clypeal margin entire, mouth narrow, almost 1.5x as wide as malar space. Eye in frontal view about 2.75x as long as width. Malar space about 0.4x eye height, malar sulcus finely developed, genal carina absent. POL 2.25x OOL. Antennae (Fig. 11d) inserted distinctly below centre of face, well above lower ocular line; flagellum with white, dense hairs; antennal formula 11263; scape 4.22-4.33x as long as wide; scape long 0.46x eye height, its tip well below lower edge of anterior ocellus; pedicel (Fig. 11e) in lateral view 1.4-1.5x as long as wide; funicular segments distinctly transverse, almost in same length and distinctly widening towards tip, F1 1.6x; F2 1.9x, F3 2.1x, F4 1.8x, F5 2.5x, F6 3.0x as long as wide, and 1.7x as wide as F1, funicular segments with 4-5 linear sensillae in a row; club 1.5x as wide; C1 1.2x as long as C2; combined length of flagellum 3.2x as long as length of club, and 2.3x as long as scape.

Mesosoma (Figs. 11a,f) in profile distinctly convex dorsally, about 1.6x as long as wide in dorsal view, almost as wide as head; pronotum rounded, with distinct neck and collar, anterior margin of collar not margined, posterior margin finely reticulate, with short pale hairs; mesoscutum (Fig. 11f) with fine reticulation, about 1.3x as wide as long, with 4-5 rows, sparse, fine, long, pale setae; notauli very shallow and incomplete; scutellum (Figs. 11f,g) 1.2x as long as space between sublateral grooves, having fine reticulation, with conspicuous sublateral grooves, axilla with obviously longitudinal carina; frenal area absent, with 2 pairs of long black setae laterally, 2-3 setae basally.

Forewing (Fig. 4h) densely hairy on both sides, 2.2-2.32x as long as wide; a/b 1.92-2.5x; marginal vein 2.8x post marginal vein, and 4.0x stigmal vein; post marginal vein 1.43-1.5x stigmal vein; stigma petiolate, almost as long as wide; costal cell 7.5-9.0x as long as wide, with 1 complete row, and 3-4 complete rows setae in basal and apical areas.

Metasoma (Figs. 11a,b) long, without petiole, about 2.83-3.2x as long as wide, about 1.6x as long as mesosoma length; last tergit (epipygium) about 1.5x as long as broad; ovipositor sheath 0.33x as long as last tergit.


**Comments:** *Colotrechnus viridis* (Masi) is similar to *Colotrechnus akifkansui* n. sp. in having antenna with club 1.3-1.5x as long as wide; F1 distinctly transverse and combined length of flagellum at most 2.7x as long as club. But it differs from
C. akifkansui n. sp. in having F1 with at least 4 linear sensillae, F2-F6 at least 5-6 linear sensillae; combined length of flagellum 2.1-2.55x as long as club; Scutellum with 2 pairs setae metasoma 2.83-3.2x as long as wide (in C. akifkansui n. sp. club at least 1.74x as long as wide; F1 with at most 2 linear sensillae, F2-F6 at most 3-4 linear sensillae; combined length of flagellum at least 2.6x as long as club; metasoma at most 2.6x as long as wide).

**Colotrechnus akifkansui n. sp.** (Figs. 12a-f, 4i)

**Etymology.** The name is derived from the name of Prof. Dr. Akif Kansu who was a Turkish entomologist in the Ankara University.

**Diagnosis.** F1 with at most 2 linear sensillae, F2-F6 at most 3-4 linear sensillae; club at least 1.74x as long as wide; combined length of flagellum at least 2.6x as long as club; metasoma at most 2.6x as long as wide; combined length of flagellum about 2.03-2.31x as long as scape, 2.6-2.7 as long as club; F1 1.6-2.1x as wide as long; F2-F6 distinctly transverse, slightly widening towards tip, F2 2.0-2.3x as wide as long; F6 1.2-1.5x wider than F2, 2.2-2.4x as wide as long; Club 1.74-1.8x as long as wide; C1 1.4-1.5x as wide as long, 1.25-1.31x as long as C2; Forewing 2.1-2.21x as long as wide; a/b 2.0-2.32x; costal cell 8.0-8.33x as long as wide, with 1 complete row, and at base and apical 2 rows of setae. Head in frontal view 1.1-1.2x as wide as high, and 2.5x as wide as length; POL 2.75x OOL eye in frontal view about 2.4-2.8x as long as width. Malar space about 0.26x eye height; mesosoma about 1.2x as long as wide in dorsal view, almost as wide as head (42:35); mesoscutum about 1.3-1.46x as wide as long, with 4-5 rows, sparse, fine, short, pale setae; scutellum 1.15x as long as minimum distance between axillary grooves, with 3 pair setae laterally; metasoma about 2.6-2.0x as long as wide, about 1.4-1.6x as long as mesosoma length; last tergit (epipygium) about 1.33-1.4x as long as broad; ovipositor sheath 0.3-0.14x as long as last tergit.

**Description. Female:** Body (Figs. 12a,b) length 1.32-2.1 mm.

Colour. Body dark blue to violet, with metallic greenish reflection, antenna black; legs almost same colour with body, except tarsi pale yellow, pretarsi testaceous. Wings with venation testaceous, setae pale yellow.

Head (Fig. 12c) in frontal view 1.1-1.2x as wide as high, and 2.5x as wide as length. Face with fine reticulation; antennal scrobe broad, smooth, frontal area finely reticulate, with white sparsely placed, appressed pubescence; lower face faintly concave, with fine white pubescence; clypeal margin entire, mouth narrow, almost 2.0-2.2x as wide as malar space. Eye in frontal view about 2.4-2.8x as long as width. Malar space about 0.26x eye height, malar sulcus finely developed, genal carina absent. POL 2.75x OOL. Antennae (Figs. 12c,d) inserted distinctly below centre of face, well above lower ocular line; flagellum with white, dense hairs; antennal formula 11263; scape 3.9-4.4x as long as wide; long, 0.4-0.5x eye height, its tip well below lower edge of anterior ocellus; pedicel in lateral view 1.6-1.7x as long as wide; funicular segments distinctly transverse, almost in same length and distinctly widening towards tip, F1 2.3x; F2 2.0x, F3 1.8x, F4 2.0x, F5 2.44x as long as wide, F6 2.1-2.5x as long as wide and 1.2x as wide as F1, funicular segments with 4-5 linear sensillae in a row; club 1.8-1.9x as wide; C1 1.25-1.3x as long as C2; combined length of flagellum 2.63-2.74x as long as length of club, and 2.1-2.36x as long as scape.

Mesosoma (Fig. 12e) in profile slightly convex dorsally, scutellum distinctly convex, about 1.2x as long as wide in dorsal view, almost as wide as head; pronotum rounded, with distinct neck and collar, anterior margin of collar not margined, posterior margin finely reticulate, with short pale hairs; mesoscutum
with fine reticulation, about 1.3-1.46x as wide as long, with 4-5 rows, sparse, fine, short, pale setae; notauli very shallow and incomplete; scutellum (Fig. 12e) 1.15x as long as space between sublateral groves, having fine reticulation, with conspicuous sublateral grooves, axilla with obviously longitudinal carina; frenal area absent, with 3 pairs of long black setae laterally, 2-3 pale, setae basally.

Forewing (Fig. 4i) densely hairy on both sides, 2.1-2.2x as long as wide; a/b 2.0-2.32x; marginal vein 2.3-2.7x post marginal vein, and 3.6-3.8x stigmal vein; post marginal vein 1.4-1.6x stigmal vein; stigma petiolate, almost 1.3-1.6x as long as wide; costal cell 7.9-8.3x3x as long as wide, with 1 complete row, and 2 rows setae in basal and apical areas (Fig. 11).

Metasoma (Figs. 12a,b) long, without petiole, about 2.6-2.0x as long as wide, about 1.4-1.6x as long as mesosoma length; last tergit (epipygium) (Fig. 12f) about 1.33-1.4x as long as broad; ovipositor sheath 0.3-0.14x as long as last tergitt.

**Material studied:** Turkey: Holotype Fem, Gaziantep, Oğuzeli, Keçikuyusu, 27.iv.2017, leg. M. Doğanlar, Paratype. Ağrı, Taşlıçay, 04.vii.2010, leg. M. Doğanlar, antennae and forewings of types were slide mounted in Canada Balsam, and the types were deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC).

**Comments:** Colotrechnus akiykansui n. sp. is similar to Colotrechnus viridis (Masi). The species were discussed before.

**ACKNOWLEDGEMENTS**

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**LITERATURE CITED**


Figure 1. *Colotrechnus karatasensis* n. sp. a-c. female. a.- b.body, a. in lateral view, b. in dorsal view; c. head, in frontal view; d. mesosoma, in dorsal view; e. scutellum; f. propodeum; g. female antenna. (Scale bar for a, b= 0.64 mm; for c= 0.27 mm; for d, g= 0.30 mm; for e= 0.19 mm; for f= 12 mm).

Figure 2. *Colotrechnus karatasensis* n. sp. a-c. female. a. Forewing; b. costal cell, and veins; c. stigmal and postmaginal veins (Scale bar for a= 0.38 mm; for b= 0.18 mm; for c= 0.12 mm).
Figure 3. Colotrechnus bekiralkani n. sp. female. a. body, in dorsal view; b. head, in frontal view; c. antenna; d. mesosoma, in dorsal view; e. metasoma, in dorsal view. (Scale bar for a = 0.38 mm; for b, d = 0.31 mm; for c = 0.10 mm; for e = 0.24 mm).

Figure 4. Colotrechnus spp. female. Forewings. a. bekiralkani n. sp.; b. subcoeruleus Thomson; c. kemaliyenensis n. sp.; d. mustafaoezeri n. sp.; e. zduezguenesae n. sp.; f. hasangirayi n. sp.; g. bireckensis n. sp.; h. viridis (Masi); i. akifkansui n. sp. (Scale bar for a = 0.6 mm; for b, e, h = 0.95 mm; for c = 0.73 mm; for d = 0.44 mm; for f = 0.34 mm; for g = 0.50 mm; for i = 0.62 mm).
Figure 5. *Colotrechnus subcoeruleus* Thomson. female. a.-b. body, a. in lateral view, b. in dorsal view; c. head, in frontal view; d. mesosoma, in dorsal view; e. Forewing; f.-g. costal cell, f. lower side, g. upper side; h. stigmal and postmarginal veins (Scale bar for a= 0.50 mm; for b= 0.56 mm; for c= 0.48 mm; for d= 0.32 mm; for e, h= 0.24 mm; for f, g= 0.13 mm; for i, j= 0.10 mm).

Figure 7. *Colotrechnus kemaliyenensis* n. sp. male. a. body, in dorsal view; b. mesosoma, in dorsal view; c. scutellum; d. antenna; e. basal segments of flagellum; f. F5 and club (right antenna); g. club (left antenna). (Scale bar for a=0.56 mm; for b=0.37 mm; for c=0.42 mm; for d=0.25 mm; for e=0.42 mm; for f=0.50 mm; for g=0.58 mm).

Figure 7. *Colotrechnus mustafaoezeri* n. sp. female. a.-c. body. a. in lateral view; b. in dorsal view; c. in dorso-lateral view; d. head, in frontal view; e. mesosoma, in dorsal view; f. scutellum, in dorso-lateral view; g. antenna; h. basal segments of antenna; i. apical segments of flagellum. (Scale bar for a-c= 0.47 mm; for d= 0.35 mm; for e, f= 0.24 mm; for g= 0.12 mm; for h, i= 0.06 mm).
Figure 8. *Colotrechnus zduezguenesae* n. sp. a-g. female. a-b. body, a. lateral view, b. dorsal view; c-d. head, fronto-dorsal view, d. frontal view; e. antenna; f. part of mesosoma; g. scutellum. h. male antenna. (Scale bar for a, b= 0.82 mm; for c, d= 0.41 mm; for e, h= 0.13 mm; for f, g= 0.41 mm).

Figure 9. *Colotrechnus hasangirayi* n. sp. female. a. body, in dorsal view, b. head and mesosoma, in lateral view; c-d. head, c. in frontal view, d. in dorsal view; e. antenna and club; f. mesosoma; g. male antenna. (Scale bar for a, b= 0.75 mm; for c, d= 0.36 mm; for e, g= 0.12 mm; for f= 0.60 mm).
Figure 10. *Colotrechnus birecikensis* n. sp. female. a-b. body, a. lateral view, b. dorsal view; c-d. head, c. frontal view, d. dorsal view; e. antenna; f. mesosoma; g. scutellum and propodeum; h. male antenna. (Scale bar for a, b= 0.91 mm; for c, d= 0.55 mm; for e, h= 0.21 mm; for f, g= 0.44 mm).

Figure 11. *Colotrechnus viridis* (Masi, 1921) female. a-b. body, a. lateral view, b. dorsal view; c. head, in frontal view, d. antenna; e. basal segments of flagellum; f. mesosoma; g. scutellum. (Scale bar for a, b= 0.87 mm; for c= 0.47 mm; for d= 0.26 mm; for f= 0.45 mm; for g= 0.23 mm).
Figure 12. *Colotrechnus akifkansui* n. sp. female. a-b. body, a. lateral view, b. dorso-lateral view; c. head frontal view, d. antenna; e. mesosoma; f. tip of metasoma. (Scale bar for a, b= 0.35 mm; for c= 0.23 mm; for d= 0.10 mm; for e= 0.24 mm).
BENTHIC OSTRACOD ASSEMBLAGES AS BIOINDICATORS OF ANTHROPOGENIC IMPACTS IN INTRTedal ENVIRONMENT

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ABSTRACT: Sediment samples intertidal currents of 4 locations in the estuary of Bahía Blanca were studied; with different degree of disturbance due to anthropic action. A total of 4 genera were obtained with 5 autochthonous species; on the basis of the results obtained it can be concluded that Neocytherideis ruidis and Leptocythere darwini are two species very sensitive to the contamination by human activity since it was only found in the samples taken from the intertidal Canal Tres Brazas that is characterized as the area with the least degree of modification. In the sites with greater degree of disturbance Cyprideis salebrosa hartmanni was the one that more development.

KEY WORDS: Ostracod, estuary, Bahía Blanca, anthropic action

Ostracods are small crustaceans, provided with a calcareous shell, live in marine, brackish and freshwater environments. They are very useful in paleoecological and paleostratigraphic research, since they are sensitive to ecological changes and have a very wide stratigraphic range, since they are recorded from the Cambrian to the present (Horne, 2002; Laprida, 2006, 2007). They can be used as environmental tracers of the changes that occur in their environment. Coastal areas constitute a very changing environment and are often influenced by human activity. For this reason, the characterization of the associations of these areas is of great interest, since these studies make possible the characterization of natural evolution episodes and others Anthropic influence in these environments (Rubio et al., 2006). The objective of this study is to analyze the ostracofauna present in marshes with different degree of disturbance by human action and to detect those species which are more sensitive to pollutants.

STUDY AREA

The Bahía Blanca estuary is located in the southern end of the province of Buenos Aires, Argentina. It is a mesomareal system conformed by channels of diverse dimensions and oriented in direction Northwest-Southeast. These channels have sinusoidal channels separated by islands and extensive tidal plains composed in general by silt-loamy sediments that are in constant morphodynamic evolution. Freshwater inputs come from the Sauce Chico river and the Napostá Grande stream, which contribute with low volumes of water and sediments (Ginsberg & Perillo, 1990).
The islands are composed of plant communities typical of the halophilous steppe (Verettoni, 1961; Verettoni & Aramayo, 1976). The tidal flats in the topographically higher areas are covered by dense Spartina vegetation, while in the lower areas there is no vegetation cover. The salinities are vertically homogeneous except in the sectors associated to the mouths of streams where the waters have a marked stratification (Piccolo et al., 1987). The longitudinal distribution of salinity in the main channel presents a homogeneous pattern except at the head of the estuary where the lowest salinity concentrations are recorded. Within the main channel is the Tres Brazas channel, which is one of the longest that flows into the aforementioned channel. El canal Tres Brazas no presenta descarga de agua dulce y su circulación es totalmente mareal dominante. This channel is highly sinuous and has numerous tributary channels that drain the tidal plains, including the Tierra Firme channel (Ginsberg & Perillo, 1990) (Fig. 1).

**Anthropogenic action in the study area**

Estuaries, such as the one under study, usually serve as a geochemical trap for materials dissolved in water, first increasing their concentration and eventually transferring them to cohesive sediments through different processes. Many of the pollutants of anthropic origin are associated with the fine fraction of the sediment, or at least present a similar dynamic in their behavior. As a consequence, potentially dangerous substances tend to disperse and are concentrated in those areas where the lower energy flows allow the sediment to settle, for example in tidal flats and marshes. Once the contaminated material has been deposited, it can be considered that there are no negative effects on the environment because the substance is immobilized (Grecco, 2011). In the study area, the main access routes of exogenous substances to the system are mainly effluents from urban nuclei (sewage effluents) and industrial effluents. They all do it through freshwater courses, which drain into the estuary. It is important to mention that the dredging of the Main Navigation Channel is another important activity in the area with the potential to influence the transportation of pollutants, since it suspends much of the sediment which may be contaminated.

Some studies have reported increases in secondary productivity as a result of nutrient enrichment (Nixon & Buckley, 2002), while in other cases eutrophication has evidenced reductions in benthic invertebrate diversity and abundance, as proposed by the Pearson & Rosenberg (1978).

Eutrophication has consequences for systems that are often evident through changes in biological communities, but nutrient enrichment can also alter the physical and chemical conditions of sediments and this, in turn, may have an impact on the cycling of nitrogen and phosphorus (Eyre & Ferguson, 2002). When organic matter input increases in response to nutrient enrichment, benthic microbial metabolism is stimulated and this phenomenon can lead to profound changes in nutrient release dynamics and oxygen consumption rates (Cloern, 2001). Jørgensen & Richardson (1996) concluded that sediments and benthic communities are the most sensitive elements to eutrophication and hypoxia. The importance of eutrophication in an environment and many of its consequences is known, but little is known about the possible response of benthic communities to this new state of the system and the consequences for the dynamics of nutrient fluxes. Pearson & Rosenberg (1978) developed a qualitative model, based on changes in abundance, biomass and number of species in a given environment, as enrichment with organic matter increases (Fig. 2). As a qualitative model it can be used as a conceptual framework for the analysis of changes in the benthic
communities. According to this model, changes in the variables mentioned follow a typical pattern that can be described as follows: in the early stages of eutrophication, as the organic contribution increases, the quantity of species and the total biomass also increase. This trend continues until reaching a relative maximum from which, if organic enrichment increases, both biomass and species richness decrease. If the eutrophication process progresses, the reducing conditions in the sediments intensify and a secondary peak of biomass and abundance of individuals is observed, associated to small and opportunistic species, generally polychaetes. If the enrichment continues, at the end of the gradient all fauna disappears, and the sediment becomes azoic.

MATERIALS AND METHODS

In this work, four zones were sampled, covering an interesting variability of environmental conditions, both in terms of their hydrological and sedimentary characteristics and the biological environment, characterized by the dominant vegetation type. Zone 1: Villa del Mar (V) (38°52'S-62°06'O) is found in the external sector of the Principal Canal, in the transition between environments dominated by fine sediments and sandy coasts. Zone 2: Club Almirante Brown (B) (38°45'S-62°18' O). Zone 3: Canal Maldonado (M) (38°44'S-62°19' O). Zone 4: Canal Tres Brazas (CTB) (38°55'S–62°14'O).

For the extraction of the samples a metal hoop of 10 cm of diameter by 2 cm of height was used, and the superficial 2 cm were collected. The material collected in the containers was washed with a set of sieves of 500 and 63 micrometers mesh light in order to remove the coarse and fine fractions, following the recommendations. All the present ostracods were separated by the picking technique, and sorted in portamicrofósiles.

For taxonomic identification, the generic classification proposed by Moore and Pitrat, 1961 was followed. For the specific determination, updated local bibliography was used (Bertels et al., 1990, 1997, 1999; Ferrero, 2006, 2009; Laprida, 2006, 2007, 2009; Whatley et al., 1975, 1987, 1988, 1995).

RESULTS

The salinity (UPS) varied between 46.6 in the Almirante Brown bread basin (B2) and 10.6 in the marshes of Villa del Mar; The content of organic matter (MO%) gave values between 4 and 9 corresponding the lowest values to the samples of marshes with Sarcocornia perennis of the localities of Canal Maldonado and Villa del mar. The PH yielded values between 7.80 and 8.35 the lowest value corresponds to the tidal flats of the Tres Brazas Canal and the highest values to the salt marshes with Sarcocornia perennis of Villa del Mar.

Six autochthonous species were found with live specimens at the time of sampling; Cyprideis salebrosa hartmanni was very abundant in the samples of tidal plain of the Canal Maldonado, Almirante Brown and Canal Tres Brazas; Marshes with Sarcocornia perennis of the Canal Maldonado. Leptocythere darwini and Neocytherideis ruidis are found in the tidal and marshy plains of the Canal Tres Brazas; Loxocythere variosculpta was more abundant in the marshes and tidal flats of the Canal Maldonado (See appendix 1) (Fig. 3).

DISCUSSION

The higher salinity in the Admiral Brown saline can be due to the high evaporation rate at this site and therefore the concentration of salts added to the lack of S. perennis mats that protect the bucket from desiccation and, Consequently, produce a moderating effect on salinity as proposed by Calvo & Pratolongo (2009). The number of species of atrophic present in the different
sampling points was lower in the sites with greater degree of antropic action; Coinciding with that proposed by Ruiz (2012) who studied the diversity of the atrophic present in sites with high degree of contamination in water bodies of Africa. The absence of L. darwini and N. ruidis in the samples of Canal Maldonado, Almirante Brown and Villa del Mar may be due to the great anthropic impact of these places; In the lower marsh of the Maldonado Calvo Marcilese Channel, 2011 finds foraminifera specimens assigned to Haynesina germanica, Ammonia tepida and Elphidium gunteri, species that are currently considered opportunistic in zones with marked contamination and anthropic impact (Cearreta et al., 2000; Armynot du Châtelet et al., 2004; Calvo Marcilese & Langer, 2010). These sites are under the direct influence of the Canal Maldonado, which flows into this sector of the estuary after crossing an agricultural area and crossing the city of Bahía Blanca. Associated with this discharge, high levels of various pollutants and in particular polycyclic aromatic hydrocarbons have been recorded (Arias et al., 2008), a fact that at one point could have caused the proliferation of opportunistic species such as Cypriidea salebrosa hatmanni, but that with the passage of time and the increase of the contaminating focus, could prevent the survival of them. The fine sediments (silts and clays) in the estuary are deposited in the tidal plains and marshes; because many of the pollutants of anthropic origin are associated with the fine fraction of the sediment, or at least present a similar dynamic in their behavior. The environments mentioned above are those that retain more contaminants and therefore the benthic ostracod in these sites is more affected since they live in direct relation with the substrate; species such as Neocytherideis ruidis and Leptocythere darwini are characterized by being in marshes; the Spartina that is covering the marshes fulfills the function of retaining more fine sediment, which also can accumulate more pollutants in the sites sampled with a high degree of anthropic impact.

CONCLUSIONS

Based on the results obtained we can conclude that sites with more disturbance have shown a decrease in the diversity of benthic ostracod species and proliferation of opportunistic species. Samples taken from the tidal flats and marshes of the Three Brazes Canal were the ones with the greatest diversity. This is the first contribution on ostrichs and contamination for the study site.

ACKNOWLEDGEMENTS

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LITERATURE CITED


**Appendix 1.** Studied species of ostracods.

**Loxocythere variasculpta** Whatley, Moguilevsky, Toy, Chadwick y Ramos, 1997

**Cyprideis salebrosa hartmanni** Ramírez, 1967

**Cyprideis multitentata** Hartmann, 1955

**Neocytherideis ruidis** Whatley, Moguilevsky, Chadwick, Toy y Ramos 1998

**Leptocythere darwini** Whatley, Moguilevsky, Toy, Chadwick y Ramos

**Callistoxythere litoralesis** (Rossi de García, 1966)
Figure 1. Map showing the sites sampled. M: Canal Maldonado; B: Admiral Brown; V: Villa del Mar; CTB: Canal Tres Brazas.

Figure 3. A. *Cyprideis multidentata* Hartmann, 1955 (x321), external view left valve (MiUNS 309, CMD); B. *Loxocythere variascupta* Whatley et al., 1997 (x706), side view carapace (MiUNS 304, CTB); C. *Cyprideis salebrosa hartmanni* Ramírez, 1967 (x329), external view right valve (MiUNS 308, CMD); D. *Cyprideis salebrosa hartmanni* Ramírez, 1967 (x390), external view left valve (MiUNS 308, CMD); E. *Leptocythere darwini* Whatley et al., 1997, external view left valve (MiUNS 328, CTB); F. *Leptocythere darwini* Whatley et al., 1997, external view right valve (MiUNS 328, CTB); G. *Neocytherideis ruidis* Whatley et al., 1998 (x660), external view right valve (MiUNS 310, CTB); H. *Callistocythere litoralensis* (Rossi de Garcia, 1966) (x868), external view left valve (MiUNS 329, CMD). Scale: 100 µm.
CONTRIBUTIONS TO THE KNOWLEDGE OF ADEPHAGAN FAUNA IN ADIYAMAN PROVINCE, TURKEY (COLEOPTERA: DYTISCIDAE, GYRINIDAE, HALIPLIDAE AND NOTERIDAE)

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ABSTRACT: Water beetles belong to four families (Coleoptera: Adephaga: Dytiscidae, Gyrinidae, Haliplidae and Noteridae) collected from Adıyaman province (south-eastern part of Turkey) between 2013-2014 years, were evaluated. Totally, 34 species (Dytiscidae: 31, Gyrinidae: 1, Haliplidae: 1, Noteridae: 1) were described. Of these; Hydaticus seminiger De Geer, 1774 and Liopterus haemorrhoidalis (Fabricius, 1787) are second record for the Dytiscidae fauna of Turkey. Moreover, all described species are new record for Adıyaman province and 30 of them are new record for the south-eastern region of Turkey.

