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PRIMARY JOB OF A SCIENTIST: ORIGINAL RESEARCH OR FAULT-FINDING?

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[Hołyński, R. B. 2014. Primary job of a scientist: Original research or fault-finding?. Munis Entomology & Zoology, 9 (2): 589-590**]**

Some years ago I published a paper (HOŁYŃSKI 2003) in which – as one of many serious drawbacks of the obligatory peer-reviewing system – I emphasized the "*very high – out of any reasonable proportion with the typically resulting (if any...) improvements – costs [.. in terms ... mainly of time and effort of all the involved parties – the reviewer, author and editor, who could use it much more profitably ...]*". My paper has not provoked any reaction – people do not like to question the sanctity of Sacred Cows, and anyway it is much easier to repeat uncritically a dogma of the allegedly enormous importance of the peer-reviewing system to assure the high level of scientific publications than to find and formulate serious counter-arguments to opposite contentions – but facts supporting my conclusions are now more numerous and persuasive than ever before. One of such facts, known to editors of any "peer-reviewed" journal, is the increasing difficulty in finding appropriate and willing reviewers – the question raised, among others, by GRAUR (2014), who "*discovered a negative correlation between the number of papers that a scientist publishes per year and the number of times that that scientist is willing to accept manuscripts for review*". Such correlation is perfectly expectable: some people spend their time on effective scientific research, some others are more interested in "looking for a mote in other's eye" – the time is not infinite, one must choose, so the corrlation must be negative! GRAUR (2014) concludes that "*the biggest consumers of peer-review seem to contribute the least to the process*", but this is a glaring misconception: I, *e.g.*, do not consider myself a "consumer" but rather a "sufferer" of the obligatory peer-reviewing system, which costs me (and, of course, any other author) hours spent on superfluous or even harmful adjusting my formulations to those preferred by the reviewers, or at least on idle quarreling and lengthy explications why I consider my original formulation better! If ***an author*** asks me – as some of my Colleagues frequently do – to read his/her manuscript and ***informally*** comment on it, I of course never refuse because I consider my duty to offer the ***desired*** help, but I always reject the ***editors'*** requests to serve as ***formal*** "peer-reviewer" whose objections (just or groundless, honest or unfair...) may cause the rejection of the paper by the editor, or at least cause superfluous stress and waste of time of the author. Honest discussion is either that carried directly between me and the author, or – concerning already published paper – openly, by ***also published and signed*** comments, not by "shooting from behind a fence", behind the double shield of anonymity and non-responsibility...

To conclude: GRAUR's (2014) proposal to "*ask senior authors to provide evidence of their contribution to peer review as a condition for considering their manuscripts*" evidently aims at putting the cart before the horse: the primary job of a scientist is ***doing original research***; to subordinate it to accessory task of reviewing others' work would, at that, be profoundly unfair (demanding scientists to do what at least many of them consider superfluous or detrimental), harmful to the scientific progress (forcing most effective researchers to spend time on unfruitful "finding quarrel in a straw" instead of productive studies), and finally provoking further multiplication of (already now by no means rare…) poor, hurried, superficial and/or malicious comments… The proper solution of the problem would be just to "*abolish the peer review altogether*", not nearly "*tantamount to doing away with science as we know it*": for centuries NEWTONS, DARWINS, EINSTEINS and innumerable others neither reviewed others' papers nor expected their own to be reviewed (indeed some – like *e.g.* EINSTEIN – angrily protested against the very idea!), and nevertheless the "*science as we know it*" has been developed mainly by those "*Giants on whose shoulders we stay to see further*"! I do not wish to repeat here the many-sided argumentation presented in detail in the paper cited above (HOŁYŃSKI 2003), but quotation of concluding remarks seems necessary: "*Obviously I do not advocate automatic acceptation of any dabblery or charlatanry, I only suggest not to apply the cure which is worse than the malady… I am sure that the "optional" peer-review system would be much more adequate and much less harmful: a submitted paper should be looked through by the editor (concentrating on its **scientific** value, **not** on formal "editorial standards"!) – in most cases it will be immediately evident to him/her whether the results are reliable and non-trivial (in which case the paper should be accepted) or not (what would warrant its rejection). Naturally in those (rather rare) instances when the editor suspects serious (**scientific!**) problems but feels not competent to decide, he/she could ask for the opinion of an "expert" referee, whose conclusions (if negative) should be sent to the author who can either accept them or not – in the latter case it is the editor's duty and responsibility to evaluate the soundness of the arguments of **both** sides, and decide to reject the paper (if the "worthlessness" of presented results seems evident) or accept it (otherwise)*".

LITERATURE CITED

Graur, D. 2014. Payback time for referee refusal. Nature, 505 (7484): 483.

Hołyński, R. B. 2003. Obligatory "peer-reviewing": can cosmetics really help? Antenna, 27 (4): 251-256.

PHLOIOCOPUS MAGNANII N. SP., A NEW CHECKERED BEETLE FROM IRAN (COLEOPTERA: CLERIDAE)

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[Zappi, I. 2014. *Phloiocopus magnanii* n. sp., a new checkered beetle from Iran (Coleoptera: Cleridae). Munis Entomology & Zoology, 9 (2): 591-598**]**

ABSTRACT: *Phloiocopus magnanii* n. sp., a new species of *Phloiocopus* Guérin-Méneville, 1835, from Iran, is described and figured. *Opilo desertorum* Gerstmeier, 2010 is reported for the first time from Iran and Qatar.

KEY WORDS: Coleoptera, Cleridae, Clerinae, *Phloiocopus*, Iran, new species, *Opilo desertorum*, new country record.

The genus *Phloiocopus* Guérin-Méneville, 1835 includes about fifty species (Corporaal, 1950), mainly distributed in the Afrotropical and Malagasy regions. Four species are found in the Palearctic region (Löbl & Smetana, 2007), where their distribution is limited to North Africa and the Middle East: *P. andresi* (Schenkling, 1912), *P. arabicus* (Corporaal, 1941), *P. basalis* (Klug, 1842) and *P. tricolor* Guérin-Méneville, 1835.

The taxonomy of the genus is rather confused due to the many superficial descriptions and the lack of a comprehensive revision. The scientific contributions to this genus during the last few decades have been few, and include the description of a new species from Madagascar (*P. loici* Menier, 2001), the transfer of *P. bayonnei* Chobaut, 1897 to a new genus *Flabellotilloidea* Gerstmeier & Kuff, 1992 and subfamily (Tillinae). Finally, *P. rufus* Pic, 1935 described from Lebanon was recognised as a junior synonym of *P. andresi* (Schenkling, 1912) (Gerstmeier, 1998).

This paper describes and figures a new species of *Phloiocopus* from Iran, reared from the branches of eight different tree species.

MATERIALS AND METHODS

Morphological observations were undertaken using Meiji EMZ 13 stereo microscopes, with an ocular micrometer for measurements.

The micro-photographs were taken with the Canon MP-E 65mm f/2.8 1-5x Macro Photo lens on a Canon EOS 600D (18.0 MP) digital camera (habitus of adults), with a Reflex Pentax K20D (14.6 MP) digital camera on a Nikon Labophot 1 microscope (all the other images). CombineZM was used to create the stacked images.

Male and female genitalia were macerated in a cold solution of 10% potassium hydroxide for some hours and examined in glycerol.

The following abbreviations are used in the text:

MSNG = Civic Museum of Natural History “G. Doria”, Genova, Italy.
CIZ = collection of Iuri Zappi, Casalecchio di Reno, Bologna, Italy.
CDB = collection of Daniele Baiocchi, Roma, Italy.
CGM = collection of Gianluca Magnani, Cesena, Italy.

Phloiocopus magnanii n. sp.

(Figs. 1-12)

Diagnosis

A species of *Phloiocopus* of moderate length, with terminal antennal segment in the male longer than the previous five segments together. Body colour predominantly brown, with a pale transverse macula at the centre of the elytra. Pronotum densely punctured, and mostly dull. Elytra with punctation coarse, deep and regular basally, becoming dense and irregular in the apical half.

The new species differs from other *Phloiocopus* of the West Palearctic region, by its elongate and slender body, by the mainly dull pronotal disc with dense and wrinkled punctation, the punctation of the elytra and by the male genitalia.

Material examined: Holotype ♂: Iran, Fars, Mian Jangal, 40 km N Fasa, 1750 m, 15.V.2005, G. Magnani leg., ex larva *Ficus sp.* emerged 12.VI.2005 (CIZ) {Pre-printed labels}; **Paratypes**: **Iran**, Fars, Sivand, 30°06'N 52°58'E, 1850 m, 14.V.2005, D. Gianasso leg., ex larva *Pistacia sp.* emerged 1.VIII.2005 (1♀, CIZ); **Iran**, Fars, env. Sivand, 30°05'N 52°53'E, 1800 m, 28.IV.2006, D. Baiocchi leg., ex larva *Ficus sp.* emerged 12.VIII.2006 (1♀, CDB); **Iran**, Fars, Dašt-e Aržan, 29°41'N 51°01'E, 27-29.IV.2006, D. Baiocchi leg., ex larva *Prunus sp.* emerged 6.VI.2006 (1♀, CDB); idem, ex larva *Pistacia sp.* emerged 28.VI.2006 (1♀, CDB); **Iran**, Fars, 2050 m, 7 km W Dašt-e Aržan, 29°38'00"N 51°54'50,7"E, 4-6.V.2008, D. Baiocchi leg., ex larva *Fraxinus sp.* emerged 18.VII.2008 (1♂, CIZ); idem, ex larva *Prunus sp.* emerged VII.2008 (1♀, CDB); idem, ex larva *Fraxinus sp.* emerged VI.2009 (1♂, CDB); idem, ex larva *Acer sp.* emerged 24.III.2011 (1♀, CDB); **Iran**, Fars, 2050 m, 7 km W Dašt-e Aržan, 29°38'00"N 51°54'50,7"E, 1-3.V.2009, D. Baiocchi leg., ex larva *Acer sp.* emerged 2009 (1♂, CDB); idem, ex larva *Prunus sp.* emerged VI.2010 (1♂, CIZ); **Iran**, Fars, Mian Jangal, 40 km NW Fasa, 1750 m, 15.V.2005, G. Magnani leg., ex larva *Prunus sp.* emerged X.2005 (1♀, CGM); **Iran**, Fars, Mian Jangal, 40 km NW Fasa, 1750 m, 18.IV.2006, G. Sama leg., ex larva *Ficus sp.*, 25.VII.2006 {Very damaged specimen} (1♀, CIZ); **Iran**, Fars, Mian Jangal, 40 km N Fasa, 1750 m, 29°09'N 53°24'E, 15-16.V.2005, D. Baiocchi leg., ex larva *Ficus sp.* emerged 30.VI. 2005 (1♀, CDB); **Iran**, Fars, W Sarvestan, 40 km NW Fasa, Mian Jangal, 1730 m, 29°09'33,7"N 53°24'16,7"E, 18.IV.2006, D. Baiocchi leg., ex larva *Ficus sp.* emerged 6.VII.2006 (1♂ and 1♀, CIZ; 1♀ CDB); idem, ex larva *Pistacia sp.* emerged 4.VII.2006 (1♀, CDB); **Iran**, Fars, W Sarvestan, 40 km NW Fasa, Mian Jangal, 1730 m, 29°09'33,7"N 53°24'16,7"E, 15.IV.2007, D. Baiocchi leg., ex larva *Pistacia sp.* emerged 28.VI.2007 (1♀, CDB); idem, ex larva *Pistacia sp.* emerged 7.VII.2007 (1♂, CIZ); idem, ex larva *Pistacia sp.* emerged 13.VII.2007 (1♀, CIZ); idem, ex larva *Pistacia sp.* emerged 18.VI.2008 (1♀, CIZ); idem, ex larva *Pistacia sp.* emerged 6.VI.2009 (1♂, CDB); **Iran**, Fars, W Sarvestan, 40 km NW Fasa, Mian Jangal, 1730 m, 29°09'33,7"N 53°24'16,7"E, 5.V.2008, D. Baiocchi leg., ex larva *Ficus sp.* emerged 2.VI.2008 (1♀, CDB); idem, ex larva *Ficus sp.* emerged 25.VI.2008 (1♂ CIZ; 1♂ CDB); idem, ex larva *Ficus sp.* emerged 3.VII.2008 (1♂ MSNG); idem, ex larva *Ficus sp.* emerged 9.VII.2008 (1♂, CDB; 1♀ CIZ); idem, ex larva *Ficus sp.* emerged 4.VIII.2008 (1♂, CIZ); idem, ex larva *Ficus sp.* emerged 1.IV.2010 (1♂ and 1♀ CDB; 1♀ MSNG); **Iran**, Fars, W Sarvestan, 40 km NW Fasa, Mian Jangal, 1730 m, 29°09'33,7"N 53°24'16,7"E, 2.V.2009, D. Baiocchi leg., ex larva *Pistacia* sp. emerged 21.VII.2009 (1♂, CDB); idem, ex larva *Prunus sp.* (1♂, CDB); **Iran**, Fars, W Sarvestan, 40 km NW Fasa, Mian Jangal, 1730 m, 29°09'33,7"N 53°24'16,7"E, 7.V.2010, D. Baiocchi leg., ex larva *Pistacia sp.* emerged 6.VII.2010

(1♀, CDB); **Iran**, Kerman, N of Deh Bakri, 29°07'40"N 57°55'99"E, 1825 m, 23-25.V.2011, D. Baiocchi leg., ex larva *Nerium sp.*(1♂, CDB); **Iran**, Kohgiluyeh and Boyer-Ahmad, NW Sisaht, Dena Reserve, 30°52'46,8"N 51°25'12,3"E, 2400 m, 26.IV.2007, D. Baiocchi leg., ex larva *Prunus* sp. emerged 7.VII-26.VII.2010 (1♂ CIZ; 1♂ and 1♀ CDB); **Iran**, Kohgiluyeh and Boyer-Ahmad, NW Sisaht, Dena Reserve, 30°52'46,8"N 51°25'12,3"E, 2400 m, 7.V.2008, D. Baiocchi leg., ex larva *Prunus sp.* emerged 31.V-7.VI.2009 (1♂ and 1♀, CIZ); **Iran**, Kohgiluyeh and Boyer-Ahmad, NW Sisaht, Dena Reserve, 30°52'46,8"N 51°25'12,3"E, 2400 m, 4-5.V.2009, D. Baiocchi leg., ex larva *Prunus sp.* emerged VII.2009 (1♂, CDB); idem, ex larva *Prunus sp.* emerged 20.VI.2010 (1♀, CDB); idem, ex larva *Prunus sp.* emerged III.2011 (1♂, CDB); **Iran**, Kordestan, 22 km N Kamyaran, 34°57'20,6"N 46°58'38,4"E, 1500 m, 8-9.V.2009, D. Baiocchi, leg., ex larva *Crataegus sp.* emerged 11.VII-21.VII.2009 (1♂ and 2♀♀, CDB); **Iran**, Kordestan, 22 km N Kamyaran, 34°57'20,6"N 46°58'38,4"E, 1500 m, 14-15.V.2010, D. Baiocchi leg., ex larva *Crataegus sp.* emerged 17.VI.2011 (1♀, CIZ); **Iran**, Lorestan, 5-15 km SW Dorud, 9/10.V.2002, 1400 m, G. Magnani leg., ex larva *Pistacia sp.* emerged 6.X.2002 (1♀, CIZ); **Iran**, Lorestan, 10-15 km SW Dorud, 30.IV.2007, 1500 m, G. Magnani leg., ex larva *Pistacia sp.* emerged 3.IX.2007 (1♂, CGM); **Iran**, Lorestan, 10-15 km SW Dorud, 2.V.2006, 1500 m, D. Gianasso leg., ex larva *Pistacia sp.* emerged 1.VII.2007 (1♂, CIZ); **Iran**, Lorestan, 10-15 km SW Dorud, 33°13'48"N 49°59'20,8"E, 1500 m, 21-23.V.2005, D. Baiocchi leg., ex larva *Ficus carica* emerged 10.VII.2005 (1♂, CDB); idem, ex larva *Amygdalus sp.* emerged 4.VII.2005 (2♂♂, CDB); idem, ex larva *Pistacia sp.* emerged 22.VII.2005 (1♂, CDB); idem, ex larva *Pistacia sp.* emerged 28.VI.2006 (1♂, CDB); **Iran**, Lorestan, 10-15 km SW Dorud, 33°13'48"N 49°59'20,8"E, 1500 m, 2.V.2006, D. Baiocchi leg., ex larva *Ficus carica* emerged 30.VII.2006 {Mesotibiae, metafemora and metatibiae very strongly curved due to teratology} (1♀, CDB); idem, ex larva *Ficus carica* emerged 4-14.VII.2006 (1♀, CIZ; 2♀♀, CDB); idem, ex larva *Ficus carica* emerged 28.VI.2007 (1♀, CIZ); idem, ex larva *Pistacia sp.* emerged 30.VI-24.VII.2006 (1♂ and 1♀ CIZ; 3♀♀ CDB); **Iran**, Lorestan, 10-15 km SW Dorud, 33°13'48"N 49°59'20,8"E, 1500 m, 30.IV.2007, D. Baiocchi leg., ex larva *Pistacia sp.* emerged 23.VI-26.VII.2007 (4♂♂ and 2♀♀, CDB); idem, ex larva *Pistacia sp.* emerged 17.VI.2008 (1♂, CDB); idem, ex larva *Pistacia sp.* emerged V.2009 (1♀, CIZ); idem, ex larva *Ficus sp.* emerged VII.2007 (1♂, CDB); **Iran**, Lorestan, 10-15 km SW Dorud, 2260 m, 9.V.2008, D. Baiocchi leg., ex larva *Pistacia sp.* emerged 30.VII-6.VIII.2008 (1♂ CIZ; 1♀ CDB).

Description of the Holotype

Size – Length from the clypeus to apex of elytra 8.8 mm.

Head – Brown, glossy surface, irregularly punctate on frons but with a conspicuous, irregular rugosity on vetex, with yellow-golden setae; clypeus amber-colored, glossy and smooth; labrum transverse, anteriorly bilobed, amber-colored, glossy with long setae near the base, becoming short nearer the anterior margin; mandibles robust, brown near the base becoming darker near the black teeth; apical segments of labial and maxillary palpi securiform, more elongated, the terminal maxillary palpomeres, more compact the terminal labial palpomeres; head, including eyes, broader than anterior margin of pronotum; large eyes, protruding laterally, coarsely faceted, conspicuously emarginated anteriorly at antennal base and with long erect setae among ommatidia, inter-ocular distance approximately a single eye width; gular process broad.

Antennae – 11-segmented, slender, brown, reaching the posterior margin of the pronotum when laid alongside; scape large and curved, small pedicel (as long as the 1/2 of the scape); antennomeres 3, 4, 5 and 6 long and slender (twice as long as the pedicel); antennomeres 7 and 8 as with the previous but with decreasing length; antennomeres 9 and 10 slightly longer than 8; 11 longer than the previous five together (its length 1/3 of the entire antenna); antennomeres 9 and 10 slightly thicker and truncate; antennomere 11 from the base to the 3/5 of its length straight, then slightly curved and obliquely truncated apical margin; macrosetae long and acuminated from scape to antennomere 10 and present only at the apex of antennomere 11, where they are much shorter; microsetae only distributed on the last three antennomeres (particularly at the apex of 9 and 10 and the whole antennomere 11) (Fig. 3).

Pronotum – Brown, slightly longer than wide (length : width ratio 1.16:1); lateral margins slightly sinuate, more constricted posteriorly; vestiture consisting of two types of golden-yellow pubescence (sparse, long, straight setae above a slightly more dense, short setae, strongly curved); surface anterior to subapical transverse glossy depression, with only few and shallow punctures; disc less glossy, darker, conspicuously and irregularly punctate-rugose, with a longitudinal impression medially; central part of pronotal base smooth in longitudinally; procoxal cavities open posteriorly, prointercoxal process expanded.

Scutellum – Transverse/elliptic, entirely punctate with golden-yellow, slender, short and strongly curved setae; colour changing from yellow-brown at the center to brown near the margins.

Elytra – Elongate, broader than head or pronotum, length : width ratio 2.65:1, initially subparallel, slightly dilated posteriorly, widest at the apical third, apices barely emarginated and pointed; ground colour yellow-brown with a pale transverse fascia in the middle, posterior third of each elytron a little darker; basal part of the elytra up to the pale transverse fascia with rows of well-defined and regular punctures, occasionally with some punctures along the interstices, punctation of the remaining surface of the elytra coarse, deep and irregular; vestiture consisting of two types of golden-yellow pubescence (sparse, long, straight setae above, with dense, short and strongly recumbent setae below).

Legs – Long with pale yellowish setae of variable length; protrochanters covered with setae sparser than those covering meso- and meta-trochanters; femora brown, becoming paler towards the base; tibiae slightly curved (especially protibiae) with a carina on each of the ventral and dorsal sides; tibial spur formula 1-2-2, spurs short and straight; tarsi with basitarsus scarcely visible from above (shorter than other tarsomeres), covered by tarsomere 2, tarsomere 3 shorter than 2, 4 shorter than 3, tarsomere 5 slightly longer than 2; pulvilli of basitarsus absent, pulvilli of tarsomeres 2, 3 and 4 developed; claws dilated at the base, without denticle; empodium very small, bisetose.

Metasternum – Yellow-brown, with fine punctation denser near the discriminal line, which is smooth and hairless; setae fine, golden-yellow, posteriorly directed.

Abdomen – Pale yellow; moderately convex, with 6 visible sternites, scarcely punctate and glossy, covered with fine, scattered, posteriorly oriented, golden-yellow setae. Aedeagus, male pygidium, male sternum VIII, spicular fork, see Figures 5 - 10.

Sexual dimorphism

The female (Fig. 2) differs from the male by the last antennomere which is as long only as the preceding three together (Fig. 4). Lenght antenna / lenght body (from apical margin of clypeus to apex of elytra) ratio is on average about 0.31 in males and about 0.24 in females.

Female pygidium, female sternum VIII, see Figures 11 - 12.

Variability in the paratypes

Size – The length from the clypeus to the apex of the elytra is 8.2-13.2 mm in males and 7.1-11.0 mm in females.

The elytral color varies from yellow-brown to lighter or darker brown, with the presence in the middle of a pale transverse fascia, more or less wide.

In some specimens there is a black and elongate macula in the posterior third of each elytron behind the pale transverse fascia (Fig. 2).

Etymology: This new species is dedicated to my friend Gianluca Magnani, a specialist of Palearctic Buprestidae beetles and who collected the holotype.

Comparative notes

Phloiocopus magnanii n. sp. is easily distinguishable from other species of the genus *Phloiocopus* living in the Western Palearctic region.

Phloiocopus tricolor Guérin-Méneville, 1835 and *Phloiocopus basalis* (Klug 1842) have the head and pronotum black or red brown, the anterior half of elytra red brown, the posterior half black with a straight and yellow transverse spot behind middle. *Phloiocopus tricolor* has a wide distribution: Syria, Saudi Arabia, Yemen, whole Sahara and Oriental Africa. *Phloiocopus basalis* is known from Egypt, Israel, Cyprus and Turkey.

Phloiocopus arabicus (Corporaal, 1914) has the head black and pronotum blackish brown. Only the basal quarter of elytra is red brown and the yellow fascia behind middle extends apically and then anteriorly towards the suture. It is known from Saudi Arabia and Yemen.

Phloiocopus magnanii n. sp. is closest to *Phloiocopus andresi* (Schenkling, 1912) from which it differs as follows: the body shape more elongated and slender; the punctation at the base of the head and on the disc of pronotum is much denser; punctation on the anterior two thirds of the elytra is arranged in 5 or 6 rows of smaller and shallow punctures (in the remaining surface of the elytra the punctation is irregular) and not in 10 regular longitudinal rows of very coarse and very deep punctures; legs are much narrower; the aedeagus is very different. *Phloiocopus andresi* is found in the Levant and Egypt.

Phloiocopus magnanii n. sp. is surprisingly very similar in shape and colour to the recently described: *Opilo desertorum* Gerstmeier, 2010. However, the two are easily distinguishable with the following characters: *Phloiocopus magnanii* n. sp. has longer terminal antennal segment in the male than the preceeding five together. The anterior part of the pronotum is smooth at the center with very sparce punctation. In addition, the punctation at the base of the elytra is defined in striae. In opposition, in *Opilo desertorum* the last antennomere is a slightly longer than the 10th antennomere. The anterior part of the pronotum is mostly punctate at the center and the punctation at the base of the elytra is irregular. The aedeagus is very different. *Opilo desertorum* is found in the UAE and Oman, and here is recorded for the first time from Iran (Hormozgan province) and from Qatar {SE Iran, Hormozgan, 10 km S di Minab, 50 m, 18.IV.2007, leg. D. Gianasso, ex larva *Acacia sp.*, emerged 1.IV.2011 (1♀, CIZ); Iran, Hormozgan, 10 km S di Minab, 55 m, 18-19.IV.2007, leg. G. Magnani, ex larva *Acacia sp.*, emerged 2.VI.2008 (1 ex., CGM); Iran, Hormozgan, 10 km S di Minab, 55 m, 18.IV.2007, leg. D. Baiocchi, ex larva *Acacia sp.*, emerged 24.IX.2007 (1♀, CIZ; 1♀, CDB); Iran, Hormozgan, env. Minab, 27°04'N 57°06'E, 80 m, 20-23.IV.2006, leg. D. Baiocchi, ex larva *Acacia sp.*, emerged 20.IX.2006 (1♂, CDB); idem, emerged 23.IX.2006 (1♂, CDB); idem, emerged 29.IX.2006 (1♂, CDB); idem, emerged XI.2006 (1♀, CDB); Iran, Hormozgan, env. Isin, 70 m, 27°19'N 56°16'E, 21.IV.2006, leg. D. Baiocchi, ex larva *Acacia sp.*, emerged 29.X.2006 (1 ex., CDB); idem, emerged 2.X.2006 (1♂, CDB); idem, emerged 17.IX.2007 (1♂, CIZ); Iran, Hormozgan, env. Isin, 80 m, 17.IV.2007, leg. D. Baiocchi, ex larva *Acacia sp.*, emerged 7.IX.2007 (2 ♂♂, CDB); Iran, Hormozgan, env. Genu, 70 m, 27°26'N 56°19'E, 19-22.IV.2006, leg. D. Baiocchi, ex larva *Acacia sp.*, emerged 13.IX.2006 (1♂, CIZ; 1♂, CDB); idem, emerged 2.XII.2006 (1 ex., CDB); Qatar, Jeryan Al Batna, Rawḑat Rashid env., 25°10'N 51°15'E, 4.III.2003, leg. G. Sama, ex larva *Acacia tortilis*, emerged 3.IX.2003 (2 exx., CIZ); Qatar, Al Ghuwairiyah env., 26°06'N 51°20'E, 9.III.2003, leg. G. Sama, ex larva *Acacia tortilis*, emerged 21.III.2004 (1 ex., CIZ); Qatar, Al Jemailiyah, W Al Nasraniyah, 25°26'N 51°04'E, 10.III.2003, leg. G. Sama (1 ex., CIZ)}.

Geographic distribution and ecological notes

Phloiocopus magnanii n. sp. is a likely endemic and at present the only *Phloiocopus* species known from Iran and represents the most easterly record of this genus.

All the examined specimens were reared from dead branches of *Acer* sp., *Amygdalus* sp., *Crataegus* sp., *Ficus* sp., *Fraxinus* sp., *Nerium* sp., *Pistacia* sp. and *Prunus* sp., collected in the Iranian provinces of Fars, Kerman, Kohgiluyeh and Boyer-Ahmad, Kordestan and Lorestan.

The larvae and adults of *Phloiocopus magnanii* n. sp. are likely to be predators of xylophagous beetles and corticolous insects.

ACKNOWLEDGEMENTS

I sincerely thank Ben Brugge (Naturalis Biodiversity Center, Leiden, The Netherlands), Manfred Uhlig and Bernd Jaeger (Museum für Naturkunde, Berlin, Germany), Stephan Blank and Lutz Behne (Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany), who provided much valuable photographs and information about some holotypes belonging to the genus *Phloiocopus*.

I am very grateful to my friends Daniele Baiocchi, Domenico Gianasso, Gianluca Magnani and Gianfranco Sama for allowing me to study their material, and to Augusto Degiovanni for technical assistance in preparation of the photographs.

Special thanks go to Darren J. Mann (Oxford University Museum of Natural History, Oxford, Great Britain) for revising the manuscript.

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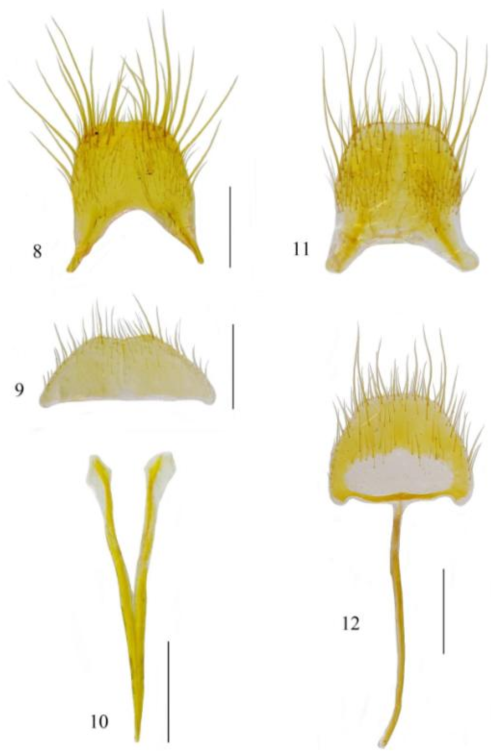
A **B**

Figure 1. *Phloiocopus magnanii* n. sp., A. Habitus of male holotype (length = 8.8 mm), B. Habitus of female paratype (length = 9.7 mm).

Figures 3-4. *Phloiocopus magnanii* n. sp., (3) left antenna, male; (4) left antenna, female. Scale bars = 0.5 mm.

Figures 5-7. *Phloiocopus magnanii* n. sp., cleared aedeagus of holotype: (5) dorsal view, (6) lateral view, (7) ventral view. Scale bar = 0.5 mm.



Figures 8-12. *Phloiocopus magnanii* n. sp., (8) male pygidium, (9) male sternum VIII, (10) spicular fork, (11) female pygidium, (12) female sternum VIII. Scale bars = 0.5 mm.

A NEW SUBSPECIES OF *CALLIDIUM AENEUM* (DEGEER) FROM SOUTH TURKEY (COLEOPTERA: CERAMBYCIDAE)

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[Özdikmen, H. & Aytar, F. 2014. A new subspecies of *Callidium aeneum* (Degeer) from South Turkey (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 9 (2): 599-601**]**

ABSTRACT: A new subspecies, *Callidium aeneum pilosicollis,* of *Callidium* (*Callidiostola*) *aeneum* (DeGeer, 1775) is described and photographed from South Turkey in the present text.

KEY WORDS: *Callidium aeneum pilosicollis,* new subspecies, Cerambycidae, Cerambycinae, Turkey.

In Palaearctic Region, the genus *Callidium* Fabricus, 1775 is represented by three subgenera as the nominate subgenus, *Callidostola* Reitter, 1913 and *Palaeocallidium* Plavilstshikov, 1940. The monotypic subgenus *Callidostola* Reitter, 1913 includes only the species *Callidium aeneum* (DeGeer, 1775).

According to Löbl & Smetana (2010), the species has two subspecies as the nominate subspecies and *Callidium aeneum longipenne* Plavilstshikov, 1940. The nominate subspecies has an Asiatic-European chorotype. It is distributed in Europe, Siberia, Far East Russia, Kazakhstan, Mongolia, China, Japan, Caucasus, Transcaucasia (Azerbaijan, Georgia) and Turkey. Besides, *Callidium aeneum longipenne* Plavilstshikov, 1940 has a SW-Asiatic chorotype. It is distributed only in Caucasus and Transcaucasia (Azerbaijan and Georgia).

Interestingly, we found two specimens of *Callidium aeneum* from İçel province in South Anatolia. As a result of study on the specimens, we decided the specimens should belong to a new subspecies of *Callidium aeneum*.

SUBSPECIES *Callidium aeneum pilosicollis* ssp. nov.

(Fig. 1A, B)

Material examined. Holotypus ♂: **Turkey:** Anatolia: İçel prov.: Central, 2003. **Paratypus** ♀: The same data as holotypus. The specimens are conserved in Entomology Department of Eastern Mediterranean Forestry Research Institute (İçel province, TURKEY).

As the nominotypical subspecies. But the new subspecies can easily distinguish from the nominotipical subspecies chiefly by

- Disc of pronotum hairy,
- Elytral structure consisting of less dense and much less rugose punctures in humeral part,
- Pronotum more than 1.5 times as wide as long,
- Elytra less than twice as long as wide at humeral part.

Holotypus ♂: 12.125 mm.
Paratypus ♀: 15.625 mm.

For example, according to Bílý & Mehl (1989), these characters in the nominotypical subspecies presented as follows:

- Disc of pronotum hairless,
- Elytral structure consisting of dense and rugose punctures in humeral part,
- Pronotum more than twice times as wide as long,
- Elytra about 2.4 times as long as wide at humeral part.

Remarks: The species *C. aeneum* (DeGeer, 1775) has three subspecies with the new subspecies now. So, it is represented by two subspecies in Turkey as the nominative subspecies and *C. aeneum pilosicollis* ssp. nov.. The nominative subspecies is distributed only in NE Anatolia (Map 1). The new subspecies is distributed only in SCW Anatolia (İçel province) (Map 2). So, the new subspecies is a southern subspecies. The other subspecies *C. aeneum longipenne* Plavilstshikov, 1940 is distributed only in Caucasus and Transcaucasia (Azerbaijan and Georgia).

Etymology: The name is derived Latin words "pilosus" and "collis" (meaning "hairy" and "pronotum" in English respectively).

Consequently, catalogic data can present as follows:

GENUS *Callidium* Fabricius, 1775: 187
Type sp. : *Cerambyx violaceus* Linnaeus, 1758
SUBGENUS *Callidostola* Reitter, 1913: 37
Type sp.: *Cerambyx aeneus* DeGeer, 1775
aeneum aeneum DeGeer, 1775: 89 (*Cerambyx*)
E: AL AU BE BH BU BY CR CT CZ EN FI FR GE GR HU IT LA LS LT NL NR NT PL RO SK SL ST SV SZ UK YU **A**: ES FE HEI JA MG TR WS
variabile Fabricius, 1775: 188
cognatum Laicharting, 1784: 59
viridans Gmelin, 1790: 1846 (*Cerambyx*)
aurichalceum Gmelin, 1790: 1857 (*Cerambyx*)
dilatatum Paykull, 1800: 91
viride Schoenherr, 1817: 459
venosum Escherich, 1818: 483
semitestaceum Pic, 1945: 6
aeneum longipenne Plavilstshikov, 1940: 300
E: AB GG ST
aeneum pilosicollis Özdikmen & Aytar, ssp. nov.
A: TR

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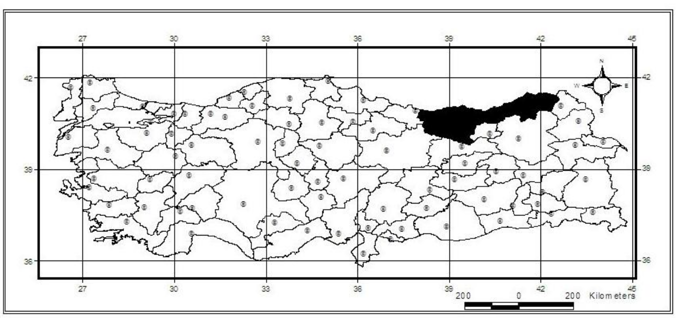
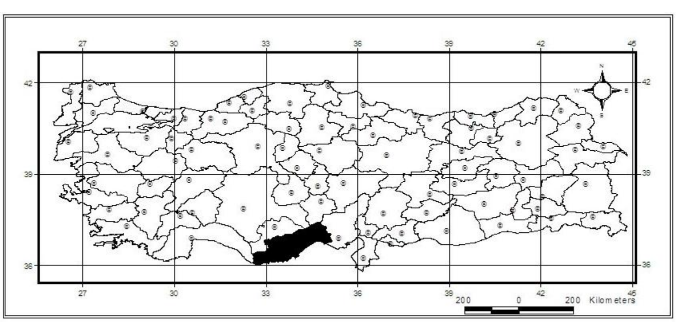
A B

Figure 1. *Callidium aeneum pilosicollis* ssp. nov.., A. Male (Holotypus), B. Female (Paratypus).



A B

Map 1. Distribution patterns of *Callidium aeneum aeneum* in Turkey.



A B

Map 2. Distribution pattern of *Callidium aeneum pilosicollis* ssp. nov. in Turkey.

DESCRIPTION OF A NEW SUBSPECIES OF *CARABUS* (*MEGODONTUS*) *CROATICUS* DEJEAN, 1826 FROM SERBIA (COLEOPTERA: CARABIDAE: CARABINAE)

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[Rapuzzi, I. 2014. Description of a new subspecies of *Carabus (Megodontus) croaticus* Dejean, 1826 from Serbia (Coleoptera: Carabidae: Carabinae). Munis Entomology & Zoology, 9 (2): 602-604**]**

ABSTRACT: A new *Carabus* L., 1758 *taxon* from Kopaonik Mountains, Serbia are described and figured: *Carabus (Megodontus) croaticus antoniocaldoni* new subspecies.

KEY WORDS: *Carabus, Megodontus, croaticus*, new subspecies, Serbia.

Carabus (*Megodontus*) *croaticus* Dejean, 1826 is widespread with different subspecies in the Western part of the Balkan peninsula from Slovenia to Macedonia and Central-Northern Albania (Apfelbeck, 1904; Breuning, 1932-1936; Drovenik, 1995; Imura et al., 1996; Brezina, 2003; Turin et al., 2003; Deuve, 2004) trough the Dinaric Alps chain. The higher number of subspecies is known from the Central-Southern part of the Mountain system: Bosnia Hercegovina, Montenegro, Albania, Macedonia; especially in the South some forms are endemic and very local. *C.* (*M.*) *c. antoniocaldoni* n. ssp. was found on Kopaonik Mountain in Central-Southern Serbia and up to now it is the Easternmost known subspecies.

Carabus (*Megodontus*) *croaticus antoniocaldoni* n. ssp.

(Figs. 1, 2)

Holotype: male, Serbia, Kopaonik mountain, 1500m, IX.2013, I. Rapuzzi and L. Caldon leg; Ivan Rapuzzi collection.
Paratype: female, same data as Holotype; Ivan Rapuzzi collection.

Description of Holotype male. Length including mandibles: 28,5 mm, maximum width of elytra: 9,6 mm. Color black without any metallic luster, only the margin of elytra and hind angle of pronotum with a very faint greenish; shine. Ticked head, surface punctured on the base, vertex smooth; short neck; hemispheric eyes, moderately prominent; vertex slightly convex. Mandibles long and strong, curved uniformly. Retinacular teeth of mandibles bidentate. Labrum bilobate. Sub apical segment of labial palpi bi-setose. Apical segment of maxillary and labial palpi moderately dilated. Tooth of mentum large and acuminate, shorter than lateral lobes. Antennae thin, reaching the half of elytra.

Small pronotum, very moderately sinuate, slightly transverse (1,25 times as broad as long), maximum width on the anterior third; disc of pronotum flat; sides margined, narrow upwards; hind angles protruding behind its base; upper surface of pronotum densely and strongly punctured, wrinkled near its base; basal depressions deep.

Elytra elongate, ovate, moderately convex, maximum width behind the middle; shoulders narrow and rounded; elytral sculpture very strong, very rough and disrupted.

Legs long and strong. Protarsi with 4 dilated segments, adhesive sole of the 4th tarsomere fully developed.

Male aedeagus (Fig. 3a, 3b).

Variability of the Paratype. Very small variability: the female is a little bit longer 32 mm. The elytra are a little more large and ovate. The apical segment of maxillary and labial palpi not dilated.

Etymology. The new *taxon* is very cordially dedicated to the memory of Mr. Antonio Caldon, father of Luisa Caldon, for his passion for nature and for environment.

Discussion. The new described subspecies from Kopaonik Mountain is of a great interest, it is the easternmost known form and it is the first time that the species is recognized on the East from Ibar river. The morphology of *C. croaticus antoniocaldoni* n. ssp. is very different from all know *C. croaticus* forms and it is probably one of the most distinct subspecies. The most important and peculiar characteristics of the new *taxon* are: black color without metallic luster, ticked head, smaller and not sinuate pronotum.

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I wish to thanks Dr. Luisa Caldon who collected the type specimens and help me in entomological research in different ways. A special thank to Dr. Božidar Drovenik (Kamnik, Slovenia) for his help with identification of the new taxa.

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Figure 1. *Carabus (Megodontus) croaticus antoniocaldoni* n. ssp. Holotype male; Fig. 2 Paratype female; Fig. 3a Male aedeagus frontal view; Fig. 3b Male aedeagus lateral view.

Figure 2. *Carabus (Megodontus) croaticus antoniocaldoni* n. ssp. Paratype female.

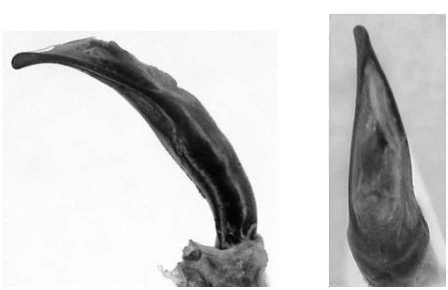

Figure 3. *Carabus (Megodontus) croaticus antoniocaldoni* n. ssp. a. Male aedeagus frontal view, b. Male aedeagus lateral view.

A NEW SPECIES OF *PHINTELLA* STRAND (ARANEAE: SALTICIDAE) FROM INDIA

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[Caleb, J. T. D. 2014. A new species of *Phintella* Strand (Araneae: Salticidae) from India. Munis Entomology & Zoology, 9 (2): 605-608**]**

ABSTRACT: A new species from the genus *Phintella* Strand in Bosenberg et Strand, namely *Phintella alboterminus* sp.nov. is described from Chennai, India.

KEY WORDS: *Phintella*, description, new species, Salticidae, India.

Phintella is placed under the clade Heliophaninae (Maddison et al., 2008). It is widely distributed containing numerous species mainly from the Oriental and Palaearctic regions (Weslowaska, 2010; Zabka, 2012; Weslowaska, 2013). Presently 52 species of *Phintella* are known worldwide (Platnick, 2014), of which 12 species are known from India (Keswani et al., 2012). In this paper, a new species *Phintella alboterminus* sp. nov is being described from Chennai, India.

Spiders of the genus *Phintella* are usually light or colored sometimes covered with metallic iridescent scales. They can be characterized by relatively high cephalothorax, unidentate chelicerae. Palpal tegulum with lobe and bump, embolus usually short, pointed or furcate. Tibia with one or more apophyses. Female internal genitalia simple, insemination ducts of different length, usually not twisted, spermathecae round in most species (Zabka, 2012; Proszynski, 2013).

MATERIALS AND METHODS

Specimens were photographed using DSLR Nikon D60, 18-55mm lens (reversed for macro photographs), preserved in 70% alcohol and later examined using a stereoscopic microscope (NIKON SMZ1000). Male palps were detached, examined and female genitalia were excised using fine surgical scalpel. The epigyne was transferred to Petri dish containing KOH 10% aqueous solution for clearing. USB digital microscope with micro-measure software was used for making measurements. All measurements are in mm (millimeters). The type specimen will be eventually deposited in the Zoological survey of India, regional station, Chennai.

Abbreviations used: ALE = Anterior lateral eyes, AME = Anterior median eyes, PLE = Posterior lateral eyes, PME = Posterior median eyes. AME-AME =Mutual distance between eyes, GPS= Global positioning system.

RESULTS

Phintella alboterminus sp. nov.

(Figs. 1-12)

Description: Male

Total length 2.82; carapace 1.42 long, 1.00 wide; abdomen 1.40 long, 0.97 wide

Cephalothorax: Blackish, covered with greenish black fine hairs, white stripe of hairs run along the rim of cephalothorax. Eye measurements: AME 0.25, ALE 0.18, PME 0.08, PLE 0.12; AME–AME 0.02, AME–ALE 0.03, PME–PME 0.64, PME–PLE 0.13, ALE–PLE 0.38. Clypeus height 0.07, clypeus covered with white scales, eyes surrounded by reddish orange scales, six spatulate scales protrude from the region between ALE's to PLE's on either side (Figs. 3 & 4). Chelicerae blackish, unidentate. Sternum brownish yellow covered with pale yellow hairs uniformly along the edges, legs yellowish, leg I robust and dark with a small modified spine at the base of tibia ventrally. Leg measurements: I 2.42 (0.77, 0.43, 0.58, 0.37, 0.27); II 1.77 (0.65, 0.25, 0.36, 0.27, 0.24); III 1.87 (0.61, 0.27, 0.32, 0.38, 0.29); IV 2.18 (0.78, 0.29, 0.44, 0.43, 0.24). Leg formula: 1432. Palp brownish, retro lateral tibial apophysis broad at base with pointed tip, tegular bump seen from the retrolateral view, embolus short and bent in s-shaped form (Figs. 9 & 10).

Abdomen: Elongate and ovoid, pairs of white spots arranged on the dorsum, similar spots placed on the lateral sides, anterior part covered by pale brownish scales, lower half covered by darker reddish black hairs, spinnerets covered by whitish scales on the dorsum.

Female: Total length 3.16; carapace 1.48 long, 1.09 wide; abdomen 1.68 long, 1.10 wide. Eye measurements: AME 0.29, ALE 0.14, PME 0.05, PLE 0.14, AME-AME 0.02; AME-ALE 0.03; PME-PME 0.75; PME-PLE 0.17; ALE-PLE 0.44; Leg measurements: I 2.18 (0.76, 0.43, 0.46, 0.30, 0.23); II 1.77 (0.67, 0.27, 0.32, 0.24, 0.27); III 2.08 (0.69, 0.28, 0.40, 0.43, 0.28); IV 2.21 (0.79, 0.32, 0.60, 0.43, 0.37) Leg formula 4132. Coloration pattern as in male but differs in the following, spatulate scales absent near the eye region, clypeus devoid of white scales, abdomen with chevron shaped markings near the posterior white spots on the dorsum (Fig. 6). Epigyne wider with two shallow grooves placed anteriorly leading to twisted ducts reaching the spermathecae apart (Figs. 11 & 12).

Etymology: Specific name refers to the white scales along the margins of the carapace ('albo' (white) and 'terminus' (boundary) in Latin).

Type material: Holotype - 1 male; 18.viii.2013 (GPS 13.125106° N, 80.135564° E, 21.73m), **Allotype:** 2 females; 18.viii.2013, Coll. John Caleb T.D and Barnaba Thomas, GPS data (same as holotype).

Type Locality: South India, Chennai, Thirumullaivoyal, Manigantapuram.

Distribution: Known heretofore from Chennai, S. India.

Diagnosis: Specimen can be distinguished from other congeners by the shape of embolus, retro lateral tibial apophysis (Figs. 9 & 10) and dorsal pattern on the abdomen with white dots on both sexes (Figs. 1 & 6) females by wider epigyne, shape of spermathecae which are elongated, almost tubular and twisted (Figs. 11 & 12).

Natural History: Found near the scrub regions adjacent to Araabath Lake building retreats among leaves of thorny plants.

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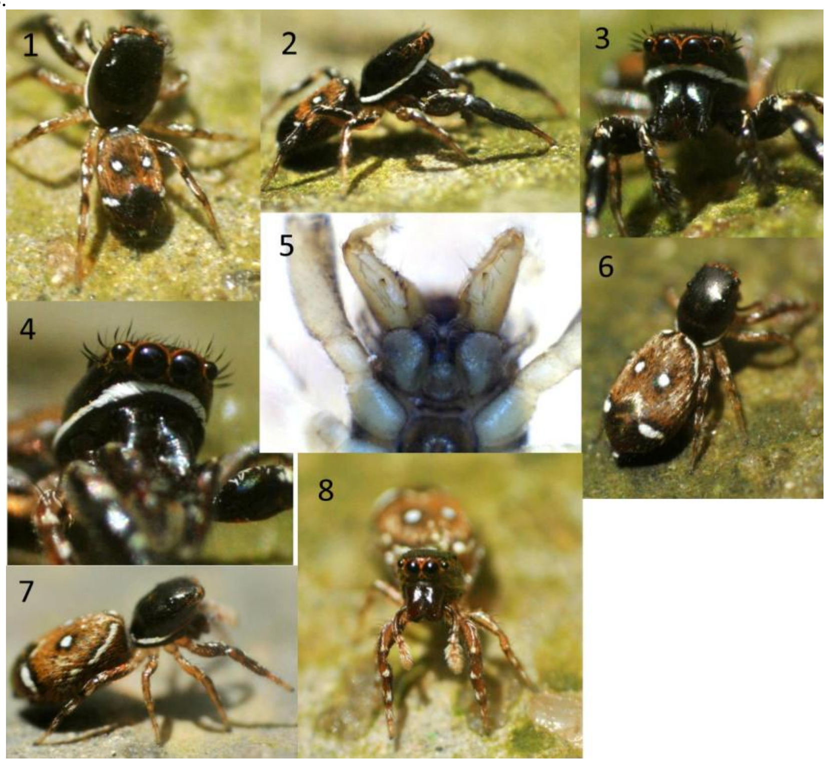
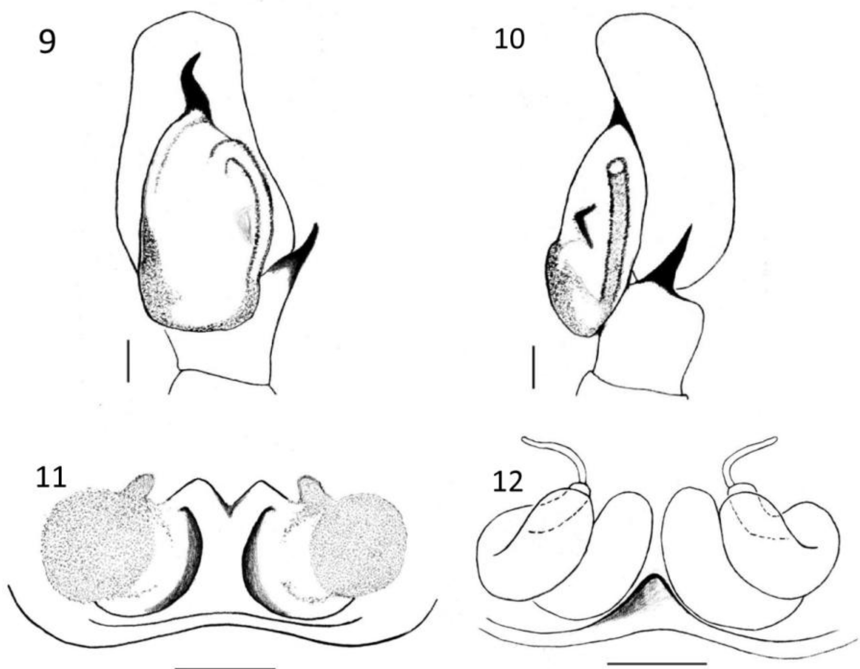
Zabka, M. 2012. *Phlegra* Simon, 1876, *Phintella* Strand 1906 and *Yamangalea* Maddison, 2009 (Arachnida: Araneae: Salticidae)- new species and new generic records for Australia. Zootaxa, 3176: 61-68.





Figures 1-12: *Phintella alboterminus* sp. nov., 1. Dorsal view of male, 2. Lateral view, 3 and 4. Front view, 5. Chelicerae, labium and endites, 6. Dorsal view of female, 7. Lateral view, 8. Front view, 9. Palp ventral view, 10. Palp retrolateral view, 11. Epigyne, 12. Internal view. Scale bars: Figs. 9-12, 0.05 mm.

TURKISH RED LIST CATEGORIES OF LONGICORN BEETLES (COLEOPTERA: CERAMBYCIDAE) PART VI – SUBFAMILY CERAMBYCINAE: ACHRYSONINI, HESPEROPHANINI, PHORACANTHINI, CERAMBYCINI, ROSALIINI, TRACHYDERINI AND CALLICHROMATINI

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[**Özdikmen, H.** 2014. Turkish Red List Categories of Longicorn Beetles (Coleoptera: Cerambycidae) Part VI – Subfamily Cerambycinae: Achrysonini, Hesperophanini, Phoracanthini, Cerambycini, Rosaliini, Trachyderini and Callichromatini. Munis Entomology & Zoology, 9 (2): 609-623]

ABSTRACT: The aim of this study is to create a Turkish Red List of the longicorn beetles. Moreover, presence such a Red List is necessary for Turkey. Even governmental evaluations could cause some erroneous decisions due to absence such a Red List. Since, governmental evaluations at the present time are based on the works that are realized with respect to the European Red List. Furthernore, Turkey appears a continental property changeable in very short distances in terms of climatical features and field structures. So, the status of European fauna and the status of Turkish fauna are not the same. Clearly, there is no any work that subjected to create a Turkish Red List except Parts I-V. Hence, a series work is planned with this purpose. This type of study is the sixth attempt for Turkey.

KEY WORDS: Red List, Conservation, Cerambycidae, Turkey

The purpose of the current study was to create a Turkish Red List of longicorn beetles similarly to "European Red List of Saproxylic Beetles" that was compiled by Ana Nieto & Keith N. A. Alexander and published by IUCN (International Union for Conservation of Nature) in collaboration with the European Union in 2010. "European Red List of Saproxylic Beetles" includes 153 species within the subfamilies Prioninae, Cerambycinae (including Stenopterinae) and Lamiinae of the European Cerambycidae. In the future, I hope that the present work will be lead to preparation a more comprehensive "Turkish Red List".

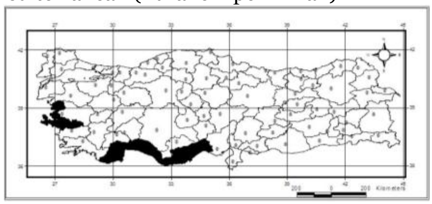
Hence, a series work is planned with this purpose. The present study is attempted as the sixth step of this aim. The previous works are Özdikmen (2014a,b,c,d,e). It should be noted that the using information at the present work on Turkish longicorn beetles are on the base of my personal database. The data of distribution are given on base of Löbl & Smetana (2010, 2011), Danilevsky (2010a,b, 2012a,b,c,d, 2013), Özdikmen (2011) and Miroshnikov (2011). Identification of chorotypes is based on the chorotype classification of the Anatolian fauna, proposed by Vigna Taglianti et al. (1999).

The evaluations of Turkish longicorn beetles at the present work based on "The IUCN Red List Categories" that was presented in Part I (Özdikmen, 2014a).

TURKISH RED LIST FOR STENOPTERINAE

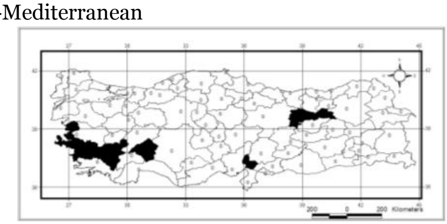
SUBFAMILY CERAMBYCINAE Latreille, 1802: 211
TRIBE ACHRYSONINI Lacordaire, 1868: 203
GENUS *ICOSIUM* Lucas, 1854: VIII
SPECIES *I. tomentosum* Lucas, 1854: IX
SUBSPECIES *I. t. atticum* Ganglbauer, 1882: 743

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is respresented only by the subspecies *I. tomentosum atticum* in Turkey. It probably is known only from SW Anatolia for Turkey. So, Turkish Red List category of the subspecies is **NT**.
Range: SE Europe, Transcaucasia (Azerbaijan), Turkey, Cyprus, Israel, Jordan.
Chorotype: Turano-Mediterranean (Turano-Apenninian)



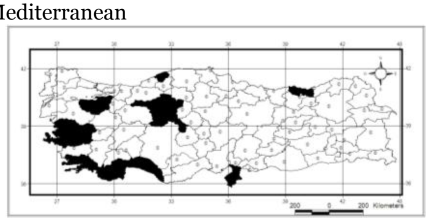
TRIBE HESPEROPHANINI Mulsant, 1839: 61
GENUS *HESPEROPHANES* Dejean, 1835: 328
SPECIES *H. sericeus* (Fabricius, 1787: 152)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in Anatolia for Turkey. However, Turkish Red List category of the species is **NT** now.
Range: S Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkmenistan, Turkey, Iraq, Cyprus, Israel, Jordan, North Africa (Algeria, Egypt, Libya, Morocco, Tunisia).
Chorotype: Turano-Mediterranean



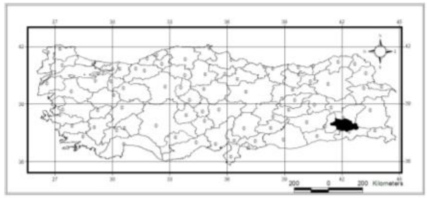
GENUS *TRICHOFERUS* Wollaston, 1854: 427
SPECIES *T. fasciculatus* (Faldermann, 1837: 266)
SUBSPECIES *T. f. fasciculatus* (Faldermann, 1837: 266)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is represented only by the nominative subspecies in Turkey. It probably is rather widely distributed in Anatolia for Turkey. So, Turkish Red List category of the subspecies is **LC**.
Range: S Europe, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Iraq, Cyprus, Syria, Lebanon, Israel, Jordan, North Africa (Algeria, Egypt, Libya, Morocco, Tunisia).
Chorotype: Turano-Mediterranean



SPECIES *T. fissitarsis* Sama, Fallahzadeh & Rapuzzi, 2005: 125

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from E Anatolia. So, Turkish Red List category of the species is **VU**.
Range: Turkey, Iran, Iraq.
Chorotype: SW-Asiatic

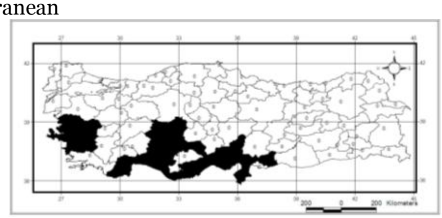


SPECIES *T. griseus* (Fabricius, 1792: 325)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in SC and SW Anatolia for Turkey. So, Turkish Red List category of the species is **LC**.

