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TWO NEW SPECIES OF THE GENUS *PARMENA* DEJEAN, 1821 (COLEOPTERA: CERAMBYCIDAE) FROM EASTERN EUROPE

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[**Danilevsky, M. L. & Hızal, E.** 2017. Two new species of the genus *Parmena* Dejean, 1821 (Coleoptera: Cerambycidae) from Eastern Europe. Munis Entomology & Zoology, 12 (1): 1-4]

ABSTRACT: *Parmena europaea* Danilevsky, sp. nov. is described from Ukraine and Rumania. The new species is supposed for Moldavia. *Parmena istanbulensis* Danilevsky & Hizal, sp. nov. is described from European Turkey (Istanbul environs). Both new species are similar to *P. balteus balteus* (L.); the distinguishing characters are discussed.

KEY WORDS: New species, taxonomy, Cerambycidae, Lamiinae, *Parmena*, Moldavia, Rumania, Turkey, Ukraine

Parmena species similar to *P. balteus* (Linnaeus, 1767) was several times recorded from Eastern Europe with different names, but all were not adequate. Plavilstshikov (1932) mentioned it for South-West Ukraine as *P. balteus balteus* (Linnaeus, 1767), which was originally described from "Lusitania" (South France, see Sama, 1984) and distributed also in North-West Italy and West Switzerland. Plavilstshikov (1958) joined Ukrainian population from Poltava Region (Yareski, 49°50'N, 33°54'E) to Italian *P. unifasciata* Rossi, 1790 (as *P. balteus unifasciata*). *P. balteus* (= *unifasciata* Rossi following Danilevsky, 1980) was recorded for the European part of USSR by Lobanov et al. (1982). The Eastern Europe was not included in the area of the genus *Parmena* by Sama (1984), but a big query mark was put by him on that territory in the areal map of the genus. According to Sama (1984) the eastern most species of the genus in West Europe is *P. unifasciata* Rossi, 1790, which penetrates eastwards to about Central Rumania (especially mentioned were Baile Herculane and Mehadia). Rumania (Banat) was included in the area of *P. unifasciata* by Sama (2002). *P. balteus* was recorded for Moldavia by Neculiseanu & Baban (2005). *P. pontocircassica* Danilevsky & Miroshnikov, 1985 was recorded for Ukraine by Bartenev, 2009. Moldova was included in the area of *P. unifasciata* by Danilevsky & Smetana (2010).

The study of a female from Ukraine and a female from Rumania (Baile Herculane) shows the considerable differences of the species from *P. unifasciata* Rossi, 1790. Supposedly same species is known from Moldavia.

Parmena europaea Danilevsky, sp. nov.

(Figs. 1-2)

Parmena balteus balteus, Plavilstshikov, 1932: 192, part. - South-West Ukraine.

Parmena balteus unifasciata, Plavilstshikov, 1958: 28, part. – including Poltava Region of Ukraine (Yareski); 1965: 396, part. – south of Ukraine, Caucasus; Panin & Săvulescu, 1961: 372 - Băile Herculane (Rumania).

Parmena unifasciata, Sama, 1984: 225, part. – including Baile Herculane and Mehadia (Rumania); 2002: 96, part. – including Banat (Rumania); Danilevsky & Smetana. 2010: 290, part. - including Moldavia and Rumania.

Parmena balteus, Neculiseanu & Baban, 2005: 201 – Moldavia.
Parmena pontocircassica, Bartenev, 2009: 273, part. – including Poltava Region of Ukraine.

Only two females are available; the species is very similar to *P. balteus balteus,* but frons wider, genae about as long as lower eye lobe (holotype) or a little longer; upper eye lobe narrow, as wide as 4 or 5 ommatidia; 1st antennal joint narrower (about 2.1 times longer than wide) and relatively longer, reaching second third of prothorax; prothorax about as long, as basal width (paratype) or a little longer; lateral thoracic tubercles much smaller; pronotum with irregular wrinkles (holotype) or relatively smooth (paratype); dark transverse elytral band much wider, not interrupted along suture, with rather contrast pale anterior and posterior borders; light setae spots near scutellum hardly pronounced (holotype) or absent (paratype); elytral punctation more sparse, but smaller; short elytral oblique setae hardly visible; body length: 6.2 (holotype) - 7.3 mm, body width: 2.3 (holotype) - 2.9 mm.

Differencial diagnoses. The new species is close to *P. pontocircassica* Danilevsky & Miroshnikov, 1985, but *P. pontocircassica* with 1st antennal joint shorter and wider; lateral thoracic tubercles bigger; elytral punctation denser and bigger, elytral band relatively narrow, usually interrupted along suture, its light borders less contrast; light setae spots near scutellum distinct.

The new species is not similar to *P. unifasciata* Rossi, 1790, which is usually much bigger and lighter (reddish); with another character of pronotal and elytral punctation.

Materials. Holotype, female with 2 labels: 1) in Russian [Poltavskaya / Yareski / VII.919], 2) *Parmena ?pontocircassica* det. S.Saluk, 1988 – Plavilstshikov's collection in Zoological Museum of Moscow University; paratype, female with 2 labels: 1) Baile-Herculane / 13.5.1960 / Dr. A. Popescy-Gorj; 2) Colectia / Dr. N. Săvulescu - preserved in "Grigore Antipa" National Museum of Natural History, Bucharest.

Distribution. East Europe, three localities are definitely known; Ukraine, Yareski (49°50'N, 33°54'E) in Poltava Region; Banat area of Rumania: Băile Herculane (44°52′43″N 22°24′51″E) and Mehadia environs (Sama, 1984, 44°54'N, 22°22'E); most probably the record for Moldavia (Neculiseanu & Baban, 2005) was connected with new species.

Etymology. Europaea (Latin) – in English: European.

***Parmena istanbulensis* Danilevsky & Hizal, sp. nov.**

(Figs. 3-4)

Two females available; small dark species also close to *P. balteus balteus*; frons, genae and eye lobes are about same; 1st antennal joint is also short and wide; prothorax a little longer, than basal width with similar lateral tubercles; pronotum with very rough big irregular punctation; partly conjugating dots of different size forming irregular wrinkles; elytra with sparse punctation less pronounced than in *P. balteus balteus*; oblique short setae rather long, pale and that is why rather distinct; pale setae spots near scutellum well developed; dark transverse elytral band wide, interrupted along suture, with contrast pale anterior

and posterior borders; elytral punctation sparser and smaller than in *P. balteus balteus*; body length: 6.7-7.4 mm, body width: 2.6-2.8 mm.
Differencial diagnoses. The new species is similar to *P. pontocircassica* Danilevsky & Miroshnikov, 1985, but *P. pontocircassica* is generally smaller; its pronotum with less rough sculpture; elytral band narrower, its light borders less contrast; erect short elytral setae hardly visible.

Materials. Holotype, female, Turkey, Istanbul, Bahçeköy Sarıyer, 25.4.2016, E. Hizal leg. – preserved in the collection of M.Danilevsky (Moscow); paratype, female, same locality, 16.6.2011, E. Hizal leg. – preserved in the collection of the Department of Forest Entomology and Protection, Faculty of Forestry, Istanbul University.

Distribution. European Turkey; the species is known from the nearest environs of Istanbul – Belgrad Forest.

Etymology. The new species is named after the name of its type locality – Istanbul province.

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LITERATURE CITED

Bartenev, A. F. 2009. Zhuki-usachi Levoberezhnoy Ukrainy i Kryma. Kharkov: Kharkovskiy Natsionalnyi Universitet: 405 pp.

Danilevsky, M. L. 1980. Novyy vid drovosekov roda Parmena Latr. (Coleoptera, Cerambycidae) iz Zakavkazya. Entomologicheskoe Obozrenie, 59: 852-854.

Danilevsky, M. L. & Miroshnikov, A. I. 1985. Zhuki-drovoseki Kavkaza (Coleoptera, Cerambycidae). Opredelitel. Krasnodar: Kubanskiy Selskokhozyaistvennyy Institut, 417 pp., 10 pls.

Danilevsky, M. L. & Smetana, A. 2010. [Cerambycidae taxa from Russia and countries of former Soviet Union, and Mongolia] In I. Lobl & A. Smetana (ed.) Catalogue of Palaearctic Coleoptera, Vol. 6. Stenstrup: Apollo Books, 924 pp.

Linnaeus, C. 1767. Systema Naturae per regna tria naturae,secundum classes, ordines, genera, species, cum characteribus differentiis, synonymis, locis. Editio duodecima, reformata. Tom. I. Pars II. Holmiae: Laurentii Salvii, [2] + 533-1327 + [37] pp.

Lobanov, A. L., Danilevsky, M. L. & Murzin, S. V. 1982. Sistematicheskiy spisok usachei (Coleoptera, Cerambycidae) fauny SSSR. II. Entomologicheskoe Obozrenie, 62: 252-277.

Neculiseanu, Z. & Baban, E. 2005. Fauna cerambicidelor (Coleoptera: Cerambycidae) din Republica Moldova.- Analele stiintifice ale USM. Seria "Stiinte chimico-biologice", 2005: 199-202.

Panin, S. & Săvulescu, N. 1961. Familia Cerambycidae (Croitori). Fauna Republicii Populare Romine, Insecta 10 (5), Coleoptera. Bucuresti: 523 pp.

Plavilstshikov, N. N. 1932. Zhuki-drovoseki – vrediteli drevesiny. Moscow, Leningrad: Gosurdarstvennoe Lesnoe Tekhnicheskoe Izdatelstvo: 200 pp.

Plavilstshikov, N. N. 1958. Fauna SSSR. Zhestokrylye. T. XXIII, vyp. 1. Zhuki-drovoseki. Ch. 3. Podsemeistvo Lamiinae, ch. 1. Moskva - Leningrad: Izdatel'stvo Akademii Nauk SSSR, 591 + [1] pp.

Plavilstshikov, N. N. 1965. 75. Sem. Cerambycidae – zhuki-drovoseki, usachi, pp. 389-419. In: G.Ya. Bey-Bienko (red.). Opredelitel nasekomykh Evropeyskoy chasti SSSR, v.II. Zhestkokrylye i veerokrylye. Moscou-Leningrad: Nauka: 668 pp.

Rossi, P. 1790. Fauna Etrusca sistens insecta quae in provinciis Florentina et Pisana praesertim collegit. Tomus primus. Liburni: Typis Thomae Masi & Sociorum, xxii + 272 pp., 10 pls.

Sama, G. 1984. Studi sul genere Parmena Latreille,1829. (Prima parte). Rivista Piemontese di Storia Naturale, 5: 205-230.

Sama, G. 2002. Atlas of Cerambycidae of Europe and the Mediterranean area. Vol. 1: northern, western, central and eastern Europe, British Isles and continental Europe from France (excl. Corsica) to Scandinavia and Urals. Zlín: Kabourek, 173 pp.

1 **2**

Figures 1-2. *Parmena europaea* Danilevsky, sp. n., 1. female, holotype, 2. female, paratype.

3 **4**

Figures 3-4. *Parmena istanbulensis* Danilevsky & Hizal, sp. n., 3. female, holotype, 4. female, paratype.

TURKISH SPECIES OF *TORYMUS* DALMAN, 1820 (HYMENOPTERA: TORYIDAE: TORYMINI), WITH DESCRIPTIONS OF NEW SPECIES

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[Doğanlar, M. 2017. Turkish species of *Torymus* Dalman, 1820 (Hymenoptera: Toryidae: Torymini), with descriptions of new species. Munis Entomology & Zoology, 12 (1): 5-22**]**

ABSTRACT: Turkish species of *Torymus* Dalman, 1820 (Hymenoptera: Torymidae), collected from several parts of Turkey, were studied in the last 30 years. Totally 32 species of *Torymus*, were obtained, such as: the known species are *T. nitidulus* (Walker), *T. cyaneus* Walker, *T. pygmaeus* Mayr, *T. ramicola* Ruschka, *T. igniceps* Mayr, *T. fastuosus* Boheman, *T. longicalcar* Graham, *T. flavipes* (Walker), *T. erucarum* (Schrank), *T. phillyreae* Ruschka, *T. apiomyiae* Boucek & Mihajlovic, *T. bedeguaris* (Linnaeus), *T. geranii* (Walker), *T. auratus* (Müller), *T. arcella* Graham & Gijswijt, *T. cultriventris* Ratzeburg, *T. verbasci* Ruschka, *T. cultratus* Graham & Gijswijt, *T. rubi* (Schrank), the newly recorded species are *T. pulchellus* Thomson, *T. quercinus* Boheman, *T. poae* (Hoffmeyer), *T. nobilis* Boheman, *T. micrurus* Boucek, *T. nigritarsus* (Walker), *T. artemisiae* Mayr, *T. monticola* Graham & Gijswijt, *T. hornigi* Ruschka, *T. tipulariarum* Zetterstedt, *T. millefolii* Ruschka, and 2 new species are *T. basarani* sp. nov. and *T. bingoelensis* sp. nov. In order to identify the parasitoid species, an identification key for the known Turkish species, was provided. The new species were described, their diagnostic characters were illustrated and compared with the similar species of the genus.

KEY WORDS: *Torymus* spp., Hymenoptera, Torymidae, Turkey

The genus *Torymus* was described by Dalman (1820) having type species *Ichneumon bedeguaris* Linnaeus, designated by Curtis 1835:552. Grissell (1995) gave the synonyms of genus, including *Diamorus* Walker 1834, and of species, and recorded 317 world species. Noyes (2015) gave 417 species from all over the world. From Turkey, Stonova et al. (2012) listed 15 species and Noyes (2015) 12 species. Doğanlar (2016) stated *Diamorus* as a distinct genus by giving diagnostic characters of hypopigium, and listed 2 species from Turkey. Diagnostic characters of the genus, *Torymus*, host records and distributions of the known species were given by Grissell (1995) and Noyes (2015), and the known Turkish species of *Torymus* were listed by Doğanlar (2016).

By this work 32 species, 2 of them new and 11 of them new record for Turkey, were found. The new species were described, and a new identification key for the Turkish species was provided by using the characters were given by Graham & Gijswijt (1998).

MATERIAL AND METHOD

This study is based upon examination and identification of the specimens collected from some parts of Turkey in the last 30 years. The examined specimens and types of the new species were deposited in Insect Museum of Biological Control Station, Yüreğir, Adana, Turkey (IMBC). Specimens, associated with galls were reared from galls which were kept in the cages (50x50x80 cm) under laboratory conditions (20-25° C and 50-60% relative humidity). The adults emerged from the galls were collected, killed, mounted on card and kept in the museum. Some 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 for further morphological studies. The species were identified by following the keys of Grissell (1995), Graham & Gijswijt (1998), Zerova & Seryogina (2003). Wings and antennae of holotypes of the new species were slide-mounted in Canada balsam. 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 Gibson (1997). Abbreviations used in the key and descriptions are: OOL= shorter distance between ocello-ocular line, POL= distance between posterior ocelli, F1-6 = funicular segments.

RESULTS AND DISCUSSION

Key to the Turkish species of *Torymus* Dalman based on characters were given by Graham & Gijswijt (1998)

1-Hind tibia with one distinct spur. Posterior third of scutellum mainly smooth, without setae; Scutellar frenum indicated by an area devoid of setae but not deliminated anteriorly by an impressed line. Mesoscutum and scutellum very shiny, with distinct transverse striae, with fine reticulations between striae. Antennal flagellum pale brown or testaceous beneath...2

--Hind tibia with two distinct spurs; scutellar frenum present or not; other characters variable..3

2-Antenna with Fl anelliform, distinctly broader than long, usually lacking sensilla; some of the following segments broader than long. Ovipositor sheaths as long as or very slightly longer than metasoma plus mesosoma. Dorsal surface of hind coxa bare in basal half. Body bright blue, green, or golden green. Fore coxae at least yellow apically, sometimes about half yellow. Scape yellow beneath, or almost wholly so. Very small species: length 1.2-1.8 mm... ***T. nitidulus* (Walker)**

-- Antenna with Fl distinctly longer than broad, with two long sensillae; segments of flagellum distinctly longer than broad. Ovipositor sheaths as long as or very slightly longer than metasoma. Dorsal surface of hind coxa bare, in almost whole length. Body bright blue- green, legs yellow, except base of mid coxae with basal half metallic. Scape and pediel yellow wholly so. Length of body+ovipositor: 2.88+1.5 mm............................ ....***T. basarani* sp. nov.**

3-- Antenna with Fl slightly to quite distinctly shorter than F2, seen in profile with only one sensillum or two sensilla. Ovipositor sheaths somewhat longer than the body, index 3.5-4.5. Dorsal surface of hind coxa bare in basal half. Antenna with anellus broader than long; scape nearly 4 times as long as broad; F2 distinctly longer than broad. Body rather dark bluegreen to blue, gaster sometimes more or less violet . Antennal scape testaceous except dorsally. Head with temples converging strongly .... ***T. ramicola* Ruschka**

--Antenna with Fl as long as or longer than F2 and provided with sensilla (usually more than 2 visible in profile); if F1 is somewhat shorter than F2 (*T. pygmaeus, pulchellus*) then the ovipositor sheaths are much shorter than the body. Dorsal surface of hind coxa often pilose in basal half.. 4

4- Posterior 0.25 to 0.45 of scutellum ("frenal area") differentiated in some way from the rest: either extensively or wholly polished and smooth, and delimitated anteriorly by a weak to strong impressed line. Hind femur without tooth... 5

-- Scutellum without any such differentiated area posteriorly, wholly reticulate (though occasionally the sculpture becomes gradually weaker towards the posterior edge of the scutellum) and with some piliferous punctures in the posterior part.............................. 6

5- Ovipositor sheaths 1.66x longer than the body; index 6.0. Posterior ocelli smaller, OD 0.71x OOL. POL 2.5x OOL. Distance between lateral ocellus and occipital carina 1.44x OOL. Upper surface of costal cell with some setae. Mesoscutum, axillae, and scutellum anterior to frenal area aluteous between the piliferous punctures. Mesepimeron broad and almost twice higher than broad; Vertex without a suture between lateral ocelli and eyes. Head 2x as broad as long; Eyes separated almost by their own length; distance between eyes 2.75x frontal width of eye; temple 0.3x length of eye; Dorsal surface of hind coxae bare in basal half, often with a longitudinal curved carina. Hind coxa stouter, its posterior edge distinctly curved. The hind femur is 5 times as long as broad and the scutellum has the frenal area marked off by distinct transverse impressed line. Ovipositor sheaths 1.66x longer than the body; index 6.0. Gaster not compressed, dorsally flat; basal sternite extremely long, about twice length of hind coxa and reaching nearly to tip of hypopygium; hind margin of tergite 4 deeply triangularly emarginate. Propodeum very weakly alutaceous-reticulate, without striae, hind coxa with a dorsal carina. Antenna with anellus 2.5 times as broad as long. Head in dorsal view twice as broad as long.. ***T. bingoelensis* sp. nov.**

--- Ovipositor sheaths slightly shorter than the body. Ovipositor index 1.7-2.1. Posterior ocelli large, OD greater than OOL. Posterior 0.25-0.3 of mesoscutum, axillae partly, and scutellum anterior to frenal area smooth and polished between the very distinct piliferous punctures. Eyes separated by somewhat less than their length. Head and thorax green to blue; gaster sometimes with slight violet tinge in places. Body-length 2.1-4.0 mm.. ***T. cyaneus* Walker**

6- Antenna with Fl lacking sensilla, a little shorter than F2. Antennal flagellum proximally not or only just as stout as pedicellus, but thickening obviously distad so that the clava is about twice as broad as F l, which is sometimes slightly shorter than F2; pedicellus 1.8-2.0 times length of Fl; distal segments of funicle usually slightly broader than long. Forewing with lower surface normally with one row of setae, or none, below the cubital vein; Hind coxa nearly bare dorsally, only 2-3 setae in basal half; Gaster strongly compressed, ovipositor sheaths about as long as gaster. body bluegreen to greenish-blue; antennal scape black, or paler below, the radicula always pale; legs with femora mainly black, tibiae sometimes more or less infuscate; gaster often partly or mainly bronze. Body length 1.2-2.1 mm parasite of *Contarinia subulifex* in galls on *Quercus cerris*.. ***T. pygmaeus* Mayr**

-- Antenna with Fl having sensilla, as long as or longer than F2; other characters variable.. 7

7- Propodeum sloping at only about 30 degrees relative to longitudinal axis of body, relatively dull, with distinct, more or less raised reticulation, often also with some irregular wrinkles or rugosity. Mesoscutum and scutellum shiny, with large though widely spaced piliferous punctures. Hind coxa with dorsal surface bare. Antenna: F4-F7 each with a stripe of micropilosity beneath. Ovipositor sheaths much shorter than the body. Thorax green to blue; vertex often coppery or crimson. Legs, except mid and hind coxae, red.. ***T. igniceps* Mayr**

-- Propodeum sloping more steeply, in most species shiny with some superficial or engraved sculpture. Mesoscutum and scutellum usually less shiny, if with large punctures then these are closer together. A very few species in which the propodeal sculpture sometimes approaches. Antennal flagellum without areas of micropilosity beneath; hind coxa bare and ovipositor sheaths shorter than the body... 8

8- Ovipositor index 1.5-1.55. Ovipositor sheaths shorter than the body; antennal flagellum very stout, tending to be cylindrical; sensilla rather short, in 2 (occasionally 3) rows on each funicular segment; scape extensively to wholly testaceous; Propodeum with at least some weak longitudinal stria, often 23 longitudinal striae, on each side of median line. Forewing with M 68.5 times length of ST; stigma distinctly petiolate; speculum not reaching ST. Species associated with *Quercus*.......................... ***T. fastuosus* Boheman**

-- Not having the above combination of characters.. 9

9- Shorter spur of hind tibia only half as long as the longer spur, length of the latter only equal to maximum breadth of the tibia. Gaster tending to appear triangular in profile, the tip of the hypopygium situated only slightly beyond the apex of the basal sternite. Hind coxa normally bare dorsally in basal half. Malar space 0.3-0.36 length of eye. Mesoscutum and scutellum shiny; scutellum, except at the sides, with very sparse piliferous punctures. Facial pilosity composed of thicker and slightly flattened setae, which tend to hide the surface somewhat. Ovipositor sheaths 0.65-0.75 length of gaster, index 1.15-1.6. Antenna with Fl 1.5 times as long as the anellus and sometimes lacking sensilla. Species associated with *Salix* but host unknown....... ***T. pulchellus* Thomson**

-- Shorter spur of hind tibia in most species more than half as long as the longer spur; if only half (*T. longicalcar, flavipes*) then length of longer spur is much greater than the breadth of the tibia. Gaster nearly always with tip of hypopygium situated more distad. Hind coxa either bare, or more or less pilose, dorsally in basal half.............................. 10

10- Longer spur of hind tibia 0.6-0.65 length of basitarsus and 1.65-2.0 times the breadth of the tibia. Hind coxa bare dorsally in basal half; basitarsus of hind legs nearly or quite half as long as tibia.. 11

-- Longer spur of hind tibia 0.3-0.5 length of basitarsus and usually less than 1.65 times the breadth of the tibia but if as much as 1.65 then hind coxa pilose dorsally in basal half. Basitarsus of hind legs usually relatively shorter.. 12

11 - Gaster with tip of hypopygium very near or level with apex of gaster; ovipositor sheaths usually a little longer than the body, o.i. 3.3-3.5. Thorax slender, 1.9-2.2 times as long as broad. Legs very slende, hind coxa more than 2.5 times as long as broad. Gaster reddish-yellow ventrally i n at least basal half, sometimes whole gaster except the dorsal surface pale.. ***T. longicalcar*** **Graham**

-- Gaster with tip of hypopygium situated at about 0.75 its length; ovipositor sheaths shorter than body, o.i. about 3.0. Thorax more squat, 1.75-1.8 times as long as broad. Legs stouter; hind coxa about twice as long as broad. Gaster normally without pale area, rarely obscurely reddish at extreme base.................................... ***T. flavipes*** **(Walker)**

12- Ovipositor sheaths at most as long as metasoma plus mesosoma, which has numerous and moderately close piliferous punctures on mesoscutum and scutellum, antennal scape reaching level of vertex and 0.9 length of eye, flagellum usually with F l stouter than pedicellus and at most 1.5 times as long as broad; F l most often distinctly broader at base than the anellus, from which it is separated by a distinct constriction; anellus sometimes broader than long; clava ventrally with a small area of micropilosity on C3 only; . Propodeum with fine, superficial or engraved sculpture, sometimes partly smooth; head and thorax partly purplish or coppery, gaster with a reddish subbasal ring or band.. 13

-- Ovipositor sheaths fully as long as, or a little longer than, the body; index 3.5-4.8. Mesoscutum and scutellum (especially the latter) with sparse piliferous punctures. Antennal scape shorter than transverse diameter of eye, only 0.7 length of eye and reaching only to lower edge of anterior ocellus, pedicellus plus flagellum 1.25-1.35 times breadth of head; anellus distinctly transverse; Fl slightly shorter than, or as long as pedicellus. Legs with femora black; hind tibiae sometimes more or less infuscate medially. Head and thorax blue-green to blue, or with violet parts; gaster blue-green, blue, or mainly violet.. 14

13- Host on *Populus*. Malar space 0.42-0.47 length of eye............ ***T. quercinus*** **Boheman**

-- Host on *Poa*. Malar space about 0.35 length of eye....................... ***T. poae*** **(Hoffmeyer)**

14-- Vertex with punctures minute and generally not well visible amongst the reticulation, if rather more distinct then F l slightly shorter than pedicellus and propodeum, weakly alutaceous. PM twice as long as ST. Head in dorsal view 2.05-2.15 times as broad as long, with temples converging strongly and 0.15-0.25 length of eyes. Ovipositor index 1.95-2.25. Mouth 2.2-2.35 times as long as malar space. Mesosoma rather stout, as broad as head. Hosts: *Rabdophaga salicis* and *R. saliciperda* on *Salix*............................ .... ***T. tipulariarum*** **(Zetterstedt)**

-- Not having the above combination of characters.. 15

15- Antennal scape reaching above level of vertex.. 16

-- Antennal scape usually not reaching level of vertex... 17

16- Ovipositor sheaths shorter than body but longer than gaster. Ovipositor index 1.8-2.4. Gaster with at least a reddish subbasal ring, often more extensively reddish ventrally. Head and mesosoma mainly to wholly dark blue, or violet. Length of antennal scape 0.8-0.85 length of eye. Malar space 0.31-0.37 length of eye. POL 1.8-2.1 times OOL. on *Quercus*.. ***T. nobilis*** **Boheman**

-- Ovipositor sheaths longer than body, index 3.8-4.1. Head and dorsum of thorax partly to mainly purplish. Forewing often with a dark discal cloud or streak................................ .... ***T. erucarum*** **(Schrank)**

17- Setae of mesoscutum, and those of scutellum mainly, very short, decumbent, dense, only a few in posterior quarter of scutellum are longer and somewhat raised. Notauli shallow. Face below toruli thickly clothed with silvery-white downward pointing setae;

sides of face above toruli with similar setae which tend to point obliquely outwards. Malar space 0.4-0.46 length of eye. Mouth only 1.55-1.75 malar space..........................18

-- Setae of mesoscutum at least slightly raised, usually longer; setae of scutellum more or less raised, very long in posterior part. Notauli usually deeper but if approaching the condition seen in *T. phillyreae* then malar space shorter. Setae of face usually sparser.... 20

18- Tip of hypopygium at most at 0.8 length of gaster. Ovipositor index 1.5-1.8, sheaths 1.0-1.15 length of gaster. Hind coxa dorsally with at most seven setae in a single or slightly irregular row. Hair row on underside costal cell complete. Head with temples converging very strongly and weakly curved. Gena wholly alutaceous, the sculpture extending to or virtually to the malar sulcus on its posterior side Setae of mesoscutum, and those of scutellum mainly, very short, decumbent, dense, only a few in posterior quarter of scutellum are longer and somewhat raised. Notauli shallow. Face below toruli thickly clothed with silvery-white downward pointing setae; sides of face above toruli with similar setae which tend to point obliquely outwards. Malar space 0.40.46 length of eye. Mouth only 1.55-1.75 malar space. Legs mainly testaceous, including fore coxae more or less; at most hind femora and tibiae infuscate Hosts on different plants, as far as known not on *Artemisia* in Europe..................................... ***T. phillyreae*** **Ruschka**

-- Tip of hypopygium nearly level with apex of gaster. Ovipositor index at most 0.85. Hind coxa about in most species at most 2.5 times as long as broad and with their posterior edge distinctly curved. Other characters variable.. 19

19- Ovipositor index 0.85. Base of scutellum broad, nearly truncate....................................... .... ***T. triangularis*** **Thomson**

-- Ovipositor index about 0.6. Base of scutellum rounded.................. ***T. micrurus*** **Boucek**

20-- Legs black, with only knees and extreme base of tarsi obscurely testaceous, or almost wholly black, only hind tarsi more or less pale at base.. 21

-- Legs relatively paler, yellow, at most some parts of femora and tarsi black..................... 22

21- Forewing: speculum very small, not extending under the parastigma; basal and costal cells wholly pilose. Legs short and stout; hind femur about 3.3 times as long as broad; spur of hind tibia about 0.45 length of basitarsus. Ovipositor sheaths about 1.4 times length of gaster; index about 2.0....................... ***T. apiomyiae*** **Boucek & Mihajlovic**

-- Forewing: speculum always extending under the parastigma; basal cell.Basal cell of forewing extensively pilose.. ***T. nigritarsus*** **(Walker)**

22- Species either with less conspicuous or more widely spaced piliferous punctures on mesoscutum and scutellum; or with shorter ovipositor sheaths; or with temples converging less strongly and often curved; lateral ocelli usually smaller, often with OOL at least a little greater than OD.. 23

-- Mesoscutum and scutellum with relatively conspicuous piliferous punctures, which on mesoscutum and basal part of scutellum are mostly separated by less than twice their diameter; ovipositor sheaths at least as long as gaster plus thorax, sometimes slightly longer than whole body; index at least 2.85; temples converging strongly, straight or very weakly curved; lateral ocelli large, OOL equal to OD; genae, in front view of head straight.. 25

23 - Gaster not pale marked but mainly coppery or fiery over at least posterior half weakly in some dwarfs. Malar space 0.32-0.36 length of eye. Forewing sometimes more or less infumate discally. Hosts in *Rosa* galls............................... ***T. bedeguaris*** **(Linnaeus)**

-- Gaster either with a reddish or testaceous subbasal band at least on the sides; or else without coppery or fiery colour except sometimes on the middle segments. Malar space 0.23-0.30 length of eye. Forewing hyaline. Hosts in *Quercus* galls.............................. 24

24- Ovipositor index 2.65-3.3, sheaths usually as long as gaster plus thorax, rarely as long as body. Gaster normally with pale subbasal band, at least at sides. Legs tending to be more reddish-testaceous, especially the femora which are rarely dark marked................ .... ***T. geranii*** **(Walker)**

-- Ovipositor index 3.4-4.3, sheaths as long as or very slightly longer than body. Gaster immaculate, bluegreen, green or goldengreen, with sometimes a little coppery tinge on middle segments. Legs paler testaceous or yellow, with hind femora often brown or broadly black medially. Mesoscutum and scutellum with relatively conspicuous piliferous punctures, which on mesoscutum and basal part of scutellum are mostly separated by less than twice their diameter; temples very weakly curved; lateral ocelli large, OOL 0.9 OD, genae, in front view of head straight. Malar space 0.30 length of eye. Forewing hyaline. Ovipositor index 3.52; sheaths very slightly longer than body;. Gaster immaculate, bluegreen, green or goldengreen, with sometimes a little coppery tinge on middle segments. Legs yellow. Hosts in *Quercus* galls.... ***T. auratus* (Müller)**

25- Ovipositor index 2.7-3.55, sheaths about as long as metasoma plus three quarters to whole of mesosoma. Longer spur of hind tibia 0.4-0.45 length of basitarsus. OOL 1.0-1.3 times OD. Genae, in front view of head, straight. Anterior margin of clypeus truncate, or curved slightly forwards.. 26

-- Ovipositor index 0.5-2.6, sheaths at most as long as metasoma plus two thirds of mesosoma but often shorter than this.. 27

26- Tip of hypopygium very nearly level with apex of gaster Legs, including fore coxae mainly yellow.. ***T. arcella* Graham & Gijswijt**

-- Tip of hypopygium more remote from apex of gaster; At least hind femora broadly black medially, hind tibiae and fore coxae most often mainly to wholly dark. Head with temples 0.2-0.32 apparent length of eyes. Anterior margin of clypeus broadly truncate. Mouth about 2.0 malar space. Pedicellus plus flagellum 1.17-1.25 breadth of head. POL slightly less than 1.9 times OOL. Host: on *Artemisia* Length 1.5-2.6 mm......................... .... ***T. artemisiae* Mayr**

27- Genae, in front view of head appearing distinctly curved; head tending towards a circular shape. Antennal anellus quadrate or only very slightly broader than long. Head 2.05-2.15 times as broad as long; temples converging rather strongly, weakly curved. Mesoscutum, axillae and scutellum shiny, with minute, sparsely distributed piliferous punctures (especially the scutellum)................................ ***T. cultriventris* Ratzeburg**

-- Genae, in front view of head, straight or nearly so; head more trapeziform. Antennal anellus sometimes distinctly broader than long.. 28

28- Mouth 1.5-1.8 malar space; legs dark: all femora, and at least mid and hind tibiae, more or less infuscate. Mouth 1.75-1.8 malar space, the latter 0.37-0.4 length of eye. Antenna with flagellum proximally not or only just as stout as pedicellus, but thickening distinctly distad, Fl quadrate Ovipositor index 1.7-1.9... .... ***T. monticola* Graham & Gijswijt**

-- Mouth 2.0-2.6 malar space.. 29

29- Mouth 2.0-2.2 malar space... 30

-- Mouth 2.3-2.6 malar space.. 31

30- Ovipositor index 2.5-2.6. Sides of upper face with several small but distinct punctures. OOL 1.0-1.2 times OD. Piliferous punctures of mesoscutum and scutellum smaller or minute, usually less close together, on scutellum usually widely separated. Host on *Verbascum*.. ***T. verbasci* Ruschka**

-- Ovipositor index 1.15-1.9 and at most slightly longer than gaster. Antennal flagellum moderately clavate. OOL 1.0-1.2 times OD. Piliferous punctures of mesoscutum and scutellum smaller or minute, usually less close together, on scutellum usually widely separated. Host on *Origanum*.. ***T. hornigi* Ruschka**

31- Sculpture of mesonotum over anterior two-thirds, tending to be transversely rippled-scaly, without piliferous punctures. Ovipositor index 2.65, sheaths as long as metasoma plus half mesosoma. Temples slightly longer 0.25 length of eyes. Malar space slightly longer, 0.4 length of eye. Body bright green, more golden-green on genae and parts of mesosomal pleuron. All coxae dark. Hind femur mainly black; fore femur with black dorsal stripe, mid femur with dark median ring. Gaster with tip of hypopygium nearly level with apex of gaster, Length 2.75 mm................. ***T. cultratus* Graham & Gijswijt**

-- Mesonotum with distinct piliferous punctures on mesoscutum and scutellum................ 32

32-- Piliferous punctures of mesoscutum and scutellum moderate sized, rather close, especially on anterior part of scutellum where they are separated by at most twice their diameter. Ovipositor index 2.1-2.4. Head with temples converging very strongly. Malar space 0.26-0.29 length of eye. Mouth 2.3-2.6 malar space. Ocelli larger: OOL at most 1.05 times OD. Hypopygium with a number of setae along its length. All legs, including coxae, yellow. Host usually on *Rubus,* occasionally on *Rosa,* rarely on *Pteridium*............ .... ***T. rubi* (Schrank)**

-- Piliferous punctures of mesoscutum and scutellum smaller or minute, usually less close together, on scutellum usually widely separated. Gaster with tip of hypopygium situated at about 0.8 length of gaster. Ovipositor sheaths as long as metasoma plus half to two thirds of mesosoma. Ovipositor index 2.05-2.6. Genae, in front view of head, straight or nearly so; Mouth at least 1.75 malar space, the latter at most 0.37 length of eye. POL 2.1-2.55 times OOL. Antenna with outer surface of antennal scape, except at extreme base, with minute reticulation; Antennal flagellum short and notably stout; more clavate distal segments of funicle distinctly transverse, relatively slender proximally but the clava at least 1.5 times as broad as F l . Body blue-green.Very small to small species, length 1.5-2.2 mm. Host on *Achillea*.. ***T. millefolii*** **Ruschka**

Torymus apiomyiae **Boucek & Mihajlovic, 1986**

Torymus apiomyiae Boucek & Mihajlovic, 1986: 447-449; Grissell, 1995: 275.
Type material: Holotype, fem. (BMNH): Yugoslavia "Macedonia, Bistrica nr. Bitolj, l.iv.1983, M . Postolovski". Paratypes: 33 females,14 males (BMNH, FFB): same origin as holotype, l.iv.1983, 14 & 23.iii.1984, and 1985.
Biology: Parasite of *Apiomyia bergenstammi* (Wachtl) (Dipt. Cecidomyiidae) on *Pirus*.
Distribution: Macedonia (Boucek & Mihajlovic, 1986).
Distribution in Turkey: Hatay, Yayladağ, Altınözü (Doğanlar & Yiğit, 2005).
Materials studied: 4 females, 1 male, Hatay, Belen, Kömürçukuru, 11.iii.2004, reared from galls of *Apiomyia bergenstammi* on *Pyrus malus* L., M.Doğanlar; 1 female, same data, except 12.iii.2004.

Torymus arcella **Graham & Gijswijt, 1998**

Torymus arcella Graham & Gijswijt, 1998: 53-54, fem.
Type material: Holotype, fem, (BMNH): 'Turkey, Kars. Ararat below Serdarbulak 4.iv.l969 5.000" "Guichard & Harvey B.M. 1960-364" "Torymus arcella spec. nov. M. de V. Graham det. & M.J. Gijswijt". Paratypes: 2 females, (BMNH): same data as holotype.
Biology:unknown.
Distribution: Kars (Graham & Gijswijt, 1998).
Distribution in Turkey: Kars. Ararat below Serdarbulak (Graham & Gijswijt, 1998; Zerova & Seryogina, 2003).

Torymus artemisiae **Mayr, 1874**

Torymus artemisiae Mayr, 1874:105, fem ; Grissell, 1995: 275.
Type material: In NHMW five specimens exist under this name, 2 *â S* (not described) and 3 9 9, on minutien pins mounted on two blocks. The female on the first block is here designated lectotype. It is labelled (1) "Collect. G. Mayr" (2) *"Tor. artemisiae* G. Mayr, Type" (3) "*Artem. scop.* Tultscha [unreadable] Mai 75".
Biology: Reared from galls of *Rhopalomyia artemisiae* (Low) (Dipt. Cecidomyii-dae) (Graham & Gijswijt, 1998).
Distribution: Romania (Graham & Gijswijt, 1998).
Distribution in Turkey: Tokat. **New record for Turkey.**
Materials studied: 4 females, 1 male, Tokat, Batmantaş, 17.viii.1972, swept from field of *Medicago sativa* L., M. Doğamlar.

Torymus auratus **(Müller, 1764)**

Cynips aurata Müller, 1764: 68, no. 598, fem. The conclusion must be that Müller is the first to name the species described and figured by Rösel von Rosenberg (1755). Christ (1791: 388) seems to have used Rösel's descriptions without mentioning the source (Graham & Gijswijt 1998).
Type material: Types of *Cynips aurata* Müller, *Cynipsichneumon nigricornutus* Christ and *Cynipsichneumon rubicornutus* Christ not found. (See under comments below). Lectotypes were designated for *Callimome nitens* Walker, *C. inconstans* Walker and *C. amyrius* Walker by Eady (1959: 265).
Biology: A parasite in many species of cynipid oak galls (Graham & Gijswijt, 1998).
Distribution: All over Europe (Graham & Gijswijt 1998); Japan (Yasumatsu, 1955).
Distribution in Turkey: Askew et al., 2013; by this work: Bingöl; Genç, Hamamlar.
Materials studied: 1 fem., 1 male, Bingöl, Genç, 15.x.1974, reared from galls of Cynipidae on *Quercus*; 1 fem., Bingöl, Hamamlar, 15.10. 1974, same host, M. Doğanlar.

Torymus basarani sp. nov.

(Figs. 1a-g)

Etymology: The species is derived from the name of my friend, Agriculture Enginier, BS, Üstün Başaran, who spend his whole life in several parts of the agriculture of Turkey.

Description:

Female. Body (Fig. 1a) blue green;. Antennae with scape yellow, flagellum pale testaceous. Legs pale yellow, fifth tarsal segments brown. Tegulae yellow. Wings hyaline, venation pale yellow. Length body+ovipositor: 2.88 + 1.5 mm.

Head (Fig. 1b) having ertex with fine reticulation, in dorsal view almost 1.2x as wide as mesoscutum, width to length 45:25; POL 1.8x OOL; OOL 1.25x diameter of lateral ocellus. Head in frontal view 1.1x as wide as high in ratio 45:40; dorsal margin of torulus distinctly above level of lower edge of eyes; Mouth 3.33 times malar space, the latter 0.31 length of eye. face with fine sculpture; Antenna (Fig. 1c) with toruli distinctly above lower eye line; scape not reaching anterior ocellus; pedicellus plus flagellum about 1.22 times breadth of head, flagellum proximally stouter than pedicellus, moderately clavate; pedicellus 1.87 times as long as broad; anellus distinctly transverse, 1.5x as long as broad; F l-F4 1.2x longer than broad, apparently with only 2-3 sensillae, F5 slightly transverse , F6 1.3x, F7 1.4x as broad as long; clava 1.86 times as long as broad; sensilla sparse, in one row.

Mesosoma (Figs. 1a,d) slightly bulged in profile, propodeum declined, distinctly visible from above; sculpture of pronotum, mesoscutum with transverse striatons and with fine reticulation, and scutellum (Fig. 1e) having scutellar frenum indicated by an area devoid of setae but not deliminated anteriorly by an impressed line; pronotum 0.37x as long as mesoscutum; propodeum (Fig. 1e) almost smooth, with fine longitudinal striae. Forewing (Fig. 1g) with basal cell bare, speculum open broad; costal cell 1.62x marginal vein; marginal vein about 10.5x stigmal vein, 5.25x postmarginal vein; stigmal vein (Fig. 2e) short, stigma small; Hind coxae dorsally bare,without distinct carina. Hind femora (Fig. 1f) 3.82x as long as width; hind tibia with one apical spur, the latter slightly shorter than breadth of tibia and 0.36x as long as first segment of tarsus.

Metasoma (Figs. 1a,e) hardly compressed, basal sternite extending somewhat beyond coxa; hypopygium extending 0.63x along gaster.. Ovipositor index 1.94, Ovipositor sheaths slightly longer than metasoma (1.16x); excluding ovipositor as long as rest of body.

Male. Unknown.

Material studied: Holotype, female, Turkey: Tokat, 25.vi. 1985, H. Çam, swept from pasture, on card, left antenna slide mounted in Canada balsam,deposited in the Insect collection of Research Station of Biological Control, Adana. Paratype: 1 female, same data as holotype.

Biology: Unknown.

Distribution: Turkey: Tokat.

Comments. The female of T. *basarani* sp. nov. resembles those of *T. nitidulus* (Walker) in having hind tibia with one apical spur and scutellar frenum indicated by an area devoid of setae but not deliminated anteriorly by an impressed line. But the new species differs from *T. nitidulus* in having antenna (Fig. 1c) with Fl distinctly longer than broad, with two long sensillae, flagellar segments F1-F4 distinctly longer than broad; Ovipositor sheaths as long as or very slightly longer than metasoma. (in *T. nitidulus* antenna with Fl anelliform, distinctly broader than long, usually lacking sensilla and some of the following segments broader than long; Ovipositor sheaths as long as or very slightly longer than metasoma plus mesosoma.

Torymus bedeguaris (Linnaeus, 1758)

Ichneumon Bedeguaris Linnaeus, 1758: 567, 9 (ex parte); 1761: 408 (ex parte).

Torymus bedeguaris; Mayr, 1874:101-102; Thomson, 1876: 87; Eady, 1959:262; Grissell, 1976:19-21; Boucek, 1977: 24; Nikol'skaya & Zerova, 1978: 371; Sellenschlo & Wall, 1984: 22, 102; Grissell, 1996, 276.

Type material: The lectotype of *Ichneumon bedeguaris* L. fem. (NR) desgnated by Graham & Gijswijt (1998).

Biology: A common parasite in galls of *Diplolepis* spp. on *Rosa.*

Distribution: Holarctic.

Distribution in Turkey: Ankara (Bayram et al., 1998; Daneshvar et al., 2009); Sivas

(Gençer, 2003); Erzurum (Özbek et al., 1999).
Materials studied: Tokat, 12 females, 10 males, 03-20.iii. 1989, reared from galls of *Diplolepis mayri*, H. Çam; 1 female, 1 male, 13.iv.1989, reared from galls of *Diplolepis rosae*, H. Çam; 1 male, 03.v.1998, swept from leaves of *Prunus mahalep*, H. Çam; 1 female, 4 males, Fidanlık, 15.iv. 1989, reared from galls of *D. mayri*, H. Çam;3 females,1 male, Taşlıçiftlik, 09.ix.-13.xii.1989, reared from galls of *D. mayri*, H. Çam; 3 female, 3 males, Kızılıniş, 02.vi.1989, reared from galls of *D. rosae*, H. Çam; 2 females, 5 males, Çamlıbel, 07.v.-02.vi.1989, reared from galls of *D.rosae*, H. Çam; 4 female, 3 males, Artova, 18-27.ix.1989, reared from galls of *D.mayri*, H. Çam; 1 female, 5 males, Çamlıbel, 05.i.-28.ii. 1990, reared from galls of *D. mayri*, H. Çam; Hatay, Altınözü, 1 female, 1 male, 30.i.1999, reared from galls of *D. mayri*; Erzurum, 3 females, 2 males, 28.vi.1976, reared from galls of *D. mayri,* M. Doğanlar; 3 females, 2 males, 12.-21.ii. 1996, reared from galls of *D. mayri,* H. Özbek; Erzurum, Serçeme, 3 males, 28.vi.1976, reared from galls of *D. mayri,* M. Doğanlar.

***Torymus bingoelensis* sp. nov.**

(Figs. 2a-g)

Etymology: The species is derived from the name of Bingöl from which the types were collected.
Description:
Female. Body (Fig. 2a) blue green; antennae brown, pedicel testaceous. Legs tetaceous, fore and mid tibiae medially, hind tibia almost wholly black, tarsi pale yellow, except fifth tarsal segments brown. Tegulae testaceous. Wings hyaline, venation testaceous. Length body+ovipositor: 3.38 + 5.62 mm.
Head (Fig. 2b) having vertex without a suture between lateral ocelli and eyes, with fine reticulation,. Head in frontal view 1.32x as wide as high, in ratio 52:38; Eyes separated almost by their own length; distance between eyes 2.8x frontal width of eye; temple 0.3x length of eye; Posterior ocelli (Fig. 2b) smaller, OD 0.71x OOL. POL 2.5x OOL. Distance between lateral ocellus and occipital carina 1.44x OOL. Vertex in dorsal view almost 1.1x as wide as mesoscutum, width to length 52:24; Mouth 2x times malar space, the latter 0.33 length of eye. Face with fine sculpture; Antenna (Fig. 2c) with toruli distinctly above lower eye line; scape reaching above anterior ocellus; pedicellus plus flagellum about 0.9 times breadth of head, flagellum proximally slightly stouter than pedicellus, almost filiform; pedicellus 1.5 times as long as broad; anellus 2.5 times as broad as long; F l 1.25x wider than broad, apparently with dense 6-7sensillae, F2 quadrate; F3 1.13x; F4-F7 distinctly transverse, about 1.36x as broad as long; clava 1.18 times as long as broad; sensilla dense, in two rows.
Mesosoma (Figs. 2a,d) slightly bulged in profile, propodeum declined, distinctly visible from above; Mesoscutum and scutellum (Fig. 2d) with numerous and closer piliferous punctures, mesoscutum, axillae; scutellum (Fig. 2e) anterior to frenal area aluteous between the piliferous punctures, with the frenal area marked off by distinct transverse impressed line. Mesepimeron broad and almost twice higher than broad; pronotum long, 0.67x as long as mesoscutum; Propodeum (Fig. 2f) very weakly alutaceous-reticulate, without striae. Forewing (Fig. 2g) upper surface of costal cell with some setae, with basal cell bare, speculum open broad; costal cell 1.52x marginal vein; marginal vein about 8.33x stigmal vein, 3.85x postmarginal vein; stigmal vein short, stigma small; hind leg (Fig. 2h) with hind coxae stouter, its dorsal surface bare in basal half, often with a longitudinal curved carina; hind femur is 5 times as long as broad; hind tibia with two apical spur, the longer spur slightly longer than breadth of tibia and 0.66x as long as first segment of tarsus; the shorter spur 0.74x length of second spur.
Metasoma (Fig. 2a) not compressed, dorsally flat; basal sternite extremely long, about twice length of hind coxa and reaching nearly to tip of hypopygium; hind margin of tergite 4 deeply triangularly emarginate.; hypopygium extending 0.83x along gaster. Ovipositor index 6.0, Ovipositor sheaths 1.66x longer than the body; excluding ovipositor 0.75x as long as rest of body.
Male. Similar to female except antenna (Fig. 2i) with flagellum proximally distinctly stouter than pedicellus, almost filiform; pedicellus 1.12 times as long as broad; anellus twice as broad as long; Fl 1.2x wider than broad, apparently with dense 4 sensillae, F2-F7 distinctly transverse, about 1.5x as broad as long; clava 1.92 times as long as broad; sensilla dense, in

one row.
Materials examined: Holotype, female, Turkey: Bingöl, 15.iii. 1974, M. Doğanlar, laboratory reared from galls of Cynipidae on *Quercus* spp., collected in August, 1973, on card, left antenna slide mounted in Canada balsam, deposited in the Insect collection of Research Station of Biological Control, Adana. Paratypes: 1 female, same data as holotype. 1 male, same data as holotype, except 20.ii.1974.
Biology: Reared from galls of Cynipidae on *Quercus* spp.
Distribution: Turkey: Bingöl.
Comments: The female of *T. bingoelensis* sp. nov. resembles those of *T. druparum* (Boheman) and *T. cyaneus* Walker in having posterior 0.25 to 0.45 of scutellum ("frenal area") differentiated in some way from the rest: either extensively or wholly polished and smooth, and delimitated anteriorly by a weak to strong impressed line and hind femur without tooth. But it differs from *T. druparum* in having mesepimeron broad and almost twice higher than broad; head 2x as broad as long; distance between eyes 2.75x frontal width of eye; posterior ocelli smaller, OD 0.71x OOL. POL 2.5x OOL; distance between lateral ocellus and occipital carina 1.44x OOL; hind femur is 5 times as long as broad; ovipositor sheaths 1.77x longer than the body; index 6.0; antenna with anellus 2.5 times as broad as long. Species associated with cynipid galls on *Quercus* spp. (in *T. druparum* mesepimeron small and slightly higher than broad; head 1.82x as broad as long; distance between eyes 2.64x frontal width of eye; posterior ocelli smaller, OD 0.83x OOL. POL 2.0x OOL; distance between lateral ocellus and occipital carina equal to OOL; hind femur is not 4 times as long as broad; ovipositor sheaths somewhat longer than the body; index 3.9-4.3; antenna with anellus 1.15-1.3 times as broad as long. Species associated with *Sorbus* and *Malus*). The new species differs from *T. cyaneus* in having ovipositor sheaths 1.66x longer than the body; ovipositor index 6.0; posterior ocelli smaller, OD 0.71x OOL; mesoscutum, axillae, and scutellum anterior to frenal area aluteous between the piliferous punctures; eyes separated almost by their own length (in *T. cyaneus* ovipositor sheaths slightly shorter than the body; ovipositor index 1.7-2.1; posterior ocelli large, OD greater than OOL; posterior 0.25-0.3 of mesoscutum, axillae partly, and scutellum anterior to frenal area smooth and polished between the very distinct piliferous punctures; eyes separated by somewhat less than their length).

Torymus cultratus Graham & Gijswijt, 1998

Torymus cultratus Graham & Gijswijt, 1998: 79-80.
Type material: Holotype, fem, (BMNH): "Turkey: Kütahya Murat Dagi. 1700 m. 31.vii.1962. Guichard & Harvey. BM 1962-299".
Biology: Unknown.
Distribution: Turkey (Asia Minor) (Graham & Gijswijt, 1998; Zerova & Seryogina, 2003).
Distribution in Turkey: Kütahya, Murat Dağı (Graham & Gijswijt, 1998).

Torymus cultriventris Ratzeburg, 1844

Type material: *Torymus cyaneus* Walker: described from Austrian material sent by Kollar to F.W. Hope. Original material not found.
Biology: reared from galls of *Mikomyia coryli* Kieffer on *Corylus avellana* L.(Ural & Kurt, 1973; Işık et al., 1987).
Distribution: Austria, Belgium, Croatia, Czech Republic, France, Germany, Great Britain, Hungary, Netherlands, Slovakia, Sweden (Graham & Gijswijt, 1998; Popescu, 2006; Noyes, 2015).
Distribution in Turkey: Eastern Black-See Region (Ural & Kurt, 1973; Işık et al., 1987; Öncüer, 1991).

Torymus cyaneus Walker, 1847

Torymus cyaneus Walker, 1847: 227, *S* 9 ; Boucek, 1977: 25; Boucek & Graham, 1978a: 226; Grissell, 1995: 279.
Type material: *Torymus cyaneus* Walker: described from Austrian material sent by Kollar to F.W. Hope. Original material not found.
Biology: Reared from different oak galls. Askew (1961: 184-185) gives an account of the biology of this species.

Distribution: Austria, Belgium, Croatia, Czech Republic, France, Germany, Great Britain, Hungary, Netherlands, Slovakia, Sweden (Graham & Gijswijt, 1998; Popescu, 2006; Askew et al., 2013; Noyes, 2015).

Distribution in Turkey: Muğla , Datça, Yazı vill., 27.12.2008, 2 ♀♀. (Stonova et al., 2012; Askew et al., 2013).

Materials studied: 1 female, Tokat, Şenköy, 08.vii.1987, swept from leaves of *Ulmus* sp., M. Doğanlar.

Torymus erucarum (Schrank, 1781)

Ichneumon erucarum Schrank, 1781: 275.

Torymus erucarum; Mayr, 1874: 87; Thomson, 1876: 86-87.

Type material: *Ichneumon erucarum* Schrank, original material lost (Graham & Gijswijt, 1998).

Biology: Reared from galls of *Andricus quercusradicis* (Fabr.) (Hym. Cynipidae) on roots of Quercus (Graham & Gijswijt, 1998).

Distribution: Austria,France, Germany, Great Britain, Netherlands, Portugal, Yugoslavia. (Graham & Gijswijt, 1998; Noyes, 2015).

Distribution in Turkey: Ankara (Bayram et al., 1999; Stonova et al., 2012).

Materials studied: 1 female, 1 male, Ankara, Çamlıdere, 26.x.1994, reared from galls of *Andricus tinctorius* Behzodi, Ş. Bayram.

Torymus fastuosus Boheman, 1834

Torymus fastuosus Boheman, 1834: 347348, 9; Boucek, 1977: 25; Grissell, 1995: 280.

Type material: No type material has been designated (Graham & Gijswijt, 1998).

Biology: Reared from galls of *Trigonaspis megaptera* (Panzer) on *Quercus* (Graham & Gijswijt, 1998).

Distribution: Croatia, Great Britain, Netherlands, Sweden. (Graham & Gijswijt, 1998; Noyes, 2015).

Distribution in Turkey: Askew et al. (2013).

Torymus flavipes (Walker, 1833)

Callimome flavipes Walker, 1833: 124.

Type material: *Cynips auratus* Geoffroy: original material destroyed. Neotype, 9, (BMNH): France, Seine et Marne, Forêt de Fontainebleau, 12.viii.1981 (Graham) designated by Graham (1992: 1098). Lectotypes were designated for all Walker species by Eady (1959: 266-268) (Graham & Gijswijt, 1998).

Biology: Reared from Cynipid galls in oaks (Graham & Gijswijt, 1998); reared from galls of Chesnut gall-wasp, *Dryocosmus kuriphilus* Yasumatsu in *Castanea sativa* Müller (Doğanlar, 2014).

Distribution: Probably the whole of Europe. (Graham & Gijswijt, 1998; Noyes, 2015).

Distribution in Turkey: Isparta prov., Kasnak meşesi protected area, 26.05.2007, 2 ♀♀ (Malaise trap) (Stonova et al., 2012); Yalova (Doğanlar, 2014).

Marerials studied: 1 male, Tokat, 06.v.1986, swept from *Prunus cerasi*, M. Doğanlar; 1 female, Tokat, Korucak, 26.iv. 1992, swept from *Prunus cerasi*, H. Çam; 1 female, Yalova, 21.ix. 1914, reared from galls of *Dryocosmus kuriphilus* Yasumatsu in *Castanea sativa* Müller (Doğanlar, 2014).

Torymus geranii (Walker, 1933)

Callimome geranii (Curtis MS.) Walker, 1833: 121.

Type material: *Callimome geranii* Walker: lectotype, *fem.,* (BMNH): here validated, labelled: *"Call, geranii* Walker, lectotype *fem.* M . de V. Graham + Z. Boucek det. 1976"; paralectotypes: *3 fem.* (BMNH), labelled as lectotype.

Biology: Reared from cynipid galls on *Quercus.* (Graham & Gijswijt, 1998).

Distribution: Belgium, Croatia, France, Germany, Great Britain, Netherlands, Poland, Slovakia, Yugoslavia (Serbia) (Graham & Gijswijt, 1998; Noyes, 2015).

Distribution in Turkey: Turkey (Askew et al., 2013).

Torymus hornigi Ruschka, 1921

Torymus hornigi Ruschka, 1921: 338, fem.
Type material: Holotype, fem, (NHMW) here designated. It is labelled "Austr. inf. Annaberg 14.4.80 Wachtl; Type [a red bordered circular label]; 26; *Torymus hornigi* Ruschka, Type".
Biology: Reared from galls of *Gisonobasis origani* (Wachtl) (Dipt. Cecidomyiidae) in swollen flowers of *Origanum vulgare*. (Graham & Gijswijt, 1998).
Distribution: Austria (Graham & Gijswijt, 1998).
Distribution in Turkey: Tokat. **New record for Turkey**
Marerials studied: 1 female, Tokat, Batmantaş, 17.viii.1992, swept from field of *Medicago sativa* L., M. Doğanlar.

Torymus igniceps Mayr, 1874

Torymus igniceps Mayr, 1874:103-104, 69; Grissell, 1995: 282.
Type material: 5 syntypes of *T. igniceps* are in NHMW. A female, here designated lectotype, is mounted on a minutien pin and labelled: "Aachen Fr; f; 20; Collect. G. Mayr; *Tor. igniceps* Myr det. Forster [sic]". The left antenna is broken off beyond F5. The other syntypes are designated paralecto-types (NHMW) (Graham & Gijswijt, 1998).
Biology: Most probably a parasite of a host on *Carex* in marshy places. (Graham & Gijswijt, 1998); reared from galls of *Rhodites* spp. - Hym.: Cynipidae (Kılınçer, 1983).
Distribution: Czech Republic, Great Britain, Italy, Netherlands, Sweden (Graham & Gijswijt, 1998; Noyes, 2015).
Distribution in Turkey: Ankara (Kılınçer, 1983).

Torymus longicalcar Graham, 1994

Torymus longicalcar Graham, 1994e: 122-124, *6* 9; Grissell, 1995: 283.
Type material: Holotype of *T. longicalcar:* 9, (NHMW), designated by Graham (1994e). Paratypes: 59 9 9, 38 *6 6* (NHMW, MJG, TMA), designated by Graham (1994) (Graham & Gijswijt, 1998).
Biology: Reared from galls of *Dryomyia concinna* Mayr and *Pediaspis aceris* (Foerster) on *Acer* spp. and from *Dryomyia circinans* on *Quercus* (Graham & Gijswijt, 1998); reared from galls of Cynipidae on *Quercus* sp. by M. Doğanlar.
Distribution: Austria. Denmark, Germany, Greece, Hungary, Italy, Switzerland, Slovakia. (Graham & Gijswijt, 1998; Noyes, 2015).
Distribution in Turkey: Muğla prov., Yılanlı Mountain, Yemişendere vill., 12.09.2006, 1 ♀ (Stonova et al., 2012); Hatay, Belen, Güzeloluk by this work.
Marerials studied: 1 female, Hatay, Belen, Güzeloluk, 08.vi.2004, M. Doğanlar.

Torymus micrurus Boucek, 1994

Torymus micrurus Boucek, 1994:79-80, 9; Grissell, 1995: 284.
Type material: Holotype, fem, (BMNH): Germany, Aken an der Elbe, 9.vi.l940 (H. Koller). Paratypes: (BMNH, ZMHU): 1 fem. topotypic; 1 fem. France, Vaucluse, Mont Ventoux, 22.vii.1978 (Graham).
Biology: Unknown.
Distribution: France, Germany (Graham & Gijswijt, 1998; Noyes, 2015).
Distribution in Turkey: Bingöl. **New record for Turkey.**
Marerials studied: 5 females, Bingöl, Bilaloğlu, 11.vii.2003, H. Özbek.

Torymus millefolii Ruschka, 1921

Torymus millefolii Ruschka, 1921:339, male, female.
Type material: Lectotype, fem, (NHMW): here designated, mounted on a minutien pin on a pitch block with a male, labelled: "e *Hormomyia millefolii* Znaim Coll. Wachtl"; *"T. millefolii* Ruschka, Type"; "Type" (red label). Paralectotypes: (here designated), the male aside to the lectotype; also two other females, labelled *"Rhopalomyia millefolii";* "Jicin Bohmen Baudys"; *millefolii* Ruschka det. Ruschka", "Type" (red label)".
Biology: Reared from galls of *Rhopalomyia millefolii* (Loew).
Distribution: Austria, Czech Republic. (Graham & Gijswijt, 1998; Noyes, 2015).
Distribution in Turkey: Tokat. **New record for Turkey.**

Marerials studied: 1 female, Tokat, 21.iv.1989, swept from pasture, H. Çam.

Torymus monticola Graham & Gijswijt, 1998

Torymus monticola Graham & Gijswijt, 1998: 124-125.
Type material: Holotype, fem, (BMNH): France-Lozere "Aigoual Prat Peirot 5.7.1977, M. de V. Graham". Paratypes, 5 females, 7 females, (BMNH, MJG): same data as holotype (one female without head).
Biology: Unknown.
Distribution: France (Graham & Gijswijt, 1998; Noyes, 2015).
Distribution in Turkey: Tokat. **New record for Turkey.**
Marerials studied: 1 female, Tokat, Artova, Gökdere, 06.v.1988, reared from galls of Cynipidae on *Quercus* sp., M. Doğanlar.

Torymus nigritarsus (Walker, 1833)

Callimome nigritarsus Walker, 1833:135, *6* 9.
Torymus nigritarsus; Boucek & Graham, 1978a: 227; Grissell, 1995: 284.
Type material:_ lectotype, fem, (BMNH): designated by Eady (1959: 261).
Biology: Parasite of *Taxomyia taxi* Inchb. (Dipt. Cecidomyiidae) on *Taxus baccata* (Graham & Gijswijt, 1998).
Distribution: Austria, France, Great Britain, Netherlands, Sweden (Graham & Gijswijt, 1998; Noyes, 2015).
Distribution in Turkey: Tokat. **New record for Turkey.**
Marerials studied: 2 females, Tokat, 11.v.1989, swept from pasture, H. Çam.

Torymus nitidulus (Walker, 1833)

Callimome nitidulus Walker, 1833:138, 9. Grissell, 1995: 284.
Type material: *Callimome nitidulus* Walker: lectotype, 9, (BMNH, type Hym. 5.1610): designated by Eady (1959: 260).
Biology: Reared from birch catkins with *Semudobia* spp. (Dipt. Cecidomyiidae) (Graham & Gijswijt, 1998).
Distribution: Holarctic; possibly over whole zone of *Betula* spp. from northern U.S.A., Europe, Asia to Mongolia and China (Graham & Gijswijt, 1998).
Distribution in Turkey: Erzurum (Doğanlar, 1984; Öncüer, 1991 (as *Lioterphus pallidicornis* (Boheman, 1834)); Stonova et al., 2012).
Marerials studied: 2 females, Erzurum, 18. viii. 1979, swept from field of *Onobrychis sativa* L., M. Doğanlar.

Torymus nobilis Boheman, 1834

Torymus nobilis Boheman, 1834: 339-340, *8* 9; Mayr, 1874: 92-93.
Type material: Lectotype of *Torymus nobilis* Boheman, 9 (NR) and paralectotypes *2 8 8* (NR), all designated by Graham (1994: 53).
Biology: Reared from galls on roots of *Quercus* spp: *Andricus quercusradicis, Bio-rhiza pallida* etc. (Graham & Gijswijt, 1998).
Distribution: Croatia, Czech Republic, Denmark, France, Germany, Great Britain, Ireland, Spain, Sweden (Graham & Gijswijt, 1998).
Distribution in Turkey: Hatay. **New record for Turkey.**
Marerials studied: 1 female, Hatay, Samandağ, Çevlik, Kale, 09.vi.1994, swept from pasture, M. Doğanlar.

Torymus phillyreae Ruschka, 1921

Torymus phillyreae Ruschka, 1921: 340-341.
Type material:_*T. phillyreae* Ruschka: lectotype, *2,* (NHMW): here designated, mounted on a minutien pin, stayed with a male on one block, labelled (1) "e *Diplosis phillyr*. Miramare ex coll. Wachtl" (2) *"Torymus phillyreae* Ruschka, Type" (3) red label "Type" (4) NHMW acces. label "no. 321". Paralectotypes: 2 9 9,3 *8 8* (NHMW), here designated, the male mounted with the lectotype, a male and a female mounted on one block labelled "Miramare Istria; 3; *Torymus phillyreae* Ruschka Type" and a blue label, (2) one male and one female on a block with same labels as (1) except for "1" instead of "3", one female

(remounted, on card, by Boucek), labelled in Boucek's hand: "Miramare bei Triest ex *Braueriella phillyreae* Wachtl.; 9 *Torymus phillyreae* Rusch. det. Z. Boucek, 1978."
Biology: The species seems to have a whole range of hosts. The abundancy in which it occurs in places (see remarks on swarming behaviour in Graham, 1993) suggests very common hosts. Until now it has been reared in Italy from galls of *Braueriella phillyreae* on *Phillyrea;* in Britain from *Asphondylia sarothamni* (Loew): on *Cytisus scoparii;* in Spain from *Stictodiplosis scrophulariae* Kieffer. on *Scrophularia peregrina*. In that country *phillyreae* was rather abundant on *Genista florida* in several places. In France from *Asphondylia sarothamni* on *Calicotome spinosa*. Gijswijt collected in Southern France, near Aix en Provence about 600 galls of *Braueriella phillyreae* from which emerged (besides other non-torymid species) 18 males and 51 females of *T. phillyreae* (Graham & Gijswijt, 1998).
Distribution: France, Great Britain, Greece, Italy, Spain. (Graham & Gijswijt, 1998).
Distribution in Turkey: Hatay, Antakya, Samandağ (Doğanlar, 2011; Doğanlar et al., 2011; Doğanlar, 2012).
Materials studied: 1 female, Tokat, 15.ix.1989, swept from pasture, H. Çam; 3 females, Tokat, 20.v.1986, swept from pasture, H. Çam; 2 females, 1 male, 21.ii.1996, lab reared from galls *Diplolepis mayri* Schld., Ş. Güçlü; 2 males, Hatay, Samandağ, Vakıflı, 15.iv.2007, reared from galls of *Dasineura oleae*, M. Doğanlar; 3 males, 03.v.2012, hyperparasite on *Odinodiplosis amygdali*, M. Doğanlar.

Torymus poae (Hoffmeyer, 1930)

Callimome poae Hoffmeyer, 1930: 26, 82,1930: 238.
Type material: *Callimome poae* Hoffmeyer: lectotype, fem., (MNHN): here designated, on a minutien pin, stayed with adona pith block, labelled "Museum Paris Coll. Giraud 1877"; *"Callimome poae* Hoffmeyer Type" "type" (in red lettering) (Graham & Gijswijt, 1998).
Biology: Reared from *Poomyia poae* Bosc. (Graham & Gijswijt, 1998).
Distribution: Germany (Graham & Gijswijt, 1998; Noyes, 2015).
Distribution in Turkey: Adana, Tokat. **New record for the Turkish fauna.**
Materials studied: 1 female, Adana, Tufanbeyli, 03.x.1979, A. Beyarslan; 1 female,1 male, Adana, Feke, 02.x. 1979, A. Beyarslan; 2 females, Tokat, Pazar, 28.iv.1988, swept from *Prunus cerasi*, H. Çam.

Torymus pulchellus Thomson, 1876

Torymus pulchellus Thomson, 1876: 98; Eady, 1959: 268; Graham, 1969: 67; Sellenschlo & Wall, 1984: 27.
Type material: *Callimome Aerope* Walker: no trace of Walker's material of male *aerope* had been found in BMNH (Eady, 1959: 268). (Graham & Gijswijt, 1998).
Biology: Unknown. The species is associated with *Salix* (Graham has swept it from foliage of *S.fragilis* and *S. alba* (Graham & Gijswijt, 1998).
Distribution: France, Great Britain, Ireland, Netherlands, Sweden (Graham & Gijswijt, 1998; Noyes, 2015).
Distribution in Turkey: Erzincan. **New record for the Turkish fauna.**
Materials studied: 1 female, Erzincan, 09.v.1982, swept from pasture, M. Doğanlar.

Torymus pygmaeus Mayr, 1874

Torymus pygmaeus Mayr, 1874:120-121, *8* 9; Sellenschlo & Wall, 1984: 27; Grissell, 1995: 286.
Type material: Lectotype, 9, (NHMW): designated by Graham & Gijswijt (1998), mounted on a minutien pin fixed on a pith block with a *8* and labelled: "Collect. G. Mayr; *Torymus pygmaeus* G. Mayr, Type; *subulif*. May 72" [-Mayr's hand]; Graham's lectotype label. Paratypes: (NHMW): the *8* fixed on the same block as the lectotype and a 9 and a *8* plus 9, mounted on two pithblocks and similarly labelled. All designated by Graham & Gijswijt, 1998).
Biology: Reared from galls of *Contarinia subulifex* Mayr (Dipt. Cecidomyiidae) on *Quercus cerris*. (Graham & Gijswijt, 1998).
Distribution: Austria, Sweden, Ukraine (Graham & Gijswijt, 1998; Noyes, 2015).

Distribution in Turkey: Çanakkale, Atıkhisar vill., 28.04.2007, 1 ♀ (Stonova et al., 2012).
Materials studied: 1 female, Sivas, Campus of Cumhuriyet Univ., 09.vi.1992, swept from pasture, L. Gençer.

Torymus quercinus Boheman, 1834

Torymus quercinus Boheman, 1834: 373, 9; Mayr, 1874: 101; Thomson, 1876: 84; Eady, 1959: 268, in part.; Boucek, 1977: 26; Boucek & Graham, 1978a: 227; Sellenschlo & Wall 1984: 27; Grissell, 1995: 286.
Type material:_*Torymus quercinus* Boheman: lectotype, here designated: a 9. (NR) labelled "Sm" (Smaland) and "Bhn". (Graham & Gijswijt, 1998).
Biology: Reared from galls of *Harmandia petioli* Kieffer (Dipt. Cecidomyiidae) on *Populus tremula* (Graham & Gijswijt, 1998).
Distribution: Czech Republic, Germany, Great Britain, Sweden, Yugoslavia (Montenegro) (Graham & Gijswijt, 1998; Noyes, 2015).
Distribution in Turkey: Tokat. **New record for the Turkish fauna**.
Materials studied: 1 female,Tokat, 02.v.1986, swept from pasture, H. Çam.

Torymus ramicola Ruschka, 1921

Torymus ramicola Ruschka, 1921: 337, 82; Sellenschlo & Wall, 1984: 27; Grissell, 1995: 286. *Callimome ramicola;* Hoffmeyer, 1930: 238.
Type material: Lectotype, 9, (NHMW): here designated, a female pinned on a pith block with a male, labels: "e *Diplosis ramicola* coll. Wachtr'; *"T. ramicola* Ruschka, Type"; "Type" (red label) (Graham & Gijswijt, 1998).
Biology: Reared from *Diplosis ramicola* Kieffer (Dipt. Cecidomyiidae) on *Artemisia* (Graham & Gijswijt, 1998); reared from galls of *Dryocosmus kuriphilus* Yasumatsu on *Castanea sativa* Miller (Doğanlar, 2014).
Distribution: Austria (Graham & Gijswijt, 1998).
Distribution in Turkey: Yalova (Doğanlar, 2014).
Materials studied: 1 female, 18.ix. 2014, reared from galls of *D. kuriphilus*, M. Doğanlar.

Torymus rubi (Schrank, 1781)

Cynips Rubi Schrank, 1781: 320-322, fem.
Torymus rubi; Boucek& Graham, 1978: 227; Grissell, 1995: 286-287.
Callimome macropterus Walker, 1833:124, fem.
Type material.— *Cynips rubi* Schrank: no type material found.
Callimome macropterus Walker: lectotype, fem, (BMNH): designated by Eady (1959: 263) [examined]. It bears the BMNH label Type Hym. 5.1570.
Biology: Reared from galls of *Diastrophus rubi* (Bouche), *Diplolepis rosae* (Linnaeus) (Hym. Cynipoidea), *Perrisia acrophilae* Winnertz,), a gall on *Pteridium aquilinum* (Dipt. Cecidomyiidae), *Stereonychus fraxini* on *Fraxinus* (Col. Curculionidae) (Graham & Gijswijt, 1998).
Distribution: Austria, Belgium, Croatia, Czech Republic, France, Germany, Great Britain, Netherlands, Poland, Spain (Graham & Gijswijt, 1998).
Distribution in Turkey: Ankara (Kılınçer, 1983); Sivas (Gençer, 2003).

Torymus tipulariarum Zetterstedt, 1838

Torymus tipulariarum Zetterstedt, 1838: 420, *6* fem; Mayr, 1874:111-112, in part; Thomson, 1876: 95.
Type material: Lectotype of *T. tipulariarum* fem (ZIL), here designated, mounted with a *male* on one pin; labelled [in Zetterstedt's hand] "var. b. *male, fem.* 9"; also *"Torymus tipulariarum* Zett. Type. Ch. Ferriere det". Paratypes of *tipulariarum:* the *male* mounted with th lectotype and a *male* and a fem (ZIL) mounted on a pin, with a white pupa-case of a Cecidomyiid fly below, labelled "e tubercul. ramulor *Salix* 26 May 1819".
Biology: Reared from galls of *Rabdophaga salicis* on *Salix* (Graham & Gijswijt, 1998).
Distribution: France, Britain, Netherlands, Sweden (Graham & Gijswijt, 1998).
Distribution in Turkey: Balıkesir. **New record for Turkey.**

Materials studied: 1 female, Balıkesir, 13.viii.1979, swept from leaves of *Olea europea*, B. Hepdurgun.

Torymus verbasci Ruschka, 1921

Torymus verbasci Ruschka, 1921: 339-340, fem. Male.
Type material: *Misocampus nigricornis:* no type material seen. See for details under comments. *Torymus verbasci:* syntypes, 9 *males,* 10 *2 2* in N H M W ; 1 fem in B M N H . The specimens in N H M W are on 19 separate mounts. A *2,* here designated lectotype is labelled *"Asph. verbasci* St. Georgen b. Press-burg" [Bratislava]; *"verbasci* n. sp. det. Ruschka". The other specimens are designated paralectotypes, as the female specimen in B M N H , which is labelled "/12/79; *Asph verbasci; T. verbasci* R."
Biology: Reared from *Asphodylia verbasci* Vallot. (Dipt. Cecidomyiidae) (Graham & Gijswijt, 1998; Doğanlar & Üremiş, 2014).
Distribution: Austria (Graham & Gijswijt, 1998).
Distribution in Turkey: Hatay, Antakya, Harbiye (Doğanlar & Üremiş, 2014).
Materials studied: 11 females, 7 males, Hatay, Antakya, Harbiye, 12.ix.-24.x.2014, reared from bud galls of *Asphondylia verbasci* (Vallot) on *Verbascum gaillardotti*, M. Doğanlar.

LITERATURE CITED

Askew, R. R. 1961a. On the palaearctic species of *Syntomaspis* Foerster (Hym., Chalcidoidea, Torymidae). Entomologist's mon. Mag., 96: 184-191.

Askew, R. R. 1961b. On the Biology of the Inhabitants of Oak Galls of Cynipidae (Hym.) in Britain. Trans. Soc. Brit. Ent., 14: 237-268.

Askew, R. R., Plantard, O., Gómez, J. F., Hernandez Nieves, M. & Nieves-Aldrey, J. L. 2006. Catalogue of parasitoids and inquilines in galls of Aylacini, Diplolepini and Pediaspidini (Hym., Cynipidae) in West Palaearctic. Zootaxa, 1301: 1-60.

Askew, R. R., Melika, G., Pujade-Villar, J., Schönrogge, K., Stone, G. N. & Nieves-Aldrey, J. L. 2013, Catalogue of parasitoids and inquilines in cynipid oak galls in the west Palaearctic. Zootaxa, 3643 (1): 83.

Bayram S., Ulgenturk, S. & Toros, S. 1998. Research on the insects causing galls on dog rose (*Rosa* spp.) and their parasitoids in Ankara province. Türkiye Entomoloji Dergisi, 22 (4): 259-268.

Boheman, C. H. 1834. Skandinaviska Pteromaliner. K. Svenska Vetensk. Acad. Handl., 54: 329-380.

Bouček, Z. 1952. Results of the Zoological Scientific Expedition of the National Museum in Praha to Turkey. 7.Hymenoptera I Chalcidoidea (first part). Acta Entomologica Musei Nationalis Pragae, 27: 47-57.

Bouček, Z. 1977. A faunistic review of the Yugoslavian Chalcidoidea (Parasitic Hymenoptera). Acta Entomologica Jugoslavica, Supplement, 13: 1-145.

Bouček, Z. 1982. Four new Mediterranean Torymidae Walker, 1833 (Hymenoptera). Entomologist's Gazette, 33 (3&4): 183-191.

Boucek, Z. & Graham, M. W. R. de V. 1978. British Ckeck-list of Chalcidoidea (Hymenoptera): Taxonomoc Notes and Additions. Entomologist's Gaz., 29: 225-235.

Çanakçıoğlu, H. 1969. Insect damage on cones of forest trees in Turkey. Orman Fakültesi Istanbul UniversitesiDerdisi, Seri A, 19: 83-88.

Daneshvar, S., Talebi, A. A. & Fathipour, Y. 2009, The wasps associated with seeds and galls of *Rosa canina* in Iran. Advances in Environmental Biology, 3 (1): 63-64.

Doğanlar, M. 1982. Hymenopter parasites of some lepidoptereous pests in eastern Anatolia. Turkish Journal of PlantProtection, 6 (4): 197–205.

Doğanlar, M. 1984. Notes on Chalcidoidea of Turkey, I. Chalcididae, Eurytomidae Walker, 1832, Torymidae Walker,1833, Ormyridae, Perilampidae, Eucharitidae. Turkish Journal of Plant Protection, 8: 151-158.

Doğanlar, M. 2011. Parasitoids complex of the olive leaf gall midges, *Dasineura oleae* (Angelini 1831) and *Lasioptera oleicola* Skuhravá, 2011 (Diptera: Cecidomyiidae) in Hatay Turkey, with descriptions of new genus and species from Tetrastichinae (Hymenoptera: Eulophidae). Türk. entomol. derg., 35 (2): 245-264.

Doğanlar, M. 2012. Almond bud gall midge, *Odinadiplosis amygdali* (Anagnostopoulos) (Diptera: Cecidomyiidae), parasitoid complex and economic importance in Hatay province. Türk. entomol. bült., 2 (4): 233-242.

Doğanlar, M. 2014. Yalova'da (Türkiye) Kestane gal arısı, *Dryocosmus kuriphilus* Yasumatsu (Hymenoptera: Cynipidae)'nin doğal düşman faunası hakkında ilk kayıtlar (First reports on the natural enemy fauna of the Chesnut Gall-wasp, *Dryocosmus kuriphilus* Yasumatsu (Hymenoptera: Cynipidae) in Yalova, Turkey). Türk. biyo. müc. derg., 5 (1): 67-74.

Doğanlar, M. 2016. The morphology of hypopygia and its importance in taxonomy of the genera of Torymidae Hymenoptera), with review of the genera and species of Turkey. Entomofauna, 37: 521-544.

Doğanlar, M. & Yigit, A. 2005. Parasitoids of *Apiomyia bergenstammi* (Wachtl) (Dipt., Cecidomyiidae), a new pest on pears, in Hatay province, Turkey. Journal of Applied Entomology, 129 (2): 118-120.

Doğanlar, M., Sertkaya, E. & Skuhravá, M. 2011, Pest status of olive leaf gall midge *Dasineura oleae* (Angelini, 1831), description of *Lasioptera oleicola* Skuhravá sp. new (Diptera: Cecidomyiidae) and effectiveness of parasitoids on their populations in Hatay, Turkey. Türkiye Entomoloji Dergisi, 35 (2): 280-281.

Doğanlar, M. & Üremiş, İ. 2014. *Verbascum gaillardotii* Boiss. and its natural enemy complex in Hatay province, Turkey. Munis Entomology & Zoology, 9 (2): 783-791.

Gençer, L. 2003. The chalcidoid parasitoids of *Diplolepis mayri* Schld. (Hymenoptera: Cynipidae), a pest of *Rosa canina* L. in Sivas province. Turkish Journal of Entomology, 27 (2): 107-111.

Graham, M. W. R. de Vere. 1992. Hymenoptera collections of Boyer de Fonscolombe, with an account of his work and a description of the natural features of his estate. J. nat. Hist., 26: 1089-1111.

Graham, M. W. R. de Vere. 1994a. New European species of *Torymus* Dalman (Hym., Chalcidoidea). Entom. M . Mag., 130: 21-54.

Graham, M. W. R. de V. & Gijswijt, M. J. 1998. Revision of the European species of *Torymus* Dalman (Hymenoptera:Torymidae Walker, 1833). Zoologische Verhandelingen, Leiden, 317: 1-202.

Grissell, E. E. 1995. Toryminae (Hymenoptera: Chalcidoidea: Torymidae Walker, 1833): a redefinition, generic classification and annotated world catalogue of species. Memoirs on Entomology, International, 57, 470 p.

Işık, M., Ecevit, O., Kurt, A. & Yücetin, T. 1987. Doğu Karadeniz Fındık bahçelerinde entegre savaş olanakları üzerinde araştırmalar. Ondokuzmayıs Üniversitesi Yayın no: 20, Samsun, 95 pp.

Kılınçer, N. 1983. Untersuchungen über die parasiten von rosengallwespen (Rhodites spp. - Hym.: Cynipidae) in Ankara region. Turkish Plant Protection Bulletin, 23 (1): 1-11.

Kılıc, N. & Alaoğlu, O. 1996. Biology and parasitoids of the satin moth *Leucoma salicis* (L.) (Lepidoptera,Lymantriidae) a pest of poplar trees in Erzurum Province (Turkey). Turkish Journal of Entomology, 20 (4): 269-279.

Korkmaz, E., Orgen, S., Gencer, L., Ulgenturk, S. & Başıbüyük, H. 2010. Determination of some wheat pests and their parasitoids in wheat fields of Central Anatolia Region. Turkish Journal of Entomology, 34 (3): 361-377.

Mayr, G. 1874. Die Europaischen Torymiden biologisch und systematisch bearbeitet. Verh. K . K . zool.-bot. Ges. Wien, 24: 53-142.

Noyes, J. 2015. Universal Chalcidoidea Database. World Wide Web electronic publication. (web page:http://www.nhm.ac.uk/entomology/chalcidoids/), (Accessed on: January 2015).

Öncüer, C. 1991. A catalogue of the parasites and predators of insect pests of Turkey. Ofset Basımevi, Bornova-İzmir, pp. 354.

Öncüer, C., Yalçın, E. & Erkin, E. 1978. The natural enemies of the pupae of *Euproctis chrysorrhoea* L. (Lepidoptera:Lymantriidae), which damages fruit trees in the Aegean region, and their effectiveness. Türkiye Bitki Koruma Dergisi, 2 (1): 31-36.

Özbek, H., Güçlü, Ş. & Hayat, T. 1996. Investigations on the phytophagous and predator insect species on stone fruits in the north-east agricultural region of Turkey. Turkish Journal of Agriculture and Forestry, 20 (3): 267-282.

Özbek, H., Güçlü, Ş. & Tozlu, G. 1999. Biology and natural enemies of *Diplolepis mayri* (Hymenoptera: Cynipidae), a pest of *Rosa canina* in Erzurum Province. Turkish Journal of Entomology, 23 (1): 39-50.

Polat, A. & Tozlu, G. 2010. Investigations on the brief biology, host plants and parasitoids of *Archips rosana* (Linnaeus,1758) (Lepidoptera: Tortricidae) in Erzurum. Turkish Journal of Entomology, 34 (4): 529-542.

Popescu, I. E. 2006a. A faunistic review of the Romanian Torymidae Walker, 1833 fauna (Hymenoptera, Chalcidoidea, Eurytomidae Walker, 1832). Analele Ştiinţifice ale Univ. "Al. I. Cuza" Iaşi, seria Biologie Animală, 52: 163-174.

Sarıkaya, O. & Avcı, M. 2005. Studies on the parasitoid complex of *Choristoneura murinana* (Hbn.) (Lep.: Tortricidae)in Turkey. Journal of Pest Science, 78: 63-66.

Schimitschek, E. 1944. Die Forstinsekten der Türkei (Prague: Volk und Reich), p. 371.

Sertkaya, E., Telli, S. & Yiğit, A. 2006. Pest status and parasitoids of gall midge, *Asphondylia capsici* (Diptera:Cecidomyiidae) in Antakya Province. Turkish Journal of Entomology, 30 (3): 223-234.

Stonova, A., Civelek, H. S., Yörük, B., Sarı, S. & Atahan, T. 2012. Checklists of Turkish Eurytomidae Walker, 1832 and Torymidae Walker, 1833 (Hymenoptera, Chalcidoidea). Türk. entomol. derg., 36 (1): 69-82.

Thomson, C. G. 1876. Hymenoptera Scandinaviae IV. 1-192 (1875), Lundiae.

Ural, I. & Kurt, A. 1973. Doğu Karadeniz Bölgesi fındık bahçelerinde zarar yapan Fındık gal sineği (*Mikomyia coryli* Kieffer) nin biyolojisi ve mücadelesi üzerinde araştırmalar. Bitki Koruma Bülteni, 13 (1): 1-18.

Walker, F. 1832. based on morphological characters. Zoological Journal of the Linnean Society, 151: 441-510.

Walker, F. 1833. Monographia Chalciditum. Ent. Mag., 1: 128-139.

Zerova, M. & Seryogina, L. 2003. Torymid chalcid wasps (Hymenoptera, Chalcidoidea, Torymidae Walker, 1833) oftribe Torymini of the Ukrainian Fauna. Vestnik Zoologii, Supplement, 17: 1-103.

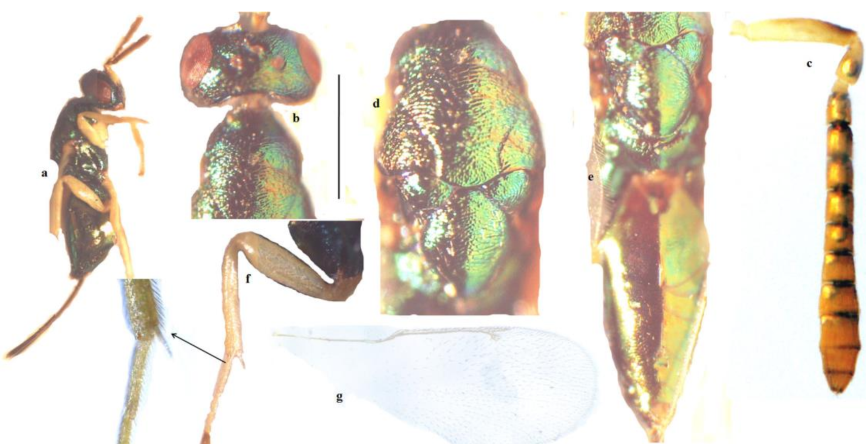

Figure 1. *Torymus basarani* sp. nov., female. (a) body; (b) head and pronotum, in dorsal view; (**c**) antenna; (**d**) mesosoma; (**e**) scutellum and metasoma, in dorsal view; f. hind leg; g. fore wing; (Scale bar for a= 1.75 mm; b =0.8 mm; for c= 0.23 mm; for d,e= 0.46 mm; for f= 0.75 mm; for g= 0.93 mm).

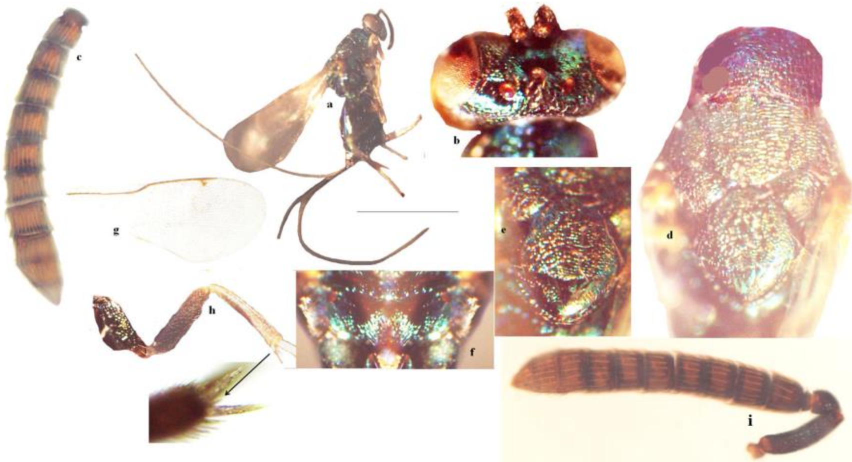

Figure 2. *Torymus bingoelensis* sp. nov., female. (a) body; (b) head, in dorsal view; (c) antenna; (d) mesosoma; (e) scutellum, in dorsal view; f. propodeum; g. fore wing; h. hind leg; i. male antenna. (Scale bar for a= 2.5 mm: for b= 0.55 mm, for c,i=0.3 mm; for d-f= 0.75 mm; for h= 1.4 mm for g= 1.78 mm).

A NEW SPECIES OF *PHYTOECIA* (*PHYTOECIA*) DEJEAN FROM TURKEY (CERAMBYCIDAE: LAMIINAE)

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[Özdikmen, H. 2017. A new species of *Phytoecia* (*Phytoecia*) Dejean from Turkey (Cerambycidae: Lamiinae). Munis Entomology & Zoology, 12 (1): 23-26**]**

ABSTRACT: The following new species is described: *Phytoecia* (s.str.) *gamzeae* sp. nov. from Çankırı province (Turkey), close to *Phytoecia virgula* (Charpentier, 1825) and *Phytoecia vulneris* Aurivillius, 1923.

KEY WORDS: Cerambycidae, Lamiinae, *Phytoecia gamzeae,* new species, Turkey

During the study of the collected Cerambycidae specimens in my collection, I have identified some specimens belonging to a new species *Phytoecia gamzeae* that collected from Ankara, Çankırı, Çorum, Kırıkkale and Konya provinces, of *Phytoecia* (s.str.) Dejean which will be described in the text.

Phytoecia (*Phytoecia*) *gamzeae* sp. nov.
(Figs. 1-4)

Type material. Holotype ♂: Turkey: Çankırı prov.: Şabanözü, Büyükyakalı village, N 40°28'38"- E 33°14'25", 23.V.2014, 1091 m. Paratypes 10 ♂♂ & 4 ♀♀: Ankara prov.: Yenimahalle, Konutkent, 01.VI.2007, 850 m, 2 ♂♂; Çankırı prov.: Çankırı-Kızılırmak road, N 40°27'- E 33°48', 05.V.2013, 639 m, 1 ♂; Çankırı road, Tuz stream bridge, N 40°23'- E 33°33', 11.V.2013, 725 m, 1 ♀; Şabanözü-Orta road, 24 km to Orta, N 40°28'- E 33°16', 08.VI.2013, 1300 m, 1 ♂; Çorum prov.: Kırıkkale-Çorum road, 20 km to Sungurlu, N 40°05'- E 34°07', 27.IV.2013, 665 m, 1 ♂; Oğuzlar-Dodurga road, 5 km to Dodurga, N 40°50'- E 34°46', 28.IV.2013, 742 m, 1 ♀; Çorum-Osmancık road, N 40°49'- E 34°51', 28.IV.2013, 480 m, 1 ♂; Sungurlu-Çorum road, 25 km to Çorum, N 40°23'- E 34°43', 01.VI.2013, 878 m, 1 ♀; Exit of Laçin, N 40°46'- E 34°52', 01.VI.2013, 695 m, 1 ♀; Kırıkkale prov.: Kulaksız-Sulakyurt road, 5 km to Sulakyurt, 07.VII.2011, 1 ♂; Konya prov.: Cihanbeyli, 31.V.1997, 1040 m, 1 ♂; Kulu, Tavşançalı, 17.V.1997, 1000 m, 2 ♂♂. The specimens were deposited at Gazi University in Ankara (Turkey).

Description of holotype.

Body length: 9.6 mm, width: 2.25 mm.

Color: Totally black with the exception of red colored certain parts of legs, abdominal areas and a spot on pronotal disc. Head totally black. Pronotum entirely black with the exception of a median red spot on disc. Scutellum and elytra completely black. Pygidium red. Underside of the body entirely black with the exception of red last sternite. Legs black with the exception of certain red areas. Anterior femora entirely red in apical half. Middle and hind femora also red in apical half with the exception of black small areas at the distal end. Anterior tibiae almost completely red with the exception of a darkened small areas at the distal end. Middle and hind tibiae quite black. The remaining parts of all legs black.

Pubescence: Body clothed with whitish-yellow hairs. Head with dense, short, recumbent, whitish-yellow ground pubescence that a little sparser on vertex and rather dense, long, erect darkened setae. Antennae almost regularly clothed with whitish-yellow ground pubescence and here and there a few darkened setae. Pronotum with sparser ground pubescence and dense, long, erect darkened setae. The pubescence of scutellum as in elytra. Elytra with dense, short, recumbent, whitish-yellow ground pubescence and a few long, erect darkened setae in basal portion and rather dense, long, semi-erect or recumbent darkened setae in the remaining parts. Underside of the body clothed with only whitish-yellow ground pubescence completely.

Punctuation: Head, pronotum and elytra with very dense, distinct punctuation regularly (including median red spot on disc of pronotum). However, the punctuation of head and pronotum denser than that of elytra, but elytral punctuation larger than that of head and pronotum.

Moreover, antennae slightly shorter than body length. 3^{rd} and 4^{th} antennal segments long, almost about the same length. 1^{st} segment rather shorter than 3^{rd} and 4^{th}, and almost about the same length with 5^{th} segment. Pronotum transverse, about 1.1 times shorter than basal width. Elytra relatively flat, about 3.1 times longer than basal width. Humeral carinae recognizable except for one fourth apical portion. Elytral apex obliquely truncated with a tooth at the inner angle.

Diagnosis. The new species is closely related to *P. virgula* that described from Croatia and *P. vulneris* that described from Italy (Rome). *P. virgula* is distributed in Turkey too. *P. vulneris* is not distributed in Turkey and impossible for Turkey. It is easily distinguished from *P. virgula* by completely punctuated red spot on pronotum mainly (red spot on pronotum in *P. virgula* at least in central parts unpunctuated) (Fig. 3), and from *P. vulneris* by completely black colored hind tibiae as in *P. virgula* (hind tibiae red colored basally in *P. vulneris*) (Bense, 1995).

Variability. Females are almost completely as the same as males. Among the females, body length changes 8.62 to 12.00 mm and body width changes 2.00 to 2.62 mm. Among the males, body length changes 6.75 to 10.75 mm and body width changes 1.75 to 2.62 mm.

Distribution. According to types, the new species is distributed in Central Anatolian Region and southern part of Central Black Sea Region in Turkey. It can expect the new species is more widely distributed at least in Anatolia.

Etymology. The name is dedicated to my wife Gamze Özdikmen (Turkey).

LITERATURE CITED

Bense, U. 1995. Illustrated key to the Cerambycidae (excl. Dorcadionini) and Vesperidae of Europe. Margraf Verlag, Germany, 512 pp.

Figure 1. *Phytoecia gamzeae* sp. nov., Holotype ♂ (left), Paratype ♀ (right).

Figure 2. *Phytoecia virgula* (Charpentier, 1825) (♂) from Çankırı province.

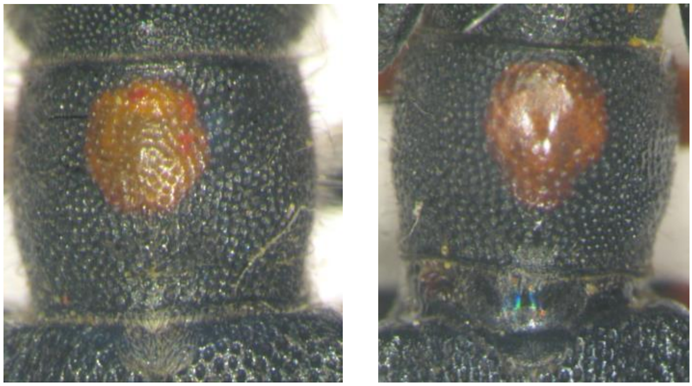

Figure 3. Pronotum of *Phytoecia gamzeae* sp. nov., Holotype ♂ (left), Pronotum of *Phytoecia virgula* (Charpentier, 1825) ♂ (right) from Çankırı province.

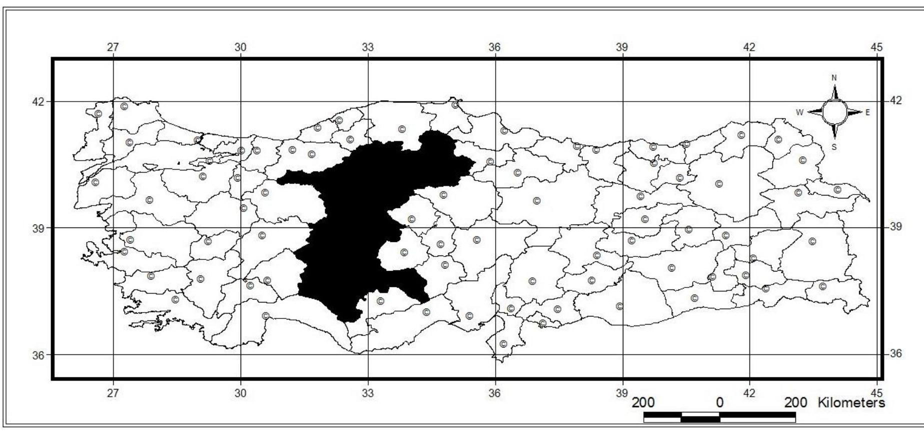

Figure 4. The distribution patterns of *Phytoecia gamzeae* sp. nov.

FIRST RECORD OF *RUBORRIDION MUSIVUM* SIMON, 1873 (ARANEAE: THERIDIIDAE) FROM INDIA.

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[Quasin, S., Siliwal, M., Patil, V. & Uniyal, V. P. 2017. First record of *Ruborridion musivum* Simon, 1873 (Araneae: Theridiidae) from India. Munis Entomology & Zoology, 12 (1): 27-30**]**

ABSTRACT: The theridiid spider *Ruborridion musivum* (Simon, 1873) is reported from India for the first time, based on specimens collected from Maharashtra and Uttarakhand. A brief description and illustrations of the female is provided in this paper.

KEY WORDS: Theridiidae, *Ruborridion musivum*, India, new record

The comb-footed spider family Theridiidae (Sundevall, 1833) is one of the most speciose family with 122 genera and 2470 species (World Spider Catalog, 2016). In India it is represented by 18 genera and 52 species (World Spider Catalog, 2016). The monotypic genus *Ruborridion* Wunderlich, 2011, however, has not been reported from India so far. Here, we report *R. musivum* based on female specimens collected from Nanda Devi Biosphere Reserve-NDBR, Uttarakhand and Dapoli, District Ratnagiri, Maharashtra.

The type species *Ruborridion musivum* was originally described as *Theridion musivum* by Simon (1873). Wunderlich (1987) placed *R. musivum* in *Paidiscura* based on the body colouration, haemolymph color, shape of labium and sternum, genital structures. Subsequently, Knoflach & Thaler (2000) rejected this transfer. Later, Wunderlich (2011) created the genus *Ruborridion* to accommodate *Theridion musivum* Simon 1873. The species is presently known only from the Mediterranean region (Wunderlich, 2011).

MATERIAL AND METHOD

The material examined for the present study was collected from two study sites. First site was Joshimath and Sunil Goan, NDBR. This site is located in the northern region of the Western Himalaya (India). Another site was Dapoli taluka in Maharashtra (India). This site is located on the western coast of India and the samples were collected from the forest using vegetation beating and litter sorting method. The specimen were then preserved and examined under a stereomicroscope (MOTIC ™); all the illustrations were prepared with the aid of a camera lucida. All measurements are in millimeters (mm) using an ocular micrometer. Epigynum were dissected and cleaned using lactic acid. Photographs were taken with a Leica DFC 290 stereomicroscope. Specimens were deposited in the public museum of the Wildlife Information Liaison Development Society (WILD), Coimbatore, Tamil Nadu, India.

Abbreviations: ALE = anterior lateral eye; AME = anterior median eye; PME= Posterior median eyes, PLE= Posterior lateral eyes; Fe=femur; Mt=metatarsus; Pa=patella; Ta=tarsus; Ti=tibia

TAXONOMY

Ruborridion musivum (Simon, 1873)

(Table 1; Figs. 1A-C)

Material Examined:
1 female, 17 November 2009, Joshimath, NDBR, Uttarakhand, India: elevation 2182 m, 30°29′42.1″N 79°42′19.3″E, WILD-09-ARA-1237 (Shazia Quasin).
1 female, 23 July 2015, Sunil Gaon, NDBR, Uttarakhand, India: Elevation 2237 m, 30°33′02.6″N 79°33′14.0″E WILD-15-ARA- 1303 (Irina Das Sarkar).
1 female, 10 October 2013, Jamage sacred grove (Dapoli), CFOR-S367, (Vinayak Patil & Pradip Patil).
1 female, 03 October 2013, Pangari sacred grove (Dapoli), CFOR-S390, (Vinayak Patil & Mayur Naik).

Description Female (WILD-09-ARA-1237): Spider in life bright orangish-red (Fig. 1A). But colour fades in alcohol except for tibia to tarsus reddish.

Total length 2.18. Carapace 0.66 long, 0.72 wide. Abdomen 1.52 long, 1.72 wide. Carapace wider than long; pear shaped, broader posteriorly; caput raised, covered with long pallid hairs; clypeus 0.08 high; fovea with wide depression; striae distinct. Eyes: both rows slightly procurved. Eyes: AME=PME 0.041, ALE 0.027, PLE 0.03. Distance between eyes: PME-PLE 0.027, ALE-PLE adjacent, AME-ALE 0.029, AME-AME 0.042, PME-PME 0.047, OQ 0.13 long, 0.32 wide, MOQ 0.12 long, 1.16 wide. Sternum 0.4 long, 0.32 wide, shield shaped, anteriorly widest, posteriorly narrowing down. Labium triangular, distinctly wider than long. Endites longer than wide. Sternum, endites, labium, legs covered with black long hairs. Chelicerae covered with few stiff hairs. Chelicerae one promarginal tooth, retromarginal tooth absent. Morphometry of legs is given in Table 1. Abdomen globular, without markings; three sigillas; uniformly covered with long black hairs dorsally and ventrally. Spinnerets three pairs, colulus absent.

Epigyne: Externally epigastrial area highly sclerotized and posteriorly slightly protruding like broad scape, atrium round, copulatory ducts and spermathecae partially visible (Fig. 1A). Spermathecae round, fertilization ducts small emerging posterior-prolateral end of spermathecae along with the copulatory duct; copulatory ducts, highly coiled and before opening into atrium they are heavily sclerotised and get fused (Fig. 1B).

Distribution. — Maharashtra, Uttarakhand, India (present record); Mediterranean.

Remark. — Female specimens from Uttarakhand were collected from untidy tangle webs. However, web structure was not observed in specimens collected from Maharashtra as they were collected by vegetation beating method.

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LITERATURE CITED

Knoflach, B. & Thaler, K. 2000. Notes on Mediterranean Theridiidae (Araneae) - I. Memorie della Società Entomologica Italiana, Genova, 78: 411-442.

Simon, E. 1873. Aranéides nouveaux ou peu connus du midi de l'Europe. (2e mémoire). Mémoires de la Société Royale des Sciences de Liège, 5 (2): 187-351.

Wunderlich, J. 2011. Extant and fossil spiders (Araneae). Beiträge zur Araneologie, 6: 1-640.

World Spider Catalog. 2016. Bern: Natural History Museum. Available at: http://wsc.nmbe.ch, version 16 [Date accessed: 20 July 2016].

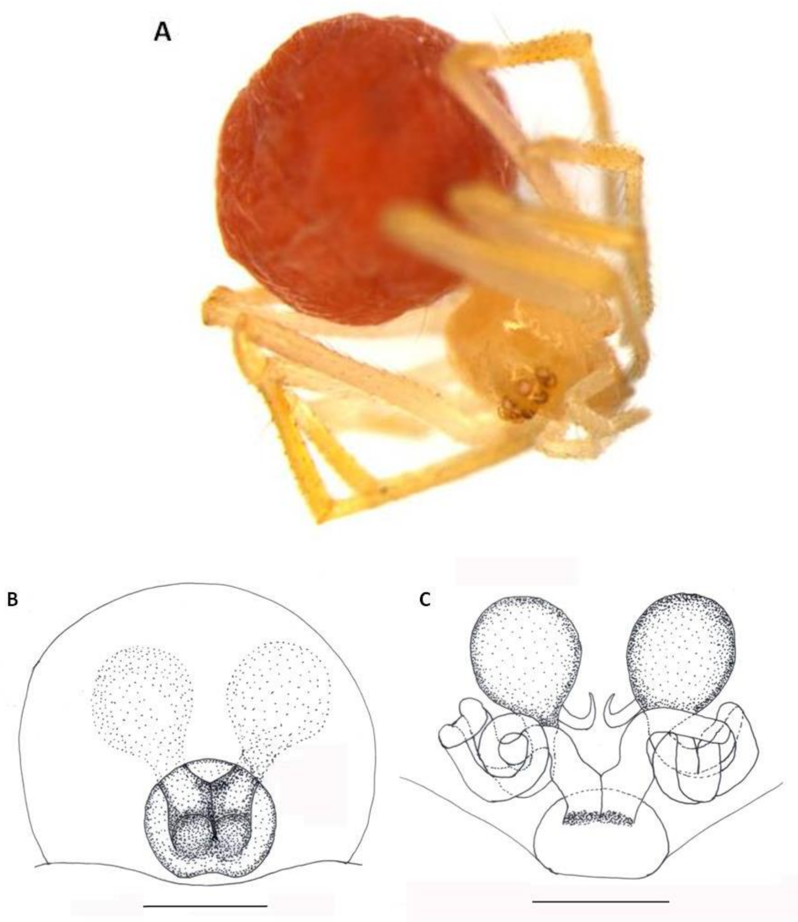

Figure 1: *Ruborridion musivum*, female A. Habitus; B. External Epigynum; C. Internal Epigynum. B-C: Scale = 0.1 mm.

Table 1. Leg measurements (in mm) of *Ruborridion musivum* (Simon, 1873)

Legs	**I**	**II**	**III**	**IV**
Fe	1.09	0.86	0.67	0.96
Pa	0.28	0.24	0.25	0.30
Ti	0.76	0.45	0.27	0.54
Mt	0.86	0.72	0.46	0.65
Ta	0.44	0.37	0.31	0.34
Total	3.43	2.64	1.96	2.79

NEW LOCALITIES OF ZERCONID MITES FROM TURKEY (ACARI: ZERCONIDAE)

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[Karaca, M. & Urhan, R. 2017. New localities of zerconid mites from Turkey (Acari, Zerconidae). Munis Entomology & Zoology, 12 (1): 31-37**]**

ABSTRACT: In this study, we reported the presence of 20 zerconid mite species belonging to 2 genera (*Prozercon* and *Zercon*) from Amasya, Balıkesir, Bolu, Bursa, Eskişehir and Isparta provinces of Turkey. Specimens were collected between 2011 and 2015. Distributions of species within Turkey are presented as a catalogue of provincial records. Unknown immature stages (deutonymphs and protonymphs) of some known zerconid mites and males of *Zercon ignobilis* are here recorded for the first time. Several species known previously from only a few localities in Turkey have been shown to have much wider distributions in the country. In addition, the habitats of these species found in the provinces were given.

KEY WORDS: Acari, Mesostigmata, Zerconidae, zerconid mites, new localities, Turkey

According to recent molecular systematic studies the family Zerconidae belongs to suborder Monogynaspida, cohort Gamasina and the superfamily Zerconoidea (Sikora, 2014). Zerconid mites are important members of the soil fauna and these free-living mites colonise in various soil substrates (Karaca & Urhan, 2015a). Their body lengths vary between 200-700 micrometers. They mostly associated with humus and soil, decomposed litter, leaf mould, plant parts, and mosses (Urhan, 2010b), however, there are rare records from wood subsrates, ant-hills, nests of birds and small terrestrial mammals (Mašán & Fend'a, 2004). These small, predatory mites feed on the eggs, larvae and nymphs of other mites and springtails (Shereef et al., 1984; Martikainen & Huhta, 1990). Their dorsal shields divided into two separate parts: podonotum and opisthonotum. These mites are weakly sclerotized and their life cycle include four active stages; larva, protonymph, deutonymph and adult. The presence of zerconids in various soil subsrates shows that they can be used as bioindicators for environmental changes (Sikora, 2014).

The members of Zerconidae are well known from the Holarctic region (Krantz, 1978), however, in recent years there are locality reports from alpine zone of Central Mexico and Taiwan (Ma et al., 2011; Ujvári, 2011a-b, 2012). In present, approximately 40 genera which are comprised of more than 400 species are known worldwide. Only two genera, *Prozercon* and *Zercon*, and 88 species were recorded known from Turkey until now (Karaca & Urhan, 2014, 2015b). In Turkey, the first study of zerconids was published by Polish acarolog C. Błaszak (1979) based on samples collected from Amanos Mountains and surrounding of Bolu province, collected by B. Dominiak and J. Pawlowski. From 1992 to date, further studies about zerconids have been made by R. Urhan and his team-mates in Turkey.

The aim of this study was to make a contribution to Turkish zerconid mites fauna.

MATERIAL AND METHODS

Soil, litter and moss samples were taken from 27 different localities in forestlands of Amasya, Balıkesir, Bolu, Bursa, Eskişehir and Isparta provinces (Fig. 1). The samples were placed in plastic bags, labelled and transferred to the laboratory and placed in combined Berlese funnels. Mites were extracted for 5-7 days according to the humidity of the samples. At the end of this process, the contents of the bottles were transferred to Petri dishes and mites were separated under a stereo-microscope. They were placed in 60% lactic acid for clearing and mounted on permanent microscope slides using a glycerine medium. The examination and drawing of mites were carried out using an Olympus BX50 microscope with DP25 camera. The examined materials are stored in 70% ethanol and deposited in the Acarology Laboratory of Pamukkale University, Denizli (Turkey). Morphological terminology, idiosomal chaetotaxy and poidotaxy (Fig. 2) used in the description follows that of Mašán & Fend'a (2004).

A list of localities is given in Table 1. The 'List of species' gives the sampling locations for each species. The dates of sampling and total number of individuals are also noted.

RESULTS

Family Zerconidae Canestrini, 1891
Genus *Prozercon* Sellnick, 1943
Type species: *Zercon fimbriatus* C. L. Koch, 1836

Prozercon balikesirensis **Urhan, 2008**

Materials: BU_1: 2 females, 23.09.2011; IS_2: 7 females, 23.06.2015. **Distribution in Turkey:** Balıkesir, İstanbul (Urhan, 2008a; Duran, 2013; Karaca, 2015). **Distribution in the world:** Turkey (Urhan, 2008a).

Prozercon buraki **Urhan, 2008**

Materials: BO_3: 98 females, 19 males, 8 deutonymphs, 6 protonymphs, 12.10.2012; BO_4: 24 females, 5 males, 2 deutonymphs, 13.10.2012; BO_5: 19 females, 2 males, 2 deutonymphs, 13.10.2012; BO_{10}: 3 females, 15.10.2012; BO_{11}: 8 females, 2 males, 1 deutonymph, 15.10.2012; BO_{12}: 16 females, 7 males, 2 deutonymphs, 15.10.2012; **Distribution in Turkey:** İstanbul, Kocaeli (Urhan, 2008a; Duran, 2013; Karaca, 2015). **Distribution in the world:** Turkey (Urhan, 2008a). **Remark:** Deutonymph and protonymph individuals of this species are recorded for the first time.

Prozercon carpathofimbriatus **Mašán & Fend'a, 2004**

Materials: BU_1: 6 females, 23.09.2011. **Distribution in Turkey:** Edirne, İstanbul, Kırklareli, Tekirdağ (Duran, 2013; Karaca, 2015). **Distribution in the world:** Croatia, Czech Republic, Poland, Slovakia, Turkey (Mašán & Fend'a, 2004; Ujvári 2011c; Duran, 2013).

Prozercon demirsoyi **Urhan & Ayyıldız, 1996**

Materials: BO_1: 12 females, 8 males, 3 deutonymphs, 11.10.2012; BO_2: 7 females, 11.10.2012; BO_3: 3 females, 4 males, 3 deutonymphs, 12.10.2012; BO_4: 6 females, 13.10.2012; BO_6: 1 female, 14.10.2012; BO_8: 18 females, 1 male, 14.10.2012; BO_9: 40 females, 14 males, 5 deutonymphs, 14.10.2012; BO_{10}: 38 females, 16 males, 3 deutonymphs, 15.10.2012; BO_{11}: 77 females, 28 males, 6 deutonymphs, 2 protonymphs, 15.10.2012; BO_{12}: 38 females, 13 males, 4 deutonymphs, 15.10.2012; BO_{17}: 3 females, 2 males, 18.10.2012; **Distribution in Turkey:** Artvin, Giresun, İstanbul (Urhan & Ayyıldız, 1996b; Öztaş, 2011; Duran, 2013; Karaca, 2015). **Distribution in the world:** Turkey (Urhan & Ayyıldız, 1996b).

Prozercon graecus **Ujvári, 2011**

Materials: BO_4: 9 females, 5 males, 13.10.2012; BO_{13}: 18 females, 19 males, 6 deutonymphs, 1 protonymph, 16.10.2012; BO_{14}: 5 females, 3 males, 2 deutonymphs, 17.10.2012; BO_{19}: 3 females, 2 males, 1 deutonymph, 18.10.2012. **Distribution in Turkey:**

Kırklareli, Tekirdağ (Karaca, 2015; Karaca & Urhan, 2015b). **Distribution in the world:** Greece, Turkey (Ujvári 2011c; Karaca, 2015). **Remark:** Deutonymph individuals of this species are recorded for the first time.

***Prozercon sultani* Duran & Urhan, 2015**

Materials: BO_7: 2 females, 1 deutonymph, 14.10.2012; BO_{14}: 3 females, 1 male, 17.10.2012. **Distribution in Turkey:** İstanbul (Duran, 2013; Duran & Urhan, 2015; Karaca, 2015). **Distribution in the world:** Turkey (Duran, 2013). **Remark:** Deutonymph individuals of this species are recorded for the first time.

***Prozercon tragardhi* (Halbert, 1923)**

Materials: BO_1: 10 females, 6 males, 2 deutonymphs, 11.10.2012. **Distribution in Turkey:** Erzurum, Giresun, İstanbul, Kırklareli, Tekirdağ (Urhan, 1995; Öztaş, 2011; Duran, 2013; Karaca, 2015). **Distribution in the world:** Austria, Czech Republic, England, Germany, Hungary, Iceland, Ireland, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, Sweden, Swiss, Turkey, Ukraine (Urhan & Ayyıldız, 1992; Mašán & Fend'a, 2004; Ujvári, 2009).

Genus *Zercon* C. L. Koch, 1836

Type species: *Zercon triangularis* C. L. Koch, 1836

Zercon agnostus* Błaszak, 1979

Materials: AM_1: 57 females, 32 males, 18 deutonymphs, 6 protonymphs, 13.03.2011. **Distribution in Turkey:** Adana, Yozgat (Błaszak, 1979; Urhan et al., 2007). **Distribution in the world:** Turkey (Błaszak, 1979; Urhan et al., 2007). **Remark:** Deutonymph and protonymph individuals of this species are recorded for the first time.

***Zercon burdurensis* Urhan, 2001**

Materials: IS_1: 2 females, 22.06.2015. **Distribution in Turkey:** Burdur (Urhan, 2001). **Distribution in the world:** Turkey (Urhan, 2001).

***Zercon cabylus* Athias-Henriot, 1961**

Materials: BO_1: 18 females, 1 male, 11.10.2012; BO_5: 1 female, 13.10.2012; BO_{10}: 1 female, 15.10.2012; BO_{11}: 5 females, 15.10.2012. **Distribution in Turkey:** Artvin, Tekirdağ (Urhan & Ayyıldız, 1996a; Karaca, 2015). **Distribution in the world:** Algeria, Turkey (Athias-Henriot, 1961; Urhan & Ayyıldız, 1996a).

***Zercon cokelezicus* Urhan, 2009**

Materials: ES_2: 15 females, 8 males, 10.04.2013. **Distribution in Turkey:** Denizli (Urhan, 2009). **Distribution in the world:** Turkey (Urhan, 2009).

***Zercon colligans* Berlese, 1920**

Materials: AM_1: 31 females, 17 males, 11 deutonymphs, 8 protonymphs, 13.03.2011; ES_1: 23 females, 12 males, 7 deutonymphs, 4 protonymphs, 10.04.2013; IS_1: 1 female, 22.06.2015. **Distribution in Turkey:** Artvin, Aydın, Çanakkale, Denizli, Edirne, Erzurum, Giresun, İstanbul, Kırklareli, Tekirdağ (Urhan, 1991, 1995; Güler, 1999; Orman, 2001; Öztaş, 2011; Duran, 2013; Karaca, 2015). **Distribution in the world:** France, Italy, Sweden, Swiss, Turkey (Sellnick, 1958; Urhan & Ayyıldız, 1994).

***Zercon denizliensis* Urhan, 2011**

Materials: ES_2: 9 females, 5 males, 10.04.2013. **Distribution in Turkey:** Denizli, Giresun (Urhan, 2011; Öztaş, 2011). **Distribution in the world:** Turkey (Urhan, 2011).

***Zercon foveolatus* Halašková, 1969**

Materials: BO_5: 1 female, 1 male, 13.10.2012; BO_6: 1 male, 14.10.2012; BO_7: 1 female, 1 male, 14.10.2012. **Distribution in Turkey:** Kırklareli, Kocaeli, Tekirdağ (Urhan, 2008b; Karaca, 2015). **Distribution in the world:** Czechoslovakia, Romania, Slovakia, Turkey, Ukraine (Halašková, 1969; Petrova, 1977; Karg, 1993; Mašán & Fend'a, 2004; Urhan, 2008b).

***Zercon ignobilis* Błaszak, 1979**

Materials: BO_1: 1 female, 11.10.2012; BO_3: 3 females, 1 male, 2 deutonymphs, 1 protonymph, 12.10.2012; BO_4: 4 females, 13.10.2012; BO_5: 36 females, 2 males, 13.10.2012; BO_6: 113 females, 5 males, 3 deutonymphs, 14.10.2012; BO_7: 12 females, 14.10.2012; BO_8: 10 females, 14.10.2012; BO_9: 23 females, 1 male, 14.10.2012; BO_{10}: 22 females, 15.10.2012; BO_{11}: 13 females, 2 males, 15.10.2012; BO_{12}: 81 females, 4 males, 15.10.2012; BO_{16}: 1 female, 17.10.2012; BO_{20}: 2 females, 20.10.2012. **Distribution in Turkey:** Bolu (Błaszak, 1979). **Distribution in the world:** Turkey (Błaszak, 1979). **Remark:** Male, deutonymph and protonymph individuals of this species are recorded for the first time.

***Zercon laczii* Ujvári, 2010**

Materials: BO_{16}: 22 females, 1 male, 17.10.2012. **Distribution in Turkey:** İstanbul (Duran, 2013; Karaca, 2015). **Distribution in the world:** Croatia, Turkey (Ujvári, 2010; Duran, 2013).

***Zercon lepurus* Błaszak, 1979**

Materials: BO_3: 10 females, 12.10.2012; BO_4: 5 females, 1 male, 13.10.2012. **Distribution in Turkey:** Bolu, İstanbul (Błaszak, 1979; Duran, 2013; Karaca, 2015). **Distribution in the world:** Turkey (Błaszak, 1979).

***Zercon longisetosus* Urhan, 2008**

Materials: BO_{13}: 76 females, 23 males, 8 deutonymphs, 1 protonymph, 16.10.2012; BO_{14}: 112 females, 13 males, 2 deutonymphs, 17.10.2012; BO_{15}: 123 females, 14 males, 6 deutonymphs, 17.10.2012; BO_{17}: 81 females, 32 males, 4 deutonymphs, 2 protonymphs, 18.10.2012; BO_{18}: 126 females, 29 males, 18 deutonymphs, 6 protonymphs, 18.10.2012; BO_{19}: 152 females, 59 males, 24 deutonymphs, 8 protonymphs, 18.10.2012. **Distribution in Turkey:** Kocaeli (Urhan, 2008c). **Distribution in the world:** Turkey (Urhan, 2008c). **Remark:** Protonymph individuals of this species are recorded for the first time.

***Zercon marinae* Ivan & Călugăr, 2004**

Materials: BA_1: 9 females, 4 males, 03.11.2013. **Distribution in Turkey:** Çanakkale, Edirne, İstanbul, Kırklareli, Tekirdağ (Duran, 2013; Karaca, 2015). **Distribution in the world:** Romania, Turkey (Ivan & Călugăr, 2004; Ujvári & Călugăr, 2010; Duran, 2013).

***Zercon yusufi* Urhan, 2010**

Materials: BO_2: 1 female, 11.10.2012; BO_6: 10 females, 14.10.2012; BO_7: 10 females, 1 male, 14.10.2012; BO_{20}: 1 female, 20.10.2012. **Distribution in Turkey:** Kütahya (Urhan, 2010a). **Distribution in the world:** Turkey (Urhan, 2010a).

DISCUSSION

In this paper, several unknown stages (deutonymphs and protonymphs) of *Prozercon buraki*, *P. graecus*, *P. sultani*, *Zercon agnostus*, *Z. ignobilis*, *Z. longisetosus* and male individuals of *Zercon ignobilis* are reported for the first time.

The unique zoogeographical position of Turkey between Asia, Europe and North Africa, in the western Palearctic region, provides a rich biological diversity in terms of both floral and faunal elements. As zerconids are closely related with litter types plant communities which are specific to a particular area, may allow spreading endemic zerconid species associated with these special floral elements. Terra typica of 58 zerconid species is Turkey. Most probably, it is expected to found new species and new records of zerconids in Turkey with local faunistic investigations (especially in Black Sea and Mediterranean regions).

* First records of nymphs of *Zercon agnostus* was presented as a poster and published as an abstract at 12nd National Ecology and Environment Congress, which was held at Muğla Sıtkı Koçman University between 14–17 September 2015, in Muğla, Turkey.

LITERATURE CITED

Athias-Henriot, C. 1961. Mesostigmates (Urop.excl.) edaphiques mediterraneens (Acaromorpha, Anactinotrichida). Acarologia, 3: 381-509.

Błaszak, C. 1979. Systematic studies on the family Zerconidae, IV. Asian Zerconidae (Acari, Mesostigmata). Acta Zoologica Cracoviensia, 24 (1): 3-112.

Duran, E. H. 2013. İstanbul ili zerkonidlerinin (Acari, Mesostigmata, Zerconidae) sistematik yönden incelenmesi. Institute of Sciences, Pamukkale University, Denizli, M. Sc. Thesis, 142 pp.

Duran, E. H. & Urhan, R. 2015. A new species of the genus *Prozercon* Sellnick, 1943 (Acari: Mesostigmata: Zerconidae) from Turkey. Zoology in the Middle East, 61 (2): 174-178.

Güler, S. 1999. Kaklık ovası ve çevresi zerkonidlerinin (Acari, Gamasida, Zerconidae) sistematik yönden incelenmesi. Institute of Sciences, Pamukkale University, Denizli, M. Sc. Thesis, 40 pp.

Halašková, V. 1969. Zerconidae of Czechoslovakia (Acari: Mesostigmata). Acta Universitatis Carolinae-Biologica, 3-4: 175-352.

Ivan, O. A. & Călugăr, A. 2004. Studiul familiilor Zerconidae Canestrini, 1891 si Scheloribatidae Grandjean, 1933 (Acari: Gamasina, Oribatida): morfologia, taxonomia, ecologia si raspandirea speciilor din fauna Romaniei. Revista de Politica Stiintei si Scientometric (Numar special), 54 pp.

Karaca, M. 2015. Trakya bölgesi (Türkiye) zerkonid akarları (Acari, Mesostigmata, Zerconidae) üzerine sistematik araştırmalar. Institute of Sciences, Pamukkale University, Denizli, Ph. D. Thesis, 282 pp.

Karaca, M. & Urhan, R. 2014. Contributions with new records to zerconid mite fauna of Turkey (Acari: Zerconidae). Turkish Bulletin of Entomology, 4 (3): 147-155.

Karaca, M. & Urhan, R. 2015a. A new record of zerconid mites (Acari, Mesostigmata, Zerconidae) from the Thrace region of Turkey. Turkish Journal of Zoology, 39 (1): 188-190.

Karaca, M. & Urhan, R. 2015b. Two new records of the genus *Prozercon* Sellnick, 1943 (Acari: Zerconidae) from Turkey. Turkish Journal of Zoology, 39 (5): 949-955.

Karg, W. 1993. Acari (Acarina), Milben, Parasitiformes (Anactinochaeta), Cohors Gamasina Leach. Raubmilben. Zoologisches Museum Berlin (Hrsg.), Dahl, F. (Begr.), Die Tierwelt Deutschlands und der angrenzenden Meeresteile, 59. Teil., Gustav Fischer Verlag, Jena, 309-329.

Krantz, K. W. 1978. A manual of acarology. Oregon State University, second edition, Corvallis, Oregon, 509 pp.

Ma, L. M., Ho, C. C. & Wang, S. C. 2011. One new species of Zerconidae and one new recorded species of Blattisocidae from Taiwan (Acari: Mesostigmata). Formosan Entomologist, 31: 239-247.

Martikainen, E. & Huhta, V. 1990. Interactions between namatods and predatory mites in raw humus soil: a microcosm experiment. Revue D'ecologie Et de Biologie Du Sol, 27 (1): 13-20.

Mašán, P. & Fenďa, P. 2004. Zerconid mites of Slovakia (Acari, Mesostigmata, Zerconidae). Slovak Academy of Sciences, Institute of Zoology, Bratislava, 238 pp.

Orman, Ş. N. 2001. Bozdoğan ilçesi (Aydın) Epicrioidea (Acari, Gamasida) üst familyası üzerine sistematik araştırmalar. Institute of Sciences, Pamukkale University, Denizli, M. Sc. Thesis, 47 pp.

Öztaş, M. 2011. Giresun ili zerkonidlerinin (Acari, Mesostigmata, Zerconidae) sistematik yönden incelenmesi. Institute of Sciences, Pamukkale University, Denizli, M. Sc. Thesis, 149 pp.

Petrova, A. D. 1977. Family Zerconidae Canestrini, 1891. A key to the soilinhabiting mites, Mesostigmata. Nauka, Leningrad, 577-621.

Sellnick, M. 1958. Die familie Zerconidae Berlese. Acta Zoologica Academiae Scientiarum Hungaricae, 3: 313-368.

Shereef, G. M., Afifi, M. A. & El Bishlawy, S. H. O. 1984. Description, life cycle and feeding habitats of *Zercon adalicus* n. sp. (Acari, Gamasida, Zerconidae). Bulletin of Faculty of Agriculture, Cairo University, 35: 1765-1774.

Sikora, B. 2014. Mites of the family Zerconidae (Acari: Mesostigmata) of the Nearctic region. Annales Zoologici, 64 (2): 131-250.

Ujvári, Z. 2009. Contribution to the mesostigmata fauna of Slovenia (Acari: Mesostigmata: Zerconidae et Macrochelidae). Acta Entomologica Slovenica, 17 (2): 115-124.

Ujvári, Z. 2010. Zerconid mites (Acari: Mesostigmata: Zerconidae) from Croatia with description of four new species. Journal of Natural History, 44: 1671-1696.

Ujvári, Z. 2011a. First records of Zerconidae (Acari: Mesostigmata) south of the tropic of Cancer, Mexico, with description of five new species. International Journal of Acarology, 37 (3): 201-215.

Ujvári, Z. 2011b. New zerconid mites (Acari: Mesostigmata: Zerconidae) from Taiwan. Zoological Studies, 50 (1): 87-102.

Ujvári, Z. 2011c. Six new species of *Prozercon* Sellnick, 1943 (Acari, Mesostigmata, Zerconidae) from Greece, with remarks on the genus. Zootaxa, 2785: 1-31.

Ujvári, Z. 2012. *Draconizercon punctatus* gen. et sp. nov., a peculiar zerconid mite (Acari: Mesostigmata: Zerconidae) from Taiwan. Opuscula Zoologica Budapest, 43 (1): 79-87.

Ujvári, Z. & Călugăr, A. 2010. New zerconid mite species (Acari: Mesostigmata: Zerconidae) from Romania. Acta Zoologica Academiae Scientiarum Hungaricae, 56 (3): 235-255.

Urhan, R. 1991. Erzurum ovası zerkonidleri üzerine (Acari, Mesostigmata, Zerconidae) sistematik araştırmalar. Institute of Sciences, Erzurum Atatürk University, Erzurum, M. Sc. Thesis, 42 pp.

Urhan, R. 1995. Artvin ili zerkonidlerinin (Acari, Mesostigmata, Zerconidae) sistematik yönden incelenmesi. Institute of Sciences, Erzurum Atatürk University, Erzurum, Ph. D. Thesis, 129 pp.

Urhan, R. 2001. New species of zerconid mites (Acari, Gamasida, Zerconidae) from Turkey. Acarologia, 42: 67-73.

Urhan, R. 2008a. Contributions to the genus *Prozercon* Sellnick, 1943 (Acari: Zerconidae) from Turkey, with the description of two new species and a key to species. Zoology in the Middle East, 45: 97-104.

Urhan, R. 2008b. *Zercon foveolatus* Halašková, 1969, a new record of a zerconid mite (Acari, Zerconidae) for the Turkish fauna. Turkish Journal of Zoology, 32: 213-215.

Urhan, R. 2008c. Two new species of *Zercon* C. L. Koch (Acari, Mesostigmata, Zerconidae) from Turkey: *Zercon longisetosus* sp. n. and *Zercon osmaneliensis* sp. n. Turkish Journal of Zoology, 32: 217-224.

Urhan, R. 2009. Zerconid mites (Acari, Mesostigmata, and Zerconidae) from Turkey. Turkish Journal of Zoology, 33: 321-329.

Urhan, R. 2010a. Two new species of *Zercon* (Acari: Zerconidae) from Turkey. Biologia, 65 (1): 92-98.

Urhan, R. 2010b. *Prozercon celali* sp. nov. of soil mites (Acari: Zerconidae) from Turkey. Annales Zoologici, 60 (1): 133-137.

Urhan, R. 2011. Two new species of zerconid mites (Acari, Mesostigmata) from Honaz Mountain National Park (Turkey). Turkish Journal of Zoology, 35 (2): 163-174.

Urhan, R. & Ayyıldız, N. 1992. Türkiye faunası için yeni bir *Prozercon* Sellnick, 1943 (Acari, Mesostigmata, Zerconidae) türü. Turkish Journal of Zoology, 17: 83-89.

Urhan, R. & Ayyıldız, N. 1994. Türkiye faunası için yeni *Zercon* C. L. Koch, 1836 (Acari, Mesostigmata, Zerconidae) türleri. Turkish Journal of Zoology, 18 (1): 53-60.

Urhan, R. & Ayyıldız, N. 1996a. Türkiye faunası için dört yeni *Zercon* C. L. Koch, 1836 (Acari, Mesostigmata, Zerconidae) türü. Turkish Journal of Zoology, 20: 293-302.

Urhan, R. & Ayyıldız, N. 1996b. Two new species of the genus *Prozercon* Sellnick from Turkey (Acari: Zerconidae). Genus, 7 (3): 569-580.

Urhan, R., Ayyıldız, N., Toluk, A., Koçoğlu, E. & Taşdemir, A. 2007. *Zercon agnostus* Błaszak, 1979 (Acari: Zerconidae) üzerine bir çalışma. Journal of Arts and Sciences, Çankaya University, 7: 171-179.

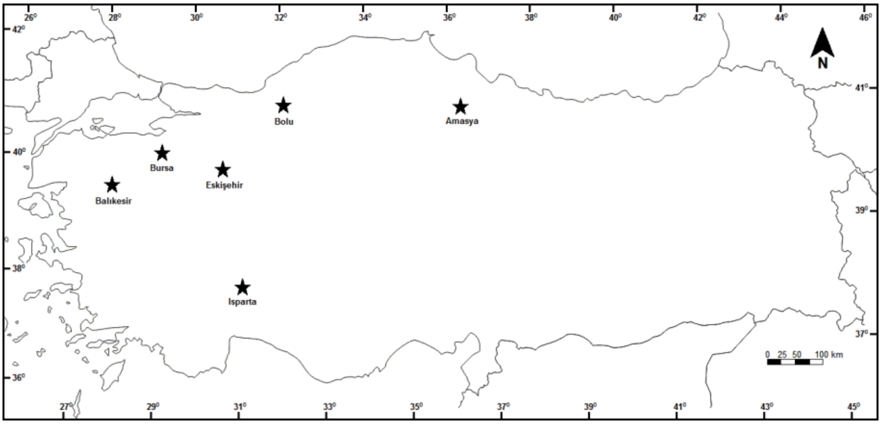

Figure 1. Research areas and collecting localities (*).

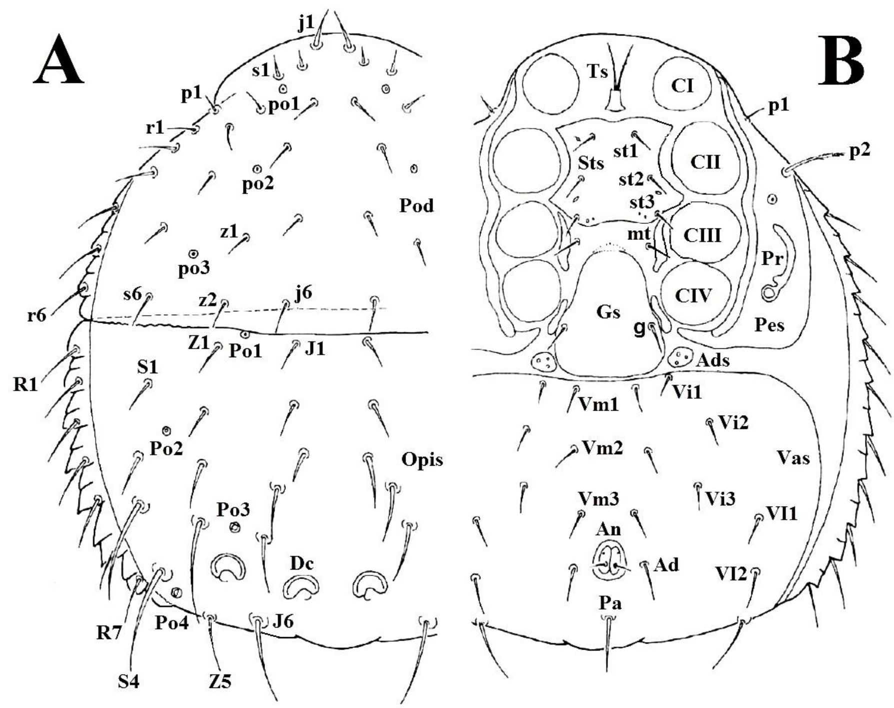

Figure 2. General view of a zerconid mite (female): A) dorsal view, B) ventral view. Abbreviations: (Pod) podonotum, (j1-6, z1-2, s1-6, p1-2 and r1-7) podonotal setae, (po1-3) podonotal glands, (Opis) opisthonotum, (J1-6, Z1-5, S1-4 and R1-7) opisthonotal setae, (Po1-4) opisthonotal glands, (Dc) dorsal cavities, (Ts) tritosternum, (Sts) sternal shield, (st1-st3) sternal setae, (mt) metasternal seta, (Gs) genital shield, (g) genital seta, (CI-CIV) endopodal shields, (Ads) adgenital shield, (Pr) peritreme, (Pes) peritremal shield, (Vas) ventroanal shield, (Vm1-Vm3) ventromediales setae, (Vi1-Vi3) ventrointernales setae, (VI1-VI2) ventrolaterales setae, (An) anal orifice, (Ad) adanal setae, (Pa) postanal seta (modified after Masan & Fend'a, 2004).

Table 1. List of sampling sites in research areas. Abbreviations: (AM) Amasya, (BA) Balıkesir, (BO) Bolu, (BU) Bursa, (ES) Eskişehir, (IS) Isparta.

No.	Sampling site	Coordinates	Altitude (m)	Habitat(s)	Code
1.	Urban Forest (Centre, Amasya)	40°.38'N-35°.47'E	600	*Juniperus* sp. + *Pinus brutia*	AM_1
2.	Hamamlı village (Erdek, Balıkesir)	40°.24'N-27°.53'E	95	*Quercus* sp.	BA_1
3.	Yedigöller National Park (Centre, Bolu)	40°.56'N-31°.45'E	830	*Pinus nigra*	BO_1
4.	Yedigöller National Park (Centre, Bolu)	40°.56'N-31°.45'E	830	Moss + *Ulmus* sp.	BO_2
5.	Yedigöller National Park (vicinity of Sazlıgöl)	40°.56'N-31°.44'E	850	*Ulmus* sp.	BO_3
6.	Yedigöller National Park (vicinity of Şelale)	40°.56'N-31°.44'E	785	Moss	BO_4
7.	Gölcük village (Centre, Bolu)	40°.48'N-31°.42'E	1040	*Alnus* sp. + *Quercus* sp.	BO_5
8.	Gölcük village (Centre, Bolu)	40°.48'N-31°.42'E	1075	*Quercus* sp.	BO_6
9.	Gölcük village (Centre, Bolu)	40°.48'N-31°.42'E	1075	Moss	BO_7
10.	Gölcük village (Centre, Bolu)	40°.48'N-31°.42'E	1050	*Pinus nigra*	BO_8
11.	Gölcük village (Centre, Bolu)	40°.48'N-31°.42'E	1050	*Ulmus* sp.	BO_9
12.	Gölcük village (Centre, Bolu)	40°.49'N-31°.41'E	1130	*Pinus nigra*	BO_{10}
13.	Gölcük village (Centre, Bolu)	40°.49'N-31°.41'E	1130	*Ulmus* sp.	BO_{11}
14.	Gölcük village (Centre, Bolu)	40°.49'N-31°.41'E	1130	*Quercus* sp.	BO_{12}
15.	Gerede village (Gerede, Bolu)	40°.48'N-32°.11'E	1630	*Picea* sp. + *Pinus sylvestris*	BO_{13}
16.	Plateau road (Gerede, Bolu)	40°.49'N-32°.11'E	1705	*Pinus sylvestris*	BO_{14}
17.	Plateau road (Gerede, Bolu)	40°.49'N-32°.11'E	1705	*Picea* sp.	BO_{15}
18.	Plateau road (Gerede, Bolu)	40°.49'N-32°.11'E	1705	Moss	BO_{16}
19.	Gerede plateau (Gerede, Bolu)	40°.49'N-32°.13'E	1750	*Pinus sylvestris*	BO_{17}
20.	Gerede plateau (Gerede, Bolu)	40°.49'N-32°.13'E	1750	Moss	BO_{18}
21.	Gerede plateau (Gerede, Bolu)	40°.49'N-32°.13'E	1750	*Picea* sp.	BO_{19}
22.	Abant road (Mudurnu, Bolu)	40°.37'N-31°.17'E	1335	*Crataegus* sp.	BO_{20}
23.	Güngörmez village (Karacabey, Bursa)	40°.19'N-28°.20'E	475	*Pinus* sp. + *Quercus* sp.	BU_1
24.	İdrisyayla village (Seyitgazi, Eskişehir)	39°.22'N-30°.26'E	1370	*Juniperus* sp. + *Quercus* sp.	ES_1
25.	Çürüttüm village (Seyitgazi, Eskişehir)	39°.21'N-30°.25'E	1400	*Cistus* sp. + *Pinus nigra*	ES_2
26.	Kırıntı village (Eğirdir, Isparta)	39°.39'N-30°.50'E	1225	*Juniperus oxycedrus* + Moss	IS_1
27.	Yukarıgökdere village (Eğirdir, Isparta)	37°.44'N-30°.49'E	1540	*Quercus vulcanica* + Moss	IS_2

FIRST DETECTION OF *PHRYNETA LEPROSA* (FABRICIUS) IN TURKEY (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT: The paper presents a new invasive alien longhorned beetle species (Coleoptera: Cerambycidae: Lamiinae) for Turkey. Accordingly, *Phryneta leprosa* is a new detection to Turkish fauna of invasive alien longhorned beetles.

KEY WORDS: Cerambycidae, Lamiinae, invasive alien species, new detection, Turkey

International trade is increasing rapidly with developing transportation routes. As a result of this, it became easier for many animal species to move from their natural habitats with the breakdown of the natural barriers between countries and continents (Lowe et al., 2000). Many species are introduced outside their natural geographic range due to the increasing rate of trade in the world. Some of them are able to establish in their new environment and to develop dense populations where they can outcompete native species or disrupt ecosystem functioning. Insects take an important place among these animals. Insect populations are controlled by several factors in their natural habitats, but they causes important problems as they move by living plants and wood materials to another area. They are so called invasive alien species in their new location. These species' common characteristics are fast growth and reproduction, high dispersal ability, tolerance of wide range of environmental conditions and ability to feed with various food types (Anonymous, 2011). Phytosanitary standards and regulations are the basis for preventative management to avoid unintentional international movement of such plant pests.

The increase in importing of the plants and wood material in the recent years has been causing the presence of these species in Turkey. In this research *Phryneta leprosa* is given as new detection to Turkish fauna of invasive alien longhorned beetles.

MATERIAL AND METHODS

Samples for this work were carried out in 2015 in Kocaeli province of Turkey. A map showing distribution pattern of the species in Turkey is added. The type information for each species is arranged according to Tavakilian (2015). For distributional data of the species, Löbl & Smetana (2010) and Danilevsky (2015) for Palaearctic are chiefly used in the text.

RESULTS

Subfamily Lamiinae Latreille, 1825
Tribe Phrynetini J. Thomson, 1864

Genus *Phryneta* Dejean, 1835
(type species *Lamia marmorea* Olivier, 1797)
Inesida J. Thomson, 1860: 86 (type species *Lamia leprosa* Fabricius, 1775)

Phryneta leprosa (Fabricius, 1775)
(Figs. 1, 2)

Original combination: *Lamia leprosa* Fabricius, 1775: 178.

Type information: ex collection Drury [type locality "America"].

Synonym: *Lamia brunicornis* Guérin-Méneville, 1844: 239 [Guinea].

Range: Europe introduced: France, Malta and **Afrotropical region**.

Report from Turkey: This species detected as 4 ♂♂ and 1 ♀ in early June 2015 on exporting Iroko timbers (Moraceae: *Milicia regia* (A. Chev.) C.C. Berg, 1982) from Cameroon and 1 ♂ in summer of 2016 on exporting Kosipo timbers (Moraceae: *Entandrophragma candollei* Harms, 1896) from Cameroon in Kocaeli province of North-Western Anatolia (Turkey).

Remarks: This species is known as "Castilloa Borer" commonly. It is widely distributed in the Afrotropics where it attacks mostly Moraceae and Ulmaceae. It has been introduced to Malta and France in Europe until now. It is a new record from Turkey.

Mifsud & Dandria (2002) stated "*It is a known pest of Castilloa, of which entire plantations have often been destroyed; in Cameraon, this tree is now no longer planted (Aulmann, 1913). In Uganda, severe attacks were reported on Morus (Hargreaves, 1924). P. leprosa (Fabricius) is regarded as a major pest of Chlorophora in West Africa, where extensive damage owing to the relatively large galleries which extend deep into the heartwood of these trees was recorded (Duffy, 1957). The adult beetle is known to cause appreciable damage by gnawing the bark of young trees. Larval development of P. leprosa (Fabricius) is reported to occur on a number of different unrelated plant species namely Chlorophora excelsa, Funtimia elastica, Hevea, Manihot, Castilloa elastica, probably Ficus elastica, Antiaris africana, Antiaris toxicaria, Celtis africana, C. zenkeri, C. durandii, Bosqueia phoberos, Holoptelea grandis, Chaetacme aristata and Morus spp. (Duffy, 1957), Canarium schweinfurthii, Cynometra alexandrei, Entandrophragma angolense, Staudtia stipidata, Morus mesozygia, Beilschmiedia corbisieri, Celtis brieyi, Celtis mildebrandii, Mammea africana, Milleltia drastica, Morinda lucida, Ompgalocarpum, Oxystigma oxyphylllum, Parinari holstii, Pleiocarpa micrantha, P. tubicina, Pterocarpus soyauxii, Ricinodendron africanum, Scorodophloeus zenkeri, Strombosiopsis tetranda, Synsepalum subcordatum, Tetrapleura relraptera, Alstonia spp. and Afzelia africana (Duffy, 1980)*".

P. leprosa (Fabricius) was reported by Mifsud & Dandria (2002) and Vincent (2007) from Maltese Islands and France in *Morus nigra, Morus alba* and *Ficus carica.*

RECOMMENDATIONS

The pest *P. leprosa* should urgently be placed in plant quarantine directive Ek-1 A as a quarantine pest due to transported by exporting logs. Moreover, this species detected on exporting logs from Africa according to the present work. So exporting logs from Africa either should fumigate in port of entry or infected logs should redelivery to exporter.

LITERATURE CITED

Anonymous. 2011. Invasive species. http://en.wikipedia.org/wiki/Invasive_species (Accessed 04.11.2011).
Danilevsky, M. L. 2015. Catalogue of Palaearctic Cerambycoidea. Available from: http://www.cerambycidae.net/catalog.pdf (accessed 08.03.2015).
Lowe, S., Browne, M., Boudjelas, S. & De Poorter, M. 2000. 100 of the World's worst invasive alien species a selection from the global invasive species database. Published by The Invasive Species Specialist Group (ISSG) a specialist group of the Species Survival Commission (SSC) of the World Conservation Union (IUCN), 12 pp. First published as special lift-out in Aliens 12, December 2000. Updated and reprinted version: November 2004.
Löbl, I. & Smetana, A. 2010. Catalogue of Palaearctic Coleoptera, Vol. 6. Chrysomeloidea. Stenstrup: Apollo Books 924 pp.
Mifsud, D. & Dandria, D. 2002. Introduction and establishment of *Phryneta leprosa* (Fabricius) (Coleoptera, Cerambycidae) in Malta. The Central Mediterranean Naturalist, 3 (4): 207-210.
Tavakilian, G. 2015. Base de données Titan sur les Cerambycidés ou Longicornes. Available from: http://lis-02.snv.jussieu.fr/titan/ (Accessed 31.07.2015).
Vincent, R. 2007. Catalogue des Coléoptères du département de la Saône-et-Loire. Vol. I. Cerambycidae. Terre Vive, Supplément hors-série: 184 pp.

Figure 1. *Phryneta leprosa* (Fabricius, 1775).

Figure 2. The distribution pattern of *Phryneta leprosa* (Fabricius, 1775) in Turkey.

EFFECT OF ANTIBIOTIC ADMINISTRATION ON GROWTH AND DEVELOPMENT OF SILK GLAND IN MULBERRY SILKWORM (*BOMBYX MORI* L.)

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ABSTRACT: Nutrition is the important physiological process, which plays a prime role in the growth and in turn it affects the productivity of the silkworm. The supplementation of different materials along with mulberry leaves to silkworm results higher yield because the production of quality silk mainly depends on larval nutrition. The influence of antibiotic on growth and development of silkworm larva and silk gland was assessed. Solution of two concentrations (50 and 100 ppm) of antibiotic (Norfloxacin®) was administered orally along with mulberry leaves to two popular Indian silkworm hybrids (CSR2× CSR4 and BL67×CSR101) during 5th instar larval period. It was found that administration of antibiotic enhanced the growth and development of silkworm and recorded significantly higher silk gland, larval, shell and cocoon weight in treated batches. The growth of the silk gland during different hours of 5th instar was observed and maximum growth was recorded during 144 hrs and it was significantly higher for treated batches. The study summarizes that supplementation of mulberry leaves with antibiotic have a significant improvement in growth and development of silkworm larva, silk gland as well as other economical traits of silkworm.

KEYWORDS**:** Antibiotic administration, Norfloxacin, Growth of silk gland, larval weight, *Bombyx mori* L.

The productivity and quality in sericulture depends on the healthiness, growth of the larvae and the environmental conditions. The quality of silk is affected by cocoon reelability, neatness, non-breakable filament length, cleanness etc. to certain extent. The quantity of available dietary protein is important in feeding of herbaceous insect for its growth, survival and population dynamics. It has been proved that a nutritionally un balanced diet drastically reduce growth rate of herbivorous animals by promising a metabolic load (Naik & Delvi, 1987). Fortification of mulberry leaves is considered as one of the effective method to enrich the silkworm food. In recent years attempts have been made to fortify the leaves with nutrients like proteins, amino acids, vitamins, minerals, carbohydrates crude extracts of jaggery and molasses to harvest better quality of cocoon and silk. (Etebari et al., 2004; Etebari & Matindoost, 2005; Nirmala et al., 2002; Rahmathulla et al., 2012).

Various antibiotics are extensively employed in the nutrition of non-herbaceous animals for raising their productivity. The beneficial effect of the antibiotics has been attributed to their activity in conditioning the composition of intestinal flora, to their potential role as possible growth factors, to their biological efficiency in increased turning over of the feed in to body weight and to their potential disease control activity (Goldberg, 1959; Walton, 1977). The mechanism of action of antibiotics in biomass accumulation is still not completely understood. There is a controversy as to whether the antibiotic acts entirely through its antibacterial property or by favorably affecting the physiology and metabolism by an increase in the feed efficiency or by the activation of enzymes or through hormones, which control and regulate growth (Verma & Kushwaha, 1971). Many investigators reported biochemical action of antibiotic on aminoacid profile of *B. mori* silk protein (Afrikion, 1960; Walton, 1977). The administration of antibiotic causes the physiological changes in silkworm have a direct bearing on the leaf consumption and its further conversion to cocoon. (Aftab Ahamed et al., 2001). Bohidar & Pradhan (2000) studied the effect of oral administration of four antibiotics on the rearing performance of eri silkworm, *Samia cynthia ricini*.

The natural silk synthesized by the silkworm and spun in the form of a cocoon is originally synthesized in the silk gland. Silk gland of *B. mori* is a typical exocrine gland secreting large amount of silk proteins. It is a paired organ consisting of modified labial/salivary glands located at the two lateral sides under the alimentary canal. Silk inside the silk gland is in liquid state. The change of this liquid silk protein to solid cocoon fibers of certain morphological character is a complex physiological and physicochemical process. The process of spinning of cocoon is a fairly complicated physio-chemical phenomenon and not merely the extrusion of the silk proteins stored in the silk gland.

Silk gland weight is highly correlated to silk production since most of the cell functions are involved in silk production in the mature larva. A high silk gland weight is obtained differently in different strains, either by higher number of cells with cells of small size or by larger cells, which are smaller in number (Prudhomme & Couble, 1979). It is striking that there is only a low correlation between silk production and the relative size of the silk gland to body weight. So, activity of the silk gland is primarily determined by its own characteristics and it remains largely independent of other organs.

In the present investigation, the effect of administration of an antibiotic (Norfloxacin®) on growth and development of silk gland of a productive bivoltine hybrid (CSR2 × CSR4) and a crossbreed hybrid (BL61× CSR101) was studied. The study also evaluated the influence of antibiotic on subsequent increase in other economic traits of silkworm.

MATERIALS AND METHODS

Study material

A productive bivoltine hybrid silkworm (CSR2×CSR4) developed by breeders of Central Sericultural Research and Training Institute, Mysore, India under the collaboration of Japanese experts was used as one of the study material. This hybrid is suitable to rear during favorable season (August–February) under Indian environmental condition and is popular for its high survivability, yield and silk ratio and also producing quality bivoltine silk matching with the international standards. The crossbreed hybrid is used in the present study is a new multivoltine × bivoltine breed (BL67 × CSR101) and can be reared throughout the year under Indian conditions.

Young age silkworm rearings was conducted by following the new standard package and practices (Rajan et al., 2001) by providing fresh tender leaves of V1 mulberry variety with high moisture content of 75-80%. The temperature (27±1°C) and humidity (85– 90%) was maintained during young age rearing. During late age rearing it was maintained 25 ±1°C and 70± 5 % respectively.

Antibiotic administration

The experiment was conducted at Central Sericultural Research and Training Institute, Mysore (2002-03), Norfloxacin® is a broad-spectrum antibiotic called the quinolones (Fig. 1) and it is active against both gram positive and negative bacteria. It is a synthetic chemotherapeutic agent occasionally used to treat common as well as complicate urinary tract infections. It works by entering the bacterial cell and inhibiting a chemical called DNA-gyrase, which is involved in the production of genetic material (DNA). Therefore it prevents the bacteria from reproducing and their further growth is stopped.

The freshly moult out fifth instar larvae were grouped in to three batches for each hybrid. Each batch was separated with three replications of 100 larvae and reared at temperature of 25±1°C and a relative humidity of 75±5%. The batch 1 & 2 were experimental batches (T-1 and T-2), and the larvae were fed with mulberry leaves fortified with two different concentrations of antibiotic Norfloxacin® (50 and 100 ppm). However, the batch-3 (Control) larvae were considered as a carrier control fed with normal mulberry leaf sprayed with distilled water. The solution was prepared by adding powdered antibiotic in distilled water and made the required concentration. The known quantity of leaf as per the standard recommendation (Rajan et al., 2001) was sprayed with freshly prepared solution (50 ml for each batch/feeding) and dried the leaf samples of treatments and control for 15 minutes after keeping in shade. The treatment was initiated on the first day of fifth instar and was continued up to spinning. A parallel batch for each treatment and control were maintained separately and these silkworm batches were mainly used to dissect out silk gland. Growth rate pattern of silkworm was studied daily by taking observation of weight of 5 male and female larvae. For determination weight of silk gland, every day 3 healthy larvae from additional batches of each treatment were dissected and observed the weight of silk gland after dry out moisture from the gland with the help of a tissue paper. Fully matured larvae were mounted separately replication and treatment wise in plastic collapsible montages for cocoon spinning. The cocoon harvesting and assessment was done on 6th day after mounting. The cocoon weight, shell weight and shell ratio were calculated and sample of each treatment was subjected for reeling operation and calculated the filament length. The experiment was designed under the Randomized Block Design (RBD) and was repeated two times in different season (rainy and summer) and analysis of variance (Anova) was worked out to arrive at the treatment significance levels. The treatment means values were compared by using values of critical difference (C.D.). The standard error (SE±) and critical difference were worked out by using following formulae.

C.D at 5% level of significance = S.E difference × t_5% level of significance

SE± = $\sqrt{V_E (1/r_1+1/r_2)}$ where r_1 and r_2 are numbers of the replications of the treatments to be compared.

The detailed plan of the experiment (Table 1) and formulae for calculation of different parameters are described below.

$$\text{Weight of single larva} = \frac{\text{Weight of 10 larvae (g)}}{\text{Total no. of larvae weighed (10)}}$$

$$\text{Growth index} = \frac{\text{Final weight of larvae (g)} - \text{Initial weight of larvae (g)} \times 100}{\text{Initial weight of larvae (g)}}$$

$$\text{Weight of single cocoon} = \frac{\text{Weight of 10 male cocoons} + \text{Weight of 10 female cocoons (g)}}{\text{No. of cocoons weighed (20)}}$$

$$\text{Single shell weight} = \frac{\text{Total shell weight of 10 male cocoons + Total shell weight of 10 female cocoon shell (g)}}{\text{Total no of cocoon shell weighed (20)}}$$

$$\text{Tissue somatic index} = \frac{\text{Silk gland weight (g)} \times 100}{\text{Larval weight (g)}}$$

$$\text{Silk conversion index} = \frac{\text{Shell weight (g)} \times 100}{\text{Silk gland weight (g)}}$$

$$\text{Average filament length} = \frac{\text{Total filament length (m)}}{\text{Total no. of cocoons reeled}}$$

RESULTS AND DISCUSSION

After the administration of antibiotic, day-to-day increase in weight of silkworm larva as well as silk gland was observed during 5th instar for bivoltine and crossbreed hybrid silkworm. Maximum increase in larval weight was observed at 48 hrs with respect to the weight of previous day in treatments and control (Fig. 2). In bivoltine hybrid it was recorded higher in treated batches when compared with control. Similar, results were also observed in cross breed hybrid (Fig. 3). Similar, to larval weight maximum growth of silk gland with respect to previous day was observed at 72 hrs and also it was significantly higher for treated batches (Fig. 4). The same trend was repeated in cross breed hybrid (Fig. 5).

Maximum larval and silk gland weight was observed at 144 hrs of larval development and it was recorded higher for treated batches of bivoltine hybrid as well as cross breed hybrid (Figs. 2-5). Slight decrease in silk gland weight was observed after 144 hrs of development during full maturation period of silkworm. The fully matured larval weight in bivoltine hybrids was recorded significantly higher for T2 (6.18g) followed by T1 (5.85g) and least weight was recorded for control (5.43g) (Table 2). Similar trend was observed in cross breed hybrid also and it was recorded higher for T2 (4.82g) followed by T1 (4.65g) and control (4.08g) (Table 3). Similarly, weight of silk gland also recorded at the end of the 5th instar larval period and it was recorded significantly higher in antibiotic administered batches of bivoltine hybrid (1.97g for T2 and 1.885g for T1) when compared with the control (1.745g) (Table 2). Similar, observations were recorded in the case of cross breed hybrid and it was significantly higher in antibiotic treated batches (1.541g for T2 and 1.484g for T1) (Table 3). This explains the allometric growth of silk gland and extra production silk on treatment with antibiotics.

Daily increment of larval and silk gland weight was calculated based on day to day observation and from these data growth index with respect to initial weight of larva and silk gland were calculated (Tables 4 & 5). Maximum growth index of larva was recorded at 144 hrs of development and it was also significantly higher in treated batches (526.77 for T2, 493.30 for T1 and 439.55 for control). Same trend was observed in cross breed hybrid (479.32 for T2, 458.89 for T1 and 380.76 for control). Similar, observations were made for growth index of silk gland of bivoltine hybrid and it was recorded maximum at 144 hrs (Table 4) and recorded significant difference between treated and control batches (839.15 for T2, 789.15 for T1 and 697.16 for control). Similar, observations were also made in the case of cross breed hybrid and it was recorded significantly higher for T2 (775.56) followed by T1 (740.90) and control (660.79)(Table 4). Sailaja et al. (1991) reported that antibiotic terramycin having an effect on the development and organic composition of silkworm *B.mori*. Oral treatment with antibiotic terramycin increased larval and cocoon weight in *B.mori*. It changes in biochemical composition indicated increased protein synthesis and an increase in carbohydrate uptake from the blood.

Comparatively shorter larval duration of 5th instar silkworm was observed in treated batches of bivoltine hybrid and it was recorded as 140 hrs and 142 hrs for T2 and T1 respectively. In cross breed hybrid also same trend was repeated and it was recorded shortest larval duration in T2 (138 hrs) (Table 2). Earlier studies of Verma & Kushwaha (1971) and Radhakrishna Rai & Devaiaha (1998) reported there was no influence of antibiotic administration on larval duration. Banuprakash et al. (1999) recorded that the larval duration was shorter in antibiotic (chloramphenicol) treated silkworms, but the difference was not so vivid. Aftab Ahamed et al. (2001) reported that food assimilated, assimilation rate, assimilation efficiency, food converted, conversion rate, and conversion efficiencies were significantly higher in the antibiotic treated silkworm batches, though the dry food consumed is on par with the carrier control. A notable feature of the results is that the enhancement in the major commercial traits was not accompanied by a prolonged larval duration. This might be due to a direct stimulating effect of antibiotic on protein synthesis in silk gland.

Tissue somatic index represent the ratio between silk gland and larval weight and there was no significant difference between control and treatments (32.22 for T1, 32.15 for T2 and 32.13 for control) in bivoltine hybrid (Table 2). Similar observations were made in the case of cross breed hybrid also.

Silk conversion index is the percentage of silk in the fiber to the laminal silk in the silk gland. It was recorded higher in treated batches of bivoltine hybrids (27.26 for T1 and 28.22 for T2) when compared with control (25.94) (Table 2). Similarly, in cross breed hybrid also it was recorded higher in treated batches (26.21 for T1 and 26.54 for T2) (Table 3). Aftab Ahamed et al., (2001) reported that administration of chloramphenicol resulted in increased conversion of food in to shell content, indicating its beneficial results of higher silk synthesis. The total consumption during larval period of *B. mori* over 80% is consumed during the final instar and the silk, which is spun out finally as cocoon, is synthesized during fifth instar. Prudhomme et al. (1985) reported that silk produce in early instar is degraded during subsequent moults, hence supplementation in the earlier instars does not improve the cocoon production in addition to increasing the cost of rearing.

The enhanced growth and development of larval weight and silk gland reflected in commercial characters of silkworm and subsequent productivity in sericulture. The shell weight represents actual silk content of the cocoon and it was significantly higher in treated batches (0.556g for T2 and 0.514g for T1) when compared with control (Table 2). Same trend was observed in the case of cross breed hybrid (0.409 for T2 and 0.387 for T1). The cocoon weight was also recorded significantly higher in treated batches (2.03 for T2, 2.07g for T1 and 1.97g for control) of bivoltine hybrid. Similar observations were made in the case of cross breed hybrid. Bohidar & Pradhan (2000) studied the effect of four different antibiotics on eri silkworm and were found Norfloxacin to be the best antibiotic among. Aftab Ahamed et al. (2001) recorded that 25 and 50 ppm of chloramphenicol administration enhance significantly the cocoon weight. Govindan et al. (1990) reported that the antibiotic administrated silkworm larvae had higher digestive amylase activity in the intestine and later better utilization of food in to larvae and pupae.

The average filament length (AFL) of both hybrids was recorded after the process of reeling and it was found that significantly higher in treated batches of bivoltine hybrid (1230 m for T2 and 1064 m for T1) when compared with control (974m) (Table 2). Similar observation was made in cross breed hybrid (973m for T2, 939 m for T1 and 890 m for control). The increased cocoon shell weight is aptly reflected in the filament length of treated batches. So the results clearly indicated that the antibiotic administration causes an increase in filament length. The study results were in support with the earlier studies (Verma & Kushwaha, 1971; Tayade et al., 1988; Banuprakash et. al., 1999).

The study results concluded that the administration of antibiotic Norfloxacin enhanced growth and development of larval and silk gland of silkworm. This growth of larva and silk gland subsequently enhanced commercial characters of silkworm such as cocoon weight, shell weight, silk ratio and filament length in treated batches. This application can be used for getting higher productivity in sericulture.

LITERATURE CITED

Afrikion, E. G. 1960. Causal agents of bacterial disease of silkworm and the use of antibiotics in their control. Journal of Invertebrate Pathology, 2: 299-304.

Aftab Ahamed, C. A., Chandrakala, M. V., Maribashetty, V. G. & Raghuraman, R. 2001. Impact of Chloramphenicol Administration on Nutritional Efficiency in a Multivoltine race of Silkworm, *Bombyx mori* L. Entomon, 26 (1): 1-9.

Banuprakash, K. G.,Govindan, R. & Devaiah, M. C. 1999. Influence of antibiotics on growth and development of silkworm, *Bombyx mori* L.,Proceedings of National sericulture technology seminar, pp. 170-175.

Bohidar, K. & Pradhan, P. 2000. Rearing performance of the eri silkworm, *Samia Cynthia ricini* with oral administration of antibiotics, National conference on strategies for sericulture research and development, CSRTI, Srirampura Mysore, India. 16-18, November: p. 90.

Etebari, K., Ebadi, R & Matindoost, L. 2004. Effect of feeding mulberry's enriched leaves with ascorbic acid on some biological, biochemical and economical characteristics of silkworm *Bombyx mori* L.;International. Journal of Industrail Entomology, 8: 81-87.

Etebari, K & Matindoost, L. 2005. Application of multi-vitamins as nutrients on biological and economical characteristics of silkworm *Bombyx mori* L. Journal of Asia Pacific Entomology, 8: 1-6.

Goldberg, H. S. 1959. Antibiotics- their chemistry and non-medical uses. Dnonstrand Co., Princeton, New Jersey.

Govindan, R., Devaiah, M. C. & Narayanswamy, K. C. 1990. The beneficial effects of antibiotics on the silkworm. Indian silk, 29 (7): 12-20.

Krishnaswami, S., Kamalasingh, S., Raghuraman, R., Geethadevi, R. G. & Benchamin, K. V. 1981. Chloramphenicol as a growth Promoter in silkworm *Bombyx mori* L. Proceedings of sericulture symposium and seminar. TNAU. Coimbatore. pp. 130-133.

Naik, P. & Delvi, M. R. 1987. Food utilization in different races of silkworm, *Bombyx mori* L. (Lepidoptera: Bombycidae). Sericologia, 27 (3): 391-397.

Nirmala, X., Vanishree, V. & Krishnan, M. 2002. Effect of P-soyatose on the development and economic characteristics of the silkworm *Bombyx mori* L. Entomon, 27 (4): 347-353.

Prudhomme, J. C. & Couble, P. 1979. The adaptation of the silk gland cell to the production of fibroin in *Bombyx mori* L. Biochimie, 61: 215-227.

Prudhomme, J. C., Couble, P., Garel, J. P. & Daillie, J. 1985. Silksynthesis, Incomprehensive insect Physiology, Biochemistry and Pharmacology,Vol.10 Kerkut,G.A. and Gilbert L.I. (editors). Pergamon Press.Oxford, 391-419.

Radhakrishna Rai, B. & Devaiaha, M. C. 1998. Effect of antibiotic on the growth and development of silkworm, *Bombyx mori* L. Proceeding of. International Congress Tropical Sericulture, Bangalore, pp. 61-67.