KEY WORDS: Coleoptera, Adephaga, Dytiscidae, Gyrinidae, Haliplidae, Noteridae, Adıyaman, Turkey

The family Dytiscidae Leach, 1815 is important component of aquatic beetles. The members of this family known as predaceous diving beetles and could be found in all type of fresh water habitats Nilsson & Holmen (1995). The family is represented by 182 genera and approximately 4,450 species, which are distributed around the world Nilsson & Hájek (2017a). In the Palearctic region, it is represented by 15 tribes, 80 genera and approximately 600 species Nilsson & Hájek (2017b). In Turkey 29 genera and 155 species have been reported (Gueorguiev, 1981; Darılmaz & Kıyak, 2009a, b; Fery & Erman, 2009; Fery, 2009; Fery & Hendrich, 2011a, b; Fery & Przewozny, 2011; Hájek et al., 2011; Hernando et al., 2012; Vorst & Fery, 2014). Of these 35 are endemic to Turkey Nilsson & Hajek (2017a). Gyrinidae family has 750 species belong to 13 genera in worldwide. Both adults and larvae are true aquatic Garrido et al. (2011). 11 species were known from Turkey Darılmaz & Kıyak (2009a). Haliplidae family has about 200 species belong to 5 genera in worldwide. Both adults and larvae live in a wide variety of freshwater habitats Garrido et al. (2011). 16 species were known from Turkey Darılmaz & Kıyak (2009a). Noteridae family has 250 species belong to 14 genera in worldwide. Both adults and larvae are aquatic Garrido et al. (2011). Three species were known from Turkey Darılmaz & Kıyak (2009a).

There are many systematic, faunistic, ecologic and zoogeographic studies, by the native and foreign authors about the water beetle fauna of Turkey. But there isn’t any comprehensive study about Dytiscidae, Gyrinidae, Haliplidae and Noteridae (Coleoptera: Adephaga) from Adıyaman province and other provinces of South-eastern Anatolian region until this study. The aim of this study is to give species distribution of Dytiscidae, Gyrinidae, Haliplidae and Noteridae (Coleoptera: Adephaga) from Adıyaman province, Turkey. And also it contributes new data from Turkish Aquatic Coleoptera fauna.
MATERIAL AND METHODS

The specimens were collected from freshwater habitats of Adıyaman province, Turkey (Fig. 1) by a net having a diameter of 0.5 mm during 2013-2014 periods. A total of 56 sampling were made at 35 different localities. Specimens were fixed and preserved in 70% ethyl alcohol solution at spot. The clayed and muddy substance on their surfaces was brushed off with a small paint brush in the laboratory and each specimen was checked for identifications. Genitalia of collected specimens were dissected under a stereo microscope in the laboratory. The examined Dytiscidae materials were deposited in the private collection of the first author at Dicle University, Diyarbakır, Turkey. The other specimens of the families were deposited in the private collection of the second author at Adıyaman University, Kahta Vocational High School, Turkey.

RESULTS

34 species belong to four families (Dytiscidae, Gyrinidae, Haliplidae and Noteridae) were collected and described from the study area. All identified species are new for Adıyaman province; also new to south-eastern region of Turkey except four: Hygrotus lernaeus (Schaum, 1857), Hydroglyphus geminus (Fabricius, 1792), Ilybius chalconatus (Panzer, 1796) and Laccophilus hyalinus (De Geer, 1774). Furthermore, Hydaticus seminiger De Geer, 1774 and Liopterus haemorrhoidalis (Fabricius, 1787) are second record for the Dytiscidae fauna of Turkey. Determined species and their locality data are listed in Table 1.

Family Dytiscidae Leach, 1815

Agabus biguttatus (Olivier, 1795)

Agabus bipustulatus (Linnaeus, 1767)

Agabus caraboides Sharp, 1882

Agabus conspersus (Marsham, 1802)
Specimens examined: A7, 7.6.2013, 5 ex.; A16, 3.5.2014, 2 ex.

Agabus glacialis Hochhuth, 1846

Agabus nebulosus (Forster, 1771)

Colymbetes fuscus (Linnaeus, 1758)

Deronectes sahlbergi Zimmermann, 1932
Specimens examined: A17, 06.05.2014, 3 ex.

Dytiscus marginalis (Linnaeus, 1758)
Specimens examined: A12, 4.6.2013, 5 ex.; A29, 22.5.2014, 2 ex.

Graptodytes venter vor teger Zimmermann, 1918
Specimens examined: A13, 17.6.2013, 4 ex.; 22.05.2014, 3 ex.
Hydaticus seminiger DeGeer, 1774 (Fig. 2)
Remark: This species previously reported from Denizli Province (Darilmaz & Kiyak, 2009b). It is second record for Turkish Dytiscidae fauna.

Hydroglyphus geminus (Fabricius, 1792)

Hydromorus discretus (Fairmaire and Brisout, 1859)

Hydroporus marginatus (Duftschmid, 1805)

Hydroporus palustris (Linnaeus, 1761)
Specimens examined: A9, 4.6.2013, 7 ex., 22.5.2014, 5 ex.; A12, 4.6.2013, 4 ex.

Hydroporus planus (Fabricius, 1782)
Specimens examined: A11, 04.06.2013, 8 ex.

Hydroporus pubescens (Gyllenhal, 1808)
Specimens examined: A13, 3.05.2014, 3 ex.; A16, 22.5.2014, 5 ex.

Hydroporus tessellatus (Drapiez, 1819)

Hydrovatus cuspidatus (Kunze, 1818)
Specimens examined: A9, 24.6.2013, 5 ex.; A10, 22.5.2014, 2 ex.

Hygrotus impressopunctatus (Schaller, 1783)

Hygrotus inaequalis (Fabricius, 1777)

Hygrotus lernaeus (Schaum, 1857)

Ilybius chalconatus (Panzer, 1796)

Ilybius fuliginosus fuliginosus (Fabricius, 1792)

Laccophilus hyalinus (De Geer, 1774)

Laccophilus minutus (Linnaeus, 1758)

Laccophilus poecilus Klug, 1834

Liopterus haemorrhoidalis (Fabricius, 1787) (Fig. 3)
Remark: This species reported from Kütahya (Guéorguiev 1981) without any detailed locality information. It is the second report for Turkish aquatic fauna with first detailed locality information.
**Nebrioporus stearinus suavis** (Sharp, 1882)

**Rhantus suturalis** (W.S. MacLeay, 1825)
Specimens examined: A4, 04.06.2013, 1 ex.; A9, 22.05.2014, 3 ex.

**Scarodytes halensis** (Fabricius, 1787)

**Family Gyrinidae**

**Gyrinus distinctus** Aubé, 1838

**Family Haliplidae**

**Peltodytes caesus** (Duftschmid, 1805)

**Family Noteridae**

**Noterus clavicornis** (De Geer, 1774)

**DISCUSSION**

As a result of this work 34 aquatic adephagan species belong to four families (Dytiscidae, Noteridae, Haliplidae and Gyrinidae) were identified in the research area. Despite the numerous systematic, faunistic, ecologic and zoogeographic studies about Turkish aquatic beetle, none of such studies have been performed in Adıyaman and also in South-eastern region of Turkey. Thus all identified species are recorded as new for Adıyaman province. Surprisingly all identified species are new to south-eastern region of Turkey except four. It is clear that, more different species will be record with more detailed studies for this area in the future.

**ACKNOWLEDGEMENTS**

Author would sincerely thanks to Dr. Hans Fery (Berlin/Germany) for identification of some Dytiscidae specimens. This study has partly (financially) been supported by Adıyaman University, project numbered: KMYOBAP-2012/0001.

**LITERATURE CITED**


Darılmaz, M. C. & Kıyak, S. 2009b. Two species of water beetle of the family Dytiscidae (Coleoptera) new to Turkey. Zoology in the Middle East, 46 (1): 118-120.


Table 1. Location of the sampling sites where water beetles were found.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Sampling site</th>
<th>Coordinates</th>
<th>Altitude (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Adıyaman, centrum</td>
<td>37°55’24”N 38°17’00”E</td>
<td>1160</td>
</tr>
<tr>
<td>A2</td>
<td>Adıyaman, centrum</td>
<td>37°43’41”N 38°11’50”E</td>
<td>685</td>
</tr>
<tr>
<td>A3</td>
<td>Adıyaman, centrum, Koçali</td>
<td>37°55’54”N 38°15’26”E</td>
<td>1067</td>
</tr>
<tr>
<td>A4</td>
<td>Çelikhan</td>
<td>37°59’06”N 38°15’35”E</td>
<td>1270</td>
</tr>
<tr>
<td>A5</td>
<td>Besni, Akpınar</td>
<td>37°44’54”N 37°46’37”E</td>
<td>814</td>
</tr>
<tr>
<td>A6</td>
<td>Besni, Su gözü</td>
<td>37°39’20”N 37°48’30”E</td>
<td>700</td>
</tr>
<tr>
<td>A7</td>
<td>Gölbäşi</td>
<td>37°47’57”N 37°39’45”E</td>
<td>900</td>
</tr>
<tr>
<td>A8</td>
<td>Gölbäşi</td>
<td>37°48’11”N 38°40’07”E</td>
<td>900</td>
</tr>
<tr>
<td>A9</td>
<td>Gölbäşi, Azaplı Lake</td>
<td>37°45’59”N 37°33’20”E</td>
<td>880</td>
</tr>
<tr>
<td>A10</td>
<td>Gölbäşi, Büyüik Lake</td>
<td>37°47’44”N 37°38’35”E</td>
<td>881</td>
</tr>
<tr>
<td>A11</td>
<td>Gölbäşi, Saydere</td>
<td>37°45’22”N 37°44’52”E</td>
<td>842</td>
</tr>
<tr>
<td>A12</td>
<td>Gölbäşi, Gözeler Pond</td>
<td>37°43’56”N 37°30’38”E</td>
<td>883</td>
</tr>
<tr>
<td>A13</td>
<td>Gölbäşi, Karaburun</td>
<td>37°45’53”N 37°35’51”E</td>
<td>907</td>
</tr>
<tr>
<td>A14</td>
<td>Kahta, Yassakaya fountain</td>
<td>37°55’22”N 38°36’28”E</td>
<td>630</td>
</tr>
<tr>
<td>A15</td>
<td>Kahta, Değirmenbaşi</td>
<td>37°57’40”N 38°40’17”E</td>
<td>867</td>
</tr>
<tr>
<td>A16</td>
<td>Kahta, Doluca</td>
<td>37°54’32”N 38°34’27”E</td>
<td>865</td>
</tr>
<tr>
<td>A17</td>
<td>Kahta, Karakuş Hill</td>
<td>37°52’10”N 38°35’03”E</td>
<td>872</td>
</tr>
<tr>
<td>A18</td>
<td>Kahta, Daşlıca</td>
<td>37°53’44”N 38°34’26”E</td>
<td>768</td>
</tr>
<tr>
<td>A19</td>
<td>Kahta, Karadut, Tanbaşı</td>
<td>37°54’50”N 38°48’59”E</td>
<td>854</td>
</tr>
<tr>
<td>A20</td>
<td>Kahta, Cendere Bridge</td>
<td>37°56’11”N 38°36’40”E</td>
<td>612</td>
</tr>
<tr>
<td>A21</td>
<td>Kahta Stream</td>
<td>37°52’03”N 38°37’18”E</td>
<td>550</td>
</tr>
<tr>
<td>A22</td>
<td>Kahta-Gerger way</td>
<td>37°51’43”N 38°40’25”E</td>
<td>700</td>
</tr>
<tr>
<td>A23</td>
<td>Kahta, Old Kahta</td>
<td>37°56’03”N 38°38’07”E</td>
<td>664</td>
</tr>
<tr>
<td>A24</td>
<td>Gerger</td>
<td>37°59’01”N 38°36’43”E</td>
<td>555</td>
</tr>
<tr>
<td>A25</td>
<td>Gerger</td>
<td>37°51’44”N 38°40’27”E</td>
<td>760</td>
</tr>
<tr>
<td>A26</td>
<td>Gerger, Ballı</td>
<td>37°53’17”N 38°51’16”E</td>
<td>600</td>
</tr>
<tr>
<td>A27</td>
<td>Gerger, Karagöl (Süleyklü Lake)</td>
<td>37°59’25”N 38°49’22”E</td>
<td>1115</td>
</tr>
<tr>
<td>A28</td>
<td>Gerger, Küttikli</td>
<td>37°58’25”N 38°49’05”E</td>
<td>1165</td>
</tr>
<tr>
<td>A29</td>
<td>Gerger, Şahintepe</td>
<td>37°55’24”N 38°48’39”E</td>
<td>870</td>
</tr>
<tr>
<td>A30</td>
<td>Sincik</td>
<td>38°01’47”N 38°37’10”E</td>
<td>1227</td>
</tr>
<tr>
<td>A31</td>
<td>Sincik</td>
<td>38°01’10”N 38°37’12”E</td>
<td>1200</td>
</tr>
<tr>
<td>A32</td>
<td>Sincik-Gerger way</td>
<td>37°51’36”N 38°35’46”E</td>
<td>777</td>
</tr>
<tr>
<td>A33</td>
<td>Sincik, Çatbahçe</td>
<td>37°57’51”N 38°36’00”E</td>
<td>707</td>
</tr>
<tr>
<td>A34</td>
<td>Tut</td>
<td>37°47’02”N 37°50’53”E</td>
<td>660</td>
</tr>
<tr>
<td>A35</td>
<td>Samsat</td>
<td>37°45’34”N 38°32’08”E</td>
<td>588</td>
</tr>
</tbody>
</table>
Figure 1. Map of the study area; Adıyaman province, Turkey.

Figure 2. *Hydaticus seminiger* DeGeer, 1774.
Figure 3. *Liopterus haemorrhoidalis* (Fabricius, 1787).
FIELD AND LABORATORY ASSESSMENT TO HYGIENIC BEHAVIOR OF CARNIOLAN HONEY BEES WITH STUDYING IMPACTS OF OXALIC ACID ON GROOMING BEHAVIOR

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ABSTRACT: In this study, the hygienic behavior of Tatranka and Hontianka Carniolan honey bees of Slovakia and Carniolan bee hybrids of Egypt was studied under field conditions. Also, a new laboratory method to evaluate the hygienic behavior was done. Moreover, the influence of oxalic acid treatments on the grooming behavior of the Carniolan bees was investigated. The results showed that the studied colonies exhibited hygienic trend against dead brood with percent more than 80%, and the best of them was Hontianka. The laboratory method showed that the caged bees were able to exhibit their hygienic trend by uncapping and removing dead brood from the cells. The results suggest that hygienic bees should clean at least 50% of the cells in the laboratory test. Oxalic acid treatments showed efficacy against Varroa mites and caused increase in the percents of the fallen mites. However, oxalic treatments did not enhance the grooming behavior or even change the attitude of bees against Varroa mites during grooming. The results of this study are essential towards developing naturally resistance Carniolan bees to Varroa mites. The new laboratory method can be considered as a keystone towards easier method to evaluate the hygienic behavior.

KEY WORDS: Carniolan, bees, hygienic, grooming, behavior, oxalic

The most dangerous parasite to honey bees, Apis mellifera, is Varroa mite, Varroa destructor. This mite is infesting bee colonies in most apiaries worldwide. In fact, there are multi options available for the control of Varroa mites as reviewed by Abou-Shaara (2014). However, most of them are with low efficacy or can contaminate bee products, especially acaricides. Fortunately, honey bees can naturally fight Varroa mites using hygienic and grooming behaviors. Assessing the level of these behaviors in honey bee colonies to select the best colonies to be used in the commercial apiaries is very essential to fight Varroa without polluting bee colonies. Concerning hygienic behavior, honey bee subspecies are varied in their hygienic level, and also it is varied from apiary to another (Garcia et al., 2013). Hygienic behavior has been found to be enhanced by selection (Palacio et al. 2000) or by breeding (Pernal et al., 2012; Gerula et al., 2015). The colony strength (Xonis et al., 2015), food, colony size, time of year, and environmental conditions (Bigio et al., 2013) showed no great influence on this behavior. Mating of bee queens could impact hygienic levels, the colonies with instrumentally inseminated queens have shown significantly higher levels than the colonies with naturally mated queens (Bigio et al., 2014). Although performance traits of bee colonies have shown no significant correlation with resistance traits to Varroa mites (Najafgholian et al., 2011) colonies with high propolis production have shown high hygienic level than those with low propolis production (Nicodemo et al.,
Moreover, low frequency of brood diseases is found in hygienic colonies than non-hygienic ones (Palacio et al., 2000). Carniolan honey bees, *Apis mellifera carnica*, are kept in many countries. In some countries, there are local stocks or hybrids of these bees, for example Kortowa and Dobra in Poland (Bąk et al., 2010), Tatranka and Hontianka in Slovakia. In Egypt, Egyptian bees, *Apis mellifera lamarckii*, were the common bees until the importation of huge numbers of Carniolan bees from Europe to Egypt (Sheppard et al., 2001). Therefore, the current bees in Egypt are mainly local hybrids of Carniolan bees, beside some hybrids of Italian bees. Comparing the hygienic level of Carniolan bees of Europe with those of Egypt has not been investigated.

Hygienic behavior has several steps including; detection of dead brood cells, uncapping of the cells, and partially removing the dead brood until cleaning the cells (Gramacho & Gonçalves, 2009). These steps are mostly done within 24 hours and up to 48 hours. The hygienic behavior can be triggered by mite-associated damages (Schöning et al., 2012). Under field conditions, this behavior can be assessed using some methods to kill the sealed brood including: pin-kill test, freezing method, liquid nitrogen method (Espinosa-Montaño et al., 2008), or infect the brood with diseases (Oldroyd, 1996). The pin-kill method is common and considered as fast and easy assay although it’s not highly accurate if compared with the other methods (Espinosa-Montaño et al., 2008). So far, approximately there is no laboratory method available to assess this behavior. Therefore, developing a simple laboratory method to evaluate this behavior is essential to save efforts and time during field evaluation. It is hypothesized that bee workers placed in especially designed cages in a laboratory can exhibit hygienic behavior in a way similar to their hygienic ability in their colony.

Grooming is another important behavior against the increase of Varroa mite populations in bee colonies (Guzman-Novoa et al., 2012). This specific behavior is essential towards the phoretic mites (i.e. mites on adult bee bodies), and not Varroa inside brood cells. This behavior can be performed by the individual bee (autogrooming), or by nest-mates (allogrooming). This behavior can be estimated by calculating the percent of deformed mites in the overall number of fallen mites (Stanimirovic et al., 2010). Also, it could be measured by recording the time that individual bees took to start grooming after mites were placed on their bodies (Arechavaleta-Velasco et al., 2012). The heritability of grooming behavior is low through generations (Stanimirovic et al., 2010). Previous studies have shown that Carniolan bees (Kortówka line) had lowest grooming behavior than Caucasian and mellifera bees (Bąk & Wilde, 2015). Spraying bees with oxalic acid as a safe control method against Varroa mites has been found to be with less negative impacts on honey bees than dusting method using inert sugar (Abou-Shaara et al., 2016), and this method is common. So far, the role of spraying bees with oxalic acid in enhancing grooming behavior has not been well studied. Therefore, investigating the exact role of oxalic treatments on grooming behavior of Carniolan bees (a subspecies with low grooming attitude) is essential. The objectives of the study were to compare the hygienic behavior of Carniolan bees of Slovakia (Tatranka & Hontianka) with local Carniolan hybrids of Egypt, to develop laboratory test for the hygienic behavior, and to investigate the impacts of oxalic acid treatments on the grooming behavior.
MATERIALS AND METHODS

1. Hygienic behavior of the Carniolan bees.
   Part of this experiment was done in Slovakia while the other part was done in Egypt. In Slovakia, the hygienic behavior of Carniolan honey bees (Tatranka and Hontianka) was assessed in June 2016. In Egypt, the hygienic behavior of local hybrids of Carniolan honey bees (Local Carniolan bees) was assessed in July 2016. At least three colonies per group were used. All colonies had approximately the same strength. From each colony, 100 sealed brood cells were pierced using fine pin (i.e. needle of syringe). After 48 hours, the numbers of fully cleaned cells were counted and percents of cleaned cells were calculated.

2. Laboratory method to assess the hygienic behavior.
   Firstly, specific cages were prepared. Plastic cages with approximately cylinder shape (length of 11.5 cm, and diameter of 10.5 cm) and with smooth inner surface to hinder the ability of bee workers to stand on it were used. The bottoms of the cages were made of wire mesh to allow the drop of debris and dead brood (Fig. 1a). In each cage, a piece of sealed brood comb (3X7 cm) was placed and attached well to the bottom of the cage (Fig. 1b). This piece of brood comb was covered from one side using foil to allow the bees to stand only on one side of the comb and to clean this side (Fig. 1c). These comb pieces were killed in a freezer prior the insertion into the cages, and the number of sealed brood cells was counted. In each cage also about 10 grams of honey candy (honey saturated with powdered sugar) was added to supply caged bees with food. After preparing the cages, about 100 worker bees from brood combs were added into each cage using a brush. The bees did not expose to any treatments (e.g. freezing or CO2) to narcotize the bees. The cages were tightly closed and after 48 hours the percents of completely cleaned cells were calculated, partially cleaned cells were not considered. Three hybrids of Carniolan bee colonies and three cages were used in this experiment. For each colony, hygienic behavior was assessed in the laboratory using the cages and in the field using pricing method (pin test) as mentioned in the previous experiment. Laboratory and field tests were run at the same time. The results of the two tests were compared to assess the efficacy of the laboratory method as indicator to the field one for the hygienic behavior.

3. The influence of oxalic acid treatments on the grooming behavior.
   In this experiment, six Local Carniolan bee colonies were used. The colonies were treated with oxalic acid dissolved in 60% sugar syrup (concentration of 3% oxalic acid). The colonies were treated 3 times with intervals of 4 days, and Varroa mites were collected from the drawer of each colony after 2 days from each treatment. The number of collected Varroa from each colony was counted and then Varroa mites were examined under light microscope to identify any incidences of grooming behavior. The deformed Varroa mites were classified according to the damages as: A) chelicera and/or legs, B) body shield, or C) mix of A and B as shown in Figure 2. The percents of the natural and groomed Varroa were compared. Also, natural mite fall was investigated three times with 2 days interval after the end of the oxalic acid treatments by one week, to screen the natural level of grooming behavior of Carniolan bees apart from oxalic treatments. The percent of the groomed Varroa was then compared with data of Varroa during oxalic treatment periods to highlight the impacts of oxalic on grooming behavior of the colonies. This experiment was performed during autumn 2016,
because at this season temperature (less than 30°C) was suitable for oxalic treatments.

4. Statistical analysis.
   The first experiment was analyzed using one-way ANOVA, and then means’ comparison was performed using Tukey test. For the second and third experiments, t-test was used to compare the test groups. The correlation between workers number and number of cleaned cells was calculated using pair wise Pearson correlation coefficients. The percents of the third experiment were arcsine transformed before the analysis. SAS version 9.1.3 was used to analyze the data at 5% level of significance. Means and their standard errors (S.E.) were presented in the results section.

RESULTS

1. Hygienic behavior of the Carniolan bees.
   The ability of Carniolan bee colonies in regard to clean dead brood cells differed significantly (DF=2, F=18.36, \( P=0.001<0.05 \)). Hontianka showed the highest hygienic behavior followed by Tatranka and finally Local Carniolan bees (Figure 3). Hontianka differed significantly than the other two groups, while no significant differences were found between Tatranka and Local Carniolan bees. Percent of cleaned cells for Hontianka varied from 95 to 97%, and from 87 to 91% for Tatranka, and from 82 to 89% for Local Carniolan bees. The Hontianka colonies were higher than Tatranka and Local Carniolan bees by 6.4% and 10.67%, respectively.

2. Laboratory method to assess the hygienic behavior.
   The field and the laboratory tests for the hygienic behavior differed significantly according to t-test (\( t=3.78, \ P=0.0193<0.05 \)) in percent of cleaned dead cells after 48 hours (Figure 4). The percent of the field test was higher than the laboratory one by 11.67 to 29.39%. All the colonies showed hygienic behavior under field conditions with percent higher than 80% and with percent higher than 50% under laboratory conditions. The laboratory test showed that the caged bees were able to clean dead brood cells instead of neglecting them. The number of caged bees varied from 89 to 103 bees, the correlation between the number of caged bees and the number of cleaned cells was not significant (\( r=0.35, \ P=0.7679>0.05 \)).