Range: S Europe, Turkey, Iraq, Cyprus, Syria, Lebanon, Israel, Jordan, North Africa (Algeria, Egypt, Libya, Morocco, Tunisia).

Chorotype: Mediterranean

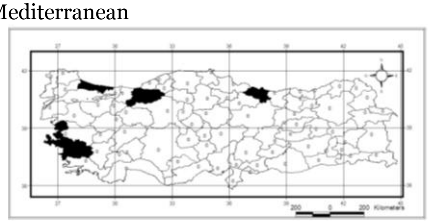


SPECIES *T. holosericeus* (Rossi, 1790: 153)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in N and W Anatolia for Turkey. However, Turkish Red List category of the species is **NT** now.

Range: E Europe (Ukraine), Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, North Africa (Algeria, Libya, Morocco, Tunisia).

Chorotype: Turano-Mediterranean

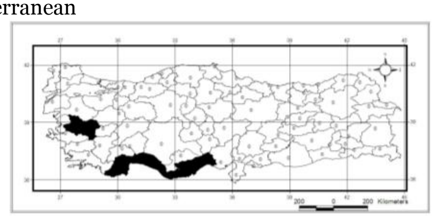


SPECIES *T. kotschyi* (Ganglbauer, 1883: 300)

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from E Anatolia. So, Turkish Red List category of the species is **NT**.

Range: E Europe (Greece: Samos), Turkey, Syria, Lebanon.

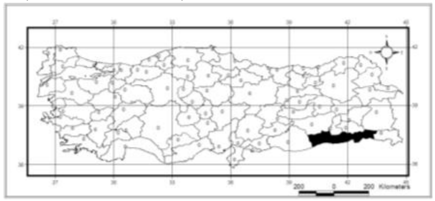
Chorotype: E-Mediterranean



SPECIES *T. lunatus* (Szallies, 1994: 261)

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from SE Anatolia. So, Turkish Red List category of the species is **VU**.

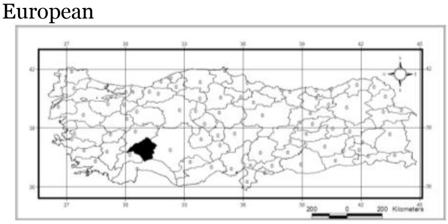
Range: Turkey, Iran.
Chorotype: SW-Asiatic (Irano-Anatolian)



SPECIES *T. pallidus* (Olivier, 1790: 256)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from SW Anatolia for Turkey. So, Turkish Red List category of the species is **EN** now.

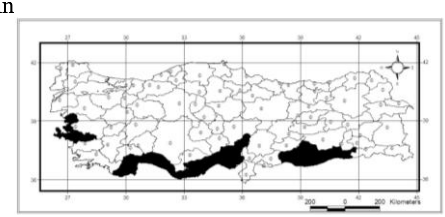
Range: C and E Europe, Caucasus, Turkey.
Chorotype: C and E European



SPECIES *T. preissi* (Heyden, 1894: 85)

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from S and SW Anatolia. So, Turkish Red List category of the species is **NT**.

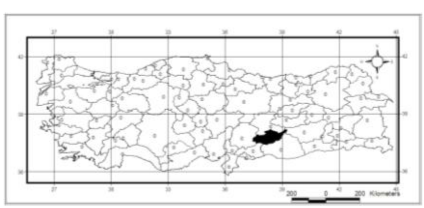
Range: Turkey.
Chorotype: Anatolian



SPECIES *T. samai* Kadlec & Rejzek, 2001: 296

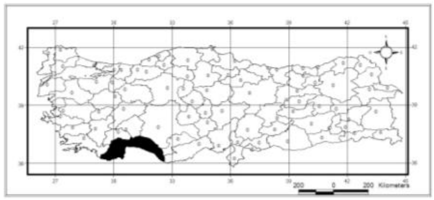
European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type locality in SCE Anatolia. So, Turkish Red List category of the species is **DD**.

Range: Turkey.
Chorotype: Anatolian



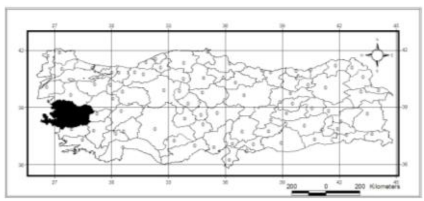
SPECIES *T. sbordonii* Sama, 1982: 217

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type locality in SW Anatolia. So, Turkish Red List category of the species is **DD**.
Range: Turkey.
Chorotype: Anatolian



SPECIES *T. spartii* (Müller, 1948: 67)

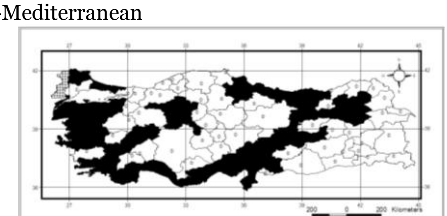
European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from WC Anatolia. So, Turkish Red List category of the species is **VU**.
Range: Turkey.
Chorotype: Anatolian



GENUS *STROMATIUM* Audinet-Serville, 1834: 80

SPECIES *S. unicolor* (Olivier, 1795: 58)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.
Range: S Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkmenistan, Iran, Turkey, Cyprus, Iraq, Syria, Lebanon, Israel, Jordan, North Africa (Algeria, Libya, Morocco, Tunisia).
Chorotype: Turano-Mediterranean

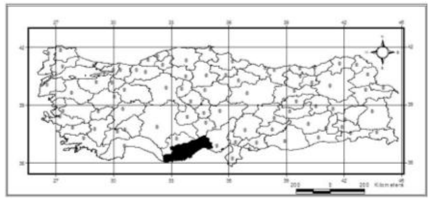


TRIBE PHORACANTHINI Newman, 1840: 2

GENUS *PHORACANTHA* Newman, 1840: 19

SPECIES *P. recurva* Newman, 1840: 4

European Red List of Saproxylic Beetles does not include the species. It is known only from SCW Anatolia. So, Turkish Red List category of the species is **VU**.
Range: S Europe, Turkey, Lebanon, Israel, North Africa (Libya, Morocco, Tunusia), and Afrotropical, Australian, Nearctic and Neotropical Regions.
Chorotype: Subcosmopolitan

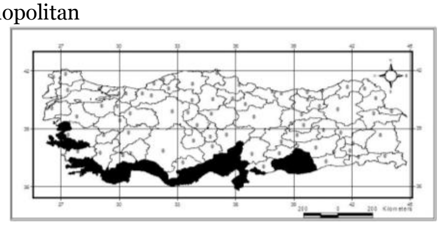


SPECIES *P. semipunctata* (Fabricius, 1775: 180)

European Red List of Saproxylic Beetles does not include the species. It is known only from SCW Anatolia. So, Turkish Red List category of the species is **VU**.

Range: S Europe, Turkey, Cyprus, Syria, Lebanon, Israel, Jordan, North Africa (Algeria, Canary Islands, Egypt, Libya, Morocco, Madeira Archipelago, Tunusia), and Afrotropical, Australian, Nearctic and Neotropical Regions.

Chorotype: Subcosmopolitan



TRIBE CERAMBYCINI Latreille, 1802: 211

GENUS *CERAMBYX* Linnaeus, 1758: 388

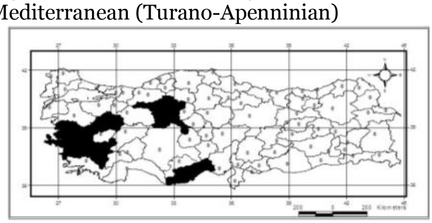
SUBGENUS *CERAMBYX* Linnaeus, 1758: 388

SPECIES *C. carinatus* (Küster, 1845: 46)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is rather widely distributed in W half of Anatolia for Turkey. So, Turkish Red List category of the species is **NT** now.

Range: SE Europe (Italy, Malta, Balkans), Turkey.

Chorotype: Turano-Mediterranean (Turano-Apenninian)



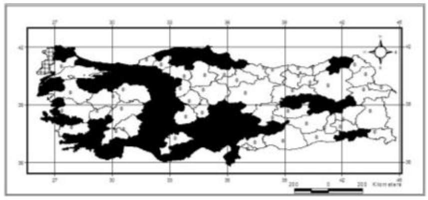
SPECIES *C. cerdo* Linnaeus, 1758: 392

SUBSPECIES *C. c. cerdo* Linnaeus, 1758: 392

According to European Red List of Saproxylic Beetles, the species was placed in **NT**. It is represented only by the nominative subspecies in Turkey. It is widely distributed in Turkey. So, Turkish Red List category of the subspecies is **LC**.

Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Iraq, Syria, Lebanon, Israel, Jordan, North Africa (Morocco).

Chorotype: Europeo-Mediterranean

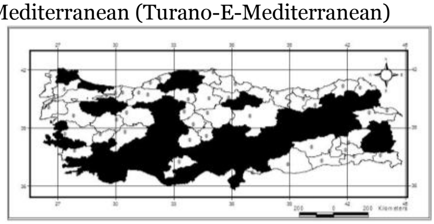


SPECIES *C. dux* (Faldermann, 1837: 264)

According to European Red List of Saproxylic Beetles, the species was placed in **NT**. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.

Range: E Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Syria, Lebanon, Israel, Jordan.

Chorotype: Turano-Mediterranean (Turano-E-Mediterranean)

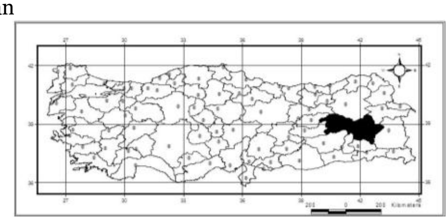


SPECIES *C. heinzianus* Demelt, 1976: 65

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from E Anatolia. So, Turkish Red List category of the species is **VU**.

Range: Turkey.

Chorotype: Anatolian

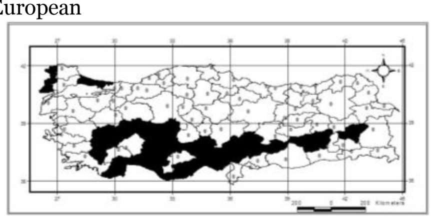


SPECIES *C. miles* Bonelli, 1812: 178

According to European Red List of Saproxylic Beetles, the species was placed in **NT**. It probably is rather widely distributed in S and W Turkey especially. So, Turkish Red List category of the species is **LC**.

Range: C and E Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.

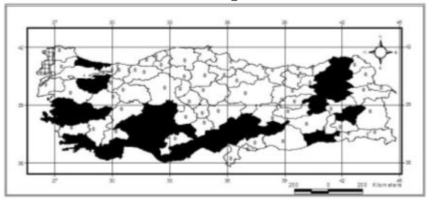
Chorotype: C and E European



SPECIES *C. nodulosus* Germar, 1817: 220

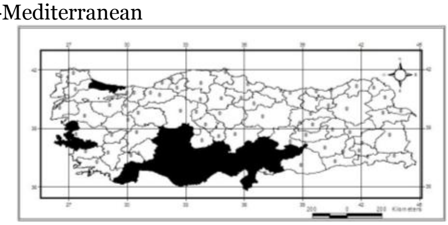
According to European Red List of Saproxylic Beetles, the species was placed in **NT**. It probably is rather widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.

Range: SC and SE Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Cyprus, Syria, Lebanon.
Chorotype: Turano-Mediterranean (Turano-Apenninian)



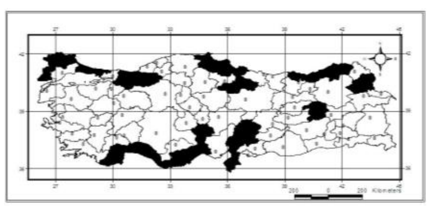
SPECIES *C. welensii* (Küster, 1845: 44)

According to European Red List of Saproxylic Beetles, the species was placed in **NT**. It probably is rather widely distributed in S and W Turkey especially. So, Turkish Red List category of the species is **LC**.
Range: S Europe, Transcaucasia (Azerbaijan, Georgia), Iran, Turkey, Cyprus, Syria, Lebanon, Israel, Jordan.
Chorotype: Turano-Mediterranean



SUBGENUS *MICROCERAMBYX* Mikšic & Georgijevic, 1973: 22
SPECIES *C. scopolii* Fuessly, 1775: 12

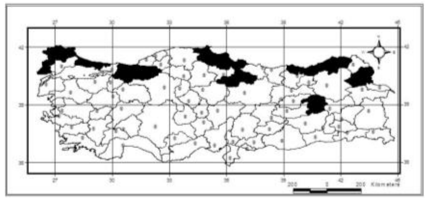
According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.
Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Syria.
Chorotype: European



Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *C. scopolii nitidus* Pic, 1892.

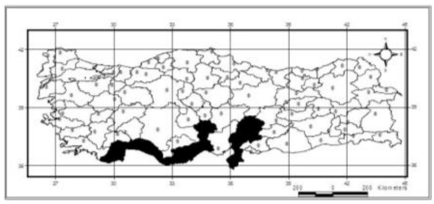
SUBSPECIES *C. s. scopolii* Fuessly, 1775: 12

According to European Red List of Saproxylic Beetles, the subspecies was placed in **LC**. It probably is rather widely distributed in N Turkey especially. So, Turkish Red List category of the subspecies is **LC**.
Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.
Chorotype: European



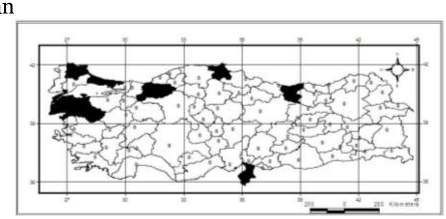
SUBSPECIES *C. s. nitidus* Pic, 1892: CXI

European Red List of Saproxylic Beetles does not include the subspecies. It is known only from SC and SW Anatolia. So, Turkish Red List category of the subspecies is **NT**.
Range: Turkey, Syria.
Chorotype: SW-Asiatic



TRIBE ROSALIINI Fairmaire, 1864: 137
GENUS *ROSALIA* Audinet-Serville, 1834: 561
SUBGENUS *ROSALIA* Audinet-Serville, 1834: 561
SPECIES *R. alpina* (Linnaeus, 1758: 392)

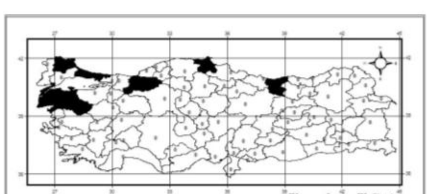
According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in N Turkey especially. However, Turkish Red List category of the species is **NT**.
Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.
Chorotype: European



Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *R. alpina syriaca* Pic, 1895.

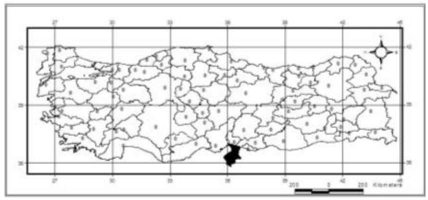
SUBSPECIES *R. a. alpina* (Linnaeus, 1758: 392)

According to European Red List of Saproxylic Beetles, the subspecies was placed in **LC**. It probably is rather widely distributed in N Turkey especially. However, Turkish Red List category of the subspecies is **NT**.
Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.
Chorotype: European



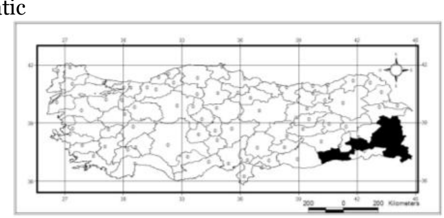
SUBSPECIES *R. a. syriaca* Pic, 1895: CCLXXXV

European Red List of Saproxylic Beetles does not include the endemic subspecies rightly. It is known only from SC Anatolia. So, Turkish Red List category of the subspecies is **EN**.
Range: Turkey.
Chorotype: Anatolian



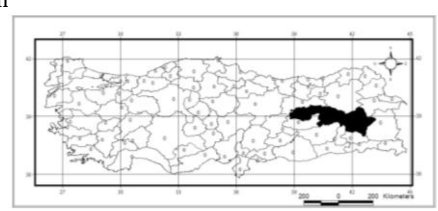
TRIBE TRACHYDERINI Dupont, 1836: 1
GENUS *PURPURICENUS* Dejean, 1821: 105
SPECIES *P. apicalis* Pic, 1905: 163

European Red List of Saproxylic Beetles does not include the species. It is known only from SE Anatolia for Turkey. So, Turkish Red List category of the species is **VU**.
Range: Turkey, Iran, Iraq.
Chorotype: SW-Asiatic



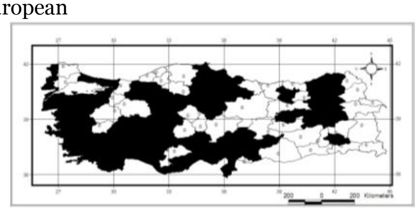
SPECIES *P. bitlisiensis* Pic, 1902: 27

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from E Anatolia. So, Turkish Red List category of the species is **EN**.
Range: Turkey.
Chorotype: Anatolian



SPECIES *P. budensis* (Götz, 1783: 70)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.
Range: S and E Europe, W Siberia, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Cyprus, Syria, Lebanon, Israel.
Chorotype: Sibero-European



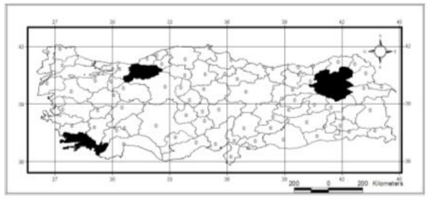
SPECIES *P. caucasicus* T. Pic, 1902: 27

SUBSPECIES *P. c. caucasicus* T. Pic, 1902: 27

European Red List of Saproxylic Beetles does not include the species. It is represented only by the nominative subspecies in Turkey. It is known only sporadically from Anatolia. So, Turkish Red List category of the subspecies is **NT** now.

Range: Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.

Chorotype: SW-Asiatic

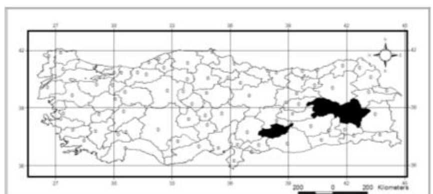


SPECIES *P. cornifrons* Sabbadini & Pesarini, 1992: 58

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from E Anatolia. So, Turkish Red List category of the species is **VU**.

Range: Turkey.

Chorotype: Anatolian

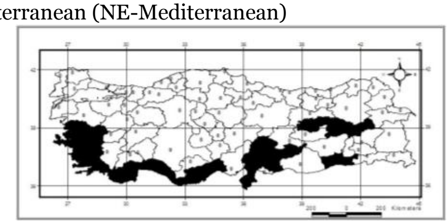


SPECIES *P. dalmatinus* Sturm, 1843: 353

According to European Red List of Saproxylic Beetles, the species was placed in **DD**. It probably is rather widely distributed in S half of Anatolia for Turkey. So, Turkish Red List category of the species is **LC**.

Range: SE Europe, Turkey, Syria, Lebanon, Israel, Jordan.

Chorotype: E-Mediterranean (NE-Mediterranean)



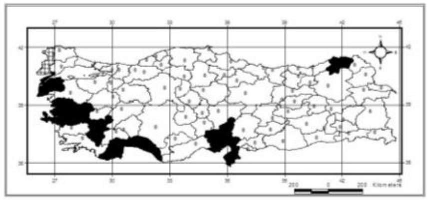
SPECIES *P. desfontainii* (Fabricius, 1792: 258)

SUBSPECIES *P. d. inhumeralis* Pic, 1891: 24

According to European Red List of Saproxylic Beetles, the species was placed in **DD**. It is represented only by the subspecies *P. desfontainii inhumeralis* in Turkey. It probably is rather widely distributed in Anatolia for Turkey. So, Turkish Red List category of the subspecies is **LC**.

Range: SE Europe (Greece), Turkey, Syria, Lebanon, Israel, Jordan.

Chorotype: E-Mediterranean (NE-Mediterranean)

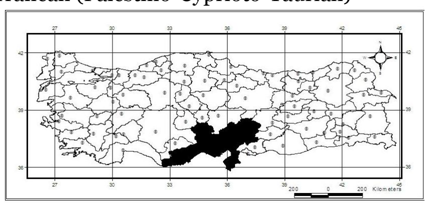


SPECIES *P. interscapillatus* Plavilstshikov, 1937: 247 [RN]

European Red List of Saproxylic Beetles, does not include the species. The species is known only from SC and SCW Anatolia for Turkey. So, Turkish Red List category of the species is **NT**.

Range: Turkey, Cyprus, Syria, Lebanon, Israel.

Chorotype: E-Mediterranean (Palestino-Cyprioto-Taurian)

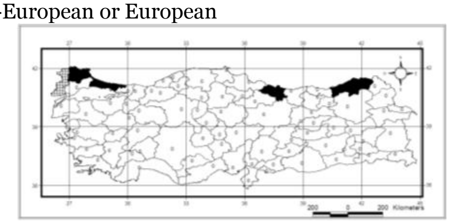


SPECIES *P. kaehleri* (Linnaeus, 1758: 393)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in N Turkey. However, Turkish Red List category of the species is **NT**.

Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.

Chorotype: Turano-European or European



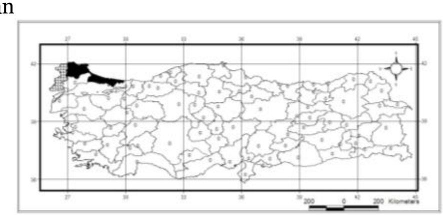
Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *P. kaehleri menetriesi* Motschulsky, 1845.

SUBSPECIES *P. k. kaehleri* (Linnaeus, 1758: 393)

According to European Red List of Saproxylic Beetles, the subspecies was placed in **LC**. It probably is rather widely distributed in NW Turkey (European Turkey). So, Turkish Red List category of the subspecies is **NT**.

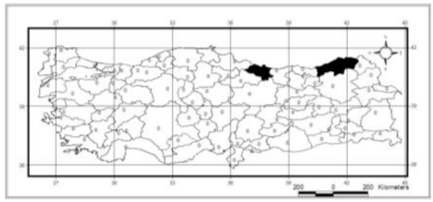
Range: Europe, Caucasus, Turkey.

Chorotype: European



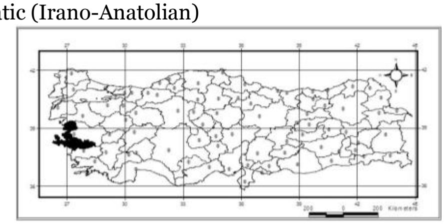
SUBSPECIES *P. k. menetriesi* Motschulsky, 1845: 87

European Red List of Saproxylic Beetles, does not include the subspecies. It is known only from NE Anatolia for Turkey. So, Turkish Red List category of the subspecies is **NT**.
Range: Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.
Chorotype: SW-Asiatic



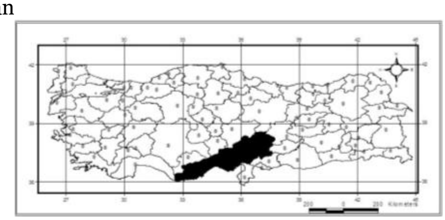
SPECIES *P. nanus* Semenov, 1907: 254

European Red List of Saproxylic Beetles, does not include the species. It is known only from W Anatolia for Turkey. So, Turkish Red List category of the species is **DD**.
Range: Iran, Turkey.
Chorotype: SW-Asiatic (Irano-Anatolian)



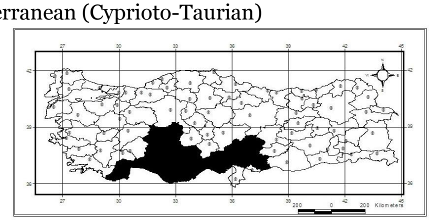
SPECIES *P. nigrotatatus* Pic, 1907: 169

European Red List of Saproxylic Beetles, does not include the endemic species rightly. It is known only from SC Anatolia. So, Turkish Red List category of the species is **VU**.
Range: Turkey.
Chorotype: Anatolian



SPECIES *P. nudicollis* Demelt, 1968: 65

According to European Red List of Saproxylic Beetles, the species was placed in **EN**. It is known only from SC and SCW Anatolia for Turkey. So, Turkish Red List category of the species is **NT**.
Range: Turkey, Cyprus.
Chorotype: E-Mediterranean (Cyprioto-Taurian)

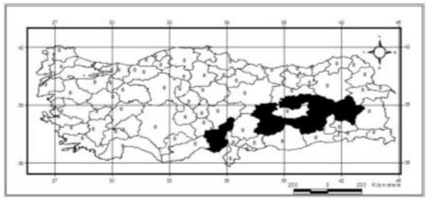


SPECIES *P. wachanrui* Levrat, 1858: 261

European Red List of Saproxylic Beetles, does not include the species. It is known only from SE and E Anatolia. So, Turkish Red List category of the species is **NT**.

Range: Transcaucasia (Azerbaijan), Iran, Iraq, Turkey.

Chorotype: SW-Asiatic



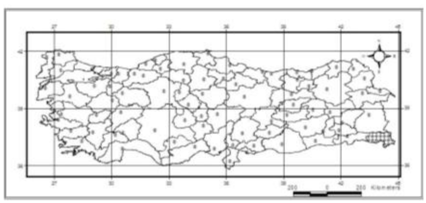
GENUS *CALCHAENESTHES* Kraatz, 1863: 97

SPECIES *C. diversicollis* Holzschuh, 1977: 129

European Red List of Saproxylic Beetles, does not include the species. It probably is distributed only in SE Anatolia for Turkey. So, Turkish Red List category of the species is **NE**.

Range: Iran, Iraq, Turkey.

Chorotype: SW-Asiatic

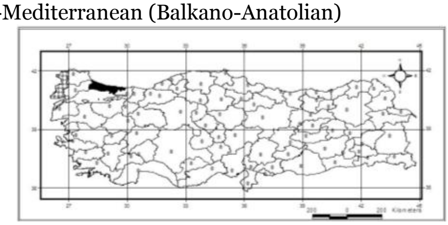


SPECIES *C. oblongomaculata* (Guerin-Meneville, 1844: 234)

According to European Red List of Saproxylic Beetles, the species was placed in **DD**. It is known only from European Turkey for Turkey. So, Turkish Red List category of the species is **DD**.

Range: SE Europe (Bulgaria, Greece, Romania), Turkey, ? Middle East and ?Cyprus.

Chorotype: Turano-Mediterranean (Balkano-Anatolian)

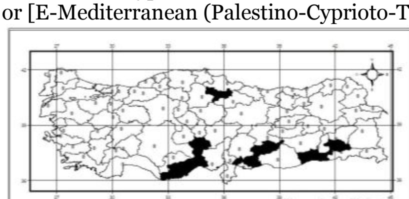


SPECIES *C. primis* Özdikmen, 2013: 150

European Red List of Saproxylic Beetles, does not include the endemic species rightly. It probably is rather widely distributed in Anatolia. So, Turkish Red List category of the species is **NT**.

Range: Turkey [? Middle East and ?Cyprus].

Chorotype: Anatolian or [E-Mediterranean (Palestino-Cyprioto-Taurian)]

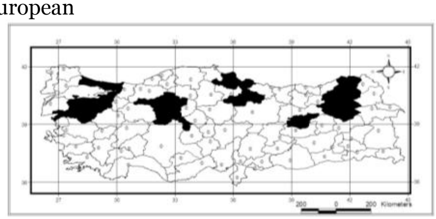


TRIBE CALLICHROMATINI Swainson & Shuckard, 1840: 293
GENUS *AROMIA* Audinet-Serville, 1834: 559
SPECIES *A. moschata* (Linnaeus, 1758: 391)
SUBSPECIES *A. m. moschata* (Linnaeus, 1758: 391)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is represented only by the nominative subspecies in Turkey. It probably is widely distributed in N Turkey especially. So, Turkish Red List category of the subspecies is **LC**.

Range: Europe, Siberia, Kazakhstan, Mongolia, Caucasus, Transcaucasia (Georgia), Turkey.

Chorotype: Sibero-European

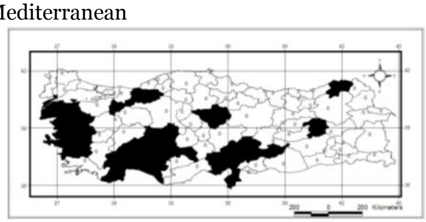


SPECIES *A. ambrosiaca* (Steven, 1809: 40)
SUBSPECIES *A. a. ambrosiaca* (Steven, 1809: 40)

European Red List of Saproxylic Beetles, does not include the species. It is represented only by the nominative subspecies in Turkey. It probably is widely distributed in Anatolia. So, Turkish Red List category of the subspecies is **LC**.

Range: S Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Iraq, Syria, Lebanon, Jordan, North Africa (Algeria, Morocco, Tunusia).

Chorotype: Turano-Mediterranean

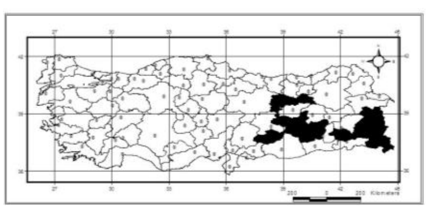


GENUS *OSPHRANTERIA* Redtenbacher, 1850: 50
SPECIES *O. coerulescens* Redtenbacher, 1850: 50

European Red List of Saproxylic Beetles, does not include the species. It probably is rather widely distributed in E Anatolia. So, Turkish Red List category of the species is **NT**.

Range: Turkey, Iran, Iraq, Pakistan.

Chorotype: Turanian



Note: The conclusions and cited references for Turkish Cerambycinae will be presented at the end of evaluations in Part VIII.

PARTIAL CHARACTERIZATION OF DIGESTIVE A-AMYLASE IN COTTON BOLLWORM, *HELICOVERPA ARMIGERA* HÜBNER (LEPIDOPTERA: NOCTUIDAE)

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** Department of Plant Protection, Faculty of Agriculture, Azarbaijan Shahid Madani University, Tabriz-IRAN. E-mail: d.mohammadi@ymail.com

[**Farshbaf Pourabad, R. & Mohammadi, D.** 2014. Partial characterization of digestive α-amylase in cotton bollworm, *Helicoverpa armigera* Hübner (Lepidoptera: Noctuidae). Munis Entomology & Zoology, 9 (2): 624-633]

ABSTRACT: In this study α-amylase activity of different developmental stages of cotton bollworm were studied. Insects reared on chickpea based artificial diet in controlled condition. Alpha-Amylase activity was determined using 4, 6-ethylidene (G7)-p-nitrophenyl-(G1)-α-D-maltoheptaoside as substrate. The most enzyme activity was observed in 6th larval stage. Male and female adults and pupas showed a minor α-amylase activity. Lumen content of 6th larval midgut showed significantly more enzyme activity in comparison with midgut tissues during circadian cycle. Starvation period non-significantly affected α-amylase activity in whole body and gut extract of 6th larval stage alimentary canel assays. Enzyme activity during embryogenesis and pupa developing period were studied and results revealed that with aging of eggs amylase activity increased but just before hatching, it started to decrease. In pupal growth period, amylase activity showed a decline manner to last period of developing days. Also the results showed that, the optimal pH for α-amylase activity in 6th larval stage of cotton bollworm was alkaline (pH 12).

KEY WORDS: *Helicoverpa armigera*, α-amylase, developmental stages.

Helicoverpa armigera Hübner (Lep., Noctuidae) is a polyphagous pest which causes economic damages on different crops including cotton, tomato, corn, sunflower and etc. worldwide (Mathews, 1999). Results of digestive physiology research's about insects' leads to developing control methods based on digestive system disruption. It is documented that proteolytic enzymes especially trypsin and chymotrypsin like activity in lepidopteran midgut are predominant (Nation, 2002). Digestive enzymes were developed in alimentary canal of insects in relation to food ingested (Sarate et al., 2012). The lepidopteran midgut content is alkalin and serin proteinases are more active than systeins (Terra & Ferreira, 2005). Proteins are not the only source of energy, carbohydrates generally presents in plants, fruits and foliages that are consumed by insects hence related enzymes should be active in alimentary canal of insects. Amylase activity of cotton bollworm poorly was surveyed and almost all enzyme related researches were concentrated on proteolytic properties of midgut and proteinase inhibitors (Chougule et al., 2003; Giri et al., 2003).

Özgur et al. (2009) were detected α-amylase activity of cotton bollworm. Presence and activity of digestive enzymes in developmental stages of insects may be differ because of feeding habitat of them especially in holometabolus insects such as Lepidoptera (Babic et al., 2008). Alpha-amylses (EC 3.2.1.1) catalyse the hydrolysis of α-D-(1-4) glucan linkages in starch and glycogen components. Starch in plants and glycogen in animals are targeted by amylase (Strobli et al., 1998; Franco et al., 2002). It is documented that enzyme activity in different developmental stages of insects in male and females may show some variations

(Tanaka & Kusano, 1980; Papadopoulos et al., 2004; Mehrabadi & Bandani, 2009). But there is a lack of information about changes in amylase activity during a given developmental stage. In egg and pupal developmental period some important events including embryogenesis and metamorphosis occurs, and these process need more enzymatic activity such as them used in metabolism (Fink, 1925; Terra, 1987).

In this study α-amylase activity during developmental period of egg and pupal stages in addition with some properties of α-amylase in last larval stages were investigated. In preparing process of enzyme samples from insects midgut the time of sampling have a critical role in uniformity of enzyme samples, in this study α-amylase activity was surveyed in lumen and tissues of midgut separately during day and night. In some insects specially that one's which have mechanisms for storing ingested foods in alimentary canals, period of starvation could affect amylase activity by concentrating it in midgut. In this study attempt was made to test effect of starvation for 24 and 48 hours on haemolymph and midgut of 6th larval stage of cotton bollworm.

MATERIALS AND METHODS

Insects

Insects reared in controlled condition, 26±2˚C and 60% RH and 16:8 (L: D) h. photoperiod regime on artificial diet based on cowpea (Shorey & Hale, 1965). Enzyme samples prepared after mass rearing for 5 generations in mentioned condition.

Enzyme extraction

In this study two different extraction procedures were used. First, the midguts' of larvae dissected from last larval stages in the aim of amylase property assays, and in second procedure whole body of different developmental stages were homogenized in phosphate buffer pH 7, after carefully crushing by handy mortar. Enzyme samples prepared at 24 hours old of each developmental stage. Fifty eggs per 1ml phosphate buffer, 20, 8 and 5 first, second and third larval stages respectively, and one individual for rest of developmental stages including 4-6 larval stages, pre-pupa, pupa and adult insects per 1ml phosphate buffer were used. For evaluating the enzyme activity during egg developmental period samples including newly oviposited, 12, 24, 48 and 72 hours old eggs prepared. In pupal stage, samples including newly developed, 6hours, 1, 2, 4, 6, 8, 10 and 12 days olds prepared. Enzyme activity also in male and female pupa and adults were compared. Each sample containing one pupa per 1ml phosphate buffer. Samples after homogenization were centrifuged in 12000 rpm (4˚C) for 10 minutes. Supernatants were stored at -20˚C for further assays.

Alpha-amylase activity in different pH values

Activity of enzyme samples were detected in 6th larval stages in pH sets of 4, 5, 6, 7, 8, 9, 10, 11 and 12. Optimal pH for amylase activity was determined using phosphate buffer and pH gradient justified using NaOH and HCl. amylase activity detected after incubation for 30 minutes in each pH values.

Alpha-amylase activity during day and night in lumen and tissues of midgut

For studying dial periodicity of alpha-amylase activity, 24 hours old last larval instars were used. Sampling was carried out every 3 hours during day and night cycles. In the aim of comparing amylase activity in lumen and tissue of midgut during day and night, alimentary canal of 6th larval stages in each sampling times, after dissection were cut longitudinally, content of lumen and tissue of each gut separately transferred to 1.5 ml micro tubes containing cold phosphate buffers pH 7, homogenized and centrifuged such as above and assayed for amylase activity.

Effect of starvation on alpha-amylase activity in cotton bollworm

Midgut and whole body of 6^{th} larval stage of cotton bollworm were compared after 24 and 48 hours starvation and the results compared with controls that feed normally on artificial diets.

Alpha-amylase activity assay

Alpha-Amylase activity was determined using 4, 6-ethylidene (G7)-p-nitrophenyl-(G1)-α-D-maltoheptaoside (EPS-G7) as substrate using an autoanalyzer (Alcyon 300) system. The reactions were carried out at 37˚C and the absorbance which is directly related to the enzyme activity was measured at 405 nm.

Total protein determination

Total protein concentrations of samples were determined by the Bradford protein assay using bovine serum albumin as a standard (Bradford, 1976). Specific activity of protease was calculated by dividing enzyme activity to protein concentration.

Statistical analysis

Statistical analysis: completely randomized design (CRD) was used and data comparing carried out by one-way analysis of variance. Duncan multiple range test (p=0.05) was used for comparing of means. Colmogorov-smirnov test were used for homogeneity tests. All experiments were studied in four replications.

RESULTS AND DISCUSSION

Alpha-amylase activity in different developmental stages

Statistical analysis of α-amylase activity in different developmental stages of cotton bollworm showed significant differences among developmental stages. The most and the least activity were detected in 6^{th} larval stage and pupa of cotton bollworm, respectively (Fig. 1). Amylase activity decreased from eggs to 4^{th} larval stage, and then started to increase in 5^{th} and 6^{th} larval stages. Amylase in pre-pupa, pupa and adults significantly were less active in comparing with other developmental stages. Male and female adult and pupas have the same amylolytic activity.

Alpha-amylase activity during day and night in lumen and tissues of midgut

Alpha-amylase activity during day and night showed some variations in different sampling times (Fig. 2). Two distinct activity picks especially in lumen content of 6^{th} larval stage of cotton bollworm were detected in 12 and 3 o'clock. In midgut tissues, alpha-amylase activity was significantly less than lumen and variation in activity was also detected.

Effect of starvation on alpha-amylase activity

Starvation for 24 hrs did not affect amylase activity significantly in whole body assays. Although a minor increase in activity detected. In midgut, amylase activity increased with developing starvation, but it was not significant. Amylase activity in 48 hrs.starved larvae was more than 24 hrs and control.

Amylase activity during pupal and egg developmental periods

There were significant differences in sampling times, the most activity measured in 48 hours old eggs and the least activity in newly oviposited eggs followed by 12 hours old eggs. Figure 4 shows that enzyme activity increased with aging of eggs for 48 hours and decreased in 72 hours old eggs.

In pupas of cotton bollworm alpha-amylase activity did not changed significantly during developmental time (Fig. 5). However the change in enzyme activity was non-significant, a decreasing rate with developing pupas could be observed. With a minor difference in both male and female pupas, this decreasing manner was detected. Alpha-amylase activity in final developing period (after 12 days) started to increase in both male and females.

Alpha- amylase activity in different pH values

Alpha-amylase activity in pH ranges from 4-11 was approximately stable with two minor pikes in pH 5 and 8, but the optimal enzyme activity was in alkaline condition (pH 12). In pH 12 alpha-amylase activities dramatically increased (Fig. 6).

DISCUSSION

Digestive enzyme activity in different developmental stage of insects well documented. Especially in holometabolus insects because of different feeding habitat digestive enzymes show some variations in larval and adults. Alpha-amylase as an important digestive enzyme is active in cotton bollworm (Ozgur et al., 2009). Blahovec et al. (2006) showed that amino peptidase, trypsin, chymotrypsin and elastase activity in house fly decreased with developing larval instars. To some extent these results are true for primary larval stage of cotton bollworm that amylase activity decreased with developing larvae to 4^{th} instar. But in 5^{th} and 6^{th} larval stage amylase activity started to increase and reached to highest activity in 6^{th} larval stage. Glutathion s-transferase are active in all developmental stages of *Apis mellifera* L. (1758), also the highest and lowest activity are found in the adult and egg stages respectively (Papadopoulos et al., 2004). Mehrabadi & Bandani (2009) have detected amylase activity in all nymphs of *Eurygaster maura* (L., 1758). They showed that with developing nymphs alpha-amylase activity increased but there were non-significant differences in amylase activity of 3^{rd}, 4^{th} and 5^{th} instars. In lepidopteran insects because of feeding activity of larval stage digestive enzyme activity are more than adults. Results of our previous study revealed that in larval stages of cotton bollworm proteolytic activity was more than other developmental stages, but with developing insects there midgut proteolytic activity decreased. Also proteolytic activity of adult and pupas was significantly less than larval stages, that the same results in amylolytic activity of cotton bollworm were detected in this study. The same proteolytic activity in male and female adults and pupas of cotton bollworm were detected in cotton bollworm, which is same about amylase activity (Mohammadi et al., 2010).

The current study showed that alpha-amylase activity in tissues of midgut was significantly less than lumen contents. Figure 2 shows that during day and night amylase activity in lumen changed in a circadian rhythmic procedure and two distinct major and minor pikes of amylase activity could be distinguished in 12 and 3 o'clock respectively. Circadian rhythmic activity and behavior of insects well studied (Bebas et al., 2001; Sato, 2003; Steel & Vafopoulou, 2006; Mizutani et al., 2008) but digestive activity during circadian cycles poorly investigated in researches. Regulating of enzyme activity was related to different factors including; release of neuropeptides, humoral regulation or intrinsic properties of the insect (Dadd, 1960; Audsley & Weaver, 2009).

Starvation could affect digestive enzyme secretion especially in insects that have non-continues feeding habitat. In Lepidoptera because of non-storage mechanisms involved in alimentary canal, digestion and feeding are continues processes (Nation, 2002). Hori (1973) showed that starvation period affected digestive enzymes of *Lygus disponsi* Linnavuori. He reported that with increasing starvation period to 12 hrs, amylase and protease activity increased but it tended to decrease after 24 hrs starvation (but the changes was non-significant). Also amylase activity of *Bombyx mori* L. was affected a little with developing starvation to 24 hrs (Hori, 1973). It is probable that starvation tends to secrete alpha-amylase within lumen without interface of food presence. Starvation could cause to increase concentration of digestive enzyme in lumen and absence of food will increase specific activity of enzyme in this study.

It is documented that within the same instars, enzyme activity increases with aging (Hori, 1973) but there is a lack of information about changes in digestive enzyme activity in eggs and pupal developmental period. Recent study revealed that in cotton bollworm midgut, with aging the eggs to 48 hrs, amylase activity increased and started to decline toward final embryogenesis. In pupal stage enzyme activity declined with aging in both male and females. Near the emerging of adults in both sexes amylase activity showed a non-significant increased manner. Sanjayan et al. (1988) reported that total protein and carbohydrates of *Atractomorpha crenulata* (Fabricius, 1793) during embryogenesis increased until just prior to hatching then started to decrease. In camel tick (*Hyalomma dromedarii* Koch, 1844) alpha-amylase activity during embryogenesis showed a sharp decline and then a gradual increase few days before hatching (Mohamed, 2000). Changes in enzyme activity during the same developmental stages with aging are related to the metabolism of carbohydrates. Pant et al. (1979) reported that carbohydrates declined during embryogenesis developing of *Antheraea mylitta* (Drury, 1773). They also reported that glycogen content of eggs decreased during embryogenesis, this decline in carbohydrates and glycogen shows activity of amylase and other enzymes. Utilization of glycogen as metabolic and physiological functions such as energy source and role in chitin synthesis has been well recognized. Levels of trehalose decreased with developing pupa of *manduca sexta* (Linnaeus, 1763), but glucose content of them increased with aging of pupas (Phalaraksh et al., 2008), increasing the glucose is a result of amylase hydrolysis activity on glycogen. Tanaka & Kusano (1980) reported that in silkworm, during pupal stage, alpha-amylase activity of males was less than females and a decrease rate during pupal developmental period also was observed. In recent study the mean amylase activity in female pupas was more than males.

The optimum pH of alpha-amylase activity varies in different orders of insects (Zeng & Cohen, 2000; Bandani et al., 2010), but in Lepidoptera midgut is generally alkaline, thus digestive enzymes should be active in this condition (Dow, 1992). The optimal pH of *Tecia solanivora* (Povolny, 1973) (Valencia-Jimenez et al., 2008), *Chilo suppressalis* Walker, 1863 (Zibaei et al., 2008), and *B. mori* (Abraham et al., 1992) were 9, 11 and 9.2 respectively. In this study also optimal pH for cotton bollworm larvae was alkalin that is in order with mentioned researches.

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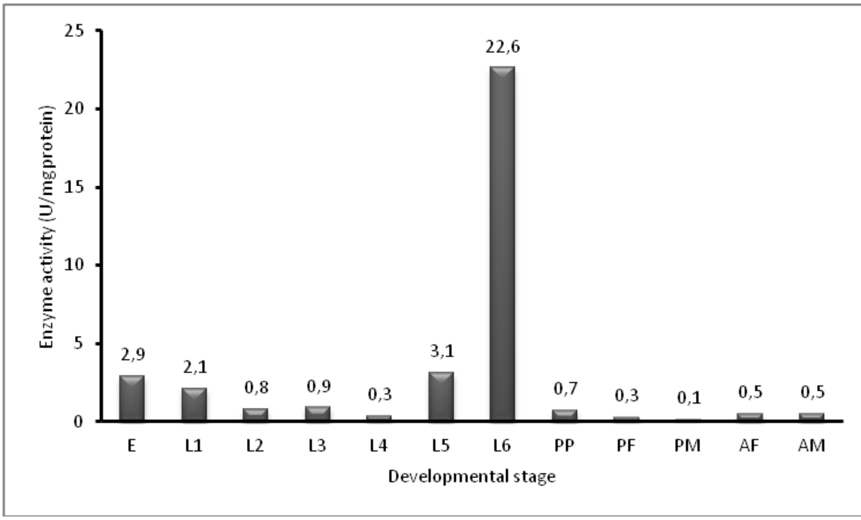

Figure 1. Alpha-amylase activity in different developmental stages of cotton bollworm (E: eggs; L1-L6: first to 6th larval stages; PP: Pre-pupa; PF and PM: male and female pupa; AF and AM: male and female adults).

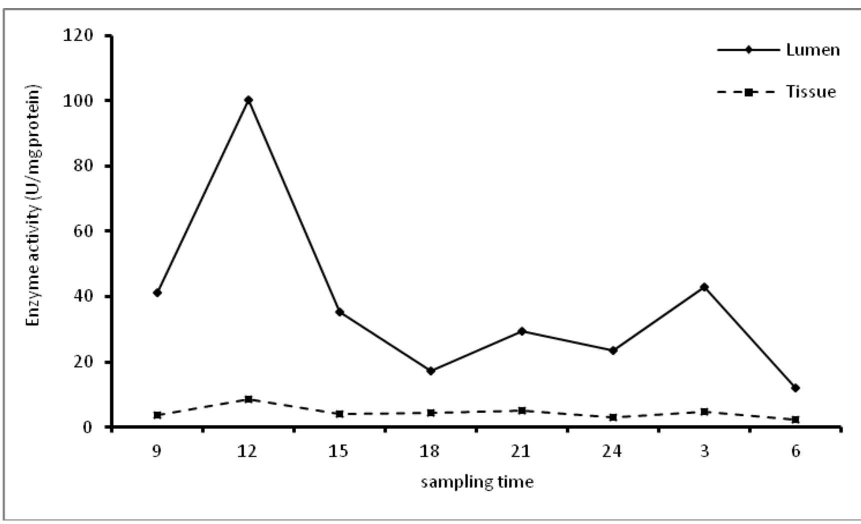

Figure 2. Comparing alpha-amylase activity in midgut lumen and tissue of 6th larval stage of cotton bollworm.

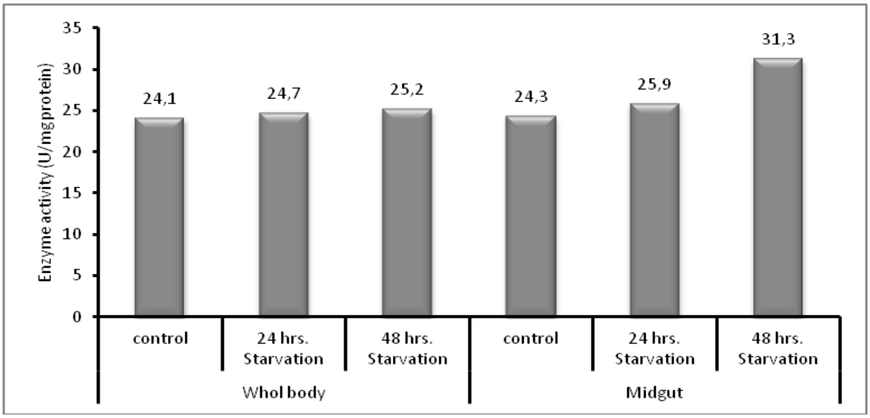

Figure 3. Effect of starvation in two different times on whole body and midgut amylase activity.

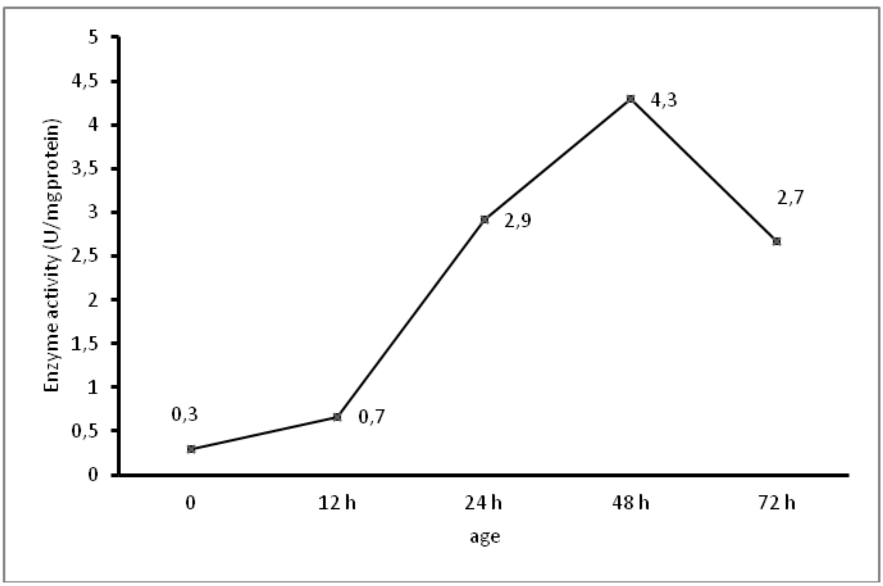

Figure 4. Amylase activity during developmental period of cotton bollworm eggs.

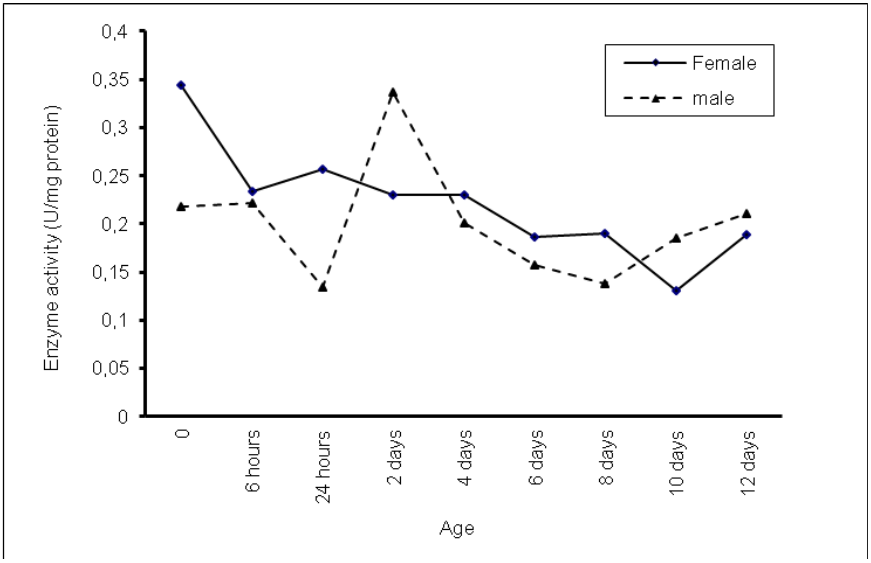

Figure 5. Alpha-amylase activity during developmental period of male and female cotton bollworm pupas.

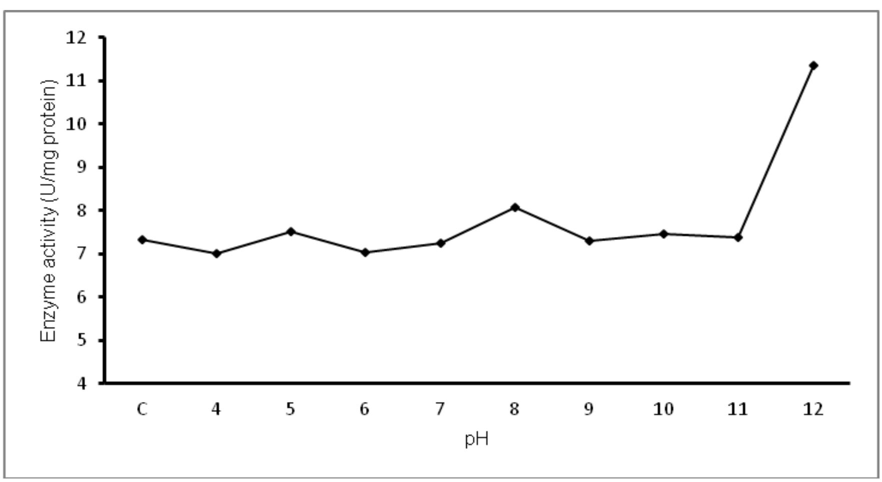

Figure 6. Cotton bollworm midgut alpha-amylase activity in different pH values.

NEW SPECIES OF *HYLLUS* C. L. KOCH (ARANEAE: SALTICIDAE) FROM INDIA

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ABSTRACT: A new species of jumping spiders from the genus *Hyllus* C. L. Koch namely *Hyllus manu* sp. nov. is described from Chennai, India. Morphological characters and illustrations of the genitalia are provided.

KEY WORDS: *Hyllus manu* sp. nov., new species, Salticidae, Chennai (Madras), South India.

Salticidae is the most diverse family with 5678 species and 597 genera in the world (Platnick, 2014). In India it is known by 207 described species from 73 Genera (Keswani et al., 2012). However, Salticidae is one of the least studied families among Indian spiders (Sunil, 2013). The Genus *Hyllus* is known by three species from India namely *Hyllus bos* (Sundevall), *Hyllus pudicus* Thorell and *Hyllus semicupreus* (Simon) (Keswani et al., 2012).

Spiders of the genus *Hyllus* are generally stout, hairy and dull coloured. Most species in the genera have "horns" formed by tufts of long bristles located at posterior median eyes. *Hyllus* includes medium-sized to large spiders with rounded carapace, clearly wider than eye field. Male pedipalp has generally long embolus, often with accompanying *pars pendula*. Epigyne is more sclerotized (Wesołowska, 2008; Proszynski, 2013).

Specimens were collected as part of spider diversity study within the Madras Christian College campus. The campus encloses a scrub jungle with an expanse of 365 acres. In this paper a new species *Hyllus manu* sp.nov. is being described from Chennai, South India.

MATERIALS AND METHODS

Specimens were collected and photographed using DSLR Nikon D60, 18-55mm lens (reversed for macro photographs). Specimens were preserved in 70% alcohol and later examined using a stereoscopic microscope (NIKON SMZ1000). Male palps were detached, examined and kept in a separate vial along with the original specimen and female genitalia were excised using fine surgical scalpel. The epigyne was then transferred to Petri dish containing KOH 10% aqueous solution for clearing. USB digital microscope with Micro-measure Software was used for making measurements. The type specimen will be eventually deposited in the Zoological survey of India, Regional Station, Chennai. Description is based on fresh specimen. All measurements are in mm (millimeters).

Abbreviations used: ALE = Anterior lateral eyes, AME = Anterior median eyes, PLE = Posterior lateral eyes, PME = Posterior median eyes. AME-AME = Mutual distance between eyes, GPS = global positioning system.