Rahmathulla, V. K., Priyabrata Das & Ramesh, M. 2011.Effect of folic acid supplementation on nutritional and feed conversion efficiency of mulberry silkworm (*Bombyx mori* Linnaeus, 1758). Tropical Zoology, 24: 145-157.

Rajan, R. K., Singh, G. B., Himanthraj, M. T., Nataraju, B. & Subbaiah, M. B. 2001. Illustrated working process of new bivoltine rearing technology. JICA publication, CSR&TI, Mysore, pp. 1-92.

Sailaja, D., Devamma, M. N., Naidu, B. P. & Sreeramulu, A. 1991. Treatment of terramycin on the development and organic composition of silkworm. *Bombyx mori* L. Environment and Ecology, 9 (3): 656-658.

Shyamala, M. B., Sharada, K., Bhat, K., Maya, G. & Bhat, J. V. 1960. Chloromycetin in the nutrition of silkworm, *B.mori*. L.II.Influence of digestion and utilization of protein, fat and minerals, Journal of Insect Physiology, (4): 229-234.

Tayade, D. S., Jawale, M. D. & Unchegankar, P. K. 1988. Effect of antibiotics on the growth of silkworm *B. mori*. L. Indian Journal of sericulture, 37 (2): 67-72.

Verma, S. K. & Kushwaha, K. S. 1971. Effect of four tetracycline antibiotics on the growth of silkworm, *B. Mori* L. Indian Journal Agriculture Science, 41: 1009-1017.

Walton, J. R. 1977. A mechanism of growth promotion- Non lethal feed antibiotic induced cell wall lesion in enteric bacteria. In Antibiotics and Antibiotics in Agriculture. (Ed) M. Woodbllne, Butterworths, London. 259-264.

Norfloxacin
$C_{16}H_{18}FN_3O_3$

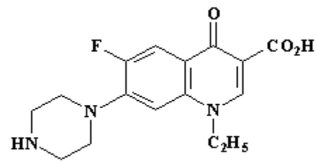


Figure 1. Chemical structure of Norfloxacin.

Table 1. Detailed plan of the experiment.

Race	Treatments with two concentrations of antibiotic		Control
Bivoltine hybrid (CSR2 × CSR4)	50 ppm (T1)	100 ppm (T2)	Distilled water sprayed
Cross breed hybrid (Bl67 × CSR101)	50 ppm (T1)	100 ppm (T2)	Distilled water sprayed

Table 2. Influence of antibiotic on growth and development of bivoltine hybrid silkworm.

Treatments	Maturation (hrs.)	Matured Larval Weight (g)	Matured Silk gland weight (g)	Growth index	Tissue somatic index	Shell weight (g)	Cocoon weight (g)	Silk conversion index	Filament length (m)
T1 (50ppm)	142	5.85	1.885	493.30	32.22	0.514	2.029	27.26	1064
T2 (100ppm)	140	6.18	1.971	526.77	32.15	0.556	2.069	28.22	1230
Control	144	5.43	1.745	439.55	32.13	0.455	1.973	25.94	974
SE±	0.333	0.083	0.018	7.93	0.440	0.006	0.019	0.123	9.658
CD 5%	1.1	0.261	0.042	25.00	1.22	0.019	0.047	0.456	30.4
F-test	**	*	**	*	NS	**	*	*	**

* Significant at 5% level, ** Significant at 1% level, NS- Non significant, SE±=Standard error

Table 3. Influence of antibiotic on growth and development of crossbreed hybrid silkworm.

Treatments	Maturation (hrs.)	Matured Larval Weight (g)	Matured Silk gland weight (g)	Growth index	Tissue somatic index	Shell weight (g)	Cocoon weight (g)	Silk conversion index	Filament length (m)
T1 (50ppm)	144	4.65	1.484	458.89	31.91	0.387	1.98	26.21	939
T2 (100ppm)	136	4.82	1.541	479.32	31.97	0.409	2.01	26.54	973
Control	144	4.08	1.291	380.76	31.61	0.335	1.72	25.96	890
SE±	0.494	0.076	0.015	0.933	0.284	0.005	0.009	0.122	4.991
CD 5%	1.60	0.239	0.035	24.994	1.23	0.016	0.039	0.421	29.88
F-test	**	*	**	*	NS	**	**	NS	**

* Significant at 5% level, ** Significant at 1% level, NS- Non significant, SE±=Standard error

Table 4. Influence of antibiotic on growth index of silkworm larva during different hours.

		Growth index of Larva in different hours					
Treatments		24 hrs	48 hrs	72 hrs	96 hrs	120 hrs	144 hrs
T1 (50ppm)	Bivoltine hybrid	57.20	146.95	226.06	332.04	413.40	493.30
	Cross breed hybrid	54.80	142.78	210.09	335.09	402.40	458.89
T2 (100ppm)	Bivoltine hybrid	70.38	160.24	260.64	356.38	447.66	526.77
	Cross breed hybrid	79.50	163.85	234.13	374.75	419.23	479.32
Control	Bivoltine hybrid	48.40	126.40	177.69	280.32	374.40	439.55
	Cross breed hybrid	51.26	125.69	185.71	300.24	350.72	380.76

Table 5. Influence of antibiotic on growth index of silk gland during different hours.

	Growth index of silk gland in different hours						
Treatments		24 hrs	48 hrs	72 hrs	96 hrs	120 hrs	144 hrs
T1 (50ppm)	Bivoltine hybrid	97.18	267.60	451.64	586.79	719.33	789.15
	Cross breed hybrid	115.25	267.20	429.94	609.65	696.59	740.90
T2 (100ppm)	Bivoltine hybrid	119.33	293.86	510.32	625.94	775.15	839.15
	Cross breed hybrid	132.76	282.38	473.86	66.47	727.27	775.56
Control	Bivoltine hybrid	91.98	241.98	374.17	520.75	652.35	697.16
	Cross breed hybrid	96.61	240.90	385.87	543.00	613.63	660.79

Figure 2. Influence of antibiotic on growth and development of bivoltine hybrid silkworm larva during 5th instar

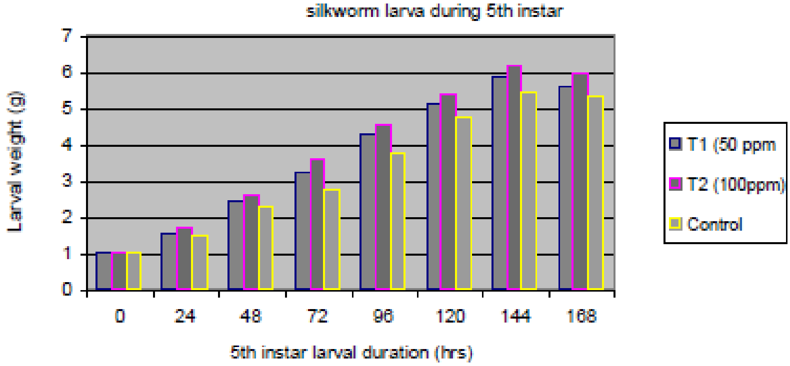


Figure 3 .Influence of antibiotic on growth and development of cross breed hybrid silkworm larva during 5th instar

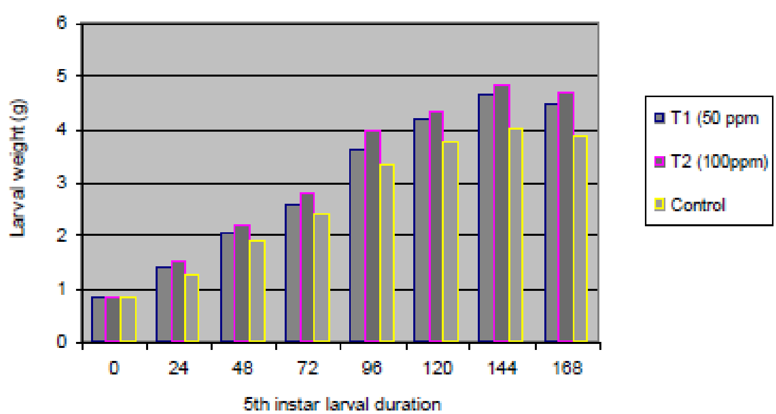


Figure 4. Influence of antibiotic on growth and development of silkgland of bivoltine silkworm hybrid during 5th instar

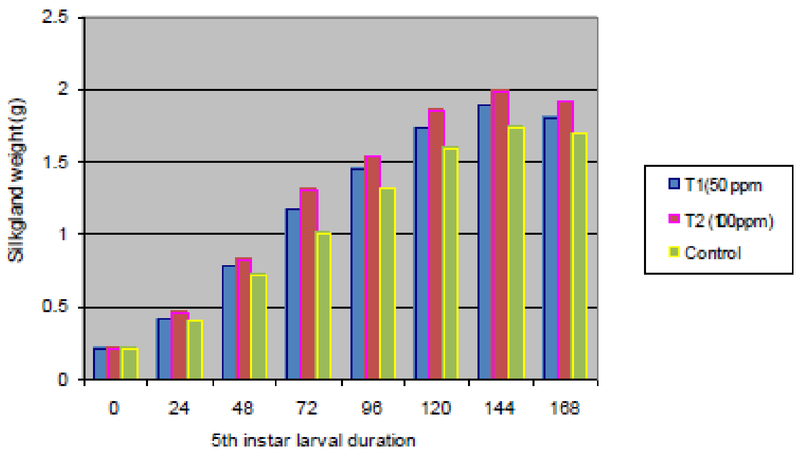
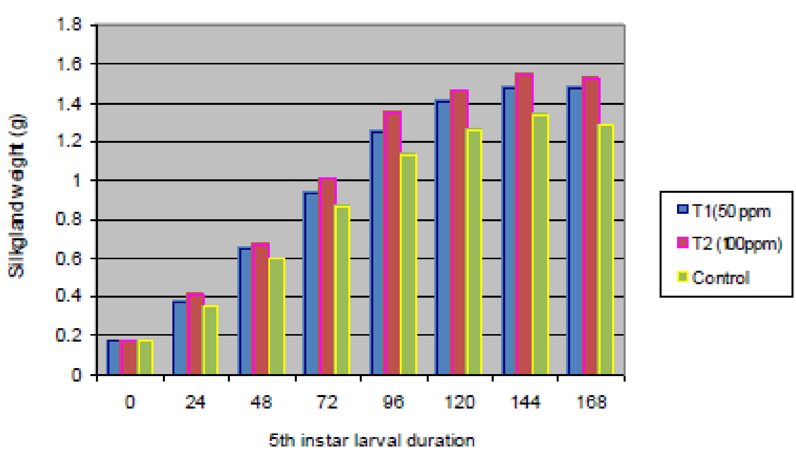


Figure 5. Influence of antibiotic on growth and development of silkgland of cross breed hybrid silkworm during 5th instar



A NEW SPECIES OF THE GENUS *HASARIUS* SIMON FROM BANGLADESH (ARANEAE: SALTICIDAE)

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[Biswas, V. 2017. A new species of the genus *Hasarius* Simon from Bangladesh (Araneae: Salticidae). Munis Entomology & Zoology, 12 (1): 50-53**]**

ABSTRACT: A new species of the genus *Hasarius* Simon namely- *H. raychaudhurii* sp. nov. is described from Khulna, Bangladesh. Distribution and illustrations of different body-parts are presented herewith.

KEY WORDS: New species, *Hasarius,* Araneae, Salticidae, Bangladesh

Salticids, a large group of jumping spiders belong to the order Araneae under the class Arachnida. Genus *Hasarius,* a member of the family Salticidae are commonly found in the garden and forests. The genus was first irected by Simon in 1871 with the type-species *Attus adansoni* Audouin, 1826. Till date, the genus contains 28 species all over the world (Platnick, 2015 ; Proszynski, 2015) of which only one species is recorded from Indian Sub-continent (Okuma et al., 1993; Keswani et al., 2012). In the world fauna, Peng et al. (1993, 2004), Borowic & Wesolowska (2002), Kim (1996), Jastrzebski (2010), Davies & Zabka (1989) contributed on this spider from different countries. Present paper contains description of *H. raychaudhurii* sp. nov. together with the diagnosis of the genus is provided.

MATERIALS AND METHODS

Specimens were collected from the bushes and leaves of plants by vialtapping and jarking of branches on the inverted umbrella. Preservation and other necessary techniques were followed by Lincoln and Sheals (1985) and Tikader (1987). Illustrations and studies were made under Stereo-Zoom Binocular Microscope. All the measurements were taken in milimeters (mm) under microscopic observations. Leg measurements are shown as: total length of different parts (viz. – femur, patella, tibia, metatarsus and tarsus).

Types are at present in the collection of the Department of Zoology, Khulna Govt. Womens' College and will be deposited to the Museum of the Department of Zoology, University of Dhaka, Bangladesh, in due course of time.

Abbreviations used: AH= Abdominal height; AL= Abdominal length; ALE= Anterior lateral eyes; AME= Anterior median eyes; AW= Abdominal width; CH= Cephalic height; CL= Carapace length; CW= Carapace width; PLE= Posterior lateral eyes; PME= Posterior median eyes; TL= Total length.

TAXONOMIC ACCOUNT
Family SALTICIDAE Blackwall, 1841
Genus *Hasarius* Simon, 1871

1825. *Attus* Savigny & Audouin, Hist. Nat., 1 (4): 169.
1871. *Hasarius*: Simon, Ann. Soc.ent.Fr., 5 (1): 329.
1922. *Tachyscarthmus*: Hogg, Proc. Zool. Soc. London, 1922: 320.
1948. *Hasarius*: Kaston, *Conn. St.* Geol. *Nat. Hist. Surv*., 70:

1985. *Hasarius*: Zabka, Ann. Zool., 39 (11):
1993. *Hasarius*: Peng et al., Salticids in China:
1995. *Hasarius*: Barrion & Litsinger, Riceland spiders of South and Southeast Asia:
2015. *Hasarius*: Proszynski, Catalogue of Salticidae, Araneae. Version 15.0, http://Salticidae.org/salticid/main.htm.
2016. *Hasarius*: Platnick, World Spider Catalog. Version 16.0, http://research.amnh.org/iz/spiders/catalog/INTRO, html

Diagnosis: Genus *Hasarius* is a small jumping spider. Body length (TL) 5.0mm – 6.0mm, blackish in colour with pointed hairs on the lateral sides. Cephalothorax anteriorly with black patch covering the ocular area upto the anterior extremity. Ocular quad wider than long. The PLE are fairly large being about the same size as the ALE which with the AME are in a recurved line. The sternum in front is not quite as broad as the labium which is about as broad as long.

Abdomen nearly oval, stout and decorated dorsally. Retromargin of chelicerae with 2 teeth. Leg I is not much stouter than the others and leg IV is little longer than III. Tibia of pedipalp often longer than the tarsus.

Type-species: *Attus adansoni* Audouin, 1826.

Distribution: Cosmopolitan; tropics of South and Southeast Asia, Australia, New Guinea and Pacific Islands (Zabka & Pollard, 2012).

Hasarius raychaudhurii sp. nov.

(Figs. 1-7)

Description: Female

Cephalothorax: Broad, little longer than wide; covered with hairs and spines; basally wide; black in colour with posterior white markings. TL 7.39 mm, CL 3.32 mm, CW 3.30 mm, CH 1.00 mm, AL 4.07 mm, AW 2.60 mm, AH 0.80mm. Cephalic region elevated, black upto the anterior extremity. Eyes 8, homogeneous, transparent, arranged in 3 rows, each basally ringed with black patch; Posterolaterals (PLE) nearly equal to the anterolaterals (ALE). Anteromedians (AME) largest and posteromedians (PME) the smallest; both PME and PLE set on the slope of a single tubercle and arranged on a same line of the ocular quad. Ocular quad trapezoid, little wide behind, formed by posteromedians (PME) and posterolaterals (PLE). Anterior row of eyes slightly recurved. Eyes sizes are – ALE = PLE and AME >ALE >PLE > PME. Interocular distance: AME–AME= 0.35, ALE–AME= 0.52, ALE–ALE= 1.50, PME–PME= 1.57, PLE-PME= 0.85, PLE–PLE= 1.35; ALE–PLE= 1.22 and AME–PME= 0.50. Clypeus vertical, narrow, with long hairs. Chelicerae broad, strong, longer than wide, brown, promargin with 1 and retromargin with 2 teeth (Fig. 2), fang slightly curved. Maxille brown, longer than wide, anteriorly broad and scopulate, posteriorly constricted (Fig. 3). Sternum light brown, longer than wide, anteriorly slightly concave and posteriorly pointed (Fig. 4), clothed with sharp spines. Legs moderately long and robust, yellow brown, clothed with hairs and spines; tarsal claws 2 with claw-tufts. Leg formula 4132. Leg measurements: **I** (TL) 5.85 mm (femur 2.02 mm, patella 0.61 mm, tibia 1.77 mm, metatarsus 0.75 mm, tarsus 0.70 mm); **II** (TL) 5.75 mm (femur 20.01 mm, patella 0.60 mm, tibia 1.75 mm, metatarsus 0.72 mm, tarsus 0.67 mm); **III** (TL) 5.79 mm (femur 2.02 mm, patella 0.60 mm, tibia 1.76 mm, metatarsus 0.73 mm, tarsus 0.68 mm); **IV** (TL) 5.94 mm (femur 2.07 mm, patella 0.76 mm, tibia 1.35 mm, metatarsus 0.92 mm, tarsus 0.84 mm) (Figs. 1, 7).

Abdomen: Elongately oval, blackish, anteriorly wide, dorsum decorated with white patch and with brown, erect, hairs, ventrally pale black; spinnerets elongate (Fig. 1). **Epigynum-Internal genitalia:** Epigynum blunt with two lateral pockets; spermathecae sac-like, fertilization tube laterally coiled and opened on a same position.

Etymology: The species is named in honour of my respected teacher Professor Dinendra Raychaudhuri, Department of Zoology, Calcutta University, India.

Type-material: Holotype - 1 female, Srimongal Tea Estate, Dist. Moulovi bazar (Sylhet), date- 12.VII.2008, Coll. V. Biswas**; Paratypes** – 2 females, Maijdi, Dist. Noakhali, date- 18.V.2007, Coll. V. Biswas, Bangladesh.

Type-locality: Srimongal (Dist. Moulovi bazar) and Noakhali, Bangladesh.

Distribution: BANGLADESH: Srimongal (Maulovi bazar, Sylhet); Noakhali (only from the type-localities).

Diagnosis : The present species *H. raychaudhurii* sp. nov. appears close to *H. adansoni* (Audouin, 1826) but stands distinct with the followings –

1. Both the species have distinct white markings on the carapace and abdomen but the number and structure of those are quite different.
2. Cheliceral structure and dentition are different (Fig. 2).
3. Structure of maxillae, labium and sternum different (Figs. 3-5) and
4. Structure of epigynum and internal genitalia differ with *H. adansoni* and any of its Indian congeners and species known from elsewhere (Zabka, 1985; Yaginuma, 1986; Devies & Zabka, 1989; Peng et al., 1993; Okuma et al., 1993; Barrion & Litsinger, 1995; Proszynski, 2003).

Therefore, the species is described as new to science.

ACKNOWLEDGEMENTS

My sincere thanks are due to Dr. S.C. Majumder, Scientist-SD, Zoological Survey of India, Kolkata, for the confirmation of the identity of the species and Dr. M.U. Ahmed, Director, Bangladesh Tea Research Institute (BTRI), Srimongal, Moulovi bazar and Md. Jasim Uddin , Associate Professor, Dept. of Zoology, Noakhali Govt. College, Noakhali, Bangladesh, for their kind help in collection of the specimens.

LITERATURE CITED

Barrion, A. T. & Litsinger, J. A. 1995. Riceland spiders of South and Southeast Asia. CABI – IRRI, 700p.

Borowiec, B. & Wesolowska, W. 2002. A new species of *Hasarius* from Mount Cameroon (Araneae: Salticidae). Genus, 13 (3): 405-408.

Davies, V. T. & Zabka, M. 1989. Illustrated key to the genera of jumping spiders (Araneae: Salticidae). Mem. Qld. Mus., 27 (2): 189-266.

Jastrzebski, P. 2010. Salticidae from the Himalayas. The genus *Hasarius* Simon, 1871 (Araneae: Salticidae). Genus, 21 (2): 319-323.

Kaston, B. J. 1948. Spiders of Connecticut. Conn. St. Geol. Nat. Hist. Surv., 70: 1-874.

Keswani, S., Hadole, P. & Rajoria, A. 2012. Checklist of spiders (Arachnida: Araneae) from India. Indian J. Arachnol., 1 (1): 1-129.

Kim, J. P. & Kim, B. W. 1996. One unrecorded genus *Hasarius* and species (Araneae: Salticidae) from Korea. Korean Arachnol., 12 (1): 15-28.

Lincoln, R. J. & Sheals, J. G. 1985. Invertebrate Animals: Collection and Preservation. British Museum (Natural History), London, 150p.

Metzner, H. 2014. Jumping spiders (Arachnida: Araneae: Salticidae) of the world. Available from: www. Jumping spiders. com (accessed on 12.12.2014).

Okuma, C., Kamal, N. Q., Hirashima, Y., Alam, Z. & Ogata, T. 1993. Illustrated Monograph on the rice-field spiders of Bangladesh. IPSA-JAICA, Salna, 93p.

Peng, X. J., Li, S. & Yang, Z. Z. 2004. The jumping spiders from Dali, Yunnan, China (Araneae: Salticidae). The Raffles Bull. Zool., 52 (2): 413-417.

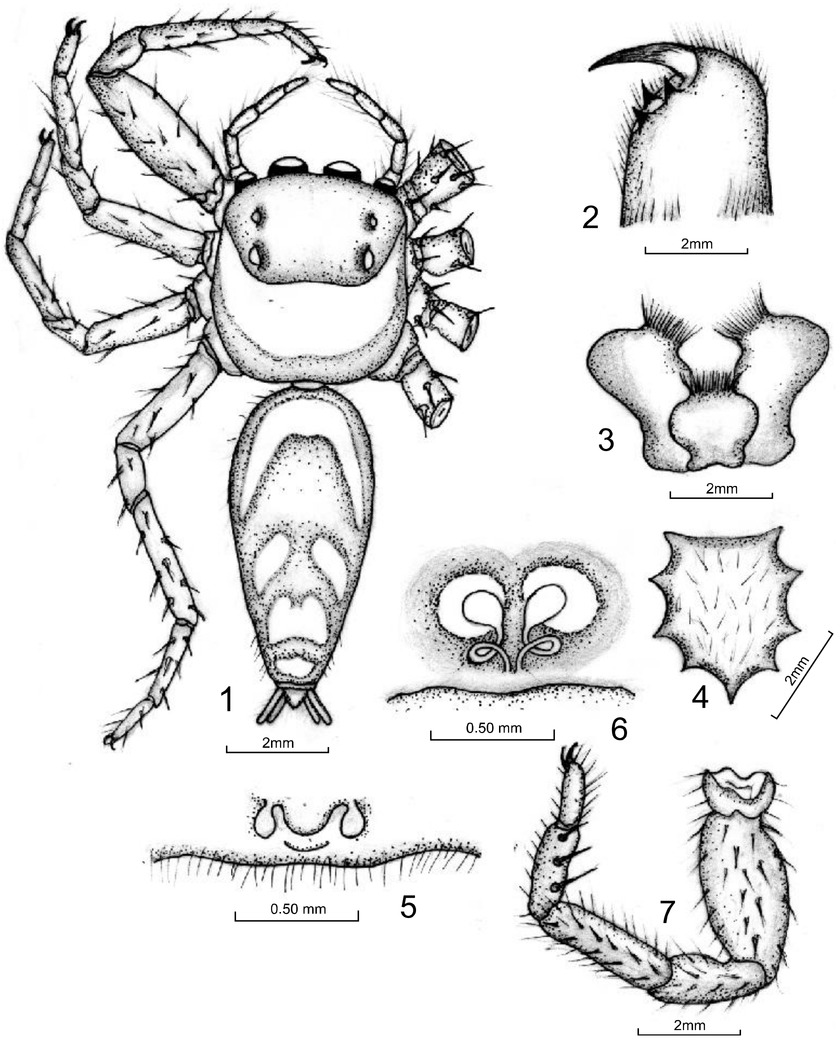
Platnick, N. I. 2014. The world spider catalog. Version 15.0, American Museum of Natural History. Online at http://research.amnh.org/iz/spiders/catalog/INTRO, html (accessed on 7^{th} December, 2015).

Proszynski, J. 2014. Salticidae (Araneae) of the world. http://Salticidae.Org/salticid/main.htm. (accessed on 7^{th} December, 2015).

Tikader, B. K. 1987. Handbook on Indian Spiders. Director, Zoological Survey of India, Kolkata, 251p.

Zabka, M. 1985. Systematic and Zoogeographic study on the family Salticidae (Araneae) from Viet-Nam. Ann. Zool. Warszawa, 11: 1-485.

Zabka, M. & Pollard, S. D. 2012. A checklist of Salticidae (Arachnida: Araneae) of New Zealand. Rec. Canterbury Mus., 16: 73-82.



Figures 1-7: *Hasarius raychaudhurii* sp. nov. 1. Whole body; 2. Chelicerae; 3. Maxillae & Labium; 4. Sternum; 5. Epigynum; 6. Internal genitalia; 7. 1^{st} leg (lateral view).

A NEW SUBSPECIES OF *PHYTOECIA* (*PHYTOECIA*) *PUSTULATA* (SCHRANK, 1776) FROM TURKEY (CERAMBYCIDAE: LAMIINAE)

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[Özdikmen, H. 2017. A new subspecies of *Phytoecia* (*Phytoecia*) *pustulata* (Schrank, 1776) from Turkey (Cerambycidae: Lamiinae). Munis Entomology & Zoology, 12 (1): 54-55**]**

ABSTRACT: The following new subspecies is described: *Phytoecia* (s.str.) *pustulata cihanae* ssp. nov. from Konya province (Turkey), close to nominal subspecies of *Phytoecia pustulata* (Schrank, 1776).

KEY WORDS: Cerambycidae, Lamiinae, *Phytoecia pustulata cihanae,* new subspecies, Turkey

According to Danilevsky (2014), *Phytoecia* (s.str.) *pustulata* (Schrank, 1776) includes 4 subspecies as *P. pustulata adulta* Ganglbauer, 1884 in Iran, *P. pustulata pulla* Ganglbauer, 1886 in South European part of Russia, Kazakhstan, Kirgizia and Uzbekistan, *P. pustulata pilipennis* Reitter, 1895 in Armenia, Azerbaijan, Iran and NE Turkey (Kars province) and *P. pustulata pustulata* (Schrank, 1776) in Europe (including European Turkey: Edirne province), Armenia, Azerbaijan, Georgia, Kazakhstan, Kirgizia, Tadjikistan, Uzbekistan and Asian Turkey (Adana, Amasya, Bilecik, Bolu, Düzce, Kahramanmaraş, Kırıkkale, Konya, Niğde, Osmaniye, Samsun, Sivas provinces).

During the study of the collected Cerambycidae specimens in my collection, I have identified some specimens belonging to a new subspecies *Phytoecia pustulata cihanae* that collected from Konya province, of *Phytoecia* (s.str.) *pustulata* (Schrank, 1776) which will be described in the text.

Phytoecia (*Phytoecia*) *pustulata cihanae* ssp. nov.

(Figs. 1-2)

Type material. Holotype ♂: Turkey: Konya prov.: Gencek-Derebucak, N 37˚25'-E 31˚29', 20.V.2008, 1212 m; Paratypes 2 ♂♂: Konya prov.: Hadim, N 36˚58'-E 32˚26', 14.V.2007, 1569 m, 1 ♂ and Konya prov.: Bozkır, Sorkun, N 37˚09'-E 32˚08', 15.V.2007, 1281 m, 1 ♂. The specimens were deposited at Gazi University in Ankara (Turkey).

Diagnosis. The new subspecies is like as the typical subspecies *Phytoecia pustulata pustulata* (Schrank, 1776), but differs from it by partly and equally reddish penultimate abdominal tergite and sternite [only last abdominal tergite (pygidium) and sternite reddish with the exception of a darkened apical area in *Phytoecia pustulata pustulata*].

Remarks. Such specimens have been already known by Breuning (1947, 1951). Breuning (1947: 59) described *Phytoecia pustulata* m. *rufoabdominalis* from Akşehir (Konya province) on the base of a male specimen in which the penultimate abdominal sternite and tergite are reddish-yellow. Then, Breuning (1951: 384, 386) made a mistake in wrongly renaming the same specimen as *Phytoecia pustulata* m. *parterufoabdominalis* nov. (Morati, 2003: 197).

Breuning's infrasubspecific names are unavailable considering the article 45.6.2 of ICZN (1999). Thus, this new subspecies named as *Phytoecia pustulata cihanae* ssp. nov.

Distribution. According to the type locality and description of Breuning, the new subspecies is distributed only in southern and southwestern parts of Central Anatolian Region in Turkey.

Etymology. The name is dedicated to my student Naciye Cihan (Turkey).

LITERATURE CITED

Breuning, S. 1947. Quelques nouvelles formes des genres *Nupserha* Thoms., *Oberea* Muls., *Conizonia* Fairm. et *Phytœcia* Muls. (Col., Cerambycidæ). Miscellanea Entomologica, 44: 57-61.

Breuning, S. 1951. Révision du genre *Phytoecia* Muls. (Suite et fin). Entomologische Arbeiten aus dem Museum G. Frey, München, 2: 353-460.

Danilevsky, M. L. 2014. Additions and corrections to the new Catalogue of Palaearctic Cerambycidae (Coleoptera) edited by I. Löbl and A. Smetana, 2010. Part. IX. Humanity space International almanac, 3 (2): 193-250.

International comission of zoological nomenclature. 1999. International Code of Zoological Nomenclature. Fourth Edition. The International Trust for Zoological Nomenclature, London, 306 pp.

Morati, J. 2003. Catalogue des types de Lamiinae (Coleoptera, Cerambycidae) conservés au Muséum d'histoire naturelle, Genève. Revue Suisse de Zoologie, 110: 155-206.

Figure 1. *Phytoecia pustulata cihanae* ssp. nov. (holotype ♂), dorsal view (left), ventral view (right).

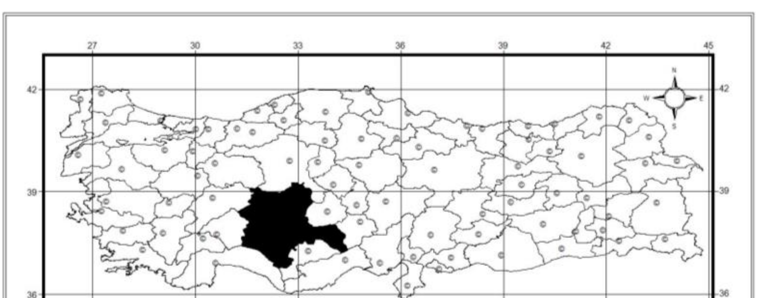

Figure 2. The distribution pattern of *Phytoecia pustulata cihanae* ssp. nov.

POPULATION DIVERSITY OF SOIL COLLEMBOLA IN AGRA DISTRICT OF UTTAR PRADESH, INDIA

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[Verma, D., Meena, S. & Yadav, R. K. 2017. Population diversity of soil Collembola in Agra district of Uttar Pradesh, India. Munis Entomology & Zoology, 12 (1): 56-59**]**

ABSTRACT: The present study was conducted to study the Collembola fauna from Agra regions during June 2014 to November 2014. There were sampled collembolan species from a variety of habitats in the urban area of Agra. Soil Collembola were extracted using dynamic behavioural modified Tullgren funnel type extractor and identified to the genus level. 279 specimens of 28 Collembolan species were collected from the different study areas. The species distribution of collembolan in Agra regions of Isotomidae (31%), Entomobryidae (29%), Hypogastruridae, (27%), Sminthuridae (7%) and Tomoceridae (6%) were observed. The species composition clearly reflected the microclimatic characters of the individual habitats. The study area as a less polluted natural environment can be considerable available for selection a conservation territory. It seems to be especially important to protect this particular mosaic like habitats for sustaining their high animal taxonomic and functional biodiversity.

KEY WORDS: Collembolans, species distribution, India

Springtails have derived their name because of the presence of forked tail-like appendage or furcula or springing organ, on the underside of the 4th abdominal segment. With the help of furcula, most Springtails jump as far as 10- 15cms. Collembola are extremely abundant in soil and leaf litter. In most terrestrial ecosystems they occur in high numbers, typically between 104 and 105 m–2. Densities of springtails of more than 105 m–2 have been found in pine forests in India and Japan, moorland in England, and dry meadows in Norway. Collembola are particularly abundant in agricultural soils that are farmed “organically”. In the rain forests, Collembola comprise about 20% of the total number of arthropods on tree trunks and 50% and 60% of the total from soil and leaf litter, respectively ace-dwelling species to those that live out all their lives in the depths of the soil. The majority of springtails feed on fungal hyphae or decaying plant material. In the soil, they may influence the growth of mycorrhizae and control fungal diseases of some plants (Lubbock, 1973). Soil conditions and vegetation cover influence the activities of diverse soil organisms including Springtail (Hansen, 2001). Collembolan communities have been shown to vary in abundance and diversity negatively according to changes in vegetation, quality of litter materials, habitat structure and human induced disturbances related to land use practices (Bengtsson et al., 2000; Ponge et al., 2003; Jose et al., 2004, 2005). Adequate knowledge of spatial pattern and seasonal population build up of such fauna is considered desirable for understanding their ecology and role in decomposition process in major land use system of a region for understanding the sustainability issues (Badejo et al., 1997). Present investigation was carried out to study the population diversity and distribution of Soil Collembola in Agra Region.

MATERIALS AND METHODS

Soil samples have been regularly collected during (June 2014 to November 2014) from different area [Sikandra (S1), Paiwal park (S_2), Victoria garden (S_3), Keetham (S_4)] of Agra regions between 08.00 to 09.00 hrs and sites. Sample areas on each sampling taken at random with stainless steel soil augur (2.5cm diameter) at a depth of 10 cm. These samples were immediately transferred to polythene bags then sealed and brought to laboratory. The extraction was done using Tullgren funnel type extractor (as modified by Murphy (1962) under 25W electric bulb. The extracted micro-arthropods were collected in specimen tube containing 70% ethanol. After identification of major taxonomic unit all the specimens were preserved in 70% ethanol separately. Prior to identification of collembola, specimens were mounted in Hoyer's solution mounting media and identified by using face contrast microscope with an enlarged view of 10x X 100x. All soil micro-arthropods were identified up to the level of their order or, family using a range of taxonomic keys (O'Connell and Bolger, 1994).

RESULTS AND DISCUSSION

279 specimens of 28 Collembolan species were collected from the different study areas. Identified species of collembolan mentioned in Table 1. During this study, the richest families were observed Isotomidae, Entomobryidae and then Hypogastruridae. The species distribution of collembolan in Agra regions of Isotomidae (31%), Entomobryidae (29%),Hypogastruridae, (27%), Sminthuridae (7%) and Tomoceridae (6%) showed in fig 2. In this fig., the highest species distribution of Isotomidae family (37%), while very numerous species belong to Tomoceridae family (6%). Fig. 2 showed population study site I proved to be the most diverse one. Collembolan species highest in study site I and lowest in study site II. The largest similarity is seen between Sikandra (S_1), Victoria garden (S_3), Keetham (S_4) area. The largest difference turned out to be between study area Sikandra (S_1), and Paliwal Park (S_2) area. Collembolans are represented numerously in soils of forest ecosystems. Agrocoenoses can support similar or slightly lower densities of springtails than natural ecosystems situated on the same type of soil. Increasing intensity of management, using of pest control chemicals, herbicides and large doses of mineral fertilizers drastically reduce Collembolan densities in the field soil (Verma and Paliwal, 2010).

CONCLUSION

This study concluded that the total number of collembola was higher throughout the summer than during the winter. Isotomidae were most active in early and late winter, while Entomobryidae Hypogastruridae and dominated in mid-winter, probably because these families are more bound to the soil than the other families, which are more active on the soil surface.

ACKNOWLEDGEMENT

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LITERATURE CITED

Badejo, M. A., Obiladae, T. G. & Olubakin, B. A. 1997. Spatial distribution and abundance of mites and springtails under different temperature and moisture regimes in a tropical rainforest floor. Tropical Ecology, 38: 31-38.

Bengtsson, J., Nilson, S. G., Franc, A. & Menozzi, P. 2000. Biodiversity, Disturbances, ecosystem function and Management of European forests. Forest Ecology Management, 132: 39-50.

Hansen, R. A. 2001. Effects of habitat complexity and composition on a diverse litter microarthropod assemblage. Ecology, 81: 1120-1132.

Jose, P. S., Maria, M. G., Cristina, P., Antonio, K., Filipa C., Marco, L., Catarina, C., Taigo, L., Pedro, L. & Susana, D. 2004. Effect of land use on Collembola diversity patterns in a Mediterranean landscape. Pedobiologia, 48: 609-622.

Jose, P. S., Thomas, B., Maria, M. M., Thomas, L., Jean-Francios, P., Carlos, S., Georgy, T., Adam, J. V., Aoife, B., Florence, D., Eva, I., Antonio, K., Silvia, S. & Allan, D. W. 2005. Changes in Collembola richness and diversity along a gradient of land-use intensity: A pan European study. Pedobiologia, 50: 147-156.

Lubbock, J. 1973. Monograph of the Collembola and Thysanura; Ray Society: London.

Murphy, P. W. 1962. The split funnel extractor – A modified tullgren funnel. *In*: Progress in Soil Zoology (*Ed.:* P.W. Murphy). Butterworths, London, pp. 178.

O'Connell, T. & Bolger, T. 1994. The microarthropod fauna associated with fungal fruiting bodies in Woodland-a study of the role of spatial and temporal diversity in determining assemblage structure. Unpublished Ph. D. thesis, National University of Ireland, Dublin.

Ponge, J. F., Gillet, S., Dubs, F., Fedoroff, E., Haese, L., Sousa, P. J. & Lavelle, P. 2003. Collembola communities as bioindicators of land use intensification. Soil Biology and Biochemistry, 35: 813-826.

Veeresh, G. K. 1983. Micro arthropods. Pp. 141-164. In: G. K. Veeresh & D. Rajagopal (eds.) applied soil Biology and ecology. Oxford & IBH Publishing Pvt. Ltd., New Delhi.

Verma, D. & Paliwal, A. K. 2010. Effects of springtails community on plant-growth. Biological Forum-An International Journal, 2 (2): 70-72.

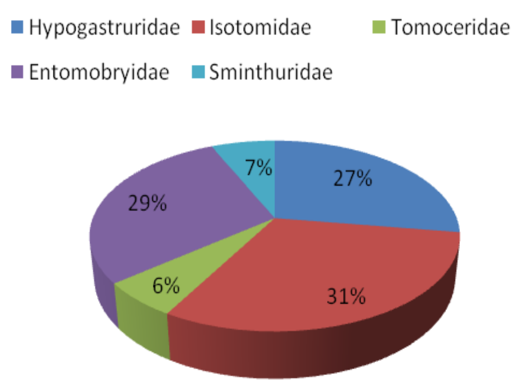

Figure 1. Species distribution of Collembola in Agra region.

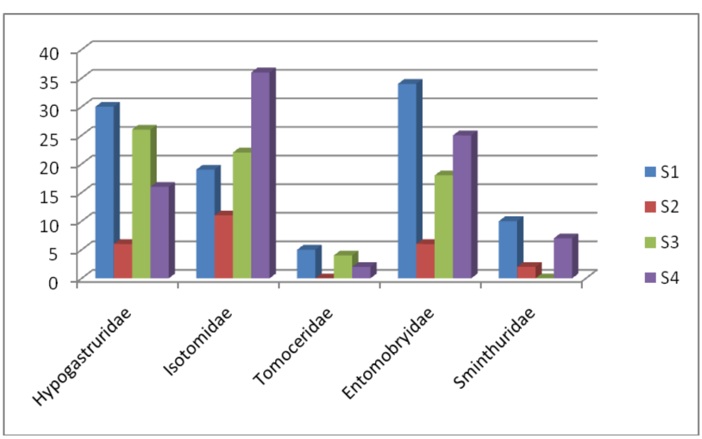

Figure 2. Population of collembola from different study areas of Agra region.

Table 1. Identified species of Collembola from different study areas of Agra region during June 2014 to November 2014.

Species	Study site				
	S_1	S_2	S_3	S_4	Total
Family Hypogastruridae Börner, 1906	**30**	**6**	**26**	**16**	**78**
Hypogastrura denticulata (Begnall, 1941)	6	1	8	3	
Ceratophysella indovaria (Salmon, 1970)	8	2	4	3	
Hypogastrura vernalis (Carl, 1901)	4	1	6	4	
Xenylla maritima Tullberg, 1869	6	2	3	4	
Friesea mirabilis (Tullberg, 1871)	4	*	3	1	
Neanura conjuncta (Stach, 1922)	2	*	2	1	
Family Isotomidae Schäffer, 1896	**19**	**11**	**22**	**36**	**88**
Folsomia nana (Gisin, 1957)	3	2	5	3	
Folsomia candida (Willem, 1902)	4	3	2	7	
Isotomiella minor (Schaffer, 1896)	2	1	3	6	
Isotomina bipunctata (Axelson, 1903)	1	3	5	2	
*Proisotoma crassicauda (*Tullberg, 1871)	3	*	2	4	
Proisotoma minuta (Tullberg, 1871)	1	1	4	6	
Isotoma notabilis (Schaffer, 1896)	5	1	1	8	
Family Tomoceridae Schäffer, 1896	**5**	*	**4**	**2**	**11**
Tomoceris vulgaris (Tullberg, 1871)	5	*	4	2	
Family Entomobryidae Schäffer, 1896	**34**	**6**	**18**	**25**	**83**
Entomobrya handschini (Stach, 1922)	4	1	2	3	
Entomobrya lanuginose (Nicolet, 1841)	9	2	*	1	
Entomobrya marginata (Tullberg, 1871)	3	*	1	2	
Entomobrya multifasciata (Tullberg, 1871)	4	*	1	3	
Orchesella flavescens (Bourlet, 1839)	2	*	*	1	
Orchesella cincta (Nicolet, 1841)	1	*	3	2	
Pseudosinella wahlgreni (Borner, 1907)	2	*	4	6	
Heteromurus nitidus (Templeton, 1835)	1	1	2	2	
Lepidocyrtus lanuginoosus (Gmelin)	3	1	2	2	
Lepidocyrtus cyaneus (Tullberg, 1871)	3	1	2	1	
Lepidocyrtus paradoxus (Uzel, 1891)	2	*	1	2	
Family Sminthuridae Lubbock, 1862	**10**	**2**	*	**7**	**19**
Sminthurides malmgreni (Tullberg, 1871)	6	*	*	2	
Bourletiella insignis (Reuter, 1876)	2	*	*	4	
Sminthurus lubbocki (Tullberg, 1871)	2	2	*	1	

FAUNA OF FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN KIRŞEHIR PROVINCE

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ABSTRACT: This study depends on Tephritidae (Diptera) samples collected from Kırşehir province during the years of 2012-2013. Specimens were collected from host plants using an insect net. Also photos of the wing patterns were given in this paper.

KEY WORDS: Diptera, Tephritidae, Kırşehir, Turkey

Fruit flies show a wide distribution in the world and these are high profile insects among commercial fruit and vegetable growers, marketers, exporters, government regulatory and the scientific community. Producers encounter significant loses without controlling methods against fruit fly populations locally. So that plant protection agencies strictly regulate the transportation of potentially infested products at both national and international levels (McPheron & Steck, 1996). Koçak & Kemal (2013) reported 156 fruit fly species from Turkey. Yaran & Kütük (2014) described *Urophora turkeyensis* from Niğde. Yaran (2014) recorded *Dioxyna sororcula*, *Terellia ivannikovi* and *Urophora trinervii* in his PhD. thesis for the first time from Turkey. Thus, 160 fruit fly species are known to date from Turkey.

In this study, we collected 1019 fruit flies specimens from Kırşehir province in 2012-2013 spring and summers and identified 36 species of fruit flies belongs to 12 genera of 3 subfamilies.

MATERIALS AND METHODS

Adult fruit flies materials were collected from host plants using an insect net in various locations of Kırşehir province in 2012 and 2013. Species were identified using the keys of Hendel (1927), White (1988), Freidberg & Kugler (1989), Merz (1994), Korneyev & White (1993 and 1999), Kütük (2003, 2006), Korneyev (2003, 2006), and Korneyev et al. (2013). Materials are deposited at the insect museum of Gaziantep University.

RESULTS

At the end of study, 36 species belonging to 12 genera in 3 subfamilies were determined listed below from Kırşehir province. In this study, 33 species of fruit flies recorded from Kırşehir for the first time. Faunistic findings and the diagnostic wing pattern of the species are given as pictures.

Acanthiophilus helianthi (Rossi, 1794); (Fig. 1)

Material examined: 1 ♂, Kırşehir, Kesikköprü, 38° 58' K, 34° 11' D, 859 m, 08.05.2013; 2 ♂♂, 2 ♀♀, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 1 ♂, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 1 ♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013; 1 ♀, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013.

Campiglossa producta (Loew, 1844); (Fig. 2)

Material examined: 2 ♂♂, 4 ♀♀, Kırşehir, Çiçekdağı, 39° 27' K, 34° 18' D, 1279 m, 08.05.2013; 2 ♂♂, Akçakent, 39° 34' K, 34° 18' D, 1363 m, 19.06.2013; 1 ♂, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013.

Chaetorellia carthami Stackelberg, 1929; (Fig. 3)

Material examined: 1 ♀, Kırşehir, Center, 39° 01' K, 34° 10' D, 967 m, 08.05.2013; 1 ♂, Mucur, 39° 04' K, 34° 17' D, 1181 m, 09.05.2013; 1 ♂, Mucur, 39° 03' K, 34° 26' D, 1108 m, 27.05.2013; 2 ♂♂, 2 ♀♀, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 9 ♂♂, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 1 ♂, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 1 ♂, Center, 39° 05' K, 34° 14' D, 1161 m, 19.06.2013; 1 ♀, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 1 ♂, Akçakent, 39° 34' K, 34° 23' D, 1257 m, 19.06.2013; 2 ♀♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013; 1 ♂, Center, 38° 56' K, 34° 11' D, 899 m, 20.06.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013.

Chaetorellia loricata (Rondani, 1830); (Fig. 4)

Material examined: 1 ♂, 1 ♀, Kırşehir, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 7 ♂♂, 3 ♀♀, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 1 ♂, Center, 39° 05' K, 34° 14' D, 1161 m, 19.06.2013; 2 ♀♀, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 1 ♂, Akçakent, 39° 34' K, 34° 23' D, 1257 m, 19.06.2013; 1 ♀, Center, 38° 56' K, 34° 11' D, 899 m, 20.06.2013; 1 ♂, 1 ♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013.

Chaetorellia succinea (Costa, 1844); (Fig. 5)

Material examined: 1 ♂, 1 ♀, B145- Kırşehir, Mucur, 39° 04' K, 34° 17' D, 1181 m, 09.05.2013; 1 ♂, Center, 39° 01' K, 34° 10' D, 967 m, 08.05.2013; 1 ♂, 1 ♀, Boztepe, 39° 10' K, 34° 11' D, 1157 m, 08.05.2013; 1 ♂, 3 ♀♀, Mucur, 39° 03' K, 34° 26' D, 1108 m, 27.05.2013; 1 ♂, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 1 ♂, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 2 ♂♂, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 2 ♂♂, Center, 39° 05' K, 34° 14' D, 1161 m, 19.06.2013; 4 ♂♂, 3 ♀♀, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 1 ♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 1 ♂, 1 ♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013; 1 ♂, Center, 39° 01' K, 34° 10' D, 965 m, 20.06.2013.

Chaetostomella cylindrica (Robineau - Desvoidy, 1830); (Fig. 6)

Material examined: 1 ♂, Kırşehir, Çoğun, 39° 15' K, 34° 07' D, 1050 m, 27.06.2012; 2 ♀♀, Center, 39° 19' K, 34° 09' D, 1114 m, 19.06.2013; 2 ♀♀, Center, 38° 50' K, 34° 12' D, 991 m, 20.06.2013; 4 ♂♂, 2 ♀♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 1 ♂, 1 ♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013; 1 ♂, Mucur, 39° 04' K, 34° 17' D, 1181 m, 09.05.2013; 4 ♂♂, 1 ♀, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 1 ♀, Center, 38° 50' K, 34° 12' D, 991 m, 20.06.2013; 1 ♂, Center, 38° 56' K, 34° 11' D, 899 m, 20.06.2013; 1 ♂, 1 ♀, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013; 1 ♂, Center, 39° 01' K, 34° 10' D, 967 m, 08.05.2013; 1 ♀, Akçakent, 39° 34' K, 34° 23' D, 1257 m, 19.06.2013.

Euaresta bullans (Wiedemann, 1830); (Fig. 7)

Material examined: 1 ♂, Kırşehir, Çoğun, 39° 19' K, 34° 09' D, 1121 m, 27.06.2012; 1 ♀, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1114 m, 19.06.2013; 13 ♀♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 1 ♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013; 1 ♂, 1 ♀, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013.

Orellia falcata Scopoli, 1763; (Fig. 8)

Material examined: 4 ♂♂, 5 ♀♀, Kırşehir, Mucur, 39° 04' K, 34° 17' D, 1181 m, 09.05.2013; 1 ♀, Center, 39° 01' K, 34° 10' D, 967 m, 08.05.2013; 4 ♂♂, 4 ♀♀, Mucur, 39° 03' K, 34° 26' D, 1108 m, 27.05.2013.

Orellia stictica (Gmelin, 1790); (Fig. 9)

Material examined: 1 ♀, Kırşehir, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013; 1 ♀, Mucur, 39° 04' K, 34° 17' D, 1181 m, 09.05.2013.

Oxyna flavipennis (Loew, 1844); (Fig. 10)

Material examined: 5 ♂♂, Kırşehir, Akçakent, 39° 34' K, 34° 18' D, 1363 m, 19.06.2013;

4 ♂♂, 2 ♀♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013.

Sphenella marginata (Fallen, 1814); (Fig. 11)

Material examined: 1 ♂, 1 ♀, Kırşehir, Boztepe, 39° 10' K, 34° 11' D, 1157 m, 08.05.2013; 1 ♀, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013; 1 ♀, Center, 39° 27' K, 34° 18' D, 1274 m, 03.07.2013; 1 ♂♂, 1 ♀, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013.

Tephritis cometa (Loew, 1840); (Fig. 12)

Material examined: 1 ♂, Kırşehir, Çoğun, 39° 19' K, 34° 09' D, 1121 m, 27.06.2012.

Tephritis dioscurea (Loew, 1856); (Fig. 13)

Material examined: 2 ♂♂, 1 ♀, Kırşehir, Çiçekdağı, 39° 27' K, 34° 18' D, 1279 m, 08.05.2013.

Tephritis formosa (Loew, 1844); (Fig. 14)

Material examined: 1 ♀, Kırşehir, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013; 1 ♂, 1 ♀, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013.

Tephritis frauenfeldi Hendel, 1927; (Fig. 15)

Material examined: 1 ♂, Kırşehir, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013.

Tephritis hyoscyami (Linnaeus, 1758); (Fig. 16)

Material examined: 1 ♂, Kırşehir, Çiçekdağı, 39° 27' K, 34° 18' D, 1279 m, 08.05.2013; 1 ♀, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013.

Tephritis postica (Loew, 1844); (Fig. 17)

Material examined: 3 ♂♂, 2 ♀♀, Kırşehir, Çoğun, 39° 21' K, 34° 10' D, 1182 m, 27.06.2012; 2 ♂♂, Kesikköprü, 38° 58' K, 34° 11' D, 859 m, 08.05.2013; 1 ♀, Boztepe, 39° 10' K, 34° 11' D, 1157 m, 08.05.2013; 7 ♂♂, 10 ♀♀, Mucur, 39° 03' K, 34° 26' D, 1108 m, 27.05.2013; 1 ♂, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 1 ♀, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 10 ♂♂, 4 ♀♀, Center, 39° 19' K, 34° 09' D, 1114 m, 19.06.2013; 3 ♂♂, 1 ♀, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 3 ♀♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013.

Tephritis praecox (Loew, 1844); (Fig. 18)

Material examined: 1 ♀, Kırşehir, Çiçekdağı, 39° 27' K, 34° 18' D, 1279 m, 08.05.2013; 1 ♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013.

Terellia gynaecochroma (Hering, 1937); (Fig. 19)

Material examined: 5 ♂♂, 1 ♀, Kırşehir, Çoğun, 39° 21' K, 34° 10' D, 1182 m, 27.06.2012; 5 ♂♂, 6 ♀♀, Mucur, 39° 03' K, 34° 26' D, 1108 m, 27.05.2013; 7 ♂♂, 4 ♀♀, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 20 ♂♂, 19 ♀♀, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 11 ♂♂, 6 ♀♀, Center, 39° 01' K, 34° 10' D, 967 m, 08.05.2013; 10 ♂♂, 7 ♀♀, Center, 38° 56' K, 34° 11' D, 899 m, 20.06.2013; 2 ♂♂, Center, 39° 27' K, 34° 18' D, 1274 m, 03.07.2013; 1 ♂, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 1 ♀, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013; 1 ♂, 1 ♀, Center, 39° 19' K, 34° 09' D, 1114 m, 19.06.2013; 1 ♀, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013; 1 ♂, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 1 ♀, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 2 ♀♀, Çiçekdağı, 39° 27' K, 34° 18' D, 1279 m, 08.05.2013; 2 ♂♂, 2 ♀♀, Kesikköprü, 38° 58' K, 34° 11' D, 859 m, 08.05.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013; 2 ♀♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013.

Terellia luteola (Wiedemann, 1830); (Fig. 20)

Material examined: 2 ♂♂, 1 ♀, Kırşehir, Çoğun, 39° 15' K, 34° 07' D, 1050 m, 27.06.2012; 7 ♂♂, 6 ♀♀, Center, 39° 01' K, 34° 10' D, 965 m, 20.06.2013; 5 ♂♂, 4 ♀♀, Center, 38° 56' K, 34° 11' D, 899 m, 20.06.2013; 1 ♂, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 3 ♂♂, Center, 39° 05' K, 34° 14' D, 1161 m, 19.06.2013; 1 ♀, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 1 ♀, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 1 ♂, Kesikköprü, 38° 58' K, 34° 11' D, 859 m, 08.05.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013.

Terellia quadratula (Loew, 1869); (Fig. 21)

Material examined: 1 ♂, 1 ♀, Kırşehir, Çoğun, 39° 31' K, 34° 22' D, 1060 m, 27.06.2012; 8 ♂♂, 1 ♀, Center, 39° 05' K, 34° 14' D, 1161 m, 19.06.2013; 1 ♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013.

Terellia ruficauda (Fabricius, 1794); (Fig. 22)

Material examined: 2 ♂♂, 1 ♀, Kırşehir, Çoğun, 39° 19' K, 34° 09' D, 1121 m, 27.06.2012; 3 ♂♂, Center, 39° 19' K, 34° 09' D, 1114 m, 19.06.2013; 2 ♂♂, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013; 1 ♂, 1 ♀, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013; 1 ♀♀, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013.

Terellia serratulae (Linnaeus, 1758); (Fig. 23)

Material examined: 1 ♂, 2 ♀♀, Kırşehir, Çoğun, 39° 19' K, 34° 09' D, 1121 m, 27.06.2012; 21 ♂♂, 10 ♀♀, Kesikköprü, 38° 58' K, 34° 11' D, 859 m, 08.05.2013; 23 ♂♂, 7 ♀♀, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013; 8 ♂♂, 3 ♀♀, Center, 39° 19' K, 34° 09' D, 1114 m, 19.06.2013; 4 ♂♂, 3 ♀♀, Boztepe, 39° 10' K, 34° 11' D, 1157 m, 08.05.2013; 8 ♂♂, 3 ♀♀, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013; 6 ♂♂, 3 ♀♀, Mucur, 39° 03' K, 34° 26' D, 1108 m, 27.05.2013; 3 ♂♂, 4 ♀♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 11 ♂♂, 1 ♀, Center, 39° 27' K, 34° 18' D, 1274 m, 03.07.2013; 6 ♂♂, 4 ♀♀, Çiçekdağı, 39° 27' K, 34° 18' D, 1279 m, 08.05.2013; 4 ♂♂, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 3 ♂♂, 1 ♀, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 2 ♂♂, Mucur, 39° 03' K, 34° 26' D, 1108 m, 27.05.2013; 1 ♂, 2 ♀♀, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 6 ♂♂, 3 ♀♀, Center, 39° 01' K, 34° 10' D, 967 m, 08.05.2013; 2 ♂♂, 1 ♀, Ortaköy, 38° 48' K, 34° 07' D, 1022 m, 08.05.2013; 3 ♂♂, 1 ♀, Center, 38° 56' K, 34° 11' D, 899 m, 20.06.2013; 1 ♀, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 1 ♂, 1 ♀, Kesikköprü, 38° 58' K, 34° 11' D, 859 m, 08.05.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013; 1 ♂, Çiçekdağı, 39° 27' K, 34° 18' D, 1279 m, 08.05.2013; 3 ♀♀, Center, 39° 01' K, 34° 10' D, 965 m, 20.06.2013.

Terellia tussilaginis (Fabricius, 1775); (Fig. 24)

Material examined: 1 ♀, Kırşehir, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013.

Terellia virens (Loew, 1846); (Fig. 25)

Material examined: 3 ♂♂, Kırşehir, Çoğun, 39° 15' K, 34° 07' D, 1050 m, 27.06.2012; 1 ♂, Çoğun, 39° 19' K, 34° 09' D, 1121 m, 27.06.2012; 8 ♂♂, 7 ♀♀, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 1 ♂, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 1 ♀, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 2 ♂♂, 2 ♀♀, Ortaköy, 38° 48' K, 34° 07' D, 1022 m, 08.05.2013; 3 ♂♂, 2 ♀♀, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013; 5 ♂♂, 1 ♀, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013; 4 ♂♂, 1 ♀, Center, 39° 19' K, 34° 09' D, 1114 m, 19.06.2013; 3 ♂♂, 5 ♀♀, Center, 39° 05' K, 34° 14' D, 1161 m, 19.06.2013; 1 ♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013; 2 ♂♂, 1 ♀, Boztepe, 39° 10' K, 34° 11' D, 1157 m, 08.05.2013; 2 ♂♂, Kesikköprü, 38° 58' K, 34° 11' D, 859 m, 08.05.2013; 1 ♂, Center, 38° 56' K, 34° 11' D, 899 m, 20.06.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013; 1 ♂, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 1 ♂, Center, 39° 01' K, 34° 10' D, 967 m, 08.05.2013; 1 ♂, 1 ♀, Kesikköprü, 38° 58' K, 34° 11' D, 859 m, 08.05.2013; 2 ♂♂, 1 ♀, Mucur, 39° 03' K, 34° 26' D, 1108 m, 27.05.2013.

Urophora affinis (Frauenfeld, 1857); (Fig. 26)

Material examined: 1 ♂, 2 ♀♀, Kırşehir, Çoğun, 39° 19' N, 34° 09' E, 1121 m, 27.06.2012; 63 ♂♂, 26 ♀♀, Center, 39° 19' N, 34° 09' E, 1114 m, 19.06.2013; 1 ♂, Boztepe, 39° 10' K, 34° 11' D, 1157 m, 08.05.2013; Akçakent, 51 ♂♂, 38 ♀♀, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 31 ♂♂, 19 ♀♀, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013; 5 ♂♂, 5 ♀♀, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013; 5 ♂♂, 2 ♀♀, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013; 7 ♂♂, 3 ♀♀, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 2 ♀♀, Akçakent, 39° 34' K, 34° 18' D, 1363 m, 19.06.2013; 1 ♂, Center, 38° 50' K, 34° 12' D, 991 m, 20.06.2013; 1 ♂, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 1 ♂, Center, 39° 27' K, 34° 18' D, 1274 m, 03.07.2013.

Urophora aprica (Fallen, 1820); (Fig. 27)

Material examined: 2 ♂♂, 1 ♀, Kırşehir, Mucur, 39° 03' K, 34° 26' D, 1108 m, 27.05.2013; 2 ♀♀, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 1 ♀, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 9 ♀♀, Center, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 4 ♂♂, 2 ♀♀, Center, 39° 27' K, 34° 18' D, 1274 m, 03.07.2013.

Urophora jaceana (Hering, 1935); (Fig. 28)

Material examined: 1 ♂, Kırşehir, Boztepe, 39° 10' K, 34° 11' D, 1157 m, 08.05.2013; 1 ♂, 7 ♀♀, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 1 ♀, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 1 ♂, Akçakent, 39° 34' K, 34° 18' D, 1363 m, 19.06.2013; 1 ♀, Center, 38° 56' K, 34° 11' D, 899 m, 20.06.2013; 2 ♂♂, 1 ♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013.

Urophora mauritanica Macquart, 1851; (Fig. 29)

Material examined: 2 ♂♂, 2 ♀♀, Kırşehir, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; Center, 1 ♀, 39° 23' K, 34° 14' D, 1168 m, 19.06.2013; 3 ♂♂, 19 ♀♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 1 ♀, Center, 39° 01' K, 34° 10' D, 965 m, 20.06.2013.

Urophora phalolepidis Merz - White, 1991; (Fig. 30)

Material examined: 1 ♂, Kırşehir, Ortaköy, 38° 48' K, 34° 07' D, 1022 m, 08.05.2013; 9 ♂♂, 1 ♀, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 2 ♂♂, 1 ♀, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1114 m, 19.06.2013; 9 ♂♂, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013.

Urophora quadrifasciata (Meigen, 1826); (Fig. 31)

Material Examined: 1 ♂, Kırşehir, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013.

Urophora solstitialis (Linnaeus, 1758); (Fig. 32)

Material examined: 1 ♂, 1 ♀, Kırşehir, Ortaköy, 38° 48' K, 34° 07' D, 1022 m, 08.05.2013; 4 ♂♂, Center, 39° 03' K, 34° 10' D, 1011 m, 27.05.2013; 2 ♂♂, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013; 1 ♂, Mucur, 39° 01' K, 34° 26' D, 1043 m, 19.06.2013; 1 ♂, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013.

Urophora stylata (Fabricius, 1775); (Fig. 33)

Material examined: 1 ♂, Kırşehir, Çoğun, 39° 15' K, 34° 07' D, 1050 m, 27.06.2012; 1 ♀, Çoğun, 39° 19' K, 34° 09' D, 1121 m, 27.06.2012; 4 ♂♂, 7 ♀♀, Center, 39° 19' K, 34° 09' D, 1114 m, 19.06.2013; 1 ♀, Center, 38° 50' K, 34° 08' D, 981 m, 20.06.2013; 1 ♀, Akçakent, 39° 34' K, 34° 19' D, 1307 m, 19.06.2013; 2 ♂♂, Mucur, 39° 01' K, 34° 26ð D, 1051 m, 03.07.2013; 4 ♂♂, 5 ♀♀, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013.

Urophora tenuior Hendel, 1910; (Fig. 34)

Material examined: 1 ♂, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013.

Urophora terebrans (Loew, 1850); (Fig. 35)

Material examined: 1 ♀, Kırşehir, Center, 38° 50' N, 34° 08' D, 974 m, 27.05.2013.

Xyphosia miliaria (Schrank, 1781); (Fig. 36)

Material examined: 1 ♀, Kırşehir, Akçakent, 39° 34' K, 34° 23' D, 1257 m, 19.06.2013; 1 ♂, Mucur, 39° 01' K, 34° 26' D, 1051 m, 03.07.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1110 m, 03.07.2013; 1 ♂, Center, 39° 19' K, 34° 09' D, 1113 m, 03.07.2013.

DISCUSSION AND CONCLUSION

This study is based on the fruit fly specimens collected from Kırşehir province during 2012-2013 spring and summer period. While 398 of 1.019 specimens collected from the study area were female, remain 621 specimens were male.

As a result of study, 36 species belongs to 12 genera from 3 subfamilies have been determined. While 882 fruit flies known in Palearctic region (Alluja & Norrbom, 2000), a total of 156 fruit flies have been determined in Turkey as a result of the faunistic studies (Koçak & Kemal, 2013). It is thought that the number of the species will increase with the maintaining of the faunistic studies like this study in our country which has a wide geography and various climatic regions. Three species of fruit flies *Orellia stictica, Terellia virens and Urophora solstitalis* were reported in previous years by the Pakyürek (2006) and Bayrak & Hayat (2012) from Kırşehir province. In this study we determined 36 species from study region and 33 species of fruit flies have been recorded for the first time from Kırşehir.

*This study was produced from master thesis of first author.

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LITERATURE CITED

Aluja, M. & Norrbom, A. 2000. Fruit Flies (Tephritidae) Phylogeny and Evolution of Behavior. CRC Press, Florida, p. 944.

Bayrak, N. & Hayat, R. 2012. Türkiye'nin Tephritidae (Diptera) Türleri. Türk Bilimsel Derlemeler Dergisi, 5 (2): 49-55.

Freidberg, A. & Kugler, J. 1989. Fauna Palaestina Insecta IV. Diptera: Tephritidae. Israel at Keterpress Enterprises, Jerusalem, 212 p.

Giray, H. 1969. Ege bölgesinde yabani otlarda bulunan Trypetidae (Diptera) türleri ile ilgili faunistik araştırmalar. Ege Üniv. Ziraat Fak. Dergisi, 6 (1): 71-78.

Giray, H. 1979. Türkiye Trypetidae (Diptera) faunasına ait ilk liste. Türkiye Bitki Koruma Dergisi, 3 (1): 35-46.

Khouzama, M. K., Kalash, S. M. & White, I. M. 2002. Flowerhead-infesting fruit flies (Diptera: Tephritidae) on thistles (Asteraceae). Lebenon. Journal of Natural History, 36: 617-629.

Koçak, A. Ö. & Kemal, M. 2013. Tephritidae in Turkey. An evaluation of its status from various standpoints (Diptera). Cesa News, 86: 1-49.

Korneyev, V. A. (1999). Phylogenetic relationships among higher groups of Tephritidae. p 73– 113. In Fruit Flies (Tephritidae): Phylogeny and Evolution of Behavior. CRC Press, Boca Raton, xi + 944 p.

Korneyev, V. A. & White, I. M. 1999. Fruit flies of genus Urophora R-D. (Diptera: Tephritidae) of east palaerctic. III. key to species. Ent. Obozr., 78 (2): 464-482.

Kütük, M. 1998. Malatya ili Tephritidae (Trypetidae)'lerinin faunası, ekolojisi ve sistematiği, MSc thesis, İnönü University, Malatya, 83 pp.

Kütük, M. 2003a. Güney Batı Anadolu bölgesi Tephritidae faunası ve sistematiği üzerine araştırmalar, PhD dissertation, Çukurova University, Adana, 217 pp.

Kütük, M. 2003b. Doğu Akdeniz bölgesi *Urophora* Rob-Des (Diptera: Tephritidae) faunası ve sistematiği üzerine araştırmalar. Türk. Entomol. Derg., 27 (2): 149-160.

Kütük, M. & Özgür, A. F. 2003. Türkiye için 8 yeni kayıt ve Güney Batı Anadolu Bölgesinde Terellinae (Tephritidae: Diptera) faunası ve sistematiği üzerine araştırmalar. Ç. Ü. Z. F. Dergisi, 18 (3): 105-114.

McPheron, B. A. & Steck, G. J. 1996. Fruit Fly Pests: A World Assessment of Their Biology and Management. St. Lucie Press, Delray Beach, Florida.

Merz, B. 1994. Diptera, Tephritidae. Insecta Helvetica Fauna, HGE Pres., Geneva.

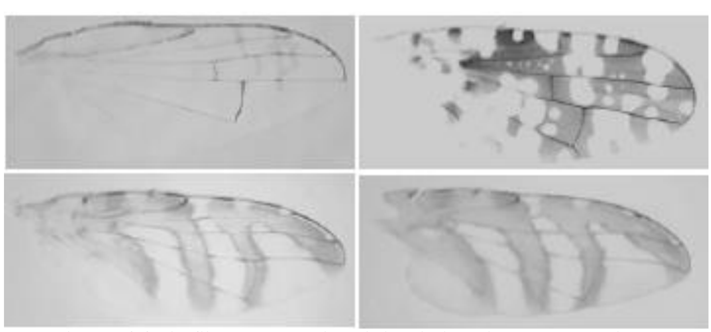
Pakyürek, B. 2006. Gazi Üniversitesi Zooloji Müzesindeki Tephritidae (Diptera) Familyası Örneklerinin Değerlendirilmesi. Yüksek lisans tezi. Gazi Üniversitesi Fen Bilimleri Enstitüsü, Ankara, 432 sayfa.

White, I. M. 1988. Tephritid flies (Diptera: Tephritidae). Handbook for the identification of British insects. Dorset Press, London.

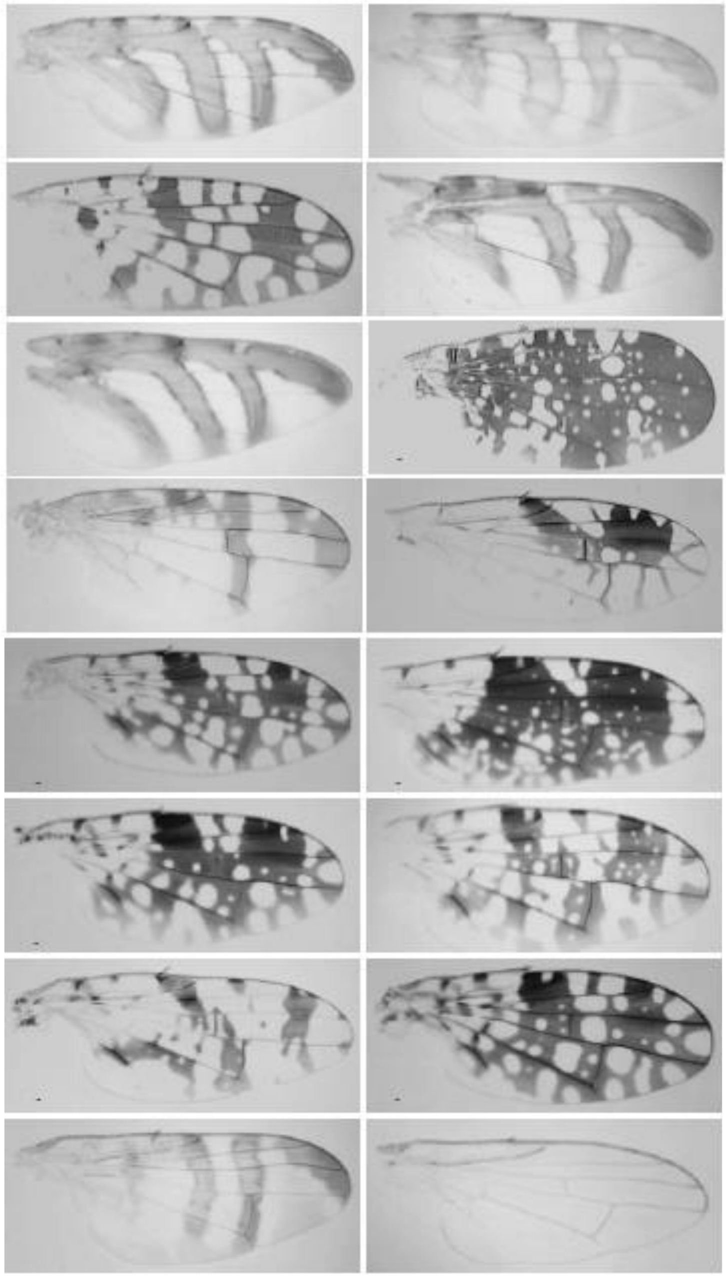
White, I. M. & Marquardt, K. 1989. A revision of the genus *Chaetorellia* Hendel (Diptera: Tephritidae) including a new species associated with spotted knapweed *Centaurea maculosa* Lam. (Asteraraceae). Bull. Entomol. Res., 79: 453-487.

Yaran, M. 2014. Aksaray, Mersin, Nevşehir ve Niğde illerinde meyve sinekleri (Diptera: Tephritidae) faunası ve sistematiği üzerine araştırmalar. Doktora Tezi, Gaziantep Üniversitesi, Fen Bilimleri Enstitüsü, Gaziantep.

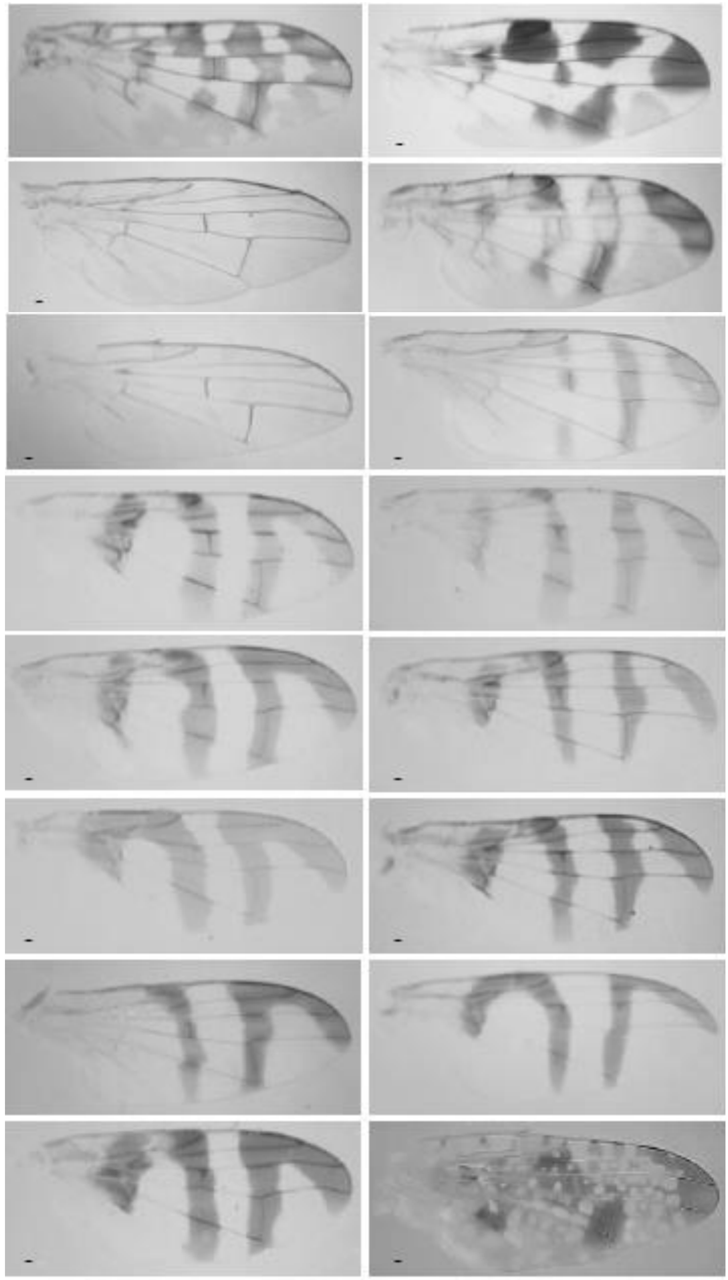
Yaran, M. & Kütük, M. 2014. A new species of *Urophora* Robineau-Desvoidy,1830 (Diptera:Tephritidae) from Turkey with a key to the *dzieduszyckii* group. Turkish Journa of Entomology, 38 (2): 149-155.



Figures 1-4. Wings of fruit flies: 1-*Acanthiophilus helianthi*, 2-*Campiglossa producta*, 3-*Chaetorellia carthami*, 4-*Cha. loricata*.



Figures 5-20. Wings of fruit flies: 5-*Cha. succinea*, 6-*Chaetostomella cylindrica*, 7-*Euaresta bullans*, 8-*Orellia falcata*, 9-*Or. stictica*, 10-*Oxyna flavipennis*, 11-*Sphenella marginata*, 12-*Tephritis cometa,* 13-*Tephritis dioscurea*, 14-*Tep. formosa*, 15-*Tep. frauenfeldi*, 16-*Tep. hyoscyami*, 17-*Tep. postica*, 18-*Tep. praecox*, 19-*Terellia gynaecochroma*, 20-*Ter. luteola.*



Figures 21-36. Wings of fruit flies: 21-*Terellia quadratula*, 22-*Ter. ruficauda*, 23-*Ter. serratulae*, 24-*Ter. tussilaginis*, 25-*Ter. virens*, 26-*Urophora affinis*, 27-*U. aprica*, 28-*U. jaceana*, 29-*U. mauritanica*, 30-*U. phalolepidis*, 31-*U. quadrifasciata*, 32-*U. solstitialis*, 33-*U. stylata*, 34-*U. tenuior*, 35-*U. terebrans*, 36-*Xyphosia miliaria*.

A NEW SUBSPECIES OF *ANAGLYPTUS MYSTICOIDES* REITTER, 1894, *ANAGLYPTUS MYSTICOIDES OBSCURISSIMUS* PIC, 1901 STAT. NOV., FROM TURKEY (COLEOPTERA: CERAMBYCIDAE: CERAMBYCINAE)

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[Özdikmen, H., Atak, Ş. & Uçkan, F. 2017. A new subspecies of *Anaglyptus mysticoides* Reitter, 1894, *Anaglyptus mysticoides obscurissimus* Pic, 1901 stat. nov., from Turkey (Coleoptera: Cerambycidae: Cerambycinae). Munis Entomology & Zoology, 12 (1): 68-70**]**

ABSTRACT: The paper presents a new subspecies of *Anaglyptus mysticoides* Reitter, 1894 from Anatolian part of Turkey. Accordingly, *Anaglyptus obscurissimus* Pic, 1901 that is a known synonym of *Anaglyptus mysticoides* Reitter, 1894 is upgraded to subspecies level as *Anaglyptus mysticoides obscurissimus* Pic, 1901 stat. nov. In accordance with this, known synonyms of *Anaglyptus mysticoides* Reitter, 1894 from Anatolia are transferred to *Anaglyptus mysticoides obscurissimus* Pic, 1901 stat. nov. as *Anaglyptus subimpressus* Pic, 1901b syn. nov., *Anaglyptus mysticoides* var. *amasinus* Pic, 1910 syn. nov. and *Anaglyptus mysticus* ssp. *anatolicus* Demelt, 1970 syn. nov.

KEY WORDS: Cerambycidae, Cerambycinae, *Anaglyptus mysticoides*, new subspecies, Turkey

Anaglyptus mysticoides obscurissimus Pic, 1901 stat. nov.

(Figs. 1a)

Anaglyptus mysticoides was described by Reitter (1894) from Central Caucasus. According to Miroshnikov (2000), Löbl & Smetana (2010), Özdikmen (2014), Tavakilian (2016) and Danilevsky (2016), this species is distributed in Transcaucasia (Armenia, Azerbaijan, Georgia) and Turkey (Anatolia). *Anaglyptus mysticoides* has 4 synonyms as *Anaglyptus obscurissimus* Pic, 1901a: 59, *Anaglyptus subimpressus* Pic, 1901b: 9, *Anaglyptus mysticoides* var. *amasinus* Pic, 1910: 10 and *Anaglyptus mysticus* ssp. *anatolicus* Demelt, 1970: 32. All synonyms of the species were described from Anatolia.

Two females were collected during fieldwork carried out in Kocaeli province in North-Western Anatolia of Turkey during ...October... 2016. The collection localities are ....Deulpur.... and ....Debnagar.... The specimens of longhorned beetles were collected, photographed and preserved in the collection of the second autor (Turkey: Kocaeli prov.).

During the study of these collected specimens from Kocaeli province, we have identified a new subspecies of *Anaglyptus mysticoides*. They differ from the nominotypical subspecies of *Anaglyptus mysticoides* by completely black elytra (basal part of elytra red in *Anaglyptus mysticoides mysticoides*) (Figs. 1a,b). All synonyms of *Anaglyptus mysticoides* described from Anatolia have the same character. Thus the valid name of new subspecies should be the name of senior synonym of *Anaglyptus mysticoides* from Anatolia as *Anaglyptus mysticoides obscurissimus* Pic, 1901 stat. nov.

The senior synonym, *A. obscurissimus* was described by Pic (1901a) from Tokat (Anatolia). The original description of Pic as follows:

> *"Anaglyptus obscurissimus. Niger, thorace in disco distincte carinato; antennis simplicibus; elytris griseo fasciatis aut maculatis et apice indistincte truncatis. Long. 13 mill. — Tokat (coll. Pic). — De coloration et fasciès analogue à mysticus L. v. hieroglyphicus Herbst., mais dessin élytral pubescent un peu jaunâtre, formé sur le milieu des élytres d'une fascie oblique et d'une large macule suturale irrégulière, prothorax à carène basale distincte, etc. Peut être variété foncée de A. mysticoides Reitt. [W., 1894, p. 128)?"*

Anaglyptus subimpressus was described by Pic (1901b) from Trabzon (Anatolia), *Anaglyptus mysticoides* var. *amasinus* was described by Pic (1910) from Amasya (Anatolia) and *Anaglyptus mysticus* ssp. *anatolicus* was described by Demelt (1970) from Samsun (Anatolia).

Consequently, the species *Anaglyptus mysticoides* Reitter, 1894 has 2 subspecies as follows:

***Anaglyptus* (*Anaglyptus*) *mysticoides mysticoides* Reitter, 1894**

Original combination: *Anaglyptus* (*Cyrtophorus*) *mysticoides* Reitter, 1894: 128

Type information: Syntypes ♂ & ♀, ex collection Edmund Reitter, Magyar Természettudományi Mûzeum, Budapest [type locality "Centralen Kaukasus" (Caucasus)]

Distribution: Transcaucasia (Armenia, Azerbaijan and Georgia)

Diagnostic character: Basal part of elytra red.

***Anaglyptus* (*Anaglyptus*) *mysticoides obscurissimus* Pic, 1901a**

Original combination: *Anaglyptus obscurissimus* Pic, 1901a: 59

Type information: Holotype, ex collection M. Pic, Muséum National d'Histoire Naturelle, Paris) [type locality "Tokat" (Turkey: Anatolia)]

New synonyms:

Anaglyptus subimpressus Pic, 1901b: 9 [Type information: Holotype, ex collection M. Pic, Muséum National d'Histoire Naturelle, Paris (type locality "Trabzon" (Turkey: Anatolia))

Anaglyptus mysticoides var. *amasinus* Pic, 1910: 10 [Type information: Holotype, ex collection M. Pic, Muséum National d'Histoire Naturelle, Paris (type locality "Amasya" (Turkey: Anatolia))

Anaglyptus mysticus ssp. *anatolicus* Demelt, 1970: 32 [Type information: (type locality "Samsun: Kavak" (Turkey: Anatolia))

Material examined: Kocaeli province: ....

Distribution: Turkey: Anatolia [Trabzon province as *Anaglyptus subimpressus* (Pic, 1901b); Amasya province as *Anaglyptus mysticoides* var. *amasinus* (Pic, 1910); Erzurum province as *Anaglyptus mysticoides* (Villiers, 1967); Samsun province: Kavak as *Anaglyptus mysticus* ssp. *anatolicus* (Demelt, 1970); Amasya province: Merzifon as *Anaglyptus mysticus* (Adlbauer, 1992); Afyon province: S of Şuhut (Başören) and Bolu province as *Anaglyptus mysticoides* (Miroshnikov, 2000); Afyon, Amasya, Bolu, Erzurum, Samsun, Tokat, Trabzon provinces (Özdikmen, 2014)] (Fig. 2).

Diagnostic character: Elytra completely black.

LITERATURE CITED

Danilevsky, M. L. 2016. Catalogue of Palaearctic Cerambycoidea. Available from: http://www.cerambycidae.net/catalog.pdf (Updated: 09.05.2016).

Demelt, C. 1970. Eine neue Cerambycidenart aus Griechenland, eine neue Subspec. aus Kleinasien sowie einige neue Cerambycidenformen. Entomologische Blätter für Biologie und Systematik der Käfer, 66 (1): 30-32.

Löbl, I. & Smetana, A. 2010. Catalogue of Palaearctic Coleoptera, Volume 6, Chrysomeloidea. Apollo Books, Stenstrup, 924 pp.

Miroshnikov, A. I. 2000. Contribution to the knowledge of the longicorn beetles of the Caucasus. 3. Genus *Anaglyptus* Mulsant, 1839 (Coleoptera, Cerambycidae). Entomologica Kubanica, Krasnodar, 1: 61-103.

Özdikmen, H. 2014. Turkish Red List Categories of Longicorn Beetles (Coleoptera: Cerambycidae) Part VIII – Subfamily Cerambycinae: Anaglyptini and Clytini. Munis Entomology & Zoology, 9 (2): 687-712.

Pic, M. 1901a. Notes diverses et diagnoses [6e article]. L'Échange, Revue Linnéenne, 17 (200): 57-59.

Pic, M. 1901b. Liste des espèces et variétés récemment décrites, avec notes complémentaires. Matériaux pour servir à l'étude des Longicornes, 3 (3): 4-9.

Pic, M. 1910. Descriptions ou diagnoses et notes diverses - Suite -. L'Échange, Revue Linnéenne, 26 (302): 9-11.

Reitter, E. 1894. Zehnter Beitrag zur Coleopteren-Fauna des russischen Reiches. Wiener Entomologische Zeitung, 13: 122-128.

Tavakilian, G. 2016. Base de données Titan sur les Cerambycidés ou Longicornes. Available from : http://lis-02.snv.jussieu.fr/titan/sel_genann1.php?numero=11003 (Accessed 03.10.2016).

a **b**

Figure 1. a. *Anaglyptus mysticoides obscurissimus* Pic, 1901 stat. nov. from Kocaeli province in Turkey, b. *Anaglyptus mysticoides mysticoides* Reitter, 1894 from "Karavansaray" (=Idzhevan) in Armenia (picture by A. I. Miroshnikov, https://www.zin.ru/animalia/coleoptera/eng/anamydmi.htm).

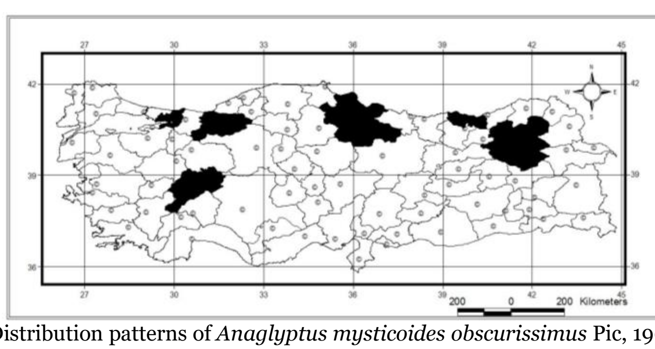

Figure 2. Distribution patterns of *Anaglyptus mysticoides obscurissimus* Pic, 1901 stat. nov. in Turkey.

ON A COLLECTION OF ORTHOPTERA (INSECTA) FROM SITANADI WILDLIFE SANCTUARY, DHAMTARI, CHHATTISGARH, INDIA

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[Gupta, S. K. 2017. On a collection of Orthoptera (Insecta) from Sitanadi Wildlife Sanctuary, Dhamtari, Chhattisgarh, India. Munis Entomology & Zoology, 12 (1): 71-78**]**

ABSTRACT: The paper deals with the study of faunal diversity of Orthoptera of Sitanadi Wildlife Sanctuary, Dhamtari district, Chhattisgarh. Altogether 39 species pertaining to 33 genera under 7 families are reported for the first time from the Sanctuary. The species *Gryllotalpa hirsuta* Burmeister, 1838 is new addition to the Chhattisgarh state.

KEY WORDS: Orthoptera, Sitanadi Wildlife Sanctuary, Chhattisgarh, India

A noteworthy contribution of Orthoptera fauna of Chhattisgarh has been made by Sinha & Agarwal (1973), Dwivedi (1978, 1990), Dwivedi & Chattoraj (1985), Shishodia (2000), Chandra et al. (2007), Gupta et al. (2008), Gupta & Chandra (2010, 2013), Shishodia et al. (2010), Chandra & Gupta (2011), Gupta & Shishodia (2014) and Skejo & Gupta (2015).

During the extensive and intensive survey of Sitanadi Wildlife Sanctuary from 2011 to 2014, a total 39 species and subspecies pertaining to 33 genera under 7 families viz. Acrididae 24 species 20 genera, Pyrgomorphidae 5 species 4 genera, Tetrigidae 3 species 3 genera, Tridactylidae 1 species 1 genus, Gryllidae 3 species 3 genera, Gryllotalpidae 2 species 1 genus, Tettigoniidae 1 species 1 genera were collected from different localities by the survey team of Zoological Survey of India, Kolkata. The species recorded for the first time from Chhattisgarh state are marked with an asterisk (*). The systematic account, details of material collected and co-ordinates and geographic distribution of all the species in Chhattisgarh are also incorporated.

MATERIALS AND METHODS

Study area

The present study was carried out in Sitanadi Wildlife Sanctuary is located in Dhamtari district. The area of Sanctuary is about 553.36 sq. km., which lies between latitudes 20° 27' 24.3714''N and longitudes 81° 58'10.7466'' E. The forest types are of Tropical Dry Peninsular Sal forests and Southern Tropical Dry Deciduous Mixed Forests. The vegetation of the Sanctuary chiefly comprises of moist peninsular Sal, Teak and Bamboo forests. The other major flora in the sanctuary comprises of Salai (*Boswellia serrata*), Tendu (*Diospyros melanoxylon)*, Haldu (*Adina cordifolia*), Harra (*Terminalia chebula*), Mahul (*Madhuca longifolia)*, Aonla (*Emblica officinalis*) and Semal (*Bombax ceiba).*

Methods

The specimens were collected by sweeping over vegetation by insect net, and the larger specimens were picked up directly by hand or with the help of fine forceps. The specimens after collection from the field were killed in benzene or ethyl acetate in a killing bottle. For temporary storage in the field they were kept in insect envelopes. The specimens were brought to laboratory and pinned, labeled and preserved for the identification. Survey site co-ordinates were recorded using GPS (Garmin Oregon 550). The identified specimens were deposited in National Zoological Collection, Zoological Survey of India, Kolkata.

SYSTEMATIC ACCOUNT

Order ORTHOPTERA
Suborder CAELIFERA
Infraorder ACRIDIDEA
Superfamily ACRIDOIDEA
Family ACRIDIDAE
Subfamily ACRIDINAE

Genus *Acrida* Linnaeus, 1758

Acrida exaltata (Walker, 1859)

1859. *Truxalis exaltata* Walker, Ann. Mag. nat. Hist., 4 (3): 222.
2010. *Acrida exaltata,* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 15-16.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sankra Forest Rest House, 12.x.2011, 1 (♂); Khallari village, 16.x.2011, 1 (♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Acrida gigantea (Herbst, 1794)

1794. *Truxalis gigantea* Herbst, Fuessly Archiv.: 173.
2010. *Acrida gigantea,* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 16.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Bhaisa Sankra, 16.viii.2013, 1 (♂); 30.viii.2013, 1 (♀); Sankra Forset Rest House, 26.ii.2014, 1 (♂); Gahnasiyar, 17.viii.2013, 1 (♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Dhamtari, Kabirdham and Raipur.

Acrida turrita (Linnaeus, 1758)

1758. *Gryllus turritus*, Linnaeus, Syst. Nat. (ed. X): 427.
1914. *Acrida turrita*, Kirby, Fauna Brit. India, Orth. : 98.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Bhoithali, 19.viii.2013, 1 (♀); Bhaisa Sankra, 4.ix.2013, 3 (♀♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Dhamtari, Kabirdham and Raipur.

Genus *Phlaeoba* Stål, 1860

Phlaeoba panteli Bolivar, 1902

1902. *Phlaeoba panteli* Bolivar, Annls. Soc. ent. Fr., 70: 581.
2010. *Phlaeoba panteli*, Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 21.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sitanadi River, 17.x.2011, 3 (♂♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bilaspur, Dhamtari, Kabirdham and Raipur.

Subfamily CATANTOPINAE

Genus *Choroedocus* Bolivar, 1914

Choroedocus illustris (Walker, 1870)

1870. *Heteracris illustris* Walker, Cat. Derm. Salt. Brit. Mus., 4: 663.
2007. *Choroedocus illustris*, Saini & Mehta, Bionotes, 9 (3): 76.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sankra Forest Rest House, 17.x.2011, 1 (♀) coll. S. K. Gupta & Party.
Distribution in Chhattisgarh: Dhamtari and Kabirdham.

Genus *Diabolocatantops* Jago, 1984

Diabolocatantops innotabilis (Walker, 1870)

1870. *Acridium innotabile* Walker, Cat. Derm. Salt. Brit. Mus., 4: 629.
2010. *Diabolocatantops innotabilis*, Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 39.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sondur Dam, 14.x.2011, 1 (♂); Sankra Forest Rest House, 2.x.2012, 2 (♀♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Stenocatantops* Dirsh & Uvarov, 1953

Stenocatantops splendens (Thunberg, 1815)

1815. *Gryllus splendens* Thunberg, Mem. Acad. Sci. St. - Petersb., 5: 236.
2000. *Stenocatantops splendens*, Shishodia & Tandon, State Fauna Series 7: Fauna of Tripura, Part 2, Zool. Surv. India: 210.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Gahnasiyar, 13.x.2011, 1 (♀); Sondur Dam, 14.x.2011, 1 (♂); Khallari village, 16.x.2011,3 (1♂, 2♀♀); Shaleybhat, 21.x.2011, 1 (♂); 22.x.2011, 1 (♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Xenocatantops* Dirsh & Uvarov, 1953

Xenocatantops humilis humilis (Serville, 1839)

1839. *Acridium humile* Serville, Ins. Orth.: 662.
1953. *Xenocatantops humilis humilis*, Dirsh and Uvarov, Tijdschr. Ent., 96: 237.
2000. *Xenocatantops humilis humilis*, Shishodia, Rec. zool. Surv. India, 98 (1): 62.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sitanadi River, 17.x.2011, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari and Raipur.

Xenocatantops karnyi (Kirby, 1910)

1910. *Catantops karnyi* Kirby, Syn. Cat. Orth. 3: 483.
2007. *Xenocatantops karnyi*, Mandal & Yadav, State Fauna Series 5: Fauna of Andhra Pradesh, Part 3. Zool. Surv. India,: 220.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Gahnasiyar, 13.x.2011, 2 (♀♀); Sondur Dam, 14.x.2011, 1 (♂); Sitanadi River, 17.x.2011 2 (♂♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Subfamily EYPREPOCNEMIDINAE

Genus *Heteracris* Walker, 1870

Heteracris pulcher (Bolivar, 1902)

1902. *Euprepocnemis pulcher* Bolivar, I. Ann. Soc. ent. Fr., Paris, 70: 630.
2010. *Heteracris pulcher,* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 59.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Khallari village, 16.x.2011, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Dhamtari and Kabirdham.

Genus *Eyprepocnemis* Fieber, 1853

Eyprepocnemis roseus Uvarov, 1942

1942. *Euprepocnemis roseus* Uvarov, Ann. Mag. nat. Hist., 9 (11): 597.
2010. *Euprepocnemis roseus,* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 57.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Gahnasiyar, 13.x.2011, 1 (♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari and Raipur.

Subfamily GOMPHOCERINAE

Genus *Aulacobothrus* Bolivar, 1902

Aulacobothrus luteipus luteipus (Walker, 1871)

1871. *Stenobothrus luteipes* Walker, Cat. Derm. Salt. Brit. Mus., 5: 82.
1993. *Aulacobothrus luteipes luteipes* Ingrisch, Ent. Scand., 24 (3): 321.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sitanadi River, 17.x.2011, 1 (♂); Arsikanhar, 9.ix.2013, 1 (♀); Gahnasiyar, 17.viii.2013, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Dhamtari and Raipur.

Genus *Leva* Bolivar, 1909

Leva indica (Bolivar, 1902)

1902. *Gymnobothrus indicus* Bolivar, Ann. Soc. ent. Fr., Paris, 70: 596.
2010. *Leva indica,* Shishodia et al. Rec. zool. Surv. India, Occ. Paper No. 314: 62.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Khallari village, 16.x.2011, 1 (♀); Sitanadi River, 17.x.2011, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Kabirdham and Dhamtari.

Subfamily HEMIACRIDINAE

Genus *Hieroglyphus* Krauss, 1877

Hieroglyphus banian (Fabricius, 1798)

1798. *Gryllus banian* Fabricius, Entomologia systematica, Suppl.: 194.
2010. *Hieroglyphus banian,* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 75.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Mahuvabahra, 15.x.2011, 1 (♂); Lelanj River, 22.x.2011, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bilaspur, Dhamtari, Kabirdham and Raipur.

Subfamily OEDIPODINAE

Genus *Aiolopus* Fieber, 1853

Aiolopus thalassinus tamulus (Fabricius, 1798)

1798. *Gryllus tamulus* Fabricius, Entomologia systematica Suppl.: 195.
1968. *Aiolopus thalassinus tamulus* Hollis, Bull. Br. Mus. nat. Hist., (Ent.), 22 (7): 347.
2010. *Aiolopus thalassinus tamulus,* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 88.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sitanadi River, 17.x.2011, 1 (♂); Gahnasiyar, 17.viii.2013, 1 (♀); Arsikanhar, 9.ix.2013, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Ceracris* Walker, 1870

Ceracris nigricornis nigricornis Walker, 1870

1870. *Ceracris nigricornis* Walker, Cat. Derm. Salt. Brit. Mus., 4: 791.
2010. *Ceracris nigricornis nigricornis* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 85.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sitanadi River, 17.x.2011, 2 (1♂, 1♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Gastrimargus* Saussure, 1884

Gastrimargus africanus africanus (Saussure, 1888)

1888. *Oedaleus* (*Gastrimargus*) *marmoratus* var. *africana* Saussure, Mem. Soc. Phys. Hist. nat. Geneve, 30 (1): 39.
2006. *Gastrimargus africanus africanus,* Shishodia, Bionotes, 8 (1): 11.
2010. *Gastrimargus africanus africanus* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 90.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Bhoithali, 16.ii.2014, 1 (♂); Bhiragaon, 18.ii.2014, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Oedaleus* Fieber, 1853

Oedaleus abruptus (Thunberg, 1815)

1815. *Gryllus abruptus* Thunberg, Mem. Acad. Sci. St. Petersb. 5: 233.
1990. *Oedaleus abruptus,* Shishodia & Mandal, Rec. zool. Surv. India, 87 (1): 70.
2010. *Oedaleus abruptus* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 93.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sitanadi River, 17.x.2011, 1 (♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Trilophidia* Stål, 1873

Trilophidia annulata (Thunberg, 1815)

1815. *Gryllus annulatus* Thunberg, Mem. Acad. Sci. St. Petersb., 5: 234.
2010. *Trilophidia annulata* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 102.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sankra Forest, 1.x.2011, 1 (♀); Mahuva bahara, 15.x.2011, 1 (♀); Sitanadi, 17.x.2011,2 (1♂, 1♀); Salhebhat, 21.x.2011, 1 (♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Morphacris* Walker, 1870

Morphacris fasciata (Thunberg, 1815)

1815. *Gryllus fasciatus* Thunberg, Mem. Acad. Sci. St. Petersb., 5: 230.
2010. *Morphacris fasciata* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 83.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sitanadi River, 17.x.2011, 2 (1♂, 1♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Subfamily OXYINAE

Genus *Oxya* Serville, 1831

Oxya fuscovittata (Marschall, 1836)

1836. *Gryllus fuscovittatus* Marschall, Ann. Wien. Mus. Vienna, 1 (2): 211.
2010. *Oxya fuscovittata* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 107.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Khallari, 16.x.2011, 5 (♀♀); Sitanadi River, 17.x.2011, 2 (♀♀); Sankra Forest Rest House, 12.x.2011, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar and Dhamtari.

Oxya hyla hyla Serville, 1831

1831. *Oxya hyla* Serville, Ann. Sci. nat. (Zool.), Paris, 22: 287.

2010. *Oxya hyla hyla* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 109.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sankra Forest Rest House, 10.x.2011, 5 (3♂♂, 2♀♀); Gahnasiyar, 13.x.2011, 5 (1♂, 4♀♀), Sondur Dam, 14.x.2011, 1 (♀); Mahuvabahara, 15.x.2011, 1(♂); Khallari village, 16.x.2011, 8 (7♂♂, 1♀); Sitanadi River, 17.x.2011, 2 (1♂, 1♀); Shaleybhat, 21.x.2011, 2 (♂♂); Lelanz River, 22.x.2011, 9 (1♂, 8♀♀) coll. S. K. Gupta & party.

Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Oxya japonica japonica (Thunberg, 1824)

1824. *Gryllus japonicus* Thunberg, Mem. Acad. Sci. St. Petersb., 9: 429.

2010. *Oxya japonica japonica* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 111.

Material examined: Chhattisgarh: Dhamtari, Sitanadi WLS, Sankra Forest Rest House, 10.x.2011, 1 (♂) coll. S. K. Gupta & party.

Distribution in Chhattisgarh: Dhamtari and Raipur.

Subfamily SPATHOSTERNINAE

Genus *Spathosternum* Krauss, 1877

Spathosternum prasiniferum prasiniferum (Walker, 1871)

1871. *Heteracris* (?) *prasiniferum* Walker, Cat. Derm. Salt. Brit. Mus., 5: 65.

2010. *Spathosternum prasiniferum prasiniferum* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No., 314: 114.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sankra Forest Rest House, 12.x.2011, 4 (1♂, 3♀♀); Gahnasiyar, 13.x.2011, 4 (1♂, 3♀♀); Sondur Dam, 14.x.2011, 11 (5♂♂, 6♀♀); Mahuva bahara, 15.x.2011, 2 (♂♂); Khallari village, 16.x.2011, 5 (3♂♂, 2♀♀); Sankra, 17.x.2011, 4 (♀♀); Shaleybhat, 21.x.2011, 1 (♀); Bhiragaon, 18.ii.2014, 1 (♀) coll. S. K. Gupta & party.

Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Superfamily PYRGOMORPHOIDEA

Family PYRGOMORPHIDAE

Subfamily PYRGOMORPHINAE

Genus *Atractomorpha* Saussure, 1862

Atractomorpha crenulata (Fabricius, 1793)

1793. *Truxalis crenulatus* Fabricius, Ent. Syst. II: 28.

1914. *Atractomorpha crenulata* Kirby, Fauna Brit. India, Orth.: 181.

2010. *Atractomorpha crenulata* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No., 314: 129.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Gahnasiyar, 5.x.2012, 2 (♂♂); 13.x.2011, 1 (♂); Sankra Forest, 10.x.2011, 1 (♂); Sankra Forest Rest House, 10.x.2011, 1 (♂); 16.ii.2014, 1 (♂); Mahuva Bahara, 15.x.2011, 1 (♂); Khallari, 16.x.2011, 4 (♂♂); Sitanadi River, 17.x.2011, 6 (5♂♂, 1♀); Bhiragaon, 18.ii.2014, 1 (♀) coll. S. K. Gupta & party.

Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Chrotogonus* Serville, 1838

Subgenus *Chrotogonus* Serville, 1838

Chrotogonus* (*Chrotogonus*) *trachypterus trachypterus (Blanchard, 1836)

1836. *Ommexecha trachypterum* Blanchard, Ann. Soc. ent. France, 5: 618.

2010. *Chrotogonus* (*Chrotogonus*) *trachypterus trachypterus* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 134.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Khallari village, 16.x.2011, 2 (1♂, 1♀) S. K. Gupta & party.

Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Chrotogonus* (*Chrotogonus*) *oxypterus (Blanchard, 1836)

1836. *Chrotogonus oxypterum* Blanchard, Ann. Soc. ent. France, 5: 622.

2010. *Chrotogonus* (*Chrotogonus*) *oxypterus* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 133.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sondur Dam, 14.x.2011, 1 (♀) S. K. Gupta & party.

Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari and Raipur.

Genus *Poekilocerus* Serville, 1831

Poekilocerus pictus (Fabricius, 1775)

1775. *Gryllus pictus* Fabricius, Systema entomologicea sistems Insectorum classes, ordines, genera, species, adjectis synonymis, locies. Flensburg et Leipzig: 289.

2000. *Poekilocerus pictus* Shishodia, Rec. zool. Surv. India, 98 (1): 41.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sitanadi River, 17.x.2011, 2 (1♂, 1♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Dhamtari, Kabirdham and Raipur.

Genus *Aularches* Stål, 1873

Aularches miliaris miliaris (Linnaeus, 1758)

1758. *Gryllus* (*Locusta*) *miliaris* Linnaeus, Systema Naturae per Regna Tria naturae, (10th ed.) : 432.
2010. *Aularches miliaris miliaris* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No., 314: 139.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Gahanasiyar, 5.x.2012, 1(♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Dhamtari.

Superfamily TETRIGOIDEA

Family TETRIGIDAE

Subfamily SCELIMENINAE

Genus *Euscelimena* Günther, 1938

Euscelimena harpago (Serville, 1839)

1839. *Tetrix harpago* Serville, Orthopteres: 763.
2005. *Euscelimena harpago* Kulkarni & Shishodia, Conservation Area Series, 24: Fauna of Melghat Tiger Reserve, Zool. Surv. India: 326.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sitanadi River, 17.x.2011, 2 (1♂, 1♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Subfamily TETRIGINAE

Genus *Ergatettix* Kirby, 1914

Ergatettix dorsiferus (Walker, 1871)

1871. *Tettix dorsifera* Walker, Cat. Derm. Salt. Brit. Mus., 5: 825.
2010. *Ergatettix dorsiferus* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 165.

Material examined: Chhattisgarh; Dhamtari, Sitanadi WLS, Sondur Dam, 14.x.2011, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Hedotettix* Bolivar, 1887

Hedotettix gracilis (Haan, 1843)

1842. *Acridium gracile* Haan, *Gesch. Ned. Overszee*. Bezitt, 2: 169.
2010. *Hedotettix gracilis* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 169.

Material examined: Chhattisgarh; Dhamatari, Sitanadi WLS, Shaleybhat, 21.x.2011, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Superfamily TRIDACTYLOIDEA

Family TRIDACTYLIDAE

Subfamily TRIDACTYLINAE

Genus *Tridactylus* Olivier, 1789

Tridactylus thoracicus Guérin, 1844

1844. *Tridactylus thoracicus* Guérin, Iconogr. R. Anim., Ins.: 336.
2010. *Hedotettix gracilis* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 184.

Material examined: Chhattisgarh; Dhamatari, Sitanadi WLS, Bhiragaon, 18.ii.2014, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bilaspur, Dhamtari, Kabirdham and Raipur.

SUBORDER ENSIFERA

Superfamily GRYLLOIDEA

Family GRYLLIDAE

Subfamily GRYLLINAE

Genus *Modicogryllus* Chopard, 1961

Subgenus *Modicogryllus* Chopard, 1961

Modicogryllus* (*Modicogryllus*) *confirmatus (Walker, 1859)

1859. *Acheta confirmata* Walker, Ann. Mag. nat. Hist., 4 (3): 221.
2010. *Modicogryllus* (*Modicogryllus*) *confirmatus* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 220.

Material examined: Chhattisgarh; Dhamatari, Sitanadi WLS, Bhiragaon, 18.ii.2014, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Genus *Phonarellus* Gorochov, 1983
Subgenus *Phonarellus* Gorochov, 1983
Phonarellus* (*Phonarellus*) *minor Chopard, 1959

1959. *Gymnogryllus minor* Chopard, Stuttg. Beitr. z. Naturk.: 1.
2010. *Phonarellus* (*Phonarellus*) *minor* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 202.

Material examined: Chhattisgarh; Dhamatari, Sitanadi WLS, Gahnasiyar, 5.x.2012, 1 (♂); Bhaisa sankra, 4.ix.2013, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Subfamily NEMOBIINAE
Genus *Dianemobius* Vickery, 1973
Dianemobius fascipes (Walker, 1869)

1869. *Eneoptera fascipes* Walker, Cat. Derm. Salt. Brit. Mus.: 67.
2010. *Dianemobius fascipes* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 240.

Material examined: Chhattisgarh; Dhamatari, Sitanadi WLS, Sankra Forest Rest House, 25.ii.2014, 19 (2♂♂, 17♀♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar and Dhamtari.

Family GRYLLOTALPIDAE
Genus *Gryllotalpa* Latreille, 1802
Gryllotalpa africana Beauvois, 1805

1805. *Gryllotalpa africana* Beauvois, Ins. Afr. Amer.: 229.
2010. *Gryllotalpa africana* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 260.

Material examined: Chhattisgarh; Dhamatari, Sitanadi WLS, Sankra Forest, 13.x.2011, 1 (♂); Bhaisa Sankra, 30.viii.2013, 2 (1♂, 1♀); Gahnasiyar, 29.viii.2013, 1 (♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bastar, Bilaspur, Dhamtari, Kabirdham and Raipur.

Gryllotalpa hirsuta Burmeister, 1838 (*)

1838. *Gryllotalpa hirsuta* Burmeister, Handb. Ent., 2: 739.
2010. *Gryllotalpa hirsuta* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 261.

Material examined: Chhattisgarh; Dhamatari, Sitanadi WLS, Sankra Forest Rest House, 13.x.2011, 2 (1♂, 1♀) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Dhamtari.
Remark: New record from Chhattisgarh state.

Superfamily TETTIGONIOIDEA
Family TETTIGONIIDAE
Subfamily PHANEROPTERINAE
Genus *Elimaea* Stål, 1874
Subgenus *Elimaea* Stål, 1874
Elimaea* (*Elimaea*) *securigera Brunner von wattenwyl, 1878

1878. *Elimaea* (*Elimaea*) *securigera* Brunner von Wattenwyl, Monographie der Phaneropteriden: 93.
2010. *Elimaea* (*Elimaea*) *securigera* Shishodia et al., Rec. zool. Surv. India, Occ. Paper No. 314: 306.

Material examined: Chhattisgarh; Dhamatari, Sitanadi WLS, Bhiragaon, 18.ii.2014, 2 (♂♂) coll. S. K. Gupta & party.
Distribution in Chhattisgarh: Bilaspur, Dhamtari, Kabirdham and Raipur.

Abbreviation: WLS: Wildlife Sanctuary; FRH : Forest Rest House.

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LITERATURE CITED

Dwivedi, K. P. 1978. Energy flow of the grasshopper *Conocephalus pallidus* Redt. (Tettigonidae: Orthoptera) population in Mohan-Bhata grassland, M. P. Indian J. Eco., 5 (2): 222-228.

Dwivedi, K. P. 1990. Bioenergetics of the grasshopper *Catantops pinguis innotabilis* Walker (Acrididae: Orthoptera) population in Mohanbhata grassland. Environment and Ecology, 8 (4): 1095-1100.

Dwivedi, K. P. & Chattoraj, A. N. 1985. Energy budget of grasshoppers *Acrida exaltata* population in MohanBhata grassland, (Bilaspur). Environment and Ecology, 3 (1): 1-5.

Chandra, K. & Gupta, S. K. 2011. Insecta: Orthoptera. Editor- Director, Zool. Surv. India, Fauna of Madhya Pradesh (including Chhattisgarh): State Fauna Series, 15 (Part-3): 105-150.

Chandra, K., Gupta, S. K. & Shishodia, M. S. 2007. A checklist of Orthoptera of Madhya Pradesh and Chhattisgarh. Zoos' Print Journal, 22 (5): 2683-2687.

Gupta, S. K. & Chandra, K. 2010. Diversity of Orthoptera in Achanakmar Wildlife Sanctuary, Chhattisgarh, India. Indian J. Trop. Biodiv., 18 (2): 211-217.

Gupta, S. K. & Chandra, K. 2013. On a Collection of Orthoptera (Insecta) from Barnawapara Wildlife Sanctuary, Chhattisgarh, India. Uttar Pradesh Journal of Zoology, 33 (3): 221-248.

Gupta, S. K. & Shishodia, M. S. 2014. Insecta: Orthoptera. Fauna of Achanakmar Amarkantak Biosphere Reserve, Coservation Area Series (Zool. Surv. India), 49: 27-82.

Gupta, S. K., Dube, K. K. & Chandra, K. 2008. On a collection of Orthoptera from Achanakmar Wildlife Sanctuary, Chhattisgarh. Natl. J. Life Sci., 5 (1): 117-126.

Shishodia, M. S. 2000. Short and long horned grasshoppers and crickets of Bastar district, Chhattisgarh, India. Rec. zool. Surv. India, 98 (1): 27-80.

Shishodia, M. S., Chandra, K. & Gupta, S. K. 2010. An Annotated checklist of Orthoptera (Insecta) from India. Rec. zool. Surv. India, Occ. Paper No. 314: 1-366 (Published by the Director, Zool. Surv. India, Kolkata).

Sinha, K. M. & Agrawal, S. M. 1973. Diagnosis of a cave-gryllid *Kempiella shankari* n. sp. (Orthoptera: Phalangopsidae). Bull. Ent., 14: 97-100.

Skejo, J. & Gupta, S. K. 2015. On the specific status of *Hedotettix cristatus* Karny, 1915 (Tetrigidae: Tetriginae). Zootaxa, 4018 (4): 584-592.

Table. Co-ordinates of collection localities of Sitanadi Wildlife sanctuary.

S. NO.	Site	Latitude N			Longitude E			Alt.(m)
		Deg	Min	Sec	Deg	Min	Sec	
1	Arsikanahar	20	14	51.6	82	09	38.8	502
2	Bhaisa sankra	20	18	06.5	82	01	04.7	457
3	Bhothali	20	17	15.4	81	59	8.0	450
4	Bhiragaon	22	14	5.6	81	59	50	430
5	Gahnasiyar	20	14	78.5	81	59	976	483
6	Khallari village	20	07	614	82	00	639	534
7	Lelanz river	21	13	938	82	01	298	488
8	Mahuvabahara	20	15	848	81	59	265	471
9	Sankra FRH	20	16	926	81	58	324	447
10	Shaleybhat	20	07	639	82	00	880	529
11	Sitanadi river	20	10	886	81	54	771	490
12	Sondur dam	20	13	688	82	06	223	487

UPDATED DISTRIBUTIONS OF ORTHOTYLINAE (HEMIPTERA: HETEROPTERA: MIRIDAE) FROM TURKEY

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[Yazıcı, G. 2017. Updated distributions of Orthotylinae (Hemiptera: Heteroptera: Miridae) from Turkey. Munis Entomology & Zoology, 12 (1): 79-88**]**

ABSTRACT: This study is based upon material of subfamily Orthotylinae collected from different localities of Turkey between 1980 and 2014, mostly 2006-2014. The study resulted in recording for Turkish fauna of eight species from five genera of Halticini and nine species from seven genera of Orthotylini. Among them, *Anapus dorsalis* (Reuter, 1890), *Orthocephalus saltator* (Hahn, 1835), *Orthotylus* (*Melanotrichus*) *flavosparsus* (C.R. Sahlberg, 1841) and *Orthotylus (Orthotylus) marginalis* Reuter, 1883 have been found the most abundant and widespread species. In addition, new localities are added for some species previously reported for Turkey.

KEY WORDS: Hemiptera, Heteroptera, Miridae, Orthotylinae, Fauna, Turkey

Miridae (or plant-bugs) is a group of Miroidea, which at World scale comprises eight subfamilies. In the World they are represented by nearly 10.040 species, 1507 genera (Cassis et al., 2006). This family comprising eight subfamilies Isometopinae, Psallopinae Cylapinae, Orthotylinae, Bryocorinae, Deraeocorinae, Mirinae and Phylinae (Cassis & Schuh, 2012). This subfamily, 1st rostral segment less than twice as thick as 2nd one. Usually distance between eye and apex of clypeus less than or equal to diameter of eye. Parameres of different form, often with teeth or processes. Aedeagus usually including twoor more strongly ramified and toothed or simple sclerotized branches (Lehr, 1988).

Turkey is biogeographically one of the most interesting countries in the West Palaearctic region. Some faunistic studies on this family in the Turkey have been made by Hoberlandt (1955), Önder (1976), Bingöl (1978), Lodos et al. (1978), Altınayar (1981), Önder et al. (1981), Yayla (1983), Özkan (1984), Karaat (1986), Önder & Lodos (1987), Özbek & Alaoğlu (1987), Çam (1988), Lodos et al. (1989), Önder et al. (1990; 1998), Yıldırım & Özbek (1992), Güçlü et al. (1995a,b), Çevik (1996), Yaşarakıncı & Hıncal (1997, 2000), Yıldırım et al. (1999), Tezcan & Önder (1999, 2003), Beyaz (2000), Atakan (2000), Özsaraç & Kıyak (2001), Lodos et al. (2003), Kıyak et al. (2004), Çetin & Alaoğlu (2005), Önder et al. (2006), Ayyıldız & Atlıhan (2006).

The aim of this paper is to present new collection and biological data on Orthotylinae in Turkey.

MATERIALS AND METHODS

The material of the Mirinae was collected from different localities of Turkey between 1978 and 2014. In addition, in previous years collected material from different localities of Turkey, Ataturk University, Faculty of Agriculture, Department of Plant Protection, the Entomology Museum, Erzurum, Turkey (EMET) preserved in the collection is also evaluated. Material was obtained by sweeping from meadow and pasture lands containing a variety of flowering plants. Provinces of the collected specimens are given in alphabetical order in the following list. The material is deposited in the Entomology Museum, Erzurum, Turkey (EMET).

RESULTS

In this study, eight species from five genera of Halticini and nine species from seven genera Orthotylini are recorded from Turkey.

Subfamily Orthotylinae
Tribe Halticini
Genus *Anapus* Stal, 1858
***Anapus dorsalis* (Reuter, 1890) (Fig. 1A)**

Material examined: Bayburt: 1550 m, 12.VIII.2009, ♀, Demirözü, 1650 m, 17.VI.2010, 3 ♀♀; Erzincan: Mercan, 25.VI.1990, 3 ♀♀; Erzurum:Aziziye, Kayapa, 1750 m, 3.VI.2010, 2 ♀♀; Palandöken, Kümbet, 11.VII.1990, 2 ♀♀; Taşlıgüney, 11.VII.1990, 2 ♀♀; Yakutiye, Güzelyayla, 2000 m, 19.VIII.2009, 3 ♀♀, Karagöbek, 2033 m, 13.VII.2011, ♀, University field, 1850 m, 11.VI.1980, 4 ♀♀, 11.VI.1990, 6 ♂♂, 11.VII.2008, ♀; Çat, 2200 m, 3.VI.2010, ♂, 1913 m, 23.VII.2011, ♀, Çirişli, 1876 m, 23.VII.2011, 3 ♀♀; Hınıs, 1742 m, 2.VII.2010, 2 ♀♀; Horasan, N 40°00′53″, E 041°59′06″, 1588 m, 22.VII.2014, 5 ♀♀, ♂, Dalbaşı, 1601 m, 17.VII.2011, 3 ♀♀; Karaçoban, Duman, 1560 m, 26.VI.2011, 2 ♀♀, Maruf, 1550 m, 26.VI.2011, 2 ♀♀; Karayazı, Kırgındere, 2215 m, 2.VII.2010, 4 ♀♀, Yukarı Söylemez, 1896 m, 2.VII.2010, ♀; Köprüköy, Güzelhisar, 1930 m, 2.VII.2010, 4 ♀♀; Narman, 1900 m, 24.VII.2009, 3 ♀♀, Dikmetaş, 2665 m, 17.VII.2010, 3 ♀♀; Oltu, Toprakkale, 1416 m, 23.VI.2011, ♀; Pasinler, Büyüktuy, 1800 m, 2.VII.2010, 2 ♀♀, Çöğender, 1737 m, 29.VII.2010, 2 ♀♀, 1768 m, 30.VII.2011, 2 ♀♀; Tekman, Körsu, 1940 m, 2.VII.2010, 5 ♀♀; Kars: Sarıkamış, Karakurt, 1500 m, 22.VI.2010, 2 ♀♀.
Distribution in Turkey: Erzurum (Hoberlandt, 1955); Ağrı, Muş, Van (Bingöl, 1978); Adana, Eskişehir, İçel, Kahramanmaraş, Kayseri, Kırıkkale, Kırşehir, Konya, Niğde (Lodos et al., 2003); Afyonkarahisar, Ankara, Çorum, Gümüşhane, Isparta, Kars, Kütahya, Mersin, Niğde, Sivas (Önder, 2006).
Distribution in the world: Armenia, Turkey (Hoberlandt, 1955); Armenia, Iran, Turkey (Linnavuori, 2007).

Genus *Euryopicoris* Reuter, 1875
***Euryopicoris nitidus* (Meyer-Dur, 1843)(Fig. 1B)**

Material examined: Erzurum: Çat, 2200 m, 3.VI.2010, ♂; Oltu, Toprakkale, N 40°27′55.5″, E 041°59′21.1″, 1416 m, 23.VI.2011, ♀.
Distribution in Turkey: Kütahya (Önder, 1976); Adana (Önder et al., 2006).
Distribution in the world: Italy (Tamanini, 1981); Iran, Palearctic Region (Linnavuori, 2007); Russia (Vinokurov & Golub, 2007); Spain (Goula & Serra, 2010).

Genus *Halticus* Hahn, 1833
***Halticus apterus* (Linnaeus,1758) (Fig. 1C)**

Material examined: Erzurum: Palandöken, Kümbet, N 39°48′57.8″, E 041°04′03.3″, 1836 m, 9.VIII.2011, ♀; Oltu, Çamlıbel, N 40°29′06″, E 041°45′47″, 1635 m, 14.VII.2014 m, ♂, İğdeli, N 40°32′44.8″, E 041°50′27.6″, 1660 m, 30.VI.2012, ♂.
Distribution in Turkey: Ankara (Hoberlandt, 1955); Artvin, Bursa, Muğla, Rize (Önder, 1976); Antalya, Çankırı, Kahramanmaraş, Karabük, Kars, Kütahya, Sakarya, Zonguldak (Lodos et al., 2003; Önder et al., 2006).
Distribution in the world: Canada (Edward, 1941); Middle Asia, Caucasia, Turkestan (Hoberlandt, 1955); Germany (Göllner-Scheiding, 1974; Schuster, 2005); Italy (Tamanini, 1981); Russia (Lehr, 1988); North America (Kerzhner & Schuh, 2001); Nearctic and Palearctic Region (Önder et al., 2006); Latvia (Petrova et al., 2010); Canary Islands (Luis, 2013).

***Halticus luteicollis* (Panzer, 1804) (Fig. 1D)**

Material examined: Uzundere, Yedigöller, N 39°18′17″, E 041°55′19″, 855 m, 7.VI.2012, ♂.
Distribution in Turkey: Ankara (Hoberlandt, 1955); Balıkesir, Bilecik, Çanakkale, Muğla (Önder, 1976); Gaziantep (Önder et al., 1995); İçel (Lodos et al., 2003); Adana, Bartın, Bolu,

Düzce, Hatay, Kastamonu, Mersin, Zonguldak (Önder et al., 2006); İzmir (Tezcan et al., 2010).

Distribution in the world: England, Swedish, Middle Asia, Turkey (Hoberlandt, 1955); Italy, Central Southern Europe, Turkey (Tamanini, 1981); Germany (Schuster, 2005); Palearctic region (Önder et al., 2006); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010); Czech Republic (Malenovský et al., 2011); Austria, Germany (Brandner & Frieb, 2014).

Genus *Orthocephalus* Fieber, 1858

Orthocephalus saltator (Hahn, 1835) (Fig. 1E)

Material examined: Artvin: Oruçlu, 247 m, 16.VI.2012, ♀; Bayburt: Çalıdere, 1700 m, 17.VI.2010, ♂; Erzincan: Mercan, 25.VI.1990, ♀; Erzurum:Aziziye, Başçakmak, N 40°00′09.8″, E 040°54′48.1″, 1863 m, 24.VI.2012, 2 ♂♂, Eskipolat, N 40°04′30.8″, E 040°56′45.1″, 1847 m, 24.VI.2012, 2 ♂♂; Yakutiye, Karagöbek, N 40°10′15.1″, E 041°26′14.9″, 2033 m, 13.VII.2011, 2 ♂♂, University field, 1850 m, 15.VII.2010, ♂; Aşkale, Küçükova, N 39°47′36.8″, E 040°42′53.3″, 1896 m, 5.VII.2012, 2 ♂♂; Çat, Çirişli, N 39°31′16.4″, E 040°58′23.4″, 1876 m, 23.VII.2011, 2 ♂♂, Hınıs, 1742 m, 2.VII.2010, ♂; İspir, Çayırözü, N 40°33′13.4″, E 040°54′44.0″, 1947 m, 4.VIII.2012, 6 ♀♀, ♂, Madenköprübaşı, N 40°26′43.3″, E 040°51′31.7″, 1256 m, 22.VI.2011, 2 ♀♀; Karayazı, Kırgındere, 2215 m, 2.VII.2010, ♂; Köprüköy, Güzelhisar, 1930 m, 2.VII.2010, ♀; Narman, Çimenli, N 40°8′47″, E 041°53′22.5″, 2311 m, 19.VII.2011, ♂, İncedere, 1987 m, 21.VII.2010, ♂; Oltu, İğdeli, N 40°32′44.8″, E 041°50′27.6″, 1660 m, 30.VI.2012, 2 ♂♂; Olur, Boğazgören, N 40°49′19.2″, E 042°12′42,.6″, 1168 m, 19.VII.2012, ♀; Pasinler, 29.VI.1987, 2 ♂♂, Çöğender, 1768 m, 30.VII.2011, ♀, Ügümü, N 40°00′39.9″, E 041°43′57.0″, 1724 m, 17.VII.2011, ♀, ♂; Pazaryolu, N 40°25′02.8″, E 040°46′41.3″, 1452 m, 15.VII.2012, 3 ♂♂, N 40°25′12.8″, E 040°46′13.5″, 1450 m, 24.VII.2011, ♀, ♂, N 40°25′12.6″, E 040°46′13.9″, 1430 m, 4.VIII.2012, 3 ♀♀, ♂; Şenkaya, Gözebaşı, N 40°24′39.9″, E 042°18′11.5″, 1794 m, 14.VII.2012, 2 ♂♂, İçmesu, N 40°25′27.0″, E 042°18′32.1″, 1656 m, 14.VII.2012, 2 ♂♂; Tekman, Körsu, N 39°34′8.2″, E 041°44′30.2″, 1901 m, 16.VII.2011, ♂; Tortum, N 40°16′37.4″, E 041°33′30″, 1661 m, 23.VI.2011, ♀, N 40°16′38″, E 041°33′29.9″, 1660 m, 31.VII.2011, 2 ♀♀; Iğdır: Tuzluca, Menderes, 1100 m, 23.VI.2010, ♀; Kars: Sarıkamış, Karakurt, 1500 m, 22.VI.2012, 2 ♀♀.

Distribution in Turkey: Bursa (Hoberlandt, 1955; Önder et al., 1981); Afyonkarahisar, Balıkesir, Bilecik, Çanakkale, Çankırı, Edirne, Kayseri, Kırklareli, Kütahya, Manisa, Tekirdağ (Önder, 1976); Mardin (Önder et al., 1995); İçel (Lodos et al., 2003); Antalya, Gaziantep, Erzurum, Hatay, Kahramanmaraş, Karaman, Kilis, Mersin, Osmaniye (Önder et al., 2006); İzmir (Tezcan et al., 2010).

Distribution in the world: Germany (Göllner-Scheiding, 1974); Italy (Tamanini, 1981); North America (Kerzhner & Schuh, 2001); Nearctic and Palearctic regions (Önder et al., 2006); Russia (Vinokurov & Golub, 2007); Holarctic, Iranian (Linnavuori, 2007, 2009); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010).

Orthocephalus vittipennis (Herrich-Schaeffer, 1835) (Fig. 1F)

Material examined: Erzurum: Yakutiye, Karagöbek, 1998 m, 3.VIII.2009, ♂.

Distribution in Turkey: Bolu (Hoberlandt, 1955); Artvin, Bilecik, Muş (Önder, 1976); Kahramanmaraş (Lodos et al., 2003); Antalya, Artvin, Bilecik, Kars, Muş (Önder et al., 2006).

Distribution in the world: Caucasia, Turkey (Hoberlandt, 1955); Germany (Göllner-Scheiding, 1974); Europe (Kerzhner & Schuh, 2001); Palearctic Region (Önder et al., 2006); West Palearctic region, Iran (Linnavuori, 2007); Russia (Vinokurov & Golub, 2007); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010); Czech Republic (Malenovský et al., 2011).

Genus *Strongylocoris* Blanchard, 1840

Strongylocoris leucocephalus (Linnaeus, 1758) (Fig. 1G)

Material examined: Erzurum: Karayazı, Yeniköy, N 39°43′31.8″, E 041°59′29.5″, 2199 m, 17.VI.2012, ♀, ♂; Köprüköy, Güzelhisar, 1930 m, 2.VII.2010, ♂; Narman, Göllü, N 40°13′52.1″, E 041°52′06.0″, 1842 m, 30.VI.2012, ♀; Oltu, Özdere, N 40°25′19.5″, E

041°43′25.1′′, 1822 m, 6.VII.2012, ♀, 2 ♂♂, Tutmaç, N 40°27′23.2′′, E 041°44′41.4′′, 1720 m, 16.VII.2012, 2 ♂♂.

Distribution in Turkey: Edirne (Hoberlandt, 1955); Bilecik, Kars, Manisa (Önder, 1976); Sakarya (Lodos et al., 2003; Önder et al., 2006).

Distribution in the world: Caucasia, Middle Asia, Turkey (Hoberlandt, 1955); Russia (Kerzhner, 1973); Italy (Tamanini, 1981); Russia (Lehr, 1988; Vinokurov & Golub, 2007); Germany (Schuster, 2005); Palearctic region (Önder et al., 2006); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010); Czech Republic (Malenovský et al., 2011); Canary Islands (Luis, 2013).

***Strongylocoris niger* (Herrich-Schaeffer, 1835) (Fig. 1H)**

Material examined: Erzurum: Aziziye, Rizekent, 2070 m, 30.VII.2010, ♂; Yakutiye, Ortadüzü, 12.VII.2009, 1850 m, 2 ♀♀; Köprüköy, Ilıcasu, N 40°5′39.6′′, E 041°51′57.1′′, 2111 m, 30.VII.2011, ♂; Pasinler, Sansar deresi, N 40°04′21.5′′, E 041°43′28.5′′, 1877 m, 17.VII.2011, ♀, Yayla, N 40°05′42.7′′, E 041°44′03.5′′, 1990 m, 17.VII.2011, 2 ♀♀.

Distribution in Turkey: Edirne (Hoberlandt, 1955); Edirne, Kars (Önder, 1976); Edirne, Kars (Önder et al., 2006); Elazığ (Matocq et al., 2014).

Distribution in the world: Israel, Caucasia, Turkestan, Turkey (Hoberlandt, 1955); Iranian, Israel (Linnavuori, 1961; 2007); Palearctic Region (Önder et al., 2006); Russia (Vinokurov & Golub, 2007); Croatia (Pajačet al., 2010); Czech Republic (Malenovský et al., 2011).

Tribe Orthotylini Van Duzee, 1916

Genus *Blepharidopterus* Kolenati, 1845

***Blepharidopterus angulatus* (Fallén, 1807) (Fig. 1I)**

Material examined: Erzincan: Yukarı Çakırman, 28.VIII.1991, ♂; Erzurum:Yakutiye, University field, 1850 m, 24.VIII.1998, ♂.

Distribution in Turkey: Artvin, (Önder, 1976); Ankara, Bolu, Karabük, Zonguldak (Lodos et al., 2003; Önder et al., 2006); İzmir (Tezcan et al., 2010).

Distribution in the world: Russia (Kerzhner, 1973); Italy, Canada, Turkey (Tamanini, 1981); Russia (Lehr, 1988; Vinokurov & Golub, 2007); Swedish (Kerzhner & Schuh, 2001); Azores Island, Nearctic ve Palearctic regions (Önder et al., 2006); Holarctic, Iranian (Linnavuori, 2007); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010); Canary Islands (Luis, 2013).

Genus *Brachynotocoris* Reuter, 1880

***Brachynotocoris puncticornis* Reuter, 1880 (Fig. 1İ)**

Material examined: Erzincan: Küçük Çakırman, 28.VIII.1991, ♀; Erzurum:Yakutiye, Dadaşköy, N 39°55′39.5′′, E 041°15′23.2′′, 1806 m, 4.VIII.2011, ♂, University field, 1850 m, 2.VIII.1998, 3 ♂♂, 5.VIII.1998, ♂, 7.VIII.1998, ♂, 12.VIII.1998, ♂, 18.VIII.1997, ♀, 20.VIII.1998, ♂; Pasinler, Övenler, N 39°59′17′′, E 041°34′43.9′′, 1710 m, 21.VIII.2011, ♂; Şenkaya, Paşalı, N 40°40′08.7′′, E 042°12′18.4′′, 1106 m, 19.VII.2011, ♀;Iğdır: Akyumak, 18.VII.1981, ♀.

Distribution in Turkey: Kırklareli (Önder, 1976); Sakarya (Önder et al., 1981); Diyarbakır (Önder et al., 1995); Adana,Hatay, İçel (Lodos et al., 2003); Gaziantep, Kırşehir, Konya, Mersin, Nevşehir (Önder et al., 2006).

Distribution in the world: Iranian (Linnavuori & Modarres, 1999; Linnavuori, 2009); Germany, Morocco, France, Russia, Spain, Italy, Portugal, Turkey (Önder et al., 2006); Iran, Northern Mediterranean (Linnavuori, 2007); Spain (Goula & Serra, 2010); Europe, Iran, Caucasia (Ghahari, 2013); Canary Islands (Luis, 2013).

Genus *Globiceps* Lepeletier & Serville, 1825

Subgenus *Kelidocoris* Kolenati, 1845

***Globiceps (Kelidocoris) fulvicollis* Jakovlev, 1877 (Fig. 1J)**

Material examined: Erzurum: Palandöken, Abdurrahmangazi, 2170 m, N 39°52′36.0′′, E 041°18′35.2′′, 22.VII.2012, ♀, 2190 m, 27.VII.2010, ♀, 2197 m, 1.VIII.2010, ♀, Kümbet, N 39°48′57.8′′, E 041°0.4′33′′, 1836 m, 9.VIII.2011, ♀; Yakutiye, Atatürk University field, 1850 m, 9.VII.2007, 2 ♂♂, 14.VII.1996, ♂, 16.VII.1996, 4 ♂♂, 22.VII.2009, 2 ♀♀, ♂, N 39°53′59,1′′, E 041°14′19,0′′, 1880 m, 22.VII.2011, 5 ♀♀, ♂, 1850 m, 23.VII.2008, 5 ♀♀, 25.VII.2007, ♂,

26.VII.2010, 2 ♂♂, 27.VII.2010, ♀, 30.VII.1996, ♂; Hınıs, N 39°52′33′′, E 041°16′46′′, 1955 m, 26.VI.2011, 2 ♂♂; Narman, Araköy, N 40°21′57.9′′, E 041°55′20.3′′, 1472 m, 23.VI.2011, ♀; Pazaryolu, N 40°25′12.1′′, E 040°47′07.7′′, 1495 m, 24.VII.2011, 2 ♀♀, 1010 m, 7.VIII.2009, ♀; Tortum, Aşağı Sivri, N 40°19′33.8′′, E 041°31′46.9′′, 1546 m, 16.VII.2012, ♀, ♂, Kireçli Geçidi, 1987 m, 21.VII.2010, 2 ♀♀, Taşbaşı, N 40°15′26.6′′, E 041°32′13.8′′, 1816 m, 13.VII.2011, ♀; Iğdır: Çalpala, 950 m, 23.VI.2010, ♂; Kars: Sarıkamış, 1900 m, 13.VIII.2009, ♂.
Distribution in Turkey: Edirne (Hoberlandt, 1955).
Distribution in the world: Caucasia, Turkestan (Hoberlandt, 1955); Germany (Schuster, 2005); West Palearctic, Iranian (Linnavuori, 2007); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010).

Genus *Heterocordylus* Fieber, 1858
Subgenus *Heterocordylus* Fieber, 1858
***Heterocordylus (H.) tumidicornis* (Herrich-Schäffer, 1835) (Fig. 1K)**

Material examined: Erzurum: Pasinler, 1.VIII.1983, ♀, Ügümü, N 40°00′39.9′′, E 041°43′57.0′′, 1724 m, 17.VII.2011, 6 ♀♀.
Distribution in Turkey: Amasya, Balıkesir, Bilecik, Çanakkale, Kütahya (Önder, 1976); Zonguldak (Lodos et al., 2003; Önder et al., 2006); İzmir (Tezcan et al., 2010).
Distribution in the world: Germany (Kerzhner & Schuh, 2001); Palearctic region (Önder et al., 2006); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010); Czech Republic (Malenovský et al., 2011).

Genus *Malacocoris* Fieber, 1858
***Malacocoris chlorizans* (Panzer, 1794) (Fig. 1L)**

Material examined: Artvin: Yusufeli, Demirkent, 14.VIII.1991, ♀, ♂; Erzurum: Aşkale, Küçükova, N 39°47′36.8′′, E 040°42′53.3′′, 1896 m, 5.VII.2012, ♀; İspir, 24.VII.1991, ♀; Oltu, 4.IX.1991, ♂; Pazaryolu, 27.VII.1991, ♂; Uzundere, Gölbaşı, 13.VIII.1991, ♂.
Distribution in Turkey: Artvin, Edirne, Giresun (Önder, 1976); Bursa, İstanbul, Sakarya (Önder et al., 1981); Antalya (Özkan, 1984); Adana (Öncüer, 1991); Bolu, Çorum, Kayseri, Nevşehir, Yozgat (Lodos et al., 2003; Önder et al., 2006).
Distribution in the world: Iranian (Linnavuori & Modarres, 1999; Linnavuori, 2009); Germany (Göllner-Scheiding, 1974; Kerzhner & Schuh, 2001; Schuster, 2005); Palearctic Region (Önder et al., 2006); West Palearctic region, Iranian (Linnavuori, 2007); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010); Canary Islands (Luis, 2013); Serbia (Prodanović & Protić, 2013).

Genus *Orthotylus* Fieber, 1858
Subgenus *Melanotrichus* Reuter, 1875
***Orthotylus (Melanotrichus) flavosparsus* (C.R. Sahlberg, 1841) (Fig. 1M)**

Material examined: Erzurum: Aziziye, 21.VII.1989, ♀, 3 ♂♂, 26.VII.1989, 3 ♂♂; Yakutiye, Dadaşköy, N 39°55′39.5′′, E 041°15′23.2′′, 1806 m, 4.VIII.2011, 10 ♀♀, 8 ♂♂, University field, 2.VII.1987, 4 ♀♀, ♂, 13.VII.1988, ♀, 16.VII.1989, ♀, ♂, 28.VII.1986, ♀, 2 ♂♂, 29.VII.1989, ♂, 13.VIII.1988, ♂, 17.VIII.1998, ♂, 22.VIII.1988, 2 ♀♀, ♂, 5.VIII.1998, ♂; Aşkale, Abdalcık, 1756 m, 1.VIII.2010, 2 ♀♀; Horasan, 16.VIII.1988, 2 ♂♂; İspir, Madenköprübaşı, N 40°26′34.3′′, E 040°50′42.4′′, 1245 m, 4.VIII.2012, ♂, Özlüce, N 40°31′13.8′′, E 040°55′11.1′′, 1736 m, 4.VIII.2012, 2 ♀♀, 9 ♂♂; Narman, 30.VI.1989, ♂, 2.VII.1987, 3 ♀♀, 6 ♂♂, Kışlaköy, N 40°19′20.7′′, E 042°02′08.3′′, 1892 m, 13.VIII.2012, 3 ♀♀, 6 ♂♂; Oltu, 3.VI.1989, 2 ♂♂, 30.VI.1989, ♂, 2.VII.1987, 3 ♀♀, 5 ♂♂, 2.VII.1989, ♂, 5.VIII.1988, ♂, 20.VIII.1988, 3 ♂♂, 23.VIII.1987, 2 ♂♂, Sarısaz, N 40°32′00.9′′, E 041°54′27.2′′, 1421 m, 30.VIII.2012, ♀; Pasinler, 1600 m, 25.VII.2009, 2 ♀♀, ♂, 16.VIII.1988, 2 ♀♀, ♂, Çöğender, 1740 m, 22.VI.2012, 3 ♀♀, 2 ♂♂, Demirdöven, 1727 m, 29.VII.2010, ♀, ♂, Övenler, N 39°59′17′′, E 041°34′43.9′′, 1710 m, 21.VIII.2011, ♂; Şenkaya, 2.VII.1989, ♂, 15.VIII.1988, 3 ♂♂; Tortum, Arılı, N 40°22′11.6′′, E 041°28′50.8′′, 1428 m, 30.VIII.2012, ♀; Iğdır: 830 m, 23.VI.2010, ♀, Akyumak, 18.VII.1991, ♀, Çalpala, 950 m, 23.VI.2010, ♂, Melekli, 850 m, 23.VI.2010, 2 ♀♀, 3 ♂♂, Aralık, 830 m, 23.VI.2010, 7 ♀♀, 2 ♂♂; Kars: Kağızman, Altıngedik, 1280 m, 22.VI.2010, ♀.

Distribution in Turkey: Iğdır (Hoberlandt, 1955); Afyonkarahisar, Ankara, Artvin, Çanakkale, Kütahya, Tekirdağ (Önder, 1976); Bolu, Bursa, İstanbul, Kocaeli, Sakarya (Önder et al., 1981); Erzurum (Özbek & Alaoğlu, 1987); İçel (Öncüer, 1991; Lodos et al., 2003); Diyarbakır (Önder et al., 1995); Afyonkarahisar, Ankara, Antalya, Artvin, Burdur, Çanakkale, Çorum, Eskişehir, Hatay, İzmir, Kahramanmaraş, Kars, Kastamonu, Kayseri, Kütahya, Nevşehir, Tekirdağ (Önder et al., 2006); İzmir (Tezcan et al., 2010).
Distribution in the world: A.B.D. (Edward, 1941); Caucasia, Turkestan (Hoberlandt, 1955); Russia (Kerzhner, 1973); Germany (Göllner-Scheiding, 1974; Schuster, 2005); Russia (Lehr, 1988; Vinokurov & Golub, 2007); Iranian (Linnavuori & Modarres, 1999; Linnavuori, 2009; Havaskary et al., 2015); Swedish (Kerzhner & Schuh, 2001); Canary Islands (Aukema et al., 2006; Luis, 2013); Nearctic, Neotropic and Palearctic regions, Azores Island, Canary Islands (Önder et al., 2006); Spain (Goula & Serra 2010); Croatia (Pajačet al., 2010); Latvia (Petrova et al., 2010).

Subgenus *Orthotylus* Fieber, 1858

***Orthotylus (Orthotylus) marginalis* Reuter 1883 (Fig. 1N)**

Material examined: Artvin: Ardanuç, Ferhatlı, 573 m, 15.VI.2010, ♀, Yusufeli, İşhan, 600 m, 16.VI.2010, ♂; Erzincan: Akyazı, 1202 m, 13.VI.2010, ♂; Erzurum: Aziziye, Başçakmak, N 40°00′09.8″, E 040°54′48.1″, 1863 m, 24.VI.2012, ♂, N 40°00′05.6″, E 040°54′39.3″, 1860 m, 20.VII.2011, ♀, Ortabahçe, N 39°53′35.3″, E 040°51′19.0″, 1763 m, 5.VII.2012, 5 ♂♂; Palandöken, Taşlıgüney, 2032 m, 26.VI.2009, 2 ♂♂; Yakutiye, Akdağ, 1820 m, 1.VII.2010, ♂, Dumlubaba, Güngörmez, 2500 m, 1.VII.2010, ♂, Karagöbek, N 40°10′15.1″, E 041°26′14.9″, 2033 m, 13.VII.2011, 2 ♂♂, University field, 1850 m, 25.VI.2009, ♂; Aşkale, Gölören, N 40°01′28.9″, E 040°47′55.1″, 1897 m, 18.VII.2012, 2 ♀♀, Küçükova, N 39°47′36.8″, E 040°42′53.3″, 1896 m, 5.VII.2012, ♀, ♂; Çat, Yaylasuyu Geçidi, 2322 m, 29.VI.2009, 2 ♂♂, Yukarı Çat, N 39°39′46.3″, E 041°00′56.2″, 2162 m, 23.VII.2011, ♀, 3 ♂♂; Horasan, Değirmenli, N 40°05′20.7″, E 042°06′56.7″, 1608 m, 22.VI.2012, ♂; Karaçoban, Duman, N 39°18′22″, E 041°55′5″, 1560 m, 26.VI.2011, ♂, Maruf, N 39°18′42″, E 041°55′5″, 1550 m, 26.VI.2011, ♀, ♂; Köprüköy, Güzelhisar, 1930 m, 2.VII.2010, 2 ♀♀, Marifet, N 39°50′03.1″, E 041°47′38.2″, 1685 m, 26.VI.2011, 2 ♂♂; Narman, Demirdağ, N 40°19′23.5″, E 041°42′45.5″, 2028 m, 16.VII.2012, 3 ♂♂; Oltu, 28.VI.1988, ♀, Çamlıbel, N 40°29′36.1″, E 041°45′45.2″, 1775 m, 13.VII.2011, ♀, Özdere, N 40°27′57.7″, E 041°44′11.9″, 1927 m, 16.VII.2012, ♂; Şenkaya, Gözebaşı, N 40°24′39.9″, E 042°18′11.5″, 1794 m, 14.VII.2012, ♂.
Distribution in Turkey: Edirne (Hoberlandt, 1955); Afyonkarahisar, Balıkesir, Bilecik, Çanakkale, Edirne, Kırklareli, Kütahya, Muğla, Uşak (Önder, 1976); Bolu, Bursa, Kocaeli (Önder et al., 1981); Adana, Ankara, Antalya, Eskişehir, İçel, Karaman, Kastamonu, Konya (Lodos et al., 2003); İzmir (Tezcan et al., 2010).
Distribution in the world: Caucasia, Turkey (Hoberlandt, 1955); Germany (Göllner-Scheiding, 1974; Schuster, 2005); Italy (Tamanini, 1981); Avrupa-Sibirya, Iranian (Linnavuori, 2007); Russia (Vinokurov & Golub, 2007); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010); Czech Republic (Malenovský et al., 2011); Canary Islands (Luis, 2013); Serbia (Prodanović & Protić, 2013).

***Orthotylus* (*Orthotylus*) *nassatus* (Fabricius, 1787) (Fig. 1O)**

Material examined: Erzurum: Yakutiye, University field, 1850 m, 30.VI.2009, ♂, 2.VIII.1996, ♀, 26.VIII.1997, ♀; Iğdır: 17.VII.1991, ♀, Akyumak, 18.VII.1991, ♀, 2 ♂♂.
Distribution in Turkey: Balıkesir, Bilecik, Mardin, (Önder, 1976); Bolu, Bursa, İstanbul, Kocaeli, Sakarya (Önder et al., 1981); Tokat (Çam, 1988); Mardin (Önder et al., 1995); Burdur, Kayseri (Çevik, 1996); Ankara, Antalya, Çorum, Eskişehir, Kahramanmaraş, Kastamonu, Kayseri, Konya, Nevşehir, Niğde (Lodos et al., 2003; Önder et al., 2006); İzmir, Manisa (Tezcan & Önder, 2003).
Distribution in the world: Israel**(**Linnavuori, 1961); Russia (Lehr, 1988); Germany (Göllner-Scheiding, 1974; Schuster, 2005); Nearctic and Palearctic regions (Önder et al., 2006); Russia (Vinokurov & Golub, 2007); West Palearctic region, Iranian (Linnavuori, 2007; 2009); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010).

***Orthotylus* (*Orthotylus*) *obscurus* Reuter, 1875 (Fig. 1Ö)**

Material examined: Erzurum: Yakutiye, University field, 1850 m, 26.VI.1996, ♂, 16.VII.1996, ♀; Narman, Göllü, N 40°13′52.1′′, E 041°52′06.0′′, 1842 m, 30.VI.2012, ♂; Tortum, 1653 m, 15.VI.2010, ♂, Pehlivanlı, N 40°29′37.1′′, E 041°30′17.6′′, 1158 m, 21.VII.2012, ♀, Şenyurt, 1265 m, 21.VII.2012, ♀.

Distribution in Turkey: Erzurum (Yıldırım et al., 1999).

Distribution in the world: Bulgaria, France, Romania, Yugoslavia (Tamanini, 1981); Germany (Schuster, 2005); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010).

Genus *Reuteria* Puton, 1875

***Reuteria marqueti* Puton, 1875 (Fig. 1P)**

Material examined: Erzurum: Yakutiye, University field, 1850 m, 19.VIII.1998, 2 ♂♂; Aşkale, Çayköy, N 39°56′46.6′′, E 040°48′27.4′′, 1720 m, 21.VI.2011, ♀; Çat, N 39°35′42.4′′, E 040°57′59.6′′, 1913 m, 23.VII.2011, ♀; Horasan, Dalbaşı, N 40°3′2.4′′, E 042°7′48.2′′, 1601 m, 17.VII.2011, ♂; Oltu, Demirtaş, N 40°24′58.6′′, E 041°44′14.4′′, 1888 m, 6.VII.2012, ♂.

Distribution in Turkey: Bursa (Önder et al., 1981); İçel (Lodos et al., 2003); Antalya (Önder et al., 2006).

Distribution in the world: Italy, Central Southern Europe (Tamanini, 1981); Nearctic and Palearctic regions (Önder et al., 2006); Spain (Goula & Serra, 2010); Croatia (Pajačet al., 2010); Austria, Germany (Brandner & Frieb, 2014).

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LITERATURE CITED

Altınayar, G. 1981. Orta Anadolu Bölgesi tahıl tarlalarındaki böcek faunasının saptanması üzerinde çalışmalar. Bitki Koruma Bülteni, 21 (2): 53-88.

Atakan, E. 2000. Avcı böcek *Chrysoperla carnea* S. (Neuroptera: Chrysopidae), *Deraeocoris pallens* Reut. (Hemiptera: Miridae) ve *Orius niger* Wolff (Hemiptera: Anthocoridae)'nin pamuk bitkisinde dağılımı. Turkey Entomoloji Dergisi, 24 (4): 267-277.

Aukema, B., Duffels, J. P. & Baez, M. 2006. A Checklist of the Heteroptera of the Canary Islands (Insecta). Denisia 19, Zugleich Kataloge der OÖ. Landesmuseen. Neue Serie, 50: 755-774.

Ayyıldız, Y. & Atlıhan, R. 2006. Balıkesir İli sebze alanlarında görülen yaprakbiti türleri ve doğal düşmanları. Yüzüncü Yıl Üniversitesi, Ziraat Fakültesi, Tarım Bilimleri Dergisi, 16 (1): 1-5.

Beyaz, G. 2000. Manisa yöresi kültür kekiği (*Origanum* spp.) üretim alanlarındaki Heteroptera takımına bağlı böcek faunasının belirlenmesi üzerine araştırmalar. Ege Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, s: 52.

Bingöl, C. M. 1978. Güneydoğu Anadolu Bölgesi'nde kültür yem bitkilerinde zarar yapan Miridae ve Curculionidae familyalarına ait böcek türleri, tanınmaları ve zararları üzerinde araştırmalar. Bölge Zirai Mücadele Araştırma Enstitüsü, 4: 7, Diyarbakır.

Brandner, J. & Frieb, T. 2014. Interessante wanzenfunde aus österreich und Bayern (Insecta: Heteroptera). Joannea Zoologie, 13: 13-127.

Cassis, G., Wall, M. & Schuh, R. T. 2006. Insect bodiversity and industrialising the taxonomic process: the Plant Bug Case Study (Insect:Heteroptera:Miridae). Reconstructing the Tree of Life, The Systematics Association Special Volume Series, 72: 193-212.

Cassis G. & Schuh, R. T. 2012. Systemetic, biodiversity, biogeography, and host associations of the Miridae (Insecta: Hemiptera: Heteroptera: Cimicomorpha). The Annual review of Entomology, 57: 377-404.

Çam, H. 1988. Tokat ve çevresinde kiraz, vişne ve idris ağaçlarında bulunan Heteroptera türlerinin tanınmaları ve beslenme rejimleri üzerinde araştırmalar. Ege Üniversitesi Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, İzmir, s: 52.

Çetin, H. & Alaoğlu, Ö. 2005. Mut (Mersin) İlçesinde zeytin ağaçlarında bulunan yararlı böcek türlerinin tespiti ve önemli türlerin popülasyon değişimi. Selçuk Üniversitesi, Ziraat Fakültesi Dergisi, 19 (36): 59-65.

Çevik, T. 1996. Orta Anadolu Bölgesi ceviz ağaçlarında zararlı ve faydalı faunanın tespiti üzerinde araştırmalar. Bitki Koruma Bülteni, 36 (1-2): 55-72.

Edward, L. T. 1941. State geological and natural history survey. State of Connecticut, Public Document No: 47: 499-658.

Ghahari, H. 2013. A study on Miridae (Hemiptera: Heteroptera) from Golestan National Park, Northern Iran. Linzer biol. Beitr., 45 (2): 1983-1989.

Goula, M. & Serra, J. R. A. 2010. Checklist of Heteroptera of Catalonia (Insecta, Hemiptera, Heteroptera) Version 1. Centre de Recursos de Biodiversitat Animal, pp: 40.

Göllner-Scheiding, U. 1974. Beitrage zur Heteropterenfauna Brandenburgs 3. Die Heteropterenfauna der Oderwiesen und hange bei Lebus/Oder (Hemiptera, Heteroptera). Faunistischeabhandlungen Staatliches Museum fur Tierkunde in Dresden, 5 (3): 181-198.

Güçlü, Ş., Hayat, R. & Özbek, H. 1995a. Erzurum ve çevre illerde ceviz (*Juglans regina* Linnaeus)'de bulunan fitofag böcek türlerinin tespiti üzerine araştırmalar. Turkey Entomoloji Dergisi, 19 (2): 137-145.

Güçlü, Ş., Hayat, R. & Özbek, H. 1995b. Artvin yöresinde zeytin (*Olea europaea* L.)'de bulunan fitofag ve predatör böcek türleri. Turkey Entomoloji Dergisi, 19 (3): 231-240.

Havaskary, M., Pourabad, R. F. & Rafiee, A. 2015. Fauna of plant bugs (Hemiptera: Heteroptera: Miridae) from Jolfa and Vicinity, NW Iran. Mun. Ent. Zool., 10 (1): 234-237.

Hoberlandt, L. 1955. Results of the zoological scientific expedition of the national museum in Praha to Turkey. Acta Entomologica Musei Nationalis Pragae, 3: 261 pp.

Karaat, Ş. 1986. Doğu ve Güneydoğu Anadolu Bölgelerinde tütün (*Nicotiana tabacum* L.)'de zararlı olan böcek türleri, tanınmaları, yayılış alanları ve zararları üzerinde araştırmalar. Diyarbakır Bölge Zirai Mücadele Araştırma Enstitüsü Müdürlüğü, Araştırma Eserleri Serisi, No: 4, s: 74.

Kerzhner, I. M. & Schuh, R. T. 2001. Corrections to the catalog "Plant Bugs of the World" By Randall T. Schuh (Heteroptera: Miridae). J. New York Entomol. Soc., 109 (2): 263-299.

Kıyak, S., Özsaraç, Ö. & Salur, A. 2004. Additional notes on the Heteroptera fauna of Nevşehir province (Turkey). G.U. Journal of Science, 17 (1): 21-29.

Lehr, P. A. 1988. Keys to the insects of the far east of the USSR, Volume II. (Hemiptera). Academy of Sciences of the USSR far east Branch Instıtute of Biology and Soil Sciences, pp: 211.

Linnavuori, R. E. & Modarres, M. 1999. Studies on the Hemiptera of the Khorasan province in NE Iran. II. Cimicomorpha: Miridae. Entomologica Fennica, 10: 215-231.

Linnavuori, R. E. 2007. Studies on the Miridae (Hemiptera) of Gilan and the adjacent provinces in northern Iran. II. list of species. Acta Entomologica Musei Nationalis Pragae, 47: 17-56.

Lodos, N., Önder, F., Pehlivan, E. & Atalay, R. 1978. Ege ve Marmara Bölgesinin zararlı bölge faunasının tespiti üzerine çalışmalar. T.C. Gıda-Tarım ve Hayvancılık Bakanlığı Zirai Mücadele ve Zirai Karantina Genel Müdürlüğü, Ankara, 135-136.

Lodos, N., Önder, F., Pehlivan, E., Atalay, R., Erkin, E., Karsavuran, Y. & Tezcan, S. 1989. Akdeniz bölgesinin ziraatta zararlı ve faydalı böcek faunasının tespiti üzerinde araştırmalar [Curculionidae, Scarabaeidae (Coleoptera), Plataspidae, Cydnidae, Acathosomatidae, Scutelleridae, Pentatomidae, Lygaeidae, Miridae (Hemiptera)]. Ege Üniversitesi, Ziraat Fakültesi, Bitki Koruma Bölümü, Bornova, İzmir, s: 75.

Lodos, N., Önder, F., Pehlivan, E., Atalay, R., Erkin, E., Karsavuran, Y., Tezcan, S. & Aksoy, S. 2003. Faunistic studies on Miridae (Hemiptera) of western Black Sea, Central Anatolia and Mediterranean Regions of Turkey. Department of Plant Protection Faculty of Agriculture University of Ege 35100 Bornova, İzmir, Turkey, s: 85.

Luis, V. 2013. Heteroptera, Equipo de Heterópteros de insectarium- biodiversidad virtual. BV news, Naticias de Biodiversidad y Geodiversidad Para el Naturalista, pp: 46.

Malenovský, I., Banar, P. & Kment, P. 2011. A contribution to the faunistics of the Hemiptera (Cicadomorpha, Fulgoromorpha, Heteroptera, and Psylloidea associated with dry grassland sites in southern Moravia (Czech Republic). Acta Musei Moraviae, Scientiae biologicae (Brno), 96 (1): 41-187.

Matocq, A., Pluot-Sigwalt, D. & Özgen, İ. 2014. Terrestrial Hemiptera (Heteroptera) collected in South-East Anatolia (Diyarbakır, Mardin and Elazığ Provinces) (Turkey): Second List. Mun. Ent. Zool., 9 (2): 884-930.

Önder, F. 1976. Turkey Miridae (Hemiptera) faunası üzerinde sistematik çalışmalar. Ege Üniversitesi Ziraat Fakültesi, Entomoloji ve Zirai Zooloji Kürsüsü, Doçentlik Tezi, İzmir, s: 506.

Önder, F., Ünal, A. & Ünal, E. 1981. Hemiptera fauna collected by light traps in some districts of northwestern part of Anatolia. Turkey Bitki Koruma Dergisi, 5 (3): 151-169.

Önder, F. & Lodos, N. 1987. Turkey'de bulunan predatör Hemiptera türleri üzerinde genel bir değerlendirme. Turkey Entomoloji Dergisi, 11 (2): 117-125.

Önder, F., Karsavuran, Y. & Tezcan, S. 1990. Yabancı ot savaşında potansiyel öneme sahip Turkey Hemiptera faunası üzerinde araştırmalar. Çevre Biyolojisi Sempozyumu, Ankara, s: 15.

Önder, F., Karsavuran, Y. & Tezcan, S. 1998. Investigations on the vertical distribution in the habitats of plant bugs (Hemiptera: Miridae) of Turkey. Ege Üniversitesi Ziraat Fakültesi Dergisi, 35 (1-3): 33-40.

Önder, F., Karsavuran, Y., Tezcan, S. & Fent, M. 2006. Turkey Hemiptera Kataloğu. Meta Basım Matbaacılık Hizmetleri, İzmir, s: 164.

Özbek, H. & Alaoğlu, Ö. 1987. Erzurum ve çevresinde patates bitkisinde bulunan fitofag Hemiptera türleri. Bitki Koruma Bülteni, 27 (3-4): 227-238.

Özkan, A. 1984. Antalya ve çevresi yumuşak çekirdekli meyve ağaçlarının Coleoptera ve Hemiptera takımlarına ait faydalı böcek türleri, tanınmaları, konukçuları ve önemlilerinin etkinlikleri üzerine araştırmalar. Biyolojik Mücadele Araştırma Enstitüsü, Antalya, s: 65.

Özsaraç, Ö. & Kıyak, S. 2001. A study on the Hemiptera fauna of Bozcaada (Çanakkale Province). Turk. J. Zool., 25: 313-322.

Pajač, İ., Barić, B. & Milošević, B. 2010. Katalog Stjenica (Heteroptera: Miridae) Hrvatske. Entomol. Croat., 14 (1-2): 23-76.

Petrova, V., Samsone, I. & Jankevica, L. 2010. True bug community on strawberry fields of Latvia. Environmental and Experimental Biology, 8: 71-74.

Prodanovic, D. J. & Protic, L. J. 2013. True bugs (Hemiptera, Heteroptera) as psyllid predators (Hemiptera, Psylloidea). ZooKeys, 319: 169-189.

Schuster, G. 2005. Wanzen aus Bayern IV (Insecta, Heteroptera). Bericht der Naturf. Gesellsch. Augsburg, 63-124.

Tamanini, L. 1981. Gli Eterotteri Della Basilicata e Della Calabria (Italia Meridionale (Hemiptera: Heteroptera). Memorie Del Museo Civico di Storia Naturale di Verona (Ipa Serie) Sezione Scienze Della Vita (A: Biologica), No 3: 75.

Tezcan, S. & Önder, F. 1999. Heteropterous insects associated with cherry trees in Kemalpaşa district of İzmir, Turkey. Ege Üniversitesi Ziraat Fakültesi Dergisi, 36 (1-3): 119-124.

Tezcan, S. & Önder, F. 2003. İzmir ve Manisa illeri ekolojik kiraz bahçelerinin faunası üzerinde araştırmalar: Hemiptera takımına bağlı türler üzerinde bir değerlendirme. Anadolu, 13 (1): 124-131.

Tezcan, S., Tezcan, F. & Gülperçin, N. 2010. İzmir'den 4000 Böcek Türü. Egetan Bas. Yay. Tan. Ltd. Şti., İzmir, pp: 250.

Vinokurov, N. N. & Golub, V. B. 2007. New records of plant bugs from the Asian part of Russia (Heteroptera: Miridae). Zoosystematica Rossica, 16 (1): 27-30.

Wheeler, A. G. & Henry, J. T. 2004. Plant Bugs (Hemiptera: Miridae). Encyclopedia of Entomology, USA.

Wheeler, A. G. 2001. Biology of the plant bugs. Cornell University Press, Ithaca, NY, pp: 507.

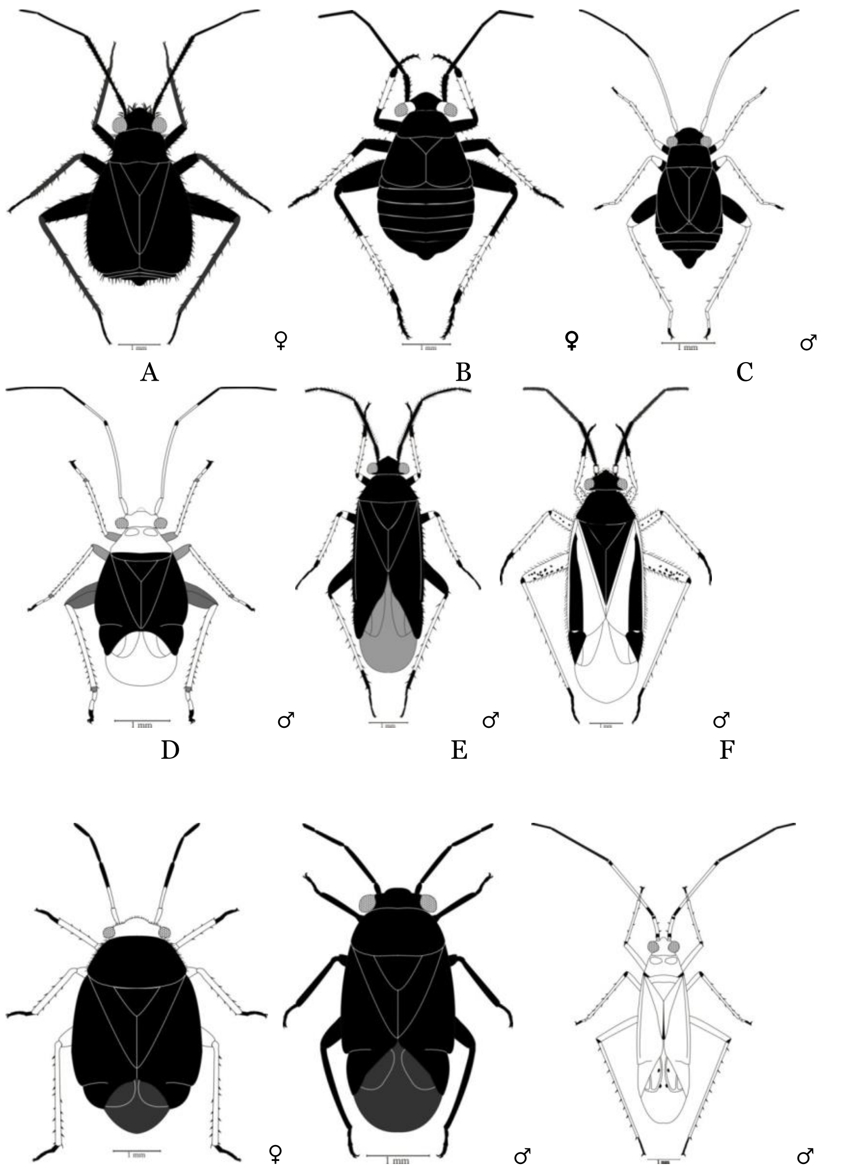
Yaşarakıncı, N. & Hıncal, P. 1997. İzmir ilinde örtü altında yetiştirilen domates, hıyar, biber ve marulda bulunan zararlı ve faydalı türler ile bunların popülasyon yoğunlukları üzerinde araştırmalar. Bitki Koruma Bülteni, 37 (1-2): 79-89.

Yaşarakıncı, N. & Hıncal, P. 2000. İzmir ilinde örtü altında yetiştirilen patlıcanda bulunan zararlılar ile bunların doğal düşmanları ve popülasyon gelişmeleri üzerinde çalışmalar. Bitki Koruma Bülteni, 40 (1-2): 29-48.

Yayla, A. 1983. Antalya ve çevresi zeytin ağaçlarında rastlanan faydalı Hemipter'lerin tanınmaları, konukçuları ve etkinlikleri üzerine araştırmalar. Biyolojik Mücadele Araştırma Enstitüsü, Antalya, s: 58.

Yıldırım, E. & Özbek, H. 1992. Erzurum Şeker Fabrikasına bağlı şekerpancarı üretim alanlarındaki zararlı ve yararlı böcek türleri. Turkey II. Entomoloji Kongresi, 28-31 Ocak 1992, Adana, 621-635.

Yıldırım, E., Özbek, H. & Önder, F. 1999. Atatürk Üniversitesi (Erzurum) kampus alanında ışık tuzaklarında yakalanan Hemiptera türleri üzerinde bir araştırma. Turkey Entomoloji Dergisi, 23 (3): 225-228.