3. The influence of oxalic acid treatments on the grooming behavior.
   The mean number of fallen mites was significantly higher during period of oxalic acid treatments than normal conditions without treatments (\( t=4.47, \ P<0.0001 \)) as in Table 1. This reflects the role of oxalic acid treatments in increasing the mite fall from the bees. The mean percents of normal and deformed Varroa mites showed insignificant differences between period of oxalic treatments and normal conditions (\( t=1.41, \ P=0.17 \)) and (\( t=1.42, \ P=0.16 \)) for normal Varroa and deformed Varroa, respectively (Table 1). The attitude of bees in causing specific damages to Varroa body did not differ significantly between the treatment period and the normal conditions (for chelicera/legs damages; \( t=0.71, \ P=0.48 \) for damages in body shield; \( t=0.31, \ P=0.76 \), for mixed damages; \( t=1.02, \ P=0.31 \)) as in Table 1. All \( P \) values were >0.05 except in case of number of fallen mites.
DISCUSSION

1. Hygienic behavior of the Carniolan bees.

The studied colonies showed variations in their hygienic ability. Hontianka was superior over Tatranka and Local Egyptian bees. These variations could be attributed to the genetic differences among them. Especially genetic factors contribute in forming the hygienic behavior of honey bees (Goode et al., 2006). All the colonies showed hygienic trend with percent of cleaned cells over 80%. This result highlights that studied colonies could be further used in specific selection programs to obtain colonies with high hygienic trend. The results of Balhareth et al. (2012) for hybrids of Carniolan bees, imported from Egypt to Saudi Arabia, showed lower percent of cleaned cells (79.32%) after 48 h than the current study (85.33%) by 6.01%. This variation could be due to the environmental factors, where climatic conditions of Saudi Arabia are harsher (hot with dry weather) than Egypt. It seems that the hybridization of the native bees of Egypt with the imported Carniolan bees over time did not harm the hygienic attitude of the Carniolan bees greatly. Therefore, the local hybrids of Carniolan bees in Egypt did not differ significantly than Tatranka Carniolan bees of Slovakia.

2. Laboratory method to assess the hygienic behavior.

The laboratory method proved that the caged bees were able to perform their hygienic behavior when they were placed into the special cages. Lacking of the significant correlation between number of the caged bees and number of the cleaned cells reflects the role of the individual bees in the hygienic behavior. The study of Scannapieco et al. (2016) reflected the essential role of the individual behavior in the hygienic behavior and its impact on the collective dynamics in bee colonies. The percent of cleaned cells after 48 h was significantly higher (more than 80%) in the field test than the laboratory one (over 50%). The higher percents are expected due to the variation between field and laboratory conditions. Large numbers of bees were able to contribute in removing the dead brood cells under field conditions while from 89 to 103 bees only were able to do this in the laboratory test. All the colonies showed hygienic behavior under field and laboratory conditions. It is suggested that caged bees succeeded in cleaning 50% or more of dead cells in the laboratory can be considered as hygienic.

3. The influence of oxalic acid treatments on the grooming behavior.

The results emphasized that spraying bees with oxalic acid is effective in increasing the number of fallen Varroa mites. Approximately, the number of fallen mites was double when oxalic was applied in comparison with the normal conditions. These findings are highly supported by the previous studies. High efficacy of 94 % and 93.40% was found to treatment with oxalic acid during autumn by Higes et al. (1999), and Akyol & Yeninar (2009), respectively. Also, high Varroa mortality was found after the treatment with Oxalic acid by Gregorc & Planinc (2004). Grooming behavior was considered as partially responsible for the high number of fallen mites by Delfinado-Baker et al. (1992). However, the results showed that the percents of deformed mites did not differ during treatment period than normal conditions without treatments. This suggests that oxalic acid treatments did not enhance the grooming behavior. But the treatments caused higher mite death or enabled the bees to through the mites from their bodies without damaging them. It is also clear from the results that attitude of the bees against Varroa mites during grooming behavior did not change by applying
the oxalic acid. Body shield of Varroa can be easily caught and damaged by bees than body appendages due to its large area. Thus, the bees caused more damages to the body shield, followed by mixture of damages to body shield and chelicera or legs, and finally damages to chelicera and/or legs only. To what extent, Stevanovic et al. (2011) found no change in the hygienic potential of bee colonies after treatments with sugar dusting. This study together with the present one suggest that grooming and hygienic behaviors of honey bees are impacted mainly by genetic factors, and not by the treatments. Moreover, Balhareth et al. (2012) found higher grooming rates for the native bees of Saudi Arabia (31.13%) than the imported Carniolan bees from Egypt (11.27%) under the same environmental conditions. This highlights the essential role of bee race (i.e. genetic characteristics) in the grooming behavior.

CONCLUSION

The study concluded that the investigated Carniolan bee colonies exhibited the hygienic behavior with cleaning percents more than 80%. The colonies can be arranged in descending order as Hontianka, Tatranka and finally Local Carniolan bees. The local Carniolan colonies are expected to be successfully selected based on their hygienic level to obtain more hygienic colonies. The study presented laboratory method to evaluate the hygienic behavior. The caged bees successfully exhibited their hygienic trend and cleaned the dead brood cells, especially the bees were placed in specific cages with smooth inner surfaces. Field and laboratory tests confirmed the hygienic trend of the studied colonies, but at least cleaning percent of 50% should be realized to consider the bees as hygienic in the laboratory test. Using the laboratory method to evaluate the hygienic behavior of other bee subspecies and large numbers of bee colonies is very essential. The study showed that oxalic acid treatments caused increase in the percents of fallen Varroa mites without enhancing the grooming behavior. Also, oxalic acid treatments did not impact the attitude of bees against Varroa mites during grooming. The bees caused damages to body shield of Varroa more than chelicera and/or legs.

ACKNOWLEDGEMENTS

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LITERATURE CITED


Nicodemo, D., De Jong, D., Couto, R. H. N. & Malheiros, E. B. 2013. Honey bee lines selected for high propolis production also have superior hygienic behavior and increased honey and pollen stores. Genetics and Molecular Research, 12: 6631-6638.


Table 1. Means±S.E. of fallen Varroa mites either normal or deformed during oxalic acid treatment period and period without treatment (normal conditions). Means accompanied with the same letter in the same row are not significantly different.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Oxalic acid treatment period</th>
<th>Period without treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of fallen mites (%)</td>
<td>12.33±1.23a</td>
<td>6.28±0.56b</td>
</tr>
<tr>
<td>Normal mites (%)</td>
<td>59.59±3.11a</td>
<td>66.49±3.77a</td>
</tr>
<tr>
<td>Deformed mites (%)</td>
<td>30.29±3.10a</td>
<td>23.33±3.77a</td>
</tr>
<tr>
<td>Mites with damaged chelicera/legs (%)</td>
<td>16.08±6.29a</td>
<td>10±6.81a</td>
</tr>
<tr>
<td>Mites with damaged body shield (%)</td>
<td>42.20±9.33a</td>
<td>38.05±9.83a</td>
</tr>
<tr>
<td>Mites with mix of damages (%)</td>
<td>28.13±8.14a</td>
<td>16.94±7.30a</td>
</tr>
</tbody>
</table>
Figure 1. Components of the cages used in the experiment to assess the hygienic behavior in the laboratory. A: bottom of the cage with mesh wire, B: piece of sealed brood comb and the candy inside the cage, and C: piece of sealed brood comb covered from one side with foil.

Figure 2. Classification of the deformed Varroa mites. A: normal body of Varroa mite, B: damages in chelicera and/or legs, C: damages in body shield, and D: damages in chelicera and/or legs and body shield. The damages are pointed out using black arrows.
Figure 3. Median and interquartile range of percents of removed dead brood cells after 48 hours for the Carniolan colonies. Local Carniolan (N=3), Hontianka (N=3) and Tatranka (N=5). Means±S.E. accompanied with the same letter are not significantly different.

Figure 4. Median and interquartile range of percents of removed dead brood cells after 48 hours for the Carniolan bees using field and laboratory tests. Means±S.E. accompanied with the same letter are not significantly different.
Figure 5. Median and interquartile range of numbers of the fallen Varroa mites (A) and percents of the normal and deformed Varroa mites (B) during oxalic acid treatment period (ox) and during normal conditions without treatments (w).
SOUTHEASTERN ANATOLIA REGION INSECT FAUNA I
(COLEOPTERA III: BUPRESTOIDEA; BYRRHOIDEA;
ELATEROIDEA; SCARABAEOIDEA; HYDROPHILOIDEA;
STAPHYLINOIDEA) OF TURKEY

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ABSTRACT: Evaluated on insect species in various ecologies have been conducted in the provinces (Adıyaman, Batman, Gaziantep, Diyarbakır, Mardin, Siirt, Şanlurfa, Şırnak) of Southeastern Anatolia region between the years 1948-2013. During this study totally 267 species were found in 15 families and in 6 superfamilies of Coleoptera. Those superfamilies are Buprestoidea, Byrrhoidea, Elateroidea, Scarabaeoidea, Hydrophiloidea and Staphylinoides. The distribution of determined insect types according to the provinces, plant hosting and feeding type is also done. Information about their identification, host plants, and distribution in Southeastern Anatolia Region was presented as detailed.

KEY WORDS: Insect Fauna, Coleoptera, Buprestoidea, Byrrhoidea, Elateroidea, Scarabaeoidea, Hydrophiloidea, Staphylinoides, Turkey

Insects (Insecta) are the most numerous group of animals in the world, with over one million species that have been described (Price, 1997). Insects are difficult to study because they represent the most species-rich, yet one of the least known, of all taxa of living organisms, a problem that is compounded by a dearth of skilled entomologists. Although the number of described insect species is uncertain due to synonyms and the lack of a global list, most authorities recognize 900,000–1,000,000 named morpho-species, representing 56% of all species known on Earth (Groombridge, 1992; Anonymous, 2003). Sensible estimates of the number of insects yet to be discovered range from another 1 million to 30 million species (Erwin, 1982, 1991), although most predict around 2–8 million more species (May, 1990; Gaston, 1991; Stork, 1997; Ødegaard, 2000). Conservative estimates suggest that 50–90% of the existing insect species on Earth have still to be discovered, yet the named insects alone comprise more than half of all known species of organism.

Insects constitute the most diverse form of animal life in terrestrial ecosystems. Most species are innocuous and essential components of natural ecosystems. Because they are cold-blooded, the rates of key physiological processes in their life cycles are determined by environmental conditions, especially temperature and precipitation. In general they have short generation times, high fecundity and high mobility (Moore & Allard, 2008).

Turkey in fact seems to be like a small continent in terms of biological diversity. Despite the Anatolia is not a continent alone, it contains all properties of a continent that should have an ecosystem and habitat. Each of seven geographical regions in Turkey has a distinguishable climate, flora and fauna. This study aims to determine insect species found in various ecologies on Southeastern Anatolia.
MATERIAL AND METHODS

Entomology studies on insect species of Southeastern Anatolia Region (Adıyaman, Batman, Gaziantep, Diyarbakır, Mardin, Siirt, Şanlıurfa, Şırnak) in different ecological provinces were made between the years 1948-2013 (Fig. 1).

In this study, we prepared for the inventory has reached the major advantage of the waterways:

- Currently in Turkey, published or unpublished entomology journals related to scanning,
- Giving more weight to faunistic studies, and in the meantime, the insect fauna of our country foreign scientific journals that publishes articles about scanning,
- Faculty of Agriculture, Faculty of Science and Regional Plant Protection Research Institute in the library of books on insect fauna and the screening of the booklet,
- The doctorate (PhD) and the master's thesis of entomology in the region on the scanning,
- Review of other studies on the insect fauna in the area.

In this study, we evaluated the information as described above were obtained.

RESULTS AND DISCUSSION

Surveys on insect species in various ecologies have been conducted in the provinces (Adıyaman, Batman, Gaziantep, Diyarbakır, Mardin, Siirt, Şanlıurfa, Şırnak) of Southeastern Anatolia region between the years 1948-2013. Almost 2600 species and subspecies almost 180 families belonging to 13 insect orders are defined owing to these studies. The distributions of determined insect species are as follows: Coleoptera included 10 families were recorded (Table 1).

**Order Coleoptera**

**Superfamily Buprestoidea**

**Family Buprestidae**

*Acmaeodera brevipes* Kiesenwetter, 1858; Distribution of the studies area: Adıyaman; Host plant: Unknown (Kısmalı et al., 1995).

*Acmaeodera flavolineata* Laporte & Gory, 1835; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al., 1995).

*Acmaeodera ocellata* Abeille de Perrin, 1891; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al., 1995).

*Acmaeodera saxicola* Spinola, 1838; Distribution of the studies area: Gaziantep, Şırnak; Host plant: Unknown (Kısmalı et al., 1995).

*Acmaeoderella boryi* Brullé, 1832; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al., 1995).

*Acmaeoderella chrysanthemi* Chevrolat, 1854; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al., 1995).

*Acmaeoderella gibbulousa* Ménétriés, 1832; Distribution of the studies area: Gaziantep, Şanlıurfa; Host plant: Unknown (Kısmalı et al., 1995).

*Acmaeoderella serricornis* Abeille de Perrin, 1900; Distribution of the studies area: Gaziantep, Şanlıurfa; Host plant: Unknown (Kısmalı et al., 1995).

*Acmaeoderella vetusta* Ménétriés, 1832; Distribution of the studies area: Diyarbakır, Gaziantep, Mardin, Şanlıurfa; Host plant: Unknown (Kısmalı et al., 1995).

*Agrilus adlbaueri* Niehuis, 1987; Distribution of the studies area: Adıyaman; Host plant: Unknown (Kısmalı et al., 1995).

*Agrilus angustatus* Illiger, 1803; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al., 1995).
Agrilus biguttatus Fabricius, 1776; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al., 1995).

Acmaeoderella vetusta Méntriés, 1832; Distribution of the studies area: Diyarbakır, Gaziantep, Mardin, Şanlıurfa; Host plant: Unknown (Kısmalı et al., 1995).

Agrilus chlorophyllus Abeille de Perrin, 1904; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt; Host plant: Unknown (Kısmalı et al., 1995).

Agrilus convexicollis Redtenbacher 1849; Distribution of the studies area: Diyarbakır, Mardin; Host plant: Unknown (Kısmalı et al. 1995).

Agrilus derausfuscatus Lacordaire, 1835; Distribution of the studies area: Gaziantep, Mardin, Siirt; Host plant: Unknown (Kısmalı et al., 1995).

Agrilus hastulifer Ratzerburg, 1837; Distribution of the studies area: Southeastern Anatolia; Host plant: Unknown (Kısmalı et al., 1995).

Agrilus roscidus Kiesenwetter, 1857; Distribution of the studies area: Diyarbakır, Gaziantep, Mardin, Şanlıurfa; Host plant: Amygdalus communis L., Prunus avium L. (Kısmalı et al., 1995; Çınar et al., 2004; Bolu et al., 2005; Bolu & Özgen, 2011; Bolu et al., 2011).

Agrilus viridicaerulans Marseul, 1868; Distribution of the studies area: Adıyaman, Diyarbakır, Mardin, Siirt; Host plant: Pistacia vera L. (Kısmalı et al., 1995; Günaydın, 1978).

Anthaxia armeniaca armeniaca Obenberger, 1929; Distribution of the studies area: Adıyaman, Diyarbakır, Gaziantep, Mardin, Şanlıurfa; Host plant: Pistacia vera L., Amygdalus communis L. (Kısmalı et al., 1995; Günaydın, 1978; Bolu, 2002; Bolu et al., 2011).

Anthaxia berytensis Abeille de Perrin, 1895; Distribution of the studies area: Diyarbakır, Mardin, Şanlıurfa, Host plant: Unknown (Kısmalı et al., 1995).

Anthaxia cichorii Olivier, 1790; Distribution of the studies area: Diyarbakır, Gaziantep, Mardin, Şırnak; Host plant: Unknown (Tozlu & Yardibi, 2013).

Anthaxia eugeniae eugeniae Ganglbauer, 1885; Distribution of the studies area: Southeastern Anatolia; Host plant: Unknown (Kısmalı et al., 1995).

Anthaxia funerula Illiger, 1803; Distribution of the studies area: Mardin; Host plant: Unknown (Kısmalı et al., 1995).

Anthaxia ghazi Cobos, 1965; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Kısmalı et al., 1995).

Anthaxia millefolii Fabricus, 1801; Distribution of the studies area: Gaziantep; Host plant: Amygdalus communis L. (Bolu & Özgen, 2011).

Anthaxia puella Bíly, 1980; Distribution of the studies area: Mardin; Host plant: Unknown (Kısmalı et al., 1995).

Anthaxia rutilipennis Abeille de Perrin, 1891; Distribution of the studies area: Diyarbakır, Gaziantep; Host plant: Amygdalus communis L., Pistacia vera L. (Bolu & Özgen, 2011).

Anthaxia tractata Abeille de Perrin, 1901; Distribution of the studies area: Diyarbakır, Mardin; Host plant: Amygdalus communis L., Prunus avium L. (Bolu & Özgen, 2011).
Aurigena viridicoerulans Marseul, 1868; Distribution of the studies area: Adıyaman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa; Host plant: *Prunus avium* L. (Günaydın, 1978; Bolu, 2002).

**Capnodis carbonaria** Klug, 1829; Distribution of the studies area: Adıyaman, Diyarbakır, Gaziantep, Mardin; Host plant: *Amygdalus communis* L., *Prunus avium* L. (Kısmalı et al., 1995; Çınar et al., 2004; Bolu et al., 2005, Bolu & Özgen, 2011, Bolu et al., 2011).

**Capnodis cariosa hauseri** (Obenberger, 1928); Distribution of the studies area: Adıyaman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: *Prunus avium* L., *Pistacia vera* L. (Kısmalı et al., 1995; Günaydın, 1978; Bolu, 2002; Yücel et al., 2002; Çınar et al., 2004; Karadağ et al., 2007).

**Capnodis miliaris** Klug, 1829; Distribution of the studies area: Diyarbakır, Şanlıurfa; Host plant: Unknown (Kısmalı et al., 1995)

**Capnodis porosa** Klug, 1829; Distribution of the studies area: Adıyaman, Gaziantep, Mardin; Host plant: Unknown (Kısmalı et al., 1995)

**Capnodis tenebrionis** Linnaeus, 1758; Distribution of the studies area: Adıyaman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa; Host plant: *Olea europea* L., *Pistacia vera* L. (Günaydın, 1978; Kısmalı et al., 1995; Bolu et al., 2005; Bolu & Özgen, 2011).

**Chalcophora detrita** Klug, 1829; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al. 1995).

**Chalcophora morgani** Théry, 1925; Distribution of the studies area: Şırnak; Host plant: Unknown (Kısmalı et al. 1995).

**Chalcophorella quadrioculata** Redtenbacher, 1843; Distribution of the studies area: Diyarbakır, Mardin; Host plant: *Amygdalus communis* L. (Bolu & Özgen, 2011).

**Chalcophorella stigmatica** Schoenherr, 1817; Distribution of the studies area: Adıyaman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: *Amygdalus communis* L., *Prunus avium* L. (Kısmalı et al., 1995; Çınar et al., 2004; Bolu et al., 2005; Bolu & Özgen, 2011).

**Chrysobothris affinis** Fabricius, 1794; Distribution of the studies area: Diyarbakır, Mardin; Host plant: *Amygdalus communis* L. (Bolu et al., 2005; Bolu & Özgen, 2011).

**Chrysobothris samai** Curletti & Magnani, 1988; Distribution of the studies area: Diyarbakır, Mardin; Host plant: *Amygdalus communis* L. (Bolu et al., 2005; Bolu & Özgen, 2011).

**Julodis armeniaca** Marseul, 1865; Distribution of the studies area: Adıyaman, Diyarbakır, Mardin; Host plant: *Amygdalus communis* L. (Kısmalı et al., 1995; Bolu et al., 2005; Bolu & Özgen, 2011).

**Julodis intricata** Redtenbacher, 1843; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Kısmalı et al., 1995)

**Julodis onopordi** Fabricius, 1787; Distribution of the studies area: Adıyaman, Diyarbakır, Gaziantep, Mardin; Host plant: Unknown (Kısmalı et al., 1995).

**Latipalpis stellio** Kiesenwetter, 1857; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Kısmalı et al., 1995)

**Melanophila picta** Fabricius, 1787; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Kısmalı et al., 1995).

**Melibeus heydeni** Abeille de Perrin, 1897; Distribution of the studies area: Diyarbakır, Mardin; Host plant: *Amygdalus communis* L. (Bolu et al., 2005; Bolu & Özgen, 2011).

**Perotis lugubris** Fabricius, 1777; Distribution of the studies area: Adıyaman, Diyarbakır, Mardin, Siirt, Şanlıurfa; Host plant: *Amygdalus communis* L. *Pistacia vera* L. (Maçan, 1986; Bolu et al., 2005; Bolu & Özgen, 2011).

**Polyctesis rhois** Marseul, 1865; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al., 1995).

**Ptosima flavoguttata** Illiger, 1803; Distribution of the studies area: Adıyaman, Diyarbakır, Gaziantep, Mardin, Şanlıurfa; Host plant: *Amygdalus communis* L., *Prunus avium* L. (Kısmalı et al., 1995; Çınar et al., 2004; Bolu et al., 2005; Bolu & Özgen, 2011).
Psiloptera mimosae Klug, 1829; Distribution of the studies area: Mardin; Host plant: Unknown (Kısmalı et al., 1995).

Scintillatrix rutilans Fabricius, 1777; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al., 1995).

Scintillatrix solieri Laporte & Gory, 1837; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Kısmalı et al., 1995).

Sphenoptera adusta Jakovlev, 1887; Distribution of the studies area: Mardin; Host plant: Unknown (Kısmalı et al., 1995).

Sphenoptera (Trop.) anthaxoides Reitter, 1895; Distribution of the studies area: Diyarbakır, Mardin; Host plant: Amygdalus communis L. (Bolu et al., 2005; Bolu & Özgen, 2011).

Sphenoptera simulatrix Reitter, 1895; Distribution of the studies area: Adıyaman, Diyarbakır, Gaziantep, Mardin, Şanlıurfa; Host plant: Prunus avium L. (Çınar et al., 2004).

Sphenoptera antiqua Illiger, 1803; Distribution of the studies area: Mardin; Host plant: Unknown (Kısmalı et al., 1995).

Sphenoptera anxia Jakovlev, 1900; Distribution of the studies area: Mardin; Host plant: Unknown (Kısmalı et al., 1995).

Sphenoptera coracina Steven, 1830; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Kısmalı et al., 1995).

Sphenoptera dichroa Jakovlev, 1887; Distribution of the studies area: Gaziantep, Mardin; Host plant: Unknown (Kısmalı et al., 1995).

Sphenoptera nereis Obenberger, 1927; Distribution of the studies area: Mardin; Host plant: Unknown (Kısmalı et al., 1995).

Sphenoptera obnubila Jakovlev, 1908; Distribution of the studies area: Mardin; Host plant: Unknown (Kısmalı et al., 1995).

Sphenoptera simulatrix Reitter, 1895; Distribution of the studies area: Southeastern Anatolia; Host plant: Unknown (Kısmalı et al., 1995).

Sphenoptera (Tropeopeltis) tappesi Marseul, 1865; Distribution of the studies area: Diyarbakır, Gaziantep, Mardin; Host plant: Amygdalus communis L., Pyrus armeniaca L., Prunus avium L., Prunus persica (L.), Prunus domestica L. (Kısmalı et al., 1995; Bulu et al., 2005; Bolu, 2008; Bolu et al., 2011; Bolu & Özgen, 2011).

Sphenoptera tauricola Obenberger, 1927; Distribution of the studies area: Adıyaman; Host plant: Unknown (Kısmalı et al., 1995).

Stigmatophorella quadrioculata Redtenbacher, 1843; Distribution of the studies area: Adıyaman; Host plant: Prunus avium L. (Kısmalı et al., 1995; Çınar et al., 2004).

Trachys scrobiculatus Kiesenwetter, 1857; Distribution of the studies area: Gaziantep; Host plant: Unknown (Kısmalı et al., 1995).

Superfamily Byrrhoidea
Family Heteroceridae

Augyles flavidus Rossi, 1794; Distribution of the studies area: Mardin, Şırnak; Host plant: Unknown (Taşar & Mascagni, 2014).

Dryops jeanneli Bollow, 1939; Distribution of the studies area: Adıyaman; Host plant: Unknown (Taşar & Mascagni, 2014).

Dryops lutulentus Erichson, 1847; Distribution of the studies area: Adıyaman; Host plant: Unknown (Taşar & Mascagni, 2014).

Dryops nitidulus Heer, 1841; Distribution of the studies area: Adıyaman; Host plant: Unknown (Taşar & Mascagni, 2014).

Dryops rufipes Krynicki, 1832; Distribution of the studies area: Adıyaman; Host plant: Unknown (Taşar & Mascagni, 2014).

Elmis maugetii maugetii Latreille, 1798; Distribution of the studies area: Adıyaman; Host plant: Unknown (Taşar & Mascagni, 2014).

Heterocerus fenestratus Thunberg, 1784; Distribution of the studies area: Adıyaman, Diyarbakır; Host plant: Light trap (Taşar & Mascagni, 2014).

Heterocerusfuscalus Kiesenwetter, 1843; Distribution of the studies area: Adıyaman; Host plant: Unknown (Taşar & Mascagni, 2014).
Superfamily Elateroidea

Family Elateridae

*Agriotes lineatus* Linnaeus, 1767; Distribution of the studies area: Adiyaman, Diyarbakır, Mardin, Siirt; Host plant: *Nicotiana tobacum* L. (Karaat, 1986).


*Cardiophorus sacratus* Erichson, 1840; Distribution of the studies area: Gaziantep; Host plant: *Nicotiana tobacum* L., *Lycopersicon esculentum*, *Gossypium hirsutum* L. (Kaballak & Sert, 2005).