RESULTS

Hyllus manu sp. nov.
(Figs. 1-10)

Description: Male:
Carapace: 3.38 Long, 2.67 Wide**; Abdomen:** 4.00 Long, 2.16 Wide**; Total length:** 7.38 **Cephalothorax:** Covered by blackish hairs scales, patch of white hairs extend from the lateral sides to meet at the posterior. Clypeus covered with black hairs. Anterior eyes covered by orange scales (Fig. 3). Eye size and inter distance between AME 0.68, ALE 0.36, PME 0.10, PLE 0.34; AME–AME 0.08, AME–ALE 0.07, PME–PME 1.83, PME–PLE 0.41, ALE–PLE 0.92. Clypeus height 0.17. Chelicerae black, 2 promargin and 1 retromargin teeth, Sternum oval shaped covered with yellowish hairs uniformly, Leg I robust, long and dark, Femur of all legs white at the base and black on the other half. Leg measurements: I 8.29 (2.36, 1.15, 2.21, 1.33, 1.24); II 6.40 (2.08, 1.19, 1.34, 0.98, 0.81); III 7.07 (2.54, 1.05, 1.40, 1.10, 0.98); IV 6.20 (2.10, 0.82, 1.40, 1.05, 0.83). Leg formula: 1324. Palp covered with dense paler yellowish hairs, bulbus with an extended process downwards, embolus long (Figs. 7 & 8).

Abdomen: long and narrow, anterior part covered by white hairs and runs mid longitudinally downwards, lateral sides black in color. Faint chevron shaped markings seen on the dorsum. Spinnerets with white hairs in the middle and blackish laterally.

Female: Carapace: 3.09 Long, 2.31 Wide; Abdomen 3.39 Long, 1.76 Wide; Total length 6.48 Eye measurements: AME 0.59, ALE 0.34, PME 0.09, PLE 0.24, AME-AME 0.07; AME-ALE 0.09; PME-PME 1.70; PME-PLE 0.32; ALE-PLE 0.72; Clypeus height: 0.35, clypeus covered by transverse narrow stripes of white hair (Fig. 6). Leg measurements: I 5.86 (2.03, 0.61, 1.77, 0.74, 0.71); II 5.04 (1.61, 1.01, 1.15, 0.58, 0.69); III 5.95 (2.07, 0.77, 1.35, 0.84, 0.92); IV 5.64 (1.80, 0.59, 1.39, 0.89, 0.97) Leg formula: 3142. Coloration pattern as in male but differs in the following. General body color dull with reddish brown spots spread sparsely in between white hairs. Cephalothorax with a white patch running from the middle to the posterior. Abdomen with paler mid-dorsal white patch and chevron shaped markings. Epigyne placed on a sclerotized plate (Fig. 9), internal view shows copulatory ducts coiling around the spermathecae (Fig. 10).

Etymology: Named in honor of our Guide, Dr. Manu Thomas Mathai.

Type material: Holotype – 1 male; 10.vi.2013**,** (GPS 12.916041° N, 80.125961° E, 32 m): **Allotype:** 1 female 12.x.2012; **Paratypes**: 1 male 12.x.2012, 1 male 23.xi.2012. Coll. John Caleb T.D. and Anulin Christudhas. GPS (data same as holotype).

Type Locality: South India, Chennai, Madras Christian College, Scrub jungle regions.

Distribution: Known heretofore from Chennai, S. India.

Diagnosis: This species can be separated from other congeners by the posterior protrusion of the bulb (Figs. 7, 8) and shape of retro lateral tibial apophysis.

Females resemble *H. semicupreus* but can be distinguished by the copulatory ducts coiling around the spermathecae (Fig. 10) and abdominal pattern (Fig. 4).

Natural History: Found among low vegetation and shrubs in the scrub regions of MCC campus.

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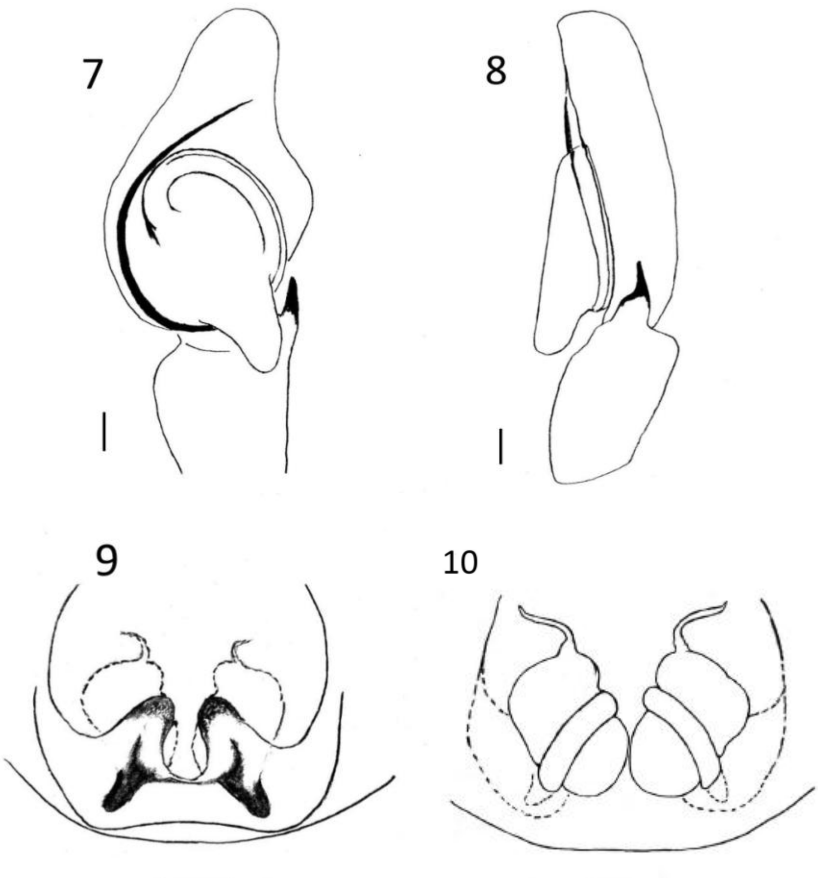

Figures 1-10: *Hyllus manu* sp. nov., 1. Dorsal view of male, 2. Lateral view, 3. Frontal view, 4. Dorsal view of female, 5. Lateral View, 6. Front view, 7. Palp ventral view, 8. Palp retrolateral view, 9. Epigyne, ventral view, 10. Internal genitalia, dorsal view. Scale bars: Figs 7-10, 0.1 mm.

AN INVESTIGATION ON THE GROWTH AND REPRODUCTIVE PERFORMANCE OF *POECILIA RETICULATA* (PETERS) (CYPRINODONTIFORMES: CYPRINIDAE) FED DIETS WITH DRIED INSECTS

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ABSTRACT: In the study, five feeds given to guppies (*Poecilia reticulata*) were evaluated for their effects on growth and reproductive performance of females. Feeds namely Diet I, II, III, IV and V formed flake food, blood worm, locust, rhino beetle and flour worm, respectively. Blood worm, locust, rhino beetle, flour worm were insects, and flake food was a commercial fish food. The growth and reproductive performance were investigated based on growth parameters, gonadal development and fry production. Fish fed Diet II, IV and V had a higher specific growth rate compared to the other groups. The ovary weight of guppies fed Diet II was significantly ($p<0.05$) higher than those with diets I, III, IV and V. The absolute fecundity values were 35.5±0.02, 58.8±0.04, 30.8±0.03, 50.2±0.05 and 48.1±0.02, respectively for the fish fed Diet I, II, III, IV and V. The number of fry produced was also significantly higher in fish fed Diet II. Between the groups, fish fed Diet II obtained the highest mean gonad weight and gonadal somatic index. The results of the present study demonstrated that the use of such dried insects is a reliable source for commercial guppy farming and the reproductive performance of the fish increased.

KEY WORDS: Insect, guppy, nutrition, fecundity, specific growth rate.

Aquarium fish are rapidly gaining importance due to their immense commercial value worldwide. Live bearing species of the family Poecilidae such as guppies and mollies are popular ornamental aquarium species. Guppies (*Poecilia reticulata*) are beautiful fish that are easy to keep and breed in aquaria. They readily eat dried food such as tropical flakes as well as *Tubifex* worms, small crustaceans such as brine shrimp, and plant matter. These feeds may not provide broodstock fish with adequate nutrients and promote optimal reproduction (Fernando et al., 1991). Broodstock nutrition is an important factor governing egg production and larval survival (Izquierdo et al., 2001). Also, gonad development and fecundity are affected by certain essential nutrients (Izquierdo et al., 2001). Dietary protein and lipid play major roles in growth and reproduction (Suting et al., 2013). Morimoto (1994) reported that for most aquatic organisms, the nutritional quality of diets given broodstock significantly affects the biochemical composition of eggs, total number of eggs spawned and the percentage of eggs hatched among other factors. Based on the afore-mentioned findings, the reproductive potentials, particularly the fecundity and quality of the guppy fry are presumably variable, depending on several factors such as the nutritional content of their diet.

Insecta is the biggest group of animals on earth. Insects are thought to be one of the biggest biological resources. Insects offer us many benefits, including their use in human and animal nutrition. The uses of many insect species as an important food source have become widespread in many parts of the world. More than 1,000 species of insects, mainly in developing countries, that are edible by humans at a certain stage of their life-cycle have been identified worldwide (Cerritos, 2009). Insects are essential agents feeding on organic matter in nature, and they efficiently exploit all organic sources. It is also important that insects are able to recycle organic wastes and provide nutrients for livestock. Therefore, they could be used as efficient biotransformers to conver abundant, low cost organic wastes into animal biomass rich in proteins and suitable for use in animal nutrition. Edible insects are one alternative resource to improve human and animal nutrition (Ramos-Elorduy, 2008). Conversely, edible insects may include contain vertebra toxins (Akinnawo et al., 2002). Therefore, the feeding of these insects may cause serious harmful effects to animals. In this context, the potential toxic effects of these edible insects need further investigation. According to our knowledge, no investigation has been carried out on the toxic or non-toxic effects of edible insects on fish species. Also, there is no study on the effects of dried insects and larvae on the reproductive performance of fish.

Therefore, the current study assess some growth and reproductive parameters of guppy fish *Poecilia reticulata* (Peters, 1859) fed four types of insect diets to study the influence of these diets on reproduction.

MATERIALS AND METHODS

Fish culture:
The guppies were obtained from commercial suppliers. Fish were acclimated in carbon- filtered city water, under standard laboratory conditions (25±1 ^{o}C, 14:10 light-to-dark photoperiod) and daily fed a commercial flake food during this period. The aquaria were cleaned and the water was changed every four days. All these procedures were made before the start of experiment. The average weight and length values of the female guppies were 0.0122-g and 1.02-cm, respectively.

Experimental design and feeding:
There were five treatment groups, each with three replicates in five 30-L rectangular glass aquaria (30X20X50 cm). Each aquarium was stocked with 10 female fry of almost uniform size. Five types of feeds were used in this study. Tetramin fish flake (Figure 1A) that is a commercially available diet for aquaria fish served as Diet I. The dried insects diets are: Diet II is blood worm (larvae of *Phlebotomus*, Loew (Diptera: Psychodidae), Figure 1B and 1C). The commercial product was made by grinding of the dried larvae. Diet III is locust (adults of *Locusta migratoria*, Linnaeus (Orthoptera: Acrididae) Figure 1D). Diet IV is rhino beetle (adults of *Dynastes hercules*, Linnaeus (Coleoptera: Scarabaeidae) Figure 1E), and Diet V is flour worm (larvae of *Tenebrio molitor*, Linnaeus (Coleoptera: Tenebrionidae) Figure 1F). Diet I, II, IV and V were obtained from commercial suppliers. Diet III was obtained from an insect farming in Antalya, Turkey. All insect samples were dried and pulverized. The weight of all feed samples was measured before the experiment. Feeding was carried out until satiation, twice a day at 800 and 1700 h throughout the experiment. Dried insect powder and flake food were dropped into the tanks and repeated until satiation was observed. At the end of the week, the remaining amount of feed was weighed and the amount of food consumed was deducted. The water quality was monitored weekly throughout the experimental period.

Determination of the growth rate and reproductive performance:
The growth rate of female guppy fry was assessed after three months by initially recording their body length and weight. The fry weight was measured using an

analytical balance device (OHAUS Adventurer™ Pro). Before the measurements, the fish were kept overnight without food. The specific growth rate and food conversion ratio were calculated with the below formulae:

Specific growth rate (SGR %/day) = 100 x (ln.final wt of fish – ln.initial wt of fish/trial day).

Food conversion ratio (FCR) = Total feed fed (g)/Total wet weight gain (g).

Reproductive performance was measured in terms of ovary weight, absolute fecundity, Gonadal Somatic Index (GSI) and the number of fry. Ten fish from each treatment were used to determine the reproductive indices. Dissections were carried out under a stereo microscope. The oviduct and mesovarium were separated and removed. The ovarian weight was measured using the same analytical balance device. All portions of ova were put into 4% formalin and the oocytes were counted under a stereo microscope. The absolute fecundity (F_a), which is the number of mature oocytes spawned by a female in a single spawning (Bagenal, 1973), was estimated as:

F_a = GW x D (GW: Weight of the ovary, D: Density of the mature oocytes = number of oocytes per g of ovarian tissue).

The GSI, which is the relation of gonad to somatic weight, was calculated by the formula (Arellano-Martínez and Ceballos-Vázquez, 2001):

GSI = (Individual gonad weight/Individual body weight) x 100.

Breeding and fry collection:
The 10 female fish were separated randomly from the experimental tanks for breeding. Each tank was stocked with 10 female and 5 male fish of the same size. Breeding tanks were provided with polythene strips arranged in bundles. After a gestation period, the newly born fry in each tank were collected daily with a hand net and kept in separate tanks. The number of fry was recorded daily during five months.

Statistical Analysis
Comparison of various growth and reproductive parameters from different dietary treatments was evaluated with analysis of variance (ANOVA) and Duncan's test by S.P.S.S. software program (version 15.0). All data was presented as mean ± S.E. of three replicates. The level accepted for statistical significance in all cases was $p<0.05$.

RESULTS

The mean values of total length (from nose to caudal fin) and final weight after 3 months rearing period are given in Table 1. The total length of the fish of the Diet II was higher than that of fish fed other diets. The total consumption of the dry diets (Diet I, II, III, IV and V) was 36.32-g. The initial and final weights were ranged from 0.0121-0.0124 and 0.144-0.215-g, respectively. The feed conversion values of the fish fed with Diet II had a high value. FCRs of Diet I, II and IV were significantly lower than with the other diets. The fish of Diet III had only a small increment in length and weight. SGR values for the fish fed all diets were 0.22 to 0.33. Differences between the SGR values were found insignificant, except for Diet III (Table 1).

The ovarian weight, absolute fecundity (F_a) and mean GSI values are given in Table 2. The fish fed Diet II had higher ovary weight, F_a and mean GS as compared to other diets. The differences between the diet groups were statistically significant.

The mean total fry production and live fry survival rate values are given in Table 3. Fry production was higher in fish fed with Diet II than with the other diets. Fry survival rates were not significantly different between the diets.

It is evident from the results of the present study that Diet II resulted in better growth and reproductive performance of female guppy compared to other diets. No diet caused any toxic effects (mortality, paralysis, abnormal swimming behavior, etc.). In general, the insect diets showed the same growth and reproductive effects of Diet I (control) and none of the insect products were toxic for the guppies.

DISCUSSION

The results of this study suggest that the effects of dried insect diets on the growth and reproductive performance of guppies were mediated. The average number of fry, total length and weight of fish were not negatively affected by the diets. The study showed that the insect products had enough essential nutrients for the guppy. Insects often contain more protein, fat and carbohydrates than equal amounts of beef or fish and a higher energy value than soybeans, maize, beef, fish, lentils, or other beans. The proximate compositions of the some insect groups are given Table 4.

As shown in Table 4, the edible insect products contain protein, lipid and carbohydrate levels. Crude protein levels are 22-66% in Ephemeroptera larvae, 40-65% in Odonata larvae, 42-73% in Hemiptera larvae, 40-57% in Homoptera larvae and eggs, 38-76% in Hymenoptera and 23-66% in Coleoptera larvae (DeFoliart, 1992; Zhang et al., 2008; Yang, 1998; Xiaoming and Ying, 1999; Ying et al., 2000; Ying et al., 2001). Blood worm used Diet II is a Diptera larva. Locust as Diet III and rhino beetle as Diet IV belong to Orthoptera and Coleoptera, respectively. Finally, flour worm as Diet IV is a Coleoptera larvae. Therefore, Diet I, II and III-IV may contain 59.39%, 44.10% and 50.41% protein, respectively. Likewise, lipid levels of the diets are 12.61%, 2.2% and 27.57%. Diet I, II and III-IV may contain 12.04%, 1.20% and 2.81% carbohydrates, respectively. The nutritional requirements for the ornamental fish have been reported by Swain (1999). The fish fry can be fed with 40-50% protein, 4-6% lipid and 40-50% carbohydrates. Accordingly, the insect diets, which used the study could be contained the recommended amount of dietary protein and lipid levels resulted in the growth and reproductive performance of female guppy.

It has been reported that the dietary protein and lipid levels play a major role in weight gain in fish and provision of adequate levels will lead to higher fry production (Milton & Arthington, 1983). Suting et al. (2013) reported that different dietary lipid sources had positive effects on growth and reproduction performance of guppy. Dahlgren (1980) conducted an experiment with three types of feed with different protein levels and recorded high growth and reproductive performance in female guppies fed 31% protein levels. In another study, it was found that 30-40% dietary protein was optimal level for breeding guppy and 9-10.5% lipid levels gained the high mean body weight, ovary weight, GSI and number of yolk oocytes (Shim & Ng, 1988). Shim & Chua (1986) also found that the diets with 30 to 40% protein appeared to be the best for gonadal development, since those diets resulted in the greatest mean ovary weight and in the largest mean number of yolk oocytes in the ovary of guppy. It has been reported that the diet contained highest levels of protein and lipid showed the maximum fry production in guppy females (Kithsiri et al., 2010). Compared to the recommended nutritional requirements, Diet II, III, IV and V contained higher protein percentages and required amount of lipid and carbohydrates. Also, the significantly low FCR recorded in the Diet II clearly indicated that those fish were fed a diet including the required amounts of protein and lipid. Therefore, by comparing the results of the present study with that of the required dietary protein and lipid levels reported, it is possible to establish the effect of the dried insect diets used on the growth and reproduction of guppies.

In conclusion, the commercial and edible insect products did not cause any health risk, conversely the products encouraged fish growth, development and reproduction. The results of the present study also indicated that Diet II (blood worms) contained highest protein level, showed the maximum fry production in guppies compared to the other diets. Diet IV and V probably had adequate levels of protein for proper maintenance of growth and reproduction. Finally, the use of feed with edible insect products is absolutely reliable for commercial guppy farming because the insects have high protein, lipid and carbohydrates levels.

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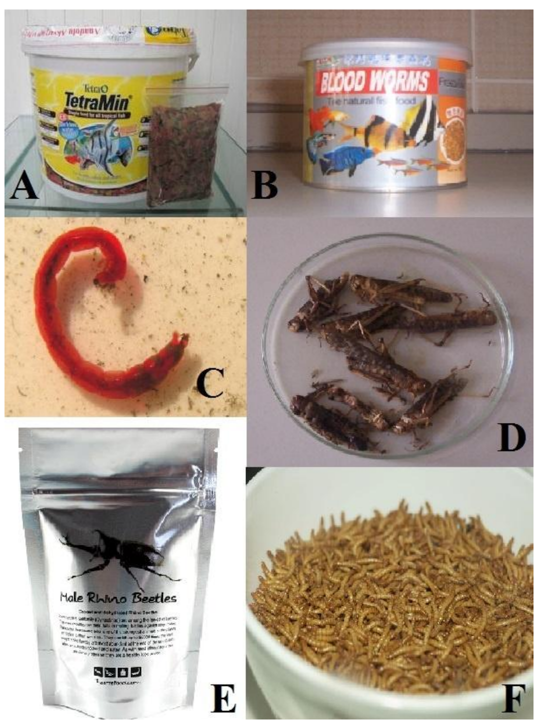

Figure 1. The feeds used in the experiment: A) Tetramin fish flake food as Diet I, B) Blood worm as Diet II (commercial) C) Blood worm larva (*Phlebotomus*), D) Locust as Diet III (*Locusta migratoria*), E) Rhino beetle as Diet IV (*Dynastes hercules*) (commercial), and F) Flour worm as Diet V (*Tenebrio molitor*).

Table 1. Growth parameters of guppy fed different diets.

Parameter	Diet I	Diet II	Diet III	Diet IV	Diet V
Initial length (cm)	1.01±0.01	1.03±0.02	1.02±0.02	1.01±0.02	1.00±0.01
Final length (cm)	1.56±0.02^{a}	2.07±0.07^{b}	1.40±0.03^{a}	1.93±0.04^{b}	1.91±0.06^{b}
Length gain	0.55±0.01	1.04±0.05	0.38±0.01	0.92±0.02	0.91±0.05
Initial weight (g)	0.0121±0.001	0.0123±0.001	0.0124±0.002	0.0124±0.002	0.0121±0.002
Final weight (g)	0.188±0.001^{b}	0.215±0.003^{c}	0.144±0.001^{a}	0.208±0.005^{c}	0.204±0.003^{c}
Weight gain	0.176±0.001	0.202±0.002	0.131±0.003	0.195±0.003	0.191±0.002
SGR (%)	0.29±0.03^{b}	0.33±0.01^{b}	0.22±0.02^{a}	0.32±0.02^{b}	0.31±0.01^{b}
FCR	2.68±0.10^{b}	1.15±0.09^{a}	6.57±0.13^{c}	1.34±0.08^{a}	1.38±0.09^{a}

SGR: Specific growth rate, FCR: Feed conversion ratio. Values within a row with different superscript letters are significantly different ($p<0.05$).

Table 2. Reproductive parameters of guppy fed different diets.

Parameter	Diet I	Diet II	Diet III	Diet IV	Diet V
Ovarian weight (g)	0.25±0.02^{a}	0.49±0.01^{c}	0.20±0.02^{a}	0.40±0.02^{b}	0.39±0.01^{b}
F_a	35.5±0.02^{a}	58.8±0.04^{c}	30.8±0.03^{a}	50.2±0.05^{b}	48.1±0.02^{b}
Mean GSI%	24.07±0.021^{b}	30.17±0.045^{d}	20.81±0.032^{a}	28.82±0.024^{c}	28.40±0.013^{c}

Values within a row with different superscript letters are significantly different ($p<0.05$).

Table 3. Fry production and fry survival during the breeding period.

Parameter	Diet I	Diet II	Diet III	Diet IV	Diet V
Mean total fry production	351±6.5^{c}	384±5.4^{d}	312±7.1^{a}	353±2.3^{c}	336±5.6^{b}
Fry survival rate	93.14±8.2	91.57±12.6	94±5.6	93.57±4.32	92±5.61

Values within a row with different superscript letters are significantly different ($p<0.05$).

Table 4. Proximate composition of some insect groups (100 g dry matter).

Insect ordo	Crude protein (%)	Crude lipid (%)	Carbohydrates (%)
Odonata	58.83	25.38	3.75
Orthoptera	44.10	2.2	1.20
Homoptera	51.13	27.73	2.17
Hemiptera	55.14	30.43*	3.23
Coleoptera	50.41	27.57	2.81
Lepidoptera	44.91	24.76	8.20
Diptera	59.39*	12.61	12.04*
Hymenoptera	47.81	21.42	3.65

* showed the highest values

COMPARISON CANNIBALISTIC BEHAVIOR BETWEEN TWO LADYBIRDS, *COCCINELLA.SEPTEMPUNCTATA* L. AND *HIPPODAMIA.VARIEGATA* (GOEZE) UNDER LABORATORY EXPERIMENTS

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[**Aleosfoor, M., Mortazavi, N. & Poorkashkooli, M.** 2014. Comparison cannibalistic behavior between two ladybirds, *Coccinella septempunctata* L. and *Hippodamia variegata* (Goeze) under laboratory experiments. Munis Entomology & Zoology, 9 (2): 645-650]

ABSTRACT: The cannibalistic behaviour of various developmental stages of *Coccinella septempunctata* L. and *Hippodamia variegata* (Goeze) were investigated at satiety and starved conditions. Both species were cannibalistic. However the rate of cannibalism was greater in the former species. In all experiments and in both coccinellids, no significant differences were detected at satiety conditions but at starved conditions, a significant effect of different predator and prey instar were recorded. Cannibalistic rate of ladybirds increased at low densities of *Schizaphis graminum* (Rondani) population and this is because of high relative frequently of encounters between predator coccinellids and the aphid.

KEY WORDS: *Coccinella septempunctata*, *Hippodamia variegata*, *Schizaphis graminum*, cannibalism.

Ladybirds (Coleoptera: Coccinellidae) are well known for their habits on aphids. They are polyphagous and live in diverse habitats Most of them are Carnivores and both adult and larvae can feed on aphids, whiteflies, psyllids, mealy bugs and scale insects (Pervez et al., 2006).

Cannibalism is a common phenomenon in predaceous ladybirds and endows nutritional and competitive advantages to the cannibals; this behaviour may evolve if the evolutionary costs are less than the advantages (Agarwala, 1991; Pervez et al., 2006; Santi & Mainai, 2007; Timms & Leather, 2007). Cannibalism rates may increase when food is rare but many predators are cannibalistic even when the prey is abundant. This is important in the dynamics of their population. Cannibalistic behaviour in larvae is a survival strategy under food depletion situations and enables larvae to complete their development (Burgio et al., 2005; Al Ansari, 2010).

Coccinella septempunctata and *Hippodamia variegata* are widespread coccinellids in Palearctic (including Iran), Nearctic and Oriental region. They are important biological control agents against aphids on the cultivated crops (Hodek & Honek, 1996). Most of the times, these two species' can be seen simultaneously in the fields. So the present study was undertaken to compare cannibalistic behaviour between these two species.

MATERIALS AND METHODS

1. Stock colony maintenance

H. variegata and *C. septempunctata* were collected from the wheat fields of Badjgah region (Fars province) and reared at 25±1 °C and photoperiod of 16 h light and 8 h darkness. Groups of thirty males and thirty females of each coccinellids were kept separately in 5 liters plastic boxes that contain moist cotton plugs and a piece of folded filter paper to increase the surface. Every day the ladybirds were fed on ad libitum supply of *S. graminum*. Filter papers were changed every day and egg clusters were removed and incubated at 15± 1°C. Once a week the ladybirds were transferred to new containers to stimulate egg laying. Coccinellids reared in laboratory at least for 4 generations (Agarwala, 1991).

S. graminum also collected from the wheat fields of Badjgah region (Fars province) and brought to the green house to form stock colony. Aphids reared in greenhouse at least for 10 generations (Agarwala, 1991).

2. Rate of food consumption in larvae and adults

Daily food consumption of the two coccinellids was measured at 25±1 °C, 65± 5% humidity and photoperiod of 16h light: 8h darkness in three separate experiments, as follows:

1. Each larval instar or adult female was gently placed in the center of a 9-cm diameter Petri dish with adequate aphids lined with filter paper.
2. Each larval instar or adult female was gently placed in the same situation with adequate conspecific eggs.
3. Each larval instar or adult female was gently placed in the same situation with adequate conspecific eggs and aphids all together.

3. Comparison between larval cannibalism at satiety and starved conditions

Neonates of *H. variegata* and *C. septempunctata* were examined at satiety conditions as bellow:

1. Putting 10 first instar larva + 10 third instar larva+ 100 aphids in each 9-cm diameter Petri dish (e1).
2. Putting 20 fourth instar larva + 500 aphids in each 9-cm diameter Petri dish (e2).
3. Putting 10 fourth instar larva + 10 different larval instars+ 300 aphids in each 9-cm diameter Petri dish (e3).

In starvation conditions, larvae starved for 12h to homogenize their hunger level and number of aphids was halved (Rahim khan et al., 2003). The experiments were replicated 10 times and all experiments were conducted under 25±1 °C, 65± 5% RH and 16L: 8D photo period. After 2h the numbers of eaten larvae were recorded (Burgio et al., 2005). Data on cannibalism events were analyzed by ANOVA (Minitab, 2000).

4. Comparison between adult cannibalism at satiety and starved conditions

Adult females of each coccinellid beetles + 70 aphids + 10 conspecific eggs were put in each 9-cm diameter Petri dish in above conditions (e4) in 10 replications. In starvation conditions, adults starved for 12h and number of aphids was halved. After 2h number of eaten eggs was recorded. Data on cannibalism events were analyzed by T- Test (Minitab, 2000).

RESULTS AND DISCUSSION

Rate of food consumption in larvae and adults Bioecology

a. Feeding with aphids or conspecific eggs

In both coccinellid species, the forth instar larvae were seemed to be more voracious and consumed higher number of aphids. Females appeared to be more reluctant in consuming eggs as compared to forth instar larvae (Table 1).

b. Simultaneous Feeding with aphids and conspecific eggs

In the presence of aphids and conspecific eggs, first and second larval instars didn't consume any eggs. The daily feeding capacity of four instar larva and adult females, were higher on aphids than eggs (Table 1).

Comparison of larval cannibalism at satiety and starved conditions

a. Satiety conditions

Based on the results, in all experiments (e1, e2 &e3) the larvae of two coccinellids didn't differ significantly in term of cannibalism at satiety conditions at 95% Confidence Interval (Table 2).

b. Starved conditions

A significant different between predator larva and prey instar were recorded in all experiments (DFCs=2, FCs= 43.67, PCs= 0.001, α= 0.005& DFH v=2, FHv= 54.40, PHv= 0.001, α= 0.005) (Fig. 1).

Comparison of adult cannibalism at satiety and starved conditions

a. Satiety conditions

No significant differences were detected between adult cannibalism in these two species (T test, P value= 0.9).

b. Starved conditions

Rate of adult cannibalism in *C. septempunctata* was significantly higher than *H. variegata* (T test, P value= 0.026) (Fig. 2).

Comparison of cannibalistic behavior at satiety and starved conditions

1. In *C. septempunctata*

The rate of cannibalism was shown to be significantly higher by starved predators than satiated ones (DF= 1, F= 178.03 and P= 0.001) (Fig. 3).

2. In *H. variegate*

Based on the results, starved *Hippodamia* coccinellids show higher rate of cannibalism than satiated ones (DF=1, F= 167.53 and P= 0.001) (Fig. 3).

Comparison of cannibalistic behavior at satiety and starved conditions

Results didn't show any significant differences between two coccinellids at satiety conditions (DF=1, F= 0.88, P= 0.35), But analyses of variance showed significant differences at starved conditions (DF=1, F= 4.02, P= 0.048) (Fig. 4).

Finally, based on all experiments, grouping information by using tukey method at 95% confidence interval is shown in Table 3.

Cannibalism is a widespread phenomenon in many arthropods. Most of the time, this behavior can be seen during food scarity (Pervez et al., 2006). The results of present experiments revealed that in both coccinellid species the forth instar larvae were seemed to be more voracious and consumed higher number of aphids. Al-Ansari (2011) observed similar results in *C. undecimpunctata*.

Based on our results coccinellid females appeared to be more reluctant in consuming eggs. It's apparently due to the defensive materials like alkaloids, pyrazines and quinolenes in coccinellids eggs. These resources synthesized by coccinellids and protected their eggs from predation (Cottrel & Yeargan, 1998a,b; Agarwala & Yasuda, 2001). Our result is in spite of Agarwala (1991). He reported that coccinellids eat eggs more efficiently than aphids.

In our experiments, in the presence of aphids and eggs, rate of aphid consumption was more than eggs. Our results support the inferences of Burgio et al. (2002), who suggested that in presence of alternative food source, the percentage of eggs attacked was lower than without an alternative food.

In all of our experiments and in both coccinellids, rate of cannibalism at starved conditions was significantly higher than satiety conditions. There is a possibility of high- level cannibalism when aphids are scare. It is because of high relative frequency of encounters between prey and predator (Dixon, 1959). When aphid population collapse, larvae and adults of coccinellids are under great pressure to survive, so unhatched eggs or smaller larvae of ladybirds are the easy targets (Agarwala, 1991).

Situations which form the attack strategy of ladybirds in the selection of food are little understood. Sometime, ladybirds are expected to adjust their attack on prey by assessing its availability. Most of the times they prefer larger and assured food supply for themselves and their offspring. In Food scarcity, cannibalism is an important evolutionary behavior for coccinellids to survive and complete their development.

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Table 1. Rate of food consumption in *C. septempunctata* and *H. variegata* larvae and adult females.

Species	Prey/diet		Larval instars 1st (From 25)	2nd (From 55)	3rd (From 120)	4th (From 250)	Adult female (From 150)
C. septempunctata	Aphids		20.5±2.1	50.3±5.5	101.7±6.1	210.1±10.2	125.5±12.1
	Eggs		17.2±4	40.1±3.1	60.3±14.3	110.8±5.5	70.9±8.1
	Eggs with aphids	Eggs	0	0	33.2±5.6	60±3.2	78±9.1
		Aphids	18.4±1.1	28.5±3.2	65.6±3.2	125.4±6.5	80.3±8.7
H. variegata	Aphids		18.2±1.8	45.4±6.2	98.5±5.5	180.1±8.7	115±7.4
	Eggs		15.1±3.5	27.9±6.1	54.3±8.6	97.3±5.5	50.5±8.9
	Eggs with aphids	Eggs	0	0	25.3±2.1	39.8±7.5	51±6.5
		Aphids	15.6±2.1	25±2.2	31.1±2.1	39.1±6.8	46.2±4.6

Table 2. Comparison larval cannibalism of *C. septempunctata* and *H. variegata* at satiety conditions.

Species	DF	F	P
C. septempunctata	2	0.33	0.719
H. variegate	2	0.26	0.769

Table 3. Final grouping information on larval cannibalism between (A) *C. septempunctata* and (B) *H. variegata* by using tukey's method at 95% confidence interval.

Species	Experiment	Number	Mean
A	e3	20	3.2^{a}
A	e4	20	2.8^{ab}
B	e3	20	2.8 ^{ab}
B	e4	20	2.4 ^{ab}
A	e1	20	1.9 ^{ab}
B	e1	20	1.6 ^{ab}
A	e2	20	1.4 ^{ab}
B	e2	20	0.9^{b}

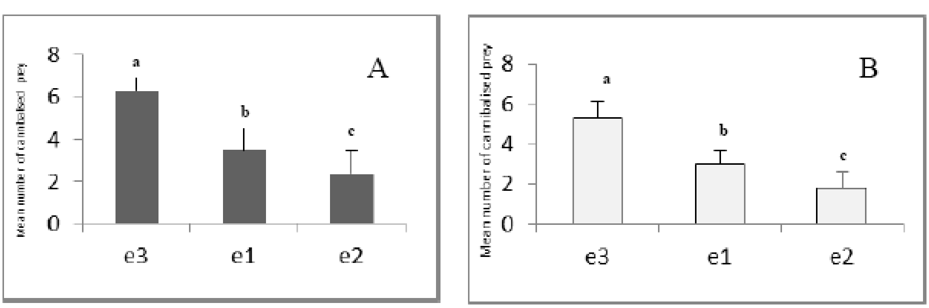

Figure 1. Larval cannibalism in starved conditions (A) *C. septempunctata* and (B) *H. variegata*. Different letters indicate that data are statistically significant.

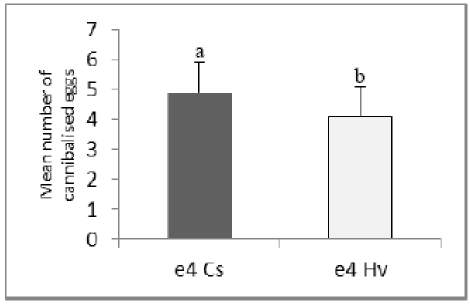

Figure 2. Comparison of adult cannibalism at starved conditions in (Hv) *H. variegata* and (Cs) C. *septempunctata*. Different letters indicate that data are statistically significant.

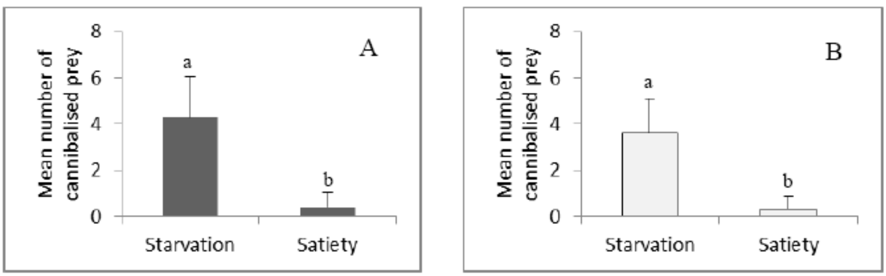

Figure 3. Comparison of cannibalistic behavior in (A) *C. septempunctata* and (B) *H. variegata* at satiety and starved conditions. Different letters indicate that data are statistically significant.

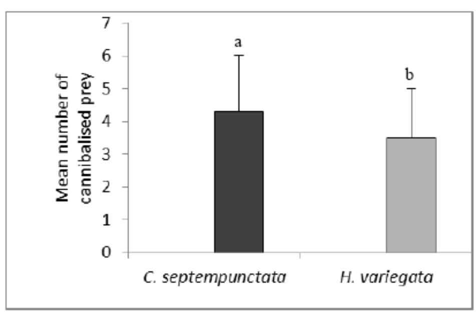

Figure 4. Comparison of cannibalistic behavior between *H. variegata* and *C. septempunctata* at starved conditions. Different letters indicate that data are statistically significant.

TURKISH RED LIST CATEGORIES OF LONGICORN BEETLES (COLEOPTERA: CERAMBYCIDAE) PART VII – SUBFAMILY CERAMBYCINAE: GRACILIINI, OBRIINI, CERTALLINI, DEILINI, STENHOMALINI, HYLOTRUPINI AND CALLIDIINI

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[Özdikmen, H. 2014. Turkish Red List Categories of Longicorn Beetles (Coleoptera: Cerambycidae) Part VII – Subfamily Cerambycinae: Graciliini, Obriini, Certallini, Deilini, Stenhomalini, Hylotrupini and Callidiini. Munis Entomology & Zoology, 9 (2): 651-665**]**

ABSTRACT: The aim of this study is to create a Turkish Red List of the longicorn beetles. Moreover, presence such a Red List is necessary for Turkey. Even governmental evaluations could cause some erroneous decisions due to absence such a Red List. Since, governmental evaluations at the present time are based on the works that are realized with respect to the European Red List. Furthernore, Turkey appears a continental property changeable in very short distances in terms of climatical features and field structures. So, the status of European fauna and the status of Turkish fauna are not the same. Clearly, there is no any work that subjected to create a Turkish Red List except Parts I-VI. Hence, a series work is planned with this purpose. This type of study is the seventh attempt for Turkey.

KEY WORDS: Red List, Conservation, Cerambycidae, Turkey

The purpose of the current study was to create a Turkish Red List of longicorn beetles similarly to "European Red List of Saproxylic Beetles" that was compiled by Ana Nieto & Keith N. A. Alexander and published by IUCN (International Union for Conservation of Nature) in collaboration with the European Union in 2010. "European Red List of Saproxylic Beetles" includes 153 species within the subfamilies Prioninae, Cerambycinae (including Stenopterinae) and Lamiinae of the European Cerambycidae. In the future, I hope that the present work will be lead to preparation a more comprehensive "Turkish Red List".

Hence, a series work is planned with this purpose. The present study is attempted as the seventh step of this aim. The previous works are Özdikmen (2014a,b,c,d,e,f). It should be noted that the using information at the present work on Turkish longicorn beetles are on the base of my personal database. The data of distribution are given on base of Löbl & Smetana (2010, 2011), Danilevsky (2010a,b, 2012a,b,c,d, 2013), Özdikmen (2011) and Miroshnikov (2011). Identification of chorotypes is based on the chorotype classification of the Anatolian fauna, proposed by Vigna Taglianti et al. (1999).

The evaluations of Turkish longicorn beetles at the present work based on "The IUCN Red List Categories" that was presented in Part I (Özdikmen, 2014a).

TURKISH RED LIST FOR STENOPTERINAE

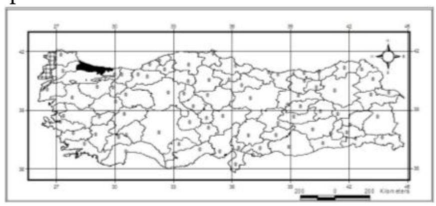
SUBFAMILY CERAMBYCINAE Latreille, 1802: 211

TRIBE GRACILIINI Mulsant, 1839: 99

GENUS *GRACILIA* Audinet-Serville, 1834: 81

SPECIES *G. minuta* (Fabricius, 1781: 235)

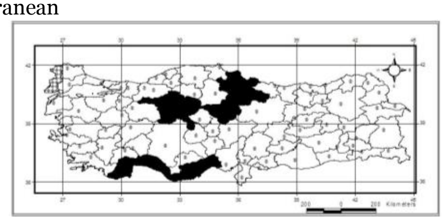
According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from NW Turkey. So, Turkish Red List category of the species is **NT**.
Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, China, and Australian, Oriental, Nearctic and Neotropical Regions.
Chorotype: Subcosmopolitan



GENUS *PENICHROA* Stephens, 1839: 270

SPECIES *P. fasciata* (Stephens, 1831: 250)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.
Range: S Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Cyprus, Syria, Israel, North Africa (Algeria, Libya, Morocco, Tunusia).
Chorotype: Mediterranean

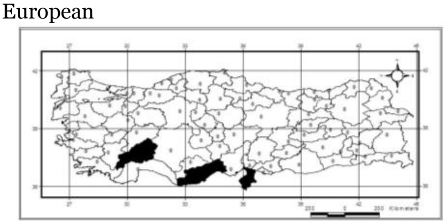


GENUS *AXINOPALPIS* Dejean, 1835: 332

SPECIES *A. gracilis* (Krynicki, 1832: 162)

SUBSPECIES *A. g. gracilis* (Krynicki, 1832: 162)

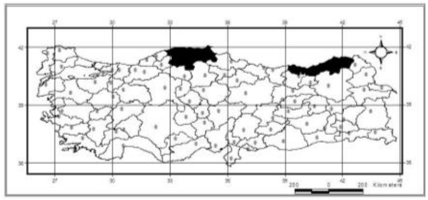
According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is represented only by the nominative subspecies in Turkey. It is known only from SC and SW Anatolia for Turkey. So, Turkish Red List category of the subspecies is **VU** now.
Range: C and E Europe, Caucasus, Transcaucasia (Georgia), Turkey, Syria, Israel.
Chorotype: C and E European



GENUS *HYBOMETOPIA* Ganglbauer, 1889: 282

SPECIES *H. starcki* Ganglbauer, 1889: 285

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from N Anatolia for Turkey. So, Turkish Red List category of the species is **VU**.
Range: Caucasus, Transcaucasia (Georgia), Turkey.
Chorotype: SW-Asiatic



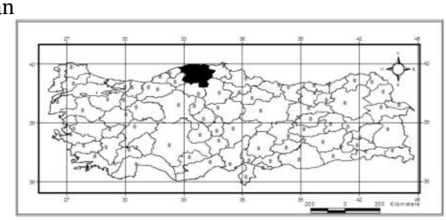
Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *H. starcki ivani* Sama, 1996.

SUBSPECIES *H. s. ivani* Sama, 1996: 106

European Red List of Saproxylic Beetles does not include the endemic subspecies rightly. It is known only from the type locality in NCW Anatolia. So, Turkish Red List category of the subspecies is **DD**.

Range: Turkey.

Chorotype: Anatolian

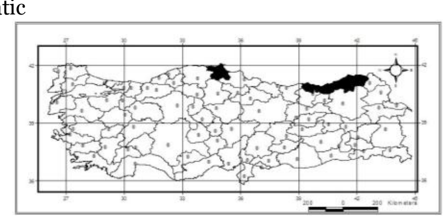


SUBSPECIES *H. s. starcki* Ganglbauer, 1889: 285

European Red List of Saproxylic Beetles does not include the subspecies rightly. It is known only from NC and NE Anatolia for Turkey. So, Turkish Red List category of the species is **VU**.

Range: Caucasus, Transcaucasia (Georgia), Turkey.

Chorotype: SW-Asiatic



TRIBE OBRIINI Mulsant, 1839: 95

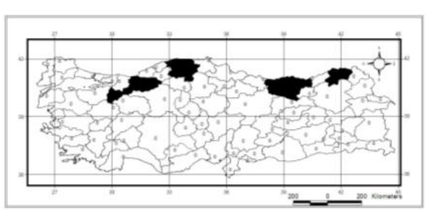
GENUS *OBRIUM* Dejean, 1821: 110

SPECIES *O. brunneum* (Fabricius, 1792: 316)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in N Anatolia for Turkey. However, Turkish Red List category of the species is **NT** now.

Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.

Chorotype: European

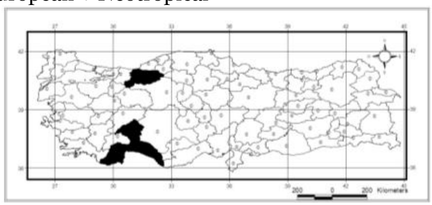


SPECIES *O. cantharinum* (Linnaeus, 1767: 637)
SUBSPECIES *O. c. cantharinum* (Linnaeus, 1767: 637)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is represented only by the nominative subspecies in Turkey. It is known only from W half of Anatolia for Turkey. However, Turkish Red List category of the subspecies is **NT** now.

Range: Europe, Siberia, Far East Russia, Kazakhstan, Mongolia, China, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, and Neotropical Region.

Chorotype: Asiatic-European + Neotropical

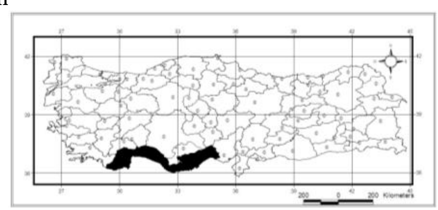


GENUS *ANATOLOBRIUM* Adlbauer, 2004: 419
SPECIES *A. eggeri* Adlbauer, 2004: 421

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from SCW Anatolia. So, Turkish Red List category of the species is **EN**.

Range: Turkey.

Chorotype: Anatolian

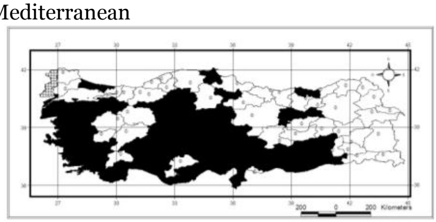


TRIBE CERTALLINI Fairmaire, 1864: 149
GENUS *CERTALLUM* Dejean, 1821: 111
SPECIES *C. ebulinum* (Linnaeus, 1767: 637)

European Red List of Saproxylic Beetles does not include the species. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.

Range: S Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Goergia), Iran, Iraq, Turkey, Cyprus, Syria, Lebanon, Israel, Jordan, North Africa (Algeria, Egypt, Libya, Morocco, Tunusia).

Chorotype: Turano-Mediterranean

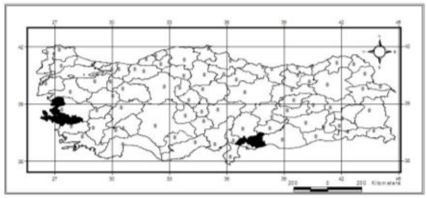


SPECIES *C. thoracicum* (Sharp, 1880: 247)

European Red List of Saproxylic Beetles does not include the species. It is known only from S Anatolia. So, Turkish Red List category of the species is **DD**.

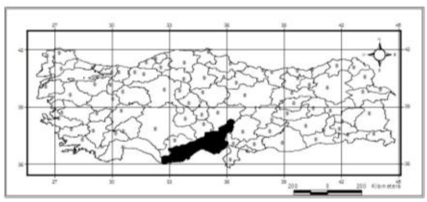
Range: Turkey, Syria, Lebanon, Israel, Jordan, Iraq, Iran.

Chorotype: SW-Asiatic



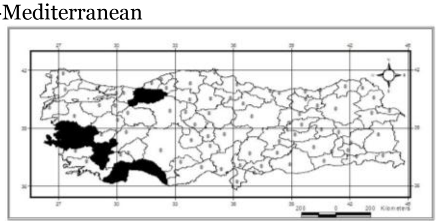
TRIBE DEILINI Fairmaire, 1864: 154
GENUS *DELAGRANGEUS* Pic, 1892: XCIII
SUBGENUS *DELAGRANGEUS* Pic, 1892: XCIII
SPECIES *D. angustissimus* Pic, 1892: XCIII
SUBSPECIES *D. a. angustissimus* Pic, 1892: XCIII

According to European Red List of Saproxylic Beetles, the species was placed in **VU** as the other subspecies except the nominative subspecies. The species is represented only by the nominative subspecies in Turkey. The endemic subspecies is known only from SC and SW Anatolia. So, Turkish Red List category of the subspecies is **VU** now.
Range: Turkey.
Chorotype: Anatolian



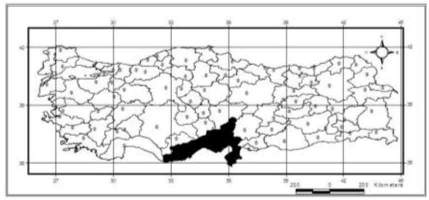
GENUS *DEILUS* Audinet-Serville, 1834: 73
SPECIES *D. fugax* (Olivier, 1790: 253)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from W half of Anatolia for Turkey. So, Turkish Red List category of the species is **NT** now.
Range: C and E Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Kazakhstan, Turkey, Cyprus, Syria, Lebanon, Israel, North Africa (Algeria, Libya, Morocco, Tunusia).
Chorotype: Europeo-Mediterranean



SPECIES *D. rugosicollis* Rapuzzi & Sama, 2012: 668
SUBSPECIES *D. r. rugosicollis* Rapuzzi & Sama, 2012: 668

European Red List of Saproxylic Beetles does not include the species. It is represented only by the nominative subspecies in Turkey. It is known only from SC Anatolia. So, Turkish Red List category of the subspecies is **VU**.
Range: Turkey, Syria, Lebanon, Israel.
Chorotype: E-Mediterranean (Palestino-Taurian)

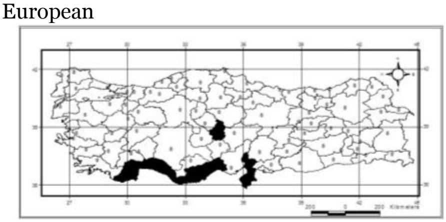


TRIBE STENHOMALINI Miroshnikov, 1989: 742
GENUS *STENHOMALUS* White, 1855: 243
SUBGENUS *OBRIOPSIS* Müller, 1948: 65
SPECIES *S. bicolor* (Kraatz, 1862: 126)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from SC and SW Anatolia for Turkey. So, Turkish Red List category of the species is **NT** now.

Range: C and E Europe, Turkey, Cyprus, Syria, Israel.

Chorotype: C and E European

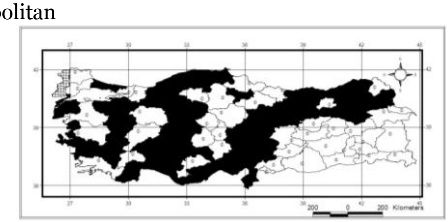


TRIBE HYLOTRUPINI Zagajkevich, 1991: 67
GENUS *HYLOTRUPES* Audinet-Serville, 1834: 77
SPECIES *H. bajulus* (Linnaeus, 1758: 396)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.

Range: Europe, W Siberia, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), China, Turkey, Cyprus, Syria, Lebanon, Israel, Jordan, North Africa (Algeria, Canary Islands, Egypt, Libya, Madeira Archipelago, Morocco, Tunusia), and Afrotropical, Australian, Nearctic, Neotropical and Oriental Regions.

Chorotype: Cosmopolitan

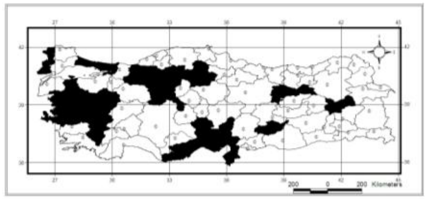


TRIBE CALLIDIINI Kirby, 1837: 170
GENUS *ROPALOPUS* Mulsant, 1839: 40
SUBGENUS *ROPALOPUS* Mulsant, 1839: 40
SPECIES *R. clavipes* (Fabricius, 1775: 188)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.

Range: Europe, Kazakhstan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Iran.

Chorotype: European or Turano-European

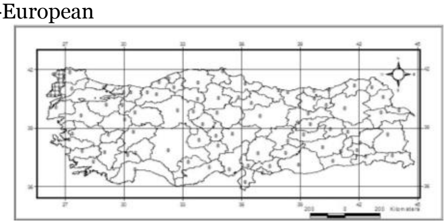


SPECIES *R. femoratus* (Linnaeus, 1758: 395)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from European Turkey for Turkey. So, Turkish Red List category of the species is **DD**.

Range: C and E Europe, Turkey.

Chorotype: C and E-European

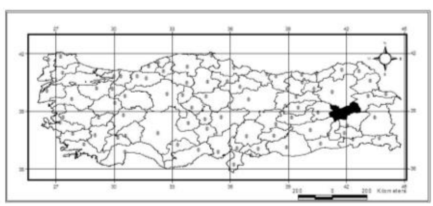


SPECIES *R. hanae* Sama & Rejzek, 2002: 105

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type locality in E Anatolia. So, Turkish Red List category of the species is **DD**.

Range: Turkey.

Chorotype: Anatolian



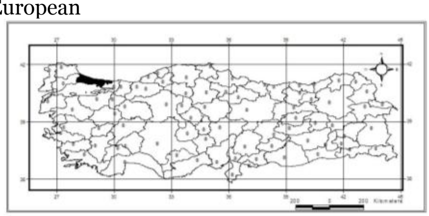
SPECIES *R. insubricus* (Germar, 1824: 154)

SUBSPECIES *R. i. insubricus* (Germar, 1824: 154)

According to European Red List of Saproxylic Beetles, the species was placed in **NT**. It is represented only by the nominative subspecies in Turkey. It is known only from NW Turkey. So, Turkish Red List category of the subspecies is **EN** now.

Range: C and S Europe, Turkey.

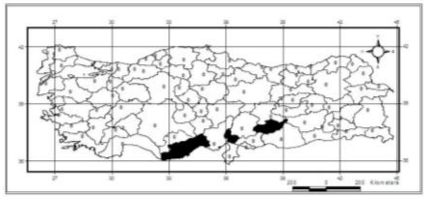
Chorotype: C and S-European



SPECIES *R. ledereri* (Fairmaire, 1866: 269)

European Red List of Saproxylic Beetles does not include the species. It is known only from S Anatolia for Turkey. So, Turkish Red List category of the species is **VU**.

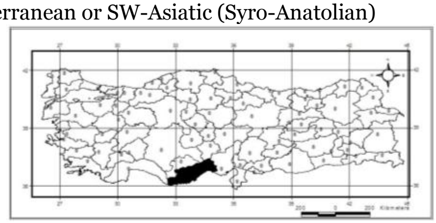
Range: Turkey, Syria, Israel, Jordan.
Chorotype: E-Mediterranean (Palestino-Taurian)



Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *R. ledereri wittmeri* Demelt, 1970.

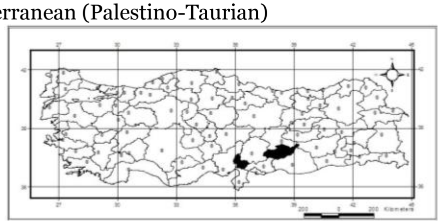
SUBSPECIES *R. l. ledereri* (Fairmaire, 1866: 269)

European Red List of Saproxylic Beetles does not include the subspecies. It is known only from SCW Anatolia for Turkey. So, Turkish Red List category of the subspecies is **EN**.
Range: Turkey, Syria.
Chorotype: E-Mediterranean or SW-Asiatic (Syro-Anatolian)



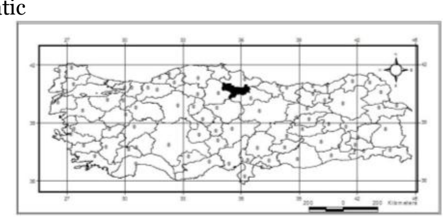
SUBSPECIES *R. l. wittmeri* Demelt, 1970: 31

European Red List of Saproxylic Beetles does not include the subspecies. It is known only from SC and SCE Anatolia for Turkey. So, Turkish Red List category of the subspecies is **VU**.
Range: Turkey, Israel, Jordan.
Chorotype: E-Mediterranean (Palestino-Taurian)



SPECIES *R. lederi* (Ganglbauer, 1882: 747)

According to European Red List of Saproxylic Beetles, the species was placed in **NE**. It is known only from NC Anatolia for Turkey. So, Turkish Red List category of the species is **EN** now.
Range: E Europe (Ukraine), Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.
Chorotype: SW-Asiatic

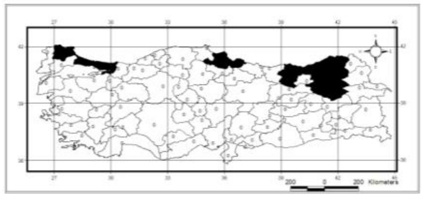


SPECIES *R. macropus* (Germar, 1824: 514)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in N Turkey. So, Turkish Red List category of the species is **LC**.