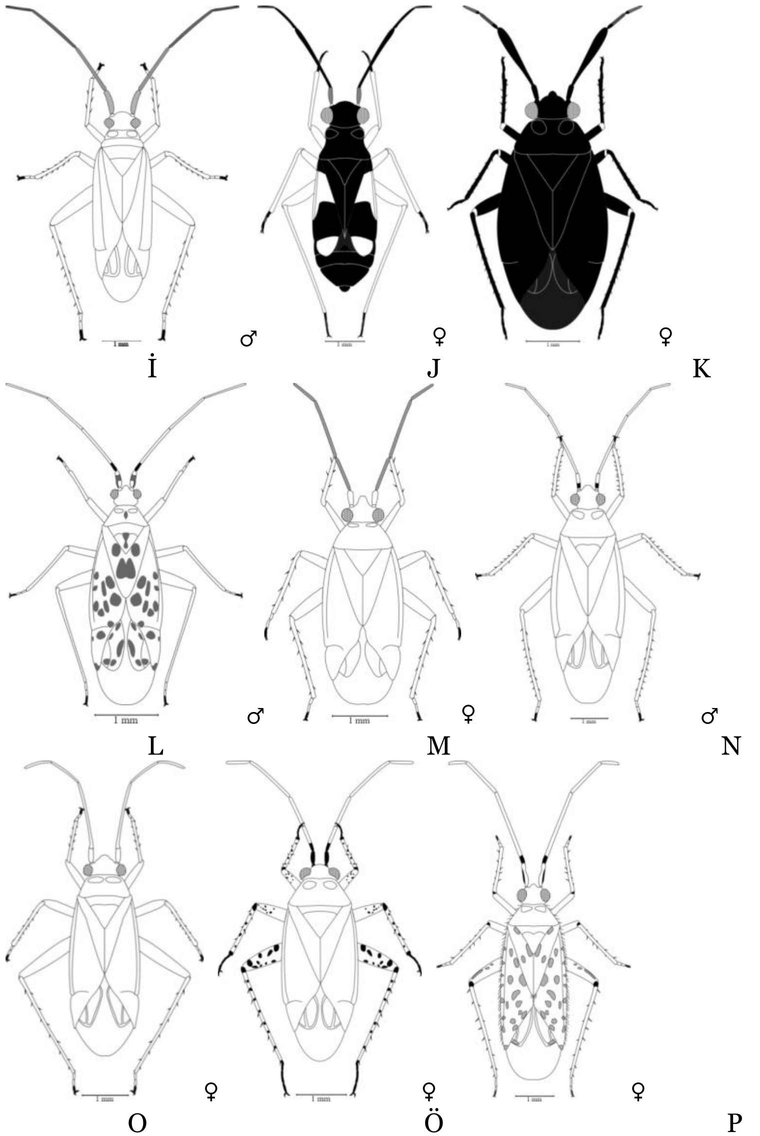


Figure 1. A- *Anapus dorsalis* (Reuter 1890); B- *Euryopicoris nitidus*(Meyer-Dur 1843); C- *Halticus apterus*(Linnaeus 1758); D- *Halticus luteicollis*(Panzer 1804); E- *Orthocephalus saltator* (Hahn 1835); F- *Orthocephalus vittipennis* (Herrich-Schaeffer 1835); G- *Strongylocoris leucocephalus* (Linnaeus 1758); H- *Strongylocoris niger* (Herrich-Schaeffer 1835); I- *Blepharidopterus angulatus* (Fallen 1807); İ- *Brachynotocoris puncticornis* Reuter 1880; J- *Globiceps fulvicollis* Jakovlev 1877; K- *Heterocordylus tumidicornis* (Herrich-Schäffer 1835); L- *Malacocoris chlorizans* (Panzer 1794); M- *Orthotylus (Melanotrichus) flavosparsus* (C.R. Sahlberg 1841); N- *Orthotylus (Orthotylus) marginalis* Reuter 1883; O- *Orthotylus (Orthotylus) nassatus* (Fabricius 1787); Ö- *Orthotylus (Orthotylus) obscurus* Reuter 1875; P- *Reuteria marqueti* Puton 1875.

A NEW SUBSPECIES OF *PLAGIONOTUS ARCUATUS* (LINNAEUS, 1758) FROM TURKEY (COLEOPTERA: CERAMBYCIDAE: CERAMBYCINAE)

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[**Özdikmen, H., Atak, Ş. & Uçkan, F.** 2017. A new subspecies of *Plagionotus arcuatus* (Linnaeus, 1758) from Turkey (Coleoptera: Cerambycidae: Cerambycinae). Munis Entomology & Zoology, 12 (1): 89-93]

ABSTRACT: The following new subspecies is described: *Plagionotus arcuatus tastani* ssp. nov. from Kocaeli province in Turkey. Accordingly, possible distribution area of new subspecies is discussed. Akey for the subspecies of *Plagionotus arcuatus* is also given.

KEY WORDS: Cerambycidae, Cerambycinae, *Plagionotus arcuatus*, new subspecies, Turkey

Plagionotus arcuatus tastani ssp. nov.

(Fig. 1, 2)

Plagionotus arcuatus was described by Linnaeus (1758) from Europe. Firstly, 3 subspecies of the species were described and restored by Lazarev (2010) as *Plagionotus arcuatus kirgizicus* Lazarev, 2010 from Kirghizia, *Plagionotus arcuatus multiinterruptus* Pic, 1933 from Armenia and *Plagionotus arcuatus lugubris* (Ménétriés, 1832) from Azerbaijan. Then, one subspecies was described by Pesarini & Sabbadini (2011) from Crete (Greece) as *Plagionotus arcuatus ghidottii* Pesarini & Sabbadini, 2011.

According to Danilevsky (2016), *Plagionotus arcuatus* (Linnaeus, 1758) is distributed in Europe, North Africa, Iran, Kazakhstan, Kirghizia, Syria, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Turkmenistan. A careful study of 30 specimens of the species *Plagionotus arcuatus* (Linnaeus, 1758) close to the nominative subspecies *Plagionotus arcuatus arcuatus* (Linnaeus, 1758) from Kocaeli province in Turkey allows the description of a new subspecies, *Plagionotus arcuatus tastani* ssp. nov. The holotype (male) and paratype (female) of the new subspecies are photographed and preserved in the collection of the second autor (Turkey: Kocaeli prov.).

The new subspecies is close to the nominative subspecies. It is characterized by poor developed transverse stripes behind the middle of elytra especially. Antemedian band of elytra usually (9 males and 11 females of 30 specimens) is more or less complete but sometimes (3 males and 7 females of 30 specimens) is divided into an outer and an inner spots. The spots are well separated. Erect abdominal setae are not very dense.

Distribution: The taxon should be distributed in all territory of Turkey. So the old records of *Plagionotus arcuatus* from Turkey should be attributed to the new subspecies. Moreover, the records of the nominative subspecies from Georgia, Iran, Kazakhstan and Syria must be attributed to the new subspecies very likely.

Etymology: This name is dedicated to Prof. Dr. Hakkı Taştan (Turkey).

Consequently, the species *Plagionotus arcuatus* (Linnaeus, 1758) has 6 subspecies as follows:

***Plagionotus arcuatus arcuatus* (Linnaeus, 1758)**

Original combination: *Leptura arcuata* Linnaeus, 1758: 399
Type information: Syntypes, ex collection C. Linnaeus, Zoologiska Institutionen, Uppsala [type locality "Suecia" (Sweden)]
Distribution: Europe and North Africa (Algeria, Morocco, Tunisia)

***Plagionotus arcuatus ghidottii* Pesarini & Sabbadini, 2011**

Original combination: *Plagionotus arcuatus ghidottii* Pesarini & Sabbadini, 2011: 47
Type information: Holotype male, ex collection C. Pesarini & A. Sabbadini, Milano [type locality "Lakki" (Greece: Crete)]
Distribution: Greece (Crete)

***Plagionotus arcuatus kirgizicus* Lazarev, 2010**

Original combination: *Plagionotus arcuatus kirgizicus* Lazarev, 2010: 161
Type information: Holotype male, ex collection M. Danilevsky, Moscow [type locality "Fergana Ridge, Kara-Unkiur river, Kyzyl Unkiur env." (Kirghizia)]
Distribution: Kirghizia

***Plagionotus arcuatus lugubris* (Ménétriés, 1832)**

Original combination: *Clytus lugubris* Ménétriés, 1832: 229
Type information: Syntypes, ex collection Ménétriés, Collection of Zoological Institute of the Russian Academy of Sciences, Saint-Petersbourg [type locality "Talysh Mountain ridge" (Azerbaijan)]
Distribution: Armenia, Azerbaijan, Iran and Turkmenistan

***Plagionotus arcuatus multiinterruptus* Pic, 1933**

Original combination: *Plagionotus arcuatus* var. *multiinterruptus* Pic, 1933: 6
Type information: Lectotype male, ex collection M. Pic, Muséum National d'Histoire Naturelle, Paris [type locality "Caucasus. Araxesthal" (Armenia, Nakhichevan)]
Reports from Turkey: Artvin: Saçinka Forests (Acısu) (Sekendiz, 1981);
Distribution: Transcaucasia (Armenia, Nakhichevan of Azerbaijan, NE Turkey

***Plagionotus arcuatus tastani* ssp. nov.**

Type information: Holotype male, ex collection Ş. Atak, Kocaeli [type locality "Kocaeli province: Gebze" (Turkey)]
Material examined: Holotype male: Kocaeli province: Gebze, Lat: 40.825921 Lng: 29.497796, 23.VI.2016, Paratypes 2 males and 3 females: The same data of holotype, 8 males and 8 females: Kocaeli province: Gebze, Lat: 40.819622 Lng: 29.493633, 23.V.2016, 1 female: Kocaeli province: Gebze, Lat: 40.825921 Lng: 29.497796, 01.VI.2016, 1 female: Kocaeli province: Gebze, Lat: 40.824195 Lng: 29.500479, 08.VI.2016, 1 female: Kocaeli province: Gebze, Lat: 40.824195 Lng: 29.500479, 08.VI.2016, 1 male: Kocaeli province: Gebze, Lat: 40.824195 Lng: 29.500479, 08.VI.2016, 1 male: Kocaeli province: Gebze, Lat: 40.824195 Lng: 29.500479, 08.VI.2016, 2 females: Kocaeli province: Başiskele, Lat: 40.696860

Lng:29.894771, 19.VI.2016, 1 female: Kocaeli province: Gebze, Lat: 40.825900 Lng:29.497778, 23.VI.2016.

Reports from Turkey: Hatay prov.: Akbez (Pic, 1892); İstanbul prov.: Belgrad Forest, Bosphorus region (Acatay, 1943; Schimitschek, 1944); İstanbul prov.: Alem Mt. (Demelt, 1967); Isparta prov.: Eğirdir (Tuatay et al., 1972); Düzce prov.: Central, İstanbul prov.: Bahçeköy (Öymen, 1987); Tokat prov.: Topçam Mt., Kastamonu prov.: Masruf pass. (Adlbauer, 1992); European Turkey (Althoff & Danilevsky, 1997); Muş prov., Osmaniye prov. (Tozlu et al., 2002); Bilecik prov.: İnegöl-Bozüyük, Çanakkale prov.: Kirazlı (Malmusi & Saltini, 2005); Isparta prov.: Eğirdir (Özdikmen et al., 2005); Samsun prov.: Alaçam (Doyran) (Özdikmen, 2007); Isparta prov.: Yukarigökdere 30 km S of Eğirdir: Kasnak Forest National Park (Sama et al., 2011); Bingöl prov.: 30/36 km east of Bingöl, Muş prov.: Buğlan pass (Sama, Rapuzzi & Özdikmen, 2012).

Distribution: Turkey, ?Georgia, ?Iran, ?Kazakhstan, ?Syria

A key for all subspecies of *Plagionotus arcuatus* (Linnaeus, 1758)

1. Pronotum without or with relatively poor developed light pubescence..............2
-. Pronotum with light pubescence...4

2. Transverse stripes (postmedian and posterior stripes) behind middle of elytra complete; distributed in Kirghizia..................*P. arcuatus kirgizicus* Lazarev, 2010
-. At least posterior stripe of elytra usually reduced small spots.............................3

3. Legs and antennae usually totally black or sometimes partly reddish; usually white pale or sometimes pale-yellow strongly reduced pubescence; distributed in Armenia, Azerbaijan, Iran and Turkmenistan...
....*P. arcuatus lugubris* (Ménétriés, 1832)
-. Legs and antennae usually red with darkened femora; usually yellow light body pubescence; distributed in Armenia, Azerbaijan and NE Turkey.............................
....*P. arcuatus multiinterruptus* Pic, 1933

4. Transverse stripes behind middle relatively stronger developed; distributed in Europe and North Africa (Algeria, Morocco, Tunisia)..
....*P. arcuatus arcuatus* (Linnaeus, 1758)
-. Transverse stripes behind middle relatively poor developed...............................5

5. Antemedian band of elytra always divided into an outer spot strongly inclinator well separated from an inner spot in the shape of a stain, while the postmedian band of elytra strongly arched and angular forward; distributed in Crete (Greece)..
....*P. arcuatus ghidottii* Pesarini & Sabbadini, 2011
-. Antemedian band of elytra complete or sometimes divided into an outer stroke not strongly inclinator, while the postmedian band of elytra strongly arched but not angular forward; distributed in Turkey, ?Georgia, ?Iran, ?Kazakhstan, ?Syria...*P. arcuatus tastani* ssp. nov.

LITERATURE CITED

Adlbauer, K. 1992. Zur Faunistik und Taxonomie der Bockkäferfauna der Türkei II (Coleoptera, Cerambycidae). Entomofauna, 13 (30): 485-509.

Althoff, J. & Danilevsky, M. L. 1997. A Check-List of Longicorn Beetles (Coleoptera, Cerambycoidea) of Europe. Slovensko Entomološko Društvo Štefana Michielija. Ljubljana, 64 pp.

Danilevsky, M. L. 2016. Catalogue of Palaearctic Cerambycoidea. Available from: http://www.cerambycidae.net/ catalog.pdf (Updated: 09.05.2016).

Demelt, C. V. 1967. Nachtrag zur Kenntnis der Cerambyciden-Fauna Kleinasiens. Entomologische Blatter, 63 (2): 106-109.

Lazarev, M. A. 2010. New subspecies of *Plagionotus arcuatus* (Linnaeus, 1758) from Transcaucasia and Kyrgyzstan (Coleoptera: Cerambycidae). Studies and Reports of District Museum Prague-East, Taxonomical Series, 6 (1-2): 149-164.

Linnaeus, C. 1758. Systema naturæ per regna tria naturæ secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Systema naturae (Editio 10) Laur. Salvius. Holmiae. 1: iii + 824 pp.

Malmusi, M. & Saltini, L. 2005. Cerambycidae raccolti dai componenti del Gruppo Modenese Scienze Naturali durante escursioni in Turchia tra il 1987-2003 (Contributo alla Fauna dei Cerambycidae di Turchia). Quaderno di studi e notizie di storia naturale della Romagna, n. 21, 28 pp. (unpublished).

Ménétriés, E. 1832. Catalogue raisonné des objets de Zoologie recueillis dans un voyage au Caucase et jusqu'aux frontières actuelles de la Perse entrepris par ordre de S. M. L' Empereur. Saint-Pétersbourg 4: 1-271 + i-xxxviii, 5 pls.

Öymen, T. 1987. The Forest Cerambycidae of Turkey. İ. Ü. Forest Faculty, İstanbul, 146 pp.

Özdikmen, H. 2007. The Longicorn Beetles of Turkey (Coleoptera: Cerambycidae) Part I - Black Sea Region. Munis Entomology & Zoology 2 (2): 179-422.

Özdikmen, H., Özdemir, Y. & Turgut, S. 2005. Longhorned Beetles Collection of the Nazife Tuatay Plant Protection Museum, Ankara, Turkey (Coleoptera, Cerambycidae). J. Ent. Res. Soc., 7 (2): 1-33.

Pesarini, C. & Sabbadini, A. 2011. Note su Cerambycidae di Grecia e Turchia, con descrizione di tre nuove specie e una nuova sottospecie (Coleoptera). Annali del Museo Civico di Storia Naturale di Ferrara, 13 (2010): 41-59.

Pic, M. 1892. Voyage de M. Charles Delagrange dans la Haute-Syrie. Année 1891 (1) Longicornes. Annales de la Société Entomologique de France, Paris, 61: 413-422.

Pic, M. 1933. Notes diverses, nouveautés (Suite.). L'Échange, Revue Linnéenne, 49 (452): 5-6.

Sama, G., Jansson, N., Avcı, M., Sarıkaya, O., Coşkun, M., Kayış, T. & Özdikmen, H. 2011. Preliminary report on a survey of the saproxylic beetle fauna living on old hollow oaks (Quercus spp.) and oak wood in Turkey (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 6 (2): 819-831

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

Schmitschek, E. 1944. Forstinsekten der Türkei und Ihre Umwelt Grundlagen der türkischen Forstentomologie, Volk und Reich Verlag Prag, 125-141 pp.

Sekendiz, O. A. 1981. Doğu Karadeniz bölümünün önemli teknik hayvansal zararlıları üzerine araştırmalar. K. T. Ü. Orman Fakültesi Yayınları no: 12, Trabzon, 114 pp.

Tozlu, G., Rejzek, M. & Özbek, H. 2002. A contribution to the knowledge of Cerambycidae (Coleoptera) fauna of Turkey. Part I: Subfamilies Prioninae to Cerambycinae. Biocosme Mèsogèen, Nice, 19 (1-2): 55-94.

Tuatay, N., Kalkandelen, A. & Aysev, N. 1972. Bitki Koruma Müzesi Böcek Kataloğu (1961-1971). T. C. Tarım Bakanlığı, Ankara, 53-55.

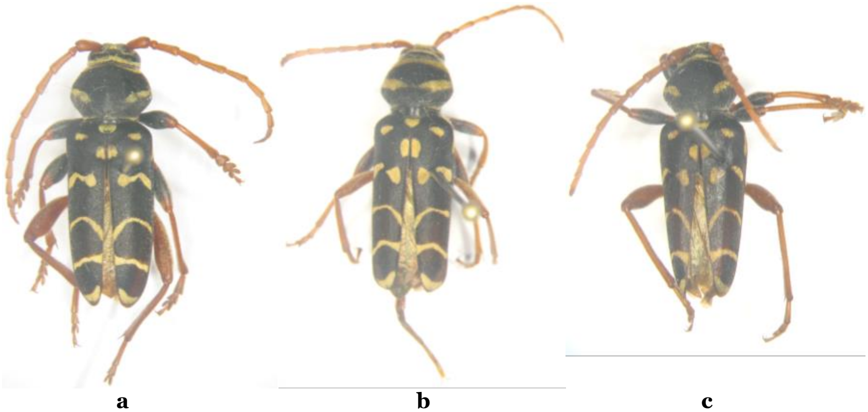

Figure 1. *Plagionotus arcuatus tastani* ssp. nov., a. Holotype male from Gebze, b. Paratype female from Gebze, c. Paratype male from Gebze.

Figure 2. Variation patterns of *Plagionotus arcuatus tastani* ssp. nov., a. Holotype male from Gebze, b. Paratype female from Gebze, c. Paratype male from Gebze, d. Paratype male from Gebze, e. Paratype female from Gebze, f. Paratype female from Başiskele, g. Paratype male from Gebze, h. Paratype male from Gebze, i. Paratype female from Gebze, j. Paratype female from Gebze, k. Paratype female from Gebze, l. Paratype female from Gebze.

PARASITES AND PATHOGENIC BACTERIA ASSOCIATED WITH HOUSEFLIES AND THE PUBLIC HEALTH IMPLICATIONS IN OSOGBO, SOUTHWESTERN NIGERIA

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ABSTRACT: Houseflies are known as nuisance pests due to their ubiquitous nature in the environment. The present study investigates the roles of houseflies as mechanical vectors of parasites and bacteria in Osogbo, Southwestern Nigeria. The body parts of the houseflies collected from slaughter slabs, dumping grounds and palm wine spots were examined for parasitic cysts and bacterial isolates. The bacteria were isolated using standard bacteriological procedures and the parasites were observed microscopically. The bacteria isolates were thereafter subjected to antibiotic sensitivity test using standard protocol. All the seventy (70) samples examined harbored pathogenic bacteria. The bacteria isolated include, *Salmonella typhii, Klebsiella pneumonia, Proteus vulgaris, Escherichia coli, Proteus mirabilis, Providencia species., Enterobacteraerogenes, Pseudomonas aeruginosa, Morganella monganii, Vibrio cholera, Shigella species and Serratia marcescens.* Even though there was variation in diversity of the bacteria across the study locations, the difference was not statistically significant (p>0.05). The cyst of *Entamoeba histolytica and* eggs of *Asacris lumbricoides* were also recovered from few houseflies. Most of the bacteria isolates showed multiple resistance to antibiotics such as ampicillin, Cefuroxime and Ceftazidine. The isolation of these multi-drug resistance bacteria and cysts of pathogenic parasites underscore the need for constant health education on promotion of environmental sanitation in the study area.

KEY WORDS: Houseflies, bacteria, parasite cysts, multidrug resistance, Osogbo, Nigeria

Houseflies (*Musca domestica*) are the most ubiquitous insects widely distributed all over the world, but more adaptable in tropical areas (Goulson et al., 2005). Houseflies are synanthropic animals, causing serious nuisance (Subejo, 2010; Howard, 2011). Housefly could be found in filth areas, therefore serving as potential mechanical vectors to parasites and bacteria. This potential underscores their public health importance to man and farm animals (Service, 1980).

Outbreak and cases of food-borne diarrheal diseases in urban and rural areas have been associated with houseflies' abundance in tropical areas, mostly in areas with poor sanitation (Gehad & Elsherbini, 2010). Houseflies have been reported to serve as mechanical vectors of enteropathogens, which serve as causative agents of gastro-intestinal disorders to humans (Otronto & Tarsitano, 2003). Graczyk et al. (2001) reported that cysts and eggs of human parasitic protozoans and helminthes could be recovered from external body, faecal deposition and regurgitation of the houseflies.

Evidence abound that the Nigerian environment is characterized by filth, thus promoting prolific breeding of the insects such as cockroaches and houseflies (Tatfeng et al., 2005; Adeleke et al., 2012). Adeleke et al. (2012) reported the roles of cockroaches as mechanical vectors of pathogenic bacteria in Osogbo metropolis. Up to this moment little is known on the roles of houseflies as mechanical vectors of pathogens in the metropolis. Based on this existing research gap, the present study was designed to determine the roles of houseflies in the transmission of pathogenic parasites and bacteria in Osogbo, Southwestern Nigeria.

MATERIALS AND METHODS

Study area: The study was conducted in Osogbo, the state capital of Osun State. Osogbo lies between longitude 4° 34'E and latitude 7° 46'N. The town's land mass is approximately 47 km^2 with a population of 156,694.

Sample collection and study sites

The study sites were categorized into three; the slaughter slabs, dumping grounds and palm wine spots. The three collection sites were duplicated, to cover different parts of Osogbo. The housefly samples were collected at different intervals, but all in the day time between the hours of 13:00 and 16:00 using sweep nets. The samples were recovered into sterile universal bottles and transported to the laboratory for further analysis.

Bacteriological examination of the samples

The house flies were kept in the universal bottles and 2ml of sterile normal saline was added to the bottles and shaken vigorously for 5 minutes and left for some minutes to dislodge debris associated with the house flies. 0.01ml of the sample was taken from each container with the use of sterile wire loop and cultured on the MacConkey agar and incubated for 24hours at 37°C. The organisms that grew on the plates were subcultured on the nutrient agar for 24hours at 37°C to obtain the pure culture for characterization. The bacteria were identified using standard microbial procedures which include macroscopic morphology, gram staining and biochemical tests as described by Baron & Finegold (1990).

Antibiotic susceptibility test

The antibiotic sensitivity test was carried out using the nutrient agar plates and antibiotic discs containing Ceftriaxone, Cephalexin, Ampicillin, Ceftazidime, Cefuroxime, Gentamycin, Ciprofloxacin, Ofloxacin, Amoxycilin Andnitrofuratoin. Inhibition diameters were measured and the zone of inhibition generated by each antibiotic disc was grouped as susceptible, resistant and intermediate by comparing the measured diameter with the manufacturer's instruction.

Parasitological analysis

2ml of normal saline was added to the universal bottles containing the houseflies. The bottles were shaken vigorously for 5 minutes. 1ml of each sample was transferred onto a clean, sterile glass slide and viewed microscopically with the 40X objective lens.

Statistical analysis

The distribution of the bacteria was expressed in percentage. The diversity of the isolates in the study locations was subjected to t-test and and chi-square analysis using SPSS version 17.0

RESULTS

A total number of seventy (70) housefly samples were collected. Twenty (20) samples were collected from slaughter slabs, twenty (20) from Dumping grounds and thirty (30) from palm wine spots. The results showed that all the house flies captured from the three locations harbored microorganism. Twelve microbial organisms were isolated namely; *Salmonella typhii, Klebsiella pneumonia, Proteus vulgaris, Escherichia coli, Proteus mirabilis, Providencia* spp., *Enterobacteraerogenes, Pseudomonas aeruginosa, Morganella monganii, Vibrio cholera, Shigella* spp. and *Serratia marcescens* were isolated. Even though there was variation in diversity of the isolates across the study locations, the difference was not statistically significant ($p>0.05$) (Table 1). *S. typhii, K. pneumonia, P. vulgaris, E. coli, P. mirabilis, Providencia* spp. and *Enterobacter* spp. were isolated from slaughter slabs while *E. coli, Enterobacter* spp., *P. aeruginosa, M. monganii* and *V. cholera* were isolated from dunping grounds. *K. pneumonia, E. coli, Enterobacter* spp., *M. monganii, V. cholera* were isolated from palm wine spot.

All the isolates were susceptible to more than three (3) antibiotics, but widely resistant to Ampicilin, Ceftazidime, Cefuroxime, Amoxycilin and cephalexin. However, only one isolate was found susceptible to Ceftriaxone from the samples isolated from palm wine spot; three (3) of the organisms isolated from the dumping grounds were susceptible to Nitrofuratoin while four (4) of the organisms isolated from slaughter slabs were susceptible to Nitrofuratoin (Tables 2-4).

The parasitological analysis showed that the houseflies harboured the cyst of *Entamoeba histolytica* and *Ascaris lumbricoides* eggs (Table 5). The cyst of *E. histolytica* was found in the three study locations.

DISCUSSION

The results showed that houseflies samples collected in the present study harboured considerable number of pathogenic bacteria and parasites. This shows that house flies constitute serious public health threats in Osogbo metropolis aside their nuisance nature. All the organisms isolated during this study are of medical importance and have been implicated in many gastrointestinal and gastroenteritis disorders (Graczyk et al., 2001; Otronto & Tarsitano, 2003).

The implication of status of houseflies in transmission of helminthic eggs and protozoan cysts is alarming since the houseflies are known to live in close association with human beings. *A. lumbricoides* and *E. histolitica* are gastro-intestinal parasites which usually cause chronic diarrhea, liver complications and stunted growth in the affected people (Mbanugo & Abazie, 2002; Montressor et al., 2002; Sam-Wobo et al., 2006; Tatfeg et al., 2005; Anosike et al., 2006; WHO, 2008).

The most commonly isolated bacteria in the present study are *V. cholera, Enterobacter* spp. *and Escherichia coli*. *V. cholera* cause the deadly disease known as cholera, and its preponderance at palmwine spots and dumping grounds is worrisome, and this may predispose people to cholera. *E. coli* is a major cause of gastrointestinal infections with acute diarrhea (Getachew et al., 2007).

Most of the isolates were resistant to antibiotics mostly Ampicillin and Amoxicillin. These antibiotics are first choice of antibiotics administered in Nigeria probably due to the fact that they are cheap (Ehinmidu, 2003). The antibiotics resistance of pathogenic microorganisms has been reported to be plasmid mediated (Oleghe et al., 2011). There is therefore need for further studies to determine the mechanisms of resistance in the isolates.

In conclusion, the results obtained in the present study implicated houseflies as potential mechanical vectors of pathogenic bacteria and parasites in Osogbo metropolis. There is therefore an urgent need for public health education and enforcement of sanitation laws among the food vendors and slaughtering houses in Osogbo metropolis.

LITERATURE CITED

Adeleke, M. A., Akatah, H. A., Hassan, A. O. & Adebimpe, W. O. 2012. Microbial load and multi-drug resistance in pathogenic bacteria isolated from feaces and body surfaces of cockroaches in an urban area of Southwestern Nigeria. Journal of Microbiology, Biotechnology and Food Sciences 1 (6): 1448-1461.

Anosike, J. C., Zaccheaus, V. O., Adeiyongo, C. M., Abanobi, O. C., Dada, E. O., Oku, E. E., Keke, I. R., Uwaezuoke, J. C., Amajuoyi, O. U., Obiukwu, C. E., Nwosu, D. C. & Ogbusu, F. I. 2006. Studies on the Intestinal Worm (Helminthiasis) infection in a Central Nigerian Rural Community. JASEM, 10 (2): 61-66.

Baron, E. & Finegold, S. 1990. Bailey and Scott's diagnostic microbiology. St. Louis: Mosby, 861 p.

Ehinmidu, J. 2003. Antibiotics susceptibility patterns of urine bacteria isolates in Zaria, Nigeria. Tropical Journal of Pharmaceutical Research, 2 (2): 223-228.

Gehad T. & El Sherbini. 2010. The role of cockroaches and flies in Mechanical transmission of medicalimportant parasites in Khaldyia village, El-fayoum, Governorate, Egypt. http://www.articlesbase.com/health articles/therole-of-cockroachand flies-in mechanical transmission-of-medical-important-parasites-in-khaldyiavillage-el-fayoum-governorates-egypt-3008480html 2010.

Getachew, S. T., Gebre-Micheal, B., Erko, M., Balkew, & Medhin, G. 2007. Non-biting cyclorrhaphan flies (Diptera) as carriers of intestinal human parasites in slum, areas of Addis Ababa, Ethiopia. Acta. Trop., 103: 186-94.

Goulson D., Dewent, H. & Dunn. 2005. Predicting fly population from weather and probable consequencesof climate change. Journal of Applied Ecology, 42: 795-800.

Graczyk, J. K., Knight, R., Eilman, R. H. & Grankold, M. R. 2001. The role of non-biting flies in the epidemiology of human infectious diseases. Microbes Infect., 3 (3): 231-235.

Howard, J. J. 2011. Nuisance flies around a landfill: patterns of abundance and distribution. Wastemanagement research, 19: 308-311.

Mbanugo, J. I. & Abazie, D. C. 2002. A comparative study of intestinal parasites infections of pregnant and non-pregnant women in Nkpor, Anambra State. The Nigeria Journal of parasitology, 23: 19-26.

Montressor, A., Crompton, D. W., Gyorkos, T. W. & Savioli, L. 2002. Helminth control in school-age children. A guide for managers of control programmes. World Health Organisation, Geneva 64 pp.

Oleghe, P., Odimegwu, D., Udofia, E. & Esimore, C. 2011. Multidrug resistant bacteria isolates recovered from herbal medicinal preparations in Southeastern Setting, Nigeria**.** Journal of Rural and Tropical Public Health, 10: 70-75.

Otronto, D. & Tarsitano, T. 2003. Molecular epidemiological survey on the vectors of Thalaziagulosa. J. parasitol., 127: 365-369.

Sam-Wobo, S. O., Oyeyemi, O. A., Idowu, O. A. & Afolarin, A. 2006. Assessment of health knowledge and risk factors associated with intestinal helminthes in tertiary schools in Abeokuta, Nigeria. Nigerian journal of parasitology, 27: 76-80.

Service, M. W. 1990. A guide to Medical Entomology. The Macmillian press ltd Hongkong, pp. 102-105.

Subejo, P. 2010. Insect identification *Muscadomestica*. http://insectpedia.blgspot.com/2010/09/housefly-muscadomestica.html 2010.

Tatfeng, Y. M., Usuanlete, M. U., Orukpe, A., Digbam, A. K., Okodua, M., Oviasogi, F. & Turny, A. K. 2005. Mechanical transmission of pathogenic organisms. The role of Housefly. J. Vector Borne Dis., 42 (4): 129-134.

WHO. 2008. First Inter-Ministerial Conference on Health and Conference in Africa: Health security through Health environment. IMCHE/1/p8.

Table 1. Bacteria isolates from the body of houseflies in different study locations in Osogbo, Nigeria.

NAME OF ORGANISM	SLAUGHTER SLABS	DUMPING GROUNDS	PALM WINE SPOTS
Salmonella typhii	+	-	+
Klebsiella pneumonia	+	-	+
Proteus vulgaris	+	-	-
Escherichia coli	+	+	+
Proteus mirabilis	+	-	-
Providencia sp.	+	-	-
Enterobacter sp.	+	+	+
Pseudomonas aeruginosa	+	+	-
Morganellamonganii	-	+	+
Vibrio cholera	-	+	+
Shigella sp.	-	-	+
Serratiamarcescens	-	-	+

Legend: + Means presence of bacteria; - Means absence of bacteria (p>0.05)

Table 2. Antibiotics susceptibility of pathogenic bacteria isolated from house flies collected from slaughter slabs in Osogbo.

BACTERIA	SENSITIVE	RESISTANCE
Proteus vulgaris	CRO,GEN,CPR,OFL,NIT	AUG,CRX,CAZ,AMP,CL
Proteus mirabilis	GEN,CPR,OFL	AUG,NIT,AMP,CRX,CAZ,CL,CRO
Pseudomonas aeruginosa	GEN NIT	CRO,AMP,CAZ,CRX,CL,OFL,CPR,AUG
Escherichia coli	GEN,CPR,OFL,NIT	CRO,CL,CAZ,CRX,AUG,AMP
Enterobacteraerogenes	OFL,NIT,GEN,CPR	CL,CAZ,CRX,CRO,AMP,AUG
Salmonella typhii	OFL,NIT,GEN,CPR	CL,CAZ,CRX,CRO,AMP,AUG
Klebsiella sp.	GEN,CPR,OFL	AUG,NIT,AMP,CRX,CAZ,CL,CRO
Providencia sp.	GEN,CPR,OFL,NIT	CRO,CL,CAZ,CRX,AUG,AMP

N:B CRO-Ceftriaxone; CL-Cephalexin; AMP-Ampicilin; CAZ-Ceftazidime; CRX-Cefuroxime; GEN-Gentamycin; CPR-Ciprofloxin; OFL-Ofloxacin; AUG-Amoxycilin; NIT-Nitrofuratoin

Table 3. Antibiotic sensitivity of bacteria isolated from houseflies collected from dumping ground in Osogbo.

BACTERIA	SENSITIVE	RESISTANT
Pseudomonas aeruginosa	CPR,OFL,GEN	AUG,NIT,CRX,CAZ,AMP,CL,CRO
Escherichia coli	GEN,CPR,OFL,NIT	CRO,CL,CAZ,CRX,AUG,AMP
Enterobacteraerogenes	GEN,CPR,OFL	AUG,NIT,CRX,CAZ,AMP,CL,CRO
Salmonella typhii	GEN,OFL,CPR,NIT	AMP,AUG,CRX,CAZ,CL,CRO
Morganellamonganii	CPR,OFL,GEN	AUG,NIT,CRX,CAZ,AMP,CL,CRO
Vibrio cholera	NIT,GEN	CRO,CL,CAZ,CRX,AUG,AMP,CPR,OFL

N:B CRO-Ceftriaxone; CL-Cephalexin; AMP-Ampicilin; CAZ-Ceftazidime; CRX-Cefuroxime; GEN-Gentamycin; CPR-Ciprofloxin; OFL-Ofloxacin; AUG-Amoxycilin; NIT-Nitrofuratoin

Table 4. Antibiotic susceptibility of bacteria isolated from houseflies collected from palm wine spots in Osogbo.

BACTERIA	SENSITIVE	RESISTANT
Escherichia coli	CRO,GEN,CPR,OFL	CL,AMP,CAZ,CRX,AUG
Enterobacteraerogenes	CRO,GEN,CPR,OFL	CL,AMP,CAZ,CRX,AUG
Klebsiella sp.	NIT,OFL,CPR,GEN	AUG,CRX,CAZ,AMP,CL,CRO
Morganellamonganii	GEN,CPR,OFL	AUG,NIT,CRX,CAZ,AMP,CL,CRO
Vibrio cholera	NIT,GEN,CPR,OFL,CRO	CL,AMP,CAZ,CRX,AUG
Shigella sp.	GEN,CPR,OFL	AUG,NIT,CRX,CAZ,AMP,CL,CRO
Serrantiamarcescens	CPR,GEN,OFL,NIT	CRX,CAZ,CL,AMP,CRO,AUG

N:B CRO-Ceftriaxone; CL-Cephalexin; AMP-Ampicilin; CAZ-Ceftazidime; CRX-Cefuroxime; GEN-Gentamycin; CPR Ciprofloxin; OFL-Ofloxacin; AUG-Amoxycilin; NIT-Nitrofuratoin

Table 5. Parasitological analysis of houseflies collected from various sites in Osogbo.

PARASITES	SLAUGHTER SLABS	DUMPING GROUNDS	PALM WINE SPOTS
Ascaris lumbricoides	+	-	-
Entamoebahistolytica	+	+	+

SIGNIFICANCE OF EPIPHALLUS IN SOME INDIAN SPECIES OF ACRIDIDAE (ORTHOPTERA: ACRIDOIDEA)

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[Usmani, S. 2017. Significance of epiphallus in some Indian species of Acrididae (Orthoptera: Acridoidea). Munis Entomology & Zoology, 12 (1): 99-109**]**

ABSTRACT: A comparative study of epiphallus is made in sixty Indian species of grasshoppers, representing forty one genera belonging to the family Acrididae. Its significance in the classification of Acrididae is shown. The study revealed that there are certain characters i.e. presence or absence of dorso-lateral appendages; broad or narrow condition of bridge; presence or absence of ancorae; single, bi or trilobite condition of lophi and shape of ancorae and lophi have significant value in separating various families, genera and species of Acridoidea. Absence of dorso-lateral appendages in the family Acrididae is taken as familial character which is present in all genera of the family Pyrgomorphidae. Presence or absence of ancorae and single, bi- or trilobite condition of lophi are considered as generic characters. Bridge without ancorae, lophi large lobiform in *Anacridium, Cyrtacanthacris* and *Schistocerca*; bridge with ancorae, lophi large lobiform in *Heteracris and Navasia*; bridge with ancorae, lophi small in Oxyrrhepes and Tristria; bridge with ancorae, lophi finger shaped in *Tristria* and *Xenocatantops*; bridge with ancorae, lophi bilobate in *Dnopherula*, *Acrotylus, Neohelithera, Locusta* and *Truxalis*; bridge with ancorae, lophi lobiform in *Aiolopus*, bridge with ancorae, lophi trilobite in *Ochrilidia*. Broad or narrow condition of bridge, Shape of ancorae and lophi is suggested as specific character in separating various species within the genera *Anacridium, Catantops, Heteracris, Oxya, Dnopherula, Hieroglyphus, Eucoptacra, Truxalis, Trilopidia, Oedaleus, Acrotylus, Aiolopus, Catantops* and *Xenocatantops*.

KEY WORDS: Significance, epiphallus, Indian species, Acrididae

The epiphallus is a strongly sclerotized structure located on dorsal side of the phallic organ. It serves to grasp the edge of female subgenital plate to fix the phallus firmly during copulation. Its taxonomic significance in various families and sub families of Acridoidea is already known. Dirsh (1956) has shown the taxonomic importance of phallic complex particularly the epiphallus in the classification of Acridoidea. Uvarov (1966) considered epiphallus as very reliable taxonomic character at the family and subfamily level and as a good specific character within the genera for locusts and grasshoppers. Jago (1977) and Mishchenko (1986) gave illustrations of epiphallus in differentiating various species of the genus *Ochrilidia*. Ajaili & Usmani (1990) have shown taxonomic significance in some Libyan species of Acridoidea.

Keeping in view the taxonomic importance of epiphallus, the present study is an attempt to make a comparative study of epiphallus in fifty nine Indian species representing forty genera of the family Acrididae. The characters i.e. broad or narrow condition of bridge; presence or absence of ancorae; single, bi- or trilobite condition of lophi and shape of ancorae and lophi are suggested as characters of taxonomic significance.

MATERIALS AND METHODS

Adult specimens were collected from various agricultural localities in India. For the study of epiphallus, the apical part of male body was cut off and boiled in test tube containing 10% KOH solution till the material become transparent. Then, washed thoroughly in water for complete removal of KOH. It was then dissected by aid of stereoscopic microscope and with the help of fine needles epiphallus was taken out. The normal process of dehydration was adapted and cleaning was done in clove oil. The epiphallus was mounted in Canada balsam on a cavity slide. Drawings were made with the help of Camera lucida.

DESCRIPTION OF EPIPHALLI

Subfamily Acridinae

1. *Truxalis eximia* (Pl. 1, Fig. A)
Epiphallus, bridge curved, moderately broad and undivided; ancorae broad, pointed, anterior projection small with obtuse apex, posterior projection narrow with acute apex; lophi bilobate, lobes distinctly separate.

2. *Truxalis nasuta* (Pl. 1, Fig. B)
Epiphallus, bridge narrow and undivided; ancorae moderate, blunt and incurved, anterior projection small with obtuse apex, posterior projection narrow with acute apex; lophi bilobate, lobes close to each other.

3. *Acrida exaltata* (Pl. 1, Fig. C)
Epiphallus, moderately broad median bridge; peglike ancorae, anterior projection small with obtusely rounded apex, posterior projection moderate with acute apex; lophi bilobed, nodulated and blunt.

4. *Neophlaeoba walayarensis* (Pl. 1, Fig. D)
Epiphallus, bridge curved, narrow and undivided; ancorae broad, blunt, anterior projection broad, distinct, posterior projection narrow with pointed apex; lophi elongate, narrow.

5. *Phlaeoba infumata* (Pl. 1, Fig. E)
Epiphallus, bridge narrow; ancorae moderate, with incurved pointed apices, anterior projection short with obtuse apex, posterior projection small with acute apex; lophi small, single lobe.

6. *Orthochtha indica* (Pl. 1, Fig. F)
Epiphallus, bridge narrow and undivided;, ancorae large, acute and incurved, anterior projection moderate and rounded, posterior projection narrow and long with rounded apex; lophi large and lobiform.

7. *Neohilethera maculatipennis* (Pl. 1, Fig. G)
Epiphallus, narrow bridge; ancorae long and slender, anterior projection pointed, posterior projection flat, posterior projection broadly expanded; lophi bilobate.

8. *Odontomellus manipurensis* (Pl. 1, Fig. H)
Epiphallus, narrow with rounded bridge; ancorae short, anterior projection broad and rounded, posterior projection narrow and blunt, apex acute; lophi lobiform, broad and large.

Subfamily Gomphocerinae

9. *Dnopherula strictus* (Pl. 1, Fig. I)
Epiphallus, bridge undivided medially; ancorae small and robust with pointed apices, anterior projection broad, circular, posterior projection rounded; lophi bilobate, anterior lobe rounded and slightly larger than posterior lobe.

10. *Dnopherula decisus* (Pl. 1, Fig. J)
Epiphallus, bridge moderate; ancorae small, pointed and incurved, anterior projection broad with rounded apex, posterior projection narrow with acute apex; lophi bilobate, anterior lobe of lophi smaller than posterior lobe.

11. *Aulacobothrus luteips* (Pl. 1, Fig. K)
Epiphallus, bridge narrow and undivided medially; ancorae small and incurved with pointed apices, anterior projection small with rounded apex, posterior projection small with acutely conical apex; lophi elongate and lobiform.

12. *Ochrilidia geniculata* (Pl. 1, Fig. L)
Epiphallus, bridge narrow and undivided; ancorae moderate, acute anterior projection broad rounded, posterior projection rectangular; lophi trilobite.

13. ***Leva indica*** (Pl. 1, Fig. M)
Epiphallus, bridge narrow and undivided medially; ancorae short with pointed apices, anterior projection rounded; lophi small and single lobed.

Subfamily Oedipodinae

14. ***Ceracris nigricornis*** (Pl. 1, Fig. O)
Epiphallus, bridge narrow and undivided medially; ancorae moderate and narrow with pointed apices, anterior projection broad and rounded, posterior projection narrow; lophi small.
15. ***Pternoscirta caliginosa*** (Pl. 2, Fig. A)
Epiphallus, narrow bridge and undivided; ancorae small with pointed apices, posterior projection rectangular; lophi large, lobiform.
16. ***Morphacris fasciata*** (Pl. 2, Fig. B)
Epiphallus, narrow bridge, ancorae narrow, posterior projection flattened, expanded, apices pointed, anterior projection broad, apices pointed; lophi large and lobiform.
17. ***Trilophidia annulata*** (Pl. 2, Fig. C)
Epiphallus, bridge narrow and undivided medially; ancorae short and incurved with acutetly pointed apices; anterior projection short with rounded apex; posterior projection small with acutly conical apex; lophi large and bilobed and posterior lobes with a shallow excavation.
18. ***Trilophidia repleta*** (Pl. 2, Fig. D)
Epiphallus, bridge narrow and undivided medially, ancorae long and narrow, anterior projection broadly rounded, posterior projection flattened; lophi large, broad basally and narrowingly apically.
19. ***Oedaleus abruptus*** (Pl. 2, Fig. E)
Epiphallus, bridge moderately broad, undivided, straight medially; ancorae moderately curved and obtuse at apex, anterior projections well developed with obtusely conical apex, posterior projections small with angularly rounded apex; lophi large, lobiform, bilobate.
20. ***Oedaleus senegalensis*** (Pl. 2, Fig. F)
Epiphallus, bridge narrow, undivided, curved medially; ancorae moderate, anterior projection narrow and pointed posterior projection broad; lophi large and bilobate.
21. ***Aiolopus simulatrix*** (Pl. 2, Fig. G)
Epiphallus, bridge moderately narrow and undivided medially, anterior margin slightly incurved in the middle; ancorae moderately broad, curved and pointed at tips, anterior projection small with obtusely rounded apex, posterior projection small with obtuse apex; lophi large and lobiform.
22. ***Aiolopus thalassinus*** (Pl. 2, Fig. H)
Epiphallus, bridge moderately narrow and undivided medially; ancorae broad, curved with acute tips, anterior projection small with obtuse apex, posterior projection small with obtuse apex; lophi large and lobiform.
23. ***Sphingonotous savignyi*** (Pl. 2, Fig. I)
Epiphallus, bridge narrow; ancorae large, anterior projection pointed, posterior projection narrow, acute; lophi narrow elongate, bilobate.
24. ***Heteropternis respondens*** (Pl. 2, Fig. J)
Epiphallus, bridge short and narrow, undivided medially, anterior margin slightly incurved in the middle; ancorae small and incurved with acute apex, anterior and posterior projection broad with rounded apex; lophi large, bilobate and lobiform.
25. ***Dittopternis venusta*** (Pl. 2, Fig. K)
Epiphallus, bridge short and undivided; ancorae moderately large, anterior projection broad with obtuse apex, posterior projection narrow with acute apex; lophi large and bilobate.
26. ***Acrotylus humbertianus*** (Pl. 2, Fig. L)
Epiphallus, bridge moderately wide and undivided medially, anterior margin incurved in the middle; ancorae short, narrow with incurved and pointed tips, anterior projection small with rounded apex; posterior projection small with obtuse apex; lophi bibobate, finely sculptured.
27. ***Acrotylus insubricus*** (Pl. 2, Fig. M)
Epiphallus, bridge moderately wide and undivided medially, anterior margin incurved in the middle; ancorae elongate, narrow with incurved and pointed tips, anterior projection small

with obtuse apex, posterior projection small with obtuse apex; lophi bibobate, finely sculptured.

28. *Locusta migratoria* (Pl. 2, Fig. N)

Epiphallus, bridge moderately narrow and undivided medially; ancorae comparatively large and incurved with pointed tips, anterior projection small with rounded apex, posterior projection small with obtuse apex; lophi large and bilobate with strongly separated lobe.

29. *Gastrimargus africanus* (Pl. 2, Fig. O)

Epiphallus, bridge narrow and undivided medially, anterior margin incurved in the middle; ancorae small and incurved with acute apex; anterior projection small and incurved with acute apex; posterior projection small with obtuse apex; lophi large, bilobate and lobiform.

Subfamily Oxyinae

30. *Oxya hyla hyla* (Pl. 3, Fig. A)

Epiphallus, bridge moderately broad and divided medially; ancorae absent, anterior projection broad, rounded, posterior projection narrow with acute apex; lophi large hook like.

31. *Oxya hyla intricata* (Pl. 3, Fig. B)

Epiphallus, bridge rounded and divided medially with high projections in the middle, anterior projection flattened, posterior projection small, with acute apex; lophi broad, flattened and tooth like inner lophi.

32. *Oxya fuscovittata* (Pl. 3, Fig. C)

Epiphallus, bridge narrow and divided medially; ancorae absent, anterior projection short with rounded apex, posterior projection short with acute apex and with boat shaped outer lophi and tooth like inner lophi, of the later the left lophus is always less developed than the right.

33. *Oxya nitidula* (Pl. 3, Fig. D)

Epiphallus, bridge broad, divided medially, anterior projection small, hook like, curved inward, posterior projection small, rounded; lophi small, streak like.

34. *Oxya japonica japonica* (Pl. 3, Fig. E)

Epiphallus, bridge broad, undivided medially, anterior projection narrow, elongate, hook like, posterior projection not distinct; lophi elongate hook like and tooth like inner lophi.

35. *Oxya velox* (Pl. 3, Fig. F)

Epiphallus, moderately broad divided medially, anterior projection small, hook like, posterior projection indistinct; lophi small with acute apex.

36. *Gesonula punctifrons* (Pl. 4, Fig. G)

Epiphallus, bridge narrow small and undivided medially; ancorae elongate and slender with pointed apices, anterior projection well developed with rounded apex, posterior projection indistinct; lophi small lobiform, bilobate.

Subfamily Spathosterninae

37. *Spathosternum prasiniferum* (Pl. 3, Fig. H)

Epiphallus, bridge wide and undivided; ancorae small with bluntly rounded and incurved apices, anterior projection long with obtuse and incurved apices, posterior projection short with obtuse apex; lophi small and rounded.

Subfamily Hemiacridinae

38. *Hieroglyphus oryzivorus* (Pl. 3, Fig. I)

Epiphallus bridge undivided; ancorae small, incurved with acute apices, anterior projection long, apex obtuse, posterior projection small with rounded apex; lophi large.

39. *Hieroglyphus banian* (Pl. 3, Fig. J)

Epihallus, bridge narrow and undivided with central protrusion at base; ancorae small, turned inwards with acute apices, anterior projection small with obtuse apex, posterior projection weakly developed; lophi robust and large with two inner lobes and sinuate outer edges.

40. *Hieroglyphus nigrorepletus* (Pl. 3, Fig. K)

Epiphallus, bridge narrow and undivided, concave; ancorae small, turned inwards with acute apices, anterior projection small, apex obtuse and incurved, posterior projection small with rounded apex; lophi robust and large.

Subfamily Catantopinae

41. *Pachyacris violascens* (Pl. 4, Fig. A)
Epiphallus, bridge undivided; ancorae small, rounded, anterior projection small, blunt, posterior projection broad, bluntly rounded; lophi lobiform.
42. *Catantops innotabilis* (Pl. 4, Fig. B)
Epiphallus, bridge broad and undivided medially, claw shaped ancorae, anterior projection broad rounded, posterior projection elongate with obtuse apex; lophi broad and lobiform.
43. *Catantops pinguis* (Pl. 4, Fig. C)
Ephiphallus, bridge undivided medially, narrow triangular ancorae, anterior projection basically rounded, posterior projection elongate obtuse; lophi narrow and lobiform.
44. *Catantops karnyi* (Pl. 4, Fig. D)
Epiphallus, bridge narrow and undivided medially; ancorae small and incurved with acutely pointed apex, anterior projection small with truncated apex, posterior projection small with obtuse apex; lophi large and lobiform.
45. *Xenocatantops humilis brachycerus* (Pl. 4, Fig. E)
Epiphallus, bridge narrow, undivided medially; ancorae small, incurved, with apices pointed, anterior projection broadly rounded, posterior projection with blunt apices; lophi elongate narrow.
46. *Xenocatantops humilis humilis* (Pl. 4, Fig. F)
Epihallus, bridge broad and undivided medially; ancorae large and incurved with acutely pointed apex, anterior projection large with blunt apex, posterior projection small with obtuse apex; lophi large and lobiform.
47. *Navasia insularis* (Pl. 4, Fig. G)
Epiphallus, bridge narrow, undivided medially; ancorae long, narrowing apically with pointed apices, anterior projection long, blunt, posterior projection small, narrow, blunt; lophi lobiform.
48. *Oxyrrhepes obtuse* (Pl. 4, Fig. H)
Ephiphallus, bridge narrow and undivided medially, anterior margin incurved in the middle; ancorae moderately large and incurved with blunt apex, anterior projection large with rounded apex, posterior projection small with obtuse apex; lophi small, finger shaped and incurved.

Subfamily Coptacidinae

49. *Eucoptacra binghamii* (Pl. 4, Fig. I)
Epiphallus, bridge narrow and divided medially; ancorae moderately broad with pointed apex, tooth shaped and incurved, anterior projection broadly rounded with obtuse apex, posterior projection less developed, bluntly rounded; lophi large, curved.
50. *Eucoptacra praemorsa* (Pl. 4, Fig. J)
Epiphallus, bridge narrow and divided medially; ancorae large, tooth shaped and incurved, anterior projection broad with obtuse apex, posterior projection broad with rounded apex; lophi large and lobiform.
51. *Epistaurus aberrans* (Pl. 4, Fig. K)
Epiphallus, bridge divided medially; ancorae moderate with pointed apex, anterior and posterior projections broadly rounded; lophi bilobed.

Subfamily Cyrtacanthacridinae

52. *Anacridium flavescens* (Pl. 4, Fig. L)
Epiphallus, bridge broad, undivided medially; ancorae absent; lophi large with pointed apices, anterior and posterior projections absent.
53. *Anacridium aegyptium* (Pl. 4, Fig. M)
Epiphallus, bridge narrow, undivided medially; ancorae absent; lophi large lobe-shaped, anterior and posterior projections absent.
54. ***Cyrtacanthacris tatarica*** (Pl. 4, Fig. N)
Epiphallus, bridge narrow and undivided; ancorae absent, anterior projection small and rounded, posterior projection absent; lophi elongate, lobiform.
55. *Schistocerca gregaria* (Pl. 4, Fig. O)
Epiphallus, bridge broad and undivided; ancorae absent; lophi large, angular and lobiform, lateral plates and their projections prominent.

Subfamily Euprepocnemidinae

56. *Heteacris nobilis* (Pl. 5, Fig. A)
Ephiphallus, bridge broad and divided medially; ancorae small, pointed and incurved, anterior projection small with excurved obtuse apex, posterior projection short with atuse apex; lophi large and lobiform.

57. *Heteracris littoralis* (Pl. 5, Fig. B)
Epiphallus, bridge broad and divided medially; ancorae small, pointed and incurved, anterior projection small with incuved acute apex, posterior projection short with obtuse apex; lophi large and lobiform.

58. *Tylotropidius varicornis* (Pl. 5, Fig. C)
Epiphallus, bridge narrow and undivided; ancorae small, obtuse and incurved, anterior projection small and obtuse, posterior projection short with obtuse apex; lophi small, lobiform.

59. *Eyprepocnemis alacris* (Pl. 5, Fig. D)
Epiphallus, bridge narrow and undivided, convex medially; ancorae moderately large, obtuse and incurved, anterior and posterior projection absent; lophi lobiform.

Subfamily Tropidopolinae

60. *Tristria pulvinata* (Pl. 5, Fig. E)
Epiphallus, narrow and undivided bridge; ancorae small with obtusely rounded apices and incurved, anterior projection excurved, small, narrow with rounded apex, posterior projection weakly developed; lophi small and narrow.

DISCUSSION

Comparative study of epiphallus in sixty species of the family Acrididae revealed that there are certain characters i.e. presence or absence of ancorae, mono-, bi- or trilobite condition of lophi and shape of ancorae and lophi have significant value in separating various families, genera and species of Acridoidea. Presence of dorso-lateral appendages in the family Pyrgomorphidae which is absent in all genera belonging to the family Acrididae.

Presence or absence of ancorae and single, bi- or trilobite condition of lophi are considered as generic characters. Bridge without ancorae, lophi large lobiform in *Anacridium, Cyrtacanthacris* and *Schistocerca;* bridge with ancorae, lophi large lobiform in *Heteracris* and *Navasia;* bridge with ancorae, lophi small in *Oxyrrhepes* and *Tristria;* bridge with ancorae, lophi finger shaped in *Tristria* and *Xenocatantops;* bridge with ancorae, lophi bilobate in *Dnopherula, Acrotylus, Neohelithera, Locusta* and *Truxalis;* bridge narrow, lophi lobiform in *Aiolopus,* bridge with ancorae, lophi trilobite in *Ochrilidia* together with other generic characters have made the identification of the genera more perfect and convenient. Broad or narrow condition of bridge; shape of ancorae and lophi are suggested as specific character in separating various species within the genera *Anacridium, Catantops, Heteracris, Oxya, Dnopherula, Hieroglyphus, Eucoptacra, Truxalis, Trilopidia, Oedaleus, Acrotylus, Aiolopus, Catantops* and *Xenocatantops*.

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LITERATURE CITED

Ajaili, A. A. & Usmani, M. K. 1990. Taxonomic significance of epiphallus in some Libyan grasshoppers (Orthoptera: Acridoidea). Annals Agric. Sci. Ain Shams Univ. Cairo, Sp. Issue, 511-519.

Dirsh, V. M. 1956. The phallic complex in Acridoidea (Orthoptera) in relation to taxonomy. Trans. R. Ent. Soc. Lond., 108: 223-349.

Jago, N. D. 1977. Revision of the genus *Orchilidia* Stal 1873, with comments on the genera *Sporobolius* Uvarov, 1941 and *Platypternodes* I. Boliver, 1908 (Orthopera, Acrididae Gomphocerinae). Acrida, 6 (1977): 163-217.

Mishchenko, L. L. 1986. On the Knowledge of grasshoppers of the genus *Orchilidia* Stal (Orthoptera, Acrididae). Entomol. Obozr., 65 (4): 709-718.

Uvarov, B. P. 1966. Grasshoppers and Locusts. A Handbook of General Acridology. Cambridge, XI + 481 pp.

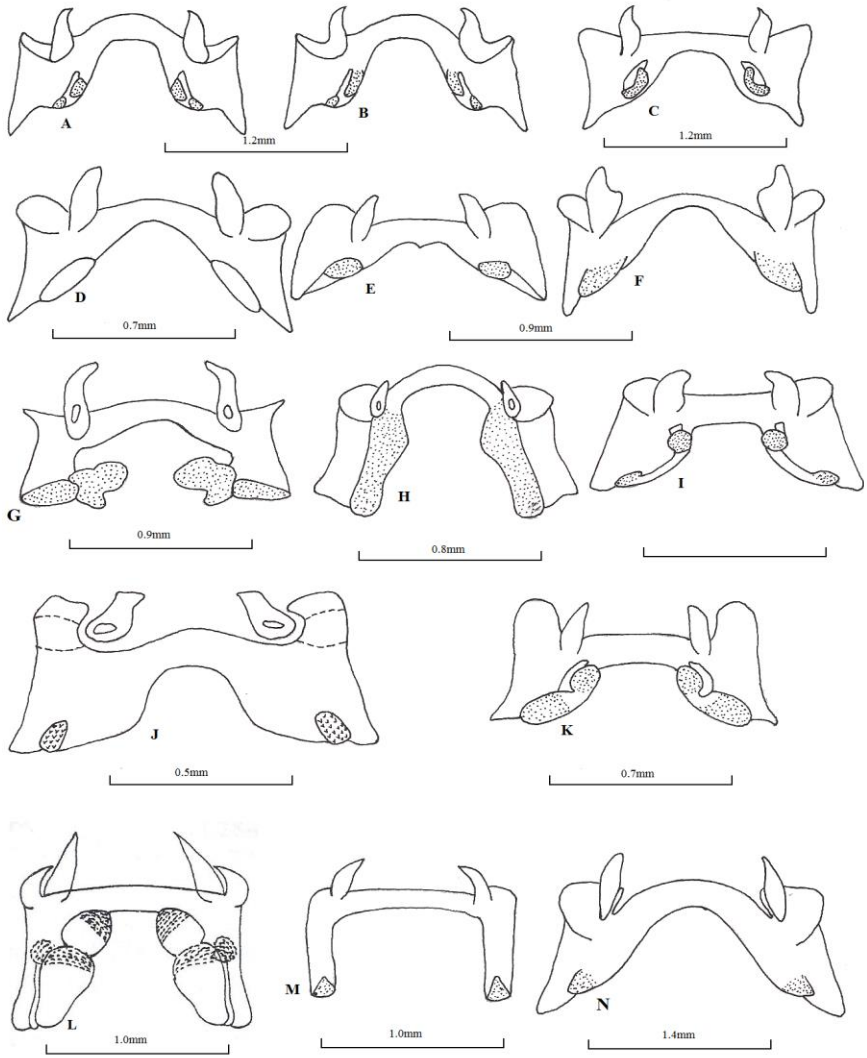

Plate 1. A-N Epiphallus A. *Truxalis eximia*, B. *Truxalis nasuta*, C. *Acrida exaltata*, D. *Neophlaeoba walayarensis*, E. *Phlaeoba infumata*, F. *Orthochtha indica*, G. *Neohilethera maculatipennis*, H. *Odontomellus manipurensis*, I. *Dnopherula strictus*, J. *Aulacobothrus luteips*, K. *Dnopherula decisus*, L. *Ochrilidia geniculata*, M. *Leva indica,* N. *Ceracris nigricornis*.

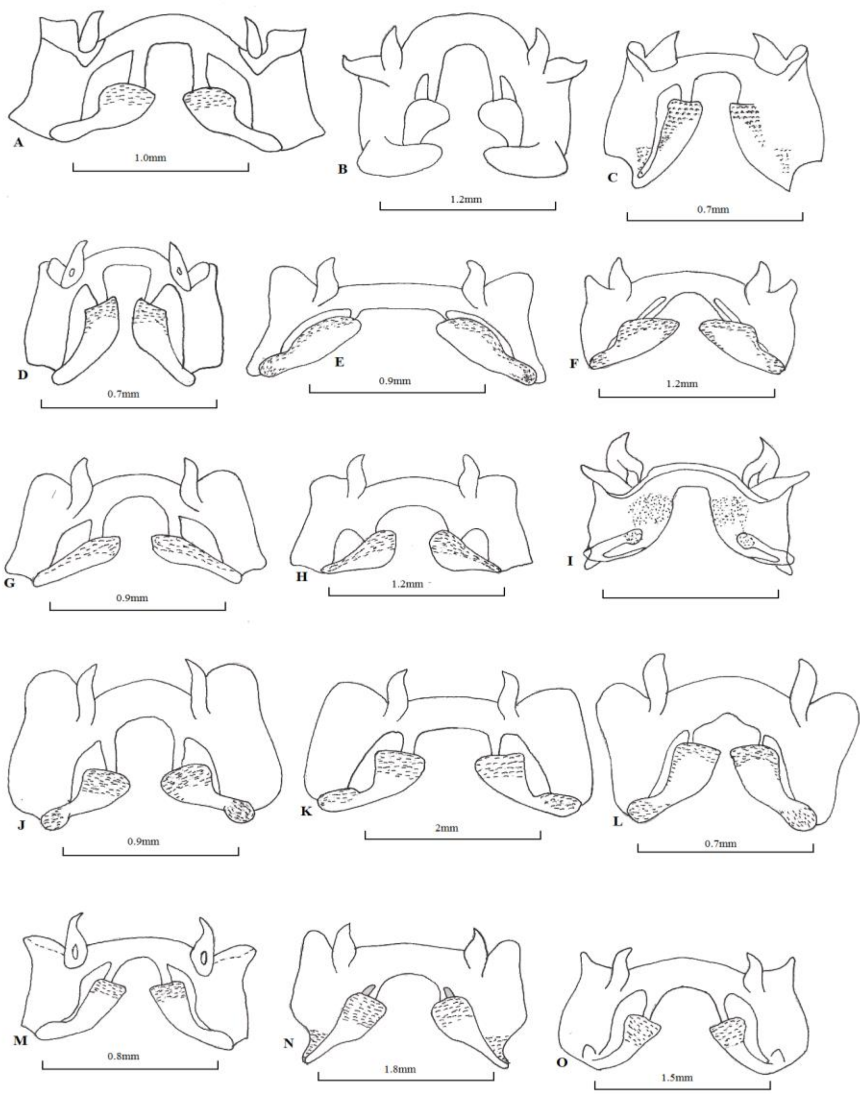

Plate 2. A-O Epiphallus; A. *Pternoscirta caliginosa*, B. *Morphacris fasciata*, C. *Trilophidia annulata*, D. *Trilophidia repleta*, E. *Oedaleus abruptus*, F. *Oedaleus senegalensis*, G. *Aiolopus simulatrix*, H. *Aiolopus thalassinus*, I. *Sphingonotous savignyi*, J. *Heteropternis respondens,* K. *Dittopternis venusta*, L. *Acrotylus humbertianus*, M. *Acrotylus insubricus*, N. *Locusta migratoria*, O. *Gastrimargus africanus*.

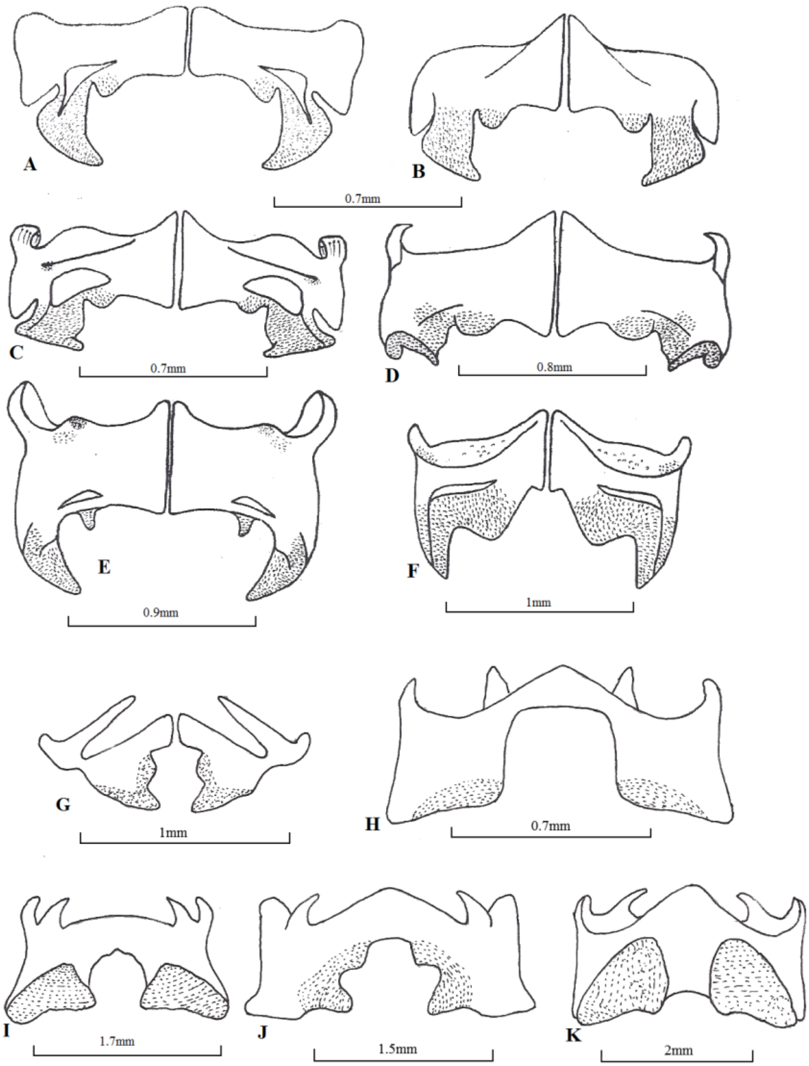

Plate 3. A-K. Epiphallus; A. *Oxya hyla hyla*, B. *Oxya hyla intricata*, C. *Oxya fuscovittata*, D. *Oxya nitidula*, E. *Oxya japonica japonica*, F. *Oxya velox*, G. *Gesonula punctifrons*, H. *Spathosternum prasiniferum*, I. *Hieroglyphus oryzivorus*, J. *Hieroglyphus banian*, K. *Hieroglyphus nigrorepletus*.

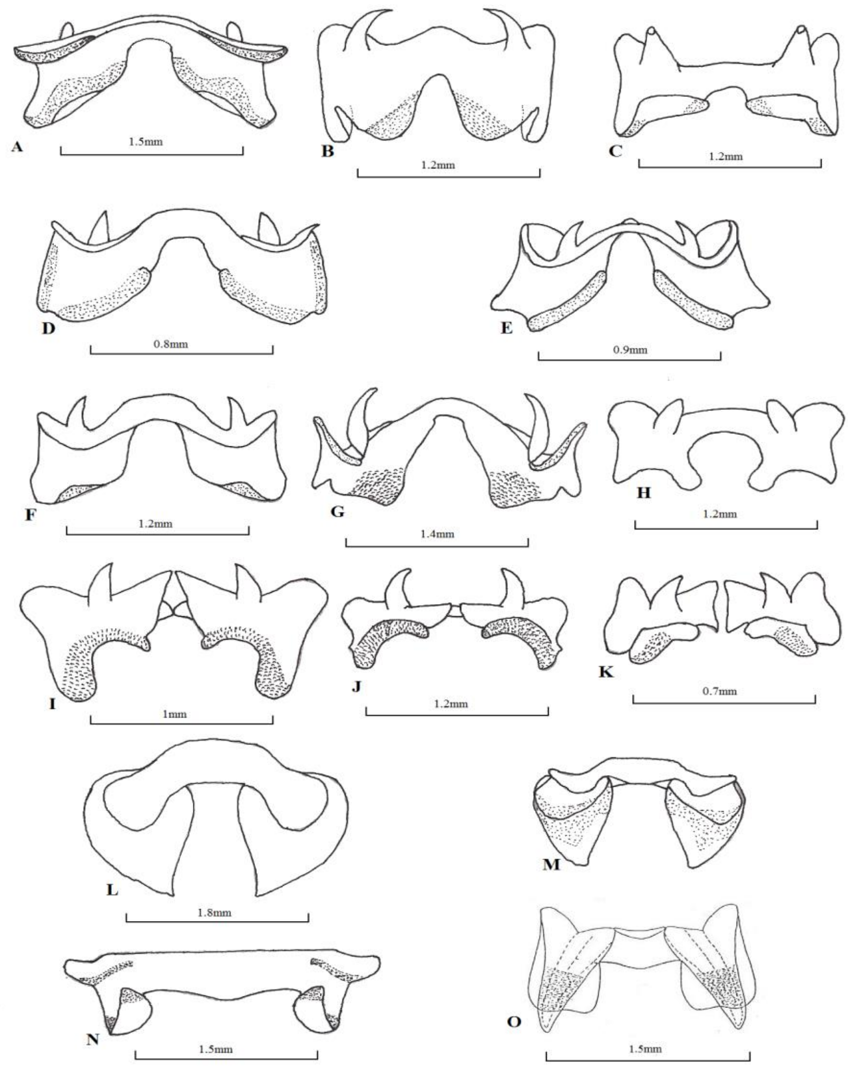

Plate 4. A-O Epiphallus; A. *Pachyacris voilascens*, B. *Catantops innotabilis*, C. *Catantops* pinguis, D. *Catantops karnyi*, E. *Xenocatantops humilis brachycerus,* F. *Xenocatantops humilis humilis*, G. *Navasia insularis*, H. *Oxyrrhepes obtusa*, I. *Eucoptacra binghamii,* J. *Eucoptacra praemorsa*, K. *Epistaurus aberrans*, L. *Anacridium flavescens*, M. *Anacridium aegyptium*, N. *Cyrtacanthacris tatarica*, O. *Schistocerca gregaria.*

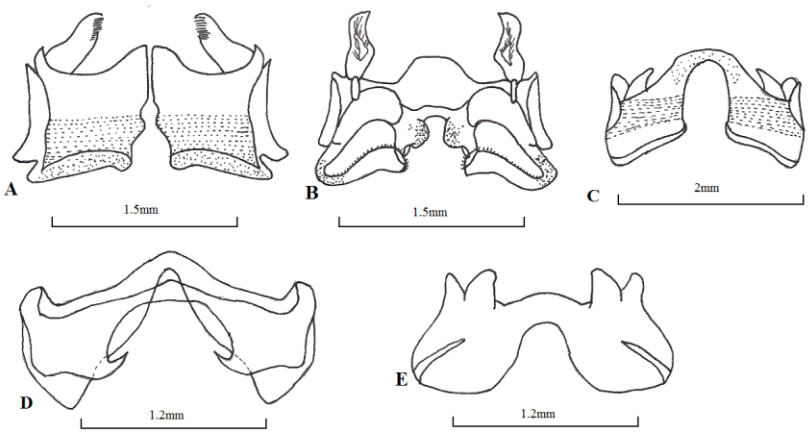

Plate 5. A-E Epiphallus; A. *Heteacris nobili*, B. *Heteracris littorali*, C. *Tylotropidius varicornis,* D. *Eyprepocnemis alacris,* E. *Tristria pulvinata.*

UPDATED SPECIES GROUP TAXA OF *PHYTOECIA* (*PHYTOECIA*) DEJEAN IN TURKEY WITH A NEW STATUS (COLEOPTERA: CERAMBYCIDAE: LAMIINAE)

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[Özdikmen, H. 2017. Updated species group taxa of *Phytoecia* (*Phytoecia*) Dejean in Turkey with a new status (Coleoptera: Cerambycidae: Lamiinae). Munis Entomology & Zoology, 12 (1): 110-119**]**

ABSTRACT: The subspecific status of *Phytoecia caerulea* (Scopoli, 1772) in Turkey is discussed and reviewed. In accordance with this, *Phytoecia baccueti* (Brullé, 1832) new status is upgraded from subspecies level to the species level. The presence of *Phytoecia caerulea bethseba* Reiche & Saulcy, 1858 in Turkey is proved. Thus, the list of Turkish *Phytoecia* (s.str.) Dejean, 1835 is updated with their type information, range and known provincial distribution in Turkey.

KEY WORDS: *P. baccueti*, *P. caerulea bethseba,* new status, Turkey

The genus *Phytoecia* Dejean includes many subgenera. Number of subgenera are changed according to different authors. Löbl & Smetana (2010) mentioned 9 subgenera for the genus in their catalogue. According to Danilevsky (2016), the genus includes 16 subgenera as *Barbarina* Sama, 2010; *Coptosia* Fairmaire, 1865; *Metallidia* Kasatkin, 2012; *Opsilia* Mulsant, 1863; *Pilemia* Fairmaire, 1864; *Pseudocoptosia* Pic, 1900; *Pseudomusaria* Pic, 1900 with stated 9 subgenera in Palaearctic catalogue of Löbl & Smetana (2010).

The subgenus *Phytoecia* Dejean included 45 species for Palaearctic Region in Löbl & Smetana (2010). Danilevsky (2016) stated 49 species with 4 newly described species as *P. bialookii* Danilevsky, 2010 from Turkey, *P. kartalensis* Danilevsky, 2010 from Turkey, *P. napolovi* Danilevsky, 2012 from Israel and *P. shokhini* Kasatkin, 2010 from Turkey for the subgenus.

Thus the subgenera is represented by 19 species in Turkey according to Özdikmen (2012) and Danilevsky (2016).

In addition, during the study of the collected Cerambycidae specimens in my collection, subspecific status and known distribution patterns of the species *Phytoecia caerulea* (Scopoli, 1772) in Turkey are discussed and reviewed in detail. As a result of this, *Phytoecia baccueti* (Brullé, 1832) is upgraded from subspecies level to the species level necessarily (stat. n.) and also the presence of *Phytoecia caerulea bethseba* Reiche & Saulcy, 1858 in Turkey is proved. So the number of representing species of the subgenus in Turkey raised up 19 to 21. In accordance with this, all members of Turkish *Phytoecia* (s.str.) are presented in the text.

MATERIAL AND METHODS

A total of 283 specimens were collected from various localities in 14 different provinces as Aksaray, Ankara, Antalya, Balıkesir, Çankırı, Çorum, Gaziantep, Hatay, Karaman, Kırıkkale, Konya, Nevşehir, Niğde and Osmaniye of Turkey in 1997-2014, were evaluated. All specimens were deposited at Gazi University of Ankara (Turkey).

Information in the present text is given in following order:

The subfamily and the tribe names are given simply. For the generic names, the type species and synonyms are provided under the taxon name. For each species, the whole subspecies are provided under the taxon names. For each species group taxa, reported from Turkey, are given alphabetically. The Turkish distribution patterns for each species group taxon are given only concerning provinces. Turkish endemic taxa are marked with the sign (*). The type information for each species group taxa are arranged under Tavakilian (2016). For distributional data of the taxa, Özdikmen (2007, 2008a, b, 2011, 2013) for Turkey and Löbl & Smetana (2010), Danilevsky (2016) for World are used in the text chiefly. Distributional abbreviations for the works are available to Löbl & Smetana (2010).

RESULTS

Phytoecia (s.str.) *baccueti* (Brullé, 1832) new status and the presence of *Phytoecia caerulea bethseba* in Turkey

According to Löbl & Smetana (2010) and Danilevsky (2016), *Phytoecia caerulea* (Scopoli, 1772) includes three subspecies as *Phytoecia caerulea caerulea* (Scopoli, 1772) [in most of Europe (including European Turkey), Kazakhstan, Tajikistan, Turkmenistan, Uzbekistan, Caucasus, Transcaucasia, Iran, Turkey (Anatolia) and Syria], *Phytoecia caerulea baccueti* (Brullé, 1832) [only in Greece and Turkey] and *Phytoecia caerulea bethseba* Reiche & Saulcy, 1858 [only in Middle East (Israel, Jordan, Lebanon and Syria) and Iran].

As seen above, the species has been represented with only two subspecies as the nominative subspecies and *Phytoecia caerulea baccueti* in Turkey. In real, however, the subspecies *Phytoecia caerulea bethseba* also occurs in Turkey. Because it was recorded by Demelt (1963) from Adana and Hatay provinces in South Turkey (Fig. 1). Unfortunately, the records of Demelt (1963) were overlooked in both catalogical works.

Saperda baccueti was described by Brullé (1832) from Greece (Peloponnes: Modon env.). It has been regarded as a subspecies of *Phytoecia caerulea* since a very long time.

A total of 283 specimens of *Phytoecia caerulea* that were collected from 14 different provinces from Turkey in 1997-2014, were evaluated in terms of subspecific status. 142 of them were determined as *Phytoecia caerulea caerulea* and 137 of them as *Phytoecia caerulea baccueti*.

As a result of this, *Phytoecia caerulea baccueti* should be accepted as a separate species because of its distribution patterns in Turkey are overlapped with that of *Phytoecia caerulea caerulea* at least for five provinces as Aksaray, Çankırı, Çorum, Kırıkkale and Konya. After old records from Turkey, overlapping area is wider than result of the present work. So the status is unavailable to the rule of allopatric distribution of subspecies. The status does not explain as hybridization area as seen in figures 2 and 3.

In the present work, a total of 142 collected specimens from 11 different provinces in Turkey as 48 from Osmaniye, 41 from Çankırı, 33 from Hatay, 6 from Niğde, 4 from Aksaray, 3 from Çorum, 2 from Gaziantep, 2 from Konya, 1 from İçel, 1 from Karaman and 1 from Kırıkkale provinces for *Phytoecia caerulea caerulea*, and a total of 141 collected specimens from 10 different provinces in Turkey as 46 from Çankırı, 45 from Kırıkkale, 32 from Ankara, 8 from Aksaray, 4 from Antalya, 2 from Çorum, 2 from Konya, 1 from Balıkesir and 1 from Nevşehir provinces for *Phytoecia baccueti* are examined.

Consequently, I propose *Phytoecia baccueti* (Brullé, 1832) should be regarded as a separate species.

For example, recently I collected 41 specimens of *Phytoecia caerulea caerulea* from 18 different localities (including Central, Eldivan, Kızılırmak, Kurşunlu and Orta counties) and 46 specimens of *Phytoecia baccueti* from 25 different localities (including Central, Kızılırmak, Korgun and Orta counties) of Çankırı provinces in the spring and summer of 2014. I see that *Phytoecia caerulea caerulea* and *Phytoecia baccueti* are collected with together in the same localities and populations (at least 12 different localities including Central, Kızılırmak and Orta counties of Çankırı province). Overlapping localities can see in Table 1.

It is clear that both taxa do not belong to the same species. Both taxa from the same locality are photographed in figure 4.

Phytoecia caerulea caerulea and *Phytoecia baccueti* have been recorded by various authors from Turkey (Figs. 2 and 3).

Old records of *Phytoecia baccueti* in Turkey can be presented as follows:

İstanbul prov., İzmir prov., Antalya prov., Isparta prov. (Demelt & Alkan, 1962); Kütahya prov. (Breuning et Villiers, 1967); Konya prov., İzmir prov., Denizli prov. (Tuatay et al., 1972); İzmir prov. (Gül-Zümreoğlu, 1972); Ankara prov., Isparta prov., Burdur prov., İzmir prov., Aydın prov., Denizli prov., Manisa prov. (Gül-Zümreoğlu, 1975); Bilecik prov., Burdur prov. (Adlbauer, 1988); Bilecik prov., Denizli prov., İzmir prov. (Tozlu et al., 2003); Yozgat prov. (Sama, Rapuzzi & Özdikmen, 2012).

Consequently, the known species group taxa of Turkish *Phytoecia* (s.str.) must be updated. In accordance with this, all members of Turkish *Phytoecia* with the new species, new subspecies and new status can be presented as follows:

List of the Turkish taxa of the nominal subgenus *Phytoecia* (*Phytoecia*), using Löbl and Smetana's catalogic country codes (2010).

Subfamily Lamiinae Latreille, 1825
Tribe Phytoeciini Mulsant, 1839
Genus *Phytoecia* Dejean, 1835: 351
Subgenus *Phytoecia* Dejean, 1835: 351

[Type species *Cerambyx cylindricus* Linnaeus, 1758]

Phytoecia (Hoplotoma) Pérez-Arcas, 1874: 151 [Type species *Phytoecia malachitica* P. H. Lucas, 1849]

P. annulipes Mulsant & Rey, 1863: 165 (Holotype ♀, ex collection Louis Reiche > R. Oberthür, Muséum National d'Histoire Naturelle, Paris) [Type locality "Caramanie" (Turkey: İçel)] **A**: TR

Turkish distribution patterns: Afyon, Aksaray, Ankara, Bayburt, Bolu, Çorum, Erzurum, Hatay, İçel, Kahramanmaraş, Kars, Kastamonu, Kütahya, Muş, Osmaniye, Yozgat provinces.

P. asiatica Pic, 1891: 102

P. asiatica asiatica Pic, 1891: 102 (Lectotype ♀, ex collection M. Pic, Muséum National d'Histoire Naturelle, Paris) [Type locality "Akbez" (Turkey: Hatay), not Syria] **A**: TR

achilleae Holzschuh, 1971: 68 [Turkey: Adana: Nurdağı pass]

Turkish distribution patterns: Adana, Hatay provinces.

Remarks: The subspecies was given by Löbl and Smetana (2010) and Danilevsky (2015) also from Syria on the base of type locality wrongly. Because Akbez is in Turkey, not Syria at the present day.

P. asiatica sublineata Holzschuh, 1984: 159 (*Phytoecia achilleae* ssp.) (Holotype ♂, collection Carolus Holzschuh, Villach) [Type locality “Chosrow” (Armenia)] **A**: AB AR TR
Turkish distribution patterns: Muş province.

P. baccueti Brullé, 1832: 262 (*Saperda*) **new status** (Syntypes, Muséum National d'Histoire Naturelle, Paris) [Type locality “Morea: Modon env.” (Greece)] **E**: GR **A**: TR
Turkish distribution patterns: Aksaray, Ankara, Antalya, Aydın, Balıkesir, Bilecik, Burdur, Çankırı, Çorum, Denizli, Eskişehir, Isparta, İstanbul, İzmir, Kayseri, Kırıkkale, Konya, Kütahya, Manisa, Nevşehir, Yozgat provinces.

P. bangi Pic, 1897: 189 (Syntypes ♂ & ♀, ex collection M. Pic, Muséum National d'Histoire Naturelle, Paris) [Type locality “Mardin” (Turkey)] **A**: IN TR
Turkish distribution patterns: İçel, Kayseri, Mardin, Niğde, Osmaniye provinces.

****P. bialookii*** Danilevsky, 2010: 22 (Holotype ♂, collection Mikhail Danilevsky, Moscow) [Type locality “Tatvan: Güroymak env.” (Turkey: Bitlis)] **A**: TR
Turkish distribution patterns: Bitlis, Muş provinces.

P. bodemeyeri Reitter, 1913: 665 (Syntypes ♂♂ & ♀♀, ex collection Edmund Reitter, Magyar Természettudományi Mûzeum, Budapest) [Type locality “Luristan” (Iran)] **A**: IN TR
Turkish distribution patterns: Catalogic record only, another published data absent until now.

P. caerulea Scopoli, 1772: 102 (*Leptura*)

P. caerulea bethseba Reiche & Saulcy, 1858: 17 (*Phytoecia bethseba*) [Type locality “Palestina”] **A**: IN IS JO LE SY TR
Turkish distribution patterns: Adana, Hatay provinces.
Remarks: The subspecies was not given by Löbl and Smetana (2010) and Danilevsky (2015) from Turkey. Because both works were overlooked the Turkish records of Demelt (1963). So it occurs also in Turkey.

P. caerulea caerulea Scopoli, 1772: 102 (*Leptura*) [Type locality “Carniola” (Slovenia)] **E**: AL AU BH BU BY CR CT CZ GR HU IT MC MD PT RO SK SL SP ST SZ TR UK YU **A**: AB AR GG IN KZ SY TD TM TR UZ

viridis Gronovius, 1764: 163 [n. 546] (*Cerambyx*) [?]
rufimana Schrank, 1789: 77 (*Saperda*) [Austria]
flavimana Creutzer, 1796: 15 (*Saperda*) [Germany]
coelestis Townson, 1797: 469 (*Saperda*) [Hungary]
gilvimana Ménétriés, 1832: 227 (*Saperda*) [Azerbaijan: Saliane]

Turkish distribution patterns: Adana, Afyon, Aksaray, Ankara, Bolu, Burdur, Çankırı, Çorum, Düzce, Eskişehir, Erzurum, European Turkey (?Edirne), Isparta, İçel, Kahramanmaraş, Karabük, Karaman, Kastamonu, Kayseri, Kırıkkale, Kırşehir, Konya, Manisa, Muğla, Nevşehir, Niğde, Osmaniye, Samsun, Sivas, Yozgat provinces.

P. croceipes Reiche & Saulcy, 1858: 17 [RN] (Holotype, ex collection E. Mulsant, Muséum National d'Histoire Naturelle, Paris as *P. puncticollis*) [Type locality “Caramanie” (Turkey: İçel)] **A**: AB AR CY GG IQ IN IS LE SY TR

puncticollis Mulsant & Wachanru, 1852: 175 [HN] [Turkey: İçel]
macilenta Mulsant & Wachanru, 1863: 421 [RN] [Turkey: İçel]
longicollis A. Costa, 1878: 27 [Palestina: Jerusalem]
annulifera Pic, 1900: 67 (*Phytoecia croceipes* var.) [Palestina: Jericho]

Turkish distribution patterns: Adana, Diyarbakır, Hatay, İçel, İzmir, Konya, Mardin, Niğde, Osmaniye, Tunceli provinces.

P. cylindrica Linnaeus, 1758: 394 (*Cerambyx*) (Syntypes, ex collection C. Linnaeus, Zoologiska Institutionen, Uppsala) [Type locality “Suecia” (Sweden)] **E**: AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IR IT LA LS LT LU MC MD NL NR NT PL PT

RO SK SL SP ST SV SZ TR UK YU **A**: AB AR ES FE GG IN KZ TR WS XIN
cinereus DeGeer, 1775: 75 (*Cerambyx*) [?]
verna O. F. Müller, 1776: 94 (*Leptura*) [Denmark]
silphoides Schrank, 1781: 145 (*Cerambyx*) [Austria: Vienna]
fuliginosa Scopoli, 1786: 49 (*Leptura*) [Italy: Insubria]
simplonica Stierlin, 1878: 438 [Switzerland: Alpes: Simplon]
grandis Pic, 1891: 2 [DA] (*Phytoecia cylindrica* var.) [Turkey: Hatay: Akbez]
kammereri Schatzmayr, 1928: 47 (*Phytoecia cylindrica* ssp.) [Italy: Basilicata: M. Vulture]
Turkish distribution patterns: Ankara, Düzce, Hatay, İstanbul, İzmir, Kahramanmaraş, Kars, Kastamonu, Kayseri, Kırıkkale, Niğde, Tunceli provinces.

__P. gamzeae__ Özdikmen, 2017a: 23 (Holotype ♂, collection H. Özdikmen, Zoological Museum of Gazi University, Ankara) [Type locality "Şabanözü, Büyükyakalı village" (Turkey: Çankırı)] **A:** TR
Turkish distribution patterns: Ankara, Çankırı, Çorum, Kırıkkale, Konya provinces.

P. geniculata Mulsant, 1863: 420
P. geniculata geniculata Mulsant, 1863: 420 (Syntypes, ex collection Perroud > Salesse, 1932 > Pic, 1958, Muséum National d'Histoire Naturelle, Paris) [Type locality "Turkey")] **A**: CY IN IQ IS JO LE PA TR
nazarena Reiche, 1877: cxxxvi [Israel: Nazareth]
ingeniculata T. Pic, 1900: 67 [Israel: Galilea: Akko]
palaestina Pic, 1930: 3 (*Phytoecia geniculata* var.) [Palestina: Jerusalem]
Turkish distribution patterns: Adana, Ankara, Antalya, Aydın, Bilecik, Burdur, Bursa, Çanakkale, Çorum, Denizli, Gaziantep, Hatay, İçel, İzmir, Kahramanmaraş, Kastamonu, Kırıkkale, Manisa, Osmaniye, Siirt provinces.
P. geniculata orientalis Kraatz, 1871: 272 [RN] (*Phytoecia orientalis*) (Syntypes, ex collection Louis Reiche > R. Oberthür, Muséum National d'Histoire Naturelle, Paris as *P. fuscicornis*) [Type locality "İstanbul env." (Turkey)] **E**: BU GR TR
fuscicornis Mulsant & Rey, 1863: 168 [HN] [Turkey: İstanbul env.]
donatellae Rapuzzi & Sama, 2010: 187 (*Phytoecia icterica* ssp.) [Greece: Joannina]
Turkish distribution patterns: Edirne, İstanbul provinces.

P. icterica Schaller, 1783: 292 (*Cerambyx*) [Type locality "Halae Saxonum" (Germany)] **E**: AU BH BU CR CZ FR GE HU IT LU MC MD PL PT RO SK SL SP ST SZ TR UK YU **A**: KZ TR WS
ephippium Fabricius, 1793: 317 (*Saperda*) [Hungary]
ragusana Küster, 1844: 55 (*Oberea*) [DA] [Croatia: Ragusa (Dubrovnik)]
subannulipes Pic, 1915: 11 [Romania: Comana & Vlasca]
Turkish distribution patterns: Afyon, Ankara, Antalya, Bayburt, Bitlis, Bolu, Çorum, Düzce, Erzurum, European Turkey (?Edirne), Gaziantep, Hatay, İstanbul, Kahramanmaraş, Kars, Kastamonu, Kilis, Konya, Kütahya, Osmaniye, Yozgat provinces.

__P. kartalensis__ Danilevsky, 2010: 21 (Holotype ♂, collection Mikhail Danilevsky, Moscow) [Type locality "Mihalıççık: Kartal pass" (Turkey: Eskişehir)] **A**: TR
Turkish distribution patterns: Eskişehir province.

P. manicata Reiche & Saulcy, 1858: 17 (Syntypes ♂ & ♀, ex collection Louis Reiche > R. Oberthür, Muséum National d'Histoire Naturelle, Paris) [Type locality "Syria"] **A**: IS JO LE PA SY TR
Turkish distribution patterns: Adana, Ankara, Diyarbakır, Hatay, Isparta, İzmir, Kahramanmaraş, Kırıkkale, Kocaeli, Konya, Osmaniye, Siirt provinces.

P. nigricornis Fabricius, 1782: 499 (*Saperda*) (Holotype, ex collection J. C. Fabricius, Zoologisk Museum, Copenhague) [type locality "Leipzig" (Germany)] **E**: AL AU BE BH BU BY CR CT CZ EN FI FR GE GR HU IT LA LT LU MC MD NT PL RO SK SL SP ST SV SZ TR UK YU **A**: AB AR ES GG KZ TR WS
melanoceras Gmelin, 1790: 1838 (*Cerambyx*) [Germany: Leipzig]
canaliculata Frölich, 1793: 144 (*Saperda*) [Austria]
solidaginis Bach, 1856: 39 [Germany: Sachsen]

julii Mulsant, 1863: 429 [France: Seine: Asnière]
caroni Mulsant & Godart, 1876: 419 [France: Indre et Loire: Tours env.]
tristriga Reitter, 1913: 70 (*Phytoecia nigricornis* var.) [Russia: Orenburg (Ural): Guberlya]
Turkish distribution patterns: Adana, European Turkey (?Edirne or Kırklareli), Niğde provinces.
Remarks: The species was not given by Löbl and Smetana (2010) and Danilevsky (2015) from Anatolia (Asian Turkey). Because both works were overlooked the Turkish records of Bodemeyer (1900). So it occurs also in Anatolia for Turkey.

P. pubescens Pic, 1895: 64 (*Phytoecia manicata* var.) (Holotype ♂, ex collection M. Pic, Muséum National d'Histoire Naturelle, Paris) [Type locality "Baudu" (Syria)] **E**: BH BU CR GR MC ST **A**: AB AR GG IN IS JO LE SY TR
glaphyra K. Daniel, 1906: 177 [Turkey: Adana]
Turkish distribution patterns: Adana, Amasya, Ankara, Bolu, Çankırı, Çorum, Diyarbakır, Erzurum, Hatay, İçel, İstanbul, İzmir, Konya, Mardin provinces.

P. pustulata Schrank, 1776: 66 (*Cerambyx*)
****P. pustulata cihanae*** Özdikmen, 2017b: 54 (Holotype ♂, collection H. Özdikmen, Zoological Museum of Gazi University, Ankara) [Type locality "Gencek-Derebucak" (Turkey: Konya)] **A:** TR
Turkish distribution patterns: Konya province.
P. pustulata pilipennis Reitter, 1895: 161 (*Phytoecia pilipennis*) (Syntypes ♂♂, ex collection Edmund Reitter, Magyar Természettudományi Mûzeum, Budapest) [Type locality "Nakhichevan: Ordubad, Araxesthal" (Armenia)] **A**: AB AR IN TR
vexans Reitter, 1895: 162 (*Phytoecia pustulata* var.) [Armenia: Nakhichevan: Araxesthal, Ordubad]
adnexa Pic, 1947: 1 (*Phytoecia pustulata* var.) [Iran: Astrabad]
Turkish distribution patterns: Kars province.
P. pustulata pustulata Schrank, 1776: 66 (*Cerambyx*) (Syntypes, ex collection F. P. Schrank, Naturhistorisches Museum Wien) [Type locality "Linz, Vienna" (Austria)] **E**: AL AU BH BU BY CR CT CZ FR GE GR HU IT LA MC MD PL PT RO SK SL SP SZ ST TR UK YU **A**: AB AR GG KI KZ TD TR UZ
lineola Fabricius, 1781: 235 (*Saperda*) [Italy]
posegana Piller & Mitterpacher, 1783: 67 (*Cerambyx*) [Hungary: Posaganam]
vulnerata Schaller, 1783: 293 (*Cerambyx*) [?]
murina Marseul, 1870: 384 [Russia: Volgograd: Sarepta]
obscuripes Pic, 1895: 65 (*Phytoecia pustulata* var.) [?]
macedonica Pic, 1929: 9 (*Phytoecia pustulata* var.) [Macedonia]
brevenotata Pic, 1936: 4 (*Phytoecia pustulata* var.)
Turkish distribution patterns: Adana, Amasya, Bilecik, Bolu, Düzce, Edirne, Kahramanmaraş, Kırıkkale, Konya, Niğde, Osmaniye, Samsun, Sivas provinces.
Remarks: The subspecies was not given by Löbl and Smetana (2010) and Danilevsky (2015) from European Turkey. Because both works were overlooked the record of European Turkey of Althoff & Danilevsky (1997). Moreover, the subspecies was recorded by Şenyüz & Özdikmen (2013) from Edirne province in European Turkey. So it occurs also in European Turkey for Turkey.
Known other subspecies:
P. pustulata adulta Ganglbauer, 1884: 572 **A**: IN
P. pustulata pulla Ganglbauer, 1886: 130 **E**: ST **A**: KZ KI UZ

P. rufipes Olivier, 1795: 25 (*Saperda*)
P. rufipes latior Pic, 1895: 66 (*Phytoecia rufipes* var.) (Syntypes 2♀♀, ex collection M. Pic, Muséum National d'Histoire Naturelle, Paris) [Type locality "Akbez" (Turkey: Hatay)] **A**: SY TR
Turkish distribution patterns: Adana, Aksaray, Hatay, Niğde provinces.
P. rufipes rufipes Olivier, 1795: 25 (*Saperda*) (Syntypes, ex collection Guillaume-Antoine Olivier) [Type locality "Var" (France)] **E**: BH BU CR FR GR (Crete) IT PT SL SP ST SZ UK **A**: AR ES GG IN KI KZ TD TM TR UZ WS
umbellatarum Gistel, 1831: 303 (*Saperda*) [Spain]
sibirica Gebler, 1833: 304 (*Saperda*) [Russia: Altai: Loktewsk]

coeca Küster, 1848: 85 (*Oberea*) [Spain: Murcia: Cartagena]
ledereri Mulsant, 1851: 132 [Spain]
femoralis Mulsant, 1862: 416 ["Algeria", probably mislabeled]
ludovici Pic, 1891: 133 [1891m: cxxxv] [Russia: Volgograd: Sarepta]

Turkish distribution patterns: Adana, Adıyaman, Çankırı, İçel, Kahramanmaraş, Kırıkkale, Malatya provinces.

P. shokhini Kasatkin, 2010: 61 (Holotype ♂, ex collection D. G. Kasatkin, Rostov-na-Donu, Collection of Zoological Institute of the Russian Academy of Sciences, Saint-Petersbourg) [Type locality "Ovacık" (Turkey: Tunceli)] **A**: TR
Turkish distribution patterns: Tunceli province.

****P. subannularis*** Pic, 1901: 14 (Holotype, ex collection M. Pic, Muséum National d'Histoire Naturelle, Paris) [Type locality "Syria" but may be mislabeled, could be Turkey: Hatay] **A**: TR
Turkish distribution patterns: Hatay province.

P. virgula Charpentier, 1825: 225 (*Saperda*) (Holotype, ex collection Toussaint de Charpentier, Museum für Naturkunde der Humboldt-Universität zu Berlin) [Type locality "Dalmatia" (Croatia)] **E**: AL AU BH BU BY CR CT CZ FR GE GR HU IT LT MC MD PL PT RO SK SL SP ST SZ TR UK YU **A**: AB AR CY GG IN IS JO KI KZ LE SY TD TM TR UZ XIN

punctum Ménétriés, 1832: 227 (*Saperda*) [Azerbaijan: Lenkoran]
cyclops Küster, 1848: 88 [Spain: Murcia: Cartagena]
grisea Pic, 1891: 139 (*Phytoecia virgula* var.) [Russia: Volgograd: Sarepta]
major Pic, 1901: 14 (*Phytoecia virgula* var.) [Syria]
bravardi Pic, 1947: 1 (*Phytoecia virgula* var.) [Macedonia]

Turkish distribution patterns: Adana, Adıyaman, Afyon, Aksaray, Ankara, Amasya, Bartın, Bayburt, Bilecik, Bingöl, Bolu, Burdur, Çankırı, Çorum, Denizli, Erzincan, Erzurum, Eskişehir, European Turkey (?Edirne), Gümüşhane, Hatay, Isparta, İstanbul, İzmir, Kahramanmaraş, Karabük, Kars, Kastamonu, Kırıkkale, Konya, Kütahya, Manisa, Nevşehir, Niğde, Osmaniye, Samsun, Tunceli, Van provinces.

CONCLUSION

Löbl & Smetana (2010) mentioned 19 species group taxa of 17 species for members of the subgenus *Phytoecia* (s.str.) in Turkey. Then, Özdikmen (2012) and Danilevsky (2016) gave 24 species group taxa of 19 species. According to result of the present work, Turkish *Phytoecia* (s.str.) consist of 27 species group taxa of 21 species with newly described species and subspecies (Appendix 1).

According to the present work, 6 of 21 species are endemics to Turkey. In the other word, 29% of the known species of Turkish *Phytoecia* (s.str.) are endemics. Among Palearctic species, however, 22 of 49 species are endemics for different countries according to Danilevsky (2016). In the other word, 44% of the known species of Palaearctic *Phytoecia* (s.str.) are endemics. Accordingly, the endemism ratio of the known species of Turkish *Phytoecia* (s.str.) is highly lower than that of Palearctic species. From point of this view, Turkey can include still at least a few undescribed species.

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LITERATURE CITED

Adlbauer, K. 1988. Neues zur Taxonomie und Faunistik der Bockkäferfauna der Türkei (Coleoptera, Cerambycidae). Entomofauna, 9: 257-297.

Althoff, J. & Danilevsky, M. L. 1997. A Check-List of Longicorn Beetles (Coleoptera, Cerambycoidea) of Europe. Slovensko Entomološko Društvo Štefana Michielija. Ljubljana, 64 pp.

Bodemeyer, H. E. V. 1900. Quer durch Klein Asien, in den Bulghar Dagh; Eine Naturvissenschafliche studien-Reise. Coleopterologisches, 196 pp.

Breuning, S. 1951. Révision du genre *Phytoecia* Muls. (Suite et fin). Entomologische Arbeiten aus dem Museum G. Frey, München, 2: 353-460.

Breuning, S. & Villiers, A. 1967. Cérambycides de Turquie (2. note). L' Entomologiste, 23: 59-63.

Brullé, A. G. 1832-1836. Expédition scientifique de Morée. Section des Sciences Physiques. Tome III. - 1.re Partie. Zoologie. Deuxième Section. Des animaux articulés. F.G. Levrault, Paris, 3: 1-400.

Charpentier, T. 1825. Horae Entomologicae adjectis tabulis novem coloratis. Gosohorsky, Wratislawiae, 1-255.

Danilevsky, M. L. 2010. Four new *Phytoecia* (Coleoptera: Cerambycidae) from Turkey. Studies and Reports of District Museum Prague-East, Taxonomical Series, 6: 19-30.

Danilevsky, M. L. 2016. Catalogue of Palaearctic Cerambycoidea. Available from: http://www.cerambycidae.net/catalog.pdf (accessed 16.08.2016).

Demelt, C. V. 1963. Beitrag zur Kenntnis der Cerambycidenfauna Kleinasiens und 13. Beitrag zur Biologie palaearkt. Cerambyciden, sowie Beschreibung einer neuen *Oberea*-Art. Entomologische Blatter, 59: 132-151.

Demelt, C. V. & Alkan, B. 1962. Short information of Cerambycidae Fauna of Turkey. Bitki Koruma Bülteni, 2: 49-56.

Fabricius, J. C. 1782. Appendix and Index. Hamburgi et Kilonii: Carol Ernest Bohnii, 2: 495-517.

Gül-Zümreoğlu, S. 1972. Catalogue of Insect and common pests (1928-1969). T. C. Publications of Agriculture Ministry, Bornova, İzmir, 119 pp.

Gül-Zümreoğlu, S. 1975. Investigations on taxonomy, host plants and distribution of the Longhorned Beetles (Cerambycidae-Coleoptera) in Aegean Region. T. C. Ministry of Food, Agriculture and Stockbreeding, No: 28, İstiklal Press, İzmir, 208 pp.

Holzschuh, C. 1984. Beschreibung von 21 neuen Bockkäfern aus Europa und Asien (Cerambycidae, Col.). Koleopterologische Rundschau, Wien, 57: 141-165.

Kasatkin, D. G. 2010. A new species of the genus *Phytoecia* Dejean, 1835 (Coleoptera: Cerambycidae) from Eastern Turkey. Caucasian Entomological Bulletin, 6: 73-74.

Kraatz, G. 1871. Synonymische Bemerkungen. Berliner Entomologische Zeitschrift, 14: 271-272.

Linné, C. 1758. Systema naturæ per regna tria naturæ secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Systema naturae (Editio 10) Laur. Salvius. Holmiae, 1: 824 pp.

Löbl, I. & Smetana, A. 2010. Catalogue of Palaearctic Coleoptera, Vol. 6. Chrysomeloidea. Stenstrup: Apollo Books, 924 pp.

Mulsant, É. 1862. Histoire Naturelle des Coléoptères de France. Longicornes. Annales de la Société Impériale d'Agriculture, d'Histoire Naturelle et des Arts Utiles de Lyon, 1862: 1-480.

Mulsant, E. & Rey, C. 1863. Longicornes nouveaux ou peu connus. Annales de la Société Linnéenne de Lyon (Nouvelle série), 10: 144-184.

Olivier, G.-A. 1795. Entomologie ou Histoire Naturelle des Insectes, avec leurs caractères génériques et spécifiques, leur description, leur synonymie et leur figure enluminée Coléoptères. Imprimerie de Lanneau, Paris, 4: 1-519.

Özdikmen, H. 2007. The Longicorn Beetles of Turkey (Coleoptera: Cerambycidae) Part I – Black Sea Region. Munis Entomology & Zoology, 2: 179-422.

Özdikmen, H. 2008a. The Longicorn Beetles of Turkey (Coleoptera: Cerambycidae) Part II – Marmara Region. Munis Entomology & Zoology, 3: 7-152.

Özdikmen, H. 2008b. The Longicorn Beetles of Turkey (Coleoptera: Cerambycidae) Part III – Aegean Region. Munis Entomology & Zoology, 3: 355-436.

Özdikmen, H. 2011. The Longicorn Beetles of Turkey (Coleoptera: Cerambycidae) Part IV – Mediterranean Region. Munis Entomology & Zoology, 6: 6-145.

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

Özdikmen, H. 2013. The Longicorn Beetles of Turkey (Coleoptera: Cerambycidae) Part V – South-Eastern Anatolian Region. Munis Entomology & Zoology, 8: 67-123.

Özdikmen, H. 2017a. A new species of *Phytoecia* (*Phytoecia*) Dejean from Turkey (Cerambycidae: Lamiinae). Munis Entomology & Zoology, 12 : 23-26.

Özdikmen, H. 2017b. A new subspecies of *Phytoecia* (*Phytoecia*) *pustulata* (Schrank, 1776) from Turkey (Cerambycidae: Lamiinae). Munis Entomology & Zoology, 12: 54-55.

Pic, M. 1891. Descriptions d'espèces et variétés de Longicornes Syriens. L'Échange, Revue Linnéenne, 7: 102.

Pic, M. 1895. Sur les *Phytæcia* voisins de punctum Mén. et *ephippium* Fab.. L'Échange, Revue Linnéenne, 11: 63-70.

Pic, M. 1897. Descriptions de Coléoptères asiatiques de la famille des Cerambycidae. Bulletin de la Société zoologique de France, Paris, 22: 188-190.

Pic, M. 1901. Descriptions. Matériaux pour servir à l'étude des Longicornes, 3: 9-14.

Reiche, L. J. & Saulcy, F. 1858. Espèces nouvelles ou peu connues de Coléoptères, recueillies par M. F. de Saulcy, Membre de l'Institut, dans son Voyage en Orient (Fin). Annales de la Société Entomologique de France, Paris, 6: 5-60.

Reitter, E. 1895. Zwölfter Beitrag zur Coleopteren-Fauna des russischen Reiches. Wiener Entomologische Zeitung, 14: 149-162.

Reitter, E. 1913. Eine Serie neuer Coleopteren aus der paläarktischen Fauna. Deutsche entomologische Zeitschrift, 6: 649-666.

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

Schaller, J. G. 1783. Neue Insekten beschrieben. Schriften der naturforschenden Gesellschaft zu Halle, 1: 217-328.

Schrank, F. P. 1776. Beyträge zur Naturgeschichte. Leipzig, Fritsch, 8: 1-137.

Scopoli, G. A. 1772. Observationes zoologicae. Annus V. Historico Naturalis. Christian Gottlob Hilscheri, Lipsiae, 5: 1-128.

Şenyüz, Y. & Özdikmen, H. 2013. A contribution to the knowledge of Turkish longicorn beetles fauna (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 8: 571-577.

Tavakilian, G. 2016. Base de données Titan sur les Cerambycidés ou Longicornes. Available from: http://lis-02.snv.jussieu.fr/titan/ (Accessed 16.08.2016).

Tozlu, G., Rejzek, M. & Özbek, H. 2003. A contribution to the knowledge of Cerambycidae (Coleoptera) fauna of Turkey Part II : Subfamily Lamiinae. Biocosme Mésogéen, Nice, 19: 95-110.

Tuatay, N., Kalkandelen, A. & Aysev, N. 1972. Bitki Koruma Müzesi Böcek Kataloğu (1961-1971). T. C. Tarım Bakanlığı, Ankara, 53-55.

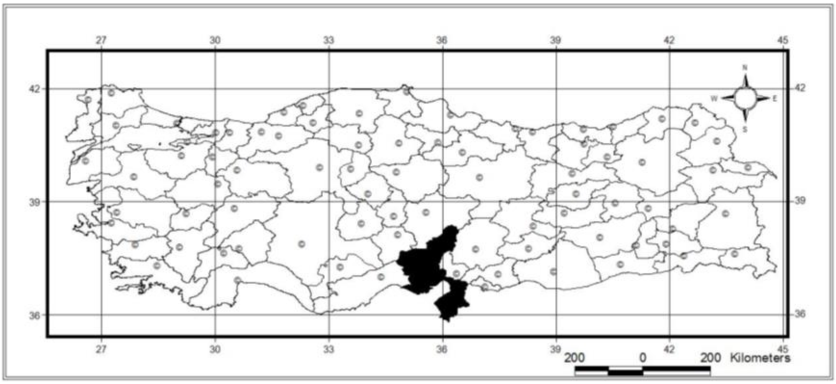

Figure 1. The distribution patterns of *Phytoecia caerulea bethseba* Reiche & Saulcy, 1858 in Turkey.

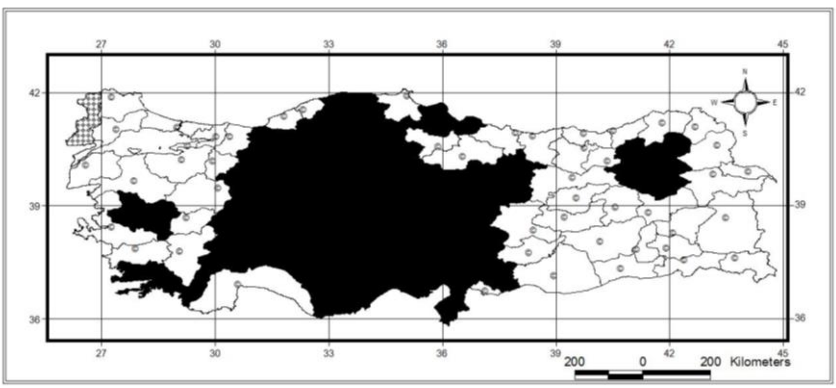

Figure 2. The distribution patterns of *Phytoecia caerulea caerulea* (Scopoli, 1772) in Turkey.

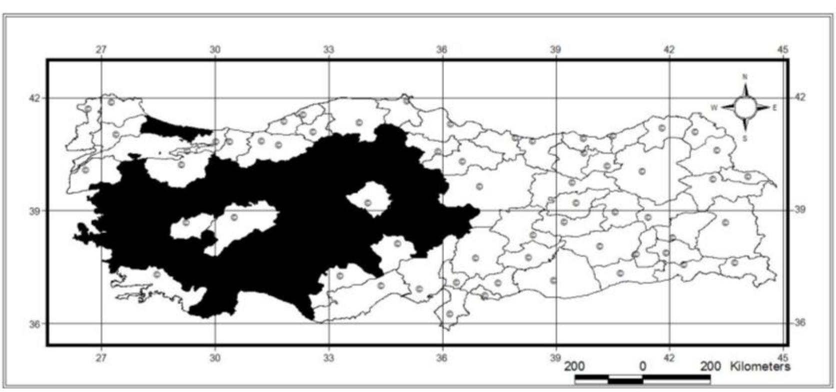

Figure 3. The distribution patterns of *Phytoecia baccueti* (Brullé, 1832) in Turkey.

Figure 4. *Phytoecia baccueti* (Brullé, 1832) (left) and *Phytoecia caerulea caerulea* (Scopoli, 1772) (right).

Table 1. Collected specimens of *Phytoecia baccueti* (Brullé, 1832) and *Phytoecia caerulea caerulea* (Scopoli, 1772) from Çankırı province.

Phytoecia baccueti		***Phytoecia caerulea caerulea***	
Locality name and no	Number of specimens	Locality name and no	Number of specimens
Kızılırmak-1	2		
Kızılırmak-2	6	Kızılırmak-2	4
Kızılırmak-3	1	Kızılırmak-3	1
Kızılırmak-4	1	Kızılırmak-4	-
Kızılırmak-5	-	Kızılırmak-5	3
Kızılırmak-6	2	Kızılırmak-6	3
Kızılırmak-7	3	Kızılırmak-7	-
Kızılırmak-8	1	Kızılırmak-8	1
Kızılırmak-9	3	Kızılırmak-9	6
Kızılırmak-10	2	Kızılırmak-10	-
Kızılırmak-11	2	Kızılırmak-11	1
Kızılırmak-12	4	Kızılırmak-12	7
Central-1	2	Central-1	2
Central-2	-	Central-2	1
Central-3	1	Central-3	1
Central-4	4	Central-4	1
Central-5	1	Central-5	1
Central-6	1	Central-6	-
Central-7	1	Central-7	-
Central-8	-	Central-8	2
Orta-1	1	Orta-1	-
Orta-2	1	Orta-2	3
Orta-3	2	Orta-3	-
Orta-4	-	Orta-4	1
Korgun-1	1	Korgun-1	-
Korgun-2	1	Korgun-2	-
Korgun-3	1	Korgun-3	-
Korgun-4	1	Korgun-4	-
Korgun-5	1	Korgun-5	-
Kurşunlu-1	-	Kurşunlu-1	2
Eldivan-1	-	Eldivan-1	1

A REVIEW OF THE GENUS *BAGAUDA* BERGROTH, 1903 (HETEROPTERA: REDUVIIDAE) FROM INDIA

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[**Chandra, K., Mukherjee, P., Kushwaha, S., Hassan, M. E. & Biswas, B.** 2017. A review of the genus *Bagauda* Bergroth, 1903 (Heteroptera: Reduviidae) from India. Munis Entomology & Zoology, 12 (1): 120-126]

ABSTRACT: The paper presents a revision of the genus *Bagauda* Bergroth, 1903 from India. Key to the species of the genus and distributions of each species in India and abroad have been included.

KEY WORDS: Heteroptera, Reduviidae, *Bagauda*, revision, India

Bergroth (1903) erected the genus *Bagauda* (Heteroptera: Reduviidae) based on the type species *Bagauda avidus* Bergroth, 1903, belonging to the subfamily Emesinae of the family Reduviidae. The family Reduviidae, commonly known as "Assassin bugs" are the largest group of predaceous terrestrial Hemiptera, comprising of 6878 species and subspecies under 981 genera belonging to 25 subfamilies (Henry, 2009) from the world. Of which 465 species under 144 genera belonging to 14 subfamilies (Biswas & Mitra, 2011) are recorded from India. The subfamily Emesinae is represented by 28 species and 14 genera under four tribes, *viz.*, Emesinii, Leistarchini, Metapterini and Ploiariolini. The group was monographed by Wygodzinsky, 1966, who recognized six tribes Collartidini, Leistarchini, Emesini, Ploiariini, Deliastini and Metapterini, comprising 86 genera, out of which 20 are monotypic and known from a single locality. Distant (1906) erected a new species *viz. Bagauda splendens* from SriLanka. Later on, Chandra et al. (2015) has recorded this species from Chhindwara District of Madhya Pradesh, India. Paiva (1919) added another new species *viz. Bagauda cavernicola* from Assam. Wygodzinsky (1966) in his monograph of Emesinae added a new species *viz. Bagauda similis* from West Bengal. Till to date four species under the genus *Bagauda* Bergroth has been so far known from India. In this paper the genus *Bagauda* Bergroth is reviewed with a new distributional record of *Bagauda avidus* Bergroth from Madhya Pradesh, key to the species of the genus *Bagauda* Bergroth and distributions of each species in India and abroad is also included.

MATERIALS AND METHODS

This study is based on 14 specimens present in Hemiptera Section, Zoological Survey of India, Kolkata, collected from various localities of Indian subcontinent. The specimens were studied and photographed by using a Leica Stereo microscope M 205A. The specimens are deposited in the National Zoological Collection of Zoological Survey of India, Hemiptera Section, Kolkata. All measurements are in millimetres.

RESULTS AND DISCUSSION

Genus *Bagauda* Bergroth, 1903

1903. *Bagauda* Bergroth, Rev. d'Ent., 22: 12.

Diagnosis: Macropterous; head fusiform, anteocular and postocular moderately elevated, postocular region rounded, interocular furrow not extending behind level of posterior border of eyes; eyes medium sized; rostrum slender, straight, first segment reaching middle of anteocular region of head, second subequal to first, third as long as or longer than first or second; antennae inserted nearer to apex of head than anterior border of eyes, first segment three times longer than pronotum; pronotum more than twice the length of head, base considerably wider than apex, medially constricted, basal margin sinuate, completely covering mesonotum, scutellum exposed, anterior lobe subcylindrical, narrowed posteriorly whereas posterior lobe subrectangular with sides diverging posteriorly; scutellum subtriangular; hemelytra passing abdominal apex, exterior cell of membrane longer than interior cell; forelegs stout, fore femora moderately incrassated, beneath finely spinose, fore tibia and tarsi united about as long as femora, fore tarsi single-jointed, hind femora invariably passing abdominal apex.

Key to the species of the genus *Bagauda* Bergroth

1. Length 14-16 mm..*cavernicola* Paiva
- Length 10-13 mm...2

2. Forelegs and forewings with contrasting light and dark colour pattern..............................3
- Forelegs and forewings rather uniformly brownish, lacking conspicuously contrasting pattern elements...*avidus* Bergroth

3. Fore lobe of pronotum longer than hind lobe; forelegs dark, femur with a subapical stramineous, incomplete annulus; anterior two-thirds and posterior lobe of pronotum dark brown..*similis* Wygodzinsky
- Fore lobe of pronotum about as long as hind lobe; trochanter, base of femur and apex of tibia of forelegs, yellowish; pronotum dark brown......................................*splendens* Distant

Bagauda cavernicola Paiva, 1919

1919. *Bagauda cavernicola* Paiva, Rec. Indian Mus., 16: 349-377.
1966. *Bagauda cavernicola*, Wygodzinsky, Bull. Amer. Mus. Nat. Hist., 133: 95.
1990. *Bagauda cavernicola*, Maldonado, Carribbean J. Sci. (special ed.), 99 pp.

Description: Body castaneous brown in colour (Fig. 1); anterior region of fore lobe of pronotum and hind lobe dark brown, rest yellowish brown (Fig. 2); membrane fuliginous, a large round spot on corium; apex of fore, mid and hind femora and base of fore, mid and hind tibiae creamy white; head (1.47 mm) shorter than anterior lobe of pronotum (1.74 mm), anteocular region of head (0.91 mm) distinctly longer than postocular region (0.55 mm); first segment of antennae (10.53 mm) longer than second segment (9.84 mm) and exceeding the length of head and pronotum together (4.72 mm); first segment of rostrum (0.46 mm) slightly shorter than second segment (0.52 mm), third segment (0.61 mm) longer than second segment (0.52 mm) (Fig. 3); anterior lobe of pronotum (1.74 mm) slightly longer than posterior lobe (1.50 mm) and constricted area of pronotum extending to the anterior half of posterior lobe; scutellum transverse; hemelytra exceeding the length of abdomen; legs with hind tibiae (22.33 mm) 1.5

times longer than hind femora (14.58 mm), first tarsal joint slightly longer than second joint but shorter than third joint.

Measurements: (1 ♂ in mm). Body length 15.57; head length 1.47, width across eye 1.10; length of anteocular region 0.91, postocular region 0.55; length of antennae 26.37, lengths of antennal segments I: 10.53, II: 9.84, III: 4.04, and IV: 1.95; rostral length 1.701, length of rostral segments I: 0.46, II: 0.52 and III: 0.61; length of pronotum 3.25; length of anterior pronotal lobe 1.74, posterior pronotal lobe 1.50, width of anterior pronotal lobe 1.19, posterior pronotal lobe 1.76; length of fore coxa: 2.55, trochanter: 0.65, femur: 4.02, tibia: 2.23, tarsus: 1.70, claws: 0.12; mid coxa: 0.70, trochanter: 0.51, femur: 11.01, tibia: 15.27, tarsus: 0.37, claw: 0.12; hind coxa:1.03, trochanter: 0.51, femur: 14.58, tibia: 22.33, tarsus: 0.55, claw: 0.14.

Material examined: 6exs., India: Assam: West Garo hills: Siju cave, 2.XI.1917, R. Friel; 5exs., Assam: Garo hills: Siju cave, 10.II.1922, S.K. and B.N.C.

Distribution: India: Assam. Elsewhere: SriLanka.

***Bagauda avidus*, Bergroth 1903**

1903. *Bagauda avidus* Berger, Rev. d' Ent., 22: 13.
1904. *Bagauda avidus* Distant, Fauna Brit. India, Rhynchota, 2: 208.

Description: Body yellowish brown in colour, opaque (Fig. 5); head oval, anteocular region (0.79 mm) longer than postocular region (0.32 mm); antennae black, first segment of antennae (4.95 mm) slightly longer than second (4.74 mm); rostrum with first segment (0.43 mm) about as long as second (0.40 mm), third (0.35 mm) little shorter than the other two (Fig. 7); pronotum with anterior lobe (1.40 mm) longer than posterior lobe (1.15 mm), posterior lobe dark brown with angles of pronotum distinctly nodulose (Fig. 6); fore femora moderately incrassated with very minute, fine and black spines and its length (3.06 mm) about as long as tibia and tarsus together (3.00 mm) (Fig. 7), hind femora dark brownish, apices of mid and hind femora and bases of mid and hind tibiae creamy white, mid and hind tibia longer than femora.

Measurements: (1 ♂ in mm). Body length 10.96; head length 1.11, width across eye 0.88; length of anteocular region 0.79, postocular region 0.32; length of antennae 12.22, lengths of antennal segments I: 4.95, II: 4.74, III: 1.80, and IV: 0.73; rostral length 1.18, length of rostral segments I: 0.43, II: 0.40 and III: 0.35; length of pronotum 2.55; length of anterior pronotal lobe 1.40, posterior pronotal lobe 1.15, width of anterior pronotal lobe 0.82, posterior pronotal lobe 1.47; length of fore coxa: 1.81, trochanter: 0.49, femur: 3.06, tibia: 1.93, tarsus: 1.07, claws: 0.12; mid coxa: 0.70, trochanter: 0.41, femur: 7.83, tibia: 9.87, tarsus: 0.36, claw: 0.12; hind coxa: 0.75, trochanter: 0.50, femur: 10.60, tibia: 12.03, tarsus: 0.40, claw: 0.13.

Material examined: 1 ex, India: Madhya Pradesh: Senoi: Simariya village: Pench Tiger Reserve, 7.VIII.2001, Coll. R.K. Singh.

Distribution: India: Maharashtra, Madhya Pradesh and Tamil Nadu. Elsewhere: SriLanka.

***Bagauda similis* Wygodzinsky, 1966**

1966. *Bagauda similis* Wygodzinsky, Bull. Amer. Mus. Nat. Hist., 133: 98-100.
1990. *Bagauda similis*, Maldonado, Carribbean J. Sci. (special ed.), 99 pp.
2006. *Bagauda similis*, Ambrose, Zoos' Print Journal, 21 (9): 5.

Description: Body dark brown (Fig. 9); head suboval, interocular furrow extend backwardly almost to level of posterior border of eyes; anterior two-thirds and posterior lobe of pronotum dark brown (Fig. 10); rostrum straight, first segment (0.47 mm) slightly longer than second segment (0.41 mm) which is subequal to third segment (0.47 mm) (Fig. 11); antennae bare in both sexes, length of first segment (8.90 mm) longer than rest of the segments; eyes extends beyond anteocular region of head; fore lobe of pronotum (1.67 mm) smooth, longer than posterior lobe (1.31 mm) (Fig. 10) and on posterior region with stramineous spot (occupying whole length of pronotum in male), hind lobe dilated rugose punctate with a distinct narrow, median longitudinal ridge, posterior two-thirds of fore lobe laterally with a distinct narrow carina; fore wings attaining apex of abdomen; abdomen slender; forelegs dark, fore coxae stout, as long as prothorax along ventral surface, femur with a subapical stramineous, incomplete annulus and with spine-like setae at under surface, spines of base of posteroventral series not distinctly longer or stouter than remainings, tibiae somewhat longer than half of length of femur, on ventral surface with one series of short inclined spines, tarsus half as long as tibia, third joint longer than second, their combined length slightly less than half as long as first, two subequal claws; mid and hind legs elongate, hind femora extending apex of fore wing.

Measurements: (1 ♂ in mm). Body length 12.41; head length 1.11, width across eye 1.11; length of anteocular region 0.70, postocular region 0.41; length of antennae 15.86, lengths of antennal segments I: 8.90, II: 1.68, III: 3.59, and IV: 1.60; rostral length 1.36, length of rostral segments I: 0.47, II: 0.41 and III: 0.47; length of pronotum 2.98; length of anterior pronotal lobe 1.67, posterior pronotal lobe 1.31, width of anterior pronotal lobe 0.86, posterior pronotal lobe 1.48; length of fore coxa: 1.50, trochanter: 0.56, femur: 3.85, tibia: 1.98, tarsus: 1.50, claws: 0.12; mid coxa: 0.54, trochanter: 0.43, femur: 9.95, tibia: 14.26, tarsus: 0.39, claw: 0.12; hind coxa: 0.44, trochanter: 0.40, femur: 12.34, tibia: 20.54, tarsus: 0.57, claw: 0.13.

Material examined: 1ex., India: West Bengal: Baigachi, 14.VII.1943, Biswas and party.

Distribution: India: Tamil Nadu, West Bengal.

Bagauda splendens **Distant, 1906**

1906. *Bagauda splendens* Distant, Ann. Mag. Nat. Hist., (7) 18: 364.
1909. *Bagauda decorus* :Breddin, Ann. Soc. Ent. Belg.: 301.
1910. *Bagauda splendens* : Distant, Fauna Brit. India, Rhynchota, 5: 176.

Description: Body dark brownish black in colour (Fig. 13); head, eyes, anterior margin of pronotum, scutellum, apical area of abdomen beneath black; pronotum, membrane, anterior femora (excluding base) and anterior tibiae brown; head suboval, narrower in front of eyes (Fig. 14); rostrum with the first segment reaching middle of anteocular portion of head, second segment subequal to first, third slightly shorter than second (Fig. 15); head sub-oval, narrow infront of eyes than behind, anteocular region (0.91 mm) longer than postocular region (0.34 mm); first segment of antennae (6.61 mm) longer than second (5.15 mm); pronotum dark brown, its length (2.66 mm) more than twice as long as head (1.25 mm), the anterior lobe (1.37 mm) constricted and about as long as posterior lobe (1.30 mm), which is convex with a central longitudinal narrow ridge and with a nodule near each posterior angle, its basal margin wavy (Fig. 14); scutellum triangular; corium, chestnut brown in colour between the veins and with a pale creamy patch before the membrane, the latter with a central pale vein, lateral area of corium transversely striate; hemelytra passing the abdominal apex (Fig. 16), exterior cells of the membrane longer than the interior; trochanter, base of femur and apex of tibia of forelegs, yellowish (Fig. 15), fore femora (2.79 mm) moderately thickened and finely spinous beneath, about as long as fore tibiae and tarsi together (2.95 mm), hind femora (10.02 mm) about as long as entire body (10.85 mm), apex of mid and hind femora and base of mid and hind tibia, creamy white; tarsi three-jointed.

Measurements: (1 ♂ in mm). Body length 10.85; head length 1.25, width across eye 0.86; length of anteocular region 0.91, postocular region 0.34; length of first antennal segment 6.61, length of second antennal segment 5.15, rest two segments are damaged; rostral length 1.29, length of rostral segments I: 0.43, II: 0.42 and III: 0.44; length of pronotum 2.66; length of anterior pronotal lobe 1.37, posterior pronotal lobe 1.30, width of anterior pronotal lobe 0.87, posterior pronotal lobe 1.55; length of fore coxa: 1.69, trochanter: 0.52, femur: 2.79, tibia: 1.80, tarsus: 1.15, claws: 0.07; mid coxa: 0.58, trochanter: 0.47, femur: 7.49, tibia: 9.58, tarsi damaged; hind coxa: 0.64, trochanter: 0.35, femur: 10.02, tibia: 14.67, tarsus: 0.34, claw: 0.12.

Material examined: 1ex, India: Madhya Pradesh: Chhindwara: near the origin of the River Gayeni (Patalkot), 13.X.1992, Coll. R. K. Singh and party.

Distribution: India: Madhya Pradesh. Elsewhere: SriLanka.

SUMMARY

The genus *Bagauda* Bergroth from Indian subcontinent is reviewed, recognizing four species from the subcontinent. The species *Bagauda avidus* Bergroth is reported here for the first time from Madhya Pradesh. Measurements of different body parts were taken which can be utilised as an additional diagnostic characters. Key to the species of the genus *Bagauda* Bergroth and distributions of each species in India and abroad have been included in the present study.

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LITERATURE CITED

Ambrose, D. P. 2006. A checklist of Indian assassin bugs (Insecta: Hemiptera: Reduviidae) with taxonomic status, distribution and diagnostic morphological characteristics. Zoos' Print Journal, 21 (9): 2388- 2406 (plus web supplement of 34 pages).

Bergroth, E. 1903. Descriptions preliminaires de Ploearinae d'Afrique. Rev. Entomol., 22: 8-11.

Biswas, B. & Mitra, B. 2011. Checklist on Indian Assassin Bugs (Insecta: Hemiptera: Reduviidae). Zool. Surv. India, 1-33.

Breddin, G. 1909. Rhynchoten von Ceylon gesammelt von Dr. Walter Horn. Ann. Soc. Entomol. Belg., 53: 250-309.

Chandra, K., Biswas, B., Kushwaha, S., Mukherjee, P. & Bal, A. 2015. First record of Bagauda splendens Distant (Heteroptera: Reduviidae) from India. Prommalia, 3: 74-78.

Distant, W. L. 1906. Oriental Reduviidae. Ann. Mag. Nat. Hist., (7) 18: 363-371.

Distant, W. L. 1910. The Fauna of British India, including Ceylon and Burma, Rhynchota, 5 : Taylor and Francis, London, 362 pp.

Henry, T. J. 2009. Biodiversity of Heteroptera, Insect Biodiversity Science and Society (By Robert , G. Foottit and Piter, H. Adler eds.): pp. 224-263.

Maldonado, C. 1990. Systematic Catalogue of the Reduviidae of the World (Insecta: Heteroptera), Carribbean J. Sci. (special ed.), University of Puerto Rico.: pp. 1- 694.

Paiva, C. A. 1919. Rhynchota from the Garo Hills, Assam. Rec. Indian Mus., 16: 349-377.

Wygodzinsky, P. 1966. A monograph on the Emesinae (Reduviidae : Hemiptera). Bull. Amer. Mus. Nat. Hist., 133: 1-614.

1 2 3 4

Figures 1-4. *Bagauda cavernicola* Paiva: 1. Dorsal view of male; 2. head and pronotum, dorsal view; 3. head with rostrum and forelegs, lateral view; 4. abdominal tip of male, ventral view.

5 6 7 8

Figures 5-8. *Bagauda avidus,* Bergroth: 5. Dorsal view of male; 6. head and pronotum, dorsal view; 7. head with rostrum and forelegs, lateral view; 8. abdominal tip of male, ventral view.

9 10 11 12

Figures 9-12. *Bagauda similis* Wygodzinsky: 9. Dorsal view of male; 10. head and pronotum, dorsal view; 11. head with rostrum, lateral view; 12. abdominal tip of male, ventral view.

13 14 15 16

Figures 13-16. *Bagauda splendens* Distant: 13. Dorsal view of male; 14. head and pronotum, dorsal view; 15. head with rostrum and forelegs, lateral view; 16. abdomen, lateral view.

ACCEPTANCE OF TERTIARY AND NON-FOOD PLANTS BY ERI SILKWORM, *SAMIA CYNTHIA RICINI* BOISDUVAL (LEPIDOPTERA: SATURNIIDAE)

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[**Anbu Radhika, S., Sakthivel, N. & Sahayaraj, K.** 2017. Acceptance of tertiary and non-food plants by eri silkworm, *Samia cynthia ricini* Boisduval (Lepidoptera: Saturniidae). Munis Entomology & Zoology, 12 (1): 127-132]

ABSTRACT: Performance of fourth and fifth instar larvae of eri silkworm, *Samia cynthia ricini* Boisduval (Lepidoptera: Saturniidae) on tertiary, papaya (*Carica papaya* L) (Caricaceae), and non-food plants, Indian acalypha, *Acalypha indica* L. (Euphorbiaceae), mulberry *Morus alba* L. (Moraceae), great morinda, *Morinda citrifolia* (Rubiaceae), white lead tree *Leucaena leucocephala* (Lam.) de Wit (Fabaceae) compared to its primary food plant, castor (*Ricinus communis* L) (Euphorbiaceae) was observed under laboratory conditions. Both fourth and fifth stadium larvae preferred castor followed by papaya. The fifth stadium larvae gained their weight both in non-starved and starved conditions whereas, fourth instar larvae losses the weight. Under Palayamkottai condition, first time, the biological traits like developmental times, reproduction and cocoon shell ratio was recorded. Results revealed that the tertiary food plant C. papaya can also be fed to eri silkworm on scarcity of castor leaves for successful production of eri silk.

KEY WORDS: Eri silkworm, biology, tertiary food plant, non-food plants, preference, weight gain or loss, economic traits

Eri silkworm, *Samia cynthia ricini* (Boisd.) (Lepidoptera: Saturniidae) is polyphagous in nature feeds on wide range of plants over 30 species (Choudhury, 1982; Reddy et al., 1989). The host plants are categorized as primary, secondary and tertiary based upon the degree of acceptance by the larvae, their growth, development and cocoon yield (Bindroo et al., 2007). Castor (*Ricinus communis*) and kesseru (*Heteropanax fragrans*) are considered to be the primary hosts while tapioca (*Manihot esculenta*) and payam (*Evodia flaxinifolia*) are secondary and these plants can be used for commercial production of eri silk (Sakthivel, 2012). Rest of the plant species like barkesseru (*Ailanthus excelsa*), papaya (*Carica papaya*), Jatropha (*Jatropha curcas*), barpat (*A. grandis*), gulancha (*Plumeria acutifolia*), gamari (*Gmelina arborea*) *etc* are tertiary on which the silkworm could complete its lifecycle. Eri silkworm could also survive on certain non host plants species if meet with starvation due to non availability of its food plants.

Therefore, the present study was carried out to find out the acceptance of commonly available tertiary, papaya (*Carica papaya* L) (Caricaceae), and some non-food plants, Indian acalypha, *Acalypha indica* L. (Euphorbiaceae), mulberry, *Morus alba* L. (Moraceae), great morinda, *Morinda citrifolia* (Rubiaceae), white lead tree, *Leucaena leucocephala* (Lam.) de Wit (Fabaceae) at Palayamkottai zone of Tamil Nadu, India by eri silkworm and feasibility if eri silk production compared to its primary food plant, castor (*Ricinus communis* L) (Euphorbiaceae).

MATERIAL AND METHODS

Source of eri silkworm and its maintenance

Disease fee laying (eggs) of *S. cynthia ricini* were obtained from the Eri Silkworm Seed Production Center, Central Silk Board, Hosur - 635109, Tamil Nadu, India were surface sterilized with 0.05% sodium hypochloride and incubated in petriplates (9.8 x 2cm). A small wet cotton swab was placed inside the petriplate to maintain the optimum temperature (25 ± 1°C) and relative humidity (80–85 %).After hatching, a tender leaf of castor was placed over the neonate larvae and allowed for 15 minutes. The worms crawled on the leaf were then transferred into plastic troughs (16 x 7cm) and the stock culture were maintained as per the standard procedure (Sakthivel, 2012) on castor leaves under laboratory condition (29±1°C temperature; 65 – 75 % RH).

Biological traits: For biological traits experiment, local castor variety was used. Tender leaves were fed four times a day up to third instar larvae and semi-tender and mature leaves were fed five times a day to the fourth and fifth instars, respectively. A total of 300 first stadium larvae were randomly selected from the stock culture and divided into six groups. Each group (50 larvae) is considering as a replicate and maintained them till their pupation in a paper box (37 x 6.4 cm and 3 mm thickness). Rearing arena was checked daily and dead larvae and unfed food was removed. Egg period, larval period and weight, pupal period and weight and adult period were recorded. Survival rate of each stadium was also recorded. Ten cocoons were randomly selected and the mean cocoon weight was computed in grams using monopan balance up to two decimals accuracy. After removing the pupa and exuvium from the 10 randomly selected cocoons, the shell weight was recorded in grams using the same balance. Ten fertilized gravid female moths were selected randomly replication and were allowed to lay eggs on plastic tray of uniform size in a dark room for 48 hours. The eggs laid were collected and counted to record the average fecundity per female.

Food Acceptance bioassay: On a plastic tray (18.5 length and 10.2cm width) mature leaves of leaves of *C. papaya, A. indica, M. Alba, M. citrifolia, L. leucocephala* along with the primary food plant castor, *R. communis* (approximately one gram each) was placed. Equal distance (3 cm) was maintained between each plant leaves. Then three uniform sized newly moulted fourth instar larvae were introduced at the centre of the feeding arena and record the food acceptance of the larvae in minutes by visual method. Six replications were maintained. In another set of experiment, newly moulted larvae were starved for 24 hours and then the acceptance of tested plants was recorded as mentioned above. In the third set of experiment, newly moulted larvae were starved for 48 hours and then the experiment was carried out. Similar experiments were also conducted for fifth instar larvae (0 day, 1-day starved and 2-days starved). Acceptance was calculated by using the following formula: Acceptance (%) = Number of larvae accepted a particular leaf/Total number of larvae used x 100.

Weight gain/loss: The mean preference results showed that eri silkworm larvae accepted castor followed by *C. papaya*. Hence, secondary food plant papaya was provided to the larvae and allowed to feed continuously for 24 hours. Initial and final weight of the larvae was recorded. From the data, the weight gain and/or loss was calculated by using the following formula.

Weight gain and / or loss per day (weight/ day / animal) = Initial weight - final weight/ Experimental days.

The experiment was conducted for both fourth and fifth instar larvae. Ten replications were maintained for each stadium.

Statistical analysis: The larval weight (mg), larval period, pupal period, adult period, fecundity and hatchability and economic parameters were analyzed by students 't' test whereas acceptance behavior was analysis by ANOVA using SPSS software (20 version). The interpretation of the data was done using critical difference values calculated at 5%.

RESULTS AND DISCUSSIONS

The potentiality of ericulture as a viable subsidiary occupation has been highlighted by several workers (Prakash et al., 2003; Saratchandra, 2003). It is evident that there will be a substantial increase in annual income of the farmers by practicing ericulture which brings socioeconomic change at the rural level. Since, Vellore (12.9202° N, 79.1333° E) and Palayamkottai (8°43' N, 77°48' E) are the hottest cities in Tamil Nadu, no farmer has been undertaken this practice here. Hence it is worthwhile to record the biological traits of eri silkworm under Palayamkottai condition. Incubation period was 9.5 days as observed by (Basaiah, 1988) on local castor variety.

Total larval period, pupal period and adult period were 19.9, 10.3 and 8.3 days respectively. Previously it was reported that the larval period varied at various locations, for instance, 20.0 and 45.0 days under Mysore (Anonymous, 1979), 21.0-28.0 and 16.0-19.0 days under Dharwad and Raichur conditions respectively (Devaiah et al., 1978; Patil et al., 1986). Further, significantly longer total larval period (25.7±1.6-days) as observed by Kavane (2014) and more larval survival (29%) ($t=2.000$; $P<0.05$) were recorded while SCR fed with papaya during fourth and fifth stadium. In Tamil Nadu, during winter the larval duration was 29.0 days where as it was 23.16-21.13 days during rainy and summer seasons respectively (Sakthivel, 2012). He further reported that the moderate average temperature (20-27°C) and relative humidity (RH-63-71%) in Tamil Nadu which are ideal for growth and development of silkworm and cocoon formation whereas high temperature (35.54°C) and low relative humidity (48.15%) summer prevalent are known to have negative impact of silkworm rearing and hence lower cocoon yield indicating spatial influence too. However, Rajadurai et al. (2010) did not find much difference in larval periods in different seasons.

The results indicate that Palayamkottai is a suitable place for rearing eri silk worm. This was also supported by normal body size observed in adults. For instance, the length of the head, thorax and abdomen is about 1.96, 7.3 and 14.4 mm respectively and mean total length is 2.36 cm. The average for, mid and hind leg length is 1.0, 1.1, and 1.3 cm respectively. Though only 28% of larvae attained into fifth stadium, 95.24% pupation having 1.1 ± 0.1g pupal weight and 100% adult emergence recorded when the larvae were fed with castor leaves. However, when larvae were provided with papaya leaves in fourth and fifth stadium, 87% of the larvae attained in to pupae and 92% pupae emerged as adults.

The sex ratio of the emerged adult was 1: 0.57 both in castor and papaya fed eri silkworm. In an average a female lay 138.66 ± 12.26 eggs with the hatching per cent of 60.78 ± 5.6 in papaya leaves fed SCR. It was significantly increased when the larvae were fed with castor leaves (189.38 ± 2.95 eggs with the hatching per cent of 71.87 ± 2.5) ($t=2.021$; $P<0.05$).

The cocoon and shell weight was 1.375 ± 0.2 mg and 0.175 ± 0.03 mg respectively with the cocoon shell ratio of 13.53% as observed by Ibrahim et al. (2015). However, the cocoon shell ratio was ranged from 9.65% to 11.87% even after the application of Juvenile Hormone analogue (JHA) methoprene (Magadumn & Magadum, 1991). Biochemical analysis of shell fiber consists of more proportion of fibroin (75.06 ± 1.125%) and less proportion of sericin (24.71 ± 0.85%). An opposite trend was recorded while the eri silkworm fed with papaya leaves (Table 3).

Fourth stadium larvae lasts its weight when *C. papaya* ($P < 0.05$) provided at 1 and 2-days starved *S. cynthia ricinii,* however fifth stadium larvae accepts papaya leaves and gained weight whether it was starved (df1,18; F=4.41; $P < 0.005$) or not (df1,19; F=4.38; $P < 0.005$) (Figure 1). *Carica papaya* was reported as preferred secondary food plant (Nangia et al. (2000). Further, Subramanian et al. (2013) recorded low mortality and moderate feeding was observed in the case of *Carica papaya*. No significant difference was observed between castor and papaya fed larvae considering cocoon and pupal weights (t=2.57; P>0.05). However, significantly heavier shell weight and cocoon shell ratio was observed in castor fed eri silkworm (t=1.943; P>0.05) (Table 3). Castor is considered as the primary food plant of eri silkworm. However, during the scarcity of castor leaves especially at fifth instar when the larvae consume more quantity of leaves, secondary food plants like papaya can be used for successfully rearing purpose as proposed other plants by Reddy et al. (1989) and Rajesh Kumar & Gangwar (2010).

Invariable of starvation, *Samia cynthia ricinii* fourth (mean value = 56.1±3.3%) (df1,19; F=3.52; $P < 0.005$) and fifth (mean value = 61.1±2.3 %) (df1,18; F=3.55; $P < 0.005$) stadium larvae highly accepted its primary host plant. Mean value indicates that fifth stadium highly accepts the castor to perform its normal physiological and biological activities than fourth stadium. Considering the tertiary and non food plants, during non-starved fourth stadium larvae accepted both *M. alba* and *A. indica* (df1,17; F=3.59; $P < 0.05$) (Table 1). However, during starvation the larvae preferred *C. papaya* leaves (df1,16; F=3.635; $P < 0.005$). Fifth stadium larvae accepted *M. citrifolia* (df1,19; F=3.5231; $P < 0.05$) during non-starvation period and papaya (df1,18; F=3.552; $P < 0.005$) at starvation periods as observed for fourth stadium (Table 2). The indigenous population of eri silkworm in Tamil Nadu, India uses a variety of plants as food. Our study reveals that, we can utilize papaya leaves along with castor for rearing the larvae at Palayamkottai climatic conditions. Present results indicates that the eri silkworm can be reared with local variety of castor leaves the food plant to the growing larvae instead of depending much on the secondary or tertiary food plants. All life trait parameters were in favor of economical values of sericulture. Since, both castor and papaya leaves were accepted by the eri silkworm among all six plants tested here, these plants can be used for the successful production of eri silk at Palayamkottai condition.

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LITERATURE CITED

Anonymous. 1979. The poor man's silk. Indian Silk, 18 (1): 33-37.

Basaiah, J. M. M. 1988. Consumption and utilization of castor and tapioca by the eri silkworm. M. Sc. (Sericulture) Thesis, University of Agricultural Sciences, Bangalore, pp. 119.

Bindroo, B. B., Sing, T. N., Sahu, A. K. & Chakravorty, R. 2007. Eri Silkworm host plants. Indian Silk, 5: 13-17.

Chowdhary, S. N. 1982. Eri Silk Industry, Published by Directorate of Sericulture and weaving Government of Assam. Pages: 171- 175.

Devaiah, M. C., Govindan, R. & Rangaswamy, H. R. 1978. Performance of Eri silkworm, *Philosamia ricini* Hutt.on castor leaves under Karnataka condition. All India Symp. Seric. Sci.,Bangalore, pp. 48.

Ibrahim, A. 2015. Studies on the Effect of wet castor leaf feeding and feeding frequencies on economic traits of eri-silkworm, *Samia cynthia ricini* Boisduval (Saturnidae: Lepidoptera). Sci. Technol. Arts Res. J., 4 (1): 63-67.

Kavane, R. P. 2014. Carica Papaya - A Potential Host Of Philosamia Ricini Eri Silkworm Under Western Maharashtra Condition. Indian Journal of App. Res., 4 (11): 472-474.

Magadum, V. B. & Magadum, S. B. 1991. Eri Silkworm, *Samia cynthia ricini*Boisdual. Korean J. Sericulture Sciences, 33 (2): 93-96.

Nangia, N., Jagadish, P. S. & Nageshchandra, B. K. 2000. Evaluation of the volumetric attributes of the eri silkworm reared on various host plants. Int. J. Wild Silkmoth and Silk, 5: 36-38.

Patil, G. M., Govindan, R. & Sangappa, H. H. 1986. Performance of eri silkworm, *Samia cynthia ricini* Boisduval on castor, *Ricinuscommunis*L. under Raichur conditions. Proc. Natl. Sem. Pros. Prob. Seric. India, Vellore, University of Madras, Tamil Nadu, India, pp. 46-48.

Prakash, K. S., Prasad, R. N., Ravikishore, C. V. N., Rama Rao, M., Krishna Rao, J. V. & Khanna, R. P. 2003.Eri culture – An additional source of income for tapioca farmers. Indian Silk, 41 (12): 29-30.

Rajadurai, S., Philip, T. & Sekar, M. A. 2010. Seasonal rearing performance of eri silkworm, *Samia cynthia ricini* (Boisduval) on castor and tapioca under South Karnataka conditions. Indian Journal of Sericulture, 49 (2): 134-137.

Rajesh Kumar & Gangwar, S. K. 2010. Impact of varietal feeding on *Samia ricini* Donovan in spring and autumn season of Uttar Pradesh, ARPN Journal of Agriculture Biological Sciences, 5 (3): 46-51.

Reddy, D. N. R., Kotikal, Y. K. & Vijayendra, M. 1989. Development and silk yield of eri silkworm *Samia Cynthia ricini* Boisdual, (Lepidoptera: Saturnidae) as influenced by the food plant. Mysore Journal of Argiculture Sciences, 23: 506-508.

Sakthivel, N. 2012. Studies on utilization of tapioca (*manihotesculenta*crantz) for ericulture in Tamil Nadu. Ph.D. thesis, Periyar University, Salem, Tamil Nadu, Pages: 237.

Saratchandra, 2003. A thought for development of eri Culture in India, Indian Silk, 41: 25-28.

Subramanianan, K., Sakthivel, N. & Qadri, S. M. H. 2013. Rearing technology of eri silkworm (*Samia cynthia ricini*) under varied seasonal and host plant conditions in Tamil Nadu. International Journal of Life Sciences Biotechnology and Pharma Research, 2 (2): 130-141.

Table 1. Larval developmental period (days), survival (%) and weight (g) of eri silkworm reared at Palayamkottai under laboratory condition with castor leaves.

Parameters	Larval stadium					Total
	First	Second	Third	Fourth	Fifth	
Developmental period (Days)	6.5±0.6	3.7±0.2	3.2±0.01	3.3±0.2	3.0±0.2	19.9±0.7
Larval survival (%)	66.7	61.7	84.5	85.0	87.5	23.3
Larval weight (g)	0.02±0.01	0.31±0.02	1.28±0.2	2.35±0.45	5.31±0.3	-

- Indicates not applicable

Table 2. Tertiary and non-food-plant acceptance (%) behavioral response of *Samia cynthiaricini* fourth and fifth stadium larvae in relation to starvation (0, 1 and 2 days) under laboratory conditions.

Starvation period (days)	Food Plants provided					
	Morus alba	*Carica papaya*	*Morindacitrifolia*	*Acalyphaindica*	*Leucaenaleucocephala*	*Ricinuscommunis*
Fourth stadium larvae						
0	15.0±2.3a	8.0±2.2b	10.0±0.0c	15.9±2.2ad	3.3±1.2e	46.7±2.1 f
1	10.0±1.3a	26.3±1.5b	13.3±1.5c	13.3±1.2cd	0	55.0±2.2f
2	6.7±1.2a	23.3±1.2b	0.0±0.0c	3.0±1.2ad	0	66.7±1.2f
Mean	10.5±0.3a	19.2±0.7b	7.8±0.8c	10.4±0.8ad	1.1±0.3e	56.1±3.3f
Fifth stadium larvae						
0	3.3±1.2a	13.7±1.2b	21.7±1.5 c	15.3±1.2d	3.3±1.2e	43.2±1.0 f
1	6.0±1.2 a	16.0±1.4 b	10.0±0.0c	3.3±1.2 d	0	66.0±1.2 f
2	10.3±1.3 a	17.5±1.0 b	0.0±0.0 c	1.6±1.0 d	0	73.0±1.2 f
Mean	7.0±0.8a	15.4±0.3b	10.6±0.7c	6.5±0.3ad	1.1±0.3e	61.1±2.3f

Mean followed by same alphabets in the row is not significant by Turkey test at 5% level.

Table 3. Comparative performance and economic traits of *Samia cynthiaricini* fed with papaya (only forth and fifth stadium) and castor leaves (in all stadium).

Parameters	Papaya	Castor
Effective rate of rearing (ERR)	74.13±10.2NS	92.38±7.2
Cocoon weight (g)	1.21±0.7NS	1.37±0.2
Pupal weight (g)	1.0±0.1NS	1.1±0.1
Shell weight (g)	0.215±0.1*	0.275±0.03
Cocoon shell ratio (%)	17.57*	20.01
Fibroin content (%)	70.01±0.78*	75.06±1.12
Sericin content (%)	29.69±0.19*	24.4±0.85

Statistical analysis was made between Papaya and castor fed group by students't' test and significance expressed at 5% level, NS- indicates not significant

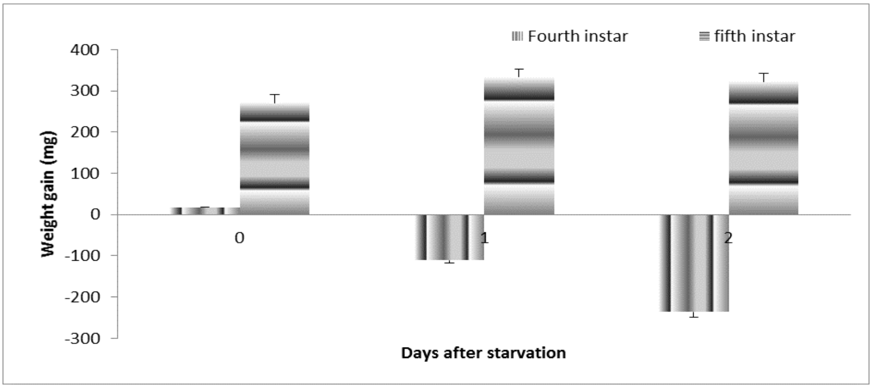

Figure 1. Weight gain or weight loss (mg) of *Samia cynthia ricinii* fourth and fifth nymphal instars fed with papaya plant leaves when compared with castor leaves.

A FAUNISTIC SURVEY ON MEGACHILIDAE (HYMENOPTERA: APOIDEA) FROM NORTHERN IRAN

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ABSTRACT: The fauna of Megachilidae (Hymenoptera) from Golestan and Mazandaran provinces (Northern Iran) is studied in this paper. Totally 24 species of the subfamily Megachilinae from 8 genera and 4 tribes (Anthidiini, Lithurgini, Megachilini, Osmiini) were collected and identified. Four species *Coelioxys* (*Coelioxys*) *aurolimbata* Förster, 1853, *Hoplitis* (*Hoplitis*) *adunca* (Panzer, 1798), *Megachile* (*Eutricharaea*) *apicalis* Spinola, 1808 and *Megachile* (*Megachile*) *pilicrus* Morawitz, 1878 are new records for the fauna of Iran.

KEY WORDS: Hymenoptera, Megachilidae, fauna, new record, distribution, Iran

Megachilidae (Hymenoptera) with more than 4000 described species worldwide (Michener, 2007) is a large family of specialized, morphologically rather uniform bees found in a wide diversity of habitats on all continents except Antarctica, ranging from lowland tropical rain forests to deserts to alpine environments (Litman et al., 2011). The front wings without exception have got two marginal cells, and the stigma is small. The pollen-collecting scopa of all nonparasitica females is located on the abdominal sterna (Stephen et al., 1969; Özbek & van der Zanden, 1992). It has been reported that some species belonging to the Megachilidae are effective pollinators in some plants (Bosch & Blas, 1994; Vicens & Bosch, 2000). These solitary bees are both ecologically and economically relevant; they include many pollinators of natural, urban and agricultural vegetation (Gonzalez et al., 2012). Furthermore, it has been reported that the Megachilidae species can be used as a commercial species when a decrease is observed in the primary pollinator belonging to the other family (Richards, 1997; Güler & Çağatay, 2006).

The fauna of Iranian Megachilidae has been studied rather well and several papers were published by Popov (1967), Esmaili & Rastegar (1974), Warncke (1981), Ebadi (1995), Talebi et al. (1995), Modarres Awal (1997), Izadi et al. (1998, 1999, 2000, 2004, 2006), Karimpour et al. (2002), Engel (2006), Tavakkoli et al. (2010), Khaghaninia et al. (2010), Khodaparast et al. (2011), Monfared & Khodaparast (2012), Rasekh Adel et al. (2012a,b,c), Salehi Sarbijan et al. (2012), Soraya Mohtat et al. (2012), Keshtkar et al. (2012, 2015), Khodaparast & Monfared (2012, 2013), Monfared et al. (2012), and Nadimi et al. (2013a,b, 2014). The aim of this research is faunistic survey on Megachilidae of Golestan and Mazandaran provinces (Northern Iran).

Golestan province (36.8393°N 54.4444°E) is located in the north of Iran and south of the Caspian Sea. Geographically, Golestan is divided into two sections, the plains and the mountains of the Alborz range. In the eastern Alborz section, the mountains have a north-easterly aspect and gradually decrease in height. The highest point of the province is Shavar - 3945 m above sea level. The climate of Golestan is temperate for most of the year.

Mazandaran province (36.5656°N 53.0588°E) is located on the southern coast of the Caspian Sea. Mazandaran province is geographically divided into two parts: the coastal plains, and the mountainous areas. The Alborz Mountain Range surrounds the coastal strip and plains of the Caspian Sea. Given the climatic changes and varying rates of rainfall in different parts of Mazandaran province, this region has a variety of climates, including the mild and humid climate of Caspian shoreline and the moderate and cold climate of mountainous regions. The western and central plains of the province, up to the northern foothills of Alborz Mountain Range, experience the mild climate of the Caspian region. The province contains a moderate, subtropical climate with an average temperature of 25 °C in summer and about 8 °C in winter.

MATERIALS AND METHODS

The specimens of this research were collected by sweeping net and Malaise traps from some regions of northern Iran (Golestan and Mazandaran provinces). The collected specimens were placed in ordinary paper envelopes after being killed with cyanid, and then placed in a desiccator to prepare them for morphological study. The materials were pinned and labeled according to current taxonomic rules and were examined with a stereomicroscope. For the determination of the genera and species, the keys developed by Osychnyuk et al. (1978), Dorn & Weber (1988), Warncke (1980, 1992), Banaszak & Romasenko (1998), Scheuchl (2006), Michener (2007) and Amiet et al. (2004) were used. Classification of the different taxa follows Michener (2007). Names of the valid genera within tribes, and valid species names are listed alphabetically within genera.

RESULTS

Totally 24 species from 8 genera of Megachilidae (*Anthidium* Fabricius, *Chelostoma* Latreille, *Coelioxys* Latreille, *Haetosmia* Popov, *Hoplitis* Klug, *Lithurgus* Berthold, *Megachile* Latreille, and *Osmia* Panzer) were collected from some regions of Northern Iran. Four species *Coelioxys* (*Coelioxys*) *aurolimbata* Förster, 1853, *Hoplitis* (*Hoplitis*) *adunca* (Panzer, 1798), *Megachile* (*Eutricharaea*) *apicalis* Spinola, 1808 and *Megachile* (*Megachile*) *pilicrus* Morawitz, 1878 are new records for the fauna of Iran. The list of species with distributional data is given below alphabetically.

Family Megachilidae Latreille, 1802

Subfamily Megachilinae Latreille, 1802

Tribe Anthidiini Ashmead, 1899

Genus *Anthidium* Fabricius, 1805

***Anthidium* (*Anthidium*) *florentinum* (Fabricius, 1775)**

Material examined: Golestan province, Minudasht, 37°10′N 55°30′E, 2♀♀, 1♂, October 2012. Mazandaran province, Sari, 36°30′N 53°30′E, 1♀, June 2013. **Distribution in Iran:** Alborz (Talebi et al., 1995), East Azarbaijan (Khaghaninia et al., 2010), Fars (Izadi et al., 1998, 1999; Khodaparast et al., 2011; Khodaparast & Monfared, 2012; Keshtkar et al., 2012), Golestan, Tehran (Esmaili & Rastegar, 1974), Guilan (Tavakkoli et al., 2010), Khorasan (Rasekh Adel et al., 2012b,c), Kuhguiloyeh & Boyerahmad (Monfared et al., 2012), West Azarbaijan (Karimpour et al., 2002). **General distribution:** Asia Minor, Caucasus, Central Asian part of the former USSR, South and Central Europe, Siberia, Syria (Banaszak & Romasenko, 1998), Iran (Warncke, 1980), USA (Comba & Comba, 1991). **Plant**

association: Polylectic (Fabaceae and Lamiaceae) (Banaszak & Romasenko, 1998), *Medicago sativa* (Fabaceae), *Euphorbia* (Euphorbiaceae), *Epilobium hirsutum* (Onagraceae) (Khodaparast & Monfared, 2012). **Comments:** This species was collected from alfalfa and onion fields, and is a dominant species in alfalfa fields (Rasekh Adel et al., 2012b,c).

Tribe Lithurgini Newman, 1834

Genus *Lithurgus* Berthold, 1827

***Lithurgus cornutus* (Fabricius, 1787)**

Material examined: Golestan province, Kalaleh, 37°43′N 55°49′E, 1♀, October 2012. **Distribution in Iran:** East Azarbaijan (Khaghaninia et al., 2010), Kuhguiloyeh & Boyerahmad (Monfared et al., 2012). **General distribution:** Iran (Warncke, 1981), Asia Minor, Caucasus, Kazakhstan, North Africa, South, East and Central Europe (Banaszak & Romasenko, 1998), China, Greece, Hungary, Italy, Japan, Morocco, Romania, Taiwan, Turkey, the former USSR, former Yugoslavia (van den Zanden, 1986). **Plant association:** Oligolectic (Asteraceae) (Banaszak & Romasenko, 1998; Güler & Sorkun, 2007).

Tribe Megachilini Latreille, 1802

Genus *Coelioxys* Latreille, 1809

***Coelioxys* (*Coelioxys*) *aurolimbata* Förster, 1853**

Material examined: Mazandaran province, Savadkooh, 36°05′N 52°55′E, 1♂, August 2014. **New record for Iran. General distribution:** Caucasus, Central Asian part of the former USSR, Europe, North Africa, Turkey (Banaszak & Romasenko, 1998).

Genus *Megachile* Latreille, 1802

***Megachile* (*Eutricharaea*) *apicalis* Spinola, 1808**

Material examined: Mazandaran province, Behshahr, 36°41′N 53°44′E, 2♀♀, 1♂, June 2013. **New record for Iran. General Distribution:** Canada, Caucasus, Central Asian part of the former USSR, North Afiica, South and Central Europe (Banaszak & Romasenko, 1998).

***Megachile* (*Eutricharaea*) *leachella* Curtis, 1828**

Material examined: Mazandaran province, Ramsar, 36°47′N 50°32′E, 1♂, September 2012. **Distribution in Iran:** East Azarbaijan (Khaghaninia et al., 2010). **General distribution:** Asia, Caucasus, Europe, North Africa, North America, Russain Far East, Siberia (Banaszak & Romasenko, 1998), Iran (Khaghaninia et al., 2010). **Plant association:** Polylectic (mainly Fabaceae) (Banaszak & Romasenko, 1998).

***Megachile* (*Xanthosarus*) *nigriventris* Schenck, 1870**

Material examined: Golestan province, Kordkoy, 36°41′N 54°12′E, 1♀, 2♂♂, August 2009. **Distribution in Iran:** East Azarbaijan (Khaghaninia et al., 2010). **General distribution:** North, South and Central Europe (Banaszak & Romasenko, 1998). **Plant association:** Polylectic (Rosaceae, Fabaceae and Caprifoliaceae) (Banaszak & Romasenko, 1998).

***Megachile* (*Megachile*) *pilicrus* Morawitz, 1878**

Material examined: Golestan province, Kordkoy, 36°41′N 54°12′E, 2♀♀, August 2009. **New record for Iran. General Distribution:** Caucasus Central Asian part of the former USSR (Banaszak & Romasenko, 1998), South, Eastern and Central Europe (Comba & Comba, 1991).

***Megachile* (*Eutricharaea*) *rotundata* (Fabricius, 1787)**

Material examined: Mazandaran province, Savadkooh, 36°05′N 52°55′E, 4♀♀, 3♂♂, August 2014. Golestan province, Minudasht, 37°10′N 55°30′E, 1♀, 1♂, October 2012. **Distribution in Iran:** Alborz (Talebi et al., 1995), East Azarbaijan (Khaghaninia et al., 2010), Fars (Izadi et al., 1998, 1999), Golestan (Esmaili & Rastegar, 1974), Guilan (Tavakkoli et al., 2010), Tehran (Esmaili & Rastegar, 1974; Imani & Tirgari, 1998), West Azarbaijan (Karimpour et al., 2002). **General distribution:** Caucasus, Central Asian part of the former USSR, Europe, Far East Russia, Kazakhstan, North Africa, North and South America, New Zeland (Comba & Comba, 1991; Banaszak & Romasenko, 1998), Turkey (Özbek & Zanden, 1994). **Plant association:** Polylectic (Asteraceae, Fabaceae and Lamiaceae) (Banaszak & Romasenko, 1998).

Tribe Osmiini Newman, 1834
Genus *Chelostoma* Latreille, 1809
***Chelostoma* (*Chelostoma*) *emarginatum* (Nylander, 1856)**

Material examined: Mazandaran province, Behshahr, 36°41′N 53°44′E, 1♀, 1♂, June 2013. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Austria, Azerbaijan, Bulgaria, Bosnia-Herzegovina, Croatia, Czech Republic, France, Greece, Hungary, Iran, Italy, Macedonia, Portugal, Romania, Serbia and Montenegro, Sicily, Slovakia, Slovenia, Spain, Switzerland, Turkey (Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on *Ranunculus* (Ranunculaceae) and possibly also on closely related genera (Amiet et al., 2004; Sedivy et al., 2008; Grace, 2010; Müller, 2012).

***Chelostoma* (*Gyrodromella*) *proximum* Schletterer, 1889**

Material examined: Golestan province, Kalaleh, 37°43′N 55°49′E, 2♀♀, October 2012. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Azerbaijan, Caucasus, China, Far East, Georgia, Iran, Russia, Turkmenistan, Turkey, Ukraine (Banaszak & Romasenko, 1998; Grace, 2010). **Plant association:** Probably Oligolectic on Campanulaceae (Banaszak & Romasenko, 1998; Müller, 2012).

Genus *Haetosmia* Popov, 1952
***Haetosmia vechti* (Peters, 1974)**

Material examined: Mazandaran province, Savadkooh, 36°05′N 52°55′E, 1♀, 2♂♂, August 2014. **Distribution in Iran:** Tehran (Nadimi et al., 2013a). **General distribution:** Greece, Iran, Palestine, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on *Heliotropium* (Boraginaceae) (Mavromoustakis, 1954).

Genus *Hoplitis* Klug, 1807
***Hoplitis* (*Hoplitis*) *adunca* (Panzer, 1798)**

Material examined: Golestan province, Gorgan, 36°50′N 54°30′E, 1♀, spring 2012. **New record for Iran. General distribution:** Asia Minor, Caucasus, Central Asian part of the former USSR, North Africa (Warncke, 1992; Banaszak & Romasenko, 1998; Amiet et al., 2004), South, Eastem and Central Europe (Comba & Comba, 1991).