*Drasterius bimaculatus* Rossi, 1790; Distribution of the studies area: Gaziantep; Host plant: Unknown (Surgut & Varlı, 2012)

*Melanotus fusiceps* Gyllenhal, 1817; Distribution of the studies area: Adiyaman, Mardin, Şanlıurfa; Host plant: Unknown (Kabalak & Sert, 2005).

*Pittonotus theseus* Germar, 1817; Distribution of the studies area: Gaziantep, Şanlıurfa; Host plant: Unknown (Kesdek et al., 2006).

Superfamily Scarabaeoidea

Family Aphodiidae

*Aphodius consputus* Creutzer, 1799; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Aphodius ghardimaouensis* Balthasar, 1829; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Aphodius granarius* Linnaeus, 1767; Distribution of the studies area: Diyarbakır, Gaziantep; Host plant: Winter quarters (Lodos et al., 1984; Lodos et al., 1999; Gözüaçık, 2012).

*Aphodius erraticus* Linnaeus, 1758; Distribution of the studies area: Diyarbakır, Gaziantep; Host plant: Winter quarters (Lodos et al., 1984; Lodos et al., 1999; Gözüaçık, 2012).

*Aphodius fimetarius* Linnaeus, 1758; Distribution of the studies area: Diyarbakır, Gaziantep; Host plant: Winter quarters (Lodos et al., 1984; Lodos et al., 1999; Gözüaçık, 2012).

*Aphodius fritschei* Balthasar, 1933; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Winter quarters (Pehlivan et al., 1995).

*Aphodius immundus* Creutzer, 1799; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995; Lodos et al., 1999).

*Aphodius lineimargo* Reitter, 1892; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Aphodius lineolatus* Illinger, 1803; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

*Aphodius luridus* Fabricius, 1775; Distribution of the studies area: Diyarbakır, Gaziantep; Host plant: Winter quarters (Lodos et al., 1984; Lodos et al., 1999; Gözüaçık, 2012).

*Acrossus luridus* Fabricius, 1775; Distribution of the studies area: Adiyaman, Diyarbakır, Gaziantep; Host plant: Unknown (Lodos et al., 1984; Lodos et al., 1999).

*Aphodius melanostichus* Schmidt, 1840; Distribution of the studies area: Diyarbakır; Host plant: Winter quarters (Lodos et al., 1984; Lodos et al., 1999; Gözüaçık, 2012).

*Aphodius moestus* Fabricius, 1801; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Aphodius persicus* Petrovitz, 1961; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).
Aphodius prodromus Brahms, 1790; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

*Aphodius pubescens* Sturm, 1800; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

*Aphodius quadriguttatus* Herbst, 1783; Distribution of the studies area: Diyarbakır, Gaziantep; Host plant: Winter quarters (Lodos et al., 1984; Lodos et al., 1999; Gözüaçık, 2012).

*Aphodius quadramaculatus* Linnaeus, 1761; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Lodos et al., 1999).

*Aphodius tessulatus* Paykull, 1798; Distribution of the studies area: Diyarbakır; Host plant: Winter quarters (Lodos et al., 1984; Gözüaçık, 2012).

*Aphodius transvolgensis* Semenov, 1898; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Aphodius satellitus* Herbst, 1789; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Aphodius serotinus* Panzer, 1799; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Aphodius sphacelatus* Panzer, 1798; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Aphodius suarius* Faldermann, 1835; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

*Aphodius subterraneus* Linnaeus, 1759; Distribution of the studies area: Diyarbakır; Host plant: Winter quarters (Lodos et al., 1984; Gözüaçık, 2012)

*Aphodius vittatus* Say, 1825; Distribution of the studies area: Gaziantep; Host plant: Winter quarters (Lodos et al., 1984; Gözüaçık, 2012).

*Paracoptochirus singularis* Harold, 1868; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Amphimallon caucasicus* Gyllenhal, 1817; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Amphimallon persicus* Petrovitz, 1963; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Anoxia meridionalis* Reitter, 1890; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Hoplia kunzei* Schmidt, 1840; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

*Haplidia migliaccidii* Baraud, 1975; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

*Haplidia transversa* Fabricius, 1801; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).
Homaloplia labrata Burmeister, 1855; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995).

Polyphylla fullo Linnaeus, 1758; Distribution of the studies area: Southeastern Anatolia; Host plant: Unknown (Karagöz et al., 2011)

Polyphylla olivieri Castelnau, 1840; Distribution of the studies area: Adıyaman; Host plant: Unknown (Karagöz et al., 2011)

Family Rutelidae

Anisoplia austriaca Herbst, 1783; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995; Lodos et al., 1999).

Anisoplia farraria Ericson, 1848; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995).

Anisoplia leucaspis Laporte de Castelnau, 1840; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995).

Anisoplia noahi Petrovitz, 1873; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995).

Anisoplia segetum Herbst, 1783; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995).

Anisoplia syriaca Reitter, 1903; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995).

Anomala osmanlis Blanchard, 1851; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995).

Anomala solida Erichson, 1848; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995).

Blitopertha abdita Petrovitz, 1959; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Blitopertha nazarena Marseul, 1878; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Amygdalus communis L., Cucumis sativus L., Triticum sp. (Adıgüzel, 1975; Karaca et al., 2012).

Pharaonus varicoloreus Burmeister, 1844; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Gossypium hirsitum L., Glycyrrhiza glabra L. (Karaat & Göven, 1985; Karaat et al., 1986).

Brancoplia leucaspis Laporte de Castelnau, 1840; Distribution of the studies area: Şırnak; Host plant: Unknown (Karaat & Göven, 1985; Karaat et al., 1986).

Family Scarabaeidae

Caccobius histeroides Ménetriés, 1832; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Caccobius schreberi Linnaeus, 1767; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehliván et al., 1995; Lodos et al., 1999).

Copris hispanus Linnaeus, 1764; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Chironitis freijfer Rossi, 1792; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Chironitis haroldi Ballion, 1870; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Epicometis (Tropinota) hirta Poda, 1761; Distribution of the studies area: Diyarbakır, Mardin; Host plant: Amygdalus communis L. (Bolu et al., 2005).

Euoniticellus fulvus Goeze, 1777; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).
Euoniticellus pallipes Fabricius, 1781; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Gymnopleurus flagellatus Fabricius, 1787; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995; Lodos et al., 1999).

Gymnopleurus geoffroyi geoffroyi Fuessly, 1775; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995; Lodos et al., 1999).

Gymnopleurus mopsus Pallas, 1781; Distribution of the studies area: Adıyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995; Lodos et al., 1999).

Onitis damoetas Steeven, 1806; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Pehlivan et al., 1995; Lodos et al., 1999; Gözüaçık, 2012).

Onitis humerosus Pallas, 1771; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995; Lodos et al., 1999; Gözüaçık, 2012).

Onthophagus aleppensis Redtenbacher, 1843; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Onthophagus atramentarius Ménétriers, 1838; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Onthophagus amyntos Olivier, 1789; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Onthophagus fissicornis Steven, 1809; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995; Lodos et al., 1999).

Onthophagus fissinarius Fairmaire, 1895; Distribution of the studies area: Diyarbakır; Host plant: Winter quarters (Lodos et al., 1984; Gözüaçık, 2012).

Onthophagus furcatus Fabricius, 1781; Distribution of the studies area: Diyarbakır, Mardin, Siirt; Host plant: Light trap (Lodos et al., 1999; Özgen et al., 2011.)

Onthophagus fracticornis Preyssler, 1790; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Onthophagus gibbosus Scriba, 1790; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Onthophagus lucidus Sturm, 1800; Distribution of the studies area: Diyarbakır; Host plant: Winter quarters (Lodos et al., 1984; Gözüaçık, 2012).

Onthophagus sürmeli Petrovitz, 1963; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Onthophagus opacicollis Reitter, 1892; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Onthophagus ruficapillius Brullé, 1832; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Onthophagus sericatus Reitter, 1893; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Onthophagus taurus Schreber, 1759; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Scarabaeus pius Illiger, 1803; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Family Glaphyridae

Eulasia alepensis (Menetries, 1832); Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Eulasia chalybaea Linnaeus, 1758; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).
Eulasia fastuosa Reitter, 1890; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Eulasia ithaea (Reitter, 1890); Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Eulasia praeusta Champenois, 1896; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Eulasia pretiosa Reitter, 1890; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Eulasia vittata Fabricius, 1775; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Euonthophagus atramentarius Ménétriés, 1838; Distribution of the studies area: Adiyaman, Diyarbakır, Gaziantep; Host plant: Unknown (Pehlivan et al., 1995).

Glaphyrus festivus Ménétriés, 1836; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Glaphyrus micans Faldermann, 1835; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Glaphyrus varians Reitter, 1903; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Pygopleurus angulatus Fairmaire, 1884; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Pygopleurus foina Reitter, 1890; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Pygopleurus kareli Petrovitz, 1962; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Pygopleurus mithridates Petrovitz, 1962; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Pygopleurus rufovillosus Reitter, 1907; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Pygopleurus vulpes Fabricius, 1781; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Oxythyrea cinctella Schaum, 1841; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Palaeonthophagus lucidus Illiger, 1800; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Pehlivan et al., 1995).

Family Dynastidae

Pentodon bispinosus Küster, 1852; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Pentodon idiota Herbst, 1789; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).
Pentodon punctatus Villers, 1789; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Family Cetoniidae

Aethiessa mesopotamica Burmeister, 1842; Distribution of the studies area: Gaziantep; Host plant: Althaea rosae, Onopordum sp., Quercus sp., Verbascum sp. and Unknown. (Lodos et al., 1999).

Cetonia aurata Linnaeus, 1758; Distribution of the studies area: Gaziantep; Host plant: Cistus sp., Crataegus sp., Quercus sp., Sinapis sp., Unknown (Lodos et al., 1999).

Chromovalcus peryrani Mulsant, 1852; Distribution of the studies area: Gaziantep; Host plant: Althaea rosae, Centaurea sp., Cirsium sp., Cistus sp., Euphorbia sp., Onopordum sp., Rumex sp., Salvia sp., Sinapis sp., Verbascum sp., Apiaceous plants, Unknown (Lodos et al., 1999).

Melolontha albida Frivaldszyk, 1835; Distribution of the studies area: Gaziantep; Host plant: Unknown (Lodos et al., 1999).

Netocia afflcta Gory & Percheron, 1833; Distribution of the studies area: Gaziantep; Host plant: Althaea rosae, Onopordum sp. and Unknown. (Lodos et al., 1999).

Netocia subpilosa Desbrochers des Loges, 1869; Distribution of the studies area: Gaziantep; Host plant: Lens esculenta and Onopordum sp. (Lodos et al., 1999).


Potosia cuprea Fabricius, 1775; Distribution of the studies area: Gaziantep; Host plant: Althaea rosae, Cirsium sp., Genista sp., Onopordum sp., Quercus sp., Pyrus elaeagnifolia, Rosa sp., Thymus sp., Verbascum sp., Vitis vinifera and Unknown. (Pehlivan et al., 1995).

Potosia afflcta Gory & Percheron, 1833; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Potosia cuprea Reitter, 1898; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Potosia speciosa Adams, 1817; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Potosia subpilosa Desbrochers des Loges, 1869; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Potosia vidua Gory & Perch., 1833; Distribution of the studies area: Adiyaman, Batman, Diyarbakır, Gaziantep, Mardin, Siirt, Şanlıurfa, Şırnak; Host plant: Unknown (Pehlivan et al., 1995).

Tropinota hirta Podà, 1761; Distribution of the studies area: Mardin; Host plant: Prunus avium L. (Lodos et al., 1999).


Superfamily Hydrophiloidea

Family Hydrophilidae

Laccobius gracilis Motschulsky, 1855; Distribution of the studies area: southeastern Anatolia; Host plant: Unknown (Yılmaz, 2011).

Laccobius hindukuschi Chiesa, 1966; Distribution of the studies area: southeastern Anatolia; Host plant: Unknown (Yılmaz, 2011).
Laccobius obscratus orchymonti Gentili, 1976; Distribution of the studies area: Southeastern Anatolia; Host plant: Unknown (Yılmaz, 2011).
Laccobius scutellaris Motschulsky, 1855; Distribution of the studies area: Southeastern Anatolia; Host plant: Unknown (Yılmaz, 2011).
Laccobius sipylus d’Orchymont, 1839; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Yılmaz, 2011).
Laccobius sulcatulus Reitter, 1909; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Yılmaz, 2011).
Laccobius syriacus Guillebeau, 1896; Distribution of the studies area: Diyarbakır, Gaziantep, Mardin, Şanlıurfa; Host plant: Unknown (Yılmaz, 2011).

Family Helophoridae

Helophorus aquaticus Linnaeus, 1758; Distribution of the studies area: Diyarbakır, Mardin, Şırnak; Host plant: Winterquarters (Lodos et al., 1984; Yılmaz, 2011; Gözüaçık, 2012).
Helophorus (Atracthelophorus) brevipalpis Bedel, 1881; Distribution of the studies area: Diyarbakır, Mardin; Host plant: Unknown (Gözüaçık, 2012).
Helophorus (Atracthelophorus) daedalus d’Orchymont, 1932; Distribution of the studies area: Diyarbakır, Şırnak; Host plant: Unknown (Yılmaz, 2011).
Helophorus (R.) hilaris Sharp, 1916; Distribution of the studies area: Diyarbakır, Mardin, Şırnak; Host plant: Unknown (Karalar, 2007).
Helophorus (Atracthelophorus) lewisi Angus, 1985; Distribution of the studies area: Diyarbakır, Şırnak; Host plant: Unknown (Karalar, 2007).
Helophorus (Eutrichelophorus) micans Faldermann, 1835; Distribution of the studies area: Diyarbakır; Host plant: Winterquarters (Lodos et al., 1984; Yılmaz, 2011; Gözüaçık, 2012).
Helophorus (Empleurus) nubilus Fabricius, 1777; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Yılmaz, 2011).
Helophorus pallidipennis Mulsant & Wachanru, 1852; Distribution of the studies area: Diyarbakır, Şırnak; Host plant: Unknown (Yılmaz, 2011).
Helophorus syriacus Kuwert, 1885; Distribution of the studies area: Diyarbakır, Gaziantep, Mardin; Host plant: Unknown (Yılmaz, 2011).

Superfamily Staphylinoidea

Family Staphylinidae

Anotylus inustus Gravenhorst, 1806; Distribution of the studies area: Batman, Diyarbakır, Kilis, Mardin, Siirt; Host plant: Gossypium hirsutum L., Pistacia vera L. (Anlaş, 2009; Özgen & Anlaş, 2011).
Anotylus nitidulus Gravenhorst, 1802; Distribution of the studies area: Kilis, Siirt Host plant: Gossypium hirsutum L., Pistacia vera L. (Anlaş, 2009; Özgen & Anlaş, 2011).
Anotylus tetracarinatus Block, 1799; Distribution of the studies area: Diyarbakır; Host plant: Pistacia vera L. (Şimşek, 2012).
Bisnius fimetarius Gravenhorst, 1802; Distribution of the studies area: Kilis, Şanlıurfa; Host plant: Gossypium hirsutum L., Pistacia vera L. (Anlaş, 2009; Özgen & Anlaş, 2011).
Bledius furcatus Olivier, 1811; Distribution of the studies area: Diyarbakır, Kilis; Host plant: Gossypium hirsutum L., Pistacia vera L. (Anlaş, 2009; Özgen & Anlaş, 2011).
Bolitobius castaneus Stephens, 1832; Distribution of the studies area: Diyarbakır, Mardin; Host plant: Unknown (Özgen & Anlaş, 2011).
Bryoporus multipunctatus Hampe, 1867; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Özgen & Anlaş, 2011).
Carpelimus bilineatus Stephens, 1834; Distribution of the studies area: Diyarbakır, Mardin, Siirt; Host plant: Gossypium hirsutum L., Pistacia vera L. (Özgen & Anlaş, 2011).
Coproporus colchicus Kraatz, 1858: Distribution of the studies area: Diyarbakır, Mardin; Host plant: Unknown (Özgen & Anlaş, 2011).
Medon fusculus Mannerheim, 1830: Distribution of the studies area: Adıyaman, Mardin; Host plant: Prunus avium L. (Tezcan & Anlaş, 2009).
Sepedophilus littoreus Linnaeus, 1758: Distribution of the studies area: Diyarbakır, Mardin; Host plant: Unknown (Özgen & Anlaş, 2011).
Tachinus corticinus Gravenhorst, 1802: Distribution of the studies area: Gaziantep; Host plant: Unknown (Özgen & Anlaş, 2011).
Tachinus fimetarius Gravenhorst, 1802: Distribution of the studies area: Adıyaman, Diyarbakır, Mardin; Host plant: Unknown (Özgen & Anlaş, 2011).
Tachyporus chrysomelinus Linnaeus, 1758: Distribution of the studies area: Diyarbakır; Host plant: Unknown (Özgen & Anlaş, 2011).
**Tachyporus hypnorum** Fabricius, 1775; Distribution of the studies area: Adiyaman, Diyarbakır, Gaziantep, Mardin, Şırnak; Host plant: *Gossypium hirsutum* L., *Pistacia vera* L. (Özgen & Anlaş, 2011; Özgen et al., 2011)

**Tachyporus nitidulus** Fabricius, 1781; Distribution of the studies area: Diyarbakır, Gaziantep, Mardin; Host plant: *Gossypium hirsutum* L., *Pistacia vera* L. (Özgen & Anlaş, 2011; Özgen et al., 2011; Şimşek, 2012).

**Tachyporus pusillus** Gravenhorst, 1806; Distribution of the studies area: Diyarbakır; Host plant: Unknown (Özgen & Anlaş, 2011).

**Tachyporus scutellus** Erichson, 1839; Distribution of the studies area: Adiyaman; Host plant: Unknown.

**Thinodromus arcuatus** Stephens, 1834; Distribution of the studies area: Batman; Host plant: *Gossypium hirsutum* L., *Pistacia vera* L. (Özgen & Anlaş, 2011).

**Xantholinus rufippennis** Erichson, 1839; Distribution of the studies area: Diyarbakır, Gaziantep, Mardin; Host plant: *Prunus avium* L. (Ergül et al., 1972).

### Family Hydraenidae

**Ochthebius** (*Hymenodes*) *difficilis* Mulsant, 1844; Distribution of the studies area: Adiyaman, Gaziantep, Kilis, Siirt; Host plant: Unknown (Topkara & Balık, 2008)

### Family Silphidae

**Ablattari alaevigata** Fabricius, 1775; Distribution of the studies area: Diyarbakır; Host plant: Unknown

**Alycepa undata** Muller, 1776; Distribution of the studies area: Diyarbakır; Host plant: Unknown.

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**LITERATURE CITED**


Özgen, İ. & Anlaş, S. 2011. New and additional records of the Subfamily Tachyporinae (Coleoptera: Staphylinidae) from Turkey, with observations on agricultural importance of the genus Tachyporus. Türkiye Entomoloji Dergisi, 5: 303-312.


Figure 1. Sampling localities in Southeastern Anatolia Region of Turkey.

Table 1. Number of species of Coleoptera on Southeastern Anatolia Region.

<table>
<thead>
<tr>
<th>Superfamily</th>
<th>Family</th>
<th>Number Species</th>
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<tr>
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<td>Buprestidae</td>
<td>75</td>
<td>27.92</td>
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<tr>
<td>Byrrhoidea</td>
<td>Heteroceridae</td>
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<tr>
<td>Elateroidea</td>
<td>Elateridae</td>
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<td>Aphodidae</td>
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<td></td>
<td>Cetoniidae</td>
<td>16</td>
<td>6.04</td>
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<tr>
<td></td>
<td>Melolonthidae</td>
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<td></td>
<td>Rutelidae</td>
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<td>Glaphyridae</td>
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<td>Scarabaeidae</td>
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<td>Dynastidae</td>
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<td>Helophoridae</td>
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<td>Staphyloidea</td>
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</table>
FIRST FAUNISTICAL RECORDS OF DERMESTIDAE (COLEOPTERA) IN ELAZIĞ PROVINCE (TURKEY)

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ABSTRACT: In this study, a total of 8 species of 3 genera belonging to 3 subfamilies (Dermestinae, Attageninae, Megatominae) from the family Dermestidae were recorded from Turkey. All of species is firstly recorded in Elazığ province of Turkey.

KEY WORDS: Coleoptera, Dermestidae, faunistics, new regional record, Elazığ, Turkey

Dermestidae is one of the smallest beetle families. This family includes more than 1600 species grouped into 62 genera (Háva, 2015). The Larvae and adults found on carcasses, dry museum specimens, homes, stored food, nests (bees, wasps, birds). Adults of some found on frequent flowers. Larder beetles (Deremestes spp.), Carpet beetles (Anthrenus spp.) and Fur beetles (Attagenus spp.) are widespread and common. In Turkey; Some faunistic studies on the family Dermestidae have been conducted by foreign and native researchers in Turkey (Lodos, 1998; Háva, 2000, 2002, 2003a,b, 2006, 2007; Háva & Tezcan, 2004, Tezcan et al., 2004; Háva & Herrmann, 2010; Bulak et al., 2013). In this paper new faunistic records of 8 species belonging to the family Dermestidae (Coleoptera) are given in Elazığ province of Turkey.

MATERIAL AND METHODS

The Dermestidae material was collected from Elazığ in Turkey between 2013 and 2017. The insect samples for this study were collected by pig carcas and egg trap. Some specimens were collected by sweep net.

RESULTS

Family Dermestidae
Subfamily Dermestinae

*Dermestes (Dermestinus) undulatus* Brahm, 1790

Material: Elazığ, Harput, 20.7.20131, 3 exc.
Distribution of Turkey: European Turkey (Háva, 2007).
General Distribution: Holarctic species (Háva, 2015).

*Dermestes (Dermestinus) frischii* Kugelann, 1792

Distribution of Turkey: Erzurum (Bulak et al., 2013), İzmir (Tezcan et al., 2004).

*Dermestes (Dermestinus) intermedius intermedius* Kalik, 1951

Material: Elazığ, Baskil, 12.7.2013, 5 exc.
Distribution of Turkey: Muş (Bulak et al., 2013).
General Distribution. Species known from Austria; Bulgaria; Czech Republic; Crete; Croatia; Cyprus; Germany; Greece; Hungary; Italy; Macedonia; Romania; Russia: Ingushetia Republic, Osetia; Slovakia; Turkey; Ukraine (Háva, 2015).

**Dermestes (Dermestinus) erichsoni Ganglbauer, 1904**

**Material:** Elazığ, Ağın, 23.5.2005., 3 exc.

**Distribution of Turkey:** European Turkey (Anonymous, 2017).

**General Distribution.** Species known from Europe; Turkey; Ukraine; Caucasus; W Russia; Syria; Algeria; Morocco; Tchad?; Tunisia (Háva, 2015).

**Dermestes (Montandonia) oliveri Lepesme, 1939**

**Material:** Elazığ, Harput, 20.07.2013, 35 exc.

**Distribution of Turkey:** European Turkey (Háva, 2007).

**General Distribution:** Central and South Europe; Armenia; Cyprus; Georgia; Ukraine; Turkey; Tunisia; Caucasus; Iran; Lebanon; Russia; Syria; Turkmenistan (Háva, 2015).

**Subfamily Attageninae**

**Attagenus dispar Redtenbacher, 1843**

**Material:** Elazığ, Baskil, Doğancık, 23.5.2017, 2 exc.

**Distribution of Turkey:** European Turkey (Háva, 2015).

**General Distribution:** Species known from Armenia; Greece; Turkey; Egypt; Iran; Syria (Háva, 2015).

**Subfamily Megatominae**

**Trogoderma versicolor Creutzer, 1799**

**Material:** Elazığ, Baskil, 22.7.2014, 8 exc.

**Distribution of Turkey:** Afyonkarahisar, Diyarbakır (Kalkan, 1963; Güler, 2012).

**Distribution.** Cosmopolitan species (Háva, 2015).

**Trogoderma granarium Everst, 1899**

**Material:** Elazığ, Baskil, 11.6.2015, 5 exc.

**Distribution of Turkey:** Widespread (Tezcan et al., 2004; Hava, 2015).

**Distribution.** Cosmopolitan species (Háva, 2015).

This is the first study in Elazığ province regarding the species of Dermestidae family. The study contains brief information on the distribution of this family species. Most of the species found in the region were detected for the first time in Elazığ fauna. *D. undulatus* and *D. frischii* species among these species were detected on the stinking egg in the egg sampling. Also, *T. granarium* and *T. versicolor* thar are the other two of these species are among important species in our country and worldwide in terms of economic entomology. Especially, *T. granarium* species has been shown on the invasive species list in our country (Öztemiz & Doğanlar, 2015).

**LITERATURE CITED**


NEW FAUNISTIC RECORDS OF WATER AND RIPARIAN BEETLES (COLEOPTERA) FROM TURKEY

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*** Şırnak Directorate of Agricultural Quarantine, Şırnak, TURKEY.


ABSTRACT: Paper presents results of studies of various freshwater habitats on cotton fields in the Şırnak province of Turkey. Studies were carried between years 2014-2015 in two localities (Cizre and Silopi). Hydaticus histrio Clark is recorded from Turkey for the second time. Laccophilus minutus (L.) and Heterocerus fenestratus (Thunb.) are recorded for the first time from the Şırnak province. New records of Hydroglyphus geminus (Fabr.), Laccobius syriacus Guill., Bidessus calabricus Guignot and Enochrus quadripunctatus (Herbst) for fauna of the Sotheastern Anatolia Region are given. The most abundant species was H. geminus (Fabr.).