Range: C and E Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.

Chorotype: C and E-European

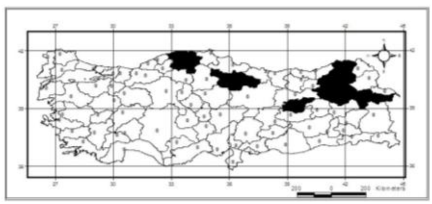


SPECIES *R. sculpturatus* (Pic, 1931: 9)

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from N Anatolia. So, Turkish Red List category of the species is **NT** now.

Range: Turkey.

Chorotype: Anatolian



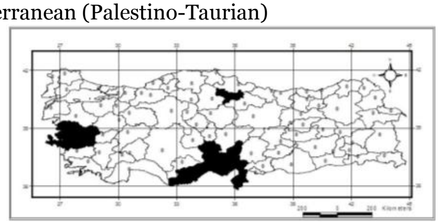
GENUS *LEIODERES* Redtenbacher, 1849: 482

SPECIES *L. tuerki* (Ganglbauer, 1886: 517)

European Red List of Saproxylic Beetles does not include the species rightly. It probably is rather widely distributed in Anatolia for Turkey. However, Turkish Red List category of the species is **NT** now.

Range: Turkey, Syria, Lebanon.

Chorotype: E-Mediterranean (Palestino-Taurian)



GENUS *SEMANOTUS* Mulsant, 1839: 54

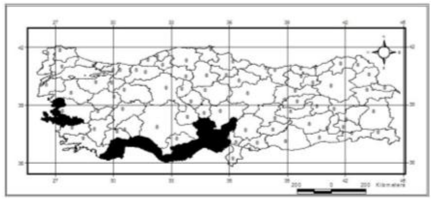
SPECIES *S. russicus* (Fabricius, 1777: 232)

SUBSPECIES *S. r. russicus* (Fabricius, 1777: 232)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is represented only by the nominative subspecies in Turkey. It is known only from SC and SW Anatolia for Turkey. So, Turkish Red List category of the subspecies is **NT** now.

Range: C and E Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Syria, Lebanon, Jordan.

Chorotype: C and E-European

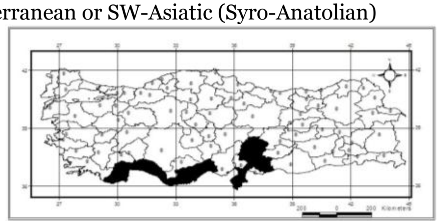


GENUS *CALLIDIUM* Fabricius, 1775: 187
SUBGENUS *CALLIDIUM* Fabricius, 1775: 187
SPECIES *C. syriacum* Pic, 1892: CXI

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from SC and SW Anatolia for Turkey. So, Turkish Red List category of the species is **NT** now.

Range: Turkey, Syria.

Chorotype: E-Mediterranean or SW-Asiatic (Syro-Anatolian)

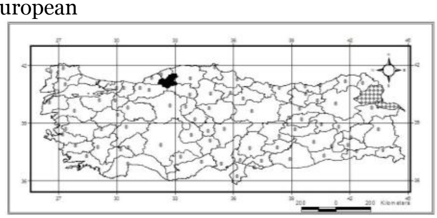


SPECIES *C. violaceum* (Fabricius, 1775: 395)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from N Anatolia for Turkey. However, Turkish Red List category of the species is **DD** now.

Range: Europe, Siberia, Far East Russia, Kazakhstan, Mongolia, Korea, China, Japan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.

Chorotype: Asiatic-European

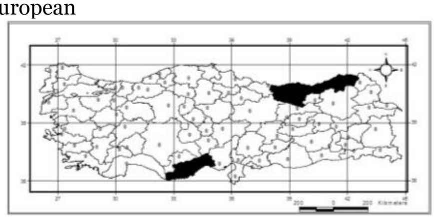


SUBGENUS *CALLIDOSTOLA* Reitter, 1913: 37
SPECIES *C. aeneum* (DeGeer, 1775: 89)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from NE and SCW Anatolia for Turkey. So, Turkish Red List category of the species is **NT** now.

Range: Europe, Siberia, Far East Russia, Kazakhstan, Mongolia, China, Japan, Caucasus, Transcaucasia (Azerbaijan, Georgia), Turkey.

Chorotype: Asiatic-European



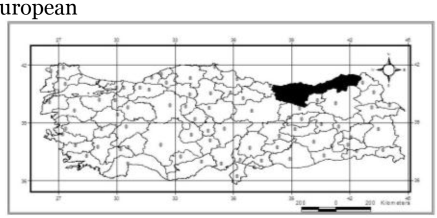
Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *C. aeneum pilosicollis* Özdikmen & Aytar, 2014.

SUBSPECIES *C. a. aeneum* (DeGeer, 1775: 89)

According to European Red List of Saproxylic Beetles, the subspecies was placed in **LC**. It is known only from NE Anatolia for Turkey. So, Turkish Red List category of the subspecies is **VU** now.

Range: Europe, Siberia, Far East Russia, Kazakhstan, Mongolia, China, Japan, Caucasus, Turkey.

Chorotype: Asiatic-European

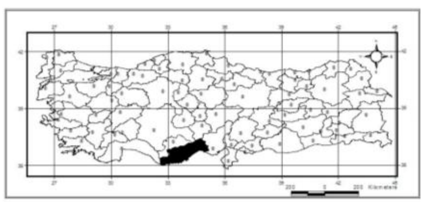


SUBSPECIES *C. a. pilosicollis* Özdikmen & Aytar, 2014

European Red List of Saproxylic Beetles does not include the endemic subspecies rightly. It is known only from SCW Anatolia for Turkey. So, Turkish Red List category of the subspecies is **DD** now.

Range: Turkey.

Chorotype: Anatolian



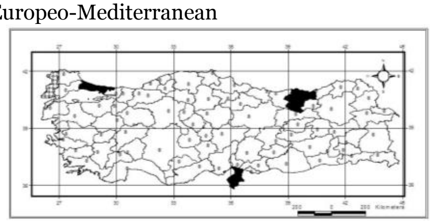
GENUS *PYRRHIDIUM* Fairmaire, 1864: 133

SPECIES *P. sanguineum* (Linnaeus, 1758: 396)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is wider distributed than known in Turkey. However, Turkish Red List category of the species is **DD** now.

Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Syria, North Africa (Algeria, Tunusia).

Chorotype: Turano-Europeo-Mediterranean



GENUS *PHYMATODES* Mulsant, 1839: 47

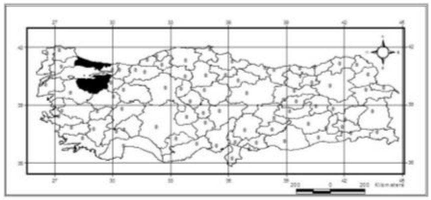
SUBGENUS *MELASMETUS* Reitter, 1913: 39

SPECIES *P. femoralis* (Ménétriés, 1832: 228)

SUBSPECIES *P. f. demelti* Heyrovsky, 1962: 41

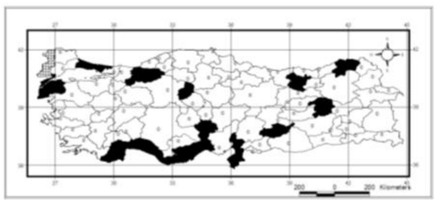
European Red List of Saproxylic Beetles does not include the endemic subspecies rightly. The species is represented only by the subspecies *P. femoralis demelti* in Turkey. It is known only from NW Turkey. So, Turkish Red List category of the subspecies is **EN** now.

Range: Turkey.
Chorotype: Anatolian



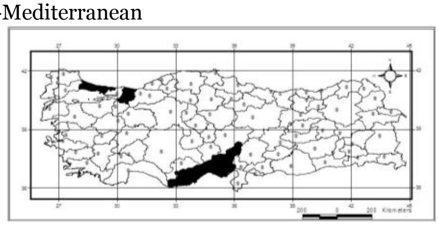
SUBGENUS *PHYMATODES* Mulsant, 1839: 47
SPECIES *P. testaceus* (Linnaeus, 1758: 396)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.
Range: Europe, Siberia, Far East Russia, Kazakhstan, Japan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Cyprus, Syria, Israel, Iraq, North Africa (Algeria, Madeira Archipelago, Morocco, Tunusia), Nearctic.
Chorotype: Holarctic



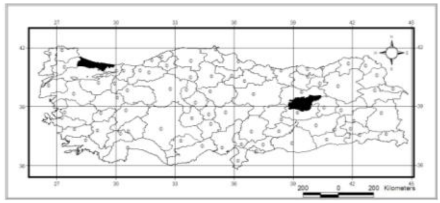
SUBGENUS *PHYMATODERUS* Reitter, 1913: 39 nec Dejean, 1837
SPECIES *P. lividus* (Rossi, 1794: 98)

According to European Red List of Saproxylic Beetles, the species was placed in **NT**. It probably is rather widely distributed in W half of Turkey. So, Turkish Red List category of the species is **NT**.
Range: S and E Europe, Caucasus, Transcaucasia (Azerbaijan, Georgia), Turkey, Syria, Lebanon, North Africa (Algeria).
Chorotype: Europeo-Mediterranean



SPECIES *P. pusillus* (Fabricius, 1787: 155)
SUBSPECIES *P. p. pusillus* (Fabricius, 1787: 155)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is represented only by the nominative subspecies in Turkey now. It probably is rather widely distributed in Turkey. So, Turkish Red List category of the species is **DD**.
Range: C and E Europe, Turkey.
Chorotype: C and E European



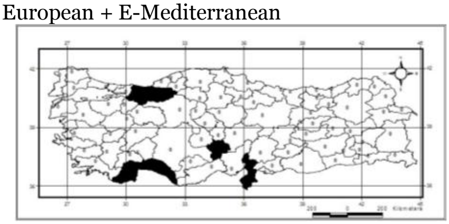
SUBGENUS *PHYMATODELLUS* Reitter, 1913: 40

SPECIES *P. rufipes* (Fabricius, 1777: 232)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed at least in W half of Turkey. So, Turkish Red List category of the species is **NT**.

Range: C and E Europe, Caucasus, Turkey, Syria, Israel.

Chorotype: C and E European + E-Mediterranean



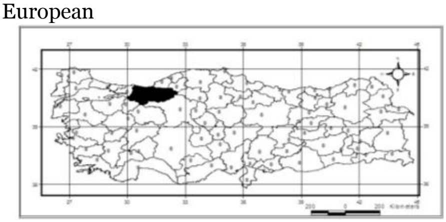
Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *P. rufipes syriacus* (Pic, 1891).

SUBSPECIES *P. r. rufipes* (Fabricius, 1777: 232)

According to European Red List of Saproxylic Beetles, the subspecies was placed in **LC**. It is known only from NW Anatolia for Turkey. So, Turkish Red List category of the subspecies is **DD**.

Range: C and E Europe, Caucasus, Turkey.

Chorotype: C and E European

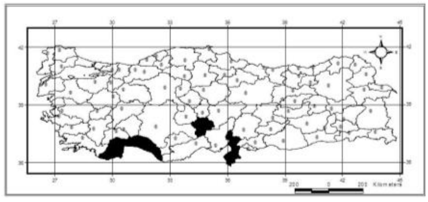


SUBSPECIES *P. r. syriacus* (Pic, 1891: 118)

European Red List of Saproxylic Beetles does not include the subspecies rightly. It is known only from SC and SW Anatolia for Turkey. So, Turkish Red List category of the subspecies is **NT** now.

Range: Turkey, Syria, Israel.

Chorotype: E-Mediterranean (Palestino-Taurian)



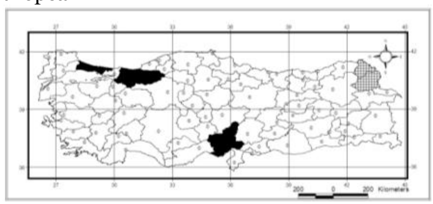
SUBGENUS *POECILIUM* Fairmaire, 1864: 134

SPECIES *P. alni* (Linnaeus, 1767: 639)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is wider distributed than known in Turkey. So, Turkish Red List category of the species is **NT** now.

Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Kazakhstan, Turkey.

Chorotype: Turano-European



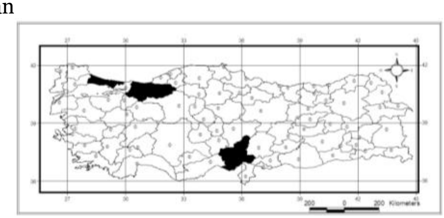
Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *P. alni pici* (Aurivillius, 1912).

SUBSPECIES *P. a. alni* (Linnaeus, 1767: 639)

According to European Red List of Saproxylic Beetles, the subspecies was placed in **LC**. It probably is wider distributed than known in Turkey. So, Turkish Red List category of the subspecies is **NT**.

Range: Europe, Caucasus, Kazakhstan, Turkey.

Chorotype: European

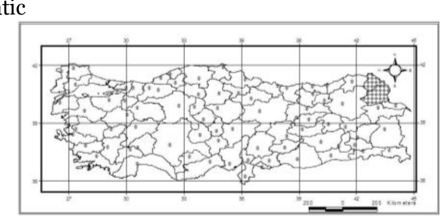


SUBSPECIES *P. a. pici* (Aurivillius, 1912: 349)

European Red List of Saproxylic Beetles does not include the subspecies rightly. It probably is distributed only in NE Anatolian for Turkey. So, Turkish Red List category of the subspecies is **NE** now.

Range: Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.

Chorotype: SW-Asiatic

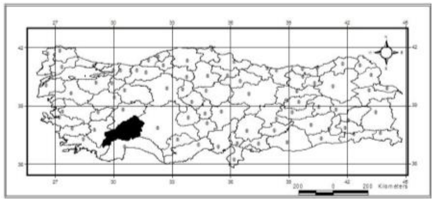


SPECIES *P. kasnaki* (Sama, 2011: 826)

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from SCW Anatolia. So, Turkish Red List category of the species is **VU** now.

Range: Turkey.

Chorotype: Anatolian

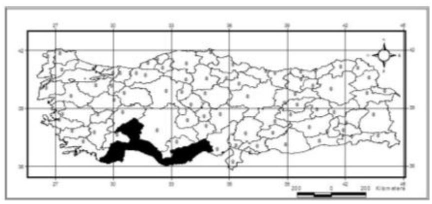


SPECIES *P. magnanii* (Sama & Rapuzzi, 1999: 468)

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type localities in SCW Anatolia. So, Turkish Red List category of the species is **DD** now.

Range: Turkey.

Chorotype: Anatolian



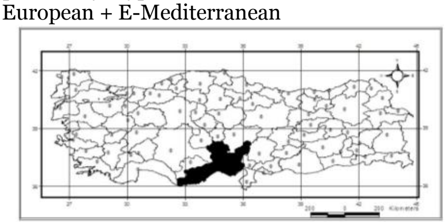
SUBGENUS *PARAPHYMATODES* (Plavilstshikov, 1934: 215)

SPECIES *P. fasciatus* (Villers, 1789: 257)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from SC Anatolia for Turkey now. So, Turkish Red List category of the species is **VU**.

Range: C and E Europe, Turkey, Cyprus, Israel.

Chorotype: C and E European + E-Mediterranean



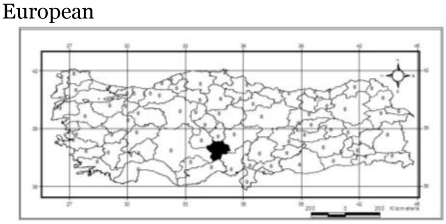
GENUS *LIODERINA* Ganglbauer, 1886: 517

SPECIES *L. linearis* (Hampe, 1871: 335)

According to European Red List of Saproxylic Beetles, the species was placed in **DD**. It is known only from C Anatolia for Turkey now. So, Turkish Red List category of the species is **DD**.

Range: C and E Europe, Turkey.

Chorotype: C and E European



Note: The conclusions and cited references for Turkish Cerambycinae will be presented at the end of evaluations in Part VIII.

FIRST RECORD OF THE GENUS *ATRACTOTHROMBIUM* FEIDER, 1952 (ACARI: MICROTROMBIDIIDAE) FROM TURKEY

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[Adil, S. & Sevsay, S. 2014. First record of the genus *Atractothrombium* Feider, 1952 (Acari: Microtrombidiidae) from Turkey. Munis Entomology & Zoology, 9 (2): 666-677**]**

ABSTRACT: *Atractothrombium sylvaticum* (C. L. Koch, 1835) is described based on active postlarval forms and larvae obtained from adult females kept in the laboratory. This genus is first new record from Turkey. Original drawings for all known stages of the species are included. Also, morphological features, biology and zoogeographical distributions are given here.

KEY WORDS: Acari, Microtrombidiidae, *Atractothrombium*, adult, larvae, Turkey.

Microtrombidiidae Thor, 1935 have got 115 genus and the genus of *Atractothrombium* Feider, 1952 have 14 species (Makol & Wohtlmann, 2012). To date, this genus hasn't been reported from Turkey (Erman et al., 2007; Makol & Wohtlmann, 2012).

In this paper adults and deutonymphs of *Atractothrombium sylvaticum* **(**C. L. Koch, 1835) collected from soil and larvae were obtained from females and described and illustrated which is collected from Erzincan, Turkey.

MATERIAL AND METHODS

The following collecting methods were used: hand collecting, litter sifting and extraction in Berlese funnels. Larvae were reared from eggs deposited by adults collected in the field. Larvae obtained from females under conditions of laboratory. Females for lay eggs were used glass vials (34×24mm), filled to the upper margin with charcoaled Plaster-of Paris.

Examined material was preserved in 70% ethyl alcohol and cleared in 9% KOH. Specimens for light microscope studies were fixed on slides in Hoyer's medium (Krantz & Walter, 2009). Measurements were taken and drawings made under a Leica DM 4000 microscope with differential interference contrast and phase contrast. For morphological terminology see by Gabryś (1999) and Mąkol (2005) followed in the text. All measurements are given in micrometers (μm).

RESULTS AND DISCUSSION

Family Microtrombidiidae Thor, 1935
Genus: *Atractothrombium* Feider, 1952
Type sp.: *Microtrombidium fusicomum* Berlese, 1910

Atractothrombium sylvaticum (C. L. Koch, 1835)

Adult. Standart measurements in Table 1. Colour in life red or reddish. Idiosoma slightly enlarged in the shoulders and narrowed toward the end (Fig. 1). Body length is 1630-1992 and width 1248-1469.

Gnathosoma. Chelicera is typical for Microtrombidiidae and internal edge of cheliceral blade serrated (Fig. 2). Medial surface of palp tibia one robust paradont, two row ctenidia and radula. Distal ctenidium of palp tibia composed of 4–5 long and strong spinisetae situated behind paradont. Proximal ctenidium consists of 5–7 thinner and more slender spinisetae. Radula consist of 9-10 spine like setae (Fig. 3). Lateral face of palp tibia covered setulose or few nude setae and with long, strong basidont situated at the base of palp tarsus and with one long, smooth, whip-like setae at the base of odontus. Tip of palp tarsus with 1 eupathidia (ζ) and 3 solenidion (ω) (Fig. 4).

Idiosoma. Anterior border of aspidosoma triangular in outline (Fig. 5). Anterior process of crista metopica narrowed toward the end and border of anterior region not merge with vertex. Sclerotized vertex with 21-25 long, setulose and nonsensillary setae (AM). Sensillary area of crista metopica rounded and bear two medium lenght, smooth sensillary setae. Posterior process distinct, sessile double eyes placed on at half length of the anterior part of crista metopica and anterior lenses much bigger than posterior ones. Dorsal opisthosomal setae uniform, short, narrowing distally, covered with delicate setules (Fig. 6). Mid-dorsal setae (mdS) of almost the same length as post-dorsal ones (pdS). Ventral setae uniform, slightly longer and narrowed. Genital opening between koksa III and IV; consist of epivalve and centrovalve. Centrovalves covered densely with nude setae and epivalve with delicate setae; three pairs of genital acetabula (Fig. 7). Anus with barbed setae (Fig. 8).

Legs. Each one occur seven part. Legs without lamellar processes, shorter than idiosoma and with one pair claw (Fig. 9).

Deutonymphs. Body smaller than adult. Other characters as in adults. Medial surface of palp tibia one paradont, one row ctenidia and radula (Fig. 10). Lateral face of palp tibia covered setulose or few nude setae and with thiny, long basidont situated at the base of palp tarsus (Fig. 11). Two pairs of genital papillae (Fig. 12).

Larvae. Standard measurements in Table 2. All larvae reared collected the field from females in the laboratory condition. Colour in life orange.

Gnathosoma. (Fig.13). Chelicera typical, cheliceral blade with teeth along on internal edge, slightly curved, and sharp towards the tip (Fig. 14). Movable gnathosoma typical and at anterior end with a ring-like sclerite (stephanostome) bearing about 30-40 distal teeth (Fig. 13). One pair of protorostral (adoral) setae situated laterally. Ventrally at anterior part of gnathosoma a pair of prominent tritorostral (subcapitular) setae, each with 7–8 finger-like setules at the distal end. Palpal formula: ƒPp: 0-N-N-NNN-NNωζζNNNN. Palp femur and genu each with one minute spine-like seta. Palp tibia with one smooth seta, one small seta and one minute spine setae. Palp tibial claw (odontus) distinctly bifurcate in more than half of its length. Palp tarsus with one prominent proximal solenidion (ω), two eupathidia(ζ), two long and four short spine setae (Fig. 15).

İdiosoma, dorsum (Fig. 16). Scutum (L 176, W 150) with laterally stolascutum. Scutum surface of the sclerite punctuated. Setae on scutum: anterior pair AM smooth, median pair AL smooth and posterior pair PL thicker and short barbed. One pair of smooth trichobothria (S) towards the end pointed. Laterally at the level of posterior end of scutum paired eye lenses on common sclerites. Scutellum punctuate, with striation similar to that on scutum, bears one pair of barbed c_1 setae situated at half length of the sclerite. Dorsal setae formula: ƒD: (2)4-6-6-6-4. Setae d_1 on the largest plates, setae c_2 on the second largest plates, setae, c_3-d_3-e_{1-3}-f_{1-3}-h_1 smaller platelets.

Idiosoma, ventrum (Fig. 17). One pair of Claparéde's organs laterally between coxae I and II. Coxal plates punctuated. Coxa I with setae 1a placed in medial

position and nude, 1b lateral position, bifurcate. Supracoxala I absent. Coxa II with setae 2b bifurcate. Coxa III with setae 3b with bifurcate. One pair of setulated intercoxal setae 3a, nude and pointed top of the end. Posteriorly following four barbed setae anterior and lateral to anal opening. Anal opening without sclerite.
Legs (Figs 18-20). Segmentation formula: 6-6-6. Leg chaetotaxy in Table 3. Excluding of sensillar setae, all setae with setules. All tarsi with one paired claws and claw-like empodium. Leg III tarsus with modified inner claw (smilum), scopa and lophotrix (Fig. 20).

Material examined. 02.06.2011, 6 female, 4 postlarvae and 15 deutonimf. Grassy-mossy soil, N39°36'42" E39°28'53" 2060 m Ergan Mountain, Erzincan, Turkey. Leg. S.Adil. 09.06.2012 4 female. Grassy-mossy soil, N39°36'22" E39°28'55" 2065 m. Ergan Mountain, Erzincan, Turkey. Leg. S.Adil.

Distribution. Austria, France, Germany, Hungary, Ireland, Italy, Norway, Poland, Romania, Switzerland, Netherlands (Makol & Wohltmann, 2012). New for Turkish fauna.

Biology. Adults (n=6 female, 4 postlarvae and 15 deutonimf) collected from land (grassy and mossy area) in April-May 2011. 6 females deposited eggs 10-17 days at laboratory condition. Eggs single pack and colour of light orange. Eggs developed into prelarvae 6-8 days and 13-17 days larvae. Totally 166 larvae obtained from eggs.

DISCUSSION

Turkish specimens of *Atractothrombium sylvaticum* differs some morphological differences from European specimens (Gabryś, et al. 2005): Adults of Turkish specimens differs from European specimens in several respect. Proximal ctenidium of Turkish specimens consist of 6-7 thinner spinisetae, European specimens consist of 5-9 setae; the radula of Turkish specimens consist of 8-10 long spine like setae, European specimens consist of 5-9 setae. Inaddition, morphological differences are available of these specimens (see Table 1).

Turkish specimens larvae also differ from European specimens larvae by the AL setae and coxal setae. Turkish specimens setae on scutum AL nude, thicker and pointed towards the end, European specimens AL setae few short barb and thinner. Turkey specimens on coxa I *1a* setae nude and pointed towards the end, coxa II *2a* bifurcate, coxa III *3a* nude or thiny setules and *3b* bifurcate, European specimens on coxa I *1a* setae with 0-1 setules, coxa II *2a* with 1-3 setules, coxa III *3a* and *3b* with 2-3 setules. All coxal setae are thicker than European specimens. Morphometric data on larvae of Turkish specimens and European specimens show of Table 2. In addition, morphological differences are available chaetotaxy of legs I-III (genu-tarsus) for larvae of Turkish specimens and European species (see Table 3).

ACKNOWLEDGEMENTS

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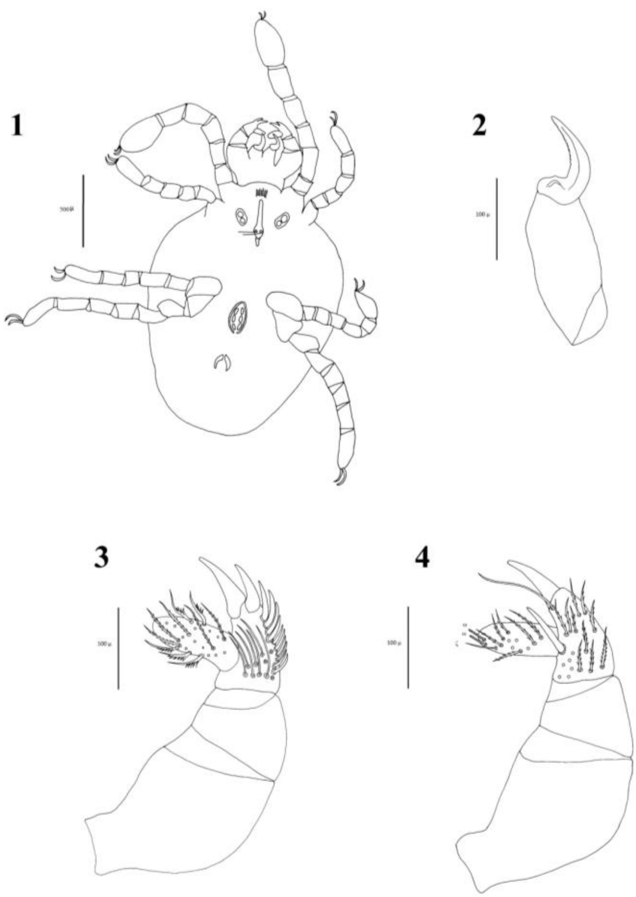
Table 1. Morphometric data on adults of *Atractothrombium sylvaticum.*

Character	Turkish specimens ♀ (n=10)		European *specimens* neotype (Gąbrys et al., 2005)
	Min.	Max.	
LB	1630	1992	1855
WB	1248	1469	1537
LB/WB	1,29	1,35	1,20
Ch BS (L)	167	218	220
Ch BS (W)	83	101	98
Ch Cl	108	121	117
PaTr (L)	65	93	73
PaTr (W)	86	125	103
PaFe (L)	175	234	147
PaFe (W)	150	180	161
PaGe (L)	91	122	80
PaGe (W)	106	119	122
PaTi (L)	109	132	107

PaTi (W)	67	77	78
Odo (L) (Lft/Rt)	78/80	86/93	72/82
Par (W) (Lft/Rt)	55/62	58/62	lack/67
diCt(n) (Lft/Rt)	5/4	5/5	6/6
prCt(n) (Lft/Rt)	6/6	6/6	6/5
Bas (n) (Lft/Rt)	1/1	1/1	lack/1
Bas (Lft/Rt)	68/68	77/79	lack/75
Rad (n) (Lft/Rt)	9/5?	10/10	5/10
PaTaSol(n)	2/2	2/3	4/5
PaTa (B)	95	118	115
PaTa (E)	39	47	42
mdS [S]	22-26	25-30	24-27
mdS [P]	4-7	5-7	7-9
pdS [S]	24-30	27-35	24-27
pdS [P]	4-7	5-7	7-9
vS [S]	23-28	25-35	25-30
vS [P]	4-7	5-7	7-9
CML	303	390	406
CMW	25	32	37
ASB	28	34	268
PSB	32	33	138
AM (n)	20	22	20
AM (L)	0	70-100	60-90
RCM	215	245	229
SAL	69	70	69
SAW	68	75	62
SB	36	42	38
SE	115	145	170
pPr	51	76	108
acpPr	16	18	20
OL	84	86	82
OCM	121	140	160
ao	34	34	32

pO	30	30	27
O-O	252	302	320
OaD	114	156	166
OSD	117	130	102
GOp (L)	245	296	200
gs [S]	25-35	35-40	25-37
pgs [S]	25-35	25-35	25-37
An (L)	101	113	137
An La	20-30	20-30	25-50
Cx_I	256	280	343
Tr_I	99	119	117
Bf_I	217	272	235
Tf_I	150	193	166
Ge_I	186	230	205
Ti_I	205	207	215
Ta_I (L)	305	325	353
Ta _I (W)	177	181	176
Ta _I (L/W)	1,68	1,83	2
Leg I	1418	1626	1634
Cx_II	221	232	245
Tr_II	133	159	147
Bf_II	130	168	166
Tf_II	119	120	120
Ge_II	140	158	157
Ti_II	160	193	175
Ta_II	250	279	265
Leg II	1153	1309	1275
Cx_III	220	231	235
Tr_III	114	120	118
Bf_III	128	196	176
Tf_III	113	118	117
Ge_III	134	155	147
Ti_III	147	169	167
Ta_III	224	273	245

Leg III	1085	1257	1205
Cx_IV	217	296	275
Tr_IV	175	189	186
Bf_IV	171	200	205
Tf_IV	172	172	186
Ge_IV	196	214	205
Ti_IV	221	265	255
Ta_IV	276	320	295
Leg IV	1428	1656	1607
IP	5084	5848	5721



Figures 1-4. *Atractothrombium sylvaticum* Adult. (1) General view, in transparency, setae omitted; (2) chelicera; (3) palp tibia and tarsus, medial aspect; (4) palp tibia and tarsus, lateral aspect.

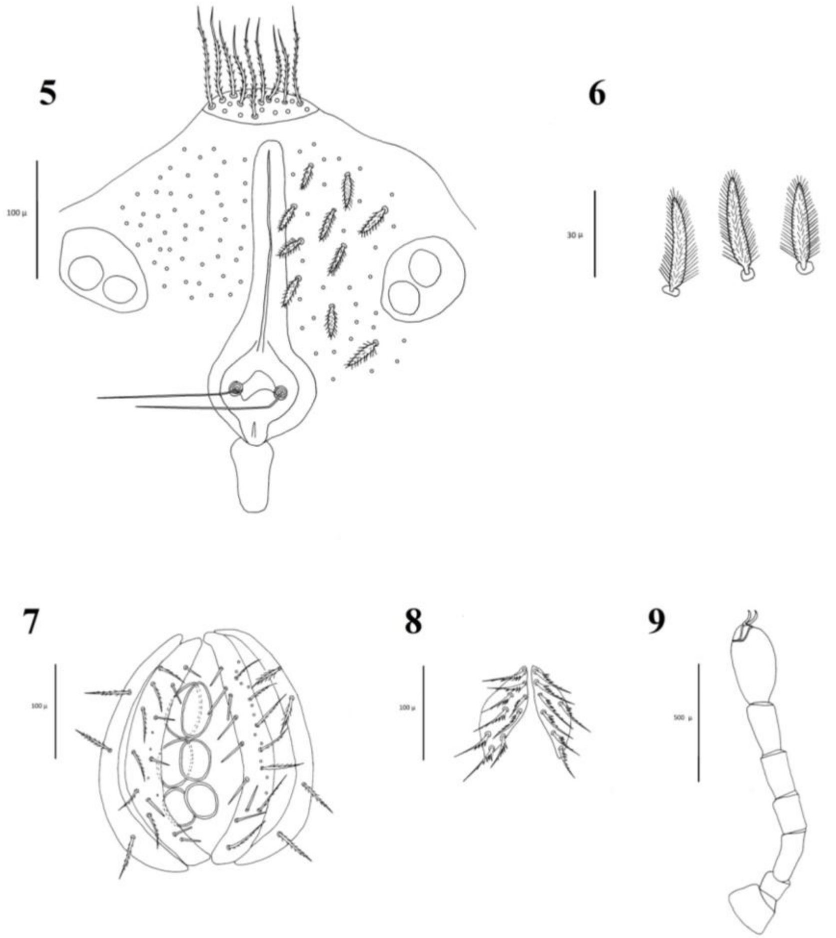
Table 2. Morphometric data on larva of *Atractothrombium sylvaticum*.

	Turkish specimens		European specimens	
Character	**Min.**	**Max.**	**Min.**	**Max.**
L	329.2	350	319.9	401.8
W	190.4	213	186.2	235.2
L/W	1.72	1.64	1.56	1.90
Scutum L	176.2	185.7	159	175
Scutum W	150	169	134	145
AA	59	76.3	54	69.3
AW	116	129,6	106	135
PW	127.6	148.1	119	154.4
SB	100.1	116.4	100	130.6
ASB	158.2	167.1	140	174.2
PSB	20.3	20.8	14	25.7
AP	45.4	50.6	40	57.5
AM	24.2	40	29.7	55
AL	30.6	35.5	28	41.5
PL	48.2	47.2	42	57.4
S	56.5	78	41.5	80
MA	85	93.4	80	102.9
HS	53.5	50.7	47.5	63.3
LSS	131.4	171.7	152.5	180
SL(=c1)	52	57.5	53.4	65.3
SS	75.3	86.8	68	95.4
Cx I	73.6	77.4	50	77.2
Tr I	39.8	37.5	35	47.5
Fe I	62.8	61.7	51.4	62.5
Ge I	26.3	25.8	20	30
Ti I	53.6	51.4	42	55
Ta I	88	91,7	62.5	91
Leg I	344.1	345.5	280	352.5
Cx II	70.4	80.8	46	75.2

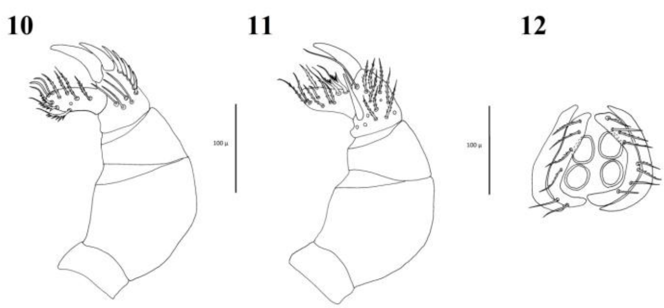
Tr II	36.8	41.3	32	45
Fe II	62.6	71.2	53.4	67.5
Ge II	21.5	22.6	17.8	26
Ti II	46.6	46.7	39.6	52.5
Ta II	81.2	87	72	87.5
Leg II	319.1	349.6	276	332.5
Cx III	57.7	73.3	46	69.3
Tr III	40.4	46.4	37.5	52.5
Fe III	66.1	73.8	58	73.2
Ge III	23.1	22.8	19.8	27.5
Ti III	52.3	58	48	62.5
Ta III	71	76.9	63.3	83.1
Leg III	310.6	351.2	281	347.5
IP	973.8	1046.3	873	1010

Table 3. Chaetotaxy of legs I-III (genu-tarsus) for larvae of *Atractothrombium sylvaticum*.

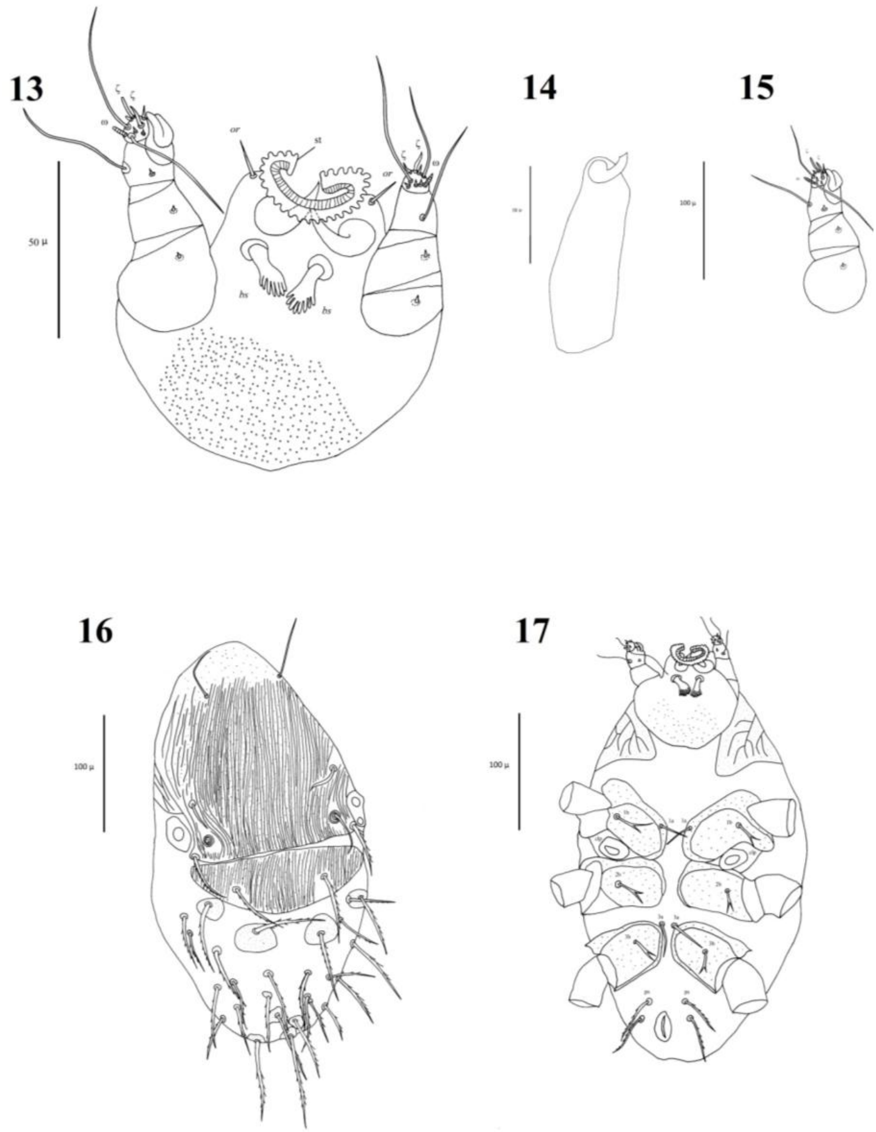
	Turkish specimens	**European specimens**
Ge I	4 B, 2σ, 1κ	4 B, 2 σ, 1κ
Ti I	6 B, 2φ, 1κ	6 B, 2 φ, 1 κ
Ta I	16(17) B, 2 ζ,1 ω,1 ε	17 B, 2 ζ, 1 ω,1 ε
Ge II	2 B,1 σ,1 κ	2 B, 1 σ, 1 κ
Ti II	5 B, 2 φ	5 B, 2 φ
Ta II	13 B,1 ω,1 ζ,1 ε	13 B, 1 ω, 1 ε, 1 ζ
Ge III	2 B,1 σ	2 B, 1 σ
Ti III	5 B	5 (6) B
Ta III	10 B, lofhotrix, scopa	10 B, lophotrix, scopa



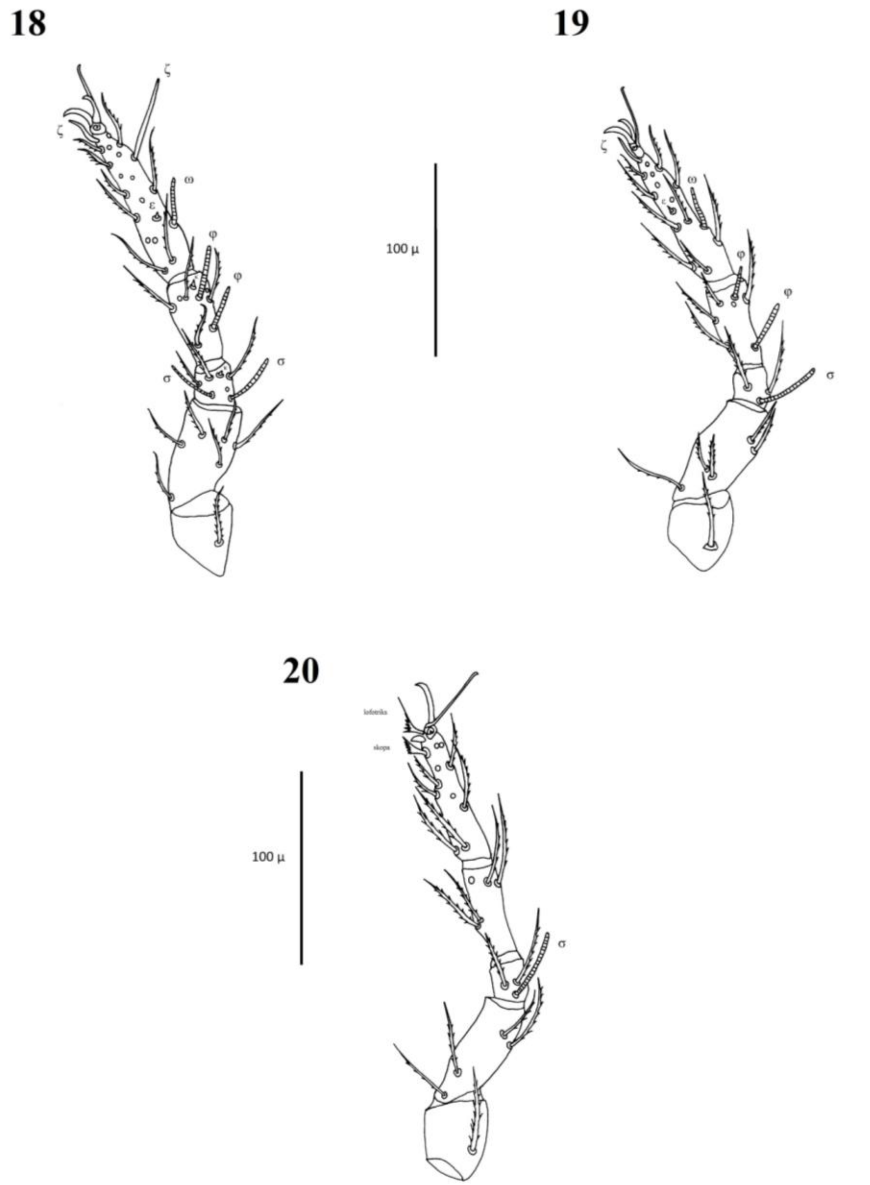
Figures 5-9. *Atractothrombium sylvaticum* Adult. (5) crista metopica region; (6) dorsal opisthosomal setae (pdS); (7) genital opening; (8) anus; (9) leg I, setae omitted.



Figures 10-12. *Atractothrombium sylvaticum* Deutonimf. (10) palp tibia and tarsus, medial aspect; (11) palp tibia and tarsus, lateral aspect; (12) genital opening.



Figures 13-17. *Atractothrombium sylvaticum*, larva. (13) Gnathosoma, ventral view; or = protorostral seta, st = stephanostome, bs = tritorostral seta; (14) chelicerata; (15) palp dorso-lateral aspect; (16) dorsal sides of the body; (17) ventral dorsal side of the body; clp = Claparéde's organ.



Figures 18-20. *Atractothrombium sylvaticum*, larva. (18) leg I; (19) leg II; (20) leg III

LARVAL FEEDING FROM SOME ARTIFICIAL DIETS AND ITS EFFECTS ON BIOLOGICAL PARAMETERS OF THE MEDITERRANEAN FLOUR MOTH

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ABSTRACT: In this study, we evaluated the effects of five diets including: (1) wheat flour + wheat bran (3:1 w/w) (FB), (2) wheat germ + brewer's yeast + glycerol (10:1:2 w/w) (MYG), (3) wheat germ + brewer's yeast (10:1 w/w) (MY), (4) wheat bran + brewer's yeast + glycerol (20:1:2 w/w) (BYG), and (5) wheat bran + brewer's yeast + glycerol + water (100:5:10:5 w/w) (BYGW) on some biological parameters of the Mediterranean flour moth, *Anagasta kuehniella*. All experiments were done at laboratory conditions of 25 ± 2 °C temp., 70 ± 8% R.H., and L:D 12:12. Each experiment repeated four times. Some biological properties of larvae and adults investigated. Results showed that rearing diets had no effect on embryonic development and percentage egg hatch. Highest means of larval period, pre-oviposition period, and egg to adult emergence period; and lowest means of weight of male and female larvae, pupae, and adults, female fecundity, and adult males' and females' longevity were observed on BYG diet. In contrast, highest means of female fecundity, percentage of survival from egg to adult, weight of larvae, pupae and adults, and adult longevity, and lowest means of per-oviposition period, larval period, and egg to adult emergence period observed on FB and MYG diets. Based on these parameters, FB and MYG diets (MYG without considering the economic costs) are the best diets for rearing the Mediterranean flour moth.

KEY WORDS: Mediterranean flour moth, artificial diet, biological properties.

The Mediterranean flour moth *Anagasta kuehniella* (Zeller), as a beneficial insect, has its own significance both in mass-rearing programs of parasitoid wasps; and in physiological, toxicological, and ecological investigations. This moth and other stored-product moths and beetles are often used in laboratories with the aim of studying insect life histories and adult mating strategies (Ryne et al., 2004). These insects are cosmopolitan and are able to develop in different commodities and have adapted to live in high densities and on abundant but poor diets (Trematerra, 1997). By literature review, it was revealed that in those laboratory experiments in which this insect and its closely related species, the Almond moth *Ephestia cautella* (Walker), were used for purposes other than mass rearing, larvae were reared on standard artificial diets including wheat germ, glycerol, dried yeast and wheat bran (eg. Cook et al., 1997; Sasaki & Ishikawa, 1999; Ikeda et al., 2003; Ryne et al., 2004) instead of natural diets of wheat flour and bran or flours and kernels of other grains. This is mainly done to eliminate the unrecognizable and variable effects of natural diets (Ryne et al., 2004). In insect artificial dies, glycerol is added as an additional nutrient to prevent mold growth (Norris, 1934; Bell, 1975) and to act as a humectant because first instars rarely survive if dietary moisture is too low (Benson, 1973). Some artificial diets such as an artificial one consisting of a hybrid commercial yellow maize and yeast and a diet containing white maize with very high lysine and tryptophan contents added to yeast can use for mass rearing of *Trichogramma* spp. on *A. kuehniella* (Magrini et al., 1995). Due to this and because of lacking any comprehensive investigation regarding the effects of these diets on the biology of this insect, the present study carried out to compare selected artificial diets with a natural food containing wheat flour and bran, and also to pave the way for choosing the best and the most appropriate artificial diet in prospective researches with ecological, toxicological, and physiological aims.

MATERIALS AND METHODS

Insect culture

To fulfill the project, newly laid eggs (max. 24 hrs old) of *A. kuehniella* were used. The larvae reared on wheat flour for 5 generations. Experimental conditions were as 25±2 ^{o}C Temp., 70 ± 8% R.H., and L12: D12.

Food treatments

The ingredients of diets in the present study included wheat flour, wheat bran, wheat germ, brewer's yeast, and glycerol. The treatments comprised of: (1) wheat flour + wheat bran (FB) (3:1 w/w) (Yazdanian et al., 2000); (2) wheat germ + brewer's yeast + glycerol (MYG) (10:1:2 w/w) (Ryne et al., 2004); (3) wheat germ + brewer's yeast (MY) (10:1 w/w) (Ryne et al., 2004); (4) wheat bran + brewer's yeast + glycerol + water (BYGW) (100:5:10:5 w/w) (Ikeda et al. 2003); and (5) wheat bran + brewer's yeast + glycerol (BYG) (20:1:2 w/w) (Sasaki & Ishikawa, 1999). The experiments conducted in a one-way ANOVA with four replications.

Biological parameters

In this study, we investigated the following biological parameters: larval period duration (the days between the observations of first instars to emergence of the first pupa); weight of fifth instars, pupae, and adult males and females (weighting of 20 individuals from each developmental stage; in the case of fifth instars, those who were finished their feeding were selected); fecundity (random selection of 25 pairs of males and females with maximum longevity of 12 hrs from each treatment and counting eggs laid every day); Male and female adults' longevity, proportions of eggs hatched, and survival from egg to adult (rearing of 100 eggs in each replication and calculating the percentage of survival using the formula: Survival % = [No. of adults emerged/No. of eggs] × 100).

Data analyses

The data were analyzed by using the MSTAT-C statistical software (ver. 2.10). Means were separated by using the LSD test, at P = 0.01.

RESULTS AND DISCUSSION

Larval period

In the present study, the shortest and longest larval periods observed in MYG (14.00 days) and BYG (23.75 days) diets ($F_{4,15}$ = 57.49; P = 0.0000) (Fig. 1). Yazdanian et al. (2000) reported that in moisten diets (12% moisture content), larval period declined compared to dry diets (8% moisture content). According to our results, in diets containing glycerol, due to provision and retention of moisture by glycerol (Ryne et al., 2004), larvae contribute less energy for feeding and producing metabolic water and their food needs are provided at a higher speed. As a result, larval period decreases (Yazdanian et al., 2000). On the other hand, in diets containing wheat bran, due to its toughness, the larvae (especially firs instars) feed hardly on them and consequently larval period prolongs (Yazdanian et al., 2000). Adding water to BYG diet (the BYGW diet), because of providing more food moisture, decreased the larval period significantly (Fig. 1).

Weight of fifth instars male and female larvae

The main effects, diet ($F_{4,30}$ = 17.52) and sex ($F_{1,30}$ = 18.17) were highly significant ($P \leq 0.0002$). However, the associated interaction, diet × sex ($F_{4,30}$ = 1.75) was not significant ($P = 0.165$).

According to the results of this investigation, the highest weights for fifth instars male and female larvae observed in MYG (26.60 and 28.46 mg), MY (26.64 and 27.52 mg), and FB (21.55 and 26.58 mg) diets while the lowest ones observed in BYG (20.40 and 21.45 mg) diet (Fig. 2). In all investigated diets, female larvae weighed more than male ones. Yazdanian et al. (2000) reported that rearing the larvae on diets containing wheat flour + wheat bran (3:1 w/w), wheat flour, wheat flour + wheat bran (1:1 w/w), and wheat flour + wheat bran (1:3 w/w) resulted to the highest weight of fifth instars male and female larvae, respectively. They justified the maximum growth on diet containing 25% bran with the fact that only fifth instars were capable of feeding on bran and this together with the nutrient richness of bran comparing to flour have increased the larval body weight. In diets lacking bran, though larvae fed well on them, they weighed less due to lack of nutrients. In diets containing higher amounts of bran, because of feeding of first, second and third instars on rough particles of bran, and because of tension imposed on them, more body weight loss is depicted that their later effects are shown in pupae and adults. Ziaie Madbooni & Farshbaf Pour Abad (2012) did not observe any significant difference in larval body weight by rearing the *A. kuehniella* on different cultivars of wheat (Rasad, Shiroodi, Tajan, Gowhadasht, Niknejhad, N-80-19, Zagros, Azar 2, Sardari, and Arta), except for Shiroodi and Arta. In these two cultivars, because of insufficient flour available to larvae, their body weight decreased. The kernels of these two cultivars have high moisture contents and roughness, and are not well grind. As a result, larvae especially early instars cannot feed properly. In the present study, feeding of early instars from BYG diet decreased larval body weight due to the presence of bran in the diet and feeding stresses by consuming it. Adding water to this diet (BYGW diet) helped to increase larval body weight (for female larvae significantly). In MYG and MY diets, the presence of brewer's yeast and wheat germ, which are two substances containing vitamins, could lead to higher body weight. In all diets, female larvae weighed more than male ones that this corresponds to Yazdanian et al. (2000) and Eyvazian Kari (2001).

Weight of male and female pupae

As for the previous biological parameter, the main effects, diet ($F_{4,30}$ = 18.15) and sex ($F_{1,30}$ = 11.91) were highly significant ($P \leq 0.0017$) and the associated interaction, diet × sex ($F_{4,30}$ = 1.17) was not significant ($P = 0.345$).

Highest weights of male and female pupae observed in MYG (24.50 and 27.83 mg) and MY (21.77 and 25.09 mg) diets and the lowest amounts observed in BYG (15.03 and 17.88 mg) diet (Fig. 3). Rodriguez et al. (1988) reared the larval *A. kuehniella* on four seeds (soybean, barley, wheat, and corn) and two vitamin containing foods (wheat germ and bread yeast) and observed that adding wheat germ and bread yeast to diet increased body weight of female pupae. Furthermore, body weight of female pupae was higher than that of male pupae. In our study, this is also true about the male pupae. They suggested that in *A.*

kuehniella, weight of pupae is related to the larval diets. Higher body weight of female pupae comparing to the male ones is in correlation with female and male larval body weight from which they have evolved.

Weight of male and female adults

In this case, not only the main effects, diet ($F_{4,30}$ = 72.30) and sex ($F_{1,30}$ = 103.52) were highly significant (P = 0.0000), but the associated interaction, diet × sex ($F_{4,30}$ = 21.60) was also highly significant (P = 0.0000).

As for the two previous biological parameters, highest body weights for male and female adults observed in MYG (15.16 and 22.49 mg) and MY (12.54 and 20.50 mg) diets, and the least ones observed in BYG (8.57 and 10.31 mg) diet (Fig. 4). Yazdanian et al. (2000) reported that highest means of male and female adults' body weight reared on different diets containing different proportions of wheat flour and bran varied from 9.04 up to 15.13 mg for males, and from 15.39 up to 21.53 mg for females that showed a significant difference. In their study, dry and moisten diets (with 8% and 12% moisture content, respectively) had no effect on body weight. Eyvazian Kari (2001) also reported means from 12.42 up to 17.31 mg and from 17.11 up to 23.96 mg for male and female adults, respectively, reared on diets containing wheat flour and bran. Vieira et al. (1995) reported that the male and female adult weight on three different textures of maize flour (fine, medium, and coarse) were 13.19, 14.77, and 12.38 mg for males and 19.37, 21.81, and 18.30 mg for females. In an experiment with soft wheat flours with the same nutritional value but different particle size, rearing on samples with greatest particle size (250-419 μm) caused the highest mean number of adults and the shortest developmental period (Locatelli et al., 2008). This insect prefers flours (Yazdanian et al., 2000; Eyvazian Kari, 2001) and it is suggested that particle size of flours with the same nutritional value determines the suitability of flour for this species. Like fifth instars and pupae, and in all treatments, female adult weight was more than that of male counterparts. The significance of the interaction of two main effects (i.e. diet × sex) on adults' body weight (but not on the weights of larvae and pupae) reveals the probable different efficiencies of digested food by and hence in the digestive physiology of male and female larvae, which affect the adult stage.

Fecundity

According to results, the higher oviposition rate (eggs/female) observed in FB (325.76 eggs), MYG (295.72 eggs), MY (234.40 eggs), BYGW (205.56 eggs), and BYG (105.56 eggs) diets, respectively ($F_{4,120}$ = 27.08; P = 0.0000) (Fig. 5). These results are correlated with means of females' body weight. Solis et al. (2006) reported that fecundities of *A. kuehniella* on three artificial diets: corn meal, bread crumb, and a mixture of both in equal proportions were equal to 203.82, 154.42, and 226.62 eggs/female, respectively. In a research by Yazdanian et al. (2000), the number of eggs laid by females reared on dry and moisten diets of: wheat flour + wheat bran (3:1), wheat flour, wheat flour + wheat bran (1:1), and wheat flour + wheat bran (1:3) were respectively evaluated as 347.37 & 354, 297.30 & 316.97, 280.00 & 288.00, and 264.00 & 269.00 eggs/female. The number of eggs per female by rearing larvae on different diets containing wheat flour and bran (Eyvazian Kari, 2001) varied from 289 up to 411. Decreasing the fecundity of this species due to the feeding of larvae on rough food particles and weight loss of female adults as e result are in accordance with Yazdanian et al. (2000) and Eyvazian Kari (2001) findings.

Male and female adults' longevity

ANOVA of data showed that the main effect, diet ($F_{4,240}$ = 19.01) and the associated interaction, diet × sex ($F_{4,240}$ = 4.21) were highly significant ($P \leq 0.0026$). However, the other main effect, sex ($F_{1,240}$ = 3.36) was not significant ($P = 0.068$).