***Hoplitis* (*Hoplitis*) *flabellifera* (Morice, 1901)**

Material examined: Mazandaran province, Amol, 36°28′N 52°21′E, 3♀♀, 1♂, April 2013. **Distribution in Iran:** Fars (Khodaparast et al., 2011; Khodaparast & Monfared, 2012, 2013), Tehran (Nadimi et al., 2013a). **General distribution:** Armenia, Iran, Jordan, Palestine, Syria, Turkey (Grace, 2010; Müller, 2012). **Plant association:** Polylectic with a strong preference for *Anchusa* (Boraginaceae) (Müller, 2012), *Vicia* (Fabaceae), *Borago officinalis* (Boraginaceae), *Centuria* (Asteraceae) (Khodaparast & Monfared, 2012), *Vicia* (Asteraceae), *Borago officinalis* (Boraginaceae), *Centaurea* (Asteraceae) (Khodaparast & Monfared, 2013).

Genus *Osmia* Panzer, 1806
***Osmia* (*Monosmia*) *apicata* Smith, 1853**

Material examined: Mazandaran province, Behshahr, 36°41′N 53°44′E, 2♀♀, June 2013. **Distribution in Iran:** Kuhguiloyeh & Boyerahmad (Monfared et al., 2012), Tehran (Nadimi et al., 2013a). **General distribution:** Albania, Armenia, Bulgaria, Croatia, Iran, Italy, Jordan, Georgia, Greece, Macedonia, Palestine, Russia, Serbia and Montenegro, Slovenia, Syria, Turkey (Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on *Onosma* sp. (Boraginaceae) (Müller, 2012).

***Osmia* (*Osmia*) *bicornis* (Linnaeus, 1758)**

Material examined: Mazandaran province, Qaemshahr, 36°28′N 52°52′E, 2♀♀, 2♂♂, August 2014. **Distribution in Iran:** Guilan, Tehran (Nadimi et al., 2013a), Kuhguiloyeh & Boyerahmad (Monfared et al., 2012). **General distribution:** Algeria, Cyprus, Europe, Far Eastern Siberia, Iran, Kazakhstan, Kyrgyzstan, Morocco, Tunisia, Turkmenistan, Palestine, Syria, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic, prefer Rosaceae and Fabaceae (Banaszak & Romasenko, 1998; Müller, 2012).

***Osmia* (*Metallinella*) *brevicornis* (Fabricius, 1798)**

Material examined: Golestan province, Minudasht, 37°10′N 55°30′E, 2♂♂, October 2012. **Distribution in Iran:** Mazandaran, Tehran (Nadimi et al., 2013a). **General**

distribution: Algeria, Caucasus, Cyprus, Iran, Morocco, Northern Asia, South eastern- and Central-Europe, Tunisia, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on Brassicaceae (Banaszak & Romasenko, 1998; Müller, 2012).

***Osmia* (*Helicosmia*) *caerulescens* (Linnaeus, 1758)**

Material examined: Mazandaran province, Sari, 36°30′N 53°30′E, 1♀, 2♂♂, June 2013. **Distribution in Iran:** Alborz (Talebi et al., 1995), Fars (Khodaparast & Monfared, 2012, 2013), Kuhguiloyeh & Boyerahmad (Monfared et al., 2012), Tehran (Esmaili & Rastegar, 1974; Nadimi et al., 2013a). **General distribution:** Algeria, Canada, China, Cyprus, Egypt, Europe, India, Iran, Jordan, Kazakhstan, Kyrgyzstan, Morocco, Syria, Tajikistan, Tunisia, Turkey, Turkmenistan, USA, Uzbekistan (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic, prefers Fabaceae, Lamiaceae, Boraginaceae and Antirrhineae (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012), *Vicia* sp. (Fabaceae), *Borago officinalis* (Boraginaceae), *Medicago sativa* (Fabaceae), *Euphorbia* sp. (Euphorbiaceae), *Epilobium hirsutum* (Onagraceae) (Khodaparast & Monfared, 2012, 2013).

***Osmia* (*Pyrosmia*) *cephalotes* Morawitz, 1870**

Material examined: Mazandaran province, Amol, 36°28′N 52°21′E, 2♀♀, 1♂, April 2013. Golestan province, Gorgan, 36°50′N 54°30′E, 2♀♀, spring 2012. **Distribution in Iran:** Fars (Khodaparast & Monfared, 2012, 2013), Guilan, Mazandaran (Nadimi et al., 2013a). **General distribution:** Algeria, Caucasus, Cyprus, Iran, Jordan, Libya, Morocco, Palestine, South- and Eastern-Europe, Syria, Tunisia, Turkey, Turkmenistan (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic with a preference for Fabaceae (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012), *Vicia* (Fabaceae), *Borago officinalis* (Boraginaceae) (Khodaparast & Monfared, 2012, 2013).

***Osmia* (*Osmia*) *cornuta* (Latreille, 1805)**

Material examined: Mazandaran province, Qaemshahr, 36°28′N 52°52′E, 1♀, August 2014. **Distribution in Iran:** Kerman (Salehi Sarbijan et al., 2012), Tehran (Nadimi et al., 2013a). **General distribution:** Algeria, Cyprus, Egypt, Europe, Iran, Tunisia, Turkmenistan, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic; prefers Rosaceae (Westrich, 1989; Banaszak & Romasenko, 1998; Amiet et al., 2004).

***Osmia* (*Helicosmia*) *dimidiata* Morawitz, 1870**

Material examined: Golestan province, Gonbad, 37°30′N 55°00′E, 1♀, 2♂♂, September 2013. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Asia minor, Caucasus, Cyprus, Iran, Morocco, Kyrgyzstan, Lebanon, Palestine, South Europe, Turkey, Turkmenistan (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Probably oligolectic on Asteraceae, visiting *Cirsium syriacum*, *Calendula persica*, *Centaurea hyalolepis*, *Statice sinuata*, *Echium sericeum*, *Scolymus hispanicus* and *Marrubium vulgare apolum* (Grace, 2010; Müller, 2012).

***Osmia* (*Helicosmia*) *melanogaster* Spinola, 1808**

Material examined: Mazandaran province, Qaemshahr, 36°28′N 52°52′E, 1♂, August 2014. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Algeria, Caucasus, Cyprus, Egypt, Iran, Jordan, Libya, South, Eastern and Central Europe, Morocco, Palestine, Syria, Tunisia, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on Carduoideae (Asteraceae) (Müller, 2012).

***Osmia* (*Helicosmia*) *niveata* (Fabricius, 1804)**

Material examined: Golestan province, Gonbad, 37°30′N 55°00′E, 1♀, 1♂, September 2013. **Distribution in Iran:** Fars (Khodaparast et al., 2011; Khodaparast & Monfared, 2012, 2013), Guilan (Tavakkoli et al., 2010; Nadimi et al., 2013a), Mazandaran (Nadimi et al., 2013a). **General distribution:** Cyprus, Europe, Iran, Jordan, Lebanon, Northern Africa, Palestine, Syria, Turkey, Turkmenistan (Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on Asteraceae with a distinct preference for Carduoideae (Westrich, 1989; Amiet et al., 2004; Müller, 2012).

***Osmia* (*Allosmia*) *rufohirta* Latreille, 1811**

Material examined: Mazandaran province, Sari, 36°30′N 53°30′E, 1♀, June 2013. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Algeria, Caucasus, China, Jordan, Morocco, South, Central and Eastern Europe, Syria, Turkmenistan, Tunisia, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic with a preference for Fabaceae (Banaszak & Romasenko, 1998; Müller, 2012).

***Osmia* (*Helicosmia*) *signata* Erichson, 1835**

Material examined: Mazandaran province, Amol, 36°28′N 52°21′E, 2♀♀, April 2013. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Albania, Algeria, China, Cyprus, Egypt, France, Greece, Corsica, Crete, Iran, Italy, Jordan, Morocco, Palestine, Portugal, Sardinia, Sicily, Spain, Syria, Turkey, Turkmenistan, Ukraine (Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on Asteraceae (Müller, 2012).

DISCUSSION

Upon the results of this research (with 24 species and 4 new records) together with other works on Megachilidae of northern Iran (e.g. Tavakkoli et al., 2010; Nadimi et al., 2013a,b, 2014) indicate that there is a diverse fauna of these beneficial insects in northern Iran. Although the fauna of Megachilidae of southern Iran was studied rather well (see references) but the fauna of northern Iran was poorly studied. Regarding to the diverse flora in northern Iran, we expect much more species of Megachilidae in the mentioned area. The megachilids are important pollinators of several wildflowers, vegetables and fruits, and are used as pollinators by commercial growers of blueberries, onions, carrots and alfalfa (Bohart, 1972; Pitts-Singer & Cane, 2011). In addition to the species diversity of Iranian Megachilidae, there are many other unknown data such as the diversity of nesting biology and floral relationships. Diverse materials are used in nest building and the inclusion of these foreign materials in nest construction may have promoted a massive range expansion and diversification within the family (Cane et al., 2007; Litman et al., 2011; Gonzales et al., 2012). Also, many insects (e.g. Chrysididae, Mutillidae, Formicidae, Rhipiphoridae, Meloidae, Cleridae, etc.) attack the nests of leafcutting bees (Ahmed Khattaby, 1992; Woodward, 1994). Determining of these natural enemies is an interesting research work in different regions of Iran.

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LITERATURE CITED

Ahmed Khattaby, A. M. 1992. Studies on the common enemies of family Megachilidae (Hymenoptera) in Egypt. Ph. D dissertation of Zagazig University, Egypt, 123 pp.

Amiet F., Hermann, M., Müller, A. & Neumeyer, R. 2004. Apidae 4: *Anthidium*, *Chelostoma*, *Coelioxys*, *Dioxys*, *Heriades*, *Lithurgus*, *Megachile*, *Osmia*, *Stelis*. Fauna Helvetica, 9: 1–273.

Banaszak, J. & Romasenko, L. 1998. Megachilid Bees of Europe. Pedagogical University of Bydgoszcz, Poland, 239 pp.

Bohart, G. E. 1972. Management of wild bees for the pollination of crops. Annual Review of Entomology, 17: 287–312.

Bosch, J. & Blas, M. 1994. Foraging behaviour and pollinating efficiency of *Osmia cornuta* and *Apis mellifera* on almond (Hymenoptera, Megachilidae and Apidae). Applied Entomology and Zoology, 29: 1-9.

Cane, J. H., Griswold, T. L. & Parker, F. D. 2007. Substrates and materials used for nesting by North American *Osmia* bees (Apiformes: Megachilidae). Annals of the Entomological Society of America, 100: 350–358.

Comba, L. & Comba, M. 1991. Catalogo Degli Apoidei Laziali (Hym.; Aculeta). Fragmenta Entomologica, 82: 1–117.

Dorn, M. & Weber, D. 1988. Die Luzerne-Blattschneiderbiene und Ihre Verwandten in Mitteleuropa. Neue Brehm Bücherei, Wittenberg.

Ebadi, R. 1995. Collection, identification and preliminary study of pollinator insect fauna in Esfahan province. Proceedings of 12th Iranian Plant Protection Congress, p. 309.

Esmaili, M. & Rastegar, R. 1974. Identified species of Aculeate Hymenoptera of Iran. Journal of the Entomological Society of Iran, 2 (1): 41–52 (in Persian).

Engel, M. S. 2006. A new species of *Osmia* from Iran (Hymenoptera: Megachilidae). Acta Entomologica Slovenica, 14: 123–130.

Gonzalez, V. H., Griswold, T., Praz, C. J. & Danforth, B. N. 2012. Phylogeny of the bee family Megachilidae (Hymenoptera: Apoidea) based on adult morphology. Systematic Entomology, 37: 261–286.

Grace, A. 2010. Introductory biogeography to bees of the Eastern Mediterranean and Near East. Bexhill Museum Association, 283 pp.

Güler, Y. & Çağatay, N. 2006. Faunistic study on Megachilini, Osmiini and Anthidiini tribes (Hymenoptera: Megachilidae) in Central Anatolia. Journal of Entomological Research Society, 8 (2): 15–34.

Güler, Y. & Sorkun, K. 2007. Pollen Preferences of *Hoplosmia bidentata* and *Lithurgus cornutus* (Hymenoptera: Megachilidae). Entomologica Fennica, 18 (3): 274–278.

Imani, B. & Tirgari, S. 1998. Survey of the efficiency of the alfalfa leafcuttter bees *Megachile rotundata* F. (Hym. Megachilidae) on alfalfa seed production in Shahriar region. Proceedings of 13th Iranian Plant Protection Congress, p. 51.

Izadi, H., Ebadi, R. & Talebi, A. A. 1998. Pollinator of bees in the north of Fars province. Proceedings of 13th Iranian Plant Protection Congress, p. 197.

Izadi, H., Ebadi, R. & Talebi, A. A. 1999. Introduction of a part of fauna of pollinator bees in north of Fars province. Journal of Sciences and Technology of Agriculture and Natural Resources, 2 (4): 89–104.

Izadi, H., Ebadi, R. & Talebi, A. A. 2004. Pollinator bees of north parts of Fars Province, Iran. Proceeding of XV th International Plant Protection Congress, Beijing China, p. 436.

Izadi, H., Mahdian, K. & Ebadi, R. 2000. Introduction of several genera of pollinator bees (Hym.: Apoidea) in Kerman province. Proceedings of 14th Iranian Plant Protection Congress, p. 365.

Izadi, H., Samih, M. A. & Mahdian, K. 2006. Identification and introduction of some Iran pollinator bees of Colletidae, Halictidae, and Megachilidae (Hym: Apoidea). Communication Agriculture Applied Biological Science, 71 (2): 621–624.

Karimpour, Y., Fathipour, Y. & Talebi, A. A. 2002. Preliminary investigation on the fauna of the polinator bees (Apoidea) of western part of Urmia Lake. Proceedings of 15th Iranian Plant Protection Congress, pp. 165–166.

Keshtkar, A., Monfared, A. & Haghani, M. 2012. Collecting and identifying of pollinator bees (Hymenoptera: Apoidea) from urban parks and gardens of Shiraz city. Proceedings of 20th Iranian Plant Protection Congress, p. 211.

Keshtkar, A., Monfared, A. R. & Haghani, M. 2015. A survey on pollinators bees (Hymenoptera: Apoidea) in parks and gardens of Shiraz city, Iran. Entomofauna, 36 (4): 53-64.

Khaghaninia, S., Güler, Y. & Mousavi, M. 2010. Megachilids bees (Hymenoptera: Apoidea) of Aynali forests with four new records for Iran. Munis Entomology & Zoology, 5, Suppl., 890–895.

Khodaparast, R., Monfared, A. R., Müller, A. & Praz, C. 2011. Collecting and identifying of pollinator bees (Hymenoptera, Apoidea, Megachilidae) in Fars province. Proceedings of the 2nd Iranian Pest Management Conference (IPMC), p. 78.

Khodaparast, R. & Monfared, A. 2012. A survey of bees (Hymenoptera: Apoidea) from Fars Province, Iran. Zootaxa, 3445: 37–58.

Khodaparast, R. & Monfared, A. 2013. Taxonomic studies on Osmiine bees (Hymenoptera, Apoidea: Megachilidae) of Fars province (Iran). Entomofauna, 34 (19): 229–260.

Litman, J. R., Danforth, B. N., Eardley, C. D. & Praz, C. J. 2011. Why do leafcutter bees cut leaves? New insights into the early evolution of bees. Proceedings of the Royal Society, Series B: Biological Sciences, 278: 3593–3600.

Mavromoustakis, G. A. 1954. New and interesting bees (Hymenoptera, Apoidea) from Israel. Bulletin of the Research Council of Israel, 4: 256–275.

Michener, C. D. 2007. The bees of the world. The Johns Hopkins University Press, New York, 953 pp.

Modarres Awal, M. 1997. Family Megachilidae (Hymenoptera), pp. 276-277. *In*: Modarres Awal, M. (ed.). List of agricultural pests and their natural enemies in Iran. Ferdowsi University Press, 429 pp.

Monfared, A. & Khodaparast, R. 2012. Recording 19 species of parasitic bees of Apoidea (Hymenoptera) from Fars province. *Procee*dings of 20th Iranian Plant Protection Congress, p. 159.

Monfared, A., Azhari, Sh. & Khodaparast, R. 2012. Recording of forty species of bees (Hymenoptera: Apoidea) from cold regions of Kuhgiluyeh & Boyrahmad province, Iran. Proceedings of 20th Iranian Plant Protection Congress, p. 222.

Müller, A. 2012. Palaearctic Osmiine Bees, ETH Zürich. http://blogs.ethz.ch/osmiini

Nadimi, A., Talebi, A. A. & Fathipour, Y. 2013a. The tribe Osmiini (Hymenoptera: Megachilidae) in the north of Iran: new records and distributional data. Entomofauna, 34 (17): 205–220.

Nadimi, A., Talebi, A. A. & Fathipour, Y. 2013b. A preliminary study of the cleptoparasitic bees of the genus *Coelioxys* (Hymenoptera: Megachilidae) in northern Iran, with six new records. Journal of Crop Protection, 2 (3): 271-283.

Nadimi, A., Talebi, A. A., Zhu, C.-D. & Fathipour, Y. 2014. Study of the tribe Anthidiini (Hymenoptera: Megachilidae) in northern Iran, with the description of a new species. North-western Journal of Zoology, 10 (2): 413-424.

Osychnyuk, A. Z., Panfilov, D. V. & Ponomareva, A. A. 1978. Nadsem. Apoidea – Pchelinye, pp. 279-519. *In*: Medvedeva, G.S. (ed.), Opredelitel`nasekomyh Evropejskoj 894haste SSSR, 3, Pereponchatokrylye, pt. 1, Akademija Nauk SSSR, Leningrad, 583 pp.

Özbek, H. & van der Zanden, G. 1992. A Preliminary Review of the Megachilidae of Turkey Part I. Osmiini (Hymenoptera: Apoidea). Türkiye Entomoloji Dergisi, 16 (1): 13–32.

Özbek, H. & van der Zanden, G. 1994. A preliminary review of the Megachilidae of Turkey part IV. Megachilini and Lithurgini (Hymenoptera: Apoidea). Türkiye Entomoloji Dergisi, 18 (3): 157–174.

Pitts-Singer, T. L. & Cane, J. H. 2011. The alfalfa leafcutting bee, *Megachile rotundata*: the world's most intensively managed solitary bee. Annual Review of Entomology, 56: 221–237.

Popov, V. B. 1967. The bees (Hymenoptera, Apoidea) of Iran. Trudy Zoologiceskzo Instituta Akademija Nauk SSSR (St. Petersburg), 43: 184–216.

Rasekh Adel, M., Sadeghi Namghi, H. & Husseini, M. 2012a. The first report of *Anthidium diadema* (Latreille, 1809) (Hym.: Megachilidae) from Iran. Journal of Plant Protection, 25 (4): 438–440 [in Persian with English summary].

Rasekh Adel, M., Sadeghi Namghi, H. & Husseini, M. 2012b. Biodiversity of Apoidea (Insecta: Hymenoptera) associated with onion and alfalfa fields in Mashhad and Chenaran Regions. Iranian Journal of Plant Protection Science, 43 (1): 191–199.

Rasekh Adel, M., Sadeghi Namghi, H. & Husseini, M. 2012c. Pollinator bees (Hym.: Apoidea) in onion and alfalfa fields in Mashhad and Chenaran. Proceedings of the 20th Iranian Plant Protection Congress, p. 759.

Richards, K. W. 1997. Potential of the alfalfa leafcutter bee, *Megachile rotundata* (F.) (Hym., Megachilidae) to pollinate hairy and winter vetches (*Vicia* spp.). Journal of Applied Entomology, 121: 225-229.

Salehi Sarbijan, S., Khani, A., Izadi, H., Monfared, A., Khodaparast, R. & Soraya Mohtat, M. 2012. Collecting and identification of pollinator bees of superfamily of Apoidea (Hymenoptera) of north regions of southern Kerman province. Proceedings of the 20th Iranian Plant Protection Congress, p. 125.

Scheuchl, E. 2006. Illustrierte Bestimmungstabellen der Wildbienen Deutschlands und Österreichs. Band 2: Megachilidae und Melittidae. 192 pp.

Sedivy, C., Praz, C. J., Müller, A., Wildmer, A. & Dorn, S. 2008. Patterns of host-plant choice in bees of the genus Chelostoma: the constraint hypothesis of host-range evolution in bees. Evolution, 62: 2487–2507.

Soraya Mohtat, M., Ravan, S., Monfared, A., Salehi Sarbijan, S. & Khodaparast, R. 2012. Collecting and identification of pollinator bees of superfamily of Apoidea (Hymenoptera) of north regions of Sistan & Baluchistan province. Proceedings of the 20th Iranian Plant Protection Congress, p. 121.

Stephen, W. P., Bohart, G. E. & Torchio, P. F. 1969. The biology and external morphology of bees. Agricultural Experiment Station, Oregon State University, Corvallis, Oregon, 140 pp.

Talebi, A. A., Esmaili, M. & Tirgari, S. 1995. Alfalfa pollinator bees (Hym.: Apoidea) in Karadj. Proceedings of 12th Iranian Plant Protection Congress, p. 93.

Tavakkoli, G. R., Hajizadeh, J. & Talebi, A. A. 2010. Introducing 39 pollinating bees (Hymenoptera: Apoidea) occurring on legum (Fabacae) crops from Guilan province. Proceedings of the 19th Iranian Plant Protection Congress, p. 120.

Warncke, K. 1980. Die Beienangattung *Anthidium* Fabricius, 1804, in der. Westpalaarktis und im Turkestanischen Becken. Entomofauna, Zeitschrift Für Entomologie, 1 (10): 119–209.

Warncke, K. 1981. Beitrag zur Bienenfauna des Iran: 13. Die Bienengattung *Lithurgus*. Boletin Museo Civico di Storia Naturale di Venezia, 31 [1980]: 197–199.

Warncke, K. 1992. Die Westpalaarktischen Arten der Bienengattung *Coelioxys* Latr. (Hymenoptera, Apidae, Megachilinae). Berlinische Gesellschaft Naturforschender Freunde, 53: 31–77.

Westrich, P. 1989. Die Wildbienen Baden-Württembergs. Ulmer, Stuttgart, 972 pp.

van der Zanden, G. 1986. Die paläarktischen Arten der Gattung *Lithurgus* Latreille, 1825 (Hymenoptera, Apoidea, Megachilidae). Mitteilungen aus dem Zoologischen Museum in Berlin, 62: 53–59.

Vicens, N. & Bosch, J. 2000. Pollinating efficacy of *Osmia cornuta* and *Apis mellifera* (Hymenoptera: Megachilidae, Apidae) on 'Red Delicious' apple. Environmental Entomology, 29 (2): 235-240.

Woodward, D. R. 1994. Predators and Parasitoids of *Megachile rotundata* (F.) (Hymenoptera: Megachilidae), in South Australia. Journal of Australian Entomological Society, 33: 13-15.

STUDIES ON INTESTINAL HELMINTHIASIS AMONG SCHOOL CHILDREN IN OSOGBO LOCAL GOVERNMENT AREA OF OSUN STATE, SOUTH-WESTERN NIGERIA

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ABSTRACT: Intestinal helminthiasis is one of the neglected parasitic diseases currently receiving attention from the international organization. This study was conducted in six selected primary schools in Osogbo town, southwestern Nigeria. Faecal samples from 336 pupils were examined using direct smear and formol either concentration method. Out of the 336 samples examined, 103 (30.1%) were positive for one or more intestinal parasites. Three helminth parasites were identified in the feacal samples namely*;* *Ascaris lumbricoides* (24%), hookworm (6%) and *Trichuris trichura* (3%) with cases of mixed infection; *A. lumbricoides* and hookworm (1.20%), *A lumbricoides* and *T. trichura* (0.3%), Hookworm and *T. trichura* (0.3%). None of the parasites was sex – dependent since the parasites were found in both sexes and all age groups. The infections were school dependent as public schools have significantly higher prevalence ($p<0.05$) than the private schools. The study revealed that poor socio economic status, large family size, low education level and poor environmental situation are the major contributory factors to the relatively high prevalence of helminthiasis recorded. Level of prevalence and intensity can be reduced by children targeted treatment program and school based deworming programmes.

KEY WORDS: Intestinal helminthes, school-aged children, mixed infection, Nigeria

Human parasitic worms are among the most prevalent chronic infection in human in developing countries and major cause of disease burden among children throughout the world (WHO, 2000]. More than 2,000 million people are infected by soil transmitted helminthes (STH) worldwide, of which more than 300 million suffer from associated severe morbidity (Montressor et al., 2002). Climate is an important determinant factor for transmission of these infections in the tropical and sub-tropical areas, with adequate moisture and warm temperate essential for larva development. Equally important determinants are poverty and inadequate clean water supplies and sanitation (Mahfooz et al., 2010). Morbidity and rate of transmission of STH infections are directly related to the number of worms harbored in the host (Bethony et al., 2009).

Intestinal helminthes are transmitted by eggs ejected in human faeces; which in-turn contaminate the soil and water sources in area that lack adequate sanitation (Sam-Wobo et al., 2012). It has been shown that multiple infections with intestinal helminth are very common (Sam-Wobo et al., 2008). Heavy infestation with *Ascaris lumbricoidess* and *Trichuris trichura* causes protein energy malnutrition and may interfere with appetite, growth physical fitness cognitive development and school performance in malnourished children (WHO, 2010). Hookworm infestation is a leading cause of Anaemia (Roche & Layrisse, 2001). Whipworm infestation in children causes growth retardation and anaemia (Bundy & Cooper, 1993).

In many developing countries, the only education children receive is in primary school, and this is the age when they are more frequently infected by helminthes. This infection could thwart the effort of a country to provide basic school education (Partnership for child development, 1999), especially in a school age children. In view of the negative socio – economic impact of these parasite infections on children, there is a need for the development of good preventive and control measures against intestinal infection. This cannot be done effectively without baseline data on the occurrence of parasitic infection on a particular area.

The result of this study will be useful to both researcher and health authority in diagnosis, planning and implementing control programmes for intestinal helminths infections in the area. To best of our knowledge, there is paucity of information on human intestinal helminthiasis have been reported in Osogbo Local Government. The present study is an effort to determine the prevalence and associated risk factors of intestinal helminths infection among school children in Osogbo, southwestern Nigeria.

MATERIALS AND METHODS

Study Area

The study was conducted in Osogbo, (latitude 7°46N and Longitude 4°36E), the capital of Osun State in Southwestern Nigeria with a population of 156,694. The study population was randomly drawn from six primary schools in Osogbo Local Government area.

The pupils were between 3 and 14 age bracket.

Ethical Clearance

Consent and Ethnical clearance

Prior to the commencement of the study, permission was obtained from the zonal education department of the Osogbo Local Government. Verbal consent was also sought from the parents of the participating pupils through the Parent -Teacher Association of each school. The purpose of the study was explained to them. The study was conducted with 336 consented individuals.

Questionnaire Survey

Structure questionnaires were administered on each respondent so as to collect social demographic data including age, sex, and source of water.

Parasitologigal Survey

Preparation of faecal smear and identification of parasite

A total of three hundred and thirty six (336) pupils participated in the study.

The Specimen bottles were distributed on the eve of the day of examination and the pupils were given direction to avoid contaminating the feaces with soil and other objects.

Each pupil was instructed to deposit his/her feaces on a clean paper and to place about 5g of feaces with the aid of a clean stick in the sample bottle and cork it firmly. The container was identified by label containing the child name. Stool samples were collected from the pupils as soon as they arrived at the school premises. Samples were transported to Microbiology and Parasitology Laboratory of Ladoke Akintola University of Technology Teaching Hospital, Osogbo, within four hours of passage in order to ensure proper identification of hookworm eggs (WHO, 2003). The appearance of each stool was first carefully examined Macroscopic for, consistency, blood, Mucus or adult worm using X10 and X40 objective lenses. The feacal samples were then examined microscopically for intestinal helminthes by direct smear saline method. Negative samples were later subjected to concentration method. The number of each species of eggs in the entire preparation were counted and recorded to give appropriate number of eggs/g of stool (WHO, 2003).

Data Analysis

The data obtained were analyzed using Chi – square statistical package. The differences were considered to be statistically significant when P-value obtained was less than 0.05.

RESULTS

Of the three hundred and thirty six (336) pupils examined, 103 (31%) were infected with intestinal helminth. Three intestinal helminth parasites were identified, namely *Ascaris lumbricoides*, Hookworm and *Trichuris trichura*. *A. lumbricoides* had the highest prevalence 79(24%) while *T. trichiura* had the least prevalence 9(3%). The prevalence of Hookworm was 2(6%). The prevalence of mixed infection due to Hookworm and *Trichuris* was 1(0.30%) and that of Hookworm and *A. lumbricoides* was 4(1.19%) (Table 1). Table 2 presents the prevalence of the infection in relation to the sex. There was no significant variation in the prevalence of *A. lumbricoides* (p>0-05) in males as compared with the females. Similarly, the total prevalence of hookworm among males, (6.5%) was not statistically different (p>0.05) from the total prevalence among females (6.1%).

The prevalence of helminth infection was generally even across the age groups. The lowest prevalence was in age group 3-5 15 (24.2%) while the highest prevalence was in age 6-8 50(34.5%) (Table 3).

The prevalence of helminth infection was higher in public schools as compared with private schools with the exception of *T. trichura* which had higher prevalence in private school (7%) than primary schools (2%). The prevalence of *A.lumbricoides* and hookworm was higher in public schools than private schools (Table 4).

DISCUSSION

Intestinal parasitic diseases remain a public health problem especially faecal contamination of food and water (Jimenez-Gonzalez et al., 2009). This is more common in school-going children and it is associated with high morbidity and mortality and economic loss to the county (WHO, 2008). The present study on intestinal helminthiasis shows that *A. lumbricoides* is more prevalent among the school children in Osogbo Local Government Area. This result and those reported by Adeyeba & Tijani (2002), Sam-Wobo et al. (2005), Anantaphruti et al. (2004), Uneke et al. (2007) showed that *A. lumbricoides* is common throughout Nigeria. In the present study, the 31% overall prevalence of intestinal helminth agreed with 37.3% reported by Anosike et al. (2005) and several other reports from different parts of Africa (Dada et al., 1993). The high prevalence of Ascaris infection may be attributed to high level of unhygienic practices or the habit of defecating indiscriminately in open places among school children which eventually contaminate the environment. Intestinal parasites have been reported to have deleterious effect on school children (Adeyeba & Akinlabi, 2002).

The presence of *T. trichura* infection in the study area was not unexpected though in a low infestation rate, since it is known that similar condition which influences the endemicity of *A. lumbricoides* also influences its endemicity (O'larcalin & Holland, 2000). The reason accounting for this could be that *T. trichura* is less resistant to cold, drought and dry climate (Crompton & Nesheim, 2002). Surprisingly infestation with Hookworm was low in this study while it was prevalent in many other studies (Merid et al., 2001; Ijagbone & Olagunju, 2006; Osazuwa et al., 2011). Results of present study, like previous studies reveal no significant variation among sex. Reason being that the risk factors of the problem are equal (Agbolade & Odaibo, 1986; Mafiana & Omotayo, 1989; Taiwo & Agbolade, 2000).

Result of this survey shows that intestinal helminthiasis is most prevalent among age group 6-8 and 9-10 years. This is due to the fact that children in this age are school –aged pupils. They do not take much care about the cleanliness of the hands and clothing. They do not wash their hands frequently, particularly before meals and after going to toilet (Ahmad Khan et al., 2004), all these are contributory to the transmission of helminthiasis. None wearing of shoes by children, playing on wet grounds could also expose them to Hookworm infection.

In present study, it was observed that the population with a better socio-economic status has comparatively low prevalence and intensity of the infection, as children from public schools had high prevalence and intensity than those in private schools. Socio-economically stable families can keep personal hygiene and cleanliness of house hold and their belongings. Sufficient house space also prevents over- crowding and heavy feacal pollution of premises. Good sanitary facilities are a very effective measure to control helminthiasis (Mahfouz et al., 2010).

In conclusion, the present study reveals that intestinal helminth is highly prevalent among school- age children in Osogbo Local Government Area. The high intestinal helminth prevalence supports the idea that children are the most affected groups. It is therefore suggested that intervention methods have to be adopted to reduce intestinal helminthes infection among children. This may include improving sanitation and personal hygiene through continuous health education, mass deworming and periodic treatment of schools children. Ministry of Environment should regularly check the level of hygiene among the populace and fine defaulters.

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LITERATURE CITED

Adeyeba, O. A. & Akinlabi, A. M. 2002. Intestinal parasitic infections among school children in Rural Community, Southwest Nigeria. and Community Members in a West–Central Border Area of Thailand. South west. Asian. J. Trop. Med. Public. Health, 35: 260-266. Nig. J. parasitol., 17: 17-21.

Adeyeba, O. A. & Tijani, B. D. 2002. Intestinal Helminthiasis among Malnourished School Age Children in peri-Urban Area of Ibadan, Nigeria Afr. J. Clin. Microbiology.

Agbolade, O. M. & Odaibo, A. B. 1986. *Schistosoma haematobium*. Infection among Pupils and snail intermediate host in Ago – Iwoye, Ogun State. Nig. J. parasito., 17: 17-20.

Ahmad Khan, Sultana, A., Khan, A. M., Rashid, H. & Najm, S. A. 2004. A study of prevalence, Distribution and Risk factors of Intestinal Helminthic Infestation in District BAGH (Azad Kashmir). Pak. J. Med. Res., 12: 243-248.

Anantaphruti, M. T., Waikagil, J., Maikpanich, W., Nuamtanong, S. & Pubam, S. 2004. Soil Transmitted Helminthiasis and Health Behaviours among School Children and Community Members in a West – Central Border Area of Thailand, South-west. Asian J. Trop. Med. Public. Health, 35:.260-266.

Anosike, J. G., Zaccheaus, V. O., Adeiyondgo, C. M., Abanobi, O. C., Dada, E. O., Oku, E. E., Keke, I. R., Uwazuroke, J. C., Amajuyi, O. U., Obiukwu, C. E., Nwosu, D. C. & Ogbusu, F. I. 2005. Studies on

Intestinal worms (Helminthiasis) Infestation In Central Nigerian Rural Community. J. App. Sci. Environ. Manage, 10 (2): 61-66.

Bethony, J., Broker, S., Albonico, M., Alger, S. M., Loukes, D., Diemert, D. & Hokez, P. J. 2009. Soil Transmitted helminth infection: ascariasis trichiuriassis and hookworm. Lancet 2006, 367: 1521-32.

Bundy, D. A. P. & Cooper, E. S. 1993. *Trichuris* and Trichuriasis in Humans. Adv. Parasitol., 28: 102-173.

Crompton, D. & Nesheim, M. 2002. Nutritional impact of intestinal helminthiasis during the human life cycle. Annu. Rev. Nutr., 22: 35-59.

Dada, E. O., Adeiyongo, C. M., Anosiko, J. C., Zaccheaus, V. O., Okeye, S. N. & Oti, E. E. 1993. Observations on the epidemiology of human taeniasis among the Goemai tribe of Northern Nigeria. App. Parasitol., 34 (4): 23-29.

Ijagbone, I. F. & Olagunju, T. F. 2006. b. Intestinal Helminths Parasites in School Children in Iragbiji, Boripe Local Government, Osun State, Nigeria. Afr. J. Biomed. Res., 9 (1): 63-65.

Jimenez-Gonzalez, D. E., Marquez-Rodriguez, K., Rodriguez, J. M., Gonzales, X., Oxford, J., Sanchez, R., Kawa-karasik, S., Flisser, A. & Maravilla, P. 2009. Prevalence and risk factors ociated with Intestine parasites in a Rural Community of CentralMexico. Journal of Parasitology and Vector Biology, 1 (2): 009-012.

Mafiana, C. F. & Omotayo, A. B. 1989. Urinary schistosomiasis: an evaluation Microscopic egg count and chemical reagent strip in children in south western of Nigeria. Helminthologia, 35: 31-35.

Mahfouz, A. A. R., El-Morshed, H., Fargtialy, A. & Khalil, A. 2010. Ecological determinants of Intestinal parasitic infections among pre-school children in an urban squatter settlement of Egpt. Journal of Tropical pediatric, 43: 341-44.

Merid, Y., Mekete, M. H. G. & Teklemariam, S. 2001. Intestinal helminthic infection among children at Lake Awassa Area, South Ethiopic. Ethiop. J. Health.

Montressor, A., Crompton, D. W., Gyorkos, T. W. & Savioli, L. 2002. Helminth Control in School- age Children. A guide for managers of Control programmes. World Health Organization Geneva, p. 64.

O'larcalin, P. & Holland, C. V. 2000. The public health importance of *Ascaris lumbricoides*. Parasitology, 121: 51-71.

Osazuwa, F., Oguntade, M. A. & Imade, P. 2011. A significant Association between Intestinal World Helminth Infection and Anaemia Burden in Children in RuralCommunities of Edo State, Nigeria. North AM. J. med. Sci., 3 (1): 30-34.

Partnership for child development. 1999. A situation analysis: a participatory approach that promote health, nutrition and learning in school. 1999 pcd, oxfor to building programs.

Roche, M. & Layrisse, M. 2001. Hookworm anaemia. AM J. Trop. Med. Hyg., 15: 1029-1102.

Sam-Wobo, S. O., Asiwaju, R., Idowu, O. A., Eromosele, C. O. & Adeleke, M. A. 2012. Communal evaluation of intestinal Helminthes in some Guineworm – controlled Communities in Ogun State, Nigeria. Journal of Entomology and Hematology, 4 (2): 7-11.

Sam-Wobo, S. O., Mafiana, C. F., Agwuegbo, S., Adebanji, A. O., Adeyangi, O. & Idowu, O. A. 2008. Incidence of Ascariasis infection among primary school children in Ogun State, Nigeria: A Generalized Linear Model Approach. Nigerian Journal of Parasitology, 29: 32-37.

Sam-Wobo, S. O., Mafiana, C. F. & Amusan, A. A. 2005. Health knowledge and hygienebehaviours in relation to Ascariasis among School Children in Ogun State, Nigeria. Tanzania Health Res. Bull., 7: 62-66.

Taiwo, A. K. & Agbolade, O. M. 2000. Intestinal helminthias among School children in Oru, Ogun state, Nigeria. Nigerian Journal of science, 34: 283-236.

Uneke, C. I., Eze, O. K., Oyibo, P. G., Azu, N. C. & Ali, E. 2007. Soil Transmitted Helminths Infection in School Children in South-Eastern Nigeria. The public Health implication. Interest. J. third World Med., 4 (1): 1-12.

WHO. 2000. World Health Report 2000-Conquering Suffering. Enriching Humanity. World Health Organisation Geneva.

WHO. 2003. Controlling disease due to helminth infection.World Health Organisation Geneva, pp.61-62.

WHO. 2008. Public Health significance of Intestinal parasitic Infections. Bulletin of W.H.O., 65 (5): 575-588.

WHO. 2010. Neglected Tropical Diseases- PCT Data bank.

Table 1. Intestinal Helminths Infection among School Children in Osogbo Local Government Area.

Parameters	Frequency of occurrence	Percentage of occurrence
Number Examined	336	100
Number Infected	103	30.65
Number Infected with *Ascaris*	79	23.51
Number Infected with Hookworm	21	6.25
Number Infected with *Trichuris*	09	2.68
Mixed Infection		
Double Infection with Hookworms and *Trichuris*	01	0.30
Double Infection with Hookworms and *Ascaris*	04	1.19
Double Infection with *Ascaris* and *Trichuris*	01	0.30

Table 2. Prevalence of the infection by Sex of school Children in Osogbo Local Government Area.

SEX	NUMBER EXAMINED	ASCARIS	HOOKWORM	TRICHURIS
MALE	155	23.2%	6.5%	1.9%
FEMALE	181	23.9%	6.1%	3.3%

Prevalence %

Table 3. Prevalence of the Infection by Age Group of School Children in Osogbo Local Government.

AGE (YRS)	NUMBER EXAMINED	*ASCARIS*	HOOKWORM	*TRICHIRUS*
3 -5	62	19.4%	1.6%	3.2%
6 -8	145	23.4%	7.8%	3.4%
9 -11	94	25.5%	7.5%	1.1%
12 -14	35	25.9%	5.7%	2.9%

Prevalence %

Table 4. Prevalence of Ascaris *Lumbricoides, Trichuris* and Hookworm in Public and Private School in Osogbo Local Government Area.

SCHOOLS	Number Examined	*A. lumbricoides*	*T. trichuris*	Hookworm
PUBLIC SCHOOL	175	55%	2%	12%
PRIVATE SCHOOL	161	26%	7%	9%

Prevalence %

A NEW SPECIES OF *PHYLLOTRETA* CHEVROLAT FROM TURKEY (CHRYSOMELIDAE: GALERUCINAE: ALTICINI)

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[Özdikmen, H., Coral Şahin, D. & Bal, N. 2017. A new species of *Phyllotreta* Chevrolat from Turkey (Chrysomelidae: Galerucinae: Alticini). Munis Entomology & Zoology, 12 (1): 147-150**]**

ABSTRACT: The following new species is described: *Phyllotreta aygulae* sp. nov. from Bartın province in North-Western part of Anatolia, close to *Phyllotreta atra* (Fabricius), *Phyllotreta weiseana* Jakobson, *Phyllotreta lubischevi* Lopatin and *Phyllotreta annae* Konstantinov.

KEY WORDS: Chrysomelidae, Galerucinae, Alticini, *Phyllotreta aygulae,* new species, Turkey

Phyllotreta Chevrolat, 1836 is one of the largest worldwide alticine genus which contains approximately 150 species in the Palearctic region and more than 250 species worldwide (Konstantinov & Vandenberg, 1996, 2015). The members of this genus are specialist feeders on the Brassicaceae and related groups (Jolivet & Hawkeswood, 1995). Thus most species of this genus are known as crop pests. Adults usually feed on the foliage of host plant.

Heikertinger (1941) and Warchalowski (2003, 2010) divided *Phyllotreta* species into two main groups on the base of upper side with yellow or reddish pattern, sometimes elytra entirely or almost entirely yellow and upper side uniformly black or black with metallic reflex. These authors also divided *Phyllotreta* species with uniformly black upper side into two groups based on whether they have the central part of the frons punctured. The new species *Phyllotreta aygulae* is a member of the group having the central part of frons punctured. The characters of the new species suggest that it is clearly different from the other known group members.

Phyllotreta aygulae sp. nov.

(Figs. 1-2)

Type material. Holotype ♂: Turkey: Bartın prov.: Güzelcehisar, 12.V.2015, 250 m, leg. D. Şahin, Paratypes: 11 ♂♂ and 6 ♀♀: Same locality, data and collectors; 1 ♂: Turkey: Ankara prov.: Akyurt, Yeşiltepe, 14.VIII.2015, 1063 m, on *Brassica oleracea acephala*; 1 ♂: Turkey: Çankırı prov.: Ilgaz, Candere-Bükcük villages, 26.IV.2015, 874 m, leg. N. Silkin; 3 ♀♀: Turkey: Ankara prov.: Nallıhan, Davutoğlan, 05.V.2015, 474 m, on *Eruca vesicaria* (L.)Cav. and *Lepidium sativum* L., leg. D. Şahin; 1 ♀: Turkey: Ankara prov.: Haymana, 07.V.2015, 1025 m, leg. D. Şahin; 1 ♀: Turkey: Çankırı prov.: Bayramören, exit of Yurtpınar village, 24.IV.2015, 829 m, leg. N. Silkin; 1 ♀: Turkey: Çankırı prov.: Ilgaz, Candere-Bükcük villages, 26.IV.2015, 874 m, leg. N. Silkin. The holotype is deposited in Nazife Tuatay Plant Protection Museum (NTM) (Turkey: Ankara). The paratypes are deposited in the collections of Nazife Tuatay Plant Protection Museum (NTM) and Gazi University (Turkey: Ankara).

Description of holotype.

Body length 2.25 mm. Body width 1.125 mm.

Black without metallic lustre.

Head entirely black; frons with sparse, deep punctures near eyes; central parts of frons and vertex distinctly punctured; frontal keel convex, acute; antennae thin, antennomere 2 and 3 blackish-brown or brown, remaining antennomeres entirely black, antennomere 3 as long as 2 and slightly shorter than 4. Proportions: ♂: 26-18-18-20-22-18-16-20-18-16-24.

Pronotum entirely black, short, more than 1.5 times as wide as long, with rounded lateral sides, the greatest width in middle of lateral margin; disc clearly shagreened, distinctly punctured; distances between punctures shorter than their diameter.

Lateral sides of elytra small rounded; humeral calli well developed; elytral apices with acute sutural angles; apices of hind margin with row short setae; elytral puncturation slightly bigger than pronotal puncturation.

Ventral side of the body entirely black with densely light pubescence.

Legs black with the exception of blackish-brown or brown tarsi.

Aedeagus in figures 2A,B,C.

Spermatheca in figure 2D.

Female. The same as male.

Differential diagnosis. The new species is a member of the group having upper side with uniformly black and the central part of the frons punctured definitely. The new species is close to the species *Phyllotreta atra* (Fabricius, 1775) described from Sweden, *Phyllotreta weiseana* Jakobson, 1901 desribed from S Russia and Caucasus, *Phyllotreta lubischevi* Lopatin, 1992 described from Kirgizia and *Phyllotreta annae* Konstantinov, 1992 described from Kazakhstan. Only *Phyllotreta atra* (Fabricius, 1775) and *Phyllotreta weiseana* Jakobson, 1901 have been known from Turkey until now.

The new species differs from *Phyllotreta atra* by shape of apex of aedeagus in dorsal view (acutely with a median tooth in the new species; sub-rounded with a median tooth in *Phyllotreta atra*), shape of apex of aedeagus in lateral view (directed slightly backwards in the new species; straightened, not directed backwards in *Phyllotreta atra*), and shape of distal pump of spermatheca (obtuse ending in the new species; acute ending in *Phyllotreta atra*) chiefly.

The new species differs from *Phyllotreta weiseana* by coloration of antennae (antennomere 2 and 3 blackish-brown or brown, remaining antennomeres entirely black in the new species; entirely black in *Phyllotreta weiseana*), coloration of legs (black with the exception of blackish-brown or brown tarsi in the new species; tibiae and tarsi at least partly red in *Phyllotreta weiseana*), shape of antennomere 3 in male (antennomere 3 without tooth-like process in the new species; antennomere 3 with a tooth-like process in *Phyllotreta weiseana*), shape of aedeagus in dorsal view (acutely with a median tooth in the new species; widely rounded in *Phyllotreta weiseana*), and shape of apex of aedeagus in lateral view (directed slightly backwards in the new species; directed clearly backwards in *Phyllotreta weiseana*) chiefly.

The new species differs from *Phyllotreta lubischevi* by coloration of antennae (antennomere 2 and 3 blackish-brown or brown, remaining antennomeres entirely black in the new species; entirely black in *Phyllotreta lubischevi*), coloration of legs (black with the exception of blackish-brown or brown tarsi in the new species; entirely black in *Phyllotreta lubischevi*), punturation of vertex (punctured in the new species; smooth in *Phyllotreta lubischevi*), shape of elytral apices (elytral apices with acute sutural angles in the new species; elytral apices rounded in *Phyllotreta lubischevi*), shape of aedeagus in ventral view (median lobe of aedeagus long and slender, almost parallel sided in the new species; median lobe of aedeagus clearly widened in basal half, narrower in apical half in *Phyllotreta lubischevi*), and shape of apex of aedeagus in lateral view (directed slightly backwards in the new species; straightened, not directed backwards in *Phyllotreta lubischevi*) chiefly.

The new species differs from *Phyllotreta annae* by coloration of body (black without metallic reflex in the new species; black with weak metallic reflex in *Phyllotreta annae*), shape of aedeagus in ventral view (median lobe of aedeagus long and slender, almost parallel sided in the new species; median lobe of aedeagus clearly widened in basal half, narrower in apical half in *Phyllotreta annae*), shape of apex of aedeagus in lateral view (directed slightly backwards in the new species; straightened, not directed backwards in *Phyllotreta annae*), and shape of distal pump of spermatheca (straightened, not curved in the new species; clearly curved in *Phyllotreta annae*) chiefly.

Anyway the new species is clearly different from the other known group members by shape of aedeagus.

Variability. Body length of all paratypes is over 2.0 mm. It changes 2.25 to 2.35 mm in both sexes.

Distribution. Known only from Western Black Sea Region of Northern Anatolia (Bartın province) and North parts of Central Anatolian Region (Ankara and Çankırı provinces) of Turkey.

Etymology. The name is dedicated to Asiye Aygül Aşar (Turkey) who is student of the first author.

A short key for the closely related species to new species on the base of Warchalowski (2010) and forms of genitalae

1. Median lobe of aedeagus clearly widened in basal half, narrower in apical half in ventral view...2
-. Median lobe of aedeagus long and slender, almost parallel sided in ventral view...............3

2. Body black with weak metallic reflex; apex of aedeagus acute; elytral apices with acute sutural angles; apices of hind margin of elytra with row of short setae......................*P. annae*
-. Body pure black without metallic reflex; apex of aedeagus sub-rounded with a median tooth; elytral apices wide rounded; apices of hind margin of elytra without row of short setae..*P. lubischevi*

3. In male antennomere 3 with a tooth-like process; apex of aedeagus widely rounded.......... ....*P. weiseana*
-. In male antennomere 3 without tooth-like process; apex of aedeagus more or less pointed, not widely rounded...4

4. Apex of aedeagus acutely with a median tooth; in lateral view apex directed slightly backwards; distal pump of spermatheca obtuse ending..............................*P. aygulae* sp. nov.
-. Apex of aedeagus sub-rounded with a median tooth; in lateral view apex straightened, not directed backwards; distal pump of spermatheca acute ending.....................................*P. atra*

LITERATURE CITED

Heikertinger, F. 1941. Bestimmungs-Tabellen europaischer Kafer (7. Stuck), LXXXII. Fam. Chrysomelidae. 5. Subfam. Halticinae. 1. Gatt. *PhylIotreta* Steph. Bestimmungstabelle der palaarktischen *Phyllotreta*-Arten (Tei1 II). Koleopterologische Rundschau, 27: 69-116.

Jolivet, P. & Hawkewood, T. J. 1995. Host-plants of Chrysomelidae of the world: an essay about the relationships between the leaf beetles and their host-plants. Leiden, the Netherlands (Backhuys Publishers), 281 pp.

Konstantinov, A. S. & Vandenberg, N. J. 1996. Handbook of Palearctic flea beetles (Coleoptera: Chrysomelidae: Alticinae). Contributions on Entomology, International, 1: 236-439.

Konstantinov, A. S. & Vandenberg, N. J. 2015. Guide to Palearctic Flea Beetle Genera (Coleoptera: Chrysomelidae: Alticinae). http://www.sel.barc.usda.gov/coleoptera/ fleabeetles/fleas.htm [accessed 20 February 2015].

Warchałowski, A. 2003. Chrysomelidae: the leaf beetles of Europe and the mediterranean Area. Warszawa (Natura Optima Dux Foundation), 600 pp.

Warchałowski, A. 2010. The Palaearctic Chrysomelidae: Identification keys, Vol 1 - 2. Warszawa (Natura Optima Dux Foundation), 1212 pp.

Figure 1. *Phyllotreta aygulae* sp. nov. (holotype ♂); dorsal view (left), ventral view (right).

Figure 2. *Phyllotreta aygulae* sp. nov., A. Dorsal view of aedeagus, B. Ventral view of aedeagus, C. Lateral view of aedeagus, D. Spermatheca.

CYNIPIDAE (INSECTA: HYMENOPTERA) FAUNA OF İSTANBUL

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[Azmaz, M. & Katılmış, Y. 2017. Cynipidae (Insecta: Hymenoptera) fauna of İstanbul. Munis Entomology & Zoology, 12 (1): 151-167**]**

ABSTRACT: In order to contribute to the cynipid fauna (Hymenoptera: Cynipidae) of Turkey, this study was carried out in Istanbul. Gall specimens were collected between 2012 and 2013 from different habitats of Istanbul. In result of the study, 75 species which are 2 species belonging to 1 genus (Ceroptresini), 54 species belonging to 12 genera (Cynipini), 4 species belonging to 1 genus (Diplolepidini), 1 species belonging to 1 genus (Phanacidini) and 14 species belonging to 2 genera (Synergini), were totally recorded from Istanbul. Five of these species were recorded the first time from Turkey; *Phanacis hypochoeridis* (Kieffer, 1887) (also as a new genus record), *Synergus dacianus* Kierych, 1985, *S. diaphanus* Houard, 1911, *S. physocerus* Hartig, 1843 and *S. radiatus* Mayr, 1872 (Hymenoptera: Cynipidae). First locality record of *Diplolepis nervosa* (Curtis, 1838) was also provided for Turkey. Data about host plants and/or host galls, localities and Turkey distributions are given.

KEY WORDS: Cynipidae, Istanbul, new record, fauna, Turkey

Cynipidae belonging to Cynipoidea is the largest family with roughly 1400 described species (Ronquist, 1999; Ronquist et al., 2015). Approximately 300 of these species are known from Western Palearctic (Dalla-Torre & Kieffer, 1910; Nieves-Aldrey, 2001; Stone et al., 2001; Melika, 2006). Located in between Europe and Asia (western Palearctic) Turkey has special significance due to its contained three phytogeographic regions (Euro-Siberian, Irano-Turanian and Mediterranean) with over 12000 plant taxa (Avcı, 2005).

There are local faunistic studies about Cynipidae and new records were contributed to Turkey fauna (Güçlü et al., 2008; Katılmış & Azmaz, 2015; Katılmış & Kıyak, 2009a, 2009b, 2010, 2011a, 2011b, 2011c, 2011d, 2011e, 2012; Kıyak et al., 2008; Kıyak & Katılmış, 2010; Kemal & Koçak, 2010; Koçak & Kemal, 2012; Mete & Demirsoy, 2012; Mutun & Dinç, 2011, 2015). Katılmış & Kıyak (2008) listed 81 gall wasps (Cynipidae). Furthermore, seven new oak gallwasp species were described from Turkey (Melika & Stone, 2001; Melika et al., 2004; Dinç et al., 2014; Mutun et al., 2014). *Andricus megatruncicolus* Melika was described from Iran and its Turkey distribution was also mentioned (Tavakoli et al., 2008).

Although Istanbul has been metropol during centuries owing to its ancient history and socio-economic importance, 45% of Istanbul is still forestland. Moreover, there are moist forests (beech, hornbeam, chestnut, etc.) in the northern part of Istanbul and dry forests (oaks, chestnut, etc.) in mid and southern parts of Istanbul (Gürel & Gündüz, 2011). However, nearly forestland in all southern part of Istanbul unfortunately disappeared, the rest of forestland alarmed for its future due to rapid industrialization and urbanization. Initially some studies were carried out about gall wasps, as forest pests of Istanbul. In a result of these studies, 40 species were determined in forests of Istanbul (Acatay, 1943; Alkan, 1952; Baş, 1973; Fahringer, 1922; Schimitschek, 1953). In addition, four oak gall wasps were recorded from Istanbul as new to Turkey (Azmaz &

Katılmış, 2015). Gall wasp species diversity in Istanbul might be higher than current known number. However, no regular faunistic study has been unfortunately performed in Istanbul.

MATERIALS AND METHODS

All gall specimens on host plants were collected from different localities in Istanbul between 2012 and 2013 (Fig. 1). After collection, all gall specimens were taken photos. Galls were kept in laboratory conditions and checked weekly for emerged wasps. Adult gall wasps and inquilines were subsequently fixed in ethanol. The adults were then air-dried, fixed on cards (5x10 mm), and pinned.

All gall specimens and the adults were deposited in the Pamukkale University, Faculty of Arts & Sciences, Department of Biology, Zoology Laboratory, Denizli, Turkey. Data about host plants and/or host galls, localities (in appendix) and Turkey distributions are given. New records are denoted by an asterisk (*).

RESULTS

1. Tribe: **Ceroptresini** Nieves-Aldrey, Nylander & Ronquist, 2015
1.1. Genus: ***Ceroptres*** Hartig, 1840
1.1.1. *Ceroptres cerri* Mayr, 1872
Material examined: ISTANBUL, siv-V, 1♀. **Host gall**: *Aphelonyx cerricola*. **Turkey distribution**: Afyon, Denizli, Kütahya, Uşak (Katılmış & Kıyak, 2011d).

1.1.2. *Ceroptres clavicornis* Hartig, 1840
Material examined: ISTANBUL, bey-XII, 1♂, 2♀♀; cat-XIII, 2♀♀; sar-VIII, 1♀; sil-IV, 2♀♀; sil-V, 1♀; sil-XVII, 1♀; sil-XIX, 3♀♀. **Host gall**: *Andricus conglomeratus*, *A. curvator, A. glutinosus*. **Turkey distribution**: Afyon, Kütahya (Katılmış & Kıyak, 2011d).

2. Tribe: **Cynipini** Latreille, 1802
2.1. Genus: ***Andricus*** Hartig, 1840
2.1.1. *Andricus amblycerus* (Giraud, 1859)
Material examined: ISTANBUL, bey-XIII; cat-VIII; cat-XXI; cat-XXIII; cek-III; ey-III; sar-XII, 3♀♀; sil-X; sil-XII; sil-XVIII; sil-XXII; sil-XXX; sil-XXXIV. **Host oak**: *Q. cerris, Q. petraea, Q. pubescens*, *Q. robur*. **Turkey distribution**: İstanbul, Kırklareli, Van (Baş, 1973; Kemal & Koçak, 2010).

2.1.2. *Andricus amenti* Giraud, 1859
Material examined: ISTANBUL, cat-II; cat-XIII; pen-VI; sil-XVII; sil-XX. **Host oak**: *Q. petraea, Q. robur*. **Turkey distribution**: Artvin, İstanbul, Van (Acatay, 1943; Baş, 1973; Kemal & Koçak, 2010).

2.1.3. *Andricus bulgaricus* Vassileva-Samnalieva, 1977
Material examined: ISTANBUL, cat-XVI; cat-XX. **Host oak**: *Q. pubescens*. **Turkey distribution**: Kütahya, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.1.4. *Andricus caliciformis* (Giraud, 1859)
Material examined: ISTANBUL, arn-I; arn-V; bey-II; bey-VII; bey-XII; bey-XVI; cat-VII; cat-VIII; cat-IX; cat-XXIII; cat-XXIV; ey-III; ey-V; pen-III; sar-IV; sar-VII; sar-XII; sar-XVI; sil-II; sil-III; sil-VII; sil-VIII; sil-X; sil-XI; sil-XII; sil-XIII; sil-XIV; sil-XVI; sil-XVII; sil-XVIII; sil-XXII; sil-XXIII; sil-XXXI; sil-XXXII; sil-XXXIII; sil-XXXIV; sil-XXXV; sil-XXXVI; sis-I; siv-IV; siv-VII; tuz-I. **Host oak**: *Q. frainetto, Q. hartwissiana, Q. infectoria, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Balıkesir, İstanbul, Kütahya, Manisa, Van (Baş, 1973; Kemal & Koçak, 2010).

2.1.5. *Andricus callidoma* (Hartig, 1881)
Material examined: ISTANBUL, arn-II; arn-III; bey-II; bey-III; cat-I; cat-II; cat-XXVI; cek-II; ey-I; sar-I; sar-III; sil-V; sil-VI; sil-VII; sil-IX; sil-XVII; sil-XX; sil-XXVIII. **Host oak**: *Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Burdur, Isparta, İstanbul, Kırklareli, Van (Acatay, 1943; Baş, 1973; Kemal & Koçak, 2010; Kıyak et al., 2008).

2.1.6. *Andricus caputmedusae* (Hartig, 1843)
Material examined: ISTANBUL, arn-V; arn-VIII; bey-II; bey-VII; bey-VIII; bey-XII; bey-XIII; bey-XVI; cat-XXIII; ey-III; ey-IV; kar-I; sar-IV; sar-VI; sar-VII; sar-XII; sar-XIII; sar-XIV; sar-XV; sar-XVI; sar-XVII; sil-I; sil-II; sil-III; sil-IX; sil-X; sil-XII; sil-XVI, 3♀♀; sil-XVII; sil-XVIII; sil-XXII; sil-XXIII; sil-XXXI; sil-XXXII; siv-II; siv-IV; tuz-I. **Host oak**: *Q. cerris, Q. frainetto, Q. hartwissiana, Q. infectoria, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Afyon, Ankara, Antalya, Balıkesir, Bolu, Burdur, Bursa, Denizli, Düzce, Erzincan, Gümüşhane, Isparta, İstanbul, İzmir, Kırklareli, Kütahya, Kocaeli, Konya, Muğla, Sakarya, Sinop, Tokat, Uşak, Van (Acatay, 1943; Alkan, 1952; Baş, 1973; Çanakçıoğlu, 1956; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012; Mutun & Dinç, 2011; Rokas et al., 2002; Schimitschek, 1938, 1944).

2.1.7. *Andricus cecconii* Kieffer, 1901
Material examined: ISTANBUL, ey-III. **Host oak**: *Q. cerris*. **Turkey distribution**: Afyon, Antalya, Burdur, Denizli, Isparta, Kütahya, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008).

2.1.8. *Andricus conglomeratus* (Giraud, 1859)
Material examined: ISTANBUL, arn-IV; arn-V; bey-I; bey-III; bey-IV, 1♀; bey-VI; bey-XII; bey-XIV; bey-XIX; bey-XX; cat-II; cat-III; cat-IV; cat-V; cat-VI, 4♀♀; cat-IX; cat-X; cat-XI; cat-XIII; cat-XIV; cat-XV; cat-XVII; cat-XVIII; cat-XIX; cat-XXIII; cat-XXVI; cat-XXVIII; cat-XXIX; cek-III; cek-V; ey-I; ey-II; ey-III; ey-IV; ey-VI; ey-VII; kar-I; pen-V; pen-VI; sar-I, 1♀; sil-IV, 1♀; sil-V; sil-VI; sil-IX, 2♀♀; sil-X; sil-XIII, 1♀; sil-XIV; sil-XV; sil-XVII, 3♀♀; sil-XIX, 2♀♀; sil-XX, 2♀♀; sil-XXV, 1♀; sil-XXVII; sil-XXVIII; sil-XXX; sil-XXXVII; sil-XXXIV; sil-XXXVIII; siv-III; tuz-I. **Host oak**: *Q. frainetto, Q. infectoria, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Ankara, Bolu, Burdur, Denizli, Isparta, İstanbul, Kırklareli, Kütahya, Sakarya, Samsun, Van (Acatay, 1943; Alkan, 1952; Baş, 1973; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Schimitschek, 1944).

2.1.9. *Andricus conificus* (Hartig, 1843)
Material examined: ISTANBUL, arn-IV; cat-IX; cat-X; cat-XI; ey-III; ey-IV; sil-V; sil-XXXIV; siv-III. **Host oak**: *Q. frainetto, Q. petraea, Q. pubescens*. **Turkey distribution**: Bolu, Van, Zonguldak (Baş, 1973; Kemal & Koçak, 2010).

2.1.10. *Andricus coriarius* (Hartig, 1843)
Material examined: ISTANBUL, arn-VIII; bey-VII; cat-VI; cat-VIII; cat-XXIII; cat-XXV; cek-II; ey-III; ey-VI; sar-V; sar-VII; sil-III; sil-VI; sil-VII; sil-XIV; sil-XVI; sil-XX; sil-XXI; sil-XXV; sil-XXXI; siv-I; siv-II; siv-III; siv-IV; siv-VI; siv-VII. **Host oak**: *Q. frainetto, Q. hartwissiana, Q. infectoria, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Afyon, Ankara, Antalya, Balıkesir, Burdur, Bursa, Denizli, Erzincan, Gümüşhane, Isparta, İstanbul, Kırklareli, Kütahya, Tokat, Uşak, Van (Acatay, 1943; Baş, 1973; Fahringer, 1922; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012; Mutun & Dinç, 2011; Rokas et al., 2002; Schimitschek, 1937).

2.1.11. *Andricus coronatus* (Giraud, 1859)
Material examined: ISTANBUL, cat-I; cat-XIII; cat-XVIII; cat-XXII; cat-XXIII; cat-XXIV; cat-XXV; sil-III; sil-VIII; sil-XII; sil-XVI; sil-XXXV; siv-I; siv-II; siv-IV; siv-V; siv-VII. **Host oak**: *Q. cerris, Q. frainetto, Q. pubescens*. **Turkey distribution**: Afyon, Antalya, Denizli, Isparta, İstanbul, Kütahya, Muğla, Uşak, Van (Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008).

2.1.12. ***Andricus corruptrix*** **(Schlechtendal, 1870)**
Material examined: ISTANBUL, arn-VI; bey-XII; bey-XVIII; bey-XX; cat-II; ey-III; sar-IX; sil-V; sil-XII; sil-XVII; sil-XXV; sil-XXXVIII; sil-XL. **Host oak**: *Q. pubescens, Q. robur*. **Turkey distribution**: Afyon, Kütahya, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.1.13. ***Andricus crispator*** **Tschek, 1871**
Material examined: ISTANBUL, bey-X; sil-VIII; sil-XXIII. **Host oak**: *Q. cerris*. **Turkey distribution**: Kütahya (Katılmış & Kıyak, 2009a).

2.1.14. ***Andricus curvator*** **Hartig, 1840**
Material examined: ISTANBUL, arn-I; arn-IV; arn-VI; bey-I; bey-III; bey-XII; bey-XVI; bey-XVII; bey-XVIII; cat-II; cat-VIII; cat-IX; cat-X; cat-XIII; cat-XVI, 1♀; cat-XXVI; cek-V; cek-IV; ey-VI; ey-VII; kar-I; pen-I; pen-IV; pen-VI; sar-XVI; sil-IV; sil-VII; sil-XXVII; sil-XXXVIII; siv-VI; siv-II. **Host oak**: *Q. cerris, Q. frainetto, Q. hartwissiana, Q. petraea, Q. pubescens*. **Turkey distribution**: Afyon, Ankara, Aydın, Bolu, Burdur, Bursa, Denizli, İstanbul, Kırklareli, Kütahya, Uşak, Van (Acatay, 1943; Baş, 1973; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008).

2.1.15. ***Andricus fecundatrix*** **(Hartig, 1840)**
Material examined: ISTANBUL, bey-III; bey-VI; ey-II; ey-III; pen-I; pen-II; sar-I; sar-XVII; sil-II; sil-V; sil-VIII; sil-XVII; sil-XIX; sil-XXIII; sil-XXXI; sil-XXXIX; sil-XL. **Host oak**: *Q. frainetto, Q. infectoria, Q. petraea, Q. pubescens*. **Turkey distribution**: Afyon, Ankara, Balıkesir, Erzincan, İstanbul, Kocaeli, Kütahya, Manisa, Van (Acatay, 1943; Alkan, 1952; Baş, 1973; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Mete & Demirsoy, 2012; Schimitschek, 1938).

2.1.16. ***Andricus galeatus*** **(Giraud, 1859)**
Material examined: ISTANBUL, bey-VII; ey-III; ey-VI; sar-XII; sil-II; sil-VIII; sil-XI; sil-XII; sil-XVIII; sil-XXXII; sil-XXXIV; sil-XXXVI. **Host oak**: *Q. frainetto, Q. infectoria, Q. petraea, Q. pubescens*. **Turkey distribution**: İstanbul, Kırklareli, Kütahya, Van (Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.1.17. ***Andricus gallaeurnaeformis*** **(Boyer de Fonscolombe, 1832)**
Material examined: ISTANBUL, pen-I; pen-II; sar-II; siv-II. **Host oak**: *Q. infectoria*. **Turkey distribution**: Afyon, Kütahya, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.1.18. ***Andricus glutinosus*** **(Giraud, 1859)**
Material examined: ISTANBUL, arn-IV; bey-II; bey-III; bey-IV; bey-XII; bey-XIII; bey-XIV; bey-XVIII; bey-XIX; bey-XX; cat-III; cat-IV; cat-V; cat-VI; cat-VIII; cat-IX; cat-XIV; cat-XV; cat-XVI; cat-XII; cat-XVII; cat-XVIII; cat-XIX; cat-XXV; cat-XXVII; cek-I; cek-III; cek-V; ey-I; ey-IV; ey-V; ey-VII; ey-VIII; pen-VI; sar-I; sar-II; sar-VII; sar-X; sar-XI; sar-XVI; sil-IV; sil-V; sil-VII; sil-IX; sil-X; sil-XI; sil-XII; sil-XIII; sil-XIV; sil-XV; sil-XVII; sil-XVIII; sil-XXI; sil-XXIV; sil-XXV; sil-XXVII; sil-XXVIII; sil-XXX; sil-XXXIII; sil-XXXIV; sil-XXXVII; sil-XXXVIII; sil-XIX; sil-XL; siv-III; siv-IV. **Host oak**: *Q. frainetto, Q. hartwissiana, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Ankara, Bolu, İstanbul, Kırklareli, Sakarya, Van (Acatay, 1943; Baş, 1973; Karaca, 1956; Kemal & Koçak, 2010; Schimitschek, 1944).

2.1.19. ***Andricus grossulariae*** **Giraud, 1859**
Material examined: ISTANBUL, bey-II; bey-VI; cat-VI; cat-VII; cat-VIII; cat-XX; cat-XXI; cat-XXII; cat-XXIII; cat-XXIV; ey-III; ey-IV; ey-V; ey-VI; pen-III; sar-IV, 5♀♀ aseksüel; sar-VII, 5♀♀ aseksüel; sil-I; sil-III; sil-VI; sil-XII; sil-XXXI; sil-XXXII; siv-I; siv-II; siv-III; siv-IV. **Host oak**: *Q. cerris, Q. frainetto, Q. infectoria, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Afyon, Antalya, Aydın, Burdur, Denizli, Erzincan, Gümüşhane, Isparta, İstanbul, Kırklareli, Kütahya, Sinop, Uşak, Van (Acatay, 1943; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012; Mutun &

Dinç, 2011; Schimitschek, 1938, 1944).

2.1.20. *Andricus infectorius* (Hartig, 1843)
Material examined: ISTANBUL, arn-I; arn-II; arn-IV; arn-VIII; bey-II; bey-III; bey-IV; bey-V; bey-XIX; bey-XX; cat-IV; cat-V; cat-VI; cat-XXIII; cat-XXIV; cat-XXVI; cat-XXVII; cat-XXIX; ey-III, 2♀♀; ey-IV; ey-VI; kar-III; kar-IV; pen-V; sil-IV; sil-V; sil-VI; sil-VII; sil-XII; sil-XXXIV; sil-XXXVII; sil-XXXVIII; sil-XL; siv-I; siv-II; siv-V, 1♀; siv-VI. **Host oak**: *Q. cerris, Q. frainetto, Q. hartwissiana, Q. infectoria, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Afyon, Ankara, Aydın, Balıkesir, Batman, Burdur, Çanakkale, Çorum, Denizli, Diyarbakır, Gökırmak Valley (Karadeniz Region), Isparta, İstanbul, İzmir, Kütahya, Manisa, Mardin, Muğla, Niğde, Şırnak, Uşak, Van (Acatay, 1943; Alpaut, 1942; Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Schimitschek, 1938).

2.1.21. *Andricus inflator* Hartig, 1840
Material examined: ISTANBUL, cat-VIII; pen-I. **Host oak**: *Q. cerris, Q. infectoria*. **Turkey distribution**: Afyon, Denizli, Kütahya, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.1.22. *Andricus kollari* (Hartig, 1843)
Material examined: ISTANBUL, bey-VII; cat-VI; cat-XVII; cat-XXVIII; sar-V; sar-XVIII; sil-I; sil-VII; sil-XVI; sil-XX, 1♀; sil-XXIX; sil-XXXVIII; siv-V. **Host oak**: *Q. cerris, Q. frainetto, Q. hartwissiana, Q. infectoria, Q. petraea, Q. pubescens*. **Turkey distribution**: Ankara, Aydın, Balıkesir, Burdur, Bursa, Denizli, Eskişehir, Gümüşhane, Isparta, İstanbul, Kütahya, Uşak, Van (Acatay, 1943; Alkan, 1952; Alpaut, 1942; Çanakçıoğlu, 1956; Fahringer, 1922; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mutun & Dinç, 2011).

2.1.23. *Andricus lignicolus* (Hartig, 1840)
Material examined: ISTANBUL, cat-I; cat-VIII; cat-XIV; cat-XX; cek-III; ey-VI; pen-VII; sil-II; sil-VII; sil-VIII; sil-XI; sil-XII; sil-XIV; sil-XVI; sil-XVII; sil-XVIII; sil-XIX; sil-XXXVII. **Host oak**: *Q. cerris*, *Q. petraea, Q. robur*. **Turkey distribution**: Afyon, Burdur, Denizli, Isparta, İstanbul, Kütahya, Uşak, Van (Acatay, 1943; Alkan, 1952; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Schimitschek, 1938).

2.1.24. *Andricus lucidus* (Hartig, 1843)
Material examined: ISTANBUL, sar-VII; sil-II; sil-III; sil-VIII; sil-IX; sil-XVI; sil-XVIII; sil-XXXIII; sil-XXXIV; siv-VI. **Host oak**: *Q. cerris*, *Q. infectoria, Q. pubescens*. **Turkey distribution**: Afyon, Burdur, Denizli, Erzincan, Gümüşhane, Isparta, İstanbul, Kütahya, Uşak, Van (Acatay, 1943; Alkan, 1952; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012; Mutun & Dinç, 2011; Schimitschek, 1938).

2.1.25. *Andricus megalucidus* Melika, Stone, Sadeghi & Pujade-Villar, 2004
Material examined: ISTANBUL, siv-I, 1♀; siv-VI. **Host oak**: *Q. infectoria*. **Turkey distribution**: Afyon, Burdur, Denizli, Erzincan, Isparta, Kütahya, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Melika et al., 2004; Mete & Demirsoy, 2012).

2.1.26. *Andricus mitratus* (Mayr, 1870)
Material examined: ISTANBUL, bey-I; bey-II; bey-IV; bey-XII; bey-XIII; bey-XIV; bey-XVIII; bey-XIX; bey-XX; cat-I; cat-II; cat-V; cat-XIII; cat-XVII; cat-XXV; cek-I; cek-II; cek-V; ey-VI; ey-VII; pen-V; pen-VI; sil-V; sil-VII; sil-IX; sil-X; sil-XIV; sil-XV; sil-XVII; sil-XVIII; sil-XIX; sil-XX; sil-XXV; sil-XXVII; sil-XXVIII; sil-XXX; sil-XXXIII; sil-XXXIV; sil-XXXIX; sil-XL. **Host oak**: *Q. frainetto, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Bolu, İstanbul, Kütahya, Samsun, Van, Zonguldak (Acatay, 1943; Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Rokas et al., 2002; Schimitschek, 1944).

2.1.27. *Andricus moreae* (Graeffe, 1905)
Material examined: ISTANBUL, cat-XXIV. **Host oak**: *Q. infectoria*. **Turkey**

distribution: Erzincan, Van (Kemal & Koçak, 2010; Mete & Demirsoy, 2012).

2.1.28. *Andricus multiplicatus* Giraud, 1859
Material examined: ISTANBUL, sil-VIII. **Host oak**: *Q. cerris*. **Turkey distribution**: Afyon, Denizli, Kütahya, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.1.29. *Andricus quercustozae* (Bosc, 1792)
Material examined: ISTANBUL, arn-I; arn-V; bey-XIII; cat-I; cat-V; cat-VII; cat-VIII; cat-XVIII; cat-XXI; cat-XXII; cat-XXIII; cat-XXIV; cat-XXV; cek-III; sil-II; sil-III; sil-V; sil-VI; sil-VII, 1♀; sil-VIII; sil-X; sil-XI; sil-XII; sil-XIII; sil-XIV; sil-XVI; sil-XVII; sil-XVIII; sil-XIX; sil-XXII; sil-XXIII; sil-XXIV; sil-XXVIII; sil-XXXI; sil-XXXIII; sil-XXXIV; sil-XXXV; sil-XXXVI; sil-XL; siv-II; siv-IV; siv-V, 1♀; siv-VII; tuz-I. **Host oak**: *Q. frainetto, Q. infectoria, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Afyon, Ankara, Antalya, Aydın, Balıkesir, Burdur, Bursa, Denizli, Erzincan, Gümüşhane, Isparta, İstanbul, Kütahya, Mersin, Muğla, Sakarya, Uşak, Van (Acatay, 1943; Alkan, 1952; Baş, 1973; Çanakçıoğlu, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012; Mutun & Dinç, 2011; Rokas et al., 2002; Schimitschek, 1938).

2.1.30. *Andricus solitarius* (Boyer de Fonscolombe, 1832)
Material examined: ISTANBUL, arn-IV; arn-V; arn-VI; bey-III; bey-IV; bey-XII; bey-XIII; bey-XX; cat-II; cat-IV; cat-V; cat-VI; cat-IX; cat-X; cat-XIII; cat-XV; cat-XVII; cat-XVIII; cat-XIX; cat-XXVI; cek-I; ey-III; ey-VI; pen-V; sar-XVI; sil-IV; sil-V; sil-VI; sil-XIII; sil-XV; sil-XVII; sil-XIX; sil-XX; sil-XXV; sil-XXVII; sil-XXVIII; sil-XXIX; sil-XXXVII; sil-XXXVIII; sil-XXXIX; siv-III. **Host oak**: *Q. cerris, Q. frainetto, Q. petraea, Q. robur*. **Turkey distribution**: Aydın, Burdur, İstanbul, Kütahya, Van (Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008).

2.1.31. *Andricus stefanii* (Kieffer, 1897)
Material examined: ISTANBUL, bey-VII; ey-IV; sil-XX. **Host oak**: *Q. frainetto, Q. infectoria, Q. petraea*. **Turkey distribution**: Afyon, Antalya, Balıkesir, Denizli, Erzincan, Isparta, İstanbul, Kırklareli, Kütahya, Van (Acatay, 1943; Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012; Schimitschek, 1937).

2.1.32. *Andricus sternlichti* Bellido, Pujade-Villar & Melika, 2003
Material examined: ISTANBUL, siv-I; siv-VI. **Host oak**: *Q. infectoria*. **Turkey distribution**: Afyon, Denizli, Erzincan, Kütahya, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Mete & Demirsoy, 2012).

2.1.33. *Andricus tomentosus* (Trotter, 1901)
Material examined: ISTANBUL, sil-XVIII; siv-I; siv-II. **Host oak**: *Q. infectoria*. **Turkey distribution**: Afyon, Ankara, Antalya, Balıkesir, Bursa, Denizli, Erzincan, Isparta, İstanbul, Kütahya, Manisa, Muğla, Samsun, Uşak, Van (Acatay, 1943; Alkan, 1952; Alpaut, 1942; Baş, 1973; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012; Schimitschek, 1938).

2.2. Genus: ***Aphelonyx*** Mayr, 1881
2.2.1. *Aphelonyx cerricola* (Giraud, 1859)
Material examined: ISTANBUL, cat-VI; cat-XX; cat-XXIV; cek-III; sil-VII; sil-VIII; sil-XI; sil-XII; sil-XIV; sil-XVI; sil-XVIII; sil-XXII; sil-XXXIV; siv-V; siv-VII. **Host oak**: *Q. cerris*. **Turkey distribution**: Afyon, Aydın, Burdur, Denizli, Isparta, Konya, Kütahya, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Rokas et al., 2002).

2.2.2. *Aphelonyx persica* Melika, Stone, Sadeghi & Pujade-Villar, 2004
Material examined: ISTANBUL, cat-VII; cat-VIII; cat-XX; cat-XXIV; cat-XXV; cek-III; ey-IV; ey-V; ey-VI; sil-II; sil-VI; sil-VII; sil-VIII; sil-XI; sil-XII; sil-XIII; sil-XIV; sil-XVIII; sil-XIX; sil-XXII; sil-XXXV; sil-XXXVI; sil-XL; siv-IV; siv-VII; siv-V. **Host oak**: *Q. cerris*.

Turkey distribution: Afyon, Denizli, Uşak, Van (Katılmış & Kıyak, 2009b; Kemal & Koçak, 2010).

2.3. Genus: ***Biorhiza*** Westwood, 1840
2.3.1. *Biorhiza pallida* (Olivier, 1791)
Material examined: ISTANBUL, arn-I; arn-II; arn-VII; bey-XII, 1♂; bey-XX; cat-IV; cat-VIII, 4♀♀; cek-I, 7♀♀, 6♂♂; cek-V; ey-VII; pen-IV; sil-VI; siv-II; siv-VI. **Host oak**: *Q. infectoria, Q. petraea, Q. pubescens*. **Turkey distribution**: Afyon, Ankara, Burdur, Denizli, Gümüşhane, Isparta, İstanbul, Kütahya, Trabzon, Uşak, Van (Acatay, 1943; Baş, 1973; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mutun & Dinç, 2011; Schimitschek, 1938, 1944).

2.4. Genus: ***Callirhytis*** Förster, 1869
2.4.1. *Callirhytis rufescens* (Mayr, 1882)
Material examined: ISTANBUL, arn-V; bey-XVII; cat-XVII; sil-XXII. **Host oak**: *Q. frainetto*. **Turkey distribution**: Kütahya, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.5. Genus: ***Cerroneuroterus*** Melika & Pujade-Villar, 2010
2.5.1. *Cerroneuroterus lanuginosus* (Giraud, 1859)
Material examined: ISTANBUL, arn-III; bey-II; ey-III; sil-XI; sil-XII. **Host oak**: *Q. cerris, Q. robur*. **Turkey distribution**: Afyon, Aydın, Burdur, Denizli, Erzincan, Isparta, Kütahya, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012).

2.5.2. *Cerroneuroterus obtectus* (Wachtl, 1880)
Material examined: ISTANBUL, bey-XI; bey-XII; cat-XII; cek-II; kar-IV; siv-I. **Host oak**: *Q. cerris*. **Turkey distribution**: Afyon, Denizli, Kütahya (Katılmış & Kıyak, 2011a).

2.6. Genus: ***Chilaspis*** Mayr, 1881
2.6.1. *Chilaspis nitida* (Giraud, 1859)
Material examined: ISTANBUL, cat-I. **Host oak**: *Q. cerris*. **Turkey distribution**: Afyon, Denizli, Kütahya, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.7. Genus: ***Cynips*** Linnaeus, 1758
2.7.1. *Cynips agama* Hartig, 1840
Material examined: ISTANBUL, bey-II; bey-VII; cat-I; cat-VI; cat-XIX; cat-XXIV; ey-I; ey-II; sil-I; sil-II; sil-III; sil-VII; sil-IX; sil-XII; sil-XVIII; sil-XXIX; sil-XXXVII; siv-IV; siv-VI. **Host oak**: *Q. frainetto, Q. petraea*. **Turkey distribution**: Afyon, Burdur, Denizli, İstanbul, Kütahya, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Schimitschek, 1938).

2.7.2. *Cynips cornifex* Hartig, 1843
Material examined: ISTANBUL, siv-I; siv-IV. **Host oak**: *Q. infectoria*. **Turkey distribution**: Afyon, Antalya, Denizli, Erzincan, İstanbul, Kütahya, Sinop, Van (Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Mete & Demirsoy, 2012).

2.7.3. *Cynips disticha* Hartig, 1840
Material examined: ISTANBUL, cat-XXIV; cat-XXV. **Host oak**: *Q. robur*. **Turkey distribution**: Afyon (Katılmış & Kıyak, 2011a).

2.7.4. *Cynips divisa* Hartig, 1840
Material examined: ISTANBUL, bey-II; bey-III; bey-XII; bey-XIX; cat-I; cat-IV; cat-XXIII; cat-XXV; sar-VI; sar-IX; sil-II; sil-V; sil-VII; sil-VIII; sil-IX; sil-XVII; sil-XXII; sil-XXXV; sis-IV; siv-IV; siv-VII. **Host oak**: *Q. frainetto, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Afyon, Ankara, Artvin, Bolu, Denizli, İstanbul, Kütahya, Niğde, Sakarya, Uşak, Van (Acatay, 1943; Baş, 1973; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.7.5. *Cynips quercus* (Fourcroy, 1785)
Material examined: ISTANBUL, bey-XIX; cat-I; cat-XXIV; cat-XXVI; ey-I; sil-VIII; sil-XI; sil-XII; sil-XIV; sil-XVI; sil-XVIII. **Host oak**: *Q. pubescens*. **Turkey distribution**: Afyon, Amasya, Antalya, Aydın, Burdur, Denizli, Erzincan, Gümüşhane, Hatay, Isparta, Kütahya, Mersin, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mutun & Dinç, 2011; Rokas et al., 2002).

2.7.6. *Cynips quercusfolii* (Linnaeus, 1758)
Material examined: ISTANBUL, bey-I; bey-II; bey-III; bey-VI; bey-VII; bey-XX; cat-I; cat-II; cat-IV; cat-V; cat-VI; cat-XXV; cat-XXVI; cat-XXVII; cat-XXIX; ey-I, 1♀; ey-II; ey-III, 1♀; ey-IV; ey-VI; pen-II; pen-V; pen-VI; sar-II; sar-IV; sar-VI; sar-IX; sar-X; sar-XV; sar-XVI; sil-I; sil-II; sil-III; sil-V; sil-VI; sil-VII; sil-VIII; sil-IX; sil-XI; sil-XII; sil-XIII; sil-XIV; sil-XVI; sil-XVII; sil-XVIII; sil-XIX; sil-XXII; sil-XXIII; sil-XXVI; sil-XXXVII; sil-XXXVIII; sil-XXXV; sil-XXXIX; siv-IV; siv-VII. **Host oak**: *Q. cerris, Q. frainetto, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Afyon, Ankara, Antalya, Artvin, Aydın, Balıkesir, Bolu, Burdur, Denizli, Erzincan, Gümüşhane, Isparta, İstanbul, Kırklareli, Kütahya, Muğla, Tunceli, Uşak, Van (Acatay, 1943; Alkan, 1952; Alpaut, 1942; Baş, 1973; Katılmış & Kıyak, 2011a; Karaca, 1956; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012; Mutun & Dinç, 2011; Schimitschek, 1938).

2.8. Genus: ***Dryocosmus*** Giraud, 1859
2.8.1. *Dryocosmus cerriphilus* Giraud, 1859
Material examined: ISTANBUL, cat-XXIV; cat-XXV. **Host oak**: *Q. cerris*. **Turkey distribution**: Afyon, Erzincan, Kütahya, Van (Katılmış & Kıyak, 2008, 2011a; Kemal & Koçak, 2010).

2.9. Genus: ***Neuroterus*** Hartig, 1840
2.9.1. *Neuroterus albipes* (Schenck, 1863)
Material examined: ISTANBUL, arn-II; bey-XIX; bey-XX; ey-I; sil-XXXIX. **Host oak**: *Q. frainetto, Q. pubescens*. **Turkey distribution**: Afyon, Denizli, İstanbul, Kütahya, Uşak, Van (Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.9.2. *Neuroterus anthracinus* (Curtis, 1838)
Material examined: ISTANBUL, bey-I; bey-II; bey-III; bey-VIII; bey-IX; bey-X; bey-XX; cat-I; cat-XXII; cat-XXIII; cat-XXVI; cat-XXVII; cat-XXIX; ey-I, 1♀; ey-IV; pen-II; sar-I; sar-VI; sar-IX; sar-XIII; sar-XIV; sar-XV; sar-XVI; sar-XIX; sil-II; sil-VIII; sil-IX; sil-XI; sil-XIII; sil-XIV; sil-XVII; sil-XXII; sil-XXIX; sil-XXXI; sil-XXXIII; sil-XXXVII; sil-XXXIX. **Host oak**: *Q. frainetto, Q. hartwissiana, Q. pubescens, Q. robur*. **Turkey distribution**: İstanbul, Kütahya, Van (Acatay, 1943; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010).

2.9.3. *Neuroterus numismalis* (Geoffroy in Fourcroy, 1785)
Material examined: ISTANBUL, arn-III; arn-IV; bey-I; bey-II; bey-III; bey-XIX; cat-I; cat-XXII; ey-I; ey-II; ey-III; ey-IV; pen-II; sar-I; sar-II; sar-VI; sil-III; sil-V; sil-XXXI; sil-XXXII; sil-XL; siv-V. **Host oak**: *Q. cerris, Q. frainetto, Q. petraea*. **Turkey distribution**: Afyon, Ankara, Antalya, Aydın, Burdur, Denizli, Erzincan, Isparta, İstanbul, Kütahya, Sakarya, Samsun, Uşak, Van (Acatay, 1943; Alkan, 1952; Baş, 1973; Karaca, 1956; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012).

2.9.4. *Neuroterus quercusbaccarum* (Linnaeus, 1758)
Material examined: ISTANBUL, arn-I; arn-II; arn-III; arn-IV; arn-V; arn-VI; arn-VII; bey-I; bey-II; bey-III; bey-VI; bey-VII; bey-XI; bey-XVII; bey-XVIII; bey-XIX; cat-I; cat-II; cat-V; cat-VI; cat-VII; cat-XX; cat-XXIII; cat-XXIV; cat-XXV; cat-XXVI; cat-XXVII; cat-XXVIII; cat-XXIX; ey-I; ey-II; ey-III; ey-IV; ey-VII; kar-I; kar-II; kar-III; pen-II; pen-III; pen-IV; pen-VII; sar-I; sar-II; sar-IV; sar-V; sar-VI; sar-VIII; sar-IX; sar-XIV; sar-XV; sar-XVI; sar-XIX; sil-I; sil-III; sil-V; sil-VII; sil-VIII; sil-XII; sil-XIII; sil-XIV; sil-XVII; sil-XXXIV; sil-XXXV; sil-XXXVIII; sil-XXXIX; sil-XL; sis-I; sis-II; sis-IV; siv-I; siv-II; siv-IV; siv-V; siv-VI; siv-VII; tuz-I. **Host oak**: *Q. frainetto, Q. petraea, Q. pubescens, Q. robur*. **Turkey distribution**: Afyon, Aydın, Burdur, Denizli, Erzincan, Gümüşhane, Isparta,

İstanbul, Kırklareli, Kütahya, Sakarya, Van (Acatay, 1943; Alkan, 1952; Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008; Mete & Demirsoy, 2012; Mutun & Dinç, 2011; Schimitschek, 1938).

2.10. Genus: ***Plagiotrochus*** Mayr, 1881
2.10.1. *Plagiotrochus quercusilicis* (Fabricius, 1798)
Material examined: ISTANBUL, arn-VI; sis-II. **Host oak**: *Q. coccifera*. **Turkey distribution**: Afyon, Denizli, Uşak, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008).

2.11. Genus: ***Pseudoneuroterus*** Kinsey, 1923
2.11.1. *Pseudoneuroterus macropterus* (Hartig, 1843)
Material examined: ISTANBUL, cat-I; sil-III; sil-XIII; sil-XVI; siv-IV. **Host oak**: *Q. cerris*. **Turkey distribution**: Afyon, Aydın, Balıkesir, Bolu, Denizli, İstanbul, Kırklareli, Kütahya, Uşak, Van (Acatay, 1943; Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Kıyak et al., 2008).

2.12. Genus: ***Trigonaspis*** Hartig, 1840
2.12.1. *Trigonaspis synaspis* (Hartig, 1841)
Material examined: ISTANBUL, ey-III; pen-I; pen-II. **Host oak**: *Q. infectoria*. **Turkey distribution**: Afyon, Amasya, Denizli, Erzincan, Konya, Kütahya, Van (Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Mete & Demirsoy, 2012; Rokas et al., 2002).

3. Tribe: **Diplolepidini** Latreille, 1802
3.1. Genus: ***Diplolepis*** Geoffroy, 1762
3.1.1. *Diplolepis eglanteriae* (Hartig, 1840)
Material examined: ISTANBUL, pen-I; sis-I; sis-IV. **Host plant**: *Rosa canina*. **Turkey distribution**: Afyon, Ankara, Erzincan, Eskişehir, Kütahya, Uşak, Van (Bayram et al., 1998; Güçlü et al., 2008; Karaca, 1956; Katılmış & Kıyak, 2010; Kemal & Koçak, 2010; Mete & Demirsoy, 2012).

3.1.2. *Diplolepis nervosa* (Curtis, 1838)
Material examined: ISTANBUL, arn-V; bey-XVI; ey-I; pen-I; sil-X; sis-III. **Host plant**: *R. canina*. **Turkey distribution**: First locality record of this species was given for Cynipidae Fauna of Turkey.

3.1.3. *Diplolepis rosae* (Linnaeus, 1758)
Material examined: ISTANBUL, arn-II; arn-V; cat-XXV; sar-VIII, 1♀; sar-XVII; sil-I; sil-VII; sil-XVIII; sil-XXI, 1♀; sil-XXII, 4♀♀; sil-XXXV; sis-III; siv-I; siv-II; siv-VI. **Host plant**: *R. canina*. **Turkey distribution**: Afyon, Ankara, Artvin, Bayburt, Denizli, Erzincan, Erzurum, Eskişehir, Kırşehir, Konya, Kütahya, Niğde, Tokat, Uşak, Van (Alkan, 1952; Bayram et al., 1998; Doğanlar, 1984, 1990; Doğanlar & Çam, 1991; Karaca, 1956; Katılmış & Kıyak, 2010; Kemal & Koçak, 2010; Kılınçer, 1983; Mete & Demirsoy, 2012; Özbek et al., 1996, 1998).

3.1.4. *Diplolepis spinosissimae* (Giraud, 1859)
Material examined: ISTANBUL, bey-XV; bey-XVI; sil-XII. **Host plant**: *R. canina*. **Turkey distribution**: Afyon, Ankara, Denizli, Erzincan, Eskişehir, Kütahya, Uşak, Van (Karaca, 1956; Katılmış & Kıyak, 2010; Kemal & Koçak, 2010; Mete & Demirsoy, 2012).

4. Tribe: **Phanacidini** Nieves-Aldrey, Nylander & Ronquist, 2015
4.1. Genus: ***Phanacis*** Förster, 1860
4.1.1. *Phanacis hypochoeridis (Kieffer, 1887)**
Material examined: ISTANBUL, sis-I. **Host plant**: *Hypochaeris radicata*. **Turkey distribution**: This species is both a new genus and species record for Cynipidae Fauna of Turkey.

5. Tribe: **Synergini** Ashmead, 1896

5.1. Genus: ***Synergus*** Hartig, 1840

5.1.1. *Synergus dacianus Kierych, 1985**

Material examined: ISTANBUL, pen-II, 1♀. **Host gall**: *Andricus gallaeurnaeformis*. **Turkey distribution**: This species is a new record for Cynipidae Fauna of Turkey.

5.1.2. *Synergus diaphanus Houard, 1911**

Material examined: ISTANBUL, bey-III, 4♀♀; sil-VIII, 1♂; siv-V, 2♀♀. **Host gall**: *Andricus caliciformis, A. infectorius*. **Turkey distribution**: This species is a new record for Cynipidae Fauna of Turkey.

5.1.3. *Synergus facialis* Hartig, 1840

Material examined: ISTANBUL, bey-II, 1♂, 1♀; bey-III, 8♂♂, 5♀♀; bey-XII, 1♂, 8♀♀; cat-II, 2♂♂, 4♀♀; cat-V, 5♀♀; cat-XIII, 2♀♀; ey-I, 3♀♀; pen-I, 1♂, 2♀♀; pen-II, 3♂♂, 3♀♀; sil-IV, 2♂♂; sil-V, 8♂♂, 20♀♀; sil-VII, 5♀♀; sil-IX, 15♂♂, 5♀♀; sil-XXIX, 1♂, 1♀. **Host gall**: *Andricus callidoma*, *A. conglomeratus*, *A. curvator*, *A. gallaeurnaeformis*, *A. glandulae*, *A. glutinosus*, *A. infectorius*, *Biorhiza pallida*, *Cynips agama, Trigonaspis synaspis*. **Turkey distribution**: Afyon, Denizli (Katılmış & Azmaz, 2015).

5.1.4. *Synergus hayneanus* (Ratzeburg, 1833)

Material examined: ISTANBUL, sil-III, 1♂; sil-VIII, 2♂♂. **Host gall**: *Andricus caliciformis*, *A. coronatus, A. galeatus*. **Turkey distribution**: Afyon, Denizli, Kütahya (Katılmış & Azmaz, 2015).

5.1.5. *Synergus incrassatus* Hartig, 1840

Material examined: ISTANBUL, bey-XII, 1♀; sil-XVIII, 1♀; sil-XX, 1♂, 1♀. **Host gall**: *Andricus callidoma*, *A. glutinosus, Neuroterus quercusbaccarum*. **Turkey distribution**: Afyon, Denizli, Kütahya (Katılmış & Azmaz, 2015).

5.1.6. *Synergus pallicornis* Hartig, 1841

Material examined: ISTANBUL, bey-XI, 1♀; pen-II, 1♀; sar-XV, 1♀. **Host gall**: *Andricus anthracinus*, *A. gallaeurnaeformis, Neuroterus quercusbaccarum*. **Turkey distribution**: Afyon, Denizli, Kütahya, Van (Katılmış & Azmaz, 2015; Katılmış & Kıyak, 2008; Kemal & Koçak, 2010).

5.1.7. *Synergus pallidipennis* Mayr, 1872

Material examined: ISTANBUL, arn-IV, 1♂; ey-III, 4♀♀; sil-XVII, 1♀. **Host gall**: *Andricus conglomeratus*, *A. conificus, A. infectorius*. **Turkey distribution**: Afyon, Kütahya (Katılmış & Azmaz, 2015).

5.1.8. *Synergus pallipes* Hartig, 1840

Material examined: ISTANBUL, bey-XI, 2♀♀; ey-I, 1♂, 1♀; pen-I, 1♀; pen-II, 1♂; sar-II, 1♀; sar-XIII, 3♂♂, 4♀♀; sar-XIV, 1♀; sil-IV, 1♂; sil-V, 1♂; sil-VII, 1♂; sil-VIII, 1♀; sil-XIX, 1♀; sil-XXIX, 1♂. **Host gall**: *Andricus conglomeratus*, *A. glutinosus*, *Cynips agama*, *C. quercusfolii*, *Neuroterus anthracinus*, *N. quercusbaccarum, Trigonaspis synaspis*. **Turkey distribution**: Afyon, Kütahya (Katılmış & Azmaz, 2015).

5.1.9. *Synergus physocerus Hartig, 1843**

Material examined: ISTANBUL, pen-I, 3♂♂; 7♀♀. **Host gall**: *Trigonaspis synaspis*. **Turkey distribution**: This species is a new record for Cynipidae Fauna of Turkey.

5.1.10. *Synergus radiatus Mayr, 1872**

Material examined: ISTANBUL, bey-III, 1♀; pen-I, 1♂; sar-II, 2♀♀; sar-IX, 1♀; sil-IV, 1♀; sil-XIII, 1♀; sil-XX, 2♀♀. **Host gall**: *Andricus callidoma*, *A. conglomeratus*, *A. glutinosus*, *Cynips quercusfolii, Neuroterus anthracinus*. **Turkey distribution**: This species is a new record for Cynipidae Fauna of Turkey.

5.1.11. *Synergus tibialis* Hartig, 1840

Material examined: ISTANBUL, kar-I, 1♀. **Host gall**: *Neuroterus quercusbaccarum*. **Turkey distribution**: Afyon, Denizli, Kütahya (Katılmış & Azmaz, 2015).

5.1.12. *Synergus umbraculus* (Olivier, 1791)

Material examined: ISTANBUL, sil-IV, 1♀; sil-XXIII, 1♀. **Host gall**: *Andricus conglomeratus, A. quercustozae*. **Turkey distribution**: Afyon, Denizli, Kütahya, Uşak (Katılmış & Azmaz, 2015).

5.1.13. *Synergus variabilis* Mayr, 1872

Material examined: ISTANBUL, bey-XI, 1♂, 1♀; sar-II, 1♂, 1♀; sar-VII, 1♀; sil-II, 1♂; sil-XVIII, 1♀. **Host gall**: *Andricus anthracinus*, *A. glutinosus*, *A. grossulariae*, *A. tomentosus, N. quercusbaccarum*. **Turkey distribution**: Afyon, Kütahya (Katılmış & Azmaz, 2015).

5.2. Genus: ***Synophrus*** Hartig, 1843

5.2.1. *Synophrus politus* Hartig, 1843

Material examined: ISTANBUL, bey-II; bey-X, 1♀; bey-XIX; cat-I; cat-VII; cat-XXIII; cat-XXIV; cat-XXV; cat-XXVII; ey-VI; pen-V; sil-II; sil-VII; sil-XI; sil-XII; sil-XX; sil-XXIII, 1♀; sil-XXXI; sil-XXXIV; sil-XXXVI; sil-XL; sil-XLI; siv-V; siv-VII. **Host oak**: *Q. cerris, Q. frainetto, Q. pubescens*. **Turkey distribution**: Afyon, Denizli, Bursa, İstanbul, Kütahya, Samsun, Uşak, Van (Acatay, 1943; Baş, 1973; Katılmış & Kıyak, 2011a; Kemal & Koçak, 2010; Schimitschek, 1938, 1944).

DISCUSSION

The study area contains two different phytogeographic regions (Euro-Siberian and Mediterranean) owing to climate differences, and it is also located between Europe and Asia. Moreover, Istanbul has special significance about species diversity of European and Asian due to Istanbul is an entry gate to Anatolia for originated European species in glacial and interglacial period (Demirsoy, 2008). So far, 138 species of Cynipidae are known from Turkey, of which 44 species are currently known from Istanbul (Acatay, 1943; Alkan, 1952; Azmaz & Katılmış, 2015; Baş, 1973; Fahringer, 1922; Schimitschek, 1953).

In result of the study, 75 species were totally recorded for Istanbul fauna. Five of these species were recorded the first time from Turkey; *Phanacis hypochoeridis* (Kieffer) (also as a new genus record), *Synergus dacianus* Kierych, *S. diaphanus* Houard, *S. physocerus* Hartig and *S. radiatus* Mayr. First locality record of *Diplolepis nervosa* was also provided for Turkey. The five of the prior known 44 species for Istanbul fauna (*Andricus dentimitratus, A. hungaricus, A. quercuscalicis, A. quercusradicis, A. seckendorffi*) were not determined in study area as habitats of these species might be damaged by urbanization.

According to Istanbul distribution of determined species, many of species were observed both sides (Asia and Europe) as Istanbul is an entry gate to Anatolia for originated European species (Demirsoy, 2008). Due to Istanbul bosphorus which its form is based on recent history, has not occurred an effective insulation (Demirsoy, 2008), cynipid gall wasps which originated in the Western Palaearctic Region except Pediaspidini (Ronquist & Liljeblad, 2001), might probably spread to Anatolia. Thus, there is no surprising difference between Cynipidae fauna of European and Asian side.

This study was carried out in Istanbul contributed both local fauna and Turkish fauna. 40 of listed species are recorded first time for cynipid fauna of Istanbul, of which 5 species are also new records for cynipid fauna of Turkey. Cynipidae Fauna of Istanbul have got 84 species at the present time (Table 1). We hope that number of cynipid species will go on to increase by local faunistic studies in the future.

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LITERATURE CITED

Acatay, A. 1943. Istanbul ve çevresi ve bilhassa Belgrad ormanındaki zaralı orman böcekleri, mücadeleleri ve işletme üzerine tesirleri. Yüksek Ziraat Enstitüsü Çalışmaları, Ankara, 142: 107-120 (in Turkish).

Alkan, B. 1952. Türkiye'nin Zoosesid (Zoocecid) leri (kökeni hayvansal bitki urları) üzerinde çalışmalar II. A. Ü. Ziraat Fakültesi 1952 yıllığı, Ankara, 17: 259-279 (in Turkish).

Alpaut, A. 1942. Über die einige Gallen aus der Pamuklu - Tal bei Ankara. Collegium, 872 (XII): 417-424 (in German).

Avcı, M. 2005. Çeşitlilik ve Endemizm Açısından Türkiye'nin Bitki Örtüsü. Istanbul Üniversitesi Edebiyat Fakültesi Coğrafya Dergisi, 13: 27-55 (in Turkish).

Azmaz, M. & Katılmış, Y. 2015. Four new records of Oak Gall Wasp (Hymenoptera: Cynipidae, Cynipini) from Turkey. Munis Entomology & Zoology, 10 (1): 201-204.

Baş, R. 1973. Türkiye'de orman ağaçlarında zarar yapan zar kanatlılar (Hymenoptera) üzerine araştırmalar. T.C. Orman Bakanlığı, Orman Genel Müdürlüğü, 570 (23): 75-124 (in Turkish).

Bayram, S., Ulgenturk, S. & Toros, S. 1998. Ankara ilinde kuşburnu (*Rosa* spp.)'da gal yapan böcekler ve bunların parazitoitleri üzerinde araştırmalar. Turk. Entomol. Derg.-Tu., 22 (4): 259-268 (in Turkish).

Çanakçıoğlu, H. 1956. Bursa ormanlarında entomolojik araştırmalar. İstanbul Üniversitesi Yayınları, 690: 28-30 (in Turkish).

Dalla-Torre, K. W. & Kieffer, J. J. 1910. Cynipidae, Verlag von R. Friedlander und Sohn, Berlin, Germany, 891 (in German).

Demirsoy, A. 2008. Genel Zoocoğrafya ve Türkiye Zoocoğrafyası: Hayvan Coğrafyası. Ankara: Meteksan A. Ş. (in Turkish).

Dinç, S., Mutun, S. & Melika, G. 2014. A new species of *Andricus* Hartig oak gallwasp from Turkey (Hymenoptera: Cynipidae, Cynipini). North-West J Zool, 10: 122-127.

Doğanlar, M. 1984. Notes on Chalcidoidea of Turkey, I. Chalcididae, Eurytomidae, Torymidae, Orymidae, Perilampidae, Eucharitidae. Turkish Journal of Plant Protection, 8: 151-158.

Doğanlar, M. 1990. Bazı Türkiye Eurytomidae (Hymenoptera, Chalcidoidea) türleri. Türkiye II. Biyolojik Mücadele Kongresi, Ankara, 165-172 (in Turkish).

Doğanlar, M. & Çam, H. 1991. The species of Eurytoma III. with two-three strong setae on hind tibiae from Türkiye, and description of a new species from Tokat, Türkiye (Hymenoptera, Eurytomidae). Turk. Entomol. Derg.-Tu., 15 (3): 143-151.

Fahringer, J. 1922. Hymenopterologische Ergebnisse einer wissenschaftlichen Studienreise nach der Türkei und Kleinasien (mit Ausschluß des Amanusgebirges). Arc. für Naturgesch A 88: 149-222 (in German).

Güçlü, Ş., Hayat, R., Shorthouse, J. D. & Tozlu, G. 2008. Gall-Inducing Wasps of The Genus *Diplolepis* (Hymenoptera: Cynipidae) on Shrub Roses of Turkey. Proc. Entomol. Soc. Wash, 110 (1): 204-217.

Gürel, A. & Gündüz, A. E. 2011. İstanbul'un Ekolojik Yapısı Üzerine Bir Araştırma. The Journal of Marmara Social Research 1 (in Turkish).

Karaca, I. 1956. Orta Anadolu orman ve meyve ağaçlarında görülen mensei nebati ve hayvani önemli urların amili ve morfolojileri hakkında araştırmalar. Ankara Üniversitesi Ziraat Fakültesi Yayınları, 84: 75-120 (in Turkish).

Katılmış, Y. & Azmaz, M. 2015. Investigation on the inquilines (Hymenoptera: Cynipidae, Synergini) of oak galls from inner western Anatolia, Turkey. Turk. J. Zool., 39 (1): 168-173.

Katılmış, Y. & Kıyak, S. 2008. Checklist of Cynipidae of Turkey, with a new genus record. J. Nat. Hist., 42 (31-32): 2161-2167.

Katılmış, Y. & Kıyak, S. 2009a. Oak gallwasp Genus *Andricus* (Hymenoptera, Cynipidae) – new records from Turkey. Zoology in the Middle East, 48: 108-110.

Katılmış, Y. & Kıyak, S. 2009b. The oak gallwasp *Aphelonyx persica*: a new record from Turkey, with some new host records. Phytoparasitica, 37: 95-97.

Katılmış, Y. & Kıyak, S. 2010. Distribution, Phenology and Effects of *Diplolepis* spp. (Hymenoptera: Cynipidae) on *Rosa canina* in the Inland Western Anatolian. J. Entomol. Res. Soc., 12.(2): 31-36.

Katılmış, Y. & Kıyak, S. 2011a. Oak gallwasps (Hymenoptera: Cynipidae) fauna of inner western Anatolia. Munis Entomology & Zoology, 6: 735-757.

Katılmış, Y. & Kıyak, S. 2011b. Herb gallwasp *Neaylax salviae* (Giraud, 1859) (Hymenoptera, Aylacini) – new record from Turkey. Turk. J. Zool., 35: 707-710.

Katılmış, Y. & Kıyak, S. 2011c. New records of herb gallwasps (Hymenoptera, Cynipidae, Aylacini) from Turkey. North-West. J. Zool., 7: 17-19.

Katılmış, Y. & Kıyak, S. 2011d. First records of inquiline wasps of the genus *Ceroptres* Hartig, 1840 (Hymenoptera, Cynipidae, Synergini) from Turkey. J. Entomol. Res. Soc., 13: 65-69.

Katılmış, Y. & Kıyak, S. 2011e. Further study on *Periclistus brandtii* (Ratzeburg, 1831) (Hymenoptera, Cynipidae) from Turkey. Entomol. News, 122: 51-54.

Katılmış, Y. & Kıyak, S. 2012. Two new records of inquiline wasp of the genus *Saphonecrus* Dalla Torre and Kieffer, 1910 (Hymenoptera: Cynipidae: Synergini) from Turkey, their associated galls and hosts. Munis Entomology & Zoology, 7: 1141-1144.

Kemal, M. & Koçak, A. Ö. 2010. Winter trips to south Van Lake and the cynipid galls on oaks (Hymenopteera, Cynipidae). Cesa News, 56: 1-66.

Kılınçer, N. 1983. Ankara'da Gül Gal Arıları (*Rhodites* spp.)'nın (Hym, Cynipidae) Parazitleri Üzerine Araştırmalar. Bitki Koruma Bülteni, 23 (1): 1-11 (in Turkish).

Kıyak, S., Kılıç, T. & Katılmış, Y. 2008. A contribution to the knowledge of the Cynipini (Cynipidae: Hymenoptera) fauna of Turkey. Munis Entomology & Zoology, 3 (1): 523-535.

Kıyak, S. & Katılmış, Y. 2010. Oak gallwasp *Dryocosmus mayri* (Hymenoptera, Cynipidae)- new record from Turkey. J. Entomol. Res. Soc., 12.(1): 67-70.

Koçak, A. Ö. & Kemal, M. 2012. List of the Hitherto Recorded Pterygot Taxa of Turkey (Insecta). Cent. Ent. Stud., 6: i-iv+ 1-1649.

Melika, G. 2006. Gall Wasps of Ukraine, Cynipidae. Vestnik zoologii, 21 (1-2): 1-300, 301-644.

Melika, G. & Stone, G. N. 2001. A new species of cynipid gall wasp from Turkey (Hymenoptera: Cynipidae). Folia Entomologica Hungarica, 62: 127-131.

Melika, G. Stone, G. N., Sadeghi, S. E. & Pujade-Villar, J. 2004. New species of cynipid gallwasps from Iran and Turkey (Hymenoptera: Cynipidae: Cynipini). Acta Zool. Hung., 50 (2): 139-151.

Mete, Ö. & Demirsoy, A. 2012. A Preliminary Study on The Gallwasp Fauna of Kemaliye (Erzincan, Turkey) and A New Record for Turkey. Hacettepe J. Biol. & Chem. Special Issue: 351-363.

Mutun, S. & Dinç, S. 2011. Contributions to the Gallwasp (Hymenoptera: Cynipidae) Fauna of Turkey with One New Record. J. Appl. Biol. Sci., 5 (3): 83-85.

Mutun, S. & Dinç, S. 2015. Twelve oak gall wasp species (Hymenoptera, Cynipidae) new to the Turkish fauna. Turk. J. Zool., 39: 962-964.

Mutun, S., Dinç, S., Bozsó, M. & Melika, G. 2014. Four new species of *Andricus* Hartig oak gallwasp from Turkey (Hymenoptera: Cynipidae, Cynipini). Zootaxa, 3760: 241-259.

Nieves-Aldrey, J. L. 2001. Fauna Iberica Hymenoptera Cynipidae, Museo Nacional de Ciencias Naturales de Madrid, CSIC, Madrid, Spain (in Spanish).

Özbek, H., Güçlü, Ş. & Tozlu, G. 1996. Erzurum, Erzincan, Bayburt ve Artvin İllerinde Kuşburnu Bitkisinde Zararlı Olan Arthropoda Türleri, Kuşburnu Sempozyumu, Gümüşhane, 219-230 (in Turkish).

Özbek, H., Güçlü, Ş. & Tozlu, G. 1998. Oltu ve çevre ilçelerde kuşburnu ve önemli zararlıları, Geçmişten Geleceğe Oltu ve Çevresi Sempozyumu, Erzurum, 567-576 (in Turkish).

Rokas, A., Atkinson, R. J., Nieves-Aldrey, J. L., West, S. A. & Stone, G. N. 2002. The incidence and diversity of *Wolbachia* in gallwasps (Hymenoptera; Cynipidae) on oak. Mol. Ecol., 11: 1815-1829.

Ronquist, F. 1999. Phylogeny, classification and evolution of the Cynipoidea. Zool. Scr., 28: 139-164.

Ronquist, F. & Liljeblad, J. 2001. Evolution of the gall wasp-host-plant association. Evolution, 55: 2503-2522.

Ronquist, F., Nieves-Aldrey, J. L., Buffington, M. L., Liu, Z., Liljeblad, J. & Nylander, J. A. A. 2015. Phylogeny, Evolution and Classification of Gall Wasps: The Plot Thickens, PLoS ONE, 10 (5):1-40.

Schimitschek, E. 1937. Türkiyede orman korunması ve entomolojisi hakkında görüşler. Y. Z. E Çalışmaları, 74 (in Turkish).

Schimitschek, E. 1938. Cecidologische Beobachtungen in der Türkei. Anzeiger für Schaedlingskunde, 7: 77-81 (in German).

Schimitschek, E. 1944. Forstinsekten der Türkei und ihre Umvelt, Berlin (Germany): Volk und Reich Verlag (in German).

Schimitschek, E. 1953. Türkiye Orman Böcekleri ve Muhiti. (ed: Abdulgafur Acatay), İstanbul Üniversitesi Yayınları, 1-471 (in Turkish).

Stone, G. N., Atkinson, R. J., Rokas, A., Csoka, G. & Nieves-Aldrey, J. L. 2001. Differential success in northwards range expansion between ecotypes of the marble gallwasps, *Andricus kollari*: a tale of two lifecycles. Mol. Ecol., 10: 761-768.

Tavakoli, M., Melika, G., Sadeghi, S. E., Pénzes, Z., Assareh, M. A., Atkinson, R. S., Bechtold, M., Mikó, I., Zargaran, M. R. , Aligolizade, D., et al. 2008. New species of oak gallwasps from Iran (Hymenoptera: Cynipidae: Cynipini). Zootaxa, 1699: 1-64.

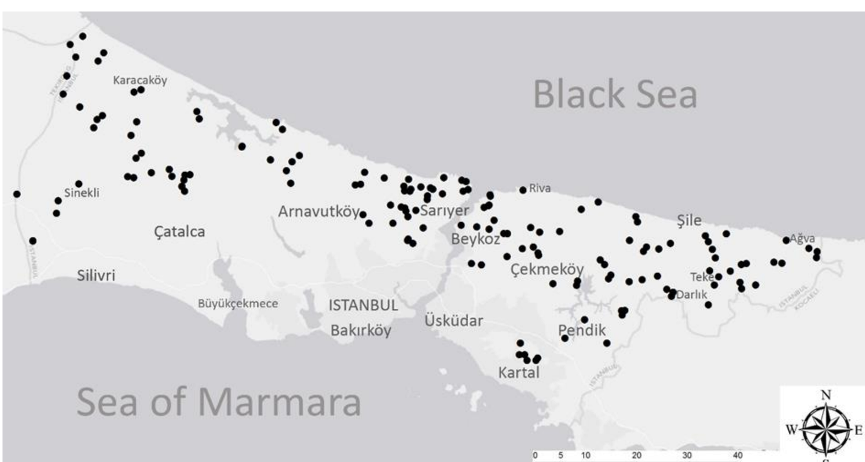

Figure 1.Map of Istanbul, showing localities.

Table 1. The species richness of Cynipidae in Istanbul and Turkey (* New record).

Tribus	Genera	Istanbul	Turkey
Aulacideini	*Aulacidea*	-	2
	Liposthenes	-	1
	Neaylax	-	1
	Rhodus	-	1
Aylacini	*Aylax*	-	2
Ceroptresini	*Ceroptres*	2	2
Cynipini	*Andricus*	40	75
	Aphelonyx	2	3
	Biorhiza	1	1
	Callirhytis	1	2
	Cerroneuroterus	2	3
	Chilaspis	1	1
	Cynips	7	8
	Dryocosmus	1	2
	Neuroterus	4	6
	Plagiotrochus	1	1
	Pseudoneuroterus	1	2
	Trigonaspis	2	2
Diastrophini	*Periclistus*	-	1
Diplolepidini	*Diplolepis*	4	6
Phanacidini	*Phanacis*	1*	1*
Synergini	*Saphonecrus*	-	2
	Synergus	13 (4*)	17 (4*)
	Synophrus	1	1
Total	**24**	**84**	**143**

Appendix: Codes and Localities of Study Areas in Istanbul.

CODES	LOCALITIES
arn-I	Arnavutköy, Durusu Park, 41°17'N, 28°35'E, 58 m, 21.X.2012
arn-II	Arnavutköy, Durusu Park, Durugöl, 41°17'N, 28°35'E, 44 m, 21.X.2012
arn-III	Arnavutköy, Tayakadın, 41°16'N, 28°42'E, 112 m, 21.X.2012
arn-IV	Arnavutköy, Yeniköy, Ökten Mining, 41°17'N, 28°43'E, 112 m, 21.X.2012
arn-V	Arnavutköy, Tayakadın, Tayakadın Promenade 2, 41°14'N, 28°41'E, 178 m, 30.V.2013
arn-VI	Arnavutköy, Tayakadın, Tayakadın Promenade 1, 41°15'N, 28°41'E, 159 m, 30.V.2013
arn-VII	Arnavutköy, Karaburun, 41°19'N, 28°40'E, 59 m, 30.V.2013
arn-VIII	Arnavutköy, Karaburun, 41°20'N, 28°39'E, 50 m, 30.V.2013
bey-I	Beykoz, Dereseki-Riva 3. km, 41°09'N, 29°09'E, 148 m, 21.X.2012
bey-II	Beykoz, Mahmutşevketpaşa, 41°08'N, 29°11'E, 66 m, 21.X.2012
bey-III	Beykoz, Mahmutşevketpaşa-Öğümce 2. km, 41°08'N, 29°11'E, 120 m, 21.X.2012
bey-IV	Beykoz, Karakiraz-Kılıçlı 5. km, 41°09'N, 29°18'E, 150 m, 03.III.2013
bey-V	Beykoz, Riva, 41°13'N, 29°13'E, 68 m, 03.III.2013
bey-VI	Beykoz, Kaynarca, 41°10'N, 29°09'E, 135 m, 03.III.2013
bey-VII	Beykoz, Anadolu Feneri, Cemetery, 41°12'N, 29°09'E, 49 m, 03.III.2013
bey-VIII	Beykoz, Anadolu Feneri-Dereseki 2. km, Dostluk Society Memorial Forest, 41°11'N, 29°09'E, 110 m, 03.III.2013
bey-IX	Beykoz, Poyrazköy, Poyrazköy Picnic Area, 41°11'N, 29°08'E, 99 m, 03.III.2013

bey-X	Beykoz, Poyrazköy-Dereseki 5. km, 41°09'N, 29°07'E, 170 m, 03.III.2013
bey-XI	Beykoz, 164. Year Police Memorial Forest, Göztepe Promenade, 41°05'N, 29°06'E, 225 m, 29.IV.2013
bey-XII	Beykoz, Polonezköy, Polonezköy Nature Park, 41°06'N, 29°11'E, 207 m, 29.IV.2013
bey-XIII	Beykoz, Polonezköy-Cumhuriyet 2. km, 41°07'N, 29°13'E, 50 m, 29.IV.2013
bey-XIV	Beykoz, Cumhuriyet, 41°07'N, 29°15'E, 27 m, 29.IV.2013
bey-XV	Beykoz, Hz. Yûşa Tomb, 41°09'N, 29°05'E, 169 m, 31.V.2013
bey-XVI	Beykoz, Anadolu Feneri-Dereseki 1. km, 41°11'N, 29°09'E, 119 m, 31.V.2013
bey-XVII	Beykoz, Anadolu Feneri, 41°12'N, 29°09'E, 68 m, 31.V.2013
bey-XVIII	Beykoz, Bozhane, Saklıdere Picnic Area, 41°09'N, 29°16'E, 30 m, 31.V.2013
bey-XIX	Beykoz, Öğümce-Mahmutşevketpaşa 1. km, 41°09'N, 29°14'E, 157 m, 21.IX.2013
bey-XX	Beykoz, Mahmutşevketpaşa-Öğümce 2. km, 41°08'N, 29°11'E, 119 m, 21.IX.2013
cat-I	Çatalca, Yaylacık-Aydınlar 1. km, 41°22'N, 28°12'E, 224 m, 25.XI.2012
cat-II	Çatalca, Binkılıç-Yalıköy 2. km, 41°25'N, 28°11'E, 235 m, 25.XI.2012
cat-III	Çatalca, Binkılıç-Yalıköy 10. km, 41°28'N, 28°12'E, 343 m, 25.XI.2012
cat-IV	Çatalca, Binkılıç-Yalıköy 12. km, 41°29'N, 28°13'E, 207 m, 25.XI.2012
cat-V	Çatalca, Yaylacık-Karamandere 8. km, 41°21'N, 28°16'E, 189 m, 25.XI.2012
cat-VI	Çatalca, Karamandere-Karacaköy 6. km, 41°23'N, 28°21'E, 39 m, 25.XI.2012
cat-VII	Çatalca, Celepköy-Örencik 2. km, 41°20'N, 28°29'E, 111 m, 25.XI.2012
cat-VIII	Çatalca, Subaşı, Subaşı Picnic Area, 41°13'N, 28°26'E, 108 m, 28.IV.2013
cat-IX	Çatalca, Subaşı, 41°13'N, 28°27'E, 157 m, 28.IV.2013
cat-X	Çatalca, Subaşı, Subaşı Picnic Area, 41°14'N, 28°27'E, 221 m, 28.IV.2013
cat-XI	Çatalca, Subaşı, Subaşı Picnic Area, 41°15'N, 28°27'E, 226 m, 28.IV.2013
cat-XII	Çatalca, Subaşı-Akalan 4. km, Akalan Bridge, 41°14'N, 28°25'E, 106 m, 28.IV.2013
cat-XIII	Çatalca, Akalan, 41°15'N, 28°25'E, 179 m, 28.IV.2013
cat-XIV	Çatalca, İhsaniye, İhsaniye Picnic Area, 41°17'N, 28°21'E, 282 m, 28.IV.2013
cat-XV	Çatalca, İhsaniye, İhsaniye Picnic Area, 41°16'N, 28°20'E, 203 m, 28.IV.2013
cat-XVI	Çatalca, Gümüşpınar-Belgrat 5. km, 41°19'N, 28°19'E, 285 m, 28.IV.2013
cat-XVII	Çatalca, Gümüşpınar-Belgrat 8. km, 41°20'N, 28°20'E, 335 m, 28.IV.2013
cat-XVIII	Çatalca, Yaylacık-Karamandere 7. km, 41°20'N, 28°15'E, 215 m, 28.IV.2013
cat-XIX	Çatalca, Karamandere-Karacaköy 5. km, 41°23'N, 28°20'E, 61 m, 28.IV.2013
cat-XX	Çatalca, Hisarbeyli-Örencik 2. km, 41°21'N, 28°28'E, 68 m, 28.IV.2013
cat-XXI	Çatalca, Subaşı, 41°15'N, 28°28'E, 135 m, 28.IV.2013
cat-XXII	Çatalca, Subaşı, Subaşı Picnic Area, 41°13'N, 28°26'E, 105 m, 22.IX.2013
cat-XXIII	Çatalca, İhsaniye, 41°15'N, 28°22'E, 145 m, 22.IX.2013
cat-XXIV	Çatalca, İhsaniye-Bekirli 2. km, 41°14'N, 28°20'E, 107 m, 22.IX.2013
cat-XXV	Çatalca, İhsaniye-Bekirli 3. km, 41°14'N, 28°19'E, 119 m, 22.IX.2013
cat-XXVI	Çatalca, İstanbul-Tekirdağ Border Line, 41°23'N, 28°06'E, 240 m, 22.IX.2013
cat-XXVII	Çatalca, İstanbul-Tekirdağ Border Line, 41°27'N, 28°06'E, 323 m, 22.IX.2013
cat-XXVIII	Çatalca, İstanbul-Tekirdağ Border Line, 41°30'N, 28°06'E, 372 m, 22.IX.2013
cat-XXIX	Çatalca, İstanbul-Tekirdağ Border Line, 41°29'N, 28°05'E, 394 m, 22.IX.2013
cek-I	Çekmeköy, İSKİ-Cumhuriyet Water Treatment Plant, 41°06'N, 29°16'E, 68 m, 29.IV.2013
cek-II	Çekmeköy, Alemdağ Forest, 41°03'N, 29°18'E, 209 m, 29.IV.2013
cek-III	Çekmeköy, Ömerli Dam, 41°03'N, 29°21'E, 24 m, 29.IV.2013
cek-IV	Çekmeköy, Ömerli Dam-Koçullu 1. km, 41°03'N, 29°21'E, 90 m, 29.IV.2013
cek-V	Çekmeköy, İSKİ-Cumhuriyet Water Treatment Plant, 41°06'N, 29°15'E, 44 m, 31.V.2013
ey-I	Eyüp, Belgrad Forest, Binbaşı Çeşmesi Promenade, 41°09'N, 28°55'E, 50 m, 20.X.2012
ey-II	Eyüp, Belgrad Forest, Falih Rıfkı Atay-Ayvad Bendi Promenade 4. km, 41°11'N, 28°55'E, 83 m, 20.X.2012
ey-III	Eyüp, Kemerburgaz, Çiftalan, 41°14'N, 28°54'E, 108 m, 20.X.2012
ey-IV	Eyüp, Kemerburgaz, Ağaçlı, 41°15'N, 28°52'E, 29 m, 20.X.2012
ey-V	Eyüp, Kemerburgaz, Odayeri-Ağaçlı, 41°13'N, 28°50'E, 83 m, 20.X.2012
ey-VI	Eyüp, Kemerburgaz, Odayeri, 41°14'N, 28°51'E, 120 m, 20.X.2012
ey-VII	Eyüp, Sevgililer Forest, 41°09'N, 28°52'E, 77 m, 30.V.2013
ey-VIII	Eyüp, Göktürk-Pirinççi 2. km, 41°10'N, 28°51'E, 134 m, 30.V.2013
kar-I	Kartal, Aydos Forest, No. 6 Gate, 40°57'N, 29°13'E, 202 m, 27.IV.2013

kar-II	Kartal, Aydos Forest, 40°56’N, 29°13’E, 261 m, 27.IV.2013
kar-III	Kartal, Aydos Forest, 40°56’N, 29°14’E, 197 m, 27.IV.2013
kar-IV	Kartal, Aydos Forest, Yeşil Vadi Picnic Area, 40°55’N, 29°14’E, 269 m, 27.IV.2013
pen-I	Pendik, Aydos Forest, 40°55’N, 29°15’E, 313 m, 19.X.2012
pen-II	Pendik, Aydos Forest, 40°55’N, 29°15’E, 360 m, 19.X.2012
pen-III	Pendik, Göçbeyli-Ballıca 3. km, 41°00’N, 29°27’E, 175 m, 29.V.2013
pen-IV	Pendik, Göçbeyli-Ballıca 4. km, 41°00’N, 29°27’E, 166 m, 29.V.2013
pen-V	Pendik, Göçbeyli-Ballıca 5. km, 41°00’N, 29°27’E, 152 m, 29.V.2013
pen-VI	Pendik, Kurtdoğmuş, 40°59’N, 29°22’E, 103 m, 29.V.2013
pen-VII	Pendik, Kurna, 50. Yıl Forest, 40°57’N, 29°19’E, 86 m, 31.V.2013
sar-I	Sarıyer, Bahçeköy, Belgrad Forest, Neşetsuyu Promenade, 41°11’N, 28°57’E, 69 m, 20.X.2012
sar-II	Sarıyer, Bahçeköy, Belgrad Forest, Falih Rıfkı Atay, 41°11’N, 28°57’E, 115 m, 20.X.2012
sar-III	Sarıyer, Bahçeköy, Belgrad Forest, Falih Rıfkı Atay, 41°11’N, 28°57’E, 106 m, 20.X.2012
sar-IV	Sarıyer, Bahçeköy, Fatih Forest Promenade-Bahçeköy 2. km, 41°09’N, 29°00’E, 150 m, 04.III.2013
sar-V	Sarıyer, Zekeriyaköy, Okan Villas, 41°12’N, 29°00’E, 130 m, 04.III.2013
sar-VI	Sarıyer, Uskumruköy, 41°12’N, 29°00’E, 80 m, 04.III.2013
sar-VII	Sarıyer, Uskumruköy-Gümüşdere 2. km, Uskumru Arıköy Villas, 41°13’N, 28°59’E, 62 m, 04.III.2013
sar-VIII	Sarıyer, Gümüşdere-Bahçeköy 2. km, 41°13’N, 28°58’E, 90 m, 04.III.2013
sar-IX	Sarıyer, Gümüşdere-Bahçeköy 3. km, 41°13’N, 28°58’E, 140 m, 04.III.2013
sar-X	Sarıyer, Gümüşdere, 41°13’N, 28°57’E, 160 m, 04.III.2013
sar-XI	Sarıyer, Gümüşdere, 41°13’N, 28°57’E, 146 m, 04.III.2013
sar-XII	Sarıyer, Kısırkaya, 41°14’N, 28°58’E, 90 m, 04.III.2013
sar-XIII	Sarıyer, Uskumruköy, 41°13’N, 29°01’E, 70 m, 04.III.2013
sar-XIV	Sarıyer, Uskumruköy-Kumköy 1. km, 41°13’N, 29°01’E, 60 m, 04.III.2013
sar-XV	Sarıyer, Kumköy-Demirci 1. km, 41°14’N, 29°03’E, 72 m, 04.III.2013
sar-XVI	Sarıyer, Demirci-Zekeriyaköy 2. km, 41°13’N, 29°02’E, 136 m, 04.III.2013
sar-XVII	Sarıyer, Rumelifeneri, İstanblue Villas, 41°14’N, 29°06’E, 40 m, 04.III.2013
sar-XVIII	Sarıyer, Rumelifeneri, Marmaracık Bay, Golden Beach Club, 41°14’N, 29°05’E, 10 m, 04.III.2013
sar-XIX	Sarıyer, Rumelifeneri-Sarıyer 2. km, 41°13’N, 29°06’E, 71 m, 04.III.2013
sil-I	Şile, Bucaklı, 41°07’N, 29°53’E, 140 m, 23.XI.2012
sil-II	Şile, Ağva-Kurfallı 2. km, 41°08’N, 29°50’E, 4 m, 23.XI.2012
sil-III	Şile, Çayırbaşı, Saklıkent Homes, 41°08’N, 29°39’E, 98 m, 24.XI.2012
sil-IV	Şile, Çayırbaşı-Yeniköy 2. km, 41°08’N, 29°39’E, 150 m, 24.XI.2012
sil-V	Şile, Yeniköy-Yaylalı 2. km, Yeniköy Stream, 41°07’N, 29°40’E, 61 m, 24.XI.2012
sil-VI	Şile, Yeniköy-Yaylalı 5. km, 41°06’N, 29°40’E, 150 m, 24.XI.2012
sil-VII	Şile, Yaylalı-Teke 2. km, 41°04’N, 29°39’E, 163 m, 24.XI.2012
sil-VIII	Şile, Teke-Yazımanayır 2. km, Teke Stream, 41°04’N, 29°40’E, 108 m, 24.XI.2012
sil-IX	Şile, Sortullu-Hacıllı 1. km, Doğan Yuvası Fire Watch-Tower, 41°03’N, 29°43’E, 308 m, 24.XI.2012
sil-X	Şile, Sortullu-Hacıllı 4. km, 41°03’N, 29°44’E, 210 m, 24.XI.2012
sil-XI	Şile, Hacıllı-Göksu 2. km, 41°03’N, 29°45’E, 100 m, 24.XI.2012
sil-XII	Şile, Soğullu, 41°05’N, 29°49’E, 73 m, 24.XI.2012
sil-XIII	Şile, Übeyli-Osmanköy 4. km, 41°05’N, 29°44’E, 138 m, 24.XI.2012
sil-XIV	Şile, Hasanlı-Sarıkavak 1. km, 41°01’N, 29°39’E, 189 m, 24.XI.2012
sil-XV	Şile, Darlık, Cemetery, 41°02’N, 29°34’E, 263 m, 24.XI.2012
sil-XVI	Şile, Akçakese-Kabakoz 2. km, 41°08’N, 29°41’E, 14 m, 02.III.2013
sil-XVII	Şile, Ahmetli-Korucu 2. km, 41°07’N, 29°34’E, 21 m, 03.III.2013
sil-XVIII	Şile, Korucu-Kalealtı 3. km, 41°07’N, 29°32’E, 30 m, 03.III.2013
sil-XIX	Şile, Korucu-Kalealtı 7. km, 41°07’N, 29°30’E, 40 m, 03.III.2013
sil-XX	Şile, Kalealtı, 41°07’N, 29°30’E, 115 m, 03.III.2013
sil-XXI	Şile, Yeşilvadi-Sofular 2. km, 41°08’N, 29°28’E, 140 m, 03.III.2013
sil-XXII	Şile, Sofular, 41°10’N, 29°29’E, 37 m, 03.III.2013
sil-XXIII	Şile, Sofular-Doğancalı 1. km, 41°10’N, 29°29’E, 21 m, 03.III.2013

sil-XXIV	Şile, Sahilköy, Sahilköy Picnic Area, 41°12'N, 29°24'E, 45 m, 03.III.2013
sil-XXV	Şile, Kurna-Karakiraz 1. km, 41°11'N, 29°21'E, 88 m, 03.III.2013
sil-XXVI	Şile, Ömerli-Yeşilvadi 7. km, 41°06'N, 29°24'E, 195 m, 29.IV.2013
sil-XXVII	Şile, Ömerli-Kervansaray 8. km, 41°05'N, 29°25'E, 161 m, 29.IV.2013
sil-XXVIII	Şile, Bıçkıdere-Oruçoğlu 1. km, 41°03'N, 29°28'E, 121 m, 29.IV.2013
sil-XXIX	Şile, Oruçoğlu-Ulupelit 2. km, 41°04'N, 29°30'E, 210 m, 29.IV.2013
sil-XXX	Şile, Darlık, 41°02'N, 29°34'E, 254 m, 29.IV.2013
sil-XXXI	Şile, Çelebi-Kadıköy 1. km, 41°06'N, 29°54'E, 156 m, 21.IX.2013
sil-XXXII	Şile, Kadıköy, 41°06'N, 29°54'E, 164 m, 21.IX.2013
sil-XXXIII	Şile, Gökmaslı, 41°05'N, 29°48'E, 106 m, 21.IX.2013
sil-XXXIV	Şile, Übeyli-Osmanköy 5. km, 41°05'N, 29°43'E, 126 m, 21.IX.2013
sil-XXXV	Şile, Übeyli-Teke 8. km, 41°04'N, 29°42'E, 62 m, 21.IX.2013
sil-XXXVI	Şile, Teke-Ağaçdere 2. km, 41°03'N, 29°40'E, 130 m, 21.IX.2013
sil-XXXVII	Şile, Darlık, Cemetery, 41°02'N, 29°34'E, 260 m, 21.IX.2013
sil-XXXVIII	Şile, Darlık, 41°03'N, 29°33'E, 265 m, 21.IX.2013
sil-XXXIX	Şile, Darlık-Ulupelit 5. km, 41°04'N, 29°32'E, 252 m, 21.IX.2013
sil-XL	Şile, Kömürlük, 41°04'N, 29°26'E, 105 m, 21.IX.2013
sil-XLI	Şile, Kömürlük, 41°04'N, 29°25'E, 190 m, 21.IX.2013
sis-I	Şişli, Ayazağa, Akdağlar Mining, 41°08'N, 28°58'E, 58 m, 30.V.2013
sis-II	Şişli, Ayazağa, Akdağlar Mining, 41°08'N, 28°58'E, 105 m, 30.V.2013
sis-III	Şişli, Ayazağa, 41°07'N, 28°58'E, 128 m, 30.V.2013
sis-IV	Şişli, Ayazağa, Akdağlar Mining, 41°08'N, 28°58'E, 60 m, 21.IX.2013
siv-I	Silivri, Çeltik-Çerkezköy 3. km, 41°08'N, 28°06'E, 122 m, 25.XI.2012
siv-II	Silivri, Seymen-Sinekli 3. km, 41°11'N, 28°09'E, 165 m, 25.XI.2012
siv-III	Silivri, Seymen-Sinekli 6. km, 41°12'N, 28°09'E, 227 m, 25.XI.2012
siv-IV	Silivri, Büyüksinekli, 41°14'N, 28°12'E, 224 m, 25.XI.2012
siv-V	Silivri, Danamandıra-Yaylacık 3. km, 41°19'N, 28°14'E, 177 m, 25.XI.2012
siv-VI	Silivri, Çeltik-Çerkezköy 3. km, 41°08'N, 28°06'E, 120 m, 22.IX.2013
siv-VII	Silivri, Çeltik-Çerkezköy 12. km, 41°12'N, 28°04'E, 149 m, 22.IX.2013
tuz-I	Tuzla, İstanbul Park-Göçbeyli 2. km, 41°57'N, 29°25'E, 179 m, 29.V.2013

PARASITOID FAUNA ASSOCIATED WITH INSECT PESTS OF VEGETABLE CROPS OF KASHMIR HIMALAYA, INDIA: CHECK LIST AND BIODIVERSITY

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ABSTRACT: Parasitoids are natural enemies of insect pests and form one of the potential biological control measures. This paper presents an up-to-date systematic checklist of parasitoids species reported to be parasitizing various insect pests in vegetable ecosystems of Kashmir. The paper deals with 54 sp. of parasitoids falling under one family of insect order Diptera and eight families of order Hymenoptera distributed over 43 insect genera recorded from the 16 host-insect pest species on 16 species of vegetable crops in diverse areas and localities of Kashmir valley. These enlisted parasitoids include 5 tachinids, 3 aphelinids, 6 aphidiids, 11 braconids, 2 chalcidids, 12-eulophids, 11-ichneumonids, 3-pteromalids and 1 trichogrammatid. Besides, geographical local distribution of enlisted parasitoids, the paper also incorporates parasitoid-Host insect pest and Host-vegetable crop catalogue-cum-checklist.

KEY WORDS: Pest, parasitoid, vegetable, braconids, ichneuomonids, eulophids, chalcidids, Kashmir

The vegetables form essential components of human diet in Kashmir as they are rich source of proteins, carbohydrates, minerals, vitamins, besides providing the necessary roughages. The Valley of Kashmir is ideally suited for cultivation of deciduous fruit and broad-leaved juicy vegetables but it is equally favorable for the insect pests. The vegetables crops in this region are damaged by a number of insect pests of different insect orders. At least 20 insect pest species have been reported infesting various vegetable crops from different areas and localities of Kashmir (Rishi, 1967; Punjabi et al., 1970; Malik et al., 1972; Zaka-ur-rab et al., 1981; Bhagat, 1986; Anonymous, 1997; Dar et al., 2002; Kumar et al., 2006; Bhat, 2008; Bhat et al., 2011).

The insect pest populations associated with vegetable crops of this region are suppressed in the field condition by various natural enemies including parasitoids, predators and pathogens. A number of parasitoid species have been reported on various types insect pests attacking vegetable crops in this region (Simmonds & Rao, 1960; Stary & Ghosh, 1975, 1978; Bhagat, 1986; Bhagat & Ahmad, 1991; Bhagat, 2008; Bhat & Bhagat, 2008; Bhat & Bhagat, 2009, 2009a,b,c; Bhat & Bhagat, 2010; Bhat et al., 2009 & 2009a; Bhat et al., 2010, 2010a,b; Bhat et al., 2011, 2013). However, the said reports are scattered in different journals and there is a lack of systematic and consolidated information of parasitoid fauna which suppress vegetable crop pests from Kashmir Valley.

Therefore, the present work was undertaken to present an up to date checklist/ diversity of such parasitoids which could act as a ready reference for their future studies. Moreover, the present work could be useful source of information for exploring the possibility of utilizing these parasitoids for biological control after standardization of their rearing technique in Kashmir region. Pathogens and predators are not considered here. The paper also provides a more up-dated Parasitoid-insect Host pest and Host-vegetable crop catalogue-cum-checklist from J&K.

MATERIAL AND METHODS

The reported host data of every parasitoid species on commonly found vegetables in Kashmir was collected by examining the published and un-published record/ literature and was presented in tabulated form. The parasitoid-Host insect pest and Host-vegetable plant catalogue-cum-checklist of these parasitoids from J&K was compiled and presented, followed by the reference citing that association. Wherever given in the literature, the local distribution of every enlisted parasitoid was also compiled and presented in the catalogue. The parasitoid species listed here include those emerged from field-collected hosts reported in the literature and from some unpublished data of my own Ph. D. thesis.

RESULTS AND DISCUSSION

The parasitoids associated with insect pests of vegetable crops in Kashmir (India) is presently represented by 53 species belonging to 8 insect families (Aphelinidae, Aphidiidae, Braconidae, Chalcididae, Eulophidae, Ichneuomonidae, Pteromalidae and Trichogrammatidae) of order Hymenoptera and 1 family (Tachinidae) of order Diptera. These parasitoids are distributed under 43 insect genera. The detailed parasitoid-Host pest and Host-vegetable catalogue-cum-checklist of these parasitoids, along with their distribution as reported in the studied, is provided in Table 1.

The families of parasitoids covered in the present paper comprised Aphelinidae with 5 species in 4 genera, Aphidiidae with 6 species in 4 genera, Braconidae with 11 species in 8 genera, chalcididae with 2 species in 1 genus, Eulophidae with 12 species in 10 genera, Ichneuomonidae with 11 species in 9 genera, Pteromalidae with 3 species in 3 genera and Trichogrammatidae with 1 species in 1 genus. The parasitoids listed herein include *Aphelinus* sp., *Encarsia* sp., *Eretmocerus* sp. in family Aphelinidae; *Aphidius* sp., *Aphidius salicis* Haliday, *Aphidius matricariae* Haliday, *Diaeretiella rapae* (M'Int), *Toxares deltiger* (Haliday) and *Trioxys (Binodoxys)* sp. in family Aphidiidae; *Apanteles* sp., *Bracon hebetor* Say, *Cotesia glomerata* Linn. *C. plutellae* (Kurdj.), *C. ruficrus* (Haliday), *Cotesia* sp., *Dacnusa* sp., *Dinocampus coccinellae* (Schrank), *Microplitis* sp., *Opius* sp. and *Zele chloropthala* Nees in family Braconidae; *Brachymeria femorata* Panz., *Brachymeria* sp. in family Chalcididae; *Asecodes* sp., *Chrysonotomyia* sp., *Chrysocharis horticola* Mani, *Closterocerus indica* (Khan et al.), *Diglyphus horticola* Khan, *Diglyphus* sp., *Euderus agromyzae, Euplectrus ceylonensis* Howard, *E. euplexae* Rohwer, *Hemiptarsenus varicornis* (Girault), *Pediobius indicus* Khan, *Quadrastichus* sp. in family Eulophidae; *Campoletis chlorideae* Uchida, *Campoletis* sp., *Charops bicolor* (Szepligeti), *Diadegma fenestrale* (Holmgren) (=*Diadegma fenestralis*), *Erioborus* sp., *Horogenes* sp., *Hyposoter ebeninus* (Grav.), *Itoplectis* sp., *Itoplectis nr.*

himalayensis, *Pimpla* sp., *Scambus* sp. in family Ichneuomonidae; *Herbertia indica* (Burks), *Pteromalus puparum, Tetrastichus sokolowskii* Kurd. in family Pteromalidae; *Compsilura concinnata* (Meigen), *Drino* sp., *Exorista larvarum* (Linnaeus), *Exorista* sp., *Voria ruralis* Fallen in family Tachinidae and *Trichogramma* sp. in family Trichogrammatidae.

The host insect pests of above mentioned parasitoids are represented by *Pieris brassicae* Linnaeus, *P. rapae* (Linnaeus), *Pontia daplidice* Linnaeus in family Pieridae (Lepidoptera), *Plutella xylostella* (Linnaeus) in family Plutellidae (Lepidoptera), *Thysanoplusia orichalcea* Fabricius, *Trichoplusia ni* (Huebner), *Helicoverpa* (=Heliothis) *armigera* (Hubner) and *Spodoptera* sp. in family Noctuidae (Lepidoptera), *Chromatomyia* (*=Phytomyza) horticola* (Goureau), *Liriomyza* trifolii (Burgess) in family Agoromyzidae (Diptera), *Bemisia tabaci* (Gennadius) in family Aleyrodidae (Homoptera), *Aphis gossypii* Glover, *Aphis fabae* (Scopoli), *Acyrthosiphon pisum* (Harris), *Brevicoryne brassicae* Linnaeus and *Lipaphis erysimi* (Kaltenbach) in family Aphidiidae (Homoptera). A total of 19 species of vegetable host crop plants of these insect pests are represented by 8 plant families including Alliaceae (*Alium cepa*), Apiaceae (*Daucus carrota*), Brassicaeae (*Brassica campestris, Brassica oleracea* var. *acephala*, *B. o. var. botrytis*, *B. o.* var. *capitata*, *B. o.* var. *gongylodes*, *B. rapa*, *B. napus*), Cucurbitaceae (*Cucurbita maxima, C. melo, C. moschata, Lygenaria siceraria, Luffa cylindrica)*, Fabaceae (*Pisum sativum, Trigonella foenum-graecum*), Leguminaceae (*Phaseolus vulgaris*), Malvaceae (*Malva sylvestris*), Polygonaceae (*Rumex nepalensis*) and Solanaceae (*Lycopersicon esculentum, Solanum melongena* and *S. tuberosum*). *Brassica oleracea* is represented by four varieties.

Now a day's, many of the species of parasitoids are being utilized for suppression /control of insect pest populations by adopting various methods of applied biological control in various parts of the world. Many of these parasitoids listed here were reported to be abundant and were obviously important in suppressing pest populations. The present work gives an opportunity to further extend the present study to explore the possibility of utilizing the reported parasitoids for biological control after standardization of their rearing technique in Kashmir region. The list of parasitoids provided herein is obviously incomplete and represents only some of the more common species. Additional field surveys and detailed studies to understand the role of these and other species will be important in implementing effective integrated pest management programs in this region.

LITERATURE CITED

Anonymous. 1997. Studies on collection and identification of vegetable pests and their natural enemies. Annual report of All India coordinated research project on Bio-control(ICAR), Banglore, India.

Bhagat, R. C. & Ahmad, M. N. 1991. Aphidiid parasitoids (Hymenoptera) of Aphids (Homoptera) of Jammu-new records, host range and biological notes. Journal of Aphidology, 5: 90-96.

Bhagat, R. C. 1986. On aphid pests and their aphidiid parasitoids of Agricultural importance in Kashmir Valley, India. Ind. Agriculturist, 30 (3): 229-235.

Bhagat, R. C. 2008. Biodiversity of parasite-fauna of Jammu, Kashmir and Ladakh. Publishing Co. New Delhi: 232 pp.

Bhat, D. M. 2008. Studies on insect parasites and predators of some insect pests of vegetable crops of Kashmir Valley. Ph.D thesis, submitted in P.G. Department of Zoology, University of Kashmir, Srinagar, J&K (India).

Bhat, D. M. & Bhagat, R. C. 2008. Studies on parasitoids of cabbage diamondback moth, *Pluttella xylostella* (L.) (Lepidoptera: Plutellidae) in Kashmir Valley. Journal of Entomological Research, 32 (4): 303-308.

Bhat, D. M. & Bhagat, R. C. 2009. Occurrence of natural enemies of the brinjal white fly, *Bemesia tabaci* (Genn.) (Homoptera: Aleyrodidae) in Kashmir Valley (India). Indian Journal of Applied and Pure Biology, 24 (2): 271-272.

Bhat, D. M. & Bhagat, R. C. 2009a. Natural parasitism of *Pieris rapae* (L.). and *Pontia daplidice* (L.) (Lepidoptera: Pieridae) on cruciferous crops in Kashmir Valley (India). American-Eurasian Journal of Agriculture and Environmental Science, 5 (4): 590-591.

Bhat, D. M. & Bhagat, R. C. 2009b. Natural Parasitism of Leaf Miner, *Chromatomyia horticola* (Goureau) (Diptera: Agromyzidae) on Vegetable Crops in Kashmir (India). World Journal of Agricultural Sciences, 5 (S): 888-891.

Bhat, D. M. & Bhagat, R. C. 2009c. Record of *Zele chloropthalma* Nees (Hymenoptera: Braconidae), a parasite of *Spodoptera* sp. (Lepidoptera: Noctuidae) from Kashmir. Indian Journal of Entomology, 71 (3): 262-263.

Bhat, D. M. & Bhagat, R. C. 2010. Record of some hymenopteran parasitoids of leaf miner on vegetables in Kashmir Valley. Annals of Plant Protection Sciences, 18 (1): 237-238.

Bhat, D. M., Bhagat, R. C. & Azim, M. N. 2009. Record of Natural enemies of *Helicoverpa armigera* from Kashmir valley. Annals of Plant Protection Sciences, 17 (1): 229-230.

Bhat, D. M., Bhagat, R. C. & Qureshi, A. 2009a. Records of some hymenopterous parasitoids of serpentine leaf miner, *Liriomyza trifolii* in vegetable ecosystems in Kashmir. Indian Journal of Plant Protection, 37 (1&2): 188-189.

Bhat, D. M., Bhagat, R. C. & Qureshi, A. 2010. Newly recorded hymenopteran parasitoids of semilooper, *Thysanoplusia orichalcea* F. on some vegetable crops in Kashmir Valley (India). Journal of Entomological Research, 34 (1) : 53-54.

Bhat, D. M., Bhagat, R. C., Qureshi, A. & Gulzar, A. 2010a. Report of natural parasitism of *Coccinella septempunctata* L. (Coleoptera: Coccinellidae) by *Dinocampus coccinellae* (Schrank) (Hymenoptera: Braconidae: Euphorinae) from Kashmir valley (India). Annals of Entomology, 28 (2): 112.

Bhat, D. M., Bhagat, R. C. & Qureshi, A. 2010b. Some Natural-enemies of *Pieris brassicae* on cruciferous crops in Kashmir Valley. Annals of Plant Protection Sciences, 18 (2): 516-518.

Bhat, D. M., Bhagat, R. C. & Qureshi, A. 2011. A survey of insect pests damaging vegetable crops in Kashmir valley (India), with some new records. Journal of Entomological Research, 35 (1): 85-91.

Bhat, D. M., Bhagat, R. C. & Qureshi, A. 2011a. Natural parasitisation of *Spodopter litura* F. (Lepidoptera: Noctuidae) by *Zele choloropthalma* Nees (Hymenoptera: Braconidae) in vegetable ecosystems of Kashmir Valley, India. Halteres, 3: 88-90.

Bhat, D. M., Qureshi, A. & Bhagat, R. C. 2013. Natural Parasitisation of *Pieris brassicae* (Lepidoptera: Pieridae) by Tachinid flies (Diptera) on some vegetable crops in Kashmir. Indian J. Applied & Pure Bio., 28 (1): 31-34.

Bhat, M. A. 2008. A report of insect-pests associated with cole crops in Kashmir. Applied Biological Research, 10: 66-67.

Dar, G. H., Bhagat, R. C. & Khan, M. A. 2002. Biodiversity of Kashmir Himalaya. Valley Book House, Srinagar, Kashmir (J&K): 399 pp.

Kumar, P. A., Namgyal, D., Mehdi, M., Mir, M. S. & Sheikh, B. A. 2006. A case study: Major insect pest associated with different vegetable crops in cold arid region Ladakh, of Jammu and Kashmir. Journal of Entomological Research, 30 (2):169-174.

Malik, R. A., Punjabi, A. A. & Bhat, A. A. 1972. Survey study of insect and non-insect pests of Kashmir. Horticulturist, 3: 29-44.

Punjabi, A. A., Bhat, A. A. & Masoodi, M. A. 1970. Insect pests of crops vegetables, fruits and stored grain products prevailing in Kashmir. Inform. Bull. Agr. Dep. J&K Govt. Kashmir (J&K), pp.16.

Rishi, N. D. 1967. Studies on insect pests of Kashmir Part III, Vegetables, major pests with their life -history and control measures. Kmr. Sci., 4: 62-78.

Simmonds, F. J. & Rao, V. P. 1960. Record of *Plutella maculipennis* Cont. and some of its parasites in Kashmir India. Canad. Ent., 92 (4): 274.

Stary, P. & Ghosh, A. K. 1975. Aphid parasites (Hymenoptera: Aphidiidae) from Meghalaya, India. Oriental Insects, 9: 343-349.

Stary, P. & Ghosh, A. K. 1978. Further records of aphid parasitoids (Hymenoptera: Aphidiidae) from Meghalaya, India. Oriental Insects, 12: 77-80.

Zaka-ur-Rab. 1981. Studies on Agromyzidae (Diptera) of Kashmir, India, some interesting palaearctic species. Bulletinode laboratorio di Entomologica Agaria, (Filippo Silvestri), 38: 133-137.

Table 1. Parasitoids of insect pests of vegetable crops recorded from Kashmir, India.

Parasitoid taxa	Host-pest range/ Order: Family	Host-plant range	Districts	Selected references
Order : Diptera				
Family: Tachinidae				
Compsilura concinnata	*Pieris brassicae* (Lep.: Pie.)	*Brassica oleracea* var. *campestris*, *B. o.* var. *gongylodes*, *B. o.* var. *capitata*, *B. o.* var. *acephala*, *Raphanus sativus*.	2,5,7	Bhat et al., 2013
Drino sp.	*Trichoplusia ni* (Lep.: Noc.)	*Pisum sativum*	7	*Bhat unpublished data
Exorista larvarum	*P. brassicae* (Lep.: Pie.)	*Brassica oleracea* var. *campestris*, *B. o.* var. *gongylodes*, *B. o.* var. *capitata*, *B. o.* var. *acephala*, *R. sativus*.	2,5,7	Bhat et al., 2013
Exorista sp.	*Helicoverpa armigera* (Lep.: Noc.)	*B. o.* var. *capitata*	2,7	Bhat et al., 2009
		B. o. var. botrytis	2,7	
Voria ruralis	*Plutella xylostella* (Lep.: Plu.)	*B. o.* var. *capitata*	7	Simmonds & Rao, 1960
	Trichoplusia ni (Lep.: Noc.)	*B. o.* var. *capitata*	7	*Bhat unpublished data
		B. o. var. *gongylodes*	2,7	
		P. sativum	5	
Order: Hymenoptera				
Family: Aphelinidae				
Aphelinus sp.	Unidentified aphid (Hom. : Aph.)	*Cucurbita moschata*	2	*Bhat unpublished data
		Rumex nepalensis	5	
Encarsia sp.	*Bemisia tabaci* (Hom.: Ale.)	*Solanum melongena*	--	Bhat & Bhagat, 2009
Eretmocerus sp.	*B. tabaci* (Hom.: Ale.)	*S. melongena*	--	
Family: Aphidiidae				
Aphidius matricariae	*A. fabae* Scopoli (Hom.: Aph.)	*R. nepalensis*	--	Bhagat & Ahmad, 1991

Aphidius matricariae	*A. fabae* Scopoli (Hom.: Aph.)	*R. nepalensis*	--	Bhagat & Ahmad, 1991
	Brevicoryne brassicae (Hom.: Aph.)	*Brassica* sp.	--	Stary & Ghosh, 1975
	Lipaphis erysimi (Hom.: Aph.)	*Brassica napus*	--	Stary & Ghosh, 1978
Aphidius salicis	*Semiaphis heraclei* (Hom.: Aph.)	*Daucus carrota*	--	Bhagat, 1986
Aphidius sp.	Unidentified aphid (Hom.: Aph.)	*Malva sylvestris*	4, 5	*Bhat unpublished data
		R. nepalensis	5	
Diaeretiella rapae	*L. erysimi* (Hom.: Aph.)	*B. campestris*	--	Bhagat, 1986 & Bhagat & Ahmad, 1991
	B. Brassicae (Hom.: Aph.)	*B. o.* var. *acephala*	--	*Bhat unpublished data
		B. o. var. *acephala*	1,3,6	
		B. o. var. *botrytis*	7	
		B. o. var. *gongylodes*	2,4,7	
		B. o. var. *capitata*	2, 7	
	Aphis craccivora (Hom.: Aph.)	*Solanum tuberosum*	--	Bhagat & Ahmad, 1991
	B. brassicae (Hom.: Aph.)	*B. o.* var. *acephala*	--	Bhagat, 1986
	B. brassicae (Hom.: Aph.)	Brassicaceae plant	--	Rao et al., 1970
		Brassica sp.	--	Stary & Ghosh, 1975
Toxares deltiger	Unidentified aphid (Hom.: Aph.)	*Lycopersicon esculentum*	2,4,6	*Bhat unpublished data
Trioxys (Binodoxys) sp.	Unidentified aphid (Hom.: Aph.)	*C. moschata*	2,4,5,6,7	
		Rumex sp.	2,5	
		Trigonella foenum-graecum	7	
Family: Braconidae				
Apanteles sp.	*P. xylostella* (Lep.: Plu.)	*B. o.* var. *gongylodes*, *B. o.* var. *capitata*, *B. o.* var. *acephala*, *B. o. var. botrytis*	2,4,5,6,7	Bhat & Bhagat, 2008
Bracon hebetor	*H. armigera*	*L. esculentum*	2, 3	*Bhat unpublished data
Cotesia glomerata	*P. rapae* (Lep.: Pie.)	*B. o.* var. *capitata*	4,5	Bhat & Bhagat, 2009a
		B. rapa	2	
	P. Brassica (Lep.: Pie.)	*B. o.* var. *capitata*	2,4,7	Bhat et al., 2010b
		B. o. var. botrytis	2,3	
C. plutellae	*P. xylostella* (Lep.: Plu.)	*B. o.* var. *gongylodes*, *B. o.* var. *capitata*, *B. o.* var. *acephala*, *B. o. var. botrytis*, *B. rapa*	2,3,4,5,6	Bhat & Bhagat, 2008
Cotesia ruficrus	*T. orichalcea* (Lep.: Noc.)	*B. o.* var. *capitata*,	2	Bhat et al., 2010
		T. foenum-graecum	5	
Cotesia sp.	*H. armigera* (Lep.: Noc.)	*B. o.* var. *capitata*	2	Bhat et al. 2009
Dinocampus coccinellae	**Coccinella septempunctata* (Col. : Coc.)	*X*	--	Bhat et al., 2010a
Opius Sp.	*Chromatomyia horticola* (Dip.: Agr.)	*B. campestris*		Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010
	Liriomyza trifolii (Dip.: Agr.)	*Lagenaria siceraria*	2,7	Bhat et al., 2009a
		Luffa cylindrica	2,7	
		C. maxima	4	
Dacnusa sp.	*C. horticola* (Dip.: Agr.)	*B. campestris*,	1,2,3,4,5, 6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010
		P. sativum		
	L. trifolii (Dip.: Agr.)	*L. siceraria*	2,5,7	Bhat et al., 2009
		L. cylindrica	2,7	
		C. maxima	4	
Microplitis sp.	*H. armigera* (Lep.: Noc.)	*L. esculentum*	2,4,5,6,7	Bhat et al., 2009
		S. tuberosum		
Zele chloropthala	*Spodoptera* sp. (Lep.: Noc.)	*B.o.* var. *capitata*	--	Bhat & Bhagat, 2009
		B. o. var. *gongylodes*	--	
		B. o. var. *acephala*	--	
	S. litura (Lep.: Noc.)	*B. o.* var. *gongylodes*,		Bhat et al., 2011a
		B. o. var. *acephala*		
Family : Chalcididae				
Brachymeria femorata	*Pieris rapae* (Lep. Pie.)	*B. o.* var. *capitata*	2,7	Bhat & Bhagat, 2009a
		B. o. var. *gongylodes*	4	
Brachymeria sp.	*Pieris brassicae* (Lep. Pie.)	*B. o* .var. *capitata*	2,4,7	Bhat et al., 2010b
		B. o. var. *gongylodes*	2,5,7	

Family2. Eulophidae				
Asecodes sp.	*L. trifolii* (Dip.:Agr.)	*L. siceraria*	5	Bhat et al., 2009a
		Cucurbita maxima	4.	
Chrysocharis horticola	*C. horticola* (Dip.: Agr.)	*Alium cepa, B. o. Acephala, B. o. gongylodes, P. sativum*	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010
Chrysonotomyia sp.	*L. trifolii* (Dip.:Agr.)	*L. siceraria*	2,7	Bhat et al., 2009
		L. cylindrica	7	
Closterocerus indica	*L. trifolii* (Dip.:Agr.)	*L. siceraria*	2,5.	Bhat et al., 2009a
		L. cylindrica	2	
		C. maxima	4	
		L. esculentum	2	
		C. melo	4	
		C. sativus	1	
		S. tuberosum	7	
Diglyphus horticola	*C. horticola* (Dip.: Agr.)	*A. cepa, B. campestris, B. o. acephala, B. o. gongylodes, B. rapa, M. sylvestris, P. sativum*	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010
Diglyphus Sp.	*C. horticola* (Dip.: Agr.)	*A. cepa, B. campestris, B. o. acephala, B. o. gongylodes, B. rapa, M. sylvestris, P. sativum*	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010
	L. trifolii (Dip.: Agr.)	*L. siceraria,*	2,5,7	Bhat et al., 2009a
		L. cylindrica	2,7	
		C. maxima	4	
		L. esculentum	2	
		C. melo	4	
		C. sativus	1,4	
		S. tuberosum	7	
Euplectrus ceylonensis	*T. orichalcea* (Lep.: Noc.)	*B. o.* var. *gongylodes*	2	Bhat et al., 2010
E. euplexae	*H. armigera* (Lep.: Noc.)	*B. o.* var. *capitata*	7	Bhat et al., 2009
Pediobius indicus	*C. horticola* (Dip.: Agr.)	*A. cepa, P. sativum, B. o. acephala*	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010
Hemiptarsenus varicornis	*L. trifolii*(Dip.: Agr.)	*L. siceraria*	2,4,7	Bhat et al., 2009a
		L. cylindrica	2,7	
Euderus agromyzae	*C. horticola*(Dip.: Agr.)	*A. cepa, B. campestris, B. o. acephala, P. sativum*	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010
Quadrastichus sp.		*L. siceraria*	2,5	Bhat et al., 2009a
		L. cylindica	2	
Family: Ichneumonidae				
Campoletis chlorideae	*T. orichalcea* (Lep.: Noc.)	*B. rapa*	1,3,5	Bhat et al., 2010
		A. cepa,	2	
		P. sativum	7	
	H. armigera (Lep.: Noc.)	*S. tuberosum*	1,2,3	Bhat et al., 2009
		L. esculentum	7	Bhat et al., 2009
		soybean	4,5,6	Bhat et al., 2009
Campoletis sp.	*Trichoplusia ni* (Lep.: Noc.)	*B. o.* var. *capitata*	2,6,7	*Bhat unpublished data
		*B. o.*var. *gongylodes*	4	
Charops bicolor	*H. armigera* (Lep.: Noc.)	*L. esculentum*	2,7	Bhat et al., 2009
Diadegma fenestrale (Holmgren) (=*Diadegma fenestralis)*	*H. armigera* (Lep.: Noc.)	*L. esculentum*	2,7	Bhat et al., 2009
	P. xylostella (Lep.: Plu.)	*B. campestris, B. o.* var. *acephala, B. o.* var. *capitata, B. o.* var . *gongylodes, R. sativus, B. rapa*	1,23,45,67	Bhat & Bhagat, 2008
Erioborus sp.	*H. armigera* (Lep. : Noc.)	*L. esculentum*	2,7	Bhat et al., 2009
Horogenes sp.	*Plutella maculipennis (=xylostella)* (Lep. : Plu.)	*B. o. var. capitata*	7	Simmonds & Rao, 1960

Hyposoter ebeninus	*P. rapae* (Lep. : Pie.)	*B.o.* var. *capitata*	2,7	Bhat & Bhagat, 2009a
		B. o .var. *gongylodes*	1,5,7	Bhat & Bhagat, 2009a
		B. o. var. *acephala*	3,6,7	Bhat & Bhagat, 2009a
	Pontia deplidice (Lep. : Pie.)	*B. o.* var. *gongylodes*	3,5	Bhat & Bhagat, 2009a
		B. o. var. *acephala*	4	
	Pieris brassicae (Lep. : Pie.)	*B. campestris*	1,2,3	Bhat et al., 2010b
		B. o. var. *capitata*	2,7	
		B. o. var *gongylodes*	1,2,3,4,5	
		*B. o.*var *botrytis*	1,2,3,5,67	
		B. o. var. *acephala*	2,7	
		B. rapa	2,3,4,5,67	
Itoplectis sp.	*Plutella maculipennis* (*=xylostella)* (Lep. : Plu.)	*B. o.* var. *capitata*	7	Simmonds & Rao, 1960
Itoplectis nr. himalayensis	*P. xylostella*	*B. o.* var. *capitata, B. o. var. gongylodes, B. campestris*	2,4,5,7	Bhat & Bhagat, 2008
Pimpla sp.	*P. brassicae* (Lep.: Pie)	*B. o.* var. *gongylodes*	5,7	Bhat et al., 2010b
Scambus sp.	*Thysanoplusia orichalcea* (Lep.: Noc.)	*Phaseolus vulgaris*	2,5	Bhat et al., 2010
		R. nepalensis	5	
Family: Pteromalidae				
Herbertia indica	*L. trifolii* (Dip.: Agr.)	*L. siceraria*		Bhat et al., 2009a
		L. cylindrica	2	Bhat et al., 2009a
Pteromalus puparum	*P. brassicae* (Lep.: Pie)	*B. o.* var. *capitata*	2,7	Bhat et al., 2010b
Tetrastichus sokolowskii	*P. xylostella*	*B. capitata, B. o.* var. *botrytis*	2,7	Bhat & Bhagat, 2008
Family: Trichogrammatidae				
Trichogramma sp.	*H. armigera* (Lep.: Noc.)	*S. tuberosum, L. esculentum*	2, 3, 4, 6, 7	Bhat et al., 2009

Keys to symbols & abbreviations:- *un-published data of Ph. D. thesis;**Non-pest host of parasitoid; -- = distribution not given; X = host plant not given; 1.=Anantnag, 2=Budgam, 3=Bandipora,4=Baramulla, 5= Ganderbal, 6=Pulwama & 7= Srinagar; Lep.= Lepidoptera, Dip.= Diptera, Hom.=Homoptera, Aph.=Aphididae, Agr.= Agromyzidae, Noc.= Noctuidae, Pie.- Pieridae, Plu.= Plutellidae

A NEW SPECIES, *PHYLLOTRETA BILGEAE* SP. NOV., FROM TURKEY (CHRYSOMELIDAE: GALERUCINAE: ALTICINI)

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ABSTRACT: The following new species is described: *Phyllotreta bilgeae* sp.. nov. from Ankara province in Northern part of Central Anatolian Region of Turkey, close to *Phyllotreta cleomica* Furth, *Phyllotreta sisymbrii* Weise and *Phyllotreta armoraciae* (Koch).