KEY WORDS: Coleoptera, Dytiscidae, Hydrophilidae, Heteroceridae, Şırnak province, faunistic, new regional records

Water beetles of Turkey are rather good recognized. Papers summarizing knowledge of recorded species where recently published for Gyrinidae, Haliplidae, Noteridae, Dytiscidae (Darılmaz & Kıyak, 2009; Erman et al., 2015) and Hydrophilidae (İncekara & Mart, 2003; Darılmaz & İncekara, 2011). We presents new data of some water and riparian beetles form Dytiscide, Hydrophilidae and Heteroceridae families.

MATERIAL AND METHODS

Materials were collected from various natural and artificial aquatic environments on cotton fields in Şırnak province in two localities: Cizre and Silopi cities (Fig. 1.). Beetles were collected from May to September in year 2014 and in the same period in year 2015.

Materials were sampled from the water, water surface and shore using hand net. Light traps were also used, in addition to other sampling methods, since many beetle species are active in the night. One light trap situated 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. Traps were emptying at two weeks interval. All the collected material was placed and kept in tubes with 96% ethanol.

The collected material is deposited in Bioengineering Department Laboratory of Firat University.

RESULTS AND DISCUSSION

Family Dytiscidae

Hydaticus histrio Clark, 1864

Distribution in Turkey: Şanlıurfa (Erman et al., 2015).
Remarks: Species distributed in south Asia, mainly in “Near East”, Arabian Peninsula and India. It is recorded from (from west to east): Saudi Arabia, Yemen, Oman, United Arab Emirates, Iraq, Iran, Afghanistan, Pakistan, India (Nilsson & Hájek, 2017). Species recorded from Turkey for the second time. This is most north-western locality of this species in its range.

**Hydroglyphus geminus** (Fabricius, 1792)


Remarks: This species is recorded for the first time from the Southeastern Anatolia Region.

**Bidessus calabrinus** (Guignot, 1957)


Remarks: This species is recorded for the first time from the Southeastern Anatolia Region.

**Laccophilus minutus** (Linnaeus, 1758)

Distribution in Turkey: Widespread species in Turkey (Erman & Erman, 2008).

Remarks: Recorded for the first time from the Şırnak province.

Family Hydrophilidae

**Lacobius syriacus** Guillebeau, 1896

Distribution in Turkey: Widespread species in Turkey (Darılmaz & İncekara, 2011; Mart et al., 2014).

Remarks: Recorded for the first time from the Şırnak province.

**Enochrus quadripunctatus** (Herbst, 1797)


Remarks: This species is recorded for the first time from the Southeastern Anatolia Region.

Family Heteroceridae

**Heterocerus fenestratus** (Thunberg, 1734)


Remarks: Recorded for the first time from the Şırnak province.
Among the identified species \textit{H. geminus} was the most abundant. All the species are recorded for the first time from the Sirnak province and the majority are also new for the in Southeastern Anatolia region.

\textbf{LITERATURE CITED}


Figure 1. Location of collecting sites.
A NEW SPECIES OF MEGASTIGMUS (HYMENOPTERA: TORYMIDAE: MEGASTIGMINAE) FROM UŞAK, TURKEY

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ABSTRACT: In this paper a new parasitoid Megastigmus Dalman, 1820 (Hymenoptera: Chalcidoidea: Torymidae: Megastigminae) species, M. usakensis sp. nov., was described from Uşak, Turkey.

KEY WORDS: New species, Chalcidoidea, Uşak, Turkey

Megastigmus (Hymenoptera: Chalcidoidea: Torymidae) was described by Dalman (1820) as the subgenus Torymus Dalman with its type species being Pteromalus bipunctatus Swederus, 1795. Later, Megastigmus was recorded as a valid genus by several authors (Curtis, 1829; Walker, 1833; Dalla-Torre, 1898; Ashmead, 1900, 1904). Crosby (1913) designated its type species as P. bipunctatus. Boucek (1988) keyed out Megastigma in the Subfamily Megastigmidae, and provided the diagnostic characters of the genus, stated that the genus contains 44 species in Australia, 35 spp. from Holarctic region in America south only to Mexico, but about 3 spp. are present in the Old World in eastern and southern Africa, while South Asia has at least 15 spp., and 1 species is found on Fiji. Grissell (1999) listed 133 world species with 5 subspecies of Megastigmus including 9 species of Bootanomyia, and gave their synonyms, distributions and literature references, and stated that 19 keys to the species of Megastigmus were provided by several authors in the world. In the last two decades some more species of Megastigmus were described (Xu & He, 1995; Xu et al., 1998; Roques & Skrzypczynska, 2003; Grissell, 2006; Doğanlar & Hassan, 2010; Doğanlar et al., 2013; Doğanlar, 2015; Roques et al., 2016; Doğanlar et al., 2017). Noyes (2017) listed 154 world species of Megastigmus, 5 of them as unavailable name in current taxon, and gave their synonyms, distributions and literature lists.

Up to now, 8 species of Megastigmus have been recorded from Turkey by several works (Novicky, 1954; Hussey, 1957; Lessmann, 1962; Öncüer, 1991; Fabre et al., 1994; Roques et al., 1999; Gencer, 2003; Roques & Skrzypczynska, 2003; Auger-Rozenberg et al., 2006; Daneshvar, 2009; Ayberk & Cebeci, 2010; Doğanlar & Doğanlar, 2010; Stojanova, 2012). Recently, the specimen of Megastigmus sp. was obtained from pane trap in the orchard of mixed trees of apple, pear and cherry in Uşak, Turkey. It was sent to the first author for identification, and it was described as a new species for science.

MATERIAL AND METHOD

The type specimen of the new species was obtained from pane trap in the orchard of mixed trees of apple, pear and cherry in Uşak, Turkey.

The left antenna of the holotype was slide-mounted in Canada balsam. The holotype of the new species was deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC). Photographs of diagnostic characters of the new species were taken by using of Leica DM 500 microscopes with a digital Leica ICC 50 camera attached to it.

RESULTS AND DISCUSSION

Megastigmus usakensis sp. nov.
(Figs. 1a-h)

Description of Female. Length (body+ ovipositor): 1.88 + 0.5 mm. Colour: Body (Fig. 1a) yellow, except occiput, metasoma dorsally tan, ovipositor sheaths black and ovipositor brown. Wigs hyaline, veins white, except apical part of stigma, tips of marginal vein, stigma and area blow stigma, as long as length of stigma, black; antennae three colorized, scape yellow in ¾ basally and testaceous apically, pedicel yellow, anelli, F4 and club white, F1-F3 pale testaceous, F5 testaceous, F6 and F7 black. Pilosity of body black, Legs almost white, except pretarsi black.

Morphology: Head (Figs. 1a-d) with fine transverse striae, face almost smooth. Antennae inserted slightly above lower ocular line. Relative measurements: head dorsally about twice as wide as long; in lateral view 1.32x as height as dorsal length ; frons width 2.54x eye width in frontal view; POL 2x OOL=MOL, Odia. ½ OOL, eye 1.28x as long as width; malar space 0.46x as long as width; anterior margin of clypeus slightly incised. Antennae (Fig. 1a,e) clavate, flagellar segments F1-F4 longer than width, F1- F3 in same length, F1 2x, F2-F3 1.75x as long as width; F4 slightly wider and shorter than preceding segments, 1.33 × longer than width, F5-F7 distinctly wider than preceding segments, almost same length, F5 1.08x, F6 slightly transverse, 0.86x as long as width, F7 distinctly transverse, as long as width; combined length of flagellum with pedicellus slightly shorter than width of head (12:13) and 2.35x transverse diameter of eye. Scape with 2-3 rows of setae dorsally, nearly cylindrical, distinctly broader medially, with distinct, deep cavity in frontal side, 5x as long as width, and slightly longer than transverse diameter of eye. Pedicel 2.25x as long as width, 1.12x as long as anelli plus F1. Club 0.9x as long as 3 preceding segments combined, 2x as long as width, ventrally without micropilosity. Sensillae on flagellum long and sparse, with 2-3 longitudinal linear sensillae in a row.

Mesosoma (Fig. 1a) 1.62 × as long as mesoscutum width, and as wide as height; pronotum about 1.5 × as wide as long; mesonotum about 0.8x × as long as width, with fine transverse striae, 3 pairs of setae, along deep notauli; scutellum (Figs. 1g,f) as long as broad, with fine reticulation, frenal groove distinct, fraenum almost smooth, 0.58x as long as scutellum, hind margin of scutellum distinctly carinate; scutellum with 2 pairs of setae on each side; axillae longitudinally striate, with 1 seta. Forewing (Fig. 1h) 2.36 × as long as broad, costal cell with one complete row and in apical half a second row of setae, speculum broad, closed below, basal and cubital veins with 5-6 hairs, basal cell almost bare, closed, with a row of minute setae in basal half. Stigma almost as long as width, petiolate, stigmal vein 1.2x as long as width. Relative measurements of forewing: costal cell 47: 6; parastigma 17, marginal vein 28, post marginal vein 28, stigmal vein 3, stigma (l: w) 8: 8.5, uncus 3. Hind wing 4.4 × as
long as broad. Hind coxae dorsally carinate, with 3-4 setae. Propодеum (Fig. 1g) 0.77 × as long as scutellum, about 0.68x as long as distance between inner edges of spiracles, median carina absent, plicae complete, finely reticulated, spiracles distinctly separated from posterior margin of metanotum, callus with 7-8 fine setae.

Metasoma (Fig. 1a) with distinct petiole, almost as long as mesosoma, broad, 2x as long as broad, its dorsal surface smooth. Ovipositor sheath 0.56 × as long as metasoma and 1.3x as long as hind tibia.

Male: Unknown.

Material Examined: HOLOTYPE female. TURKEY, Uşak, Banaz, Bağkonak village, 38° 44′ 47″ N, 29° 45′ 42″ E, 29, IX. 2017, leg. E. Zengin, taken from pan trap, in the orchard mixed with apple, plum and pear trees. Type of the new species was deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC).

Host: Unknown.

Distribution. Turkey: Uşak.

Remarks. *Megastigmus usakensis* sp. nov. is a unique species in having colorized antennae, beside this character, it would be similar to *Megastigmus helinae* Roques & Copeland, 2016 and *Megastigmus smithi* Roques & Copeland, 2016 in having ovipositor sheaths much shorter (0.4–0.6x) than length metasoma but it differs from both of them in having body colour yellow without any black band on the body (in the both species with a narrow black band along anterior suture of pronotum or median rufous band extending from pronotum to scutellum and parts of gaster dark brown (Roques et al., 2016).

**LITERATURE CITED**


Curtis, J. 1829. A guide to an arrangement of British Insects; being a catalogue of all the named species hitherto discovered in Great Britain and Ireland London, pp: 256.


Figure 1. *M. usakensisis* sp. nov. female. a, body, in lateral view; b-d, head, in lateral view; c, in dorsal view; d, fronto-lateral view; e, antenna; f, scutellum; g, propodeum and petiole; h, forewing. (Scale bar: for a = 1.5 mm; for b-d = 0.44 mm; for e = 0.13 mm; for f, g = 0.53 mm.).
TAXONOMIC INVESTIGATIONS ON BRACONIDAE (HYMENOPTERA) FAUNA OF BITLIS NEMRUT CALDERA AND ITS AROUND

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ABSTRACT: In order to determine Braconidae fauna of Turkey, adult specimens of Braconidae (Hymenoptera, Braconidae) were collected from various habitats of Bitlis Nemrut Caldera and its around using Malaise and light traps and sweeping nets among 2013 and 2016. The Nemrut volcano or the Nemrut Stratovolcan include the second largest crater lake in the world. The Bitlis Nemrut Mountain Caldera was regarded as a biodiversity center in 2002 and has been declared a natural area. Because it is hosting different plant and animal species. In this research were recorded height, coordinates and dominant plant genus as ecological information of the working area. Obtained material was prepared according modern taxonomic rules and appropriately labeled. Relevant literature and comparison material available in our collection was used for taxonomical examination of the material collected. The altitudes and coordinates of localities, collection dates are given. In total, 39 species belonging 12 genera of 9 subfamilies are reported for the studied region. Opius (Utetes) curtipes (Fischer, 1958) is new to the fauna of Turkey.

KEY WORDS: Stratovolcano, Nemrut Caldera, Bitlis, Braconidae, Hymenoptera

Nemrut volcano or Nemrut Stratovolcano is located on south-western shore of Ahlat and Tatvan districts found in Bitlis provincial border boundaries of Lake Van. Its elliptic diameter is 7-8 km. There are a cold water lake with 155-m depth and a small hot water lake (Ilıksu) on the west of the Caldera. The cold water lake is the second biggest crater lake in the world. The summit of the mountain is 3050 m high. Sivritepe, the highest hill, is 2935 m high, Eastern Nemrut Hill is 2625 m high, Tursuktepe in the south is 2828 m high, and Hill of Mount Nemrut in the west is 2801 m high (Fig. 1). Mount Nemrut in Bitlis is one of the highest mountains of Eastern Anatolia region. Nemrut volcano is a dormant volcano and erupted lava in 1441 for the last time. Crater chimneys erupting hot vapor also exist sporadically in the Caldera. Caldera of Mount Nemrut, Bitlis, was considered as a center of biological diversity in 2002 in terms of its plant and animal species and announced as the nature site. Mount Nemrut, Bitlis, also formed a basis for formation of Lake Van as a result of volcanic eruptions (Kemal & Koçak, 2006).

Caldera of Nemrut is habitat for numerous species such as communities of Silver birch (Betula pendula), Eurasian aspen (Populus tremula), Norway maple (Acer platanoides), different species of Service tree (Sorbus spp.), Alder buckthorn (Frangula alnus), Cotoneaster Lacteus (Cotoneaster sp.), Mahaleb cherry (Cerasus mahaleb), Plum (Prunus sp.), Oak species (Quercus spp.), Juniper (Juniperus communis), and Crater buttercup (Ranunculus crateris) which is endemic to crater (Büyüksaraç et al., 2016). In addition to these plant communities, it also hosts a great number of herbaceous plants (45-500 taxa).
Fauna of Nemrut Caldera includes hedgehog (Erinaceus concolor), brown hare (Lepus europaeus), microtus pennsylvaticus (Microtus schidlovskii), Anatolian ground squirrel (Spermophilus xanthophrymnus), Anatolian lesser mole (Nannospalax xanthodon), red fox (Vulpes vulpes), beech marten (Martes foina), marbled polecot (Vormela peregusna), Brown bear (Ursus arctos), and wild boar (Sus scrofa) among mammal species (Büyüksaraç et al., 2016).


Braconids are parasitoid insects and live as parasitoid on larvae and pupae of holometabolous insects (Coleoptera, Diptera, Hymenoptera, Lepidoptera, Trichoptera) except for Megaloptera and Siphonaptera, on eggs of Pseudoscorpionida and Araneae from Chelicerata, and adults of Araneae (Yu et al., 2012). These lead to death of host insect species (generally plant pest) on which they live in the nature and conserve the natural balance in biosystem. Braconids are used in biological control due to these characteristics.

**MATERIAL AND METHOD**

The present study was completed in three stages:

**a. The material collection:** Plants found on the Mount Nemrut, Bitlis and its surrounding are separated into following formations of vegetation in terms of physiognomic-ecological characteristics: Herbages (Steppes), Mountain Steppes, Large pasture (pastures of Steppe), Anthropogenic Steppes, Communities of Shrubs, and Forest Communities. Based on these regions, the materials were
collected within the scope of BEBAP (Bitlis Eren University Scientific Research Projects) 2013.05 project by going to these regions between July - October in 2013 and between April - October in 2014 and 2015. However, the region which was not visited frequently due to security was also studied within the scope of the BEBAP 2016.06 project. In the daytime, samples were collected from weeds, cultivated plants, and trees with the aid of an atrap made of thin nylon gauze. Adult individuals were separated from other materials with suction tube and immediately exterminated in suction tubes with cigarette smoke or in extermination bottles containing ethyl-acetate. They were taken to laboratory inside material storage containers. Samples coming into Malesia traps which were established in certain locations were selected and taken into storage containers. Nocturnal species were caught with light traps established at nights. During the field studies, the date of study, coordinates, heights, and dominant plants (at least genus or family level) of localities where the study was conducted were recorded. Information on parasitoids, hosts, general distributions (in terms of zoogeographical region) and parasitoids of species are given according Belokobylskij & Tobias (2000), Tobias (1986), and Yu et al. (2012). In the text, the host plants of host species are shown in brackets.

**b. Preparation:** When returning from field study, samples were cleansed from ethyl alcohol by transferring into distilled water and dried on plain paper by revealing morphological characteristics which are crucial for identification. Then they were glued onto triangle cardboards attached on insect needles and marked with tags of locality.

**c. Taxonomic Examination:** Comparison material in our collection and related literature were utilized when evaluating the study material (van Achterberg, 1976, 1990; Belokobylskij, 1993; Belokobylskij & Tobias, 2000; Beyarslan & Çetin Erdoğan, 2011, 2012; Beyarslan & Fischer, 1990, 2011, 2013; Beyarslan & Tobias, 2008; Fischer, 1972; Fischer & Beyarslan, 2005a; Papp, 1989, 1990; Shaw & Huddleston, 1991; Telenga, 1936; Tobias, 1986). An asterisk (*) was used within the text for the species that were recorded in Coldera.

## RESULTS

**Family: Braconidae**

1. **Subfamily: Agathidinae**
   1.1. **Genus: *Agathis* Latreille, 1804**

   *Agathis malvacearum* Latreille, 1805

   **Material examined:** Bitlis, Tatvan, Küçükçsu, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°N, 42°19’17″E), 1784 m. 13.06.2015, 15♀♀, 30♂♂.

   **Hosts:** Lepidoptera. Coleophoridae: *Coleophora galbulipennella* Zeller, 1838 [Silene sp.]; *C. graminicolella* Heinemann, 1877. Pterophoridae: *Hellinsia didactylites* (Ström, 1783); *Hellinsia didactylites* (Ström, 1783). Gelechiidae: *Metzneria aestivella* (Zeller, 1839); *M. lappella*. (Linnaeus, 1758). [Arctium minus]; Pexicopia malvella (Hübner, 1805); *Phalaena resinella* Linnaeus 1758.

   **Distribution:** Holarctic.

2. **Subfamily: Braconinae**
   2.1. **Genus: *Bracon* Fabricius, 1804**

   2.1.1. **Subgenus: *Bracon* (s.strs.) Fabricius, 1804**

   *Bracon (Bracon) chagrinishis* Beyarslan, 2002

   **Material examined:** Bitlis, Tatvan, Küçükçsu, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°26’14″N, 42°19’17″E), 1784 m. 05.08.2014, 1♀.

   **Hosts:** Unknown.
Distribution: West Palaearctic.

*Bracon (Bracon) intercessor Nees, 1834

Material examined: Bitlis, Tatvan, Küçük, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Hypericum sp.) (38°26′14″N, 42°19′17″E), 1784 m. 05.09.2014, 3♀; (38°26′14″N, 42°19′17″E), 1784 m. 05.08.2014, 2♂; Bitlis, Ahat, Abdurahman Gazi (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Hypericum sp.) (38°45′27″N, 42°31′41″E), 1649 m. 05.09.2014, 1♂; Bitlis, Nemrut Dağı, Büyüük Göl, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°38′35″N, 42°14′28″E), 2488 m. 07.06.2014, 1♂; (38°37′10″N, 42°14′28″E), 2247 m. 13.09.2014, 1♂.

Hosts: Chalcidoidea. Eurytomidae: Tetramesa hyalipennis (Walker, 1832); Tetramesa rossica (Rimsky-Korsakov, 1914). Coleoptera, Attelabidae: Attelabus nitens (Scopoli, 1763). Cerambycidae: Agapantha villosorodescens (De Geer, 1775) [Aster tripolium]; Agapantha violacea (Fabricius, 1775); Phytoclea coerulescens (Scopoli, 1763) [Anchusa sp.]. Curculionidae: Anthonomus (Anthonomus) pedicularius (Linnaeus, 1758); A. (A.) pomorum (Linnaeus, 1758); A. sorbi Germain, 1821; Curculio crux Fabricius, 1777; Curculio salicivorus Paykull, 1792; Lixus (Eulixus) brevirostris Boheman, 1835, L. (E.) incanescens Boheman, 1835 [Atriplex patula hastata]; L. (Compsolixus) juncii Boheman, 1835; Microlarinus kirchbaumeri (Jaekelin du Val, 1852); M. lypriformis (Wollaston, 1861); Sibinia femoralis Germain, 1824. Rynchitidae: Rynchites bacchus (Linnaeus, 1758); Brentidae: Apion opeticum Bach, 1854. Diptera. Agromyzidae: Liriomyza huidobrensis (Blanchard, 1926). Lepidoptera. Coleophoridae: Augasma atraphaxidellum (Kuznetsov, 1957); Gelechiidae: Scrobipalpus obsoletella (Fischer von Rösslerstamm, 1841). Sesiidae: Chamaesnecia astatiformis (Herrich-Schäffer, 1845), Paranthrene tabaniformis (Rottentberg, 1775) [Populus sp.]; Synanthedon culiciformis (Linnaeus, 1758). Tortricidae: Sparganothis pilleriana (Voukassovitch, 1924); Yponomeutidae: Argyresthia conjugella Zeller, 1839. Hymenoptera. Tenthredinidae: Pontania (Eupontania) acutifoliae Zinovjev, 1985; P. bella (Zaddach, 1876); P. (Eupontania) kriechebaumeri Konow, 1901; P. (P.) nigricantis (Kopelke, 1886), [Salix nigricans]; Pontania (Eupontania) pedunculi (Hartig, 1837); Pontania vesicator (Bremi-Wolf, 1849); Pontania (Eupontania) viminalis (Linnaeus, 1758).

Distribution: Palaearctic.

*Bracon (Bracon) longicollis (Wesmael, 1838)


Hosts: Diptera. Chloropidae: Chlorops (Chlorops) pumilionis (Bjerkander, 1778) [Hordeum vulgare].

Distribution: Oriental, Palaearctic.

*Bracon (Bracon) luteatus Spinola, 1808

Material examined: Bitlis, Tatvan, Küçük, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Hypericum sp.) (38°26′14″N, 42°19′17″E), 1784 m. 09.08.2014, 2♂♀; Bitlis, Tatvan, Küçük, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Hypericum sp.) (38°26′14″N, 42°19′17″E), 1784 m. 05.08.2014, 1♂; Bitlis, Ahat, Sari Kum Village, (Allium sp., Anchusa sp., Astragallus sp., Hypericum sp.) (38°37′23″N, 42°25′01″E), 1688 m. (38°37′23″N, 42°25′01″E), 1688 m. 06.07.2014, 1♀; Bitlis, Nemrut Dağı, İlık Göl, (38°37′10″N, 42°14′28″E), 2485 m. 13.08.2014, 3♂♀. Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°37′10″N, 42°14′28″E), 2485 m. 13.08.2014, 1♀.


Distribution: Palaearctic.
**Bracon (Bracon) nigratus** (Wesmael, 1838)

**Material examined:** Bitlis, Tatvan Mezra (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Hypericum sp.) (38°28′56″N, 42°18′40″E), 1654 m. 13.09.2014, 1♂.

**Hosts:** Diptera. Tephritidae. Chaetostomella cylindrica (Robineau-Desvoidy, 1830).

**Lepidoptera. Coleophoridae:** Coleophora millefolii Zeller, 1849. Tortricidae: Cydia composiformis (Fabricius, 1775). Zygaenidae: Zygaena (Mesembrynum) minos (Denis & Schiffermüller, 1775); Zygaena minos ([Denis & Schiffermüller], 1775).

**Distribution:** Palaeartic.

*Bracon (Bracon) quercus* Tobias, 1986

**Material examined:** Bitlis, Nemrut Dağı, Ilık Göl, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°37′10″N, 42°14′28″E), 2485 m. 13.09.2014, 1♂, 1♀; Bitlis, Tatvan Mezra (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Hypericum sp.) (38°28′56″N, 42°18′40″E), 1654 m. 13.09.2014, 1♂; Bitlis, Nemrut Dağı, Büyük Göl, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°38′35″N, 42°41′15″E), 2488 m. 13.09.2014, 2♂♂.

**Hosts:** Unknown.

**Distribution:** West Palaeartic.

*Bracon (Bracon) trucidator* Marshall, 1888

**Material examined:** Bitlis, Nemrut Dağı, Ilık Göl, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°37′10″N, 42°14′28″E), 2485 m. 13.09.2014, 1♀, 2♂♂.

**Hosts:** Coleoptera. Curculionidae: Ceutorhynchus fairmairei Brisout, 1880.


**Distribution:** Palaeartic.

2.1.2. Subgenus: *Glabrobracon* Fahringer, 1927

*Bracon (Glabrobracon) lvidus* Telenga, 1936

**Material examined:** Bitlis, Tatvan, Küçük, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Hypericum sp.) (38°26′14″N, 42°19′17″E), 1784 m. 05.08.2014, 2 E, 1♀; Bitlis, Ahlat, San Kum Village, (Allium sp., Anchusa sp., Astragallus sp., Hypericum sp.) (38°37′23″N, 42°25′01″E), 1688 m. 06.09.2014, 1♂.

**Host:** Hymenoptera. Tenthredinidae: Pontania vesicator (Bremi, 1849).

**Distribution:** Palaeartic.

*Bracon (Glabrobracon) popovi* Telenga, 1936

**Material examined:** Bitlis, Tatavan, Küçük, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Hypericum sp.) (38°26′14″N, 42°19′17″E), 1784 m. 05.08.2014, 1♀.