Male and female adults lived longer in FB (10.44 and 8.92 days) and MYG (10.32 and 8.92 days) diets, respectively, but died sooner in MY (8.80 and 7.48 days), BYG (7.52 and 7.48 days), and BYGW (7.30 and 6.36 days) diets (Fig. 6). In all treatments, males lived longer than females, but the differences were not significant. Kind of diet may have no effect on adult longevity (e.g. Ayvaz & Karabörklü, 2008). In their experiment, Flap et al. (1995) reared four groups of *A. kuehniella* adults including: (1) pairs with free mating, no feeding; (2) pairs with free mating, feeding from honey; (3) pairs allowed to mate once, no feeding; and (4) virgin adults, no feeding. They observed that in all investigated groups, male adults' longevity (about 12 days) was longer than that of females (about 9 days). Ryne et al. (2004) studied the effects of glycerol on fecundity and longevity in the almond moth, *Ephestia cautella* (Walker). Their results showed that larval diets containing glycerol (wet larval diets) significantly increased male and female longevity. It is suggested that glycerol in insect diets is an inert additional nutrient (Bell, 1975; Benson, 1973) and because of its positive effect on moisture retention increases the quality of diets (Benson, 1973). Yazdanian et al. (2000) and Eyvazian Kari (2001) also reported that in this species, male lived longer than females. This phenomenon could possibly be a result of oviposition (one of the most energy-demanding activities) on females.

Proportion of eggs hatched

In all treatments, egg hatchability evaluated equal to 100%. In the research by Solis et al. (2006), proportion of eggs hatched in the *A. kuehniella* reared on three artificial diets: corn meal, breadcrumb, and a mixture of both in equal proportions were equal to 59.30, 85.30, and 90.30 per cent, respectively. Their results differ with our findings and this difference might be due to rearing of larvae on rough and coarse diets by Solis et al. In experiments carried out by Yazdanian et al. (2000) and Eyvazian Kari (2001) on this insect and diets based on wheat flour and bran, proportions of eggs hatched varied respectively from 88.50 up to 90.00 per cent, and from 89.75 up to 91.50 per cent with no significant difference. Proportions of eggs hatched reported by Amaral Filho & Habib (1990), Rodrigeuz Filho et al. (1991), and Jacob & Cox (1977) are 92.54, 98.00, and 97.00 per cent, respectively. Vinuela & Marco (1990) stated that presence of food has the highest effect on egg hatching and emergence of larvae even if there is no direct contact between eggs and food. Thus, we can say that food odor is one of stimulants that encourage larvae to leave the eggs and absence of the odor can decrease proportion of eggs hatched.

Survival from egg to adult

The higher survival rates from egg to adult observed in MYG (98.00%), MY (92.25%), and FB (92.00%) diets, and the lowest means observed in BYG (65.50%) and BYGW (73.75%) ($F_{4,15}$ = 33.94; P = 0.0000) (Fig. 7). According to our results, the presence of bran had a negative effect on survival rate. This finding is in accordance with Yazdanian et al. (2000) and Eyvazian Kari (2001) who stated that this insect prefers flours.

Results obtained from the present study indicated that considering the important biological parameters while rearing the Mediterranean flour moth, and also considering the economic costs, the natural diet containing wheat flour + wheat bran (3:1) is the best for mass rearing of biocontrol agents on eggs and larvae of this moth. In addition, this diet is prepared fast and easy and its constituents are easily available. In small-scale rearing in research laboratories, using the MYG diet is recommended for aims other than mass rearing of natural enemies such as for carrying out investigations e.g. physiological, ecological, and toxicological studies.

ACKNOWLEDGEMENTS

We really appreciate the financial support by the Gorgan University of Agricultural Sciences and Natural Resources for the present research.

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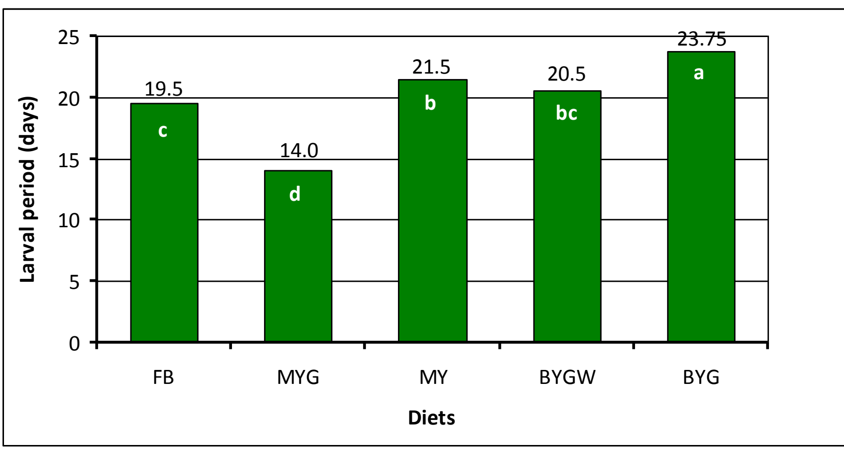

Figure 1. The effect of different larval diets on larval period.

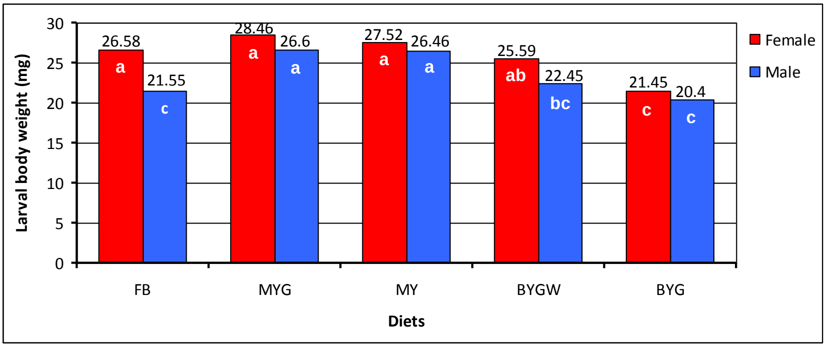

Figure 2. Larval body weight after feeding from different diets by larvae.

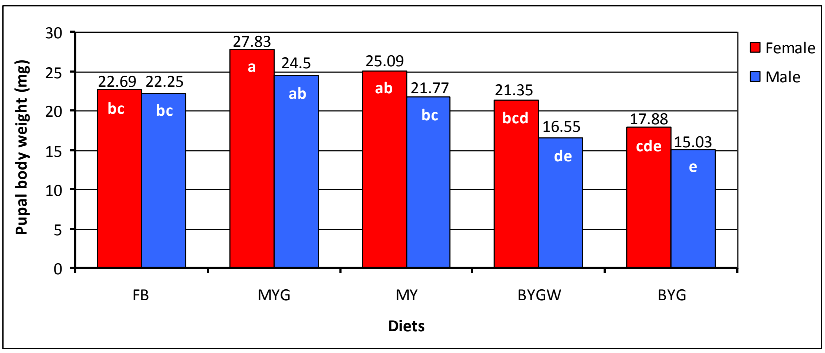

Figure 3. Pupal body weight after feeding from different diets by larvae.

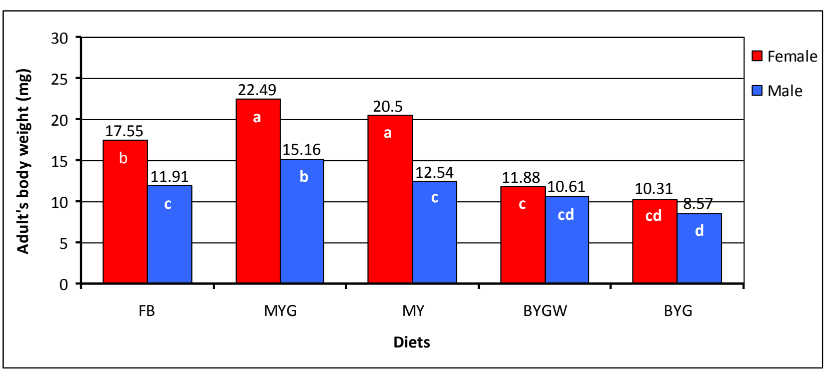

Figure 4. Adult's body weight after feeding from different diets by larvae.

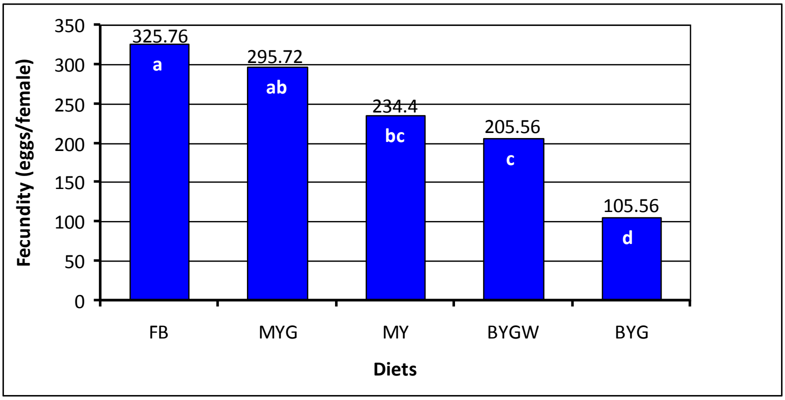

Figure 5. The significant effect of different larval diets on female fecundity.

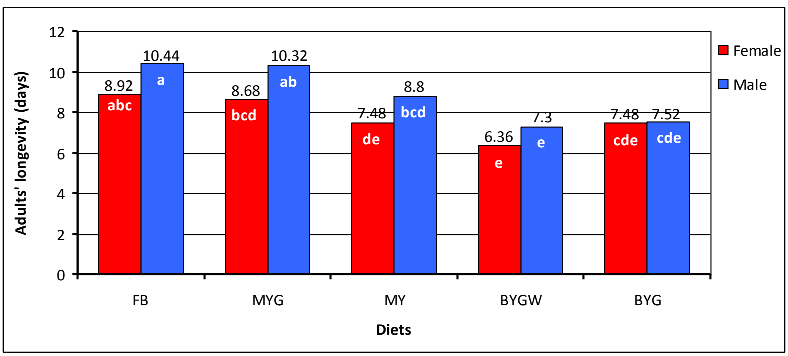

Figure 6. Adult longevity is affected by feeding of larvae from different diets.

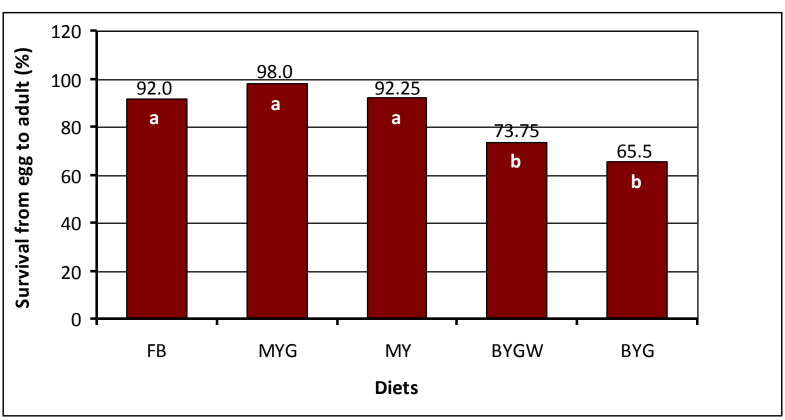

Figure 7. Larval feeding from different diets and its significant effect on survival from egg to adult parameter.

TURKISH RED LIST CATEGORIES OF LONGICORN BEETLES (COLEOPTERA: CERAMBYCIDAE) PART VIII – SUBFAMILY CERAMBYCINAE: ANAGLYPTINI AND CLYTINI

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[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**]**

ABSTRACT: The aim of this study is to create a Turkish Red List of the longicorn beetles. Moreover, presence such a Red List is necessary for Turkey. Even governmental evaluations could cause some erroneous decisions due to absence such a Red List. Since, governmental evaluations at the present time are based on the works that are realized with respect to the European Red List. Furthernore, Turkey appears a continental property changeable in very short distances in terms of climatical features and field structures. So, the status of European fauna and the status of Turkish fauna are not the same. Clearly, there is no any work that subjected to create a Turkish Red List except Parts I-VII. Hence, a series work is planned with this purpose. This type of study is the eighth attempt for Turkey.

KEY WORDS: Red List, Conservation, Cerambycidae, Turkey.

The purpose of the current study was to create a Turkish Red List of longicorn beetles similarly to "European Red List of Saproxylic Beetles" that was compiled by Ana Nieto & Keith N. A. Alexander and published by IUCN (International Union for Conservation of Nature) in collaboration with the European Union in 2010. "European Red List of Saproxylic Beetles" includes 153 species within the subfamilies Prioninae, Cerambycinae (including Stenopterinae) and Lamiinae of the European Cerambycidae. In the future, I hope that the present work will be lead to preparation a more comprehensive "Turkish Red List".

Hence, a series work is planned with this purpose. The present study is attempted as the eighth step of this aim. The previous works are Özdikmen (2014a,b,c,d,e,f,g). It should be noted that the using information at the present work on Turkish longicorn beetles are on the base of my personal database. The data of distribution are given on base of Löbl & Smetana (2010, 2011), Danilevsky (2010a,b, 2012a,b,c,d, 2013), Özdikmen (2011) and Miroshnikov (2011). Identification of chorotypes is based on the chorotype classification of the Anatolian fauna, proposed by Vigna Taglianti et al. (1999).

The evaluations of Turkish longicorn beetles at the present work based on "The IUCN Red List Categories" that was presented in Part I (Özdikmen, 2014a).

TURKISH RED LIST FOR STENOPTERINAE

SUBFAMILY CERAMBYCINAE Latreille, 1802: 211

TRIBE ANAGLYPTINI Lacordaire, 1868: 404

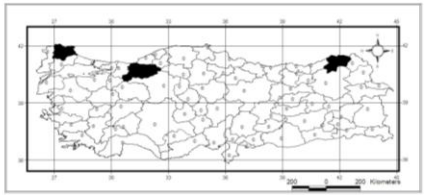
GENUS *PARACLYTUS* Bates, 1884: 234

SPECIES *P. sexguttatus* (Adams, 1817: 308)

European Red List of Saproxylic Beetles does not include the species. It is known only from N Turkey. However, Turkish Red List category of the species is **VU**.

Range: SE Europe (Bulgaria), Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.

Chorotype: SW-Asiatic + Balkano-Anatolian

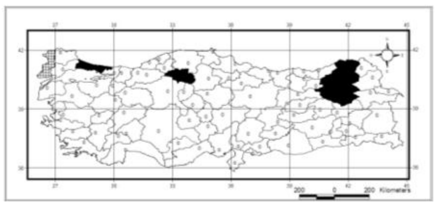


GENUS *ANAGLYPTUS* Mulsant, 1839: 91

SUBGENUS *ANAGLYPTUS* Mulsant, 1839: 91

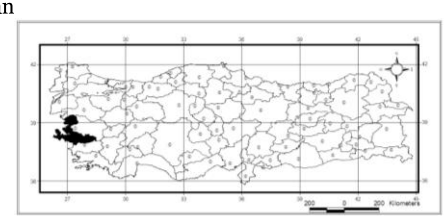
SPECIES *A. arabicus* (Küster, 1847: 95)

According to European Red List of Saproxylic Beetles, the species was placed in **NE**. It is known only from N Turkey. However, Turkish Red List category of the species is **NT**.
Range: Caucasus, Transcaucasia (Armenia, ?Azerbaijan, Georgia), Turkey.
Chorotype: SW-Asiatic



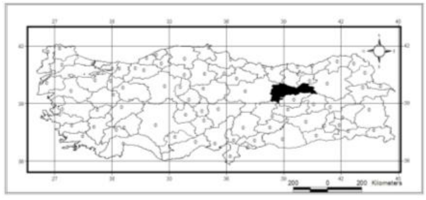
SPECIES *A. croesus* Pesarini & Sabbadini, 1997: 47

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type locality in W Anatolia. So, Turkish Red List category of the species is **DD**.
Range: Turkey.
Chorotype: Anatolian



SPECIES *A. danilevskii* Miroshnikov, 2000b: 77

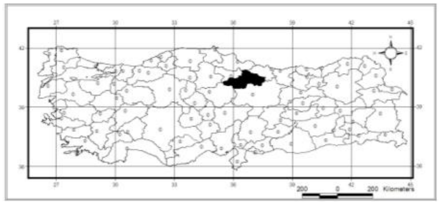
European Red List of Saproxylic Beetles does not include the species rightly. It is known only from NE Anatolia for Turkey. So, Turkish Red List category of the species is **NT** now.
Range: Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.
Chorotype: SW-Asiatic



SPECIES *A. ganglbaueri* Reitter, 1886: 67

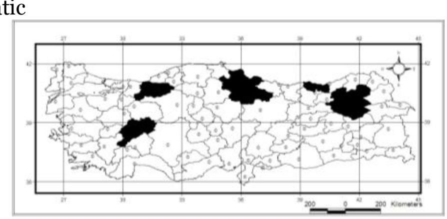
European Red List of Saproxylic Beetles does not include the species rightly. It is known only from NC Anatolia for Turkey. So, Turkish Red List category of the species is **DD** now.

Range: Transcaucasia (Azerbaijan), Iran, Turkey.
Chorotype: SW-Asiatic



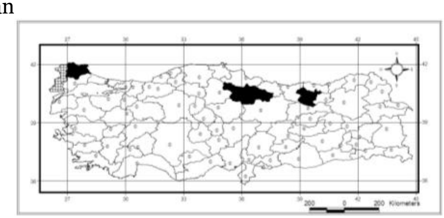
SPECIES *A. mysticoides* Reitter, 1894: 128

European Red List of Saproxylic Beetles does not include the species rightly. It probably is wider distributed than known in Anatolia for Turkey. So, Turkish Red List category of the species is **LC** now.
Range: Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.
Chorotype: SW-Asiatic



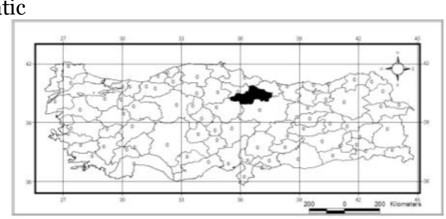
SPECIES *A. mysticus* (Linnaeus, 1758: 398)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from N Turkey. So, Turkish Red List category of the species is **NT**.
Range: Europe, Turkey.
Chorotype: European



SPECIES *A. simplicicornis* Reitter, 1906: 298

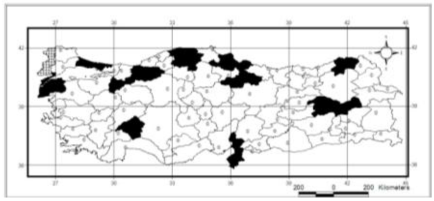
European Red List of Saproxylic Beetles does not include the species rightly. It is known only from NC Anatolia for Turkey. So, Turkish Red List category of the species is **DD** now.
Range: Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.
Chorotype: SW-Asiatic



TRIBE CLYTINI Mulsant, 1839: 70
GENUS *PLAGIONOTUS* Mulsant, 1842: 1
SUBGENUS *PLAGIONOTUS* Mulsant, 1842: 1

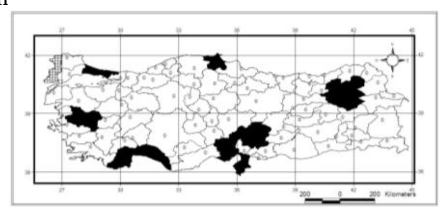
SPECIES *P. arcuatus* (Linnaeus, 1758: 399)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is rather widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.
Range: Europe, Caucasus, Kazakhstan, Kirgizia, Transcaucasia (Armenia, Georgia), Iran, Turkey, Syria, North Africa (Algeria, Morocco, Tunusia).
Chorotype: Centralasiatic-Europeo-Mediterranean



SPECIES *P. detritus* (Linnaeus, 1758: 399)

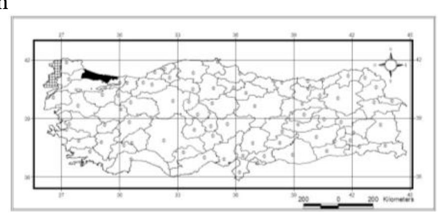
According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is rather widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.
Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Kazakhstan, Turkey, Syria.
Chorotype: European



Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *P. detritus caucasicola* Plavilstshikov, 1936.

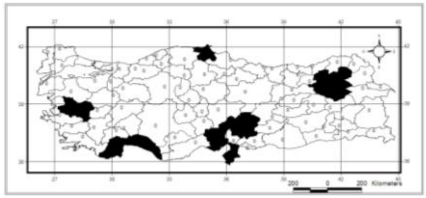
SUBSPECIES *P. d. detritus* (Linnaeus, 1758: 399)

According to European Red List of Saproxylic Beetles, the subspecies was placed in **LC**. It is known only from European Turkey for Turkey. So, Turkish Red List category of the subspecies is **NT**.
Range: Europe, Caucasus, Kazakhstan, Turkey.
Chorotype: European



SUBSPECIES *P. d. caucasicola* Plavilstshikov, 1936: 435

European Red List of Saproxylic Beetles does not include the subspecies rightly. It is rather widely distributed in Anatolia for Turkey. So, Turkish Red List category of the subspecies is **LC**.
Range: Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Syria.
Chorotype: SW-Asiatic



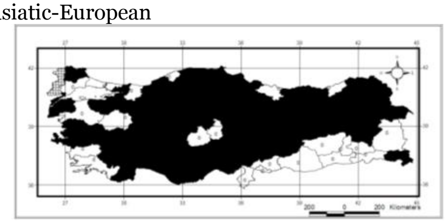
SUBGENUS *ECHINOCERUS* Mulsant, 1862: 143

SPECIES *P. floralis* (Pallas, 1773: 724)

European Red List of Saproxylic Beetles does not include the species. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.

Range: Europe, Siberia, Kazakhstan, Kirgizia, Tadjilistan, Uzbekistan, Turkmenistan, China, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Israel, Jordan.

Chorotype: Centralasiatic-European



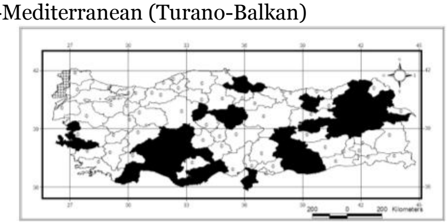
SUBGENUS *NEOPLAGIONOTUS* Kasatkin, 2005: 51

SPECIES *P. bobelayei* (Brullé, 1832: 253)

European Red List of Saproxylic Beetles does not include the species. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.

Range: SE Europe, Turkmenistan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Syria, Israel, Jordan.

Chorotype: Turano-Mediterranean (Turano-Balkan)

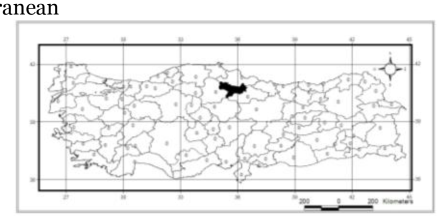


SPECIES *P. scalaris* (Brullé, 1832: 254)

European Red List of Saproxylic Beetles does not include the species. It is known only from NC in Anatolia for Turkey. So, Turkish Red List category of the species is **DD**.

Range: SE Europe (Italy, Greece), Turkey, North Africa (Algeria, Morocco, Tunusia).

Chorotype: Mediterranean



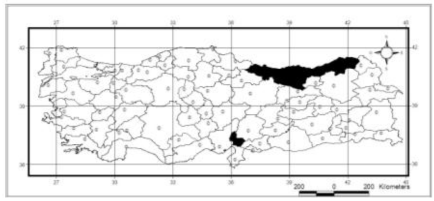
GENUS *ISOTOMUS* Mulsant, 1862: 143

SPECIES *I. comptus* (Mannerheim, 1825: 36)

According to European Red List of Saproxylic Beetles, the species was placed in **DD**. It is known only from NE and SC Anatolia for Turkey. So, Turkish Red List category of the species is **NT**.

Range: E Europe (Ukraine), Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.

Chorotype: SW-Asiatic



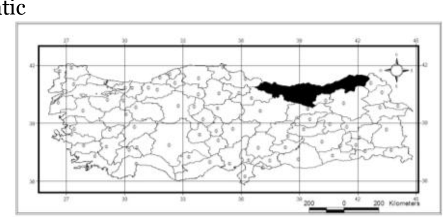
Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *I. comptus meridionalis* Özdikmen & Aytar, 2012.

SUBSPECIES *I. c. comptus* (Mannerheim, 1825: 36)

According to European Red List of Saproxylic Beetles, the subspecies was placed in **DD**. It is known only from NE Anatolia for Turkey. So, Turkish Red List category of the subspecies is **NT**.

Range: E Europe (Ukraine), Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.

Chorotype: SW-Asiatic

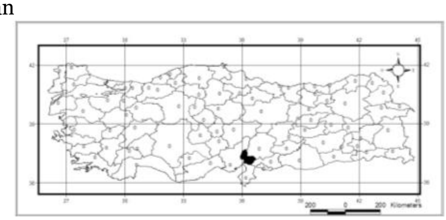


SUBSPECIES *I. c. meridionalis* Özdikmen & Aytar, 2012: 653

European Red List of Saproxylic Beetles does not include the endemic subspecies rightly. It is known only from the type locality in SC Anatolia. So, Turkish Red List category of the subspecies is **DD**.

Range: Turkey.

Chorotype: Anatolian

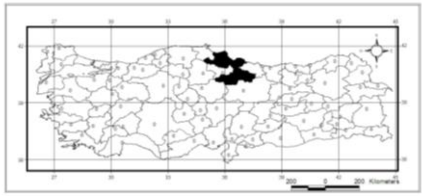


SPECIES *I. speciosus* (Schneider, 1787: 125)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from NC Anatolia for Turkey. So, Turkish Red List category of the species is **VU**.

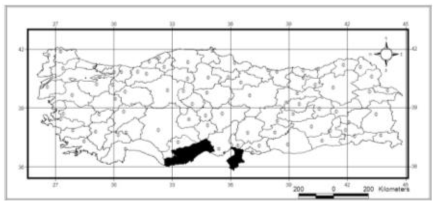
Range: C and E Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.

Chorotype: C and E Europe + SW-Asiatic



SPECIES *I. syriacus* (Pic, 1902: 25)

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from SC Anatolia. So, Turkish Red List category of the species is **EN**.
Range: Turkey.
Chorotype: Anatolian

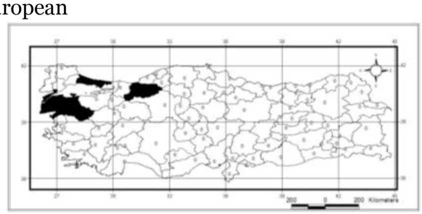


GENUS *CHLOROPHORUS* Chevrolat, 186: 290

SUBGENUS *CHLOROPHORUS* Chevrolat, 1863: 290

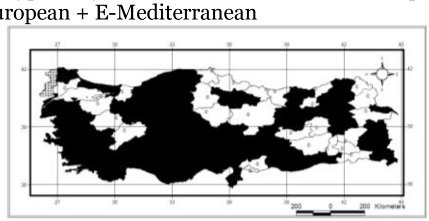
SPECIES *C. herbstii* (Brahm, 1790: 148)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from NC Anatolia for Turkey. So, Turkish Red List category of the species is **VU**.
Range: Europe, Siberia, Kazakhstan, Caucasus, Turkey.
Chorotype: Sibero-European



SPECIES *C. varius* (Müller, 1766: 188)

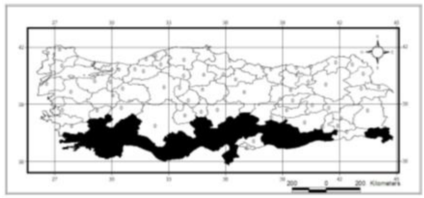
According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.
Range: Europe, W Siberia, Kazakhstan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Cyprus, Syria, Lebanon, Israel, Jordan, Iraq, North Africa (Egypt).
Chorotype: Sibero-European + E-Mediterranean



Moreover, the species is represented by two subspecies in Turkey as the nominative subspecies and *C. varius damascenus* (Chevrolat, 1854).

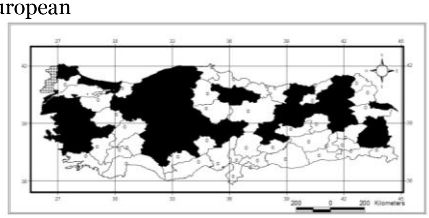
SUBSPECIES *C. v. damascenus* (Chevrolat, 1854: 483)

European Red List of Saproxylic Beetles does not include the subspecies rightly. It is known only from S Anatolia. So, Turkish Red List category of the subspecies is **LC**.
Range: Europe (Greece: Rodos), Iran, Turkey, Cyprus, Syria, Lebanon, Israel, Jordan, Iraq, North Africa (Egypt).
Chorotype: E-Mediterranean



SUBSPECIES *C. v. varius* (Müller, 1766: 188)

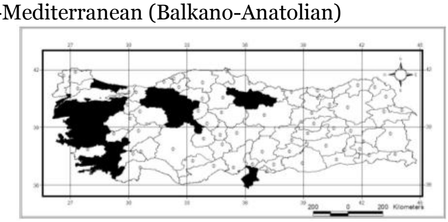
According to European Red List of Saproxylic Beetles, the subspecies was placed in **LC**. It is widely distributed in Turkey. So, Turkish Red List category of the subspecies is **LC**.
Range: Europe, W Siberia, Kazakhstan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.
Chorotype: Sibero-European



SUBGENUS *CRASSOFASCIATUS* Özdikmen, 2011: 538

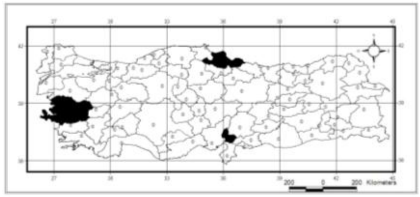
SPECIES *C. aegyptiacus* (Fabricius, 1775: 194)

According to European Red List of Saproxylic Beetles, the species was placed in **DD**. It probably is rather widely distributed at least in W half Turkey. So, Turkish Red List category of the species is **LC**.
Range: SE Europe (Macedonia, Bulgaria, Greece), Turkey.
Chorotype: Turano-Mediterranean (Balkano-Anatolian)



SPECIES *C. convexifrons* Holzschuh, 1981: 100

According to European Red List of Saproxylic Beetles, the species was placed in **EN**. It probably is rather widely distributed at least in W half Turkey. So, Turkish Red List category of the species is **VU**.
Range: SE Europe (Greece: Samos Island), Turkey.
Chorotype: E-Mediterranean (Aegean)

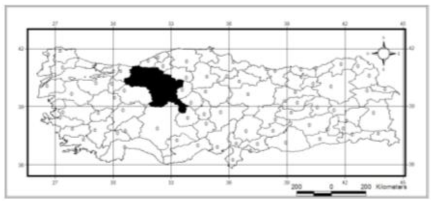


SPECIES *C. cursor* Rapuzzi & Sama, 1999: 331

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from NW Anatolia. So, Turkish Red List category of the species is **EN**.

Range: Turkey.

Chorotype: Anatolian

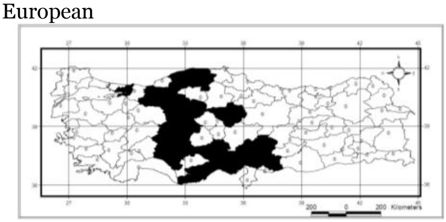


SPECIES *C. hungaricus* Seidlitz, 1891: 828

European Red List of Saproxylic Beetles does not include the species. It probably is rather widely distributed at least in W half of Turkey. So, Turkish Red List category of the species is **LC**.

Range: C and E Europe, Turkey.

Chorotype: C and E European

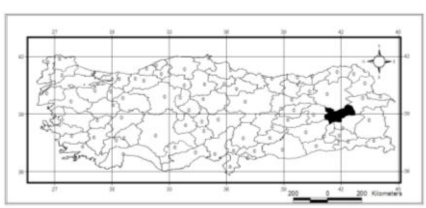


SPECIES *C. niehuisi* Adlbauer, 1992: 497

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type locality in E Anatolia. So, Turkish Red List category of the species is **DD**.

Range: Turkey.

Chorotype: Anatolian

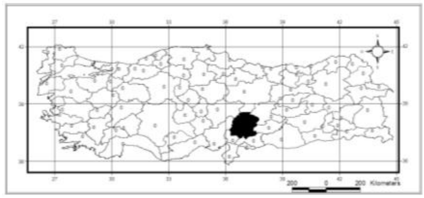


SPECIES *C. oezdikmeni* Sama & Rapuzzi, 2011: 87

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type locality in SCE Anatolia. So, Turkish Red List category of the species is **DD**.

Range: Turkey.

Chorotype: Anatolian

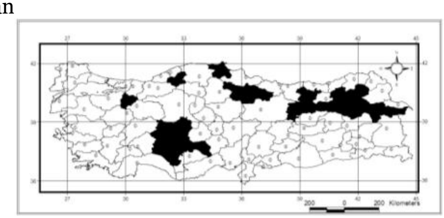


SPECIES *C. robustior* (Pic, 1900: 11)

European Red List of Saproxylic Beetles does not include the endemic species rightly. It probably is rather widely distributed in Anatolia. So, Turkish Red List category of the species is **LC**.

Range: Turkey.

Chorotype: Anatolian

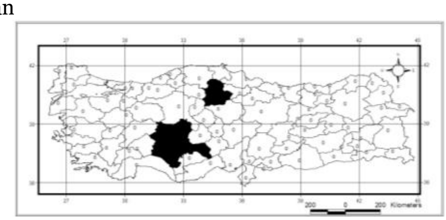


SPECIES *C. semrae* Özdikmen & Kaya, 2014

European Red List of Saproxylic Beetles does not include the endemic species rightly. It probably is rather widely distributed at least in C Anatolia. However, it is known only from the type localities now. So, Turkish Red List category of the species is **DD**.

Range: Turkey.

Chorotype: Anatolian

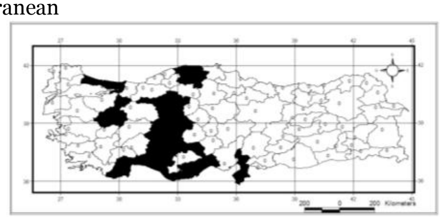


SPECIES *C. trifasciatus* (Fabricius, 1781: 244)

European Red List of Saproxylic Beetles does not include the species. It probably is widely distributed at least in W half of Turkey. So, Turkish Red List category of the species is **LC**.

Range: S Europe, Turkey, Syria, Israel, North Africa (Algeria, Morocco, Tunusia).

Chorotype: Mediterranean



SUBGENUS *PERDEROMACULATUS* Özdikmen, 2011: 537

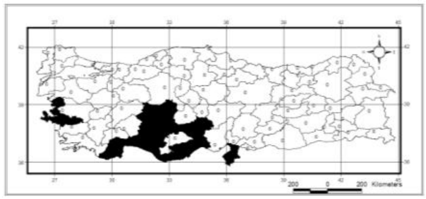
SPECIES *C. gratiosus* (Marseul, 1868: 203)

SUBSPECIES *C. g. sparsus* (Marseul, 1868: 203)

European Red List of Saproxylic Beetles does not include the species. It is represented only by the subspecies *C. gratiosus sparsus* in Turkey. It is known only from SC and SW Anatolia for Turkey. So, Turkish Red List category of the subspecies is **NT**.

Range: SE Europe (Greece: Rhodos Island), Turkey, Syria.

Chorotype: E-Mediterranean

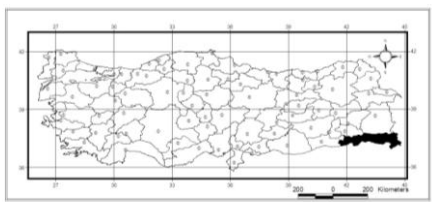


SPECIES *C. grosseri* Sama & Rapuzzi, 2011: 85

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type localities in SE Anatolia. So, Turkish Red List category of the species is **DD**.

Range: Turkey.

Chorotype: Anatolian

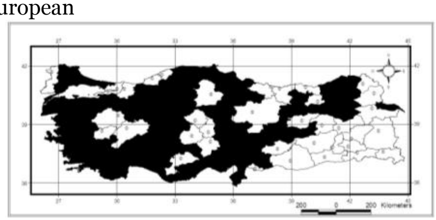


SPECIES *C. sartor* (Müller, 1766: 188)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.

Range: Europe, Siberia, Kazakhstan, Turkmenistan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Syria, Lebanon, Israel, Jordan.

Chorotype: Sibero-European

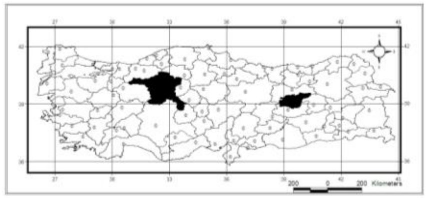


SPECIES *C. wewalkai* Holzschuh, 1969: 77

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from CN and EW Anatolia. So, Turkish Red List category of the species is **VU** now.

Range: Turkey.

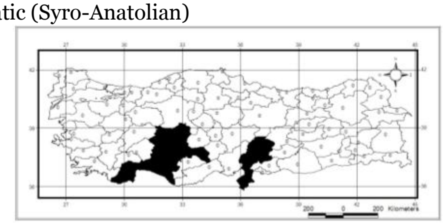
Chorotype: Anatolian



SUBGENUS *HUMEROMACULATUS* Özdikmen, 2011: 537

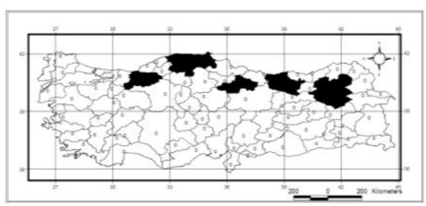
SPECIES *C. dinae* Rapuzzi & Sama, 1999: 329

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from SC and SW Anatolia. So, Turkish Red List category of the species is **NT** now.
Range: Turkey, Syria.
Chorotype: SW-Asiatic (Syro-Anatolian)



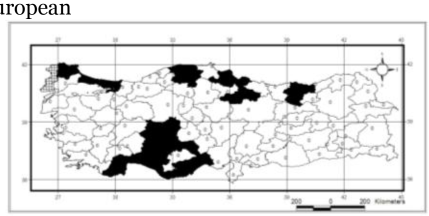
SPECIES *C. dominici* Sama, 1996: 110

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from N Anatolia. So, Turkish Red List category of the species is **NT** now.
Range: Turkey.
Chorotype: Anatolian



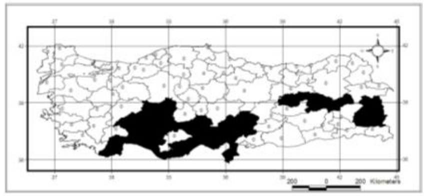
SPECIES *C. figuratus* (Scopoli, 1763: 55)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.
Range: Europe, Siberia, Kazakhstan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.
Chorotype: Sibero-European



SPECIES *C. nivipictus* (Kraatz, 1879: 91)

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from SC, SW and SE Anatolia. So, Turkish Red List category of the species is **LC** now.
Range: SE Europe (Greece: Samos Island), Turkey, Syria, Iran.
Chorotype: SW-Asiatic

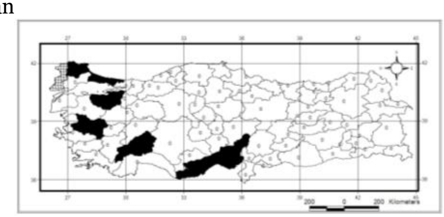


GENUS *XYLOTRECHUS* Chevrolat, 1860: 456
SUBGENUS *XYLOTRECHUS* (Chevrolat, 1860: 456)
SPECIES *X. antilope* (Schoenherr, 1817: 465)
SUBSPECIES *X. a. antilope* (Schoenherr, 1817: 465)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is represented only by the nominative subspecies in Turkey. It probably is rather widely distributed at least in W half of Turkey. However, Turkish Red List category of the species is **NT** now.

Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Cyprus.

Chorotype: European

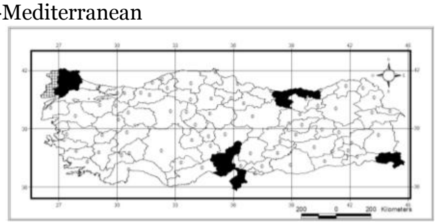


SPECIES *X. arvicola* Olivier, 1795: 64

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It probably is rather widely distributed in Turkey. However, Turkish Red List category of the species is **NT** now.

Range: Europe, Kazakhstan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Syria, North Africa (Algeria, Morocco).

Chorotype: Europeo-Mediterranean

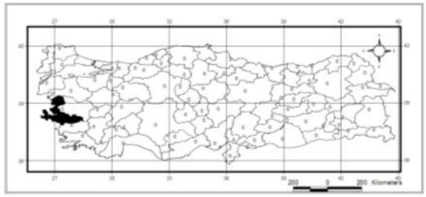


SPECIES *X. stebbingi* Gahan, 1906: 244

European Red List of Saproxylic Beetles does not include the species. It has sporadic distribution in the World. It is known only from W Anatolia for Turkey. So, Turkish Red List category of the species is **EN** now.

Range: C and S Europe (France, Greece, Italy, Slovenia, Switzerland), Turkey, Israel, Afghanistan, Bhutan, Nepal, Pakistan, India, Tadjikistan, Tibet, North Africa (Tunusia) and Oriental Region.

Chorotype: Centralasiatic-Europeo-Mediterranean + Oriental



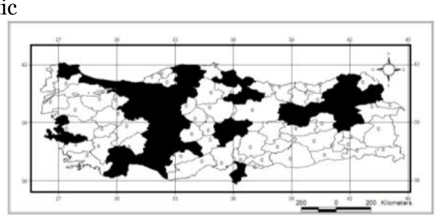
GENUS *RUSTICOCLYTUS* Vives, 1977: 130

SPECIES *R. rusticus* (Linnaeus, 1758: 398)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is widely distributed in Turkey. So, Turkish Red List category of the species is **LC**.

Range: Europe, Siberia, Far East Russia, Kazakhstan, Mongolia, Korea, Tadjikistan, Turkmenistan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, North Africa (Algeria, Morocco).

Chorotype: Palaearctic



GENUS *TURANOCLYTUS* Sama, 1994: hevrolat, 1860: 456

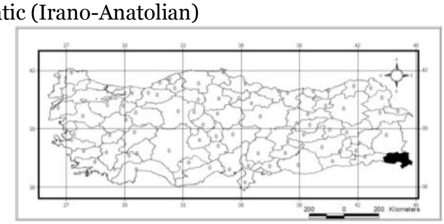
SPECIES *T. ilamensis* (Holzschuh, 1979: 115)

SUBSPECIES *T. i. ilamensis* (Holzschuh, 1979: 115)

European Red List of Saproxylic Beetles does not include the species rightly. It is represented only by the nominative subspecies in Turkey. It is known only from SE Anatolia for Turkey. So, Turkish Red List category of the species is **EN** now.

Range: Turkey, Iran.

Chorotype: SW-Asiatic (Irano-Anatolian)

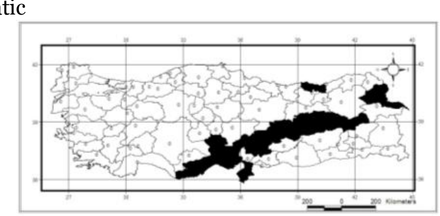


SPECIES *T. sieversi* (Ganglbauer, 1890)

European Red List of Saproxylic Beetles does not include the species rightly. It probably is rather widely distributed at least in E half of Turkey. So, Turkish Red List category of the species is **LC**.

Range: Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Iran.

Chorotype: SW-Asiatic



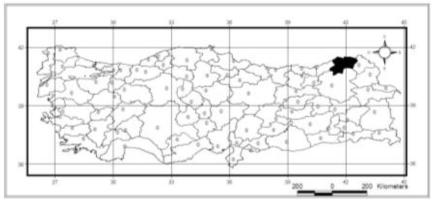
GENUS *PSEUDOSPHEGESTHES* Reitter, 1913: 50

SPECIES *P. brunnescens* (Pic, 1897: 262)

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from NE Anatolia for Turkey. So, Turkish Red List category of the species is **EN**.

Range: Caucasus, Transcaucasia (Georgia), Turkey.

Chorotype: SW-Asiatic

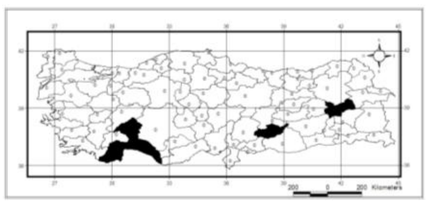


SPECIES *P. longitarsus* Holzschuh, 1974: 90

European Red List of Saproxylic Beetles does not include the endemic species rightly. It probably is wider distributed than known in Anatolia. So, Turkish Red List category of the species is **NT** now.

Range: Turkey.

Chorotype: Anatolian

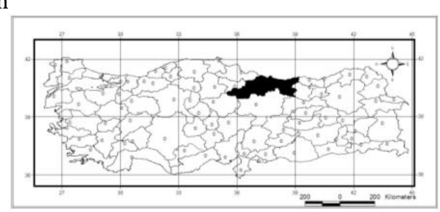


SPECIES *P. samai* Danilevsky, 2000: 44

European Red List of Saproxylic Beetles does not include the endemic species rightly. It probably is wider distributed than known in Anatolia. But it is known only from the type localities in NCE Anatolia now. So, Turkish Red List category of the species is **DD**.

Range: Turkey.

Chorotype: Anatolian



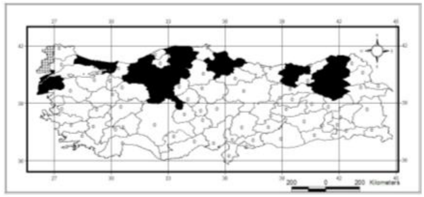
GENUS *CLYTUS* Laicharting, 1784: 88

SPECIES *C. arietis* (Linnaeus, 1758: 399)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is rather widely distributed in N Turkey. So, Turkish Red List category of the species is **LC**.

Range: Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkmenistan, Turkey, North Africa (Madeira Archipelago).

Chorotype: Turano-European or Turano-Europeo-Mediterranean



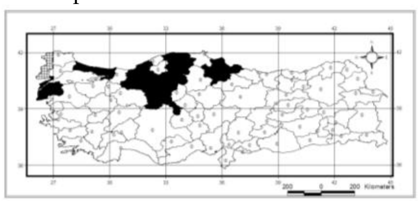
Moreover, the species is represented by three subspecies in Turkey as the nominative subspecies, *C. arietis lederi* Ganglbauer, 1882 and *C. arietis oblitus* Roubal, 1932.

SUBSPECIES *C. a. arietis* (Linnaeus, 1758: 399)

According to European Red List of Saproxylic Beetles, the subspecies was placed in **LC**. It is rather widely distributed in N Turkey. So, Turkish Red List category of the subspecies is **LC**.

Range: Europe, Caucasus, Turkey, North Africa (Madeira Archipelago).

Chorotype: European or Europeo-Mediterranean

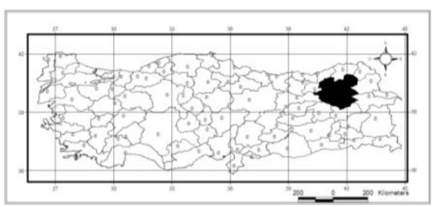


SUBSPECIES *C. a. lederi* Ganglbauer, 1882: 730

European Red List of Saproxylic Beetles does not include the subspecies rightly. It is known only from E Anatolia for Turkey. So, Turkish Red List category of the subspecies is **DD**.

Range: Transcaucasia (Azerbaijan), Turkey, Iran, Turkmenistan.

Chorotype: Turanian

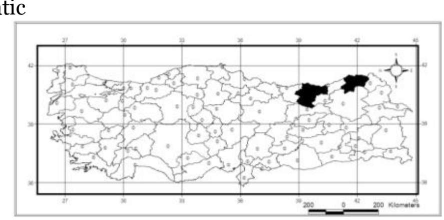


SUBSPECIES *C. a. oblitus* Roubal, 1932: 17

European Red List of Saproxylic Beetles does not include the subspecies rightly. It is known only from NE Anatolia for Turkey. So, Turkish Red List category of the subspecies is **VU**.

Range: Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey.

Chorotype: SW-Asiatic

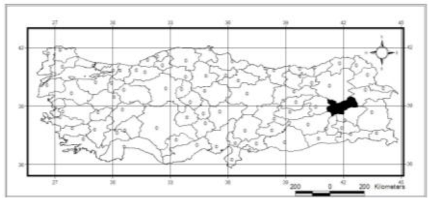


SPECIES *C. buglanicus* Kadlec, 2005: 106

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type locality in E Anatolia now. So, Turkish Red List category of the species is **DD**.

Range: Turkey.

Chorotype: Anatolian

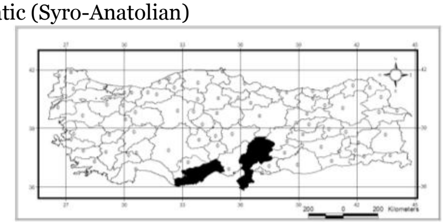


SPECIES *C. ciliciensis* (Chevrolat, 1863: 334)

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from SC and SCW Anatolia for Turkey. So, Turkish Red List category of the species is **VU**.

Range: Turkey, Syria.

Chorotype: SW-Asiatic (Syro-Anatolian)

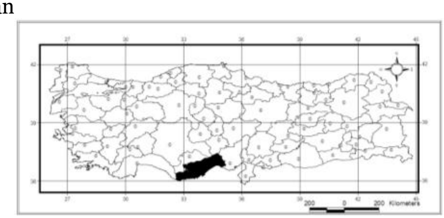


SPECIES *C. gulekanus* Pic, 1904: 65

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from SCW Anatolia. So, Turkish Red List category of the species is **EN**.

Range: Turkey.

Chorotype: Anatolian

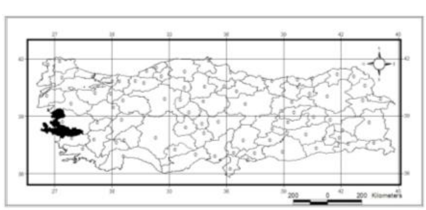


SPECIES *C. insignitus* Fairmaire, 1866: 269 [DA]

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type locality of W Anatolia. So, Turkish Red List category of the species is **DD**.

Range: Turkey.

Chorotype: Anatolian

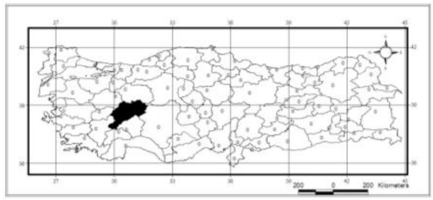


SPECIES *C. kumalariensis* Johanides, 2001: 219

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from the type locality of CW Anatolia. So, Turkish Red List category of the species is **DD**.

Range: Turkey.

Chorotype: Anatolian

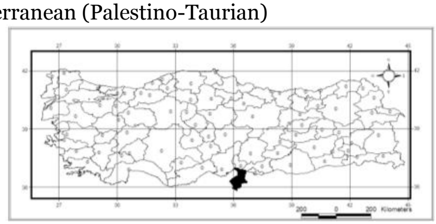


SPECIES *C. madoni* Pic, 1891: CCXI

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from SC and SCW Anatolia for Turkey. So, Turkish Red List category of the species is **EN**.

Range: Turkey, Syria, Lebanon, Israel.

Chorotype: E-Mediterranean (Palestino-Taurian)



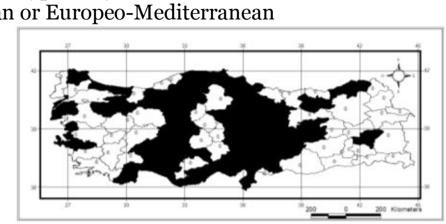
SPECIES *C. rhamni* Germar, 1817: 223

SUBSPECIES *C. r. temesiensis* (Germar, 1824: 519)

According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is represented only by the subspecies *C. rhamni temesiensis* in Turkey. It is widely distributed in Turkey. So, Turkish Red List category of the subspecies is **LC**.

Range: C and E Europe, Kazakhstan, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey, Cyprus, Syria, Lebanon, Israel.

Chorotype: European or Europeo-Mediterranean

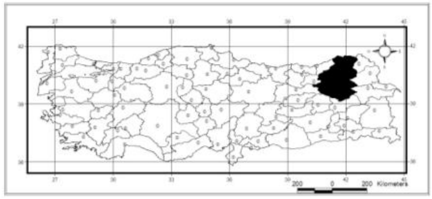


SPECIES *C. schneideri* Kiesenwetter, 1879: 313 [= 1879: 57]

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from NE Anatolia for Turkey. So, Turkish Red List category of the species is **EN**.

Range: Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.

Chorotype: SW-Asiatic

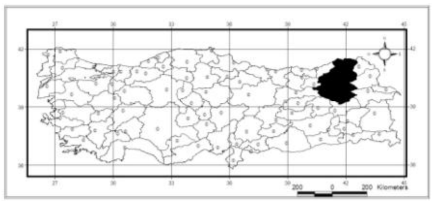


SUBSPECIES *C. s. inapicalis* Pic, 1895: 38

European Red List of Saproxylic Beetles does not include the endemic subspecies rightly. It is known only from NE Anatolia. So, Turkish Red List category of the subspecies is **EN**.

Range: Turkey.

Chorotype: Anatolian

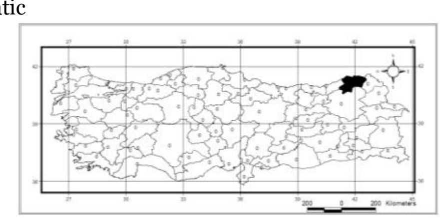


SUBSPECIES *C. s. schneideri* Kiesenwetter, 1879: 313

European Red List of Saproxylic Beetles does not include the subspecies rightly. It is known only from NE Anatolia for Turkey. So, Turkish Red List category of the subspecies is **EN**.

Range: Transcaucasia (Armenia, Azerbaijan, Georgia), Iran, Turkey.

Chorotype: SW-Asiatic

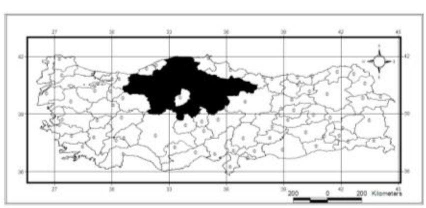


SPECIES *C. schurmanni* Sama, 1996: 108

European Red List of Saproxylic Beetles does not include the endemic species rightly. It is known only from CN Anatolia. So, Turkish Red List category of the species is **NT**.

Range: Turkey.

Chorotype: Anatolian

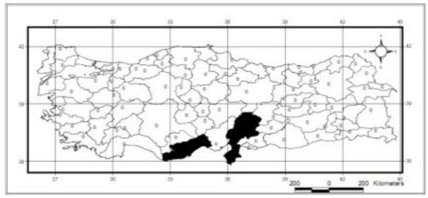


SPECIES *C. taurusiensis* (Pic, 1903: 139)

European Red List of Saproxylic Beetles does not include the species rightly. It is known only from SC and SCW Anatolia. So, Turkish Red List category of the species is **VU**.

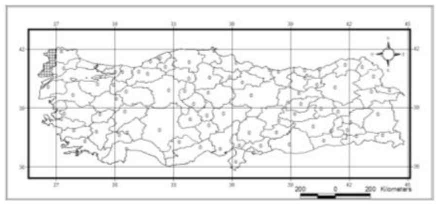
Range: Turkey, Israel.

Chorotype: E-Mediterranean (Palestino-Taurian)



SPECIES ***C. tropicus*** **(Panzer, 1795: 265)**

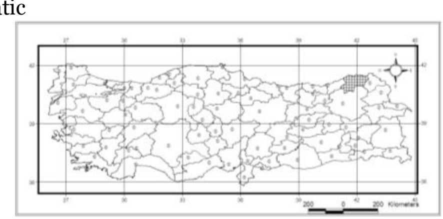
According to European Red List of Saproxylic Beetles, the species was placed in **LC**. It is known only from European Turkey. So, Turkish Red List category of the species is **DD**.
Range: Europe, Turkey.
Chorotype: European



GENUS *SPHEGOCLYTUS* Sama, 2005: 69

SPECIES *Sphegoclytus vesparum* (Reitter, 1889: 375)

European Red List of Saproxylic Beetles does not include the species rightly. It probably is distributed only in NE Anatolia. So, Turkish Red List category of the species is **NE**.
Range: Transcaucasia (Azerbaijan), Iran, Turkey.
Chorotype: SW-Asiatic



CONCLUSION:

With the present work, "Turkish Red List Categories" for 153 Turkish species group taxa determined (Appendix 1).

For Turkish Cerambycinae: The subfamily includes 153 species group taxa (108 species + 45 subspecies) in Turkey. Among them;

10 species and 7 subspecies is placed within "Endangered (EN)" Category.