KEY WORDS: Chrysomelidae, Galerucinae, Alticini, *Phyllotreta aygulae,* new species, Turkey

Phyllotreta Chevrolat, 1836 is one of the largest worldwide alticine genus which contains approximately 150 species in the Palearctic region and more than 250 species worldwide (Konstantinov & Vandenberg, 1996, 2015). The members of this genus are specialist feeders on the Brassicaceae and related groups (Jolivet & Hawkeswood, 1995). Thus most species of this genus are known as crop pests. Adults usually feed on the foliage of host plant.

Heikertinger (1941) and Warchalowski (2003, 2010) divided *Phyllotreta* species into two main groups on the base of upper side with yellow or reddish pattern, sometimes elytra entirely or almost entirely yellow and upper side uniformly black or black with metallic reflex. The new species *Phyllotreta bilgeae* is a member of the group having upper side with yellow or reddish pattern. The characters of the new species suggest that it is clearly different from the other known group members.

Phyllotreta bilgeae sp. nov.

(Figs. 1-4)

Type material. Holotype ♂: Turkey: Ankara prov.: Haymana, Soğulca village, N 39° 22ʹ 26ʹʹ E 32° 21ʹ 03ʹʹ, 22.V.2014, 948 m, leg. D. Şahin. Paratype ♂: Same locality, data and collectors. The specimens are deposited in the collection of Nazife Tuatay Plant Protection Museum (NTM) (Turkey: Ankara).

Description of holotype.

Body length 1.9 mm. Body width 0.9 mm.

Head entirely black; frons and vertex with metallic reflection; frons and vertex sparsely, finely punctate. Antennomeres 1-6 light-brown, 7 basally light-brown apically black, the remaining antennomeres completely black. Proportions: ♂: 22-15-16-18-22-19-21-20-20-16-24.

Pronotum entirely black with greenish metallic reflection; puncturation distinct, moderately dense and confused; shape subrectangular, lateral and posterior margins rather evenly rounded.

Each elytron with a very broad yellow stripe, and with a narrow, black lateral and apical margins beginnig from near humerus, black colour on apical margin approximately as the breadth as lateral margin; elytral base and humerus completely yellow without dark margin; elytra with a narrow, parallel sided, black sutural stripe, only apically becoming extremely narrowed, black colour of sutural stripe on each elytron approximately as the breadth as apical margin; elytral puncturation fine, moderately dense, confused; texture smooth; epipleura entirely black.

Ventral side of the body entirely black; apical sternite with a small depression at apex.

Fore and middle femora basally black, light-brown apically; hind femora entirely black; all tibiae and possibly all tarsi light-brown.

Aedeagus in figures 3B,J and 4I.

Female. Unknown.

Differential diagnosis. The new species is a member of the group having upper side with yellow or reddish pattern definitely. The new species is close to *Phyllotreta cleomica* Furth, 1979 described from Israel, *Phyllotreta sisymbrii* Weise, 1888 described from Caucasus, and *Phyllotreta armoraciae* (Koch, 1803) of which type locality is not known, lectotype from Hungary designated by Smith (1985). Only *Phyllotreta sisymbrii* Weise, 1888 has been known from Turkey until now.

The new species differs from *Phyllotreta sisymbrii* by body length (normally under 2.0 mm in the new species; normally over 2.0 mm in *Phyllotreta sisymbrii*), coloration of antennae (antennomeres 1-6 light-brown, 7 basally light-brown apically black, the remaining antennomeres completely black in the new species; antennomeres 1-4 light-brown or yellow, the remaining antennomeres completely black in *Phyllotreta sisymbrii*), proportion of antennomeres 3 and 4 (antennomere 3 smaller than 4 in the new species; antennomere 3 longer than 4 in *Phyllotreta sisymbrii*), black sutural stripe (narrower than *Phyllotreta sisymbrii*, only apically narrowed in the new species; broader than the new species, apically and behind scutellum narrowed in *Phyllotreta sisymbrii*), and shape of apex of aedeagus (sub-rounded with a median tooth in the new species; obtuse in *Phyllotreta sisymbrii*) chiefly.

The new species differs from *Phyllotreta cleomica* by coloration of antennae (antennomeres 1-6 light-brown, 7 basally light-brown apically black, the remaining antennomeres completely black in the new species; antennomeres 1-4 light-brown, sometimes yellow, 5 basally light-brown apically darkened, the remaining antennomeres completely black in *Phyllotreta cleomica*), proportion of antennomeres 1 and 5 (antennomere 1 as long as 5 in the new species; antennomere 1 longer than 5 in *Phyllotreta cleomica*), elytral pattern (elytra with narrow black lateral and apical margins beginning from near humerus, black colour at apical margin approximately as the breadth as of lateral margin, base and humerus completely yellow without dark margin, and a narrow, parallel sided, black sutural stripe, only apically becoming extremely narrow in the new species; elytra with narrow, black lateral margins, black colour at apical margin usually approximately twice the breadth of lateral margins but occasionally entirely yellow at apex, at base dark margin extremely narrow; sutural black stripe narrow but broader than lateral black margin, broadest in middle 2/3 then tapered apically becoming extremely narrow in *Phyllotreta cleomica*), coloration of legs (fore and middle femora basally black, apex light-brown, hind femora entirely black in the new species; fore and middle femora basally dark-brown, apex lighter-brown, hind femora darker brown to black in *Phyllotreta cleomica*), humeral callus (entirely or almost entirely pale in the new species; covered by black colour in *Phyllotreta cleomica*), and shape of apex of aedeagus (sub-rounded with a median tooth in the new species; acute in *Phyllotreta cleomica*) chiefly.

The new species also differs from *Phyllotreta armoraciae* by body length (normally under 2.0 mm in the new species; normally over 2.5 mm in *Phyllotreta armoraciae*), coloration of antennae (antennomeres 1-6 light-brown, 7 basally light-brown apically black, the remaining antennomeres completely black in the new species; antennomeres 1-3 light-brown or yellow, the remaining antennomeres completely black in *Phyllotreta armoraciae*), proportion of antennomeres 1 and 11 (antennomere 1 smaller than 11 in the new species; antennomere 1 longer than 11 in *Phyllotreta armoraciae*), proportion of antennomeres 4 and 5(antennomere 4 smaller than 5 in the new species; antennomere 4 longer than 5 in *Phyllotreta armoraciae*), black sutural stripe (narrower than *Phyllotreta armoraciae*, only apically narrowed in the new species; broader than the new species, apically and behind scutellum narrowed in *Phyllotreta armoraciae*), and shape of apex of aedeagus (sub-rounded with a median tooth in the new species; crescent in *Phyllotreta armoraciae*) chiefly.

In addition, some species of Plaearctic *Phyllotreta* [e.g. *P. erysimi* Weise, 1900; *P. lativittata* (Kutschera, 1860); *P. pallidipennis* Reitter, 1891; *P. undulata* (Kutschera, 1860) and *P. variipennis* (Boieldieu, 1859)] are remarkably similar to the new species. However the new species differs from them by elytral patterns, coloration of antennae and proportions of antennal segments chiefly (Fig. 2).

Anyway the new species, *Phyllotreta bilgeae* sp. nov., is easily distinguished by structure of aedeagus from all other *Phyllotreta* species (Figs. 3-4).

Distribution. Known only from the type locality.

Etymology. The name is dedicated to Bilge Bahar Şahin (Turkey) who is daughter of the second author.

A short key for the closely related species to new species on the base of Warchalowski (2010) and forms of aedeagus

1. Humeral callus at least partly covered by black colour; apex of aedeagus acute; in male antennomeres 1-4 light-brown, sometimes yellow, 5 basally light-brown apically darkened, the remaining antennomeres completely black...*P. cleomica*
-. Humeral callus entirely or almost entirely pale; apex of aedeagus and coloration of antennae not as above..2

2. Body length over 2.5 mm; in male antennomeres 1-3 light-brown or yellow, the remaining antennomeres completely black; apex of aedeagus crescent..............................*P. armoraciae*
-. Body length under 2.5 mm; in male at least first four antennal segment pale; coloration of antennae and apex of aedeagus not as above..3

3. Apical margin of elytra narrowly darkened..4
-. Apical margin of elytra broadly darkened..5

4. Body length normally over 2.0 mm; black sutural stripe of elytra broader, apically and behind scutellum narrowed; in male antennomeres 1-4 light-brown or yellow, the remaining antennomeres completely black; apex of aedeagus obtuse.....................................*P. sisymbrii*

-. Body length normally under 2.0 mm; in male antennomeres 1-6 light-brown, 7 basally light-brown apically black, the remaining antennomeres completely black; black sutural stripe narrower, only apically narrowed; apex of aedeagus sub-rounded with a median tooth..*P. bilgeae* sp. nov.

5. Mid part of sutural stripe parallel; dark parts of elytra mostly brownish; in male antennomeres 1-6 light-brown, 7 basally light-brown apically black, the remaining antennomeres completely black; in male antennomere 5 not distinctly thickened, about as long as 4..*P. pallidipennis*
-. Mid part of sutural stripe not parallel, but lanceolate; dark parts of elytra black, contrasting on ground; in male antennomeres 1-4 light-brown or yellow, the remaining antennomeres completely black, antennomere 5 distinctly thickened, about 3 times longer than 4..*P. variipennis*

LITERATURE CITED

Borowiec, L. 2013. The Leaf Beetles of Europe and the Mediterranean Subregion (Checklist and Iconography). Last modification 7 August 2013. http://culex.biol.uni.wroc.pl/cassidae/European %20Chrysomelidae/index.htm [accessed 18-October-2015].

Furth, D. G. 1979. Zoogeography and host plant ecology of the Alticinae of Israel, especially *Phyllotreta* with descriptions of three new species (Coleoptera: Chrysomelidae). Israel Journal of Zoology, 28: 1-37.

Heikertinger, F. 1941. Bestimmungs-Tabellen europaischer Kafer (7. Stuck), LXXXII. Fam. Chrysomelidae. 5. Subfam. Halticinae. 1. Gatt. *PhylIotreta* Steph. Bestimmungstabelle der palaarktischen *Phyllotreta*-Arten (Tei1 II). Koleopterologische Rundschau, 27: 69-116.

Jolivet, P. & Hawkewood, T. J. 1995. Host-plants of Chrysomelidae of the world: an essay about the relationships between the leaf beetles and their host-plants. Leiden, the Netherlands (Backhuys Publishers), 281 pp.

Konstantinov, A. S. & Vandenberg, N. J. 1996. Handbook of Palearctic flea beetles (Coleoptera: Chrysomelidae: Alticinae). Contributions on Entomology, International, 1: 236-439.

Konstantinov, A. S. & Vandenberg, N. J. 2015. Guide to Palearctic Flea Beetle Genera (Coleoptera: Chrysomelidae: Alticinae). http://www.sel.barc.usda.gov/coleoptera/ fleabeetles/fleas.htm [accessed 20 February 2015].

Warchałowski, A. 2003. Chrysomelidae: the leaf beetles of Europe and the mediterranean Area. Warszawa (Natura Optima Dux Foundation), 600 pp.

Warchałowski, A. 2010. The Palaearctic Chrysomelidae: Identification keys, Vol 1 - 2. Warszawa (Natura Optima Dux Foundation), 1212 pp.

Figure 1. *Phyllotreta bilgeae* sp. nov. (holotype ♂); dorsal view (left), ventral view (right).

Figure 2. Antennae of males. A. *P. bilgeae* sp. nov., B. *P. armoraciae* [from Borowiec (2013)], C. *P. erysimi* [from Borowiec (2013)], D. *P. lativittata* [from Borowiec (2013)], E. *P. pallidipennis* [from Borowiec (2013)], F. *P. sisymbrii* [from Borowiec (2013)], G. *P. undulata* [from Borowiec (2013)], H. *P. variipennis* [from Borowiec (2013)].

Figure 3. Ventral view of aedeagus. A. *P. cleomica* [from Furth (1979)], B. *P. bilgeae* sp. nov.; Dorsal view of aedeagus. C. *P. armoraciae* [from Borowiec (2013)], D. *P. erysimi* [from Borowiec (2013)], E. *P. lativittata* [from Borowiec (2013)], F. *P. pallidipennis* [from Borowiec (2013)], G. *P. sisymbrii* [from Borowiec (2013)], H. *P. undulata* [from Borowiec (2013)], I. *P. variipennis* [from Borowiec (2013)], J. *P. bilgeae* sp. nov.

Figure 4. Lateral view of aedeagus. A. *P. cleomica* [from Furth (1979)], B. *P. armoraciae* [from Borowiec (2013)], C. *P. erysimi* [from Borowiec (2013)], D. *P. lativittata* [from Borowiec (2013)], E. *P. pallidipennis* [from Borowiec (2013)], F. *P. sisymbrii* [from Borowiec (2013)], G. *P. undulata* [from Borowiec (2013)], H. *P. variipennis* [from Borowiec (2013)], I. *P. bilgeae* sp. nov.

CHECKLIST OF SPIDERS (ARACHNIDA: ARANEAE) OF THE STATE OF TAMIL NADU, INDIA

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ABSTRACT: A checklist of spiders from the state of Tamil Nadu based on published records, World Spider Catalogue (2016) and collections of the Records of Zoological Survey of India has been presented. Till date 226 species are recorded from this state, representing 33 families and 120 genera. Spider diversity in Salticids was dominated followed by Araneids, Lycosids, Thomisids and Sparassids.

KEY WORDS: Checklist, Arachnida, Araneae, spiders, Tamil Nadu

Tamil Nadu has a geographic area of 130,058 km² with a total forest area of about 22,844 km². The state which ranks 13th among the Indian states and Union territories for forest area, has 14 Wildlife sanctuaries, 14 bird sanctuaries, 5 National Parks, 4 Tiger reserves, 4 elephant reserves and 3 Biosphere Reserves. The region also records high floral and faunal diversity (Mittermeier et al., 1999). Western Ghats, one of the hotspots of India run through the state of Tamil Nadu occupying an area of about 27,069 km².

Invertebrate fauna in the state is poorly documented. Checklists are either limited to butterflies or certain other economically important species such as mosquitoes. Arachnids had no exception. Until now Pocock's Fauna of British India (Pocock, 1900) remains to be the reference for spider identification in India.

Taxonomic studies on spiders in Tamil Nadu were carried out by Simon (1880, 1885a,b, 1892, 1895, 1900, 1901, 1902, 1903, 1905, 1906), Pocock (1899, 1901), Narayan (1915), Gravely (1921, 1924, 1931, 1935), Reimoser (1934), Tikader (1972a,b, 1977, 1980, 1987), Tikader & Gajbe (1976, 1977), Majumder & Tikader (1991), Proszynski (1992a,b), Vijayalakshmi & Ahimaz (1993), Barrion & Litsinger (1995), Coyle (1995), Smith (2004), Gajbe (1999, 2008), Ganeshkumar & Mohanasundaram (1998), Logunov (2001), Logunov & Hereward (2006), Siliwal & Molur (2009), Siliwal et al. (2007, 2011), Sanap & Mirza (2011), Platnick et al. (2011, 2012), Baehr & Baehr (1993), Baehr et al. (2012), Gupta et al. (2013), Caleb & Mathai (2013, 2014a,b,c), Caleb et al. (2014, 2015), Karthikeyani & Kannan (2013) and Tanasevitch (2015). Studies on biodiversity of spiders were carried out by Sugumaran et al. (2007), Kapoor (2008), Jayakumar & Sankari (2010), Shunmugavelu & Karthikeyani (2010), Karthikeyani & Kannan (2012), Karthikeyani & Muthuchelian (2014), Muthuchelian & Karthikeyani (2015). The state records about 63 publications related to spiders until December 2015. The main objective of this paper is to make a complete up-to-date checklist of spiders of Tamil Nadu with it its distribution details and bibliography.

MATERIALS AND METHODS

The present checklist is based on published literatures on spiders reported from Tamil Nadu. Two major source of information were from World Spider Catalogue (2016) and Records of Zoological Survey of India. The checklist includes families, genera and species in alphabetical order. For each species, authority, year and distribution details of species with relevant references are given.

Check list: spiders of Tamil Nadu

Till today, 226 species of spiders belonging to 120 genera and 33 families have been reported from the State of Tamil Nadu. (Table 1). Among the thirty three families, Salticidae (28 genera and 39 species) dominated in terms of spider diversity followed by Araneidae (7 genera and 20 species), Lycosidae (8 genera and 18 species), Thomisidae (9 genera and 17 species) and Sparassidae (4 genera and 15 species).

Table 1. Number of genus and species reported from Tamil Nadu.

Families	**Genus**	**Species**
Araneidae	7	20
Barychelidae	2	4
Clubionidae	3	6
Corinnidae	4	6
Ctenidae	1	1
Deinopidae	1	1
Dipluridae	1	1
Eresidae	1	3
Eutichuridae	2	5
Gnaphosidae	3	6
Hahniidae	1	1
Hersiliidae	1	2
Idiopidae	3	7
Linyphiidae	1	5
Liocranidae	2	12
Lycosidae	8	18
Mimetidae	2	2
Nephilidae	3	3
Oonopidae	4	10
Oxyopidae	2	3
Philodromidae	1	2
Pholcidae	4	4
Salticidae	28	39
Segestriidae	2	2
Selenopidae	2	3
Sparassidae	4	15
Tetragnathidae	3	7
Theridiidae	2	2
Theraphosidae	6	12
Thomisidae	9	17
Titanoecidae	1	1
Trachelidae	2	2
Zodariidae	4	4
33	**120**	**226**

Checklist of Tamil Nadu State spiders (alphabetically by families)

Family: Araneidae Clerck, 1757

Genus: *Araneus* Clerck, 1757

Araneus bilunifer Pocock, 1900 Distribution: Tamil Nadu: Chengalpattu

Araneus viridisomus Gravely, 1921 Distribution: Tamil Nadu: Chennai

Genus: *Argiope* Audouin, 1826

Argiope aemula (Walckenaer, 1841) Distribution: Tamil Nadu: Nilgiri Hills

Argiope anasuja Thorell, 1887 Distribution: Tamil Nadu: Ramanathapuram, Chengalpattu, Ooty, Tuticorin, Sivakasi

Argiope lobata (Pallas, 1772) Distribution: Tamil Nadu: Karur

Argiope pulchella Thorell, 1881 Distribution: Tamil Nadu: Nilgiri Hills, Kumbakarai Falls under Kodaikanal Hills, Chinnapallam village, Rameshwaram, Aattur near Tuticorin, Perumalmalai near Kodaikanal Hills

Genus: *Chorizopes* O.P. Cambridge, 1870

Chorizopes calciope (Simon, 1895) Distribution: Tamil Nadu: Kodaikanal

Chorizopes frontalis O. Pickard-Cambridge, 1870 Distribution: Tamil Nadu: Coonoor

Genus: *Cyclosa* Menge, 1866

Cyclosa mulmeinensis (Thorell, 1887) Distribution: Tamil Nadu: Gingee near Villupuram

Genus: *Cyrtophora* Simon, 1864

Cyrtophora cicatrosa (Stoliczka, 1869) Distribution: Tamil Nadu: Chengalpattu, Chinnapallam village, Rameshwaram, Aattur near Tuticorin, Sivakasi

Cyrtophora citricola (Forsskal, 1775) Distribution: Tamil Nadu: Chengalpattu

Cyrtophora moluccensis (Doleschall, 1857) Distribution: Tamil Nadu: Nilgiri Hills

Genus: *Eriovixia* Archer, 1951

Eriovixia excelsa (Simon, 1889) Distribution: Tamil Nadu: Coonoor

Eriovixia laglaizei (Simon, 1877) Distribution: Tamil Nadu: Ooty

Genus: *Gasteracantha* Sundevall, 1833

Gasteracantha cancriformis (Linnaeus, 1758) Distribution: Tamil Nadu: Chennai

Gasteracantha dalyi Pocock, 1900 Distribution: Tamil Nadu: Yercaud, Shevaroy Hills

Gasteracantha geminata (Fabricius, 1798) Distribution: Tamil Nadu: Tirunelveli, Ooty, Ramanathapuram, Chennai, Kumbakarai Falls under Kodaikanal Hills

Gasteracantha remifera Butler, 1873 Distribution: Tamil Nadu: Ooty

Genus: *Neoscona* Simon, 1864

Neoscona theisi (Walckenaer, 1841) Distribution: Tamil Nadu: Pondicherry, Kumbakarai Falls under Kodaikanal Hills

Neoscona vigilans (Blackwall, 1865) Distribution: Tamil Nadu: Chengalpattu, Ooty

Family: Barychelidae Simon, 1889

Genus: *Sason* Simon, 1887

Sason rameshwaram Siliwal & Molur, 2009 Distribution: Tamil Nadu: Rameshwaram Island

Sason robustum (O.P. Cambridge, 1883) Distribution: Tamil Nadu: Chennai

Genus: *Tigidia* Simon, 1892

Tigidia nilgiriensis Siliwal et al., 2011 Distribution: Tamil Nadu: Kothagiri, Nilgiri Hills

Tigidia rutilofronis Siliwal et al., 2011 Distribution: Tamil Nadu: Marudhamalai in Coimbatore

Family: Clubionidae Wagner, 1887

Genus: *Clubiona* Latreille, 1804

Clubiona acanthocnemis Simon, 1906 Distribution: Tamil Nadu: Coonoor, Nilgiri Hills

Clubiona nilgherina Simon, 1906 Distribution: Tamil Nadu: Coonoor, Nilgiri Hills

Clubiona shillongensis Majumder & Tikader 1991 Distribution: Tamil Nadu: Coonoor, Chennai

Genus: *Matidia* Thorell, 1878

Matidia incurvata Reimoser, 1934 Distribution: Tamil Nadu: Karian Shola, Coimbatore

Genus: *Simalio* Simon, 1857

Simalio castaneiceps Simon, 1906 Distribution: Tamil Nadu: Coonoor, Nilgiri Hills

Simalio percomis Simon, 1906 Distribution: Tamil Nadu: Coonoor, Nilgiri Hills

Family: Corinnidae Karsch, 1880

Genus: *Aetius* O. P. Cambridge, 1896

Aetius decollatus O. P. Cambridge, 1896 Distribution: Tamil Nadu: Mudumalai

Genus: *Castianeira* Keyserling, 1879

Castianeira zetes Simon, 1897 Distribution: Tamil Nadu: Chennai

Castianeira flavipes Gravely, 1931 Distribution: Tamil Nadu: Nilgiri Hills

Castianeira quadrimaculata Reimoser, 1934 Distribution: Tamil Nadu: Kolukkumalai near Bodinayakanur

Genus: *Coenoptychus* Simon, 1885

Coenoptychus pulcher Simon, 1885 Distribution: Tamil Nadu: Ramanathapuram, Chennai

Genus: *Corinnomma* Karsch, 1880

Corinnomma rufofuscum Reimoser, 1934 Distribution: Tamil Nadu: Mudumalai

Family: Ctenidae Keyserling, 1877

Genus: *Ctenus* Walckenaer, 1805

Ctenus indicus Gravely, 1931 Distribution: Tamil Nadu: Ooty

Family: Deinopidae C. L. Koch, 1850

Genus: *Deinopis* MacLeay, 1839

Deinopis scrubjunglei Caleb & Mathai, 2014 Distribution: Tamil Nadu: Chennai

Family: Dipluridae Simon, 1889

Genus: *Indothele* Coyle, 1995

Indothele rothi Coyle, 1995 Distribution: Tamil Nadu: Down Hill from Kodaikanal

Family: Eresidae C. L. Koch, 1845

Genus: *Stegodyphus* Simon, 1873

Stegodyphus pacificus Pocock, 1900 Distribution: Tamil Nadu: Nilgris Hills

Stegodyphus sarasinorum Karsch, 1892 Distribution: Tamil Nadu: Chennai, Pondicherry, Chengalpattu, Ooty, Nilgris Hills

Stegodyphus tibialis O. Pickard-Cambridge, 1869 Distribution: Tamil Nadu: Chennai, Coonoor, Nilgris Hills, Rajapalyam

Family: Eutichuridae Lehtinen, 1967

Genus: *Cheiracanthium* C. L. Koch, 1839

Cheiracanthium conflexum Simon, 1906 Distribution: Tamil Nadu: Coonoor, Nilgiri Hills

Cheiracanthium insigne O.P. Cambridge, 1874 Distribution: Tamil Nadu: Chennai

Cheiracanthium trivialis (Thorell, 1895) Distribution: Tamil Nadu: Chennai

Cheiracanthium trivittatum, Simon, 1906 Distribution: Tamil Nadu, Gingee Hills near Villupuram

Genus: *Eutichurus* Simon, 1897

Eutichurus chingliputensis Majumder & Tikader, 1991 Distribution: Tamil Nadu: Vedanthangal Sanctuary, Chengalpattu, Chennai

Family: Gnaphosidae Pocock, 1898

Genus: *Callilepis* Westring, 1874

Callilepis rukminiae Tikader & Gajbe, 1977 Distribution: Tamil Nadu: Karur, Salem

Genus: *Poecilochroa* Westring, 1874

Poecilochroa tridotus Caleb & Mathai, 2013 Distribution: Tamil Nadu: Chennai

Genus: *Zelotes* Gistel, 1848

Zelotes ashae Tikader & Gajbe, 1976 Distribution: Tamil Nadu: Gingee near Villupuram

Zelotes maindroni (Simon, 1905) Distribution: Tamil Nadu: Gingee near Villupuram

Zelotes nilgirinus Reimoser, 1934 Distribution: Tamil Nadu: Nilgiri Hills

Zelotes tambaramensis Caleb & Mathai, 2013 Distribution: Tamil Nadu: Tambaram near in Chennai

Family: Hahniidae Bertkau, 1878

Genus: *Scotospilus* Simon, 1886

Scotospilus maindroni Lehtinen, 1967 Distribution: Tamil Nadu: Coonoor

Family: Hersiliidae Thorell, 1870

Genus: *Hersilia* Audouin, 1826

Hersilia savignyi Lucas, 1836 Distribution: Tamil Nadu: Chennai, Vellore, Nilgiri Hills, Alagar koil near Madurai, Tiruchirapalli

Hersilia tibialis Baehr & Baehr, 1993 Distribution: Tamil Nadu: Vellore, Chennai, Ooty, Alagar koil near, Madurai

Family: Idiopidae Simon, 1889

Genus: *Idiops* Perty, 1833

Idiops constructor Pocock, 1900 Distribution: Tamil Nadu: Chengalpattu, Shevaroy Hills

Idiops madrasensis (Tikader, 1977) Distribution: Tamil Nadu: Kulasekeram near Kanyakumari, Chennai

Idiops mettupalayam Ganesh Kumar & Siliwal, 2013 Distribution: Tamil Nadu: Mettupalayam

Genus: *Heligmomerus* Simon, 1892

Heligmomerus prostans Simon, 1892 Distribution: Tamil Nadu: Kodaikanal, Palni Hills

Genus: *Scalidognathus* Karsch, 1892

Scalidognathus montanus Pocock, 1900 Distribution: Tamil Nadu: Shevaroy Hills

Scalidognathus nigriaraneus Sanap & Mirza, 2011 Distribution: Tamil Nadu: Dodabetta Peak, Ooty

Scalidognathus tigerinus Sanap & Mirza, 2011 Distribution: Tamil Nadu: Maruthamalai near in Coimbatore

Family: Linyphiidae Blackwall, 1859

Genus: *Oedothorax* bertkau in Forster & Bertkau, 1883

Oedothorax cunur Tanasevitch, 2015 Distribution: Tamil Nadu: Coonoor, Nilgiri Hills

Oedothorax kodaikanal Tanasevitch, 2015 Distribution: Tamil Nadu: Palani Hills

Oedothorax paracymbialis Tanasevitch, 2015 Distribution: Tamil Nadu: Hulical near Coonoor, Nilgiri Hills

Oedothorax rusticus Tanasevitch, 2015 Distribution: Tamil Nadu: Kodaikanal, Palani Hills

Oedothorax stylus Tanasevitch, 2015 Distribution: Tamil Nadu: Anaimalai Hills near Valparai

Family: Liocranidae Simon, 1897

Genus: *Oedignatha* Thorell, 1881

Oedignatha carli Reimoser, 1934 Distribution: Tamil Nadu: Coonoor

Oedignatha dentifera Reimoser, 1934 Distribution: Tamil Nadu: Attakatti in Coimbatore district

Oedignatha escheri Reimoser, 1934 Distribution: Tamil Nadu: Kukkal Shola near Kodaikanal

Oedignatha lesserti Reimoser, 1934 Distribution: Tamil Nadu: Mudhumalai

Oedignatha microsculata Reimoser, 1934 Distribution: Tamil Nadu: Coonoor

Oedignatha scrobiculata Thorell, 1881 Distribution: Tamil Nadu: Chennai

Oedignatha tricuspidata Reimoser, 1934 Distribution: Tamil Nadu: Attakatti in Coimbatore district, Coonoor

Oedignatha uncata Reimoser, 1934 Distribution: Tamil Nadu: Mariyan Shola near Kodaikanal Hills

Genus: *Sphingius* Thorell, 1890

Sphingius barkudensis Gravely, 1931 Distribution: Tamil Nadu: Chennai

Sphingius caniceps Simon, 1906 Distribution: Tamil Nadu: Gingee near Villupuram, Chennai

Sphinguius kambakamensis Gravely, 1931 Distribution: Tamil Nadu: Chengalpattu

Sphingius nilgiriensis Gravely, 1931 Distribution: Tamil Nadu: Nilgiri Hills

Family: Lycosidae Sundevall, 1833

Genus: *Arctosa* C.L.Koch, 1847

Arctosa lesserti Reimoser, 1934 Distribution: Tamil Nadu: Masinagudi near Mudumalai

Genus: *Draposa* Kronestedt, 2010

Draposa atropalpis Gravely, 1924 Distribution: Tamil Nadu: Chennai, Gudalur, Nilgiri Hills

Draposa lyrivulva (Bosenberg & Strand, 1906) Distribution: Tamil Nadu: Chennai, Chengalpattu

Draposa oakleyi Gravely, 1924 Distribution: Tamil Nadu: Ooty, Nilgiri Hills

Genus: *Geolycosa* Montgomery, 1904

Geolycosa carli (Reimoser, 1934) Distribution: Tamil Nadu: Coonoor

Genus: *Hippasa* Simon, 1885

Hippasa agelenoides (Simon, 1884) Distribution: Tamil Nadu: Chennai

Hippasa greenalliae (Blackwall, 1867) Distribution: Tamil Nadu: Trichirapalli, Ooty, Coimbatore, Ramnadapuram, Krusadai Island, Gulf of Mannar

Hippasa loundesi Gravely 1924 Distribution: Tamil Nadu: Yercaud, Shevaroy Hills

Hippasa lycosina Pocock, 1900 Distribution: Tamil Nadu: Nilgiri Hills

Hippasa madraspatana Gravely, 1924 Distribution: Tamil Nadu: Chennai

Genus: *Lycosa* Latreille, 1804

Lycosa bistriata Gravely, 1924 Distribution: Tamil Nadu: Chennai

Lycosa chaperi Simon, 1885 Distribution: Tamil Nadu: Coimbatore

Lycosa indagatrix Walckenaer, 1837 Distribution: Tamil Nadu: Chengalpattu, Salem, Chennai

Genus: *Pardosa* C. L. Koch, 1847

Pardosa birmanica Simon, 1884 Distribution: Tamil Nadu: Ooty, Nilgiri Hills, Chennai

Pardosa pseudoannulata (Bosenberg & Strand, 1906) Distribution: Tamil Nadu: Chennai, Ooty, Coimbatore, Aduthurai near Thanjavur, Sivakasi, Yercaud Hills

Pardosa sumatrana (Thorell, 1890) Distribution: Tamil Nadu: Chennai, Coonoor, Ooty, Gudalur, Nilgiri Hills, Yercaud, Shevaroy Hills

Genus: *Trochosa* C. L. Koch, 1847

Trochosa punctipes (Gravely, 1924) Distribution: Tamil Nadu: Chengalpattu

Genus: *Wadicosa* Zyuzin, 1985

Wadicosa quadrifera (Gravely, 1924) Distribution: Tamil Nadu: Chennai, Chengalpattu

Family: Mimetidae Simon, 1881

Genus: *Mimetus* Hentz, 1832

Mimetus indicus Simon, 1906 Distribution: Tamil Nadu: Coonoor

Genus: *Melaenosia* Simon, 1906

Melaenosia pustulifera Simon, 1906 Distribution: Tamil Nadu: Gingee near Villupuram

Family: Nephilidae Simon, 1894

Genus: *Herennia* Thorell, 1877

Herennia multipuncta (Doleschall, 1859) Distribution: Tamil Nadu: Ooty

Genus: *Nephila* Leach, 1815

Nephila pilipes (Fabricius, 1793) Distribution: Tamil Nadu: Ooty, Tirunelveli

Genus: *Nephilengys* L.Koch, 1872

Nephilengys malabarensis (Walckenaer 1841) Distribution: Tamil Nadu: Ooty

Family: Oonopidae Simon, 1890

Genus: *Brignolia* Dumitresco and Georgesco, 1983

Brignolia cardamom Platnick et al., 2011 Distribution: Tamil Nadu: Cardomom hills, Palani Hills, Kodaikanal, Varushanad Hills, Suruli Falls

Brignolia kumily Platnick et al., 2011 Distribution: Tamil Nadu: Cardomom Hills near North East of Kumily

Brignolia parumpunctata (Simon, 1893) Distribution: Tamil Nadu: Alagarkoil, Madurai

Brignolia rothorum Platnick et al., 2011 Distribution: Tamil Nadu: Kodaikanal

Brignolia valparai Platnick et al., 2011 Distribution: Tamil Nadu: Anaimalai Hills, Valparai

Brignolia nilgiri Platnick et al., 2011 Distribution: Tamil Nadu: Coonoor, Nilgiri Hills

Brignolia kodaik Platnick et al., 2011 Distribution: Tamil Nadu: Kodaikanal

Genus: *Gamasomorpha* Karsch, 1881

Gamasomorpha clypeolaria Simon, 1907 Distribution: Tamil Nadu: Pondicherry

Genus: *Pelicinus* Simon, 1891

Pelicinus madurai Platnick et al., 2012 Distribution: Tamil Nadu: Alagarkovil, Madurai

Genus: *Prethopalpus* Baehr et al, 2012

Prethopalpus madurai Baehr et al, 2012 Distribution: Tamil Nadu: Madurai

Family: Oxyopidae Thorell, 1870

Genus: *Oxyopes* Latreille, 1804

Oxyopes hindostanicus Pocock, 1901 Distribution: Tamil Nadu: Chennai, Nilgiri Hills, Sivakasi

Genus: *Peucetia* Thorell, 1869

Peucetia graminea Pocock, 1900 Distribution: Tamil Nadu: Kotagiri, Nilgiri Hills, Chennai

Peucetia viridana (Stoliczka, 1869) Distribution: Tamil Nadu: Chennai, Chengalpattu, Ooty, Sivakasi

Family: Philodromidae Thorell, 1870

Genus: *Tibellus* Simon, 1875

Tibellus pateli Tikader, 1980 Distribution: Tamil Nadu: Coimbatore

Tibellus vitilis Simon, 1906 Distribution: Tamil Nadu: Pondicherry, Gingee near Villupuram, Coonoor

Family: Pholcidae C. L. Koch, 1850

Genus: *Artema* Walckenaer, 1837

Artema atlanta Walckenaer, 1837 Distribution: Tamil Nadu: Pondicherry, South Arcot, Gingee near Villupuram

Genus: *Belisana* Thorell, 1898

Belisana dodabetta Huber, 2005 Distribution: Tamil Nadu: Dodabetta, Nigiri Hills

Genus: *Crossopriza* Simon, 1893

Crossopriza lyoni (Blackwall, 1867) Distribution: Tamil Nadu: Pondicherry, Perumalmalai near Kodaikanal, Gingee near Villupuram

Genus: *Pholcus* Walckenaer, 1805

Pholcus phalangioides (Fuesslin, 1775) Distribution: Tamil Nadu: Tiruchirapalli, Perumalmalai near Kodaikanal Hills

Family: Salticidae Blackwall, 1841

Genus: *Aelurillus* Simon, 1884

Aelurillus kronestedti Azarkina, 2004 Distribution: Tamil Nadu: Chennai

Genus: *Bianor* Peckham & Peckham, 1886

Bianor incitatus Thorell, 1890 Distribution: Tamil Nadu: Valparai near Pollachi, Chennai

Genus: *Brettus* Thorell, 1895

Brettus albolimbatus Simon, 1900 Distribution: Tamil Nadu: Tiruchirappalli

Brettus anchorum Wanless, 1979 Distribution: Tamil Nadu: Nilgiri hills

Genus: *Carrhotus* Thorell, 1891

Carrhotus viduus (C.L. Koch, 1846) Distribution: Tamil Nadu: Madurai

Genus: *Chalcotropis* Simon, 1902

Chalcotropis pennata Simon, 1902 Distribution: Tamil Nadu: Tiruchirapalli, Madurai

Genus: *Chrysilla* Thorell, 1887

Chrysilla jesudasi Caleb & Mathai, 2014 Distribution: Tamil Nadu: Chennai

Genus: *Colaxes* Simon, 1900

Colaxes nitidiventris Simon, 1900 Distribution: Tamil Nadu: Tiruchirapalli

Genus: *Cyrba* Simon, 1876

Cyrba ocellata (Kroneberg, 1875) Distribution: Tamil Nadu: Coimbatore

Genus: *Harmochirus* Simon, 1885

Harmochirus exaggeratus Caleb & Mathai, 2015 Distribution: Tamil Nadu: Chennai

Harmochirus zabkai Logunov, 2001 Distribution: Tamil Nadu: Chennai, Alagarkoil Hills near Madurai

Genus: *Hyllus* C. L. Koch, 1846

Hyllus manu Caleb et al., 2014 Distribution: Tamil Nadu: Chennai

Genus: *Jerzego* Maddison, 2014

Jerzego bipartitus (Simon, 1903) Distribution: Tamil Nadu, Chennai

Genus: *Langona* Simon, 1901

Langona albolinea Caleb & Mathai, 2015 Distribution: Tamil Nadu: Chennai

Langona tigrina (Simon, 1885) Distribution: Tamil Nadu: Coimbatore

Genus: *Mashonarus* Wesolowska & Cumming, 2002

Mashonarus davidi Caleb, Mungkung & Mathai, 2015 Distribution: Tamil Nadu: Chennai

Genus: *Myrmarachne* MacLeay, 1839

Myrmarachne megachelae Ganesh Kumar & Mohanasundaram, 1998 Distribution: Tamil Nadu: Coimbatore

Myrmarachne ramunni Narayan, 1915 Distribution: Tamil Nadu: Chennai

Myrmarachne roeweri Reimoser, 1934 Distribution: Tamil Nadu: Pykara near Ooty, Gudalur

Genus: *Onomastus* Simon, 1900

Onomastus indra Benjamin, 2010 Distribution: Tamil Nadu: Kodaikanal

Onomastus patellaris Simon, 1900 Distribution: Tamil Nadu: Kodaikanal, Trichy

Genus: *Phanuelus* Caleb & Mathai, 2015

Phanuelus gladstone Caleb & Mathai, 2015 Distribution: Tamil Nadu: Chennai

Genus: *Phlegra* Simon, 1876

Phlegra prasanna Caleb & Mathai, 2015 Distribution: Tamil Nadu: Chennai

Genus: *Phintella* Strand in Bosenberg & Strand, 1906

Phintella alboterminus Caleb, 2014 Distribution: Tamil Nadu: Chennai

Phintella coonooriensis Proszynski, 1992 Distribution: Tamil Nadu: Coonoor

Phintella nilgirica Proszynski, 1992 Distribution: Tamil Nadu: Nilgiri Hills

Phintella volupe (Karsch, 1879) Distribution: Tamil Nadu: Chennai

Genus: *Plexippus* C. L. Koch, 1846

Plexippus gajbei Karthikeyani & Kannan, 2013 Distribution: Tamil Nadu: Kumbakarai Falls under Kodaikanal Hills

Genus: *Phintella* Bosenberg & Strand, 1906

Phintella accentifera (Simon, 1901) Distribution: Tamil Nadu: Madurai

Genus: *Pilia* Simon, 1902

Pilia saltabunda Simon, 1902 Distribution: Tamil Nadu: Kodaikanal

Pilia escheri Reimoser, 1934 Distribution: Tamil Nadu: Karteri valley near in Ooty

Genus: *Piranthus* Thorell, 1895

Piranthus casteti Simon, 1900 Distribution: Tamil Nadu: Tiruchirapalli

Genus: *Pseudicius* Simon, 1885

Pseudicius modestus Simon, 1885 Distribution: Tamil Nadu: Ramanathapuram

Genus: *Stenaelurillus* Simon, 1886

Stenaelurillus lesserti Reimoser, 1934 Distribution: Tamil Nadu: Masinagudi near Mudumalai

Genus: *Synagelides* Strand, 1906

Synagelides lehtineni Logunov & Hereward, 2006 Distribution: Tamil Nadu: Doddabetta, Nilgiri Hills

Genus: *Thyene* Simon, 1885

Thyene bivittata Xie & Peng, 1995 Distribution: Tamil Nadu: Chennai

Genus: *Viciria* Thorell, 1877

Viciria diatreta Simon, 1902 Distribution: Tamil Nadu: Tiruchirapalli, Chennai

Viciria minima Reimoser, 1934 Distribution: Tamil Nadu: Coonoor

Genus: *Zeuxippus* Thorell, 1891

Zeuxippus histrio Thorell, 1891 Distribution: Tamil Nadu: Vellore

Family: Segestriidae Simon, 1893

Genus: *Ariadna* Audouin, 1826

Ariadna nebulosa Simon, 1906 Distribution: Tamil Nadu: Madurai

Genus: *Segestria* Latreille, 1804

Segestria inda Simon, 1906 Distribution: Tamil Nadu: Gingee near Villupuram

Family: Selenopidae Simon, 1897

Genus: *Makdiops* Crews & Harvey, 2011

Makdiops nilgirensis (Reimoser, 1934) Distribution: Tamil Nadu: Nilgiri Hills

Genus: *Selenops* Latreille, 1819

Selenops radiatus Latreille, 1819 Distribution: Tamil Nadu: Chidambaram

Selenops shevaroyensis Gravely, 1931 Distribution: Tamil Nadu: Yercaud

Family: Sparassidae Bertkau, 1872

Genus: *Heteropoda* Latreille, 1804

Heteropoda fabrei Simon, 1885 Distribution: Tamil Nadu: Ramanathapuram, Tiruchirappalli

Heteropoda hampsoni Pocock, 1901 Distribution: Tamil Nadu: Ooty, Nilgiri Hills

Heteropoda lentula Pocock, 1901 Distribution: Tamil Nadu: Tirunelveli

Heteropoda leprosa Simon, 1884 Distribution: Tamil Nadu: Ooty, Nilgiri Hills

Heteropoda malitiosa Simon, 1906 Distribution: Tamil Nadu: Gingee, Coonoor

Heteropoda nilgirina Pocock, 1901 Distribution: Tamil Nadu: Kotagiri, Ooty, Coonoor, Nilgiri Hills

Heteropoda sexpunctata Simon, 1885 Distribution: Vandalur, Pallavaram, Chennai, Nagalapuram Hills, Chengalpattu

Heteropoda venatoria (Linnaeus, 1767) Distribution: Tamil Nadu: Ooty, Kumbakarai Falls under Kodaikanal Hills, Chennai

Genus: *Olios* Walckenaer, 1837

Olios milleti (Pocock, 1901) Distribution: Tamil Nadu: Chennai, Kambakam Hills, Chengalpattu, Sivakasi

Olios obesulus (Pocock, 1901) Distribution: Tamil Nadu: Chennai

Olios sensilis Simon, 1880 Distribution: Tamil Nadu: Tiruchirappalli

Genus: *Palystes* L. Koch, 1875

Palystes flavidus Simon, 1897 Distribution: Tamil Nadu: Tiruchirappalli

Genus: *Thelcticopis* Karsch, 1884

Thelcticopis ajax Pocock, 1901 Distribution: Tamil Nadu: Ooty

Thelcticopis maindroni Simon, 1906 Distribution: Tamil Nadu: Coonoor

Thelcticopis rufula Pocock, 1901 Distribution: Tamil Nadu: Nilgiri Hills

Family: Tetragnathidae Menge, 1866

Genus: *Leucauge* White, 1841

Leucauge decorata (Blackwall, 1864) Distribution: Tamil Nadu: Nilgiri Hills, Red Hills, Aattur near Tuticorin, Chengalpattu, Yercaud, Kumakarai Falls under Kodaikanal Hills

Genus: *Orsinome* Thorell, 1890

Orsinome marmorea Pocock, 1901 Distribution: Tamil Nadu: Nilgiri Hills

Genus: *Tetragnatha* Latreille, 1804

Tetragnatha ceylonica O. Pickard-Cambridge, 1869 Distribution: Tamil Nadu: Chennai

Tetragnatha cochinensis Gravely, 1921 Distribution: Tamil Nadu, Nilgiri Hills

Tetragnatha geniculata Karsch, 1892 Distribution: Tamil Nadu: Chennai

Tetragnatha javana (Thorell, 1890) Distribution: Tamil Nadu: Ooty, Nilgiri Hills

Tetragnatha mandibulata Walckenaer, 1841 Distribution: Tamil Nadu: Pondicherry

Family: Theridiidae Sundevall, 1833

Genus: *Parasteatoda* Archer, 1946

Parasteatoda brookesiana (Barrion & Litsinger, 1995) Distribution: Tamil Nadu: Mettupalayam, Coimbatore

Genus: *Theridion* Walckenaer, 1805

Theridion nilgherinum Simon, 1905 Distribution: Tamil Nadu: Nilgiri Hills

Family: Theraphosidae Thorell, 1869

Genus: *Annandaliella* Hirst, 1909

Annandaliella pectinifera Gravely, 1935 Distribution: Tamil Nadu: Coimbatore

Genus: *Haploclastus* Simon, 1892

Haploclastus cervinus Simon, 1892 Distribution: Tamil Nadu: Shembaganur, Kodaikanal, Palani Hills

Haploclastus nilgirinus Pocock, 1899 Distribution: Tamil Nadu: Nilgri Hills
Haploclastus tenebrosus Gravely, 1935 Distribution: Tamil Nadu: High wavy Mountains, Madurai
Genus: *Neoheterophrictus* Siliwal & Raven, 2012
Neoheterophrictus madraspatanus Gravely, 1935 Distribution: Tamil Nadu: Chengalpattu, Velacheri, Chennai
Genus: *Plesiophrictus* Pocock, 1899
Plesiophrictus fabrei (Simon, 1892) Distribution: Tamil Nadu: Madurai
Plesiophrictus linteatus (Simon, 1891) Distribution: Tamil Nadu: Pondicherry
Plesiophrictus nilagiriensis Siliwal, Molur & Raven, 2007 Distribution: Tamil Nadu: Nilgiri Hills
Genus: *Poecilotheria* Simon, 1885
Poecilotheria formosa Pocock, 1899 Distribution: Tamil Nadu: Kadiampatti, Malapuram, Salem
Poecilotheria hanumavilasumica Smith, 2004 Distribution: Tamil Nadu: Mandapam near Ramanathapuram, Rameswaram Island
Poecilotheria regalis Pocock, 1899 Distribution: Tamil Nadu: Sengottai, Mudumalai, Masinagudi, Avinashi, Nilgiri Hills, Moongipallam near Anaikatti, Puttapathi near Siruvani, Theppakadu near Ooty, Arakkonam
Genus: *Sahydroaraneus* Mirza & Sanap, 2014
Sahydroaraneus collinus Pocock, 1899 Distribution: Tamil Nadu: Shevaory Hills, Yercaud

Family: Thomisidae Sundevall, 1833

Genus: *Angaeus* Thorell, 1881
Angaeus pentagonalis Pocock, 1901 Distribution: Tamil Nadu: Nilgiri Hills
Genus: *Diaea* Thorell, 1869
Diaea pougneti Simon, 1885 Distribution: Tamil Nadu: Coimbatore
Genus: *Dietopsa* Strand, 1932
Dietopsa parnassia Simon, 1895 Distribution: Tamil Nadu: Coonoor, Palani Hills
Genus: *Henriksenia* Lehtinen, 2004
Henriksenia hilaris (Thorell, 1877) Distribution: Tamil Nadu: Pondicherry, Gingee
Genus: *Lycopus* Thorell, 1895
Lycopus trabeatus Simon, 1895 Distribution: Tamil Nadu: Coonoor
Genus: *Oxytate* L. Koch, 1878
Oxytate chlorion (Simon, 1906) Distribution: Tamil Nadu: Coonoor
Oxytate virens (Thorell, 1891) Distribution: Tamil Nadu: Yercaud
Genus: *Ozyptila* Simon, 1864
Ozyptila theobaldi Simon, 1885 Distribution: Tamil Nadu: Coimbatore
Genus: *Runcinia* Simon, 1875
Runcinia escheri (Reimoser, 1934) Distribution: Tamil Nadu: Masinagudi near Mudumalai
Runcinia insecta (L. Koch, 1875) Distribution: Tamil Nadu: Coimbatore
Genus: *Thomisus* Walckenaer, 1805
Thomisus granulifrons Simon, 1906 Distribution: Tamil Nadu: Pondicherry, Gingee
Thomisus leucaspis Simon, 1906 Distribution: Tamil Nadu: Gingee
Thomisus lobosus Tikader, 1965 Distribution: Tamil Nadu: Kodaikanal Hills
Thomisus pugilis Stoliczka, 1869 Distribution: Tamil Nadu: Chennai
Thomisus rigoratus Simon, 1906 Distribution: Tamil Nadu: Gingee, Coonoor
Tmarus fasciolatus Simon, 1906 Distribution: Tamil Nadu: Coonoor, Gingee
Tmarus soricinus Simon, 1906 Distribution: Tamil Nadu: Coonoor

Family: Titanoecidae Lehitinen, 1967

Genus: *Anuvinda* Lehtinen, 1967
Anuvinda escheri (Reimoser, 1934) Distribution: Tamil Nadu: Mudhumalai

Family: Trachelidae Simon, 1897

Genus: *Trachelas* L.Koch, 1872
Trachelas oreophilus Simon, 1906 Distribution: Tamil Nadu: Gingee Hills near Villupuram
Genus: *Utivarachna* Kishida, 1940

Utivarachna fronto Simon, 1906 Distribution: Tamil Nadu: Palni Hills, Kodaikanal, Trichirappalli

Family: Zodariidae Thorell, 1881

Genus: *Cryptothele* L. Koch, 1872

Cryptothele collina Pocock, 1901 Distribution: Tamil Nadu: Ooty, Chennai

Genus: *Cydrela* Thorell, 1873

Cydrela escheri (Reimoser, 1934) Distribution: Tamil Nadu: Kleine Shola gegen, Kukkal near Kodaikanal

Genus: *Hermippus* Simon, 1893

Hermippus cruciatus Simon, 1905 Distribution: Tamil Nadu: Gingee near Villupuram, South Arcot

Genus: *Mallinella* Strand, 1906

Mallinella nilgherina (Simon, 1906) Distribution: Tamil Nadu: Nilgiri Hills

CONCLUSION

For conservation assessment of any species group, check list is inevitable. The information generated in this study provides a baseline data with complete profile of spiders from Tamil Nadu which can be useful for future workers. The distribution and occurrence of spiders are influenced by habitat structure and vegetation parameters. In recent times habitat loss and habitat fragmentation are said to be major threats for species (IUCN, 2015). Understanding the species status and conservation initiatives are very much needed to protect this species from extinction. Creating awareness and there by involving local communities are very much needed to slow down habitat alteration and fragmentation.

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LITERATURE CITED

Azarkina, G. 2004. Two new species of the genus *Aelunllus* Simon, 1884 from Pakistan and Sri Lanka (Araneae: Salticidae). Bull. Br. Arachnol. Soc, 13: 49-52.

Baehr, M. & Baehr, B. 1993. The Hersiliidae of the Oriental Region including New Guinea. Taxonomy, phylogeny, zoogeography (Arachnida, Araneae). Spixiana, 19 (Suppl.): 1-96.

Baehr, B. C., Harvey, M. S., Burger, M. & Thoma, M. 2012. The new Australiagenus Globin spider genus *Prethopalpus* (Araneae: Oonopidae). Bull. Amer. Mus. nat. Hist., 369: 1-113.

Barrion, A. T. & Litsinger, J. A. 1995. Riceland Spiders of South and Southeast Asia. CAB International, Wallingford, UK, xix + 700 pp.

Benjamin, S. P. 2010. Revision and cladistic analysis of the jumping spider genus *Onomastus* (Araneae: Salticidae). Zool. Journal. Linn. Soc., 159: 711-745.

Blackwall, J. 1864. Descriptions of seven new species of East Indian spiders received from the Rev. O. P. Cambridge. Annals and Magazine of Natural History, (3) 14: 36-45.

Blackwall, J. 1865. Descriptions of recently discovered species and characters of a new genus, of Araneida from the East of Central Africa. Annals and Magazine of Naal History, (3) 16: 336-352.

Blackwall, J. 1867. Descriptions of several species of East Indian spiders, apparently to be new or little known to arachnologists. Annals and Magazine of Natural History, (3) 19: 387-394.

Bosenberg, W. & Strand, E. 1906. Japanische Spinnen. Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft, 30: 93-422.

Butler, A. G. 1873. A monographic list of the species of Gasteracantha or crab-spiders, with descriptions of new species. Trans. ent. Soc. Lond., 1873: 153-180.

Caleb, J. T. D. & Mathai, M. T. 2013. New species of *Poecilochroa* Westring and *Zelotes* Gistel (Araneae: Gnaphosidae) from Tamil Nadu, India. Indian Journal of Arachnology, 2 (2): 1-6.

Caleb, J. T. D. 2014. A new species of *Phintella* Strand (Araneae: Salticidae) from India. Munis Entomology and Zoology, 9 (2): 605-608.

Caleb, J. T. D. & Mathai, M. T. 2014a. A new species of *Deinopis* MacLeay (Araneae: Deinopidae) from India. Indian Journal of Arachnology, 3 (1): 1-7.

Caleb, J. T. D. & Mathai, M. T. 2014b. Description of some interesting jumping spiders (Araneae: Salticidae) from South India. Journal of Entomology and Zoology Studies, 2 (5): 63-71.

Caleb, J. T. D. & Mathai, M. T. 2014c. Record of *Araneus viridisomus* Gravely, 1921 (Araneae:Araneidae) from Tamil Nadu, India. Indian Journal of Arachnology, 3 (2): 1-5.

Caleb, J. T. D., Christudhas, A. Laltanpuii, K. & Chitra, M. 2014. New species of *Hyllus* C. L. Koch (Araneae: Salticidae) from India. Munis Entomology and Zoology, 9 (2): 634-637.

Caleb, J. T. D., Karthikeyani, R. & Muthuchelian, K. 2014. Description of *Drassodes luridus* O. P. Cambridge (Araneae: Gnaphosidae): First record from Tamil Nadu, India. Journal of Entomology and Zoology Studies, 2 (4): 135-138.

Caleb, J. T. D. & Mathai, M. T. 2015. Description of a new species of *Harmochirus* Simon (Araneae: Salticidae) from South India. Munis Entomology and Zoology, 10 (1): 117-121.

Caleb, J. T. D., Mungkung & Mathai, M. T. 2015. Four new species of jumping spider (Araneae: Salticidae: Aelurillinae) with the description of a new genus from South India. Peckhamia, 124 (1): 1-18.

Coyle, F. A. 1995. A revision of the funnelweb mygalomorph spider subfamily Ischnothelinae (Araneae, Dipluridae). Bulletin of the American Museum of Natural History, 226: 1-133.

Doleschall, L. 1857. Bijdrage tot de Kenntis der Arachniden van den Indischen Archipel. Natuurkundig Tijdschrift voor Nederlandsch-Indie, 13: 339-434.

Doleschall, L. 1859. Tweede Bijdrage tot de Kenntis der Arachniden van den Indischen Archipel. Acta Societatis Scientiarum Indica-Neerlandica, 5: 1-60.

Fabricius, J. C. 1793. Entomologiae systematica emendata et aucta, secundum classes, ordines, genera, species adjectis synonimis, locis, observationibus, descriptionibus. Hafniae 2: 407-428.

Fabricius, J. C. 1798. Supplementum entomologiae systematicae. Hafniae, 572 pp. (Araneae, pp. 291 294).

Forsskal, P. 1775. Descriptiones animalium avium, amphibiorum, piscium, insectorum, vermium; quae in itinere orientali observavit Petrus Forskal [sic]. Hauniae, pp. 85-86.

Fuesslin, J. C. 1775. Verzeichnis der ihm bekannten schweizerischen Insekten, mit einer ausgemahlten Kupfertafel: nebst der Ankündigung eines neuen Inseckten Werkes. Zurich and Winterthur, 62 pp. (Araneae, pp. 60-61).

Gajbe, U. A. 1999. Studies on some spiders of the family Oxyopidae (Araneae: Arachnida) from India. Rec. Zool. Surv. India, 97 (3): 31-79.

Gajbe, U. A. 2008. Fauna of India and the adjacent countries spider (Arachnida: Araneae: Oxyopidae). Rec. Zool. Surv. India. III: 1-117.

Ganeshkumar, M. & Mohanasundaram, M. 1998. A new species of ant-like spider from cotton fields of Tamil Nadu (Araneae: Salticidae). Zoo's Print Journal, 13 (11): 27-28.

Gravely, F. H. 1921. Some Indian spiders of the subfamily Tetragnathinae. Records of the Indian Museum, Calcutta, 22: 423-459.

Gravely, F. H. 1924. Some Indian spiders of the family Lycosidae. Records of the Indian Museum, Calcutta, 26: 587-613.

Gravely, F. H. 1931. Some Indian spiders of the families Ctenidae, Sparassidae, Selenopidae and Clubionidae. Records of the Indian Museum, Calcutta, 33: 211-282.

Gravely, F. H. 1935. Notes on Indian mygalomorph spiders. II. Records of the Indian Museum, Calcutta, 37: 69-84.

Gupta, N., Ganeshkumar, M., Das, S. K. & Siliwal, M. 2013. Three new species of *Idiops* Perty, 1833 (Araneae: Idiopidae) from India. Zootaxa, 3635: 237-250.

Huber, B. A. 2005. High species diversity, male-female coevolution, and metaphyly in southeast Asian pholcid spiders: the case of *Belisana* Thorell 1898 (Araneae, Pholcidae). Zoologica, 155: 1-126.

IUCN. 2015. The IUCN Red List of Threatened Species. Eds. Molur, S., Siliwal, M. & Daniel, B. A. Version 2015.2. (downloaded on 23 Feb 2016).

Jaykumar, S. & Sankari, A. 2010. Spider population and their predatory efficiency in different rice establishment techniques in Aduthurai, Tamil Nadu. Journal of Biopesticides 3 (1 Special Issue): 20-27.

Kapoor, V. 2008. Effect of rainforest fragmentation and shade-coffee plantations on spider communities in the Western Ghats, India. J. Insect Conserv, 12: 53-68.

Karsch, F. 1879. Arachnologische Beitrage. Zeitschrift für die Gesammten Naturwissenschaften, 52: 534-562.

Karsch, F. 1892. Arachniden von Ceylon und von Minikoy gesammelt von den Herren Doctoren P. und F. Sarasin. Berliner Entomologische Zeitschrift, 36: 267-310.

Karthikeyani, R. & Kannan, S. 2012. Diversity and bio-control Potential of Huntsman spider *Heteropoda venatoria* Linnaeus (Araneae: Sparassidae). J. Bio sci. Res., 3 (4): 240-244.

Karthikeyani, R. & Kannan, S. 2013. A new *Plexippus* spider from the Western Ghats, Kumbakarai Falls, Theni District, Tamil Nadu, South India (Arachnida: Araneae: Salticidae). Indian Journal of Arachnology, Maharashtra, 2 (2): 42-46.

Karthikeyani, R. & Muthuchelian, K. 2014. Proceedings of the seminar on "Importance of taxonomy in conservation of faunal diversity in Tamil. Organized by ENVIS Centre on Faunal Diversity, Zoological Survey of India, Kolkatta &Southern Regional Centre and Marine Biology Regional Centre of Zoological Survey of India, Chennai. (1st and 2nd September 2014) Pp. 191-197.

Koch, C. L. 1846. Die Arachniden. Nürnberg, Dreizehnter Band, pp. 1-234, Vierzehnter Band, pp. 188.

Koch, C. L. 1875. Die Arachniden Australiens. Nürnberg, 1: 577-740.

Kroneberg, A. 1875. Araneae. In: Fedtschenko, A. P. (ed.) Puteshestvie v Tourkestan. Reisen in Turkestan. Zoologischer Theil. Nachrichten der Gesellschaft der Freunde der Naturwissenschaften zu Moskau, 19: 1-58.

Latreille, P. A. 1819. Articles sur les araignées. Nouveau Dictionnaire d'Histoire Naturelle, Paris Ed. II, 22.

Lehtinen, P. T. 1967. Classification of the cribellate spiders and some allied families, with notes on the evolution of the suborder Araneomorpha. Annales Zoologici Fennici, 4: 199-468.

Linnaeus, C. 1758. Systema naturae per regna tria naturae, secundum classes, ordines, genera, species cum characteribus differentiis, synonymis, locis. Editio decima, reformata. Holmiae, 821 pp. (Araneae, pp. 619-624).

Linnaeus, C. 1767. Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus differentiis, synonymis, locis. Editio duodecima, reformata. Holmiae, 533-1327 (Araneae, pp. 1030-1037).

Logunov, D. V. 2001. A redefinition of the genera *Bianor* Peckham & Peckham, 1885 and *Harmochirus* Simon, 1885, with the establishment of a new genus *Sibianor* gen. n. (Aranei: Salticidae). Arthropoda Selecta, 9: 221-286.

Logunov, D. V. & Hereward, J. 2006. New species and synonymies in the genus *Synagelides* Strand in Bosenberg & Strand, 1906 (Araneae: Salticidae). Bulletin of the British Arachnological Society, 13: 281-292.

Lucas, H. 1836. Observations sur les Araneides du genre *Hersilia* et description de deux especes nouvelles appartenant a ce genre. Magasin de Zoologie, 6 (8): 1-11.

Majumder, S. C. & Tikader, B. K. 1991. Studies on some spiders of the family Clubionidae from India. Records of the Zoological Survey of India, Occasional Paper, 102: 1-174.

Mittermeier, R. A., Myers, N., Robles Gill, P. & Mittermeier, C. G. 1999. Hotspots: Earth's biologically richest and most endangered terrestrial ecoregions. Conservation International. ISBN 686397582.

Muthuchelian, K. & Karthikeyani, R. 2015. Biodiversity of Spiders (in Tamil Language). Published by New Century Book House Pvt. Ltd., Chennai, pp. 156.

Narayan, K. 1915. Notes on ant-like spiders of the family Attidae in the collection of the Indian Museum. Records of the Indian Museum, Calcutta, 11: 393-406.

Pallas, P. S. 1772. Spicilegia zoologica. Tomus 1. Continens quadrupedium, avium, amphibiorum, piscium, insectorum, molluscorum aliorumque marinorum fasciculos decem. Berolini, 1 (9): 44-50.

Pickard-Cambridge, O. 1869a. Catalogue of a collection of Ceylon Araneida lately received from Mr. J. Nietner, with descriptions of new species and characters of a new genus. I. Journal of the Linnean Society of London, Zoology, 10: 373-397.

Pickard-Cambridge, O. 1869b. Descriptions and sketches of some new species of Araneida, with characters of a new genus. Annals and Magazine of Natural History, (4) 3: 52-74.

Pickard-Cambridge, O. 1870. On some new genera and species of Araneida. Proceedings of the Zoological Society of London, 1870: 728-747.

Pickard-Cambridge, O. 1874. On some new species of *Drassides*. Proceedings of the Zoological Society of London, 1874: 370-419.

Pickard-Cambridge, O. 1883. On some new genera and species of spiders. Proceedings of the Zoological Society of London, 1883: 352-365.

Pickard-Cambridge, O. 1896. On some new and little-known spiders (Araneidae). Proceedings of the Zoological Society of London, 1896: 1006-1012.

Platnick, N. I., Duperre, N., Ott, R. & Kranz-Baltensperger, Y. 2011. The goblin spider genus *Brignolia* (Araneae, Oonopidae). Bulletin of the American Museum of Natural History, 349: 1-131.

Platnick, N. I., Duperre, N., Ott, R., Baehr, B. C. & Kranz-Baltensperger, Y. 2012. The goblin spider genus *Pelicinus* (Araneae, Oonopidae), Part 1. American Museum Novitates, 3741: 1-43.

Pocock, R. I. 1899. Diagnoses of some new Indian Arachnida. Journal of the Bombay Natural History Society, 12: 744-753.

Pocock, R. I. 1900. The fauna of British India, including Ceylon and Burma. Arachnida. London, pp. 1-279.

Pocock, R. I. 1901. Descriptions of some new species of spiders from British India. Journal of the Bombay Natural History Society, 13: 478-498.

Proszynski, J. 1992a. Salticidae (Araneae) of the Old World and Pacific Islands in several US collections. Annales Zoologici, Warszawa, 44: 87-163.

Proszynski, J. 1992b. Salticidae (Araneae) of the Old World and Pacific Islands in several US collections. Annales Zoologici, Warszawa, 44: 87-163.

Reimoser, E. 1934. Araneae aus Sud-Indien. Revue Suisse de Zoologie, 41: 465-511.

Sanap, R. V. & Mirza, Z. A. 2011. Two new trapdoor spider species of the genus *Scalidognathus* Karsch, 1891 (Araneae: Idiopidae) from the southern Western Ghats of India. Acta Zoologica Lituanica, 21: 96-102.

Shunmugavelu, M. & Karthikeyani, R. 2010. Spider fauna of the family Araneidae from Kumbakarai Falls, Theni Dist, Tamilnadu, South India. Proc. Zool. Soc. India, 9 (2): 25-31.

Siliwal, M., Molur, S. & Raven, R. 2007. A new species of the genus *Plesiophrictus* (Araneae: Theraphosidae: Ischnocolinae) from Western Ghats, India. Zoo's Print Journal, 22: 2853-2860.

Siliwal, M. & Molur, **S.** 2009. A new species of the genus *Sason* (Araneae: Barychelidae) from Rameshwaram Island, Tamil Nadu, India. Zootaxa, 2283: 60-68.

Siliwal, M., Gupta, N., Sanap, R. V., Mirza, Z. A. & Raven, R. 2011. First record of the genus *Tigidia* Simon, 1892 (Araneae: Barychelidae) from India with description of three new species from the Western Ghats, India. Journal of Threatened Taxa, 3: 2229-2241.

Simon, E. 1877. Etudes arachnologiques. 5e Memoire. IX. Arachnides recueillis aux iles Phillipines par MM. G. A. Baer et Laglaise. Annales de la Societe Entomologique de France, (5) 7: 53-96.

Simon, E. 1880. Revision de la famille des Sparassidae (Arachnides). Actes de la Societe Linneenne de Bordeaux, 34: 223-351.

Simon, E. 1884. Arachnides recueillis en Birmanie par M. le chevalier J. B. Comotto et appurtenant au Musee civique d'histoire naturelle de Genes. Annali del Museo Civico di Storia Naturale di Genova, 20: 325-372.

Simon, E. 1885a. Materiaux pour servir a la faune arachnologiques de l'Asie meridionale. I. Arachnides recueillis a Wagra-Karoor pres Gundacul, district de Bellary par M. M. Chapter. II. Arachnides recueillis a Ramnad, district de Madura par M. l'abbe Fabre. Bulletin de la Societe Zoologique de France, 10: 1-39.

Simon, E. 1885b. Materiaux pour servir à la faune arachnologiques de l'Asie meridionale. III. Arachnides recueillis en 1884 dans la presqu'ile de Malacca, par M. J. Morgan. IV. Arachnides recueillis a Collegal, district de Coimbatoore, par M. A. Theobald G. R. Bulletin de la Societe Zoologique de France, 10: 436-462.

Simon, E. 1889. Arachnides de l'Himalaya, recueillis par MM. Oldham et Wood-Mason, et faisant partie des collections de l'Indian Museum. Premiere partie. Journal of the Asiatic Society of Bengal, 58: 334-344.

Simon, E. 1891. Etudes arachnologiques. 23e Mémoire. XXXVIII. Descriptions d'espèces et de genres nouveaux de la famille des Aviculariidae. Annales de la Societe Entomologique de France, 60: 300-312.

Simon, E. 1892. Histoire naturelle des araignees. Paris, 1: 1-256.

Simon, E. 1893a. Histoire naturelle das araignees. Paris, 1: 257-488.

Simon, E. 1893b. Etudes arachnologiques. 25e Memoire. XL. Descriptions d'especes et de genres nouveaux de l'ordre des Araneae. Annales de la Societe Entomologique de France, 62: 299-330.

Simon, E. 1895a. Histoire naturelle des araignees. Paris, 1: 761-1084.

Simon, E. 1895b. Descriptions d'arachnides nouveaux de la famille des Thomisidae. Annales de la Societe Entomologique de Belgique, 39: 432-443.

Simon, E. 1897. Etudes arachnologiques. 27e Memoire. XLII. Descriptions d'especes nouvelles de l'ordre des Araneae. Annales de la Societe Entomologique de France, 65: 465-510.

Simon, E. 1900a. Etudes arachnologiques. 30e Mémoire. XLVII. Descriptions d'especes nouvelles de la famille des Attidae. Annales de la Societe Entomologique de France, 69: 27-61.

Simon, E. 1900b. Descriptions d'arachnides nouveaux de la famille des Attidae. Annales de la Societe Entomologique de Belgique, 44: 381-407.

Simon, E. 1901. Histoire naturelle des araignees. Paris, 2: 381-668.

Simon, E. 1902. Description d'arachnides nouveaux de la famille des Salticidae (Attidae) (suite). Annales de la Societe Entomologique de Belgique, 46: 24-56, 363-406.

Simon, E. 1903. Histoire naturelle des araignees. Paris, 2: 669-1080.

Simon, E. 1905. Arachnides (1re partie). In: Voyage de M. Maurice Maindron dans l'Inde meridionale. 7e Memoire. Annales de la Societe Entomologique de France, 74: 160-180.

Simon, E. 1906. Arachnides (2e partie). In: Voyage de M. Maurice Maindron dans l'Inde meridionale. 8e Memoire. Annales de la Societe Entomologique de France, 75: 279-314.

Simon, E. 1907. Etude sur les araignees de la sous-section des Haplogynes. Annales de la Societe Entomologique de Belgique, 51: 246-264.

Smith, A. M. 2004. A new species of the arboreal theraphosid, genus *Poecilotheria*, from southern India (Araneae, Mygalomorphae, Theraphosidae) with notes on its conservation status. Journal of the British Tarantula Society, 19: 48-61.

Stoliczka, F. 1869. Contribution towards the knowledge of Indian Arachnoidea. Journal of the Asiatic Society of Bengal, 38: 201-251.

Sugumaran, M. P., Soundarajan, R. P. & Lakshmanan, V. 2007. Spider fauna in Horticultural crops of Yercaud Hills. Zoos' Print Journal, 22 (6): 2721-2722.

Tanasevitch, A. V. 2015. Notes on the spider genus *Oedothorax* Bertkau, 1883 with description of eleven new species from India (Linyphiidae: Erigoninae). Revue Suisse de Zoologie, 122 (2): 381-398.

Thorell, T. 1877. Studi sui Ragni Malesi e Papuani. I. Ragni di Selebes raccolti nel 1874 dal Dott. O. Beccari. Annali del Museo Civico di Storia Naturale di Genova, 10: 341-637.

Thorell, T. 1881. Studi sui Ragni Malesi e Papuani. III. Ragni dell'Austro Malesia e del Capo York, conservati nel Museo civico di storia naturale di Genova. Annali del Museo Civico di Storia Naturale di Genova, 17: 1-727.

Thorell, T. 1887. Viaggio di L. Fea in Birmania e regioni vicine. II. Primo saggio sui ragni birmani. Annali del Museo Civico di Storia Naturale di Genova, 25: 5-417.

Thorell, T. 1890. Diagnoses aranearum aliquot novarum in Indo-Malesia inventarum. Annali del Museo Civico di Storia Naturale di Genova, 30: 132-172.

Thorell, T. 1891. Spindlar fran Nikobarerna och andra delar af sodra Asien. Bihang till Kongliga Svenska Vetenskaps-Akademiens Handlingar, 24 (2): 1-149.

Thorell, T. 1895. Descriptive catalogue of the spiders of Burma. London, pp. 1-406.

Tikader, B. K. 1965. On some new species of spiders of the family Thomisidae from India. Proceedings of the Indian Academy of Science, 61 (B): 277-289.

Tikader, B. K. 1972a. Spider fauna of India: Catalogue and bibliography. Part IV. J. Bombay Nat. Hist. Soc., 68 (3): 609-618.

Tikader, B. K. 1972b. Spider fauna of India: Catalogue and bibliography. Part V. J. Bombay Nat. Hist. Soc., 69 (1): 91-101.

Tikader, B. K. & Gajbe, U. A. 1976. Studies on some spiders of the genus *Zelotes* Gistel from India (family: Gnaphosidae). Proceedings of the Indian Academy of Science, 83 (B): 109-122.

Tikader, B. K. & Gajbe, U. A. 1977. Studies on some spiders of the genera *Gnaphosa* Latreille and *Callilepis* Westring (family: Gnaphosidae) from India. Records of the Zoological Survey of India, 73: 43-52.

Tikader, B. K. 1977. Studies on some mygalomorph spiders of the families Ctenizidae andTheraphosidae from India. Journal of the Bombay Natural History Society, 74: 306-319.

Tikader, B. K. 1980. Thomisidae (Crab-spiders). Fauna India (Araneae), 1: 1-247.

Tikader, B. K. 1987. Handbook of Indian Spiders. Calcutta, Zool. Surv. India, 251 pp.

Vijayalakshmi, K. & Ahimaz, P. 1993. Spiders: An Introduction. Cre. A publication, Madras, pp. 112.

Walckenaer, C. A. 1837. Histoire naturelle des insectes. Aptères. Paris, 1: 1-682.

Walckenaer, C. A. 1841. Histoire naturelle des Insects. Apteres. Paris, 2: 1-549.

Wanless, F. R. 1979. A revision of the spider genus *Brettus* (Araneae: Salticidae). Bulletin of the British Museum of Natural History (Zool.), 35: 183-190.

World Spider Catalog. 2016. Natural History Museum Bern online at http://wsc.nmbe.ch,version 17.0, accessed on (4th February 2016).

Xie, L. P. & Peng, X. J. 1995. Spiders of the genus *Thyene* Simon (Araneae: Salticidae) from China. Bull. Brit. Arachnol. Soc., 10: 104-108.

RE-DESCRIPTION OF *TRICHOPELMA CUBANUM* (THERAPHOSIDAE: ISCHNOCOLINAE) AND COMMENTS ABOUT THE FAMILIAL PLACEMENT OF *TRICHOPELMA*

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ABSTRACT: A detailed re-description of the type specimen of *Trichopelma cubanum* (Simon, 1903) is presented. Comments and observations are made regarding morphological characters, such as the absence of teeth on the paired claws and the presence of small teeth on the anterior edge of the booklung opening. These characters, found in other species of *Trichopelma* Simon, 1888 (represented in the Neotropical region by 16 species), suggest that the recent transfer of the genus to Theraphosidae may be unjustified, and that *Trichopelma* may indeed be more closely related to the Barychelidae.

KEY WORDS: Barychelidae, Cuba, Neotropical region, Trichopelmatinae

The genus *Trichopelma* Simon, 1888, has seventeen species and presents a Neotropical distribution (World Spider Catalog, 2015). Only one species (*Trichopelma astutum* (Simon, 1889)) is known for both sexes; four by their males only *Trichopelma astutum* (Simon, 1889), *Trichopelma nitidum* Simon, 1888, *Trichopelma scopulatum* (Fsichel, 1927) and *Trichopelma cubanum* (Simon, 1903) while the remaining are known only for their females. The genus is characterized by a transverse pallid weakness on tarsi IV of males and females, and scopula present on all legs but divided on tarsi IV of females (Raven, 1985).

Hapalopinus was proposed by Simon (1903) to host the new species *H. cubanum,* placing it in the family Theraphosidae. In 1973, Gerschman & Schiapelli (1973) placed *Hapalopinus* in the subfamily Ischnocolinae (Theraphosidae). *Hapalopinus* was later placed in the synonymy of *Trichopelma* by Raven (1985), in the family Barychelidae Simon, 1889. Raven (1985) also was created the subfamily Trichopelmatinae to include the genera *Trichopelma* and *Psalistops* Simon, 1889. Subsequently, Raven (1994) proposed the inclusion of the subfamily Trichopelmatinae in the family Theraphosidae but without any comments; therefore this proposal was not taken into account in catalogs. In 2014, Guadanucci formally transfered *Trichopelma* to the subfamily Ischnocolinae (Theraphosidae) as had been suggested by Raven (1994).

The original description of *Hapalopinus cubanum* was published by Simon (1903), but (as it was standard at the time) the description is very brief and has few characters that allow a clear differentiation of this species with the others. In modern times, such description is outdated, needing an updated and improved one, in order to allow an unambiguous identification of the species. The typical specimen of the species has poor information on the label, with the only data about his collection "Cuba", making the search for new material belonging to this species difficult.

In this paper, an updated and detailed description of *T. cubanum* is carried out, from his type specimen. Photos of various structures studied are given and comments are made about some morphological characters that are relevant to the familial placement of the genus.

MATERIAL AND METHODS

All measurements are given in millimeters and were taken on the left side of the specimen. As standard in Araneae, total lengths were taken with chelicerae, and carapace lengths without chelicerae. Reference points for measurements were taken according to Coyle (1974). All measurements were taken with a micrometric ocular on an Olympus SZ4045 stereoscope. The notation for leg spines follows Goloboff and Platnick (1987); when describing variation in chaetotaxy, only surfaces with different numbers of spines were listed. *Abbreviations***:** The following abbreviations are used in the text: AME = anterior median eyes, ALE = anterior lateral eyes, PME = posterior median eyes, PLE = posterior lateral eyes, D = dorsal, P = prolateral, R = retrolateral, V = ventral, P SUP ANT= prolateral superior anterior, P SUP = prolateral superior, R SUP= retrolateral superior, 1:2 A, 3:4 B = indicate that the spines or scopula referred to are in the apical half or basal third-fourths.

RESULTS

Genus *Trichopelma* Simon, 1888, p. 215

Type species: *T. nitidum* Simon, 1888.

Trichopelma cubanum (Simon, 1903)

Hapalopinus cubanus Simon, 1903a: 930, f. 1085-1086 (D<u>m</u>).
Hapalopinus cubanus Gerschman & Schiapelli, 1973b: 70, f. 58-62 (<u>m</u>).
Hapalopinus cubanus Schmidt, 1986: 42, f. 15-16 (<u>m</u>).
Psalistops cubanus Wunderlich, 1988: 52, f. 33 (<u>m</u>).

Type material: Holotype: ♂, Cuba. (without more data), MNHN-17702.
Diagnosis: *T. cubanum* can be distinguished by the AME-LPE separated from each other. It can be distinguished from *T. nitidum* Simon, 1888 by the presence of a more rounded bulb with a highly stylized embolus (Fig. 2), slender palpal tibia, and apical apophysis on tibia I with a curved elongate megaspine at the apex (Fig. 1C). Differs from *T. scopulatum* (Fischel, 1927) by the presence of 12 promarginal teeth on the chelicerae furrow and from *T. astutum* (Simon, 1889) by having more thorns on the palp tibiae.
Description: Total length: 14.88. Carapace (Fig. 1A): length 6.60, width 5.40. Cephalic region 4.20 length, 2.64 width, with dorsal silvery pilosity and well defined dorsal striae. Fovea recurved; 7 dark bristles in the line to the fovea and 2 thick bristles ahead of the fovea. Black hairs and bristles on lateral margins of the carapace margin. Ocular region (Fig. 1D) on a slight prominence, length 0.60, width 1.12, with 9 anterior bristles and 11 posterior ones. Anterior ocular line procurved; posterior slightly procurved, almost straight. Eyes: Diameters and interdistances: AME:ALE:PME:PLE, 0.16: 0.32: 0.16: 0.20. AME-AME: ALE-PLE: AME-ALE: AME-PME: PME-PLE 0.16:0.16:0.16:0:0.08. Chelicerae: elongate and slender, many dorsal short black bristles with an abundant pilosity. Furrow promargin with 12 teeth and 7 denticles near the apex. Intercheliceral tumescence with 11 small bristles. Labium (Fig. 1B), 0.60 length; 1.08 width; with 37 rounded cuspules and abundant apical bristles. Labiosternal suture a narrow groove with two lateral sigilla well defined. Maxillae with ~97 cuspules in inner angle, developed angular heel. Sternum (Fig. 1B), 3.12 long, 2.58 wide; with fine

hair; all sigilla small and marginal, oval. Abdomen: 6.84 length, anterior edge of the booklung opening with series of small teeth (Fig. 1G). Posterior median spinnerets: length 0.50, posterior lateral spinnerets with basal: medial: apical articles of lengths 0.59:0.35:0.24. Lengths of legs and palp (femora, patellae, tibiae, metatarsi, tarsi, total): I: 5.40, 3.00, 4.08, 3.80, 2.10, 18.38. II: 5.10, 3.00, 3.96, 4.02, 2.10, 18.18. III: 4.50, 2.40, 3.30, 4.50, 2.10, 16.80. IV: 5.88, 2.82, 5.16, 6.72, 2.58, 23.16. palp: 3.30, 2.10, 2.58, —, 1.26, 9.24.

Chaetotaxy: Femora: All with 4 thick dorsal bristles. I, 1 P SUP ANT; II, 1-1/1 P SUP ANT; III, 1-1-1 P SUP, 1-1-2 R SUP; IV, 1-1 R SUP, 1-1 P SUP (1:2 A); Palp, 1 P SUP ANT. Patellae: I, 2 V; II, 1 V A; III, 1-2 P; IV, 1 P, 1/0 V; Palp, 0. Tibiae: I, 1-1 P, 2-3-1/3-1-1 V, 1-1 P + large and conical, apical apophysis with curved elongate apical megaspine; a prolateral birramose process (the largest internal branch) (Fig. 1C); II, 1-1 P SUP, 2-2-3/2-1-3 V; III; 1-1-1/1-1 R, 2-2-3 V, 1-2/2-2 P; IV, 1-1-1-1 R, 1-1 P (1:2 B), 3-4-3 V, 1-2-1 R; Palp, 2-1-2 P. Metatarsi: I, 1-1/1 V; II, 1-1 V; III, 2-2-3 V, 1-1-1-1 P, 1-1-1 R; IV, 1-1-1-1 R, 3-1-2-3 V, 1-1-1 P. Tarsi: I-IV, 0; Palp, 0. Paired tarsal claws without teeth (Fig. 1E). Tarsi IV with a transverse pallid weakness (Fig. 1E).

Scopula: Metatarsi: I-II, not divided and symmetrical, more abundant towards the apex; III, light, more abundant on 3:4 A; IV, light, on 1:3 A. Tarsi: dense; I-II divided by a barely visible band of setae, III-IV divided by a clear very visible band delimited by line of bristles on each side (on tarsi III less visible and narrow). *Trichobothria:* not visible on tibiae and metatarsi, due to preservation. Tarsi with clavate trichobothria, (filiform: clavate): I, 14:12; II, 20:16; III, 14:14; IV, 18:20.

Colour in alcohol: cephalothorax yellow brown, abdomen light brown, dorsally with four light interrupted bands and a bigger anterior one (Fig. 1F).

DISCUSSION

The subfamily Trichopelmatinae shares several common characters with Theraphosidae such as: the abundant amount of cuspules on labium and maxillae and the short apical segment of the posterior lateral spinnerets (having a triangular state intermediate between the long and digitiform of theraphosid and the short and domed of barychelid), which is considered a modification of the condition present in the Theraphosidae (Raven, 1985). In comparison with other Barychelidae, it shares some characters that define the family such as: the biserially dentate paired claws of males (with the exception of Sasoninae; this character is also present in *Ischnocolus:* Theraphosidae); the well-developed tarsal scopulae; the numerous cuspules on the labium (is considered the plesiomorphic condition in barychelids). The maxillary heel present on the subfamily Trichopelmatinae is considered the autapomorphy of the group (Raven, 1985). Goloboff (1993) agrees with the monophyly of the family Barychelidae and proposes a new synapomorphy for the group: a series of teeth on the anterior rim of the booklung opening. This character, although it has never been used in a quantiative phylogenetic analysis, seems to be strong and unusual enough to support the monophyly of the family and is present on trichopelmatines (Goloboff, 1993).

Within the Barychelidae, clavate trichobothria may be absent, very reduced in size and limited to a few ones on the tarsus mid-length, or present in a small apical group or in a line throughout the tarsus (Guadanucci, 2012). On Trichopelmatinae, there is a pattern with two parallel rows of clavate trichobothria interspersed with filiform, separated by a row of long, thin setae.

Such pattern is also found in Harpactirinae, Theraphosinae, Eumenophorinae, and Ischnocolinae (except for the genera *Ischnocolus* Ausserer, 1871, *Heterothele* Karsch, 1879 and *Catumiri* Guadanucci, 2004) (Guadanucci, 2012). The morphology and disposition of the trichobothria was a useful character which supported the transfer of the Trichopelmatinae to the subfamily Ischnocolinae made by Guadanucci (2014).

The monophyly of the subfamily Trichopelmatinae has not been tested. The presence of ocular group rectangular in the margin of the carapace, and the unusual shape of the maxilla with a heel, are considered diagnostic characters (this last character is considered an autapomorphy by Raven, 1985). In the same work, Raven (1985, pag. 159) questioned the use of the division of tarsus IV in *Trichopelma* (as opposed to *Psalistops*) as a solid character to maintain their generic status. This problematic between *Trichopelma* and *Psalistops* remains unsolved.

The males of *Trichopelma* presented biserially dentate paired claws, according to Raven (1985). However, our analysis of *T. cubanum* revealed the absence of this character in all tarsi (Fig 5). We analyzed this character in other specimens of *Trichopelma* and found a great variability between individuals and between sexes (even within the same exemplary); confirming that the character is variable within the genus. No clear pattern of distribution in the specimens studied was observed. This same variability was found by David Ortiz (com. pess. 2014) in another batch of specimens of the same genus.

CONCLUSIONS

The observations reported here suggest the urgent need for a taxonomic and phylogenetic study of the subfamily Trichopelmatinae, with a consequent collect of the sexes that are unknown for different species. The absence of teeth in the paired tarsal claws of *T. cubanum*; the presence of teeth on the margin of the pulmonary openings and the division of the tarsis IV are characters that need to be analyzed much more carefully. These characters represent an important starting point to consider in future studies and they could play an important role in the phylogenetic relationships of the genus, being able to put into question, its current status and phylogenetic placement.

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LITERATUTE CITED

Coyle, F. A. 1974. Systematics of the trapdoor spider genus *Aliatypus* (Araneae: Antrodiaetidae). Psyche, Cambridge, 81: 431-500.

Gerschman De Pikelin, B. & Schiapelli, R. 1973. La subfamilia "Ischnocolinae" (Araneae: Theraphosidae). Revista del Museo Argentino de Ciencias Naturales. Entomología, 4: 43-77.

Goloboff, P. A. 1993. A reanalysis of mygalomorph spider families (Araneae). American Museum Novitates, 3056: 1-32.

Goloboff, P. A. & Platnick, N. I. 1987. A review of the Chilean spiders of the superfamily Migoidea (Araneae, Mygalomorphae). American Museum Novitates, 2888: 1-15.

Guadanucci, J. P. L. 2012. Trichobothrial morphology of Theraphosidae and Barychelidae spiders (Araneae, Mygalomorphae). Zootaxa, 3439: 1-42.

Guadanucci, J. P. L. 2014. Theraphosidae phylogeny: relationships of the 'Ischnocolinae' genera (Araneae, Mygalomorphae). Zoologica Scripta, 43 (5): 508-518.

Simon, E. 1903: Histoire naturelle des araignées. Paris, 2: 669-1080.
Raven, R. J. 1994. Mygalomorph spiders of the Barychelidae in Australia and the Western Pacific. Memoirs of the Queensland Museum, 35: 291-706.
Raven, R. J. 1985. The spider infraorder Mygalomorphae (Araneae): Cladistics and Systematics. Bulletin of the American Museum of Natural History, 182: 1-180.
World Spider Catalog. 2016. World spider catalog. Bern, Natural History Museum Bern, version 15.5, available online at: http://wsc.nmbe.ch [Accessed: 28/1/2016]

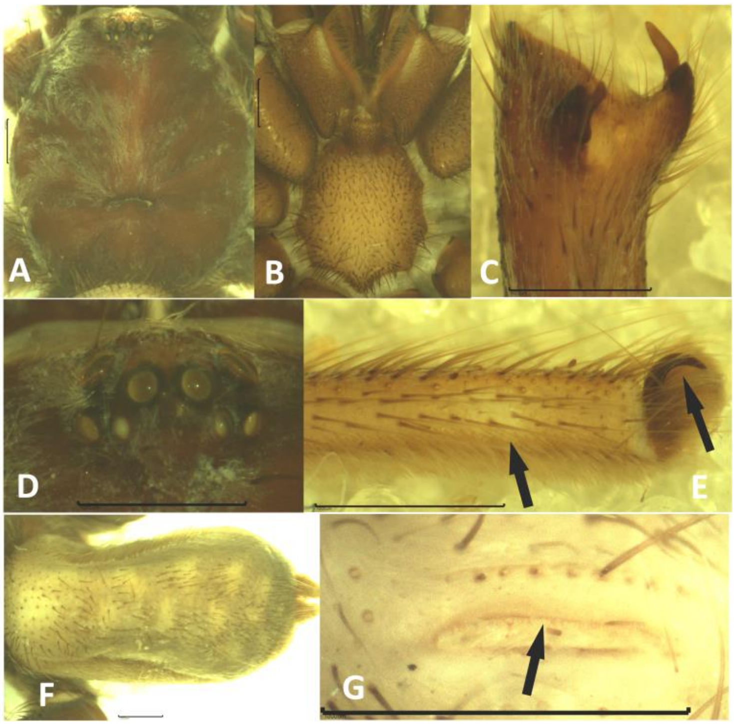

Figure 1. *Trichopelma cubanum*. A- cephalothorax. B- sternum. C- tibia I, apophysis. D- ocular region. E- tarsus IV, showing clear the transverse mark and the paired claws without teeth. F- abdomen, dorsal view. G- opening booklung showing the series of teeth. Scales= 1 mm.

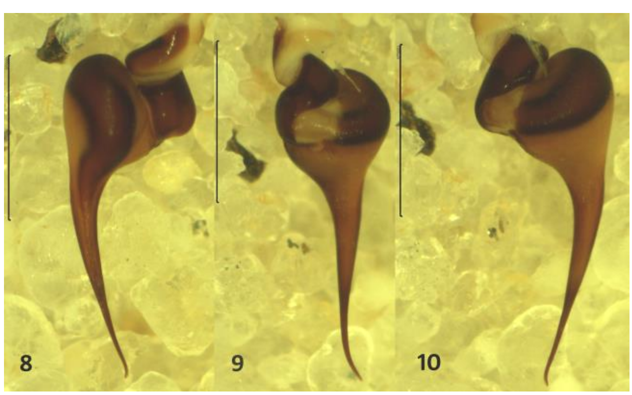

Figure 2. *Trichopelma cubanum*. Copulatory bulb, three different views. Scales= 1 mm.

PHYLLOTRETA CHEVROLAT IN TURKEY WITH A NEW RECORD (CHRYSOMELIDAE: GALERUCINAE: ALTICINI)

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ABSTRACT: Species of the genus *Phyllotreta* Chevrolat in Turkey are investigated and reviewed. As a result of this, *Phyllotreta* includes 44 species in Turkey. *Phyllotreta araxicola* Khnzorian is recorded for the first time from Turkey. Twenty seven species are reported with new distributional data from 16 different provinces in Turkey on the base of 2864 studied specimens. Accordingly eleven species as *P. atra* (Fabricius), *P. caucasicola* Heikertinger, *P. corrugata* Reiche & Saulcy, *P. erysimi* Weise, *P. nemorum* (Linnaeus), *P. nigripes* (Fabricius), *P. nodicornis* (Marsham), *P. pontoaegeica* Gruev, *P. procera* (Redtenbacher), *P. punctulata* (Marsham) and *P. undulata* (Kutschera) are recorded for the first time from Çankırı province in Northern part of Central Anatolian Region of Turkey. Eleven species: *P. astrachanica* Lopatin, *P. atra* (Fabricius), *P. cruciferae* (Goeze), *P. diademata* Foudras, *P. erysimi* Weise, *P. lativittata* Kutschera, *P. nemorum* (Linnaeus), *P. nigripes* (Fabricius), *P. punctulata* (Marsham), *P. undulata* (Kutschera) and *P. variipennis* (Boieldieu) are recorded for the first time from Bartın province in Western Black Sea Region of North Turkey. Seven species: *P. atra* (Fabricius), *P. cruciferae* (Goeze), *P. lativittata* Kutschera, *P. ochripes* (Curtis), *P. striolata* (Illiger), *P. undulata* (Kutschera) and *P. variipennis* (Boieldieu) are recorded for the first time from Zonguldak province in Western Black Sea Region of North Turkey. Four species: *P. fallaciosa* Heikertinger, *P. erysimi* Weise, *P. undulata* (Kutschera) and *P. weiseana* Jakobson are recorded for the first time from Kayseri province in Eastern part of Central Anatolian Region of Turkey. Three species: *P. fallaciosa* Heikertinger, *P. punctulata* (Marsham) and *P. undulata* (Kutschera) are recorded for the first time from Ankara province in Northern part of Central Anatolian Region of Turkey. Two species: *P. atra* (Fabricius) and *P. variipennis* (Boieldieu) are recorded for the first time from Karaman province in South part of Central Anatolian Region of Turkey. Two species: *P. atra* (Fabricius) and *P. nigripes* (Fabricius) are recorded for the first time from Afyon province in Eastern part of Aegean Region of Turkey. One species: *P. nigripes* (Fabricius) is recorded for the first time from Bolu province in Western part of Black Sea Region of Turkey. And one species: *P. corrugata* Reiche & Saulcy is recorded for the first time from Şanlıurfa province in South-Eastern Anatolian Region of South Turkey. Also known records of *P. cruciferae* (Goeze) and *P. diademata* Foudras in European Turkey and known records of *P. fornuseki* Cizek, *P. ganglbaueri* Heikertinger and *P. lorestanica* Warchalowski in Anatolia are given for the first time and contribute to distribution data in the Palaearctic catalogue.

KEY WORDS: Chrysomelidae, Galerucinae, Alticini, *Phyllotreta,* new data and records, Turkey

Phyllotreta Chevrolat, 1836 is one of the largest worldwide alticine genus which contains approximately 150 species in the Palearctic region and more than 250 species worldwide (Konstantinov & Vandenberg, 1996, 2015). The members of this genus are specialist feeders on the Brassicaceae and related groups (Jolivet & Hawkeswood, 1995). Thus most species of this genus are known as crop pests. Adults usually feed on the foliage of host plant.

The Palearctic species of *Phyllotreta* were revised by Heikertinger (1941), and recently given by Warchalowski (2003, 2010) and Döberl in Löbl & Smetana (2010).

Heikertinger (1941) and Warchalowski (2003, 2010) divided *Phyllotreta* species into two main groups on the base of upper side with yellow or reddish pattern, sometimes elytra entirely or almost entirely yellow and upper side uniformly black or black with metallic reflex. These authors also divided *Phyllotreta* species with uniformly black upper side into two groups based on whether they have the central part of the frons punctured.

Aslan et al. (1999) reported 36 species for Turkey is the first comprehensive work on Turkish *Phyllotreta*. Then Döberl in Löbl & Smetana (2010) mentioned 38 species for Turkey with the addition of *P. bulgarica* Gruev, 1977 and *P. reitteri* Heikertinger, 1911 that were firstly recorded by Aslan & Gök (2006) from Isparta province and by Gök et al. (2002) from Denizli province respectively. Later Ekiz et al. (2013), Özdikmen et al. (2014) and Özdikmen (2014) gave a total of 41 species for Turkish fauna with the addition of *P. fornuseki* Cizek, 2003 by Aslan, Gök (2006) from Isparta province, *P. ganglbaueri* Heikertinger, 1909 by Çilbiroğlu (2003) and Ekiz et al. (2013) from Isparta and Antalya provinces, and *P. lorestanica* Warchałowski, 1973 by Aslan et al. (2004) and Ekiz et al. (2013) from Erzurum and Burdur provinces. *P. aygulae* Özdikmen et al. (2017) and *P. bilgeae* Özdikmen & Coral Şahin (2017) described as new species from Turkey.

Thus, the number of species of Turkish *Phyllotreta* increases from 41 to 44 with the new species and a new record, *Phyllotreta araxicola* Khnzorian.

MATERIALS AND METHODS

A total of 2864 *Phyllotreta* specimens were collected by authors mainly from 16 different provinces in Turkey as Afyon, Ankara, Bartın, Bolu, Çankırı, Düzce, Eskişehir, Isparta, Karaman, Kayseri, Konya, Mersin, Niğde, Ordu, Şanlıurfa and Zonguldak. As a result of identification of them, twenty-seven known species were determined. The available specimens for the present study are deposited in the collections of Gazi University and Nazife Tuatay Plant Protection Museum (NTM) (Turkey: Ankara).

Information in the present text is given in following order:

The genus name, the type species and synonyms and also the valid species name and synonyms are presented. Each species group taxa, reported from Turkey, are given alphabetically. The Turkish distribution patterns for each species group taxon are given only concerning provinces. Turkish endemic taxa are marked with the sign (*).

The distribution data of the taxa, Ekiz et al. (2013), Özdikmen (2014) for Turkey and Döberl in Löbl & Smetana (2010) for Palaearctic Region are used.

Distributional abbreviations for the works are available to Döberl in Löbl & Smetana (2010). The data are given in addition to the distribution data in Palaearctic catalogue, marked underlined.

RESULTS

Phyllotreta includes 44 species in Turkey with newly described species and a new record. Turkish *Phyllotreta* is reviewed on the base of 2864 specimens of 27 species from 16 different provinces in Turkey with the present work. All members of Turkish *Phyllotreta* are presented as follows:

Phyllotreta Chevrolat, 1836

Phyllotreta Chevrolat in Dejean, 1836: 391 (type species *Chrysomela nemorum* Linnaeus, 1758 by subsequent designation by Desmarest, 1860: 351)
Orchestris Crotch, 1873: 57, 65, a junior homonym of *Orchestris* Kirby, 1837 (type species *Chrysomela nemorum* Linnaeus, 1758 by original designation)
Tanygaster Blatchley, 1921: 26-27 (type species *T. ovalis* Blatchley, 1921, by monotypy). Smith, 1979: 359 (synonymized)

Phyllotreta acutecarinata Heikertinger, 1941

Phyllotreta acutecarinata Heikertinger, 1941: Koleop. Rund., 27: 81

This species is known only from Konya province in Turkey. It is distributed in Europe (AU GR PL RU SK UK) and Asia (AF TR).

Phyllotreta araxicola Iablokoff-Khnzorian, 1968

Phyllotreta araxicola Iablokoff-Khnzorian, 1968: Ann. Soc. ent. Fr. (N. S.), 4: 273

This species has not been known from Turkey until now. It is distributed in Asia (AB AR). ***Material examined:*** **Çankırı prov.:** Yapraklı, between Gürmeç-Kayacık, 29.IV.2015. 1100 m, leg. N. Silkin, 1 specimen. ***Remarks:*** The species is a new record to Turkey.

Phyllotreta astrachanica Lopatin, 1977

Phyllotreta diademata astrachanica Lopatin, 1977: New and little known species of insects of the European part of the USSR–Leningard, p. 32

This species is known from Ankara, Antalya, Artvin and Isparta provinces in Turkey. It is distributed in Europe (AU BU CZ FR GE GR HU IT NL PL SK SL SP ST SZ YU) and Asia (AB CY GG IN KZ TR). ***Material examined:*** **Ankara prov.:** Nallıhan, Davutoğlan, 05.V.2015, 474 m, leg. D. Şahin, 18 specimens; Haymana, 07.V.2015, 1025 m, leg. D. Şahin, 3 specimens; **Bartın prov.:** Güzelcehisar, 12.V.2015, leg. D. Şahin, 13 specimens. ***Remarks:*** The species is a new record to Bartın province for Turkey.

Phyllotreta atra (Fabricius, 1775)

Altica atra Fabricius, 1775: Syst. Ent., p. 115
Chrysomela pulex Schrank, 1781: Enum Insect. Austr., p. 85
Altica aethiopissa Schrank, 1789: Der Naturforsch., 24: 69
Altica aterrima Schrank, 1798: Fauna Boica, p. 561
Haltica melaenea Illiger, 1807: Mag. Ins., 6: 60

This species is known from Ankara, Antalya, Bayburt, Bolu, Edirne, Erzurum, Eskişehir, Gümüşhane, Isparta, Kayseri, Kocaeli, Niğde, Rize, Samsun, Sivas and Trabzon provinces in Turkey. It is distributed in Europe (AL AU BE BH BU BY CR CZ DE EN FI FR GB GE GR HU IT LA LT LU MC NL NR PL RO RU SK SL SP ST SV SZ TR UK YU), North Africa (AG MO) and Asia (AB AF AR ES FE GG IN JO KI KZ MG SY TD TR YE). ***Material examined:*** **Afyon prov.:** Central, Gebeciler, 27.VII.1983, leg. T. Davarcı, 2 specimens; **Ankara prov.:** Polatlı, Sazılar, 07.V.1990, leg. M. Aydemir, 1 specimen; Ayaş, Başbereket, 09.V.1990, leg. M. Aydemir, 2 specimens; Çubuk, Sarıkoz, 16.V.1990, leg. M. Aydemir, 3 specimens; Ayaş, Bayram, 05.VI.1990, leg. M. Aydemir, 1 specimen; Ayaş, Uğurçayırı, 05.VI.1990, leg. M. Aydemir, 2 specimens; Beypazarı, Dibecik, 31.VII.1990, leg. M. Aydemir, 1 specimen; Temelli, 08.VIII.1990, leg. M. Aydemir, 2 specimens; between Yenikent-Ayaş, 01.V.2003, 1000 m, leg. H. Özdikmen, 1 specimen; Central, 01.VIII.1967, leg. M. Yüksel, 24 specimens; Çubuk, 18.IV.2014, 978 m, leg. D. Şahin, 5 specimens; Nallıhan, Davutoğlan, 05.V.2015, 474 m, leg. D. Şahin, 87 specimens; Haymana, 07.V.2015, 1025 m, leg. D. Şahin, 5 specimens; Haymana, Soğulca, 07.V.2015, 948 m, leg. D. Şahin, 156 specimens; Sincan, Malıköy, 02.VI.2015, 721 m, leg. D. Şahin, 9 specimens; Haymana, Soğulca, 02.VI.2015, 690 m, leg. D. Şahin, 3 specimens; Çamlıdere, Kuşçular, 22.VI.2015, 1410 m, leg. D. Şahin, 1 specimen; Kızılcahamam, Akdoğan, 22.VI.2015, 1031 m, leg. D. Şahin, 5 specimens; Polatlı, Yassıhöyük, 11.VIII.2015, 696 m, leg. D. Şahin, 23 specimens; Polatlı, Acıkır, 11.VIII.2015, 690 m, leg. D. Şahin, 3 specimens; Ayaş, Beypazarı road, 13.VIII.2015, 711 m, leg. D. Şahin, 1 specimen; Beypazarı, Dibecik, 13.VIII.2015, 537 m, leg. D. Şahin, 13 specimens; Ayaş, Feruz, 13.VIII.2015, 1075 m, leg. D. Şahin, 6 specimens; Akyurt, Yeşiltepe, 14.VIII.2015, 1063 m, leg. D. Şahin, 25 specimens; Haymana, Soğulca, 17.VIII.2015, 690 m, leg. D. Şahin, 9 specimens; Kazan, Cimşit, 15.IX.2015, 845 m, leg. D. Şahin, 26 specimens; Beypazarı, Hacıkaralar, 26.V.2016, leg. A. Barış, 37 specimens; Sincan, 17.VIII.2016, 842 m, leg. A. Barış, 13 specimens; **Bartın prov.:** Güzelcehisar, 12.V.2015, leg. D. Şahin, 206 specimens; Karasu, 12.V.2015, leg. D. Şahin, 1 specimen; Dallıca, 17.VI.2016, 97 m, leg. A. Barış, 4 specimens; **Çankırı prov.:** Orta, entry of İncecik village, 22.V.2014, 1600 m, leg. N. Silkin, 1 specimen; Ilgaz, entry of Belsöğüt village, 1019 m, 17.VII.2014, leg. N. Silkin, 1 specimen; Eldivan, Seydiköy, 854 m, 09.VIII.2014, leg. N. Silkin, 1 specimen; Çerkeş, Yalıözü-Ova, 19.IV.2015, 1154 m, leg. N. Silkin, 1 specimen; Çerkeş, Kuzuören village road, 20.IV.2015, 939 m, leg. N. Silkin, 3 specimens; Atkaracalar, Zerdeş return, 21.IV.2015, 1212 m, leg. N. Silkin, 1 specimen; Bayramören, Erenler-Dolaşlar, 24.IV.2015, 925 m, leg. N. Silkin, 6 specimens; Bayramören, exit of Yurtpınar village, 24.IV.2015, 829 m, leg. N. Silkin, 7 specimens; Kurşunlu, exit of Çaylıca village, 25.IV.2015, leg. N. Silkin, 1 specimen; Kurşunlu, Yeşilören village road, 26.IV.2015, 1027 m, leg. N. Silkin, 1 specimen; Central, Akçavalı-Başeğmez villages' road, 27.IV.2015, leg. N. Silkin, 1 specimen; Central, Aşağıçavuş village, 27.IV.2015, 833 m, leg. N. Silkin, 1 specimen; Yapraklı, Ayva village road, 30.IV.2015, 1256 m, leg. N. Silkin, 1 specimen; Central, Aşağıçavuş-Yukarıçavuş return, 09.V.2015, 837 m, leg. N. Silkin, 1 specimen; Central, Alanpınar-Başeğmez return, 09.V.2015, 822 m, leg. N. Silkin, 1 specimen; Kurşunlu, Kapaklı-Taşkaracalar, 11.V.2015, 1297 m, leg. N. Silkin, 1 specimen; **Eskişehir prov.:** 05.V.1993, *Hordeum vulgare*, leg. G. Altınayar, 3 specimens; **Karaman prov.:** 2015, leg. D. Şahin, 3 specimens; **Kayseri prov.:** Melikgazi, Sarımsaklı, 23.VI.2016, 1222 m, leg. D. Şahin, 58 specimens; Kocasinan, Ebiç, 23.VI.2016, 1053 m, leg. D. Şahin, 6 specimens; Beldeğirmeni, 24.VI.2016, 978 m, leg. D. Şahin, 1 specimen; Yahyalı, Sarıoğlan, 14.VII.2016, 1120 m, leg. D. Şahin, 23 specimens; Akkışla, Alevkışla, 14.VII.2016, 1278 m, leg. D. Şahin, 19 specimens; **Niğde prov.:** Exit of Ulukışla, 29.V.2001, 1350 m, leg. H. Özdikmen, 1 specimen; **Zonguldak prov.:** Devrek, Yılanlıca, 18.III.2016, 124 m, leg. C. Yücel, 45 specimens; Devrek, 20.IV.2016, leg. A. Barış, 11 specimens; Beycuma, Yörükler, 02.VI.2016, 232 m, leg. C. Yücel, 4 specimens; Beycuma, Korucuk, 02.VI.2016, 130 m, leg. C. Yücel, 2 specimens; Devrek, Yassıören, 02.VI.2016, 382 m, leg. C. Yücel, 37 specimens. ***Remarks:*** The species is a new record to Afyon, Bartın, Çankırı, Karaman and Zonguldak provinces for Turkey.

(*) *Phyllotreta aygulae* Özdikmen et al., 2017

This species is known from Ankara, Bartın and Çankırı provinces in Turkey. It is distributed in Asia (TR). ***Material examined:*** **Ankara prov.:** Nallıhan, Davutoğlan, 05.V.2015, 474 m, leg. D. Şahin, 3 specimens; Haymana, 07.V.2015, 1025 m, leg. D. Şahin, 1 specimen; Akyurt, Yeşiltepe, 14.VIII.2015, 1063 m, 1 specimen; **Bartın prov.:** Güzelcehisar, 12.V.2015, 250 m, leg. D. Şahin, 18 specimens; **Çankırı prov.:** Bayramören, exit of Yurtpınar village, 24.IV.2015, 829 m, leg. N. Silkin, 1 specimen; Ilgaz, Candere-Bükcük villages, 26.IV.2015, 874 m, leg. N. Silkin, 2 specimens. ***Remarks:*** The specimens are the holotype and paratypes of the species.

Phyllotreta balcanica Heikertinger, 1909

Phyllotreta balcanica Heikertinger, 1909: Verh. zool.–bot. Ges. Wien, 59: 292
Phyllotreta adanensis Pic, 1910a: L'Echange, Rev. Linn., 26: 26
Phyllotreta adanensis var. *anatolica* Pic, 1910b: Bull. Soc. Ent. Fr., 1910: 306

This species is known from Adana, Bursa, Erzurum and Kocaeli provinces in Turkey. It is distributed in Europe (AL AU BH BU CR FR GR HU IT MC RO SL SP ST UK YU) and Asia (AB AF KI KZ TR UZ).

(*) *Phyllotreta bilgeae* Özdikmen & Coral Şahin, 2017

This species is known from Ankara, Bartın and Çankırı provinces in Turkey. It is distributed in Asia (TR). ***Material examined:*** **Ankara prov.:** Haymana, Soğulca village, 22.V.2014, 948 m, leg. D. Şahin, 2 specimens. ***Remarks:*** The specimens are the holotype and paratype of the species.

(*) *Phyllotreta bolognai* Biondi, 1992

Phyllotreta bolognai Biondi, 1992: Fragm. Entomol., Roma, 23: 349

This species is known from Antalya, Erzurum and Isparta provinces in Turkey. It is distributed in Asia (TR).

Phyllotreta bulgarica Gruev, 1977

Phyllotreta bulgarica Gruev, 1977: Acta zool. Bulg., 8: 67

This species is known only from Isparta province in Turkey. It is distributed in Europe (BU GR) and Asia (IS TR).

Phyllotreta caucasicola Heikertinger, 1941

Phyllotreta caucasicola Heikertinger, 1941: Koleop. Rund., 27: 82

This species is known only from Ankara province in Turkey. It is distributed in Europe (ST) and Asia (AR IQ TR). ***Material examined:*** **Çankırı prov.:** Central, Ova-Kuzuköy, 29.IV.2015, leg. N. Silkin, 3 specimens. ***Remarks:*** The species is a new record to Çankırı province for Turkey.

Phyllotreta corrugata Reiche & Saulcy, 1858

Phyllotreta corrugata Reiche & Saulcy, 1858: Ann. Soc. ent. Fr., 6: 46
Phyllotreta rufitarsis var. *beauprei* Pic, 1909: L'Echange, 25: 156
Phyllotreta galloprovincialis Caillol, 1914: Cat. Col. Prov. III, 1914: 540
Phyllotreta discophora Iablokoff-Khnzorian, 1960: Notul. Ent., 40: 152
Phyllotreta bella Paliy, 1970: Entomologicheskie Issledovaniya v Kirgizii, p. 3

This species is known from Adana, Afyon, Ankara, Antalya, Burdur, Hatay, Isparta, İzmir, Kayseri, Konya, Sivas and Yozgat provinces in Turkey. It is distributed in Europe (BU FR GB GR IT MA SP ST UK), North Africa (AG EG LB MO TU) and Asia (AB AF AR CY IN IQ IS JO KZ SY TM TR UZ). ***Material examined:*** **Afyon prov.:** Sandıklı, 14.IV.1983, *Triticum,* leg. M. A. Doğru, 2 specimens; **Ankara prov.:** Polatlı, Temelli, 06.VI.1985, leg. H. Zeki, 1 specimen; Polatlı, Düç, 08.V.1990, leg. M. Aydemir, 2 specimens; Beypazarı, Dibecik, 09.V.1990, leg. M. Aydemir, 1 specimen; Çubuk, Sarıkoz, 16.V.1990, leg. M. Aydemir, 1 specimen; between Yenikent-Ayaş, 01.V.2003, 1000 m, leg. H. Özdikmen, 5 specimens; Nallıhan, Davutoğlan, 05.V.2015, leg. D. Şahin, 1 specimen; Haymana, Soğulca, 07.V.2015, 948 m, leg. D. Şahin, 2 specimens; **Çankırı prov.:** Korgun, 21-22.IV.2013, 837-957 m, leg. N. Silkin, 2 specimens; Eldivan, 23.IV.2013, 1068-1196 m, leg. N. Silkin, 2 specimens; Central, 26.IV.2014, 617-766 m, leg. N. Silkin, 2 specimens; Çerkeş, Yalıözü-Hacılar, 20.VIII.2014, 1217 m, leg. N. Silkin, 6 specimens; Kurşunlu, Kapaklı-Taşkaracalar, 17.IV.2015, 1318 m, leg. N. Silkin, 2 specimens; Çerkeş, 1 km to Kocamustafa village, 19.IV.2015, 1182 m, leg. N. Silkin, 1 specimen; Çerkeş, Yalıözü-Ova, 19.IV.2015, 1154 m, leg. N. Silkin, 4 specimens; Çerkeş, entry of Aliözü village, 20.IV.2015, 1221 m, leg. N. Silkin, 2 specimens; Çerkeş, Tohumlar-Yıpraktaşanlar return, 20.IV.2015, 1039 m, leg. N. Silkin, 5 specimens; Çerkeş, entry of Tohumlar village, 20.IV.2015, 1081 m, leg. N. Silkin, 1 specimen; Çerkeş, Kuzuören village road, 20.IV.2015, 939 m, leg. N. Silkin, 1 specimen; Çerkeş, Çaylı village, 20.IV.2015, 931 m, leg. N. Silkin, 10 specimens; Atkaracalar, Zerdeş return, 21.IV.2015, 1212 m, leg. N. Silkin, 1 specimen; Bayramören, Erenler-Dolaşlar, 24.IV.2015, 925 m, leg. N. Silkin, 2 specimens; Bayramören, exit of Yurtpınar village, 24.IV.2015, 829 m, leg. N. Silkin, 8 specimens; Atkaracalar, Eyüpözü-Hüyük, 25.IV.2015, leg. N. Silkin, 6 specimens; Atkaracalar, entry of Hüyük village, 25.IV.2015, leg. N. Silkin, 2 specimens; Ilgaz, Ödemiş village, 25.IV.2015, 1033 m, leg. N. Silkin, 1 specimen; Kurşunlu, Yeşilören village road, 26.IV.2015, 1027 m, leg. N. Silkin, 1 specimen; Central, Paşaköy, 27.IV.2015, 963 m, leg. N. Silkin, 1 specimen; Central, Dede return, 29.IV.2015, leg. N. Silkin, 2 specimens; Central, Ova village, 29.IV.2015, leg. N. Silkin, 1 specimen; Central, Ova-Kuzuköy, 29.IV.2015, leg. N. Silkin, 6 specimens; Central, Beşdut village, 29.IV.2015, leg. N. Silkin, 1 specimen; Yapraklı, İğdir road, 30.IV.2015, 1068 m, leg. N. Silkin, 6 specimens; Yapraklı, exit of Aşağıöz village, 30.IV.2015, 1139 m, leg. N. Silkin, 1 specimen;

Eldivan, entry of Küçükhacıbey village, 30.IV.2015, 920 m, leg. N. Silkin, 1 specimen; Eldivan, Büyükhacıbey village, 30.IV.2015, 923 m, leg. N. Silkin, 1 specimen; Central, Aşağıçavuş-Yukarıçavuş return, 09.V.2015, 837 m, leg. N. Silkin, 1 specimen; Şabanözü, Bakırlı, 12.V.2015, 1012 m, leg. N. Silkin, 1 specimen; Central, Ovacık-Kuzuköy, 15.V.2015, 919 m, leg. N. Silkin, 1 specimen; Central, Alaçatı, 15.V.2015, 870 m, leg. N. Silkin, 1 specimen; **Kayseri prov.:** İncesu, Kızılören, 13.VII.2016, 1965 m, leg. D. Şahin, 1 specimen; **Konya prov.:** Çumra, İnli village, 04.V.1983, leg. Ş. Gür, 1 specimen; **Şanlıurfa prov.:** Akçakale road, Talat Demirören research station, 30.IV.2015, leg. D. Şahin & C. Yetkin, 6 specimens. ***Remarks:*** The species is a new record to Çankırı and Şanlıurfa provinces for Turkey.

Phyllotreta cruciferae (Goeze, 1777)

Chrysomela cruciferae Goeze, 1777: Ent. Beitr., 1: 312
Altica brassicae Geoffroy, 1785: Ent. Par., p. 98
Altica hortensis Olivier, 1789: Entom., 1: 108
Haltica obscurella Illiger, 1807: Mag. Ins., 6: 154
Haltica nigroaenea Stephens, 1831: Ill. Brit. Ent., p. 298
Haltica elongata Stephens, 1835: Ill. Brit. Ent., p. 423
Altica poeciloceras Comolli, 1837: Col. nov. Prov. Novoc., p. 48.
Haltica punctipennis Weidenbach, 1859: *Ber.* Naturhist. *Ver. Augsburg, 1859: 85*
Phyllotreta colorea Foudras, 1860: Ann. Soc. Linn. Lyon (N. S.), 6: 370
Phyllotreta columbiana Chittenden, 1927: Ent. Amer., 8: 46

This species is known from Adana, Amasya, Ankara, Bilecik, Bursa, Burdur, Çankırı, Çorum, Edirne, Erzurum, Eskişehir, Isparta, İzmir, Kayseri, Konya, Manisa, Niğde, Tokat and Trabzon provinces in Turkey. It is distributed in Europe (AL AU BH BU BY CR CZ DE FR GB GE GR HU IT LA LS LT LU MA MC MD NL PL PT RO RU SK SL SP SV SZ TR UK YU), North Africa (AG EG MO TU), Asia (AB AF CY GG IN IS JA JO KI KZ MG PA SY TD TR "India"), Afrotropical region and introduced to Nearctic region. ***Material examined:*** **Ankara prov.:** Altındağ, Peçenek, 16.V.1990, leg. M. Aydemir, 1 specimen; between Yenikent-Ayaş, 01.V.2003, 1000 m, leg. H. Özdikmen, 2 specimens; Nallıhan, Davutoğlan, 16.IV.2014, 474 m, leg. D. Şahin, 9 specimens; Beypazarı, Kayabükü, 16.IV.2014, 493 m, leg. D. Şahin, 1 specimen; Sincan, Yenikent, 28.IV.2014, 479 m, leg. D. Şahin, 1 specimen; Nallıhan, Davutoğlan, 28.IV.2014, 474 m, leg. D. Şahin, 4 specimens; Haymana, Soğulca, 22.V.2014, 994 m, leg. D. Şahin, 1 specimen; Beypazarı, Dibecik, 29.V.2014, 531 m, leg. D. Şahin, 1 specimen; Ayaş, Sinanlı, 02.VII.2014, 787 m, leg. D. Şahin, 1 specimen; Beypazarı: Akkaya, 22.IX.2014, 563 m, leg. D. Şahin, 39 specimens; Nallıhan, Davutoğlan, 23.IX.2014, 474 m, leg. D. Şahin, 10 specimens; Nallıhan, Akçabayır, 23.IX.2014, 474 m, leg. D. Şahin, 21 specimens; Çubuk, 18.IV.2014, 978 m, leg. D. Şahin, 2 specimens; Sincan, Yenikent, 07.V.2014, 792 m, leg. D. Şahin, 1 specimen; Nallıhan, Davutoğlan, 05.V.2015, 474 m, leg. D. Şahin, 3 specimens; Haymana, Soğulca, 07.V.2015, 948 m, leg. D. Şahin, 1 specimen; Haymana, Soğulca, 02.VI.2015, 948 m, leg. D. Şahin, 2 specimens; Sincan, Malıköy, 02.VI.2015, 721 m, leg. D. Şahin, 13 specimens; Kızılcahamam, Akdoğan, 22.VI.2015, 1031 m, leg. D. Şahin, 1 specimen; Haymana, 07.VII.2015, 1025 m, leg. D. Şahin, 1 specimen; Polatlı, Yassıhöyük, 11.VIII.2015, 696 m, leg. D. Şahin, 1 specimen; Beypazarı, Hacıkara, 13.VIII.2015, 672 m, leg. D. Şahin, 2 specimens; Beypazarı, Dibecik, 13.VIII.2015, 537 m, leg. D. Şahin, 2 specimens; Akyurt, Yeşiltepe, 14.VIII.2015, 1063 m, leg. D. Şahin, 1 specimen; Haymana, Soğulca, 17.VIII.2015, 930 m, leg. D. Şahin, 1 specimen; Kazan, Cimşit, 15.IX.2015, 857 m, leg. D. Şahin, 2 specimens; Şereflikoçhisar, Deliller, 27.VI.2016, 1250 m, leg. D. Şahin, 1 specimen; Sincan, 17.VIII.2016, 842 m, leg. A. Barış, 11 specimens; **Bartın prov.:** Güzelcehisar, 12.V.2015, leg. D. Şahin, 2 specimens; Dallıca, 17.VI.2016, 97 m, leg. A. Barış, 1 specimen; **Çankırı prov.:** Eldivan, entry of Eldivan, 23.IV.2013, 922 m, N. Silkin, 1 specimen; Korgun, 21-23.IV.2013, 21.V.2014, 837-1283 m, leg. N. Silkin, 8 specimens; Kurşunlu, 23.IV.2013, 1126 m, leg. N. Silkin, 2 specimens; Eldivan, 23.IV.2013, 09.VIII.2014, 854-1196 m, leg. N. Silkin, 7 specimens; Orta, Elden plateau, 21.V.2014, 1487 m, N. Silkin, 1 specimen; Orta, 24.IV.2013, 20-22.V.2014, 1227-1602 m, leg. N. Silkin, 13 specimens; Ilgaz, 25-26.VII.2013, 18.VII.2014, 902-1230 m, leg. N. Silkin, 4 specimens; Kızılırmak, 25.IV.2014, 557 m, leg. N. Silkin, 1 specimen; Çerkeş, 27.IV.2014, 626 m, leg. N. Silkin, 2 specimens; Central, 15.VII.2014, 826 m, leg. N. Silkin, 1 specimen; **Isparta prov.:** Yalvaç, 15.IV.1983, *Triticum,* leg. M. Kaya, 1 specimen; **Kayseri prov.:** Yeşilhisar, Güzelöz, 25.VI.1997, 1320 m, leg. H. Özdikmen, 1 specimen; Melikgazi, Sarımsaklı, 23.VI.2016, 1222 m, leg. D. Şahin, 6 specimens; **Zonguldak prov.:** Devrek, Yılanlıca, 02.VI.2016, 124 m, leg. C. Yücel, 15 specimens; Beycuma, Yörükler, 02.VI.2016, 232 m, leg. C. Yücel, 2 specimens. ***Remarks:*** The species is a new record to Bartın and Zonguldak provinces for Turkey.

Phyllotreta dacica Heikertinger, 1941

Phyllotreta dacica Heikertinger, 1941: Koleop. Rund., 27: 83

This species is known from Isparta and Konya provinces in Turkey. It is distributed in Europe (BH BU CR RO UK YU) and Asia (AB TR).

Phyllotreta diademata Foudras, 1860

Phyllotreta diademata Foudras, 1860: Ann. Soc. Linn. Lyon (N. S.), p. 369

This species is known from Adana, Aksaray, Ankara, Antalya, Edirne, Erzincan, Erzurum, Eskişehir, Isparta, Kocaeli and Konya provinces in Turkey. It is distributed in Europe (AL AU BE BH BU CR CZ FR GB GE GR HU IT LU MC NL PL RO RU SK SL SP SV SZ TR UK YU) and Asia (AB AF GG IN IQ SD SU TR "Turkestan"). ***Material examined:*** **Bartın prov.:** Güzelcehisar, 12.V.2015, leg. D. Şahin, 11 specimens. ***Remarks:*** The species is a new record to Bartın province for Turkey.

Phyllotreta egridirensis Gruev & Kasap, 1985

Phyllotreta egridirensis Gruev & Kasap, 1985: Deutsch. Ent. Zeitschr., N. F., 32: 60

This species is known from Adana, Antalya, Isparta and Konya provinces in Turkey. It is distributed in Asia (IN TR).

Phyllotreta erysimi erysimi Weise, 1900

Phyllotreta erysimi Weise, 1900: Deutsch. Ent. Zeitschr., 1900: 138

This species is represented only by the nominotypical subspecies in Turkey. It is known from Ankara, Antalya, Bayburt, Erzurum, Isparta, Konya, Manisa, Samsun, Thrace, Trabzon provinces in Turkey. It is distributed in Europe (BU GR MC RO RU TR UK YU) and Asia (AB AF IN IS KI KZ MG SY TD TM TR UZ). ***Material examined:*** **Ankara prov.:** Çubuk, Güldarbı, 16.V.1990, leg. M. Aydemir, 1 specimen; Çubuk, Sarıkoz, 16.V.1990, leg. M. Aydemir, 1 specimen; Temelli, 08.VIII.1990, leg. M. Aydemir, 1 specimen; between Yenikent-Ayaş, 01.V.2003, 1000 m, leg. H. Özdikmen, 2 specimens; Sincan, Yenikent, 28.IV.2014, 479 m, leg. D. Şahin, 1 specimen; Nallıhan, Davutoğlan, 23.IX.2014, leg. D. Şahin, 1 specimen; **Bartın prov.:** Karasu, 12.V.2015, leg. D. Şahin, 4 specimens; **Çankırı prov.:** Central, Ova-Kuzuköy, 29.IV.2015, leg. N. Silkin, 1 specimen; Central, Kuzuköy-Çırçır villages, 29.IV.2015, leg. N. Silkin, 1 specimen; Eldivan, entry of Küçükhacıbey village, 30.IV.2015, 920 m, leg. N. Silkin, 2 specimens; Central, Cırcır, 15.V.2015, 798 m, leg. N. Silkin, 1 specimen; **Kayseri prov.:** Kocasinan, Ebiç, 23.VI.2016, 1053 m, leg. D. Şahin, 2 specimens; Kocasinan, Kalkancık, 23.VI.2016, 1111 m, leg. D. Şahin, 2 specimens; Kocasinan, Yuvalı, 24.VI.2016, 1115 m, leg. D. Şahin, 6 specimens; Tomarza, Köprübaşı, 12.VII.2016, 1350 m, leg. D. Şahin, 1 specimen; Yahyalı, Sarıoğlan, 14.VII.2016, 1120 m, leg. D. Şahin, 19 specimens. ***Remarks:*** The species is a new record to Bartın, Çankırı and Kayseri provinces for Turkey.

Phyllotreta fallaciosa Heikertinger, 1941

Phyllotreta fallaciosa Heikertinger, 1941: Koleop. Rund., 27: 76

This species is known only from Niğde province in Turkey. It is distributed in Europe (FR GR IT SP), North Africa (AG MO) and Asia (CY IN IS JO TR). ***Material examined:*** **Ankara prov.:** Kızılcahamam, Akdoğan, 22.VI.2015, 1031 m, leg. D. Şahin, 2 specimens; Polatlı, Yassıhöyük, 11.VIII.2015, 696 m, leg. D. Şahin, 2 specimens; Polatlı, Beypazarı, Hacıkara, 13.VIII.2015, 672 m, leg. D. Şahin, 1 specimen; Haymana, Soğulca, 17.VIII.2015, 930 m, leg. D. Şahin, 2 specimens; Şereflikoçhisar, Deliller, 27.VI.2016, 1267 m, leg. D. Şahin, 2 specimens; **Kayseri prov.:** Melikgazi, Sarımsaklı, 23.VI.2016, 1222 m, leg. D.

Şahin, 6 specimens; Kocasinan, Ebiç, 23.VI.2016, 1053 m, leg. D. Şahin, 1 specimen; Kocasinan, Yuvalı, 24.VI.2016, 1115 m, leg. D. Şahin, 1 specimen; Tomarza, Böke, 12.VII.2016, 1343 m, leg. D. Şahin, 2 specimens; Kocasinan, Çavuşağa, 14.VII.2016, 1152 m, leg. D. Şahin, 1 specimen; Yahyalı, Sarıoğlan, 14.VII.2016, 1120 m, leg. D. Şahin, 2 specimens. ***Remarks:*** The species is a new record to Ankara and Kayseri provinces for Turkey.

Phyllotreta fornuseki Cizek, 2003

Phyllotreta fornuseki Cizek, 2003: Klapalekiana, 39: 63

This species is known only from Isparta province in Turkey. It is distributed in Europe (CZ SK) and Asia (TR).

Phyllotreta ganglbaueri Heikertinger, 1909

Phyllotreta ganglbaueri Heikertinger, 1909: Verh. zool.–bot. Ges. Wien, 59: 290

This species is known from Antalya and Isparta provinces in Turkey. It is distributed in Europe (AU BH BU CR CZ FR IT PT RO SL SP SZ UK YU) and Asia (TR).

Phyllotreta judaea Pic, 1901

Phyllotreta judaea Pic, 1901: L'Echange, 17: 27

This species is known from Isparta and İzmir provinces in Turkey. It is distributed in Europe (BU SK) and Asia (AR IN IS JO TR).

Phyllotreta lativittata Kutschera, 1860

Phyllotreta lativittata Kutschera, 1860: Wien. Ent. Monatsch., 4: 307
Phyllotreta orientalis Baly, 1877: Trans. Ent. Soc. Lond., 1877: 178
Phyllotreta ruficollis Weise, 1888: Ins. Deutsch. Col. VI,. p. 859
Phyllotreta iris Reitter, 1891: Deutsch. Ent. Zeitschr., 1891: 35.
Phyllotreta rubrithorax Pic, 1900: L'Echange, 16: 80
Phyllotreta bisbinotata Pic, 1909: L'Echange, 25: 146
Phyllotreta ininterrupta Pic, 1909: L'Echange, 25: 156

This species is known from Erzurum, İzmir and Kars provinces in Turkey. It is distributed in Europe (GR IT MA) and Asia (AB AF AR CY IN IQ IS JO KI KZ LE OM SY TD TM TR UZ XIN). ***Material examined:*** **Bartın prov.:** Dallıca, 17.VI.2016, 97 m, leg. A. Barış, 1 specimen; **Zonguldak prov.:** Devrek, Yılanlıca, 02.VI.2016, 124 m, leg. C. Yücel, 2 specimens. ***Remarks:*** The species is a new record to Bartın and Zonguldak provinces for Turkey.

Phyllotreta lorestanica Warchałowski, 1973

Phyllotreta lorestanica Warchałowski, 1973: Pol. Pis. Ent., Wrocław, 43: 664

This species is known from Burdur and Erzurum provinces in Turkey. It is distributed in Asia (IN TR).

Phyllotreta maculicornis Pic, 1906

Phyllotreta maculicornis Pic, 1906: L'Echange, 22: 35

This species is known from Antalya, Isparta, Konya and Niğde provinces in Turkey. It is distributed in Asia (SY TR). ***Material examined:*** **Isparta prov.:** Gelendost, 11.V.1983, *Triticum,* leg. M. Kaya, 1 specimen; **Niğde prov.:** Altunhisar, Yeşilyurt, 29.VII.1997, leg. H. Özdikmen, 1 specimen.

Phyllotreta nemorum (Linnaeus, 1758)

Chrysomela nemorum Linnaeus, 1758: Syst. Nat., ed. 10: 373
Phyllotreta theresae Pic, 1909: L'Echange, 25: 157.
Phyllotreta künnemanni Reitter, 1905: Wien. Ent. Zeit., 24: 251

This species is known from Ankara, Bayburt, Bilecik, Bolu, Çorum, Edirne, Erzincan, Erzurum, Eskişehir, Isparta, İstanbul and Sivas provinces in Turkey. It is distributed in Europe (AL AU BE BH BU BY CR CT CZ DE EN FI FR GB GE GR HU IT LA LS LT LU MC MD NL NR NT PL RO SK SL SP ST SV SZ TR UK YU), Asia (AB CY ES FE GG IN IS KZ MG TD TR UZ WS "Korea") and introduced to Australian region. ***Material examined:*** **Bartın prov.:** Karasu, 12.V.2015, leg. D. Şahin, 4 specimens; Güzelcehisar, 12.V.2015, leg. D. Şahin, 1 specimen; **Bolu prov.:** Akçakoca, 03.VIII.1999, 400 m, *Corylus,* leg. M. Özdemir, 1 specimen; **Çankırı prov.:** Orta, 24.IV.2013, 21.V.2014, 1349-1487 m, leg. N. Silkin, 3 specimens. ***Remarks:*** The species is a new record to Bartın and Çankırı provinces for Turkey.

Phyllotreta nigripes nigripes (Fabricius, 1775)

Altica nigripes Fabricius, 1775: Syst. Ent., p. 113
Chrysomela lens Thunberg, 1784: Nova Acta Reg. Soc. Sci. Upsaliensis, 4: 13
Altica cruciferum Gmelin, 1790: Caroli a Linné Systema Naturae..., p. 1699
Haltica lepidii Koch, 1803: Ent. Hefte, 2: 64.
Phyllotreta arabidis Hoffmann, 1953: Rev. fr. d'Ent., 20: 187

This species is represented only by the nominotypical subspecies in Turkey. It is known from Adana, Ankara, Antalya, Bayburt, Bilecik, Edirne, Erzincan, Erzurum, Eskişehir, Hatay, Iğdır, Isparta, Kars, Kayseri, Konya, Manisa, Mersin, Sivas and Yozgat provinces in Turkey. It is distributed in Europe (AL AN AU BE BH BU BY CR CZ DE EN FI FR GB GE GR HU IT LA LT LU MC MD NL PL RO RU SK SL SP SV SZ TR UK YU), North Africa (AG CI EG MO TU) and Asia (AB AF CY IN IS KI KZ SY TD TR UZ). ***Material examined:*** **Afyon prov.:** Central, Gebeciler, 27.VII.1983, leg. T. Davarcı, 28 specimens; Bahçecik, 28.VII.1983, leg. T. Davarcı, 1 specimen; **Ankara prov.:** 10.V.1966, leg. E. Gülseren, 4 specimens; Atatürk Forest Farm, 21.VII.1980, leg. Y. Özdemir, 1 specimen; Ayaş, İlyakut, 31.VII.1980, leg. Y. Özdemir, 8 specimens; Beynam Forest, 16.VIII.1982, leg. Y. Özdemir, 16 specimens; Ayaş, Bayram, 16.VIII.1982, leg. Y. Özdemir, 8 specimens; Şereflikoçhisar, 25.VII.1983, leg. A. Kalkandelen, 3 specimens; Keskin, Central, 15.VII.1985, 1 specimen; Kalecik, Aktepe, 17.VII.1985, leg. H. Zeki, 1 specimen; Kalecik, Hacıköy, 17.VII.1985, leg. H. Zeki, 9 specimens; Polatlı, Düç, 08.V.1990 and 30.VII.1990, leg. M. Aydemir, 13 specimens; Sincan, İlyakut, 09.V.1990, leg. M. Aydemir, 15 specimens; Ayaş, Başbereket, 09.V.1990, leg. M. Aydemir, 2 specimens; Ayaş, Bayram, 09.V.1990, leg. M. Aydemir, 5 specimens; Çubuk, Sarıkoz, 16.V.1990, leg. M. Aydemir, 1 specimen; Çubuk, Sünlü, 16.V.1990, leg. M. Aydemir, 2 specimens; Ballıkuyumcu, 08.VIII.1990, leg. M. Aydemir, 2 specimens; Temelli, 08.VIII.1990, leg. M. Aydemir, 3 specimens; Kızılcahamam, Güvem, 28.V.1997, 1100 m, leg. H. Özdikmen, 1 specimen; Kızılcahamam, Yukarı Çanlı, 28.V.1997, 1250 m, leg. H. Özdikmen, 3 specimens; Kızılcahamam, Aköz village, 28.V.1997, 1150 m, leg. H. Özdikmen, 3 specimens; between Yenikent-Ayaş, 01.V.2003, 1000 m, leg. H. Özdikmen, 58 specimens; Nallıhan, Davutoğlan, 16.IV.2014, 474 m, leg. D. Şahin, 2 specimens; Beypazarı, Kayabükü, 16.IV.2014, 486 m, leg. D. Şahin, 31 specimens; Beypazarı, Kayabükü, 16.IV.2014, 627 m, leg. D. Şahin, 4 specimens; Nallıhan, Davutoğlan, 28.IV.2014, 474 m, leg. D. Şahin, 2 specimens; Haymana, 07.V.2015, 1025 m, leg. D. Şahin, 2 specimens; Haymana, Oyaca, 07.V.2015, 963 m, leg. D. Şahin, 1 specimen; Ayaş, Feruz, 29.V.2014, 1084 m, leg. D. Şahin, 4 specimens; Akyurt, Yeşiltepe, 30.VI.2014, 625 m, leg. D. Şahin, 1 specimens; Çubuk, 18.IV.2014, 978 m, leg. D. Şahin, 1 specimen; Ayaş, Feruz, 29.V.2014, 1084 m, leg. D. Şahin, 1 specimen; Nallıhan, Davutoğlan, 05.V.2015, 474 m, leg. D. Şahin, 3 specimens; Haymana, Soğulca, 07.V.2015, 948 m, leg. D. Şahin, 105 specimens; Sincan, Malıköy, 02.VI.2015, 721 m, leg. D. Şahin, 2 specimens; Haymana, 07.VII.2015, 1025 m, leg. D. Şahin, 12 specimens; Polatlı, Yassıhöyük, 11.VIII.2015, 696 m, leg. D. Şahin, 2 specimens; Polatlı, Beylikköprü, 11.VI.2015, 708 m, leg. D. Şahin, 2 specimens; Ayaş, Beypazarı road, 13.VIII.2015, 711 m, leg. D. Şahin, 5 specimens; Ayaş, Akkaya, 13.VIII.2015, 557 m, leg. D. Şahin, 2 specimens; Ayaş, Feruz, 13.VIII.2015, 1075 m, leg. D. Şahin, 8 specimens; Kalecik, 14.VIII.2015, 730 m, leg. D. Şahin, 4 specimens; Kalecik, Eskiköy, 14.08.2015, 1157 m, leg. D. Şahin, 4 specimens; Akyurt, Yeşiltepe, 14.VIII.2015, 1063 m, leg. D. Şahin, 5 specimens; Akyurt, Yeşiltepe, 14.VIII.2015, 1063 m, 1 specimens; Akyurt, Yeşiltepe, 14.VIII.2015, 1063 m, 1 specimens; Haymana, Soğulca, 17.VIII.2015, 930 m, leg. D. Şahin, 2 specimens; Kazan, Cimşit, 15.IX.2015, 857 m, leg. D. Şahin, 1 specimen; Şereflikoçhisar, Deliller, 27.VI.2016, 1267 m, leg. D. Şahin, 12 specimens; Çamlıdere, Çamkoru, 29.VII.2016, 1381 m, leg. D. Şahin, 1 specimen; **Bartın prov.:** Güzelcehisar, 12.V.2015, leg. D. Şahin, 1 specimen; **Bolu prov.:** Dörtdivan, 05-06.VII.1983, leg. S. Bilgitekin, 2 specimens; **Çankırı prov.:** Korgun, Çankırı-Korgun road, Aşağıçavuş village, 21.IV.2013, 837 m, leg. N. Silkin, 3 specimens; Korgun, 21-23.IV.2013, 837-1031 m, leg. N. Silkin, 18 specimens; Korgun, between Karatekin-Yolkaya village, 22.IV.2013, 957 m, leg. N. Silkin, 11 specimens; Korgun, Kayıçivi-Ildızım village return, 22.IV.2013, 982 m, leg. N. Silkin, 1 specimen; Korgun, exit of Bugay village, 22.IV.2013, 927 m, leg. N. Silkin, 1 specimen; Ilgaz, exit of Ilgaz-Gircen, 22.IV.2013, 887 m, leg. N. Silkin, 1 specimen; Ilgaz, 22.IV.2013, 25.VII.2013, 19.VII.2014, 885-1101 m, leg. N. Silkin, 5 specimens; Korgun, entry of Ildızım village, 23.IV.2013, 1031 m, leg. N. Silkin, 10 specimens; Eldivan, Maruf village, 23.IV.2013, 1196 m, leg. N. Silkin, 2 specimens; Eldivan, Akçalı Çukuröz return, 23.IV.2013, 1068 m, leg. N. Silkin, 1 specimen; Eldivan, between Akçalı-Çiftlikköy, 23.IV.2013, 1039 m, leg. N. Silkin, 4 specimens; Eldivan, 23.IV.2013, 922 m, leg. N. Silkin, 1 specimen; Eldivan, Akbulut, 23.IV.2013, 1196 m, leg. N. Silkin, 1 specimen; Eldivan, 23-24.IV.2013, 1039-1196 m, leg. N. Silkin, 8 specimens; Eldivan, entry of Hisarcıkkayı village, 24.IV.2013, 1084 m, leg. N. Silkin, 1 specimen; Orta, Yenilce village, 24.IV.2013, 1349 m, leg. N. Silkin, 13 specimens; Orta, 24.IV.2013, 24.V.2014, 1227-1602 m, leg. N. Silkin, 24 specimens; Şabanözü, 24.IV.2013, 1141 m, leg. N. Silkin, 2 specimens; Şabanözü, between Şabanözü-Eldivan road, 24.IV.2013, 1141 m, leg. N. Silkin, 2 specimens; Ilgaz, entry of Yuvasaray village, 25.VII.2013, 902 m, leg. N. Silkin, 1 specimen; Ilgaz, exit of Yuvasaray village, 25.VII.2013, 1101 m, leg. N. Silkin, 2 specimens; Ilgaz, entry of Eskikıymık village, 26.VII.2013, 1230 m, leg. N. Silkin, 2 specimens; Çerkeş, between Türbaşı-Dağçukurören village, 29.VIII.2013, 1271 m, leg. N. Silkin, 2 specimens; Kızılırmak, Karamürsel village return, 24.IV.2014, 550 m, leg. N. Silkin, 2 specimens; Central, Balıbağı plateau, 25.IV.2014, 774 m, leg. N. Silkin, 10 specimens; Kızılırmak, 24-25.IV.2014, 12.VII.-11.VIII.2014, 547-702 m, leg. N. Silkin, 7 specimens; Central, between Tuzlu-Dede village, 26.IV.2014, 874 m, leg. N. Silkin, 2 specimens; Central, 25-26.IV.2014, 15.VII.2014, 704-874 m, leg. N. Silkin, 16 specimens; Central, Haydarköy return, Alaçat village, 26.IV.2014, 704 m, leg. N. Silkin, 1 specimen; Central, Danabaşı village, 26.IV.2014, 724 m, leg. N. Silkin, 1 specimen; Orta, entry of Sakarcaören village, 20.V.2014, 1305 m, leg. N. Silkin, 1 specimen; Orta, exit of Sakaeli, 21.V.2014, 1227 m, leg. N. Silkin, 3 specimens; Orta, Elden village, 21.V.2014, 1446 m, leg. N. Silkin, 1 specimen; Orta, entry of Dodurga, 22.V.2014, 1351 m, leg. N. Silkin, 1 specimen; Orta, Kayıören return, 22.V.2014, 1602 m, leg. N. Silkin, 6 specimens; Orta, entry of İncecik village, 22.V.2014, 1600 m, leg. N. Silkin, 8 specimens; Orta, between Bulduk-Yenice, 24.V.2014, 1400 m, leg. N. Silkin, 1 specimen; Orta, İnkılap village, 24.V.2014, 1290 m, leg. N. Silkin, 1 specimen; Central, Aşağıçavuş return, 15.VII.2014, 826 m, leg. N. Silkin, 4 specimens; Ilgaz, entry of Gaziler, 19.VII.2014, 885 m, leg. N. Silkin, 2 specimens; Kızılırmak, Yeniyapan village, 11.VIII.2014, 702 m, leg. N. Silkin, 1 specimen; Korgun, exit of Buğay, 16.IV.2015, leg. N. Silkin, 1 specimen; Kurşunlu, Kapaklı-Taşkaracalar, 17.IV.2015, 1318 m, leg. N. Silkin, 1 specimen; Orta, entry of Doğanlar village, 17.IV.2015, 1450 m, leg. N. Silkin, 3 specimens; Orta, exit of Sancar village, 17.IV.2015, leg. N. Silkin, 4 specimens; Çerkeş, 1 km to Kocamustafa village, 19.IV.2015, 1182 m, leg. N. Silkin, 11 specimens; Çerkeş, Yalıözü-Ova, 19.IV.2015, 1154 m, leg. N. Silkin, 1 specimen; Çerkeş, entry of Aliözü village, 20.IV.2015, 1221 m, leg. N. Silkin, 3 specimens; Çerkeş, Çaylı village, 20.IV.2015, 931 m, leg. N. Silkin, 1 specimen; Atkaracalar, Zerdeş return, 21.IV.2015, 1212 m, leg. N. Silkin, 2 specimens; Bayramören, entry of Üçgazi village, 24.IV.2015, 847 m, leg. N. Silkin, 1 specimen; Bayramören, Erenler-Dolaşlar, 24.IV.2015, 925 m, leg. N. Silkin, 4 specimens; Bayramören, exit of Yurtpınar village, 24.IV.2015, 829 m, leg. N. Silkin, 8 specimens; Atkaracalar, entry of Eyüpözü village, 25.IV.2015, leg. N. Silkin, 1 specimen; Atkaracalar, Eyüpözü-Hüyük, 25.IV.2015, leg. N. Silkin, 2 specimens; Kurşunlu, exit of Çaylıca village, 25.IV.2015, leg. N. Silkin, 2 specimens; Ilgaz, Ödemiş village, 25.IV.2015, 1033 m, leg. N. Silkin, 1 specimen; Ilgaz, Ödemiş-Çaltıpınar, 25.IV.2015, 971 m, leg. N. Silkin, 1 specimen; Kurşunlu, Yeşilören village road, 26.IV.2015, 1027 m, leg. N. Silkin, 12 specimens; Ilgaz, exit of Belören village, 26.IV.2015, 923 m, leg. N. Silkin, 1 specimen; Ilgaz, Candere-Bükcük villages, 26.IV.2015, 874 m, leg. N. Silkin, 27 specimens; Ilgaz, entry of Musa village, 27.IV.2015, 1013 m, leg. N. Silkin, 2 specimens; Ilgaz, Ovaç village, 27.IV.2015, 1099 m, leg. N. Silkin, 1 specimen; Central, Akçavalı-Başeğmez villages' road, 27.IV.2015, leg. N. Silkin, 2 specimens; Central, entry of Başeğmez village, 27.IV.2015, 870 m, leg. N. Silkin, 1 specimen; Yapraklı, Yenice-

Yüklü, 27.IV.2015, 926 m, leg. N. Silkin, 16 specimens; Central, Dede return, 29.IV.2015, leg. N. Silkin, 5 specimens; Central, exit of Küçüklü village, 29.IV.2015, leg. N. Silkin, 1 specimen; Central, Ova village, 29.IV.2015, leg. N. Silkin, 10 specimens; Central, Ova-Kuzuköy, 29.IV.2015, leg. N. Silkin, 2 specimens; Central, Kuzuköy return, 29.IV.2015, leg. N. Silkin, 1 specimen; Central, Kuzuköy-Çırçır villages, 29.IV.2015, leg. N. Silkin, 24 specimens; Central, entry of Ünür, 29.IV.2015, 952 m, leg. N. Silkin, 2 specimens; Central, Çağbeyi-Satıyüzü villages, 29.IV.2015, 952 m, leg. N. Silkin, 1 specimen; Central, Beşdut village, 29.IV.2015, leg. N. Silkin, 2 specimens; Yapraklı, Gürmeç-Kayacık, 29.IV.2015, leg. N. Silkin, 5 specimens; Yapraklı, İğdir road, 30.IV.2015, 1068 m, leg. N. Silkin, 7 specimens; Yapraklı, exit of Aşağıöz village, 30.IV.2015, 1139 m, leg. N. Silkin, 6 specimens; Yapraklı,護Bademçay village return, 30.IV.2015, leg. N. Silkin, 11 specimens; Yapraklı, Ayva village road, 30.IV.2015, 1256 m, leg. N. Silkin, 14 specimens; Eldivan, Büyükhacıbey village, 30.IV.2015, 923 m, leg. N. Silkin, 3 specimens; Central, Aşağıçavuş-Yukarıçavuş return, 09.V.2015, 837 m, leg. N. Silkin, 13 specimens; Central, Yukarıçavuş-Paşaköy, 09.V.2015, 953 m, leg. N. Silkin, 6 specimens; Kurşunlu, 4 km to Dağören, 10.V.2015, 1110 m, leg. N. Silkin, 1 specimen; Central, Kılıççarkı, 13.V.2015, 737 m, leg. N. Silkin, 4 specimens; Eldivan, Akbulut village, 13.V.2015, 1314 m, leg. N. Silkin, 1 specimen; Central, Balıbağı village, 15.V.2015, 1037 m, leg. N. Silkin, 1 specimen; Central, Ovacık-Kuzuköy, 15.V.2015, 919 m, leg. N. Silkin, 13 specimens; Central, entry of Kuzuköy, 15.V.2015, 708 m, leg. N. Silkin, 4 specimens; Central, Alaçatı, 15.V.2015, 870 m, leg. N. Silkin, 2 specimens; Central, Altınlı, 15.V.2015, 725 m, leg. N. Silkin, 2 specimens; Central, Cırcır, 15.V.2015, 798 m, leg. N. Silkin, 7 specimens; Central, entry of Karadayı, 16.V.2015, 856 m, leg. N. Silkin, 1 specimen; Yapraklı, Yamaçbağı-Söğütlü, 26.V.2015, 1125 m, leg. N. Silkin, 2 specimens; Ilgaz, exit of Belören, 27.V.2015, 903 m, leg. N. Silkin, 4 specimens; Ilgaz, Belören-Şeyhyunus, 27.V.2015, 889 m, leg. N. Silkin, 1 specimen; Çerkeş, Akbaş-Kuzuören-Çayı-Kabak-Yıprak villages return, 22.VI.2015, 1257 m, leg. N. Silkin, 1 specimen; **Eskişehir prov.:** Seyitgazi, Central, 11.VII.1973, *Triticum*, leg. G. Altınayar, 1 specimen; Central, Geçitkuşağı Institute, 12.V.2016, leg. C. Yücel, 1 specimen; **Kayseri prov.:** İncesu, Örenşehir, 20.VI.2016, 1034 m, leg. D. Şahin, 3 specimens; İncesu, Semerkent, 20.VI.2016, 1090 m, leg. D. Şahin, 1 specimen; Develi, Çölgölü, 20.VI.2016, 1078 m, leg. D. Şahin, 1 specimen; Develi, Yahyalı road, 21.VI.2016, 1164 m, leg. D. Şahin, 2 specimens; Yahyalı, Kirazlı, 22.VI.2016, 1408 m, leg. D. Şahin, 1 specimen; Melikgazi, Sarımsaklı, 23.VI.2016, 1220 m, leg. D. Şahin, 5 specimens; Kocasinan, Ebiç, 23.VI.2016, 1053 m, leg. D. Şahin, 6 specimens; Kocasinan, Yuvalı, 24.VI.2016, 1115 m, leg. D. Şahin, 5 specimens; Yeşilhisar, Kavak road, 11.VII.2016, 1460 m, leg. D. Şahin, 2 specimens; Tomarza, Köprübaşı, 12.VII.2016, 1350 m, leg. D. Şahin, 3 specimens; Tomarza, Şiraz village, 12.VII.2016, 1438 m, leg. D. Şahin, 12 specimens; Tomarza, Böke, 12.VII.2016, 1343 m, leg. D. Şahin, 1 specimen; Talas, Ardıç, 12.VII.2016, 1549 m, leg. D. Şahin, 1 specimen; İncesu, Kızılören, 13.VII.2016, 1965 m, leg. D. Şahin, 38 specimens; Yahyalı, Sarıoğlan, 14.VII.2016, 1120 m, leg. D. Şahin, 214 specimens; Kocasinan, Çavuşağa, 14.VII.2016, 1152 m, leg. D. Şahin, 24 specimens; **Konya prov.:** Göztepe, 08.VII.1986, leg. H. Zeki, 1 specimen; **Mersin prov.:** Mut-Karaman road, 1345m, 02.VI.2001, leg. H. Özdikmen, 1 specimen. ***Remarks:*** The species is a new record to Afyon, Bartın, Bolu and Çankırı provinces for Turkey.

Phyllotreta nodicornis (Marsham, 1802)

Chrysomela nodicornis Marsham, 1802: Ent. Brit., 1: 204
Haltica antennata Koch, 1803: Ent. Hefte, 2: 67
Phyllotreta oncera Maulik, 1926: The Fauna British India, p. 378

This species is known from Ankara, Erzurum, Eskişehir, Isparta, Manisa and Sivas provinces in Turkey. It is distributed in Europe (AU BE BH BU CR CZ FR GB GE HU IT LU NL PL PT RO SK SL SP ST SZ UK YU) and Asia (TR UP). ***Material examined:*** **Ankara prov.:** Haymana, 07.V.2015, 1025 m, leg. D. Şahin, 1 specimen; **Çankırı prov.:** Çerkeş, return of Türbaşı village, 27.IV.2014, 626 m, N. Silkin, 1 specimen; Atkaracalar, Zerdeş return, 21.IV.2015, 1212 m, leg. N. Silkin, 1 specimen; Central, Akçavalı-Başeğmez villages' road, 27.IV.2015, leg. N. Silkin, 1 specimen; Central, entry of Ünür, 29.IV.2015, 952 m, leg. N. Silkin, 2 specimens; Çerkeş, Avşar-Kükürt, 20.VI.2015, 1205 m, leg. N. Silkin, 1 specimen. ***Remarks:*** The species is a new record to Çankırı province for Turkey.

Phyllotreta ochripes (Curtis, 1837)

Haltica horticola C. F. W. Richter, 1820: Suppl. Faun. Ins. Eur. I, p. 8. [DA]
Altica ochripes Curtis, 1837: Brit. Ent., 14: 630
Haltica excisa L. Redtenbacher, 1849: Fauna Austr., p. 532
Phyllotreta caucasica Harold, 1879: Col. Hefte, 16: 231
Phyllotreta cruciata Weise, 1888: Ins. Deutsch. Col., 6: 867
Phyllotreta eximia Guillebeau, 1895: Bull. Soc. Ent. Fr., p. xxvii
Phyllotreta burdigalensis Pic, 1909: L'Echange, 25: 178
Phyllotreta comanensis Pic, 1912: Bull. Soc. Ent. Fr., p. 136
Phyllotreta kerkhoveni Everts, 1919: Ent. Ber., 5: 175

This species is known from Giresun, İstanbul and Niğde provinces in Turkey. It is distributed in Europe (AU BE BH BU BY CR CZ DE FI FR GB GE GR HU IT LA LT LU NL NR PL PT RO RU SK SL SP ST SV SZ TR UK YU) and Asia (AB ES FE IN JA TR). ***Material examined:*** **Niğde prov.:** Exit of Ulukışla, 29.V.2001, 1350 m, leg. H. Özdikmen, 3 specimens; **Zonguldak prov.:** Devrek, Yılanlıca, 02.VI.2016, 124 m, leg. C. Yücel, 6 specimens; Beycuma, Korucuk, 02.VI.2016, 130 m, leg. C. Yücel, 1 specimen. ***Remarks:*** The species is a new record to Zonguldak province for Turkey.

(*) *Phyllotreta oltuensis* Gruev & Aslan, 1998

Phyllotreta oltuensis Gruev & Aslan, 1998: Türk. entomol. derg., 22: 166

This species is known only from Erzurum province in Turkey. It is distributed in Asia (TR).

(*) *Phyllotreta ozbeki* Gruev & Aslan, 1998

Phyllotreta ozbeki Gruev & Aslan, 1998: Türk. entomol. derg., 22: 167

This species is known only from Bayburt province in Turkey. It is distributed in Asia (TR).

Phyllotreta pallidipennis Reitter, 1891

Phyllotreta pallidipennis Reitter, 1891: Deutsch. Ent. Zeitschr., 1891: 34
Phyllotreta dilutipennis Reitter, 1891: Deutsch. Ent. Zeitschr., 1891: 35
Phyllotreta turcmenica Weise, 1900: Deutsch. Ent. Zeitschr., 1900: 138
Phyllotreta schreineri Jakobson, 1916: Rev. Rus. d'Ent., 15: 72

This species is known from Ankara and Kayseri provinces in Turkey. It is distributed in Europe (ST UK) and Asia (AF ES IN KI KZ MG PA TD TM TR UZ XIZ WS). ***Material examined:*** **Ankara prov.:** between Yenikent-Ayaş, 01.V.2003, 1000 m, leg. H. Özdikmen, 5 specimens; **Kayseri prov.:** İncesu, Örenşehir, 20.VI.2016, 1034 m, leg. D. Şahin, 6 specimens; Yeşilhisar, Sultansazlığı, 20.VI.2016, 1070 m, leg. D. Şahin, 1 specimen; Develi, Çölgölü, 20.VI.2016, 1078 m, leg. D. Şahin, 54 specimens; Kocasinan, Kalkancık, 23.VI.2016, 1111 m, leg. D. Şahin, 2 specimens.

Phyllotreta pontoaegeica Gruev, 1982

Phyllotreta pontoaegeica Gruev, 1982: Deuthsch. Ent. Zeitschr., N. F., 29: 99

This species is known from Antalya, Isparta and Mersin provinces in Turkey. It is distributed in Europe (BU GR) and Asia (TR). ***Material examined:*** **Çankırı prov.:** Korgun, 21.IV.2013, 666 m, leg. N. Silkin, 1 specimen; Eldivan, 23.IV.2013, 1196 m, leg. N. Silkin, 3 specimens; Ilgaz, 26.VII.2013, 1230 m, leg. N. Silkin, 2 specimens; Orta, 22.V.2014, 1600 m, leg. N. Silkin, 1 specimen; Şabanözü, 23.V.2014, 1091-1221 m, leg. N. Silkin, 2 specimens. ***Remarks:*** The species is a new record to Çankırı province for Turkey.

Phyllotreta praticola Weise, 1887

Phyllotreta praticola Weise, 1887: Deutsch. Ent. Zeitschr., 31: 333
Phyllotreta fucata Weise, 1890: Wien. Ent. Z., 9: 112

This species is known from Erzurum, İstanbul and Kayseri provinces in Turkey. It is distributed in Europe (ST) and Asia (AB AF ES IN KI KZ MG TD TR UZ WS "India" NW

China").

Phyllotreta procera (Redtenbacher, 1849)

Haltica procera L. Redtenbacher, 1849: Fauna Austr., p. 530
Haltica subtilis Wollaston, 1854: Ins. Maer., p. 441.
Phyllotreta carreti Monnot, 1913: Insecta, 3: 233

This species is known from Adana, Ankara, Antalya, Erzincan, Erzurum, Eskişehir, Isparta and Konya provinces in Turkey. It is distributed in Europe (AN AU BE BH BU CR CZ FR GB GE GR HU IT LU MA MC NL PT RO RU SK SL SP SZ UK YU), North Africa (AG CI MO MR TU), Asia (AB CY GG IN IS JO TD TM TR) and Afrotropical region. ***Material examined:*** **Ankara prov.:** Haymana, 07.V.2015, 1025 m, leg. D. Şahin, 1 specimen; **Çankırı prov.:** Yapraklı, Ayva village road, 30.IV.2015, 1256 m, leg. N. Silkin, 1 specimen. ***Remarks:*** The species is a new record to Çankırı province for Turkey.

Phyllotreta punctulata (Marsham, 1802)

Chrysomela nigroaenea Marsham, 1802: Ent. Brit., p. 197 [DA]
Chrysomela punctulata Marsham, 1802: Ent. Brit., p. 200
Phyllotreta aerea Allard, 1859: Bull. Soc. Ent. Fr., 1859: 100

This species is known from Antalya, Bursa, Burdur, Eskişehir, Giresun, Isparta, İstanbul and Kırklareli provinces in Turkey. It is distributed in Europe (AU BE BH BU CR CZ FR GB GE GR HU IT LU MC MD NL PL PT RO RU SK SL SP ST SZ TR UK YU), North Africa (MO), Asia (AB IS TR) and introduced to Nearctic region. ***Material examined:*** **Ankara prov.:** Haymana, 07.V.2015, 1025 m, leg. D. Şahin, 2 specimens; **Bartın prov.:** Güzelcehisar, 12.V.2015, leg. D. Şahin, 2 specimens; **Çankırı prov.:** Eldivan, 23.IV.2013, 922 m, leg. N. Silkin, 1 specimen; Orta, 24.IV.2013, 20-22.V.2014, 1257-1600 m, leg. N. Silkin, 5 specimens; Şabanözü, 24.IV.2013, 11.VII.2014, 1120-1141 m, leg. N. Silkin, 2 specimens. ***Remarks:*** The species is a new record to Ankara, Bartın and Çankırı provinces for Turkey.

Phyllotreta reitteri Heikertinger, 1911

Phyllotreta reitteri Heikertinger, 1911: Verh. zool.-bot. Ges., 61: 159

This species is known only from Denizli province in Turkey. It is distributed in Europe (UK) and Asia (KZ TR UZ).

Phyllotreta sisymbrii Weise, 1888

Phyllotreta sisymbrii Weise, 1888: Ins. Deutsch. Col., 6: 860

This species is known from Ankara and Erzurum provinces in Turkey. It is distributed in Europe (ST) and Asia (AB AR GG IN SY TR).

Phyllotreta striolata (Illiger, 1803)

Crioceris vittata Fabricius, 1801: Syst. El. I., p. 469 [HN]
Crioceris striolata Illiger, 1803: Mag. Ins., 2: 293
Haltica sinuata L. Redtenbacher, 1849: Fauna Austr., p. 532.
Aphtona strigula Montrouzier, 1864: Ann. Soc. Linn. Lyon (N. S.), 11: 202
Phyllotreta discedens Weise, 1888: Ins. Deutsch. Col., 6: 871
Phyllotreta monticola Weise, 1888: Ins. Deutsch. Col., 6: 871
Phyllotreta lineolata Chittenden, 1927: Ent. Amer., 8: 25
Phyllotreta vernicosa Chittenden, 1927: Ent. Amer., 8: 25
Phyllotreta artivitta Chittenden, 1927: Ent. Amer., 8: 26.

This species is known from Düzce, Edirne and Erzurum provinces in Turkey. It is distributed in Europe (AL AU BE BH BU BY CR CZ DE EN FI FR GB GE GR HU IT LA LS LT LU MC NL NR PL PT RO RU SK SL SP SV SZ TR UK YU), Asia (AB ANH AR FE FUJ GAN GUA GUI GUX HAI HEI HKG HUB JA JIA KZ MG NP SCH SD TAI TR XIZ YUN ZHE "Korea"), Australian and Oriental regions, and introduced to Afrotropical and Nearctic regions. ***Material examined:*** **Düzce prov.:** Akçakoca, Kirazlı, 30.VIII.1988, *Corylus*, leg. Ö. Ataç, 1 specimen; **Zonguldak prov.:** Devrek, Yılanlıca, 02.VI.2016, and 15.VI.2016, 124 m, leg. C. Yücel, 4 specimens. ***Remarks:*** The species is a new record to Zonguldak province for Turkey.

Phyllotreta tetrastigma (Comolli, 1837)

Altica tetrastigma Comolli, 1837: Col. nov. prov. Novocom., p. 47.

This species is known from Artvin and Erzurum provinces in Turkey. It is distributed in Europe (AU BE BH BU BY CR CZ DE EN FI FR GB GE HU IT LA LS LT LU NL NR PL RO RU SK SL SP SV SZ UK) and Asia (ES TR).

(*) *Phyllotreta toelgi* Heikertinger, 1941

Phyllotreta toelgi Heikertinger, 1941: Koleop. Rund., 27: 104

This species is known from Eskişehir and Ordu provinces in Turkey. It is distributed in Asia (TR). ***Material examined:*** **Ordu prov.:** 15.VII.1965, leg. M. Işık, 1 specimen.

Phyllotreta undulata (Kutschera, 1860)

Phyllotreta undulata Kutschera, 1860: Wien. Ent. Monatschr., 4: 301
Phyllotreta australis Blackburn, 1890: Trans. Roy. Soc. S. Aust., 13: 146
Phyllotreta biinterrupta Pic, 1915: L'Echange, 31: 33
Phyllotreta blackburni Bryant, 1925: Ann. Mag. Nat. Hist., 15: 596
Phyllotreta vittigera Broun, 1893: Man. New Zealand Col., p. 1392

This species is known from Bilecik, Erzurum, Eskişehir and İstanbul provinces in Turkey. It is distributed in Europe (AL AU BE BH BU BY CR CZ DE EN FI FR GB GE GR HU IT LA LS LT LU MC NL NR PL PT RO RU SK SL SP ST SV SZ TR UK YU), North Africa (AG), Asia (AB AR ES FE KI KZ MG TM TR UZ) and introduced to Australian and Nearctic regions. ***Material examined:*** **Ankara prov.:** Nallıhan, Davutoğlan, 05.V.2015, leg. D. Şahin, 1 specimen; Haymana, Soğulca, 07.V.2015, 948 m, leg. D. Şahin, 1 specimen; **Bartın prov.:** Güzelcehisar, 12.V.2015, leg. D. Şahin, 27 specimens; **Çankırı prov.:** Çerkeş, Kuzözeren village, 19.VIII.2014, 1081 m, leg. N. Silkin, 1 specimen; Yapraklı, Ayva village road, 30.IV.2015, 1256 m, leg. N. Silkin, 1 specimen; **Kayseri prov.:** Tomarza, Böke, 12.VII.2016, 1343 m, leg. D. Şahin, 1 specimen; İncesu, Kızılören, 13.VII.2016, 1965 m, leg. D. Şahin, 2 specimens; Yahyalı, Sarıoğlan, 14.VII.2016, 1120 m, leg. D. Şahin, 2+1 specimens; **Zonguldak prov.:** Devrek, 26.V.2015, leg. C. Yücel, 2 specimens; Devrek, Yassıören, 15.VI.2015, leg. C. Yücel, 16 specimens; Devrek, 20.IV.2016, leg. A. Barış, 6 specimens; Beycuma, Yörükler, 02.VI.2016, 232 m, leg. C. Yücel, 1 specimen; Devrek, Yılanlıca, 02 and 15.VI.2016, 124 m, leg. C. Yücel, 20 specimens. ***Remarks:*** The species is a new record to Ankara, Bartın, Çankırı, Kayseri and Zonguldak provinces for Turkey.