**Hosts:** Unknown.

**Distribution:** Palaeartic.

*Bracon (Glabrobracon) variator* Nees, 1811

**Material examined:** Bitlis, Tatavan, Küçük, (Allium sp., Anchusa sp., Astragallus sp., Cyperus sp., Hypericum sp.) (38°26′14″N, 42°19′17″E), 1784 m. 5.8.2014, 1♀.

**Hosts:** Coleoptera. Anobiidae: Ernobius nigrinus (Sturm, 1837). Buprestidae: Coraebus florentinus (Herbst, 1801). Chrysomelidae: Bruchidius lividimanus (Gyllenhaal, 1833); B. poupillieri Allard, 1868; Bruchus atomarius ( Linnaeus, 1761); B. laticollis Boheman, 1833; B. lentis Frölich, 1799; B. viciae Olivier, 1795. Curculionidae: Anthonomus pomorum (Linnaeus, 1758); Baris chlorizans Germar, 1837; B. cupriostris German, 1817; B. laticollis (Marsham, 1802); Ceutorhynchus assimilis Paykull, 1792; C. punctiger (Gyllenhaal, 1837); Gymnetron asellus (Gravenhorst, 1807); G. campanulata (Campanulaceae) Schoenherr, 1825; G. tetrum (Fabricius, 1792); Larinus flavescens German, 1824; L. jaceae (Fabricius, 1775); L. planus German, 1824; L. turbinatus (Gyllenhaal, 1836); Magdalis rufa German, 1824; Pissodes validirostris Gyllenhaal, 1835; Sibinia viscaria Linnaeus, 1761; S. viscariae (Silene inflata) Linnaeus, 1761; Sitona longulus Gyllenhaal, 1834. Diptera: Tephritidae: Sphenella marginata Fallen, 1814; Chaetostomella cylindrica (Robineau-Desvoidy, 1830); Noeta pupillata Fallen, 1814; Tephritis
2.1.3. Subgenus: Orthobracon Fahringer, 1927

*Bracon (Orthobracon) longiantennatus* Tobias, 1957

Material examined: Bitlis, Tatvan, Küçük, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°2614″N, 42°19'17″E), 1784 m. 19.08.2014, 1♀; Bitlis, Nemrut Dağı, İlh Göl, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°37°10″N, 42°14'28″E), 2485 m. 05.09.2014, 1♀.

Hosts: Unknown.

Distribution: Eastern Palaeartic.

2.1.4. Subgenus: *Pigeria* van Achterberg, 1985

*Bracon (Pigeria) piger* (Wesmael, 1838)

Material examined: Bitlis, Tatvan, Küçük, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°2614″N, 42°19'17″E), 1784 m. 09.08.2014, 1♂; Bitlis, Ahlat, Abdurrahman Gazi, (Allium sp., Anchusa sp., Astragalus sp., Hypericum sp.) 38°45'27″N, 42°31'41″E), 1689 m. 09.08.2014, 1♂;

Hosts: Coleoptera. Curculionidae: Pissodes validirostris (Sahlberg, 1834). Lepidoptera. Tortricidae: Cnephasia longana (Haworth, 1811); Cydia nigricana (Fabricius, 1794). Noctuidae: Heliothis peltigera ([Denis & Schiffermüller], 1775). Pyralidae: Etia zinckene (Treitschke, 1832).

Distribution: Holartic.

2.2. Genus: Glyptomorpha Holmgren, 1868

2.2.1. Subgenus: Glyptomorpha Holmgren, 1868

Glyptomorpha (Glyptomorpha) pectoralis (Brullé, 1832)

Material examined: Bitlis, Tatvan, Küçük, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°2614″N, 42°19'17″E), 1784 m. 05.08.2014, 1♀.

Hosts: Coleoptera. Buprestidae: Chrysobothris affinis (Fabricius, 1794); Sphenoptera gossypii Kerremans, 1892; S. laticollis (Oliver, 1790); S. montana Dejean, 1833. Cerambycidae: Plagionotus arcuatus (Linné, 1758).

Distribution: Afrotropical, Oriental, Palaeartic.

2.3. Genus: Pseudovipio Szépligeti, 1896

*Pseudovipio inscriptor* (Nees, 1834)

Host: Lepidoptera. Crambidae: Ostrinia nubilalis (Hübner, 1796).
Distribution: Palaearctic.

3. Subfamily: Cheloniinae

3.1. Genus: Ascogaster Wesmael, 1835

*Ascogaster bidentula* Wesmael, 1835

Material examined: Bitlis, Nemrut Dağı Krater Lake, (Anchusa sp., Astragalus sp., Cyperus sp., Euphorbia sp., Juniperus sp., Quercus sp., Pinus sp.), (38°37′10″N, 42°14′28″E), 2485 m. 18.07.2015, 3♀.

Hosts: Lepidoptera. Tortricidae: Archips rosana Linnaeus, 1758, Epinotia cruciana (Linnaeus, 1761). Geometridae: Eupithecia venosata (Fabricius, 1787), Gypsonoma sociana (Haworth, 1811), Notocelia roborana, Pandemis sp., Rhopobota myrtillana (Humphreys & Westwood, 1845).

Distribution: Oriental, Palaearctic.

*Ascogaster excisa* (Herrich-Schäffer, 1838)


Hosts: Unknown.

Distribution: Palaearctic.

*Ascogaster similis* (Nees, 1816)


Distribution: Palaearctic.

3.2. Genus: Chelonus Panzer, 1806

3.2.1. Subgenus: Chelonus s.str.) Panzer, 1806

*Chelonus* (Chelonus) corvulus Marshall, 1885


Hosts: Lepidoptera. Noctuidae: Agrotis segetum. ([Denis & Schiffermüller], 1775), Chortodes elymi (Treitschke, 1825). Coleophoridae: Coleophora anatipennella. (Hübner, 1796). Tortricidae: Cydia corticana Hübner, 1825, Zeiraphera isertana (Fabricius, 1794), Pyralidae: Eupithecia venosata (Fabricius, 1787), Bupalus piniarius (Muller, 1758), Prodenia cinerella (Lederer, 1825), Holcotaena cerata (Linnaeus, 1758), Loxostege sticticalis, (Linnaeus, 1761).

Distribution: Palaearctic.

3.2.2. Subgenus: Stylochelonus Hellén, 1958

*Chelonus* (Stylochelonus) mucronatus Thomson, 1874
Material examined: Bitlis, Ahlat, Sarı Kum Village, (Allium sp., Anchusa sp., Astragalus sp., Hypericum sp.) (38°37'23″N, 42°19'17″E), 1684 m.

Hosts: Unknown.

Distribution: Palaeartic.

4. Subfamily: Euphorinae

4.1. Genus: Wesmaelia Förster, 1862

Wesmaelia petiolata (Wollaston, 1858)

Material examined: Bitlis, Tatvan, Küçükku, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°26'14″N, 42°19'17″E), 1784 m. 15.08.2014, 1♂.

Hosts: Nemiptera, Holarctic and Oriental.

4. Subfamily: Hormiinae

5.1. Genus: Hornius Nees, 1819

Hornius moniliatus (Nees, 1811)

Material examined: Bitlis, Tatvan, Küçükku, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°26'14″N, 42°19'17″E), 1784 m. 05.08.2014, 6♀, 1♂.

Hosts: Lepidoptera. Coleophoridae: Coleophora trifariaella Zeller, 1849. Crambidae: Achyra nudalis (Hübner, 1796); Hellula undalis (Fabricius, 1781); Paratalanta hyalinalis (Hübner 1796); Pyrausta aurata (Scopoli, 1763) [Menina piperita]; Pyrausta purpuralis (Linnaeus, 1758); Pyrausta sanguinalis (Linnaeus, 1767). Elachistidae: Agonopterix assimilella (Teitschke, 1832). Gelechiidae: Dichomeris marginella (Fabricius, 1781); Pexicopia malvella (Hübner, 1805). Oecophoridae: Agonopterix adspersella (Kollar, 1832); Depressaria pulcherrimella Stainton, 1849. Tortricidae: Archips ceraegeana (Hübner, 1799); Pandemis corylana (Fabricius, 1794). Scythrididae: Scythis inspersella (Hübner 1817).

Distribution: Holarctic and Oriental.

6. Subfamily: Macrocentrinae

6.1. Genus: Macrocenfrus Curtis, 1833

Macrocenfrus collaris (Spinola, 1808)

Material examined: Bitlis, Tatvan, Küçükku, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°26'14″N, 42°19'17″E), 1784 m. 05.08.2014, 3♀, 10♂.

Hosts: Lepidoptera. Coleophoridae: Coleophora trifariaella Zeller, 1849. Crambidae: Achyra nudalis (Hübner, 1796); Hellula undalis (Fabricius, 1781); Paratalanta hyalinalis (Hübner 1796); Pyrausta aurata (Scopoli, 1763) [Menina piperita]; Pyrausta purpuralis (Linnaeus, 1758); Pyrausta sanguinalis (Linnaeus, 1767). Elachistidae: Agonopterix assimilella (Teitschke, 1832). Gelechiidae: Dichomeris marginella (Fabricius, 1781); Pexicopia malvella (Hübner, 1805). Oecophoridae: Agonopterix adspersella (Kollar, 1832); Depressaria pulcherrimella Stainton, 1849. Tortricidae: Archips ceraegeana (Hübner, 1799); Pandemis corylana (Fabricius, 1794). Scythrididae: Scythis inspersella (Hübner 1817).

Distribution: Holarctic and Oriental.
7.1. Genus: **Opis** Wesmael, 1835

7.1.1. Subgenus: **Allophlebus** Fischer, 1972

*Opis (Allophlebus) tabificus* Papp, 1979

**Material examined**: Bitlis, Tatvan, Küçükıkuş, (Allium sp., Anusha sp., Atragallus sp., Cyperus sp., Hypericum sp.) (38°26′14″N, 42°19′17″E), 1784 m. 20.08.2014, 1♀.

**Hosts**: Unknown.

**Distribution**: Afrotropical, Neotropical, Oriental and Palaearctic.

7.1.2. Subgenus: **Cryptonastes** Foerster, 1862

*Opis (Cryptonastes) pygmaeus* Fischer, 1962

**Material examined**: Bitlis, Tatvan, Küçükıkuş, (Allium sp., Atragallus sp., Artjasrallus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp.), (38°26′40″N, 42°19′19″E), 1721 m. 18.08.2014, 1♀, 1♂.

**Hosts**: Diptera. Agromyzidae: Liriomyza cicerinae (Rondani, 1874) [Ononis arvensis]; Phytomyza adjuncta Hering, 1928.

**Distribution**: Palaearctic.

7.1.3. Subgenus: **Merotrichys** Fischer, 1972

*Opis (Merotrichys) filicornis* Fischer, 1963

**Material examined**: Bitlis, Tatvan, Küçükıkuş, (Allium sp., Anusha sp., Atragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp.), (38°26′40″N, 42°19′19″E), 1721 m. 18.08.2014, 1♀, 1♂.

**Hosts**: Diptera. Agromyzidae: Phytomyza scotina Foerster, 1862.

**Distribution**: Neotropical.

7.1.4. Subgenus: **Nosopoea** Foerster, 1862

*Opis (Nosopoea) speciosus* Fischer, 1959

**Material examined**: Bitlis, Tatvan, Mezra, (Allium sp., Anusha sp., Atragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp.), (38°26′40″N, 42°19′19″E), 1695 m. 13.09.2014, 1♂.

**Hosts**: Unknown.

**Distribution**: West Palaearctic.

7.1.5. Subgenus: **Phaedrotoma** Foerster, 1862

*Opis (Phaedrotoma) depeculator* Foerster, 1862

**Material examined**: Bitlis, Tatvan, Küçükıkuş, (Allium sp., Anusha sp., Atragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp.), (38°26′40″N, 42°19′19″E), 1721 m. 10.08.2014, 1♀.

**Hosts**: Diptera. Agromyzidae: Cerodontha denticornis (Panzer, 1806) [Holeus lanatus]; Chromatomyia ramosa (Hendel, 1923); C. succisa, (Hering, 1922); Ophiomyia sp. [Medicago sativa]; Phytomyza griffithsi Spencer, 1963 [Plantago media]; P. plantaginis Robineau-Desvoidy, 1851 [Plantago lanceolata].

**Distribution**: Palaearctic.

*Opis (Phaedrotoma) diversus* (Szépligeti, 1898)

**Material examined**: Bitlis, Tatvan, Mezra, (Allium sp., Anusha sp., Atragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp.), (38°26′40″N, 42°16′52″E), 1695 m. 13.09.2014, 1♂.

**Hosts**: Diptera. Agromyzidae: Calycomyza solidaginis (Kaltenbach, 1869) [Solidago virgaurea]; Chromatomyia scabiosa (Hendel, 1935) [Scabiosa columbaria]; C. succisa, (Hering, 1922); C. syngenesiae, Hardy 1849; Liriomyza centauraeae Hering, 1927 [Centaurae nigra]; Phytomyza gentianaeae Hendel, 1920 [Centaurium minus]; P. plantaginis Robineau-Desvoidy, 1851.

**Distribution**: Palaearctic.

*Opis (Phaedrotoma) exigus* Wesmael, 1835

**Material examined**: Bitlis, Ahat, Abdurrahman Gazi, (Allium sp., Anusha sp., Atragallus sp., Cyperus sp., Euphorbia sp., Hypericum sp.), (38°45′37″N, 42°31′17″E), 1671 m. 16.09.2014, 1♂; Bitlis, Tatvan, Küçükıkuş, (Hypericum sp., Juniperus sp., Quercus

**Hosts. Diptera. Agromyzidae:** Agromyza nana Meigen, 1830 [Medicago sativa, Oxalis pescaprae]; A. rondonis Strobl, 1900 [Hordeum murinum]; Calycomyza solidaginis (Kalchenbach, 1869) [Solidago virgaurea]; Chromatomyia horticola (Goureau, 1851); Chromatomyia scabiosae (Hendel, 1935); Chromatomyia succincta (Hering, 1922); Chromatomyia syngenesiae Hardy, 1849 [Mispates orontium]; Liriomyza sp. [Artemisia vulgaris, Euphorbia paralias]; Liriomyza centaurea Hering, 1927; L. congesta (Becker, 1903); L. flaveola (Fallén, 1823); L. sonchi Hendel, 1931 [Conyza bonariensis]; L. trigata (Meigen, 1830); Phytomyza alpina Groschke, 1957 [Senecio jacobaeae]; Phytomyza cressistella Zetterstedt, 1860; P. gentianaec Hendel, 1920; P. glechomae Kaltenbach, 1862; P. griffithsi Spencer, 1963 [Plantago media]; P. orobanchia (Kaltenbach, 1864) [Orobanche sp.]; P. plantaginis Robineau-Desvoidy, 1851; P. pulula Zetterstedt, 1848 [Achillea millefolium]; Scaptomyza graminis (Fallén, 1823).

**Distribution:** West Palaearctic.

7.1.6. **Subgenus: Utetes Foerster, 1862**

**Opillus (Opillus) curtipes** (Fischer, 1958)

**Material examined:** Bitlis, Tatvan, Mezra, (Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°30.7′N, 42°16.52″E), 1695 m. 23.09.2014, 1♂.

**Hosts:** Unknown.

This species is new to the fauna of Turkey.

**Distribution:** West Palaearctic.

8. **Subfamily: Orgilinae**

8.1. **Genus: Orgilus Haliday, 1833**

*Orgilus (Orgilus) pimpinellae* Niezabitowski, 1910

**Material examined:** Bitlis, Bitlis Nemrut Dağı, Ilık Göl, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°37′10″N, 42°14′28″E), 2485 m. 13.09.2014, 3♀.

**Hosts: Lepidoptera. Elachistidae:** Agonopterix bipunctosa (Curtis, 1850) [Centauraea].

**Gelechidae:** Anacampsis populella (Clerck, 1759) [Salix repens]; Anacampsis temerella (Lienig & Zeller, 1846) [Salix repens]; Argylamprotes micena (Denis & Schiffermüller, 1775); Athrips pruinosella (Lienig & Zeller, 1846) [Vaccinium uliginosum]; Caryocolum tricolorrella (Haworth, 1812); Coleophora discordella Zeller, 1849; Dichomeris juniperella (Linnaeus, 1761); Phthorimaea operculella (Zeller ?), Scrobipalpa ocellatella (Boyd ?), Tinea nanella Denis & Schiffermüller, 1775. **Elachistidae:** Coleophora spiraeella Rebel, 1916. **Elachistidae:** Depressaria pimpinellae Zeller, 1839 [Pimpinella major]; Acrolepiidae: Digitivalva armicella (Heyden, 1863). **Momphidae:** Mompha miscella [Denis & Schiffermüller], 1775.

**Distribution:** West Palaearctic.

*Orgilus (Orgilus) ponticus* Tobias, 1986

**Material examined:** Bitlis, Bitlis Nemrut Dağı, Ilık Göl, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°37′10″N, 42°14′28″E), 2485 m. 13.08.2014, 3♀.

**Hosts:** Unknown.

**Distribution:** Palaearctic.

9. **Subfamily: Rogadinae**

9.1. **Genus: Aleiodes Wesmael, 1838**

*Aleiodes (Aleiodes) bicolor* (Spinola, 1808)

**Material examined:** Bitlis, Tatvan, Küçük Göl, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°26′14″N, 42°19′17″E), 1784 m. 05.08.2014, 10♀; Bitlis, Tatvan, Mezra, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°28′56″N, 42°18′40″E), 1654 m. 13.09.2014, 6♀; Bitlis, Bitlis Nemrut dağı, Büyük Göl, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Euphorbia sp., Hypericum sp., Juniperus sp., Quercus sp., Pinus sp.), (38°38′35″N, 42°41′15″E), 2488 m. 13.09.2014, 5♀.
Hosts: Lepidoptera. Cranbidae: Loxostege sticticalis (Linnaeus, 1761); Pyrausta purpuraria (Linnaeus, 1758); P. sanguinalis (Linnaeus, 1767); Geometridae: Apocheima cinerarius (Erschoff, 1874); Archiearis parthenias (Linnaeus, 1761); Eupithecia linariata (9, 1775); Operophtera sp. Lycanaeidae: Aricia agestis (Denis & Schiffermuller, 1775); A. Artaxerxes (Fabricius, 1793); Cupido acetos Hoffmannsegg, 1804); C. minimus (Faussly 1775); Lysandra cordon (Poda, 1761); Pfeleus idas (Linnaeus, 1761); Polyommatus albicans (Gerhard, 1851); P. damon (Denis & Schiffermuller, 1775); P. eros (Ochsenheimer, 1808); P. icarus (Rottemburg, 1775); Lymantaeridae: Dasychira albidnata Bremer, 1864; Leucoma salicis (Linnaeus, 1758). Noctuidae: Apamea sordens (Hufnagel, 1766). Nymphalidae: Maniola jurtina (Linnaeus, 1758); Aglais urticae (Linnaeus, 1758). Pterophoridae: Emmelina monodactyla (Linnaeus, 1758); Helinsia tehradactyla (Hübner, 1813). Zygaenidae: Jordanita chloros (Hubner, 1813); J. graeca (Jordan, 1907); Rhagades pruni (Denis & Schiffermuller, 1775); Zygana filipendula (Linnaeus, 1758); Z. lonicerae (Scheven, 1777); Z. purpurea (Brunnich, 1763); Z. viticea (Denis & Schiffermuller, 1775).

Distribution: Palaearctic.

Aleiodes (Aleiodes) circumscriptus (Nees, 1834)
Material examined: Bitlis, Tatvan, Kıcıksu, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°28′54″N, 42°09′08″E), 1823 m. 17.09.2015, 10♀. Hosts: Lepidoptera. Arctiidae: Atolmis rubricollis (Linnaeus, 1758); Lymantaeridae: Leucoma salicis (Linnaeus, 1758). Gelechiidae: Caryocolum amaurella (Hering, 1924). Geometridae: Thera variata (Denis & Schiffermuller, 1775); Abrazas grossulariata Linnaeus, 1758; Bupalus piniarius Linnaeus, 1758; Cypripedium ruficiliaria (Herrich-Schaffer, 1855); Epirrhoe galiata (Denis & Schiffermuller 1775); Epirrha autumnata (Borkhausen, 1794); Eupithecia alliaria (Staudinger, 1874); E. linariata (Denis & Schiffermuller, 1775); E. subfuscata (Haworth, 1809); gymnoscelis ruffissatia (Haworth, 1809); Hylaera fasciaria (Linnaeus, 1758); Lycia isabella (Harrison, 1914). Noctuidae: Apamea crenata (Hufnagel, 1766); Autographa gamma (Denis & Schiffermuller, 1775); O. stabilis (Haworth, 1809); Stenopterus armiger (Hübner, 1808); Hoplodrma octogonaria (Goze, 1781); Lithomois solidaginis (Hubner 1803); Mamestra brassicae (Linnaeus, 1758); Noctua fimbriata (Schreber, 1759); N. prunula (Linnaeus, 1758); Orthisia gracilis (Denis & Schiffermuller 1775); Orthisia incerta (Hufnagel, 1766); O. stabilis (Denis & Schiffermuller, 1775); Penicillaria jocosatricula (Guenee, 1852); Pseudalitta unipuncta (Haworth, 1809); Spodoptera exigua (Hübner, 1808); Xestia agathina (Duponchel, 1827); X. baya (Denis & Schiffermuller, 1775); X. xanthographa (Denis & Schiffermuller, 1775). Pterophoridae: Pterophorus pentadactyla (Linnaeus 1758). Pyralidae: Dioryctria abietella (Denis & Schiffermuller 1775); Euboea crocealis (Denis & Schiffermuller, 1775). Tortricidae: Archips rosana (Linnaeus, 1758); Closena bergmanniana Linnaeus, 1758; C. holmiana Linnaeus, 1758; Cydia climacina (Hativaerts, 1754); C. Strobilella (Linnaeus, 1758); Pammea amygdalana (Duponchel, 1842); P. gallicolana (Lienig & Zeller, 1846); Tortrix viridana (Linnaeus, 1758); Zetaphera griseana (Hübner, 1799).

Distribution: Palaearctic.

Aleiodes (Aleiodes) gasstritor (Thunberg, 1822)
Material examined: Bitlis, Tatvan, Kıcıksu, (Allium sp., Anchusa sp., Astragalus sp., Cyperus sp., Hypericum sp.) (38°26′14″N, 42°19′08″E), 1654 m. 05.08.2014, 3♀. Hosts: Lepidoptera. Cranbidae: Ostrinia nubilalis (Hübner, 1796); Phyltenaia coronata (Hufnagel, 1767). Drepanidae: Clix glauca (Scopolii, 1763). Elachistidae: Depressaria absynthiella (Herrich-Schaffer, 1865). Geometridae: Alsopila pometaria (Harris, 1841); Apocheima cinerarius (Erschoff, 1874); A. Hispidaria (Denis & Schiffermuller, 1775); Chiasmos clathrata (Linnaeus, 1758); Chloroclystis v-ata (Haworth, 1809); Diagrannia gnomosarina (Guenee, 1857); Epiprita autumnata (Borkhausen, 1794); Prunella defoliaria (Clerck, 1759); Eupithecia alliaria (Staudinger, 1870); E. miserulata (Grote, 1863); E. pusillata (Denis & Schiffermuller, 1775); Glona cribbratoria (Guenee,
1858); *Hylaea fasciaria* (Linnaeus, 1758); *Hypagryts unipunctata* (Haworth, 1809); *Isturgia limbaria* (Fabricius, 1775); *Lycia hirtaria* (Clerck, 1760); *Lycia pomonaria* (Hubner, 1790); *Oepopthera brumata* (Linnaeus, 1758); *Pithonandria atrilineata* (Butler 1881); *Tephrina arenacearia* (Denis & Schiffermüller, 1775). **Lasiocampidae:** *Malacosoma neustria* (Linnaeus, 1758). **Lymnantriidae:** *Euproctis chrysorrhoea* (Linnaeus, 1758); *E. similis* (Fuessly, 1775); *Hypona scabra* (Fabricius, 1798); *Leucoma salicis* (Linnaeus, 1758). **Noctuidae:** *Agraphe agnata* (Staudinger, 1892); *Autographa gamma* (Linnaeus, 1758); *Harpyia hermelina* (Stephens, 1829); *Heliacoverpa armigeria* (Hubner, 1808); *Pseudalitia unipuncta* (Haworth, 1809); *Spodoptera exigua* (Hubner, 1808); *Thychoclistis ni* (Hubner, 1803). **Notodontidae:** *Cerura vinula* (Linnaeus, 1758); *Taufmetopoea processionea* (Linnaeus, 1758). **Yponomeutidae:** *Prays oleae* (Bernard, 1788). **Tortricidae:** *Archips rosana* (Linnaeus, 1758); *Lobesia botrana* (Denis & Schiffermüller, 1775). **Distribution:** Holartic and Oriental region.

**Aleiodes (Aleiodes) signatus** (Nees, 1811)

Material examined: Bitlis, Bitlis Nemrut dağı, Büyük Göl, (*Allium* sp., *Anchusa* sp., *Astragallus* sp., *Cyperus* sp., *Euphorbia* sp., *Juniperus* sp., *Quercus* sp., *Pinus* sp.), (38°38′35″N, 42°41′15″E), 2488 m. 13.09.2014, 2♀♀; Bitlis, Tatvan, Küçükal, (*Allium* sp., *Anchusa* sp., *Astragallus* sp., *Cyperus* sp., *Hypericum* sp.) (38°26′14″N, 42°19′17″E), 1784 m. 05.08.2014, 4♀♀; Bitlis, Tatvan, Mezra, (*Allium* sp., *Anchusa* sp., *Astragallus* sp., *Cyperus* sp., *Hypericum* sp.) (38°28′56″N, 42°18′40″E), 1654 m. 13.09.2014, 4♀♀.