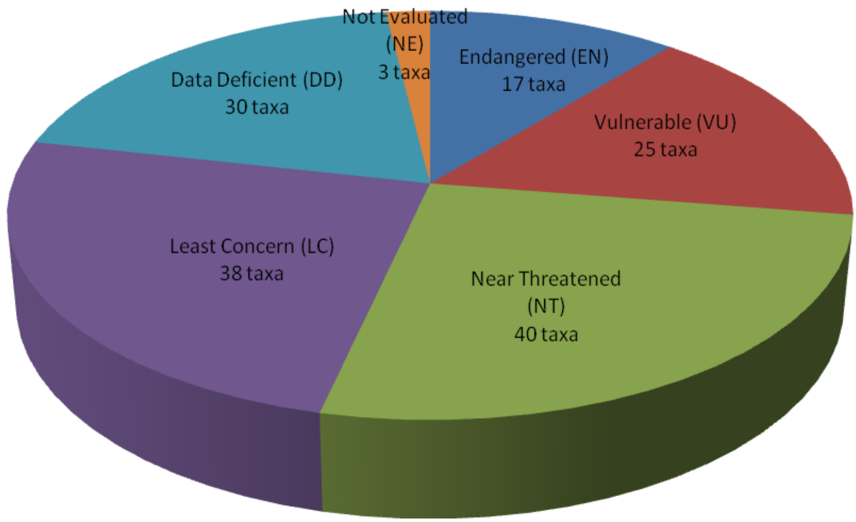
19 species and 6 subspecies are placed within "Vulnerable (VU)" Category.

26 species and 14 subspecies are placed within "Near Threatened (NT)" Category.

27 species and 11 subspecies are placed within "Least Concern (LC)" Category.

24 species and 6 subspecies are placed within "Data Deficient (DD)" Category.

2 species and 1 subspecies are placed within "Not Evaluated (NE)" Category.



Consequently, only a total of 65 taxa of Cerambycinae were evaluated in "European Red List Saproxylic Beetles". Among them, the Red List Categories of 46 taxa were changed in "Turkish Red List".

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Appendix 1. Red List Categories of Turkish longicorn beetles belonging to the subfamily Cerambycinae.

TAXA	TURKISH RED LIST CATEGORY	EUROPEAN RED LIST CATEGORY	ENDEMISM FOR TURKEY
CERAMBYCINAE			
ACHRYSONINI			
Icosium tomentosum atticum	**NT**	**LC**	**---**
HESPEROPHANINI			
Hesperophanes sericeus	**NT**	**LC**	**---**
Trichoferus fasciculatus fasciculatus	**LC**	**LC**	**---**
Trichoferus fissitarsis	**VU**	**---**	**---**
Trichoferus griseus	**LC**	**LC**	**---**
Trichoferus holosericeus	**NT**	**LC**	**---**
Trichoferus kotschyi	**NT**	**---**	**---**
Trichoferus lunatus	**VU**	**---**	**---**
Trichoferus pallidus	**EN**	**LC**	**---**
Trichoferus preissi	**NT**	**---**	**YES**
Trichoferus samai	**DD**	**---**	**YES**
Trichoferus sbordonii	**DD**	**---**	**YES**
Trichoferus spartii	**VU**	**---**	**YES**
Stromatium unicolor	**LC**	**LC**	**---**
PHORACANTHINI			
Phoracantha recurva	**VU**	**---**	**---**
Phoracantha semipunctata	**VU**	**---**	**---**
CERAMBYCINI			
Cerambyx carinatus	**NT**	**LC**	**---**
Cerambyx cerdo cerdo	**LC**	**NT**	**---**
Cerambyx dux	**LC**	**NT**	**---**
Cerambyx heinzianus	**VU**	**---**	**YES**
Cerambyx miles	**LC**	**NT**	**---**
Cerambyx nodulosus	**LC**	**NT**	**---**
Cerambyx welensii	**LC**	**NT**	**---**
Cerambyx scopolii	**LC**	**LC**	**---**
Cerambyx scopolii scopolii	**LC**	**LC**	**---**
Cerambyx scopolii nitidus	**NT**	**---**	**---**
ROSALIINI			
Rosalia alpina	**NT**	**LC**	**---**
Rosalia alpina alpina	**NT**	**LC**	**---**
Rosalia alpina syriaca	**EN**	**---**	**YES**
TRACHYDERINI			
Purpuricenus apicalis	**VU**	**---**	**---**
Purpuricenus bitlisiensis	**EN**	**---**	**YES**
Purpuricenus budensis	**LC**	**LC**	**---**
Purpuricenus caucasicus caucasicus	**NT**	**---**	**---**
Purpuricenus cornifrons	**VU**	**---**	**YES**
Purpuricenus dalmatinus	**LC**	**DD**	**---**
Purpuricenus desfontainii inhumeralis	**LC**	**DD**	**---**
Purpuricenus interscapillatus	**NT**	**---**	**---**
Purpuricenus kaehleri	**NT**	**LC**	**---**
P. kaehleri kaehleri	**NT**	**LC**	**---**
P. kaehleri menetriesi	**NT**	**---**	**---**
Purpuricenus nanus	**DD**	**---**	**---**
Purpuricenus nigrotatatus	**VU**	**---**	**YES**

Purpuricenus nudicollis	**NT**	**EN**	**---**
Purpuricenus wachanrui	**NT**	**---**	**---**
Calchaenesthes diversicollis	**NE**	**---**	**---**
Calchaenesthes oblongomaculata	**DD**	**DD**	**---**
Calchaenesthes primis	**NT**	**---**	**?YES**
CALLICHROMATINI			
Aromia moschata moschata	**LC**	**LC**	**---**
Aromia ambrosiaca ambrosiaca	**LC**	**---**	**---**
Osphranteria coerulescens	**NT**	**---**	**---**
GRACILIINI			
Gracilia minuta	**NT**	**LC**	**---**
Penichroa fasciata	**LC**	**LC**	**---**
Axinopalpis gracilis	**VU**	**LC**	**---**
Hybometopia starcki	**VU**	**---**	**---**
H. starcki ivani	**DD**	**---**	**YES**
H. starcki starcki	**VU**	**---**	**---**
OBRIINI			
Obrium brunneum	**NT**	**LC**	**---**
Obrium cantharinum cantharinum	**NT**	**LC**	**---**
Anatolobrium eggeri	**EN**	**---**	**YES**
CERTALLINI			
Certallum ebulinum	**LC**	**---**	**---**
Certallum thoracicum	**DD**	**---**	**---**
DEILINI			
Delagrangeus angustissimus angustissimus	**VU**	**---**	**YES**
Deilus fugax	**NT**	**LC**	**---**
Deilus rugosicollisrugosicollis	**VU**	**---**	**---**
STENHOMALINI			
Stenhomalus bicolor	**NT**	**LC**	**---**
HYLOTRUPINI			
Hylotrupes bajulus	**LC**	**LC**	**---**
CALLIDIINI			
Ropalopus clavipes	**LC**	**LC**	**---**
Ropalopus femoratus	**DD**	**LC**	**---**
Ropalopus hanae	**DD**	**---**	**YES**
Ropalopus insubricus insubricus	**EN**	**NT**	**---**
Ropalopus ledereri	**VU**	**---**	**---**
R. ledereri ledereri	**EN**	**---**	**---**
R. ledereri wittmeri	**VU**	**---**	**---**
Ropalopus lederi	**EN**	**NE**	**---**
Ropalopus macropus	**LC**	**LC**	**---**
Ropalopus sculpturatus	**NT**	**---**	**YES**
Leioderes tuerki	**NT**	**---**	**---**
Semanotus russicus russicus	**NT**	**LC**	**---**
Callidium syriacum	**NT**	**---**	**---**
Callidium violaceum	**DD**	**LC**	**---**
Callidium aeneum	**NT**	**LC**	**---**
C. aeneum aeneum	**VU**	**LC**	**---**
C. aeneum pilosicollis	**DD**	**---**	**YES**
Pyrrhidium sanguineum	**DD**	**LC**	**---**
Phymatodes femoralis demelti	**EN**	**---**	**YES**
Phymatodes testaceus	**LC**	**LC**	**---**
Phymatodes lividus	**NT**	**NT**	**---**
Phymatodes pusillus pusillus	**DD**	**LC**	**---**
Phymatodes rufipes	**NT**	**LC**	**---**
P. rufipes rufipes	**DD**	**LC**	**---**

P. rufipes syriacus	**NT**	---	---
Phymatodes alni	**NT**	**LC**	---
P. alni alni	**NT**	**LC**	
P. alni pici	**NE**	---	---
Phymatodes kasnaki	**VU**	---	**YES**
Phymatodes magnanii	**DD**	---	**YES**
Phymatodes fasciatus	**VU**	**LC**	---
Lioderina linearis	**DD**	**DD**	---
ANAGLYPTINI			
Paraclytus sexguttatus	**VU**	---	---
Anaglyptus arabicus	**NT**	**NE**	---
Anaglyptus croesus	**DD**	---	**YES**
Anaglyptus danilevskii	**NT**	---	---
Anaglyptus ganglbaueri	**DD**	---	---
Anaglyptus mysticoides	**LC**	---	---
Anaglyptus mysticus	**NT**	**LC**	---
Anaglyptus simplicicornis	**DD**	---	---
CLYTINI			
Plagionotus arcuatus	**LC**	**LC**	---
Plagionotus detritus	**LC**	**LC**	---
P. detritus detritus	**NT**	**LC**	---
P. detritus caucasicola	**LC**	---	---
Plagionotus floralis	**LC**	---	---
Plagionotus bobelayei	**LC**	---	---
Plagionotus scalaris	**DD**	---	---
Isotomus comptus	**NT**	**DD**	---
I. comptus comptus	**NT**	**DD**	---
I. comptus meridionalis	**DD**	---	**YES**
Isotomus speciosus	**VU**	**LC**	---
Isotomus syriacus	**EN**	---	**YES**
Chlorophorus herbstii	**VU**	**LC**	---
Chlorophorus varius	**LC**	**LC**	---
C. varius damascenus	**LC**	---	---
C. varius varius	**LC**	**LC**	---
Chlorophorus aegyptiacus	**LC**	**DD**	---
Chlorophorus convexifrons	**VU**	**EN**	---
Chlorophorus cursor	**EN**	---	**YES**
Chlorophorus hungaricus	**LC**	---	---
Chlorophorus niehuisi	**DD**	---	**YES**
Chlorophorus oezdikmeni	**DD**	---	**YES**
Chlorophorus robustior	**LC**	---	**YES**
Chlorophorus semrae	**DD**	---	**YES**
Chlorophorus trifasciatus	**LC**	---	---
Chlorophorus gratiosus sparsus	**NT**	---	---
Chlorophorus grosseri	**DD**	---	**YES**
Chlorophorus sartor	**LC**	**LC**	---
Chlorophorus wewalkai	**VU**	---	**YES**
Chlorophorus dinae	**NT**	---	---
Chlorophorus dominici	**NT**	---	**YES**
Chlorophorus figuratus	**LC**	**LC**	---
Chlorophorus nivipictus	**LC**	---	---
Xylotrechus antilope antilope	**NT**	**LC**	---
Xylotrechus arvicola	**NT**	**LC**	---
Xylotrechus stebbingi	**EN**	---	---
Rusticoclytus rusticus	**LC**	**LC**	---
Turanoclytus ilamensis ilamensis	**EN**	---	---

Turanoclytus sieversi	**LC**	**---**	**---**
Pseudosphegesthes brunnescens	**EN**	**---**	**---**
Pseudosphegesthes longitarsus	**NT**	**---**	**YES**
Pseudosphegesthes samai	**DD**	**---**	**YES**
Clytus arietis	**LC**	**LC**	**---**
C. arietis arietis	**LC**	**LC**	**---**
C. arietis lederi	**DD**	**---**	**---**
C. arietis oblitus	**VU**	**---**	**---**
Clytus buglanicus	**DD**	**---**	**YES**
Clytus ciliciensis	**VU**	**---**	**---**
Clytus gulekanus	**EN**	**---**	**YES**
Clytus insignitus	**DD**	**---**	**YES**
Clytus kumalariensis	**DD**	**---**	**YES**
Clytus madoni	**EN**	**---**	**---**
Clytus rhamni temesiensis	**LC**	**LC**	**---**
Clytus schneideri	**EN**	**---**	**---**
C. schneideri inapicalis	**EN**	**---**	**YES**
C. schneideri schneideri	**EN**	**---**	**---**
Clytus schurmanni	**NT**	**---**	**YES**
Clytus taurusiensis	**VU**	**---**	**---**
Clytus tropicus	**DD**	**LC**	**---**
Sphegoclytus vesparum	**NE**	**---**	**---**

A CHECKLIST OF IRANIAN SCOLIIDAE (HYMENOPTERA: VESPOIDEA)

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ABSTRACT: The present work comprises a comprehensive faunistic list of the family Scoliidae (Hymenoptera) have been recorded fom Iran so far. It includes 37 species and subspecies in 8 genera (*Proscolia* Rasnitsyn, *Campsomeriella* Betrem, *Campsomeris* Guérin, *Colpa* Dufour, *Dasyscolia* Bradley, *Micromeriella* Betrem, *Megascolia* Betrem and *Scolia* Fabricius) and two subfamilies (Proscoliinae and Scoliinae). Synonymies, local and global distribution data are given.

KEY WORDS*:* Hymenoptera, Vespoidea, Scoliidae, Checklist, Iran.

Scoliidae is a small family of solitary aculeate wasps belonging to the Vespoidea. They distribute widespread in tropical and warmer temperate zones. The family Scoliidae contains about 560 valid species in 43 valid genera in currently two subfamilies: Proscoliinae and Scoliinae (Osten, 2005b), of which 69 species are present in the western Palaearctic region (Osten, 2000), but only Scoliinae in the Central Europen (Osten, 1999).

Scoloids have an importance in terms of biological control. There is a worldwide very little information on the hosts of Scoliidae (Schulten, 2007). The scoliid larvae develop as ectoparasitoids of the second and third instars coleopteran larvae (Illingworth, 1919, 1921), usually Scarabeoidea and rarely Curculionoidea inhabiting the soil. For this reason, scoliid wasps have importance in biological balance of scarabeoid and curculionid pests of field crops (Day et al., 1981; Osten, 2005a, b; Gupta & Jonathan, 2003). Additionally scoliids are pollinators of various wild plants (Özbek & Anlaş, 2011).

Studies of the scoliid fauna of Iran have been conducted by various authors, major studies are those by Betrem (1927), Esmaili & Rastegar (1974), Tkalcu (1987), Osten (2000, 2005a, b), Osten et al. (2003), Sakenin et al. (2008, 2010), Fallahzadeh & Saghaei (2010), Makhan (2012), Samin & Bagriacik (2013) and many others. The first comprehensive faunistic study of the Iranian scoliid fauna was that by Osten et al. (2003), who recorded 43 scoliid taxa from Iran and neighbouring areas, of which 32 species were reported from Iran alone; several taxonomic problems were presented and solved in this study, in addition to dealing with the co-evolution and biology of scoliids and their hosts. The present study is a compilation of previous records of scoliid species from the fauna of Iran, using all available literatures.

MATERIALS AND METHODS

The published data on Scoliidae family in Iran was summarized in this paper. All the published records with provincial distribution are given together with synonyms and general distribution. Classification, nomenclature and distribution data of Scoliidae suggested by Osten (2000, 2005a, b) and Fauna Europaea Web Service (2004) have been followed.

RESULTS

In the present study, a total of 37 scoliid species and subspecies in 8 genera and two subfamilies are recorded as the fauna of Iran.

Subfamily Proscoliinae Rasnitsyn, 1977
Genus *Proscolia* Rasnitsyn, 1977
Proscolia archaica Rasnitsyn, 1977

Distribution in Iran: East Azarbaijan (Osten et al., 2003).
Distribution outside Iran: Armenia (Day et al., 1981; Osten & Özbek, 1999), Arazdayan near the Turkish-Iranian border, the river Aras (Osten & Özbek, 1999).

Subfamily Scoliinae Latreille, 1802
Tribe Campsomerini (Osten, 2001)
Genus *Campsomeriella* Betrem, 1941
Campsomeriella thoracica thoracica (Fabricius, 1787)

Scolia thoracica Fabricius, 1787. *Scolia thoracica eriophora* Klug, 1832 (Osten, 2000; Osten et al., 2003).
Distribution In Iran: Alborz (Chahartaghi et al., 2002b), Bushehr, Hormozgan (Betrem, 1927; Osten et al,. 2003), Golestan, Guilan, Khuzestan, Lorestan, Sistan & Baluchestan (Osten et al., 2003), East Azarbaijan (Samin & Bagriacik, 2013), Fars (Fallahzadeh & Saghaei, 2010), Kerman (Steinberg, 1962; Osten et al., 2003), Tehran (Chahartaghi Abineh, 2002; Osten et al,. 2003).
Distribution outside Iran: Afghanistan, Crete, Cyprus, Dodecanese Is., Iraq, Jordan, Italy, Malta, North Aegean Is., North Africa (Morocco, Egypt), Spain, Syria (Osten, 2000), Greece (Osten, 2000; Osten & Arens, 2004), Oman (Osten, 2005c), Saudi Arabia (Gadallah, 2004), Turkey (Osten & Özbek, 1999; Osten, 2000; Özbek & Anlaş, 2007), UAE (Schulten, 2007). Distributed from Morocco to Iran and from southern Spain through southern Italy, southern Greece to Turkey, one of the most common scoliid wasps in Israel throughout the whole year (Osten, 2002).

Genus *Campsomeris* Guérin, 1838
Campsomeris sp.

Distribution in Iran: Iran (no locality cited) (Esmaili & Rastegar, 1974).

Genus *Colpa* Dufour, 1841
Colpa (*Colpa*) *klugii* (Van der Liden, 1827)

Scolia klugii Van der Linden, 1827.
Distribution in Iran: Guilan, Hormozgan (Osten et al., 2003), Iran (no locality cited) (Osten, 2000).
Distribution outside Iran: Albania, Balkans, Croatia, Pakistan, Portugal, Ukrain (Osten, 2000), Greece (Osten, 2000; Osten & Arens, 2004), Turkey (Madl, 1997; Osten & Özbek, 1999; Osten, 2000; Anlaş & Çevik, 2004; Tezcan et al., 2004; Özbek & Anlaş, 2007, 2011).

Colpa (*Crioscolia*) *moricei* (Saunders, 1901)

Scolia (*Trielis*) *moricei* Saunders, 1901.
Distribution in Iran: Sistan & Baluchestan (Osten et al., 2003; Osten, 2002, 2005a).
Distribution outside Iran: Afghanistan (Osten, 2005a), Algeria, Israel (Osten, 2000, 2002, 2005a), Egypt, Turkey (Osten, 2000), Tajikistan (Osten, 2002; 2005a), Turkmenistan (Steinberg, 1962; Osten, 2000, 2002, 2005a).

Colpa (*Colpa*) *sexmaculata* (Fabricius, 1781)

Scolia interrupta Fabricius, 1782; *S. sareptana* Eversmann, 1849.
Distribution in Iran: Ardabil (Samin & Bagriacik, 2013), East Azarbaijan (Sakenin et al., 2008; Samin & Bagriacik, 2013), West Azarbaijan (Sakenin et al., 2010; Samin & Bagriacik, 2013).
Distribution outside Iran: Azerbeidjan (Steinberg, 1962), Central Europe, North Africa. Portugal to Balkan and Turkey to Southern Russia (Osten, 2000), Czech Republic, Slovakia (Bogusch, 2007), Greece (Osten & Arens, 2004; Shedl, 2010), Turkey (Tezcan et al., 2004).

Colpa (*Heterelis*) *quinquecincta* (Fabricius, 1793)

Scolia quinqecincta Fabricius, 1793; *Tiphia villosa* Fabricius, 1793; *Colpa continua* Lepelletier, 1845; *Elis villosa* Saussure & Sichel, 1964.
Distribution in Iran: Alborz, East Azarbaijan (Steinberg, 1962; Osten et al., 2003), Fars, Tehran (Osten et al., 2003), Golestan, Kerman (Osten et al., 2003 under *C.* (*Heterelis*) *quinquecincta* and *C.* (*Heterelis*) *quinquecincta quinquecincta* f. *abdominalis* (Spinola, 1806)), Khorasan (Osten et al., 2003 under *C.* (*Heterelis*) *quinquecincta quinquecincta* f. *abdominalis*), Mazandaran (Osten et al., 2003; Samin & Bagriacik, 2013), Kordestan (Sakenin et al., 2010), Sistan and Baluchestan (Osten et al., 2003 under *Colpa* (*Heterelis*) *quinquecincta rudaba* (Kirby, 1889)), Iran (no locality cited) (Osten, 2005a).
Distribution outside Iran: Afghanistan, Armenia (Osten et al., 2003), Greece (Osten & Arens, 2004; Schedl, 2010), Kazakhstan, Kirgizstan, Tajikistan, Turkmenistan (Osten, 2005a), Israel, Morocco, Portugal, the Balkans, Ukraine (Osten, 2000), Slovakia (Bogusch, 2007), South Europe except Iberian Peninsula (Tüzün, 2004), Turkey (Madl, 1997; Osten & Özbek, 1999; Tüzün & Bağriaçik, 2000; Tüzün, 2004; Anlaş & Çevik, 2004; Tezcan et al., 2004; Osten, 2005a; Japoshvili & Karaca, 2010; Özbek & Anlaş, 2007, 2011).
Comments: This form was considered the synonym of *C. quinquecincta armeniaca* Steinberg, 1962 and *C. quinquecincta rudaba* (Kirby, 1889) by (Osten, 2000, 2005b).

Colpa (*Heterelis*) *quinquecincta* f. *abdominalis* (Spinola, 1806)

Scolia abdominalis Spinola, 1806; *Campsoscolia* (*Campsoscolia*) *armeniaca* Steinberg, 1962.
Distribution in Iran: Golestan, Kerman, Khorasan, Tehran (Tkalcu, 1987 as *C. qu. rudaba*).
Distribution outside Iran: Azerbaijan, Turkmenistan (Steinberg, 1962), Mediterranean region to Israel (Osten, 2000), Greece (Osten & Arens, 2004), Turkey (Madl, 1997; Osten & Özbek, 1999). Widespread in the eastern Mediterranean region to Iran and Turkmenistan, southern Italy, Israel (Osten, 2002).

Colpa (*Heterelis*) *quinquecincta rudaba* (Kirby, 1889)

Elis rudaba Kirby, 1889; Misidentified as *Campsomeris erigone* Bingham, 1897 (Tkalcu, 1987).
Distribution in Iran: Sistan and Baluchestan (Osten et al., 2003).
Distribution outside Iran: Pakistan (Osten, 2000)

Genus *Dasyscolia* Bradley, 1951

Dasyscolia ciliata araratica (Radoskovsky, 1890)

Tiphia ciliata Fabricius, 1787 [nominotypical subspecies]. *Dielis araratica* Radoskovsky, 1890 (Osten, 2000; Osten et al., 2003).
Distribution in Iran: Alborz (Chahartaghi et al., 2002b), Ardabil (Sakenin et al., 2010), Chaharmahal and Bakhtiari, Isfahan (Osten et al., 2003), Fars (Osten et al., 2003; Fallahzadeh & Saghaei, 2010), Golestan, Hamadan, Khorasan, Khuzestan, Mazandaran (Steinberg, 1962; Osten et al., 2003), Tehran (Chahartaghi Abineh, 2002; Osten et al., 2003), Iran (no locality cited) (Esmaili & Rastegar, 1974).
Distribution outside Iran: Greece (Osten & Arens 2004), Israel (Bodenheimer, 1937 as *Dasyscolia araratica*; Osten, 2000, 2002), Turkey (Bradley, 1950; Osten & Özbek, 1999; Osten, 2000, 2002; Anlaş & Çevik, 2004; Tezcan et al. 2004; Özbek & Anlaş, 2007, 2011).

***Dasyscolia ciliata ciliata* (Fabricius, 1787)**

Tiphia ciliata Fabricius, 1787 [nominotypical subspecies]. *Scolia aurea* Fabricius, 1793. *Colpa rufa* Lepeletier, 1845 (Osten, 2005b).
Distribution in Iran: Fars (Fallahzadeh & Saghaei, 2010).
Distribution outside Iran: Balearic Is., Greece, Malta, North Africa (Egypt, Morocco), Portugal, Spain (Osten & Arens, 2004).

Genus *Micromeriella* Betrem, 1972
***Micromeriella aureola aureola* (Klug, 1832)**

Scolia aureola Klug 1832. *Scolia fasciatella* Gerstaecker, 1862.
Distribution in Iran: Hormozgan, Sistan and Baluchestan (Osten et al., 2003).
Distribution outside Iran: Oman (Osten, 2005c), Saudi Arabia (Gadallah, 2004), Sudan, Morocco and Canary Island (Osten, 2000), UAE (Schulten, 2007 as *Lobhargita aureola aureola*). This subspecies is rather common in the Sahel area of the Afrotropical region, the Palaearctic area, and the Arabian Peninsula (Schulten, 2007 as *Lobhargita aureola aureola*).

***Micromeriella hyalina angulata* (Morawitz, 1888)**

Dielis angulata Morawitz, 1888. *Campsomeris angulata* (Morowitz, 1888) (in Steinberg, 1962).
Distribution in Iran: Bushehr, East Azarbaijan, Fars, Hormozgan, Kerman, Khorasan, Sistan and Baluchestan (Steinberg, 1962; Osten et al., 2003), Iran (no locality cited) (Osten, 2000).
Distribution outside Iran: Afghanistan, Pakistan (Osten et al., 2003), Israel (Osten, 2000, 2002), Kazakhstan, Uzbekhistan (Osten, 2005a), Turkmenistan (Osten, 2000, 2002; Osten et al., 2003), Turkey (Osten & Özbek, 1999; Özbek & Anlaş, 2011).

Tribe Scoliini Osten, 2001
Genus *Megascolia* Betrem, 1928
***Megascolia bidens* (Linnaeus, 1767)**

Sphex bidens (Linnaeus, 1767).
Distribution in Iran: East Azarbaijan (Sakenin et al., 2010), Mazandaran, Semnan, West Azarbaijan (Samin & Bagriacik, 2013).
Distribution outside Iran: Balearic Islands, Dodecanese Islands, Portugal, Near East (including Asian Turkey, Georgia, Armenia, Azerbaijan, Lebanon, Russia, Syria, Israel, Jordan, Arabian Peninsula, Iraq), North Africa, Israel (Bodenheimer, 1937; Osten, 2002), Algeria, Morocco, Tunisia (Osten, 2002).

***Megascolia* (*Regiscolia*) *maculata maculata* (Drury, 1773)**

Sphex maculata Drury, 1773. *Scolia flavifrons* (Fabricius, 1775). *Triscolia flavifrons haemorrhoidalis* Fabricius, 1787. *Scolia haemorrhoidalis* Eversmann, 1849. *Scolia* (*Lacosi*) *versicolor* Saussure, 1859.
Distribution in Iran: Bushehr, Isfahan, Guilan, Hormozgan, Khuzestan, Lorestan, Sistan and Baluchestan (Osten et al., 2003), East Azarbaijan (Sakenin et al., 2010), Fars (Osten et al., 2003; Fallahzadeh & Saghaei, 2010), Golestan (Tkalcu, 1987; Osten et al., 2003), Mazandaran (Osten et al., 2003; Samin & Bagriacik, 2013), Semnan (Makhan, 2012), Tehran (Chahartaghi Abineh, 2002; Osten et al., 2003), Iran (no locality cited) (Esmaili & Rastegar, 1974 as *M. flavifrons haemerrhoidalis*).
Distribution outside Iran: Entire Mediterranean region, ranging from France to Greece, Eastern Mediterrenean to Turkmenistan (Osten, 2000). Albania, Austria, Bosnia and Herzegovina, Bulgaria, Crete, Croatia, Cyclades Is., Dodecanese Is., France, Iraq, Hungary, Macedonia, North Africa, Romania, Russia South, Turkmenistan, Slovenia, Czech Republic (Bogusch et al., 2011), South parts of the Mediterranean region, South European subspecies reaches Central Europe, Turkey to Central Asia (Macek et al., 2010), Greece (Osten & Arens, 2004; Schedl, 2010), Israel (Bodenheimer, 1937 as *Megascolia flavifrons haemerrhoidalis*; Osten, 2002), Italy (Schedl, 2007), Slovakia (Bogusch, 2007), Turkey (Tkalcu, 1987; Madl, 1997; Osten & Özbek, 1999; Osten, 2000; Anlaş & Çevik, 2004; Tezcan et al., 2004; Japoshvili & Karaca, 2010; Özbek & Anlaş, 2007, 2011).

Megascolia (Regiscolia) rubida **(Gribodo, 1893)**

Triscolia haemorrhoidalis var. *rubida* Gribodo 1893; *Scolia insignis* Saussure, 1858.
Distribution in Iran: Iran (no locality cited) (Steinberg, 1962; Osten et al., 2003), Iran (no locality cited) (Osten, 2000).
Distribution outside Iran: Afghanistan (Osten, 2000; Osten et al., 2003), India (Kumar, 2012), Kazakhstan (Osten et al., 2003), Kirgizstan, Uzbekistan (Osten, 2005a; Osten et al., 2003), Pakistan (Osten et al., 2003; Kumar, 2012), Tadzikistan (Osten, 2005a), Turkmenistan (Osten, 2000; Kumar, 2012).

Genus *Scolia* Fabricius, 1775

Scolia* (*Scolia*) *aenigmatica **Betrem, 1928**

Distribution in Iran: Khorasan (Steinberg, 1962), Qazvin (Osten et al., 2003), Tehran (Osten, 2005a), Iran (no locality cited) (Betrem, 1935; Osten, 2005a).
Distribution outside Iran: Afghanistan, Pakistan, Turkmenistan (Osten, 2005a; Osten et al., 2003), Azerbeidjan, Iraq, Tadzhikistan, Uzbekhistan (Osten, 2005a), Turkey (Osten, 2000; Özbek & Anlaş, 2007).

Scolia* (*Scolia*) *aenigmatica mesopotamica **Betrem, 1935**

Distribution in Iran: East Azarbaijan, Golestan, Mazandaran (Steinberg, 1962; Osten et al., 2003).
Distribution outside Iran: Iraq (Osten et al., 2003), Mesopotamia, Transcaucasia (Betrem, 1935).

Scolia* (*Discolia*) *affinis **Guérin, 1838**

Scolia affinis Guérin, 1838. *Scolia* (*Lacosi*) *jurinei* Saussure, 1855. *Scolia* (*Discolia*) *aureipennis* Lepeletier: Saussure & Sichel, 1864. *Scolia* (*Scolia*) *aureipennis* Lepeletier: Betrem, 1928; *Scolia* (*Discolia*) *jurinei* Saussure: Betrem & Bradley, 1964; *Scolia jurinei* Saussure: Bradley, 1974.
Distribution in Iran: Isfahan, Semnan (Samin & Bagriacik, 2013).
Distribution outside Iran: Ranges from Sri Lanka north through India and Bangladesh and eastward into Southeast Asia (Krombein, 1978), Bangladesh, India, Myanmar, Nepal, Pakistan (Kumar, 2012).

Scolia* (*Scolia*) *anatoliae **Osten, 2004**

Scolia (*Scolia*) *anatoliae* Osten 2004: 204-208. *Scolia boeberi* Klug, 1805. *Scolia erythrocephala boeberi* Klug, 180. *Scolia eiythrocephala infuscata* (Klug 1832). *Scolia kasakhstanica* (Steinberg, 1962).
Distribution in Iran: Fars (Fallahzadeh & Saghaei, 2010), Tehran (Osten et al., 2003 as *Scolia* (*Scolia*) *boeberi* Klug, 1805; Osten, 2004; Osten, 2005a).
Distribution outside Iran: Crete, Dodecanese Is., Kasakhstan, Kirgistan, Syria, Turkey, Turkmenistan, Uzbekistan (Osten & Özbek, 1999; Osten, 2004; Özbek & Anlaş, 2007, 2011).

Scolia* (*Scolia*) *asiella **Betrem, 1935**

Distribution in Iran: Golestan, Sistan and Baluchestan (Osten et al., 2003), Iran (no locality cited) (Osten, 2000).
Distribution outside Iran: Armenia (Osten et al., 2003), Greece (Osten & Arens, 2004), Turkey (Betrem, 1935; Osten & Özbek, 1999; Osten, 2000; Anlaş & Çevik, 2004; Tezcan et al., 2004; Özbek & Anlaş, 2007, 2011).

Scolia* (*Scolia*) *boeberi **Klug, 1805**

? *Elis* (*Trielis*) *fedtschenki* Saussure, 1880. ? *Scolia dejiani ksakhstanica* Steinberg, 1962.
Distribution in Iran: Tehran (Osten et al., 2003).
Distributionoutside Iran: Crete, Rhodes, Turkey to Uzbekistan (Osten, 2000), Greece (Schedl, 2010; Osten & Arens, 2004), Turkey (Osten et al., 2003), Turkmenistan (Betrem, 1935).

Scolia* (*Scolia*) *concolor **Eversmann, 1849**

Scolia incana Nagy, 1970.

Distribution in Iran: Kerman (Steinberg, 1962; Osten, 2005a), Khorasan (Osten et al., 2003).
Distribution outside Iran: China, Kasakhstan, Kyrgyzstan, Tadzhikistan (Nagy & Rumania, 1970; Osten, 2005a), Mongolia (Nagy & Rumania, 1970), Turkmenistan, Uzbekistan (Steinberg, 1962; Nagy & Rumania, 1970; Osten, 2005a), Turkey (Özbek & Anlaş, 2007).

Scolia erivanensis Radoskovski, 1879

Distribution in Iran: Alborz (Esmaili & Rastegar, 1974), East Azarbaijan (Osten et al., 2003).
Distribution outside Iran: Armenia (Osten, 2000; Osten et al., 2003), Turkey (Osten & Özbek, 1999; Osten, 2000; Osten et al., 2003).

Scolia (Scolia) erythrocephala barbariae Betrem, 1935

Distribution in Iran: East Azarbaijan, Khorasan (Osten et al., 2003).
Distribution outside Iran: Algeira (Betrem, 1935), Greece (Osten, 2000; Osten & Arens, 2004; Schedl, 2010), Israel (Osten, 2002), Marocco (Betrem, 1935; Osten, 2000), Tunusia (Betrem, 1935; Osten, 2000), Turkey (Osten & Özbek, 1999; Osten, 2000; Özbek & Anlaş, 2007, 2011).

Scolia (Scolia) fallax Eversmann, 1849

Scolia galbula (Pallas, 1771) (Misidentification by Betrem, 1935; Steinberg, 1962; Osten et al., 2003); *Scolia syriacola* Betrem, 1935. *Scolia moreana* Muche, 1962. *Scolia tricolor* Bradley, 1972. *Scolia popovi* Steinberg, 1962.
Distribution in Iran: Alborz (Chahartaghi et al., 2002a), East Azarbaijan (Osten et al., 2003; Sakenin et al., 2008), Golestan, Kordestan (Osten et al., 2003), Fars (Osten et al., 2003; Fallahzadeh & Saghaei, 2010), Mazandaran (Samin & Bagriacik, 2013), Tehran (Chahartaghi Abineh, 2002; Osten et al., 2003), West Azarbaijan (Sakenin et al., 2010), Iran (no locality cited) (Osten, 2005a).
Distribution outside Iran: Eastern Mediterranean region to Turkmenistan (Osten, 2000). Bulgaria, Cyprus, Israel, from Ukraine to Urals (Osten, 1999; Tüzün, 2004), Armenia (Osten, 1999; Osten et al., 2003; Tüzün, 2004), Azerbaijan (Osten et al., 2003; Osten, 2005a), Georgia, Turkmenistan (Osten, 2005a), Greece (Osten, 1999; Osten & Arens, 2004; Tüzün, 2004), Israel (Osten, 1999, 2002), Turkey (Madl, 1997; Osten & Özbek, 1999; Osten et al., 2003; Tüzün, 2004; Anlaş & Çevik, 2004; Tezcan et al., 2004; Özbek & Anlaş, 2007, 2011).

Scolia (Scolia) flaviceps flaviceps Eversmann, 1846

Scolia erythrocephala flaviceps Eversmann, 1846.
Distribution in Iran: East Azarbaijan (Osten et al. 2003; Samin & Bagriacik, 2013), Fars, (Fallahzadeh & Saghaei, 2010; Osten et al., 2003), Golestan, Guilan, Hormozgan, Mazandaran (Osten et al., 2003), Tehran (Chahartaghi Abineh, 2002; Osten et al., 2003).
Distribution outside Iran: Crete, Iraq, Tadzikhistan, Turkmenistan, Uzbekistan, Central Asia, Cyprus, Transcaucasia (Osten, 1999), Greece (Osten & Arens, 2004; Schedl, 2010), Ranges from southern France, Italy, the Balkan, until the eastern Mediterranean Region including Egypt to the Caspian Sea (Osten, 2000), Turkey (Madl, 1997; Osten & Özbek, 1999; Osten, 2000, 2004; Özbek & Anlaş, 2011), Turkmenistan (Osten, 2004).

Scolia (Scolia) flaviceps mangichlakensis Radoskovsky, 1879

Scolia flaviceps var. *mangichlakensis* (Radoskovsky, 1879). *Scolia mangichlakensis* Radoskovsky, 1879.
Distribution in Iran: Golestan, Khorasan, Sistan and Baluchestan (Osten et al., 2003), Iran (no locality cited) (Osten, 2005a).
Distribution outside Iran: Cyprus, Daghestan, Kasakhstan, Turkmenistan (Osten, 2000, 2005a), Iraq, Jordan, Syria (Osten, 1999), Israel (Osten, 1999, 2000, 2002, 2005a), Turkey (Osten 1999; Osten, 2000, 2005a).

***Scolia* (*Scolia*) *flaviceps quettaensis* (Cameron, 1908)**

Scolia quettaensis Cameron, 1908. *Scolia erythrocephala schmidti* Betrem 1928. *Scolia erythrocephala quettaensis* (Cameron, 1908).

Distribution in Iran: Bushehr, Hormozgan, Kerman, Khorasan, Khuzestan, Sistan and Baluchestan (Osten et al., 2003), Fars (Steinberg, 1962), Southern Iran (no locality cited) (Osten, 2000).

Distribution outside Iran: Afghanistan, Iraq, UAE (Osten et al., 2003), Oman (Osten, 2005c), Pakistan (Osten, 2000, 2002), Saudi Arabia (Gadallah, 2004).

***Scolia* (*Scolia*) *fuciformis* (Scopoli, 1786)**

Scolia insubrica Scopoli, 1786. *S. amabilis* Eversmann, 1849.

Distribution in Iran: Alborz (Chahartaghi et al., 2002a), Khuzestan (Sakenin et al., 2008), West Azarbaijan (Sakenin et al., 2010). Fars, Golestan (Osten et al., 2003), Iran (no locality cited) (Esmaili & Rastegar, 1974 under *Scolia* (*Scolia*) *insubrica* Scopoli, 1786).

Distribution outside Iran: The Balkans, Egypt, Italy (Osten, 2000, 2002; Tüzün, 2004), East Mediterranean Region, South France, Turkey to the Caspian Sea (Osten, 2000, 2002), Greece (Osten & Arens, 2004), Turkey (Osten & Özbek, 1999; Tüzün, 2004; Tezcan et al., 2004; Özbek & Anlaş, 2007, 2011).

***Scolia* (*Scolia*) *galbula* (Pallas, 1771)**

Vespa galbula Pallas, 1771. *Vespa tricolor* Pallas, 1771. *Scolia quadricincta* Scopoli, 1786. *Scolia bifasciata* Rossi, 1790. *Scolia dejeani dejiani* Linden, 1829. *Scolia trifasciata* Vogrin, 1954. *Scolia moreana elisabethae* Muche, 1962. *Discolia kugleri* Nagy, 1979.

Distribution in Iran: Alborz (Chahartaghi et al., 2002a), East Azarbaijan (Sakenin et al., 2008), Fars, Mazandaran, Tehran (Osten et al., 2003), Kermanshah (Osten et al., 2003; Sakenin et al., 2010), North western Iran (Osten, 2005a).

Distribution outside Iran: Azerbaijan, Georgia, Transcaucasia (Osten, 2005a), France, Italy, former Yugoslavia, Hungary, Ukraine, Bulgaria, Cyprus, Caucasus, Egypt (Osten, 1999; Tüzün, 2004), Greece (Osten, 1999; Tüzün, 2004; Osten & Arens, 2004; Schedl, 2010), Israel (Osten, 2002), Turkey (Hamon, 1993 as *S. moreana elisabethae*; Osten & Özbek, 1999; Osten, 1999, 2000; Anlaş & Çevik, 2004; Tüzün, 2004; Tezcan et al. 2004; Özbek & Anlaş, 2007, 2011).

***Scolia* (*Discolia*) *hirta hirta* (Schrank, 1781)**

Apis hirta Schrank, 1781. *Sphex bicincta* Scopoli, 1786. *Scolia cincta* Klug, 1805. *Scolia alulus* Nagy, 1967. *Scolia mongolina* Nagy, 1970.

Distribution in Iran: East Azarbaijan (Steinberg, 1962), Golestan (Betrem, 1935; Steinberg, 1962; Osten et al., 2003), Guilan, West Azarbaijan (Samin & Bagriacik, 2013), Khorasan, Mazandaran, Tehran (Betrem, 1935; Osten et al., 2003), Iran (no locality cited) (Betrem, 1935; Esmaili & Rastegar, 1974).

Distribution outside Iran: Entire Mediterranean region, western Palaearctic from Germany, Poland, Sweden (Osten, 2000), South and East Europa, a part of Middle Europa, North Africa, Kazakhstan, Lebanon, Turkmenistan, South Russia, Ukraine. From Portugal to Kazakhstan and Siberia (Osten, 1994, 1997), Czech Republic, Slovakia (Bogusch, 2007), Greece (Osten & Arens, 2004; Schedl, 2010), Israel, Jordan (Osten, 2002), Italy (Schedl, 2007), Turkey (Osten & Özbek, 1999; Tüzün & Bağriaçik, 2000; Anlaş & Çevik 2004; Tüzün, 2004; Tezcan et al., 2004; Japoshvili & Karaca, 2010; Özbek & Anlaş, 2007, 2011).

***Scolia* (*Scolia*) *persica* Betrem, 1935**

Distribution in Iran: Bushehr (Osten et al., 2003), Iran (no locality cited) (Betrem, 1935).

Distribution outside Iran: Endemic to Iran (Betrem, 1935; Osten et al., 2003).

***Scolia* (*Scolia*) *popovi* Steinberg, 1962**

Distribution in Iran: Sistan and Baluchestan (Steinberg, 1962), Iran (no locality cited) (Osten et al., 2003; Osten, 2005a).

Distribution outside Iran: Turkmenistan (Steinberg, 1962; Osten, 2005a).

***Scolia* (*Scolia*) *sexmaculata sexmaculata* (O. F. Müller, 1766)**

Vespa sexmaculata O. F. Müller, 1766. *Scolia quadripunctata* Fabricius, 1775. *Scolia biguttata* Fabricius, 1787. *Scolia violacea* Panzer, 1799. *Scolia syriaca* Klug, 1832. *Scolia hispanica* Betrem, 1935. *Scolia beiruti* Betrem, 1935. *Scolia montana* Steinberg, 1962. *Scolia dionysopolis* Tkalcu, 1988.

Distribution in Iran: Alborz (Esmaili & Rastegar, 1974; Osten et al., 2003), East Azarbaijan (Osten et al., 2003; Samin & Bagriacik, 2013), Golestan, Khorasan, Kordestan, Markazi, Mazandaran, Qom (Osten et al., 2003), Fars, (Fallahzadeh & Saghaei, 2010), Tehran (Chahartaghi Abineh, 2002; Osten et al., 2003), West Azarbaijan (Samin & Bagriacik, 2013).

Distribution outside Iran: Albania, Andorra, Austria, Balearic Is., Bosnia and Herzegovina, Bulgaria, Channel Is., Corsica, Croatia, Cyclades Is., France, Kazakhstan, Kyrgyzstan, Hungary, Macedonia, Malta, Moldova, North Aegean Is., North Africa, Portugal, Romania, Russia Central, Russia East, Russia South, Slovakia, Slovenia, Spain, Switzerland, Turkmenistan, Ukraine, former Yugoslavia. Common in the Mediterranean Region, Germany, England (Isle of Wight) (Osten, 2000), Czech Republic (Macek et al., 2010; Bogusch et al., 2011), Greece (Osten & Arens, 2004; Schedl, 2010), Israel (Osten, 2002), Italy (Schedl, 2007), South and Central Europe, Middle East (Macek et al., 2010), Turkey (Madl, 1997; Osten & Özbek, 1999; Tüzün & Bağrıaçık, 2000; Anlaş & Çevik, 2004; Tezcan et al., 2004; Tüzün, 2004; Japoshvili & Karaca, 2010; Macek et al., 2010; Özbek & Anlaş, 2007, 2011).

***Scolia* (*Scolia*) *sexmaculata orientalis* (Steinberg, 1962)**

Scolia quadripunctata orientalis Steinberg, 1962. *Scolia sexmaculata steinbergi* Betrem, 1964: Betrem & Bradley, 1964.

Distribution in Iran: Fars (Osten et al., 2003; Fallahzadeh & Saghaei, 2010), Guilan (Osten et al., 2003), Tehran (Chahartaghi Abineh, 2002), Iran (no locality cited) (Osten, 2005a).

Distribution outside Iran: Georgia, Turkmenistan (Steinberg, 1962; Osten, 2005a).

***Scolia* (*Scolia*) *sinensis* Saussure, 1846**

Scolia indica Uchida, 1925.

Distribution in Iran: Iran (no locality cited) (Osten, 2005a).

Distribution outside Iran: China, Korea (Osten, 2005a; Kumar, 2012), India, Tajikistan (Kumar, 2012), Pakistan (Steinberg, 1962; Osten, 2005a; Kumar, 2012), Turkmenistan, Uzbekistan (Steinberg, 1962; Osten, 2005a).

***Scolia* (*Discolia*) *turkestanica* Betrem, 1935**

Scolia vollenhoveni Saussure, 1880.

Distribution in Iran: Alborz (Chahartaghi et al., 2002a), Bushehr, Fars, Golestan, Hormozgan, Kerman (Steinberg, 1962; Osten et al., 2003), Sistan and Baluchestan (Betrem, 1935; Steinberg, 1962; Osten et al., 2003; Osten, 2005a).

Distribution outside Iran: Armenia, Iraq (Osten et al., 2003), Kirgistan, Tadzhikistan (Osten, 2005a), Turkey (Osten & Özbek, 1999; Osten et al., 2003; Osten, 2005a; Özbek & Anlaş, 2007, 2011), Turkmenistan, Uzbekistan (Osten et al., 2003; Osten, 2005a).

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AN APPROVAL FOR ACCEPTION AS A SEPARATE SPECIES OF *PURPURICENUS NUDICOLLIS* DEMELT, 1968 (COLEOPTERA: CERAMBYCIDAE)

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[Özdikmen, H., Cihan, N. & Kaya, G. 2014. An approval for acception as a separate species of *Purpuricenus nudicollis* Demelt, 1968 (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 9 (2): 724-726**]**

ABSTRACT: In this study, *Purpuricenus nudicollis* Demelt, 1968 is upgraded the species rank.

KEY WORDS: *Purpuricenus nudicollis, Purpuricenus interscapillatus*, Cerambycidae, Cerambycinae, Turkey.

It has been accepted commonly that the species, *P. interscapillatus* Plavilstshikov, 1937 has two subspecies as the nominative *P. interscapillatus interscapillatus* Plavilstshikov, 1937 and the other *P. interscapillatus nudicollis* Demelt, 1968 (e.g. Löbl & Smetana, 2010).

Known distribution patterns of the subspecies, however, are overlapped at least in Turkey. The nominative subspecies, *P. interscapillatus interscapillatus* is distributed in Turkey, Cyprus, Syria, Lebanon and Israel. The other subspecies, *P. interscapillatus nudicollis* is distributed only in Turkey and Cyprus (Sama & Makris, 2001; Löbl & Smetana, 2010).

The subspecies should be having hybridization areas at least in Turkey and Cyprus naturally. But this case has more complexities from expected result. Since, the nominative subspecies, *P. interscapillatus interscapillatus* has been recorded from Adana, Hatay, İçel, Kahramanmaraş, Niğde and Osmaniye provinces, while the subspecies, *P. interscapillatus nudicollis* has been reported from Adana, Antalya, Gaziantep, İçel, Kahramanmaraş, Konya, Karaman and Osmaniye provinces. So, distribution patterns of both subspecies are overlapped (Map 1, 2). Even, we collected both taxa in the same locality from Osmaniye province (see below). In this case, the theorical rule of allopatric distribution for the subspecies is void in view of the sympatric distribution of these subspecies.

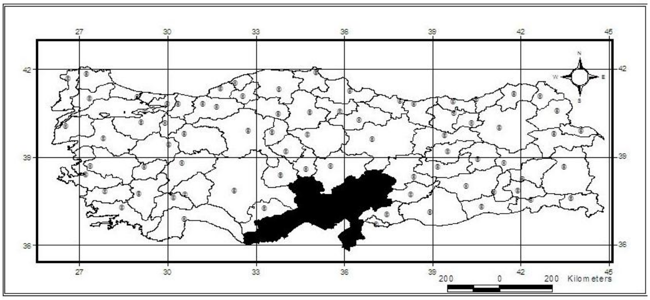
Consequently, these subspecies should be regarded as separate species. Moreover, status in Cyprus needs further investigations.

SPECIES *Purpuricenus interscapillatus* Plavilstshikov, 1937: 247 [RN]
humeralis Pic, 1891b: 23 [HN]
longevittatus Pic, 1941b: 2

The species is known only from SC and SCW Anatolia for Turkey.

Records fron Turkey: Hatay prov.: Antakya (Dörtyol), İçel prov.: Namrun (Nurdağı pass) (Sabbadini & Pesarini, 1992); Adana prov.: Pozantı (Tekir plateau), Niğde prov.: Niğde-Bor road (Okçu village), İçel prov.: Erdemli-Güzeloluk road 5th km and Mersin-Gözne road (entry of Yeniköy) (Özdikmen, 2006); Hatay prov.: Yukarı Ekinci village and Sazlık, Osmaniye prov.: Hasanbeyli (Kalecikli village), Zorkun road (Çiftmazı), Zorkun road (Karacalar village) (Özdikmen, Güven & Gören, 2010); Hatay prov., İçel prov. and Kahramanmaraş prov. (personal data).

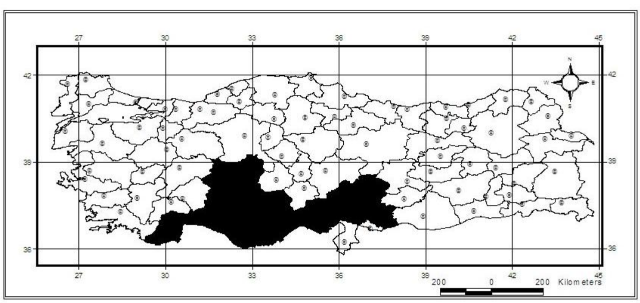
Range: Turkey, Cyprus, Syria, Lebanon, Israel.
Chorotype: E-Mediterranean (Palestino-Cyprioto-Taurian)



SPECIES *Purpuricenus nudicollis* Demelt, 1968: 65

The species is known only from SC and SCW Anatolia for Turkey.
Records from Turkey: Konya prov.: Kızılören (Sama, 1982); Antalya prov.: Korkuteli, Karaman prov.: Central (Adlbauer, 1988); İçel prov.: Erdemli (Hoskovec & Rejzek, 2003); Osmaniye prov.: Zorkun road (Karacalar village) (Özdikmen, Güven & Gören, 2010); Antalya prov.: Alanya (Dikmetaş plateau), Konya prov.: Hadim-Alanya road (Turgut & Ozdikmen, 2010). Adana prov., Gaziantep prov. and Kahramanmaraş prov. (personal data).

Range: Turkey, Cyprus.
Chorotype: E-Mediterranean (Cyprioto-Taurian)



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A REVIEW OF SOME SPECIES OF *EPOMPHALE* GIRAULT (HYMENOPTERA: EULOPHIDAE: CERANISINAE) FROM SEVERAL PARTS OF THE WORLD, WITH DESCRIPTION OF NEW SPECIES

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[**Doğanlar, M. & Doğanlar, O.** 2014. A review of some species of *Epomphale* Girault (Hymenoptera: Eulophidae: Ceranisinae) from several parts of the world, with description of new species. Munis Entomology & Zoology, 9 (2): 727-755]

ABSTRACT: Eleven species of *Epomphale* Girault (Hymenoptera: Eulophidae: Ceranisinae), 4 from the *menes* species group and 7 from the *auriventris* species group, were obtained from several parts of the world. The species are: in the *menes* species group, *E. menes* (Walker), and *E. filizinancae* n. sp. from Turkey; *E. africanensis* n. sp. from Pretoria, South Africa, and *E. kirimensis* n. sp. from Crimea, Ukraine; in the *auriventris* species group, *E. auriventris* Girault, *E. rubensteina* Girault, and *E. kemalae* n. sp. from Australia, *E. kocaki* n. sp., *E. oezdikmeni* n. sp., and *E. filizinancae* n. sp. from Turkey, *E. planitianus* (Erdös) from Ukraine. An identification key to the species of *Epomphale* from several parts of the world is provided.

KEY WORDS: Taxonomy, Eulophidae, Ceranisinae, *Epomphale*, new species, Australia, South Africa, Western Palearctic.

In Europe Walker (1839) described *Pteroptrix menes* as new species from London, England, transferred to *Ceranisus* by Graham (1959). In Australia Girault (1915) described *Epomphale* with type-species, *Epomphale auriventris* Girault, 1915, by original designation, and later he described *Epomphale rubensteina* Girault, 1934, both of them were synonymized under *Ceranisus menes* by Boucek (1988) and accepted by Triapitsyn (2005). The genus, *Epomphale*, and its species, *E. auriventris* and *E. rubensteina*, were upgraded by Doğanlar & Doğanlar (2013).

Erdös (1966) described *Ceranisus planitianus* from Hungary, and it has been recorded from several parts of the world, such as Canada, USA, Israel, Moldova, Spain (Triapitsyn & Morse, 2005); Czechoslovakia (Loomans & Van Lenteren, 1995); Turkey (Doğanlar & Triapitsyn, 2007); Ukraine (Doğanlar et al. (2011). Then, Doğanlar & Doğanlar (2013) transferred it to *Epomphale* by giving some characters.

By this work the species of genus was reviewed by adding some diagnostic characters and some of the new species were described, and the known ones were redescribed.

MATERIAL AND METHOD

Morphological terminology follows Gibson (1997). This study is based upon examination and identification of about more than 100 specimens collected from Ukraine, including Crimea, and from the southern and southeastern Anatolia (Turkey). The specimens of Australian species were sent from SARDI collections near Adelaide by Dr. Glenys Wood and Dr. Richard V. Glatz, Senior Research

Scientist, SARDI Entomology Room E112a, Waite Building, Waite Road, Urrbrae, SA, 5064 GPO Box 397, Adelaide, SA, 5001, and the specimens from Africa sent by Miss. Ros Urban in South African National Collection of Insects, ARC- Plant Protection Research Institute, Pretoria, South Africa.

Some of the studied species were slide-mounted in Canada balsam.

Photographs of diagnostic characters of the genera were taken by using Leica DM 6000 B microscope with a digital Leica DFC 295 camera attached to it. Electron micrographs were taken from uncoated specimens with a ZEISS EVO/ LS10, Bruker X Flash 6110 scanning electron microscope.

The examined specimens were deposited in the collections indicated by the following acronyms: IMRSBC, Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey, and ANIC, Australian National Insect Collection, Canberra, Australia; SANC, South African National Collection of Insects, ARC-Plant Protection Research Institute, ARC Roodeplaat West, KwaMhlanga Road, Pretoria, South Africa. Abbreviations used in the key and descriptions are: C = claval segment, and F = funicular segment.

RESULTS AND DISCUSSION

Epomphale Girault, 1915

Epomphale Girault, 1915: 211. Type-species, *Epomphale auriventris* Girault, 1915, by original designation, (synonymized under *Ceranisus* by Boucek, 1988: 733).
Epomphale Girault, upgraded by Doğanlar & Doğanlar, 2013: 495-497.

Detailed diagnosis for the genus and its redescription was given by Doğanlar & Doğanlar (2013). Some of new diagnostic characters are as follows:
Head with malar sulcus inverted Y-shaped, divided section varies from 1/4 of sulcus to about 3/4; mid lobe of mesoscutum with 2 pairs (rarely with 2+3 setae), reticulated in several aspects, varies from engraved to raised sculpture; forewing blade on lower side widely bare below marginal vein, having some admarginal setae in apical half of speculum and with a distinct bare area extending from stigma to almost tip of forewing in several shapes; setal pattern of hind wing on lower side distinct almost for each species; stigmal vein wide and sessile, its petiole almost nil or petiolate.
Biology: Larval parasitoids of various Thripidae (Terebrantia).
Distribution : Worldwide.
Below we describe the most species, including some new species of *Epomphale*, and provide an identification key for the known species of the genus.