Phyllotreta variipennis variipennis (Boieldieu, 1859)

Haltica variipennis Boieldieu, 1859: Ann. Soc. Ent. Fr., 3, 7: 477
Phyllotreta varians Foudras, 1860: Ann. Soc. Linn. Lyon, (N. S.), 6: 360

This species is represented only by the nominal subspecies in Turkey. It is known from Ankara, Eskişehir, Isparta, İstanbul and İzmir provinces in Turkey. It is distributed in Europe (BH BU CR FR GR IT MA MC PT SL SP SZ TR YU), North Africa (AG CI MO TU) and Asia (CY IN IQ IS TR). ***Material examined:*** **Bartın prov.:** Güzelcehisar, 12.V.2015, leg. D. Şahin, 11 specimens; Dallıca, 17.VI.2016, 97 m, leg. A. Barış, 2 specimens; **Karaman prov.:** 2015, leg. D. Şahin, 9 specimens; **Zonguldak prov.:** Devrek, 26.V.2015, leg. C. Yücel, 4 specimens; Devrek, Yassıören, 15.VI.2015, leg. C. Yücel, 12 specimens; Devrek, 20.IV.2016, leg. A. Barış, 3 specimens; Yılanlıca, 02.VI.2016, 124 m, leg. C. Yücel, 28 specimens; Beycuma, Korucuk, 02.VI.2016, 130 m, leg. C. Yücel, 11 specimens; Beycuma, Yörükler, 02.VI.2016, 232 m, leg. C. Yücel, 2 specimens. ***Remarks:*** The species is a new record to Bartın, Karaman and Zonguldak provinces for Turkey.

Phyllotreta vilis Weise, 1888

Phyllotreta vilis Weise, 1888: Ins. Deutsch. Col., 6: 861
Phyllotreta seidlitzi Weise, 1888: Ins. Deutsch. Col., 6: 861

This species is known from Ankara, Isparta, İstanbul, İzmir and Mersin provinces in

Turkey. It is distributed in Europe (BU CR GR IT) and Asia (TR). ***Material examined:*** **Ankara prov.:** Ayaş, İlyakut, 31.VII.1980, leg. Y. Özdemir, 1 specimen; **Isparta prov.:** Gelendost, 11.V.1983, *Triticum,* leg. M. Kaya, 1 specimen.

Phyllotreta vittula **(Redtenbacher, 1849)**

Haltica vittula L. Redtenbacher, 1849: Fauna Austr., p. 532
Phyllotreta vittula ssp. *exigua* Heikertinger, 1911: Verh. Zool.-bot. Ges. Wien, 61: 160
Phyllotreta rivularis Motschulsky, 1849: Bull. Mosc., 22: 147.

This species is known from Ankara, Antalya, Edirne, Erzurum, Isparta, İzmir provinces in Turkey. It is distributed in Europe (AL AU BE BH BU BY CR CZ DE EN FI FR GB GE GR HU IR IT LA LT LU MC NL NR PL RO RU SK SL SP SV SZ TR UK YU), Asia (AB AF ES FE HEI IN KI KZ MG TD TR WS "Korea") and introduced to Nearctic region.

Phyllotreta weiseana **Jakobson, 1901**

Phyllotreta weiseana Jakobson, 1901: Öfv. Finska Vetesk.-Soc. Förh., 43: 141
Phyllotreta denticornis Weise, 1890: Wien. Ent. Z., 9: 112 [HN]

This species is known from Ankara, Bayburt, Erzurum and Konya provinces in Turkey. It is distributed in Europe (ST UK) and Asia (AB IN KZ TR). ***Material examined:*** **Ankara prov.:** Polatlı, Yassıhöyük, 11.VIII.2015, 696 m, leg. D. Şahin, 1 specimen; **Kayseri prov.:** Develi, Çölgölü, 20.VI.2016, 1078 m, leg. D. Şahin, 1 specimen; Kocasinan, Karakimse, 23.VI.2016, 1154 m, leg. D. Şahin, 1 specimen; Kocasinan, Ebiç, 23.VI.2016, 1053 m, leg. D. Şahin, 3 specimens; Kocasinan, Kalkancık, 23.VI.2016, 1111 m, leg. D. Şahin, 2 specimens; Kocasinan, Yuvalı, 24.VI.2016, 1115 m, leg. D. Şahin, 8 specimens; Tomarza, Böke, 12.VII.2016, 1343 m, leg. D. Şahin, 4 specimens; Tomarza, Köprübaşı, 12.VII.2016, 1350 m, leg. D. Şahin, 1 specimen; Akkışla, Alevkışla, 14.VII.2016, 1278 m, leg. D. Şahin, 1 specimen. ***Remarks:*** The species is a new record to Kayseri province for Turkey.

DISCUSSION

The center of diversity of the genus *Phyllotreta* Chevrolat seems to be in temperate regions. *Phyllotreta* Chevrolat is one of the largest alticine genera with 144 species in the Palearctic region and more than 250 species worldwide (Döberl in Löbl & Smetana, 2010; Konstantinov & Vandenberg, 2015).

According to findings, Turkish fauna of *Phyllotreta* Chevrolat includes 44 species with the newly described species, *P. aygulae* and *P. bilgeae*, and a new record, *P. araxicola*. Thus Turkish *Phyllotreta* fauna is rather rich. It is represented with approximately 31% of Palaearctic species. Among them, six species are endemic to Turkey now as *P. aygulae* Özdikmen et al., *P. bilgeae* Özdikmen & Coral Şahin, *P. bolognai* Biondi, *P. oltuensis* Gruev & Aslan, *P. ozbeki* Gruev & Aslan and *P. toelgi* Heikertinger. So the endemism ratio for *Phyllotreta* in Turkey is approximately 14%. Another endemic species *P. ispartaensis* Gök, 2005 was synonymized with *P. maculicornis* Pic, 1906 by Ekiz et al. (2013).

In the present work, a total of 2864 specimens of 27 species of the genus were examined. These species that constitute approximately 61% of whole Turkish fauna, are *P. araxicola* (1 specimen), *P. astrachanica* (34 specimens), *P. atra* (919 specimens), *P. aygulae* (26 specimens), *P. bilgeae* (2 specimens), *P. caucasicola* (3 specimens), *P. corrugata* (106 specimens), *P. cruciferae* (204 specimens), *P. diademata* (11 specimens), *P. erysimi* (39 specimens), *P. fallaciosa* (22 specimens), *P. lativittata* (3), *P. maculicornis* (2 specimens), *P. nemorum* (9 specimens), *P. nigripes* (1183 specimens), *P. nodicornis* (6 specimens), *P. ochripes* (10 specimens), *P. pallidipennis* (68 specimens), *P. pontoaegeica* (9 specimens), *P. procera* (2 specimens), *P. punctulata* (12 specimens), *P. striolata*

(5 specimens), *P. toelgi* (1 specimen), *P. undulata* (81 specimens), *P. variipennis* (82 specimens), *P. vilis* (2 specimens) and *P. weiseana* (22 specimens).

Accordingly eleven species are recorded for the first time from Çankırı province as *P. atra*, *P. caucasicola*, *P. corrugata*, *P. erysimi*, *P. nemorum*, *P. nigripes*, *P. nodicornis*, *P. pontoaegeica*, *P. procera*, *P. punctulata* and *P. undulata*. Eleven species are recorded for the first time from Bartın province as *P. astrachanica*, *P. atra*, *P. cruciferae*, *P. diademata*, *P. erysimi*, *P. lativittata*, *P. nemorum*, *P. nigripes*, *P. punctulata*, *P. undulata* and *P. variipennis*. Seven species are recorded for the first time from Zonguldak province as *P. atra*, *P. cruciferae*, *P. lativittata*, *P. ochripes*, *P. striolata*, *P. undulata* and *P. variipennis*. Four species are recorded for the first time from Kayseri province as *P. erysimi* Weise, *P. fallaciosa*, *P. undulata* and *P. weiseana*. Three species are recorded for the first time from Ankara province as *P. fallaciosa*, *P. punctulata* and *P. undulata*. Two species are recorded for the first time from Karaman province as *P. atra* and *P. variipennis*. Two species are recorded for the first time from Afyon province as *P. atra* and *P. nigripes*. One species is recorded for the first time from Bolu province as *P. nigripes*. And one species is recorded for the first time from Şanlıurfa province as *P. corrugata*.

Moreover, in the present review, the records of European Turkey of *P. cruciferae* and *P. diademata* and the records of Anatolia of *P. fornuseki*, *P. ganglbaueri* and *P. lorestanica* are firstly given in addition to the distribution data in the Palaearctic catalogue of Döberl in Löbl & Smetana (2010).

LITERATURE CITED

Allard, E. 1859. Diagnoses latines de quelques haltises de France. Bulletin de la Société Entomologique de France, 1859: 100-102.

Aslan, İ., Gruev, B. A. & Özbek, H. 1999. A Preliminary Review of the Subfamily Alticinae (Coleoptera, Chrysomelidae) in Turkey. Turkish Journal of Zoology, 23: 373-414.

Aslan, İ., Özbek, H. & Warchałowski, A. 2004. Five new records, new localities and new host plants for the Turkish flea-beetle fauna (Coleoptera, Chrysomelidae, Alticinae). Entomologica Fennica, 15: 138-141.

Aslan, E. G. & Gök, A. 2006. New records of five flea beetles for the Turkish fauna (Coleoptera: Chrysomelidae, Alticinae). Entomologische Zeitschrift, 116: 119-121.

Baly, J. S. 1877. Descriptions of new genera and of uncharacterized species of Halticinae. The Transactions of the Entomological Society of London, 1877: 157-184.

Biondi, M. 1992. Note sui crisomelidi alticini della fauna di Turchia, con descrizione di tre nuove specie (Coleoptera, Chrysomelidae, Alticinae). Fragmenta Entomologica, Roma, 23: 341-354.

Blackburn, T. 1890. Notes on Australian Coleoptera with descriptions of new genera and species. Transactions of the Royal Society of South Australia, 13: 121-160.

Broun, T. 1893. Manual of the New Zealand Coleoptera. Parts V-VII. Wellington: Goverment Printer, pp. 975-1504.

Bryant, G. E. 1925. New species of Phytophaga from the Fiji Islands. The Annals and Magazine of Natural History, 15: 590-600.

Caillol, H. 1914. *Catalogue* des Coléoptères de Provence 3. Mémoires de la Société Linnéenne de Provence, 1914: 1–594.

Chittenden, F. H. 1927. The species of *Phyllotreta* North of Mexico. Entomologica Americana (N. S.), 8: 1-62.

Cizek, P. 2003. *Phyllotreta fornuseki* sp. n. (Coleoptera: Chrysomelidae) aus Mähren und aus der Slowakei. Klapalekiana, 39: 63-65.

Comolli, A. 1837. De Coleopteris novis ac rarioribus minusve cognitis provinciae Novocomi. Ticini Regii, 54 pp.

Curtis, J. 1837. British Entomology; being illustrations and descriptions of the genera of Insects found in Great Britain and Ireland: containing coloured cigures from nature of the most rare and beautiful species, and in many instances of the plants upon which they are found. London, 14: 626-673.

Çılbıroğlu, E. G. 2003. Isparta İli Alticinae (Coleoptera: Chrysomelidae) Türlerinin Ekofaunası. Süleyman Demirel Üniversitesi, 90 pp. Isparta (Master thesis).

Döberl, M. 2010. Alticinae. Pp. 491-563 in: Löbl, I. & Smetana, A. (eds). Catalogue of Palaearctic Coleoptera, Vol. 6. Chrysomeloidea. Stenstrup: Apollo Books.

Ekiz, A. N., Şen, İ., Aslan, E. G. & Gök, A. 2013. Checklist of leaf beetles (Coleoptera: Chrysomelidae) of Turkey, excluding Bruchinae. Journal of Natural History, 47: 2213-2287.

Everts, E. 1919. Nieuwe vondsten voor de nederlandsche coleopterenfauna xxiv. Entomologische Berichten, 5: 172-175.

Fabricius, J. C. 1775. Systema Entomologiae, sistens Insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus, 32+832 pp.

Fabricius, J. C. 1801. Systema Eleutheratorum secundum ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus. I. Bibliopolii Academici Novi, Kiliae, I: XXIV + 506 pp.

Foudras, A. C. M. E. 1860. Altisides (Opus posthumus). In: Mulsant, E. (ed.). Histoire natürelle des coléoptères de France. Annales de la Société Linnéenne de Lyon (N. S.), 6: 137-384.

Furth, D. G. 1979. Zoogeography and host plant ecology of the Alticinae of Israel, especially *Phyllotreta* with descriptions of three new species (Coleoptera: Chrysomelidae). Israel Journal of Zoology, 28: 1-37.

Geoffroy, E. L. 1785. [new taxa]. In: Fourcroy, A. F. de (ed.). Entomologia parisiensis; sive Catalogus Insectorum...novae Species. Pars prima. Parisiis: Privilegio Academiae, vii + [1] + 231 pp.

Gmelin, J. F. 1790. Caroli a Linné Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentis, synonymis, locis. Editio decima tertia aucta, reformata. I. 4. Lipsiae, pp. 1517-2224.

Goeze, J. A. 1777. Entomologische Beitraege zu des Ritter Linne 12. Ausgabe des Natursystems, 1. Leipzig, 736 pp.

Gök, A., Çılbıroğlu, E. G., Ayvaz, Y. & Yıldırım, M. Z. 2002. Two new records for the Turkish flea beetle fauna: *Phyllotreta reitteri* Heik., 1911 and *Epitrix dieckmanni* Mohr, 1968 (Coleoptera: Chrysomelidae: Alticinae). Israel Journal of Zoology, 48: 254-255.

Gruev, B. 1977. Neue Agnaben Über einigen palaarktisdchen Blattkafer und Beschreibung von zwei neuen Alticinen aus Bulgarien (Coleoptera, Chrysomelidae). Acta Zoologica Bulgarica, 8: 65-73.

Gruev, B. 1982. Eine neue *Phyllotreta*-Art aus der Balkanhalbinsel (Coleoptera, Chrysomelidae). Deutsche Entomologische Zeitschrift, N. F., 29: 99-100.

Gruev, B. & Aslan, I. 1998. Four new species of Alticinae (Coleoptera, Chrysomelidae) from Turkey. Türkiye Entomoloji dergisi, 22: 163-169.

Gruev, B. & Kasap, H. 1985. A list of some Alticinae from Turkey with descriptions of two new species (Coleoptera, Chrysomelidae). Deutsche Entomologische Zeitschrift, N. F., 32: 59-73.

Guillebeau F. 1895. Note relative a son travail concernant les Phalacridae et la description d'une nouvelle espèce de Phyllotreta (Coléoptères). Bulletin de la Société Entomologique de France, 1894: xxv-xxvii.

Harold E. 1879. Diagnosen neuer Arten. Coleopterologische Hefte, 16: 225-232.

Heikertinger, F. 1909. Diagnosen von Halticinen. Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien, 59: 290-295.

Heikertinger, F. 1911. Beschreibungen von vier neuen *Phyllotreta*-Formen aus dem palaarktischen Region., *Verhandlungen* der Zoologisch-Botanischen Gesellschaft in Wien, 61: 159-168.

Heikertinger, F. 1941. Bestimmungs-Tabellen europaischer Kafer (7. Stuck), LXXXII. Fam. Chrysomelidae. 5. Subfam. Halticinae. 1. Gatt. *PhylIotreta* Steph. Bestimmungstabelle der palaarktischen *Phyllotreta*-Arten (Tei1 II). Koleopterologische Rundschau, 27: 69-116.

Hoffmann, A. 1953. Coleopteres phytophages nouveaux ou peu connus, de la faune palearctique. Revue française d'Entomologique, 20: 186-194.

Iablokoff-Khnzorian, S. M. 1960. Coléoptères nouveaux de l'Armenie Soviétique. Notulae Entomologicae, 40: 140-153.

Iablokoff-Khnzorian, S. M. 1968. Notes sur les Chrysomelidae de L'Armenie Sovietique. Annales de la Sociéty Entomologique de France (N. S.), 4: 259-277.

Illiger, J. C. W. 1803. Abändrung der in Fabricii Systema Eleutheratorum doppelt vorkommenden Namen. Magazin für Insectenkunde, 2: 292-293.

Illiger, J. C. W. 1807. Portugiesische Käfer. Magazin für Insectenkunde, 6: 49-80.

Jakobson, G. 1901. Symbola ad Cognitionem Chrysomelidarum Rossiae asiaticae. Öfversikt af Finska Vetenskaps-Societetens Förhandlingar, 43: 99-147.

Jakobson, G. 1916. [new taxon]. In: Schreiner, J. O. (ed.). Une espèce nouvelle du genre *Phyllotreta* Foudr. (Coleoptera, Chrysomelidae). Revue Russe d'Entomologie, 15: 72-73.

Jolivet, P. & Hawkewood, T. J. 1995. Host-plants of Chrysomelidae of the world: an essay about the relationships between the leaf beetles and their host-plants. Leiden, the Netherlands: Backhuys Publishers, 281 pp.

Koch, J. D. W. 1803. Monographie des von den Verfassern in dem Departemente vom Donnersberge, und den angrenzenden Gegenden der Departemente von der Saar, und von Rhein und Mosel einheimisch beobachteten Flohkäfer. (Haltica). Entomologische, Hefte 2: 5-90.

Konstantinov, A. & Lopatin, I. 1992. On the taxonomy of *Phyllotreta* Chevr. of the Palaearctic region (Coleoptera, Chrysomelidae, Alticinae). Spixiana, 15: 261-267.

Konstantinov, A. S. & Vandenberg, N. J. 1996. Handbook of Palearctic flea beetles (Coleoptera: Chrysomelidae: Alticinae). Contributions on Entomology, International, 1: 236-439.

Konstantinov, A. S. & Vandenberg, N. J. 2015. Guide to Palearctic Flea Beetle Genera (Coleoptera: Chrysomelidae: Alticinae). http://www.sel.barc.usda.gov/coleoptera/ fleabeetles/fleas.htm [accessed 20 February 2015].

Kutschera, F. 1860. Beiträge zur Kenntnis der europäischen Halticinen. Wiener Entomologische Monatschrift, 4: 297-310.

Linnaeus, C. 1758. Systema Naturae... Ed. 10. Holmiae, 824 pp.

Lopatin, I. K. 1977. Two new subspecies of leaf-beetles (Coleoptera, Chrysomelidae) from European part of USSR. New and little known species of insects of European part of USSR, Leningrad, pp. 30-34 (in Russian).

Marsham, T. 1802. Entomologia Britannica, sistens Insecta Britanniae indigena, secundum methodum Linnaeanam disposita. I. Coleoptera. Londini, xxxi + 547 pp.

Maulik, S. 1926. The Fauna of British India, including Ceylon and Burma. Coleoptera: Chrysomelidae (Chrysomelinae and Halticinae). Taylor and Francis, London, xiii + 442 pp.

Monnot, E. 1913. Notes pour servir à l'étude des espèces françaises du genre *Phyllotreta* à élytres unicolores et description d'une espèce nouvelle. Insecta, Revue Illustrée d'Entomologie, 3: 223-235.

Montrouzier, X. 1864. [new taxa]. In: Perroud, B. P. & Montrouzier, X. (eds.). Essai sur la faune entomologique de Kanala (Nouvelle-Calédonie) & description de quelque espèces nouvelles ou peu connues. Annales de la Société Linnéenne de Lyon, (N. S.), 11: 46-257.

Motschulsky, V. 1849. Coleopteres recus d'un voyage de M.Handschuch dans le midi de l'Espagne, enumeres et suivis de notes. Bulletin de la Société imperiale des Naturalistes de Moscou. Moscou, 22: 52-163.

Olivier, A. G. 1789. Entomologie, ou histoire naturelle des insectes, avec leurs caractères génériques et spécifiques, leur description, leur synonymie, et leur figure enluminée. Coléoptères: Baudouin. Paris, 1: 1-190.

Özdikmen, H. 2014. Chorotype identification for Turkish Chrysomeloidea (Coleoptera) Part VIII – Chrysomelidae: Alticinae. Munis Entomology & Zoology, 9: 325-375.

Özdikmen, H. & Coral Şahin, D. 2017. A new species, *Phyllotreta bilgeae* sp. nov., from Turkey (Chrysomelidae: Galerucinae: Alticini). Munis Entomology & Zoology, 12 (1): 183-187.

Özdikmen, H., Coral Şahin, D. & Bal, N. 2017. A new species of *Phyllotreta* Chevrolat from Turkey (Chrysomelidae: Galerucinae: Alticini). Munis Entomology & Zoology, 12 (1): 155-158.

Özdikmen, H., Mercan, N., Cihan, N., Kaya, G., Topcu, N. N. & Kavak, M. 2014. The importance of superfamily Chrysomeloidea for Turkish biodiversity (Coleoptera). Munis Entomology & Zoology, 9: 17-45.

Paliy, V. F. 1970. Novye podrody i vidy zemlyanykh bloshek (Coleoptera, Chrysomelidae, Halticinae) iz sredney Azii. Pp. 3-15. in Procenko A. I. (ed.). Entomologicheskie Issledovaniya v Kirgizii, 6. (Novye i maloizvestnye vidy bespozvonochnykh zhivotnykh). Frunze Izdatel'stvo "ILIM", 87 pp.

Pic, M. 1900. Notes et diagnoses 2e article. L'Echange, Revue Linnéenne, 16: 77-80.
Pic, M. 1901. Notes diverses et diagnoses. L'Echange, Revue Linnéenne, 17: 25-27.
Pic, M. 1906. Habitats et descriptions de divers coléoptères palearctiques. L'Echange, Revue Linnéenne, 22: 33-35.
Pic, M. 1909. Descriptions ou diagnoses et notes diverses (Suite). L'Echange, Revue Linnéenne, 25: 145-146, 153-156, 177-179.
Pic, M. 1910a. Descriptions ou diagnoses et notes diverses (Suite). L'Echange, Revue Linnéenne, 26: 25-27.
Pic, M. 1910b. Sur divers phytophages paléarctiques et exotiques (Col.). Bulletin de la Société Entomologique de France, 1910: 305-307.
Pic, M. 1912. Notes et observations sur divers alticides (Col., Polyphaga). Bulletin de la Société Entomologique de France, 1912: 135-136.
Pic, M. 1915. Notes diverses, descriptions et diagnoses (Suite). L'Echange, Revue Linnéenne, 31: 33-34.
Redtenbacher, L. 1849. Fauna Austriaca. Die Käfer, nach der analytischen Methode bearbeitet. Wien, XXVII + 883 pp.
Reiche, L. & Saulcy, F. 1858. Especes nouvelles ou peu connues des coléoptères, recueillis par M. F. de Saulcy, Membre de l'Institut, dans son voyage en Orient, et décrités par M. M. L. Reiche et Félicien de Saulcy. Annales de la Société Entomologique de France, 6: 5-60.
Reitter, E. 1891. Neue Coleopteren aus Europa, den angrenzenden Ländern und Sibirien, mit Bemerkungen über bekannte Arten. Deutsche Entomologische Zeitschrift, 1891: 17-36.
Reitter, E. 1905. Sechzehn neue Coleopteren aus der palaearktischen Fauna. Wiener Entomologische Zeitung, 24: 241-251.
Richter, C. F. W. 1820. Supplementa faunae Insectorum Europaeae. Teil 1. Vratislaviae, 3+ 12 pp.
Schrank, F. P. 1781. Enumeratio insectorum Austriae indigenorum. Augusti Vindelicorum, 548 pp.
Schrank, F. P. 1789. Entomologische Beobachtungen. Der Naturforscher, 24: 60-90.
Schrank, F. P. 1798. Fauna Boica. Durchgedachte Geschichte der in Baiern einheimischen und zahmen Thiere. 1. Nuernberg, XII + 720 pp.
Smith, E. H. 1985. Revision of the genus *Phyllotreta* Chevrolat of America North of Mexico. Part I. The maculate species (Coleoptera, Chrysomelidae, Alticinae). Fieldiana. Zoology (N. S.), 168 pp.
Stephens, J. F. 1831. Pp. 1-366. In: Illustrations of British entomology; or, a synopsis of indigenous insects: containing their generic and specific distinctions; with an account of their metamorphoses, times of appearance, localities, food, and economy, as far as practicable. Mandibulata. Volume 4. London: Baldwin and Cradock, 413 + [1] pp.
Stephens, J. F. 1835. Appendix. In: Illustrations of British entomology; or, a synopsis of indigenous insects: containing their generic and specific distinctions; with an account of their metamorphoses, times of appearance, localities, food, and economy, as far as practicable. Mandibulata. Volume 5. London: Baldwin and Cradock, 447 pp.
Thunberg, C. P. 1784. Novae Insectorum species descriptae. Nova Acta Regiæ Societatis Scientiarum Upsaliensis, 4: 1-28.
Warchałowski, A. 1973. Zweiter Beitrag zur Kenntnis der Halticinen Nordpersiens (Coleoptera, Chrysomelidae). Polskie Pismo Entomologiczne, Wrocław, 43: 659-687.
Warchałowski, A. 2003. Chrysomelidae: the leaf beetles of Europe and the mediterranean Area. Natura Optima Dux Foundation, Warszawa, 600 pp.
Warchałowski, A. 2010. The Palaearctic Chrysomelidae: Identification keys, Vol 1 & 2. Natura Optima Dux Foundation, Warszawa, 1212 pp.
Weidenbach, C. von 1859. Sechs neue Käfer aus der Umgegend von Augsburg. Zwölfer Bericht des Naturhistorischen Vereins in Augsburg, 1859: 84-86.
Weise, J. 1887. XI. Beiträg zur Coleopteren-Fauna von Turkestan. Deutsche Entomologische Zeitschrift, 31: 305-336.
Weise, J. 1888. Chrysomelidae, Lief. V. W: Naturgeschichte der Insecten Deutschlands, Coleoptera, 6, 5. Berlin, pp. 769-960.
Weise, J. 1890. Bekannte und neue Halticiden. Wiener Entomologische Zeitung, 9: 111-116.
Weise, J. 1900. Neue Coleopteren aus Kleinasien. Deutsche Entomologische Zeitschrift, 1900: 132-140.
Wollaston, T. V. 1854. Insecta Maderensia, being an account of the Insects of the Islands of the Madeiran group. London, 43 + 634 pp.

INSECTICIDAL EFFECT SOME PLANT EXTRACTS ON *MYZUS PERSICAE* SULZER (HEMIPTERA: APHIDIDAE)

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ABSTRACT: Green peach aphid, (*Myzus persicae* Sulzer) (Hemiptera: Aphididae), is a very important pest causing serious damage to vegetables, flowers and fruit crops. The efficacy of extracts from four plants namely *Melia azedarach* L. (Meliaceae), *Veratrum album* L. (Melanthiaceae), *Rhododendron luteum* Sweet (Ericaceae), and *Helichrysum arenarium* L. (Asteraceae) was tested in a search for alternative insecticides. Bioassays were conducted by two different methods to determine the effects of different concentrations. Experiments were performed using 30 mm diameter leaf discs from radish plants, *Raphanus sativus* L. (Brassicaceae). Each treatment and control were replicated ten times. As a result of the investigation, in the leaf dipping method, the extract of *M. azederach, V. album, R. luteum* and *H. arenarium* caused 94%, 67%, 65% and 61% nymph mortality respectively at 12% concentration. The mortalities of adults at the same concentrations were 91%, 85.71%, 57% and 61% respectively. For the spraying method, adult mortalities for *M. azederach, V. album, H. arenarium* and *R. luteum* were 91%, 80.84%, 58% and 58% respectively at the same concentrations.

KEY WORDS: Plants, extract, insecticidal effect, green peach aphid

The practice of using plant derivatives, or botanical insecticides as they are now known in agriculture, dates back at least two millennia in ancient China, Egypt, Greece and India (Thacker, 2002; Ware, 1883). All over the world, the documented use of botanicals extends back more than 150 years, dramatically predating discoveries of the major classes of synthetic chemical insecticides in the mid-1930s to 1950s. However, history shows that overzealous use of synthetic insecticides led to numerous problems unforeseen at the time of their introduction: acute and chronic poisoning of applicators, farmworkers, and even consumers; destruction of fish, birds, and other wildlife; disruption of natural biological controls and pollination; extensive groundwater contamination, potentially threatening human and environmental health, and the evolution of resistance to pesticides in pest populations (Isman, 2006). In this context, many researchers are experimenting and developing alternative plant extracts as potential pesticides. Plants are the richest source of renewable natural pesticides. There are many benefits of using botanical pesticides such as reduced environmental degradation, increased safety for farm workers, increased food safety, reduction in pesticide resistance, and improved profitability of production. The majority of plant extracts contain alkaloids and terpenoids, which have been shown to affect insects' behavior, growth and development, reproduction, and survival (Arnason, 1989; Warthen, 1990). Extracts have been developed and their effects tested against insect pests of *Chrysanthemum roseum* Web. and Mohr. (Compositae), *Nicotiana tabaccum* L. (Solanaceae), *Derris elliptica* Benth (Fabaceae), neem tree, *Azadirachta indica* A. Juss (Meliaceae), and *M. azaderach*.

Researchers have shown that extract of *M. azedarach* is effective as a strong antifeeding agent and caused mortality on some species of insects (Brauer & Devkota, 1990; Oroumci & Lorra, 1993; Yelekci et al., 1981; Erdogan & Toros, 2005).

H. arenarium is a member of Asteraceae family. Also known as medicinal plant. It has been used in folk herb medicine for treatments of various conditions including for gallbladder disorders because of their bile regulatory and diuretic properties (Eroglu et al., 2010). The extract obtained from *H. arenarium* showed acaricidal effect on *T. urticae* and decreased fecundity (Erdogan et al., 2012).

R. luteum is a species of *Rhododendron* native to southeastern Europe and southwest Asia. It was determined that an extract of *R. luteum* showed acaricidal effect on *T. urticae* and decreased fecundity (Erdogan et al., 2012).

The root of *V. album* is very poisonous with a paralyzing effect on the nervous system. In two cases of fatal poisoning from eating the seeds, the toxins veratridine and cevadine were present in the blood (Fough et al., 1983). According to literature, it was determined that the extract of *Veratrum* contains a particularly toxic group of steroidal alkaloids (Bergmann, 1958).The extract of *V. album* has been used as a source of insecticides and fungicides since the era of the Romans (Gomilevsky, 2010). Researchers revealed that the extract of *V. album* extended the life of the larvae of *Musca domestica* (Diptera: Muscidae) (Ernst, 1958). Similarly, Aydin et al. (2014) found that the extract from dried rhizomes of *V. album* was toxic against *Leptinotarsa decemlineata* Say (Coleoptera: Chrysomelidae).

M. persicae is a pest of worldwide importance and causes crop losses directly by feeding and indirectly by virus transmission. Damage from aphids can be direct or indirect. Direct damage to plants occurs from the feeding activity of aphid nymphs and adults. Indirect damage can be caused by deposits of honeydew. This is the sugary, sticky liquid produced by aphids as a result of feeding on plant fluid. Crops must be sprayed with synthetic insecticides to control aphid populations. Aphids transmit many plant diseases (Petitt & Smilowitz, 1982). It is difficult to control aphid populations because they are resistant to many synthetic insecticides. The other problem with synthetic insecticides is environmental pollution and effect on non-target organisms (Barbercheck, 2011).

The aim of the current study was to investigate the efficacy of four plant extracts.

The research was undertaken under laboratory conditions at the Central Plant Protection Research Institute in Ankara in 2011.

MATERIALS AND METHODS

Insect culture

M. persicae were reared in the laboratory at 25±1◦C under long daylight (18 h: light: 6 h dark) and 65-70% relative humidity on potted radish. The radish plants used in the experimental work were grown in both a greenhouse and in the field.

Plants and Preparation of Extracts

The plants of *R. luteum, H. arenarium, V. album* used in their research were collected during 2011 in Ankara, Adana, Rize and Ordu provinces. Plant material was collected during the flowering stage at the three plants. Flowering plants were cut at soil level and whole plant was used for extraction. Only fruits of *M. azedarach* were used to obtain extract. Fruits of *M. azedarach* were collected during harvest. Harvested plants and fruits were allowed to dry in laboratory conditions. Once the plant material was grounded using a small grinder. For extraction, 200 g of each powdered materials and 400 ml of ethanol (80%) were added to the dried powder for 72 hours. The above mixture placed into Soxhlet for 5-6 hrs. to obtain the useable extract as insecticide. After filtering through a Bucher funnel and Whatman No.1 filter paper, the extracts were concentrated under low pressure using rotary evaporator (50–60°C). Crude extracts were reconstituted to have the concentration of 20% (w/v) using ethanol 80% (v/v in distillated water) and stored at 4°C in glass vials to be used as stock plant extracts. For the tests, these stock plant extracts were dissolved in distilled water containing TritonX.100 at a rate of 0.1ml/l.

Plant Extract Efficacy on M. persicae

Leaf-dipping method; from untreated radish leaves, 3 cm in diameter discs were punched out. These discs were then dipped into the plant extract test solutions (1%, 3%, 6%, and 12 %) for 60 s. The control discs were dipped in 0.01% Triton X-100 solution. Then they were left to dry for 30 minutes. The treated leaf discs were placed into petri dishes lined with moistened filter paper. Then 10 apterous adults and 10 nymphs of *M. persicae* were introduced onto the treated discs in separate petri dishes. Same procedure was used for control.

Spraying method; radish leaf discs were placed into Petri dishes on moisturized filter paper as described previously. Then 10 apterous adult *M. persicae* were transferred onto the disc and, leaf discs were sprayed with different concentration of plant extracts (1%, 3%, 6%, 12%) using a hand held sprayer; control (untreated) discs were sprayed with (0.01% Triton X-100). After spraying was completed, discs were left to dry for 15 minutes. Once adults were dried, the treated *M. persicae* were transferred to untreated leaf discs (Bollhalder & Zuber, 1996).

The experiment was replicated 10 times including control. For each petri dish, 10 adult and 10 3 day old nymphs were used. Data collection started after 1, 3, and 6 days by counting the number of living nymph and adults. The experiments were conducted in a controlled climate chamber maintained at 25±1°C and under long daylight (18:6 h light: dark). The effect was calculated according to Abbott (1925). Results were submitted to analysis of variance and the mean values were compared using Duncan's (1955) test (P = 0.05) using the statistical program SPSS 20.6.

RESULTS

Effect of the Extracts on Nymphal Stage

For the leaf-dipping method, the effects of different ethanolic extracts of *M. azaderach, V. album*, *H. arenarium* and *R. luteum* on nymphs of *M. persicae* are given in Table 1.

As shown in Table 1, it can be observed that for the nymphs treated with the four different plant ethanol extracts, the highest mortality rate was obtained at a concentration of 12% for *M. azedarach* and *V. album*. The extracts obtained from *H. arenarium* and *R. luteum* showed lower mortality rates than other extracts. Statistical analysis (at $P<0.05$) indicated statistical differences between the treatments. It was determined that the extract of *M. azedarach* and *V. album* had the highest effect on the nymphal stage of *M. persicae*. The lowest effect was for the extracts of *H. arenarium* and *R. luteum* ($F=9.138$, $P=0.00$).

Effect of the Extracts on Adults Stage

Leaf-dipping method; different concentrations of extracts of *M. azaderach, V. album, H. arenarium* and *R. luteum* were tested to evaluate their insecticidal effect against *M. persicae* adults. Results are given in Table 1. According to this, the lowest mortality for all four plant extracts was found at concentration 1%. The extract obtained from *M. azaderach* had the highest mortality rate at 12% concentration. These values were followed by extracts of *H. arenarium* and *R. luteum* respectively. Mortality rate increased with increasing concentrations (F=22.707, P=000).

Spraying method; adults treated with 12% concentration of four extracts showed the highest mortality and the lowest effect was found at 1%. It can be seen from Table 1 that the extracts of *M. azaderach, V. album, H. arenarium* and *R. luteum* at 12% concentration gave 91%, 83%, 58%and 58% mortality respectively. These results are significantly different from control (F=11.264, P=0.00).

According to the analysis, ethanolic extracts of *M. azaderach* and *V. album* caused the maximum insecticidal activity, followed by *H. arenarium* and *R. luteum*. The extracts obtained from *M. azaderach* and *V. album* each at the 12% concentration caused significant increase in mortality rate (F=12.345, P=0.00) (Table 1).

DISCUSSION

Previous researchers indicated that extracts of some plant species had insecticidal effect on *M. persicae*. For example, the extracts of *Achillea wilhelmsii* C. (Asteraceae), *Hyoscyamus niger* L. (Solanaceae), *M. azedrach*, *Azadirachta indica A. Juss.*(Meliaceae), *Allium sativum* L. (Amaryllidaceae), *Capsicum annum L.* (Solanaceae), *Menta pierita* L. (Lamiaceae) and *Tanacetum vulgare* (Asteraceae) showed large effect on *M. persicae* (Dancewicz & Gabrys, 2008; Ikeura et al., 2012; Erdogan & Yildirim, 2013).

The most important finding of our study is the demonstrated toxicity of the extracts from four species on *M. persicae*. Comparing total mortality percentages of *M. azedarach* and *V. album* ethanolic extracts gave good insight about their bioactivity. The extracts obtained from *M. azaderach* and *V. album* caused high mortality. The significant decrease in the number of pests on the treated disc indicates the effectiveness of the two plant extracts. The reduction in pests' numbers was due to the insecticidal properties of *M. azaderach* which caused mortality. It is determined that *A. indica* has got such as triterpernoids, azadirachtin and salanin which caused antifeeding, deterrent of eggs, repellent and insecticidal on insects (Schmutterer et al., 1981; Schmutterer & Asher, 1984). Of interest, *M. azaderach* is the same family *A. indica* and include the same active ingredients which effect on insects (Oelrichs et al., 1983). Earlier, Capinera (2008) reported that extract obtained from *M. azedarach* was most effective at 25%, 12.5% and 1.25% concentration causing 100% mortality of *M. persicae, Aphis gossypii* and *Aphis fabae* respectively, and showed repellent effects on all species. Recently, there have been many research projects on the effect of azadirachtin obtained from neem tree on *M. persicae*. Griffiths et al., (2009) found that adults and nymphs fed treated neem tree seed extract showed strong repellency and individuals could not build a colony. Different Neem formulations, Azadirachtin % (AZ-A, 51% vegetable oil), caused high mortality rate 12 days after treatment, and had no systemic effect on *A. fabae* (Schulz et al., 1996). Moreover, commercially available neem-based formulation, Neem Azal T/S, caused high mortality in nymph and adults of *M. persicae* (Bollhalder & Zuber, 1996).

In our study showed that the extract of *V. album* caused high mortality in nymph and adults of *M. persicae*. There were no references in the literature of other studies using ethanolic extracts of *V. album*. There are other references which report insecticidal effects of *V. album* on different insect species. For example, according to Bergmann (1958) the extract of *Veratrum* contains a particularly toxic group of steroidal alkaloids. In addition, Fough et al. (1983) found *V. album* extract consisted of the toxins, veratridine and cevadine. It was thought that these toxic substances from *V. album* caused insecticidal effects on *M. pesicae*. There are some references of insecticidal effects of *V. album* extracts on different insects. For example, Aydin et al. (2014) found that the dried rhizomes of *V. album* was toxic against *Leptinotarsa decemlineata* Say (Coleoptera: Chrysomelidae).

The extracts of *H. arenarium* and *R. luteum* showed less effect than the extracts of *M. azaderach* and *V. album*. There were no references in the literature of other studies using ethanolic extracts of *H. arenarium* and *R. luteum* plants against *M. persicae*. There are other references which report insecticidal effects of other plant extracts on *M. persicae*. For example, extract of *T. vulgare* showed repellent effect on ***M.*** *persicae* and adults could not develop a colony (Dancewicz & Gabrys, 2008). Furthermore, Pavela (2009) reported that the extracts derived from *Chrysanthemum cinerariifolium* had a mortality rate of 100% against *M. persicae* after 12 days of treatment. Similarly, Zhou et al., (2005) revealed that the extract of *Xanthium sibiricum* L. caused 87% mortality on *M. persicae*. Extracts of *Pittosporium tobira* and *Camellia japonica* caused the highest mortality against *M. persicae*, and extracts obtained from *Fatsia japonica*, *Dendropanax morbifera* and *Ficus carica* prevented reproduction of *A. gossypii* after 24 h. treatment (Kim et al., 2005). Other insect pests were also found to be inhibited by plant extracts. According to the results of Lee et al., (2001) the extracts of *Nelumbo nucifera* and *Ulva lactuca* caused mortality of 90% in *M. persicae*. Moreover, several herbal extract derived from *Geranium macrorrhizum* L., *Euphorbia cyparssias* L. and *Silybum marianum* L. caused 100 % mortality against nymphal and adult stages of *M. persicae* (Velcheva et al., 2001). Griffiths (2009) found that adults and nymphs fed treated neem tree seed extract suffered strong repellent effect and individuals could not build a colony. In addition, Lai & You (2010) revealed that extract derived from *A. sativum* showed high toxicity against *M. persicae* under both laboratory and field conditions, as well as repellent effects. Zhou & Liang (2003) revealed that the extracts of *Tephrosia vogelli* and *Cinnamomum campora* L. caused high rates of mortality in *M. persicae, A. gosyypii* and *Lipaphis erysimi*.

This study has contributed to the assessment of using medicinal plants as potential insecticides (Pavela, 2007). The extracts were evaluated for their effect on *M. persicae,* an important pest of many plants (Petitt & Smilowitz, 1982). The results of this study indicated that the ethanolic extracts of *M. azaderach* and *V. album* can be useful to control *M. persicae* populations on vegetable plants grown in IPM and organic systems of agriculture.

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LITERATURE CITIED

Abbott, W. S. 1925. A method of computing the effectiveness of an insecticide. Journal of Economic Entomolog., 18 (2): 265-267.

Arnason, J. T. B., Philogene, J. R. & Morand, P. 1989. Insecticides of plants origin. American Chemical Society Symposium Series 387. Washington. DC, USA.

Aydın, T., Çakır, A. Kazaz., C., Bayrak, N., Bayır, Y. & Taşkesengil, Y. 2014. Insecticidal Metabolites from the Rhizomes of *Veratrum album* Adults of Colorado potato beetle, *Leptinotarsa decemlineata*. Chemistry & Biodiversity, 11: 1192-1219.

Barbercheck, M. 2011. Biology and Management of aphids in Organic Production systems. eOrganic article.

Bergmann, E. D., Levinson, Z. H. & Mechoulam, R. 1958. The toxicity of *Veratrum* and *Solanum* alkaloids to housefly larvae. Journal Insect Physiology, 3 (2): 162-177.

Brauer, M. & Devkota, B. 1990. Control of *Thaumatopoea piyocampa* (Den.&Schiff) by extracts of *Melia azedarach* L. (Meliaceae). Journal Applied Entomology, 110: 128-135.

Bollhalder, F. & Zuber, M. 1996. NeemAzal-T/S against Myzus persicae. In: Kleeberg H & Zebitz CPW (Eds.). Practice oriented results on use and production of neem-ingredients and pheromones, Proceedings of the 5th Workshop. Giessen, Germany, Trifolio-M GmbH, 141-145.

Capinera, J. L. 2008. Encyclopedia of Entomology, 4, The Netherlands. pp. 4346.

Dancewicz, K. & Gabrys, B. 2008. Effect of extracts of garlic (*Allium sativum* L.), wormwood (*Artemisia absinthium* L.) and (*Tanacetum vulgare* L.) on the behaviour of the peach potato aphid *Myzus persicae* (Sulzer) during the settling on plants. Pesticides, 3-4: 93-99.

Duncan, D. B. 1955. Multiple Range And Multiple F Test. Biometrics, 11: 1-42.

Erdogan, P. & Toros, S. 2005. The effects of *Melia azedarach* L. extracts on development on larvae of Colorado Potato Beetle [*Leptinotarsa decemlineata* Say (Col.: Chrysomelidae)]. Plant Protection Bulletin, 45: 99-119.

Erdogan, P. & Yildirim, A. 2013. Investigations on the effects of two different plant extracts on the Green peach aphid [(*Myzus (N.) persicae* Sulzer) (Hemiptera: Aphididae)]. Plant Protection Bulletin, 53 (1): 33-42.

Erdogan, P., Yildirim, A. & Sever, B. 2012. Investigations on the Effects of Five Different Plant Extracts on the Two-spotted Mite *Tetranychus urticae* Koch (Arachnida:Tetranychidae). Hindawi Publishing Corporation Psyche, doi: 10.1155/2012/125284.

Eroglu, H. E., Hamzaoglu, E., Aksoy, A., Budak, U. & Albayrak, S. 2010. Cytogenetic effects of *Helichrysum arenarium* in human lymphocytes cultures. Turkish Journal of Biology, 34 (3): 253-259.

Ernst, D., Bergmann, Z., Levinson, H. & Mechoulam, R. 1958. The toxicity of *Veratrum* and *Solanum* alkaloids to housefly larvae. Journal Insect Physiology, 3**:** 162-164.

Fogh, A., Kulling, P. & Wickstrom, E. 1983. *Veratrum* Alkaloids in Sneezing-Powder a Potential Danger. Clinical Toxicology, 20 (2): 175-179.

Griffiths, D. C., Greenway, A. R. & Lyoyd, S. L. 2009. The influence of repellent materials and aphid exracts on settling behaviour and larviposition of *Myzus persicae* (Sulzer). Bulletin of Entomological Research, 68: 613-619.

Gomilevsky, V. 2010. Poisonous plants, from which insecticides for orchard-pests may be prepared. Orchard Library Series. Progressive Fruit-Growing and Market-Gardening, pp. 32-33.

Ikura, H., Kobayashi, F. & Yasuyoshi, H. 2012. Repellent Effect of Herb Extracts on the Population of Wingless Green Peach Aphid, *Myzus persicae* Sulzer (Hemiptera: Aphididae). Journal of Agricultural Science, 4: 139-144.

Isman. M. B. 2006. Botanical Insecticides deterrents and repellents in modern agriculture and an increasingly regulated World. Annual Review Entomolog., 51: 45-66.

Kim, Do-Ik., Park, J., Kim, S. G., Kuk, H., Jang, M. & Kim, S. 2005. Screening Of Some Crude Plant Extracts For Their Acaricidal And Inscticidal Efficacies. Journal Asia-Pasific Entomology, 8: 93-100.

Lai, R. & You, M. S. 2010. Antifeedant and toxic avctivities of *Allium sativum* ethanol extracts against *Myzus persicae* (Sulzer). Journal Fujian Agriculture and Foresty University (Natural Science Edition) 01.

Lee, S. G., Park, J. D., Song, C., Cho, K. Y., Lee, S. G., Kim, M. K. & Lee, H. S. 2001. Insecticidal activities of various vegetable extracts against five agricultural insect pests and four stored-product insect pests. Korea, Journal Pesticides Science, 5: 18-25.

Oelrichs, B. P., Hill, M., Vallely, P. J., John, M. K. & Tadeusz, M. F. 1983. Toxic Tetranortriterpenes of the fruit of *Melia azedarach* L. Phytochemistry, 2: 531-534.

Orumchi, S. & Lorra, C. 1993. Investigation on the effects of aqueous extracts of neem and chinaberry on development and mortality of alfalfa weevil *Hyperia postica* Gyllenh.(Col., Curculionidae). Journal Applied Entomology, 116 (3): 345-351.

Pavela, R. 2007. Possibilities of botanical insecticide exploitation in plant protection. Pest Technology, 1: 47-52.

Pavela, R. 2009. Effectiveness of Some Botanical Insecticides against *Spodoptera littoralis* Boisduvala (Lepidoptera: Noctuidae), *Myzus persicae* Sulzer (Hemiptera: Aphididae) and *Tetranychus urticae*. Plant Protection Science, 45 (4): 161-167.

Petitt, F. L. & Smilowitz, Z. 1982. Green peach aphid feeding damage to potato in various plant growth stages. Journal Economic Entomology, 75 (3): 431-435.

Schulz, C. J., Kienze, C. P. & Zebitz, W. 1996. Effects of different Neem Azal formulations on apple and *Aphis fabae* Scop. Proceedings of the 5th Workshop. pp. 81-91.

Schmutterer, H. & Ascher, K. R. S. 1984. Proceedings of the Second Neem Conference (Rauischolzhausen, 1983) GTZ Eschborn, p. 587.

Schmutterer, H., Ascher, K. R. S. & Rembold, H. 1981. Proceedings of the first Neem Conference (GTZ Rottach-Egern, 1980), p. 297.

Thacker, J. M. R. 2002. An introduction to Arthropod Pest Control. Cambridge, UK, Cambridge Univ. Press. pp. 343.

Yelekci, K., Acimis, M. & Soran, H. 1981. Extract obtained from fruit *Melia azedarach* L. effect on *Thaumetopoea pityocampa* Schiff (Lepidoptera:Thaumetopoeidae). Journal Natural Science, 5: 69-71.

Velcheva, N., Atanassov, N., Velchev, V., Karadjova, O. & Velichkova, M. 2001. Toxic action of plant extracts on some pests of economic importance. Bulgarian Journal Agriculturel Science, 7 (2): 133-139.

Ware, G. W. 1983. Pesticides. Theory and Application. San Fransisco: Freeman. pp. 308.

Warthen, J. D., Morgan, E. D. Mandava, N. B. 1990. Insect feeding deterrents, in CRC Handbook of Natural Pesticides (6) of Insect Attractants and Repellents. Pp. 23-134.

Zhou, Q. & Liang, O. 2003. Effect of plant alcohol extracts on vegetable aphids and their parasitoids. Ying Yong Tai Xue Bao, 14: 249-52.

Zhou, Q., Liang, G., Zeng, L., Shen, S. & Cen, Y. 2005. Controlling effects of plant extracts and pesticides on *Myzus persicae* and *Lipaphis erysimi* populations. YingYongTai Xue Bao, 7: 1317-1321.

Table 1. The effect of extracts obtained from different four plants on *Mysuz persicae* nymphs and adults (Mean±St.Error)*

Treatment		Leaf-dipping method				Leaf-spraying method	
		Nymph		Adult		Adult	
	Co.(%)	Mortality (%)	Effect (%)	Mortality (%)	Effect (%)	Mortality (%)	Effect (%)
	1	51.00±3.42c	46.44±3.43c	50.00±2.98d	40.70±4.17c	59.00±2.33c	40.69±4.17c
	3	63.00±3.42c	54.30±3.17c	71.00±2.77c	67.09±3.74b	63.00±3.00c	66.80±3.65b
M.	6	77.00±1.33b	71.21±2.00b	83.00±2.13b	81.16±2.72a	78.00±2.91b	80.05±3.5b
azedarach	12	94.00±2.13a	92.78±2.71a	91.00±1.80a	89.22±2.22a	91.00±2.00a	89.35±2.21a
	1	32.00±1.33c	28.05±2.21c	32.00±2.00c	22.22±1.93c	32.00±2.00c	19.27±2.77c
	3	35.00±1.53c	37.36±2.92b	36.00±1.63c	23.33±2.23c	35.00±1.67c	23.05±3.11c
H.	6	51.00±2.33b	48.19±1.76a	43.00±2.13b	32.50±3.37b	45.00±2.24b	34.99±3.04b
arenarium	12	65.00±1.67a	58.61±2.28a	57.00±2.98a	50.28±2.82a	58.00±2.00b	50.27±2.81a
	1	39.00±1.80c	28.05±2.21c	31.00±1.80c	18.75±1.83c	35.00±4.28c	21.72±2.78c
R. luteum	3	47.00±2.13b	37.36±2.92b	35.00±1.67bc	23.33±2.23b	41.00±1.67c	27.05±3.11c
	6	52.00±2.49b	48.19±1.76a	43.00±2.13b	32.50±3.37b	44.00±1.63b	35.00±3.04b
	12	61.00±3.79a	58.61±2.28a	61.00±3.64a	49.17±4.50a	58.00±2.00a	50.28±2.82a
	1	32.96±3.65c	32.96±3.65c	40.00±2.87c	32.40±3.90c	41.00±3.45c	31.30±3.90d
V. album	3	43.39±3.43c	41.39±3.43c	55.00±2.34c	46.81±5.47b	64.00±2.67b	56.80±5.47c
	6	69.00±3.03b	65.00±3.03b	71.00±3.45b	67.89±3.33a	73.00±3.02b	68.40±2.37b
	12	80.16±2.42a	80.16±2.42a	87.00±1.67a	85.71±2.44a	83.00±1.93a	80.84±3.44a
	Control	15.00±2.33d		14.00±1.67d		14.00±1.67d	

*Within columns, means ± SE followed by the same letter are not significantly different (DUNCAN's multiple *F*-test.

Co.: Concentrations

FINGERPRINTING OF LEAFHOPPERS ON MEDICINAL AND AROMATIC PLANTS IN EGYPT USING ISSRS

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ABSTRACT: Leafhoppers are one of the most important agricultural insect pests**.** Traditional morphological criterion for leafhoppers identification depending on the presence of males only**.** So, Inter Simple Sequence Repeats (ISSRs) were used to find diagnostic markers for fingerprinting fifteen leafhoppers species collected from different medicinal and aromatic plants in Egypt. Seven ISSRs primers were successfully produced 72 bands those could be used to differentiate the fifteen different leafhopper species. Also different amplified bands with 65 diagnostic morphological characters were used to determine the phylogenetic relationship among the different species; that divided into two main clusters. ISSR-PCR technique could be successfully used with morphological characters to fingerprint and identify these leafhopper species using any life stage.

KEY WORDS: Leafhoppers, fingerprinting, morphology, ISSRs, identification, markers, microsatellites, phylogeny

Leafhoppers (Hemiptera: Auchenorrhyncha: Cicadellidae). Family Cicadellidae is a globally-distributed group of sap-feeding insects that contains 20000 described species (Dietrich, 2013). They suck plant sap from the xylem, phloem or mesophyll cells (Knight, 1983) causing a drying of the leaf tissue. Leafhoppers release their toxic saliva into the plant tissue causing leaves turn yellow, their edges dry and their tissue dies "hopper burn." and the plant becomes stunted (Ebesu, 2004) and cause serious plant injury either directly through feeding or indirectly by transmitting plant pathogens including viruses, bacteria and phytoplasmas (Weintraub & Beanland, 2006). Identification of leafhopper species is mainly based on adult male especially genitalia characters. While another additional characters, such as coloring, details in head and elytral characters are also important in the identification on generic level (Herakly, 1970). Identification of Cicadomorphan species is difficult because of their tremendous diversity and the paucity of comprehensive identification keys (Dietrich, 2005). The classical taxonomy proves its reliability but has limitations, such as, requirement of adult specimens especially males for morphological analysis. As well as morphology and high genetic diversity poses problems in phylogenetic studies of insects (Pires & Marinoni, 2010). To solve these problems, DNA based markers have been adopted and are increasingly used as molecular markers for fingerprinting and detecting phylogeny among species (De León & Jones, 2004; De León et al., 2004a,b; De Mandal et al., 2014; Sreejith & Sebastian, 2015). The present work aims at fingerprinting and detecting phylogenetic relationships among different leafhopper species infest medicinal and aromatic plants in Egypt.

MATERIALS AND METHODS

Survey of leafhopper species:

Field survey of leafhopper species was carried out during three successive years from 2013 to 2015 in different localities of Egypt. Fifteen leafhopper species were collected from different medicinal and aromatic plants at different localities. The species are listed alphabetically by scientific name in Table 2.

Samples were caught using the sweep net and aspirator from each plant then were transferred to the laboratory where individuals of leafhopper were mounted on slides for identification using available keys. Each species was put in especial tube and preserved at -20°C until molecular analysis.

ISSR-PCR Analysis

a. DNA Extraction

Fifteen different species of leafhoppers samples were collected and extracted DNA from them. Animal tissues were ground under liquid nitrogen to a fine powder, and then bulked DNA extraction was performed using DNeasy Mini Kit (QIAGEN).

b. Polymerase Chain Reaction (PCR)

PCR amplification was performed using seven Inter Simple Sequence Repeat (ISSR) Table 1.

Amplification was conducted in 25 µL reaction volume containing the following reagents: 2.5 µL of dNTPs (2.5 mM), 2.5 µL $Mgcl_2$ (2.5 mM), and 2.5 µL of 10 x buffer, 3.0 µL of primer (10 pmol), 3.0 µL of template DNA (25 ng / µL), 1 µL of *Taq* polymerase (1U/ µL) and 10.5 µL of sterile dd H_2O. The DNA amplifications were performed in an automated thermal cycle (model Techno 512). The PCRs were programmed for one cycle at 94°C for 4 min followed by 45 cycles of 1 min at 94°C, 1 min at 57°C, and 2 min at 72°C. The reaction was finally stored at 72°C for 10 min. Amplified products were size-fractioned using ladder marker100 bp (1000, 900, 800, 700, 60, 500, 400, 300, 200 and 100 bp) by electrophoresis in 1.5% agarose gels in TBE buffer at 120 V for 30 min. The bands were visualized by ethidium bromide under UV florescence and photographed.

Densitometry Scanning and Analysis:

All gels resulted from DNA fingerprints, were scanned using Bio-Rad GelDoc2000 to calculate the pair-wise differences matrix and plot the dendrogram among different leafhopper species.

Phylogenetic relationship among different leafhopper species:

Diagnostic Morphological characters:

For determining the phylogenetic relationships among those leafhopper species, sixty-five diagnostic morphological characters were compiled according to the previous mentioned identification keys in addition some diagnostic characters were added according to this work. All specimens used for this study were recently collected. The use of this fresh material allowed for thorough manipulation under the binocular for morphological data obtained and for extraction of genetic material. Currently only males can be identified to species. Sometimes, females and nymphs specimens were examined and identified to genus by Dr. Christopher H. Dietrich of the Illinois Natural History Survey, USA.

ISSR-PCR Data analysis:

The similarity matrix was done using Gel Works ID Advanced Software UVP-England Program. The relationships among genotypes as revealed by dendrogram was done using SPSS Windows (Version 10) Program. DICE computer package was used to calculate the pairwise difference matrix and plot the phenogram among species or genus (Yang and Quiros, 1993).

RESULTS AND DISCUSSION

Initial screening of many numbers of ISSR markers on fifteen samples of cicadellid resulted in seven ISSR primers those produced informative and polymorphic products resolvable by agarose gel electrophoresis (Fig. 1). These seven markers were amplified 73 bands as follows:

14-A Primer:

The results of ISSR analysis using 14A primer indicated that this primer produced seven bands with molecular sizes ranged between 1337-342bp. All of them were polymorphic (100%) except band with molecular size of 1337 bp. which can be assigned as a positive marker for *C. chinai*. No common band was detected by this primer. The highest number of bands were four which occurred in five species (*E. pounds, C. chinai, A. prolixa, N. modulates* and *P. alienus*). No band was recorded for *N. aegyptiacus*.

44-B Primer:

The results of ISSR marker analysis by using 44B primer indicated that this primer amplified ten bands with molecular sizes ranged between 919 – 224bp. Nine of them were polymorphic (90%). On the other hand, band with molecular size of 384 bp. was monomorphic (common). The band with molecular size of 307bp. can be assigned as a negative marker for *N. aegyptiacus*. The highest band numbers were nine recorded in *N. modulates* while the lowest band numbers were three detected in *M. sahlbergorum*.

HB-08 Primer:

The results of ISSR analysis using HB-08 primer were indicated that this primer amplified ten bands with molecular sizes ranged between 734 – 174bp. Nine of them were polymorphic (90%). Band with molecular size of 689 bp. was unique so can be assigned as a positive marker for *A. prolixa*. While bands with molecular sizes of 332 and 281bp. assigned as negative markers for *Austroagallia* sp. and *C. bipunctella zeae*, respectively. No common band was detected by this primer. The highest number of bands was eight detected in *E. pondus*, *N. aegyptiacus*, *E. cypria*, *M. sexnotatus*, *B. frontalis*, *C. chinai* and *O. albicinctus*; while the lowest number of bands was three bands detected in *N. modulates*.

HB-10 Primer:

This primer amplified nine fragments with molecular sizes ranged between 946 – 288bp. All of them were polymorphic (100%). The highest number of bands was 6 bands detected in *A. prolixa*, *E. decipiens*, *N. modulates*, *P. alienus* and *M. sahlbergorum*, while the lowest band numbers was two bands in *Austroagallia sp.*, *N. aegyptiacus* and *C. bipunctella zeae*. No common or unique band was amplified by this primer.

HB-12 Primer:

This primer amplified 12 bands with molecular sizes ranged between 1672 – 167 bp. Six of them were polymorphic. Band with molecular size of 1672 bp. can be assigned as a positive marker and unique band for *Parabolocratalis* sp. Also three bands with molecular sizes of 759, 670 and 613bp can be assigned as positive markers and unique bands for *C. chinai*. Bands with molecular sizes of 364 and 276 bp. could be assigned as positive markers and unique bands for *A. prolixa*. and *P. alienus*, respectively. The highest number of bands was six detected in *P. alienus*, while the lowest number of band was one band was detected on *Austroagallia sp.*, *E. pondus*, *N. aegyptiacus*, *E. cypria*, *M. sexnotatus*, *B. frontalis*, *C. bipunctella zeae* and *O. albicinctus*.

HB-14 Primer:

This primer amplified ten bands with molecular sizes ranged between 922 – 252bp. Eight of them were polymorphic (80%) while bands with molecular sizes of 922and 294bp. were unique where these bands can be assigned as positive markesrs for *Austroagallia* sp. and *C. bipunctella zeae* respectively. The highest number of bands was six detected in *Austroagallia sp.* while only one band was detected in *E. pondus*. No common bands were detected.

HB-15 Primer:

This primer amplified fifteen bands with molecular sizes ranged between 1542 – 315bp. Nine of them were polymorphic while bands with molecular sizes of 980 and 538bp. were common bands. On the other hand, band with molecular size of 315bp. can be assigned as a negative marker for *Austroagallia* sp. The highest number of bands was nine detected in *A.*

prolixa and *N. modulates,* while the lowest number of bands was three detected in *Austroagallia* sp.

From the above mentioned results it could be stated that six primers out of the seven tested primers had unique bands with certain molecular sizes and can be assigned to identify 7 species out of 15 cicadellid species as follows:

14-A primer at molecular size 1337bp. and HB-12 primer at molecular sizes 759, 670 and 613bp. can be assigned *Cicadulina chinai*. While 44-B primer at 384 bp. could be used to identify *Neolimnus aegyptiacus*. Also, HB-08 primer at 689 bp. and HB-12 primer at 364bp. could be assigned *Aconurella prolixa*. HB-12 primer at 1672 bp. and 276bp. could be assigned *Parabolocratalis* sp. and *Psammotettix alienus*, respectively. While HB-14 primer at 922bp. and HB-15 primer at 315bp. could be identified *Austroagallia* sp. Also, HB-14 primer at 294bp. identified *Cicadulina bipunctella zeae*.

Phylogenetic relationships and similarity matrix based on Morphological Characters and Molecular (ISSR-PCR) analysis:

Genetic similarities and Phylogenetic relationships among the fifteen leafhopper species were based on data gathered from analysis of 65 diagnostic morphological characters and seven molecular markers ISSSR-PCR (Table 4). The most close relationship was scored among *C. bipunctella zeae* and *C. chinai***.** The highest similarity value was 80.3% among the previous two species and the lowest similarity value was 26.3% among *C. bipunctella zeae* and *M. sahlbergorum* individuals.

The phylogenetic dendrogram in Figure 2 branched into two main clusters the first cluster divided into two sub-clusters. The first sub-cluster separated into two sub-sub-clusters. The first sub-sub-cluster, *E. decipiens* was found alone. The second sub-sub-cluster divided into two clades within the first clade *A. prolixa* was standed alone while the second clade included *P. alienus* and *N. modulates*. The second sub-cluster included *M. sahlbergorum* and *Parabolocratalis* sp. which were grouped together. The second cluster separated into two sub-clusters. The first sub-cluster *Austroagallia* sp. was located alone. Meanwhile, the second sub- cluster separated into two sub-sub-clusters. The first sub-sub-cluster *N. aegyptiacus* and *E. pondus* were grouped together. The second sub-sub-cluster divided into two clade the first clades, contained *M. sexnotatus* and *E. cypria* which were grouped together and the second clade divided into two sub-clades. The first sub-clade *O. albicinctus* and *B. frontalis* were grouped together. The second sub-clade contained *C. chinai* and *C. bipunctella zeae*.

In addition the combined data markers represented in Table 4 could be concluded that the both criteria could be used to discriminate between leafhopper species that belong to the same genus. Also it could be successfully separated between the fourteen genera that included the fifteen leafhopper species.

Inter Simple Sequence Repeats (ISSRs or 'microsatellites') has shown much promise for the study of the plant population (Clausing et al., 2000; Hess et al., 2000). Also ISSR-primers have been widely used for DNA fingerprinting and assessing genetic diversity in closely related germplasm (Blair et al., 1999; Charters et al., 1996). While in animals, ISSR technique broadly used as intraspecific markers for animal populations (Abbot, 2001; Ardeh, 2013; De León & Jones, 2004; De León et al., 2004a,b; Kostia et al., 2000 and Reddy et al., 1999). On the other hand few researchers used ISSR markers as interspecific markers (Helmi & Khafaga, 2011; Luque et al., 2002). However study of ISSRs used only to detect DNA polymorphisms in *Homalodisca coagulata* populations (de León & Jones, 2004; de León et al., 2004). ISSR-primers can be used as universal primers, which do not need to be adapted to individual species like in microsatellite marker. Consequently, the production of large numbers of fragments, reproducibility, and low cost are considered as advantages of the ISSR primers (Moreno et al., 1998; Weng et al., 2007).

CONCLUSION

Molecular fingerprint of fifteen leafhopper species collected from different medicinal and aromatic plants in Egypt were carried out using ISSR-PCR technique. This technique successfully generated many molecular markers for different leafhopper species; therefore they could be assigned leafhopper species and to differentiate among them in any life stage. This technique in addition to diagnostic morphological characters could be used to detect the Phylogenetic relationship among the fifteen leafhopper species.

LITERATURE CITED

Abbot, P. 2001. Individual and population variation in invertebrates revealed by Inter-simple Sequence Repeats (ISSRs). J. Insect Sci., 1 (8): 1-3.

Ardeh, M. J. 2013. The utility of ISSR-primers to make difference among populations of parasitoid, *Eretmocerus mundus* Mercet (Hymenoptera: Aphelinidae). J. Crop Prot., 2 (3): 263-269.

Blair, M. W., Panaud, O. & McCouch, S. R. 1999. Inter-simple sequence repeat (ISSR) amplification for analysis of microsatellite motif frequency and fingerprinting in rice (*Oryza sativa* L.). Theor. Appl. Genet., 98: 780-792.

Charters, Y. M., Robertson, A., Wilkinson, M. J. & Ramsay, G. 1996. PCR analysis of oilseed rape cultivars (*Brassica napus* L. *Ardeh* ssp. *oleifera*) using 5 [1]-anchored simple sequence repeat (SSR) primers. Theoretical and Applied Genetics, 92: 442-447.

Clausing, G., Vickers, K. & Kadereit, J. W. 2000. Historical biogeography in a linear system: genetic variation of Sea Rocket (*Cakilemaritima*) and Sea Holly (*Eryngium maritimum*) along European coasts. Mol. Ecol., 9: 1823-1833.

De León, J. H. & Jones, W. A. 2004. Detection of DNA Polymorphisms in *Homalodisca coagulata* (Homoptera: Cicadellidae) by Polymerase Chain Reaction-based DNA Fingerprinting Methods. Annals of the Entomological Society of America, 97: 574-585.

De León, J. H., Jones, W. A. & Morgan, D. J. W. 2004. Population genetic structure of *Homalodisca coagulata* (Homoptera: Cicadellidae), the vector of the bacterium Xylella fastidiosa causing Pierce's disease in grapevines. Annals of the Entomological Society of America, 97: 809-818.

Helmi, A. & Khafaga, A. F. 2001. Molecular fingerprinting of certain aphids in Egypt (Hemiptera: Sternorrhyncha: Aphididae) using RAPD and ISSRs markers. J.Entomol., 8 (4): 327-340.

Hess, J., Kadereit, J. W. & Vargas, P. 2000. The colonization history of *Olea europaea* L. in Macaronesia based on internal transcribed spacer 1 (ITS-1) sequences, randomly amplified polymorphic DNAs (RAPD), and intersimple sequence repeats (ISSR). Mol. Ecol., 9: 857-868.

Kostia, S., Ruohonen-Lehto, M., Vainola, R. & Varvio, S. L. 2000. Phylogenetic information in inter-SINE and inter-SSR fingerprints of the Artiodactyla and evolution of the BovtA SINE. Heredity, 84: 37-45.

Luque, C., Legal, L., Staudter, H. & Wink, M. 2002. ISSR (Inter Simple Sequence Repeats) as genetic markers in Noctuids (Lepidoptera). Hereditas, 136: 251-253.

Moreno, S., Martin, J. P. & Ortiz, J. M. 1998. Inter-simple sequence repeats PCR for characterization of closely related grape vine germplasm. Euphytica, 101: 117-125.

Reddy, K. D., Nagaraju, J. & Abraham, E. G. 1999. Genetic characterization of the silkworm *Bombyx mori* by simple sequence repeat (SSR)-anchored PCR. Heredity, 83: 681-687.

Weng, Y., Azhaguvel, P., Michels, G. J. & Rudd, J. C. 2007. Cross-species transferability of microsatellite markers from six aphid (Hemiptera: Aphididae) species and their use for evaluating biotypic diversity in two cereal aphids. Insect Mol. Biol., 16: 613-622.

Table 1. list of primers, names and their nucleotide sequences used to determine fingerprinting of leafhopper species using ISSR-PCR technique.

No	Name	Sequence
1	14A	5 CTC TCT CTC TCT CTC TTG 3`
2	44B	5` CTC TCT CTC TCT CTC TGC 3`
3	HB-08	5` GAG AGA GAG AGA GG 3`
4	HB-10	5´ GAG AGA GAG AGA CC 3`
5	HB-12	5´ CAC CAC CAC GC 3`
6	HB-14	5´ CTC CTC CTC GC 3`
7	HB-15	5´ GTG GTG GTG GC 3`

Table 2. Index of morphological characters used in determining similarity matrix among fifteen leafhopper species.

	Morohological characters	**Presence (1) or absence (0).**
1	Males only	females and nymphs (0) males (1)
2	Females only	males only and nymphs (0) females (1)
3	Nymphs only	males and females (0) nymphs (1)
4	Vertex shape 1	triangular (1) not triangular (0)
5	Vertex shape 2	rounded (1) not rounded (0)
6	Vertex shape 3	rectangular (1) not rectangular (0)
7	Vertex spots	with spots (1) without spots (0)
8	Vertex band	with band (1) without band (0)
9	Vertex depressions	with depression (1) without depressions (0)
10	Vertex pits	with pits (1) without pits (0)
11	Vertex markings	with markings (1) without markings (0)
12	Vertex with spots 1	more than two spots (1) with two spots (0)
13	Vertex with spots 2	with six spots (1) with three spots (0)
14	Vertex with band	with two bands (1) with one band (0)
15	Vertex with depression	with three depressions (1) with two depressions (0)
16	Head width	as wide as pronotum (1) not as wide as pronotum (0)
17	Head width	wider than pronotum (1) smaller than pronotum (0)
18	Pronotum spots	with spots (1) without spots (0)
19	Pronotum depressions and pits	with depressions and pits (1) without depressions and pits (0)
20	Pronotum band	with band (1) without band (0)
21	Pronotum blotches	with blotches (1) without blotches (0)
22	Pronotum arc	with arc (1) without arc (0)
23	Forewing length in male	very long (1) not very long (0)
24	Fore-wing shape	rounded (0) tapered (1)
25	Appendix	present (1) absent (0)
26	Appendix present	extending around apex (1) restricted to anal margin (0)
27	Number of apical cells	four (1) three (0)
28	Closed subapical cells	with closed subapical cells (1) without closed subapical cells (0)
29	Number of closed subapical cells	two (1) one (0)
30	Open subapical cell	central subapical cell open (1) inner subapical cell open (0)
31	Cross vein	present (1) absent (0)
32	Number in hind wing of apical cells	with more than one apical cell (1) with one apical cell (0)
33	Number in hind wing of apical cells	with four apical cells (1) with three apical cells (0)
34	scutellum spots	with spots (1) without spots (0)
35	Scutellum with shapes	with two a triangular shapes (1) without a triangular shape (0)
36	scutellum depressions and pits	with depressions and pits (1) without depressions and pits (0)
37	Abdominal apodeme	with abdominal apodeme (1) without abdominal apodeme (0)
38	Apodeme length	as long as 4th sternum abdominal segment (1) as long as two abdominal segment (0)
39	Apodeme shape	crescenticly diverging towards apex (1) slightly diverging (0)
40	Pygopher length according to genital plate	long (1) short (0)
41	Pygopher	fused (1) not fused (0)
42	Pygopher macroseatae 1	more than one row (1) reduced one row (0)
43	Pygopher macroseatae 2	uniseriate (1) scattered (0)
44	pygofer macroseatae 3	6 long and 4 short (1) 5 long and 3 short (0)
45	Pygopher spines	with spines (1) without spines (0)

46	Pygofer appendages	with tapered appendages (1) without tapered appendages (0)
47	Genital plate spines	with spines (1) without spines (0)
48	Genital plate claw	with sclerified claw (1) without claw (0)
49	Stylus number	with two pair of stylus (1) with one pair of stylus (0)
50	Stylus size	broad (1) narrow (0)
51	Stylus length	long (1) short (0)
52	Stylus preapical lobe	present (1) absent or undeveloped (0)
53	Stylus preapical lobe	long (1) short (0)
54	Stylus apophysis	long (1) short (0)
55	Apophysis shape	claw-like (1) pointed (0)
56	Apophysis	curved (1) not curved (0)
57	Connective	fussed to aedeagus (1) articulated with aedeagus (0)
58	Lateral anterior arms of connective	divergent (1) closely appressed anteriorly (0)
59	Lateral anterior arms of connective	divergent y-shaped (1) divergent u-shaped (0)
60	Aedeagus	bifid (1) not bifid (0)
61	Aedeagus bifid arms	long (1) short (0)
62	Aedeagus end	curved (1) not curved (0)
63	Aedeagus end	tapered at the end (1) not tapered at the end (0)
64	Aedeagus spines	with spine (1) without spine (0)
65	Aedeagus spines	with 2 ventral spines (1) with 3 ventral spines (0)

Table 3. Fifteen leafhopper species on medicinal and aromatic plants in Egypt arranged according to their subfamilies alphabetically.

Subfamily	Tribe	
Deltocephalinae	Chiasmini	*Aconurella prolix* (Lethierry) *Exitianus pondus* Ross *Nephotettix modulates* Melichar
	Hecalini	*Parabolocratalis* sp. Evans
	Macrostelini	*Balclutha frontalis* (Ferrari) *Cicadulina bipunctella zeae* China *Cicadulina chainai* Ghauri, *Macrosteles sexnotatus* (Fallen)
	Opsiini	*Orosius albicinctus* Distant
	Paralimnini	*Psammotettix alienus* (Dahlbom)
	Scaphoideini	*Neolimnus aegyptiacus*
Typhlocybinae	Typhlocybini	*Empoasca decipiens* Paoli *Eupteryx cypria* Ribaut
Ulopinae	Ulopini	*Megulopa sahlbergorum* Lindberg
Megophthalminae	Agalliini	*Austroagallia* sp. Evans

Table 4. Similarity matrix percentages among fifteen leafhopper species based on both diagnostic morphological characters and ISSRs markers

Species	*Austroagallia* sp.	*E. pondus*	*N. aegyptiacus*	*E. cypria*	*M. sexnotatus*	*B. frontalis*	*C. bipunctella zeae*	*C. chinai*	*O. albicinctus*	*A. prolixa*	*E. decipiens*	*N. modulates*	*P. alienus*	*Parabolocratalis* sp.	*M. sahlbergorum*
***Austroagallia* sp.**															
E. pondus	53.8														
N. aegyptiacus	52.4	69													
E. cypria	48.9	58	58												
M. sexnotatus	58.7	61	62	75											
B. frontalis	49	65	63	62.7	72										
C. bipunctella zeae	45.8	59	55	56.9	64	79									
C. chinai	43.4	56	52	52.4	64	73.1	80.3								
O. albicinctus	47.4	62	67	56.4	74	80	73.2	70.7							
A. prolixa	41.2	56	41	44.3	48	58.5	54.7	55.1	57.4						
E. decipiens	31.3	40	31	56.3	42	37.8	36.7	38.7	32.7	52.2					
N. modulates	46	47	40	44.9	55	48.7	37.2	43.9	50.9	53.8	56				
P. alienus	40	53	45	56	58	57.1	48.9	53.9	59.1	62.8	54	68.9			
***Parabolocratalis* sp.**	28.2	36	31	41.8	45	32.3	24.7	33.6	38.8	42.7	52	59.1	56.6		
M. sahlbergorum	32.9	38	30	32.3	38	31.7	26.3	36.7	32	38.1	47	53.3	50	62.2	

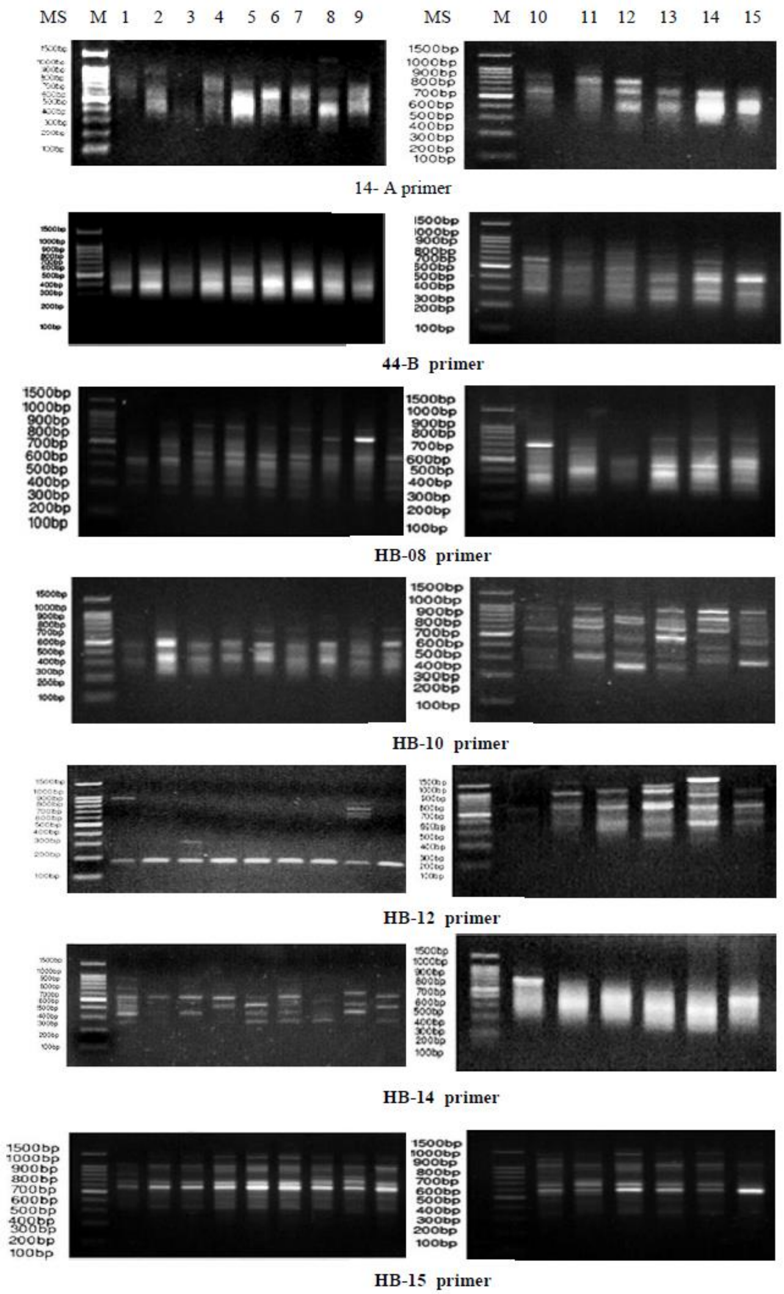

Figure 1. The ISSR-PCR banding patterns of fifteen leafhopper species amplified by seven primers. MS, molecular size; M, marker; 1. *Austroagallia* sp.; 2. *E. pondus*; 3. *N. aegyptiacus*; 4. *E. cypria*; 5. *M. sexnotatus*; 6. *B. frontalis*; 7. *C. bipunctella zeae*; 8. *C. chainai*; 9. *O. albicinctus*; 10. *A. prolix*; 11. *E. decipiens*; 12. *N. modulates*; 13. *P. alienus*; 14. *Parabolocratalis* sp.; 15. *M. sahlbergorum*.

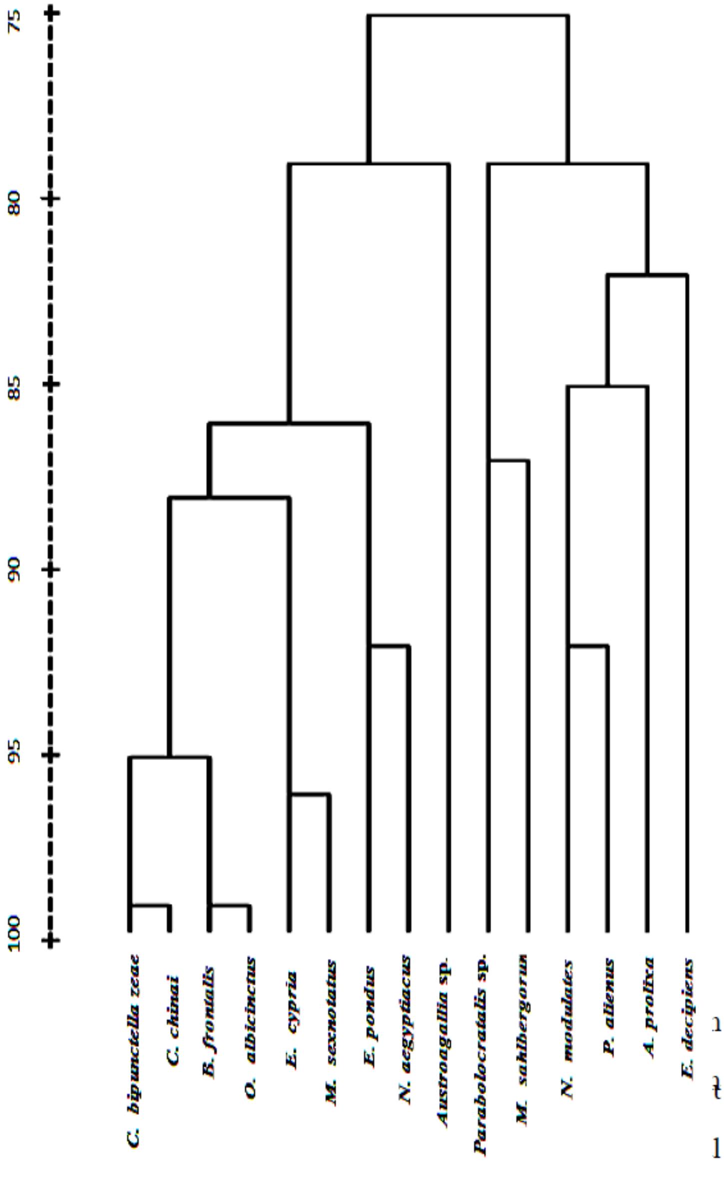

Figure 2. Dendrogram of phylogenetic relationships for the fifteen leafhopper species based on morphological characters and seven ISSR-PCR markers analysis.

SOME CONTRIBUTIONS TO TURKISH *CHEILOSIA* MEIGEN (DIPTERA: SYRPHIDAE)

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[Sarıbıyık, S. 2017. Some contributions to Turkish *Cheilosia* Meigen (Diptera: Syrphidae). Munis Entomology & Zoology, 12 (1): 234-239**]**

ABSTRACT: Material of the genera *Cheilosia* sampled from Aksaray, Ankara, Bartın, Bolu, Çankırı, Kahramanmaraş, Kastamonu, Kayseri, Nevşehir, Niğde, Sinop and Zonguldak between 1993 and 2008 is presented. 17 species have been identified. Four species as *Cheilosia bracusi* Vujic & Claussen, 1994, *Cheilosia himantopus* (Panzer, 1798), *Cheilosia transcaucasica* Stackelberg, 1960 and *Cheilosia vulpina* (Meigen, 1822) are new to the Turkish fauna.

KEY WORDS: Syrphidae, *Cheilosia*, new records, Turkey

The predominantly Holarctic genus *Cheilosia* Meigen, 1822 is one of the most diverse and species-rich genera of the family Syrphidae (Diptera), comprising about 450 species, 300 from the Palaearctic region, more than 80 from the Nearctic region, about 50 species from the Oriental region, and a couple of species which extend into the northern Neotropics. Among Palaearctic members of the subfamily Eristalinae, only the genera *Cheilosia* and *Volucella* contain species with various feeding modes of the larvae. All known larvae of the genus *Cheilosia* are saprophagous, phytophagous, fungivorous or are sap-feeders on coniferous trees. Most *Cheilosia* flies are all black in ground-color, with their color of pilosity ranging from black to yellow and red. Some *Cheilosia* species are good mimics of Hymenoptera, e.g., the color pattern of the pilosity resembles that of particular bumblebee species (Ståhls et al., 2004).

Until now twenty species of the genus *Cheilosia* have been recorded from Turkey, by Turkish and foreign researchers. In this study, the species and the people who recorded them are listed in Table 1.

MATERIAL AND METHODS

The syrphids were collected by the author from 47 sites belonging to 12 provinces (AK: Aksaray, AN: Ankara, BA: Bartın, BL: Bolu, ÇA: Çankırı, KM: Kahramanmaraş, KS: Kastamonu, KY: Kayseri, NE: Nevşehir, Nİ: Niğde, Sİ: Sinop and ZN: Zonguldak) of the Turkey with hand net from April to September, mainly during spring and autumn between the years 1993 and 2008 (Fig. 1). The surveys have been carried out in habitats in valleys, river banks and mostly high mountainous regions. The flowers being visited by syrphids have been reported in Table 2. The identification of some materials have been made by the C. Claussen (Flensburg, Germany). All samples are kept by the author (Kastamonu, Turkey).

RESULTS

The provinces from which the syrphid materials were collected by author, are given in Table 2. The first two letters given in the locality indicate the provinces visited, and the subsequent numerals indicate the locality of the provinces. The altitude is given for each locality. And the visited dates of localities are also mentioned.

Localities

Aksaray
AK01 Aksaray, Gülağaç, Kızılkaya village, 03.06.1997, 1100 m.
Ankara
AN01 Ankara, Kızılcahamam, Güvem village, 14.05.1994-22.07.1997, 950-1040 m.
AN02 Ankara, Çubuk, Karagöl, 25.05.1996, 1450 m.
AN03 Ankara, Çubuk, Ovacık village, 25.05.1996, 1150 m.
AN04 Ankara, Çubuk, Özlüce village, 05.05.1996, 1000 m.
AN05 Ankara, Çubuk, Kuruçay village, 25.05.1996, 1100 m.
Bartın
BA01 Bartın, Ulus, 24.V.1995, 60m.
Bolu
BL01Bolu, Gölcük, 18.07.1995-03.08.199611001320m.
BL02 Bolu, Yedigöller, 20.07.1995, 780 m.
BL03 Bolu, Yedigöller, Köknarli high plateau, 20.07.1995-03.08.1996, 1400-1500 m.
BL04 Bolu, Yedigöller main road 22. km., 09.07.1996, 1400 m.
BL05 Bolu, Mengen, Hızırbaba locality, 10.07.1996, 740 m.
BL06 Bolu, Gerede, Aktaş forest, 04.08.1996, 1400 m.
Çankırı
ÇA01 Çankırı, Çerkeş, Halkaoğlu village, 25.05.1995,1150 m.
ÇA02 Çankırı, Ilgaz, Çomar village, 05.07.1996, 1400 m.
ÇA03 Çankırı, Ilgaz, Ilgaz Mountain, 12.07.1997, 1500 m.
Kahramanmaraş
KM01 K.Maraş, Andırın, Kesik high plateau, 13.08.1995-14.06.1999, 1250 m.
Kastamonu
KS01 Kastamonu, Ilgaz Mountain National Park, 03.06.1995-20.08.2008, 1600-1900 m.
KS02 Kastamonu, Ilgaz Mountain, Tüfekçi village, Diphan locality, 10.06.2000-25.06.2008, 1500-1700 m.
KS03 Kastamonu, Bostan village, 12.07.1997-23.06.1999, 1200-1400 m.
KS04 Kastamonu center, 07.06.1994-10.05.2000, 720 m.
KS05 Kastamonu, Girdallı village, 05.07.1996, 1100 m.
KS06 Kastamonu, Oyrak locality, 11.05.1996, 800 m.
KS07 Kastamonu, Çatören and Bostan villages, 12.07.1997-06.08.1999, 1250 m.
KS08 Kastamonu, Yukarı İsmailli village, 07.08.1999, 1400 m.
KS09 Kastamonu, Girdallı village, , 08.06.1996, 1100 m.
KS10 Kastamonu, Seydiler, Sabuncular village, 10.07.1995, 1400 m.
KS11 Kastamonu, Ağlı, 08.07.1996, 1160 m.
KS12 Kastamonu, Biden high plateau, 21.07.1995, 1200 m.
KS13 Kastamonu, Tosya, Bürnük village, 05.07.1996,1190 m.
KS14 Kastamonu, Tosya, Ilgaz Mountain pass, 08.06.1996, 1650 m.
KS15 Kastamonu, Tosya, Dipsiz göl, 24.06.2000, 1000 m.
KS16 Kastamonu, Hanönü, Çakırçay village, 09.06.1996, 450 m.
KS17 Kastamonu, Daday, Ballıdağ locality, 10.05.2008-30.09.2008, 1400-1700 m.
Kayseri
KY01 Kayseri, Yılanlıdağı, Koyunlubaba locality, 19.05.1993-26.06.1993, 1200-1250 m.
KY02 Kayseri, Develi, Erciyes Mountain, 20.05.1993, 1700 m.
KY02 Kayseri, Develi, Yazıbaşı and Dereşimli village, 20.05.1993, 1350 m.
KY03 Kayseri, Yahyalı-Mansurlu main road 5. km., 21.05.1993, 1300 m.
KY04 Kayseri, Develi-Tomarza main road 8. km., 22.05.1993, 1450 m.
KY05 Kayseri, Yahyalı-Mansurlu main road 5.km., 12.06.1993, 1500 m.
KY06 Kayseri, Hisarcık, 13.06.1993, 1600 m.
KY07 Kayseri, Yeşilhisar, Güzelöz locality, 02.06.1997, 1260 m.
Nevşehir
NE01 Nevşehir, Göre village, 19.05.1997, 1260 m.

Niğde
Nİ01 Niğde, Ulukışla, 01.06.1997-23.06.1997, 1280-1400 m.
Sinop
Sİ01 Sinop, Boyabat, 07.07.1996, 1300 m.
Zonguldak
ZN01 Zonguldak, Devrek, 22.05.1995, 220 m.
ZN02 Zonguldak, Alaplı-Akçakoca main road 5. km., 21.05.1995, 10 m.

Table 1. The list of reported *Cheilosia* species. In the second column references are given to literatures in which the species has previously been recorded for Turkey.

Genus	Species	References pertaining to Turkey
Cheilosia	*1. Cheilosia aerea* Dufour, 1848	Dirickx (1994), (Reemer & Smit (2007), Sarıbıyık (2009)
	2. Cheilosia albitarsis (Meigen), 1822	Tuatay et al. (1967, 1972) Sarıbıyık & Hasbenli (2006), (Hurkmans et al.(1997), Sarıbıyık (2009)
	3. *Cheilosia bracusi* Vujic&Claussen, 1994	New record
	4. Cheilosia canicularis (Panzer), 1801	Hurkmans et. al. (1997), Sarıbıyık, (1999, 2001, 2003b, d, 2009), Stuke & Claussen (2000), Reemer & Smit (2007), Speight (2008)
	5. *Cheilosia himantopus* (Panzer), 1798	New record
	6. *Cheilosia illustrata* (Harris), 1776	Sarıbıyık (2001, 2003b, d, 2009)
	7. Cheilosia mutabilis (Fallen), 1817	Speight (2008),
	8. Cheilosia nigripes (Meigen), 1822	Séguy (1961), Peck (1988), Dirickx (1994), Speight (2008)
	9. Cheilosia pagana (Meigen), 1822	Tuatay et al. (1967, 1972), Dirickx (1994), Speight 2008)
	10. Cheilosia proxima (Zetterstedt), 1843	Dirickx (1994), Speight (2008), Sarıbıyık (2009)
	11. Cheilosia scutellata (Fallén), 1817	Sack (1932), Özgür (1987), Sarıbıyık (1999, 2001, 2003b, c, d, 2009), Sarıbıyık & Hasbenli (2006), Speight (2008)
	12. Cheilosia soror (Zetterstedt), 1843 =*Cheilosia rufipes* (Preyssler, 1793)	Özgür (1987), Dirickx (1994), Aktaş & Sarıbıyık (1996), Sarıbıyık, (1999, 2001, 2003a, b, c, d, 2009), Sarıbıyık & Hasbenli (2006), Reemer & Smit (2007)
	13. *Cheilosia transcaucasica* Stackelberg, 1960	New record
	14. Cheilosia urbana (Meigen), 1822 =*Cheilosia praecox* (Zetterstedt, 1843) =*Cheilosia ruralis* (Meigen, 1822)	Özgür (1987), Claussen & Lucas (1988), Dirickx (1994), Speight (2008), Sarıbıyık (2009)
	15. Cheilosia variabilis (Panzer), 1798	Dirickx (1994), Hurkmans et. al. (1997), Sarıbıyık, (1999, 2001, 2003b, d, 2009), Speight (2008)
	16. *Cheilosia vicina* (Zetterstedt), 1849 = *Cheilosia nasutula* (Becker, 1894)	Dirickx (1994), Speight (2008)
	17. *Cheilosia vulpina* (Meigen), 1822	New record

Table 2. The list of *Cheilosia* species. The locality codes are explained in the text. In some cases the number and sex of the specimens are given between brackets (f=female, m=male). In the last column, visited flowers are given.

No	Species	Localities	Flower visited
1	*Cheilosia aerea* Dufour, 1848	AN01 (1m) AN03 (1m) AN04 (1m) BA01 (3m, 2f) KM01 (1f) KS13 (1f) KS16 (1f)KY01 (5m, 1f) KY02 (2m) KY03 (1f) KY04 (5m, 2f) KY05 (1m, 2f) KY06 (1f) KY07 (2m) KY08 (1m) Nİ01 (1m, 1f)	*Crataegus* sp. Rosaceae and White Umbelliferae
2	*Cheilosia albitarsis* (Meigen, 1822)	AK01 (1f) AN01 (2m, 2fm) AN02 (2m, 5f) AN05 (1f) BL01 (1f) ÇA01(5m, 2f) ÇA02(1f) KS01 (2f) KS02 (6m, 7f) KS04 (1m) KS14 (4m 6f) KS15 (1m) KS09 (1m 2f) KY04 (2f) NE01 (1m) ZN01(1m)	*Ranunculus* sp. Ranunculaceae and White Umbelliferae
3	*Cheilosia bracusi* Vujic & Claussen, 1994	KS01 (1f)	White Umbelliferae
4	*Cheilosia canicularis* (Panzer, 1801)	KS01 (1m, 1f) Sİ01(2m) KS17 (2m, 2f)	yellow composites
5	*Cheilosia himantopus* (Panzer, 1798)	ÇA03 (1f) KS02 (1f) Sİ01(1m, 1f)	yellow composites
6	*Cheilosia illustrata* (Haris, 1776)	BL01 (1m) BL02 (2m) BL03 (8m, 5f) KS01 (4m,6f) KS09 (1m)	*Heracleum* sp. Umbelliferae
7	*Cheilosia mutabilis* (Fallen, 1817)	KS07 (1f) ZN02 (1m)	White Umbelliferae
8	*Cheilosia nigripes* (Meigen, 1822)	KS14 (1f) KY03 (1m)	*Ranunculus* sp. Ranunculaceae
9	*Cheilosia pagana* (Meigen, 1822)	BL03 (1m)	White Umbelliferae
10	*Cheilosia proxima* (Zetterstedt, 1843)	BA01 (2m, 1f)BL04 (1f) BL05 (3f) KS01 (1m) KS04 (3m, 2f) KS10 (1f) KS11 (1f)	*Ranunculus* sp. Ranunculaceae White umbellifers; *Crataegus*
11	*Cheilosia scutellata* (Fallén, 1817)	BA01 (3m, 4f) BL01 (1m) BL02 (1m) BL06 (3m) KS01 (1m, 1f) KS12 (1m)	White Umbelliferae
12	*Cheilosia soror* (Zetterstedt, 1843) =*Cheilosia rufipes* (Preyssler, 1793)	BA01 (1m, 2f) KM01 (3m, 4f)	White Umbelliferae
13	*Cheilosia transcaucasica* Stackelberg, 1960	AN01 (fm) KS02 (1m) KS07 (1f)	White Umbelliferae
14	*Cheilosia urbana* (Meigen, 1822) =*Cheilosia praecox* (Zetterstedt, 1843) =*Cheilosia ruralis* (Meigen, 1822)	AN01 (1m) KS01 (1f) KS04 (1f) KS06 (1m) KS07 (1f) KY01 (1m) KY02 (3f) KY06 (1f)	White Umbelliferae

15	*Cheilosia variabilis* (Panzer, 1798)	BL01 (1m) KS02 (2m) KS07 (1m) KS10 (1f)	*Ranunculus* sp. and white umbellifers
16	*Cheilosia vicina* (Zetterstedt, 1849) = *Cheilosia nasutula* (Becker, 1894)	KS01 (2m, 1f) KS17 (4m, 2f)	*Ranunculus* sp. and yellow Compositae
17	*Cheilosia vulpina* (Meigen, 1822)	ÇA03 (1m) KS01 (3m) KS04 (1m, 1f) KS06 (1f) KS07 (1f) KS08 (1f)	*Cistus* sp. and *Ranunculus* sp. and white Umbelliferae

DISCUSSION

The genus *Cheilosia* Meigen, 1822 (Syrphidae, Diptera) is the largest genus of European hoverflies with more than 175 European species. It is primarily distributed in the Palaearctic, with the highest diversity in the forest habitats, especially in broad-leaved woodlands (Vujić, 1996).

Until now, twenty species of the genus *Cheilosia* have been recorded from Turkey, by Turkish and foreign researchers. The number of *Cheilosia* reaches 24 with newly 4 records in the study.

It is accepted that *Cheilosia* genus is the second largest genus of hoverflies in Turkey till now and it can be expected that it would be probably the largest genus of Turkey, if is compared with genus number in Europe. Because, many collected *Cheilosia* samples have not been identified.

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LITERATURE CITED

Aktas, M. & Sarıbıyık, S. 1996. Contribution to the Syrphidae fauna of Turkey (Diptera: Syrphidae) (II), Milesiinae. Journal of the Institute of Science and Technology of Gazi University, 9 (1): 15-27.

Claussen, C. & Lucas, J. A. W. 1988. Zur Kenntnis der Schwebfliegenfauna der Insel Kreta mit der Beschreibung von Eumerus minotaurus sp. n. (Diptera: Syrphidae). Entomofauna, 9: 133-168.

Dirickx, H. G. 1994. Atlas Des Dipteres syrphides de la region mediterraneenne. Studiedocumenten van het Koninklijk Belgisch Instituut voor Natuurwetenschappen, 75: 1-317.

Hurkmans, W., Hayat, R. & Özbek, H. 1997. Insect and plants of a marsh at Küçükgeçit, Aşkale, Erzurum, Turkey: A preview on preservation. Türkiye Entomoloji Dergisi, 21 (2): 95-108.

Özgür, A. F. 1987. Akdeniz Bölgesi kıyı şeridi Syrphidae (Diptera) faunası II. Altfamilya: Cheilosiinae, Spheginae, Pelecocerinae, Milesiinae, Chysotoxinae, Volucellinae, Çukurova Universitesi. Ziraat. Fakültesi Yayinları, 2 (3): 67-81.

Peck, L. V. 1988. Family Syrphidae, pp. 11-230. In, Soos, A and Papp, L. (Editors). Catalogue of Palaeartic Diptera, 8: 363 pp.

Reemer, M. & Smit, J. T. 2007. Some hoverfly records from Turkey (Diptera: Syrphidae). Volucella, 8: 135-146.

Sack, P. 1928-1932. Syrphidae. In, Lindner, E. Die Fliegen der paläarktischen Region, IV (6). Stuttgart, Germany, 451 pp.

Sarıbıyık, S. 1999. Milesiinae Fauna of the West Blacksea Region (Diptera: Syrphidae). Kastamonu Education Journal, 7 (1): 195-204.

Sarıbıyık, S. 2001. New Records of the Subfamily Milesiinae (Diptera: Syrphidae) from Turkey. Journal of the Entomological Research Society, 3 (3): 43-51.

Sarıbıyık, S. 2003a. Fauna of Syrphinae and Milesiinae (Diptera: Syrphidae) Around Tuz Lake. Gazi Üniversitesi Kastamonu Eğitim Dergisi, 11 (2): 439-450.

Sarıbıyık, S. 2003b. The Evaluation of the Works on Syrphidae (Diptera) Fauna in the Western Blacksea Region. Gazi Üniversitesi Kastamonu Eğitim Dergisi, 11 (2): 461-466.

Sarıbıyık, S. 2003c. Milesiinae Fauna of the Kahramanmaraş's Andırın Town (Diptera: Syrphidae). Gazi Üniversitesi Kastamonu Eğitim Dergisi, 11 (1): 159-164.

Sarıbıyık, S. 2003d. Kastamonunun Syrphid Sinekleri (Diptera:Syrphidae). II. Kastamonu Kültür Sempozyumu (18-20 Eylül 2003), pp. 707-719.

Sarıbıyık, S. 2009. Syrphidae Fauna of Ballidağ (Diptera). Kastamonu Üniversitesi Kastamonu Eğitim Dergisi, 17 (2): 707-714.

Sarıbıyık, S. & Hasbenli, A. 2006. Fauna of Syrphinae and Milesiinae (Diptera, Syrphidae) in the Region of South-West Anatolia. Journal of the Entomological Research Society, 8 (1): 43-52.

Séguy, E. 1961. Diptères Syrphides de I'Europe occidentale, Mémories du Muséum National D'Histoire Naturelle, 23 : 1-248.

Speight, M. C. D. 2008. Species accounts of European Syrphidae (Diptera) 2008. in: Speight M. C. D., Castella E., Sarthou J. P., Monteil, C. (eds). Syrph the Net, the database of European Syrphidae, vol. 55, 262 pp., Syrph the Net publications, Dublin.

Ståhls, G., Stuke, J. H., Vujić, A., Doczkal, D. & Muona, J. 2004. Phylogenetic relationships of the genus *Cheilosia* and the tribe Rhingiini (Diptera, Syrphidae) based on morphological and molecular characters. Cladistics, 20: 105-122.

Stuke, J. H. & Claussen, C. 2000. Cheilosia canicularis auctt.-ein Artenkomplex. Volucella, 5: 79-94.

Tuatay, N., Gül, S., Demirtola, A., Kalkandelen, A. & Çagatay, N. 1967. Nebat Koruma Müzesi Böcek Kataloğu (1961-1966). Zirai Mücadele ve Zirai Karantina Genel Müdürlüğü Yayınları, Mesleki Kitaplar Serisi, Ankara, 66 pp.

Tuatay, N., Kalkandelen, A. & Aysev (Çağatay), N. 1972. Insect Catalogue of Plant Protection Museum (1961-1971). Zirai Mücadele ve Zirai Karantina Genel Müdürlüğü Yayınları Mesleki Kitaplar Serisi, Ankara, p. 119.

Vujić, A. 1996. Genus Cheilosia Meigen and related genera(Diptera: Syrphidae) on the Balkan Peninsula. Novi Sad: Matica Srpska. 194 pp.

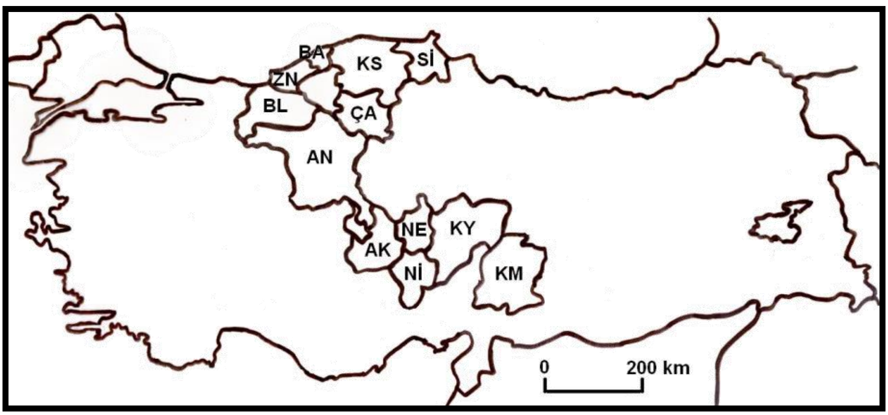

Figure 1. The research areas (AK: Aksaray, AN: Ankara, BA: Bartın, BL: Bolu, ÇA: Çankırı, KM: Kahramanmaraş, KS: Kastamonu, KY: Kayseri, NE: Nevşehir, Nİ: Niğde, Sİ: Sinop, and ZN: Zonguldak).

FIRST REPORT OF THE GENUS *NEOLOSBANUS* HERATY (HYMENOPTERA: EUCHARITIDAE) FROM MAHARASHTRA WITH THE SPECIES *NEOLOSBANUS PALGRAVEI* (GIRAULT)

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[Girish Kumar, P. 2017. First report of the genus *Neolosbanus* Heraty (Hymenoptera: Eucharitidae) from Maharashtra with the species *Neolosbanus palgravei* (Girault). Munis Entomology & Zoology, 12 (1): 240-244**]**

ABSTRACT: A eucharitid wasp genus, namely, *Neolosbanus* Heraty, 1994 is reported here for the first time from Maharashtra with species *N. palgravei* (Girault, 1922). An updated checklist of the Indian subcontinent species are also provided.

KEY WORDS: Hymenoptera, Eucharitidae, *Neolosbanus*, new record, Maharashtra, India

The genus *Neolosbanus* was erected by Heraty (1994) based on the type species *Orasema palgravei* Girault from Australia. The genus belongs to the tribe Psilocharitini under the subfamily Eucharitinae (Heraty, 2002) and is distributed in the Indo-Pacific Region. Single questionable records are known from Algeria (Palaearctic) (Bouček, 1988) and Uruguay (Neotropical) (Heraty, 1994). This genus includes 16 valid species worldwide of which 10 species were reported from Oriental Region and four species were reported from the Indian subcontinent (Heraty, 1994, 2002; Girish Kumar, 2004; Noyes, 2015). Two species, namely, *Neolosbanus laeviceps* (Gahan, 1940) and *N. palgravei* (Girault, 1922) are present in India. In India, *N. laeviceps* so far recorded from Kerala, Tamil Nadu and *N. palgravei* from Karnataka and Kerala. In this paper, studied a large number of collections from different localities of the Western Ghats and adjacent areas and reporting the genus *Neolosbanus* Heraty for the first time from Maharashtra with the species *N. palgravei* (Girault) from two different localities (Barve of Kolhapur District and Kudal of Sindhudurg District) of the state.

MATERIAL AND METHODS

The specimens are collected from different localities of Western Ghats and its adjacent areas with a sweep net. It is examined under LEICA M60 stereozoom microscope and photograph captured with the camera model LEICA DFC-450. The studied specimens are deposited in the 'National Zoological Collections' of the Western Ghat Regional Centre, Zoological Survey of India, Kozhikode (= Calicut), India (ZSIK).

Abbreviations used for the Museums: QMB — Queensland Museum, Brisbane, Australia; USNM — United States National Museum of Natural History, Washington DC, USA; ZMUC — Zoologisk Museum, Copenhagen, Denmark; ZSIK — Western Ghat Regional Centre, Zoological Survey of India, Kozhikode, Kerala, India.

Abbreviations used for the terms used in the text: F = Flagellar segments; MPS = Multiporous plate sensilla.

Genus *Neolosbanus* Heraty, 1994

Neolosbanus Heraty, 1994: 93-96.

Type species: *Orasema palgravei* Girault, by original designation.

Diagnosis. Head smooth or punctate; palpi each with 3 segments; clypeus usually strongly rounded without an anteclypeus projecting over mouth parts, without marginal raw of setae; in *gemma*-group clypeus broadly rounded, fine raw of marginal setae (as in *Psilocharis* Heraty*)*; dorsal occipital margin carinate; femoral groove foveate; prepectus not fused to pronotum, foveate; petiole gradually narrowed basally; first gastral sternite smooth, not medially constricted; hypopygium with few small setae on each side of mucro; ovipositor acicular or expanded, straight, not distinctly curved, ventral valve with oblique ridges, not teeth.

Distribution. Indo-Pacific Region. Single questionable records are known from Algeria (Palaearctic) (Bouček, 1988) and Uruguay (Neotropical) (Heraty, 1994).

Biology and Hosts. *Neolosbanus palgravei* and *N. gemma* were reared from pupae of *Hypoponera* sp. (Ponerinae) (Heraty, 1994). Larval stages and oviposition habits have been described for *N. (=Parapsilogaster*) *laeviceps* (Clausen, 1940a,b) and *N. palgravei* (Heraty, 1994). Planidia are external parasites of the ant larva, with further development taking place on the pupa within the host cocoon (Heraty, 1994).

Discussion. *Neolosbanus* includes a group of species that were originally misplaced in *Losbanus* Ishii by Watanabe (1958). *Neolosbanus* Heraty closely resembles to *Psilocharis* Heraty in having: (1) Gs_1 usually evenly rounded and not constricted and (2) Dorsal occipital margin with distinct carina. However, this genus can be distinguished from *Psilocharis* in having: (1) Base of petiole gradually narrowed laterally and dorsally (In *Psilocharis* base of petiole abruptly narrowed laterally), (2) Clypeal margin strongly lobate or slightly rounded (In *Psilocharis* clypeal margin straight with well defined and narrow anteclypeus) and (3) Femoral groove narrow and foveate (In *Psilocharis* femoral groove broad and evenly impressed).

Neolosbanus palgravei (Girault, 1922)

(Fig. 1)

Orasema palgravei Girault, 1922: 105-106. Type data: Australia: Queensland, Cairns. Lectotype Female, designated by Heraty, 1994: 109 (QMB). Description of both sexes.

Psilogaster nishidai Ishii and Nagasawa, 1941: 292-294. Type data: Caroline Islands. Description of female, illustrated. Unjustified synonymy with *Orasema purpureoventris* by Bouček, 1988: 520. Synonymy with *N. palgravei* by Heraty, 1994: 109.

Losbanus nishidai; new combination by Watanabe, 1958: 27-28.

Losbanus petersoni Hedqvist, 1978: 229. Type data: Philippines: Palawan, Tagembung. Holotype Female, by original designation (ZMUC). Description of female, illustrated. Unjustified synonymy with *Orasema purpureoventris* by Bouček, 1988: 520. Synonymy with *N. palgravei* by Heraty, 1994: 109.

Orasema indica Snehalatha and Narendran, 1992: 355. Type data: India: Kerala: Trichur. Holotype Female, by original designation (USNM). Description of both sexes illustrated. Synonymy by Heraty, 1994: 109.

Neolosbanus palgravei; new combination by Heraty, 1994: 109-113. Subsequent description of both sexes, illustrated.

Female: Diagnosis. Face broadly rounded, completely polished; scrobal depression shallow, weakly impressed, completely smooth; occiput broadly emarginate; scape narrow and cylindrical; anellus present; flagellum 1.28x height of head; funicle 7 segmented; F1 3.75x as long as broad, 1.36x F2; MPS present; dorsum of mesosoma rugose-areolate frenum completely polished; frenal groove distinctly foveate dorsally; callus with few hairs, hairs short, fine and less than 10 in numbers; stigmal vein almost perpendicular to wing margin; ovipositor subapically expanded; first valvula with diagonal lateral ridges; second valvula narrow, apical ridges meeting along midline; body sparsely setose, petiole completely bare.

Colour. Head, mesosoma and petiole metallic black; coxae and femora brown except extreme apex of femora; scape and pedicel yellow; flagellar segments yellowish brown to dark brown; legs beyond femur pale yellow; claws brown; clypeus brown; mandibles brownish yellow with dark brown tips; eyes brownish white; ocelli reflecting pale yellow; wings hyaline, venation light brown; gaster brown; ovipositor pale brown.

Length. 2.40 mm.

Material examined. 1 female, INDIA: Maharashtra, Kolhapur District, Barve, 26.xii.2011, Coll. S.I. Kazmi & Party, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6398; 1 female, Sindhudurg District, Kudal, 31.xii.2011, Coll. S.I. Kazmi & Party, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6399.

Distribution. India: Karnataka, Kerala, Maharashtra (present record); Nepal. *Elsewhere*: Algeria; Australia; Japan, Palau; Papua New Guinea; Indonesia; Malaysia; Philippines; Singapore; Taiwan; Thailand; Vietnam; Solomon Islands; Caroline Islands.

Remarks. This is the first report of this species from Maharashtra state.

Other materials examined in this study

(1) *Neolosbanus laeviceps* (Gahan, 1940)

8 female, INDIA: Kerala, Palakkad District, Silent Valley National Park, Sirendri, 4.xii.2007, Coll. K. Rajmohana, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6356–6363; 7 female, Palakkad District, Silent Valley National Park, Sirendri, 22.ii.2013, Coll. P.M. Sureshan & Party, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6364–6370; 14 female, Idukki District, Mullaperiyar, 6.iv.2013, Coll. C. Bijoy, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6371–6384; 4 female, Pathanamthitta District, Gavi, 10.iv.2013, Coll. P.M. Sureshan & Party, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6385–6388; 5 female, Idukki District, Vandiperiyar, 8.i.2004, Coll. P. Girish Kumar, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6389–6393; 2 female, Kollam District, Shenduruni Wildlife Sanctuary, Pandimotta, 17.xii.2015, Coll. K. Rajmohana & Party, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6394–6395; 2 female, Thiruvananthapuram District, Ponmudi, 12.xii.2015, Coll. K. Rajmohana & Party, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6396–6397.

(2) *Neolosbanus palgravei* (Girault, 1922)

5 female, INDIA: Karnataka, Chikkamagaluru District, Sringeri, 15-22.v.2003, Coll. P.A. Sinu, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6400–6304; 1 female, INDIA: Kerala, Kasaragod District, Kasaragod, 10.vi.2001, Coll. E.J. Balamani, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6405; 1 female, Wayanad District, Pookode, 12.ii.2010, Coll. K.G. Emiliyamma & Party, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6406; 3 female & 2 male, Wayanad District, Chulliyode, 4.x.2014, Coll. P. Girish Kumar, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6407–6411; 1 female, Kozhikode

District, Malabar Wildlife Sanctuary, Kakkayam, 9.ii.1996, Coll. T.V. Mini, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6412; 1 female, Kozhikode District, Nanminda, 16.xi.2003, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6413; 2 female, Kozhikode District, Regional Engineering College Campus, 28.xi.1985, Coll. T.C. Narendran & Party, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6414–6415; 1 female, Kozhikode District, Olavanna, Malabar Botanical Garden, 6.i.2015, Coll. P.M. Sureshan & Party, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6416; 4 female, Malappuram District, Nilambur, Pookkottumpadam, 17.iv.2006, Coll. M. Sheeba, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6417–6420; 4 female & 1 male, Thrissur District, Thrissur, 19.iv.1986, Coll. T.C. Narendran, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6421–6425; 4 female, Thrissur District, Peechi, 4.i.2012, Coll. K. Rajmohana & Party, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6426–6429; 2 female, Thrissur District, Vazhachal, 28.ii.2013, Coll. P.M. Sureshan & Party, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6430–6431; 1 female, Palakkad District, Silent Valley National Park, Sirendri, 4.xii.2007, Coll. K. Rajmohana, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6432; 1 female, Ernakulum District, Thattekkad Bird Sanctuary, Urulanthanni, 6.i.2015, Coll. G. Kumar, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6433; 3 female, Ernakulum District, Thattekkad Bird Sanctuary, Kallipara, 6.i.2015, Coll. G. Kumar, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6434–6436; 2 female, Pathanamthitta District, Gavi, 10.iv.2013, Coll. P.M. Sureshan & Party, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6437–6438; 1 female, Idukki District, Meenmutti, 17.i.1992, Coll. M.B.R. & Party, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6439; 1 female, Idukki District, Vandiperiyar, 8.i.2004, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6440; 3 female & 1 male, Idukki District, Cheruthoni, 10.i.2004, Coll. P. Girish Kumar, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6441–6444; 1 female, Idukki District, Kumily, 9.iv.2013, Coll. P.M. Sureshan & Party, ZSIK Regd. No. ZSI/WGRS/I.R-INV. 6445; 3 female, Thiruvananthapuram District, Ponmudi, 12.xii.2015, Coll. K. Rajmohana & Party, ZSIK Regd. Nos. ZSI/WGRS/I.R-INV. 6446–6448.

Checklist of the Indian subcontinent species of *Neolosbanus*

(1) *N. laeviceps* (Gahan, 1940) — India: Kerala, Tamil Nadu. *Elsewhere*: Sri Lanka; Laos; Taiwan; Vietnam; Japan.

(2) *N. nepalensis* Heraty, 1994 — Nepal.

(3) *N. palgravei* (Girault, 1922) — India: Karnataka, Kerala, Maharashtra (present record); Nepal. *Elsewhere*: Algeria; Australia; Japan, Palau; Papua New Guinea; Indonesia; Malaysia; Philippines; Singapore; Taiwan; Thailand; Vietnam; Solomon Islands; Caroline Islands.

(4) *N. purpureoventris* (Cameron, 1909) — Nepal. *Elsewhere*: China; Indonesia; Laos; Malaysia; Taiwan; Thailand; Vietnam.

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LITERATURE CITED

Bouček, Z. 1988. Australasian Chalcidoidea (Hymenoptera). A Biosystematic Revision of Genera of Fourteen Families, with a Reclassification of Species. Wallingford: C.A.B. International, 832 pp.

Cameron, P. 1909. On two new genera and seven species from Borneo. Entomologist, 42: 229-234.

Clausen, C. P. 1940a. The immature stages of the Eucharide. Proceedings of the Entomological Society of Washington, 42: 161-170.

Clausen, C. P. 1940b. The oviposition habits of the Eucharidae (Hymenoptera). Journal of the Washington Academy of Sciences, 30: 504-516.

Gahan, A. B. 1940. A contribution to the knowledge of Eucharidae (Hymenoptera: Chalcidoidea). Proceedings of the United States National Museum, 88 (3086): 425-458.

Girault, A. A. 1922. New Chalcid flies from eastern Australia (Hymenoptera) – II. Insecutor Inscitiae Menstruus, 10: 100-108.

Girish Kumar, P. 2004. A review of Family Eucharitidae (Hymenoptera: Chalcidoidea) of Indian subcontinent. In: Rajmohana, K., Sudheer, K., Girish Kumar, P. & Santhosh, S. (Eds.), Perspectives on Biosystematics and Biodiversity. Prof. T.C. Narendran Commemoration Volume. Systematic Entomology Research Scholars Association, University of Calicut, Kerala, 627-646.

Hedqvist, K. J. 1978. Some Chalcidoidea collected in the Philippines, Bismark and Solomon Islands, II Eucharitidae, with keys and check-lists to Indo-Australian genera (Insecta, Hymenoptera). Steenstrupia, 4: 227-248.

Heraty, J. M. 1994. Classification and evolution of the Oraseminae in the Old World, with revisions of two closely related genera of Eucharitinae (Hymenoptera: Eucharitidae). Life Sciences Contributions, ROM, 157: 1-174.

Heraty, J. M. 2002. A revision of the genera Eucharitidae (Hymenoptera: Chalcidoidea) of the world. Memoirs of the American Entomological Institute, 68: 1-367.

Ishii, T. & Nagasawa, S. 1941. Descriptions of a new eucharid from Palau Islands. Tenthredo, 3: 291-294.

Noyes, J. S. 2015. Universal Chalcidoidea Database. World Wide Web electronic publication. Available from: http://www.nhm.ac.uk/chacidoids (Accessed on April, 2016).

Snehalatha, S. & Narendran, T. C. 1992. On a new species of *Orasema* Cameron (Hymenoptera: Eucharitidae), with a key to Indian species. Journal of the Bombay Natural History Society, 89: 335-357.

Watanabe, C. 1958. Eucharidae. Insects of Micronesia, 19: 19-34.

Figure 1. *Neolosbanus palgravei* (Girault, 1922), female.

BIODIVERSITY OF FLORA AND FAUNA ASSOCIATED WITH SAWMILLS OF ABEOKUTA, SOUTH-WESTERN NIGERIA

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[Bamidele, J. A., Idowu, A. B., Ademolu, K. O. & Aladesida, A. A. 2017. Biodiversity of flora and fauna associated with Sawmills of Abeokuta, South-Western Nigeria. Munis Entomology & Zoology, 12 (1): 245-253**]**

ABSTRACT: The biodiversity of flora and fauna was evaluated in five major sawmills of Abeokuta metropolis (7°03'N03°19'E) namely: Lafenwa, Sapon, Isale-Ake, Eleweran and Kotopo sawmills. Fauna species present around the sawmills were assessed while structured interview schedule was also organised for 193 respondents comprising workers and owners of the sawmills to assess their knowledge of and animal species commonly encountered at the sites. Flora survey was conducted using line transect method as well as direct observation. Most of the respondents (95%-100%) were within age 26 and above. Forty-three different plant species were observed. Five of these plant species (*Synedrella nodiflora, Sida acuta, Euphorbia hirta, Commelina benghalensis* and *Amaranthus spinosus*) occurred in all the study sawmills. Pilot fauna survey of the sawmills revealed a total of twenty-three animal species including insects and other invertebrates, reptiles, amphibians, birds and mammals. Twenty-six animal species were identified by the respondents from the study sawmills. Lizard and earthworms were cited more by the users of each of the study sawmills. Over 50% of the total animal species identified within the study sawmills are preys to lizards and other secondary consumers. Hence, the sawmill environments could be regarded as a complete and interacting biotic community.

KEY WORDS: Biodiversity, flora, fauna, sawmill, ecosystem, environment, wood

Sawmilling is a major enterprise providing direct and indirect employment for thousands of people in the tropical rain forest region of Nigeria, where there is abundance of trees (Ihekwaba et al., 2009). Due to the fast growth recorded in the construction sector, there has been high increase in the establishment of sawmills in different parts of the country to satisfy the growing demand for wood (Aroofor, 2000). These industries are mainly located in the wood producing rain forest areas of the country with Lagos, Ekiti, Osun, Cross River, Akwa Ibom, Imo, Ogun and Delta States, accounting for 90% of all sawmills in the country (Dosunmu & Ajayi, 2002). Several wastes has been reported to be produced during sawmilling operations, some of which include tree barks, cut slabs, sawdust, plain shavings, and strips (Akachukwu, 2000).

The biotic and abiotic components of the environment function together as an ecological system. Several anthropogenic influence, most especially industrial activities of which sawmills are also a part, has been involved in environmental modification. Biodiversity has recently emerged as an issue of both scientific and political concern primarily because of an increase in extinction rates caused by human activities (Ehrlich & Wilson, 1991). Pausas & Austin (2001) submitted that species richness patterns in relation to the environment need to be understood before drawing conclusions on the effect of biodiversity in ecosystem processes. Lalthanzara et al. (2011) reported that different land use systems may affect the abundance and diversity of soil and litter fauna.

Sawmills are a very common industry in the south-western part of Nigeria (Bamidele et al., 2014). These sawmills which were originally situated on large areas of land away from residential areas are now almost enclosed about with residential and commercial activities, isolating the sawmill areas from their original forest habitat. The ecosystem constituting several niches and habitats of the sawmill community has not been documented. As a unique ecosystem, there is need to identify and document the flora and fauna species associated with sawmills with a view to ascertain the organism biodiversity of the sawmills. This study therefore aims at conducting a survey of plants and animal species found in the vicinities of five major sawmills of Abeokuta, south-western Nigeria.

MATERIALS AND METHODS

Study sites

Five major sawmills located in Abeokuta, south-western Nigeria (7°03'N03°19'E) namely: Lafenwa, Sapon, Adatan, Elewera and Kotopo sawmills were selected and used for this study. These sawmills were about 25 to 40 years old. Each of the sawmills occupy a large area of land with several log processing and wood processing units, furniture workshops and plank markets. They are very busy in activities and supply most of the processed wood and wood products used in Abeokuta and neighbouring towns (Bamidele et al., 2014, 2015, 2016).

Fauna Survey

Pilot fauna survey: Animal species present around each of the sawmill locations were assessed. Places such as back of logs, within logs and planks, in the soil and on the vegetation around the sawmills were checked and noted. Some of the fauna species which could not be identified on the field were collected for identification in Zoology laboratory of the Federal University of Agriculture, Abeokuta.

Questionnaire based fauna survey: An assessment of animal species commonly cited around the study sawmills by users of the sawmills was also conducted through a structured interview schedule (questionnaire). A total of one hundred and ninety three (193) questionnaires were administered in all the study sawmills. Opinions of the sawmill owners and workers which include plank sellers, machine operators and furniture makers were noted. The respondents were allowed to express the names of the animal species in their local language (Yoruba).

Flora Survey

Plant species present in and around the study sawmills were sampled using line transect method. However, because of the arrangements of the sawmills where logs and planks were piled up and tents built all around for plank markets, line transect method was not so effective for an accurate plant survey on the study sawmills. Direct observation of plants growing freely around the sawmill factories, most especially within the plank markets and within the logs were therefore done to ensure a proper and more accurate plant survey.

The collected plant samples were identified in the Botany Laboratory, Department of Pure and Applied Botany and the herbarium of the Department of Forestry, Federal University of Agriculture, Abeokuta, Nigeria.

Statistical Analysis

Data obtained were subjected to statistical analysis, using the descriptive analysis of the Statistical Package for Social Sciences (SPSS) version 16.0. Charts were also constructed to present the sex and occupation of the respondents according to sawmill locations. Animal species were also classified based on their habitats.

RESULTS

Fauna Survey

Pilot fauna survey: A total of twenty-three animal species were cited in at least one of the five sawmills sampled. Fauna species observed in the study sawmills were good representative of the animal kingdom as they cut across the insect group, other invertebrates, reptiles, amphibians, birds and the mammals (Table 2). Ten (10) fauna species were noted to be common to each of the study sawmills. Among the fauna species common to the study sawmills, termites, ants, earthworms, lizards, spiders and springtails were observed to be more in abundance. The habitats from which the fauna species were found are presented in Table 4.

Questionnaire-based fauna survey

Demographic Characteristics of the Respondents: A higher percentage of the respondents (53.2% - 56.5%) from Sapon, Kotopo and Lafenwa sawmills were males while it was vice-versa in Eleweran and Adatan sawmills (Fig. 1). Almost all the respondents (95% - 100%) are above 26 years of age, while the age group 36-50 years had the highest number of respondents in all the sawmills except Adatan where the age group 50 years and above had the highest number of respondents (Table 1). The most common occupation among the respondents was plank selling (52.1-76.7%) and this was keenly followed by machine operators (8.5 - 34.2%), in the order Plank seller > Machine operators > Furniture workers > Food vendors (Fig. 2).

Questionnaire survey of fauna: A total of twenty-six (26) animal species was identified by the respondents to be present in the study sawmills. Only thirteen (13) of these animal species were observed to be common to each of the sawmills (Table 3). The frequency of occurrence of lizard (95%, 100%, 100%, 85% and 100% for Sapon, Eleweran, Kotopo, Adatan and Lafenwa sawmills respectively) was higher than those of the other animal species responded present in the study sawmills. This was followed by the earthworms which had 93.6%, 100%, 69.7%, 85% and 94.5% frequency of occurrences for Sapon, Eleweran, Kotopo, Adatan and Lafenwa sawmills respectively.

Flora survey

The highest diversity of plant was observed in Lafenwa sawmill with 28 plant species. This was followed by Adatan (23 plant species), Camp and Sapon (17 plant species) and Eleweran (13 plant species**)** sawmills (Table 5).Only five plant species (*Synedrella nodiflora, Sida acuta, Euphorbia hirta, Commelina benghalensis* and *Amaranthus spinosus*) were common to all the study sawmills while *Abutilon mauritianum, Axonopus compressus, Euphorbia hysoppifolia, Gomphrena celosoides* and *Sida rhombifolia* occurred in four of the five sawmill locations.

DISCUSSIONS

This study revealed that sawmills shelter a wide diversity of plant and animal. All the sawmills contain sheds and pack-up planks which prevent the direct evaporative effect of the sun on the soil, hence the soils were usually moistened even during the dry seasons (Bamidele et al., 2016). These conditions are suitable for the abundance of plants and animal species.

Of all the plant species observed in the sawmills, *Sida acuta, Synedrella nodiflora, Euphorbia hirta, Conmelina benghalensis* and *Amaranthus spinosus* were the plant species found common to the sawmills. These plants are weeds which have the ability to thrive and proliferate in disturbed areas and harsh environment including roadsides and waste places (Akobundu & Agyaka, 1987). Some of the plants observed in the sawmills during this study (*Sida acuta, Chromolaena odorata, Aspilia* spp. and *Ageratum conyzoides*) were earlier reported as dominant and common plant species around the sawmills of Isokan Area of Osun State, Nigeria (Oke & Oyedare, 2006). *Gomphrena celosoides, Chromolaena odorata, Euphorbia hysoppifolia, Tephrosia* spp.*, Abutilon mauritianum, Sida rhombifolia, Mimosa* spp., *Physalis angulata* and *Axonopus compressus* also had higher occurrences in the study sawmills. These plants were also identified as weed by Akobundu & Agyakwa (1987), having the ability to withstand harsh environments including roadsides and waste places. The ability to withstand harsh environment could be of significant help in the proliferation of these plants on the sawmill soils.

The major component of an ecosystem is the plants. They are major modifiers of climate and providers of community structures and they are pathway through which energy enters the ecosystem (Purves et al., 1997). The plant forms a complex interaction between the biotic and abiotic entities of the environment (Lameed & Ayodele, 2010) by making use of the abiotic entities as food to produce food in form of biomass for the animal communities. High diversity of animal species within the sawmill vicinities as recorded in this study could therefore be connected to the observed high diversity of plant species.

Among the most abundant and important invertebrates which has close association with microbial symbionts in their gut for effective lignocelluloses (wood) digestion is the termites. Termites have been reported to play an important role in the turnover and mineralization of complex biopolymers, such as wood and other cellulose and hemicelluloses containing materials (Wenzel et al., 2002). Of all the insect species found on the sawmills, termites were observed to be more in abundance and also had the highest frequencies of occurrence among the respondents. The high abundance of termites on the sawmills could probably be as a result of their ability to effectively digest lignocellulose from wood dust, which is the major sawmill waste (Bamidele et al., 2014) through their gut microflora.

Earthworms were also observed to be abundant on the study sawmill soils. The respondents also noted the presence of earthworms especially in moist areas around the study sawmills. Bamidele et al. (2016) reported higher populations of earthworms (140 – 516 earthworms/m^2) on sawmill soils than other soils. This was attributed to the moist nature of the sawmill soils particularly under sheds, beside and under piles of logs and planks awaiting processing most especially during the wet season. The activities of earthworms in sawmill soil could also be connected with their role in the degradation of sawdust as well as soil humidification and their pedobiological roles (Bamidele et al., 2014).

More than 50% of the total animal species observed around the study sawmills were arthropods. These arthropods can be predated upon by several higher animal species. Such animal species as observed in the sawmills include the agama lizard, toad, wall gecko, monitor lizards and birds. The abundance of arthropods within the vicinity of the sawmills as recorded in this study could therefore account for the high number of secondary consumers observed on the study sawmills, making the sawmills a food bank for the animals. The respondents also identified these secondary consumers among the animal species they usually encounter around the study sawmills. This could better explain the observation of some of the respondents from Sapon, Lafenwa and Kotopo sawmills that monitor lizards do not stay permanently on the sawmills but migrate from their neighbouring bush habitats to the sawmills to feed. Monitor lizards feed on arthropods, reptile eggs and some amphibians (Weavers, 1989). According to Bennett (1995), the diets of monitor lizards include a variety of animals of different sizes and they are often regarded as generalized feeders that will consume anything they are able to catch.

This study has shown that sawmill environments have rich and abundant flora and fauna populations which could be regarded as a biotic community consisting the populations of different organisms interacting together. It also revealed that the activities on the study sawmills may not be completely detrimental to the existence of the organisms. Thus, if well maintained, sawmilling activities are not entirely unfriendly to the biotic community of the sawmills.

Although, it is not a common practice to base ecological research on questionnaire survey, this study has revealed that the opinion of people who have been used to a particular area over a long period of time on the fauna species usually encountered in such areas should not be discarded. However, there is the need for a field survey to backup verbal responses.

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LITERATURE CITED

Akachukwu, A. E. 2000. Sawmilling waste in Nigeria and its effect on the environment, The Nigerian Field, 65: 219-223.

Akobundu, I. O. & Agyakwa, C. W. 1987. A handbook of West African Weed. International Institute of Tropical Agriculture, 1-571 pp.

Aroofor, R. O. 2000. Review and improvement of data related to wood products in Nigeria. E.C- F.A.O partnership programme (1998-2001), Tropical forestry budget line B7620/97-15/VIII/FOR PROJECT GCP/ INT/679/EC

Bamidele, J. A., Idowu, A. B., Ademolu, K. O. & Atayese, A. O. 2014. Microbial diversity and digestive enzyme activities in the gut of earthworms found in sawmill industries in Abeokuta, Nigeria. Revista de Biologia Tropical, 62 (3): 1241-1249.

Bamidele, J. A., Idowu, A. B., Ademolu, K. O. & Bankole, S. O. 2016. Diversity, abundance and tissue mineral composition of indigenous earthworm species of sawmills of Abeokuta, South-Western Nigeria. Munis Entomology & Zoology, 11 (1): 63-67.

Bamidele, J. A., Idowu, A. B., Ademolu, K. O., Akinloye, O. A. & Bamgbola, A. A. 2015. Heavy metal accumulation and biochemical evaluation of earthworms from sawmills in Abeokuta, South-Western Nigeria. Revista de Biologia Tropical, 63 (4): 1213-1221.

Bennett, D. 1995. A little book of monitor lizards; A Guide to the Monitor Lizards of the World and their Care in Captivity. Viper Press, Aberdeen.

Dosunmu, O. O. & Ajayi, A. B. 2002. Problems and management of sawmill waste in Lagos. Proceedings of International Environmental Pollution Control and Waste Management (EPCOWN 2002), pp. 271-278.

Ehrlich, P. R. & Wilson, E. O. 1991. Biodiversity studies: Science and policy. Science, 253: 758-762.

Ihekwaba, A. E., Nwafor, A. & Adienbo, O. M. 2009. Lung Function Indices in Primary and Secondary Sawmill Workers in Port Harcourt, Nigeria. African Journal of Applied Zoology & Environmental Biology, 11: 101-105.

Lalthanzara, H., Ramanujam, S. N. & Jha, L. K. 2011. Population dynamics of earthworms in relation to soil physico-chemical parameters in agroforestry systems of Mizoram. India Journal of Environmental Biology, 32: 599-605.

Lameed, G. A. & Ayodele, A. E. 2010. Effect of quarrying activity on biodiversity: Case study of Ogbere site, Ogun State Nigeria. African Journal of Environmental Science and Technology, 4 (11): 740-750.

Oke, S. O. & Oyedare, P. F. 2006. Effects of sawmilling activities on vegetation characteristics in Isokan area of Southwestern Nigeria. International Journal of Botany, 2 (2): 163-170.

Pausas, J. G. & Austin, M. P. 2001. Patterns of plant species richness in relation to different environments: An appraisal. Journal of Vegetation Science, 12: 153-166.

Purves, W. K., Orians, G. H. & Heller, H. C. 1997. Life: The Science of Biology, 4th Edition. Sinauer Associates Inc. U.S.A.

Weavers, B. W. 1989. Diet of the Lace Monitor Lizard (*Varanusvadus*) in south-eastern Australia. Australian Zoologist, 25 (3): 83-85.

Wenzel, M., Schonig, I., Berchtold, M., Kampfer, P. & Konig, H. 2002. Aerobic and facultatively anaerobic cellulolytic bacteria from the gut of the termite Zootermopsis angusticollis. J. Appl. Microbiol., 92: 32-40.

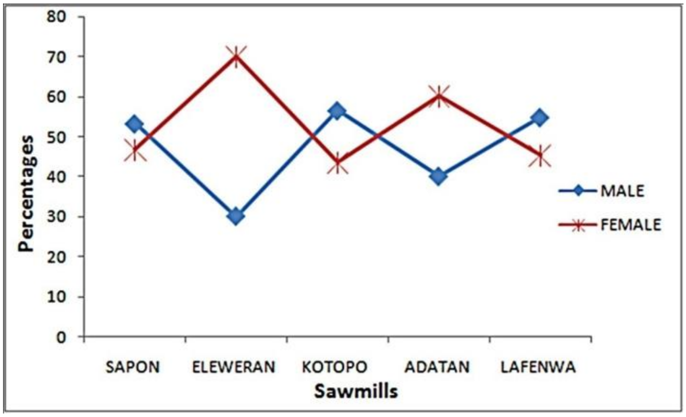

Figure 1: Sex of the respondents from the study sawmills, Abeokuta Nigeria.

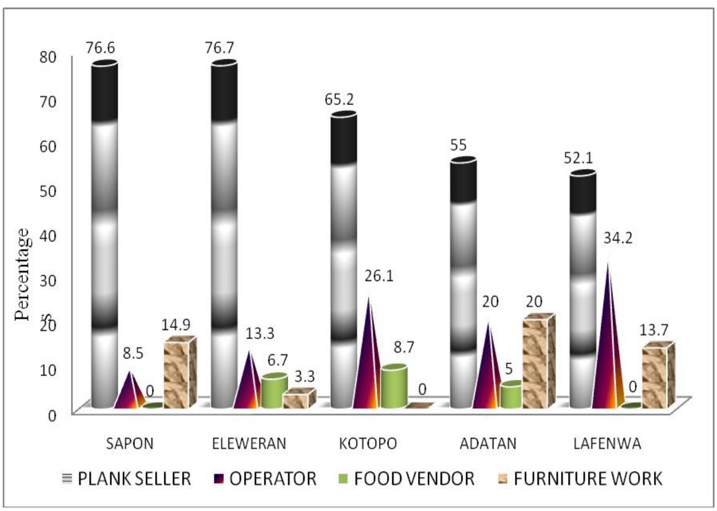

Figure 2. Occupation of the respondents from the study sawmill, Abeokuta Nigeria.

Table 1. Age (%) of the respondents from the study sawmills, Abeokuta Nigeria.

Age (Years)	Sawmill locations				
	Sapon	Eleweran	Kotopo	Adatan	Lafenwa
Below 26	0	0	0	5	0
26 – 35	36.2	23.3	13	25	30.1
36 – 50	42.6	50	52.2	20	50.7
Above 50	21.3	26.7	34.8	50	19.2
Total	100	100	100	100	100

Table 2. Animal species cited in the vicinity of sawmills of Abeokuta during field sampling.

ANIMAL GROUP	S/N	NAME OF ORGANISM	Scientific name	SAP.	ELE.	KOT.	ADA.	LAF.
Insects	1.	Termite	*Macrotermes spp.*	+	+	+	+	+
	2.	Caterpillar	*Passalus spp.*	+	-	+	-	+
	3.	Cockroach	*Periplaneta Americana*	+	+	+	+	+
	4.	Soldier ants	*Solenopsis spp.*	+	+	+	+	+
	5.	Grasshopper	*Zonocerus variegatus*	-	+	+	+	+
	6.	Butterfly	*Papilio spp.*	+	+	+	+	+
	7.	Honey bee	*Apis mellifera*	-	+	+	-	+
	8.	Housefly	*Musca domestica*	+	+	+	+	+
	9.	Red ant	*Solenopsis spp.*	+	+	+	+	+
	10.	Preying mantis	*Mantis religiosa*	-	-	-	-	+
Other Invertebrates	11.	Earthworm	*Eudrilus, Libyodrilus, Hyperiodrilus spp.*	+	+	+	+	+
	12.	Spider	*Agelenopsis spp*	+	+	+	+	+
	13.	Antlion	*Distoleon tetragrammicus*	+	+	+	+	+
	14.	Millipede	*Trigonilus spp.*	+	+	+	-	+
	15.	Centipede	*Scolopendra spp.*	-	-	-	-	+
	16.	Snail	*Archatina spp.*	+	-	+	-	+
Reptiles	17.	Lizard	*Agama agama*	+	+	+	+	+
	18.	Wall gecko	*Tarentola spp.*	-	+	-	-	-
	19.	Skink	*Eumeces spp*	+	-	+	-	+
Birds	20.	Hawk	*Accipiter spp.*	+	-	-	-	+
	21.	Cattle egret	*Bubulcus ibis*	-	-	-	-	+
Amphibians	22.	Toad	*Buffo spp.*	+	+	+	-	+
Mammalia	23.	Rats	*Ratus rattus*	-	-	+	-	+

Keys: + = Present, - = Absent, **SAP**. = Sapon; **ELE**. = Eleweran; **KOT**. = Kotopo; **ADA**. = Adatan; and **LAF**. = Lafenwa

Table 3. Frequencies of occurrence (%) of the animals in the vicinity of sawmills of Abeokuta, based on questionnaire survey.

ANIMAL GROUP	S/N	NAME OF ORGANISM	LOCAL NAME	FREQUENCY OF OCCURRENCE (%) SAP.	ELE.	KOT.	ADA.	LAF.	AVE (%)
Insects	1.	Termite	Ikan	74.5	76.7	65.2	75	71.2	72.52
	2.	Caterpillar	Ogongo	10.6	13.3	30.4	30	38.4	24.54
	3.	Cockroach	Ayan	59.6	53.3	13	30	31.5	37.48
	4.	Soldier ants	Ijalo	29.9	23.3	13	10	46.6	24.56
	5.	Grasshopper	Tata	00	10	00	45	82.2	27.44
	6.	Butterfly	Labalaba	8.5	00	13	25	47.9	18.88
	7.	Honey bee	Oyin	00	6.7	47.8	00	46.6	20.22
	8.	Housefly	Esinsin	00	10	00	00	00	2.00
	9.	Red ant	Eera	00	13.3	8.7	00	00	4.40
	10.	Preying mantis	Dakodako	6.4	00	00	00	00	1.28
Other Invertebrates	11.	Earthworm	Ekolo	93.6	100	69.7	85	94.5	88.56
	12.	Scorpion	Akeekee	80.6	90	78.3	70	69.9	77.76
	13.	Spider	Alantakun	25.5	6.7	00	05	16.4	10.72
	14.	Antlion	Guluso	10.6	00	8.7	25	53.4	19.54
	15.	Millipede	Okun	8.5	13.3	13	00	26.0	12.16
	16.	Centipede	Taninsanko	00	13	00	00	26.0	7.80
	17.	Snail	Igbin	4.3	20	21.7	20	46.6	22.52
Reptiles	18.	Lizard	Alangba	95.7	100	100	85	100	96.14
	19.	Snakes	Ejo	57.4	86.7	91.3	55	89	75.88
	20.	Monitor lizard	Aleegba	8.5	00	47.8	00	39.7	19.20
	21.	Wall gecko	Omonile	00	3.3	00	00	00	0.66
	22.	Skink	Layonbere	40.4	36.7	17.4	35	60.3	37.96
Birds	23.	Hawk	Asa	17	00	8.7	00	00	5.14
Amphibians	24.	Toad	Opolo	91.5	90.3	95.7	65	79.5	84.40
Mammalia	25.	Rats	Eku	74.5	100	73.9	80	83.5	82.38
	26.	Pouch Rat	Okete	63.8	20	52.2	35	32.9	40.78

Keys: **SAP**. = Sapon; **ELE**. = Eleweran; **KOT**. = Kotopo; **ADA**. = Adatan; **LAF**. = Lafenwa and **AVE**. = Average

Table 4. Habitats of the animals in the vicinity of sawmill of Abeokuta.

S/N	Organism	Type of Habitat
1	Termite	Within planks, in temporary mounds made around dry woods and construction planks within the sawmill
2	Caterpillar	Inside decaying logs, bark of logs and within sawdust
3	Cockroach	Within planks, other wastes materials within the sawmill and at the bark of logs
4	*Scorpion	Within planks, bark of logs, and at every crannies
5	Earthworm	In moist soils, under planks and logs and beside streams
6	Lizard	Very wide spread within the sawmill
7	Rats	Under logs and planks.
8	Soldier ants/ants	In the spaces between planks and the ground, within planks and trailing freely during wet days
9	Toad	On wet soils under logs and planks
10	*Snakes	Under logs and planks, within log bark
11	Spider	On the roofs, within planks and bark of logs
12	Grasshopper	On grass and in areas within the sawmill, closer to where vegetation is.
13	Butterfly	Flying around the sawmill, most especially in areas closer to vegetation
14	Skink	Under planks and logs. Found all around the sawmill
15	Snail	In cool areas under logs, planks and abandoned materials. Comes out mostly after a rainfall
16	Antlion	In the soil
17	*Pouch Rat	Bore hole under logs and planks.
18	Honey bee	Mostly on flowers where vegetation is available
19	Housefly	All over the sawmill
20	Wall gecko	On planks and logs and wooden structures
21	Millipede	Under planks and logs
22	Centipede	Under logs and planks
23	*Monitor lizard	Within logs and planks
24	Hawk	Seen preying on lizards within the sawmill
25	Preying mantis	On grass and in areas within the sawmill, closer to where vegetation is.

*As stated by the respondents (not cited during field survey)

Table 5. Plant species identified in the vicinity of sawmills of Abeokuta.

	LAF.	KOT.	ADA.	ELE.	SAP.
Abulitonmauritiamum	+	+	+	-	+
Ageratum conyzoide	-	+	+	-	-
Albizialebbeck	+	-	-	-	-
Alogaisusleocapus	+	+	-	-	+
Amaranthusspinosus	+	+	+	+	+
Aspiliaafricana	+	-	-	-	-
Axonopuscompressus	+	+	+	+	-
Bambusa vulgaris	-	-	-	-	-
Boerhiacoccinea	-	-	+	-	-
Chromolaenaodorata	+	-	+	+	-
Commelinabengalensis	+	+	+	+	+
Conyza spp.	+	-	+	-	-
Digitariahorizontalis	-	+	-	-	-
Dryopteris spp.	-	-	-	-	-
Elaiesguinensis	-	-	-	-	-
Euphobiahirta	+	+	+	+	+
Euphorbia heterophylla	-	+	-	-	-
Euphorbia hysoppifolia	+	-	+	+	+
Ficusaxasperata	-	-	-	-	+
Fiscus sur	+	-	-	-	+
Gliricidasepium	+	-	-	-	-
Gomphrenacelosioides	+	+	+	+	-
Laporteaaestuans	+	+	+	-	-
Latanacamara	-	-	+	-	-
Luffa cylindrical	+	-	-	-	-
Melantherascandens	-	+	-	-	-
Mimosa pigra	+	+	+	-	-
Noclialatifolia	+	-	-	-	-
Oryzabarthii	+	-	-	-	-
Paniam maximum	+	-	-	-	-
Parquetinanigrescens	+	+	-	-	-
Pepperomiapelucida	-	-	-	-	+
Phylanthusamarus	+	+	-	+	-
Physalisangulata	+	-	+	+	-
Physalismicrantha	-	-	+	-	+
Portulaca spp.	-	-	+	-	+
Rauwolhailomitoria	+	-	-	-	-
Senna occidentalis (L.)	-	-	-	-	+
Sidaacuta	+	+	+	+	+
Sidarhombifolia	+	-	+	+	+
Solanumamericanum	-	-	-	+	-
Synedrellanodiflora	+	+	+	+	-
Teefaeriaoccidentale	-	-	-	-	+
Telophrosiapedicellata	+	-	+	-	+
Tridaxprocumbens	-	-	+	-	-
Vernmia spp.	-	-	+	-	-

Keys:+ = Present, - = Absent

SAP. = Sapon; **ELE.** = Eleweran; **KOT.** = Kotopo; **ADA.** = Adatan; and **LAF.** = Lafenwa

FIRST RECORD OF *GARDENA MELINARTHRUM* DOHRN (HETEROPTERA: REDUVIIDAE: EMESINAE) FROM INDIA

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[**Mukherjee, P. & Saha, G. K.** 2017. First record of *Gardena melinarthrum* Dohrn (Heteroptera: Reduviidae: Emesinae) from India. Munis Entomology & Zoology, 12 (1): 254-257]

ABSTRACT: *Gardena melinarthrum* Dohrn, 1859, belonging to subfamily Emesinae of family Reduviidae recorded for the first time from West Bengal (Jalpaiguri dist.), India and redescribed along with additional diagnostic characters and measurements of different body parts.

KEY WORDS: Reduviidae, Reduviinae, *Gardena melinarthrum*, new record, India

The genus *Gardena* Dohrn belonging to the division Emesaria of the subfamily Emesinae under the family Reduviidae of Heteroptera (Hemiptera). The genus *Gardena* was named by Dohrn in 1859 with Ceylonese *melinarthrum* (sic) as the only species included, but this species and the genus itself were not described by Dohrn until 1860. Numerous additional species of *Gardena* have since been described from many parts of the world. Distant (1903) has described and recorded species, *bicolour* Distant, near Rangoon: Myanmar and recorded the species *melinarthrum* Dohrn from Sri Lanka under the genus *Gardena*. He further (1909) described the species *fasciata* under the genus *Gardena*. McAtee & Malloch (1926) expressed their doubt about the status of the species *Gardena bicolour* Distant, considering it is a probable synonym of *melinarthrum* described by Dohrn from Myanmar. Wygodzinsky (1966) synonymized the species *fasciata* with *Gardena brevicollis* of Stal (1871) as described and recorded from Sri Lanka, Japan, Formosa, Philippines, Malaya, Indonesia, Soemba, Australia, Bismarck, Archipelago and Solomon Island. Bergroth (1906) has described the smallest Emesinae *viz. muscicapa* ranging from 9-11mm, recorded from Japan, Philippines, Malaya, Indonesia, New Guinea, South and East Africa. Ambrose (2006) in his checklist included only one species *viz. Gardena muscicapa* (Bergroth), recorded from India (Tamil Nadu: Kumili), Brazil, Cameroon, Indonesia, Japan, Malayasia, Philippines, Russian Islands, Selangor, South Africa and Zaire, till to date. Wygodzinsky in his monograph of Emesinae has divided the subfamily Emesinae Amyot and Serville into 6 tribes *viz.* Collartidini Wygod., Leistarchini Stal, Emesini Amyot and Serville, Ploiariolini Van Duzee, Deliastini Villiers and Metapterini Stal and included a total of 32 species from the world in four groups *viz. melinarthrum*, *brevicollis*, *longimana*, and *pipara*, excluding the species *bicolour* & *seychellensis* of this genus owing to the lack of sufficient data.

Although only one species *Gardena musicapa* (Bergroth) has been recorded so far from India, the present study reports one more species *Gardena melinarthrum* Dohrn from India (West Bengal: Jalpaiguri dist.) which was earlier recorded from Sri Lanka to Formosa and Australia.

MATERIALS AND METHODS

Gardena melinarthrum Dohrn, 1859, was collected from Garumara National Park, North Range, Murti forest, Jalpaiguri district of West Bengal by the hand picking method at day time. The specimen was set pinned, dried. The specimen is deposited in the National Zoological Collection of Zoological Survey of India, Hemiptera Section, Kolkata. Different body parts were measured and their ratios were calculated for the establishment of additional diagnostic characters. Measurement and photographs of the species were taken with the aid of Leica M 205A. All measurements are in millimetres.

OBSERVATION AND RESULTS

Gardena Dohrn, 1859

1859. *Gardena* Dohrn, *Stettin*, 112 pp.
Type Species: *Gardena melinarthrum* Dohrn: By monotypy.
Distribution: All zoogeographical region.

Gardena melinarthrum Dohrn, 1859 (Plate 1, Figs. 1-6)

1859. *Gardena melinarthrum* Dohrn, Stettin, 52 pp. (nomen nudum).
1860. *Gardena melinarthrum,* Dohrn, Linnaea Ent., 14: 214.
1904. *Gardena melinarthrum*, Distant, Fauna Brit. India, Rhynchota, 2: 215.
1926. *Gardena melinarthrum* var. *femoralis* McAtee & Malloch, Philippine J. Sci., 30: 136.
1966. *Gardena melinarthrum,* Wygodzinsky, Bull. Amer. Mus. Nat. Hist., 133: 262-264.
1990. *Gardena melinarthrum,* Maldonado, Carribbean J. Sci. (special ed.), 87 pp.
2006. *Gardena melinarthrum,* Ambrose, Zoos' Print Journal, 21 (9): 4.

Description: Body black, shinning; head brownish yellow, black at base, rostrum yellowish brown, darker at base; coxae, trochanters and bases of intermediate and posterior femora brownish yellow; apices of intermediate and posterior femora and bases of intermediate and posterior tibiae creamy white; head elongate, anteocular region (AO=0.47 mm) slightly shorter than postocular region (PO=0.35 mm) (1.00:0.74); eyes moderate, interocular furrow not extending posterior border of eyes; antennae inserted near apex of head, first segment of antennae (A1=4.48 mm) about as long as abdomen (ABL=4.55 mm), ratio of antennal segments: I:II:III:IV = 1.00:0.72:0.05:0.41; rostrum bent between first and second segment, first segment short (R1=0.21 mm), second segment (R2=0.29 mm) shorter than third segment (R3=0.51 mm) which is longest, ratio of rostral segments: I:II:III = 0.41:0.56:1.00; pronotum pedunclate and covering abdomen completely, posterior lobe (PP=1.68 mm) longer than anterior lobe (AP=1.48 mm) (1.00:0.88); scutellum small, not spined; hind femora (HF=6.44 mm) much shorter than hind tibiae (HT=9.58 mm) (0.67:1.00) but considerably passing apex of abdomen; hemelytra absent.
Measurements: (1 male in mm). Body length 10.00 mm; head length, 0.83, width across eye 0.49; length of anteocular region 0.47, postocular region 0.35; length of antennae 9.79, lengths of antennal segments I : 4.48, II : 3.25, III : 0.25, and IV : 1.84; rostral length 1.019, length of rostral segments I : 0.21, II : 0.29 and III : 0.51; length of pronotum 3.16; length of anterior pronotal lobe 1.48, posterior pronotal lobe 1.68, width of anterior pronotal lobe 0.28, posterior pronotal lobe 0.20; length of fore coxa: 1.67, trochanter: 0.44, femur: 2.80, tibia: 1.68, tarsus: 0.37, claws: 0.05; mid coxa: 0.27, trochanter: 0.30, femur: 4.94, tibia: 7.221, tarsus: 0.32, claw: 0.04; hind coxa: 0.33, trochanter: 0.34, femur: 6.44, tibia: 9.588, tarsus: 0.32, claw: 0.04. Female (15.37 mm) larger than male.

Material examined: 2exs., West Bengal: Jalpaiguri District: Murti: Garumara National Park, North range, 6.III.2012, Coll. Paramita Mukherjee.
Distribution: INDIA: West Bengal. Elsewhere: Auatralian and Oriental regions.

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LITERATURE CITED

Ambrose, D. P. 2006. A Checklist of Indian Assassin bugs (Insecta: Hemiptera: Reduviidae) with taxonomic status, distribution and diagnostic morphological characteristics. Zoo' Print Journal, 21 (9): 2388-2406.

Bergroth, E. 1906. Neve Hemiptera aus Madagaskar. II. Ann. Soc. Ent. Belgique, 50: 254-270.

Dohrn, A. 1859. Catalogus Hemipterorum, Stettin, 112 p.

Dohrn, A. 1860. Beitrage zu einer monographischen Bearbeitung der Familie der Emesina. Linnea Ent., 14: 206-255.

Distant, W. L. 1903. Undescribed Oriental Rhynchota. Entomologist, 36: 1-2.

Distant, W. L. 1904. The Fauna of British India including Ceylon and Burma, Rhynchota, 2: 198-389.

Distant, W. L. 1909. Oriental Rhynchota, Heteroptera. Ann. Mag. Nat. Hist., (8) 3: 491-507.

Distant, W. L. 1910. The Fauna of British India including Ceylon and Burma, Rhynchota, 5: 181-182.

Dispons, P. & Stichel, W. 1959. Fam. Reduviidae Lat. Subfam. Emesinae A.& S. In Stichel, W., Illustrierte Bestimmungsta bellen der Wanzen. II. Europa. Berlin, 3 (3-4): 82-106.

Maldonado, C. 1990. Systematic Catalogue of the Reduviidae of the World (Insecta: Heteroptera), A special edition of Caribbean Journal of Science, Puerto Rico, 694 pp.

McAtee, W. L. & Malloch, J. R. 1926. Philippine and Malayan Ploiariinae (Hemiptera, Reduviidae). Philippine J. Sci., 30: 117-152.

Wygodzinsky, P. 1966. A monograph of the Emesinae (Reduviidae: Hemiptera). Bull. Amer. Mus. Nat. Hist., 133: 246-268.

Stal, C. 1871. Hemiptera insularum Philippinarum. Bigrag till Philippinska oarnes Hemipter fauna. Ofvers. K. Vetensk. Akad. Forhandl., 27 (7): 607-776.

PLATE : 1

Fig. 1

Fig. 2

Fig. 3

Fig. 4

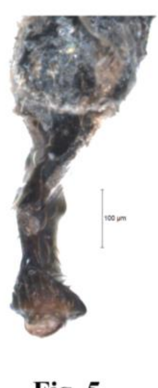

Fig. 5

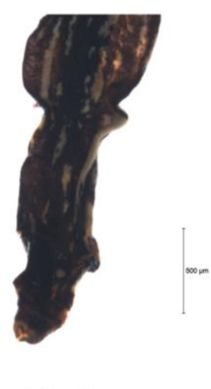

Fig. 6

Plate 1: Figures 1-6: *Gardena melinarthrum* Dohrn: 1. Lateral view of male; 2. lateral view of female; 3. head and fore legs, lateral view; 4. head and pronotum, dorsal view; 5. abdominal tip of male, ventral view; 6. abdominal tip of female, ventral view.

A NEW RECORD OF THE GENUS *EUTROMBIDIUM* VERDUN (ACARI: MICROTROMBIDIIDAE) FOR THE TURKISH FAUNA

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[Karakurt, İ. & Sevsay, S. 2017. A new record of the genus *Eutrombidium* Verdun (Acari: Microtrombidiidae) for the Turkish fauna. Munis Entomology & Zoology, 12 (1): 258-262**]**

ABSTRACT: Larvae of *Eutrombidium djordjevici* Saboori & Pešić, 2006 are first time recorded for Turkey. This species collected from an unidentified grasshoppers (Orthoptera: Acrididae), morphological features and zoogeographical distributions are given here.

KEY WORDS: Acrididae, Ectoparasite, *Eutrombidium*, Microtrombidiidae, Turkey

So far, three species relating to *Eutrombidium* have been recorded from Turkey. The three species are as follows; *Eutrombidium locustarum* (Walsh, 1866), *Eutrombidium robauxi* Southcott, 1993 and *Eutrombidium trigonum* (Hermann, 1804) (Southcott, 1993; Adil & Sevsay, 2013; Sevsay & Karakurt, 2013). This is the fourth species of *Eutrombidium* from Turkey.

In this paper larvae of *Eutrombidium djordjevici* is recorded and illustrated as an ectoparasite on undetermined, grasshoppers (Orthoptera: Acrididae) from Bayburt province, Turkey.

MATERIAL AND METHODS

Mites were extracted from an unidentified grasshopper (Orthoptera: Acrididae) from Bayburt, Turkey. Examined material was preserved in 70% ethyl alcohol and cleared in 9% KOH. Specimens for light microscope studies (8 larvae) were fixed on slides in Hoyer's medium (Krantz & Walter, 2009). Measurements were taken and drawings made under a Leica DM 4000 phase contrast microscope. Robaux (1974) and Southcott (1993) followed for the morphological terminology in the text. All measurements are given in micrometers (μm).

RESULTS AND DISCUSSION

Family Microtrombidiidae Thor, 1935
Genus *Eutrombidium* Verdun, 1909

Type species: *Trombidium trigonum* Hermann,1804

Eutrombidium djordjevici Saboori et Pešić, 2006

Diagnosis. Larva. Colour in life red. Gnathosoma with horseshoe-like sclerite bearing large denticled membranes outside. Palp femur and genu bearing one spine-like seta each and palp tibia with three setae. Hypostomal setae (*bs*) conical and stout. The surface of scutum punctuate with three pairs nonsensillary setae and one pair sensillary setae. *AM* setae smooth, *AL* and *PL* setae very slightly setulose. *PL* setae relatively short. L/W range of scutum < 1. The h_{1-2} setae are almost equal in length and with plates. *1a* setae thin, long and weakly barbed. Setae of lateral coxala (*1b*, *2b* and *3b*) bifid. Tarsus I and tarsus II terminated with two claws with end of portions trifurcate and a slender normal empodium; Tarsus

III terminated outer claw with end of portion trifurcate, inner claw modified (smilum) and a slender claw-like empodium.

Descriptions. Standard measurements in Table 1. Body length 1090-2071, width 700-1207.
Gnathosoma. With ring-like sclerite around mauth opening. Internal edge of cheliceral blades a small tooth. Adoral setae (*or*) smooth. Hypostomal setae (*bs*) conical and stout. Palp femur and genu bear short spine-like seta each. Palp tibia with a long nude seta, a short nude seta and relatively thin, conical seta close to paradont. Palp tibial claws bifid. Palp tarsus with one solenidion, two eupathidia, one long, barbed, one long nude and two short nude setae. *f*Pp formula:0-N-N-NNN-BNNNωζζ (Fig. 1).
Idiosoma dorsum. Scutum square, convex at anterior border and surface of it punctuate with three pairs of nonsensillary setae and one pair sensillary setae. *AM* setae smooth, *AL* setae rather short and *PL* setae barbed. Sensilla filiform. A pair of eyes that include double lenses and surface of eye plates, between eye lenses, punctuate. Anterior lens larger than posterior one . Scutellum almost as broad as of scutum, slightly convex at anterior border and punctuations similar to that on scutum, bears one pair of barbed c_1 setae. All dorsal setae situated on plates or platelets (the largest d_1 and c_2 plates) slightly barbed and arranged in five rows. Length of dorsal setae 22-56 in range. The $h_{1\text{-}2}$ setae with plates and both setae longer than dorsal setae. *f*D formula: 6-6-6-4-4 (c_1-c_3, d_1-$_3$, e_1-$_3$, f_1-$_2$, h_1-$_2$) (Figs. 2, 3).
Idiosoma venter. Claparéde's organs laterally between coxae I and coxae II. *ƒ*Cx formula: BB-B-B. *1a* setae long and barbed. *1b, 2b* and *3b* setae bifid. One pair of barbed intercoxal setae *3a* placed in above coxal plates III. Posteriorly following five pairs barbed setae situated on plates anterior and lateral to anal opening. *ƒ*V formula: 2-2-2u-2. Ventral setae slightly thinner than dorsal setae. Anal opening without sclerite (Fig. 4).
Legs. (Figs. 13-18). Legs segmentation formula: 6-6-6. All of them punctuate. Legs setal formula: [I] Tr (1B) – Fe (6B) – Ge (4B, 2σ, 1κ) – Ti (6B, 2φ) – Ta (16-17B, 2ζ, 1ω, 1ε) ; [II] Tr (1B) – Fe (5B) – Ge (2B, 1σ, 1κ) – Ti (5B, 2φ) – Ta (12-13 B, 1ω, 1ε,2 ζ); [III] Tr (1B) – Fe (4B) – Ge (2B, 1σ) – Ti (5B) – Ta (12-13B, scopa and lophotrix). Tarsus I and tarsus II terminated with two trifurcate claws and a slender empodium; Ta III with outer trifurcate claw inner claw modified (smilum) and a slender claw-like empodium (Figs. 5-7).
Material examined. 14 September 2013, 5 larvae were caught as an ectoparasite on undetermined grasshopper (Orthoptera: Acrididae), Yakup Abdal forest 40°03′13″N 39°43′16″E 1892 m a.s.l. and 05 April 2014, 3 larvae were caught on unidentified grasshopper, Aydıntepe Plateau 40°24′58″N 40°07′27″E 2014 m a.s.l. (leg. İ. Karakurt and H.H. Özbek) Bayburt, Turkey. The specimens were deposited in Biology Laboratory of Erzincan University, Erzincan, Turkey.
Distribution. Iran, Montenegro (Saboori & Pešič, 2006; Saboori & Hakimitabar, 2013) and Turkey.

DISCUSSION

Larvae of *E. djordjevici* were described firstly from Montenegro by Saboori & Pešič (2006). Our study shows that there are some differences between Turkish and Montenegro specimens. Saboori & Pešič (2006) expressed palpal femur and genu without setae and length of *PL* 15-25 in range. But palpal femur and genu of Turkish specimens bear a short seta and *PL* 23-32 in range (see Table 1).

On the other hand, morphologically larvae of *E. djordjevici* are very similar to larvae of *E. trigonum*. *E. djordjevici* differs from *E. trigonum* by the short *LN* (21-29, 21-23 in Turkish specimens, vs. 29-40), vestigiala (κ) seta on tibia I(absent vs. present).

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LITERATURE CITED

Adil, A. & Sevsay, S. 2013. *Eutrombidium Locustarum* (Walsh, 1866) (Acari: Microtrombidiidae)'un Gelişim Evreleri ve Türkiye'den İlk Kaydı, Erzincan Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 6 (2): 187-203.

Robaux, P. 1974. Recherches sur le developpement et la biologie des acariens Thrombidiidae, Memoires du Museum National d'Histoire Naturelle (n. s.) Serie A Zoologie, 85: 1-186.

Saboori, A. & Hakimitabar, M. 2013. A Checklist of the Trombidioidea (Acari: Prostigmata) of Iran. Journal of Crop Protection, 2 (1): 33-42.

Saboori, A. & Pešić, V. 2006. A new species of the genus *Eutrombidium* Verdun, 1909 (Acari: Eutrombidiidae) from Montenegro, Systematic & Applied Acarology, 11: 237-245.