**Species of each subfamily determined were as follows:** **Agathidinae** 1 species, **Braconinae** 14 species, **Cheloninae** 6 species, **Euphorinae** 1 species, **Hormiinae** 1 species, **Macrocenitrae** 1 species, **Opiinae** 8 species, **Orgilinae** 2 species, **Rogadinae** 5 species.

All of these species are the first record for fauna of Turkey. The study revealed...
very common species distributed as follows: Macrocentrus collaris in Afrotropical, Neotropical, Oriental, and Palaearctic regions; Opius (Allophelebus) tabificus in Afrotropical, Neotropical, Oriental, and Palaearctic regions; Glyptomorpha (Glyptomorpha) pectoralis in Afrotropical, Oriental, and Palaearctic regions; Wesmaelia petiolata in Holarctic, Neotropical and Oriental regions; Hormius moniliatus in Holarctic and Oriental regions; Ascogaster bidentula and Bracon (Bracon) longicolis in Oriental and Palaearctic regions. Distribution of other species is limited to one region for each. 23 species distributed in Palaearctic region, 6 species in Western Palaearctic region, 1 species in Eastern Palaearctic region, 1 in Holarctic region and 1 species in Neotropical region. Hosts of 10 from these species which have parasitoid lifestyle are not known. Bracon (Glabrobracon) variator use 64 and Aleiodes (Aleiodes) circumscriptus 45 different pernicious bug larvae as host.

The pine processionary [Thaumetopoea pityocampa (Denis & Schiffermüller 1775)] is a moth causing important damage for our pine forests particularly in Mediterranean, Aegean, and Marmara regions. Because it is epidemic in the years when its population increases, it completely destroys pines (Pinus brutia (red pine), P. nigra (black pine), P. sylvestris (scots pine), P. pinea (stone pine), P. haepensis (Halep pine) and Cedrus libani (Anatolian cedar) in pine zone. Aleiodes (A.) signatus is parasitoid of this pest. It can be used for biological control of this pest which is hard to control.

Distribution area of Bracon (Pigeria) piger is Holarctic region. It was placed in Puerto Rico; USA-California; USA- Oregon for biological control against species of Curculionidae (Coleoptera), Tortricidae, Pyralidae and Noctuidae (Lepidoptera). This species can be used for biological control of above-mentioned pests in Turkey, too.

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LITERATURE CITED


Figure 1. Caldera of Bitlis Nemrut (Photo: O. Subaşı).

Figure 2. The number of species for each subfamily.
SECONDARY HOST CHANGING BETWEEN APHIDS (HEMIPTERA: APHIDIDAE) AND THEIR PARASITOIDS IN WHEAT FIELDS OF SOUTHEAST ANATOLIAN REGION

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ABSTRACT: This study carried out in wheat growing areas and natural areas that nearby of wheat fields of Diyarbakır (Yenişehir, Central villages, Plant Protection Research Institute experimental area) and Şanlıurfa (Akçakale, Siverek) provinces in 2014-2015. Studies were conducted during April, May and June by sampling once a week, while in November and February months by sampling once a month, by irregular controlling of 60 different locations. According to the results; 24 aphid species of 18 genera and 10 parasitoid species of 6 genera were determined on 20 plant species [Alopecurus myosuroides Huds; Amaranthus retroflexus L.; Avena fatua L.; Avena sterilis L.; Carduus crispus L.; Centaurea solstitialis L.; Cirsium vulgare (Savi) A-Sw.; Daucus carota L. var. carota; Galium aparine L.; Lens culinaris Medicus; Lolium perenne L.; Lupinus albus L.; Onopordum acanthium L.; Orobancha sp.; Papaver rhoes L. Sillybum marianum (L.) Grtn.); Sonchus oleraceus L.; Triticum aestivum L. Emd. Fri & Pao.; Triticum durum Desf.; Vicia sativa L.]. Determining of Aphids (Hemiptera: Aphididae) and their parasitoid species including specialization of parasitoids to both aphids and host plants, demonstrated once more the importance of richness of natural enemies in Southeast Anatolian region in terms of biological control.

KEY WORDS: Wheat, cultivated plants, weeds, Aphididae, parasitoid

Turkey is one of them most important country in terms of wheat producing and among the ten the most wheat producing countries in the world. The amount of wheat crop in the world is 705.378.000 tons, while in Turkey the amount of wheat crop is nearly 20.100.000 tons (Anonymous, 2013). The amount of wheat production and cultivated areas are changing year by year in Southeastern Anatolia Region of Turkey, and it ranks the second with Marmara Region after Middle Anatolian Region. Diyarbakır and Şanlıurfa provinces are the most wheat cultivated and produced provinces in Southeast Anatolian Region.

Harmful organisms which they can cause crop losses by giving damage so many crops including wheat, which is a main strategic crop in Turkey. One of the most important harmful organisms is aphid. There are 4000 aphid species belonging to Aphidoidea family in the world (Blackman & Eastop, 2000, 2014), and according to the Turkish records, totally 510 aphid species belong to 8 subfamilies of Aphidoidea were identified in Turkey (Remaudière et al., 2006; Şenol et al., 2014). Aphids generally prefer the perennial crops as a primary host, while they also prefer annual or biennial herbaceous and shrubby plants as a
secnder host. As aphid could rapidly increase their population exponentially, they could gain resistance against pesticides and also they could easily transfer virus from one plant to another plant by migrating and changing their nutrition habit makes the aphid control very difficult and deemed as a significant problem (Goszcynski & Cichocka, 1998; Wilkaniec, 1998; Gray & Bonerjee, 1999). However, aphid are obligate or facultative, they constitute a highly risk group, due to their migration. They can be determined as annual around a crop or can immigrate seasonally. Therefore, it becomes more difficult to control aphid as long as they migrate. Aphids could usually be found in the non-cultivated areas or natural environment as they are available in the cultivated areas or exterior of the fields it is completely depend on the resources of pests where they could have.

In recent years, in the Southeast Anatolian Region mostly in early spring when low temperature occurs with high moisture in the rainy days, the population of aphid is increasing in wheat cultivated areas and consequently sometime wheat producing farmers seek how to control aphid, so they could use pesticides in a non-recommended manner at intervals. In the Southeast Anatolian Region, due to altering climate conditions, farming techniques and increase of irrigated farming areas show us, in the future aphid could have a potential risk in terms of being the main pest of wheat, therefore, it is needed to investigate more effectively control methods for this pest.

There is very few research in terms of aphid species in the wheat cultivated areas in Turkey. In the Southeast Anatolian Region, some faunistic investigation were made on aphid species in terms of their biological and ecological properties. It was mentioned that due to the changing their ecological conditions, the population of aphid in the region would be increased in the future. Also aphids can take an important role as they are virus vector even they are potential pest species at present, but they could be the main harmful organism by giving damage or transferring virus (Karaat et al., 1986; Kiran, 1994; Uygun et al., 1995; Akkaya & Uygun, 1996).

Pesticide use is generating a risk for both natural balance, human and environment health. Furthermore, it is known that chemical use isn’t always a remedy to control aphids. Even if most insecticides are commonly and simultaneously used, a few number of aphid can survive and after in a short period of insecticide application, their number can rapidly grow, and a new generation may occur that created resistance against pesticides.

Although chemical control is often preferred method due to its efficiency in a short period and due to its ease application, but also chemical control has so many risks such as human and other living health, nature and environment, soil, water or so many natural resources could be badly affected by chemical using. While struggling against pests the implementation of sustainable and environmentally friendly alternative control methods will be more useful than chemical control.

It is possible to decrease aphid population by using biological control method as it is natural method there is no any side effect and also it is possible to benefit from natural enemies that they are already existing in nature only, they need some favorable condition for their hosting and living. It is also possible to produce and release natural enemies when they are insufficient in the nature by preparing a suitable environment for them. The aphid parasitoids are the most important biological agents, which have the ability to be used for this purpose.

Ecological conditions which wheat plants are grown in, is a favorable environment especially for some small pests such as aphids that their population can rapidly increase. Weeds are also a favorable reservoir for aphids and their
parasitoids as a secondary host plant and could support potential increase of aphids and parasitoids. As many weeds species always could be found in abundant in the nature even in the absence of cultivated plants, they are suitable secondary host plants for pests by giving opportunity to them for living, feeding and sheltering (Güncan, 2013). The reason why aphid population increase at the beginning of wheat season and then decrease gradually its population without using any pesticide or without any intervene depends on the presence of weeds in the region, as they are very important secondary host plants both for aphids and for their parasitoids (Aphidiidae). The behavior of Aphidiidae parasitoid species is solitary endoparasitoid type. Female adults twitch their abdomen under the thorax during oviposition period, lay their eggs towards integument of aphids by the sink of their ovipositor into aphids and they generally lay one egg in each aphid. Even though they sometime lay two or more eggs into aphids, but only one individual complete its development period. Aphids generally live in diapause in winter as prepupa into mummified aphids in the regions where temperate is mild (climate, weather). By migration of aphids from one host to another host plant habitat with summer or in the warmer season conditions, seasonal diapause of parasitoids also could be observed (Minsk & Harrewijn, 1988).

This study carried out to determine weed species and their secondary host plant situation, to determine aphid and parasitoid species and to investigate possibility of using parasitoids with the aim of biological control. Studies carried out in wheat growing areas and natural areas that nearby of wheat fields of Diyarbakır (Yenişehir, Central villages, Plant Protection Research Institute experimental area) and Şanlıurfa (Akçakale, Siverek) provinces in 2014-2015. Field studies were conducted during April, May and June by examining and sampling shoots, plants, leaves, branches and trunk of each plant once a week, while in November and February months by sampling once a month, by irregular controlling of 60 different locations. According to the results; 20 host plant species, 24 aphid species of 18 genera and 10 parasitoid species of 6 genera were determined in Southeast Anatolian region. These results demonstrated once more the importance of richness of natural enemies in terms of biological control.

MATERIAL AND METHOD

MATERIAL

The main materials of the study consists of wheat and different plants of nearby natural areas, aphid species and their parasitoids that living on these plants. In order to determine aphid and parasitoid species KOH, 70 % ethyl alcohol, Chloral Hydrate, Phenol, Hoyer and Berlese feedlot environment were used. The other used materials are such as lam, slides, plate, glass tube, plastic container, zero (0) number brush and tight textured nylon muslin.

METHOD

Field Studies

Studies carried out in wheat growing areas and natural areas that nearby of wheat fields of Diyarbakır (Yenişehir and Central districts, villages and Plant Protection Research Institute experimental area) and Şanlıurfa (Akçakale, Siverek districts) provinces in 2014-2015. Field studies were conducted during April, May and June by examining and sampling shoots, plants, leaves, branches and trunk of each plant once a week, while in November and February months by sampling once a month, with irregular controlling of 60 different locations. Moreover, in order to determine aphids that could be present in the roots, some easy detachable plants removed from the root, the other such as in the form of tree the
soil of 5-10 cm in depth was excavated and the main stem and branches of plants and the soil of beneath has been checked.

**Laboratory Studies**

Laboratory studies carried out under controlled conditions (25±3°C temperature, 70% ±10% humidity and a 16:8 hour light- dark long day). Plant materials with mummified aphids which were thought to be parasitized were taken into plastic boxes and required label information was written on the boxes. The cover of the box plastic parts were cut as widely round and closed with tight textured nylon muslin so as to provide ventilation. Samples were kept at least 14 days for parasitoid adult emerging and daily controlled until the end of all parasitoid emerging.

**Preparation of Samples**

As plant materials, mummified or dead aphids and their parasitoid adults mixed in culture containers, their pre-extraction and separation process were made on white paper. Then, aphids and parasitoids examined and separated under binocular and were placed into small bottles or tubes with 70% alcohol. The tubes and bottles that aphids and parasitoids kept were labeled with required information and prepared for identification. The color of aphid mummies was also recorded, considering being useful for parasitoid identification.

**RESULTS AND DISCUSSION**

This study carried out in wheat growing areas and natural areas that nearby of wheat fields of Diyarbakır and Şanlıurfa provinces in 2014-2015. Studies were conducted during April, May and June by sampling once a week, while in November and February months by sampling once a month, by irregular controlling of 60 different locations. According to the results; 24 aphid species of 18 genera, 10 parasitoid species of 6 genera were determined on 20 plant species. The list of host plants, aphids and their parasitoids were given on Table 1.

According to the results of this study; 20 grouped cereals, uncultivated and cultivated plants [Alopecurus myosuroides Huds; Amaranthus retroflexus L.; Avena fatua L.; A. sterilis L.; Carduus crispus L.; Centaurea solstitialis L.; Cirsium vulgare (Savi) A-Sw.; Daucus carota L. var. carota; Galium aparine L.; Lens culinaris Medicus; Lolium perenne L.; Lupinus albus L.; Onopordum acanthium L.; Orobanchae sp.; Papaver rhoes L. Sillybum marianum (L.) Grtn.]; Sonchus oleraceus L.; Triticum aestivum L. Emd. Fri & Pao.; T. durum Desf.; Vicia sativa L.] were determined.

24 aphid species [Anoecia corni (Fabricius); Aphis craccivora Koch; Aphis fabae Scopoli; Aphis galiiscabri Schrank; Aphis gossypii Glover; Aulacorthum solani (Kaltenbach); Brachycaudus (Acaudus) cardui (L.); Brachycaudus helichrysi (Kaltenbach); Capitophorus elaeagni (deI Guercio); Diuraphis noxia (Kurdjumov); Dysaphis foeniculus (Theobald); Hyperomyzus lactucae (L.); Lipaphis erysimi (Kaltenbach); Macrosiphum euphorbiae (Thomas); Metopolophium dirhodum (Walker); Myzus (Nectarisiphon) persicae (Sulzer); Rhopalosiphum maidis (Fitch); Rhopalosiphum padi (L.); Sipha (Rungia) maydis Passenger; Sitobion avenae (F.); Smythurodes betae Westwood; Uroleucon (Uromelan) jaceae (L.); Uroleucon cichorii (Koch); Uroleucon sp.] and including 10 parasitoid species [Aphelinus paramali Zehavi & Rosen; Aphidius colemani Viereck; Aphidius ervi Haliday; Aphidius matricariae Haliday; Aphidius rhopalosiphì de Stefani-Perez; Binodoxys acalephae (Marshall); Diaeretiella rapae (M’Intosh); Lysiphlebus fabarum (Marshall);
Lysiphlebus testaceipes (Cresson); Praon volucre (Haliday) were determined on different aphid species and on different host plants as shown on Table 1.

It was revealed that Lysiphlebus fabarum is parasitising Brachycaudus (Acaudus) cardui; Praon volucre is parasitising Rhopalosiphum padi, Uroleucon (Uromelan) jaceae and Macrosiphum euphorbiae; Aphidius ervi is parasitising Myzus (Nectarosiphon) persicae; Aphidius rhopalosiphi is parasitising Rhopalosiphum maidis; Aphidius matricariae is parasitising Brachycaudus helichrysi; Lysiphlebus testaceipes; and Aphelinus paramali is parasitising Aphis gossypii; and Diaeretiella rapae is parasitising Diuraphis noxia.

It was reported that Myzus persicae leave in summer from its primary host plants to over 40 different weed species that secondary host plants such as Solanaceae, Chenopodiaceae, Compositae, Cruciferae and Cucurbitaceae families (Anonymous, 2016).

The aphid species that found highly intense in this study, fed on different plants from different families as stated in the catalog of Holman (2009).

The relation between dioecious aphids and their parasitoid is even more complex. These aphid species always change their habitats throughout the season from primary host plants to secondary host plants due to their migration behavior. Therefore, their parasitoids also change their habitat throughout the season in connection with the migration of aphids. In this case, any Dioecious aphid could be parasitized by different parasitoid species complex according to its habitat type such as Brachycaudus cardui could be given as a typical example. This aphid species could be found on the edges of wooded areas and in the parks on Prunus spinosa and P. domestica plants in winter and in spring and parasitized by Ephedrus plagiator, while this species migrate towards the end of spring and at the beginning of summer to weeds such as Carduus sp. and Arctium sp. and parasitized by Lysiphlebus fabarum and Lipolexis gracilis (Stary, 1964).

Monoecious aphids even if migrate to other plants for the purpose of feeding, they don’t change their habitat types throughout the season. Therefore, studies revealed that these aphid species generally parasitized by the same parasitoid species.

According to the former studies that conducted in Turkey and in the world about aphids and their parasitoids; Elmalı (1993), reported that 13 aphid species, 5 parasitoid and 21 predator species in wheat fields of Konya province. Kiran (1994), reported that five aphid psecies [Sitobion avenae F., Rhopalosiphum padi L., R. maidis Fitch., Schizaphis graminum Rond. and Myzus persicae Sulz.] and two parasitoid [Lysilebus faborum Marsh. and Ephedrus plagiator Nees] species in wheat fields of Southeast Anatolian Region. Majani & Rezwani (1995), investigated density of aphid species in wheat fields of Gorgan region of Iran and ordered aphid species according to their density level as; Sitobion avenae (F.), Rhopalosiphum maidis (L.), R. padi (L.), Metapolophium dirhodum (Walk ), Schizaphis graminum (Rondani), Sipha elegans del Guercio, Tetrameura ulmi (L.), Anoecia corni (F.) and Anoecia vagans (Koch) species respectively. Petrovic (1996) determined nine aphid species [D. noxia, M. dirhodum, R. maidis, R. padi, S. graminum, Sitobion avenae, S. fragariae, S. elegans and S. maydis] in wheat fields of Yugoslavia. Güz & Kılınçer (2005) were determined 10 aphid parasitoids belonging to 6 genus on weeds from Ankara Capital city of Turkey.

Stary & van Harten (1972) reported four aphid parasitoid species belonging to Aphidiidae family in Angola region. D. rapae and Ephedrus persicae parasitoid species were determined as cosmopolitan species. Aphidius platensis, which is known in South Africa, Africa, and Middle East of Australia, was obtained from some domestic aphids or some materials that collected from out. This species also
recorded in Mozambique. *A. camerunensis* was only determined on some *Sitobion* species in Cameroon. They also discussed importing of parasitoid species for using them as biological tools against aphids. Pungerl (1983) reported that separating characters of some aphidius species that commonly parasitizing pea and cereal aphid species was seems to be more variable than previously thought. He also separated *A. ervi*, *A. picipes* and *A. rhopalosiphi* species according to the number of antenna segments, the patterns that in the anterolateral region and changes in the tutorial index. The number of segments of antenna was changed for one of all three species as three segments for females, while four segments for males. The number of ridges in anterolateral region of petiole of *A. rhopalosiphi* was ranged as 6-8. Tentorial index of *A. ervi* ranged as 0.35-0.62 and tentorial index of *A. rhopalosiphi 0.35-0.60., while tentorial index of *A. picipes* ranged as 0.34-0.54. Previously published tentorial index values of *A. ervi*, *A. principles* and *A. rhopalosiphum* were ordered as 0.30-0.40, 0.28-0.37 0.30-0.35 respectively. These differences revealed that the identification of *A. rhopalosiphi* and *A. uzbekistanicus* could not be identified as reliably by used former rate of wing vein length.

Stary (1986) investigated relationship of so many aphids and their parasitoids on *Cirsium arvense* in Czechoslovakia. The most dominant aphid species were *Aphis fabae* and *Cirsii acanthoidis*, while the most related parasitoids were *L. cardui* and *L. fabarum*. Tomanovich et al. (1996) collected pea aphid (*A. pisum*) from the vicinity of Belgrade during two years to determine seasonal dynamics, interference of color polymorphism and parasitism and four parasitoid species (*A. ervi*, *A. eadyi*, *A. picipes* and *P. barbatum*) were found on pea aphid in Yugoslavia, while *A. ervi* was found as the most dominant species. Tomanovich (2000) identified 8 new aphid species with their host plants in Serbia and Montenegro including 12 Aphidiinae parasitoids, four of which new record in the world. Tomanovic & Brajkovic (2000) determined important aphid parasitoids in wheat fields of southern agro-eco systems of the Pannonia region and *A. ervi*, *A. uzbekistanicus*, *A. rhopalosiphi* and *P. gallicum* were found as the most intense parasitoid species. Tomanovich et al. (2003) recorded a new aphid parasitoid species which was *Praon uroleucon* in Yugoslavia, and this parasitoid species parasitize *Uroleucon* aphid species on *Carduus acanthoides* host plant.

It is clear that there is a strong relationship between agro eco-systems and the other systems. Weeds are known as common elements that contribute to vegetation diversity in cultivated and uncultivated areas. However, it is always preferred that cultivated areas should be clear and uninfected with weeds. Unlike many plant species, weeds that grow along roadsides and field edges are capable of staying alive in spite of so many chemical applications. Weeds have food chain relation both for pests and for beneficial insects, while so many of them don’t have any effect on cultivated plants. However, there are some basic differences between host plant, aphid, and their parasitoid in terms of classifying their relationships. While some aphid parasitoids never have any relation in food chain, so specific and represent the isolated complexes, the other aphid parasitoids have more complex relationship. One of the reasons of differences is the change of the host plant in connection with aphid host series. The composition of parasitoid species and the presence of their percentage into this composition are quite different on primary and secondary host plants species. The second reason of difference may be connected to the presence of cultivated or uncultivated host plants which are found in the vicinity of wheat fields.

The relationship of aphids and their parasitoids depend on vegetation diversity of the same or different areas. According to some studies while only a
few aphid species could give damage in monoculture areas, so many aphid populations could give damage according to host plant diversity in roadsides, borders or edges of the fields and aphid populations could show different attitude as to host plant diversity. It means that the fields that surrounded by herbaceous plants have so many plant species and heterogenic fauna. The aphid species are generally significant food source both for parasitoids and for predator.

Determination of aphid parasitoids that are a part of the habitat interactions of aphids with wild herbaceous plants will contribute valuable information for understanding complex life of host plants, aphids and their parasitoids. Undoubtedly, determination of beneficial fauna has great importance in terms of successful applications for biological control and integrated pest management approaches. With this approach, this study determined secondary host plants which are very suitable reservoir for aphids and their parasitoids and determined aphid species and their parasitoids. The reason of numerous cereal aphid species below the threshold of economic damage is depend on these herbaceous plants in the vicinity of grain fields, as their presence give opportunity to parasitoids both increases their efficiency and sustain their life. Moreover, as these weeds exit early spring before vegetables, cottons or other cultivated productions, parasitoids living on these weeds together with aphids and then, they are migrating other cultivated areas. Thus, the benefit of these herbaceous and secondary host plants is more important by hosting parasitoids to live in their habitats for suppressing and reducing the aphid population and taking under control both in wheat fields and by migrating in the fields of summer production and parasitizing aphid species in these cultivated areas.

In conclusion, so many studies emphasized the importance of different weed species as host plant of aphids and as a good reservoir of aphid parasitoid. Therefore, the approaches of biological control and integrated pest management in the framework of interaction of host plant, aphids and their parasitoids in the same ecosystem will be useful to take into account. By this study elements of this complex interaction has been determined and useful basic information has been established for the next studies. Moreover, availability of natural enemies their potential role in Southeast Anatolia region and possibility of use of biological control as an alternative control method or as supplementary part of integrated pest management were introduced.

LITERATURE CITED


Table 1. Host plants, aphid and parasitoid species in wheat field of Diyarbakır and Şanlıurfa provinces in 2014–2015.