Key to species of *Epomphale*

1. Malar sulcus with divided section short, as long as 1/4 of sulcus apically, it can be seen in slide mounted specimens (Fig. 8b), otherwise it can be supposed as straight in SEM figures (Figs. 7c, 8c).. *menes* group.............2

-- Malar sulcus divided section long, as long as 1/2 of sulcus apically, it can be seen barely (Figs. 12a; 13a).. *auriventris* group.......................5

2. Legs with femora and metasoma dark; propodeal foreman with thick ventral arm (Fig. 1d); forewing with lower side having 3 setae on hind margin of marginal vein and 4 admarginal setae on the area of speculum between stigmal and marginal vein (Figs. 3e, 4i,g); hind wing on lower side in apical half with 2 setae (Fig. 4h); total length of funicular segments as long as clava (Fig. 3b)... *E. filizinancae* **n. sp.**

-- Legs with femora and metasoma wholly lemon yellow; shape of propodeal foreman variable; lower side of forewing having speculum below marginal vein without admarginal setae (Figs. 5g,h); legs with coxae in basal half dark metallic (Fig. 6a), other parts of leg yellow, metasoma yellow; total length of funicular segments shorter than length of clava (Fig. 5c)... 3

3. Propodeal foreman with thick ventral arm (Figs. 1a,b); lower side of forewing with bare area slightly narrower apically than its width below stigmal vein (Figs. 7h,g); setal pattern of hind wing variable...4

- Propodeal foreman with narrow ventral arm (Fig. 1c); lower side of forewing with bare area distinctly narrower apically than its width below stigmal vein (Figs. 5e,g); hind wing with lower side in apical 1/4 bare, on upper side with 4 rows of setae (Figs. 5h,i)... *E. africanensis* **n. sp.**

4. Mesothoraxic spiracle overlapped by side lobe of mesoscutum (Figs. 7f,g); ventral arm of propodeal foreman bluntly pointed (Fig. 1a); hind wing with lower side having 1 rows of setae in apical half (Fig. 1j)... *E. menes* (Walker, 1839)

-- Mesothoraxic spiracle not overlapped by side lobe of mesoscutum (Fig. 8h); ventral arm of propodeal foreman sharply pointed (Fig. 1b); hind wing on lower side in apical half bare.. *E. kirimensis* **n. sp**.

5. Legs with femora and metasoma dark; forewing with lower side having below marginal vein with or without admarginal setae...6

-- Legs with femora and metasoma wholly lemon yellow; forewing with lower side having below marginal vein without admarginal setae (Fig. 9e); hind wing with 3 setae on basal part of apical half (Fig. 11f)..9

6. Forewing with lower side without admarginal setae (Fig. 9e); ventral arm of propodeal foreman bluntly pointed, ventral arm as long as width (Fig. 2c); malar sulcus with divided section narrow (Fig. 9a); hind wing on lower side in apical half with at least 2 rows of setae (Fig. 9e); in ♀ total length of funicular segments shorter than clava (Fig. 9b); in ♂ clava distinctly wider than funicular segments (Fig. 9g)...................... *E. planitianus* (Erdös, 1966)

-- Forewing with lower side with 1-3 admarginal setae (Figs. 11e, 12h, 13g); ventral arm of propodeal foreman wider than long (Figs. 2a,b,d); malar sulcus with divided section width...7

7. Forewing with lower side with 1 admarginal setae, bare area apically narrow, almost

closed (Fig. 11e); ventral arm of propodeal foreman narrow, bluntly pointed (Fig. 2d); in ♀, total length of funicular segments as long as clava (Fig. 11b); in ♂ flagellum filiform, clava as width as, but slightly longer than funicular segments (Fig. 11h).................... *E. kocaki* **n. sp.**

--- Forewing with lower side with 2-3 admarginal setae, bare area slightly narrower apically than the own width below stigmal vein (Fig. 12e); ventral arm of propodeal foreman width, sharply or bluntly pointed..8

8- Malar sulcus with divided section two branched (Fig. 12a); ventral arm of propodeal foreman width, bluntly pointed (Fig. 2a); forewing with lower side below marginal vein having with 2-3 admarginal setae far from stigmal vein (Fig. 12a); hind wing on lower side a few setae in apical half (Fig. 12f); in ♀ and ♂ funicular segments shorter than clava (Fig. 12b,h).. *E. rubensteina* Girault, 1934

-- Malar sulcus with divided section 3-branched (Fig. 13a); ventral arm of propodeal foreman width, sharply pointed (Fig. 2b); forewing with lower side below marginal vein having with 2 admarginal setae close to stigmal vein (Fig. 13f,g); hind wing on lower side in apical half bare (Fig. 13h); total length of funicular segments shorter than clava (Fig. 13b,c).. *E. oezdikmeni* **n. sp.**

9. Malar sulcus with divided section 2-branched (Fig. 14a); lower side of forewing with bare area medially narrow, apically width, with 3 setae medially (Fig. 14g); apical half of hind wing 3.5 times as long as width (Figs. 14h,e); in male total length of funicular segments as long as clava (Fig. 14b).. *E. kemalae* **n. sp.**

--Malar sulcus with divided section 3-branched (Fig. 15d); lower side of forewing with bare area width, apically narrower than the width below stigmal vein (Fig. 15g); apical half of hind wing 5 times as long as width (Figs. 15h, 16e); in both sexes total length of funicular segments shorter than clava (Fig. 15c, 16a).................................. *E. auriventris* Girault, 1915

Epomphale filizinancae **Doğanlar & Doğanlar n. sp**

(Figs. 3a-f; 4a-j)

Etymology : The name dedicated to the late Doç.. Dr. Filiz İnanç (Turkey) who has valuable contributions to the Braconidae fauna of Turkey.

Material examined: Holotype Female, (on slide), labeled: "TURKEY, Kilis, Sekili, 36°59'N, 37°41'E, 604 m, 17.iv. 2010, M. Doğanlar. Mounted in Canadian balsam, deposited in the Insect Museum of Research Station of Biological Control, Yüreğir, Adana, Turkey (IMRSBCA). **Paratype:** 3 ♂♂, same data as holotype; 1 ♂, Gaziantep, oğuzeli, Keçikuyusu Vill., 36°59'38''N, 37°37'08''E, 698 m, 28. iv. 2012, swept from pasture, M. Doğanlar; 1 ♀, Gaziantep, Akyokuş gateway, Nur Mnt., 37°09'59'' N, 37°07' 09'' E, 1100 m, 15. v. 2007, (M. Doğanlar). Mounted in Canada balsam". 1 ♂ (on slide), labeled: "TURKEY, Gaziantep Nurdağ, New Planting Area of Forest Department., 37° 09' 80'' N, 36°47' 33'' E, 505 m, 15. v. 2007, (M. Doğanlar) (all of the types are on slides, mounted in Canadian balsam, deposited in the Insect Museum of Research Station of Biological Control, Yüreğir, Adana, Turkey (IMRSBCA).

Diagnosis: Body with mesoscutum reticulated; legs with coxae, femora and metasoma dark brown; malar sulcus with divided section short, as long as 1/4 of sulcus apically, divided section turn downward; propodeal foreman with thick ventral arm; forewing with lower side having 3 setae on hind margin of marginal vein and 4 admarginal setae on the area of speculum between stigmal and marginal vein, bare area parallel sided, with two setae medially; hind wing on lower side in apical half with 2 setae; total length of funicular segments as long as clava.

Description. Female (holotype). Body black with eye red; except tibiae and tarsi black, venation brown.

Head (Figs. 3a, 4a,b). Vertexal suture widely V-shaped; frontal suture widely V-shaped; malar sulcus (Fig. 4c) with divided section short, as long as 1/4 of sulcus apically, divided section turn downward; antenna (Fig. 3b) with scape slender, about 4 x as long as wide; pedicel 2.75 x longer than wide; F1 1.7, F2 equal, 1.2 x as long as width, F1 with one sensilla; F2 2 sensilla; clava including spicula 2.5 x as long as wide, total length of funicular segments as long as clava, C1 as long as C2, C1 both with two sensilla; spicula 2/5 C2.

Mesosoma. Almost as long as metasoma; mesoscutum (Fig. 3c), and axillae with engraved reticulation, scutellum almost smooth, without metallic luster; propodeal foreman with thick ventral arm (Fig. 1d); midlobe of mesoscutum (Fig. 3c) with 2 pairs of setae; forewing (Fig. 3d,e) on upper side with a width speculum, continuing along 1/3 basal part of marginal vein; other parts uniformly covered with numerous microtrichia; on lower side having 3 setae on hind margin of marginal vein and 4 admarginal setae on the area of speculum between stigmal and marginal vein, bare area parallel sided, with two setae medially; forewing 2.3 x as long as wide; longest marginal cilia 0.22 x maximal forewing width; submarginal vein about 0.5 x marginal vein+parastigma; postmarginal vein 0.9 x as long as stigmal vein, marginal vein + parastigma 5.3 x as long as stigmal vein, the latter slightly petiolate. Hind wing on lower side in apical half with 2 setae; marginal setae at most 1.25x longer than stigmal vein; about 7.3 x as long as wide; on lower side in apical half with 2 setae, longest marginal cilia about as long as wing's maximal width.

Metasoma: Petiole about as wide as long. Ovipositor as seen Fig. 3f, occupying about 2/3 x length of metasoma, slightly exerted; ovipositor length/metatibia length ratio 4: 3.

Measurements (holotype).-Body length: 1.1 mm. Relative measurements, as length or length/width: Antenna: scape: 30/6; pedicel: 16/6; F1: 10/6; F2: 9 /7; clava: 20+4/10, C1: 10, C2: 10, spicula: 4. Forewing: 50/21; longest marginal cilia: 5. Hind wing: 60/8; longest marginal cilia: 10. Metatibia: 15; Ovipositor: 20.

Male (Figs. 4a-k) 0.9-1.0 mm. Similar to ♀ except as follows: metasoma brown, with yellowish basal spot; antennae brown, eyes black, legs brown; antennae (Figs. 4d,d_1) with scape 3.8x as long as width; pedicel 1.7x as long as width; F1 1.8 x as long as width, as long as F2; F2 petiolate apically, 1.5x as long as width; clava about 3x as long as width, including spicula, C1-C3 almost equal in length, about 0.8x as long as width; Metasoma (Fig. 4a) 1.7 x as long as width. ♂ genitalia as seen Figs. 4j,k, about 3x as long as the length between base and tip of digitus.

Comments. *Epomphale filizinancae* n. sp. is similar to *E. africanensis* n. sp., *E. menes* (Walker) and *E. kirimensis* n. sp. in having malar sulcus with divided section short, as long as 1/4 of sulcus apically. But it differs from all of them in having legs with femora and metasoma dark; forewing with lower side having 3 setae on hind margin of marginal vein and 4 admarginal setae on the area of speculum between stigmal and marginal vein (Figs. 3e, 4i,g); hind wing on lower side in apical half with 2 setae (Fig. 4h); total length of funicular segments as long as clava (Fig. 3b) (in other species legs with femora and metasoma wholly lemon yellow, at most coxae in basal half dark metallic (Fig. 6a); lower side of forewing having speculum below marginal vein without admarginal setae (Figs. 5g,h); total length of funicular segments shorter than length of clava (Fig. 5c).

Hosts.-Unknown.

Distribution: TURKEY, Kilis, Sekili; Gaziantep, oğuzeli, Keçikuyusu vill., Akyokuş gateway, Nur Mnt., Nurdağ, New Planting Area of Forest Department.

Epomphale africanensis Doğanlar & Doğanlar n. sp.

(Figs. 5a-h)

Etymology: The name is derived from the name of the continent where the specimens were collected.

Material examined: Holotype, Female, South Africa: ECape Addo, 23 33 N, 25 41 E, c 100 m, 30. v. 1996, ex flowers of *Delairea odorata*, DEL 2.15 leg. Grobbelaar, Neser & Neser (SANC Pretoria, Database No: HYMCO 1130). Paratypes: 3 ♀♀, same data as holotype. All of the types are deposited in South African National Collection of Insects, ARC- Plant Protection Research Institute, Pretoria, South Africa.

Diagnosis: Body with mesoscutum reticulated; malar sulcus split, Y-shaped, divided section short, as long as 1/4 of sulcus apically; propodeal foreman with narrow ventral arm; legs with femora and metasoma wholly lemon yellow; lower side of forewing having speculum below marginal vein without admarginal setae, bare area distinctly narrower apically than its width below stigmal vein; legs with coxae in basal half dark metallic (Fig. 2c), other parts of leg yellow, metasoma yellow; hind wing with lower side in apical 1/4 bare, on upper side with 4 rows of setae; total length of funicular segments shorter than clava.

Description. Female. Body bicolor: head and mesosoma black; metasoma yellow; antennae and legs pale yellow, but coxae basally light brown; eye reddish brown; wings hyaline, venation pale yellow.

Head. Vertexal suture straight behind hind ocelli; frontal suture widely V-shaped. Malar sulcus split, Y-shaped, divided section short, as long as 1/4 of sulcus apically (Fig. 5b).

Antenna (Fig. 5c) with scape slender, about 6 x as long as wide; pedicel 2.5 x longer than wide; F1 almost equal to F2, 1.5x as long as width, with one long sensilla; clava much wider than F2, about 2.25x as wide as F2, 1.8x as long as total length of funicular segments, including spicula 2.44 x as long as wide, C1 as long as C2, C1 with two sensilla; C2 with three sensilla; spicula 1/3 C2.

Mesosoma (Fig. 5a). Almost as long as metasoma; mesoscutum, scutellum, and axillae with distinct raised reticulation (Fig. 5d), without metallic tint. Propodeal foreman with narrow ventral arm (Fig. 1c); Forewing (Fig. 5a) with a narrow speculum, continuing along whole length of marginal vein; other parts uniformly covered with numerous microtrichia, on lower side of forewing having (Figs. 5e-g) speculum below marginal vein without admarginal setae, bare area distinctly narrower apically than its width below stigmal vein, marginal setae as long as stigmal vein; forewing about 3 x as long as wide; longest marginal cilia 0.4 x maximal forewing width; submarginal vein about 0.55 x marginal vein+parastigma; postmarginal vein 0.44 x as long as stigmal vein, marginal vein + parastigma 5.0 x as long as stigmal vein, the latter basally width. Hind wing (Figs. 5h,i) about 7.3 x as long as wide; blade uniformly setose, on upper side with 4 rows of setae, with lower side in apical 1/4 bare; longest marginal cilia about 1.6 x as long as wing's maximal width.

Metasoma (Fig. 5a) about twice as long as width. Petiole about 1.2 x as wide as long. Ovipositor occupying about 3/4x length of metasoma, slightly excreted; ovipositor length/metatibia length ratio 4:3.

Measurements. Body length: 0.8-1.0 mm. Relative measurements, as length or length/width: Antenna: scape: 25/4; pedicel: 12/6; F1: 6/3; F2: 6/4; clava: 18+3/8, C1: 9, C2: 9, spicula: 3. Forewing: 50/18; longest marginal cilia: 8. Hind wing: 46/6; longest marginal cilia: 11; metatibia: 15; Ovipositor: 20.

Male. Unknown.

Comments: *Epomphale africanensis* n. sp. is similar to *E. menes* and *E. kirimensis* n. sp. in having legs with femora and metasoma wholly lemon yellow; lower side of forewing having speculum below marginal vein without admarginal setae (Figs. 5g,h) and total length of funicular segments shorter than length of clava (Fig. 5c), but it differs from both of them in having propodeal foreman with narrow ventral arm (Fig. 1c); lower side of forewing with bare area distinctly narrower apically than its width below stigmal vein (Figs. 5e,g); hind wing with lower side in apical 1/4 bare, on upper side with 4 rows of setae (Figs. 5h,i) (in *E. menes* and *E. kirimensis* n. sp. propodeal foreman with thick ventral arm (Figs. 1a,b); lower side of forewing with bare area slightly narrower apically than its width below stigmal vein (Fig. 7h,g).

Hosts : Thripidae sp. ex flowers of *Delairea odorata*.

Distribution : South Africa: ECape Addo, 23 33 N, 25 41 E, c 100 m, 30. v. 1996.

Epomphale menes (Walker)

(Figs.6a-g, 7a-l)

Pteroptix menes Walker, 1839: 17-18. *Type locality*.-Near London, England, UK.

Material examined: TURKEY: Hatay, Antakya, Serinyol, 65 m, 17.iii.2005, (M. Doğanlar), 8 ♀♀, (swept from leek field infested by *Thrips tabaci* Lindeman), 3 ♀♀, (on points), 5 ♀♀ (on slides, mounted in Canadian balsam); Reyhanlı, Atçana, 1 ♀, 36 14 30 N, 36 22 89 E, 96 m, 3.V.07 (M. Doğanlar) (on slides, mounted in Canadian balsam); 2 ♀♀, Adiyaman, Gölbaşı, 5. ix. 2005, (E. Çıkman), (on slides, mounted in Canadian balsam); swept from lent field, (on slides, mounted in Canadian balsam); 1♀, Kahta, 34 45 98 N, 38 39 21 E, 567 m, 09.v.2005, swept from lent field, (E. Çıkman), (on slides, mounted in Canadian balsam); 1 ♀, Gaziantep, Islahiye, wheat, 37 01 65 N, 36 39 19 E, 489 m, 15.V.07 (M. Doğanlar), (on slides, mounted in Canadian balsam); 1 ♀, Araban, Yukarımülk, lent field, 37 27 89 N, 37 26 91 E, 921 m, 24.v.07, (M. Doğanlar) (on slides, mounted in Canadian balsam); FRANCE, 3♀♀, A. Loomans, (Marked as "H", Lab. rearing, H-Line 15x, 3rd generation, Ceranisus menes (Walker) (Hymenoptera: Eulophidae) Det. S. triapitsyn, 1996.

See Triapitsyn & Headrick (2005) for some of the diagnostic characters and illustrations of this species, Triapitsyn (2005) for the list of its synonyms, distribution, etc., and Loomans & van Lenteren (1995) for known hosts.

Diagnosis: Body with mesoscutum finely reticulated; malar sulcus with divided section short, as long as 1/4 of sulcus apically; mesothoraxic spiracle overlapped by side lobe of mesoscutum; propodeal foreman with thick, bluntly pointed ventral arm; metasoma and legs with coxae in basal half dark metallic, other parts yellow; lower side of forewing having speculum below marginal vein without admarginal setae; bare area slightly narrower apically than its width below stigmal vein; hind wing with lower side having 1 rows of setae in apical half; total length of funicular segments shorter than clava.

Description. Female. Body (Figs. 6a,b) bicolor: head and mesosoma black; metasoma yellow basally, dark brown apically; antennae and legs pale yellow, but coxae basally light brown; eye reddish; wings hyaline, venation pale yellow.

Head. Vertexal suture straight behind hind ocelli (Fig. 7b); frontal suture widely V-shaped (Fig. 1). Malar sulcus with divided section short, as long as 1/4 of sulcus apically (Figs. 7a,c). Antenna (Figs. 7a,c,d)) with scape slender, about 4.4x as long as wide; pedicel twice as long as width; F1 equal to F2, 1.33-1.5x as long as width, with one long sensilla; clava including spicula 3.9x as long as width, total length of funicular segments shorter than clava, C1 slightly longer than C2, C1 with two sensilla; C2 with three sensilla; spicula 1/2 C2.

Mesosoma (Figs. 6a,b, 7e-g) almost as long as metasoma; mesoscutum, scutellum, and axillae with light engraved sculpture, without metallic tint; propodeal foreman with ventral arm of propodeal foreman bluntly pointed (Fig. 1a); mesothoraxic spiracle overlapped by side lobe of mesoscutum (Figs. 7f,g); midlobe of mesoscutum with 2 pairs, scutellum with one pair of setae. Forewing (Fig. 7) with a narrow speculum, continuing along whole length of marginal vein; on upper part uniformly covered with numerous microtrichia; lower side of forewing having speculum below marginal vein without admarginal setae (Fig. 7h); bare area slightly narrower apically than its width below stigmal vein; marginal setae at least 2x longer than stigmal vein; forewing about 2.7x as long as wide; longest marginal cilia 0.31 x maximal forewing width; submarginal vein about 0.57 x marginal vein+parastigma; postmarginal vein 0.65 x as long as stigmal vein, marginal vein + parastigma 7.25x as long as stigmal vein, the latter basally wide. Hind wing about 7.7x as long as wide; blade uniformly setose on upper side (Fig. 7k), on lower side having 1 rows of setae in apical half (Fig. 7j); longest marginal cilia about 1.5 x as long as wing's maximal width.

Metasoma (Fig. 5) with petiole about 1.2 x as wide as long. Ovipositor occupying about 4/5 x length of metasoma, slightly excreted; ovipositor as seen fig. 7 l, length of ovipositor and metatibia ratio 4:3.

Measurements. -Body length: 0.8-0.83 mm. Relative measurements, as length or length/width: Antenna: scape: 22/5; pedicel: 12/6; F1: 6/4; F2: 6/4.5; clava: 27+6/8.5, C1: 15, C2: 12, spicula: 6. Forewing: 85/32; longest marginal cilia: 10. Hind wing: 72/10; longest marginal cilia: 14. Metatibia: 17. Ovipositor: 25.

Male. Unknown.

Comments: *Epomphale menes* is similar to *E. kirimensis* n. sp in having propodeal foreman with thick ventral arm (Figs. 1a,b); lower side of forewing with bare area slightly narrower apically than its width below stigmal vein (Figs. 7h,g), but it differs from *E. kirimensis* in having mesothoraxic spiracle overlapped by side lobe of mesoscutum (Figs. 7f,g); ventral arm of propodeal foreman bluntly pointed (Fig. 1a); hind wing with lower side having 1 rows of setae in apical half (Fig. 1j) (in *E. kirimensis* mesothoraxic spiracle not overlapped by side lobe of mesoscutum (8 h); ventral arm of propodeal foreman sharply pointed (Fig. 1b); hind wing on lower side in apical half bare).

Hosts: Various Thripidae (Loomans & van Lenteren, 1995; Triapitsyn, 2005).

Distribution: Cosmopolitan (Loomans & van Lenteren, 1995; Triapitsyn & Headrick, 1995; Triapitsyn & Morse, 2005); Turkey (Triapitsyn, 2005; Doğanlar & Triapitsyn, 2007).

Epomphale kirimensis Doğanlar & Doğanlar n. sp.

(Figs. 8a-f)

Ceranisus menes (Walker), misidentified by Doğanlar et al. (2011: 218).

Etymology: The name is derived from the name of the country where the specimens were collected.

Material examined: Holotype, Female, CRIMEA, Karadag, nr. Feodosiya, Karadag Nature Reserve (biostation), swept from pasture, M. Doğanlar (IMRSBCA). **Paratypes:** 8 ♀♀, UKRAINE, Cherkas'ka oblast, Kaniv Nature Reserve, Maryina Hora, 3.VII. 2008, M. Doğanlar; Cherkas'ka oblast, Pekari Village, 4.VII.2008 (swept from flowers of *Asclepias syriaca*), 24 ♀♀, M. Doğanlar; Kiev, Lysa Hora, 23.VII.2008, 11 ♀♀, M. Doğanlar; Crimea, nr. Feodosiya, Karadag Nature Reserve (biostation), 15-19.VII.2008, 65 ♀♀, M. Doğanlar & A. Gumovsky; ibid. 20.VII.2008 (collected from flowers of *Capparis spinosa*), 3 ♀♀; Crimea, nr. Koktebel, 18.VII.2008, 13 ♀♀, M. Doğanlar and A. Gumovsky; between Karadag Nature Reserve and Schchebetovka, swept from pastures on banks of Otuzka River, 13 ♀♀, M. Doğanlar & A. Gumovsky (IMRSBCA & SIZK); All of the types are deposited in the Insect Museum of Research Station of Biological Control, Yüreğir, Adana, Turkey (IMRSBCA).

Diagnosis: Body with mesoscutum finely reticulated; malar sulcus with divided section short, as long as 1/4 of sulcus apically; mesothoraxic spiracle not overlapped by side lobe of mesoscutum; propodeal foreman with thick, bluntly pointed ventral arm; metasoma and legs with coxae in basal half dark metallic, other parts yellow; lower side of forewing having speculum below marginal vein without admarginal setae; bare area slightly narrower apically than its width below stigmal vein; hind wing on lower side in apical half bare; total length of funicular segments shorter than clava.

Description: Similar to *E. menes* except as follows: Female. Body bicolor: head and mesosoma black; metasoma yellow; antennae and legs pale yellow; eye reddish;

Head. Malar sulcus (Figs. 8b,c,h) with divided section short, as long as 1/4 of sulcus apically; antenna (Fig. 8d) with scape slender, about 6.75x as long as width; pedicel 2.2x longer than width; F1 1.25x as long as width, F2 quadrate, both with one long sensilla; clava including spicula 3.75x as long as wide, C1 shorter than C2 (15:20), C1 with two sensilla; C2 with three sensilla; spicula 1/4 C2.

Mesosoma (Fig. 8a) 0.6x as long as metasoma; propodeal foreman (Fig. 1b) with thick, bluntly pointed ventral arm; mesothoraxic spiracle (Fig. 8h) not overlapped by side lobe of mesoscutum; forewing (Fig. 8e) on upper side with a broad speculum, continuing along half length of marginal vein; other parts uniformly covered with sparse microtrichia, on lower side of forewing having speculum below marginal vein without admarginal setae; bare area slightly narrower apically than its width below stigmal vein;; marginal setae about 1.5x longer than stigmal vein; forewing about 2.3x as long as width; longest marginal cilia 0.3x maximal forewing width; submarginal vein about 0.57 x marginal vein+parastigma, postmarginal vein 0.62 x as long as stigmal vein, marginal vein + parastigma 5.6x as long as stigmal vein, the latter basally broad. Hind wing about 7.3 x as long as width; blade on upper side uniformly setose, on lower side in apical half bare; longest marginal cilia about as long as wing's maximal width.

Metasoma (Fig. 8a) 1.7x as long as mesosoma. Ovipositor as seen fig. 8i; ovipositor length/metatibia length ratio 3: 2.

Measurements. Body length: 0.8-0.9 mm. Relative measurements, as length or length/width Antenna: scape: 35/6; pedicel: 16/7; F1: 7/5; F2: 7/7; clava: 26+4/9, C1: 10, C2: 16, spicula: 4. Forewing: 75/33; longest marginal cilia: 13. Hind wing: 84/12; longest marginal cilia: 14. Metatibia: 10. Ovipositor: 55.

Male. Unknown.

Comments: The characters were discussed below other species.

Hosts: Various Thripidae on flowers of *Asclepias syriaca*; of *Capparis spinosa* and flowers of several plants in pasture.

Distribution: CRIMEA, Karadag, nr. Feodosiya, Karadag Nature Reserve (biostation); nr. Koktebel; on banks of Otuzka River, between Karadag Nature Reserve and Schchebetovka; UKRAINE, Cherkas'ka oblast, Kaniv Nature Reserve, Maryina Hora; Cherkas'ka oblast, Pekari Village; Kiev, Lysa Hora.

Epomphale planitianus (Erdös, 1966)

(Figs. 9a-h)

Ceranisus planitianus Erdös, 1966: 408,409. *Type locality.* – Hungary.

See Triapitsyn & Headrick (2005) for some diagnostic characters and illustrations of *C. planitianus* and also Triapitsyn (2005) for the list of its synonyms, distribution, etc. Loomans & van Lenteren (1995) listed the known hosts of this species. The species was recorded from Turkey by Doğanlar & Triapitsyn (2007), and from Ukraine by Doğanlar et al. (2011).

Material examined: UKRAINE: Cherkas'ka oblast, Kaniv (Maryina Hora), 2.VII.2008, 8 ♀♀, 4 ♂♂, M. Doğanlar, on slide mounted in Canada balsam, (IMRSBCA); Poltavska oblast, Kremenchug region, near Piddubne Village, 14-15.VII.1997, 2 ♀♀, 1 ♂, A. Gumovsky (SIZK).

Diagnosis: Body with mesoscutum reticulated; legs with coxae mostly dark; metasoma dark; Malar sulcus narrowly Y-shaped, divided section long, two branched, as long as 1/2 of sulcus apically; ventral arm of propodeal foreman bluntly pointed, as long as width; forewing with lower side below marginal vein without admarginal setae; bare area parallel sided; hind wing on lower side in apical half with at least 2 rows of setae; in ♀ total length of funicular segments shorter than clava; in ♂ clava distinct, wider than funicular segments.

Redescription: Similar to *E. menes* excepts as follows: Female. Body dark; metasoma basally pale brown, antennae brownish; legs brown, except tibiae and tarsi light brown, venation yellow.

Head (Fig. 9a). – Vertexal and frontal sutures widely V-shaped behind posterior ocelli. Malar sulcus narrowly Y-shaped, divided section long, two branched, as long as 1/2 of sulcus apically. Antenna (Fig. 9b) with scape slender, about 4.5x as long as width; pedicel 2.4x longer than width; F1 equal to F2, slightly longer than width, with one long sensilla; clava including spicula 2.14 x as long as width, C1 0.8x as long as C2, C1 with two sensilla; C2 with three sensilla; spicula 1/3 C2.

Mesosoma (Fig. 9c) almost as long as metasoma; mesoscutum, scutellum, and axillae with distinct engraved sculpture; ventral arm of propodeal foreman (Fig. 2c) bluntly pointed, as long as broad; midlobe of mesoscutum with 2+3 pairs, scutellum with one pair of setae. Forewing (Fig. 9d) on upper side with a narrow speculum, continuing along half length of marginal vein; other parts uniformly covered with numerous microtrichia, on lower side below marginal vein without admarginal setae; bare area parallel sided; marginal setae almost as long as stigmal vein; forewing about 2.7x as long as width; longest marginal cilia 0.3x maximal forewing width; submarginal vein about 0.63 x marginal vein+parastigma, postmarginal vein 0.57x as long as stigmal vein, marginal vein + parastigma 5.7x as long as stigmal vein. Hind wing on lower side in apical half with at least 2 rows of setae; about 8.2x as long as wide; on upper side blade uniformly setose, longest marginal cilia about 1.4x as long as wing's maximal width.

Metasoma with ovipositor as seen fig. 9 f, occupying about 3/4 of length of metasoma; ovipositor length/metatibia length ratio 1.2:1.

Measurements. Body length: 0.9-1.1 mm. Relative measurements, as length or length/width Antenna: scape: 23/6; pedicel: 11/6; F1: 7/4; F2: 5/4; clava: 18.5+1.5/8, C1: 8, C2: 10.5, spicula: 1.5. Forewing: 80/34; longest marginal cilia: 8. Hind wing: 75/12; longest marginal cilia: 12. Metatibia: 21. Ovipositor: 28.

Male – Similar to ♀ except as follows: metasoma black, with brown basal spot; antenna (Fig. 9 g) with, all flagellar segments with long setae; funicular segments spherical, 3 segmented clava having segments equal in length, but gradually tapering, with long spicula, almost equal length to C3. Metasoma slightly shorter than mesosoma, twice as long as width; petiole slightly shorter than width. ♂ genitalia as fig. 9h.

Comments: *Epomphale planitianus* is similar to *E. kocaki* n. sp., *E. rubensteina* and *E. oezdikmeni* n. sp. in having legs with coxae, femora and metasoma dark, but it differs in having forewing with lower side without admarginal setae (Fig. 9e); ventral arm of propodeal foreman bluntly pointed, ventral arm as long as width (Fig. 2c); malar sulcus with divided section narrow (Fig. 9a) (in *E. kocaki* n. sp., *E. rubensteina* and *E. oezdikmeni* n. sp. Forewing with lower side with 1-3 admarginal setae (Figs. 11e, 12h, 13g); ventral arm of propodeal foreman wider than long (Figs. 2a,b,d); malar sulcus with divided section wide).

Hosts. – Unknown.

Distribution : Canada, USA, Israel, Moldova, Spain (Triapitsyn & Morse, 2005); Czechoslovakia (Loomans & van Lenteren, 1995); Turkey (Doğanlar & Triapitsyn, 2007); Ukraine (Doğanlar et al. (2011).

Epomphale kocaki Doğanlar & Doğanlar n. sp.

(Figs. 10a-b; 11a-i)

Etymology: The name dedicated to Prof. Dr. Ahmet Ömer Koçak (Turkey) who has valuable contributions to the Lepidoptera fauna of Turkey.

Material examined: Holotype: Female, Bingöl- Muş provinces border, 38 54 12 N, 40 50 57 E, 1650 m, swept from pasture, leg. O.& Z. Doğanlar, mounted in Canada balsam, deposited in (IMRSBCA). **Paratypes:** 2 ♂♂, 6 ♀♀, same data as holotype. All of the types are deposited in the Insect Museum of Research Station of Biological Control, Yüreğir, Adana, Turkey (IMRSBCA).

Diagnosis: Body with mesoscutum finely reticulated; malar sulcus divided section width, long, as long as 1/2 of sulcus apically; ventral arm of propodeal foreman narrow, bluntly pointed, ventral arm of propodeal foreman wider than long; legs with coxae and femora dark brown; metasoma brown in ♀, dark in ♂; forewing with lower side with 1 admarginal setae; bare area apically narrow, almost closed; hind wing on lower side bare in apical half; in ♂ flagellum filiform, clava as width as, but slightly longer than funicular segments.

Description: Similar to *E. planitianus* excepts as follows: Female. – Body (Fig. 10a) black; legs dark brown, except tibiae and tarsi yellow, venation dark.

Head (Figs. 10a, 11a) with malar sulcus broadly Y-shaped, divided section long, two branched, as long as 1/2 of sulcus apically. Antenna (Fig. 11b) with scape slender, about 3.4x as long as width; pedicel twice longer than width; F1 and F2 equal in length and width, but F1 truncate cone shaped, with two long sensilla; clava including spicula 1.54x as long as width, C1 0.7x as long as C2.

Mesosoma (Fig. 10a) 1.2x as long as metasoma; ventral arm of propodeal foreman (Fig. 2d) narrow, bluntly pointed, ventral arm of propodeal foreman broader than long; midlobe of mesoscutum (Fig. 11c) with engraved fine reticulation. Forewing (Fig. 11d) on upper side with a broad speculum, continuing along whole length of marginal vein; on lower side with 1 admarginal setae; bare area apically narrow, almost closed; forewing about 2.93x as long as width; longest marginal cilia 0.4x maximal forewing width; submarginal vein about 0.62 x marginal vein+parastigma, postmarginal vein 0.44x as long as stigmal vein, the latter distinctly narrower basally; marginal vein + parastigma 5.0x as long as stigmal vein. Hind wing about 9.0x as long as wide; on upper side blade uniformly setose; on lower side in apical half with bare; longest marginal cilia about 1.3x as long as wing's maximal width.

Metasoma with ovipositor occupying about 0.7 length of metasoma; ovipositor length/metatibia length ratio 1.16:1.

Measurements. Body length: 0.9-1.1 mm. Relative measurements, as length or length/width Antenna: scape: 32/8; pedicel: 19/11; F1: 8/9; F2: 9/10; clava: 26+4/13, C1: 11, C2: 15, spicula: 4. Forewing: 90/28; longest marginal cilia: 8. Hind wing: 85/12; longest marginal cilia: 15. Metatibia: 24. Ovipositor: 30.

Male – Similar to female except as follows: metasoma black, with brown basal spot; antenna (Figs. 10b, 11h) with flagellum filiform, clava as width as, but slightly longer than funicular segments, all flagellar segments with long setae; clava with long spicula, almost equal length to C3. Metasoma 0.83x as long as mesosoma, 1.67 as long as width; male genitalia as fig. 11i.

Comments: *Epomphale kocaki* n. sp. is similar to *E. rubensteina* Girault and *E. oezdikmeni* n. sp. in having forewing with lower side with admarginal setae (Fig. 11e); ventral arm of propodeal foreman wider than long (Figs. 2a,b,d); malar sulcus with divided section wide, but it differs in having forewing with lower side with 1 admarginal setae, bare area apically narrow, almost closed (Fig. 11e); ventral arm of propodeal foreman narrow, bluntly pointed (Fig. 2d); in female, total length of funicular segments as long as clava (Fig. 11b); in male flagellum filiform, clava as width as, but slightly longer than funicular segments (Fig. 11h), (in both species forewing with lower side with 2-3 admarginal setae, bare area slightly narrower apically than the own width below stigmal vein (Fig. 12e), and in *E. rubensteina* with female and male antenna distinctly clubbed, funicular segments shorter than clava (Figs. 12b,h).

Hosts: Unknown.

Distribution :TURKEY: Muş and Bingöl provinces.

Epomphale rubensteina Girault, 1934

(Figs. 12a-h)

Epomphale rubensteina Girault, 1934: 3. Type locality: WA: Perth (Feb. 5, 1932, B. A. O'Connor); synonymized by Boucek, 1988: 734 under *Ceranisus menes*, and synonymy was accepted by Triapitsyn (2005), upgraded by Doğanlar & Doğanlar, 2013.

Material examined: 18 ♀♀, 7 ♂♂, Virginia, South Australia, collected with a vacuum sampler from native saltbush vegetation, 15th December, 2008, leg. Glenys Wood, and Helen De Graaf (PIRSA - SARDI); 1 ♂, Stirling Range Drive, Stirling Range Nat. Pk., WA. 23 September, 1981, leg. I.D. Naumann, J.C. Cardale ex ethanol; 2 ♂♂, Young distr. 45 km from Boorowa, NSW, 12 Oct. 1994, leg. M. Steiner & S. Goodwin, associated with thrips on cherry, No. 387.

Diagnosis: Body with mesoscutum reticulated; legs with coxae and femora dark brown; metasoma dark; malar sulcus split, narrowly Y-shaped, two branched; ventral arm of propodeal foreman width, bluntly pointed, ventral arm of propodeal foreman broader than long; forewing with lower side having 2-3 admarginal setae, far from stigmal vein; bare area apically narrower than the own width below stigmal vein; hind wing on lower side a few setae in apical half; in ♀ and ♂ funicular segments shorter than clava.

Description of the species were given by Girault (1934) as follows: "From genotype: Scape, pedicel, venation, abdomen, coxae, femora black. Forewing with several more lines cilia."

Redescription: Similar to *E. planitianus* excepts as follows: Female. – Body black, except tibiae and tarsi yellow.

Head (Fig. 12a) with malar sulcus very broadly Y-shaped, divided section two branched, as long as 3/4 of sulcus apically; ventral arm of propodeal foreman width, bluntly pointed, ventral arm of propodeal foreman broader than long (Fig. 2a); antenna (Fig. 12b) with scape slender, about5x as long as width; pedicel 2.5x longer than width; F1 1.4x and F2 1.5x as long as width, F1 with one, F2 with two long sensilla; clava including spicula 3.8x as long as width, C1 0.9x as long as C2. spicula 1/3 C2.

Mesosoma 1.3x as long as metasoma; narrow, bluntly pointed, ventral arm of propodeal foreman (Fig. 2a) width, bluntly pointed; midlobe of mesoscutum (Fig. 12c) with raised reticulation. Forewing (Figs. 12d,e) on upper side with a broad speculum, continuing along half length of marginal vein; on lower side with 2 admarginal setae; bare area apically narrow, with 2 setae apically; forewing about 2.6x as long as width; longest marginal cilia 0.36x maximal forewing width; submarginal vein about 0.5x marginal vein+parastigma, postmarginal vein 0.5x as long as stigmal vein, the latter distinctly narrower basally; marginal vein + parastigma 5.5x as long as stigmal vein. Hind wing about 7.7x as long as wide; on upper side blade uniformly setose; on lower side in apical half bare; longest marginal cilia about 1.54x as long as wing's maximal width.

Metasoma: ovipositor as seen fig. 12 g. with ovipositor occupying about 0.7 length of metasoma; ovipositor length/metatibia length ratio 1.38:1.

Measurements. Body length: 0.8.3-0.88 mm. Relative measurements, as length or length/width Antenna: scape: 30/6; pedicel: 14/6; F1: 7/5; F2: 7/6; clava: 23+4/7, C1: 11, C2: 12, spicula: 4. Forewing: 100/38; longest marginal cilia: 13. Hind wing: 115/16; longest marginal cilia: 18. Metatibia: 16. Ovipositor: 22.

Male – Similar to female except as follows: antenna (Fig. 12h) with flagellum filiform, clava as width and long as funicular segments, all flagellar segments with long setae; scape 4.25x as long as width, distinctly narrowing apically; pedicel 2.6x as long as width; F1 and F2 equal in length and width, slightly longer than width; clava including spicula thrice as long as width, 3 segmented, segments equal to each other, with spicula 1/2 length of C3. Metasoma 0.8x as long as mesosoma, 1.57 as long as width; male genitalia as fig. 12 i.

Comments: *Epomphale rubensteina* is similar to *E. oezdikmeni* n. sp. in having forewing with lower side with 2-3 admarginal setae, bare area slightly narrower apically than the own width below stigmal vein (Fig. 12e); ventral arm of propodeal foreman wide, but it differs from *E. oezdikmeni* n. sp. in having malar sulcus with divided section two branched (Fig.12a); ventral arm of propodeal foreman wide, bluntly pointed (Fig. 2a); forewing with lower side below marginal vein having with 2-3 admarginal setae far from stigmal vein (Fig. 12a); hind wing on lower side a few setae in apical half (Fig. 12f); in female and male funicular segments shorter than clava (Figs. 12b,h) (in *E. oezdikmeni* n. sp. malar sulcus with divided section 3-branched (Fig. 13a); ventral arm of propodeal foreman wide, sharply pointed (Fig. 2b); forewing with lower side below marginal vein having with 2 admarginal setae close to stigmal vein (Figs. 13f,g); hind wing on lower side in apical half bare (Fig. 13h); total length of funicular segments shorter than clava (Figs. 13b,c).

Hosts: Unknown.

Distribution: Australia, WA, Perth. PNG: 25 km E of Mt. Hagen, and Bubia nr Lae, xii. 1982 (Boucek, 1988).

Epomphale oezdikmeni Doğanlar & Doğanlar n. sp.

(Figs. 13a-j)

Etymology: The name dedicated to Prof. Dr. Hüseyin Özdikmen (Turkey) who has valuable contributions to the Coleoptera fauna of Turkey.

Material examined: Holotype: Male, Turkey: Niğde, Ulukışla, Gümüş, 37°30'59''N, 34°34'17''E, 1280 m, 6.vi.2006, swept from *Astragallus* plantation, (M. Doğanlar), deposited in the Insect Museum of Research Station of Biological Control, Yüreğir, Adana, Turkey (IMRSBCA). **Paratypes:** 1 ♀, Niğde, Ulukışla, Gümüş, 37°30'59''N, 34°34'17''E, 1280 m, 6.v.2005, (M. Doğanlar); 1 ♀, Gümüş, Ulukışla, Niğde, 07. vi. 2008, swept from *Carduus* flowers, Leg. M. Doğanlar, mounted Canada balsam, deposited in (IMRSBCA).

Diagnosis: Body with mesoscutum reticulated; legs with coxae, femora and metasoma dark; malar sulcus widely Y-shaped, with divided section 3-branched; ventral arm of propodeal foreman width, sharply pointed; forewing with lower side below marginal vein having with 2 admarginal setae close to stigmal vein, bare area apically slightly narrower than the own width below stigmal vein; hind wing on lower side in apical half bare; total length of funicular segments shorter than clava.

Description. Male (holotype). Body black; metasoma brown; antennae brownish; legs brown, except tibiae and tarsi light brown, venation yellow.

Similar to *E. planitianus* excepts as follows:

Head (Fig. 13a) malar sulcus widely Y-shaped, with divided section 3-branched; Antenna (Fig. 13 b, c) with scape slender, about 3x as long as width; pedicel 1.8x longer than width; F1 1.3x and F2 quadrate, F1 with one, F2 with two long sensilla; clava 3-segmented, including spicula 2.3x as long as width, C1 1.25x as long as C2, the latter 1.6x as long as C3. spicula 3/5 C3.

Mesosoma 1.3x as long as metasoma; narrow, bluntly pointed, ventral arm of propodeal foreman wide, sharply pointed Fig. 2 b); midlobe of mesoscutum (Fig. 13d) with raised longitudinal reticulation. Forewing (Figs. 13e,f,g) on upper side with a short speculum, continuing along 1/3 length of marginal vein; on lower side with 2 admarginal setae, close to stigmal vein; bare area apically narrow, without setae apically; forewing about 2.92x as long as width; longest marginal cilia 0.32x maximal forewing width; submarginal vein about 0.56x marginal vein+parastigma, postmarginal vein 0.3x as long as stigmal vein, the latter broad basally; marginal vein + parastigma 6.0x as long as stigmal vein. Hind wing about 6.5x as long as wide; on upper side blade uniformly setose; on lower side in apical 1/4 bare; longest marginal cilia about 1.4x as long as wing's maximal width.

Metasoma: 0.77 as long as mesosoma; metasoma / metatibia length ratio 1/ 2; male genitalia as seen fig. 13i,j.

Measurements. Body length: 0.8-0.9 mm. Relative measurements, as length or length/width Antenna: scape: 35/6; pedicel: 16/7; F1: 7/5; F2: 7/7; clava: 26+4/9, C1: 10, C2: 16, spicula: 4. Forewing: 128/48; longest marginal cilia: 10. Hind wing: 115/12; longest marginal cilia: 15. Metatibia: 19. Metasoma: 38.

Female: similar to male except as follows: Antenna with scape slender, about 5.5x as long as width; pedicel 2.2x longer than width; F1 1.75x and F2 1.2x as long as width; clava 2-segmented, including spicula 2.7x as long as width, C1 0.54x as long as C2; spicula 1/5 C2.

Comments.-The characters were discussed under the former species.

Hosts. Thripidae sp. on *Astragallus* sp. and *Carduus* sp.

Distribution: TURKEY: Niğde, Ulukışla, Gümüş,

Epomphale kemalae Doğanlar & Doğanlar n. sp.

(Figs.14a-h)

Etymology: The name dedicated to Dr. Muhabbet Kemal Koçak (Turkey) who has valuable contributions to the Lepidoptera fauna of Turkey.

Material examined: Holotype, Female, S. of Morpeth, NSW, 15 January, 1995, associated with Thrips on Lucerne, leg. M. Steiner & S. Goodwin, N: 549; **Paratype:** 1 ♀, Mt. Glorious, SEQ. 27° 21' S, 152° 45' E, 11 March, 1998, Open Forest, leg. C. J. Burwell; 1 ♀, Emu Creek, 2 km NE Petford, 26 April, 1997, NEQ, 17 20 S, 144 57 E, Leg. C. J. Burwell. All of the types are deposited in the (ANIC).

Diagnosis: Body with mesoscutum reticulated; malar sulcus split, widely Y-shaped, divided section 2-branched; metasoma and legs wholly yellow; forewing with lower side having speculum below of marginal vein without admarginal setae; bare area medially narrow, with 3 setae, apically width; hind wing on lower side almost bare, only with 3 setae on basal part of apical half; total length of funicular segments as long as clava.

Description: Similar to *E. auriventris* excepts as follows:

Female. head with malar sulcus (Fig. 14a) split, widely Y-shaped, divided section 2-branched; Antenna (Fig. 14b) with scape cylindrical, about 5x as long as width; pedicel twice longer than width; F1 and F2 equal each other, almost quadrate, F1 with two, F2 with three long sensilla; clava including spicula 2.2x as long as width, C1 0.75x as long as C2. spicula 1/2 C2.

Mesosoma 3/4 as long as metasoma; midlobe of mesoscutum (Fig. 14c) with engraved fine reticulation. Forewing (Figs. 14d,f) on upper side with a broad speculum, continuing along whole length of marginal vein; on lower side (Fig. 14g) without admarginal setae; bare area medially narrow, with 3 setae, apically wide; forewing about 2.6x as long as width; longest marginal cilia 0.32x maximal forewing width; submarginal vein about 0.6x marginal vein+parastigma, postmarginal vein 0.3x as long as stigmal vein, the latter distinctly narrower basally; marginal vein + parastigma 3.14x as long as stigmal vein. Hind wing (Fig. 14h) about 8.33x as long as wide; on upper side blade uniformly setose; on lower side almost bare, only with 3 setae on basal part of apical half; longest marginal cilia about 1.3x as long as wing's maximal width.

Metasoma 1.37x as long as mesosoma; ovipositor occupying about 0.625 length of metasoma; ovipositor length/metatibia length ratio 1.16:1.

Measurements. Body length: 0.8-0.88 mm. Relative measurements, as length or length/width Antenna: scape: 30/6; pedicel: 13/8; F1: 8/8; F2: 8/8; clava: 19+5/11, C1: 8, C2: 11, spicula: 5. Forewing: 70/26; longest marginal cilia: 9. Hind wing: 65/10; longest marginal cilia: 13. Metatibia: 24. Ovipositor: 28.

Comments. *Epomphale kemalae* n. sp. is similar to the other species of the *auriventris* group in having malar sulcus divided section long, as long as 1/2 of sulcus apically, but it differs from them (except *E. auriventris*) in having legs with femora and metasoma wholly lemon yellow (in those species legs with coxae, femora and metasoma dark). *Epomphale kemalae* n. sp. differs from *E. auriventris* malar sulcus with divided section 2-branched (Fig. 14a); lower side of forewing with bare area medially narrow, apically width, with 3 setae medially (Fig. 14g); apical half of hind wing 3.5 times as long as width (Figs. 14h,e); in male total length of funicular segments as long as clava (Fig. 14b) (in *E. auriventris* malar sulcus with divided section 3-branched (Fig. 15d); lower side of forewing with bare area width, apically narrower than the width below stigmal vein (Fig. 15g); apical half of hind wing 5 times as long as width (Figs. 15h, 16e); in both sexes total length of funicular segments shorter than clava (Figs. 15c, 16a).

Hosts. Thripidae sp. on *Astragallus* sp. and *Carduus* sp.

Distribution: TURKEY: Niğde, Ulukışla, Gümüş.

Epomphale auriventris Girault

(Figs. 15a-h, 16a-h)

Epomphale auriventris Girault 1915: 211, type: female on slide, Gordonvale (Carins), Queensland, No. Hy 2537, Queensland Museum, Brisbane, synonymized by Boucek, 1988: 734 under *Ceranisus menes*, and synonymy is accepted by Triapitsyn (2005); upgraded by Doğanlar & Doğanlar, 2013.

Material examined: 32 ♀♀, 5 ♂♂, Virginia, South Australia, collected with a vacuum sampler from native saltbush vegetation, 15th December, 2008, leg. Glenys Wood, and Helen De Graaf (PIRSA - SARDI); 2 ♂♂, 16 km N Boonah, SEQ, 27 54 S, 152 41 E, 17 Feb. 1996, leg. C.J. Burwell; 1 ♂, Emu Creek, 12 km NE Petford, NEQ, 17 50 S 144 57 E, 26 Apr., 1997, leg. C.J. Burwell; 1 ♀, George Track, Blue Mts, NP (off Valey Ridges Rd. Bilpin), NSW, 16 Apr. 1994, legs. S. Goodwin, M. Steiner, swept from Acacia ?terminalis, Det by S. V. Triapitsyn, 2005 as *Ceranisus menes* (Walker).

Diagnosis: Body with mesoscutum reticulated; malar sulcus split, widely Y-shaped, divided section 3-branched, 1st branch divided from half of sulcus, two branches about 1/3 length of sulcus; metasoma and legs wholly yellow; forewing with lower side having speculum below of marginal vein with 3 admarginal setae on the area of speculum in apical 1/3 of marginal vein; bare area medially width, apically narrower than the width below stigmal vein without setae; apical half of hind wing 5 times as long as width, with 3 setae on basal part of apical half; in both sexes total length of funicular segments shorter than clava.

Description of the species were given by Girault (1934) as follows: "Female: length, 0.70 mm. Metallic purple, the thorax with very fine sculpture somewhat as in the Tetrastichini, the legs and abdomen golden yellow, the latter with two distinct cros-stripes of black close together at distal third and indication of a third stripes just proximad of the others. Antennae pallid, without a distinct terminal seta but with several long but colorless lateral apical setae. Pedical longer than either funicle joint boyh of which are distinctly longer than wide but not long, 2 a little longer than 1; club slender, conic ovate, longer than the funicle, divided near middle. Wings hyaline, fore wing slender (about 15 lines of discal cilia where widest), its marginal clia moderately long, the longest about a third the greatest wing width or somewhat less. Hind wings acuminate, where widest with about three lines of discal cilia, the caudal marginal fringes a little longer the longest marginal cilia of the fore wing. Discal cilia of the latter caudo-proximal bounded by a convex line of cilia.

From one ♀ captured by sweeping secondary forest growths, January 8, 1914.

Habitat: Gordanvale (Cairns), Queensland.

Type: No. Hy 2537, Queensland Museum, Brisbane, the ♀ on a slide."

Redescription: Similar to *E. menes* excepts as follows:

Female. Metasoma in apical half black (Fig. 15a); head as seen Fig. 12b, with malar sulcus (Fig. 15d) split, widely Y-shaped, divided section 3-branched, 1st branch divided from half of sulcus, two branches about 1/3 length of sulcus; Antenna (Fig. 15c) with scape medially broad, about 3.5x as long as width; pedicel 2.6x longer than width; F1 1.6x and F2 1.7x as long as width, F1 with one, F2 with two long sensilla; clava including spicula 3.0x as long as width, C1 0.75x as long as C2. spicula 1/2 C2.

Mesosoma as long as metasoma; ventral arm of propodeal foreman (Fig. 2e) bluntly pointed, almost V-shaped; midlobe of mesoscutum (Fig. 15e) with raised reticulation. Forewing (Fig. 15f) on upper side with a narrow speculum, continuing along 1/3 length of marginal vein; on lower side (Fig. 15g) without admarginal setae; bare area apically almost closed by 2-3 setae; forewing about 2.85x as long as width; longest marginal cilia 0.38x maximal forewing width; submarginal vein about 0.65x marginal vein+parastigma, postmarginal vein 0.5x as long as stigmal vein, the latter distinctly narrower basally; marginal vein + parastigma 3.8x as long as stigmal vein. Hind wing (Fig. 15h) about 8.7x as long as wide; on upper side blade uniformly setose; on lower side in apical half with 3 setae in a row medially, apical 1/4 bare; longest marginal cilia about 1.34x as long as wing's maximal width.

Metasoma 2.2x as long as width; with ovipositor occupying about 0.62 length of metasoma; ovipositor as seen fig.15i. ovipositor length/metatibia length ratio 1.45:1.

Measurements. Body length: 0.8-0.88 mm. Relative measurements, as length or length/width Antenna: scape: 30/6; pedicel: 14/6; F1: 7/5; F2: 7/6; clava: 27+5/11, C1: 11, C2: 12, spicula: 4. Forewing: 100/38; longest marginal cilia: 13. Hind wing: 115/16; longest marginal cilia: 18. Metatibia: 11. Ovipositor: 16.

Male – Similar to ♀ except as follows: antenna (Fig. 16a) with flagellum clavate, clava distinctly wider than funicular segments, all flagellar segments basally narrower, with longer setae; F1 and F2 equal in length and width, slightly longer than width; clava including spicula 2.5x as long as width, 3 segmented, segments equal to each other, with spicula 1/2 length of C3. Metasoma 0.6x as long as mesosoma, 1.7 as long as width.

Comments. The characters were discussed under the former species.

Hosts: Unknown.

Distribution: Australia, QLD, Gordonvale (Girault, 1915); Kuranda, Proserpine, Mackay and Gympie districts; Mt Tibrogargan; Bribie Island (Boucek, 1988).

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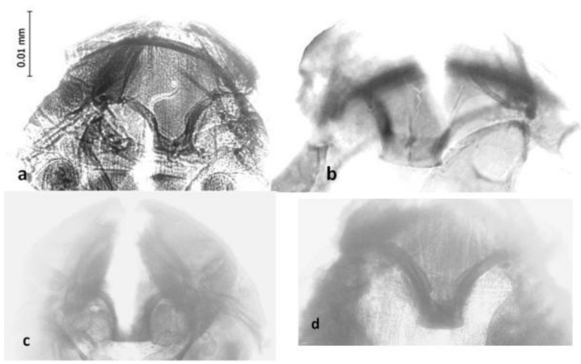

Figure 1. *Epomphale* spp. Propodeal foreman. a. *E. menes* (Walker, 1839); b. *E. kirimensis* n. sp.; c. *E. africanensis* n. sp.; d. *E. filizinancae* n. sp.

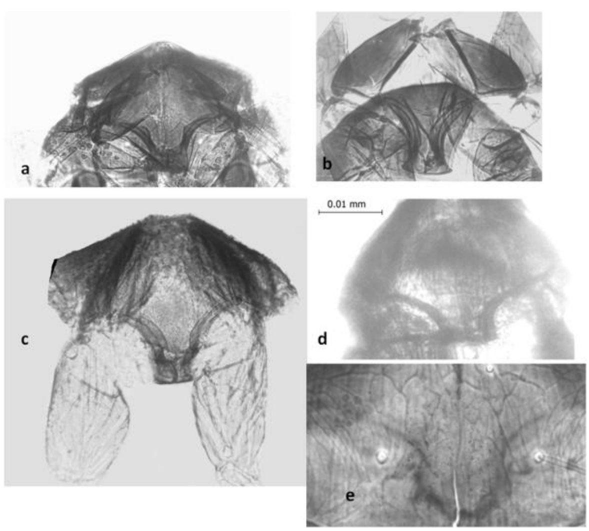

Figure 2. *Epomphale* spp. Propodeal foreman. a. *E. rubensteina* Girault, 1934; b. *E. oezdikmeni* n. sp.; c. *E. planitianus* (Erdös, 1966); d. *E. kocaki* n. sp.; e. *auriventris* Girault, 1915.