Sevsay, S. & Karakurt, İ. 2013. *Eutrombidium trigonum* (Hermann) (Acari: Microtrombidiidae)'un gelişim evreleri ve yapısal özellikleri, Turkish Journal of Entomology, 37 (1): 145-157.

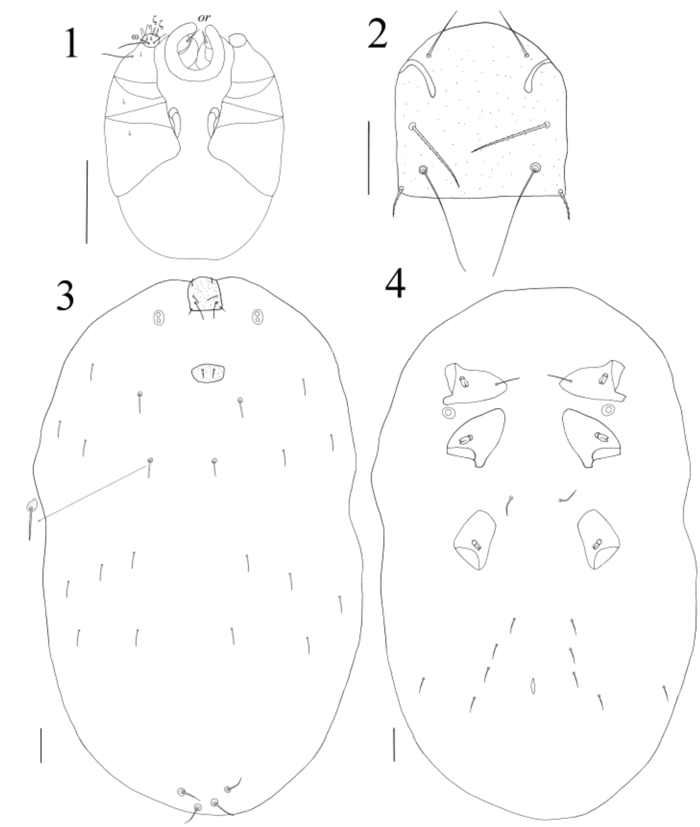
Southcott, R. V. 1993. Revision of the taxonomy of the larva of the subfamily Eutrombidiinae (Acari: Microtrombidiidae). Invertebrate Taxonomy, 7: 885-959.

Walter, D. E. & Krantz, G. W. 2009. Collecting, rearing, and preparing specimens. In: Krantz, G.W. and Walter, D.E. (Eds.), A Manual of Acarology. 3rd edition. Texas Tech University Press, pp. 83-96.

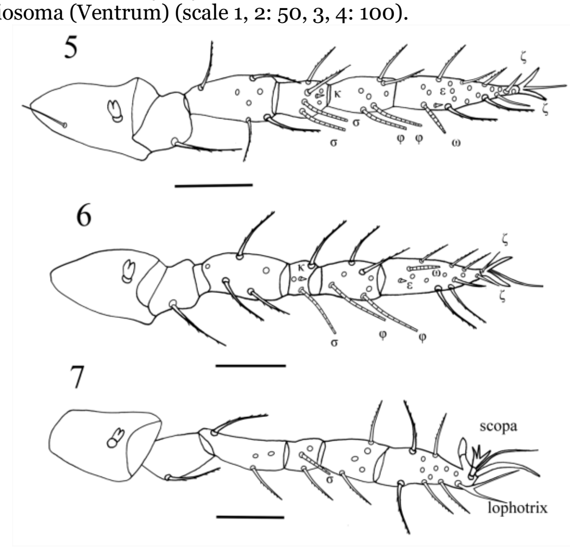
Table 1. Morphometric data on larvae of *E. djordjevici*.

	E. djordjevici (n=8)		*E. djordjevici* Saboori &Pešić, 2006
Character	**Mean**	**Min.-max.**	**Min.-max.**
IL	1670	1090-2071	225-2003
IW	1150	700-1207	151-940
LN	23	21-25	21-29
MA	55	52-57	52-62
AW	107	103-112	99-107
PW	120	115-126	101-121
SB	85	82-92	72-89
MSA	52	50-55	52-61
ASB	100	90-112	99-121
PSB	21	20-22	17-25
L	121	118-126	119-141
W	125	123-128	116-136
AP	43	42-45	35-47
SA	21	17-30	25-37
SP	18	16-24	20-25
AM	54	47-57	35-50
AL	52	47-55	33-47
PL	27	23-32	15-25
AMB	73	69-78	62-79
S	83	77-85	77-82
PLN	17	12-20	15-32
HS	73	69-80	62-74
LSS	129	123-142	106-134

SS	51	43-59	32-79
SL	37	30-40	27-33
DS	34	22-56	19-50
MDS	42	30-50	27-52
LPS	84	80-87	87-99
MPS	83	80-85	82-92
AW/SS	2.45	2.15-2.86	2.06-3.09
HS/PLN	4.51	4.16-5.63	1.94-4.23
CX_I	69	65-75	57-62
TR_I	35	33-38	30-32
FE_I	39	35-52	45-59
GE_I	23	21-30	25-35
Tİ_I	44	40-49	39-42
TA_I (L)	76	70-80	72-92
TA_I (H)	17	16-18	17-20
LEG I	289	278-310	278-307
CX_II	66	58-75	54-67
TR_II	31	28-35	29-37
FE_II	48	45-55	47-59
GE_II	21	18-24	20-24
Tİ_II	36	33-40	30-42
TA_II (L)	67	65-70	67-82
TA_II (H)	17	15-20	19-21
LEG II	271	260-290	254-307
CX_III	57	55-65	52-62
TR_III	33	30-38	37-42
FE_III	51	45-58	52-62
GE_III	20	18-23	20-22
Tİ_III	41	39-48	33-52
TA_III (L)	54	52-58	49-62
TA_III (H)	17	16-18	20-20
LEG III	260	250-275	242-288
IP	843	815-865	784-902
SA/SP	1.35	1.2-1.5	1.0-1.76
AW/AMB	1.55	1.4-1.6	1.31-1.59
SL/SS	0.75	0.61-0.82	0.57-0.86
LSS/SS	2.65	2.15-3.25	2.53-3.6



Figures 1-4. *Eutrombidium djordjevici* (larva) 1. Gnathosoma 2. Scutum 3. Idiosoma (dorsum) 4. Idiosoma (Ventrum) (scale 1, 2: 50, 3, 4: 100).



Figures 5-7 *Eutrombidium djordjevici* (larva) 5. Leg I 6. Leg II 7. Leg III (scale 5-7: 50).

GENETIC AND MORPHOLOGICAL VARIATIONS AMONG GEOGRAPHICAL POPULATIONS OF *RHOPALOSIPHUM PADI* (L.) (HEMIPTERA: APHIDIDAE) IN EGYPT, USING RAPD AND ISSR MARKERS

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ABSTRACT: Morphological and genetic variation of sixteen geagraphical populations of *Rhopalosiphum padi* (L.) collected from different locality of Egypt, were studed by investgating eighteen morphometric or numeric morphological characters, applying two molecular techniques; Random Amplified Polymorphic DNA (RAPD) and Inter Simple Sequence Repeats (ISSRs) with whole genomic DNA of aphid. Moreover, phylogenetic relationships among those populations were also concerned on base of morphological or genetic variation. Most tested morphological characters were nearly constant among investigated populations except five characters. Population of El-Fayoum Governorate was nearly different morphologically than others. The tested primers gave 47.27% polymorphism among *R. padi* geographical populations. Arbitrary primer C11 generated two unique bands with molecular weights 1400 and 1570 bp characterized Aswan and Menia populations, respectively. In addition, arbitrary primer (OPA-09) showed highest level of polymorphism at all (73.77%). Proximity matrix analysis, based on combined effect of RAPD- PCR and ISSRs, showed highest similarity value (85%) between geographical populations of Aswan and Sohag Governorates, while the lowest was with Qena and El-Sharqya populations. Moreover, the tested populations could be divided successfully into two main clusters, the first cluster include populations of Upper and Middle Egypt Governorates, while the second cluster includes populations of Lower Egypt Governorates.

KEY WORDS: *Rhopalosiphum padi,* genetic, ISSR, RAPD-PCR, geotypes, wheat, phylogeny, Egypt

Aphid is a serious pest with wide range of agricultural crops in the temperate world; it can cause severe damage directly by depriving the plant of its essential nutrients or indirectly by transmitting viruses (Blackman, 1974; Minks & Harrewijn, 1987; Blackman & Eastop, 1994, 2000). Bird cherry-oat aphid *Rhopalosiphum padi* (Linnaeus, 1758), is considered as one of dominant aphid species attack wheat and other plants of the families Gramineae. It was recorded for first time in Egypt by (Habib & El- Kady, 1961) on wheat. Confiding this species on cereal plants will be obvious and effective with higher generations' numbers under future climatic conditions in most regions of Egypt (Tabikha, 2016).

Molecular markers are rapid identification for large numbers of individuals collected at immature stages (Carew et al., 2003, 2005). These techniques have been successfully applied to identify organisms in cryptic groups of invertebrates and also to identify species from eggs and immature stages (Clark et al., 2001; Carew et al., 2003, 2005; Hebert et al., 2004; Choe et al., 2006). Early genetic studies depend on using PCR-random amplified polymorphic DNA technique to differentiate and study phylogenetic among aphid species in Egypt (Shahadi-

Fatima et al., 2007; Tabikha, 2008; Amin et al., 2013), moreover detecting large amounts of genetic variation among and within biotypes of species (Black et al., 1992; Cenis et al., 1993). PCR-RFLP technique has been used not only to differentiate between aphid biotypes (Sunnucks et al., 1997; Shufran, 2003) but also to characterize genetic relationship of geographic population of aphid species in different countries. Mitochondrial DNA have been extensively used for studying population structure, phylogeography and phylogenetic relationship at various taxonomic levels (Xu et al., 2009).

Mitochondrial DNA methodology found to be a very promising tool for analyzing aphid population structure such as *Rhopalosiphum padi* from different localities in Spain (Martinez et al., 1992). Spatial and seasonal patterns of mitochondrial DNA diversity for *R. padi* populations were also examined in France (Martinez-Torres et al., 1997). Same technique has been also used to demonstrate the presence of two predominant lineages of *R. padi* in New Zealand (Bulman et al., 2005).

In addition, PCR techniques were used with other aphid species, that RAPD-PCR was used to estimate nucleotide diversity and genetic structure of *Rhopalosiphum padi, Aphis gossypii* and *Myzus persicae*, collected from two geographic distributions (Martinez et al., 1997), to detect the differentiation of *Myzus persicae* on tobacco from different regions (Yang-Xiao et al., 1999) and *Aphis gossypii* in China (Zou-Chen et al., 2000, 2001). 588 bp region of (mtDNA-COI) were sequenced and analysed among different geographic population of *Sitobion avenae* in China (Zhao-huan et al., 2011).

Although Simple Sequence Repeats ISSRs (microsatellites) considered as punctual and sensitive genetic techniques which has been used by plant biologists (Wolfe & Liston, 1998) it was rarely used in zoological studies (Reddy et al., 1999; Kostia et al., 2000). This technique was used for population-level studies in two species of cyclically parthenogenetic aphids, *Acyrthosiphon pisum* and *Pemphigus obesinymphae* (Abbot, 2001), and to differentiate among eleven cereal aphid species found in Egypt (Helmi et al., 2011). Moreover it was also used to characterize microsatellite loci in *Aphis gossypii,* which collected from different host plants and different locations (Vanlerberghe et al., 1999) and to identify different biotypes of greenbug, *Schizaphis graminum* (Weng et al., 2007).

So, current study aimed to use RAPD-PCR and ISSRs for studying genetic variation and phylogeographic relationship among *Rhopalosiphum padi* geographical populations collected from 16 locations along latitudes of Egypt.

MATERIALS AND METHODS

1. Samples Collection and Preservation:

Specimen (apterous viviparous) of *Rhopalosiphum padi* (L.) collected from leaves, leaves' sheaths and spinks of wheat, *Triticum aestivum* from sixteen different administrative regions in Egypt (between latitudes of 22° and 32°N and longitudes 25°E and 35°E) during March, 2015. Data about latitudes and longitudes of region and date of collection and amount of each specimen were recorded and presented in Table 1 then preserved in Eppendorf tubes with ethyl alcohol 70% till further specimen mounting and morphological studies. Ten adult females were caged separately on wheat leaves by using leaf cages under field conditions of each region. After three days, offspring of next generation for each stem mother were collected by hair brush and preserved in Eppendorf tubes with ethyl alcohol 70% and transferred to laboratory under cooling and then preserved under -20° C till further use in molecular genetics studies.

2. Mounting Samples and Morphological Studies:

Slides of preserved adults apterae specimens were prepared and mounted, after maceration procedure according to Blackman and Eastop (2000) and a permanent euparal mounting technique was chosen following Martin's (1983) method of dehydrating the macerated specimens. The species was identified and confirmed by using taxonomic keys of Blackman and Eastop, (1984, 2000) and Fathi & El-Fatih (2009). Eighteen morphometric or numeric morphological characters were investigated in specimens of each region as follow:

1. Ratio between each antennal segment (I, II, III, IV, V, Basal part of VI and Unguis of VI) to total length of antenna.
2. Ratio between width of first Antennal seg. to width of second antennal seg.
3. Ratio between width to length of Apical rostal segment.
4. Ratio between width to length of Sphiniculi.
5. Ratio between width to length of Cauda.
6. Ratio between length of first to second tarsal segment.
7. Number of sensorial seta on antennal segment (I, II, III, IV, V and Basal part of VI).

Obtained data subjected to ANOVA test Analysis by using COSTAT (2008) statistical software computer program, then hierarchical clusters analysis based average linkage method for tested morphological characters of each aphid geographical population and their Euclidean distance, was performed by SYSTAT 13 Computer program.

3. Molecular Genetic Characterizations:

Sixteen specimens of geographical populations for Bird cherry-oat aphid, collected from wheat plants in different localities of Egypt, were subjected to Polymerase Chain Reaction with six arbitrary ten-mer primers (RAPD- PCR) and with four Inter Simple Sequence Repeat (ISSRs) primers.

a) DNA extraction

DNA from aphid was extracted using a Cetyl Trimethyl Ammonium Bromide (CTAB) protocol Weeks et al. (2000) with some modifications. Five individuals of apterus aphid adults were grinded in Eppendorf tubes under liquid nitrogen to a fine powder, powdered were transferred to 1.5 ml tubes and 750 µl of extracted buffer (2% PVP-40, pH 8.0 EDTA 20 mM, CTAB 5% (W/V) Tris-HCl pH 8.0 100 mM, NaCl 1.4 M, 2.0% mercapto ethanol) stored in 60˚C was added to each sample, mixed then kept in 60˚C hot water bath for 35 minutes. During incubation period, the contents of the tubes were shaken gently several times. Equivalent to the volume of the tube, the mixture of chloroform – isoamyl alcohol (1:24) was added to each tube containing the sample and was mixed gently for one minute. The mixture was centrifuged for 15 min at 13,000 rpm, and then supernatant was taken and poured into a new sterile tube, 1 ml of cold isopropanol solution was added to each tube and the solution in the tubes was gently mixed several times. Let the DNA precipitate in -20°C (freezer) for 30 min at least. The tubes containing DNA strands were centrifuged for 10 min at 13000 rpm on 4˚C and the supernatant was emptied gently so that the DNA remained intact inside the tube. Then 500 ml of ethanol 70% was added to the tubes containing DNA, and centrifuged at 13,000 rpm on 4˚C for 5 min. The upper phase was discarded and tubes were upside down in air and placed on absorbent paper so that the deposition dried and finally 50 µl of sterile double- distilled water was added to each tube. The samples were stored overnight in the refrigerator until the mass of DNA distilled in water. To detect the extracted DNA, 1.2% Agarose gel in TBE buffer was used then 5 µl of DNA with double amount of loading buffer was mixed and electrophorized under a constant voltage of 80 volts for 1.5 hours. Quantity and quality of extracted DNA was determined by spectrophotometry and agarose gel electrophoresis.

b) RAPD-PCR preparations and conditions:

Six random primers that consist of 10 bases were used to differentiate and fingerprint the tested Bird cherry-oat aphid geographical populations. The arbitrary primers sequences are presented in Table 2. For RAPD analysis, PCR amplification was carried out in total volume of 25µl containing 2.5µl 10 x buffer, 2.5µl 50 mM $MgCl_2$, 2.5µl 4 mM dNTPs, 7µl 50pmol primer,1µl 10 ng of isolate genomic DNA and 0.2µl (5 units/ µl) Taq DNA polymerase (Promega Germany).

Amplification was performed in a thermal cycler and The following PCR programme was applied: Initial Denaturation (Initial strands separation) on 95°C for 5 min; then 40 cycles were performed, each cycle contained Denaturation on 95°C for 1 min, Annealing on 30°C for 1 min and Extension on 72°C for 1 min; finally, an extra final extension step on 72°C for 10 min Istock et al. (2001). Two µl of loading dye were added prior to loading of 10 µl per gel slot. Electrophoresis was performed at 100 volt with 0.5 x TBE as running buffer in 1.5% agarose/0.5x TBE gels and then gel was stained in 0.5 µg/cm^3 (w/v) ethidium bromide solution and distained in deionized water. Finally the gel was visualized and photographed using gel documentation system (Bio-Rad Gel Doc. 2000).

c) ISSR preparations and conditions:

PCR amplification was performed using four Inter Simple Sequence Repeats (ISSRs) primers to differentiate and finger prints the geographical population of Bird cherry-oat aphid. The ISSR primers sequences of DNA are presented in Table 3. PCR amplification was conducted in total volume of 25 µL containing: 2µL DNA, 2µL of primer, 2.5µl 10 x buffer, 2.5µl 50mM MgCl2, 2.5µl 4mM dNTPs and 0.2 µl (5 units/ µl) Taq DNA polymerase (Promega Germany).

The DNA amplifications were performed in an automated thermal cycler with PCR conditions as follow: for one cycle on 94°C for 5 min, followed by 40 cycles [1 min on 94°C, 75 second on 44°C (for HB-09 and HB-14 primers) or 40°C (for HB-12 and HB-13 primers) and 2 min on 72°C] then Final extension for 10 min on 72°C. PCR products were separated by gel electrophoresis in 1% (w/v) agarose gel in TBE buffer at 120 V for 30 min then the bands were visualized by staining with Ethidium bromide, and photographed by using gel documentation system (Bio-Rad Gel Doc.2000).

4. Genetic Relatedness among Aphid Geographical Population:

To calculate pairwise difference matrix among the sixteen geographical populations of *R. padi*, Gene_Profiler_Eval computer program was used to record bands variations with each primer of RAPD and ISSRs markers, then resulting polymorphic bands from each geographical population were scored as 1 for presence of band and 0 for its absence. It was assumed that the bands with the same size were identical. Genetic comparisons based on RAPD or/and ISSRs fingerprints among geographical population were calculated using Jaccard's similarity coefficient embedded in Multi Variate Statisical Pakage (MVSP) Version 3.1. computer program. Cluster analysis of the data matrix was performed by the Unweighted Pair Group Method with Arithmetic Means (UPGMA) with Jaccard's similarity coefficient Sneath and Sokal (1973).

RESULTS

Morphological and genetic variation of sixteen geagraphical populations of *Rhopalosiphum padi* (L.) collected from different locality of Egypt, were studied by investgating eighteen morphometric or numeric morphological characters and using ten PAPD and ISSR primers in polymerase chain reaction (PCR) for extracted DNA of each population. Moreover, phylogenetic relationships among those populations were also concerned on base of morphological or genetic variation among the populations.

1. Morphological Variation and Relatedness Analysis.

Most of the tested morphometeric and numeric morphological characters were nearly constant among investigated geographical population of *R.padi* in Egypt except five characters, which were varied signficantly from geographical population to another. Those varied characters were ratio between second antennal segment length to total antenna length, first to second antennal segment width, length of first to second tarsal segment, and width to length of sphiniculi, in addition numbers of sensorial hairs on fourth antennal segments. Results of ANOVA test analysis confirmed presence significant geographical variation for those characters among populations as followed: (F= 2.146*, LSD 0.05= 2.9e-5), (F= 3.104**, LSD 0.05= 0.015), (F= 2.481*, LSD 0.05= 0.302), (F= 3.478**, LSD 0.05= 0.176) and (F= 2.461*, LSD 0.05= 0.998), respectively. So it will be recommended avoiding of use those characters in discriminate *R. padi* species. In contrary the rest constant tested characters can be used as taxonomic characters for *R. padi* species as possible or at least characterized *R. padi* population of Egypt, but it is unsuitable for discriminate geographical populations of *R. padi* inside Egypt.

Relatedness among sixteen geographical populations of *R. padi*, based on morphometric and numeric morphological characters as graphically illustrated in figure 1 that reflected the sixteen geographical populations can be classifying into two main clusters. The first cluster separate El-Fayoum population from others which indicate that population is nearly different morphologically than others. The second cluster divided to two sub-clusters, the first sub-cluster includes Assiut and Menia population, while the second sub-cluster divided to two groups. First group separate the south populations (Swan, Qena and Sohag Governorates) from Lower Egypt population, which the last one include two sub-groups, the first sub-group include population in closed localities (El-Behera, Kafer El-Shikh, Dakahli, Domiata) in addition Beni-Suif Governorates. While the second sub-group include population in semi closed governorates (El-Monfia, El-Giza, El-Sharqya and El- Gharbia Governorates).

2. Molecular Genetic Variation and Characterization.

Genetic variation among the sixteen geographical population of *R. padi* were assessed by using six Random Amplified Polymorphic DNA (RAPD) primers and four Inter Simple Sequence Repeats (ISSRs) primers with whole genomic DNA of aphid. Analysis of obtained data revealed that the used primers showed different levels of polymorphism. These primers generated 880 fragments, 416 bands of them were considered as polymorphic markers (47.27%) for different geographical populations of *R. padi*, while 496 bands were considered as monomorphic bands (52.73%).

a) <u>RAPD-PCR analysis.</u>

The obtained bands pattern of applying RAPD-PCR technique are shown in Figure (2), which reflect that four arbitrary primers (C11, C14, OPA-03 and OPA-09) from the six tested primers gave successfully different levels of polymorphism among tested geotypes, while the other primers (OPA-11 and OPA-12) didn’t show any polymorphism among geotypes. The four primers generated 481 different DNA fragment bands with wide molecular sizes (140-1570 bp). 273 polymorphic distinct fragment bands were recorded to achieve 56.76% polymorphism among tested geotypes. The highest number of DNA fragment bands (129) was observed with primer OPA-03, while the lowest number was 103 bands, generated by primer C11.

Primer C11 generated 103 bands with widest molecular weights at all ranged from 225 to 1570bp. 71 bands of them were considered as polymorphic markers for different geotypes (68.93%), while 2 bands of them were considered as unique bands that characterized population of Aswan and Menia with molecular weights 1400 and 1570 bp, respectively. In contrary, two common bands were detected among the sixteen geographical population of *R. padi* in molecular weights 325 and 986bp. This primer generated lowest numbers of bands (3 bands) with population of Beni-Suif Governorate, while highest numbers (9 bands) observed with population of El-Dakahlia Governorate.

The generated RAPD profile of DNA fragment bands with primer C14 gave highest number of bands (10 bands) with El-Qaloubia geographical population. In contrast, this primer gave lowest numbers of DNA fragments (6 bands) with the population collected from Menia Governorate. In addition, it generated 127 bands with molecular weights ranged from 150 to 1100bp. Sixty three bands of them were considered as polymorphic markers for different geotypes to achieve moderated polymorphism level at all (49.60%). Four common bands were detected among the sixteen geographical populations in molecular weights 263, 316, 350 and 618bp.

It was obvious from bands analysis for PCR products generated by OPA-03 primer that were 129 bands with closest molecular sizes at all, ranged from 160 to 781 bp and lowest level of polymorphism among the sixteen tested geotypes (37.98%), where 49 bands of them were polymorphic bands. This primer generated lowest numbers of bands (4 bands) with population of Qena, while highest numbers (9 bands) observed with populations of Aswan, Assiut, El-Fayoum, El-Monofia, Kafer El-Shikh and Domiata Governorates. Highest number of common bands (Five) was detected among the sixteen geographical populations in molecular weights 362, 387, 436, 470 and 504bp.

The last arbitrary primer (OPA-09) generated 122 bands with molecular weights ranged from 140 to 1000 bp. Number of generated bands in different geotypes ranged from 4 bands in El-Behera population to 10 bands in populations of Qena and Sohag. This primer showed highest level of polymorphism at all (73.77%) whereas two common bands were only detected among the sixteen geographical populations of *R. padi* with molecular weights 140 and 300bp. So it may be considered as best DNA marker primers to differentiate among *R. padi* geographical population in Egypt.

b) <u>ISSR analysis.</u>

Four ISSRs primers (HB-09, HB-12, HB-13 and HB-14) were tested with the sixteen geographical populations of *R. padi* to detect molecular markers for each geotypes as shown in Figure (3). All tested ISSRs primers gave successfully different levels of polymorphism among tested geotypes that generated 399 different DNA fragment bands with molecular sizes (182-1000 bp). Obvious 143 polymorphic fragment bands were noticed to achieve polymorphism percent 35.84% among tested geotypes. The highest number of DNA fragment bands (115) was observed with primer HB-13, while the lowest number was 87 bands, generated by primer HB-09. Highest level of polymorphism (46.67%) was observed with primer HB-12, among the tested geotypes.

The generated ISSRs profile of DNA fragment bands with the primer HB-09 gave 87 bands with molecular weights ranged from 182 to 700bp. highest number of bands (6 bands) observed with most geographical population (Aswan, Qena, Sohag, Assuit, El-Qaluobia, El-Monfia, El-Gharbia and Domiata Governorates), while lowest numbers of bands (4 bands) occurred with population of Menia Governorate. It generated 39 polymorphic bands to achieve polymorphism level (44.83%). In contrast, three common bands were detected among the sixteen geographical populations with molecular weights 182, 183 and 625bp.

Primer HB-12 generated 90 bands with molecular weights ranged from 280 to 1000bp. Moreover, 42 bands pattern of them were considered as polymorphic markers for different geotypes with percent of polymorphism (46.67%) (Highest level comparing with tested ISSRs primers). In contrary, three common bands were detected among the sixteen geographical populations in molecular weights 532, 665 and 740bp. This primer generated lowest numbers of bands (4 bands) with populations of El-Monfia Governorate, while highest numbers (7 bands) observed with populations of Aswan and El-Fayoum Governorates.

Primer HB-13 generated 115 bands with molecular weights ranged from 165 to 990bp. Numbers of generated bands in different geotypes ranged from 6 bands in populations of El- Monofia and El-Dakahlia to 8 bands in populations of Qena, Assiut, El-Qaloubia, Kafer El-Shikh and Domiata Governorates. This primer showed lowest level of polymorphism at all 16.52% whereas highest numbers of common bands (6 bands) were detected among the sixteen geographical populations with molecular weights 165, 256, 300, 333, 424 and 586bp. So it may be considered as less suitable ISSRs primer to differentiate geographical populations of *R. padi* in Egypt, while it may be DNA marker primers to characterized *R. padi* species of Egypt at all or species specific primers.

Primer HB-14 generated 107 bands with molecular weights ranged from 285 to 912 bp where 43 bands of them were polymorphic bands to give 40.19% polymorphism among the sixteen tested geotypes. This primer generated lowest numbers of bands (5 bands) with populations of El-Qaloubia and El-Behera Governorates, and generated 6 bands with population of Aswan, El-Fayoum and El- Gharbia Governorates. While highest numbers (8 bands) observed with *R. padi* populations of El-Fayoum, El-Dakahlia and Kafer El-Shikh Governorates. Common bands were detected among the sixteen geographical population species in molecular weights 285, 402, 420 and 738bp.

3. Genetic Relatedness among Geographical Populations of *R. padi* in Egypt.

Genetic similarities and phylogenetic relationships among the tested sixteen geographical population of *R. padi* were based on RAPD- PCR and ISSRs analysis, in addition the combined effect of those techniques. To calculate proximity matrix and design dendrograms, the obtained data were subjected to cluster analysis by using Unweighted Pair Group Method with Arithmetic Means (UPGMA) and Jaccard's similarity coefficient embedded in NTSYS-pc computer program.

The results of proximity matrix analysis for the tested sixteen geographical population of *R. padi*, based on RAPD- PCR, reflected that the highest similarity value 77.8% was recorded between geographical populations of El-Dakahlia and Kafer El-Shikh Governorates, while the lowest similarity value (48.6%) was recorded between geographical populations of Aswan and El-Giza Governorates. Moreover, dendrogram analysis based on RAPD-PCR polymorphism was graphically illustrated in Figure (4), which reflects that the sixteen geographical populations of *R. padi* could be classify into two main clusters with similarity percentage 61%, the first cluster divided to two sub-clusters, the first one includes only geographical population of El-Behera governorate; while the second include two groups with similarity percentages 68%, the first group divided to two sub-groups with similarity percentages 73%; the first includes El-sharqya, Kafer El-

Shikh and El-Dakahlia populations, while the second includes Domiata and El-Qaloubia. The second sub-cluster includes El-Monfia and El-Giza population. The second cluster had populations of Upper Egypt governorates that divided to two sub-clusters with similarity percentage 68%, the first sub- cluster includes populations of Qena, Menia, Beni-Suif, El-Fayoum and El-Gharbia Governorates with similarity 69%; while the second sub-cluster includes populations of Assuit, Sohag and Aswan Governorates with similarity 73.3%.

Proximity matrix analysis for the tested sixteen geographical population of *R. padi*, based on ISSR-PCR, reflected that the highest similarity value 96.3% was recorded between geographical populations of Aswan and Sohag Governorates, while the lowest similarity value (61.3%) was recorded between geographical populations of Assiut and El-Sharqya Governorates. In addition, dendrogram analysis based on ISSRs polymorphism was graphically illustrated in Figure (5), which reflects that the sixteen geographical populations of *R. padi* separated to two main clusters with similarity percentage 77.5%, the first cluster divided to two sub-clusters, the first one includes only geographical population of El-Monofia Governorate; while the second sub-clusters includes two groups with similarity percentage 81%; the first group includes populations of El-Gharbia and El-Sharqya Governorates, while the second group divided to two sub-groups with similarity 81.3%; the first include Domiata and El-Behera, Kafer El-Shikh and El-Dakalia Governorates; while the second include the populations of El-Qaloubia, El-Giza, Beni-Suif and Menia Governorates. The second cluster had populations for south of Upper Egypt governorates (Aswan, Qena and Sohag, Assiut) in addition to El-Fayoum Governorate with similarity percentage 85%.

The results of proximity matrix analysis for the tested sixteen geographical population of *R. padi*, based on combined effect of RAPD- PCR and ISSRs, showed that the highest similarity value 85% was recorded between geographical populations of Aswan and Sohag Governorates, while the lowest similarity value (58.8%) was recorded between geographical populations of Qena and El-Sharqya Governorates. Moreover, dendrogram analysis based on combined effect of RAPD- PCR and ISSRs polymorphism is graphically illustrated in Figure (6), which reflects that the sixteen geographical populations of *R. padi* could be divided successfully into two main clusters with similarity percentage 68%, the first cluster include populations of Upper and Middle Egypt Governorates in addition population of El-Gharbia Governorate, while the second cluster includes populations of Lower Egypt Governorates. So the first cluster includes two sub-cluster with similarity 75%; the first sub-cluster includes populations of Aswan, Sohag, Assiut and Qena Governorates with similarity percentage 77%, while the second sub-cluster includes populations of Menia, Beni-Suif, El-Fayoum and El-Gharbia with similarity 76.5%. The second cluster of Lower Egypt could be also divided to two sub-cluster, the first sub-cluster includes populations of El-Monofia and El-Giza Governorates with similarity 79%, while the second sub-cluster could be divided to two groups; the first group includes populations of El-Qaloubia, El-sharqya, Kafer El-Shikh and El-Dakahlia Governorates with similarity percentage 75.5%, while the second group include populations in costal Governorates (El-Behera and Domiata) with similarity percentage 78%.

DISCUSSION

Classical morphological criteria for aphid species identification may be affected by environmental factors such as climatic conditions and physiological status of the host plant (Helmi et al., 2011). The RAPD-PCR analysis was suitable method to determine genetic distances among different taxa (families, subfamilies, genera, species and populations within species) of aphids, moreover to differentiate aphids especially for closely and related species (Black et al., 1992; Cenis et al., 1993; Lushai et al., 1997; Zhang et al., 2000; Jain et al.; 2010). Using of different primers in the RAPD method permits the detection of different levels of DNA polymorphism for *Myzus persicae* population (Yang et al., 1999), to detect a close relationship between the green spruce aphid, *Elatobium abietinum* in two localities (Sigurdsson et al., 1999), distinguish different geographical and/or host associated populations of some cryptic complex species (Zitoudi et al., 2001; Bulman et al., 2005; Helmi et al., 2011) and to distinguish among six biotypes of *Schizaphis graminium* (Black et al., 1992). Whereas *Diuraphis noxia* populations, collected from various host plants and regions, gave 69 polymorphic DNA bands amplified by 7 primers (Puterka et al., 1993). Random primer A11 gave a diagnostics constant loci to differentiate populations of *Aphis gossypii* collected on cucurbits, which was absent in those collected from other host plants (Vanlerberghe & Chavigny, 1998). In contract collected populations of *A. gossypii* from different localities can be differentiated (Zou-Chen et al., 2000). Each of geographical and seasonal distribution of *Sitobion avenae* populations had low effect on genetic variability (Figueroa et al., 2005).

In Egypt RAPD-PCR technique is successively used to fingerprint of some sap-sucking insect species belonging to the same taxonomic category such as fingerprinting of ten aphids species belonging to Genus *Aphis* (Shahadi-Fatima et al., 2007), eighteen aphid species belonging to Tribe Aphidini (Sub-tribe Rhapalosiphina) and Tribe Macrosiphini (Tabikha, 2008) and to differentiate eleven different cereal aphid species (Helmi et al., 2011).

Some taxonomic studies were based on ISSRs techniques and applied with aphids such as (Abbot et al., 2001) that studied population-level in two species of cyclically parthenogenetic aphids; *Acyrthosiphon pisum* and *Pemphigus obesinymphae*, and reported that ISSRs are suitable for invertebrate populations with small size bodies and low levels of within-population variation; (Weng et al., 2007) studied host-associated genetic differences and regional differences among the green bug, *Schizaphis graminum* biotypes and cited that the use of ISSRs would be useful for aphid genetic, ecological, and evolutionary studies.

In Egypt, (ISSRs) were used to find diagnostic markers for fingerprinting eleven cereal aphids collected from different cereal plants and from different localities in Egypt. Whereas HP-09 primer generated 23 bands with molecular weight ranged from 117 to 1109bp. and generated 5 bands with *R. padi* and showed 82.6% polymorphism; HP-11 primer generated 30 bands with molecular weights ranged from 124 to 1301bp. and showed 73.3 % polymorphism; HP-12 primer generated 22 bands with molecular weight ranged from 95 to 842bp. with 90.9% polymorphism, and detected one marker band for *R. padi* ; HP-13 primer: generated 25 bands with molecular weight ranged from 123 to 1016bp. with 88% polymorphism and detected also one marker band for *R. padi*; finally HP-14 primer generated 22 bands with molecular weights ranged from 32 to 963bp. with 81.8% and detect one marker band for *R. padi* (Helmi et al., 2011).

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LITERATURE CITED

Abbot, P. 2001. Individual and population variation in invertebrates revealed by Inter-simple Sequence Repeats (ISSRs). 3 pp. Journal of Insect Science, 1.8. Available online: insectscience.org/1.8.

Amin, A. H., Draz, K. A., Soliman, Kh. A. & Tabikha, R. M. 2013. Genetic fingerprints and phylogenetic relationships of eighteen aphid species from Egypt (Hemiptera: Sternorrhyncha: Aphididae). Munis Entomology & Zoology, 8 (1): 387-406.

Black, W. C., DuTeau, N. M., Puterka, G. J., Nechols, J. R. & Pettorini, J. M. 1992. Use of the random amplified polymorphic DNA polymerase chain reaction (RAPD-PCR) to detect DNA polymorphisms in aphids (Homoptera: Aphididae). Bulletin of Entomological Research, 82: 151-159.

Blackman, R. L. 1974. Aphids. Ginn & Company Limited, London and Aylesbury, UK.

Blackman, R. L. & Eastop, V. S. 1984. Aphids on the world's crops: An Identification and Information Guide (text book). John Wiley & Sons; 465 pp.

Blackman, R. L. & Eastop, V. F. 1994. Aphids on the World's Trees: An Identification and Information Guide. CAB International in association with the Natural History Museum, Wallingford, USA.

Blackman, R. L. & Eastop, V. F. 2000. Aphids on the World's Crops: An Identification and Information Guide, 2nd edn. John Wiley & Sons Ltd, Chichester, UK.

Bulman, S. R., Stufkens, M. A. W., Nichol, D., Harcourt, S. J., Harrex, A. L. & Teulon, D. A. J. 2005. *Rhopalosiphum* aphids in New Zealand. I. RAPD markers reveal limited variability in lineages of *Rhopalosiphum padi*. New Zealand Journal of Zoology, 32: 29-36.

Carew, M. E., Pettigrove, V. & Hoffmann, A. A. 2003. Identifying chironomids (Diptera: Chironomidae) for biological monitoring with PCR-RFLP. Bulletin of Entomological Research, 93: 483-490.

Carew, M. E., Pettigrove, V. & Hoffmann, A. A. 2005. The utility of DNA markers in classical taxonomy: Cytochrome Oxidase I markers to differentiate Australian *Cladopelma* (Diptera: Chironomidae) midges. Annals of the Entomological Society of America, 98: 587-594.

Cenis, J. L., Perez, P. & Fereres, A. 1993. Identification of aphid (Homoptera: Aphididae) species and clones by random amplified polymorphic DNA. Annals of the Entomological Society of America, 86: 545-550.

Choe, H. J., Lee, S. H. & Lee, S. 2006. Morphological and genetic indiscrimination of the grain aphids *Sitobion avenae* complex (Hemiptera: Aphididae). Applied Entomology and Zoology, 41: 63-71.

Clark, T. L., Meinke, L. J. & Foster, J. E. 2001. PCR-RFLP of the mitochondrial cytochrome oxidase (subunit I) gene provides diagnostic markers for selected *Diabrotica* species (Coleoptera: Chrysomelidae). Bulletin of Entomological Research, 91: 419-427.

Costat Software 2008. Version 6.3, CoHort, 798 Lighthouse Ave, PMB 320, Monetery, CA93940, USA.

Fathi, A. H. & El Fatih, M. M. 2009. Identification of apterous viviparous of cereal aphids in Egypt (Hemiptera: Sternorrhyncha: Aphidoidea). Bull. Ent. Soc. Egypt, 86: 307-325.

Figueroa, C. C. , Simon, J. C., Le Gallic, J. F., Leterme, N. P., Briones, L. M., Dedryver, C. A. & Niemeyer, H. M. 2005. Genetic structure and clonal diversity of an introduced pest in Chile, the cereal aphid *Sitobion avenae*. Heredity, 95: 24-33.

Habib, A. & El-kady, E. 1961. The Aphididae of Egypt. Bull. Soc. Entomol. Egypte, 45: 1-137.

Hebert, P. D. N., Penton, E. H., Burns, J. M., Janzen, D. H. & Hallwachs, W. 2004. Ten species in one: DNA barcoding reveals cryptic species in the Neotropical skipper butterfly *Astraptes fulgerator*. Proceedings of the National Academy of Sciences of the United States of America, 101: 14812-14817.

Helmi, A., Khafaga, A. F. & El-Fatih, M. M. 2011. Molecular Fingerprinting of certain cereal aphids in Egypt (Hemiptera: Sternorrhyncha: Aphididae) using RAPD and ISSR markers. Munis Entomology & Zoology, 6 (1): 363-376.

Istock, C. A., Ferguson, N., Istock, N. L. & Duncan, K. E. 2001. Geographical diversity of genomic lineages in *Bacillus subtilis* (Ehrenberg) Cohn sensu lato.Org. Divers. Evol., 1: 179-191.

Jain, S. K., Neekhra, B., Pandey, D. & Jain, K. 2010. RAPD marker system in insect study: A review, Indian Journal of Biotechnology, 9: 7-12.

Kostia, S., Ruohonen-Lehto, M., Vainola, R. & Varvio, S. L. 2000. Phylogenetic information in inter-SINE and inter-SSR fingerprints of the Artiodactyla and evolution of the BovtA SINE. Heredity, 84: 37-45.

Lushai, G., Loxdale, H. D., Brookes, C. P., Ven Mende, N., Harrington, R. & Herdie, J. 1997. Genotypic variation among different phenotypes within aphid clones. Proc. Biol. Sci., 264 (1382): 725-730.

Martin, J. H. 1983. The identification of common aphid pests of tropical agriculture. Tropical Pest Management, 29: 395-411.

Martinez, T. D., Moya, A., Hebert, P. D. N. & Simon, J. C. 1997. Geographic distribution and seasonal variation of mitochondrial DNA haplotypes in the aphid *Rhopalosiphum padi* (Hemiptera: Aphididae). Bull. Ent. Res., 87 (2): 161-167.

Martiniz, D., Moya, A., Latorre, A. & Fereres, A. 1992. Mitochondrial DNA variation in *Rhopalosiphum padi* (Homoptera: Aphididae) populations from four Spanish localities. Ann. Entomol. Sot. Am., 85: 241-246.

Minks, A. K. & Harrewijn, P. eds. 1987. Aphids: Their Biology, Natural Enemies and Control. Elsevier, New York, USA.

Puterka, G. J., Black, W. C., Steiner, W. M. & Burton, R. L. 1993. Genetic variation and phylogenetic relationships among worldwide collections of the Russian wheat aphid, *Diuraphis noxia* (Mordvilko), inferred from allozyme and RAPD-PCR markers. Heredity, 70 (6): 604-618.

Reddy, K. D., Nagaraju, J. & Abraham, E. G. 1999. Genetic characterization of the silkworm *Bombyx mori* by simple sequence repeat (SSR)-anchored PCR. Heredity, 83: 681-687.

Shahadi-Fatima, H., Amin, A. H. & Soliman, Kh. A. 2007. Genetic fingerprints and phylogenetic relationships of ten *Aphis* species found in Egypt (Hemiptera: Aphididae). J. Biol. Chem. Environ. Sci., 2 (4): 173-188.

Shufran, K. A. 2003. Polymerase chain reaction-restriction fragment length polymorphisms identity mtDNA haplotypes of greenbug (Hemiptera: Aphididae). Journal of the Kansas Entomological Society, 76: 551-556.

Sigurdsson, V., Halldorsson, G., Sigurgeirsson, A., Thorsson, A. E. T. & Anamthawat-Jonsson, K. 1999. Genetic differentiation of the green spruce aphid (*Elatobium abietinum* Walker), a recent invader to Iceland. Agricultural and Forest Entomology, 1 (3): 157-163.

Sneath, P. H. A. & Sokal, R. R. 1973. Numerical taxonomy - the principles and practice of numerical classification. (W. H. Freeman: San Francisco).

Sunnucks, P., Driver, F., Brown, W. V., Carver, M., Hales, D. F. & Milne, W. M. 1997. Biological and genetic characterization of morphologically similar *Therioaphis trifolii* (Hemiptera: Aphididae) with different host utilization. Bulletin of Entomological Research, 87: 425-436.

Tabikha, R. M. 2008. Taxonomical studies on some aphid species by using modern techniques. Ph.D. Thesis, Fac. Agri. Alexandria University, Damanhour branch, Egypt, 193 pp.

Tabikha, R. M. 2016. Impacts of temporal and spatial climatic changes on annual generations of *Rhopalosiphum maidis* and *R. padi* (Hemiptera: Aphididae) in Egypt, using geographical information system (GIS). Journal of Entomology and Zoology Studies, 4 (1): 394-401.

Vanlerberghe, M. F. & Chavigny, P. 1998. Host based genetic differentiation in the aphid *Aphis gossypii* Glover, evidenced from RAPD fingerprints. Mol. Eco., 7 (7): 905-914.

Vanlerberghe, M. F., Chavigny, P. & Fuller, S. J. 1999. Characterization of microsatellite loci in the aphid species *Aphis gossypii* Glover. Mol. Eco., 8 (4): 693-695.

Weeks, A. R., Van Opijnen, T. & Breeuwer J. A. 2000. AFLP fingerprinting for assessing intraspecific variation and genome mapping in mites. Exp. Appl. Acarol., 24: 775-793.

Weng, Y., Azhaguvel, P., Michels, G. J. & Rudd, J. C. 2007. Cross-species transferability of microsatellite markers from six aphid (Hemiptera: Aphididae) species and their use for evaluating biotypic diversity in two cereal aphids. Insect Mol. Biol., 16 (5): 613-622.

Wolfe, A. D. & Liston, A. 1998. Contributions of PCR-based methods to plant systematics and evolutionary biology. In: Soltis, D.E., Soltis P.S., Doyle J.J., editors. Wolfe, A.D., Xiang, Q-Y, Kephart, S.R. 1998. Assessing hybridization in natural populations of *Penstemon* (Scrophulariaceae) using hypervariable inter simple sequence repeat markers. Mol. Ecol., 7: 1107-1125.

Xu, Q., Liu, R. & Liu, Y. 2009. Genetic population structure of the swimming crab, Portunus trituberculatus in east China sea based on mtDNA 16S rRNA sequence. Journal of Experimental Marine Biology and Ecology, 371: 121-129.

Yang, X.-W., Zhang, X.-X., Cheng, X.-F. & Wang, Y. 1999. On the RAPD-PCR analysis of DNA polymorphism of green peach aphid from different hosts. Acta Phytophylacica Sinica, 26 (2): 147-152.

Zhang, S., Yang, X. & Ma, J. 2000. A study on genetic distance among different taxa of aphids (Homoptera: Aphidoidea). Acta Ent. Sin., 7 (3): 235-242.

Zhao-huan, X., Ju-lian, C., Deng-fa, C., Young, L. & Francis, F. 2011. Genetic variation among the geographic population of grain aphid *Sitobion avenae* (Hemiptera: Aphididae) in China inferred from mitochondrial COI gene sequence. Agriculture Science in China, 10 (7): 1041-1048.

Zitoudi, K., Margaritopoulos, J. T., Mamuris, Z. & Tsitsipis, J. A. 2001. Genetic variation in *Myzus persicae* populations associated with host-plant and life cycle category. Ent. Exp. et. Appl., 99 (3): 303-311.

Zou-Chen, H., Yang-Xiao, W., Chen-Xiao, F. & Li-Ying, X. 2000. Repeat sequence Primer-PCR study on DNA polymorphism of geographic populations of cotton aphid *Aphis gossypii* in China. Acta Ent. Sin., 7 (4): 315-321.

Zou-Chen, H., Yang-Xiao, W., Chen-Xiao, F. & Li-Ying, X. 2001. Study on geographic population differentiation of cotton aphid, *Aphis gossypii,* using repeat sequence primers PCR. Entomological Knowledge, 38 (5): 348-351.

Table 1. List of localities (Governorates) names and associated geographical information for collected specimens of *Rhopalosiphum padi* in Egypt.

Sample No.	**Locality (Governorate)**	**GPS**		**Date of collection**	**Sample Size**
		Latitudes	**Longitudes**		
1	Aswan	24° 25' 14.48" N	32° 56' 07.97" E	2/3/2015	20
2	Qena	25° 43' 20.31" N	32° 37' 43.31" E	1/3/2015	8
3	Sohag	26° 33' 50.43" N	31° 43' 42.67" E	3/3/2015	15
4	Assiut	27° 08' 50.26" N	31° 17' 34.61" E	3/3/2015	22
5	Menia	28° 06' 44.21" N	30° 44' 39.94" E	4/3/2015	17
6	Beni-Suif	29° 05' 15.55" N	31° 06' 37.54" E	4/3/2015	13
7	El-Fayoum	29° 26' 19.88" N	30° 46' 19.06" E	5/3/2015	11
8	El-Giza	30° 01' 03.64" N	31° 12' 17.60" E	18/3/2015	7
9	El-Qaloubia	30° 17' 11.36" N	31° 11' 59.49" E	21/3/2015	20
10	El-Sharqya	30° 35' 43.89" N	31° 27' 46.04" E	16/3/2015	8
11	El-Monofia	30° 36' 23.18" N	31° 00' 00.55" E	21/3/2015	18
12	El-Gharbia	30° 49' 15.06" N	30° 59' 33.52" E	16/3/2015	5
13	El-Dakahlia	31° 03' 55.40" N	31° 22' 15.66" E	24/3/2015	8
14	KaferEl-Shikh	31° 07' 27.38" N	30° 57' 12.12" E	10/3/2015	7
15	El-Behera	31 °19' 42.13" N	30° 24' 16.66" E	12/3/2015	17
16	Domiata	31° 24' 01.19" N	31° 41' 59.04" E	24/3/2015	5

Table 2. Arbitrary ten-mer primers employed in the RAPD-PCR analysis.

Primer Code	Nucleotide Sequence 5\ ------------------- 3\
C_{11}	AAAGCTGCGG
C_{14}	TGCGTGCTTG
OPA-03	AGTCAGCCAC
OPA-09	CTCACCGTCC
OPA-11	CAATCGCCGT
OPA-12	CAATCGCCGT

Table 3. ISSR primers employed in the ISSR-PCR analysis.

Primer Code	Nucleotide Sequence 5\ ------------------- 3\
HB-09	GTGTGTGTGTGTGG
HB-12	CACCACCACGC
HB-13	GAGGAGGAGGC
HB-14	GTGTGTGTGTGTGC

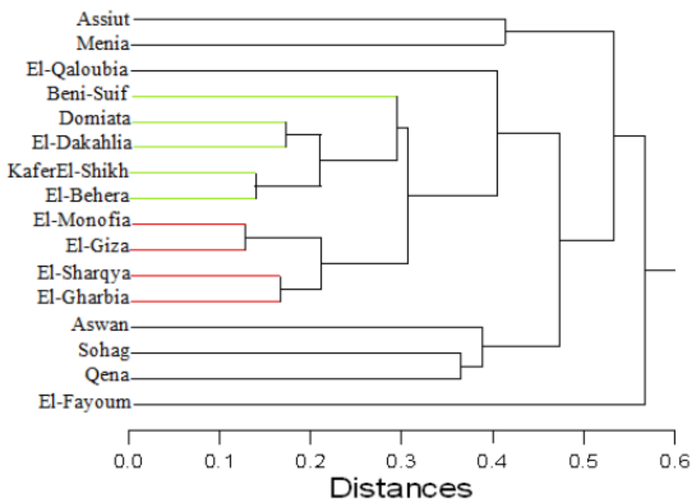

Figure 1. Hierarchical clusters show morphological relatedness among sixteen geographical populations of *R. padi*, based on morphometric and numeric morphological characters.

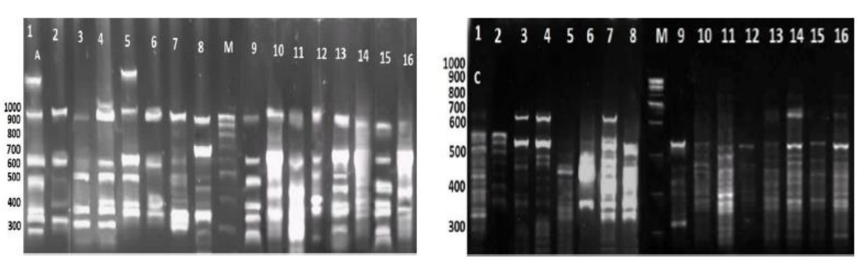

Figure 2. DNA fragment banding generated by four arbitrary primers [Primer C11(A), C14(B), OPA-03(C), and OPA-09(D)] for geographical population of *R. Padi* collected from sixteen localities [Aswan(L1), Qena(L2), Sohag(L3), Assiut(L4), Menia(L5), Beni-Suif (L6), El-Fayoum(L7), El-Giza(L8), El-Qaloubia(L9), El-Sharqya(L10), El-Monofia(L11), El-Gharbia(L12), El-Dakahlia(L13), Kafer El-Shikh(L14), El-Behera(L15) and Domiata(L16)], in addition DNA marker(M).

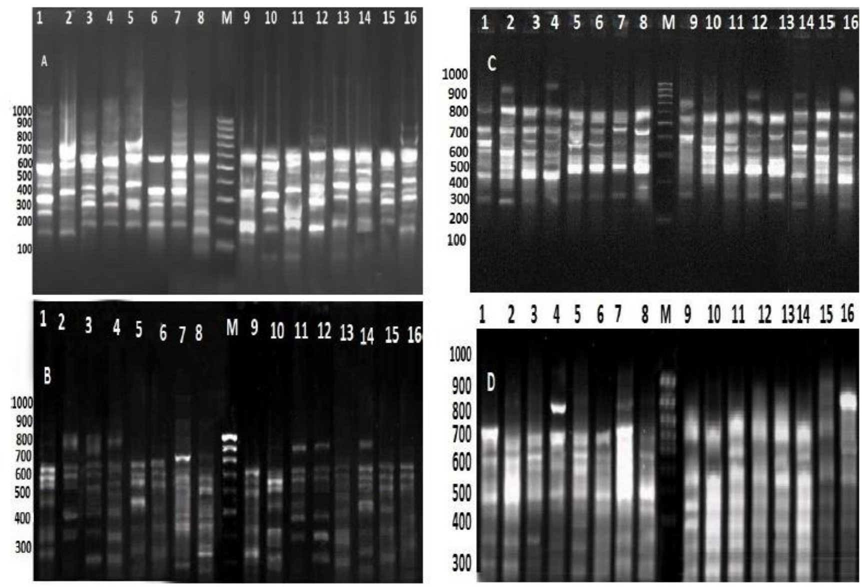

Figure 3. DNA fragment banding generated by four ISSRs primers [Primer HB-09 (A), HB-12(B), HB-13 (C), and HB-14 (D)] for geographical population of *R. Padi* collected from sixteen localities [Aswan(L1), Qena(L2), Sohag(L3), Assiut(L4), Menia(L5), Beni-Suif (L6), El-Fayoum(L7), El-Giza(L8), El-Qaloubia(L9), El-Sharqya(L10), El-Monofia(L11), El-Gharbia(L12), El-Dakahlia(L13), Kafer El-Shikh(L14), El-Behera(L15) and Domiata(L16)], in addition DNA marker(M).

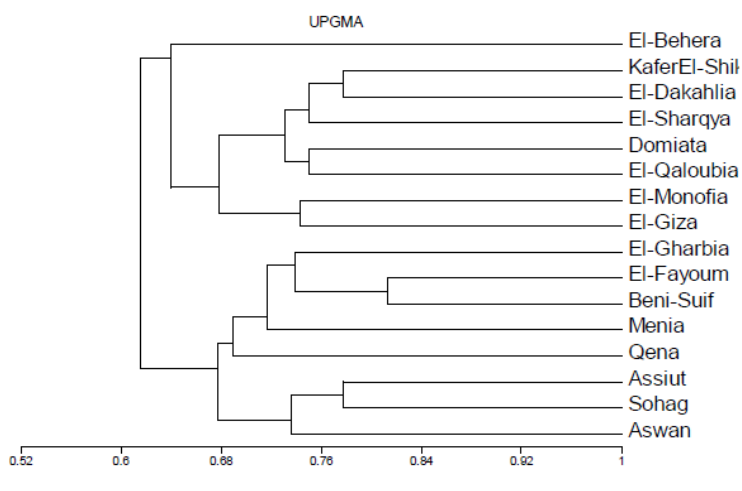

Figure 4. Dendrogram show phylogenetic relationship among the sixteen geographical population of *R. padi* based on RAPD-PCR analysis.

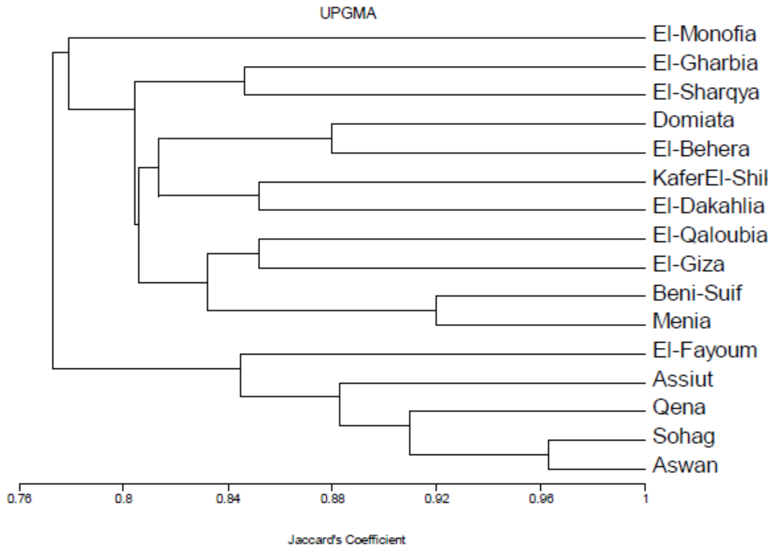

Figure 5. Dendrogram show phylogenetic relationship among the sixteen geographical population of *R. padi* based on ISSRs analysis.

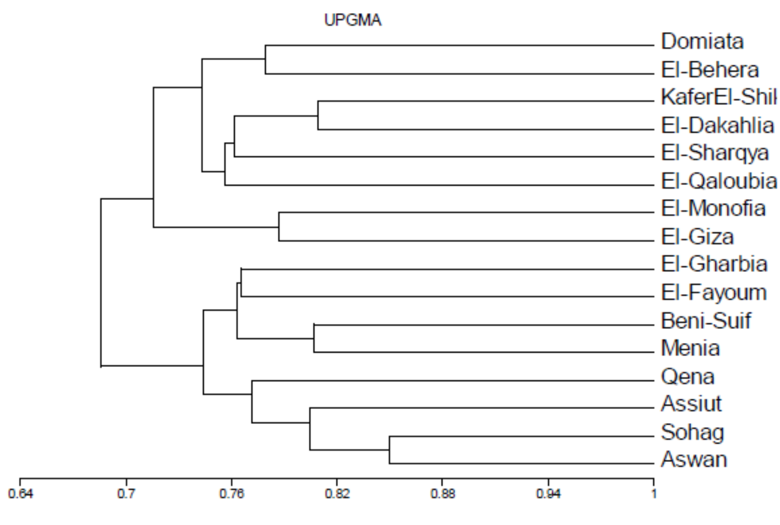

Figure 6. Dendrogram show phylogenetic relationship among the sixteen geographical population of *R. padi* based on combined effect of RAPD-PCR and ISSRs analysis.

FIRST RECORD OF *ACANTHASPIS PORRECTA* DISTANT (HETEROPTERA: REDUVIIDAE: REDUVIINAE) FROM INDIA

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[**Mukherjee, P. & Saha, G. K.** 2017. First record of *Acanthaspis porrecta* Distant (Heteroptera: Reduviidae: Reduviinae) from India. Munis Entomology & Zoology, 12 (1): 277-279]

ABSTRACT: *Acanthaspis porrecta* Distant, 1904, belonging to subfamily Reduviinae of family Reduviidae recorded for the first time from West Bengal (Bankura dist.), India and redescribed along with additional diagnostic characters and measurements of different body parts.

KEY WORDS: Reduviidae, Reduviinae, *Acanthaspis porrecta*, new record, India

The genus *Acanthaspis* was established by Amyot & Serville (1843) for the type species *Acanthaspis sexguttata* Fabricius under the subfamily *Acanthaspidinae* and well reprensented in Oriental and Ethiopian region. Distant (1904) in "*The Fauna of British India including Ceylon and Burma"* has placed this genus under the division Acanthaspisaria of the subfamily Acanthaspidinae including 40 species. A perusal of literature reveals that altogether 90 species under 46 genera belonging to 9 Subfamilies of the family Reduviidae are so far known from West Bengal (Distant, 1904, 1910; Cook, 1977). Biswas et al. (1994) while dealing with the fauna of West Bengal has included 73 species under 43 genera belonging to 8 subfamilies of the family Reduviidae from West Bengal, with a note that further 17 species under 12 genera were not available for their study. However, they (1994) have included other 4 species *viz. fulvipes* (Dallas), *lineatipes* Reuter, *maculata* (Distant) and *sexguttata* (Fabr.) in the same work recorded from West Bengal. After reviewing the checklist of Indian Assassin bugs (Insecta: Hemiptera: Reduviidae) published by Ambrose (2006) it is found that till to date seven species *viz. fulvipes* (Dallas), *lineatipes* Reuter, *maculata* (Distant), *luteipes* Walker, *quinquespinosa* (Fabr.), *rugulosa* Stal and *sexguttata* (Fabr.) are recorded under genus *Acanthaspis* Amyot and Serville from West Bengal. Present study recorded *Acanthaspis porrecta* Distant for the first time from India (West Bengal: Bakura dist.: Belbani) which was earlier recorded from Sri Lanka.

MATERIALS AND METHODS

This study is based on the materials collected from a field survey from Belbani, Bakura district of West Bengal. The specimen is deposited in the National Zoological Collection of Zoological Survey of India, Hemiptera Section, Kolkata. Different body parts were measured and their ratios were calculated for the establishment of additional diagnostic characters. Measurement and photographs of the species were taken with the aid of Leica M 205A microscope. All measurements are in millimetres.

OBSERVATION AND RESULTS

Acanthaspis Amyot & Serville, 1843

1843. *Acanthaspis* Amyot & Serville, Histoire Naturelle des Insects Hemipteres Libraire Encyclopedique de Roret, Paris: Fain et Thunot., 336 pp.
Type species : *Acanthaspis sexguttata* Fabricius
Distribution : Ethiopian and Oriental regions.

Acanthaspis porrecta Distant, 1904 (Plate 1, Figs. 1-7)

1904. *Acanthaspis porrecta* Distant, Fauna Brit. India, Rhynchota, 2: 261.
1990. *Acanthaspis porrecta,* Maldonado, Carribbean J. Sci. (special ed.), 387 pp.

Material examined: 1ex., INDIA: West Bengal: Bankura District: Belbani, 3.IX.1986, Coll. P. Mukhopadhyay and party.
Description: Head, anterior lobe of pronotum, base of scutellum and hemelytra excluding spots, mesonotum, metanotum, abdomen, black; antennae, rostrum, base of posterior lobe of pronotum, a spot at apex of corium and a large transverse spot almost crossing corium at inner angle, spots to connexivum above and beneath, coxae, trochanters and legs pale yellowish brown; head longer (HL=2.32 mm) than wide (HW=2.11 mm) (1.00:0.54), anteocular area (AO=1.35 mm) longer than postocular area (PO=0.97 mm) (1.00: 0.71) (Fig. 4); first segment of antennae (A1=1.86 mm) passing apex of head and distinctly shorter than second segment (A2=3.76 mm), ratio of antennal segments: I:II:III:IV = 0.49:1.00:0.71:0.44; first segment of rostrum (1.23 mm) slightly longer than second segment (1.11 mm), ratio of rostral segments: I:II:III = 1.00:0.90:0.48 (Fig. 3); anterior lobe of pronotum (AP=1.64 mm) shorter than posterior lobe (PP=2.29 mm) (0.71:1.00) (Fig. 5), which is with two short but prominent tubercles; scutellum longer (SL=2.33 mm) than wide (SW=1.77 mm) (1.00: 0.75) and with very long, robust, laterally porrect spine at apex; hemelytra not exceeding the length of abdomen; hind femora (HF=6.22 mm) shorter than hind tibiae (HT=8.07 mm); abdomen longer (AL= 9.96 mm) than wide (AW= 4.68 mm) (1.00: 0.46).

This species is closely related to *Acanthaspis luteipes* Walker, but can be easily separated by its very long, robust laterally porrect apical spine of scutellum and piceous hemelytra excluding spots.
Measurements: (1 female in mm). Body length 17.97; head length 2.32, width across eye 2.11; length of anteocular region 1.35, postocular region 0.97; length of antennae 9.96, lengths of antennal segments I : 1.86, II : 3.76, III : 2.67, and IV : 1.66; rostral length 2.94, length of rostral segments I : 1.23, II : 1.11 and III : 0.60; length of pronotum 3.94; length of anterior pronotal lobe 1.64, posterior pronotal lobe 2.29, width of anterior pronotal lobe 2.92, posterior pronotal lobe 4.91; length of fore coxa: 2.19, trochanter: 1.23, femur: 3.86, tibia: 4.74, tarsus: 1.73, claws: 0.57; mid coxa: 1.33, trochanter: 0.89, femur: 3.24, tibia: 3.98, tarsus: 1.44, claw: 0.43; hind coxa: 1.35, trochanter: 0.90, femur: 6.22, tibia: 8.07, tarsus: 2.31, claw: 0.57.
Distribution: INDIA: West Bengal. Elsewhere: Sri Lanka.

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Survey of India for his valuable suggestions and support. The helpful co-operation of the staff members of Hemiptera Section are thankfully acknowledged.

LITERATURE CITED

Ambrose, D. P. 2006. A Checklist of Indian Assassin bugs (Insecta: Hemiptera: Reduviidae) with taxonomic status, distribution and diagnostic morphological characteristics. Zoo' Print Journal, 21 (9): 2388-2406.

Amyot, C. J. B. & Serville, A. 1843. Histoire Naturelle' des Insectes, Hemipteres. Libraire Encyclopedique de Roret Paris. Fam. et Thunot, Ixxvi+ 675+6 pp., 12 pls.

Biswas, B., Sen, G. C. & Ghosh, L. K. 1994. Insecta: Hemiptera: Reduviidae. Fauna of West Bengal, State Fauna Series 3, Part 5: 369-411.

Cook, M. L. 1977. A key to the genera of Asian Ectrichodinae (Insecta: Reduviidae) together with a checklist of genera and species, Oriental Insects, 11: 63-88.

Distant, W. L. 1904. The Fauna of British India including Ceylon and Burma, Rhynchota, 2: 198-389.

Distant, W. L. 1910. The Fauna of British India including Ceylon and Burma, Rhynchota, 5: 169-220.

Maldonado, C. 1990. Systematic Catalogue of the Reduviidae of the World (Insecta: Heteroptera), A special edition of Caribbean Journal of Science, Puerto Rico, 694 pp.

PLATE : 1

Plate 1: Figures 1-7. *Acanthaspis porrecta* Distant. 1. Dorsal view of female; 2. ventral view of female; 3. head with rostrum, lateral view; 4. head, dorsal view; 5. pronotum, dorsal view; 6. foreleg, ventral view; 7. abdominal tip of female, ventral view.

RECORD OF *ELASMUS* WESTWOOD (HYMENOPTERA: CHALCIDOIDEA: EULOPHIDAE: EULOPHINAE: ELASMINI) OF PUNJAB, INDIA

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[**Kazmi, S. I. & Sheela, S.** 2017. Record of *Elasmus* Westwood (Hymenoptera: Chalcidoidea: Eulophidae: Eulophinae: Elasmini) of Punjab, India. Munis Entomology & Zoology, 12 (1): 280-284]

ABSTRACT: The present paper deals with the study of subfamily Eulophinae of Punjab which includes 04 female species. Out of these *Elasmus viridiscutellatus* Verma & Hayat is new records from Punjab. A key to Punjab species is also given.

KEY WORDS: New record, parasitic wasps, Chalcidoidea, Eulophidae, Elasmini, Punjab, India

The genus *Elasmus* is the only member of the hymenopteran subfamily Elasminae (formerly classified as a separate family, Elasmidae), and contains approximately 226 species worldwide. Indian species of genus *Elasmus* Westwood was reviewed by Verma et al. (2002) and Narendran et al. (2008). The genus *Elasmus* contains 54 species from India; out of which 06 species (including male species) are represented from the Indian state Punjab. In the present paper *Elasmus viridiscutellatus* Verma & Hayat is new records from Punjab. Besides, new records, diagnosis, hosts and distribution of all known species are provided. Few male specimens of *Elasmus* sp. were also collected but not included.

The present study is based on the specimens collected from Indian state Punjab during 2012 to 2014. By the sweeping method and were collected with the help of aspirator. Freshly collected specimens were killed in ethyl acetate fumes and stored in 70% ethyl alcohol. They were later dried and mounted on rectangular card using water soluble glue. Dried specimens were photographed by Leica stereo microscope version 3.6.0.

Terminology used The following abbreviations are used: F1-F3 = first, second and third funicle segments; TI – TVII = gastral terga 1 to 7; F = female; M = male; BMNH = The Natural History Museum, London; USNM = The U. S. National Museum, Washington, D.C.

An asterisk (*) marked after the name of the species indicates that it is a new record from the state Punjab. The species studied are deposited in the National Zoological collections, Zoological Survey of India, Kolkata, India.

Genus *Elasmus* Westwood

Elasmus Westwood, 1833: 343 [Type species *Elasmus flabellatus* Fonscolombe, by monotypy] *Aneure* Nees, 1834: 194 [Type species *Aneure nuda* Nees, designated by Gahan & Fagan, 1923: 12. Synonymy by Westwood, 1839: 74]

Heptocondyla Rondani, 1877: 182 [Type species *Heptocondyla unicolor* Rondani, by monotypy. Synonymy by Bouček, 1974: 252, 279]

Cyclopleura Cameron, 1913: 96 [Type species *Cyclopleura fumipennis* Cameron (*Elasmus cameroni* Verma & Hayat as replacement name), designated by Gahan & Fagan, 1923: 41. Synonymy by Waterston, in Mahdihasan, 1925]

Austelasmus Riek, 1967: 148 [Type species *Elasmus trifasciativentris* Girault, by original designation. Synonymy by Burks, in Krombein et al., 1979: 1020]

Diagnosis:

Female. The *Elasmus* are easily recognized by the enlarged body, yellowish, and brown to black in colour, with metallic luster. Antenna with funicle 3-segmented and a conspicuous anellus, scutellum with a triangular apical projection, notaular lines incomplete, fore wings elongate and narrow, densely covered with setae, with a very long marginal vein, hind coxae compressed and disc like; hind tibiae with diamond-shaped or wavy lines patterns of setae, tarsi four-segmented.

Male. Similar to female except antennal formula (1143) with F1 to F3 each with a dorsal ramus.

Biology: They are mainly parasitoids or hyperparasitoids of lepidopteran larvae, though several species are parasitoids of *Polistes* wasp larvae. Some species develop regularly both as primary and hyperparasitoids. They are usually gregarious.

Distribution: *Elasmus* have been distributed all over major zoogeographical regions but they are not particularly abundant.

Statistics: Number of world genera one and species nearly 226 (from Indian region 54, Nearctic 16, Neotropical 20).

Key to species of *Elasmus* Westwood, from Punjab based on females

(Adopted from Verma et al., 2002; Narendran et al., 2008)

1. Hind coxa completely dark brown to black, at most with extreme apex yellowish (Mid coxa largely dark brown to black)..2

--. Hind coxa yellow at least apical third...3

2. F1 slightly shorter than pedicel and at most slightly longer than broad, F2 and F3 broader than long; body blackish; gaster completely black or apices of TI and TII and occasionally also TIII, and basal four sternites, honey yellow....................................***brevicornis* Gahan**

--. F1-3 usually elongate, F1 almost sub-equal in length to pedicel; F3 at most quadrate, usually larger than broad, if pedicel longer than F1 then F2 and F3 quadrate, usually clearly longer than broad; pedicel shorter than F1; F1-3 relatively longer; F3 1.5× as long as broad; forewing 3.5 × as long as broad..***johnstoni* Ferriere**

3. Gaster with narrow, dusky yellow stripes at apices of TI-TIV; pedicel only slightly shorter than F1 which is at most 2.5× as long as broad; forewing hyaline; hind femur yellowish with blackish margins; mid coxa and femur largely yellow...***viridiscutellatus* Verma & Hayat**

--. Gaster reddish, orange, or honey yellow, at most with dark spots or bands, but apical two terga more or less completely dark; pedicel about 2× as long as broad and only slightly shorter than F1; F1 about 2.5× as long as broad; gaster with T1 about 3x as long as TII; head entirely blackish..***zehntneri* Ferriere**

Elasmus brevicornis Gahan

(Figs. 2, 5)

Elasmus brevicornis Gahan, 1922: 50, M, F. Type F: Indonesia: Java, Buitenzora (USNM).

Diagnosis: Body dark brown to black; head, pronotum and mesoscutum with bluish shine; tegula brownish, yellowish at base, gaster blackish with the venter except at apex, apices of TI and TII somewhat honey yellow; antennal radicle and scape pallid, flagellum yellowish brown; wings hyaline. Legs: coxae dark brown except yellowish at apex of fore coxa; fore femur with brownish infuscation at base; middle and hind femora dark brown, yellowish at base and tip; all trochanters, tibiae and tarsal segments yellowish.

Hosts: *Biloba subsecivela; Cnaphalocrocis medinalis; Diaphania indica; Hapalia machaeralis on Tectona grandis; Lamprosema indicate; Lygropia*

quarternalis defoliating *Helictares isora; Marasma suspicalis; Nausinoe geometralis*. Braconid*, Apanteles machaeralis*.
Distribution: India: Punjab, Andhra Pradesh, Kerala, Chhattisgarh, Uttar Pradesh, Delhi, Goa, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, West Bengal.
Materials examined: INDIA: Punjab, Hoshiarpur, Mahengrowal, Takhni-Rehmapur WLS Riverside, 1 F, 10.xi.2013 (S. I. Kazmi), [N 31° 38.985'; E075°55.494', Elevation 1200']; Dholbaha Dam, 1 F, 11.xi.2013 (S. I. Kazmi), [N 31° 44.120'; E 075°53.421' Elevation 1604']; Ludhiana, Doraha, 1 F, 15.xi.2013 (S. I. Kazmi), [N 30° 51.553'; E 076° 07.825', Elevation 820']

Elasmus johnstoni Ferriere

(Fig. 4)

Elasmus johnstoni Ferriere, 1929: 258, F, M. Type F: Sudan, Wad Medani (BMNH).
Elasmus valparaicus Mani & Saraswat, 1972: 481, F.: India (USNM). Synonymy by Narendran et al., 2008: 12.

Diagnosis: Body dark brownish with bluish green shine on propodeum and base of TI of gaster; tegulae brownish; antennal radicle and scape dusky; flagellum brownish; wings hyaline; legs concolourous with body, except sometimes trochanters, base and apex of all femora, base and extreme apex of hind tibia and tibial spurs yellowish.
Hosts: *Earias insulana; E. cupreoviridis; E. fabia; Hapalia machaeralis; Hyblaea puera; Nephanteryx rhodobasalis; Pectinophora gossypiella; Sylepta derogate; Braconidae: Apanteles impartunus; A. machaeralis; A. malevolus.*
Distribution: India: Punjab, Haryana, Jharkhand, Maharashtra, Rajasthan, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, Chhattisgarh, West Bengal.
Specimen examined: INDIA: Punjab, Ludhiana, Jhar Sahib, 1 F, 15.xi.2013 (S. I. Kazmi), [N 30° 53.282'; E'076°07.825', Elevation 820']

Elasmus viridiscutellatus Verma & Hayat*

(Figs. 1, 3)

Elasmus viridiscutellatus Verma & Hayat, 2002: 270-271, F. Type F: India: Maharashtra, Elephanta caves off Mumbai (BMNH).

Diagnosis: Body blackish with greenish blue shine on frontovertex, pronotum and mesoscutum, more intense on scutellum, propodeum less bluish; tegulae dark, appear metallic; posterior extension of metanotum hyaline except at base yellowish; gaster blackish dorsally with bluish green shine at base of TI; apex of TI-IV with transverse dusky yellow strips; antennal pedicel yellow, dorsal margin slightly brownish; flagellum dark brown covered with short black setae; wings hyaline; legs yellowish except extreme base of fore coxa, sides of middle coxa at base, dorsal and ventral margin in middle of middle femur, brownish; slightly less than basal half of hind coxa blackish with bluish shine, dorsal margin of hind femur and a spot on ventral margin, brownish.
Hosts: *Cnephalocrosis medinalis*, larvae.
Distribution: India: Punjab, Andhra Pradesh, Bihar, Maharashtra, Tamil Nadu, West Bengal.
Specimen examined: INDIA: Punjab, Roopnagar, Bhaku Majara, 1 F, 14.xi.2013 (S. I. Kazmi) [N 30° 54.416'; E 076°22.905', Elevation 856']

Elasmus zehntneri Ferriere

Elasmus sp. Zehntner, 1900: 1 (by Ferriere, 1929).
Elasmus zehntneri Ferriere, 1929: 417, F, M. Type F: Indonesia, West Java (BMNH).
Elasmus mahabaleswarensis Mani & Saraswat, 1972: 475-476, F: India (USNM). Synonymy by Narendran et al., 2008: 13.

Diagnosis: Head and thorax blackish with bluish green shine on frontovertex, pronotum and mesoscutum; less bluish on scutellum; gaster honey yellow with brownish spots as follows: faint brownish spots at base of TI; bases of TII-V slightly extending on lateral side with triangular brownish spots; TVI to apex completely dark brown to blackish; antennal radicle dusky; scape yellowish, dorsal margin slightly brownish; flagellum brownish; wings hyaline; legs yellowish; basal third of hind coxa metallic black, basal third or so of middle femur broadly brownish; tibia and tarsal segments of all legs yellowish.
Male: Not studied. (INDIA: Punjab, Patiala, Ranidhee, Bhadson WLS, 1 M, 07.iii.2013 (S. I. Kazmi) [N 30° 30.409'; E 076°13.972', Elevation 790']
Hosts: *Bissetia steniella; Chilo infuscatellus; Pectinophora gossypiella; Scirpophaga* sp., *S. auriflue; Tryporyza monostigma; T. novella; T. rhodoproctalis.*
Distribution: India: Punjab, Andhra Pradesh, Bihar, Delhi, Karnataka, Maharashtra, Tamil Nadu, Kerala, West Bengal.
Specimen examined: None. Above description is based on Verma et al., 2002.

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LITERATURE CITED

Ferriere, C. 1929**.** The Asiatic and African species of *Elasmus* Westwood (Hymenoptera: Chalcidoidea). Bull. Ent. Res., 20: 411-423.

Gauthier, N., La Salle, J., Quicke, D. L. J. & Godfray, H. C. J. 2000. Phylogeny of Eulophidae (Hymenoptera: Chalcidoidea), with a reclassification of Eulophinae and the recognition that Elasmidae are derived eulophids. Syst. Ent., 25: 521-539.

Kazmi, S. I. & Girish Kumar, P. 2013. The species of *Elasmus* Westwood (Hymenoptera: Eulophidae: Eulophinae) from West Bengal, India, Prommalia I: 79-92.

Kazmi, S. I. & Girish Kumar, P. 2015. *Elasmus* Westwood (Hymenoptera: Chalcidoidea: Eulophidae: Eulophinae: Elasmini) of Maharashtra, India. Munis Entomology & Zoology, 10 (2): 460-467.

Kazmi, S. I., Sheela, S. & Girish Kumar, P. 2008. The Species of *Elasmus* Westwood (Hymenoptera: Eulophidae: Eulophinae) from Uttar Pradesh, India. Columban J. Life ScI., 9 (1&2): 124-129.

Khan, F. R. & Hayat, M. 2011. Record of some species of *Elasmus* from India (Hymenoptera: Chalcidoidea: Eulophidae). Bionotes, 13 (1): 7-10.

Mani, M. S. 1989. *Elasmidae,* pp 1158-1205. In: Fauna of India. Chalcidoidea Part II. Zoological Survey of India, Government of India.

Mani, M. S. & Saraswat, G. G. 1972. On some *Elasmus* (Hymenoptera: Chalcidoidea) from India. Oriental Ins., 6: 459-506.

Narendran, T. C., Sheeba, M. & Kulkarni, H. 2008. A review on the taxonomy of the Indian species of *Elasmus* Westwood (Hymenoptera: Chalcidoidea: Eulophidae: Eulophinae: Elasmini). Biospectra, 3 (1): 1-25.

Riek, E. F. 1967. Australian Hymenoptera Chalcidoidea, family Eulophidae, subfamily Elasminae. Aust. J. Zool., 15: 146-199.

Verma, M. & Hayat, M. 1985. Family Elasmidae: pp. 233-234. In: B. R. Subba Rao & M. Hayat (eds): The Chalcidoidea (Insecta: Hymenoptera) of India and the adjacent countries. Part I. Oriental Ins., 19: 163-310.

Verma, M. & Hayat, M. 1986. Family Elasmidae: pp. 173-178. In B. R. Subba Rao & M. Hayat (eds): The Chalcidoidea (Insecta: Hymenoptera) of India and the adjacent countries. Part II. Oriental Ins., 20: 1-430.

Verma, M., Hayat, M. & Kazmi, S. I. 2002**.** The species of *Elasmus* from India (Hymenoptera: Chalcidoidea: Eulophidae). Oriental Ins., 36: 245-306.

Fig. 1. *Elasmus viridiscutellatus* Verma & Hayat

Fig. 2. *Elasmus brevicornis* Gahan

Fig. 3. *E. viridiscutellatus* Verma & Hayat, Forwing

Fig. 4. *Elasmus johnstoni* Ferr.

Fig. 5. *E. brevicornis* Gahan, Antennae

FIRST RECORD OF THE MAPLE GALLWASP, *PEDIASPIS ACERIS* (GMELIN, 1790) (CYNIPIDAE: PEDIASPIDINI) FROM TURKEY, WITH A NEW HOST RECORD

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[Katılmış, Y. & Azmaz, M. 2017. First record of the maple gallwasp, *Pediaspis aceris* (Gmelin, 1790) (Cynipidae: Pediaspidini) from Turkey, with a new host record. Munis Entomology & Zoology, 12 (1): 285-287**]**

ABSTRACT: In this study, we report a new record that *Pediaspis aceris* (Gmelin, 1790) belonging to the maple gallwasp (Pediaspidini), on *Acer hyrcanum* Fisch. & Mey. (Aceraceae) in Isparta. *P. aceris* is a new record for Cynipidae fauna of Turkey in tribe, genus and species levels. At the same time, *A. hyrcanum* is a new host record for this species. Geographical distribution, host and photos of the gall are given.

KEY WORDS: Cynipidae, Pediaspidini, new record, new host, Turkey

Although Cynipidae belonging to Cynipoidea is the largest family with roughly 1400 described species (Ronquist et al., 2015), Pediaspidini belonging to Cynipidae has only 2 species belonging to 2 genera (*Himalocynips*, *Pediaspis*). Both genera are monotypic. *Himalocynips vigintilis* Yoshimoto, 1970 is only known from Nepal (Eastern Palearctic) and there is no data about its biology (Liljeblad & Ronquist, 1998). *P. aceris* as a European species is significant because it is the only gall wasp except Cynipini to show both sexual and asexual generations, a life cycle trait that has either evolved independently in the Pediaspidini, or indicates a sister group relationship between Cynipini and Pediaspidini. Moreover, both generations of *P. aceris* induce gall on maple (*Acer monspessulanum* L., *A. platanoides* L., *A. pseudoplatanus* L. and *A. opalus* Miller) (Melika, 2006).

Cynipidae fauna of Turkey is represented by seven taxa (Aulacideini, Aylacini, Ceroptresini, Cynipini, Diastrophini, Diplolepidini, Synergini). Approximately 150 species belonging to these taxa were totally recorded from Turkey according to faunistic studies in last decade (Kemal & Koçak, 2010; Kıyak & Katılmış, 2010; Katılmış & Kıyak, 2008, 2009a,b, 2010, 2011a,b,c,d, 2012a,b; Mutun & Dinç, 2011, 2015; Mete & Demirsoy, 2012; Çetin et al., 2014; Dinç et al., 2014; Mutun et al., 2014; Azmaz & Katılmış, 2015; Katılmış & Azmaz, 2015).

MATERIALS AND METHODS

All gall specimens on host plant were collected from Isparta in 2010 and 2015. After photos of the gall specimens were taken, data about locality and host plant were recorded. Galls were kept in laboratory conditions and checked weekly for emerged wasps. Adult gall wasps were subsequently fixed in ethanol. The adults were then air-dried, fixed on cards (5x10 mm), and pinned. The terminology used to describe gall wasp morphology follows Melika (2006). The gall specimens and adults were deposited in the Pamukkale University, Faculty of Arts & Sciences, Department of Biology, Entomology Laboratory, Denizli, Turkey.

RESULTS

Tribe Pediaspidini Ashmead, 1903
Genus *Pediaspis* Tischbein, 1852
Species *Pediaspis aceris* (Gmelin, 1790)

Material examined: ISPARTA, Eğirdir, above Yukarıgökdere village, Davraz mountain, Kasnak Oak Nature Protection Area, 37°44' N, 30°49' E, 1540 m, collected 02.VI.2010, 11.VI.2015, 2♀, 1♂, on *A. hyrcanum* (Fig. 1).
Host: *Acer hyrcanum* is a new host record as a maple tree.
Distribution: Known from Austria, Belgium, France, Germany, Georgia, Hungary, Iberian Peninsula, Iran, Romania, Russia, Switzerland, Ukraine (Melika, 2006).

DISCUSSION

As faunistic studies about gall wasps in Turkey include mainly oak gall wasps (Cynipini) on oaks, *P. aceris* that known only from Western Palearctic as a European species, has not been unfortunately recorded from Turkey so far. As a result of this study, tribe Pediaspidini was recorded as a new taxon for Cynipidae fauna of Turkey. Furthermore, a new host record (*A. hyrcanum*) was provide for *P. aceris*. We predict that species richness of the Turkish fauna will increasingly continue with faunistic studies.

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LITERATURE CITED

Azmaz, M. & Katılmış, Y. 2015. Four new records of Oak Gall Wasp (Hymenoptera: Cynipidae, Cynipini) from Turkey. Munis Entomology & Zoology, 10: 201-204.

Çetin, G., Orman, E. & Polat, Z. 2014. First record of the Oriental chestnut gall wasp, *Dryocosmus kuriphilus* Yasumatsu (Hymenoptera: Cynipidae) in Turkey. Bitki Koruma Bülteni, 54: 303-309.

Dinç, S., Mutun, S. & Melika, G. 2014. A new species of *Andricus* Hartig oak gallwasp from Turkey (Hymenoptera: Cynipidae, Cynipini). North-West. J. Zool., 10: 122-127.

Katılmış, Y. & Azmaz, M. 2015. Investigation on the inquilines (Hymenoptera: Cynipidae, Synergini) of oak galls from inner western Anatolia, Turkey. Turk. J. Zool., 39: 168-173.

Katılmış, Y. & Kıyak, S. 2008. Checklist of Cynipidae of Turkey, with a new genus record. J. Nat. Hist., 42: 2161-2167.

Katılmış, Y. & Kıyak, S. 2009a. Oak gallwasp Genus *Andricus* (Hymenoptera, Cynipidae) – new records from Turkey. Zool. Middle East, 48: 108-110.

Katılmış, Y. & Kıyak, S. 2009b. The oak gallwasp *Aphelonyx persica*: a new record from Turkey, with some new host records. Phytoparasitica, 37: 95-97.

Katılmış, Y. & Kıyak, S. 2010. Distribution, Phenology and Effects of *Diplolepis* spp. (Hymenoptera: Cynipidae) on *Rosa canina* in the Inland Western Anatolian. J. Entomol. Res. Soc., 12: 31-36.

Katılmış, Y. & Kıyak, S. 2011a. Oak gallwasps (Hymenoptera: Cynipidae) fauna of inner western Anatolia. Munis Entomology & Zoology, 6: 735-757.

Katılmış, Y. & Kıyak, S. 2011b. Herb gallwasp *Neaylax salviae* (Giraud, 1859) (Hymenoptera, Aylacini) – new record from Turkey. Turk. J. Zool., 35: 707-710.

Katılmış, Y. & Kıyak, S. 2011c. New records of herb gallwasps (Hymenoptera, Cynipidae, Aylacini) from Turkey. North-West. J. Zool., 7: 17-19.

Katılmış, Y. & Kıyak, S. 2011d. First records of inquiline wasps of the genus *Ceroptres* Hartig, 1840 (Hymenoptera, Cynipidae, Synergini) from Turkey. J. Entomol. Res. Soc., 13: 65-69.

Katılmış, Y. & Kıyak, S. 2012a. Further study on *Periclistus brandtii* (Ratzeburg, 1831) (Hymenoptera, Cynipidae) from Turkey. Entomol. News, 122: 51-54.

Katılmış, Y. & Kıyak, S. 2012b. Two new records of inquiline wasp of the genus *Saphonecrus* Dalla Torre and Kieffer, 1910 (Hymenoptera: Cynipidae: Synergini) from Turkey, their associated galls and hosts. Munis Entomology & Zoology, 7: 1141-1144.

Kemal, M. & Koçak, A. Ö. 2010. Winter trips to south Van Lake and the cynipid galls on oaks (Hymenopteera, Cynipidae). Cesa News, 56: 1-66.

Kıyak, S. & Katılmış, Y. 2010. Oak gallwasp *Dryocosmus mayri* (Hymenoptera, Cynipidae)- new record from Turkey. J. Entomol. Res. Soc., 12: 67-70.

Liljeblad, J. & Ronquist, F. 1998. A phylogenetic analysis of higher-level gall wasps relationships (Hymenoptera: Cynipidae). Systematic Entomology, 28: 229-252.

Melika, G. 2006. Gall Wasps of Ukraine. Cynipidae. Vestnik zoologii, 21: 1-644.
Mete, Ö. & Demirsoy, A. 2012. A Preliminary Study on The Gallwasp Fauna of Kemaliye (Erzincan, Turkey) and A New Record for Turkey. Hacettepe J. Biol. & Chem., Special Issue, 351-363.
Mutun, S. & Dinç, S. 2011. Contributions to the Gallwasp (Hymenoptera: Cynipidae) Fauna of Turkey with One New Record. J. Appl. Biol. Sci., 5: 83-85.
Mutun, S. & Dinç, S. 2015. Twelve oak gall wasp species (Hymenoptera, Cynipidae) new to the Turkish fauna. Turk. J. Zool., 39: 962-964.
Mutun, S., Dinç, S., Bozsó, M. & Melika, G. 2014. Four new species of *Andricus* Hartig oak gallwasp from Turkey (Hymenoptera: Cynipidae, Cynipini). Zootaxa, 3760: 241-259.
Ronquist, F., Nieves-Aldrey, J. L., Buffington, M. L., Liu, Z., Liljeblad, J. & Nylander, J. A. A. 2015. Phylogeny, Evolution and Classification of Gall Wasps: The Plot Thickens. PLoS ONE, 10: 1-40.

Figure 1. *Pediaspis aceris* sexual galls on leaf (a) and on fruit (b) (a scale bar 1 cm).

A REVIEW OF THE GENUS *STILBULA* SPINOLA, 1811 (HYMENOPTERA: EUCHARITIDAE) FROM THE INDIAN SUBCONTINENT WITH THE DESCRIPTION OF FIVE NEW SPECIES OF FROM KERALA

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[Girish Kumar, P. 2017. A review of the genus *Stilbula* Spinola, 1811 (Hymenoptera: Eucharitidae) from the Indian subcontinent with the description of five new species from Kerala. Munis Entomology & Zoology, 12 (1): 288-308**]**

ABSTRACT: Five new species of eucharitid wasps (Hymenoptera: Eucharitidae) are described from Kerala, India. A key to species from the Indian subcontinent and an updated checklist of Oriental species are also provided.

KEY WORDS: Hymenoptera, Eucharitidae, *Stilbula*, new species, review, key, checklist, Indian subcontinent

The genus *Stilbula* was erected by Spinola (1811) based on the type species *Ichneumon cyniformis* Rossi. The genus belongs to the tribe Eucharitini of the subfamily Eucharitinae (Heraty, 2002). Thirty five species are known from all over the world of which 16 species were from Oriental Region and 9 species were recorded from Indian subcontinent (Girish Kumar & Narendran, 2008; Heraty, 2002; Noyes, 2015). In this paper, the genus *Stilbula* Spinola is reviewed from the Indian subcontinent with the description of 5 new species from Kerala. A key to the species of the Indian subcontinent and an updated checklist of Oriental species are also provided.

The types are deposited in the 'National Zoological Collections' of the Western Ghat Regional Centre, Zoological Survey of India, Kozhikode (= Calicut), India (ZSIK).

MATERIAL AND METHODS

The specimens are collected by using triangular sweep net and also by using malaise trap. They are studied under LEICA M60 stereozoom microscope and images captured with the camera model LEICA DFC-450. The drawings were done using the drawing tube of the same Leica microscope.

Abbreviations used for the Museums: BMNH — Natural History Museum (or British Museum of Natural History), London, UK; CNCI — Canadian National Collection, Agriculture Canada, Ottawa, Ontario, Canada; NZC —Zoological survey of India, Kolkata, India; QMB — Queensland Museum, Brisbane, Australia; USNM — United States Museum of Natural History, Washington D.C., USA; ZSIK — Zoological Survey of India, Western Ghats Regional Centre, Kozhikode, India.

Abbreviations used for the terms used in the text: F = Funicular segment; Gt = Gastral terga; MPS = Multiporous plate sensilla; MV = Marginal vein; OOL = Ocellocular line; PMV = Postmarginal vein; POL = Postocellar line; SSS = Scutoscutellar sulcus; STV = Stigmal vein.

Genus *Stilbula* Spinola

Stilbula Spinola, 1811: 150. Type species: *Ichneumon cyniformis* Rossi, by monotypy.
Eltolada Cameron, 1909: 230. Type species: *Eltolada trimaculata* Cameron. Subsequently designated by Gahan & Fagan, 1923: 50. Synonymy by Hedqvist, 1978: 245.

Diagnosis. Body metallic blue, green or yellow with dark maculations; in lighter forms head black or black with a metallic luster; antennal flagellum simple, 12 segmented, rarely 11 in females; scape less than 1.5x as long as broad; basal flagellomere in males long, often slightly flattened; hypostomal lobes broadly separated posterior to the mandibles; maxillary complex relatively large, without palpi; frenal projection arises from a single basal stalk and diverges in to a pair of short cylindrical spines, although the apex rarely projecting and truncate or narrowly emarginate; propodeum slightly swollen laterad to postspiracular furrow; fore wing slightly lanceolate, bare; costal cell narrow; stigma broad, triangular; hind wing broad, venation complete; petiole usually long, cylindrical and smooth; first gastral tergite has a single split medially.

Distribution. Widespread in the Old World.

Key to species of *Stilbula* Spinola, 1811 from the Indian subcontinent

1. Female 2
– Male 8

2. Striations on frons strong, completely striated more or less in a circular manner (Fig. 9 of Narendran & Sheela, 1996: 67, Fig. 21D of Mani et al., 1974: 38) 3
– Striations on frons weak, with longitudinal striations mostly on upper half (Figs. 15, 26) 6

3. Petiole without a distinct ring or band 4
– Petiole with a brownish or blackish ring or band at or near middle, rest of portions pale yellow or white or pale brown 5

4. Petiole brownish black to very dark brown; scutellar teeth about 0.30x scutellar process (Fig. 20 B of Mani et al., 1974: 37); scutellar process subequal to scutellum; F1 7x as long as broad; head nearly black with blue reflections .... *S. atkinsoni* (Mani & Dubey, 1974)
– Petiole pale yellow; scutellar teeth about half (0.5x) of scutellar process (Fig. 22); scutellar process distinctly shorter (0.28x) than median length of scutellum; F1 3.33x as long as broad; head metallic green .... *S. silentvalliensis* Girish Kumar **sp. nov.**

5. Scutellar teeth bluntly and shortly bifurcate, not diverging; flagellar segments not shorter (see Fig. 21 B of Mani et al., 1974: 38) .... *S. mysorensis* (Mani & Dubey, 1974)
– Scutellar teeth diverging; flagellar segments shorter (Fig. 8 of Narendran & Sheela, 1996: 67) .... *S. ashokai* Narendran, 1996

6. Petiole without a ring or band .... *S. shendurunica* Girish Kumar **sp. nov.**
– Petiole with a brownish or blackish ring or band at or near middle, rest of portions pale yellow or white or pale brown 7

7. Scutellar process with a single narrow frenal spine (see Fig. 309 of Heraty, 2002: 327); flagellum testaceous; mesoscutal side lobes swollen; body dark brown with bluish reflections; labrum with 6 digits; body length 2.5 mm .... *S. minispina* Heraty, 2002
– Scutellar process with a slender elongate stalk (Fig. 27); flagellum dark brown to black; mesoscutal side lobes rounded; body black with dark green metallic reflections; labrum with 9 digits; body length 5 mm .... *S. tanjorensis* (Mani & Dubey, 1974)

8. Scutellum with an upturned, smooth, cleft frenal process (see Fig. 310 of Heraty, 2002: 327); funicular segments slightly swollen apically (see Fig. 321 of Heraty, 2002: 327); head black with green reflections; mesosoma mostly black with bluish green reflections, lower half of mesoscutum, upper corner of prepectus, acropleuron and propodeum yellow; wings hyaline except a small infuscate spot around STV (see Fig. 322 of Heraty, 2002: 327); labrum with 9 digits .... *S. nilgiri* Heraty, 2002
– Scutellum not as above; other characters partly or completely different 9

9. Gastral petiole of uniform colour; Body generally with dark metallic green reflections; head black; coxae concolourous with mesosoma, rest of legs brown; antenna brownish yellow; gaster dark metallic green, terminal segment somewhat brown along margins; head coarsely and umbilicately punctate; antenna with dense pubescence; pedicel short and transverse; fore wing with stigma sessile; PMV very long; scutellar process bidentate, about as long as gastral petiole .... *S. indica* (Mani, 1935)
– Gastral petiole with dark ring or band medially or submedially; other characters partly or completely different 10

10. Posterior process of scutellum with a slender elongated stalk diverging into elongated spines (see Fig. 5 of Girish Kumar & Narendran, 2007: 2869); frons with weak longitudinal striations seen mostly on upper half (see Fig. 4 of Girish Kumar & Narendran, 2007: 2869); body black with dark green or shiny bluish green with metallic reflections; stigma distinct (see Fig. 1 of Girish Kumar & Narendran, 2007: 2869); mesopleuron with a large smooth area (see Fig. 1 of Girish Kumar & Narendran, 2007: 2869); mouth plate 8 or 9 digitate .... *S. tanjorensis* (Mani & Dubey, 1974)
– Posterior process of scutellum stouter (Figs. 4, 8); other characters partly or completely different 11

11. Mesopleuron distinctly and closely punctate without a patch of smooth area .... *S. lata* Narendran, 1996
– Mesopleuron (Figs. 1, 6, 10) with a distinct smooth area on anterior half 12

12. POL 2x or more than 2x (2.25 - 2.85x) OOL 13
– POL less than 2x (1.60 - 1.68x) OOL 15

13. Fore wing with brown infumation adjoining stigma .... *S. ashokai* Narendran, 1996
– Fore wing without brown infumation adjoining stigma (Fig. 10) 14

14. POL 2.80 x OOL (Fig. 4 of Girish Kumar & Narendran, 2008: 114); head and mesosoma black with metallic green reflections; base of coxa brown with metallic green reflections; body length 6.28 mm; stalk of scutellar process as long as broad (Fig. 4 of Girish Kumar & Narendran, 2008: 114); mouth plate 8 digitate (Fig. 3 of Girish Kumar & Narendran, 2008: 114); hamuli 7 in number .... *S. bangalorica* Girish Kumar & Narendran, 2008
– POL 2.42x OOL (Fig. 13); head and mesosoma dark brown with metallic black reflections; lateral ocellus reflecting red; base of coxa dark brown without metallic green reflections; body length 4.77 mm; stalk of scutellar process 0.86x as long as broad (Fig. 13); mouth plate 9 digitate (Fig. 12); hamuli 3 in number .... *S. namida* Girish Kumar **sp. nov.**

15. Stalk of scutellar process (excluding teeth) 0.86 x as long as broad (Fig. 4); STV perpendicular to wing margin and finger like (Fig. 1); petiole 1.42x as long as hind femur (Fig. 1); F1 1.27x as long as F2; body length 4.47 mm; hamuli 3 in number .... *S. bullista* Girish Kumar **sp. nov.**
– Stalk of scutellar process (excluding teeth) 1.21x as long as broad (Fig. 8); STV angled to wing margin and stout (Fig. 6); petiole 1.62x as long as hind femur (Fig. 6); F1 1.44x as long as F2; body length 5.96 mm; hamuli 4 in number .. *S. muthangensis* Girish Kumar **sp. nov.**

Stilbula ashokai Narendran, 1996

(Image 1)

Stilbula ashokai Narendran, *in* Narendran & Sheela, 1996: 69-70. Holotype female (examined), India: Kerala, Malampuzha (QMB), by original designation. Description of both sexes, illustrated.

Diagnosis. Head width (Fig. 9 of Narendran & Sheela, 1996: 67) in frontal view 1.50x (in female) and 1.60x (in male) its median length excluding mandibles; POL 2.50 x OOL; median ocellus separated from occipital margin by less than its own diameter; frons with more or less oblique and semicircular striations (Fig. 9 of Narendran & Sheela, 1996: 67) extending from ocellar area to supraclypeal and clypeal margins; clypeus and supraclypeal areas smooth; vertex longitudinally striated; mouth plate 14 digitate; gena obliquely striate; tentorial pits and clypeogenal sulci distinct, deep; eye separated by less than 2x height of eye in frontal view; antenna 12 segmented (Fig. 8 of Narendran & Sheela, 1996: 67), more elongated in male (Fig. 11 of Narendran & Sheela, 1996: 67); mesoscutum and scutellum deeply and closely punctate, interstices carinate; notauli distinct, foveolate; mesoscutum without a median fovea; SSS ecarinate; width of scutellar stalk subequal to its length (excluding teeth); scutellum with a median longitudinal pitted fovea; mesopleuron (Fig. 8 of Narendran & Sheela, 1996: 67) with a smooth area on anterior half; propodeum completely punctate, interstices carinate, without a median carina; callus bare; fore wing (Fig. 8 of Narendran & Sheela, 1996: 67) 2.83x as long as its maximum width; petiole smooth, distinctly shorter than gaster, longer than hind femur, slightly swollen at middle; gaster shorter than mesosoma, subglobose, smooth.

Colour. Head and mesosoma black with metallic refringence; antenna yellowish brown with scape, pedicel, last two funicular segments and club paler; coxae brown, remaining parts of legs straw yellow; fore wing with brown infumation adjoining STV (Fig. 8 of Narendran & Sheela, 1996: 67); petiole yellow with pale brown band in middle; gaster yellowish brown with Gt1 black.

Length. Female 4.1 mm; Male 3.43 mm.

Host & Biology. Unknown.

Material examined. *Holotype*. Female, INDIA: Kerala, Palakkad Dist., Malampuzha (10°53'N 76°46'E), Coll. T.C. Narendran, 10.i.1986 (QMB). *Paratypes*. 2 Females and 4 Males, INDIA: Kerala, Palakkad Dist., Malampuzha (10°53'N 76°46'E), Coll. T.C. Narendran, 10.i.1986, NZC Regd. Nos. 10205/H3–10207/H3 & 10209/H3–10211/H3; 1 Female, INDIA: Kerala, Thiruvananthapuram Dist., Sreekaryam (8°30'N 76°57'E), Coll. T.C. Narendran, 25.ii.1989, NZC Regd. No. 10204/H3. *Other material examined:* 1 Male, INDIA: Kerala, Thrissur, Coll. K. Rajmohana, 23.ii.1996, ZSI Regd. No. ZSI/WGRS/I.R-INV. 6242; 2 Male, INDIA: Kerala, Ernakulum, Coll. T.C. Narendran, 9.ii.1989, ZSI/WGRS/I.R-INV. 6243 & 6244; 1 Male, INDIA: Kerala, Palakkad Dist., Parambikulam WLS, Coll. P.M. Sureshan, 5.ii.1995, ZSI/WGRS/I.R-INV. 6245; 3 Male, INDIA: Kerala, Malappuram Dist., Cali. Uni. Campus, Coll. B.K. Sajitha, A.M. Smitha & Lakshmi, 10.x.1998, 4.ii.1999 & 4.iv.1999, ZSI/WGRS/I.R-INV. 6246–6248.

Distribution. India: Kerala, Tamil Nadu.

Stilbula atkinsoni (Mani & Dubey, 1974)

Schizaspidia atkinsoni Mani & Dubey *in* Mani et al, 1974: 36.Holotype female, Burma: Badaung Reserve, Schwebo (USNM). Description of female, illustrated.

Stilbula atkinsoni; Hedqvist, 1978: 246. Change of combination.

Diagnosis. Female. Frons finely striate, face below smooth, with sparse microscopic punctures; clypeus almost straight anteriorly; gena obliquely closely

striate (Fig. 20D of Mani et al., 1974: 37); F1 7x as long as broad; F2 0.7x F1; scutellar process subequal to scutellum (Fig. 20B of Mani et al., 1974: 37), teeth narrow, widely diverging, teeth 0.3x scutellar process; fore wing as in Fig. 20A of Mani et al. (1974: 37); petiole 0.55x as long as gaster, 0.70x as long as mesosoma, slender, elongate, cylindrical, smooth, abruptly thicker at middle.
Colour. Body dark metallic blue green; head nearly black with blue reflections; antennae brownish black; wings hyaline; fore wing with brown infumation adjoining STV becoming fainter behind; veins dark brown; coxae concolorous with mesosoma, rest of legs brown; petiole brownish black to very dark brown; gaster black.
Length. Female 5.2 mm.
Male. Unknown.
Host & Biology. Unknown.
Distribution. Myanmar: Badaung Reserve, Schwebo.
Remarks. No specimens were available for studies; hence the diagnosis was taken from Mani et al. (1974).

Stilbula bangalorica **Girish Kumar & Narendran, 2008**

(Image 2)

Stilbula bangalorica Girish Kumar & Narendran, 2008: 114-116. Holotype male (examined), India: Karnataka, Bangalore (NZC), by original designation. Description of male, illustrated.

Diagnosis. Male. Head 1.53x as broad as high (excluding mandibles) (Fig. 3 of Girish Kumar & Narendran, 2008: 114) in frontal view; POL 2.85 x OOL; median ocellus separated from occipital margin by less (0.42x) than its own diameter; frons finely carinate, carinae converging below toruli; lower face transversely carinate; vertex smooth laterad to ocelli, rugose medially; eyes separated by 1.79x their height, bare; clypeus smooth basally, transversely striate apically; labrum with 8 digits; F1 1.34 x as long as F2; antenna distinctly longer than combined length of head, mesosoma and petiole (15: 11.9); mesoscutum and scutellum deeply and closely punctate, interstices carinate, surface bare; notauli distinct and foveolate; SSS deeply impressed and strongly carinate; frenal process stout, pitted; each tooth of posterior scutellar process shorter than its stalk, stalk as long as wide (Fig. 3 of Girish Kumar & Narendran, 2008: 114); mesepisternum with a smooth area (Fig. 1 of Girish Kumar & Narendran, 2008: 114); Fore wing 3.35x as long as broad; hamuli 7 in number; petiole 0.85 x as long as gaster, 5.66x as long as hind coxa, 1.70x as long as hind femur, smooth and swollen submedially; Gt_1 glabrous.
Colour. Head and mesosoma black with metallic green reflections; antenna yellowish brown; mandibles yellow with brownish tinge; coxae dark brown with metallic green reflections except apices near to trochanters brownish yellow, remaining parts of legs yellow; tegulae brown; wings hyaline except for small infuscate spot around STV, venation brown; petiole yellow with pale brown band submedially; upper half of gaster dark brown, lower half pale brown.
Length. Male 6.28 mm.
Female. Unknown.
Host & Biology. Unknown.
Material examined. *Holotype*. Male, INDIA: Karnataka; Bangalore (12°58'N 77°35'E), Coll. C.A. Virakthamath, 6.x.1989, NZC Regd. No. 9996/H3. *Paratypes*. 9 Males, Same data as of holotype, NZC Regd. Nos. 9997/H3–10005/H3.
Distribution. India: Karnataka.

Stilbula bullista Girish Kumar sp. nov.

(Figs. 1-5; Image 3)

Holotype. Male. Length 4.47 mm. Head and mesosoma dark brown with metallic black reflections; antenna brownish yellow; mandibles yellowish brown; ocelli reflecting yellowish brown; eyes brown with silvery white reflections; coxae brown, remaining parts of legs pale brownish yellow, claws brown; tegula brown; wings hyaline except for small infuscate spot around STV, venation pale brown; petiole brownish yellow with brown band submedially; upper half of gaster dark brown, lower half pale brownish yellow.

Head. 1.49x as broad as high (excluding mandibles) (Fig. 3) in frontal view; POL 1.66x OOL; median ocellus separated from occipital margin by less (0.62x) than its own diameter; frons finely carinate, carinae converging below toruli; face with protuberances, lower face transversely carinate; vertex striate laterad to ocelli, rugose medially; eyes separated by 1.85x their height, bare; malar space 0.68x height of eye; clypeus smooth without protuberances; lower margin of clypeus with transverse striations; supraclypeal area not defined; apical tooth of mandible long and thin. Antenna (Fig. 2) 12 segmented; scape as long as broad; funicle 9 segmented; F1 4.20x as long as broad, 1.27x as long as F2; flagellomeres slightly swollen apically; scape and pedicel bare, flagellar segments densely pilose; MPS absent; antennal length shorter than the combined length of head, mesosoma and petiole (10.6: 12).

Mesosoma. Mesoscutum and scutellum deeply and closely punctate, interstices carinate, bare; notauli distinct and foveolate; SSS deeply impressed and strongly carinate; scutellum (Fig. 4) broadly rounded with a slight median furrow, 1.56x as broad as the distance between SSS and frenal carina (including axilla); frenal line smooth and complete dorsally; frenal process stout; pitted; each tooth of posterior scutellar process shorter than its stalk; stalk 0.86x as long as wide; propodeum (Fig. 5) completely punctate, interstices carinate, without a median fovea, bare; callus bare; mesepisternum with a smooth area (Fig. 1); upper mesepimeron completely punctate, interstices carinate; femoral groove broad, transversely carinate, swollen anterior to mid coxa. Fore and mid coxa almost smooth with few faint striations at base, bare; mid coxa without ventral sulcus; hind coxa almost glabrous with very minute pits and hairs; all femora almost glabrous. Fore wing (Fig. 1) 3.01 x as long as broad; STV perpendicular to wing margin, 2x as long as broad, finger-like, surrounded by brown infumation; PMV 4.50x STV; wing disc with microtrichia except at basal area bare; hind wing with microtrichia and marginal fringes; hamuli 3 in number.

Metasoma (Fig. 1). Petiole 0.86x as long as gaster, 5.47x as long as hind coxa, 1.42x as long as hind femur, smooth, slightly swollen submedially; Gt_1 glabrous.

Female. Unknown.

Host & Biology. Unknown.

Etymology. The species epithet is an anagram of the generic name '*Stilbula*'.

Material examined. *Holotype*. Male, INDIA: Kerala, Malappuram Dist.; Pullangode Reserve Forest, Chenappadi (11°12'N 76°20'E), Coll. P.M. Sureshan & Party, 1.v.1993, ZSI Regd. No. ZSI/WGRS/I.R-INV. 6249.

Distribution. India: Kerala.

Discussion. This new species closely resembles to *S. lata* Narendran (1996) in having: (1) Posterior process of scutellum stouter; (2) Petiole with dark ring or band submedially, shorter than gaster; (3) Median ocellus separated from occipital margin by less than its own diameter and (4) Hamuli 3 in number. However, this new species differ from *S. lata* in having: (1) Mesopleuron without a smooth area anteriorly (In *S. lata* mesopleuron completely punctate without a smooth area); (2) Scutellar process (excluding teeth) shorter (0.86x) than its width (In *S. lata* scutellar process (excluding teeth) longer (1.30x) than its width); (3) STV finger-like and its margins clear (In *S. lata* margins of STV not clear); (4) POL 1.60x OOL (In *S. lata* POL 2.50x OOL); and (5) Head and mesosoma dark brown with metallic green refringence (In *S. lata* head and mesosoma bluish green with metallic refringence).

This new species is also close to *S. muthangensis* Girish Kumar sp. nov. in having: (1) Scutellar process stout; (2) Head and mesosoma dark brown with metallic black reflections; (3) Antenna brownish yellow; (4) Fore wing with infumation adjoining stigma; (5) Median ocellus separated from occipital margin by less than its own diameter and (6) Mesopleuron with a smooth area. However, this new species differs from *S. muthangensis* sp. nov. in having: (1) Stalk of scutellar process (excluding teeth) 0.86x as long as broad (In *S. muthangensis* stalk of scutellar process (excluding teeth) 1.21x as long as broad); (2) STV perpendicular to wing margin and finger like (In *S. muthangensis* sp. nov. STV angled to wing margin and stout); (3) Petiole 1.42x as long as hind femur (In *S. muthangensis* sp. nov. petiole 1.62x as long as hind femur); (4) F1 1.27x as long as F2 (In *S. muthangensis* sp. nov. F1 1.44 x as long as F2); (5) Body length 4.47 mm (In *S. muthangensis* sp. nov. body length 5.96 mm); and (6) Hamuli 3 in number (In *S. muthangensis* sp. nov. hamuli 4 in number).

Stilbula indica (Mani, 1935)

Schizaspidia indica Mani, 1935: 254. Holotype male, Assam (NZC). Description of male.
Stilbula indica; Hedqvist, 1978: 247. Change of combination.

Diagnosis. Male. Head coarsely, umbilicately punctate; antennae elongate, densely hairy, segments cylindrical; pedicel very short, transverse; fore wing with MV shorter than SMV, STV sessile; PMV very long; scutellar process bidentate, about as long as petiole.

Colour. Body generally black with dark metallic green reflections; head black; antenna brownish; coxa concolorous with mesosoma, rest of the legs brown; gaster dark metallic green, terminal segment somewhat brown along the margins; wings hyaline.

Length. 4 mm.

Female. Unknown.

Host & Biology. Unknown.

Distribution. India: Assam.

Remarks. No specimens were available for studies; hence the diagnosis was taken from Mani (1935, 1989).

Stilbula lata Narendran, 1996

(Image 4)

Stilbula lata Narendran, 1996: 69-70. Holotype female (examined), India: Kerala, Kayamkulam (NZC), by original designation. Description of male, illustrated.

Diagnosis. Male. Head width (Fig. 6 of Narendran & Sheela, 1996: 67) in frontal view 1.60x its median length (excluding mandibles); POL 2.50x OOL; median ocellus separated from occipital margin by less than its own diameter; frons with distinct oblique and semicircular striations (Fig. 6 of Narendran & Sheela, 1996: 67); clypeal area slightly striate, shiny; supraclypeal area smooth, shiny; clypeogenal sulci and tentorial pits deep and distinct; vertex and scrobe longitudinally and transversely striate, upper part of scrobe rugoso-punctate; mouth plate 12 digitate; eyes separated in front view by 1.80x height of eye; mesoscutum and scutellum deeply and closely punctate; scutellum with a median

longitudinal fovea; each tooth of posterior scutellar process shorter than its stalk, 1.30x as long as its width (Fig. 7 of Narendran & Sheela, 1996: 67); propodeum completely punctate without median carina; mesopleuron distinctly and closely punctate without a patch of smooth area; fore wing (Fig. 5 of Narendran & Sheela, 1996: 67) 2.90x as long as its maximum width; petiole smooth, distinctly shorter than remaining part of gaster, longer than hind femur, middle part slightly thickened; gaster shorter than mesosoma.
Colour. Head and mesosoma bluish green with metallic refringence; interstices of mesosoma with slight purple reflections; antenna pale brownish yellow; coxae brown with apices paler; wings hyaline.
Length. 3.3 mm.
Female. Unknown.
Host & Biology. Unknown.
Material examined. *Holotype*. Male, INDIA: Kerala, Thrissur (10°31'N 76°13'E), Coll. T.C. Narendran, 4.xii.1988, NZC Regd. No. 10156/H3. *Paratype*. 1 Male, INDIA: Kerala, Alappuzha Dist., Kayamkulam (9°10'N 76°30'E), Coll. T.C. Narendran, 19.ii.1989, NZC Regd. No. 10202/H3. *Other materials examined*. 7 Males, INDIA: Kerala, Ernakulum (10°1'N 76°18'E), Coll. T.C. Narendran, 9.ii.1989, ZSI Regd. Nos. ZSI/WGRS/I.R-INV. 6250–6256.
Distribution. India: Kerala.

***Stilbula minispina* Heraty, 2002**

Stilbula minispina Heraty, 2002: 253-254. Holotype female, India: Tamil Nadu, Siruvani Forest (BMNH), by original designation. Description of female, illustrated.

Diagnosis. Female. Head 1.5x as broad as high; frons smooth and bare with only faint indications of vertical striae, lower face smooth; vertex smooth laterad to ocelli, weakly rugulose medially; vertex broadly rounded, occipital carina absent; eyes separated by 1.7x their height, bare; clypeus smooth; labrum with 6 digits; F2 1.4x as long as F3; mesosoma areolate-rugose and bare; mesoscutum anteriorly and side lobe smooth, side lobes broadly swollen medially; scutellum without median furrow; frenal process thin and obliquely truncate (Fig. 309 of Heraty, 2002: 327), 2.5x as long as broad; lower mesepisternum smooth; fore wing 2.7x as long as broad; petiole 4x as long as hind coxa.
Colour. Body dark brown with bluish reflections; antenna, legs and most of petiole yellowish brown; petiole with infuscate band medially; wings hyaline except for broad infuscate spot posterior to stigma, venation pale brown basally, clear apically.
Length. 2.5 mm.
Male. Unknown.
Host & Biology. Unknown.
Distribution. India: Tamil Nadu.
Remarks. No specimens were available for studies; hence the diagnosis was taken from Heraty (2002).

***Stilbula muthangensis* Girish Kumar sp. nov.**

(Figs. 6-9; Image 5)

Holotype. Male. Length 5.96 mm. Head and mesosoma dark brown with metallic black reflections; antenna brownish yellow; mandible yellowish brown; ocelli reflecting yellowish brown; eyes dark brown; coxae brown, remaining parts of legs pale brownish yellow; claws pale brown; tegula brown; wings hyaline except for small infuscate spot around STV, veins brown; petiole brownish yellow with brown band submedially; upper half of gaster black, lower half brown.

Head. 1.59x as broad as high (excluding mandibles) (Fig. 7) in frontal view; POL 1.68x OOL; median ocellus separated from occipital margin by less (0.41x) than its own diameter; frons finely carinate, carinae converging just below toruli; face with protuberances, lower face transversely carinate; vertex striate laterad to ocelli, rugose medially; eyes separated by 2.09x their height, bare; malar space 0.81x height of eye; clypeus smooth with protuberances, few faint transverse striations above clypeus; supraclypeal area not defined; labrum with 12 digits; apical tooth of mandible long and thin. Antenna (Fig. 6) 12 segmented; scape slightly longer than broad; funicle 9 segmented; F1 5.50 x as long as broad, 1.44x as long as F2; flagellomeres slightly swollen apically; scape and pedicel bare, flagellar segments pilose; MPS absent; antennal length shorter than the combined length of head, mesosoma and petiole (11: 12.8).
Mesosoma. Mesoscutum and scutellum deeply and closely punctate, interstices carinate, surface bare; notauli distinct and foveolate; SSS deeply impressed and strongly carinate; scutellum broadly rounded with median furrow, 1.77x as broad as the distance between SSS and frenal carina (including axilla) (Fig. 8); frenal line smooth and complete dorsally; frenal process pitted; each tooth of posterior scutellar process shorter than its stalk; stalk 1.21x as long as broad; propodeum (Fig. 9) completely punctate, interstices carinate without median carina, bare; callus bare; mesepisternum with a smooth area (Fig. 6); upper mesepimeron completely punctate, interstices carinate; femoral groove broad, transversely carinate, swollen anterior to mid coxa; fore coxa smooth with very small protuberances; mid coxa smooth with few faint striations, without ventral sulcus; hind coxa and all femora glabrous. Fore wing (Fig. 6) 2.90x as long as broad; STV angled to wing margin, stout, 1.60x as long as broad; PMV 2 x as long as STV; wing disc with microtrichia; hind wing with microtrichia and marginal fringes; hamuli 4 in number.
Metasoma (Fig. 6). Petiole 0.85x as long as gaster, 5.20x as long as hind coxa, 1.62x as long as hind femur, smooth and slightly swollen submedially; Gt_1 glabrous.
Female. Unknown.
Host & Biology. Unknown.
Etymology. The species is named after the collection locality.
Material examined. *Holotype*. Male, INDIA: Kerala, Wayanad Dist., Muthanga WLS (11°44' N 76°29' E), Coll. T.C. Narendran & Party, 7.v.2000, ZSI Regd. No. ZSI/WGRS/I.R-INV. 6257.
Distribution. India: Kerala.
Discussion. This new species resembles to *S. ashokai* Narendran (1996) in having: (1) Scutellar process stout; (2) Mesopleuron with a distinctly smooth area; (3) Petiole distinctly shorter than gaster; (4) Fore wing with infumation adjoining stigma; and (5) Median ocellus separated from occipital margin by less than its own diameter. However, this new species differs from *S. ashokai* in having: (1) POL 1.68x OOL (In *S. ashokai* POL 2.5x OOL); (2) Head and mesosoma dark brown with metallic black reflections (In *S. ashokai* head and mesosoma black with metallic green refringence); (3) Body length 5.96 mm (In *S. ashokai* body length 3.43 mm); and (4) Eyes separated by 2.09x their height (In *S. ashokai* eyes separated by less than 2x their height).

This new species is also similar to *S. bullista* Girish Kumar sp. nov. in having: (1) Scutellar process stout; (2) Head and mesosoma dark brown with metallic black reflections; (3) Antenna brownish yellow; (4) Fore wing with infumation adjoining stigma; (5) Median ocellus separated from occipital margin by less than its own diameter; and (6) Mesopleuron with a smooth area. However, this new species differs from *S. bullista* sp. nov. in having: (1) Stalk of scutellar process (excluding teeth) 1.21x as long as broad (In *S. bullista* sp. nov. scutellar process (excluding teeth) 0.86x as long as broad); (2) STV angled to wing margin and stout (In *S. bullista* sp. nov. STV perpendicular to wing margin and finger-like; (3) Gastral petiole 1.62x as long as hind femur (In *S. bullista* sp. nov. gastral petiole 1.42x as long as hind femur); (4) F1 1.44x as long as F2 (In *S. bullista* sp. nov. F1 1.27x as long as F2); (5) Body length 5.96 mm (In *S. bullista* sp. nov. body length 4.47 mm); and (6) Hamuli 4 in number (In *S. bullista* sp. nov. hamuli 3 in number).

Stilbula mysorensis (Mani & Dubey, 1974)

Schizaspidia mysorensis Mani & Dubey *in* Mani et al, 1974: 37. Holotype female, India: Mysore (USNM), by original designation. Description of female, illustrated.
Stilbula mysorensis; Hedqvist, 1978: 247. Change of combination.

Diagnosis. Female. Labrum with 11 digits; gena with obliquely longitudinal striae (Fig. 21E of Mani et al., 1974: 38); head frontal view as in Fig. 21D of Mani et al. (1974: 38) and head dorsal view as in Fig. 21C of Mani et al. (1974: 38); antenna (Fig. 21B of Mani et al., 1974: 38) with scape 1.7x as long as broad; F1 4x as long as broad; F2 0.6x as long as F1; scutellum (Fig. 21F of Mani et al., 1974: 38) with a median longitudinal sulcus; propodeum without median carina; scutellar process bluntly and shortly bifurcate; scutellar process about 0.27x as long as scutellum; Fore wing (Fig. 21A of Mani et al., 1974: 38) with SMV: MV: PMV = 125: 100: 25; petiole (Fig. 21H of Mani et al., 1974: 38) smooth, slender, cylindrical, almost equal to gaster and equal to mesosoma.

Colour. Body black with metallic coppery reflections; head black; antenna dark brown; mandible brown; fore wing hyaline with a brown stigmal cloud; veins dark brown; coxae concolorous with mesosoma, rest of legs brown; petiole yellowish brown with a black band submedially; gaster brown except Gt_1 black.

Length. 3 mm.

Male. Unknown.

Host & Biology. Unknown.

Distribution. India: Karnataka: Mysore.

Remarks. No specimens were available for studies; hence the diagnosis was taken from Mani et al. (1974) and Mani (1989).

Stilbula namida Girish Kumar sp. nov.

(Figs. 10-13; Image 6)

Holotype. Male. Length 4.77 mm. Head and mesosoma dark brown with metallic black reflections; antenna and mandibles pale brownish yellow; median ocellus reflecting brownish yellow, lateral ocelli reflecting red; eyes reddish brown; coxae dark brown with apices near to trochanter yellowish brown, remaining parts of legs pale brownish yellow, claws brown; tegula yellowish brown; wings hyaline, veins pale brown; petiole yellow with pale brown band submedially; upper half of gaster brown, lower half yellowish brown.

Head. 1.69 x as broad as high (excluding mandibles) (Fig. 12) in frontal view; POL 2.42 x OOL; median ocellus separated from occipital margin by less (0.5x) than its own diameter; frons finely carinate, carinae converging below toruli; lower face transversely carinate; vertex striate laterad to ocelli, slightly rugose medially; eyes separated by 1.90x their height, bare; malar space 0.87x height of eye; clypeus smooth on upper half, faint transverse striations on lower half; supraclypeal area not well defined, transversely striated on upper half, smooth on lower half; labrum with 9 digits; apical tooth of mandible long and thin. Antenna

(Fig. 11) 12 segmented; scape as long as broad; funicle 9 segmented; F1 4.36x as long as broad, 1.26x as long as F2; flagellomeres slightly swollen apically; scape and pedicel bare; flagellar segments pilose; MPS absent; antennal length longer than combined length of head, mesosoma and petiole (12.4: 11.7).

Mesosoma. Mesoscutum and scutellum deeply and closely punctate, interstices carinate, surface bare; notauli distinct and foveolate; SSS deeply impressed, strongly carinate; scutellum broadly rounded with median furrow, 1.44x as broad as distance between SSS and frenal carina (including axilla) (Fig. 13); frenal line smooth and complete dorsally; frenal process stout, pitted; each tooth of posterior scutellar process shorter than its stalk; stalk 0.86x as long as wide; propodeum completely punctate, interstices carinate, without a median carina, bare; callus bare; mesepisternum with a smooth area (Fig. 10); upper mesepimeron punctate, interstices carinate; femoral groove broad and transversely carinate, swollen anterior to mid coxa. Fore and mid coxae striate basally; mid coxa without ventral sulcus, hind coxa and all femora glabrous. Fore wing (Fig. 10) 3.55 x as long as broad; STV 1.40x as long as broad; PMV 1.14x as long as STV; wing disc with microtrichia except at basal area bare; hind wing with microtrichia and marginal fringes; hamuli 3 in number.

Metasoma (Fig. 10). Petiole 0.83x as long as gaster, 3.87x as long as hind coxa, 1.40x as long as hind femur, smooth and swollen submedially; Gt_1 glabrous.

Female. Unknown.

Host & Biology. Unknown.

Etymology. The species name is an arbitrary combination of letters.

Material examined. *Holotype*: Male, INDIA: Kerala, Kozhikode Dist., Nanminda (11°26' N 75° 50'E), Coll. P. Girish Kumar, 8.iv.2001, ZSI Regd. No. ZSI/WGRS/I.R-INV. 6258.

Distribution. India: Kerala.

Discussion. This new species resembles to *S. ashokai* Narendran (1996) in having: (1) Mesopleuron with a distinct smooth area on anterior half; (2) Posterior process of scutellum stouter; (3) Median ocellus separated from occipital margin by less than its own diameter; and (4) Petiole distinctly shorter than remaining part of gaster. However, this new species differs from *S. ashokai* in having: (1) Fore wing without a brown infumation adjoining stigma (In *S. ashokai* fore wing with a brown information adjoining stigma); (2) Head and mesosoma dark brown with metallic black reflections (In *S. ashokai* head and mesosoma black with metallic green reflections); (3) Mouth plate 9 digitate (In *S. ashokai* mouth plate 12 digitate); (4) Fore wing 3.55x as long as its maximum width (In *S. ashokai* fore wing 2.83x as long as its maximum width); and (5) Hamuli 3 in number (In *S. ashokai* hamuli 4 in number).

This new species is also close to *S. bangalorica* Girish Kumar & Narendran (2008) in having: (1) Fore wing without brown infumation adjoining stigma; (2) Mesopleuron with a distinct smooth area on anterior half; and (3) Posterior process of scutellum stouter. However, this new species differs from *S. bangalorica* sp. nov. in having: (1) POL 2.42x OOL (In *S. bangalorica* POL 2.80x OOL); (2) Head and mesosoma dark brown with metallic black reflections (In *S. bangalorica* head and mesosoma black with metallic green reflections); (3) Base of coxa dark brown without metallic green reflections (In *S. bangalorica* base of coxa brown with metallic green reflections); (4) Body length 4.77 mm (In *S. bangalorica* body length 6.28 mm); (5) Stalk of scutellar process 0.86x as long as broad (In *S. bangalorica* stalk of scutellar process as long as broad); (6) Mouth plate 9 digitate (In *S. bangalorica* mouth plate 8 digitate); and (7) Hamuli 3 in number (In *S. bangalorica* hamuli 7 in number).

Stilbula nilgiri Heraty, 2002

Stilbula nilgiri Heraty, 2002: 254-255. Holotype male, India: Nilgiri Hills (CNCI), by original designation. Description of male, illustrated.

Diagnosis. **Male**. Head 1.6x as broad as high; frons finely carinate, carinae coverging below toruli; lower face transversely carinate; vertex broadly rounded, occipital carina absent; eyes separated by 2.3x their height, bare; clypeus smooth basally, transversely striate apically; labrum with 9 digits; antenna (Fig. 321 of Heraty, 2001: 327) with F2 2.4x as long as broad, 1.5x as long as F3; F-F6 swollen subapically; scutellum without median furrow; frenal process (Fig. 310 of Heraty, 2001: 327) upturned, smooth, about as long as broad and cleft medially; lower mesepisternum smooth to transversely carinate; fore wing (Fig. 322 of Heraty, 2001: 327) 2.6x as long as broad; petiole 3.3x as long as broad and 5.6x as long as hind coxa, smooth and swollen medially.

Colour. Head black with green reflections; mesosoma mostly black with bluish green reflections, lower half of mesoscutum and upper corners of prepectus, acropleuron and propodeum yellow; apical half of coxae, remainder of legs and petiole yellow; basal half of coxae and gaster dark brown; wings hyaline except for some infuscate spot around stigmal vein, veins pale brown.

Length. 5.2 mm.

Female. Unknown.

Host & Biology. Unknown.

Distribution. India: Tamil Nadu: Nilgiri Hills.

Remarks. No specimens were available for studies; hence the diagnosis was taken from Heraty (2002).

Stilbula shendurunica Girish Kumar sp. nov.

(Figs. 14-18; Images 7 & 8)

Holotype. Female. Length 4.78 mm. Head and mesosoma dark with metallic green reflections; antenna dark brown except scape and pedicel brownish yellow; mandibles yellow, margins with brown reflections; ocelli reflecting black; eye reflecting reddish brown; legs pale yellow except coxae brown, claws dark; hind coxa with metallic reflections; tegulae brownish yellow; fore wing with a narrow brown infumation adjoining stigma; veins brown; petiole completely pale yellow without dark band medially; gaster dark brown.

Head. 1.55x as broad as high (excluding mandibles) (Fig. 15) in frontal view; POL 1.44 x OOL; median ocellus separated from occipital margin by about half of its own diameter; frons weakly striated, some striations converging well below toruli more or less in a circular manner; lower face weakly, transversely striated; vertex with few strong striations; eyes separated by 2.10x their height, bare; gena obliquely striate; malar space as long as height of eye; tentorial pit and clypeogenal sulci distinct and deep; clypeus almost entirely smooth, without strong transverse striations, with an incomplete one striation at apex; supraclypeal area not well defined, smooth; labrum with 12 digits; apical tooth of mandible long and thin. Antenna (Fig. 14) 12 segmented; scape 1.50x as long as broad; funicle 9 segmented; F1 3.83x as long as broad, 1.77x as long as F2; scape and pedicel bare; flagellar segments pilose, pilosity well pronounced; MPS numerous, large and exposed; clava ventrally depressed; antenna 1.21x as long as head and mesosoma combined.

Mesosoma. Mesoscutum and scutellum closely punctate, interstices carinate, surface bare; notauli distinct, foveolate; mesoscutum without median fovea; SSS deeply impressed, strongly carinate; scutellum (excluding axilla) 0.96x wider than median distance between SSS and frenal groove at base of scutellar process (Fig.

17), with a weak median furrow; frenal process stout and pitted; scutellar process distinctly shorter (0.35x) than the median length of scutellum; scutellar teeth about half of the scutellar process; propodeum completely punctate, interstices carinate, without a median carina; callus bare; mesepimeron (Fig. 16) with a large smooth area at middle; upper mesepimeron completely punctate, interstices carinate; femoral groove broad and transversely carinate, swollen anterior to mid coxa. Fore coxa slightly striated basally; mid coxa striated ventro-laterally; hind coxa and all femora glabrous; all tibiae and tarsi with setae. Fore wing (Fig. 18) 2.61 x as long as broad; wing disc with microtrichia except at basal area bare; STV and PMV not clear; hind wing with microtrichia and marginal fringes; hamuli 4 in number.

Metasoma. Petiole 0.43x as long as gaster (Image 8), 2.63x as long as hind coxa, shorter (0.78x) than hind femur, smooth and swollen sub medially; gaster 1.22x as long as head and mesosoma combined, elongate-oval and smooth; ovipositor not visible externally.

Male. Unknown.

Host & Biology. Unknown.

Etymology. The species name is named after the collection locality.

Material Examined. *Holotype*: Female. INDIA: Kerala, Kollam Dist., Shenduruni WLS (8°51'N 77°13'E), Pandimotta, Coll. K. Rajmohana & Party, 17.xii.2015, ZSIK Regd. No. ZSI/WGRS/I.R-INV.6259.

Distribution. India: Kerala: Shenduruni Wildlife Sanctuary: Pandimotta.

Discussion. This new species closely resembles to *S. silentvalliensis* Girish Kumar sp. nov. in having petiole completely pale yellow without dark band medially. However, this new species distinctly differs from *S. silentvalliensis* in the following features: (1) Frons weakly striated, some striations converging well below toruli more or less in a circular manner (In *S. silentvalliensis* frons completely striated more or less in a circular manner, converging well below toruli); (2) Clypeus almost entirely smooth, without strong transverse striations, with an incomplete one striation at apex; (In *S. silentvalliensis* clypeus smooth with strong transverse striations on apical half); (3) Fore wing with a narrow brown infumation adjoining stigma (In *S. silentvalliensis* fore wing with dark brown infumation adjoining stigma and pale brown infumation extends to the remaining portion after stigma); (4) Gaster 1.22x as long as head and mesosoma combined (In *S. silentvalliensis* gaster about as long as head and mesosoma combined); (5) Labrum with 12 digits (In *S. silentvalliensis* labrum with 14 digits); (6) Clava ventrally depressed (In *S. silentvalliensis* clava ventrally not depressed); and (7) Gaster entirely dark brown (In *S. silentvalliensis* upper half of gaster dark brown, lower half yellowish brown).

***Stilbula silentvalliensis* Girish Kumar sp. nov.**

(Figs. 19-23; Images 9 & 10)

Holotype. Female. Length 6.40 mm. Head metallic green; mesosoma brown with metallic green reflections; antenna yellowish brown with scape, pedicel, base of first funicular segment, last funicular segment and club paler; mandibles yellow, apical margins with brown reflections; ocelli reflecting whitish yellow; eye reflecting reddish brown; legs pale yellow except coxae brown, claws dark; tegulae pale yellow; fore wing with dark brown infumation adjoining stigma and pale brown infumation extends to the remaining portion after stigma of the wing; fore wing veins dark brown; hind wing vein pale brown; petiole completely pale yellow without dark band medially; upper half of gaster dark brown, lower half yellowish brown.

Head. 1.61x as broad as high (excluding mandibles) (Fig. 20) in frontal view; POL 1.63 x OOL; median ocellus separated from occipital margin by about half of its own diameter; frons completely striated more or less in a circular manner, converging well below toruli; lower face transversely carinate; vertex with few strong striations; eyes separated by 2.22x their height, bare; gena obliquely striate; malar space 0.92x height of eye; tentorial pit and clypeogenal sulci distinct and deep; clypeus smooth with strong transverse striations on apical apical half; supraclypeal area not well defined, smooth; labrum with 14 digits; apical tooth of mandible long and thin. Antenna (Fig. 19) 12 segmented; scape 1.43x as long as broad; funicle 9 segmented; F1 3.33x as long as broad, 1.58x as long as F2; scape and pedicel bare; flagellar segments pilose, pilosity well pronounced; MPS numerous, large and exposed; clava ventrally not depressed; antenna as long as head and mesosoma combined.

Mesosoma. Mesoscutum and scutellum closely punctate, interstices carinate, surface bare; notauli distinct, foveolate; mesoscutum with a weak median fovea; SSS deeply impressed, strongly carinate; scutellum (excluding axilla) 0.89x wider than median distance between SSS and frenal groove at base of scutellar process (Fig. 22) with a median furrow; frenal process stout and pitted; scutellar process distinctly shorter (0.28x) than the median length of scutellum; scutellar teeth about half of the scutellar process; propodeum completely punctate, interstices carinate, without a median carina; callus bare; mesepimeron (Fig. 21) with a large smooth area at middle; upper mesepimeron completely punctate, interstices carinate; femoral groove broad and transversely carinate, swollen anterior to mid coxa. Fore coxa slightly striated basally; mid coxa striated ventro-laterally; hind coxa and all femora glabrous; all tibiae and tarsi with setae. Fore wing (Fig. 23) 2.63 x as long as broad; wing disc with microtrichia except at basal area bare; hind wing with microtrichia and marginal fringes; hamuli 4-5 (4 in one hind wing; 5 in other hind wing) in number.

Metasoma. Petiole 0.43x as long as gaster (Image 10), 3x as long as hind coxa, slightly shorter (0.91x) than hind femur, smooth and swollen sub medially; gaster about as long as head and mesosoma combined, sub oval and smooth; ovipositor exerted and acicular.

Male. Unknown.

Host & Biology. Unknown.

Etymology. The species name is named after the collection locality.

Material Examined. *Holotype*: Female. INDIA: Kerala, Palakkad Dist., Silent Valley (11°04'N 76°31'E), Havlok, Coll. P. M. Sureshan & Party, 23.ii.2013, ZSIK Regd. No. ZSI/WGRS/I.R-INV.6260.

Distribution. India: Kerala: Silent Valley.

Discussion. This new species closely resembles to *S. atkinsoni* (Mani & Dubey, 1974) in having: (1) Frons completely striated more or less in a circular manner; and (2) Petiole without a distinct ring or band. However, this new species distinctly differs from *S. atkinsoni* in the following features: (1) Petiole pale yellow (In *S. atkinsoni* petiole brownish black to very dark brown); (2) Scutellar teeth about half (0.5x) of scutellar process (In *S. atkinsoni* scutellar teeth about 0.30x scutellar process); (3) Scutellar process distinctly shorter (0.28x) than scutellum (In *S. atkinsoni* scutellar process subequal to scutellum); (4) F1 3.33x as long as broad (In *S. atkinsoni* F1 7x as long as broad); and (5) Head metallic green (In *S. atkinsoni* head nearly black with blue reflections).

This new species also closely resembles to *S. shendurunica* Girish Kumar sp. nov. in having petiole completely pale yellow without dark band medially. However, this new species distinctly differs from *S. shendurunica* in the following features: (1) Frons completely striated more or less in a circular manner, converging well below toruli (In *S. shendurunica* frons weakly striated, some striations converging well below toruli more or less in a circular manner); (2) Clypeus smooth with strong transverse striations on apical half (In *S. shendurunica* clypeus almost entirely smooth, without strong transverse striations, with an incomplete one striation at apex); (3) Fore wing with dark brown infumation adjoining stigma and pale brown infumation extends to the remaining portion after stigma (In *S. shendurunica* fore wing with a narrow brown infumation adjoining stigma); (4) Gaster about as long as head and mesosoma combined (In *S. shendurunica* gaster 1.22x as long as head and mesosoma combined); (5) Labrum with 14 digits (In *S. shendurunica* labrum with 12 digits); (6) Clava ventrally not depressed (In *S. shendurunica* clava ventrally depressed); and (7) Gaster upper half of gaster dark brown, lower half yellowish brown (In *S. shendurunica* entirely dark brown).

***Stilbula tanjorensis* (Mani & Dubey, 1974)**

(Figs. 24-27; Images 11 & 12)

Stilbula tanjorensis Mani & Dubey *in* Mani et al, 1974: 39-41. Holotype female India: Tanjore (USNM), by original designation. Description of both sexes illustrated.
Stilbula tanjorensis; Hedqvist, 1978: 247. Change of combination.

Redescription. Plesiotype Female. Length 4.70 mm. Head and mesosoma blackish brown with metallic green reflections; antenna dark brown; mandibles brownish yellow; ocelli reflecting reddish brown; eyes reddish brown; coxae brown, remaining parts of legs pale brownish yellow; claws and tegulae brown; wings hyaline with brown infumation adjoining STV, veins brown; petiole pale brownish yellow with brown band medially; gaster dark brown with upper half of Gt_1 black.

Head. 1.40x as broad as high (excluding mandibles) (Fig. 26) in frontal view; POL 2.50 x OOL; median ocellus separated from occipital margin by less (0.87 x) than its own diameter; frons finely carinate, carinae reaches up to the level of toruli; face with minute protuberances; lower face transversely carinate; vertex striate-rugose; eyes separated by 1.64x their height, bare; malar space 0.64x height of eye; clypeus smooth with minute protuberances, supraclypeal area not defined, lower half smooth; labrum with 7 digits; apical tooth of mandible long and thin. Antenna (Fig. 25) 12 segmented; scape longer than broad; funicle 9 segmented; F1 3x as long as broad, 1.2x as long as F2; flagellomeres not swollen apically; scape and pedicel bare; flagellar segments pilose; MPS absent; antenna distinctly shorter than combined length of head, mesosoma and petiole (6.3 : 9.6).

Mesosoma. Mesoscutum and scutellum closely punctate, interstices carinate, surface bare; notauli distinct and foveolate; SSS deeply impressed, strongly carinate; scutellum broadly rounded with a slight median furrow; frenal line smooth and complete dorsally; frenal process (Fig. 27) slender and pitted; propodeum completely punctate, interstices carinate, without a median carina; callus bare; mesepisternum with a smooth area (Fig. 24); upper mesepimeron completely punctate, interstices carinate; femoral groove broad, transversely carinate, swollen anterior to mid coxa. Fore coxa weakly striated anteriorly; mid coxa weakly rugose dorsally and ventrally, smooth laterally, with ventral sulcus; hind coxa and all femora glabrous; tibiae smooth and bare except at apices near to tarsi with weak setae; tarsi setose. Fore wing (Fig. 24) 2.84x as long as broad; STV 2.25x as long as broad; PMV 2x as long as STV; wing disc with microtrichia except at basal third bare; hind wing with microtrichia and marginal fringes; hamuli 3 in number.

Metasoma (Fig. 24). Petiole 0.49x as long as gaster, 3.2x as long as hind coxa, as long as hind femur, smooth, slightly swollen medially; Gt_1 glabrous.

Male. Length 4.31 mm; petiole with a band submedially; antenna dark brownish yellow; POL 2.16 x OOL (Fig. 3 of Girish Kumar & Narendran, 2007: 2869); median ocellus separated from occipital margin by less (0.57x) than its own diameter; carinae reaches below level of toruli (Fig. 4 of Girish Kumar & Narendran, 2007: 2869); vertex striate laterad to ocelli, rugose in between ocellus, broadly rounded; eyes separated by 1.88 x their height; malar space 0.73 x height of eye; F1 4.16x as long as broad (Fig. 2 of Girish Kumar & Narendran, 2007: 2869); 1.47x as long as F2; flagellomeres slightly swollen apically; antenna longer than the combined length of head, mesosoma and petiole (13.80: 10.45). Antenna (Fig. 1 of Girish Kumar & Narendran, 2007: 2869) with STV 2.1x as long as broad; PMV 1.33x as long as STV; petiole 0.82x as long as gaster, 5.11 x as long as hind coxa, 1.58 x as long as hind femur, smooth, swollen submedially. Other characters almost as in female.

Host & Biology. Unknown.

Material examined. *Plesiotype*: Female, INDIA: Tamil Nadu; Coimbatore (11°0' N 76°58' E), Coll. T.C. Narendran & Party, September 1987, ZSI Regd. No. ZSI/WGRS/I.R-INV. 6261. *Other material examined*: 3 Males, same data of plesiotype, ZSI/WGRS/I.R-INV. 6262–6264; 1 female & 4 Males, INDIA: Kerala, Pathanamthitta Dist., Gavi (9°26' N 77° 09' E; alt. 1184 m.), Coll. P.M. Sureshan & Party, 10.iv.2013, ZSI/WGRS/I.R-INV. 6265–6268; 1 Male, INDIA: Kerala; Idukki Dist., Marayoor (10°16'N 77°09'E; alt. 995m.), Coll. P.M. Sureshan & Party, 4.ix.2013, ZSI/WGRS/I.R-INV. 6269; 13 Males, INDIA: Kerala, Kozhikode Dist., East Hill (11° 17' N 75° 46' E; alt. 32 m.), Coll. P.M. Sureshan & Party, 30.iii.–22.iv.2015, ZSI/WGRS/I.R-INV. 6270–6282.

Distribution. India: Kerala, Tamil Nadu.

Checklist of Oriental species of the genus *Stilbula* Spinola, 1811

(1) *S. ashokai* Narendran, 1996 — India: Kerala, Tamil Nadu.
(2) *S. atkinsoni* (Mani & Dubey, 1974) — Myanmar.
(3) *S. bangalorica* Girish Kumar & Narendran, 2008 — India: Karnataka.
(4) *S. bullista* Girish Kumar **sp. nov.** — India: Kerala.
(5) *S. indica* (Mani, 1935) — India: Assam.
(6) *S. insularis* Cameron, 1908 — Chagos Archipelago.
(7) *S. knuthii* Alfken, 1900 — Indonesia: Java.
(8) *S. lata* Narendran, 1996 — India: Kerala, Tamil Nadu.
(9) *S. leucopoda* (Cameron, 1909) — Malaysia: Sarawak.
(10) *S. minispina* Heraty, 2002 — India: Tamil Nadu.
(11) *S. muthangensis* Girish Kumar **sp. nov.** — India: Kerala.
(12) *S. mysorensis* (Mani & Dubey, 1974) — India: Karnataka.
(13) *S. namida* Girish Kumar **sp. nov.** — India: Kerala.
(14) *S. nilgiri* Heraty, 2002 — India: Tamil Nadu.
(15) *S. palawanensis* Hedqvist, 1978 — Philippines.
(16) *S. peethavarna* Narendran, 1996 — Thailand; Taiwan (Noyes, 2015, opined that the record from Taiwan requires conformation).
(17) *S. polyrhachicida* (Wheeler & Wheeler, 1924) — Philippines; Taiwan.
(18) *S. shendurunica* Girish Kumar **sp. nov.** — India: Kerala.
(19) *S. silentvalliensis* Girish Kumar **sp. nov.** — India: Kerala.
(20) *S. tanjorensis* (Mani & Dubey, 1974) — India: Kerala, Pondicherry, Tamil Nadu.
(21) *S. trimaculata* (Cameron, 1909) — Malaysia: Sarawak; Philippines.

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LITERATURE CITED

Cameron, P. 1909. On two new genera and seven species from Borneo. Entomologist, 42: 229-234.

Gahan, A. B. & Fagan, M. M. 1923. The type species of the genera of Chalcidoidea or chalcid-flies. Bulletin of the United States National Museum, 124: 1-173.

Girish Kumar, P. & Narendran, T. C. 2007. New record of *Stilbula tanjorensis* (Mani & Dubey) (Hymenoptera: Eucharitidae) from Kerala, India. Zoos' Print Journal, 22 (10): 2869.

Girish Kumar, P. & Narendran, T. C. 2008. A new species of *Stilbula* Spinola (Hymenoptera: Eucharitidae) from Karnataka. Journal of Environment and Sociobiology, 5 (2): 113-117.

Hedqvist, K. J. 1978. Some Chalcidoidea collected in the Philippines, Bismark and Solomon Islands, II Eucharitidae, with keys and check-lists to Indo-Australian genera (Insecta, Hymenoptera). Steenstrupia, 4: 227-248.

Heraty, J. M. 2002. A revision of the genera of Eucharitidae (Hymenoptera: Chalcidoidea) of the world. Memoirs of the American Entomological Institute, 68: 1-367.

Mani, M. S. 1935. New Indian Chalcidoidea (Parasitic Hymenoptera). Records of the Indian Museum, 37: 241-258.

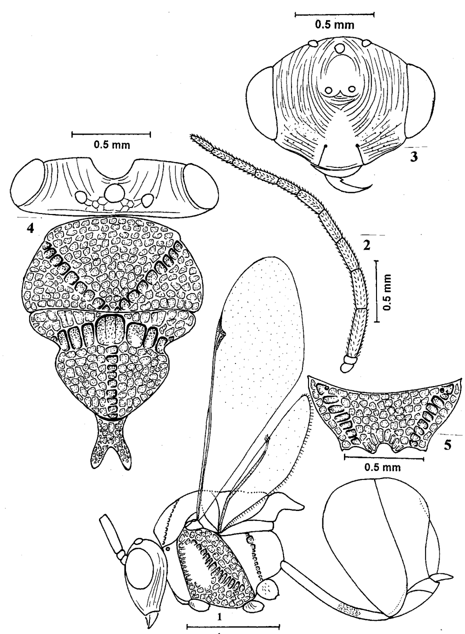
Mani, M. S. 1989. Family Eucharidae. *In* the fauna of India and the adjacent countries. Zoological survey of India Publications, 476-498.

Mani, M. S., Dubey, O. P., Kaal, B. K. & Saraswat, G. G. 1974. Description of some new species and new records of some known Chalcidoidea (Hymenoptera) from India. Memoirs of the School of Entomology, 3: 1-108.

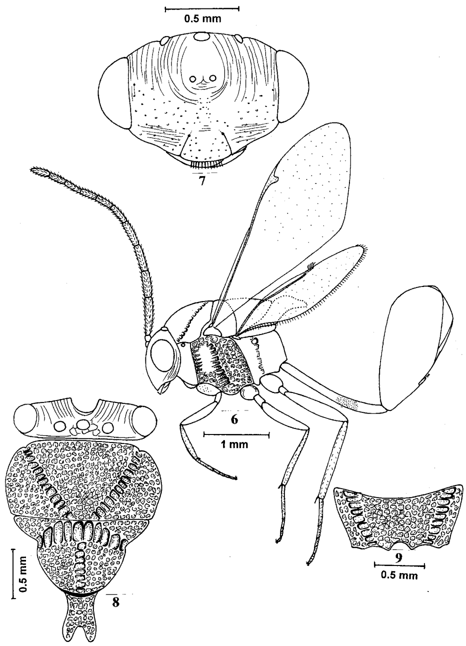
Narendran, T. C. & Sheela, S. 1996. Description of three new species of Oriental *Stilbula* Spinola (Hymenoptera: Eucharitidae) with a key to Indopacific species. Entomon, 21: 65-75.

Noyes, J. S. 2015. Universal Chalcidoidea Database. World Wide Web electronic publication. http://www.nhm.ac.uk/chacidoids (Accessed on March, 2016).

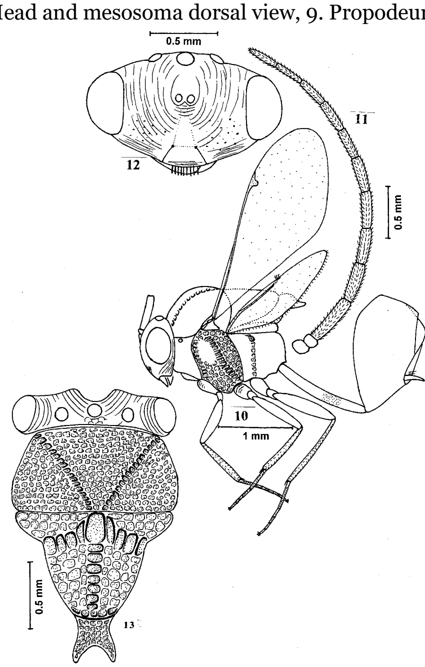
Spinola, M. 1811. Essai d'une nouvelle classification des Diplolepaires. Annales du Museum d'histoire naturelle, Paris, 17: 138-152.



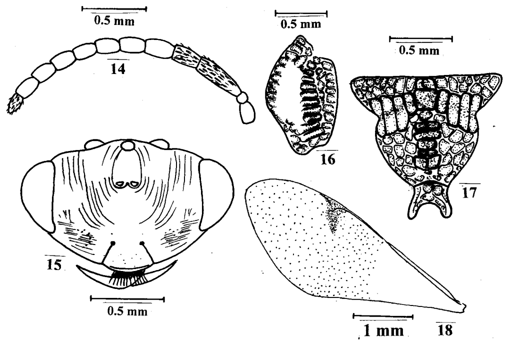
Figures 1-5. *Stilbula bullista* Girish Kumar sp. nov. Holotype Male. 1. Body profile, 2. Antenna, 3. Head frontal view, 4. Head and mesosoma dorsal view, 5. Propodeum.



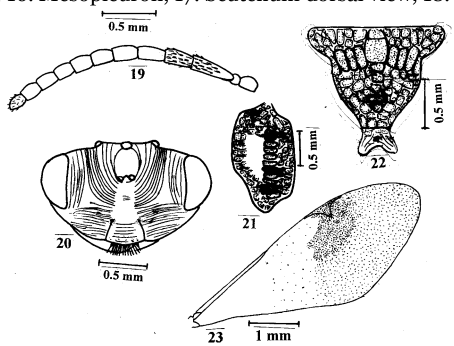
Figures 6-9. *Stilbula muthangensis* Girish Kumar sp. nov. Holotype Male. 6. Body profile, 7. Head frontal view, 8. Head and mesosoma dorsal view, 9. Propodeum.



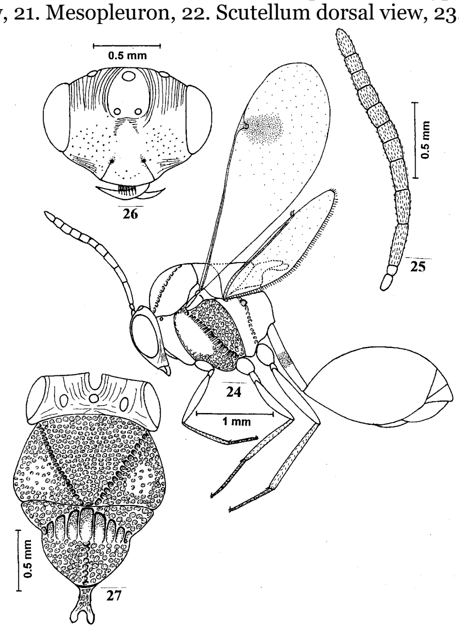
Figures 10-13. *Stilbula namida* Girish Kumar sp. nov. Holotype Male. 10. Body profile, 11. Antenna, 12. Head frontal view, 13. Head and mesosoma dorsal view.



Figures 14-18. *Stilbula shendurnica* Girish Kumar sp. nov. Holotype Female. 14. Antenna, 15. Head frontal view, 16. Mesopleuron, 17. Scutellum dorsal view, 18. Forewing.



Figures 19-23. *Stilbula silentvalliensis* Girish Kumar sp. nov. Holotype Female. 19. Antenna, 20. Head frontal view, 21. Mesopleuron, 22. Scutellum dorsal view, 23. Forewing.



Figures 24-27. *Stilbula tanjorensis* (Mani & Dubey) Female. 24. Body profile, 25. Antenna, 26. Head frontal view, 27. Head and mesosoma dorsal view.

Plate 1

Image 1. *Stilbula ashokai* Narendran Male profile

Image 2. *Stilbula bangalorica* Girish Kumar & Narendran Holotype Male profile

Image 3. *Stilbula bullista* Girish Kumar sp. nov. Holotype Male profile

Image 4. *Stilbula lata* Narendran Male profile

Image 5. *Stilbula muthangensis* Girish Kumar sp. nov. Holotype Male profile

Image 6. *Stilbula namida* Girish Kumar sp. nov. Holotype Male profile

Plate II

Image 7. *Stilbula shendurunica* Girish Kumar sp. nov. Holotype Female profile

Image 8. *Stilbula shendurunica* Girish Kumar sp. nov. Holotype Female Metasoma

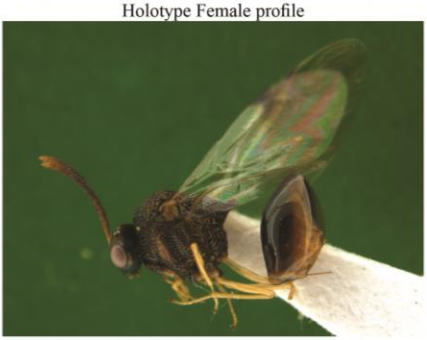


Image 9. *Stilbula silentvalliensis* Girish Kumar sp. nov. Holotype Female profile

Image 10. *Stilbula silentvalliensis* Girish Kumar sp. nov. Holotype Female Metasoma

Image 11. *Stilbula tanjorensis* (Mani & Dubey) Female profile

Image 12. *Stilbula tanjorensis* (Mani & Dubey) Male profile

NEW FOOD PLANTS AND NEW RECORDS OF TWO SPECIES OF *EPITRIX* FOUDRAS IN TURKEY (CHRYSOMELIDAE: GALERUCINAE: ALTICINI)

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[Özdikmen, H., Coral Şahin, D. & Bal, N. 2017. New food plants and new records of two species of *Epitrix* Foudras in Turkey (Chrysomelidae: Galerucinae: Alticini). Munis Entomology & Zoology, 12 (1): 309-312**]**

ABSTRACT: *Epitrix* species in Alticini tribe are generally known as potato flea beetles in the world and they are recorded to cause damage especially in the Solanaceae family plants. While this taxon contains more than 100 species, it has 17 species in Palearctic region and 7 species in Turkey. Two species of *Epitrix* were determined in the studies conducted in Ankara, Bartın, Çankırı, Ordu and Zonguldak provinces in 2014-2016. *Epitrix hirtipennis* (Melsheimer, 1947) is known as tobacco flea beetle, its damage in cucumber, pepper, tomatoes, melon, eggplant and beet were also known. In this study, cabbage (Brassicaceae: *Brassica oleracea*) and potato (Solanaceae: *Solanum tuberosum*) were determined as a new food plants of this species. It was determined from Ankara and Zonguldak provinces and so it is a new record to Zonguldak province. New food plants of *Epitrix pubescens* (Koch, 1803) were observed and determined as radish (Brassicaceae: *Raphanus sativus*), maize (Poaceae: *Zea mays*), bean (Fabaceae: *Phaseolus vulgaris*), cabbage (Brassicaceae: *Brassica oleracea*) ve potato (Solanaceae: *Solanum tuberosum*). It was determined from Ankara, Bartın, Çankırı, Ordu and Zonguldak provinces and so it is new record to Bartın, Çankırı, Ordu and Zonguldak provinces.

KEY WORDS: Chrysomelidae, Alticini, *Epitrix*, new host plants, new records, Turkey

Alticini species, called as flea beetles and the biggest subfamily of Chrysomelidae family. It is represented by approximately 500 genera including more than 8000 species in worldwide, 90 genera including 1388 species in Palearctic region (Konstantinov & Vandenberg, 1996). In Turkey, the subfamily includes 343 species group taxon (314 species and 29 subspecies) belonging to 22 genera (Özdikmen et al., 2014; Aslan & Alkan, 2015). Alticini species generally phytophagous insect and feed on herbaceous plants and they are one of the major pests of the vegetable, industrial and other cultural plants. Alticini species feed on above ground organs of plants, especially leaves and also stem, flowers and fruits. Instead of direct damage, flea beetles also give indirect damage by transferring viruses and bacteria, which cause important plant diseases.

Epitrix species in Alticini tribe are generally known as potato flea beetles in the world and they are recorded to cause damage especially in the Solanaceae family plants. Although this genus is represented by more than 100 species in worldwide, it includes 17 species in Palearctic Region and only 7 species in Turkey. In addition, four *Epitrix* species (*E. cucumeris, E. subcrinita*, *E. similaris* and *E. tuberis*) are found in EPPO A1 and A2 lists of quarantine species but they have not been found in Turkey.

MATERIALS AND METHODS

This study was performed in Ankara, Bartın, Çankırı, Ordu and Zonguldak provinces in 2014-2016. *Epitrix* specimens were collected by using net and aspirator from the host plants. Specimens were taken into tubes contained %70 alcohol in them. Specimens were identified by using identification key of Warchałowski (2010). In addition, in identification studies the first author's collection were used as reference material. Insect samples were kept in Nazife Tuatay Plant Protection Museum in Plant Protection Central Research Institute and at Gazi University.

RESULTS AND DISCUSSION

Two species of *Epitrix* were determined in the studies conducted in Ankara, Bartın, Çankırı, Ordu and Zonguldak provinces. *Epitrix pubescens* (Koch, 1803) was determined from Ankara, Bartın, Çankırı, Ordu and Zonguldak provinces and so it is new record to Bartın, Çankırı, Ordu and Zonguldak provinces. *Epitrix hirtipennis* (Melsheimer, 1947) was determined from Ankara and Zonguldak provinces and so it is a new record to Zonguldak province.

Epitrix pubescens (Koch, 1803)

(Fig. 1)

Material examined: Ankara: Ankara: Haymana, Soğulca, 39°22'26"N, 32°21'03"E, 02.VI.2015, 948 m, *Phaseolus vulgaris* L. (Bean), 40 specimens, *Solanum melongena* L. (Eggplant), 1 specimen, *Raphanus sativus* L.(Turp) 1 specimen specimen; Kazan, Sancar, 40°13'57"N, 32°46'14"E, 03.V.2016, 917 m, 1 specimen; **Bartın:** Karasu, 41°39'23"N, 32°14'07"E, 12.V.2015, 38 m, 4 specimens; **Çankırı** Ilgaz, Belsöğüt Köyü, 40° 56' 51,6" N, 33° 36' 13" E, 17.VII.2014, 1019m, 8 specimens; **Ordu:** Fatsa, Bolaman, 23.VII.2016, 180 m, 7 specimens; **Zonguldak** : Devrek, 20.IV.2016, *Brassica* sp.(Cabbage), 1 specimen; Beycuma, Yörükler, 41°20'44"N, 31°58'04"E, 02.VI.2016, 232 m, *Zea mays* L. (Maize), 1specimens; Devrak, Yılanlıca, 41°15'60"N, 31°58'98"E, 02.VI.2016, 124 m, Maize, 1 specimen; Devrek, Yılanlıca, 41°15'60"N, 31°58'98"E, 15.VI.2016, 124 m, Cabbage, 1 specimen.

Records in Turkey: Anatolian: Balıkesir, Bilecik, Denizli, Düzce, Eskişehir, Erzurum, İstanbul and Europe: Kırklareli (Ekiz et al., 2013; Özdikmen, 2014).

Range: Kazakhstan, Kirghizistan, West Siberia, Caucasia, Iran, Turkey, Cyprus, Israel (Löbl & Smetana, 2010; Özdikmen, 2014).

Chorotype: Sibero-Europea (Özdikmen, 2014).

Remarks: In the study, new food plants of *Epitrix pubescens* (Koch, 1803) were observed and determined as radish (Brassicaceae: *Raphanus sativus*), maize (Poaceae: *Zea mays*), bean (Fabaceae: *Phaseolus vulgaris*), cabbage (Brassicaceae: *Brassica oleracea*) ve potato (Solanaceae: *Solanum tuberosum*). It was determined that this species give damage to leaves of these cultured plants.

This species is a new record for Bartın, Çankırı, Ordu and Zonguldak provinces.

***Epitrix hirtipennis* (Melsheimer, 1847)**
(Fig. 2)

Material examined: Ankara: Haymana, Soğulca, 39°22'24"N, 32°21'01"E, 17.VIII.2015, 930 m, *Solanum melongena* L. (Eggplant), 2 specimens; **Zonguldak:** Devrek, 20.IV.2016, *Brassica* sp. (Cabbage), 1 specimen; Devrek, 41°15'60"N, 31°58'98"E, 02.VI.2016, 124 m, *Solanum tuberosum* L. (Potato), 3 specimens.

Records in Turkey: İzmir, Mardin, Ankara (Ekiz et al., 2013; Özdikmen, 2014).

Range: North America, Canada, Mexico, Italy, Bulgaria, Greece, Turkey, Syria (Löbl & Smetana, 2010; Özdikmen, 2014).

Chorotype: Turano-Mediterranean (Turano-Apenninian) + Nearctic + Neotropical (Özdikmen, 2014).

Remarks: *E. hirtipennis* is a pest of tobacco typically. In the World, it is known as a pest of tobacco, potato, tomato and eggplant mostly. In addition, it is also observed that this species feeds on pea, cabbage, pepper and radish (Capinera, 2001). As an American originated species, it has been distributed from Canada to Mexico and then it entered to Europe from Italy in 1984. Other host plants in abroad are tomato, cucumber, melon, Russian turnip and some weeds and ornamental plants (Turanlı & Kısmalı, 1996a,b). In Turkey, according to study performed by Turanlı & Kısmalı (1996a,b) it made an epidemy in 1993 and it caused serious product lost in tobacco production area. Despite of intense disinfection in the area, the species dispersion and its damage could not be stopped.

In the study, it was determined from Ankara and Zonguldak provinces. It is a new record to Zonguldak province. Cabbage (Brassicaceae: *Brassica oleracea*) and potato (Solanaceae: *Solanum tuberosum*) were determined as food plants of this species.

Note: This study presented in International Conference on Biological Sciences (ICBS) Konya, TURKEY (October 21-23, 2016) as a poster presentation.

LITERATURE CITED

Aslan, E. G. & Alkan, K. 2015. The Alticini (Coleoptera: Chrysomelidae: Galerucinae) fauna of Davraz Mountain (Isparta): Comments on host plant and altitude preferences with two new records for Turkish fauna. Turk. J. Zool., 39: 488-493.

Capinera, J. L. 2001. Handbook of Vegetable Pests. Academic Press, San Diego, 729 pp.

Ekiz, A. N., Şen, İ., Aslan, E. G. & Gök, A. 2013. Checklist of leaf beetles (Coleoptera: Chrysomelidae) of Turkey, excluding Bruchinae. Journal of Natural History, 47: 2213-2287.

Konstantinov, A. S. & Vandenberg, N. J. 1996. Handbook of Palearctic flea beetles (Coleoptera : Chrysomelidae: Alticinae). Contr. Ent. Intern., Gainesville, 1 (3): 237-439.

Löbl, I. & Smetana, A. 2010. Catalogue of Palaearctic Coleoptera, Vol. 6. Chrysomeloidea. Stenstrup: Apollo Books, 924 pp.

Özdikmen, H. 2014. Chorotype identification for Turkish Chrysomeloidea (Coleoptera) Part VIII – Chrysomelidae: Alticinae. Munis Entomology & Zoology, 9: 325-375.