<table>
<thead>
<tr>
<th>Host Plants</th>
<th>Aphid Species</th>
<th>Parasitoid Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amaranthus retroflexus</td>
<td>Aphis fabae</td>
<td>Binodoxys acalephae 3♀ 2♂</td>
</tr>
<tr>
<td></td>
<td>Macrosiphum euphorbiae</td>
<td>Praon volucre 7♀ 4♂ 2♂</td>
</tr>
<tr>
<td>Alopecurus myosuroides</td>
<td>Diuraphis noxia</td>
<td>Diaeretiella rapae 9♀ 7♂</td>
</tr>
<tr>
<td>Avena sterilis</td>
<td>Sipha (Rungsia) maydis</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Anoeia corni</td>
<td>-</td>
</tr>
<tr>
<td>Orobanche sp.</td>
<td>Smynthurodes betae</td>
<td>-</td>
</tr>
<tr>
<td>Carduus crispus</td>
<td>Aphis gossypii</td>
<td>Aphelinus paramali 3♀ 2♂</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lysiphlebus testaceipes 8♀ 6♂</td>
</tr>
<tr>
<td>Cirsium vulgare</td>
<td>Uroleucon (Uromelan) jaceae</td>
<td>Praon volucre 11♀ 9♂</td>
</tr>
<tr>
<td>Triticum aestivum</td>
<td>Metopolophium dirhodum</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Rhopalosiphum padi</td>
<td>Praon volucre 45♀ 33♂</td>
</tr>
<tr>
<td></td>
<td>Rhopalosiphum maidis</td>
<td>Aphidius rhopalosiphi 3♀ 5♂</td>
</tr>
<tr>
<td></td>
<td>Aulacorthum solani, Uroleucon sp.</td>
<td>Diaeretiella rapae 7♀ 3♂</td>
</tr>
<tr>
<td>Sonchus oleraceus</td>
<td>Hyperomyzus lactucae</td>
<td>Aphidius colemani 7♀ 4♂</td>
</tr>
<tr>
<td>Galium aparine</td>
<td>Aphis galiiscabri</td>
<td>Praon volucre 3♀ 2♂</td>
</tr>
<tr>
<td>Papaver rhoeas</td>
<td>Lipaphis erysini</td>
<td>Diaeretiella rapae 5♀ 4♂</td>
</tr>
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<td></td>
<td>Rhopalosiphum padi</td>
<td>Praon volucre 6♀ 5♂</td>
</tr>
<tr>
<td></td>
<td>Macrosiphum euphorbiae</td>
<td>Praon volucre 5♀ 3♂</td>
</tr>
<tr>
<td>Centaurea solstitialis</td>
<td>Brachycaudus (Acaudus) cardui</td>
<td>Lysiphlebus fabarum 2♀</td>
</tr>
<tr>
<td>Lolium perenne</td>
<td>Anoeia corni</td>
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<td></td>
<td>Metopolophium dirhodum</td>
<td>-</td>
</tr>
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<td>Lupinus albus</td>
<td>Aphis craccivora</td>
<td>Binodoxys acalephae 2♀ 2♂</td>
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<tr>
<td>Triticum durum</td>
<td>Sitobion avenae</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Rhopalosiphum padi</td>
<td>Praon volucre 7♀ 6♂</td>
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<tr>
<td></td>
<td>Rhopalosiphum maidis</td>
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</tr>
<tr>
<td>Lens culinaris</td>
<td>Aphis craccivora</td>
<td>Binodoxys acalephae 2♀ 2♂</td>
</tr>
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<td>Silybum marianum</td>
<td>Brachycaudus (Acaudus) cardui</td>
<td>Lysiphlebus fabarum 20♀ 11♂</td>
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<td></td>
<td>Brachycaudus (Acaudus) cardui</td>
<td>Aphidius ervi 7♀ 3♂</td>
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<td></td>
<td>Aphis fabae</td>
<td>Lysiphlebus fabarum 2♀</td>
</tr>
<tr>
<td></td>
<td>Uroleucon cichorii</td>
<td>Praon volucre 5♀ 4♂</td>
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<tr>
<td></td>
<td>Capitophorus elaeagni</td>
<td>-</td>
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<tr>
<td></td>
<td>Myzus (Nectarosiphon) persicae</td>
<td>-</td>
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<tr>
<td></td>
<td>Aulacorthum solani</td>
<td>Diaeretiella rapae 9♀ 7♂</td>
</tr>
<tr>
<td>Onopordum acanthium</td>
<td>Brachycaudus (Acaudus) cardui</td>
<td>Lysiphlebus fabarum 22♀ 11♂</td>
</tr>
<tr>
<td></td>
<td>Rhopalosiphum maidis</td>
<td>Aphidius rhopalosiphi 3♀ 5♂</td>
</tr>
<tr>
<td></td>
<td>Brachycaudus helichrysi</td>
<td>Aphidius matricariae 8♀ 5♂</td>
</tr>
<tr>
<td></td>
<td>Brachycaudus (Acaudus) cardui</td>
<td>Lysiphlebus fabarum 8♀ 6♂</td>
</tr>
<tr>
<td>Vicia sativa</td>
<td>Myzus (Nectarosiphon) persicae</td>
<td>Lysiphlebus fabarum 4♀ 6♂</td>
</tr>
<tr>
<td>Avena fatua</td>
<td>Aphis craccivora</td>
<td>Lysiphlebus fabarum 5♀ 6♂</td>
</tr>
<tr>
<td>Daucus carota L. var. carota</td>
<td>Dysaphis foeniculus</td>
<td>Lysiphlebus fabarum 4♀ 3♂</td>
</tr>
</tbody>
</table>
TWO NEW SPECIES OF HARMONIA (COLEOPTERA: COCCINELLIDAE) FROM DÜZCE, TURKEY

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ABSTRACT: This study was carried out to determine the Coccinellidae (Coleoptera) fauna in Duzce province of Turkey. Two species Harmonia axyridis (Pallas, 1773) and Harmonia quadripunctata (Pontoppidan, 1763) belonging to Coccinellidae family have been described for the first time from Duzce province, the west Black Sea region of Turkey. Sampling was made on coniferous plants and rose during July 2017. The harlequin ladybird, H. axyridis was recorded on Macrosiphum rosae (L.) on rose (Rosa spp.) belonging to Rosaceae family. The cream-streaked ladybird, H. quadripunctata was recorded on Pinius pini (Gmelin) on pine (Pinus spp.) belonging to Pinaceae family in July, 2017. Harmonia axyridis is one of the most important an invasive biocontrol agent for aphid control which has unexpected impacts on native coccinellid populations, ecosystems and people in the world. Knowing the distribution of this species plays an important role in dealing with biological invasions. New distribution location of Harmonia species was given in the present paper.

KEY WORDS: Coccinellidae, fauna, Harmonia, new record, Düzce

Coccinellidae are cosmopolitan in distribution and found almost everywhere. This family includes about 360 genera and 6000 species (Uygun, 1981; Vanderberg, 2002). The ladybird beetles are mostly predatory, although its larvae and adults feeding on aphids, mites, thrips, scale insects, psyllids, whiteflies and eggs of butterflies and moths, the species in the tribe Coccinellini feed primarily on aphids. In most countries, the harlequin ladybird, Harmonia axyridis (Pallas, 1773) was introduced for the control of aphids (Brown et al., 2008; Sæthre et al., 2010). Over time, it was seen that H. axyridis prey on and competed with the other native species (Brown & Miller, 1998) as well as negative impacts on non-target pests, household pest, humans and fruit production (Kuznetsov, 1997; Koch, 2003; Koch et al., 2004; Kovach, 2004; Nalepa et al., 2004; Pell et al., 2008; Roy & Wajnberg, 2008; Osawa, 2011). Due to the high dispersal capacity of H. axyridis (Hodek et al., 1993; Nalepa et al., 1996; Osawa, 2000; Berkvens et al., 2009; Brown et al., 2011), spread quickly in other continents and countries, and many habitats have been invaded. In Turkey, H. axyridis species that have recently entered our country and firstly recorded by Bukejs & Telnov (2014) in Cappadocia /Nevsehir (Goreme). Because of all the adverse effects of H. axyridis mentioned above, It is necessary to follow this invasive species and to prevent further spread of H. axyridis in Turkey. The aim of the present paper is to provide new information on the distribution of this species introduced in Turkey.

MATERIAL AND METHODS

Sampling was made on coniferous plants and rose in Düzce during July 2017 (Fig. 1). Materials have been collected by shaking the plants and visual inspections
of the plants (Sæthre et al., 2010). The material collected was brought to the laboratory. The samples were separated individually and labelled for identification. The identification of the insects were made by Dr. Derya Şenal (Seyh Edebalı University, Faculty of Agriculture Sciences and Technology, Bilecik, Turkey). The specimens were deposited in the Duzce University, Faculty of Agriculture and Natural Science, Turkey.

RESULTS AND DISCUSSION

In this study, two species belonging to the Coccinellini tribe of Coccinellinae (Coccinellidae) were reported in Düzce, Turkey (Fig. 2). Details of the collection data are as follows:

Subfamily Coccinellinae
Tribe Coccinellini
Genus Harmonia Mulsant, 1850

*Harmonia axyridis* (Pallas, 1773)

(Fig. 2a)

**Synonyms:** Coccinella 19-sinata Faldermann, 1835; Coccinella axyridis Pallas, 1773; Coccinella conspicua Faldermann, 1835; Coccinella succinea Hop, 1845; Coccinella bisex-notata Herbst, 1793; Harmonia spectabilis Faldermann, 1835; Leis axyridis Mulsant, 1850; Ptychanatis axyridis (Pallas) Crotch, 1874; Ptychanatis yedoensis Takizawa, 1917; Anatis circe Mulsant, 1850.

**Material examined:** Düzce: Konuralp, Turkey, 40°50’19.3848” N and 31°9’45.3924” E, 153 m, 4.VII.2017, leg. Sevcan Oztemiz (1 specimen, 7 samples: 4♀; 3♂), Macrosiphum rosae (Linnaeus, 1758) on rose (*Rosa* spp.) belonging to Rosaceae family.

**Distribution in Turkey:** This species was previously reported in Cappadocia / Nevşehir (Göreme) by Bukejs & Telnov (2014), in Tekirdağ (Malkara) (Aysal & Kivan, 2014); Çanakkale (Ayvack, Bozcaada, Çan, Ecebat, Geyikli) (Bastug & Kasap, 2015) and Bartın (İnkum, Amasra, Bartın Center) (Sobutay, 2016).

**Distribution in the World:** Europe, North and South America, Middle East, South Africa and Australia (Stals & Prinsloo, 2007; Brown et al., 2008; Smith & Fisher, 2008).

*Harmonia quadripunctata* (Pontoppidan, 1763)

(Fig. 2b)

**Synonyms:** Coccinella quadripunctata Pontoppidan, 1763; Harmonia marginepunctata (Schaller, 1783).

**Material examined:** Düzce: Konuralp, Turkey, 40°50’19.3848” N and 31°9’45.3924” E, 153 m, 18.VII.2017, leg. Sevcan Oztemiz (1 specimen, 2 samples: 1♀; 1♂), *Pineus pini* (Gmelin) on pine (*Pinus* spp.) belonging to Pinaceae.

**Distribution in Turkey:** This species was previously reported in İzmir, Afyon, Isparta, Denizli, Bursa, Adana and Ankara provinces (Giray, 1970; Uygın, 1981); Ankara (Düzgüneş et al., 1980) Ülgentürk & Toros, 2000; Dostbil & Ülgentürk, 2016), Samsun, Amasya, Tokat (Kılıç & Aykaç, 1989); Erzurum (Özbek & Çetin, 1991); Manisa, İzmir (Tezcan & Uygın, 2003); Maraş (Aslan & Uygın, 2005); Konya (Sahbaz & Uysal, 2006); Artvin, Rize (Portakaldalı, 2008); Isparta (Gümüş & Avci, 2015).
**Distribution in the World:** Europe, North America, Canada, Near East, Northern Asia (excluding China) (Korschefsky, 1932; Horion, 1961; Vandenberg, 1990).

As shown, two different Harmonia species were detected in two different host plants. *Harmonia axyridis* is primarily considered an arboreal species and is common in various forest trees, ornamental trees and shrubs (Brown, 2003). Similarly, in this study, we found the multicoloured ladybird on rose. *H. axyridis* in North America is reported from 40 plant species (Kovach, 2004). *H. axyridis* is also reported to be a pest to apple, pear, raspberry, wine grapes, citrus, bean, corn, wheat and potato agriculture (Koch & Galvan, 2008; Roy & Roy, 2008; Vandereycken et al., 2013). The species is also found from woodlands and forest habitats, parks and gardens, agricultural and horticultural habitats as well as from buildings in cities and villages (Aysal & Kivan, 2014; Bukejs & Telnov, 2015). Due to its strong ability to disperse, it has adapted to different environmental conditions (Brown et al., 2011; Cornacchia & Nardi, 2012). *Harmonia quadripunctata* is a conifer specialist and predator of various species of aphids, over-winter in coniferous trees such as pines. Cream-streaked ladybirds are occasionally found on herbaceous plants, shrubbery, grassland, shrubs such as nettle and gorse in close proximity to conifers (Vandenberg, 1990). Similarly, in this study, we found the ladybird on pine. Both ladybirds are likely to bespread in Turkey in which have rich biodiversity, different climate and geography. For this reason, it is necessary that the distribution of ladybirds entered our country four years ago should be revealed as soon as possible. In particular, the multicoloured ladybird has an negative impact on ecosystem by reducing biodiversity of other aphidophages and non-pest insects. A risk assessment by van Lenteren et al. (2008) reported that *H. axyridis* should never have been used in biological control because of intraguild predation and resource competition.

**CONCLUSION**

The Coccinellidae fauna of Duzce was revealed with the results obtained with this study. These results have the potential to provide information on the biological control practices that will take place in the Integrated Pest Management programs in future. Furthermore, it is thought that this study will contribute to the study of Duzce and our country in determining insect biodiversity. It would be neccessary to carry out further research into the distribution of the species and monitoring of its population in Turkey to determine the spread of *H. axyridis* and *H.quadripunctata* in different hosts. The results obtained will be used in control programs against pests, and will contribute to the biodiversity of Duzce Province and our country.

**ACKNOWLEDGEMENTS**

We would like to express our thanks to Dr. Derya Şenal for identification of the species.

**LITERATURE CITED**


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Figure 1. The locality of two Harmonia species in Turkey.

Figure 2. Adults of Harmonia, a: Harmonia axyridis (Pallas), b: Harmonia quadripunctata (Pontoppidan) (Coleoptera: Coccinellidae).
A LITTLE KNOWN MELOLONTHID SPECIES FROM TURKEY: 
**XANTHOTROGUS (XESTOTROGUS) VALIDUS KRAATZ, 1884** 
(COLEOPTERA: SCARABAEIDAE: MELOLONTHINAE)

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ABSTRACT: The aim of the study is to give additional information on Xanthotrogus (Xestotrogus) validus Kraatz, 1884. To date, this taxon seems restricted to Turkey, the records in the literature from Iraq, even if probable, need confirmation.

KEY WORDS: Coleoptera, Melolonthinae, Xanthotrogus validus, distributional records, Turkey, Iraq

In Turkey occur nearly 650 species of the Superfamily Scarabaeoidea belonging to 14 families and 100 genera, (Carpaneto et al., 2000; Rezai, 2015). Melolonthinae are present in over 170 species, many of them being poorly known as for their biology, chorology or distribution. Among this family, Xanthotrogus (Xestotrogus) validus has been described as Rhizotrogus by Kraatz (1884) on a single male from “Malatia”. Later, Reitter (1902) erected the genus Xestotrogus for this species, reporting it from “Mesopotamien”, but without detailed location records. Medvedev (1951) reported this species from Iraq. Baraud (1987) considered Xestotrogus as a genus per se, recording validus from “Mésopotamie” and Turkey. He also quoted Alfieri’s records (1976) from Egypt, which are certainly based on wrong identifications and which have not been reported since then. Keith (2002) transferred Ancylonycha nitens Baudi, 1870, considered as endemic to Cyprus, to Xestotrogus on the evident similarity of the male genitalia. Nikolajev (2004) finally downgraded Xestotrogus to a subgenus to Xanthotrogus Reitter, 1902 and erected the genus Cyprotrogus to accommodate nitens – because of the glabrous parameres and the inner sclerites of endophallus. With this manuscript, new locality records related to the species were recorded.

MATERIAL AND METHODS

Materials were collected from various natural environments on herbs in Elazığ (Baskil) province (Fig. 1). Beetles were collected from May to June in year 2014 and in the spring period in year 2017. Additionally; Second author was examine to X. validus in the Muséum nationale d’Histoire naturelle of Paris. The collected new material is deposited in Bioengineering Department Laboratory of Fırat University (Elazığ/Turkey).

RESULTS

**Xanthotrogus (Xestotrogus) validus Kraatz, 1884**

Material examined: 2♂♂, 06.06.2014, Turkey, Elazığ, Baskil, Şefkat, 2♂♂, 25.05.2015, Turkey, Elazığ, Baskil, 3♂♂, Turkey, Elazığ, Baskil, Doğancık,
15.05.2017, on grasses, Leg. Özgen (private Collection); 4♂♂, Asia. min. Malatya-Tecde (Muséum nationale d’Histoire naturelle, Paris); 2♂♂, Turquie, Malatya, Sultansuyu, 15.4.1983 (Muséum nationale d’Histoire naturelle, Paris). Totally: 13♂♂. The female still remains unknown. We also figure for the first time the habitus of the male.

It seems that the historical record by Edmund Reitter (1902) from Mesopotamia instead of Malatya, indeed located in the historical surroundings of that antique region, misled to the further records from Iraq. We were not able to date to trace any specimen or original literature record from that land. Therefore, we consider for the moment this taxon to be endemic to Turkey: Elazığ and Malatya prov., though its presence in Iraq is not improbable.

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![Figure 1](image-url)  
Figure 1. Distribution area of *X. validus*. 
Figure 2. Some habitus view of *Xanthotrogus* (*Xestotrogus*) *validus*.

Figure 3. Male genitalia of *Xanthotrogus* (*Xestotrogus*) *validus*.
RICANIA JAPONICA (HEMIPTERA: RICANIIDAE): FOUND IN THE WESTERN BLACK SEA, TURKEY

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ABSTRACT: The exotic species Ricania japonica Melichar, 1898 (Hemiptera: Ricaniidae) was collected for the first time in the Western Black Sea Region, Turkey in 2017. It is Far East origin and assumed to be invaded from Georgia in 2006 to the Eastern Black Sea Region of Turkey, and then a sudden outbreak occured and has increased its distribution area to the West of Turkey.

KEY WORDS: Ricania japonica, Ricaniidae, new record, Western Black Sea, Turkey

The family Ricaniidae includes over 45 genera and 450 species worldwide (Chou et al., 1985; Xu et al., 2006; Ginezdilov, 2009). In the genus Ricania, the Japanese planthopper, Ricania japonica Melichar, 1898, is a polyphagous sap-feeding insect which can be found on various trees, fruit, vegetable and ornamental plants, shrubs and weeds. Species of the genus Ricania identified so far in Turkey are Ricania simulans (Walker, 1851) (Ak et al., 2013; Gokturk & Mihli, 2015); Ricania aylae Dlabola, 1983 (Demir & Demirsoy, 2009) and Ricania hedenborgi Stål, 1865 (Lodos & Kalkandelen, 1981; Tezcan & Zeybekoglu, 2001). In some sources, it is stated that records of R. simulans in Turkey are misidentifications of R. japonica (Demir, 2009). Ricania japonica has been confirmed with our study. Similarly, Demir (2009) reported that R. aylae may be a synonym of R. hedenborgi. Further studies are needed to assess precisely accurate diagnosis, distribution and impacts on native ornamental and crop plants in Turkey. The aim of the present paper is to provide new information on the distribution of this species introduced in Turkey and clarify confusion in the identification of species.

MATERIAL AND METHODS

Sampling was made on plants in Akçaköca, Düzce during September 2017 (Fig. 1). Materials have been collected by visual inspections of the plants. The material collected was brought to the laboratory. The samples were separated individually and labelled for identification. Dried specimens were used for the description. The confirmation of the species determination was made by Ilia Gjonov (Sofia University, Bulgaria). The specimens were deposited in the Duzce University, Faculty of Agriculture and Natural Science, Turkey.

RESULTS AND DISCUSSION

Details of the examined material of the species is given below:

Subfamily Ricaniinae
Tribe Ricaniini
Genus *Ricania* Germar, 1818

*Ricania japonica* Melichar, 1898
(Fig. 2)

**Syn.** *Ricania episcopalis* Uhler, 1896

**Material examined:** Düzce: Açakoca, Turkey, 41°5'17.452'' N and 31°7'26.314'' E, 153 m, 21.IX.2017, leg. Sevcan Oztemiz (1 specimen, 7 samples: 4♀♀; 3♂♂), on hazelnut.

**Distribution in Turkey:** This species was previously reported in Rize, Artvin, Trabzon provinces (Demir, 2009; Ak et al., 2013; Gokturk & Mihli, 2015).

**Distribution in the World:** Japan, China, Korea, Georgia, Ukraine, Bulgaria and Oriental region (Dlabola, 1967; Nast, 1972, 1987; Ginezdilov & Sugonyaev, 2009; Gjonov, 2011).

*Ricania* species have been recorded on crops, such as bean, cucumber, tomato, aubergine, maize, apple, pear, cherry, grapevine, fig, citrus, kiwifruit and tea (Tezcan & Zeybekoglu, 2001; Demir 2009; Ak et al., 2015). In the study, we found on hazelnut in Açakoca, Düzce.

**CONCLUSION**

The Ricaniidae fauna of Western part of Turkey was revealed with the result obtained with this study. It would be necessary to carry out further research into the distribution of the species and monitoring of its population in Turkey to determine the spread of *R. japonica* in different hosts. As in *R. japonica*, it would be useful to gather regular information about the species composition, coverage, and impact of the invasive species in Turkey which has been exposed to new introductions more in the last decade.

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Figure 1. The locality of *Ricania japonica* in Turkey.

Figure 2. Adults of *Ricania japonica*.
RODENT BIBLIOGRAPHY OF TURKEY
(MAMMALIA: RODENTIA)

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ABSTRACT: This study is based on literature records of scientific studies about rodents of Turkey to date. Additional attempt was given to track for some old literature which were available in library shelves or from researchers themselves. This study includes some research topics such as taxonomy, systematics, distribution, biology, ecology, karyology, cytology and behaviour of Turkish rodents represented by 68 species in Turkey. A total of 484 literature record, reviewed with their scoped areas, has been presented to be the state-of-the-art for new researches. This publication does not aim to validate nor authorize the content of studies but rather attempts to put them in to an order based upon a selection of those publications that have complete information of layout and fully presented according to academic rules and necessities, and so as to be written in order of author, year, title, periodical or book, volume, issue and pages, properly.

KEY WORDS: Rodents, bibliography, literature, Mammalia, Turkey

World mammals have 28 orders, 53 families 1229 genera and 5416 species. Order Rodentia is the the largest of mammal groups with 33 families, 482 genera and 2277 species (Wilson & Reeder, 2005). Mammals in Turkey are represented by 9 order as Erinaceomorpha, Soricomorpha, Chiroptera, Carnivora, Lagomorpha, Rodentia, Perissodactyla, Artiodactyla, and Cetace. Previously, bibliographies related to Chiroptera, Carnivora and Artiodactyla from Turkey were published (Albayrak et al., 1997, 1998, 2000). Therefore, the review presented in this study will be followed by the Orders Erinaceomorpha, Soricomorpha, Lagomorpha, Perissodactyla and Cetace to be able to complete a whole Turkish mammalian bibliography. The name of the Order Insectivora has been changed to two orders as the Order Erinaceomorpha and the Order Soricomorpha recently (Wilson & Reeder, 2005).

This study aims to prepare the bibliography of Order Rodentia which has the highest number of species in Turkey as in the World.

MATERIAL AND METHOD

This study was carried out with scanning of literature, related books in libraries and also records provided from the autobiographies of the researchers. All the literature about Rodentia, including taxonomy, systematics, distribution, bioecology, behaviour, karyology, cytology, genetics and molecular biology, is sorted by alphabetical order of the author's name and year in the findings section. Some periodicals are abbreviated according to “Web of Science” and some were cited according to abbreviation used by the periodicals. The references section contains the general mammalian literature.

RESULTS

A total of 68 rodent species live in Turkey. There have been some changes in the status of the taxa so far. It was noticeable that the molecular studies also
recommended considerable changes in the status of some taxa. The updated list of the studies of Turkish rodent fauna were given below.


In addition to the previously published mammal bibliography (Aytuğ & Çakman, 1972; Önder, 1982; Doğramacı, 1989), ever since the first record of rodents in Turkey, the names of some taxa and taxonomic categories have been changed. In this study, a total of 484 references was accessed on the Rodentia. Then 319 of them belong to native researchers and 90 foreign researchers and 75 native and foreign researchers (Fig. 1).

According to literature, 68 species of 171 mammalian species recorded in Turkey belong to the Order Rodentia. Five species, *Spermophilus taurensis*, *Microtus guentheri*, *Microtus dogramacii*, *Dryomys laniger* and *Acomys cilicicus* belonging the Order Rodentia and one species, *Crocidura arispa* belonging the Order Soricomorpha are endemic.

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![Figure 1. Numerical distribution of studies on rodent species in Turkey.](image-url)
SCIENTIFIC NOTES

NEW RECORD OF ARISTOBIA APPROXIMATOR THOMSON (COLEOPTERA: CERAMBYCIDAE) AS A PEST OF QUERCUS SERRATA IN MANIPUR, INDIA

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Aristobia approximator (Thomson, 1865) (Coleoptera : Cerambyciidae) is recorded as a pest of Quercus serrata, food plant of oak tasar silkworm, Antheraea proylei for the first time in Manipur.

Quercus serrata Thunberg commonly known as oak is the primary food plant of Oak tasar silkworm, Antheraea proylei and is susceptible to various insects pest which adversely affect the leaf quality and quantity as well as plant body leading to poor crop yield. This oak flora is abundantly available in Manipur which can be exploited for raising oak tasar cocoons. Inspite of having abundant oak, the main constraints being faced in oak tasar culture is the attack of the food plants by a large number of insect pests (Singh & Kulshrestha, 1990) causing serious depredations in silk productivity. The insects attacking the oak plants destroy all the stages of the plant by sucking the sap, defoliating the leaves, boring the meristem, cutting the seedlings and decaying the root leading to growth loss and mortality. The damage caused by these insect enemies’ ranges between 15 to 25 % of the crop loss (Devi & Singh, 2011).

While studying the population dynamics of insect pest infesting Q. serrata in Manipur, Aristobia approximator was found infesting the plant (Figs. 1 & 2). The infestation of the plant by A. approximator was observed throughout the year but its maximum incidence was observed during June to August. Various workers (Singh & Tikoo, 1990; Singh, 1991; Singh & Singh, 1991; Konthoujam et al., 2009; Devi & Singh, 2011) had reported hairy caterpillar, Phaler a raya Moore, Leaf roller, Apoderus notatus Fabricius, semilooper, Hyblaea puera Cramer, black beetle, Cleoporus lefeverei Duvivier, stem borers, Batocera lineolata Chevrolat, aphids etc. as pest of Q. serrata from Manipur. This is the first report of A. approximator as pest of Q. serrata in Manipur.

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Figure 1. *Aristobia approximator* (adult).

Figure 2. *Q. serrata* bark damaged by *A. approximator*. 