Özdikmen, H., Mercan, N., Cihan, N., Kaya, G., Topcu, N.N. & Kavak, M. 2014. The importance of superfamily Chrysomeloidea for Turkish biodiversity (Coleoptera). Munis Entomology & Zoology, 9: 17-45.

Turanlı, F. & Kısmalı, Ş. 1996a. Tobacco Flea Beetle *Epithrix hirtipennis* Melsh. (Coleoptera: Chrysomelidae), a new tobacco pest in Türkiye. XX. International Congress of Entomology Proceedings (August 25-31, Firenze, Italy), p. 492.

Turanlı, F. & Kısmalı, Ş. 1996b. Urla (İzmir) ilçesinde tütünlerde yeni bir zararlı olan *Epithrix hirtipennis* Melsh.(Coleoptera: Chrysomelidae) üzerinde araştırmalar. Türkiye III. Entomoloji Kongresi Bildirileri (24-28 Eylül, Ankara), pp. 243-250.

Warchalowski, A. 2010. The Palaearctic Chrysomelidae: Identification keys, Vol 1 & 2. Natura Optima Dux Foundation, Warszawa, 1212 pp.

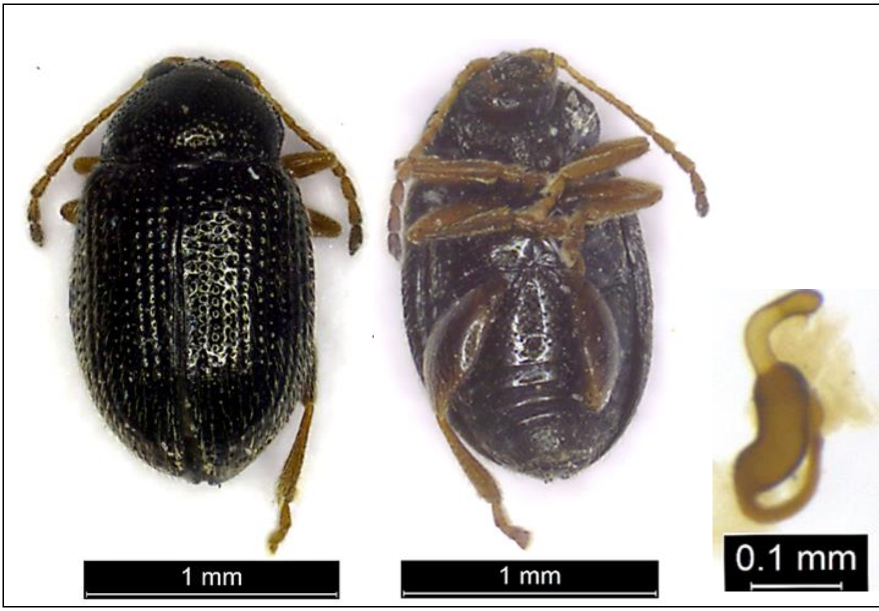

Figure 1. *Epitrix pubescens* (Koch, 1803): Dorsal (left), Ventral (middle), spermatheca (right).

Figure 2. *Epitrix hirtipennis* (Melsheimer, 1847): Dorsal (left), Ventral (middle), spermatheca (right).

A NEW PARASITOID SPECIES RECORD FOR TURKISH FAUNA *SPATHIUS* (*SPATHIUS*) *BREVICAUDIS* RATZEBURG, 1844 (HYMENOPTERA: BRACONIDAE: DORYCTINAE)

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[Beyarslan, A. 2017. A new parasitoid species record for Turkish fauna *Spathius* (*Spathius*) *brevicaudis* Ratzeburg, 1844 (Hymenoptera: Braconidae: Doryctinae). Munis Entomology & Zoology, 12 (1): 313-315**]**

ABSTRACT: In order to determine Braconidae fauna of Turkey, adult specimens were collected from various habitats of Turkish Marmara region using Malaise and light traps and sweeping nets. *Spathius (Spathius) brevicaudis* Ratzeburg,1844 is recorded from Bursa, Cumalıkızık. It is new to Turkey.

KEY WODS: Braconidae, Doryctinae, Spathius, Fauna, Bursa, Cumalıkızık, new record

Doryctinae is one of the most diversified subfamilies in Braconidae. More than 1300 doryctine species have been described in 187 recognized genera belonging to 16 tribes, most of which are restricted to tropical and subtropical regions (Belokobylskij, 1986, 1992; Yu et al., 2012). Doryctinae shows a wide range of biological habits, perhaps one of the most diverse in the family Braconidae. Most species for which the biology is known are idiobiont ectoparasitoids of mostly wood-boring beetle larvae in the families Anobiidae, Bostrichidae, Buprestidae, Cerambycidae, Colydiidae, Curculionidae, ucnemidae, Mordellidae, and Scolitidae (Coleoptera); a few stemboring lepidopterous larvae in the families Crambidae, Gelechiidae, Gracillariidae, Lyonetiidae, Momphidae, Cosmopterigidae, Bostrichidae, Buccalatricidae, Coleophoridae, Elachistidae, Lymantriidae, Micropterigidae, Nepticulidae, Pyralidae, Tineidae, Tischeriidae, Tortricidae, and Sesiidae (Lepidoptera); certain sawfly larvae of Cephidae, Tenthredinidae, and Xiphydriidae (Hymenoptera); and Oligochaeta (Lumbricidae) and Aranaea (Theridiidae) (Marsh, 1997; Yu et al., 2012; Beyarslan, 2014). Although many doryctines attack beetle larvae in seeds, a few species are now known to be phytophagous in seeds or to be gall inducers in various tropical plants (Wharton & Hanson, 2005).

The subfamily Doryctinae is less common in Turkey. The fauna of the Turkish Doryctinae has been poorly studied until recently and only 9 species were recorded so far: *Dendrosoter Caenopachys*) *hartigii* (Ratzeburg), *Dendrosoter* (*D.*) *middendorffii* (Ratzeburg), *Dendrosoter* (*D.*) *protuberans* (Nees), *Spathius* (*S.*) *curvicaudis* Ratzeburg, *Spathius* (*S.*) *rubidus* (Rossi), *Pambolus* (*Phaenodus*) *pallipes* (Förster), *Hormius propodealis* (Belokobylskij), *Dolopsidea indagator* (Haliday) and *Dolopsidea tatianae* (Telenga) (Belokobylskij, 1986, 2001; Beyarslan &Aydogdu, 2013; Hedqvist, 1976; Mancini et al., 2003; Schimitschek, 1939, 1941, 1944 and Zaldivar-Riverón et al., 2008). Later 58 species belonging 25 genera were reported for the studied Regions of Turkey, among which 52 species were recorded for the first time from Turkey (Beyarslan, 2014). Adult specimens of Doryctinae were collected from various habitats Aegean region of Turkey using Malaise and light traps and sweeping nets. Also the number of Turkis Doryctinae species has increased from 61 to 62.

MATERIAL AND METHOTS

Adult specimens of Doryctinae were collected by sweeping from various habitats in the Turkish Marmara region. Relevant literature was used for taxonomical examination and identification of the materials (Tobias 1986; Belokobylskij 1986, 1992, 2001). Material are deposited in the collection of the Biology Department of the Faculty of Arts and Science of Bitlis Eren University.

RESULTS

Spathius (*Spathius*) *brevicaudis* Ratzeburg, 1844

Material examined: Bursa, Cumalıkızık village (40° 10´37"N, 29° 10´ 17"E), 253 m. 18.IX.1992, 2 female, 1male, leg. Ö. Çetim.

Distribution: Palaearctic, Oriental. Austria, Azerbaijan, Bulgaria, China, Czech Republic, Czechoslovakia, Denmark, France, Georgia, Germany, Hungary, Italy, Japan, Kazakhstan, Korea, Moldova Mongolia, Poland, Romania, Russia, Slovakia, Sweden, Switzerland, Former Yugoslavia (Yu et al., 2012).

Hosts: Coleoptera. Buprestidae: *Agrilus viridis* Linnaeus, 1758; *Anthaxia quadripunctata* (Linnaeus, 1758); *A. (A.) manca* (Linnaeus, 1767); **Cerambycidae:** *Acanthocinus griseus* (Fabricius, 1792); *Arhopalus coreanus* (Sharp, 1905); *Exocentrus lusitanus* (Linnaeus, 1767). **Curculionidae:** *Carphoborus minimus* (Fabricius, 1798); *Ceutorhynchus pallidactylus* (Marsham, 1802; *Dryocoetes autographus* (Ratzeburg, 1837); *Hylesinus fraxini* (Panzer, 1779); *Ips acuminatus* (Gyllenhal, 1827); *I. typographus* (Linnaeus, 1758) [*Picea excelsa*]; *Lixus (Eulixus) bidens* Capiomont, 1874; *Magdalis (Magdalis) frontalis* (Gyllenhal, 1827); *M. (Magdalis) violacea* (Linnaeus, 1758); *Niphades variegatus* (Faust, 1890); *Orthotomicus angulatus* (Eichhoff, 1876); *Phloeotribus rhododactylus* (Marsham, 1802); *Pissodes (Pissodes) castaneus* (De Geer, 1775); *P. notatus* (Fabricius, 1775); *Pityogenes bidentatus* (Herbst, 1784); *P. bidentatus* (Herbst, 1784) (syn. *Bostrichus bidens*); *P. chalcographus* (Linnaeus, 1761); *Pityophthorus micrographus* (Linnaeus, 1758); *Polygraphus subopacus* Thomson, 1871; *Rhynchaenus quercus* (Linnaeus, 1758); *R. salicis* (Linnaeus, 1758); *R. testaceus* (Mueller, 1776); *R. fagi* (Linnaeus, 1758); *R. pilosus* (Fabricius, 1781); *Scolytus intricatus* (Ratzeburg, 1837); *S. koenigi* Schevyrew, 1890; *S. laevis* Chapuis, 1869; *S. mali* (Bechstein, 1805); *S. multistriatus* (Marsham, 1802); *S. rugulosus* (Müller, 1818); *Shirahoshizo insidiosus* (Roelofs, 1875); *S. pini* Morimoto, 1962; *S. rufescens* (Roelofs, 1875); *Tomicus piniperda* (Linnaeus, 1758) (Syn. *Blastophagus piniperda* (Linnaeus, 1758)). **Scolytidae:** *Blastophagus minor* (Hartig, 1834). **Hymenoptera. Xiphydriidae**: *Xiphydria longicollis* (Geoffroy, 1785).

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LITERATURE CITED

Belokobylskij, S. A. 1986. [A review of the Palaearctic species of the genera *Pambolus* Hal. and *Dimerus* Ruthe (Hymenoptera, Braconidae)]. Trudy Zoologicheskogo Instituta Leningrad, 159: 18-37 (in Russian).

Belokobylskij, S. A. 1992. On the classification and phylogeny of the Braconid wasps subfamilies Doryctinae and Exothecinae (Hymenoptera, Braconidae). I. Classification. Entomological Review, 72: 109-137.

Belokobylskij, S. A. 2001. [New taxa of the braconid subfamilies Doryctinae and Exothecinae (Hymenoptera, Braconidae) from west Palearctic.]. Entomologicheskoe Obozrenie, 80: 451-471 (in Russian).

Beyarslan, A. 2014. A faunal study of the subfamily Doryctinae in Turkey (Hymenoptera: Braconidae). Turkish Journal of Zoology, 39: 126-143.

Beyarslan, A. & Aydogdu, M. 2013. Additions to the rare species of Braconidae fauna Hymenoptera: Braconidae) from Turkey. Munis Entomology & Zoology, 8: 369-374.

Hedqvist, K. J. 1976. New species of *Spathius* Nees, 1818 and a key to the species of Europe and Canary Islands (Hym. Ichneumonoidea, Braconidae). Eos, 51: 51-63.

Mancini, D., Priore, R., Battaglia, D & van Achterberg, C. 2003. *Caenopachys hartigii* (Ratzeburg) (Hymenoptera: Braconidae: Doryctinae) confirmed for Italy, with notes on the status of the genus *Caenopachys* Foerster. Zoologische Mededelingen. Leiden, 77: 459-470.

Marsh, P. M. 1997. Subfamily Doryctinae. In: Wharton, R. A., Marsh, P. M. & Sharkey, M. J. editors. Manual of the New World Genera of the Family Braconidae (Hymenoptera): Subfamily Doryctinae. Washington, DC, USA: Special Publications of the International Society of Hymenopterists, pp. 206-233.

Schimitschek, E. 1939. Die Lebensweise des ryocoetes minor. Forstarchiv, 15: 271-274.

Schimitschek, E. 1941. Forstinsekten der Tuerkei und ihre Umwelt. Prague: Volk und Reich. Zeitschrift für Angewandte Entomologie, 27: 84-113.

Schimitschek, E. 1944. Forstinsekten der Tuerkei und ihre Umwelt. Prague: Volk und Reich. 371 pp. (273-279).

Tobias, V. I. 1986. Subfamily Doryctinae. In: Medvedev, G. S. editor. Keys to the Insects of the European Part of the USSR: Subfamily Doryctinae. Volume III, Hymenoptera Part IV. New Delhi: Amerind Publishing Co. Pvt. Ltd., pp. 28-117.

Wharton, R. A. & Hanson, P. E. 2005. Biology and evolution of braconid gall wasps,. In: Ramon, A., Schaefer, C. W. & Withers, T. M. editors. Biology, Ecology and Evolution of Gall-Inducing Arthropods. Enfield, NH, USA: Science Publishers, pp. 495-505.

Yu, D. S., van Achterberg, C. & Horstmann, K. 2012. Ichneumonoidea 2011 (Biological and taxonomical information). Taxapad Interactive Catalogue. Available at www.taxapad.com.

Zaldivar-Riverón, A., Belokobylskij, S. A., Leon, R. V., Briceno, G. R. & Quicke, D. L. J. 2008. Molecular phylogeny and historical biogeography of the cosmopolitan parasitic wasp subfamily Doryctinae (Hymenoptera: Braconidae). Invertebrate Systematics, 22: 345-363.

NEW DATA ON THE DISTRIBUTION AND ECOLOGY OF *OXYTHYREA ALBOPICTA* (MOTSCHULSKY, 1845) (COLEOPTERA, SCARABAEIDAE CETONIINAE)

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[Uliana, M. & Polat, A. 2017. New data on the distribution and ecology of *Oxythyrea albopicta* (Motschulsky, 1845) (Coleoptera, Scarabaeidae Cetoniinae). Munis Entomology & Zoology, 12 (1): 316-322**]**

ABSTRACT: *Oxythyrea albopicta* (Motschulsky, 1845) is a scattered, uncommon species widespread from Eastern Europe to the Tibetan Plateau. Authors provide a significant number of new records, mostly from eastern Turkey, including the first ones from Turmenistan and Afghanistan. All known records are summarized in two maps. In spite of its scarcity *O. albopicta* is observed in very different enviroments and its alleged scarcity may partly depend from unaccurate samplings and confusion with the similar and much more abundant *O. cinctella*.

KEY WORDS: *Oxythyrea albopicta*, distribution, ecology, new records

Within the genus *Oxythyrea*, *O. albopicta* (Motschulsky, 1845) is one of the species with the broadest range, spanning from Eastern Europe to the westernmost spurs of the Tibetan Plateau.

In spite of this extensive distribution, *O. albopicta* is a poorly known, uncommon species, mostly recorded from scattered findings. Known distribution has been significantly updated by the recent contribution by Tauzin (2015), who listed and mapped several localities based on directly examined specimens.

The aim of this paper is to summarize published data and provide original information on distribution and ecology of this species. First records are given for Turkmenistan and Afghanistan, and several new localities are listed for North Eastern Turkey, where its presence was to date poorly documented.

MATERIAL AND METHODS

New records are based on specimens recently collected by authors in Eastern Turkey and on specimens coming from different sources and preserved in the following collections:

AUCE: Atatürk University collection (Dept. of Plant Protection, Faculty of Agriculture), Erzurum
HNHM: Hungarian Natural History Museum, Budapest
MHNG: Muséum d'histoire naturelle de Genève, Geneva
MUCC: Marco Uliana collection, Codevigo
RBINS: Royal Belgian Institute of Natural Sciences, Bruxelles

Mapping considered all available data, including all literature records known to authors (Medvedev, 1964; Dahlgren, 1972; Mikšić, 1978, 1982; Rataj, 1988; Rozner & Rozner, 2009a,b; Tauzin & Rittner, 2012; Tauzin, 2015; Shokhin, 2016).

Records were mapped via Google Earth. In the absence of original geographical coordinates, placement of toponyms on the map was searched mainly via Google Earth and Google Maps. Toponyms giving no match or leading to doubtful results were also checked against other gazetteers available on the web, in particular www.fallingrain.com.

Undetailed records referring to broad areas have been discarded when the same area was covered by more detailed records, while they have been retained (but not mapped) when no records with better precision were available.

Maps images are based on the relief overlay for Google Earth available at http://ge-map-overlays.appspot.com/world-maps/maps-for-free-relief, with modified colors.

RESULTS

Distribution

Original records are listed in table 1; records #19 and #22 are first country records for Turkmenistan and Afghanistan.

All records known to authors are mapped in fig. 1 and 2, except the following ones: Georgia, Gomi (Olsoufieff, 1916; Medvedev, 1964; two toponyms with this name are present in Georgia); Armenia: Ejlar (Olsoufieff, 1916) or Eylar (Medvedev, 1964). The locality "between v. Barda and Kacharly" (W Azerbaijan, Medvedev, 1964) was approximated to Barda. In addition, there are generic records in Armenia for the Valley of the river Aras and for that of the river Arpa (Medvedev, 1964), and in Turkey, for the Nur Dağlari range (Tauzin, 2015, as “Mont Amanus”), areas not or only marginally covered by the precise records available.

Records from southern Russia are considered doubtful according to their own source (Medvedev, 1964), while its presence in Montenegro, mentioned by Rataj (1988) without any further information, requires confirmation: in fact, no specimens from Montenegro were found in the collection R. Alexis (RBINS), where the ex coll. Rataj is now contained (A. Drumont, pers comm.).

Ecology

The documented altitudinal range spans from 600 m (Macedonia, Stip) to 2700 m (central Iran, near Khonsar), but the species is probably present also at a lower altidude, as suggested by the record “5 km NW of Viničani” (Rozner & Rozner, 2009), which addresses to an area ranging between about 150 and 450 m, and from the report by Rataj (1988), recording the species “from the lowlands to the foothills”.

Adults activity spans between the beginning of April (6 April at Kaladarscht, northern Iran, (Tauzin, 2015)) and the middle of August (11 August in two localities of Erzurum province (present data), 17 august at an unknown locality (Medvedev, 1964)).

In spite of its scarcity, the species does not seems stenoecious as it is observed in very different environments, including, in Turkey, natural and seminatural grasslands either in mesophilous valleys floors (Fig. 3) or in steppic plateaus (Fig. 4), and road margins and clearings within shrubby thermophilous forest (Fig. 5). In the Bekaa Valley, central Lebanon, it was observed on various flowers, including *Heracleum*, in a rocky, fresh and damp mountain grassland; in SW Syria on purple thistles (probably, *Onopordum*) in a cultivated subdesertic steppe (G. Sabatinelli, pers. comm). Adults have been observed feeding on flowers, including Asteraceae, Apiaceae, Lamiaceae, and Papilionaceae.

DISCUSSION

The distribution range of *O. albopicta* almost matches that of *Oxythyrea cinctella*, which is spanning from the southern Dinaric Alps, in Montenegro and Eastern Serbia (Mikšić 1982, Rataj 1988) to the western edge of the Tibetan Plateau in Pakistan and Xinjiang (Bezdek, 2016), slightly east of the range so far ascertained for *O. albopicta*.

However, while *O. cinctella* is usually an ubiquitous species that can be observed by the hundreds in a single site, *O. albopicta* appears to be generally scattered in fragmented populations and mostly observed in spare specimens, as already noted by other authors (Medvedev, 1964; Tauzin, 2015). We confirm this condition in Turkey and the Levant, areas where we could directly observe the species or for which we received samples and information from colleagues. In addition, most of the records for which information on sample amount is available (40) are composed of one or few specimens (average 1.8). Notices of more abundant density can be inferred from the series of 15 specimens recorded for Stip, Macedonia (Mikšić, 1982), originally held by Institut für Pflanzenforschung in Eberswalde, four now held in Mikšić collection (Croatian Natural History Museum, Zagreb), and from the observations by G. Sabatinelli (pers. comm.) in two localities of the Levant: the species was observed in number in Chtaura (Lebanon, Beqaa Valley) and in southern Syria (40 Km S Damascus), in both cases about 20-30 specimens were observed with density of 2-3 specimens per flower, anyway considerably lower than the density of others *Oxythyrea* occurrying in the same area. It is worth mentioning that Rataj (1988) indicates the species as “very abundant”, without giving any further detail, an information that appears to be at least questionable.

Most of the records are concentrated in the central part of its range, between the northern slopes of Caucasus and southern Syria, including several original records that testify its widespread presence in eastern Turkey. Only scattered records are available east and west of this area. Eastwards there is surely a relevant lack of sampling, as suggested by its broad distribution in Iran being completely unknown before the recent contribution by Tauzin (2015). On the other hand, the almost complete absence of records between the Taurus range and Macedonia is less likely to depend on poor sampling, as this area has been much better explored in the recent decades. Its presence in Macedonia, indeed, was firstly reported by Dahlgren (1972) and then by Mikšić (1978, 1982) on the same series of specimens, and subsequently confirmed by additional records (Rozner & Rozner, 2009) for the same area.

As already observed by Tauzin (2015), this species is usually found mixed with much more abundant specimens of *O. cinctella*, an observation that we can confirm for all our field observations in Erzurum and Erzincan provinces and for the record of Tepehan (province of Malatya). This condition can be also inferred from some of the specimens from collections, namely those from Kale, Sivas and Kopeth Dagh, that we discovered unnoticed mixed among several *O. cinctella*. Given the mentioned dilution of *O. albopicta* among abundant populations of *O. cinctella* and the strong similarity of the two species, it is likely that *O. albopicta* is more widespread than what documented, although underestimated due to poor attention paid to *Oxythyrea* in areas where only *O. cinctella* is supposed to be present.

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LITERATURE CITED

Bezděk, A. 2016. Cetoniinae, pp. 367- 412. In: Löbl I. E Löbl D. (eds), Catalogue of Palaearctic Coleoptera. Volume 3, Scarabaeoidea, Scirtoidea, Dascilloidea, Buprestoidea, Byrrhoidea. Revised and updated edition. Brill; Leiden, Boston. XXVIII+983 pp.

Dahlgren, G. 1972. Zur Taxonomie der Gattungen *Aethiessa*, *Oxythyrea*, *Tropinota* und *Musurgus* (Col. Scarabaeidae). Entomologica Scandinavica, 3: 161-168.

Fairmaire, L. 1866. Notice sur les Coloptérès récoltés par M. J. Lédérer sur le Bosz-Dagh (Asie Mineure). Annales de la Société entomologique de France, (Ser. 4) 6: 249-280.

Medvedev, S. I. 1964. *Plastinchatousye (Scarabaeidae).* Podsem. Cetoniinae, Valginae. Fauna SSSR. Zhestkokrylye. Tom 10, vyp. 5. Izdatel'stvo Akademii Nauk SSSR, Moskva, Leningrad, 375 pp.

Mikšić, R. 1978. Eine weiterer Beitrag zur Kenntnis der jugoslawischen *Oxythyrea*-Arten. Acta Entomologica Jugoslavica, 14 (1-2): 69-71.

Mikšić, R. 1982. Monographie der Cetoniinae der paläarktischen und orientalischen Region. Band III. Forstinstitut in Sarajevo, Sarajevo, 529 pp.

Olsoufieff, G. 1916. Obzor bronzovok Kavkaza i sopredel'nikh stran. (Revision des Cetoines du Caucase et des pays limitrophes). Izvestia Kavkazskogo Muzeia, 10: 155-180.

Rataj, K. 1988. Zlatohlávkovití. Cetonidae. V. Díl. Cetoniini druhy palearktické oblasti. Karel Rataj, Vimperk, 175 pp.

Rozner, I. & Rozner, G. 2009. Additional data to the Lamellicornia fauna of Turkey (Coleoptera: Lamellicornia). Natura Somogyiensis, 15: 69-100.

Rozner, I. & Rozner, G. 2009. Data to the Lamellicornia fauna of the Republic of Macedonia. Natura Somogyiensis, 15: 57-68.

Shokhin, I. V. 2016. Contribution to the fauna of lamellicorn beetles (Coleoptera: Scarabaeoidea) of Southern Russia. Addition 1. Caucasian Entomological Bulletin, 12 (1): 75-79.

Tauzin, P. & Rittner, O. 2012. Cetoniinae of the Levant: chorological general survey (Coleoptera, Scarabaeidae). Le Coléoptériste, 15 (suppl.): 1-72.

Tauzin, P. 2015. Liste synonymique des espèces paléarctiques du genre *Oxythyrea* Mulsant, 1842 et précision sur *Oxythyrea albopicta* (Motschulsky, 1845) (Coleoptera, Cetoniinae, Leucocelina). Le Coléoptériste, 18 (2): 114-124.

Table 1. New records for *Oxythyrea albopicta*.

#	Locality	height	date	Legit	Specim.	Coll.
	TURKEY					
1	Bicakcilar, 25 Km N Sarigel [= Bıçakçılar; Sarıgöl]	-	13.7.1996	M. Sarovec	1♂1♀	MUCC
2	Gumushane, Kale	1500	13.VI.2009	F. Angelini	1	MUCC
3	Erzurum, Tortum, Suyatağı	1044	21.VII.2012	A. Polat	1	AUCE
4	Erzurum, Aşkale, Demirkıran	1712	11.VIII.2012	A. Polat	1♂	AUCE
5	Erzurum, Çat, Değirmenli	1938	11.VIII.2012	A. Polat	2♂3♀	AUCE
6	Erzurum, Tekman, Erduran	1938	11.VI.2012	A. Polat	2♂2♀	AUCE, MUCC
7	Sivas	-	-	-	1	RBINS
8	Bosz-Dagh bei Konia [= Bozdağl, near Konya]	-	-	[coll. Petrovitz]	1	MHNG
9	Erzincan	-	26.6	R. Petrovitz		MHNG
10	Erzincan, Road to Karadag	1450	11.6.2013	A. Polat & M. Uliana	2	MUCC, AUCE
11	Erzincan, 30 Km E of Erzincan	1230	10.6.2013	A. Polat & M. Uliana	3	MUCC, AUCE
12	Tunceli, Pulumur, Dereboyu	1709	8.8.2012	M. Yuksel	1♀	AUCE
13	Elazig, SW Elazig	-	9.6	R. Petrovitz	1	MHNG
14	Malatya, 3 Km N Tepehan	1190	21.5.2010	M. Uliana	4	MUCC
15	Bitlis prov., Bitlis, Kireçtaşı	1410	25.VII.2011	A. Polat	1♂	AUCE
	SYRIA					
16	muh. Dara'a, Bosra,	850	18.4.2005	N. Rahmé, A. Markus, A. Kotan, A.Podlussàny	1	HNHM
	ARMENIA					
17	Aragatsotn prov., Arai-Ler Mt., between 40°23'N 44°25'E and 40°24'N 44°26'E	-	19.5.1994	M. Kalashian	1	MUCC
	IRAN					
18	N Iran, Shemshak	-	-	Holzschuh	1	MHNG
	TURKMENISTAN					
19	Turkmenistan, Kopeth Dagh, Aj-Dere Pass	1000	9.IV.1992	V. Dolin	1	MUCC
	UZBEKISTAN					
20	Tien Shan, Silvestral reserve of Tshatkal, steppe meadow	1200	3.6.1981	O. Merkl	2	HNHM, MUCC
21	East Uzbekistan, Kuramynsky Mts., Kamtchyk pass	1800	7.6.1996	N. Khot'ko	1♂1♀	MUCC
	AFGHANISTAN					
22	umg. Kabul	1740	27.6.1952	J. Klapperich	1	HNHM

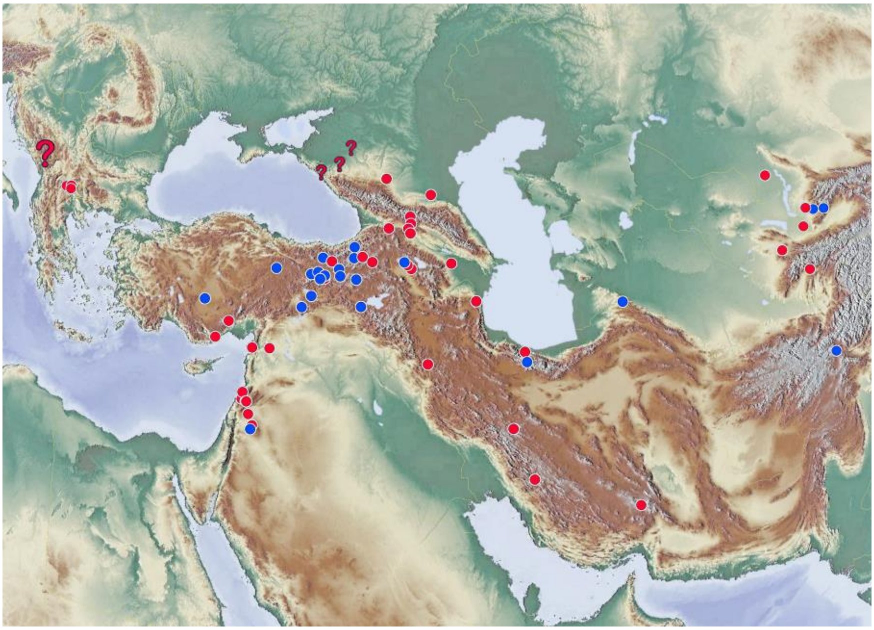

Figure 1. General distribution of *Oxythyrea albopicta*. Blue dots: original records. Red dots: literature records. ? = doubtful records (all from literature).

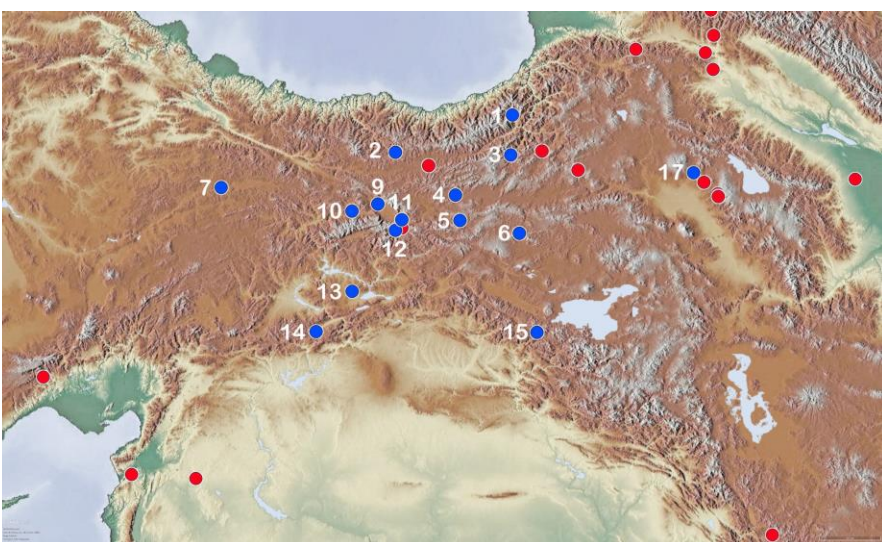

Figure 2. Details of distribution in eastern Anatolia and close areas. Blue dots: original records. Red dots: literature records. Numbers refers to entries of Table 1.

Figure 3. Habitat of *Oxythyrea albopicta* at 30 km E of Erzincan (Turkey, Erzincan), 10.VI.2013.

Figure 4. Habitat of *Oxythyrea albopicta* near Karadağ (Turkey, Erzincan), 11.VI.2013.

Figure 5. Habitat of *Oxythyrea albopicta* near Tepehan (Turkey, Mardin), 21.V.2010.

TWO NEW *DORCADION* DALMAN, 1817 (COLEOPTERA, CERAMBYCIDAE) FROM NİĞDE PROVINCE OF TURKEY

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[Danilevsky, M. L. 2017. Two new *Dorcadion* Dalman, 1817 (Coleoptera, Cerambycidae) from Niğde province of Turkey. Munis Entomology & Zoology, 12 (1): 323-327**]**

ABSTRACT: *Dorcadion gortovannyii* sp. n. close to *D. petrovitzi* Heyrovský, 1964 is described from Bulghar Ridge in about 7 km southwards Darboğaz (2500 m, 37°24'33"N, 34°33'51"E) in Niğde province of Turkey. *D. scabricolle antonkozlovi* ssp. n. close to *D. s. caramanicum* K. Daniel & J. Daniel, 1903 is described from Güney vill. environs (37°36'57"N, 34°29'50"E) in about 8 km northwards Ulukışla in Niğde province of Turkey. *D. s. caramanicum* is shortly redescribed. *D. s. yahyaliense* Bernhauer & Peks, 2011, stat. nov. is accepted. The sense of *D. blanchardi* Mulsant & Rey, 1863 is discussed.

KEY WORDS: New species, new subspecies, taxonomy, Cerambycidae, Lamiinae, *Dorcadion*, Niğde, Turkey

Two *Dorcadion* specimens collected in Niğde province of Turkey were recently received by me for study. Both are described below as holotypes of new taxons.

Dorcadion (Cribridorcadion) gortovannyii sp. n.

(Fig. 1)

Only one male available, body elongated, totally dark-brown, antennae, legs and elytra considerably lighter; frons with small, dense, regular punctation; vertex glabrous, with bigger punctation, with deep longitudinal furrow; genae about as wide as lower eye lobe; antennae rather thick, reaching apical elytral forth, 1st joint about as long as 3rd, 4th joint much shorter, 5th joint shorter than 4th; prothorax transverse, shorter than basal width, with short obtuse lateral tubercles; pronotum glabrous at centre, with rather scattered small irregular punctation, with large, smooth, shining areas; with shallow central furrow bearing strongly reduced white setae stripe; lateral sides of pronotum with very dense irregular conjugated punctation; scutellum round, very small; elytra oblong, about 1.9 times longer than central width, regularly oval, glabrous, shining, with very small scattered indistinct punctation; rough sculpture present just near humery only; narrow dense sutural white stripe present; narrow white marginal stripe is limited by epipleurae; humeral white stripe about totally reduced; poor traces of humeral stripes are hardly visible near elytral apices; legs with fine pale pubescence and reddish tibiae brushes; abdomen covered with very dense, pale, short recumbent pubescence; body length (from frons to elytral apices): 13.5 mm, body width: 4.9 mm.

The new species is close to *D. petrovitzi* Heyrovský, 1964 (Fig. 2) described from Namrun (37°10'7"N, 34°36'4"E) environs, because of same body colour, glabrous male pronotum and elytra, but *D. petrovitzi* smaller and wider; prothorax with longer acute lateral spines; male pronotum lusterless, with very dense small punctation; scutellum larger; male elytra with dense and distinct punctation; humeral white stripes present.

Dorcadion bulgharmaadense Breuning, 1946 was described from nearby (Bulghar-Maaden, 37°27'N, 34°37'26"E) on the base of a single female [the attribution of the original description to a male by Breuning (1962) was a mistake]. Male of *Dorcadion bulgharmaadense* is not known to me, but several female characters listed by Breuning (1946) definitely signify another species: black body colour with dark-red antennae and legs, long lateral thoracic spines, dense pronotal punctation, bigger size – 17 mm.

Materials. Holotype, male, Turkey, Niğde Province, about 7 km southwards Darboğaz, 37°24'33"N, 34°33'51"E, 2500 m, 11.06.2013, A. Kozlov & R. Gortovannyi leg. - author's collection.

Dorcadion petrovitzi Heyrovský, 1964; 1 male and 1 female (autochromal): "Asia minor mer., Namrun, 5.67, I. Dr. Schurmann" - author's collection.

Dedication. The new species is dedicated to Russian traveler entomologist Roman Sergeevich Gortovannyi (Zhukovsky, Moscow Region of Russia) for his help in author's entomological work.

Dorcadion (Cribridorcadion) scabricolle antonkozlovi ssp. n.

(Fig. 3)

A single male is available; the new subspecies is close to *D. s. caramanicum* K. Daniel & J. Daniel, 1903 (Figs 4-6) described from nearby (Bulghar-Maaden, 37°27'N, 34°37'26"E and Bulghar-Magara) because of very narrow humeral and sutural elytral stripes; lateral thoracic tubercles short and obtuse; but new subspecies has elongated bigger body; sparse pronotal punctation with wide smooth areas at centre; 1st antennal joint black; white basal elytral strokes absent; legs relatively dark with darkened distal parts of all femora; body length: 12.5 mm, body width: 4.7 mm.

D. s. caramanicum differs by short and wide body; pronotum with very dense small punctation; antennae black with red 1st joint; white basal elytral strokes distinct; legs totally red; body length in males: 10.5-12.0 mm, width: 4.2-4.5 mm; body length in female: 11.9 mm, width: 5.1 mm.

D. s. antonkozlovi **ssp. n.** could be regarded as close to another subspecies known from the region. *D. s. yahyalıense* Bernhauer & Peks, 2011, **stat. nov.** described as a species from Nigde province: "38 km ö. Yahyalı (120 km ö. Niğde)". But in fact *D. s. yahyalıense* is much more close to *D. s. caramanicum,* than to *D. s. antonkozlovi* **ssp. n.** because of wide, short body. The holotype of *D. s. yahyalıense* **stat. nov.** depicted by Bernhauer & Peks (2011: 224) is very similar to available males (Figs 4-5) of *D. s. caramanicum*. The area of *D. s. yahyalıense* **stat. nov.** is rather big (from about 120 km eastwards Niğde to 20 km north-westwards Niğde) and could include several different subspecies. Unfortunately the photos of the paratypes of *D. s. yahyalıense* **stat. nov.** are shown without labels of specimens. At least one paratype (Abb. 17) seems to have smooth, shining pronotum and must represent another very peculiar subspecies. The photos of *D. scabricolle* by Bernhauer & Peks, (2011: 224) also belong to specimens of uncertain origin hardly connected with the typical populations from Georgia.

Materials. Holotype, male, Turkey, Niğde province, Güney vill. environs, 37°36'57"N, 34°29'50"E, about 8 km northwards Ulukişla, 05.2014, A. Kozlov & R. Gortovannyi leg. - author's collection.

D. s. caramanicum K. Daniel & J. Daniel, 1903; 4 males and 1 (androchromal) female, "Klein Asien, Bulghar Maaden" [37°27'N, 34°37'26"E] – Zoological Museum of Moscow University. The type material of *D. s. caramanicum* most probably belong to available series.

Remarks. *D. scabricolle* (Dalman, 1817 - "Habitat in Georgia Asiae") was described from Georgia. Now 3 Georgian populations are known to me: Mtskheta environs, Hudadovsky forest (41°43'22"N, 44°49'11"E) in Tbilisi and Tbilisi Botanical Garden (41°41'N, 44°48'E).

Totally 18 subspecies of *D. scabricolle* are now accepted from West Anatolia to Iran. The descriptions of several more subspecies are now in preparation.

D. blanchardi Mulsant & Rey, 1863 also could be a subspecies of *D. scabricolle*. *D. blanchardi* was described from "Perse" (together with *D. hampii* Mulsant & Rey, 1863: 157 and *D. infernale* Mulsant & Rey, 1863: 158 – all from collection of Pellet). All three taxa are distributed in Anatolia, and the original geographical indications were wrong. The type localities of each taxon are not known now, and could be correctly identified on the base of comparisons of type specimens with available materials. If the type specimens can not be discovered, then the designations of neotypes are necessary. The situation with *D. blanchardi* is especially difficult as similar forms of *D. scabricolle* (with wide regularly oval body and wide elytral stripes) are known in different parts of Anatolia. My own series of "*D. blanchardi*" was collected in 5 km southwards Göksün. Specimens of "*D. blanchardi*" depicted by Bernhauer & Peks (2011: 226) must be also connected with Göksün, though all 3 are shown without labels. A male of *D. scabricolle* preserved in the collection of S.Murzin (Moscow) with old label "Syrie / M.Galant coll." is rather similar to the specimens from near Göksün. Kraatz (1888) recorded his "*D. blanchardi*" from Malatia. Breuning (1962: 461) recorded *D. blanchardi* from Malatia on the base of Kraatz data. *D. resadıyeense* Bernhauer & Peks, 2011 is most probably corresponds with "*D. blanchardi*" sensu Kraatz (1888).

So, most probably the local populations of *D. scabricolle* in different parts of Anatolia could be similar externally to each other and to our specimens from Göksün.

Dedication. The new species is dedicated to Russian traveler entomologist Anton Olegovich Kozlov (Moscow) for his help in author's entomological work.

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LITERATURE CITED

Bernhauer, D. & Peks, H. 2011. Fünf neue Arten der Gattung *Dorcadion* Dalm. aus dem mittleren bis östlichen Taurus (Coleoptera, Cerambycidae, Lamiinae). 6. Beitrag zur Kenntnis der türkischen Dorcadion. Coleoptera, 15: 215-227.

Breuning, S. 1946. Nouvelles formes de *Dorcadion* (Col. Cerambycidae). Miscellania Entomologia, 43: 93-132.

Breuning, S. 1962. Revision der Dorcadionini (Coleoptera, Cerambycidae). Entomologische Abhandlungen und Berichte aus dem Staatlichen Museum für Tierkunde in Dresden, 27: 1-665.

Daniel, K. & Daniel, J. 1903. Nova. von Hauptmann v. Bodemeyer in Kleinasien gesammelt. Münchener Koleopterologische Zeitschchrift, 1 [1902-1903]: 319-332.

Heyrovský, L. 1964. Eine neue *Dorcadion*-Art aus Kleinasien. Reichenbachia, 3: 97-98.

Kraatz, G. 1888. Anhang. 1. Dorcadion blanchardi Mulsant, 75-76S. In: Heyden L. F. J. D. von.: Neue und interessante Coleopteren aus Malatia in Mesopotamien. Deutsche Entomologische Zeitschrift, 32: 72-78.

Mulsant, E. & Rey, C. 1863. Longicornes nouveaux ou peu connus. Annales de la Société Linnéenne de Lyon, (2) 10: 144-184.

Figure 1. *D. gortovannyii* sp. n., male, holotype.

Figure 2. *D. petrovitzi*, male, “Asia minor mer., Namrun, 5.67, I.Dr. Schurmann”.

Figure 3. *D. scabricolle antonkozlovi* ssp. n., holotype, male.

Figures 4-5. *D. scabricolle caramanicum,* males, “Klein Asien, Bulghar Maaden”.

Figure 6. *D. scabricolle caramanicum,* female, “Klein Asien, Bulghar Maaden”.

HEMIPTERA (HETEROPTERA) FROM VARZEGHAN, NW IRAN: PENTATOMOMORPHA, NEPOMORPHA, GERROMORPHA, LEPTOPODOMORPHA

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ABSTRACT: In this project the fauna of 8 families dependent to infraorders Pentatomomorpha, Nepomorpha, Gerromorpha, Leptopodomorpha (Hemiptera: Heteroptera) including Pentatomoidae, Coreidae, Scutelleridae, Corixidae, Notonectidae, Gerridae, Hydrometridae, Saldidae we studied in Varzaqan and its vicinity, East-Azarbaijan provonce in the northwest of Iran. During 2011-2013 totally 24 species from 21 genera were identified.

KEY WORDS: Hemiptera, Heteroptera, Varzeghan, Iran

The true bugs (Hemiptera: Heteroptera) are aquatic, semi-aquatic and terrestrial species. Some terrestrials live in concealed habitats (e.g. beneath litter or bark, in the soil, etc.) (Anufriev et al., 1998). Corixidae feed on algae and small aquatic animals; all other water bugs, all bugs living on the surface of water (water striders) and at the shores (Saldidae, Ochteridae) are predacious. Most Pentatomomorpha are phytophagous, only some Lygaeidae and Pentatomidae secondarily became predacious (Anufriev et al., 1998). The terrestrial Heteroptera deposit eggs in plant tissues (Miridae, Nabidae, etc.) or lay them on the surface of plants and other objects (Reduviidae, all Pentatomomorpha) (Anufriev et al., 1998).

Varzeghan is a county which situated in East Azarbaijan province and jointed with Arasbaran protected area at the north west of Iran.

The fauna of Heteroptera from northwest of Iran was so far studied and published by Modarres (1987 & 1996), Farshbaf (2000), Sadeghi (2004), Sadaghian et al. (2004), Khalilzadeh et al. (2005), Askari et al. (2009), Gharaat et al. (2009), Hassanzadeh et al. (2009 a,b), Nateq Golestan et al. (2010), Havaskary et al. (2010, 2012), Nikdel et al. (2011). This research aimed to identification of recently collected Heteroptera from Varzegan region.

MATERIAL AND METHOD

The terrestrial specimens were collected by sweeping net, light trap, aspirator. Samplings were made durin 2011-2013. In aquatic collecting, nets were used to sweep the surface of the water. Identifications of the species were confirmed by Dr. P. Moulet (Museum Requien, France). The examined material was deposited at the Entomology Laboratory of Tabriz Islamic Azad University.

RESULTS

In the current project 24 species from 22 genera and 8 families were collected and identified. All of the species are new for Varzegan County. The list of species is given below.

Infraorder Pentatomomorpha
Family Coreidae Leach, 1815
Subfamily Coreinae Leach, 1815

***Centrocoris spiniger* (Fabricius, 1781)**

Material Examined: Astemal (4 specimens), 6 August 2011.

***Coreus marginatus marginatus* (Linnaeus, 1758)**

Material Examined: Sari Chaman (4 specimens), 20 June 2013; Gol Akhor (1 specimen), 5 June 2011; Joshin (2 specimens), 18 July 2013; Someh del (8 specimens), 18 May 2011.

***Syromastus rhombeus* (Linnaeus, 1767)**

Material Examined: Someh del (2 specimens), 18 May 2011.

Subfamily Pseudophloeinae Stål, 1868

***Ceraleptus gracilicornis* (Herrish-Shaffer, 1833)**

Material Examined: Siah Kalan (1 specimen), 5 June 2012.

***Coriomeris scabricornis* (Panzer, 1809)**

Material Examined: Baker Abad (1 specimen), 18 July 2013.

Family Pentatomidae Leach, 1815
Subfamily Pentatominae Leach, 1815

***Carpocoris* (*Carpocoris*) *fuscispinus* (Boheman, 1849)**

Material examined: Gol Akhor (4 specimens), 5 June 2012; Marz Abad (2 specimens), 12 May 2013; Central Dizmar (1 specimen) 5 June 2012; Arazil (5 specimens), 5 Agust, 2011; Lilab (2 specimens), 1 July 2013.

***Dolycoris baccarum* (Linnaeus, 1758)**

Someh del (8 specimens), 18 May 2011; Central Dizmar (6 specimens) 5 June 2012; Lilab (5 specimens), 1 July 2013.

***Aelia acuminata* (Linnaeus, 1758)**

Material examined: Azomdel (2 specimens) 12 May 2012; Joshin (5 specimens), 1 June 2013; Dizmar (3 specimens), 25 July 2013.

***Codophila varia* (Fabricius, 1787)**

Material Examined: Joshin (3 specimens), 1 June 2013.

***Apodiphus amygdali* (Germar, 1817)**

Material Examined: Central Dizmar (2 specimens) 5 June 2012; Sari Chaman (4 specimens), 20 June 2013.

***Sciocoris (Sciocoris) sulcatus* Fieber, 1851**

Material Examined: Sina (6 specimens), 5 June 2012.

***Eurydema ornata* (Linnaeus, 1758)**

Material Examined: Sina (9 specimens) 5 June 2012; Gol Akhor (6 specimens), 5 June 2012; Marz Abad (3 specimens), 12 May 2013; Central Dizmar (2 specimens) 5 June 2012; Arazil (12 specimens), 5 Agust, 2011.

***Graphosoma lineatum lineatum* (Linnaeus, 1758)**

Material Examined: Lilab (2 specimens), 1 July 2013.

Family Scutelleridae Leach, 1815
Subfamily Eurygastrinae Amyot & Serville, 1843

***Eurygaster integriceps* Puton, 1881**

Material Examined: Lilab (9 specimens), 1 July 2013; Sina (Many specimens) 5 June 2012; Gol Akhor (12 specimens), 5 June 2012; Marz Abad (3 specimens), 12 May 2013; Central Dizmar (8 specimens) 5 June 2012; Arazil (9 specimens), 5 Agust, 2011.

Subfamily Odontotarsinae Mulsant & Rey, 1866

***Odontotarsus purpureolineatus* (Rossi, 1790)**

Material Examined: Dizmar (2 specimens) 5 June 2012.

Infraorder Nepomorpha Popov, 1968
Famiy Corixidae (Leach, 1815)
Subfamily Corixinae Leach, 1815

***Corixa* sp.**

Material examind: Dashly chay Stream (3 specimens), 15 June 2013.

***Sigara (Eremocorixa) iranica* (Lindberg, 1964)**

Material Examined: Vardin Pond (3 specimens), 4 June 2013; Andergan River (2 specimens), 4 June 2013; Dizaj River (11 specimens), 25 June 2013; Dashiy chay Stream (6 specimens), 1 July 2013.

***Sigara (Vermicorixa) lateralis* (Leach, 1817)**

Material Examined: Dizaj Pond (1 specimen), 25 June 2013.

***Sigara (Pseudovermicorixa) nigrilineata nigrolineata* (Fieber, 1848)**

Material Examined: Dizaj Pond (24 specimens), 25 June 2013; Kheiradin Pond (15 specimens), 26 June 2013; Dashly chay Stream (15 specimens), 7 July 2013; lalelu Pond (4 specimens), 6 September 2013; Kasin Pond (41 specimens), 27 septanber 2013.

Family Notonectidae (Latreille, 1802)
Subfamily Notonectinae Latreill, 1802

***Notonecta viridis* (Delcourt, 1909)**

Material Examined: Dashly chay Stream (7 specimens), 25 June 2013; Astemal River (8 specimens), 13 September 2013; Dizaj Pond (2 specimens), 7 October 2013.

Inferaorder Gerromorpha Popov, 1971
Family Gerridae (Leach, 1815)

***Gerris* (*Gerris*) *costae fiebri* (Stichel, 1938)**

Material Examined: Arzil River (3 specimens), 25 June 2013; Dashly chay Stream (1 specimen), 7 July 2013; Lalelu Pond (2 specimens), 6 September 2013.

***Gerris* (*Gerris*) *thoracicus* (Schummel, 1832)**

Material examind: Varzaqun River (2 specimens), 4 June 2013; Lalelu Pond (2 specimens), 6 September 2013; Dizaj Pond (3 specimens), 29 September 2013.

Family Hydrometridae (Bilberg, 1820)
Subfamily Hydrometrinae Billberg, 1820

***Hydrometra stagnorum* (Linnaeus, 1758)**

Material Examined: Arzil River (1 specimen), 25 June 2013; Andargan River (1 specimen), 25 June 2013; Dashly chay Pond (1 specimen), 15 July 2013.

Infera order Leptopodomorpha Popov, 1971
Family Saldidae (Amyot & Selville, 1843)

Subfamily Saldinae Amyot & Selvil, 1843

***Saldula arenicola* (Scholtz, 1874)**

Material Examined: Around the Andargan basin. (1 specimen), 25 June 2013; Dashly chay Stream (1 specimen), 25 June 2013.

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LITERATURE CITED

Anufriev, G. A., Danzing, E. M., Emeljanov, A. F., Kanyukova, V. B., Kerzhner, I. M., Konovalova, Z. A., Pashchenko, N. F., Tshernova, G. P. & Vinokurova, N. N. 1988. Key to the Insect of the Far East of the USSR, Volume II. Homoptera and Heteroptera, Akademy of Science of the USSR Far East Branch institute of Biology and Soil science, Leningrad Nauka Publishing House. Hereoptera section, 250 pp.

Askari, O., Pourabad, R. F. & Khaganinia, S. 2009. Faunistic study of Heteroptera of Zanjanroud region in Zanjan province of Iran. Munis Entomology & Zoology, 4 (2): 560-563.

Aukema, B. & Rieger, C. 2006. Catalogue of the Heteroptera of the Palaearctic Region. Volume 5. Pentatomomorpha II[M]. Amsterdam: The Netherlands Entomological Society. 550 pp.

Farshbaf Pour-Abad, R. 2000. Heteroptera fauna of Alfalfa fields of Maragheh and nearby cities. 14th Iranian plant Protection congress, Isfahan University of Technology, Iran, Volume 1, p. 232.

Gharaat, M. A., Hassanzaheh, M., Safaralizaheh, M. H. & Fallahzadeh, M. 2010. Determination Notes on the true bug (Heteroptera) fauna of Azerbaijan province, Iran. Turk. J. Zool., (TUBITAK), 33: 421-31.

Hassazadeh, M., Pourabad, R. F., Gharaat, M. A. & Beykpor, A. R. 2009. A study on the Heteroptera fauna of Shend Abad region and environ (Iran). Munis Entomology & Zoology, 4 (2): 527-530.

Hassanzadeh, M., Farshbaf, P. R. & Shayesteh, N. 2009. An investigation on some Heteroptera in Marand region (Iran)[J]. Munis Entomology & Zoology, 4 (1): 19-24.

Havaskary, M., Hosseinpor, F. & Modaress Awal, M. 2010. Cimicomorpha and Pentatomomorha of Alfalfa from Mashhad and vicinity, NE Iran. Munis Entomology & Zoology, 5 (1): 253-261.

Havaskary, M., Farshbaf Pour-Abad, R., Kazemi, M. H. & Rafeii, A. (2012) A contribution to the stink bugs from Khodafarin, NW Iran (Heteroptera: Pentatomidae: Pentatominae). Munis Entomology & Zoology, 7 (1), 607–616.

Khalilzadeh, A. R., Farshbaf, P. R., Kazemi, M. H. et al. 2005. Heteroptera of pasture in Azarshahr region (East Azarbayjan) [J]. Journal of Forest and Pasture, , 76/77: 77-83 (In Persian with English Summary).

Modarres Awal, M. 1987. Collecting and determining of the fauna of Heteroptera in Ardabil area and Research Station of University of Tabriz in Moghan[J]. Journal of the Entomological Society of Iran, 9: 15-28 (In Persian with English Summary).

Modarres Awal, M. 1996. Studies on some Cimicomorpha and Pentatomorpha (Heteroptera) fauna in Ardabil Province [J]. Journal of Agricultural Science and Technology (Mashhad University), 10(1): 102-112 (In Persian with English Summary).

Modarres Awal, M. 2002. List of agricultural pests and their natural enemies in Iran. III. Ed, Univ. Ferdowsi, Mashhad, 429 pp.

Nateq Golestan, M. Safaralizadeh, M. H. & Sarafrazi, A. 2010. Preliminary study on Pentatomids in West Azerbaijan province of Iran (Heteroptera). Munis Entomology & Zoology, 5 (2): 686-691.

Nikdel, M., Dordaei, A. A. & Matocq, A. 2011. Faunistic study on Hemiptera in Arasbaran area (East Azarbaijan province, Iran). Munis Entomology & Zoology, 6 (1): 389-395.

Sadeghi, R. 2004. Collecting and determining of Heteroptera fauna of Ghorigol and vicinity[D]. Tabriz: Tabriz University. 90 pp. (In Persian with English Summary).

Sadaghian, B., Dordaei, A. A. & Nikdel, M. 2004. An investigation on some Heteroptera in Arasbaran forests. 16th Iranian Plant Protection Congress, 1: 128.

SOME ADDITIONAL NOTES ON THE GENUS *OCYPUS* STEPHENS IN TURKEY (COLEOPTERA: STAPHYLINIDAE: STAPHYLININAE)

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[Özgen, İ., Yaman, S. & Örgel, S. 2017. Some additional notes on the genus *Ocypus* Stephens in Turkey (Coleoptera: Staphylinidae: Staphylininae). Munis Entomology & Zoology, 12 (1): 332-335**]**

ABSTRACT: In this study, 10 species of the genus *Ocypus* were reported from different parts of Turkey. Many new localities have been found for some species which have already been reported in Turkey. *Ocypus curtipennis* (Motschulsky, 1849), *O. exicus* (Müller, 1950) and *O. mus* (Brullé, 1932) are found the most common and abundant species in this country.

KEY WORDS: Staphylinidae, Staphylininae, Ocypus, Turkey

According to recent contributions, nearly 1900 species of the family Staphylinidae are distributed from Turkey, 350 of them are belonging to the subfamily Staphylininae. (Anlaş, 2007, 2009; Abacıgil et al., 2013; Schülke & Smetana, 2015; Fırat & Sert, 2016).

The genus *Ocypus* Leach, 1819 contains more than 160 species in the Palaearctic region (Schülke & Smetana, 2015), 35 of which occur in Turkey (Anlaş, 2009).

Distribution of the Turkish *Ocypus* species are still poorly studied. The aim of this study is to enhance scientific knowledge on the distribution of Turkish *Ocypus*.

MATERIAL AND METHODS

The present paper is based primarily on material collected in different parts of Turkey by using different collection methods in 2006-2011. Material is deposited in the private collection of the first author. Classification and nomenclature of the *Ocypus* suggested by Herman (2001) and Smetana (2004) has been followed in this study.

The specimens of *Ocypus* were collected from fields in different parts of Turkey, between 2006-2011. Classification and nomenclature of the genus *Ocypus* suggested by Herman (2001), Anlaş (2009) and Schülke & Smetana (2015) have been followed in this study. The reference specimens of this study are deposited in the collection of the Alaşehir Zoological Museum, Manisa (AZMM) of the Celal Bayar University and in the private collection of the first author.

RESULTS

Ocypus curtipennis Motschulsky, 1849

Material examined: Bursa: 2 exs., 08.VI.2007, Uludağ, Aynalı lake, leg. Koç (AZMM). **Diyarbakır:** 4 exs., 01.III.2008, Çermik 4 km S, 38°07'11"N, 39°27'43"E, leg Özgen (cOzg). **Elazığ**: 4 exs., 30. X.2010, Central province, Doğukent, 38°40'50"N, 39°15'42"E, 1080m, leg. Özgen (cOzg). **Gaziantep**: 3 exs., 22.III.2008, Gaziantep University campus, 37°02'10"N 37°18'23"E, leg Yağmur (AZMM); 3 exs., 19.XI.2006, Islahiye, Kabaklar village 1 km S, 37°02'09"N, 36°34'39"E, leg. Yağmur (AZMM); 2 exs., 01.X.2009, Oğuzeli leg Yağmur (AZMM); 3 exs., 12.XI.2010, Şahinbey, Sarısalkım, leg. Yağmur (AZMM); 1 ex., 17.XI.2010, Şahinbey, Sarısalkım, leg. Yağmur (AZMM). **Hatay**: 3 exs., 15.XI.2010, Hassa, Zeytinoba, village, leg.Yağmur (AZMM). **İzmir:** 2 exs., 28.V.2010, Buca, Kaynaklar, 38°21'43"N, 27°17'19"E, 365m, leg. Anlaş (AZMM); 3 exs., 30.X.2010, Buca, Kaynaklar, leg. Anlaş (AZMM). **Kahramanmaraş**: 2 ex, 01.VIII.2010 Türkoğlu, Narlı 5 km N, 37°19'12"N, 37°10'13"E, 777 m, leg. Anlaş (AZMM). **Kırklareli:** 3 exs., 12.IV.2008, Vize, Kıyı village, Selvez, leg. Kunt (AZMM); 2 exs., 01.X.2009, Demirköy, Dupnisa-Sarpdere road, leg. Kunt (AZMM); 1 ex., (Date unknown), Demirköy, Sarpdere village, leg. Kunt (AZMM). **Kilis:** 2 exs., 01.X.2009, Polatli road 2 km S, 36°46'06"N, 37°04'17"E, leg.Yağmur (AZMM). **Manisa:** 2 exs., 28.VIII.2007, Gölmarmara, Akpınar, 1 km E, 38°42'15"N, 27°58'56"E, 67m, leg. Anlaş (AZMM); 2 exs., 12.XI.2006, Turgutlu, Çıkrıkçı-Baktırlı road, leg. Anlaş (AZMM); 3 exs., 01.XI.2010, Gölmarmara, Beyler 1 km NE, 38°42'10"N, 27°58'56"E, 120m, leg. Anlaş (AZMM).

Distribution in Turkey: Bolu, Elazığ, Giresun, Izmir, Mardin, Manisa (Anlaş, 2009; Özgen & Anlaş 2010). First record of the European part of Turkey.

Ocypus excisus (G. Müller, 1950)

Material examined: Adıyaman: 2 exs., 18.III.2007, Gölbaşı, Kösüklü, leg Yağmur (AZMM). **Diyarbakır:** 4 exs., 25.V.2011, Çınar, leg. Özgen (cOzg). **Gaziantep**: 1 ex., 31.III.2007 Şehitkamil, Kartalyücesi mts., 37°04'08"N, 36°55'04"E, leg.Yağmur (AZMM); 1 ex., 13.XI.2010, Nizip, Bilek village, 10 km W, leg Yağmur (AZMM); 4 exs., 17.III.2007 Center, Şahinbey, Sofalıcı village, Sof mts., 37°08'42"N, 37°07'44"E, leg. Yağmur (AZMM); 2 exs., 13.XI.2010 Sof mts, leg Yağmur (AZMM); 1 ex., 18.III.2007 Şahinbey, Ozanlı village, S of Burç village, leg.Yağmur (AZMM); 2 exs., 12.XI.2010, Sarısalkım, leg. Yağmur (AZMM); **Kilis:** 3 exs., 11.III.2007, Elbeyli, Çanak village 1 km W, leg Yağmur (AZMM). **Manisa:** 1 ex., (Date unknown), Spil mts, national Park, 1200 m, leg. Anlaş (AZMM); 3 exs., 17.V.2007, Soma, Hamidiye, 39°16'33"N, 27°45'50"E, 827m, leg. Anlaş (AZMM); 1 ex., 28.III.2008, Gördes, Karaağaç village, leg. Anlaş (AZMM). **Şanlıurfa**: 3 exs., 24.XII.2006, Central province, Tektek mts., 36°49'55"N, 39°12'08"E, 426m, leg. Koç (AZMM); 2 exs., 24.XII.2006, Central province, Tektek mts, 36°49'50"N, 39°12'13"E, 462m, leg. Koç (AZMM); 2 exs., 18.III.2007, Birecik 10 km E, Arat mts., leg. Yağmur (AZMM); 3 exs., 23.III.2008, Birecik, Çiçekalan village 2 km N, Karadağ mts., leg Yağmur (AZMM); 1 ex, 23.XII.2006, Birecik 10 km N, Arat mts., leg. Yağmur (AZMM); 1 ex., 11.IV.2008, Siverek, Güvercin village, 37°51'54"N, 39°17'41"E, 820m, leg. Yağmur (AZMM).

Distribution in Turkey: *Ocypus excisus* is known from Turkey but without precise locality (Anlaş, 2009). Thus, this species is here reported for the first time with the precise locality informations for Turkish fauna.

Ocypus fulvipennis Erichson, 1840

Material examined: Erzincan: 4 exs., 16.V.2011, Central province, Ahmetli, 39°53'55"N, 39°23'33"E, 1914m, leg. Khachikov & Özgen (AZMM, cOzg).

Distribution in Turkey: Ankara, Bayburt, Bolu, Giresun, Izmir, Manisa, Sakarya (Anlaş, 2009; Assing, 2013; Firat & Sert, 2016). First record for Eastern Anatolia Region.

Ocypus helleni G. Müller, 1926

Material examined: Diyarbakır: 4 exs., 14.IV.2010, Silvan 3 km N, Köçek mts., 38°11'21"N, 41°00'30"E, 1185m, leg. Özgen (cOzg). **Hakkari**: 1 ex., 19.V.2010, Çukurca 1 km, leg. Yağmur (AZMM). **Muş**: 2 exs., 30.V.2011, Buglan, leg. Khachikov (AZMM).

Distribution in Turkey: Ankara, Ardahan, Elazığ, Erzurum, Eskişehir, Kayseri, Konya (Anlaş, 2009; Kesdek et al, 2009; Özgen et al., 2015; Firat & Sert, 2016). First record for Southeastern Anatolia Region.

Ocypus mus (Brullé, 1832)

Material examined: Balıkesir: 2 exs., 30.X.2009, Altınoluk, Adatepe, 29°34'24"N, 26°37'18"E, 300m, leg. Anlaş (AZMM). **Bursa:** 2 exs., 25.IX.2010, Uludağ, Bayraklı, leg. Kunt (AZMM). **Diyarbakır:** 5 exs, 26.V.2011, Çınar, leg. Özgen (cOzg). **Eskişehir**: 2 exs.,

10.XI.2010, Meşelik, pitfall traps. leg. Kunt (AZMM). **Gaziantep**: 3 exs., 25.V.2007, Şehitkamil, Sofalıcı 5 km SW, 37°07'44"N, 37°05'13"E, leg. Anlaş (AZMM); 1 ex., 18.XI.2006,Nizip, Bilek village 10 km W, , leg. Yağmur (AZMM); 4 exs. 18.XI.2006, Nizip, Bilek village 10 km W, leg. Yağmur (AZMM); 3 exs., 18.XI.2006, Islahiye, Fevzipaşa, 37°06'10"N, 36°38'59"E, leg.Yağmur (AZMM). **Hatay**: 4 exs., 01.X.2009, Hassa, Koruhöyük village 5 km E, 36°48'54"N, 36°36'43"E, leg. Yağmur (AZMM); 3 exs, 15.XI..2010, Yayladağı, Leylekli 2 km, leg.Yağmur (AZMM). **Izmir:** 2 exs., 28.V.2010, Buca, Kaynaklar, leg. Anlaş (AZMM); 2 exs., 04.V.2010, Buca, Kaynaklar, leg.Yağmur (AZMM); 1ex., 11.XII.2010, Buca, Kaynaklar, leg. Anlaş (AZMM); 2 exs., 03.IV.2010, Buca, Kaynaklar, leg. Anlaş (AZMM); 3 exs., 08.V.2010, Ödemiş, Bozdağlar, road to ski resort, ca. 38°21'26"N, 28°06'52"E, 1600m, leg. Anlaş (AZMM); 4 exs, 02.III.2008, Bozdağ, 2500m, leg. Anlaş (AZMM); 3 exs., 21.V.2006, Torbalı, Orman village, leg. Anlaş (AZMM); 1 ex., 31.XII.2009 Bozdağ, 2500m, leg. Anlaş (AZMM). **Kahramanmaraş:** 1 ex., 19.XII.2009, Pazarcık, Çınar village 2 km N, 37°29'49"N, 37°20'25"E, leg.Yağmur (AZMM); 2 exs., 15.XI.2010, Narlı 3 km. N, 37°19'33"N, 37°09'38"E, 696m, leg. Yağmur (AZMM). **Kırklareli:** 1ex, 03.X.2009, Demirköy, Dupnisa-Sarpdere road, leg. Kunt (AZMM); 4 exs., 24.XII.2006, Demirköy, leg. Kunt (AZMM). **Manisa:** 1 ex., 21.X.2006, Alaşehir, Azıtepe, 700m, leg. Anlaş (AZMM), 1ex., 27.IX.2008, Spil National Park, ca. 38°33'06"N, 27°23'42"E, 1000m, leg. Anlaş (AZMM); 2 exs., 21.V.2006, Turgutlu, Çıkrıkçı-Baktırlı road, leg. Anlaş (AZMM); 1 ex., 31.III..2007, Kula, Sarnıçköy. leg. Anlaş (AZMM); 1 ex., 28.III.2007, Saruhanlı, Bedeller village, leg. Anlaş (AZMM); 1 ex., 15.II.2008, İzmir border, leg. Anlaş (AZMM); 1 ex., 08.III.2008, Ahmetli, Derici village, leg. Anlaş (AZMM). **Mardin**: 2 exs, 30.I.2008, Yeşilli, leg. Özgen (cOzg).
Distribution of Turkey: This species is widespread in Turkey (Anlaş, 2009, Anlaş & Rose, 2009; Japoshvili & Anlaş, 2011; Abacıgil et al., 2013; Assing, 2013; Çiftçi & Hasbenli, 2016; Fırat & Sert, 2016).

Ocypus nitens (Schrank, 1781)

Material examined: Kırklareli: 4 exs., 03.X.2009, Demirköy**,** leg. Kunt (AZMM).
Distribution in Turkey: Balıkesir (Anlaş, 2009; Abacigil et al, 2013). First record of the European part of Turkey.

Ocypus olens (O. Müller, 1764)

Material examined: Gaziantep: 2 exs., 12.XI.2010, Sakçagözü Hill, 1008m, leg.Yağmur (AZMM).
Distribution in Turkey: İzmir, Manisa, Mersin, (Anlaş, 2009). First record for Southeastern Anatolia Region.

Ocypus orientis Smetana & Davies, 2000

Material examined: Gaziantep: 6 exs., 18.XI.2010, Islahiye, Kabaklar, leg. Yağmur (AZMM). **Muş**: 2 exs., 30.V.2011, Buglan, leg. Kasatkin & Khachikov (AZMM).
Distribution of Turkey: Balıkesir, Bursa, Isparta, Izmir, Manisa (Anlaş,2009; Anlaş & Rose, 2009; Japoshvili & Anlaş, 2011; Abacıgil et al., 2013). First record for Eastern and Southeastern Anatolia Regions.

Ocypus picipennis picipennis (Fabricius, 1793)

Material examined: Diyarbakır: 2 exs., 25.V.2011, Çınar, leg. Özgen (cOzg). **Gümüşhane:** 7 exs., 16.V.2011, Kelkit, Çimenli, 39°58'06"N, 39°22'48"E, 1689 m, leg.Özgen & Anlaş (AZMM).
Distribution in Turkey: This species is widespread in Turkey (Anlas, 2009; Fırat & Sert, 2016).

Ocypus sericeicollis (Ménétriés, 1832)

Material examined: Adıyaman: 3 exs., 05.IV.2008, Gölbaşı, Karakuyu village, 1 km W, 37°41'52"N, 37°38'14"E, 1210m, leg. Yağmur (AZMM). **Diyarbakır:** 3 exs, 17.XI.2010, Eğil, Kalkan, leg.,Özgen (cOzg). **Eskişehir**: 2 exs., 10.XI.2010, Sivrihisar, pitfall traps, leg. Kunt (AZMM). **Gaziantep:** 2 exs., 12.V.2007, Islahiye, Fevzipaşa, 37°06'10"N, 36°38'59"E, leg. Yağmur (AZMM); 6 exs., 13.XI.2010, Şahinbey, Kartal 1 km. S, leg. Yağmur (AZMM). **Hatay:** 3 exs., 28.III.2007, Hassa 4 km N 36°09'13"N, 36°32'09"E, leg. Yağmur (AZMM),

İzmir: 2 exs., 02.III.2008, Karaburun, Hasseki, 38°38'17"N, 26°24'13"E, 415m, leg. Anlaş (AZMM); 1 ex., 15.II.2008, Bozdağ, 2500 m, leg. Anlaş & Yağmur (AZMM). **Kahramanmaraş:** 1 ex, 2007, Pazarcık, Çınar village 2 km N, 37°29'49"N, 37°20'25"E, leg. Yağmur (AZMM). **Şanlıurfa**: 1 ex., 29.III.2008, Halfeti 2 km S, 37°14'23"N, 37°52'35"E, leg. Yağmur (AZMM); 5 exs., 16.XI.2010, Diyarbakır vicinity, 37°49'12"N, 39°38'01"E, 1103m, leg. Özgen (cOzg). **Şırnak:** 2 exs., 08.III.2008, Dicle river 4 km W, Yalıntepe village, leg. Özgen (cOzg).
Distribution of Turkey: This species is widespread in Turkey (Anlaş, 2009; Fırat & Sert, 2016).

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LITERATURE CITED

Abacıgıl, T., Varlı, S. & Tezcan, S. 2013. Faunistic studies on Staphylininae (Coleoptera: Staphylinidae) in Kazdağları (Balıkesir province) in Turkey. Munis Entomology & Zoology, 8 (1): 415-433.

Anlaş, S. 2007. The present situation Staphylinidae (Coleoptera) fauna of Turkey. Linzer biologische Beiträge, 39 (2): 5-9.

Anlaş, S. 2009. Distributional checklist of the Staphylinidae (Coleoptera) of Turkey, with new and additional records. Linzer biologische Beiträge, 41: 215-342.

Anlaş, S. & Rose, A. 2009. Some additional notes about Staphylininae (Coleoptera: Staphylinidae) fauna of Turkey. Munis Entomology & Zoology, 4 (2): 327-333.

Assing, V. 2013: On the Staphylinidae (Coleoptera) of Turkey IX. Five new species, a new synonymy, and additional records. Stuttgarter Beiträge zur Naturkunde A, Neue Serie 6: 103-125.

Çiftçi, D. & Hasbenli A. 2016. Faunistic studies on Steninae, Paederinae and Staphylinae (Coleoptera: Staphylinidae) from Sündiken Mountains (Turkey). Entomofauna, 37 (6): 101-136.

Fırat, S. & Sert, O. 2016. Faunistic and zoogeographical composition and preliminary evaluations of some ecological features of the subfamily Staphylininae (Coleoptera: Staphylinidae) of the Central Anatolian Region of Turkey. Turkish Journal of Zoology, 40 (1): 164-185.

Herman, L. H. 2001. Catalog of the Staphylinidae (Insecta: Coleoptera). 1758 to the end of the second millennium. V.Staphylinine Group (Part 2). Staphylininae: Diochini, Maorothiini, Othiini, Platyprosopini, Staphylinini (Amblyopinina, Anisolinina, Hyptomina, Philonthina). Bulletin of the American Museum of Natural History, 265: 2441-3020.

Japoshvili, G. & Anlaş, S. 2011. Notes on the family Staphylinidae (Coleoptera) collected by Pitfall traps in Gölcük Natural Park, Isparta Province of Turkey. J. Entomol. Res. Soc., 13: 41-48.

Kesdek, M., Yıldırım, E., Anlaş, S. 2009. Contribution to the knowledge of Staphylinidae (Coleoptera) fauna of Turkey. Munis Entomology& Zoology, 4 (2): 355-364.

Schülke, M. & Smetana, A. 2015. Hydrophiloidea e Staphylinoidea. In: Löbl I, Löbl D, Editors. Catalogue of Palaeartic Coleoptera. Revised and Updated Edition, Volume 2/2. Leiden: Brill. pp. 1007e1134.

Smetana, A. 2004. Family Staphylinidae (except subfamilies Pselaphinae and Scaphidiinae). In: Löbl I. & A. Smetana (eds), Catalogue of Palaearctic Coleoptera. Volume 2. Hydrophiloidea, Histeroidea, Staphylinoidea. Apollo Books, Stenstrup: 237-698.

Özgen, İ. & Anlaş, S. 2010. A cow dung investigation on Staphylinidae (Coleoptera) with a new record from Turkey. Munis Entomology & Zoology, 5 (2): 642-645.

Özgen, İ. & Anlaş, S., Khachikov, E. A. & Akın, T. 2015. Contribution to the knowledge of Staphylininae (Staphylinidae, Coleoptera) in Elazığ province of Turkey. Journal of Entomology and Zoology Studies, 3 (1): 224-226.

FAUNISTIC STUDY OF CIMICOMORPHA FROM TABRIZ AND VICINITY, NW IRAN (HEMIPTERA: HETEROPTERA)

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ABSTRACT: In this research the fauna of Cimicomorpha (Hemiptera: Heteroptera) from Tabriz and its surrounding ranges (East Azarbaijan province, Iran) is studied during 2012-2015. Totally 38 species from 28 genera of families Anthocoridae (3 genera and 4 species), Miridae (16 genera and 21 species), Tingidae (5 genera and 5 species) and Reuviidae (4 genera and 7 species) were determined.

KEY WORDS: Hemiptera, Heteroptera, Cimicomorpha, Fauna, Tabriz, Iran

The true bugs (Heteroptera) with more than 40,000 described species are a large and widely distributed group of insects (Weirauch & Schuh 2011). Most species are terrestrial, but many are aquatic and semi- aquatic. Terrestrial species are often associated with plants and feed in vascular tissues or on the nutrients stored within seeds. Other species live as scavengers in the soil or underground in caves or ant nests. Still others are predators on a variety of small arthropods. A few species even feed on the blood of vertebrates. Bed bugs, and other members of the family Cimicidae, live exclusively as ectoparasites on birds and mammals (including humans). Aquatic Heteroptera can be found on the surface of both fresh and salt water, near shorelines, or beneath the water surface in nearly all freshwater habitats. With only a few exceptions, these insects are predators of other aquatic organisms (Meyer, 2016). Within the true bugs (Heteroptera), Cimicomorpha with more than 20,000 species, now currently placed in 17 families (Weirauch & Schuh, 2011).

Tabriz (the studied area) has a semi-arid climate with regular seasons. The annual precipitation is around 280 millimeters (11 in), a good deal of which falls as snow during the winter months and rain in spring and autumn. The city enjoys mild and fine climate in spring, dry and semi-hot in summer, humid and rainy in autumn and snowy cold in winter. The average annual temperature is 12.6 °C (54.7 °F). Cool winds blow from east to west mostly in summer. This county with 2270 km ^{2} area is situated in the north-western part of Iran (Fig. 1). Four cities and 76 villages comprise an overall population of approximately 1.58 million. Elevations range from 1320 to 3710 meters above sea level. Tabriz County contains some of the most important human habitations in the East Azerbaijan province and includes its major industrial and agricultural centers. Agriculture is one of the main sources of income for the population (Feizizadeh, 2008; Feizizadeh & Blaschke, 2012).

In the North West of Iran (East and West Azarbaijan, Ardabil provinces) , Aras River is one of the world significant aquatic ecosystems with high biodiversity which flows in and along the countries of Turkey, Armenia, Azerbaijan, and Iran and Protection of the ecosystem is an essential requirement.

Although a good effort by Aras Free Zone organization in Iran is done to preserve this aquatic ecosystem (Fig. 2). But implementing a serious comprehensive coordinated program between countries of Armenia, Turkey, Azerbaijan and Iran is essential and otherwise serious danger threatens the biodiversity survival of these habitats.

MATERIALS AND METHODS

The fauna of Iranian Cimicomorpha (Hemiptera: Heteroptera) from East Azarbaijan studied by Modarres Awal (1987,1996, 1997, 1998), Baroughi (1997), Farshbaf Pour-Abad (2000), Sadaghian et al. (2004), Khalilzadeh (2008), Askari et al. (2009), Sadeghi et al. (2009), Khaghaninia et al. (2010a,b,c, 2011, 2013), Arkani et al. (2011), Ebrahimi et al. (2012), Havaskary (2012).

In this research, the specific name, author and description date, locality and date of collection for species are provided. The system and nomenclature follow principally Aukema & Rieger (1999).

RESULTS

A total of 38 species from 28 genera of four families Anthocoridae (3 genera and 4 species), Miridae (16 genera and 21 species), Tingidae (5 genera and 5 species) and Reuviidae (4 genera and 7 species) are listed in this paper.

Family Anthocoridae
Subfamily Anthocorinae

***Anthocoris nemoralis* (Fabricius, 1794)**

Material examined: Esfanjan (2 specimens), 12 May 2012.

***Anthocoris pilosus* (Jakovlev, 1877)**

Material examined: Khosrow shahr (2 specimens), 2 June 2012.

***Orius niger* (Wolff, 1811)**

Material examined: Esfanjan (4 specimens), 12 May 2012; Khosrow shahr (5 specimens), 8 June 2013; Tazeh Kand (3 specimens) 20 May 2014.

***Temnostethus reduvinus parilis* (Horváth, 1891)**

Material examined: Julfa (1 specimen), 30 May 2014.

Fmaily Miridae
Subfamily Bryocorinae

***Dicyphus (Dicyphus) eckerleini* Wagner, 1963**

Material examined: Bostan Abad (2 specimens), 5 July 2015.

***Macrolophus* sp.**

Material examined: Julfa (3specimens),30 May 2015.

Subfamily Deraeocorinae

***Bothynotus pilosus* (Boheman, 1852)**

Material examined: Azarshahr (2 specimens), 24 May 2013.

***Deraeocoris lutescens* Schilling, 1837**

Material examined: Iilkhchi (3 specimens), 8 Junly 2015; Marand (4 specimens), 1 June 2014.

***Deraeocoris punctulatus* Fallén, 1807**

Material examined: Akhula (7 specimens), 29 May 2014; Teimourlu (6 specimens), 30 May 2014; Tazeh Kand (9 specimens), 4 June 2013; Esfanjan (3 specimens), 12 May 2012; Khajeh (2 specimens), 5 June 2015.

Subfamily Mirinae

***Camponotidea fieberi* Reuter, 1879**

Material examamened: Bostan Abad (2 specimens), 1 June 2014.

***Adelphocoris lineolatus* Goeze, 1778**

Material examined: Sardrod (25 specimens) 15 July 2015; Akhula (12 specimens), 29 May 2014; Mayan (15 specimens) 22 July 2015; Teimourlu (18 specimens), 30 May 2014; Tazeh Kand (21 specimens), 4 June 2013; Esfanjan (9 specimens), 12 May 2012; Khajeh (16 specimens), 5 June 2015.

***Charagochilus gyllenhali* Fabricius, 1807**

Material examined: Teimourlu (2 specimens), 30 May 2014.

***Eurystylus bellevoyei* Reuter, 1879**

Material Examined: Esfanjan (4 specimens), 12 May 2012; Sardrod (5 specimens) 15 July 2015.

***Lygus gemellatus* Herrich-Schaeffer, 1835**

Material Examined: Sardrod (3 specimens) 15 July 2015; Tazeh Kand (5 specimens), 4 June 2013; Bostan Abad (7 specimens), 18 June 2012; Byraq (3 specimens) 5 June 2013.

***Lygus pratensis* Linnaeus, 1758**

Material Examined: Esfanjan (2 specimens), 12 May 2012; Tazeh Kand (2 specimens), 4 June 2013; Khajeh (1specimen), 5 June 2015.

***Lygus rugulipennis* Poppius, 1911**

Material Examined: Byraq (3 specimens) 5 June 2013; Azarshahr (2 specimens) 15 june 2015.

***Orthops frenatus* Horváth, 1894**

Material Examined: Bostan Abad (3 specimens), 5 July 2015; Bkhshayesh (4 specimens) 3 June 2013.

***Polymerus brevicornis* Reuter, 1879**

Material Examined: Sardrod (3 specimens) 15 July 2015; Bostan Abad (7 specimens), 18 June 2012.

***Polymerus cognatus* Fieber, 1858**

Material Examined: Bostan Abad (4 specimens), 10 June 2013; Byraq (2 specimens) 5 June 2013.

***Stenodema calcarata* Fallén, 1807**

Material Examined: Teimourlu (3 specimens), 30 May 2014.

***Stenodema turanica* Reuter, 1904**

Material Examined: Teimourlu (2 specimens), 30 May 2014; Bostan Abad (7 specimens), 18 June 2012.

Subfamily Orthotylinae

***Orthotylus flavosparsus* (C. R. Sahlberg, 1841)**

Material Examined: Bostan Abad (6 specimens), 5 July 2015.

***Orthotylus minutus* Jakovlev, 1877**

Material Examined: Bostan Abad (8 specimens), 5 July 2015; Sardrod (6 specimens) 15 July 2015.

Subfamily Phylinae

***Campylomma verbasci* Meyer-Dür, 1843**

Material examined: Akhula (6 specimens), 29 May 2014; Khajeh (2 specimens), 5 June 2015.

***Oncotylus viridiflavus longipes* Wagner, 1954**

Material Examined: Azarshahr (2 specimens) 2 June 2015.

***Pilophorus confusus* Kirschbaum, 1856**

Material examined: Safian (3 specimens) 2 June 2014.

Family Tingidae
Subfamily Tinginae

***Agramma* (*Agramma*) *minutum* Horváth, 1874**

Material Examined: Bostan Abad (2 specimens), 5 July 2015.

***Dictyla echii* (Schrank, 1782)**

Material Examined: Julfa (3 specimens), 7 June 2015.

***Monosteira unicostata* (Mulsant & Rey, 1852)**

Material Examined: Kurdasht Julfa (2 specimens), 30 May 2015.

***Stephanitis* (*Stephanitis*) *oschanini* Vasiliev, 1935**

Material Examined: Sardrod (Many specimens) 15 July 2015; Akhula (25 specimens), 29 May 2014; Mayan (28 specimens) 22 July 2015; Teimourlu (40 specimens), 30 May 2014; Tazeh Kand (14 specimens), 4 June 2013; Esfanjan (Many specimens), 12 May 2012; Khajeh (10 specimens), 5 June 2015.

***Tingis* (*Tingis*) *auriculata* (A. Costa, 1847)**

Material Examined: Oshtobin (2 specimen), 8 June 2015.

Family Reduviidae
Subfamily Harpactorinae

***Rhynocoris iracundus* (Poda, 1761)**

Material Examined: Julfa (2 specimens) 15 August 2015.

***Rhinocoris punctiventris* (Herrich -Schaeffer, 1848)**

Material Examined: Bostan Abad (4 specimens) 1 April 2015.

Subfamily Peiratinae

***Pirates hybridus* (Scopoli, 1763)**

Material Examined: Azar shar (2 specimens) 15 July 2014.

***Ectomocoris ululans* (Rossi, 1790)**

Material Examined: Sardrod (1 specimen) 3 April 2012.

Subfamily Reduviinae

***Reduvius jakovleffi* (Reuter, 1892)**

Material Examined: Kiamaki (3 specimens) 15 August 2014.

***Reduvius pallipes* (Klug, 1830)**

Material Examined: Dozal Julfa (2 specimens), 12 April 2013; Sardrod (2 specimens) 3 April 2012; Azar shar (3 specimens) 15 July 2014.

Subfamily Stenopodainae

***Oncocephalus impictipes* (Jakovlev, 1885)**

Material Examined: Safian (1 specimen) 28 July 2013.

ACKNOWLEDGEMETS

The authors are grateful to Mr. Mohsen Khadem Arab Baghi (manager of Aras Free Zone Orgnization) for kindly supporting of researchers.

LITERATURE CITED

Askari, O., Farshbaf Pour-Abad, R. & Khaghaninia, S. 2009. Faunistic study of Heteroptera of Zanjan Roud region in Zanjan province of Iran. Munis Entomology & Zoology, 4: 560-563.

Aukema, B. & Rieger, C. 1999. Catalogue of the Heteroptera of the Palaearctic Region. Volume 3. Cimicomorpha II[M]. Amsterdam: The Netherlands Entomological Society, 577 pp.

Baroughi, H. 1977. Etude de la faune entomologique (Tabriz et environs), 2, ordre des heteropteres (sic). University of Tabriz, Faculty of Agriculture, 12 (1): 1-33.

Ebrahimi, A., Hosseini, R. & Vafai Shoushtari, R. 2012. A faunal study of plant bugs (Hemiptera: Miridae) in Ghorveh and its counties (Kurdistan province, Iran). Entomofauna, 33 (4): 25-40.

Farshbaf Pour-Abad, R. 2000. Heteroptera fauna of alfalfa fields of Maragheh and nearby cities. Proceedings of 14th Iranian Plant Protection Congress, Isfahan University of Technology, Isfahan, 232 pp.

Feizizadeh, B. 2008. Estimation agricultural lands area from SPOT satellite imagery based on remote sensing and GIS techniques. National project for Ministry of Agricultural and Jahad of East Azerbaijan Province, Iran.

Feizizadeh, B. & T. Blaschke 2012. Land suitability analysis for Tabriz County, Iran: multi-criteria evaluation approach using GIS, Journal of Environmental Planning and Management, DOI:10.1080/09640568.2011.646964.

Hassazadeh, M., Farshbaf Pour-Abad, R. & Shayesteh, N. 2009a. An investigation on some Heteroptera in Marand region (Iran). Munis Entomology & Zoology, 4 (1): 19-24.

Hassazadeh, M., Farshbaf Pour-Abad, R., Gharaat, M. A. & Beykpor, A. R. 2009b. A study of the Heteroptera fauna of Shend Abad Region and environ (Iran). Munis Entomology & Zoology, 4 (2): 527-530.

Havaskary, M., Farshbaf Pour-Abad, R., Kazemi, M. H., Refeii, A. & Havaskary, S. 2012. An investigation to the fauna of Cimicomorpha (Heteroptera) from Parsabad-e-Moghan and vicinity, NW Iran. Munis Entomology & Zoology, 7 (2): 1101-1105.

Khaghaninia, S., Askari, O., Farshbaf Pour-Abad, R. & Shalim, K. 2010a. Some additional notes about Heteroptera fauna of Qaradag forests-Iran. Munis Entomology & Zoology, 5 (2): 513-518.

Khaghaninia, S., Farshbaf Pour-Abad, R. & Askari, O. 2010b. First record for seven species of leaf bugs (Hemiptera, Miridae) for Iran insect fauna from East Azarbayjan province. Munis Entomology & Zoology, 5 (1): 309-310.

Khaghaninia, S., Farshbaf Pour-Abad, R., Askari, O. & Fent, M. 2010c. An introduction to true bugs fauna of Gunber valley including two new records for Iranian fauna (Hemiptera: Heteroptera). Munis Entomology & Zoology, 5 (2): 354-360.

Khaghaninia, S., Farshbaf Pour-Abad, R. & Askari, O. 2011. A contribution to the Heteroptera fauna of Zunuz region, northwest of Iran. North-Western Journal of Zoology, 7 (1): 35-38.

Khaghaninia, S., Farshbaf Pour-Abad, R., Askari, O. & Havaskari, M. 2013. A faunistic study of True Bugs (Heteroptera) from Horand Grasslands, NW Iran. Munis Entomology & Zoology, 8 (1): 468-474.

Khalilzadeh, A. 2008. Identification of Heteroptera fauna of alfalfa fields in Azarshahr region of Azarbayejane-sharqi province, Iran. Journal of New Agricultural Science, 4 (9): 5.

Meyer, J. R. 2016. General Entomomolgy, Hemiptera Suborder Heteroptera. https://projects.ncsu.edu/cals/course/ent425/library/compendium/heteroptera.html

Modarres Awal, M. 1987. Collecting and determining of the fauna of Heteroptera in Ardabil area and research station of university of Tabriz in Moghan. Journal of the Entomological Society of Iran, 9: 15-28.

Modarres Awal, M. 1996. Studies on some Cimicomorpha and Pentatomorpha (Heteroptera) fauna in Ardabil province. Journal of Agricultural Science and Technology, 10, 102–112. [in Persian, English summary]

Modarres Awal, M. 1997. Determination of some fauna of Cimicomorpha and Pentatomorpha (Het.) in Tabriz area. Journal of Agricultural Sciences, 7: 43-56.

Modarres Awal, M. 1998. Fauna of Cimicomorpha and Pentatomomorpha (Het.) in Tabriz. Proceedings of 13th Iranian Plant Protection Congress. Campus of Agriculture and Natural Resources, University of Tehran, Karaj, pp. 238.

Sadaghian, B., Dordaei, A. A. & Nikdel, M. (2004) An investigation on some Heteroptera in Arasbaran forests. Proceedings of 16th Iranian Plant Protection Congress, Tabriz University, pp. 128.

Sadeghi, R., Farshbaf Pour-Abad, R., Kazemi, H. & Hassanzadeh, M. 2009. Introduction of some Heteroptera of Qurigol (Iran). Munis Entomology & Zoology, 4 (2): 498-500.

Weirauch, Ch. & Schuh, R. T. 2011. Systematics and evolution of Heteroptera: 25 years of progress. Annual Review of Entomology, 56: 487-510.

Worldwide climate. 2016. http://www.worldclimate.com.

VADONIA PERSICA SP. NOV. FROM IRAN AND *VADONIA KLICHAI* SP. NOV. FROM GREECE, TWO NEW SPECIES OF THE GENUS *VADONIA* (COLEOPTERA: CERAMBYCIDAE)

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[Vartanis, J. 2017. *Vadonia persica* sp. nov. from Iran and *Vadonia klichai* sp. nov. from Greece, two new species of the genus *Vadonia* (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 12 (1): 341-345**]**

ABSTRACT: The new species *Vadonia persica* sp.nov. comes from Iran, and for the time being, it is endemic to Iran. *Vadonia persica* sp. nov. was compared with the species *Vadonia bicolor* (Redtenbacher, 1850) and *Vadonia instigmata* (Pic, 1890). The new species *Vadonia klichai* sp.nov. comes from Greece, and for the time being, it is endemic to Greece. *Vadonia klichai* sp. nov. was compared with the species *Vadonia insidiosa* (Holzschuh, 1984), *Vadonia mainoldii* (Pesarini-Sabbadini, 2004), *Vadonia unipunctata dalmatina* (J.Müller, 1907), *Vadonia saucia* (Mulsant et Godart, 1855).

KEY WORDS: Coleoptera, Cerambycidae, Lepturinae, *Vadonia*, two new species from Iran and Greece

Vadonia persica sp. nov.

(Figs. 1a-d)

Body: Quite black, including legs and antennae. Abdominal ventrites black, with very short black setae. Setae are parallel and decumbent.

Elytra: Dark black, with very short black setae throughout their length. Setae denser on humeri, moderately erect but short black, only slightly erect setae on outer side of humeri. With four longitudinal costae on each elytron. The first costa is parallel with scutellum sides and then with elytral suture. Further three costae are evenly distributed throughout elytral area from humeri to elytral apex.

Elytral apices considerably divergent at ends, thus leaving large spaces between them. Elytral apices truncate, not rounded. Elytral punctation very fine, indistinct, coarser only around scutellum and humeri. Elytra darker, without considerable shine. In males, elytra 2.4 times longer than wide at humeri. Elytra narrow, rather flattened, not robust. Elytra in 2/3 of specimens without puncture in males as well as females, but in 1/3 of all specimens, there is a minute, nearly indistinct punctures in males as well as females.

Legs: Black tibia with 2 terminal spines in males. Femora with adjacent and short setae. Basal metatarsomere in males 1.35 times longer than metatarsites 2 and 3 combined.

Scutellum: Black, straight on sides, with sharp angle, triangular, as long as wide.

Pronotum: Black, with very dense and coarse punctation. Interspaces between punctures smaller than puncture diameter. Pronotum setation black, erect on middle area, directed outward laterally.

Head: Black, very densely punctate. Intervals between punctures smaller than puncture diameter. On temples with black, long setae.

Antennae: Black, but antennomeres 3 and 4 partially (1/2) dark red and black. Antennae not serrate, in males reaching two thirds elytra length, in females about half elytra length.

Aedeagus: Very characteristic of the species (see the photo). Different from other species from Iran or Turkey. It was compared with species from the same group, such as *Vadonia bicolor* (Redtenbacher, 1850) and *Vadonia instigmata* (Pic, 1890). Aedeagus tip in the new species *Vadonia persica* sp.nov. only gently achieves its apex.

Body size: m*m* 14-15 mm, f*f* 15-16 mm.

The variability in paratypes: 2/3 of males and females with elytra without any black spot at the middle of elytra, but 1/3 of males and females have minute black spot in middle of each elytron.

HOLOTYPUS: m*-Irán-Zagros Mt.,Atashgah-Čaharmahál a Bachtijárí 10.6.2014,lgt. D. Loupanec,coll J. Vartanis (Czechia Republik, Uherský Brod). PARATYPUS: 1 m*,1 f*-Irán-Zagros Mt., Kohgiluyeh and Boyer-Ahmad provincie 30.5.2015 lgt. Dalihod, coll J. Vartanis. 4 m*m*, 3 f*f*-Irán Isfahan-Kolah Ghazi NP 18.7.2016, lgt. Murasty D., coll J. Vartanis.

Differential diagnosis: The new species from Iran, *Vadonia persica* sp. nov. was compared with all the species from Iran and Turkey, where the main character of males are 2 spines on the tibia. In all the male species mentioned, aedeagi were compared and are very characteristic of each species. In the whole genus *Vadonia,* the aedeagus serves as the principal character in the identification of all the known species. In my collection, I have all the species of the genus *Vadonia*. In addition, I also studied the holotype of the species *Vadonia bicolor* (Redtenbacher, 1850). The similar species *Vadonia instigmata* (Pic, 1890) is different in the aedeagus shape as well as in the pronotum which is covered with long, decumbent setae throughout its area, the setation being light. In this species, the elytra are rather yellowish-brown without the black central spot and without black apices of elytra. Setae on elytra are light, very long on humeri and on sides of humeri; they are directed downward. The whole elytra area are covered with light setation. Punctation is very sparse. The body size of males ranged between 15 and 19 mm. The species is rather cylindrical, elytra are not flattened. The species is considered to be endemic to Turkey but it also occurs in northern Iran, at localities southwest of Azerbaijan in the province Takab, near Takht, Suleiman Agh Bolagh 2.200-2.700 m. In addition, it occurs at many locations in Turkey, Hakkari, Diyarbakir, Adiyaman prov. A further similar species was *Vadonia bicolor* (Redtenbacher, 1850) which has its pronotum very sparsely setaceous, nearly bare and bright. On sides, it is very shortly and sparsely setaceous. The setae are light. The pronotum punctation is very sparse, with very long distances between punctures. Antennae are rather dark red. The elytra are without the central spots and without black tips. They are very bright and very sparsely covered with light setae. The setae are very short, humeri and outer sides being rather bare, with only few erect setae on sides. The punctation is very fine and sparse. The body size of males is between 15 and 19 mm. The species occurs in Iran and was also found in Turkey - Kahta, Nemrut Dagi Mt.2400 m. The new species *Vadonia persica* sp. nov. is very different from the above mentioned species; it is found on different plants of Asteraceae sp. The elytra have a very characteristic shape and the species exerts characteristic setation, colour of setae, shape of elytra and different minor characters, particularly in the aedeagus.

ETYMOLOGY: The new species from Iran, *Vadonia persica* sp. nov. is named after the name of the country Persia (= Iran).

***Vadonia klichai* sp. nov.**

(Figs. 1a-e)

Body: Black including all legs and antennae. Abdominal ventrites black, with decumbent long, grey setae. The setae are parallel.

Elytra: Dark black throughout, without spot. Very finely and densely punctate. Setation of elytra light, with very long and decumbent setae on humeri, and short and light setae in posterior two thirds of elytra. Elytra punctation very dense, intervals between punctures as large as puncture diameter. All paratypes and holotype are quite black, without any other colour.

Legs: Black, very densely setaceous, the setae decumbent. Tibia with two terminal spines in males. Femora with decumbent setae, without any erect setae. Basal metatarsomere of males longer than second and third metatarsomeres combined including the claw.

Scutellum: Black, covered with long, light setae.

Pronotum: Black, spherical, very symmetric, strongly arcuate laterally. Very finely and densely punctate. The setation of pronotum very long, decumbent, light.

Head: Black, with very long, light and decumbent setae. No setae on temples directed outward.

Antennae: Black, with decumbent setae. Not serrate in shape, none of antennomeres dilated outward. Antennae of males rather long, reaching the last quarter of elytra, in females exceeding half of elytra.

Aedeagus: Considerably different from other species (see the photo). Aedeagus tip dilated apically at angle of 45° on both sides, producing the triangular shape in a certain position. The tip reaching immediately the apex, not elongate and narrowed as in other species and thus strongly different from all the above listed species, with which the species was compared, such as *Vadonia unipunctata dalmatina* (Müller, 1907), *Vadonia insidiosa* (Holzschuh, 1984), *Vadonia mainoldii* (Pesarini-Sabbadini, 2004), *Vadonia saucia* (Mulsant-Godart, 1855).

Body size: m*m*14-15 mm, f*f* 15 mm.

Variability: All paratypes were completely black including elytra with exception of a specimen, in which 1/3 of elytra area was yellow. In this specimen, the elytra are black, with very wide central band surrounding scutellum and extending to the elytral apex. Posterior third of elytra is black. A yellow narrow band starting on outer side of humeri of each elytron is extended on outer side up to 2/3 of elytra. On this yellow band, there is a black point on each elytron.

HOLOTYPUS: m*-Greece, Pindos-National Park Pindu, 8.7.2013, lgt.-coll. J. Vartanis (Czech Republic). PARATYPUS: 2 m*m*,3 f*f*-Greece, Pindos-NP Pindu, 9-10.7.2013, lgt.-coll. J. Vartanis.1 f*- Greece, Korfu island-Ermones 18.6.2016 lgt. J. Steinhofer, coll. J. Vartanis. 1 m*,2 f*f*- Greece, Thessalia-Chaliki 4.7.2015 lgt., coll. J. Klícha (Czech Republic).

Differential diagnosis: The new species *Vadonia klichai* sp. nov. occurs in the southwest part of Greece in the area of Pindos and Thessalia and one specimen was caught on the island Corfu, which is west of continental Greece. The species falls into a group of *Vadonia* species, in which the males have two spines on the tibia and was thus compared with species exerting this character. In addition, its aedeagus is very characteristic, where the tip is strongly dilated on both sides and is in the shape of triangle, thus being very different from other species. All the other species from Greece have the aedeagus tip only narrowed and rounded without any other shapes; this concerns species from the whole group of *Vadonia unipunctata* (Fabricius, 1787) including all the known subspecies occurring in Greece (such as *dalmatina, macedonica*). It was also compared with the species *Vadonia insidiosa* (Holzschuh, 1984) and *Vadonia mainoldii* (Pesarini-Sabbadini, 2004). All the above listed species have different colour of elytra, different setation of the pronotum elytra and other shapes of the aedeagus. Their aedeagus is only arcuate without any swellings or other structural elements. In addition, the new species was also compared with a remote species *Vadonia saucia* (Mulsant-Godart, 1855), which occurs only on Crimea (Russia) and in northern Romania (Tulcea). This species has its aedeagus strongly narrowed and the tip achieves the end very gently; it is swollen at end, but with sharp edges and thus, the aedeagus is very different from the new species. The new species *Vadonia klichai* sp. nov. is endemic to Greece: from continental part of northwest area up to the isle Corfu. The new species *Vadonia klichai* sp. nov. is found on plants *Knautia macedonica* and *Knautia* sp.

ETYMOLOGY: The new species *Vadonia klichai* sp. nov. was named after my colleague and specialist in Cerambycidae Jiří Klícha (Praha, Czech Republic).

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LITERATURE CITED

Bense, U. 1995. Longhorn Beetles. Illustrated key to the Cerambycidae and Vesperidae of Europe.Weikersheim, 512 pp.

Daniel, K. & Daniel, J. 1891. Revision der mit *Leptura unipunctata* F. und *fulva* Deg. verwandten Arten. Coleopteren-Studien, 1: 1-40.

Holzschuh, C. 1981. Zwanzig neue bockkäfer aus Europa und Asien (Cerambycidae, Col.). Koleopterologische Rundschau, 55: 91-112.

Holzschuh, C. 1984. Beschreibung von 21 neuen bockkäfern aus Europa und Asien (Col., Cerambycidae). Koleopterologische Rundschau, 57: 141-165.

Özdikmen, H. & Turgut, S. 2009. A review on the genera *Pseudovadonia* Lobanov et al., 1981 and *Vadonia* Mulsant, 1863 (Coleoptera: Cerambycidae: Lepturinae). Munis Entomology & Zoology, 4: 29-52.

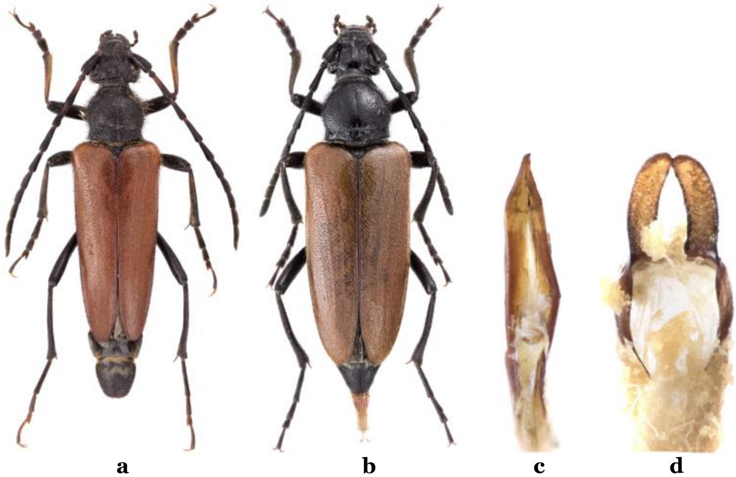

Figure 1. *Vadonia persica* sp. nov., a) male, b) female, c,d) Aedeagus.

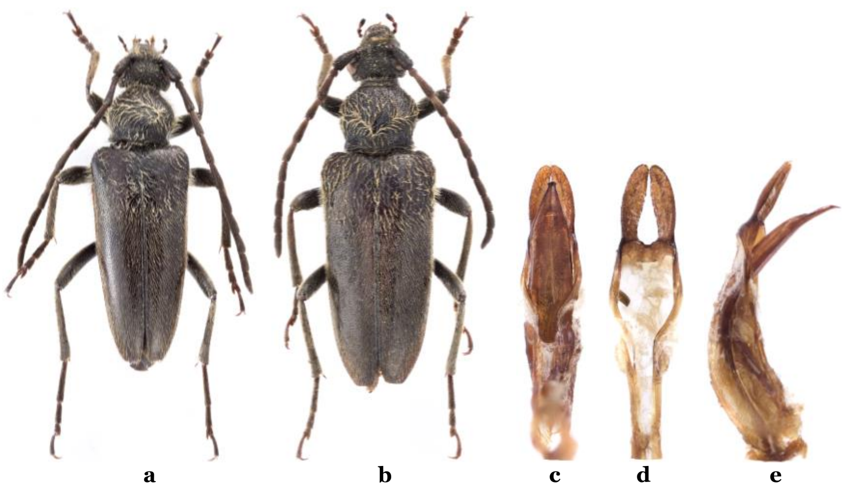

Figure 2. *Vadonia klichai* sp. nov., a) male, b) female, c,d,e) Aedeagus.

ESTIMATING POPULATION SIZE OF BROWN HARE (*LEPUS EUROPAEUS* PALLAS, 1778) IN TURKEY

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[Albayrak, İ. & Sarıçam, T. 2017. Estimating population size of brown hare (*Lepus europaeus* Pallas, 1778) in Turkey. Munis Entomology & Zoology, 12 (1): 346-350**]**

ABSTRACT: This study is based on data related to population size and certain morphological characteristics of brown hare which is common in Turkey. Records of fieldwork conducted in all Turkey between 2008 and 2010 and camera trap records obtained from Kırıkkale Province between 2015 and 2016 were analysed in this study. Brown hare is main food source of carnivores such as wolf, jackal, fox, marten and lynx. Camera trap results are the first research data on population size of Turkish brown hares. Populations size of brown hare vary in hunting and non-hunting areas. The number of brown hares in hunting areas are less than the other areas.

KEY WORDS: Brown hare, *Lepus europeus*, population size, camera trap, Turkey

According to recent literature, there are 5416 mammal species in the world and 171 mammal species were recorded in Turkey (Wilson & Reeder, 2005). *Lepus europaeus* belongs to family Leporidae of order Lagomorpha. *Lepus europeus* which is one of the gnawing animals except rodents, lives in mountains, steppes, woodlands, wetlands, open fields, edge of swamp and agricultural areas. Biological, ecological, taxonomical, caryological and distrubitional studies were conducted about brown hare in Turkey (Demirbaş & Albayrak, 2013, 2014, 2015; Albayrak, 2016). Some external characteristics of Turkish brown hare were recorded as oval head, long ears, big eyes, short tail and longer hind legs. It mates 3-4 times between February and December, and gives 3-6 leverets after 6 week pregnancy (Turan, 1984). Brown hares usually live solitary but they come together in estrus period. Brown hare suckles its leverets about three weeks and then leaves them free. Brown hare lives 7-8 years. It is keen on fruits and vegetables (Turan, 1984). Nevertheless, there is no information on population size of Turkish brown hare.

The aim of this study is to determine some biological features and population size of brown hare in Turkey.

MATERIALS AND METHODS

This study is based on brown hare specimens from Turkey. Most of specimens were obtained during hunting season and also some from traffic accidents. Additionaly, camera traps were set for daily activities in Kırıkkale Provice. Some camera traps were established for photos and some were for video. The ones established for taking photos were set to be off for 15 seconds after taking 3 photos and the ones established for recording videos were set to be off for 60 seconds after recording for 10 seconds. Camera traps took records from Hisarköy, İkiztepe fire lookout tower local between 24.3.2016 and 9.4.2016 and from Mountain Denek between 26.5.2016 and 18.8.2016.

Feces of brown hare in the field were recorded (Fig. 1). Brown hare footprints were also used for detection in winter (Fig. 1).

RESULTS

The ordo Lagomorpha is represented by two species in Turkey: One of them is European hare or brown hare (*Lepus europeus*) and the other is island rabbit, *Orytalagus cunicullus*, which is brought from Europe and let out to Gökçeada near Çanakkale Province, and now is not feral animal.

Lepus europaeus Pallas, 1778

1778. *Lepus europeus* Pallas 1778. Nova Spec.Quad. Glir. Ord., p.30.
Type locality: Poland

Diagnostic characters: Total length, 500-670 mm; condylobasal length, 79.5-93 mm; zygomatic breadth, 33.6-40.5 mm; length of $C\text{-}M^3$, 11.8-17.0 mm; length of $C\text{-}M_3$, 14.0-18.9 mm; mandibul length, 64.7-75.0 mm.

General characteristics: General coloration varies from yellowish ligth brown to yellowish brown. Brown hare generally stays in the shallow pit called as «form» on the ground in day time and is very active at nights. Feces is odorless and 0.5-1.5 cm in diameter. Of some characteristics, hindfoot lentgh is 135-160 mm and weight is 2.3-4 kg. Brown hare has not baculum but the phallus is very obvious during reproduction period (Fig. 2).

Habitat features: Brown hares live in plains with vegetation, open fields, plateau, woodlands and highlands. It also lives in croplands and grasslands near streams and reed fields and, in vineyards, orchards and fields in vacinity of residential areas. In rural areas, it is fed with plants like couch grass and wild clovers. It fondly gnaws astragalus root. It gnaws barks of soft trees like apple and prefers vegetables such as carrots, lettuce and parsley. Lentile, sunflower and sprouting chickpea are among its diet.

Lepus europeus as a hunting animal: Brown hare is an animal which is hunted constantly by both carnivors and human. Within the framework of the decisions of Central Hunting Comission, hunting of brown hare has been released for approximately three months (15.10.2016-08.01.2017) in 2016. Brown hare is located in LC category according to IUCN criteria (Fig. 3).

Population size: In camera trap studies, a significant difference in number of individuals found in hunting and non-hunting areas of Kırıkkale Province. When camera trap system records were examined, a high number of brown hares were recorded in hunting banned areas. In this area maximum number of brown hare is 71 (Fig. 4).

In a period of two and a half months, camera records showed that number of brown hares was lower in hunting area. In this area maximum number of brown hare is 10 (Fig. 5).

DISCUSSION

At the end of 1 year study about determining wildlife species in Kırıkkale with camera traps, brown hare population size is found to be bigger in Hisarköy, İkiztepe Fire lookout tower area of 2000 m^2 than Denek Mountain of 30 hectars. Previously mentioned area is a site of reforestation surrounded by wire mash and kept under control for a long time. In this way, the area is less visited by hunters. Since Denek Mountain is visited more by hunters, it is poor in terms of wildlife elements.

These results will help to understant some biological characteristics of brown hare better. It must be remembered that protection of brown hare is important for survival of some bird and mammal species.

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LITERATURE CITED

Albayrak, İ. 2016. On Some Biological Characteristics of Brown Hare (*Lepus europeus*, Pallas, 1778) in Turkey. 6, *in*: Book of Abstracts, International Conference on Biological Sciences, Selçuk University, 21-23 October, Konya, 1-300.

Demirbaş, Y. & Albayrak, İ. 2013. Türkiye Yaban Tavşanının Bugünkü Durumu. Türk Bilimsel Derlemeler Dergisi, 1: 192-194.

Demirbaş, Y. & Albayrak, İ. 2014. The taxonomic status and geographic distribution of the European hare (*Lepus europaeus* Pallas, 1778) in Turkey (Mammalia: Lagomorpha). Turk. J. Zool., 38 (2): 119-130.

Demirbaş, Y. & Albayrak, İ. 2015. A comparative study of the reproductive activities of European hare (*Lepus europeus*) population in Turkey. Turk. J. Zool., 39 (2): 991-994.

Turan, N. 1984. Türkiye'nin Av ve Yaban Hayvanları (Memeliler). Ongun Kardeşler Matbaacılık Sanayi, Ankara, 1-177.

Wilson, E. Don & Reeder, M. D. (Eds.) 1993. Mammal Species of the World: A Taxonomic and Geographic. 2nd ed., Smiths. Inst. Press. Washington, D.C., 1-1207.

Figure 1. Methods for determining the presence of brown hare; camera trap (left), feces (middle) and footprints (right).

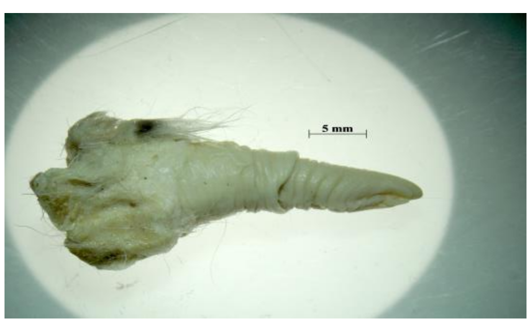

Figure 2. Phallus of brown hare.

Figure 3. Brown hare near a river.

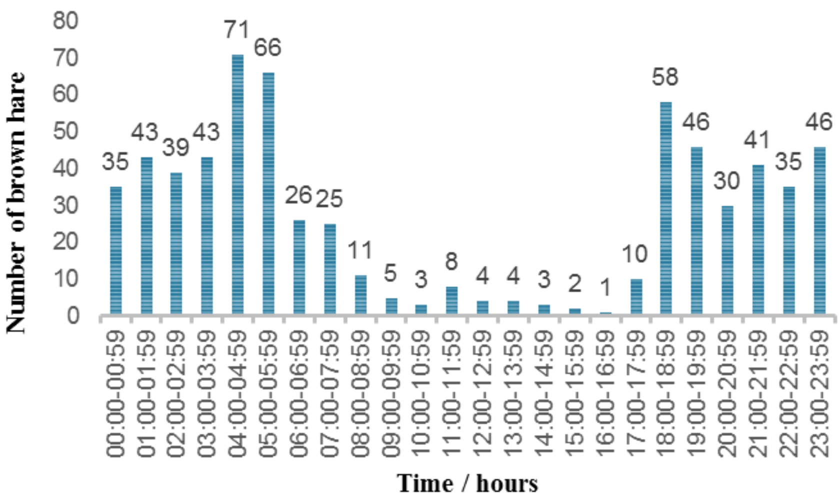

Figure 4. Number of brown hares captured by camera traps in some localities where hunting is forbidden in Kırıkkale Provice.

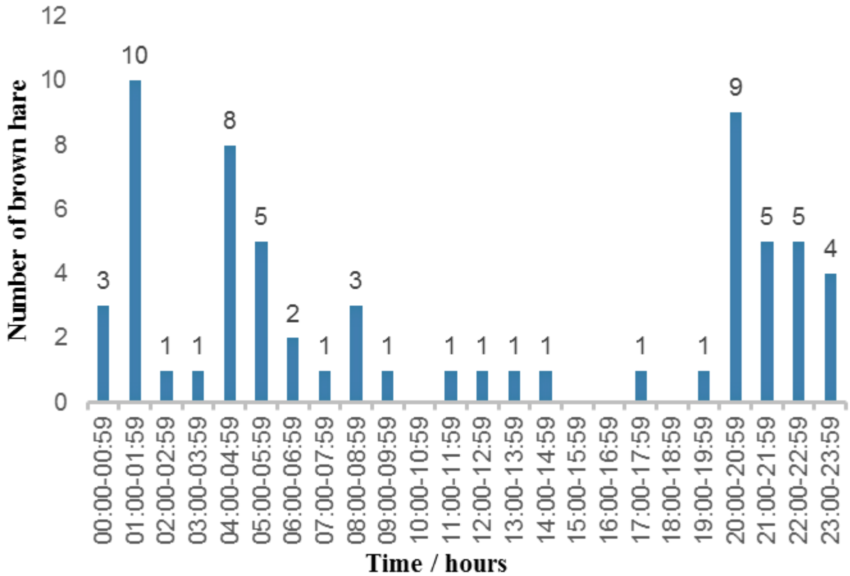

Figure 5. Number of brown hares captured by camera traps in localities where hunting is not forbidden in Kırıkkale Province.

CONTRIBUTIONS TO THE GALLWASP (HYMENOPTERA: CYNIPIDAE) FAUNA OF MANİSA PROVINCE, TURKEY

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ABSTRACT: The present paper deals with the study of family Cynipidae of Manisa province of Turkey which includes six species. All of them is new record for Manisa province of Turkey.

KEY WORDS: Fauna, gall wasp, Cynipidae, Manisa, Turkey

Studies on Cynipidae fauna of Turkey have great importance and during the last decade the studies of Melika et al. (2004), Katılmış & Kıyak (2009, 2011), Azmaz et al. (2012) and Katılmış & Azmaz (2015) have given detailed information in this field.

In this study gallwasp material reared in plastic cages from galls of *Quercus cerris, Q. infectoria, Q. ithaburensis* and *Q. pubescens* in Muradiye Campus, Celal Bayar University, Manisa, Western Turkey, 80 m above sea level, during the period of May 2013-April 2014 were evaluated.

RESULTS

In this study a total of six species were recognized and all of them is new record for Manisa province of Turkey.

Andricus bulgaricus Vassileva & Samnalieva, 1977

Material examined: Totally 15 specimens have been reared in May 17-21, 2013 at Muradiye Campus (N: 38° 40 799', E: 27° 18 722' 70 m, and N: 38° 40 566' E: 027° 18 506, 59 m), from ***Q. pubescens*** galls.
Distribution in Turkey: Previously reported from Kütahya between Domaniç-Tahtaköprü, on ***Q. pubescens*** galls by Katılmış & Kıyak (2011).

Andricus sternlichti (Bellido, Pujade & Melika, 2003)

Material examined: Totally one specimen has been reared in May, 2013 at Muradiye Campus (N: 38° 40 568' E: 27° 18 506' 58 m) from ***Q. infectoria*** galls.
Distribution in Turkey: This species previously reported from Afyon, Devlethan village, Sandıklı,Yavaşlar, Sandıklı, Otluk village (Akdağ Mountain), Sultandağı, Dereçine village, Denizli, Pamukkale University, Sciences and Arts Faculty, Buldan, way to lake 2 km, Çal, Selcen village, Beyağaç, between Beyağaç-Kartal lake 5 km, Serinhisar, Kefe upland, Babadağ, Yeniköy village, Çivril, Çağlayan village (Akdağ Mountain), Serinhisar, Ayaz village, Serinhisar, Yatağan,

Çal, Selcen village (way to Kabalar), Kütahya, Söğüt village, surrounding Söğüt dam, Kütahya, between Afyon-Kütahya 66 km, Kütahya, between Kütahya-Eskişehir, 14 km, Tavşanlı, Köprücek village, surrounding dam, Altıntaş, between Genişler village, Altıntaş, Pınarcık village, Aslanapa, between Aslanapa-Kütahya 5 km, Domaniç, Berçin village, Tavşanlı, between Tavşanlı-Emet 12 km, Kütahya, Türkmen Mountain, Kozluca village, Simav, Gümüşsu town, Simav, Örenli village, surrounding lake, Hisarcık, Dereli village, Uşak, Banaz, Ulupınar village, on ***Q. infectoria*** and ***Q. pubescens*** galls by Katılmış and Kıyak (2011). Recently reported from Denizli, Kale, Mezarlık, on ***Q. infectoria*** galls by Azmaz et al. (2012) and Erzincan, Kemaliye, on ***Q. pubescens*** galls by Mete & Demirsoy (2012).

Aphelonyx persica **Melika, Stone, Sadeghi & Pujade-Villar, 2004**

Material examined: Totally two specimens have been reared in October 23, 2013 at Muradiye Campus, (N: 38^{o} 40 568' E: 27^{o} 18 506' 58 m), from ***Q. ithaburensis*** galls.

Distribution in Turkey: Previously recorded from Afyon province, Emirdağ district, Çatallı village, Yüreğir village, Başkonak village, Bayat district, Bayat lake surrounding, Sultandağı district, Yakasenek village, Sinanpaşa (Sincanlı) district, Kırka village, Sandıklı district, Otluk village (Akdağ Mountain), Denizli province, Çivril district, Gülpınar village, Bekilli district, Buldan district–Güney district, Babadağ district, Kütahya province, Frigian valley, Kütahya-Frigian valley, Pullar lake surrounding, Gelinkaya village, Domaniç district-Tahtaköprü district 4 km Tahtaköprü forest, Berçin village, Gediz district, Murat mountain, Emet district, Şaphane district, Sofulu village, Hisarcık district-Emet district 2 km, Tavşanlı district, Köprücek village, Simav district, Örenli village, Uşak province, Emirfakı village, Göğen lake surrounding, Karahallı district-Sivaslı district, Karahallı district, Kırkyaren village, Sivaslı district, Pınarbaşı village, Banaz district, Kuşdemir village, Kızılcasöğüt village, Ulubey district, Inay village, Eşme district, Ahmetler village, on ***Q. cerris, Q. ithaburensis, Q. trojana*** galls by Katılmış & Kıyak (2009).

Chilaspis nitida **(Giraud, 1882)**

Material examined: Totally one specimen has been reared in April 4, 2014 at Muradiye Campus (N: 38^{o} 40 568' E: 27^{o} 18 515') from ***Q. cerris*** galls.

Distribution in Turkey: Reported from Afyon, Emirdağ, Çatallı village, Sultandağı, Dereçine village, Sandıklı, Sorkun village (Akdağ Mountain, Sultandağı, Yakasenek town way to Çığırtgan stream Sultandağı, Dereçine village, Sultandağı, Kırca town, Denizli, Bekilli, Honaz, below Karaçay town, Serinhisar, between Yatağan town-Kefe upland Kütahya, Kütahya, Gelinkaya village, Kütahya, Yoncalı village, Aslanapa, between Aslanapa–Kütahya 2 km, Domaniç, between Domaniç-Tavşanlı, 5 km, Tavşanlı, Kuruçay village, Kuruçay surrounding, Çavdarhisarı, between Çavdarhisarı-Gediz, 8 km, Gediz, Murat Mountain, Gediz, Murat Mountain, Simav, between Simav-Demirciköy 2 km, Simav, Örenli village, surrounding lake, Emet, Yenice, Domaniç, Berçin village, Domaniç, between Domaniç-Tahtaköprü 2 km, Tavşanlı, surrounding Güzelyurt dam, Tavşanlı, Akçaçay village, surrounding Kayaboğazı dam, Kütahya, Frigian valley, Çayca village, Kütahya, between Döğer (Afyon)-Türkmen Mountain, Göçeri village, Tavşanlı, Sekbanlı village, Simav, Gökçeler village surrounding dam, Kütahya, Türkmen Mountain, Hürünlü farm-Söğüt upland Uşak, Ulubey, between Ulubey-Güney 5 km, Sivaslı, Pınarbaşı village, Banaz, Ahad village, Sivaslı, between Cinoğlu village-Özbeyli village 2 km, on ***Q. cerris*** galls by Katılmış & Kıyak (2011).

Cynips quercusfolii (Linnaeus, 1758)

Material examined: Totally two specimens have been reared in May, 2013 at Muradiye Campus (N: 38° 40 568' E: 27° 18 506' 58 m) from ***Q. infectoria*** and ***Q. pubescens*** galls.

Distribution in Turkey: Reported from Afyon, Sultandağı, Yakasenek village, Sultandağı way to fire tower, Emirdağ, Çatallı village, Sultandağı, Deresenek village, Sandıklı, Çağlayan village (Akdağ Mountain), Sinanpaşa (Sincanlı), Kırka, Sultandağı, Yakasenek village way to Çığırtgan stream, Sultandağı, Dereçine village, Denizli, Buldan, between Buldan–Buldan lake, Serinhisar, Yatağan town way to Kefe upland, Babadağ, Akyol upland, Çivril, Çağlayan village, Kütahya, between Kütahya-Eskişehir, 14 km, Emet, Simav, Simav-Hisarcık, Pazarlar, surrounding Pazarlar dam, Kütahya, Frigian valley, Fındık village, Altıntaş, Genişler village, Kütahya, Gelinkaya village, Tavşanlı, between Tavşanlı-Domaniç 2 km, Domaniç, Berçin village, Tavşanlı, between Tavşanlı-Emet 12 km, Pazarlar, Karamanca village, Kütahya, Türkmen Mountain between Yumaklı village-Kozluca village 1 km, Domaniç, Hayme Ana village, Hisarcık, Dereli village, on ***Q. infectoria***, ***Q. pubescens*** and ***Q. vulcanica*** galls by Katılmış & Kıyak (2011). Recently reported from Erzincan, Kemaliye, on ***Q. pubescens*** and ***Q. infectoria*** galls by Mete & Demirsoy (2012).

Neuroterus quercusbaccarum (Linnaeus, 1758)

Material examined: Totally one specimen has been reared in April 4, 2014 at Muradiye Campus (N: 38° 40 799' E: 27° 18 722') from ***Q. pubescens*** galls.

Distribution in Turkey: Previously recorded from Afyon, Emirdağ, Çatallı village, Emirdağ, Yüreğil town, Döneli district, Bayat, Emirin village, Bayat, Sağırlı village, Denizli, Çal, Selcen village way to Kabalar village, Honaz, Karaçay town, Kütahya, Tavşanlı, between Tavşanlı-Domaniç 2 km, Simav, between Simav-Demirciköy 2 km, Simav, Tavşanlı, between Tavşanlı-Emet 12 km, Kütahya, Türkmen Mountain, between Yumaklı village-Kozluca village 1 km, Tavşanlı, Sekbanlı village, Simav, between Söğüt village-Gökçeler village 4 km, Simav, Gökçeler village surrounding dam, on ***Q. frainetto***, ***Q. infectoria***, ***Q. pubescens*** and ***Q. vulcanica*** galls by Katılmış & Kıyak (2011). Recently recorded from Denizli, Kale, Narlı village, on ***Q. infectoria*** by Azmaz et al. (2012) and from Erzincan, Kemaliye, on ***Q. infectoria*** galls by Mete & Demirsoy (2012).

LITERATURE CITED

Azmaz, M., Katılmış, Y., Tepe, M., Kızılkaya, E., Karaca, M. & Urhan, R. 2012. Kale ilçesi ve çevresinin meşe gal arıları (Hymenoptera, Cynipidae). Kaledavaz Sempozyumu Bildirileri, 300-307.

Katılmış, Y. & Azmaz, M. 2015. Investigation on the inquilines (Hymenoptera: Cynipidae, Synergini) of oak galls from inner western Anatolia, Turkey. Turkish Journal of Zoology, 39: 168-173.

Katılmış, Y. & Kıyak, S. 2009. The oak gallwasp *Aphelonyx persica:* a new record from Turkey, with some new host records. Phytoparasitica, 37: 95-97.

Katılmış, Y. & Kıyak, S. 2011. Oak gallwasps (Hymenoptera:Cynipidae) fauna of Inner-Western Anatolian. Munis Entomology and Zoology, 6 (2): 735-757.

Melika, G., Stone G. N., Sadeghi, S. E. & Pujade-Villar, J. 2004. New species of cynipid gall wasps from Iran and Turkey (Hymenoptera: Cynipidae: Cynipini). Acta Zoologica Academiae Scientiarum Hungaricae, 50 (2): 139-151.

Mete, Ö. & Demirsoy, A. 2012. A preliminary study on the gallwasp fauna of Kemaliye (Erzincan, Turkey) and a new record for Turkey. Hacettepe Journal of Biology and Chemistry, Special Issue, 351-363.

FURTHER NOTES ON TURKISH POLYPHAGA (COLEOPTERA: HELOPHORIDAE, HYDROCHIDAE, HYDROPHILIDAE) FROM KAHRAMANMARAŞ PROVINCE, TURKEY

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ABSTRACT: Distributional notes on Turkish Polyphaga (Coleoptera: Helophoridae, Hydrochidae, Hydrophilidae) from Kahramanmaraş province is presented. Totally, 31 species are recorded between May 2013-September 2014. Of these, *Helophorus difficilis* Angus, 1988, *H. flavipes* Fabricius, 1792, *H. longitarsis* Wollaston, 1864, *H. oscillator* Sharp, 1915, *Laccobius hauserianus* Knisch, 1914, *L.hindukuschi* Chiesa, 1966, *Helochares obscurus* (O. F. Müller, 1776), *Hydrochus brevis* (Herbst, 1793) and *H. flavipennis* Kuster, 1852 are recorded from Kahramanmaraş province for the first time.

KEY WORDS: Aquatic Coleoptera, Helophoridae, Hydrochidae, Hydrophilidae, Kahramanmaraş, Turkey

The Hydrophilidae is a large family, represented in all parts of the world and consisting of 172 genera and about 2716 known species. Of the four subfamilies recognized only two (Hydrophilinae, Sphaeridiinae) are recorded from the Palearctic region (Hansen, 1999; Fikácek, 2006). Considering the previous studies on the Turkish aquatic Coleoptera fauna; it is easily said that the Genera *Helochares*, *Laccobius* and *Coleostoma* are widely distributed in Turkey, but these statements are not validate at species level. New studies should therefore conducted on this group of insects. The aim of this study is to make a contribution to Turkish aquatic Coleoptera fauna.

MATERIALS AND METHODS

The specimens were collected by means of a sieve, ladle and net with 3x1 mm pores from the shallow areas of various springs, streams, lakes and ponds in Kahramanmaraş province of Turkey (Figure 1) between May 2013-September 2014. Firstly collected samples were killed by ethyl acetate in the research area and then aedeagophores of the beetles were dissected under a stereo microscope in the laboratory. Photographs of the main diagnostic characters were taken using Olympus SZX16 microscope. All samples were deposited in the Zoological Museum, Atatürk University, Faculty of Science, Department of Biology, Erzurum, Turkey.

RESULTS

Anacaena rufipes (Guillebeau, 1896)

Materials examined: 10♀♀, 2♂♂, Söğütlü (yalak), Elbistan, 38°16'27"K, 37°30'04"D, 1339m, 15.08.2013; 3♀♀, Sevdilli köprüsü, Söğütlü, Elbistan, 38°14'31."K, 37°34'09."D, 1404m, 15.05.2014.

***Helochares obscurus* (O. F. Müller, 1776)**

Materials examined: 3♀♀, 4♂♂, Ayvalı barajı, Dulkadiroğlu (Merkez), 37°35'15"K, 37°10'28"D, 894m, 14.09.2013.

Remark: New record for the Kahramanmaraş province.

***Helochares lividus* (Forster, 1771)**

Materials examined: 4♀♀, 2♂♂, Ayvalı barajı, Dulkadiroğlu (Merkez), 37°35'15"K, 37°10'28"D, 894m, 14.09.2013.

***Helochares lividoides* Hansen and Hebauer, 1988**

Materials examined: 2♂♂, Ayvalı barajı, Dulkadiroğlu (Merkez), 37°35'15"K, 37°10'28"D, 894m, 14.09.2013.

***Helophorus* (*Empleurus*) *nubilus* (Fabricius, 1777)**

Materials examined: 2♂♂, Sevdilli köprüsü, Söğütlü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 15.05.2014; 1♂, 18.05.2014; 1♂, Söğütlü suyu, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 18.05.2014.

***Helophorus* (*Eutrichelophorus*) *micans* (Faldermann, 1835)**

Materials examined: 3♀♀, 3♂♂, Merkaltı, 03.05.2014; 37°41'18"K, 37°13'21"D, 1448m, 2♂♂, Sevdilli köprüsü, Söğütlü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 18.05.2014; 1♂, Kevgirli suyu, Akbayır kasabası, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 18.05.2014.

***Helophorus* (*Helophorus*) *aquaticus* (Linnaeus, 1758)**

Materials examined: 5♀♀, 4♂♂, Kullar, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 19.05.2014; 3♀♀, 2♂♂, Sevdilli köprüsü, Söğütlü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 18.05.2014; 19♀♀, 7♂♂, 08.05.2014; 9♀♀, 5♂♂, Bektaşlı, Onikişubat (Merkez), 37°25'37"K, 36°17'09"D, 206m, 01.06.2014; 2♀♀, 1♂, Kevgirli suyu, Akbayır kasabası, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 18.05.2014; 1♀, 1♂, Değirmendere Göleti, Göksun, 37°53'44"K, 37°27'45"D, 1473m, 05.07.2014; 2♂♂, Söğütlü (yalak), Elbistan, 38°16'27"K, 37°30'04"D, 1339m, 18.05.2014.

***Helophorus* (*Helophorus*) *grandis* (Illiger, 1798)**

Materials examined: 3♂♂, Kuzucak, Dulkadiroğlu (Merkez), 37°34'42"K, 37°12'21"D, 996m, 10.05.2014; 3♀♀, 2♂♂, Merk Göleti, Çağlayancerit, 37°41'18"K, 37°13'21"D, 1448m, 26.04.2014; 4♀♀, 3♂♂, Kevgirli suyu, Akbayır kasabası, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 18.05.2014; 3♀♀, 1♂, Söğütlü suyu, Sevdilli köprüsü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 08.05.2014.

***Helophorus* (*Rhopalohelophorus*) *abeillei* Guillebeau, 1896**

Materials examined: 1♂, Sevdilli köprüsü, Söğütlü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 15.05.2014; 2♂♂, Çukurhisar, Onikişubat (Merkez), 37°49'41"K, 36°33'48"D, 1174m, 01.06.2014; 1♂, Değirmendere Göleti, Göksun, 37°53'44"K, 37°27'45"D, 1473m, 05.07.2014; 1♀, 1♂, Kevgirli suyu, Akbayır kasabası, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 18.05.2014.

***Helophorus* (*Rhopalohelophorus*) *brevipalpis brevipalpis* Bedel, 1881**

Materials examined: 3♀♀, 4♂♂, Esence, Afşin, 38°07'13"K, 36°51'48"D, 1241m, 16.07.2013; 3♀♀, 2♂♂, Söğütlü suyu, Sevdilli köprüsü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 15.05.2014; 23♀♀, 11♂♂, Kevgirli suyu, Akbayır kasabası, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 18.05.2014; 1♀,1♂, Çukurhisar, Onikişubat (Merkez), 37°49'41"K, 36°33'48"D, 1174m, 01.06.2014; 1♀, 4♂♂, Söğütlü (yalak), Elbistan, 38°16'27"K, 37°30'04"D, 1339m, 18.05.2014.

***Helophorus* (*Rhopalohelophorus*) *daedalus* d'Orchymont, 1932**

Materials examined: 1♀, 3♂♂, Söğütlü (yalak), Elbistan, 38°16'27"K, 37°30'04"D, 1339m, 15.08.2013; 2♀♀, 1♂, 18.05.2014; 4♀♀, 8♂♂, Bektaşlı, Onikişubat (Merkez), 37°25'37"K, 36°17'09"D, 206m, 01.06.2014; 2♀♀, 7♂♂, Merk Göleti, Çağlayancerit, 37°41'18"K, 37°13'21"D, 1448m, 26.04.2014.

***Helophorus* (*Rhopalohelophorus*) *discrepans* Rey, 1885**

Materials examined: 4♂♂, Sarsap (Ovacık), Elbistan, 38°24'23"K, 37°09'53"D, 1302m, 14.07.2013; 1♂, Kömürköy, Göksun, 38°08'50"K, 36°33'54"D, 1450m, 12.07.2015; 3♂♂, Değirmendere Göleti, Göksun, 37°53'44"K, 37°27'45"D, 1473m, 05.07.2014.

***Helophorus* (*Rhopalohelophorus*) *difficilis* Angus, 1988**

Materials examined: 21♀♀, 18♂♂, Bektaşlı, Onikişubat (Merkez), 37°25'37"K, 36°17'09"D, 206m, 01.06.2014.

Remark: New record for the Kahramanmaraş province.

***Helophorus* (*Rhopalohelophorus*) *flavipes* Fabricus, 1792**

Materials examined: 2♀♀, 1♂, Çukurhisar, Onikişubat (Merkez), 37°49'41"K, 36°33'48"D, 1174m, 01.06.2014.

Remark: New record for the Kahramanmaraş province. Recorded Bingöl, Erzurum, Kütahya and Tokat provinces only (Darılmaz & İncekara, 2011).

***Helophorus* (*Rhopalohelophorus*) *hilaris* Sharp, 1916**

Materials examined: 3♀♀, 25♂♂, Karaahmet, Göksun, 38°01'15"K, 36°34'20"D, 1368m, 27.10.2013; 1♀, 2♂♂, Kavkırt Obası, Onikişubat (Merkez), 37°39'23"K, 36°46'39"D, 541m, 13.04.2014; 13♀♀, 27♂♂, Terbüzek (Mehmetbey), Göksun, 38°06'19"K, 36°26'49"D, 1446m, 20.10.2013; 24♀♀, 38♂♂, Esence, Afşin, 38°07'13"K, 36°51'48"D, 1241m, 27.10.2013; 3♀♀, 2♂♂, Kömürköy, Göksun, 38°08'50"K, 36°33'54"D, 1450m, 12.07.2015; 22♀♀, 20♂♂, Değirmendere Göleti, Göksun, 37°53'44"K, 37°27'45"D, 1473m, 05.07.2014; 3♂♂, Bektaşlı, Onikişubat (Merkez), 37°25'37"K, 36°17'09"D, 206m, 01.06.2014.

***Helophorus* (*Rhopalohelophorus*) *lewisi* Angus, 1985**

Materials examined: 20♀♀, 24♂♂, Karagöl, Dulkadiroğlu (Merkez), 37°38'23"K, 36°56'29"D, 1597m, 23.03.2013; 2♂♂, Kullar, Nurhak, 37°58'50"K, 37°31'00"D, 1316m; 37°58'50"K, 37°31'00"D, 1316m, 19.05.2014; 4♀♀, 3♂♂, Karaahmet, Göksun, 38°01'14"K, 36°34'20"D, 1367m, 27.10.2013; 3♀♀, 5♂♂, Merkaltı, 37°41'18"K, 37°13'21"D, 1448m, 03.05.2014; 9♀♀, 7♂♂, Değirmendere Göleti, Göksun, 37°53'44"K, 37°27'45"D, 1473m, 05.07.2014.

***Helophorus* (*Rhopalohelophorus*) *longitarsis* Wollaston, 1864**

Materials examined: 7♀♀, 21♂♂, Karagöl, Dulkadiroğlu (Merkez), 37°38'23"K, 36°56'29"D, 1597m, 23.03.2013; 3♀♀, 8♂♂, 06.04.2014.

Remark: New record for the Kahramanmaraş province.

***Helophorus* (*Rhopalohelophorus*) *montenegrinus* Kuwert, 1885**

Materials examined: 1♂, Söğütlü suyu, Sevdilli köprüsü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 15.05.2014; 3♀♀, 2♂♂, Merk Göleti, Çağlayancerit, 37°41'18"K, 37°13'21"D, 1448m, 26.04.2014.

***Helophorus* (*Rhopalohelophorus*) *pallidipennis* Mulsant & Wachanru, 1852**

Materials examined: 2♀♀, 18♂♂, Karagöl, Dulkadiroğlu (Merkez), 37°38'23"K, 36°56'29"D, 1597m, 23.03.2013; 5♀♀, 7♂♂, 06.04.2014.

***Helophorus* (*Trichohelophorus*) *oscillator* Sharp, 1915**

Materials examined: 2♀♀, 3♂♂, Kevgirli suyu, Akbayır kasabası, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 18.05.2014.

Remark: New record for the Kahramanmaraş province. Recorded Tokat and Van provinces only (Polat et al., 2010; Darılmaz & İncekara, 2011; Taşar et al., 2012).

***Hydrochus brevis* (Herbst, 1793)**

Materials examined: 2♂♂, Kızıleniş, Türkoğlu, 37°21'41"K, 36°47'36"D, 595m, 28.09.2013; 1♂, Söğütlü suyu, Sevdilli köprüsü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 15.05.2014.

Remark: New record for the Kahramanmaraş province. Recorded from Artvin, Erzurum and Samsun provinces only (Darılmaz & İncekara, 2011).

***Hydrochus flavipennis* Kuster, 1852**

Materials examined: 2♀♀, 1♂, Kızıleniş, Türkoğlu, 37°21'41"K, 36°47'36"D, 595m, 28.09.2013.

Remark: New record for the Kahramanmaraş province. Recorded from Bingöl, Erzurum, Kütahya, Tokat provinces and Lake Van Basin only (Darılmaz & İncekara, 2011; Taşar et al., 2012). In Taşar et al. (2012), the name of species was writeen as "flavipes" mistakenly.

***Laccobius* (*Dimorpholaccobius*) *hauserianus* Kniz, 1914**

Materials examined: 1♀, 3♂♂, Mimarsinan Mahallesi, Onikişubat (Merkez), 37°41'34"K, 36°41'22"D, 729m, 12.04.2014.

Remark: New record for the Kahramanmaraş province. Recorded from Erzincan, Erzurum, İçel, Muğla and Sivas provinces only (İncekara, 2001, 2004; Darılmaz & İncekara, 2011).

***Laccobius* (*Dimorpholaccobius*) *hindukuschi* Chiesa, 1966**

Materials examined: 2♀♀, 1♂, Sarsap (Ovacık), Elbistan, 38°24'23"K, 37°09'53"D, 1302m, 17.05.2014; 2♀♀, 2♂♂, Çukurhisar, Onikişubat (Merkez), 37°49'41"K, 36°33'48"D, 1174m, 01.06.2014; 1♂, Değirmendere Göleti, Göksun, 37°53'44"K, 37°27'45"D, 1473m, 05.07.2014.

Remark: New record for the Kahramanmaraş province.

***Laccobius* (*Dimorpholaccobius*) *obscuratus obscuratus* Rottenberg, 1874**

Materials examined: 1♀, 3♂♂, Söğütlü (yalak), Elbistan, 38°16'27"K, 37°30'04"D, 1339m, 15.08.2013; 2♀♀, 3♂♂, Kızıleniş, Türkoğlu, 37°21'41"K, 36°47'36"D, 595m, 28.09.2013; 3♀♀, 6♂♂, Merkez, 37°34'28"K, 36°54'55"D, 600m, 09.06.2013; 5♀♀, 3♂♂, Merk Göleti, Çağlayancerit, 37°41'18"K, 37°13'21"D, 1448m, 26.04.2014; 1♀, 1♂, Değirmendere Göleti, Göksun, 37°53'44"K, 37°27'45"D, 1473m, 05.07.2014; 2♀♀, 1♂, Kullar, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 18.08.2013.

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

Materials examined: 2♂♂, Bektaşlı, Onikişubat (Merkez), 37°25'37"K, 36°17'09"D, 206m, 01.06.2014; 2♂♂, Sarsap (Ovacık), Elbistan, 38°24'23"K, 37°09'53"D, 1302m, 17.05.2014; 1♂, Çukurhisar, Onikişubat (Merkez), 37°49'41"K, 36°33'48"D, 1174m, 01.06.2014.

***Laccobius* (*Dimorpholaccobius*) *sipylus* d'Orchymont, 1939**

Materials examined: 1♂, Söğütlü suyu, Sevdilli köprüsü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 15.05.2014; 1♂, Sarsap (Ovacık), Elbistan, 38°24'23"K, 37°09'53"D, 1302m, 17.05.2014.

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

Materials examined: 2♀♀, 2♂♂, Söğütlü (yalak), Elbistan, 38°16'27"K, 37°30'04"D, 1339m, 15.08.2013; 1♀, 2♂♂, Söğütlü suyu, Sevdilli köprüsü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 15.05.2014; 2♀♀, 4♂♂, 15.05.2014; 1♂, Çukurhisar, Onikişubat (Merkez), 37°49'41"K, 36°33'48"D, 1174m, 01.06.2014; 1♂, Değirmendere Göleti, Göksun, 37°53'44"K, 37°27'45"D, 1473m, 05.07.2014.

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

Materials examined: 2♀♀, 3♂♂, Sarsap (Ovacık), Elbistan, 38°24'23"K, 37°09'53"D, 1302m, 17.05.2014.

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

Materials examined: 1♀, 2♂♂, Söğütlü (yalak), Elbistan, 38°16'27"K, 37°30'04"D, 1339m, 15.08.2013; 3♀♀, 2♂♂, Söğütlü suyu, Sevdilli köprüsü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 15.05.2014; 2♀♀, 1♂, 15.05.2014; 3♀♀, 4♂♂, Karagöl, Dulkadiroğlu (Merkez), 37°38'23"K, 36°56'29"D, 1597m, 23.03.2013; 2♀♀, 3♂♂, Kullar, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 19.05.2014; 1♀, 6♂♂, Merkaltı, 37°41'18"K, 37°13'21"D, 1448m, 03.05.2014; 2♀♀, 3♂♂, Kevgirli suyu, Akbayır kasabası, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 18.05.2014, 3♀♀, 2♂♂, 18.05.2014; 1♀, 1♂, Köseli, Onikişubat (Merkez), 37°36'19"K, 36°43'44"D, 586m, 09.06.2013; 1♂, Sarsap (Ovacık), Elbistan, 38°24'23"K, 37°09'53"D, 1302m, 17.05.2014; 1♂, Değirmendere Göleti, Göksun, 37°53'44"K, 37°27'45"D, 1473m, 05.07.2014.

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

Materials examined: 2♀♀, 2♂♂, Söğütlü suyu, Sevdilli köprüsü, Elbistan, 38°14'31"K, 37°34'09"D, 1404m, 15.05.2014; 1♀, 2♂♂, Merkaltı, 37°41'18"K, 37°13'21"D, 1448m, 03.05.2014; 2♂♂, Çukurhisar, Onikişubat (Merkez), 37°49'41"K, 36°33'48"D, 1174m, 01.06.2014; 18♀♀, 7♂♂, Kullar, Nurhak, 37°58'50"K, 37°31'00"D, 1316m, 18.08.2013; 2♀♀, 2♂♂, Söğütlü (yalak), Elbistan, 38°16'27"K, 37°30'04"D, 1339m, 18.05.2014.

DISCUSSION

Totally, 31 species are recorded between May 2013-September 2014. Of these, nine species: *Helophorus difficilis* Angus, 1988, *H. flavipes* Fabricius, 1792, *H. longitarsis* Wollaston, 1864, *H. oscillator* Sharp, 1915, *Laccobius hauserianus* Knisch, 1914, *L.hindukuschi* Chiesa, 1966, *Helochares obscurus* (O. F. Müller, 1776), *Hydrochus brevis* (Herbst, 1793) and *H. flavipennis* Kuster, 1852 are recorded from Kahramanmaraş province for the first time. Kahramanmaraş is a transition area between Medditerranean and Irano-Turanian phytogeographical regions, and the biodiversity of the area is very important in terms of biogeography and always interesting. New studies should therefore conducted on this group of insects.

LITERATURE CITED

Darılmaz, M. C. & İncekara, Ü. 2011. Checklist of Hydrophiloiedea of Turkey (Coleoptera: Polyphaga). Natural History, 45 (11-12): 685-735.

İncekara, Ü. 2001. Systematic Investigations on the Species of Hydrophilidae (Coleoptera) of Artvin, Erzurum and Rize province. Atatürk University, Graduate School of Natural and Applied Sciences, Department of Biology, Thesis (unpublished). 94 pp.

İncekara, Ü. 2004. Systematic Investigations on the Species of Hydrophilidae, Helophoridae and Hydrochidae of Erzincan Province. Atatürk University, Graduate School of Natural and Applied Sciences, Department of Biology, Ph.D. Thesis (unpublished). 178 pp.

Polat, A., İncekara, Ü. & Mart, A. 2010. A faunistic study on the Helophoridae, Hydrophilidae and Hydrochidae (Coleoptera) in Samsun and Tokat provinces (Turkey). Turk. Entomol. Derg., 34 (2): 227-239.

Tasar, G. E., Polat, A., Darılmaz, M.C., Türken, H., Aydoğan, Z., İncekara, Ü. & Kasapoğlu, A. 2012. A Good Sample to Concurrent Fauna: Study on Aquatic Coleoptera Fauna (Adephaga and Polyphaga) of Lake Van Basin (Turkey), with some Zoogeographic Remarks. J. Entomol. Res. Soc., 14 (2): 27-37.

Figure 1. Kahramanmaraş province of Turkey.

SCIENTIFIC NOTES

CYLICONEMAOIDA NOM. NOV., A REPLACEMENT NAME FOR THE PREOCCUPIED SPONGE SUBGENUS *LEPTONEMA* LENDENFELD (HEXACTINELLIDA: HYALONEMATIDAE)

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[**Dohrmann, M.** 2017. *Cyliconemaoida* nom. nov., a replacement name for the preoccupied sponge subgenus *Leptonema* Lendenfeld (Hexactinellida: Hyalonematidae). Munis Entomology & Zoology, 12 (1): 359-360]

Phylum Porifera Grant, 1836
Class Hexactinellida Schmidt, 1870
Subclass Amphidiscophora Schulze, 1886
Order Amphidiscosida Schrammen, 1924
Family Hyalonematidae Gray, 1857
Genus *Hyalonema* Gray, 1832

Subgenus *Cyliconemaoida* nom. nov.

Leptonema Lendenfeld, 1915. In Reports on the Scientific Results of the Expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, by the U.S. Fish Commission Steamer 'Albatross', from October, 1904, to March, 1905, Lieut. Commander L.M. Garrett, U.S.N., Commanding, and of other expeditions of the 'Albatross', 1891-1899 (29). The Sponges. 3. Hexactinellida. Memoirs of the Museum of Comparative Zoology at Harvard College. 42(2): 1-396, pls. 1-109. Preoccupied by *Leptonema* Guérin-Meneville, 1844. In Iconographie du règne animal de G. Cuvier: ou, Représentation d'après nature de l'une des espèces les plus et souvent non encore figurées de chaque genre d'animaux. Insectes, p. 396. (Arthropoda: Insecta: Trichoptera: Hydropsychidae).

Remarks on nomenclatural change: Lendenfeld (1915) erected the hexactinellid sponge subgenus *Hyalonema (Leptonema)* for the type species *Hyalonema (Leptonema) campanula* from off Central Peru, which was still regarded as a valid name after 100 years (van Soest et al. 2015). However, as pointed out on Wikidata (https://www.wikidata.org/wiki/User:Brya/list - errors_in_WoRMS), the name was already preoccupied for a genus of caddisflies (Trichoptera) by Guérin-Meneville (1844). Thus, the subgenus name *Leptonema* Lendenfeld, 1915 is a junior homonym of the genus name *Leptonema* Guérin-Meneville, 1844. I here propose the replacement name *Cyliconemaoida* **nom. nov.** for *Leptonema* Lendenfeld, 1915.

Etymology: For the close resemblance to *Hyalonema (Cyliconema)*. According to Tabachnick & Menshenina (2002: p. 1244) "The subgenus *Leptonema* most closely resembles *Hyalonema (Cyliconema)* differing only in the form of their respective macramphidiscs."

Summary of nomenclatural changes:

Genus *Hyalonema* Gray, 1832

Subgenus *Cyliconemaoida* **nom. nov.**
pro *Leptonema* Lendenfeld, 1915 (non Guérin-Meneville, 1844)

Hyalonema (Cyliconemaoida) acuferum Schulze, 1893 **comb. nov.**
from *Hyalonema (Leptonema) acuferum* Schulze, 1893

Hyalonema (Cyliconemaoida) campanula Lendenfeld, 1915 **comb. nov.**
from *Hyalonema (Leptonema) campanula* Lendenfeld, 1915

Hyalonema (Cyliconemaoida) campanula campanula Lendenfeld, 1915 **comb. nov.**
from *Hyalonema (Leptonema) campanula campanula* Lendenfeld, 1915

Hyalonema (Cyliconemaoida) campanula longispicula Tabachnick, 1990 **comb. nov.**
from *Hyalonema (Leptonema) campanula longispicula* Tabachnick, 1990

Hyalonema (Cyliconemaoida) choaniferum (Lévi, 1964) **comb. nov.**
from *Hyalonema (Leptonema) choaniferum* (Lévi, 1964)

Hyalonema (Cyliconemaoida) divergens Schulze, 1887 **comb. nov.**
from *Hyalonema (Leptonema) divergens* Schulze, 1887

Hyalonema (Cyliconemaoida) flagelliferum Ijima, 1927 **comb. nov.**
from *Hyalonema (Leptonema) flagelliferum* Ijima, 1927

Hyalonema (Cyliconemaoida) lusitanicum Bocage, 1864 **comb. nov.**
from *Hyalonema (Leptonema) lusitanicum* Bocage, 1864

Hyalonema (Cyliconemaoida) ovuliferum Schulze, 1899 **comb. nov.**
from *Hyalonema (Leptonema) ovuliferum* Schulze, 1899

Hyalonema (Cyliconemaoida) solutum Schulze, 1904 **comb. nov.**
from *Hyalonema (Leptonema) solutum* Schulze, 1904

Hyalonema (Cyliconemaoida) spatha Tabachnick & Lévi, 2000 **comb. nov.**
from *Hyalonema (Leptonema) spatha* Tabachnick & Lévi, 2000

Hyalonema (Cyliconemaoida) urna Schulze, 1904 **comb. nov.**
from *Hyalonema (Leptonema) urna* Schulze, 1904

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LITERATURE CITED

Guérin-Meneville, F. E. 1844. Iconographie du règne animal de G. Cuvier: ou, Représentation d'après nature de l'une des espèces les plus et souvent non encore figurées de chaque genre d'animaux. Insectes. J. B. Baillière: Paris.

Lendenfeld, R. von. 1915. The Sponges. 3. Hexactinellida. In: Reports on the Scientific Results of the Expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, by the U.S. Fish Commission Steamer 'Albatross', from October, 1904, to March, 1905, Lieut. Commander L.M. Garrett, U.S.N., Commanding, and of other expeditions of the 'Albatross', 1891-1899 (29). Mem. Mus. Comp. Zoolog. Harvard Coll., 42 (2): 1-396, pls. 1-109.

Tabachnick, K. R. & **Menshenina, L. L.** 2002. Family Hyalonematidae Gray, 1857. Pp. 1232-1263. In: Hooper, J.N.A., van Soest, R.W.M., editors. Systema Porifera. A Guide to the Classification of Sponges. Plenum: New York.

van Soest, R.W.M., Boury-Esnault, N., Hooper, J.N.A., Rützler, K., de Voogd, N.J., Alvarez de Glasby, B., Hajdu, E., Pisera, A.B., Manconi, R., Schönberg, C., Janussen, D., Tabachnick, K.R., Klautau, M., Picton, B., Kelly, M., Vacelet, J., Dohrmann, M., Díaz, C. & **Cárdenas, P.** 2015. World Porifera Database. Accessible at: http://www.marinespecies.org/porifera.

SCIENTIFIC NOTES

CONFIRMED OCCURRENCE OF *LABIDURA RIPARIA* (PALLAS, 1773) ON CYPRUS (DERMAPTERA)

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[Dvořák, L. 2017. Confirmed occurrence of *Labidura riparia* (Pallas, 1773) on Cyprus (Dermaptera). Munis Entomology & Zoology, 12 (1): 361**]**

The paper presents *Labidura riparia* (Pallas, 1773) as the first veryfied records on Cyprus. The specimens were collected from salt lake SW of Lemesos and Kouris Dam near Limassol.

The earwig fauna (Dermaptera) of Cyprus is well known, the recent study (Anlaş & Kočárek, 2012) presents seven species from Cyprus: *Euborellia moesta* (Géné, 1839), *Apterygida media* (Hagenbach, 1822), *Forficula aetolica* Brunner, 1882, *F. auricularia* Linnaeus, 1758, *F. lurida* Fischer, 1853, *F. smyrnensis* Audinet-Serville, 1839, and *Guanchia hincksi* (Burr, 1947).

As Anlaş & Kočárek (2012) wrote, *Labidura riparia* is a cosmopolitan species, preferring sandy habitats, often beaches and riverbanks, but also lives away from those environments; it probably occurs in Cyprus.

Here, this species is listed as a member of Cyprus fauna based on collected material.

Labidura riparia (Pallas, 1773)

Material examined: 1 male, 1 female, Cyprus: 10 km SW Lemesos, salt lake, 34°37'37,956"N, 32°57'37,512"E, 13.9 m a.s.l., 6.-7.VI.2016, M. Fiala leg., L. Dvořák det., coll. Municipal Museum Mariánské Lázně, Czech Republic. 1 male, Cyprus: Limassol, Kouris Dam, 23.IV.2016, Chvalkovský leg., L. Dvořák det., coll. Municipal Museum Mariánské Lázně, Czech Republic.

Distribution: This cosmopolitan species (Steinmann, 1989a,b) is very common in Turkey and is recorded from nearly all parts of Anatolia and Thrace (Anlaş & Kočárek, 2012).

Remark: These are the first verified records of *L. riparia* to Cyprus.

LITERATURE CITED

Anlaş, S. & Kočárek, P. 2012. Current status of Dermaptera (Insecta) fauna of Turkey and Cyprus. Türk. entomol. derg., 36 (1): 43-58.

Steinmann, H. 1989a. World Catalogue of Dermaptera. Series Entomologica, 43: 1-934.

Steinmann, H. 1989b. Dermaptera Catadermaptera 2. Tierreich 108, Walter de Gruyter, Berlin – New York, 504 pp.

Figure 1. Biotope of *Labidura riparia* on Cyprus. Photo: Martin Fiala.

SCIENTIFIC NOTES

SOME ECOLOGICAL AND FAUNISTICAL NOTES ON INSECT FAUNA IN ŞAHAPLI STREAM (TURKEY: ELAZIĞ: BASKİL)

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[**Özgen, İ., Topdemir, A. & Tanyıldızı, M. Ş.** 2017. Some ecological and faunistical notes on insect fauna in Şahaplı stream (Turkey: Elazığ: Baskil). Munis Entomology & Zoology, 12 (1): 362-364]

Şahaplı is located in the south of Baskil district, Şevkat creek merging with the River Geli which is stemming from the creeks of Bulutlu Mountain near Keluşağı, is the river flows into Karakaya dam lake (Anonymous, 2016). In recent years, the stream has been affected by domestic pollutants. Sewage wastes of Baskil are poured into this quarry. Because of this, biodiversity and its varieties in this stream and its vicinity are important. A detailed study on insect biodiversity in the vicinity of this stream has not been done yet. This study includes the results of surveys carried out in certain periods to determine insect biodiversity nearby the stream. In the study, glass jars with a diameter of 5 cm and a height of 10 cm were placed at the edge of the creek so that the tubulure part would be on the same surface as the soil layer. Ethylene glycol, vinegar or antifreeze was poured into the jars at a height of 4 cm and water was added to the other 4 cm clearance. The liquids in the jar-traps were brought to the laboratory by draining them into the culture jars with the aid of a strainer for 15 days. Species were separated into the family level and sent to experts for diagnosis. Besides, atrap sampling method has also been applied in order to collect the species found on weeds at the stream's waterfront. The study was carried out between April and October of 2015-2016.

RESULTS

COLEOPTERA

Carabidae

***Trechus quadristriatus* (Schrank, 1781)**

Material examined: Elazığ, Baskil, Şahaplı,1220 m, 16.05.2016, 5 exs.
Distribution in Turkey: Adana, Adıyaman, Antalya, Bilecik, Bolu, Burdur, Bursa, Erzincan, Erzurum, Giresun Hatay Içel, Izmir, Manisa Muğla, Osmaniye, Sakarya (Tezcan et al., 2007).

***Calathus melanocephalus* (Linnaeus, 1758)**

Material examined: Elazığ, Baskil, Şahaplı, 1220 m, 01.07.2015, 11 exs**.** leg. Özgen.
Distribution in Turkey: Afyon, Ankara, Ardahan, Artvin, Çankırı, Çorum, Diyarbakır, Erzurum, Erzincan, Eskişehir, Kars, Kayseri, Rize Tokat (Özgen et al., 2012; Fidan et al., 2014).

Cantharidae

***Rhagonycha fulva* (Scopoli, 1763)**

Material examined: Elazığ, Baskil, Şahaplı, 1220 m, 16.05.2016, 5 exs**.** leg. Özgen.
Distribution of Turkey: Erzurum, Isparta (Yıldırım et al., 2011; Demirözer & Karaca, 2014).

Hydrophilidae

***Coelostoma transcaspicum* (Reitter, 1906)**

Material examined: Elazığ, Baskil, Şahaplı, 1220 m, 28.10.2016, 5 exs. leg. Özgen.

Distribution of Turkey: Bingöl (Mart et al., 2006).

Staphylinidae

***Paederus mesopotamicus* (Eppelsheim, 1889)**

Material examined: Elazığ, Baskil, Şahaplı, 1220 m, 21.10.2016, 18 exs. leg. Özgen.
Distribution of Turkey: Sivas, Tunceli (Anlaş, 2009; Sert et al., 2013).

***Gauropterus sanguinipennis* (Kolenati, 1846)**

Material examined: Elazığ, Baskil, Şahaplı, 1220 m, 11.7.2015, 2 exs, leg. Özgen.
Distribution in Turkey: Adana, Amasya, Ankara, Antalya, Batman, Bayburt, Bilecik, Bingöl, Bitlis, Bursa, Elazığ, Erzincan, Erzurum, Eskişehir, Gaziantep, Hakkari, Hatay, Iğdır, Isparta, Izmir, Kars, Kastamonu, Konya, Malatya, Manisa, Mersin, Muğla, Niğde, Sakarya, Siirt, Şırnak, Tunceli, Van, Zonguldak (Anlaş, 2009; Özgen et al., 2015).

***Philonthus concinnus* (Gravenhorst, 1802)**

Material examined: Elazığ, Baskil, Şahaplı, 1220 m, 05.5.2015, 6 exs, leg. Özgen.
Distribution in Turkey: Adana, Ankara, Antalya, Ardahan, Bingöl, Bolu, Diyarbakır, Elazığ, Erzincan, Erzurum, Iğdır, Kayseri, Konya, Manisa, Mardin, Mersin, Tunceli (Anlaş, 2009; Özgen et al., 2015).

Cicindellidae

***Calomera fischeri fischeri* (M. F. Adams, 1817)**

Material examined: Elazığ, Baskil, Şahaplı , 1220 m, 22.10.2016, 14 exs, leg. Özgen.
Distribution of Turkey: Adana, Adıyaman, Antalya, Alanya, Bingöl, Bursa, Çankırı, Çorum, Denizli, Gaziantep, Gümüşhane, Elazığ, Erzincan, Erzurum, Fethiye, Hakkari Hatay, İçel, İskenderun, İzmir, İnegöl, Kahramanmaraş, Kars, Kayseri, Kütahya, Malatya, Mardin, Muğla, Nevşehir, Pamukkale, Tokat, Tunceli, Siirt, Şanlıurfa, Silifke, Şanlıurfa (Avgın, 2006).

Hemiptera

Hydrometridae

***Hebrus montanus* (Kolenati, 1857)**

Material examined: Elazığ, Baskil, Şahaplı, 1220 m, 21.10.2016, 15 exs, leg. Özgen.
Distribution of Turkey: Ankara, Bingöl, Gaziantep

***Ochterus* (*Ochterus*) *marginatus marginatus* (Latreille, 1804)**

Material examined: Elazığ, Baskil, Şahaplı, 1220 m, 21.10.2016, 11 exs.
Distribution of Turkey: Adana, Elazığ, Niğde (Önder et al., 2006; Fent et al., 2011; Matocq et al., 2014).

Miridae

Alloeomimus unifasciatus (Reuter, 1879)

Material examined: Elazığ, Baskil, Şahaplı, 1200 m, 21.10.2016, 4 exs, leg. Özgen.
Distribution of Turkey: Kahramanmaraş (Önder et al., 2006).

In the study, a total of 96 individuals of 2 orders, 7 families and 11 species were collected. As a result, all species except *C. fischeri fischeri*, *O. marginatus*, *G. sanguinipennis* and *P. concinnus* were detected for the first time in the province of Elazığ along with the surrounding stream area. The vast majority of species are species that live in beach areas that prefer aquatic habitats. Besides, the detection of *C. transcaspicum* and *A. unifasciatus* in these habitats is the second record of their faunistic presence in our country. In addition, due to the substance of the secretion paederine secreted by the *P. mesopotamicus* strain collected in the study, it is among the species which should be particularly emphasized due to the feature of dermatitis formation. The possibility of an increase in the population of this beetle at the streamside has the feature of forming dermatitis cases. This municipal waste of the district will have negative effects on the insect populations, which will have negative effects on faunistic composition in the next years. It is important to carry out ecological and faunistic studies on this stream and its neighbour.

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LITERATURE CITED

Anonymous, 2016. 23 Elazığ. Elazig province.blogspot.com/p/baskil.html. Alıntılama tarihi: 10.07.2016.

Anlaş, S. 2009. Distributional checklist of the Staphylinidae (Coleoptera) of Turkey, with new and additional records. Linzer Biologische Beiträge, 41 (1): 215-342.

Avgın, S. S. 2006. General Information and Tiger beetles *Cicindella herbacea, Calomera fisheri fisheri* and *Homodela ismenia kilikensis* collected from southeast of Turkey (Coleoptera: Cicindellidae). BAU. Fen Bilimleri Enst. Derg., 8 (2): 23-27.

Fent, M., Kment, P., Çamur-Elipek, B. & Kirgiz, T. 2011. Annotated catalogue of Enicocephalomorpha, Dipsocoromorpha, Nepomorpha, Gerromorpha, and Leptopodomorpha (Hemiptera: Heteroptera) of Turkey, with new records. Zoosystema, 2856: 1-84.

Fidan, E. C., Şirin, Ü., Kısım, E., Destire, C. & Çalışkan, H. 2014. Contribution to the knowledge of Carabidae fauna from Eskişehir Osmangazi Meşelik Kampüs. Mun. Ent. Zool., 9 (1): 258-265.

Önder, F., Karsavuran, Y., Tezcan, S. & Fent, M. 2006. Heteroptera (Insecta) Catalogue of Turkey. İzmir: Ege Üniversitesi Ziraat Fakültesi, Turkey. 164 p.

Özgen, İ., Şen, S. & Anlaş, S. 2012. Diyarbakır İli Eğil İlçesi Mera-Meşe Ekosisteminde Üç Farklı Örnekleme Yönteminde Insecta Biyoçeşitliliği. 21. Ulusal Biyoloji Kongresi, 3-7 Eylül. İzmir. 1062-1063 s.

Özgen, İ. Anlaş, S., Khachikov, E. A. & Temizer, A. 2015. Contribution to the knowledge of Staphylininae (Staphylinidae, Coleoptera) in Elazığ province of Turkey. Journal of Entomological and Zoology Studies, 3 (1): 224-226.

Sert, O., Turan, Y., Şabanoğlu, B., Anlaş, S. & Fırat, S. 2013. Faunistical, Ecological and Zoogeographical Evaluations on the Subfamily Paederinae (Coleoptera: Staphylinidae) in the Central Anatolian Region of Turkey. Türk. entomol. derg., 37 (4): 477-492.