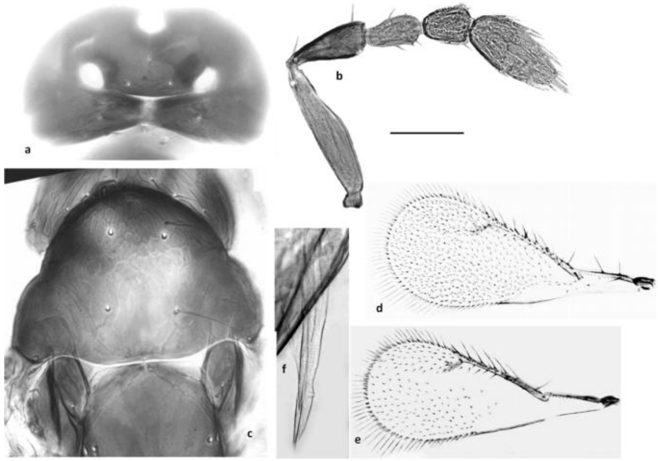

Figure 3. *Epomphale filizinancae* n. sp. Female. a. head, in dorsal view; b. antenna, in lateral view; c. mesoscutum and part of scutellum, in dorsal view; d. forewing, upper side; e. forewing, lower side; f. ovipositor, in lateral view.

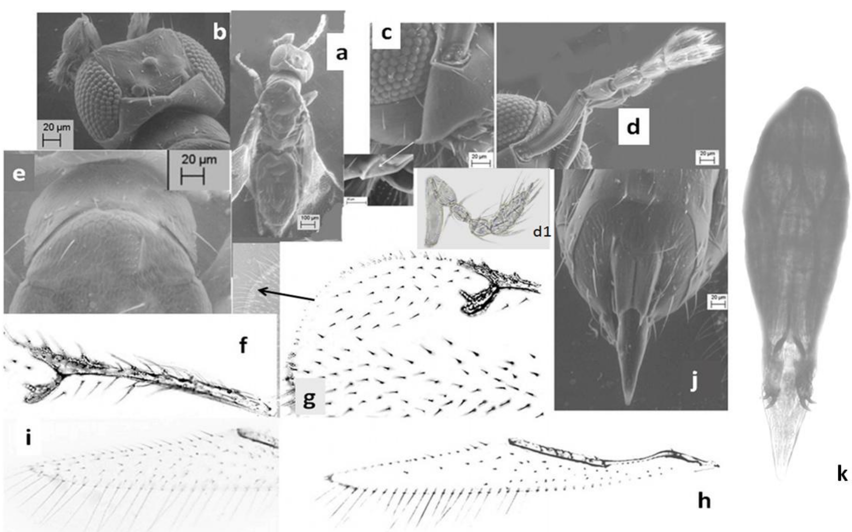

Figure 4. *Epomphale filizinancae* n. sp. Male. a. body, in dorsal view; b. head, in dorsal view; malar sulcus; d. antenna, in lateral view; e. pronotum and part of mesoscutum, in dorsal view; f. wing veins and part of speculum of forewing , lower side; g. apical part of forewing, lower side; h, i. hind wing, h. lower side, i. upper side; j. genitalia.

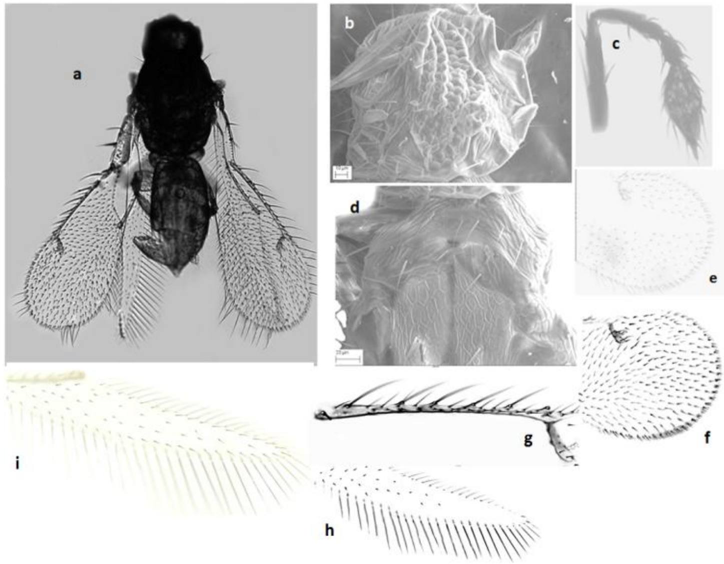

Figure 5. *Epomphale africanensis* n. sp. ♀. a. body, in dorsal view; b. head, in lateral view, arrow shows malar sulcus; c. antenna; d. propodeum and mesoscutum, in dorsal view; e, f. apical part of forewing, e. lower side; f. upper side; g, h. hind wing, g. upper side; h. lower side.

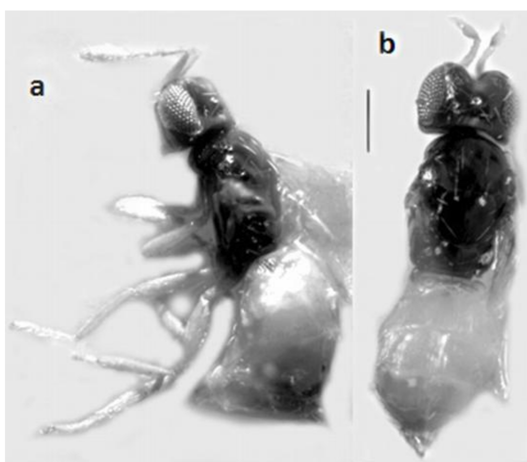

Figure 6. *Epomphale menes* (Walker, 1839) ♀ body. a. lateral view; b. dorsal view.

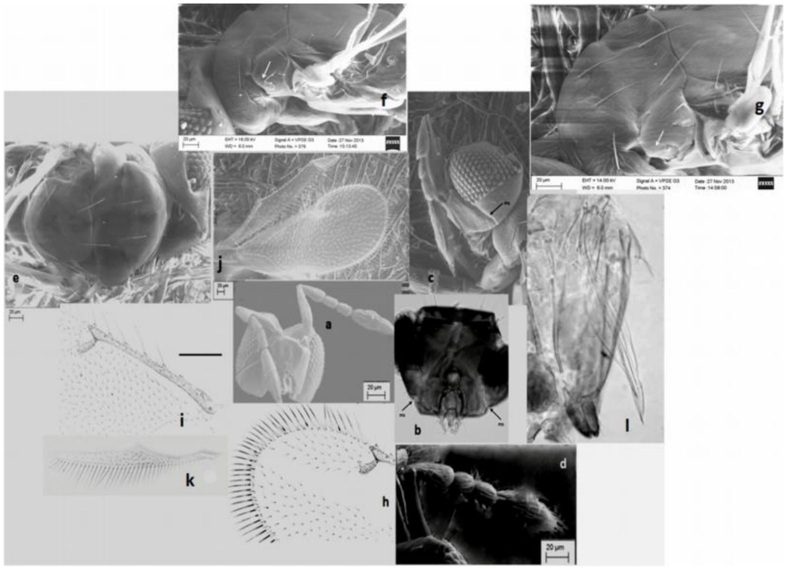

Figure 7. *Epomphale menes* (Walker, 1839). ♀. a-c. head, a. in frontal view, b. back of head, arrow shows malar sulcus; c. in lateral view; d. antenna; e. mesosoma, in dorsal view; f, g. pronotum and mesoscutum, in dorso-lateral view, arrow shows mesothoraxic stigma; h. apical part of forewing, lower side; i. forewing veins; j. fore and hind wing, forewing upper side, hind wing lower side; k. hind wing, upper side; l. ovipositor.

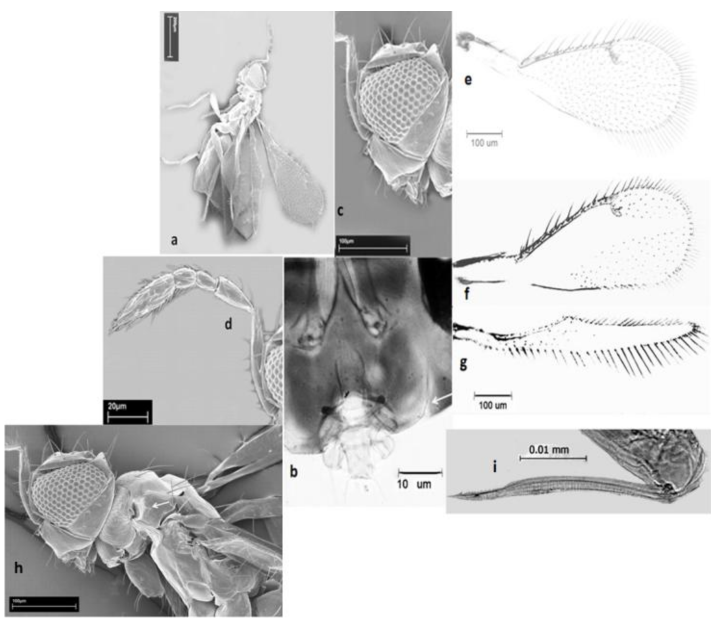

Figure 8. *Epomphale kirimensis* n. sp. ♀. a. body, in lateral view; b. lower part of head, arrow shows malar sulcus; c. head, in lateral view; d. antenna; e, f. forewing, e. upper side; f. lower side; g. hind wing, lower side; h. head and part of mesosoma, arrow shows mesothoraxic spiracle.

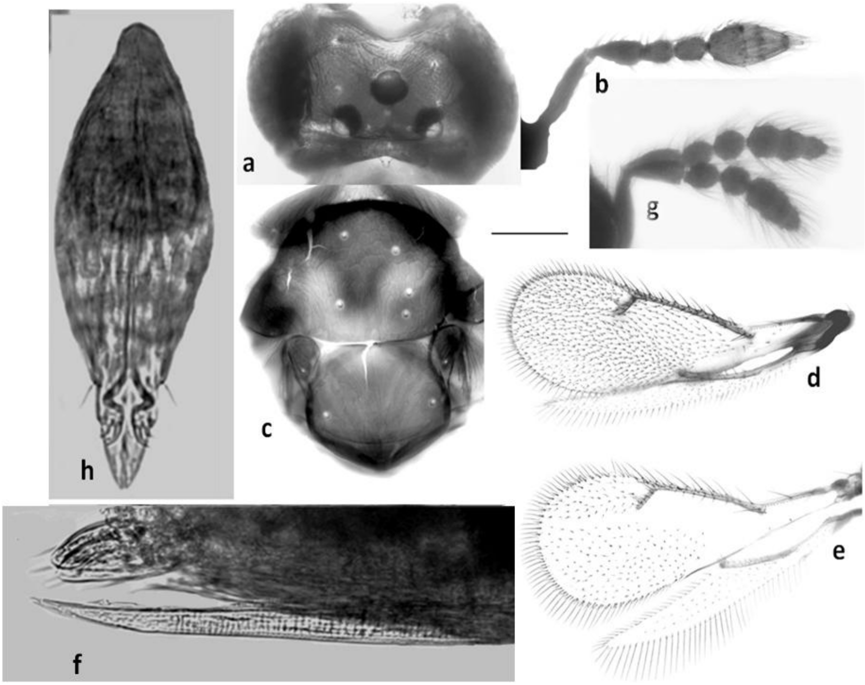

Figure 9. *Epomphale planitianus* Erdös, 1966. a. ♀ head, in dorsal view; b. ♀ antenna, in lateral view; c. ♀ mesosoma, in dorsal view; d. forewing and hind wing, upper side; e. forewing and hind wing, lower side; f. ovipositor, in lateral view; g. ♂ antennae; h. ♂ genitalia.

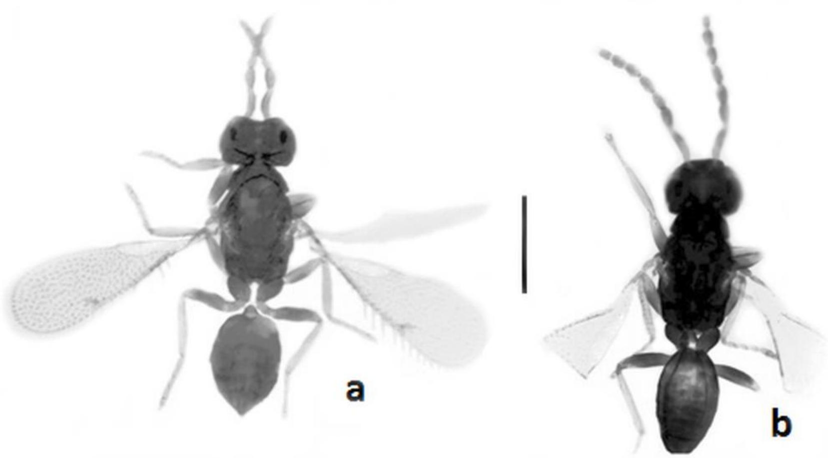

Figure 10 . *Epomphale kocaki* n. sp. a.♀; b. ♂ body.

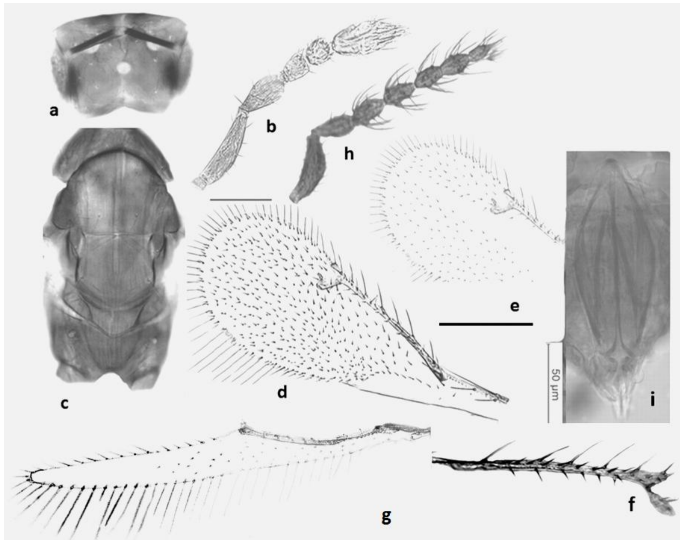

Figure 11 . *Epomphale kocaki* n. sp. a-f. Female. a. head, in dorsal view; b. antenna; c. mesosoma, in dorsal view; d, forewing, upper side; e. apical part of forewing, lower side f. hind wing, lower side; g, h. ♂, g. genitalia; h. antenna; i. Male genitalia.

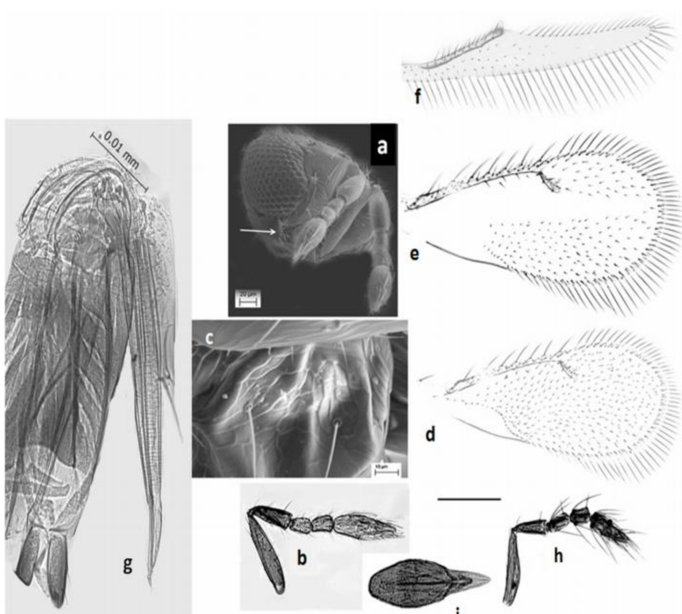

Figure 12. *Epomphale rubensteina* Girault. a-f. female. a. head, fronto-lateral view; b. antenna, in lateral view; c. part of mesonotum, in dorsal view; d.forewing upper side; e. forewing lower side; f. hind wing, lower side; g. ovipositor; h-i. ♂. h. ♂ antenna, in lateral view; i. male genitalia.

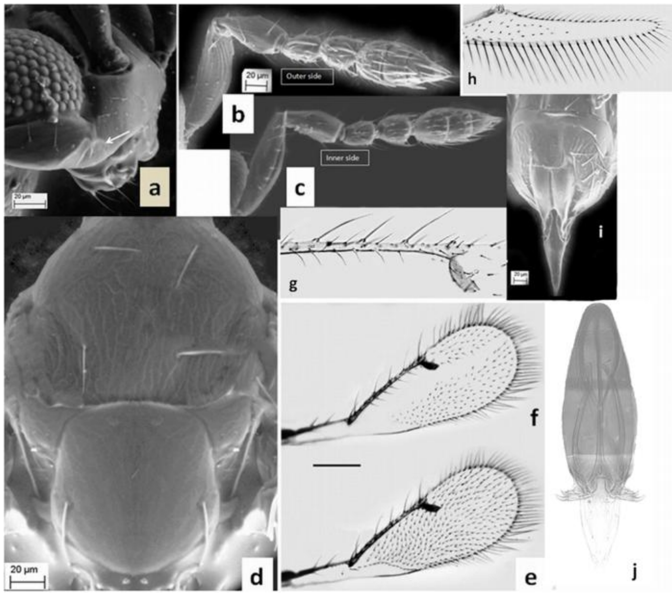

Figure 13. *Epomphale oezdikmeni* n. sp. male. a. malar sulcus; b, c. ♂ antennae, b. outer side, c. inner side; d. mesoscutum, in dorsal view; e. forewing, upper side; f. forewing, lower side; g. wing veins and part of speculum of forewing, lower side; h. apical part of hind wing; i, apical part of metasoma, in ventral view; j. male genitalia.

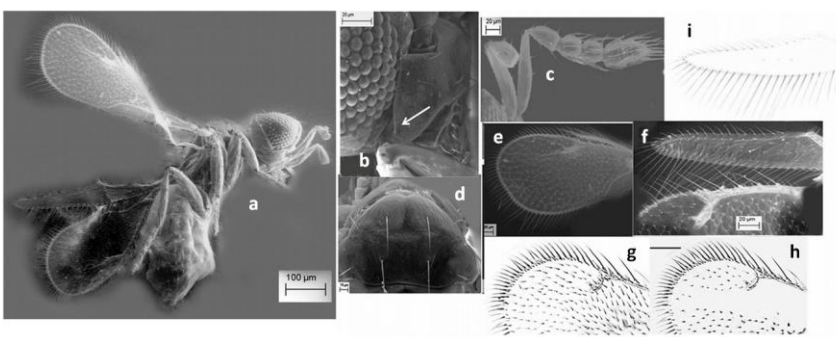

Figure 14. *Epomphale kemalae* n. sp. ♀. a. body, in lateral view; b. head, in lateral view, arrow shows malar sulcus,; c. antenna; d. propodeum and mesoscutum, in dorsal view; e, apical part of forewing, f. apical part of hind wing, upper side, and fore wing veins; g, h. apical part of fore wing, g. upper side; h, lower side; i. hind wing, lower side.

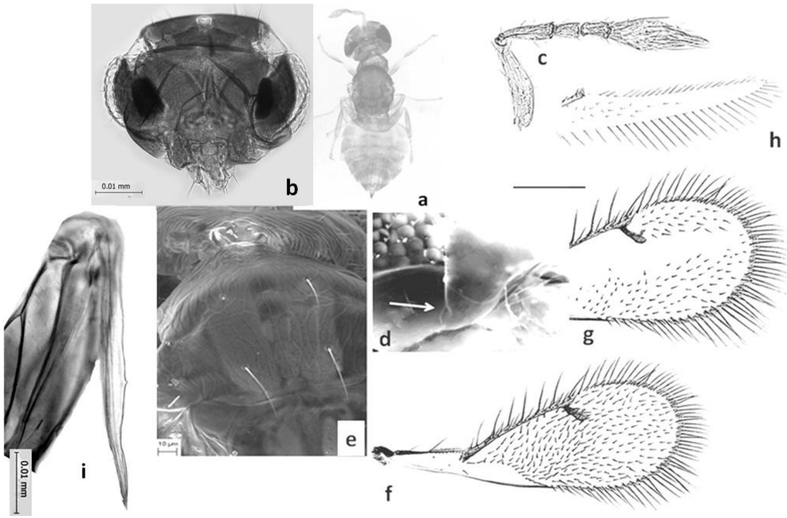

Figure 15. *Epomphale auriventris* Girault, 1915 a. female body, excluding wings; b. male head, in dorsal view; c. female antenna; d. malar sulcus; e. mesoscutum, in dorsal view; f. forewing, upper side; g. apical half of forewing, lower side; h. apical half of hind wing, lower side; i. ovipositor.

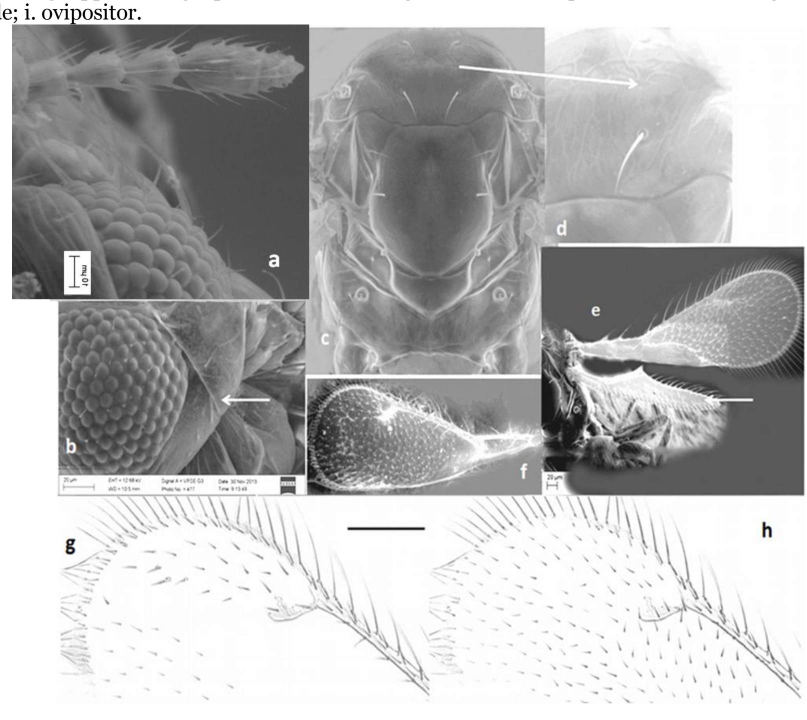

Figure 16. *Epomphale auriventris* Girault, 1915. Male. a. head with antenna, in dorsal view; b. head with malar sulcus, in lateral view; c. mesosoma, in dorsal view; d. mesoscutum, in dorsal view; e. forewing, upper side and hind wing, lower side; f. fore wing, lower side; g, h. apical part of forewing, g. lower side; h. upper side.

LABORATORY ASSESSMENT OF HOST PLANT RESISTANCE OF DIFFERENT WHEAT VARIETIES TO THE ENGLISH GRAIN APHID, *SITOBION AVENAE* F. (HOMOPTERA: APHIDIDAE) AT THE STEM ELONGATION GROWTH STAGE

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[**Kazemi, M. H.** 2014. Laboratory assessment of host plant resistance of different wheat varieties to the English grain aphid, *Sitobion avenae* F. (Homoptera: Aphididae) at the stem elongation growth stage. Munis Entomology & Zoology, 9 (2): 756-760]

ABSTRACT: The English grain aphid is regarded as one of the most important pests of small grain cereals, especially wheat varieties in many parts of the world. The pest has extended its distribution throughout the wheat fields of Iran and in particular the East Azarbaijan province. Five modern Iranian wheat varieties, namely Alamoot, Alvand, Zarrin, Sabalan and Sardari, which are the most extensively cultivated in the province, were used in laboratory screening tests for assessment of their antibiosis resistance to the aphid at the stem elongation growth stage. This work was carried out under greenhouse conditions of 24.2±4.5 ^{o}C temperature, 55.7±4.6% R.H. and 16:8 (L: D) light regime. The probable antibiosis was assessed by studying the nymphal survival rate; mean developmental time and adult fecundity (total no. of progeny/ female produced within the first 10 and 15 days of reproductive stage) calculating the relevant intrinsic rate of natural population increase (r_m value). The ANOVA of the data indicated that regarding duration of nymphal development time, adult fecundity and also r_m values, there were significant differences ($p<0.01$) between the varieties. Based on this, the highest (7.70±0.47) and lowest (5.75±0.44) mean nymphal development time was calculated on Alvand and Sabalan respectively. The greatest (59.35±2.60 & 88.15±4.81) and the least (38.30±2.20 & 58.60±3.42) numbers of progeny produced per female within the first 10 and 15 days of larviposition period was observed on Sabalan and Sardari respectively. Moreover, the highest r_m value (0.4120± 0.0074 & 0.4140± 0.0073) obtained for individuals reared on Sabalan, with the lowest (0.2620 ±0.0034& 0.2670±0.0025) being on Alvand. The present study indicated that at the stem elongation stage, Sabalan appeared to be more susceptible to the aphid whilst Alvand was more resistant and Sardari, Alamoot and Zarrin were regarded as intermediate among the others.

KEY WORDS: Resistance, wheat, English grain aphid.

The English grain aphid is regarded as one of the most important and periodical pests of small grain cereals, especially wheat varieties in many parts of the world, particularly Europe, Asia, tropical and subtropical areas (George & Gair, 1979; Lowe, 1984). The pest was first reported in Iran by Farahbakhsh (1961) and has extended its distribution throughout the wheat fields of Iran and in particular the East Azarbaijan province. This aphid causing direct feeding damages on the winter wheats in the spring by considerable reduction in crop yields (Hein et al., 1996), and can also be damaging as a vector of plant pathogenic viruses, such as Barley yellow Dwarf Virus (Markkula & Rouka, 1972; Vickerman & Wratten, 1979; Holland & Thomas, 1997). During the last 30 years, there has been a great deal of research seeking resistance to aphids in wheat varieties by the author and other experts in Iran. Only varying degrees of partial resistance have been reported, particularly in Moghan 2 and Ommid cultivares to *Rhopalosiphum padi* (L.) (Kazemi, 1988; Kazemi & van Emden, 1992) and in Alvand and Zarrin to *Diuraphis noxia* (mordvilko) (Kazemi et al., 2001a,b).This aphid feeds on wheat, barley, oat, rye and a number of grass weeds (Blackman & Eastop, 2000).

Based on the occurrence of the aphid in Iran, and also due to the highest level of infestation which has been observed in wheat fields of East Azarbaijan province in recent years, the present study was aimed at evaluating the rate of "antibiosis" resistance to the aphid, at stem elongation stage of Alamoot, Alvand, Azrrin, Sabalan and Sardari varieties, for which, the highest acreages are being devoted in wheat planting areas of the province (Kazemi et al., 2001; Kazemi, 2010).

MATERIALS AND METHODS

Plant and aphid culture: Vernalised seeds of five wheat varieties namely, Alamoot, Alvand, Zarrin, Sabalan and Sardari were evaluated at their stem elongation growth stage (30-49) against the English grain aphid, Sitobion avenae (Zadoks et al., 1974). The seeds of the varieties were obtained from the Agricultural-Jahad organization of East Azarbaidjan province. The aphid clones were collected from the Marand wheat fields and transferred to the laboratory for morphological identification according to the relevant sources (Blackman & Eastop, 2000). Stock cultures of aphids were reared under glasshouse conditions on Barley plats (var. Makuie) which are highly susceptible to the aphid (Robinson, 1992) and Kept in a 150×100×100 cm screen cage. The seeds were then put in a jar fully covered with aluminum foil and containing a few drops of distilled water and vernalized in the refrigerator at 3-5°C for eight weeks (Kay et al., 1981; Kazemi, 1988). Eight seeds of each variety were sown in 20 cm diameter plastic pots at a depth of 3 cm and thinned to four plants per pot after germination (van Emden et al., 1991). A total of 15 pots were devoted to each variety. The soil used, was a mixture of garden soil, sand and compost at a rate of 3:1:1 obtained from Khalate-pooshan agricultural experiment station.

Plant infestation: Aphids reared on the stock culture individually were confined in clip cages on the upper leaves of experimental plants (Kazemi, 1988). Since the culture plant may influence the performance and preferences of the aphids, they were reared o the experimental plants for at least one generation before the main experiments. For the main experiments, one adult apterous aphid from the appropriate culture was confined in a clip cage on the upper leaf of the experimental plant. After 24 hours, the adult was removed, and one newly born nymph was retained to develop to an adult and reproduce (Kazemi & van Enden, 1992). The position of the cages was changed once every three to four days to avoid local leaf damage. The experimental plants were kept under glasshouse conditions of 24.2±4.5°C temperature, 55.7±4.6% relative humidity and a 16:8 (L: D) light regime. The experimental design was a completely randomized block design with five treatments (varieties) and each variety with 20 replicates using individual clip-on leaf cages as experimental units, set up on the last fully grown leaves of the main plants. In order to determine the maturation time and survival rate of encaged progeny, each individual nymph was allowed to develop into an adult. The fecundity of the resultant adults was determined by daily counts of their progeny between 9 and 11 a.m. for periods of 10 and 15 days. All progenies were removed from caged leaves after completion of the counts. To calculate the daily intrinsic rate of natural increase (r_m value), nymphal survival on each variety (age specific survival rate: lx), developmental time and daily fecundity of individual aphids (age specific fecundity: mx) were used in the equation $\sum -\mathbf{rm}$ lxmx= 1 (Birch, 1948), using van Emden's STATSPAK version 8.00 based on Mallard Basic.

RESULTS AND DISCUSSION

Development time and survival rate of nymphs: The ANOVA of the data obtained on duration of developmental period indicated that there were significant differences between treatment means. Comparisons made between treatment means using Duncan's multiple range test showed significant differences (P<1%). Data presented in table 1 shows that the highest and lowest nymphal survival rate occurred on Sabalan, Sardari, Zarrin, Alamoot and Alvand varieties respectively. Also the highest and lowest growth index "GI" [more suitable measurement of insect growth on susceptible and resistant plants (Saxena et al., 1974)], belong to Sabalan (15.65) and Alvand (6.49) respectively (Table 1). The effects of feeding on various wheat varieties on survival rate of *Sitobion avenae* and *Metopolophium dirhodum*, *Rhopalosiphum paid* and *Diuraphis noxia*, have been investigated by the works of Sotherton & van Emden (1982), Kazemi & van Emden (1992), Kazemi, Talebi-Chaichi, Shakiba & Mashhadi Jafarloo (2001a,b) and Kazemi (2010) respectively. Obviously, determining the nature of the effects of defence mechanisms (Physical and Chemical) at the host plants on the survival rate of the aphid requires further complementary studies.

Fecundity: The ANOVA of obtained data indicated significant differences (P<1%) in mean fecundity of the aphid on five wheat varieties within 10 and 15 day periods of larviposition (Table 2). The highest fecundity within the two periods was recorded on Sabalan, indicating its sensitivity to the English grain aphid. Although the aphid produces more progeny and shows the highest population density at the ear emergence stage, but Appablaza and Robinson (1967), Lowe (1984) and Kazemi (2010) have noticed certain differences between the aphid population density at the seedlings and tillering growth stages of the plant. They reported that resistant variety has the lowest aphid progeny on the plant. The results of our studies confirm the findings of Appablaza & Robinson, Low and Kazemi. The least progeny produced within the first 10 and 15 days of larviposition periods were observed on Sardari and Zarrin, whilst Alamoot and Alvand were intermediate between Sabalan and Sardari at the end of 15 day larviposition period.

The Intrinsic rate of natural increase (r_m value): Data indicated significant differences between rm values at P≤1% (Table 3). Based on the aphid's intrinsic rate of increase within 10 and 15 day periods of rearing on test varieties, Sabalan had the highest rm value at both rearing periods and are thus regarded as the most susceptible variety. Alvand had the lowest r_m values and are considered to be resistant. Sardari, Zarrin and Alamoot seem to be partially resistant varieties.

CONCLUSION

The resultsof this experiment showed that the factor of growth index of the varieties varies between 6.49 to 15.65, which means Alvand, Alamoot and Zarrin had the highest resistant effect on the aphid whilst Sabalan and Sardari had the lowest effect on the aphid respectively. Also survival rate of the aphid has shown the same results with Alvand and Alamoot being resistant and Sabalan and Sardari being the susceptible varieties between the cultivars. The 10 and 15 days fecundity results showed the varies ranking of the varieties with Sabalan having the highest number of fecundity and Sardari and Zarrin having the lowest ones which means that Sardari and Zarrin were resistant to the aphid and Sabalan was susceptible. The intrinsic rate of natural population increase (r_m value) is considered as one of the most important factors of antibiosis resistance of different plant cultivars to insect pests. Sabalan had the highest r_m value whilst Alvand had the lowest value indicating the susceptibility of Sabalan to the aphid and the resistance of Alvand to this pest. The results of this study indicated that at stem elongation growth stage, amongst the varieties studied, Alvand was the resistant variety to the English grain aphid with Sabalan being the most susceptible one, while the other varities Sardari, Alamoot and Zarrin appeared to be the intermediate varieties respectively. With extension of the studies to all phonological stages of the test varieties, it is hoped that inclusion of the pest management program would be avaluable tool toward lowering the damage potential of this aphid.

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Table 1. Mean development time, survival rate and growth index of nymphs of English grain aphid on five wheat varieties under greenhouse conditions.

Variety	Mean development time (days) X±S.D.	Survival rate (%)	*Growth index*
Sardari	6.5 ± 0.513 c+	80.8	12.3
Sabalan	5.75 ± 0.444 d	90.0	15.65
Zarrin	7.6 ± 0.503 a	70.0	9.21
Alvand	7.7 ± 0.470 a	50.0	6.49
Alamoot	7.25 ± 0.444 b	65.0	8.97

+ Means followed by a similar letter are not significantly different at a level of 1%l.

Table 2. Mean fecundity of adult apterae of English grain aphid within 10 and 15 day periods of rearing on five wheat varieties.

Variety	10 day X±S.D.	15 day X±S.D.
Sardari	38.30 ± 2.203 e+	58.60 ± 3.424 e
Sabalan	59.35 ± 2.601 a	88.15 ± 4.815 a
Zarrin	42.85 ± 2.925 d	61.25 ± 3.024 d
Alvand	48.15 ± 2.134 c	72.20 ± 2.984 c
Alamoot	53.25 ± 1.997 b	78.55 ± 2.544 b

+ Means followed by a similar letter in each column are not significantly different at a 1%level.

Table 3. Intrinsic rate of increase of the English grain aphid in rearings on five wheat varieties for 10 and 15 day periods under greenhouse conditions.

	Intrinsic rate of increase (r_m values)	
Variety	10 day period X±S.D.	15 day period X±S.D.
Sardari	0.316 ± 0.0068 b+	0.320 ± 0.0063 b
Sabalan	0.412 ± 0.0074 a	0.414 ± 0.0073 d
Zarrin	0.284 ± 0.0058 d	0.287 ± 0.0053 d
Alvand	0.262 ± 0.0034 e	0.267 ± 0.0025 e
Alamoot	0.308 ± 0.0036 c	0.312 ± 0.0034 c

+ Means followed by a similar letter in each column are not significantly different at a 1%level.

A PROPOSAL ON A NEW TAXONOMICAL ARRANGEMENT OF *AROMIA MOSCHATA* (LINNAEUS) SPECIES GROUP (COLEOPTERA: CERAMBYCIDAE)

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[Özdikmen, H., Kaya, G. & Cihan, N. 2014. A proposal on a new taxonomical arrangement of *Aromia moschata* (Linnaeus) species group (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 9 (2): 761-764**]**

ABSTRACT: The paper presents a proposal on a new taxonomical arrangement of *Aromia moschata* (Linnaeus) species group. The specific and subspecific compositions are discussed and arranged in the text. As a result of this, *Aromia ambrosiaca* (Steven) is upgraded species rank. And in accordance with the status novum, three taxa as *A. moschata cruenta* Bogatchev, *A. moschata jankovskyi* Danilevsky and *A. moschata vetusta* Bogatchev are transferred to species *Aromia ambrosiaca* (Steven).

KEY WORDS: *Aromia moschata* species group, Cerambycidae, Cerambycinae, Turkey.

The Palaearctic genus *Aromia* Audinet-Serville, 1834 includes only 4 species as *Aromia bungii* Faldermann, 1835 (Korea and China, newly introduced to Germany), *Aromia japonica* Podaný, 1971 (Endemic to Japan), *Aromia moschata* (Linnaeus, 1758) (Europe, Siberia, Central Asia, Caucasus, Turkey, Iran, Middle East (Syria, Lebanon, Jordan, Iraq), North Africa (Algeria, Morocco, Tunusia)), *Aromia orientalis* Plavilstshikov, 1932 (Eastern Siberia, Far East Russia, Mongolia, Korea, Japan, China). Only the species, *Aromia moschata*, is represented in Turkey (Özdikmen, 2014).

According to Löbl & Smetana (2010), the species *Aromia moschata* consist of 6 subspecies. So, accepted taxonomical composition of *A. moschata* species group can present as follows:

Genus *Aromia* Audinet-Serville, 1834: 559
Species *Aromia moschata* (Linnaeus, 1758)

- *A. moschata moschata* (Linnaeus, 1758) (Europe, European Turkey, Caucasus, Transcaucasia (Georgia), Kazakhstan, Siberia, Mongolia),
  - *odorata* DeGeer, 1775 (*Cerambyx*)
  - *chlorophana* Fischer von Waldheim, 1823 (*Cerambyx*)
  - *alata* A. Costa, 1855
  - *auctumnalis* Westhoff, 1882
  - *thea* Reitter, 1894
  - *cupricollis* Pic, 1941
  - *perroudi* Pic, 1941
- *A. moschata ambrosiaca* (Steven, 1809) (South Europe, Caucasus, Transcaucasia (Armenia, Azerbaijan, Georgia), Turkey, Iran, Middle East (Syria, Lebanon, Jordan, Iraq), North Africa (Algeria, Morocco, Tunusia)),
  - *thoracica* Fischer von Waldheim, 1823 (*Cerambyx*)
  - *rosara* P. H. Lucas, 1847
  - *rosara* A. Costa, 1855
  - *melancholica* Reitter, 1895
  - *notaticollis* Pic, 1928
- *A. moschata cruenta* Bogatchev, 1962 (Kirgizia and Tadjikistan),

- *A. moschata jankovskyi* Danilevsky, 2007 (only Kirgizia),
- *A. moschata sumbarensis* Danilevsky, 2007 (only Turkmenistan),
- *A. moschata vetusta* Bogatchev, 1962 (only Kazakhstan).

Özdikmen (2014) proved that "*Aromia moschata is represented by two subspecies in Turkey. The nominate Aromia moschata moschata and Aromia moschata ambrosiaca*". He gave known Turkish records and distribution maps of the subspecies. He also stated that "*known distribution patterns of these subspecies are not available the rule of nonoverlapping ranges theorically in North Anatolia especially. The same status exists at least in Spain and Italy*".

For each country (Spain, Italy, Turkey), *Aromia moschata ambrosiaca* is regarded predominant. And it commonly accepted that the nominative subspecies is distributed only in Northern parts of the countries, while *Aromia moschata ambrosiaca* is distributed in other parts of the countries.

Known distribution patterns of the subspecies, however, are overlapped at least in Turkey. The records of *A. moschata ambrosiaca* from Northern provinces as Bilecik, Artvin, Çanakkale, Yozgat, Düzce and Balıkesir are the evidences (Map 1) for this case. The evidences do not regard as hybridization areas. The detailed information on distributional data and maps in Turkey of the subspecies gave in Özdikmen (2014).

From this point of view, we propose that both taxa should be accepted as separate species.

Moreover, the *moschata* species group has two different subgroups chiefly. These are:

Group I. Pronotum totally blue, green or blue-green colored (including two taxa).

- *A. moschata moschata* (Linnaeus, 1758)
- *A. moschata sumbarensis* Danilevsky, 2007

Group II. Pronotum more or less red colored (including four taxa).

- *A. moschata ambrosiaca* (Steven, 1809)
- *A. moschata cruenta* Bogatchev, 1962
- *A. moschata jankovskyi* Danilevsky, 2007
- *A. moschata vetusta* Bogatchev, 1962

Accordingly, the *moschata* species group should be separated into two species as *A. moschata moschata* (Linnaeus, 1758) and *A. ambrosiaca* (Steven, 1809). Furthermore, three taxa should be transferred to *Aromia ambrosiaca*. In this case, new taxonomical arrangement of the *moschata* species group can be presented as follows:

Genus *Aromia* Audinet-Serville, 1834: 559

Species *Aromia moschata* (Linnaeus, 1758)

- *A. moschata moschata* (Linnaeus, 1758)

  odorata DeGeer, 1775 (*Cerambyx*)
  chlorophana Fischer von Waldheim, 1823 (*Cerambyx*)
  alata A. Costa, 1855
  auctumnalis Westhoff, 1882
  thea Reitter, 1894

cupricollis Pic, 1941
perroudi Pic, 1941

- *A. moschata sumbarensis* Danilevsky, 2007

Species *Aromia ambrosiaca* (Steven, 1809) stat. nov.

- *A. ambrosiaca ambrosiaca* (Steven, 1809)
  thoracica Fischer von Waldheim, 1823 (*Cerambyx*)
  rosara P. H. Lucas, 1847
  rosara A. Costa, 1855
  melancholica Reitter, 1895
  notaticollis Pic, 1928
- *A. ambrosiaca cruenta* (Bogatchev, 1962) **comb. nov.**
- *A. ambrosiaca jankovskyi* (Danilevsky, 2007) **comb. nov.**
- *A. ambrosiaca vetusta* (Bogatchev, 1962) **comb. nov.**

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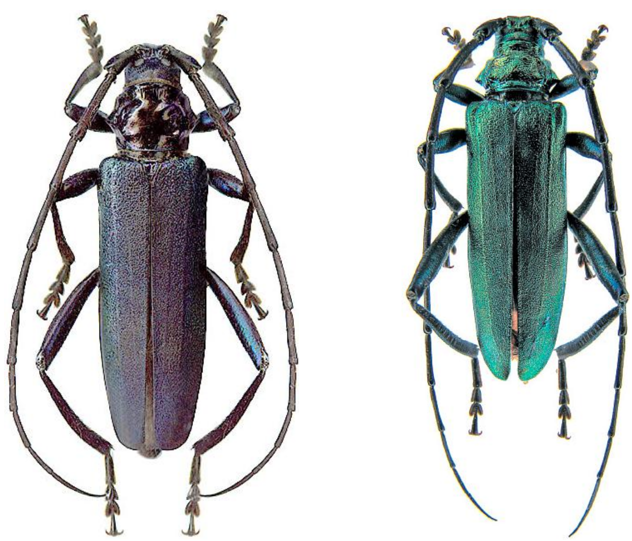
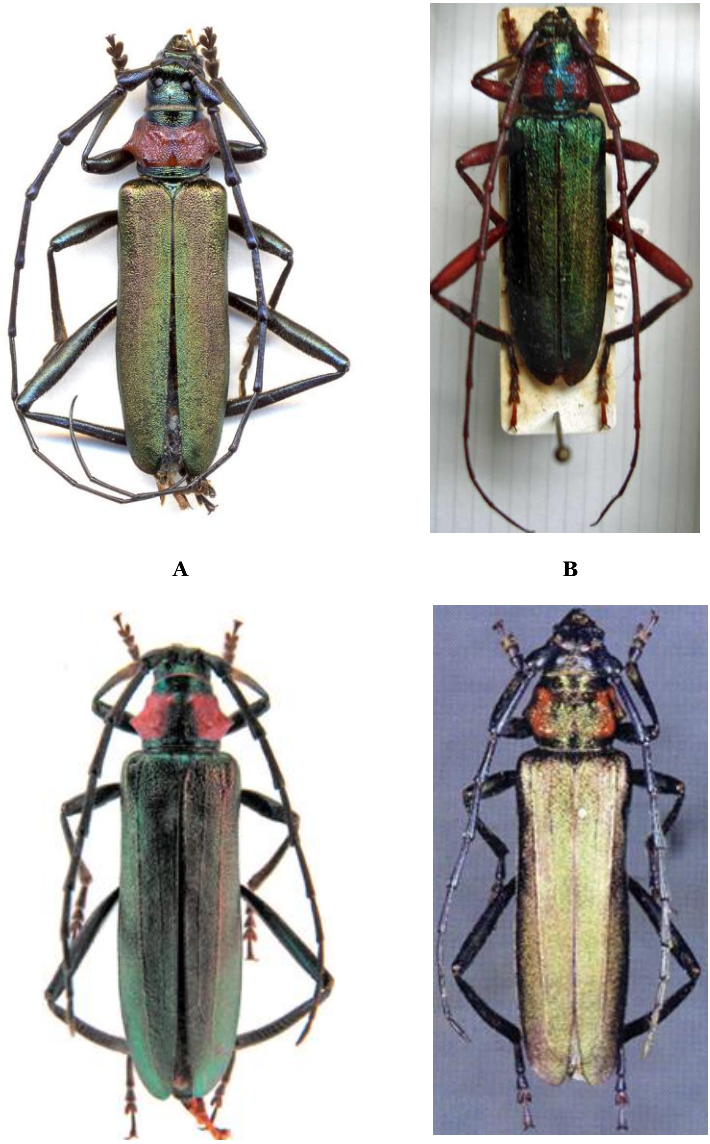


A B

Figure 1. A. *Aromia moschata moschata* (from Szczepan Ziarko in http://www.zin.ru/animalia/coleoptera/rus/aromoszi.htm), B. *Aromia moschata sumbarensis* (from Danilevsky, 2007).



A B

C D

Figure 2. A. *Aromia amrosiaca ambrosiaca* (from D. G. Kasatkin in http://www.zin.ru/animalia/coleoptera/rus/aromoadk.htm), B. *Aromia ambrosiaca cruenta* (from http://insecterra.forumactif.com/t12158-aromia-moschata-de-georgie), C. *Aromia ambrosiaca jankovskyi* (from Danilevsky, 2007). B. *Aromia ambrosiaca vetusta* (from Danilevsky, 2000).

FIRST RECORD OF THE APRICOT FLOWER MIDGE, *CONTARINA PRUNIFLORUM* COUTIN & RAMBIER (DIPTERA: CECIDOMYIIDAE) IN MALATYA PROVINCE, TURKEY

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[Doğanlar, M., Yiğit, T., Aslan, A. & Karakaş, H. B. 2014. First record of the apricot flower midge, *Contarina pruniflorum* Coutin & Rambier (Diptera: Cecidomyiidae) in Malatya province, Turkey. Munis Entomology & Zoology, 9 (2): 765-769**]**

ABSRACT: The apricot flower midge, *Contarinia pruniflorum* Coutin & Rambier, (Diptera: Cecidomyiidae) was recorded for the first time from Turkey. Female specimens and the larvae were redescribed from the Turkish materials, and distribution in Turkey was given.

KEY WORDS: *Contarinia pruniflorum*, apricot, distribution, Turkey.

The apricot flower midge, *Contarinia pruniflorum* Coutin & Rambier (Diptera: Cecidomyiidae) has been recorded by several works as a serious pest of *Prunus* spp. (Rosaceae), especially on flower buds of apricot, *P. armeniaca* (L.) Dumort. in Mediterranean countries such as: in France Coutin & Rambier, 1955 and Pierre & Chauvin-Buthaud, 2001; in Italy Pollini & Bariselli, 1996 and Tommasini, 2006; in Greece Tsagarakis & Mitsopoulus, 2007 and Kyttariolou, & Tsagarakis, 2013; in Czechoslovakia Jedlicka et al. 2009.

Gagné & Jaschhof (2014) recorded *C. pruniflorum* only from France and Czechoslovakia on *Prunus spinosa*, *P. mahaleb* (Rosaceae), but Pierre & Chauvin-Buthaud (2001) recorded that some apricot orchards the Drôme and Hérault regions in the South of France. Tommasini (2006) stated that the first report of the presence of *C. pruniflorum* on apricot dates back to 1996 in Emilia Romagna, Italy, and in recent years, it has affected the entire area of production of apricots. Tsagarakis & Mitsopoulus (2007) recorded that the damaged flowers by *C. pruniflorum* on apricot reached 60-65% at the observation orchards in Greece. Alford (2007) gave some biological data for the species.

Up to now only two natural enemy, *Gastrancistrus pacillus* Walk. (Hym., Chalcidoidea: Pteromalidae) and *Synopeas* sp. (Hymenoptera: Platygastridae), has been recorded as larval parasitoid of *C. pruniflorum* by Coutin & Rambier (1955). It was stated that the parasitism rate reached 8% in 1953 and 14% in 1954.

The aims of this work were identification of the apricot flower midge in Malatya province, Turkey. For that purpose the adults and the immature stages of the midge were studied.

MATERIAL AND METHOD

The study was conducted in 2009-2014 in Malatya province, Turkey. The adults on buds of *P. armeniaca* and buds with larvae of the pest were collected from the orchards mainly in the period from March to April. The buds with larvae brought to laboratory in plastic bags, and kept under laboratory conditions (24°C temperature and 60-70 % relative humidity) for rearing purpose. They were placed into jars filled with soil and kept outside.

In order to obtain distribution of the pest in Malatya province the infested apricot trees (3-30 years old) in the villages were selected randomly. Samplings were made 5-6 times in from March to April, 2009-2014. The specimens of the midges were collected by mouth aspirator from buds and the larvae were obtained from the infested buds of apricot trees. The records of distribution of the pest were obtained from the larvae sent by the researcher in other localities, such as Mut, Mersin and Kemalpaşa, İzmir, of Turkey. The wings, antenna and genitalia of the female and larvae of the pest were slide-mounted in Canada balsam.

The specimens of the midges were identified by comparing the characters of the adults and larvae with the characters given by Gagné & Jaschhof (2009) for identification of the genus, and for the species with the characters given by Coutin & Rambier (1955) in the original description of *C. pruniflorum*.

The examined specimens were deposited in the collection of the Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC) and of Apricot Research Station, Tecde Road, 44100 Malatya, TURKEY.

Photographs of diagnostic characters of the species were taking by using a stereo-microscope (LEIKA GM 500, Germany) with a digital camera (LEIKA ICC50 HD) attached to it.

RESULTS AND DISCUSSION

During investigations conducted in 2009-2010 in Malatya Province, Turkey, adults of the pest which were collected and preserved in vials without fluid was destroyed, and the adults collected in 2014 and the larvae kept in vials with ethanol was stayed in good conditions. By works the pest was identified as the Apricot flower midge, *Contarinia pruniflorum* Coutin & Rambier. The species was redescribed from Turkish materials as follows:

Contarinia pruniflorum Coutin & Rambier, 1955

(Figs. 1-3)

Contarinia pruniflorum Coutin & Rambier, 1955: 106-109, Types: Holotype ♂, Cecid no 179, paratype ♂♂, no 226, and nrs. 180-188 and 227-228 (in coll. Faunistique agricole, Versailles); nrs. 9695 and 9705 in coll. Barnes, Rothamsted (Angleterre); ♀♀: 224 (allotype), no 225 and nrs. 189-192 and 229-231 (in coll. Faunistique agricole, Versailles); nrs. 9706 and 9714 in coll. Barnes, Rothamsted (Angleterre).

Material examined: Turkey: Malatya, Kale, 1-15. ii. 2014, 74 ♀♀; Kıyıcak, 1.-15. ii. 2014, 65♀♀; all of the specimens were collected by T. Yigit . Many specimens of larvae, in vials with ethanol, from both locations, and from Mut, Mersin, collected from bud of *Prunus armeniaca* L., and Kemalpaşa, İzmir, collected from bud of *Prunus persica* (L) Stokes.

Description: The following description is mainly based on Coutin & Rambier (1955) by adding some figures:

The midges (Figs. 1a,c) are body orange-red, over-shadowed a brilliant blackish hair; head, thorax and legs black, tinged with red wings transparent blackish head with pale yellow appendages, body except the antennae about 2-2.5 mm in length.

Head (Fig. 2b). Antenna: 1.2 mm. with 12 flagellomeres cylindrical; the first two sections of flagellum welded together, the first 2/5 times longer than the second. all of the segments short and wide base, becoming increasingly long and narrow

towards tip of antenna, last article with a terminal extension as long as the neck of the previous article; each segments with two whorls of lights nets and uneven long bristle.
Palps (Fig. 2b): 4-segmented, first very short, quadrangular, second twice as long as broad, 3rd about 3 times, 4th segments 4 times as long as broad.
Wings (Fig. 2c): subcostal vein extending slightly beyond the tip of wing; Rs rudimentary, third vein curved, reaching just beyond tip of wing; fifth vein forked.
Legs (Figs. 2d,e): tarsal claws bowed at midlength, and simple on all legs, empodium well developed, about as long as claws.
Abdomen (Figs. 2a,f): female abdominal sternite 7 not longer than preceding sternite; ovipositor very elongated, when fully extended 2.1 mm, two terminal cerci with 8th large bristles at their greatest extremity.

Larva (Fig. 3): Colour whitish-yellow. 2.0-2.3 mm. Head (Fig. 3a) with antennae 0.3 times as long as capsule, posterolateral apodemes about as long as head capsule. Sternal spatula orange-brown with long stem and anterior part divided by bluntly pointed lobes; a lateral papilla each side of spatula. Terminal segment (Fig. 3b) with four pairs of papillae setose.

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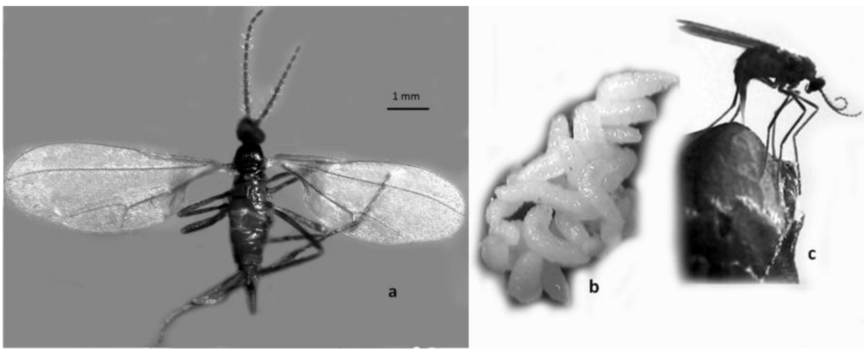

Figure 1. *Contarinia pruniflorum* Coutin & Rambier, female. a. body in dorsal view; b. mass of larvae; c. egg laying female onto bud of apricot, in lateral view.

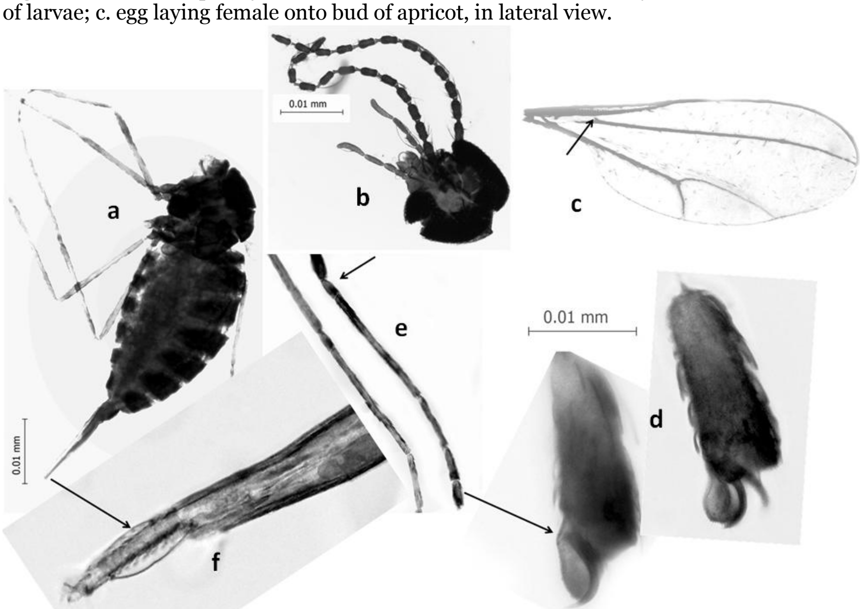

Figure 2. *Contarinia pruniflorum* Coutin & Rambier, female. a. thorax and abdomen with sternite 7 not longer than preceding sternite, in lateral view: b. head with antennae, in frontal view; c. forewing, arrow states undeveloped R_s; d. pretarsi with simple tarsal claws bowed at midlength; e. fore tarsi, arrow states short metatarsus; f. tiny cerci.

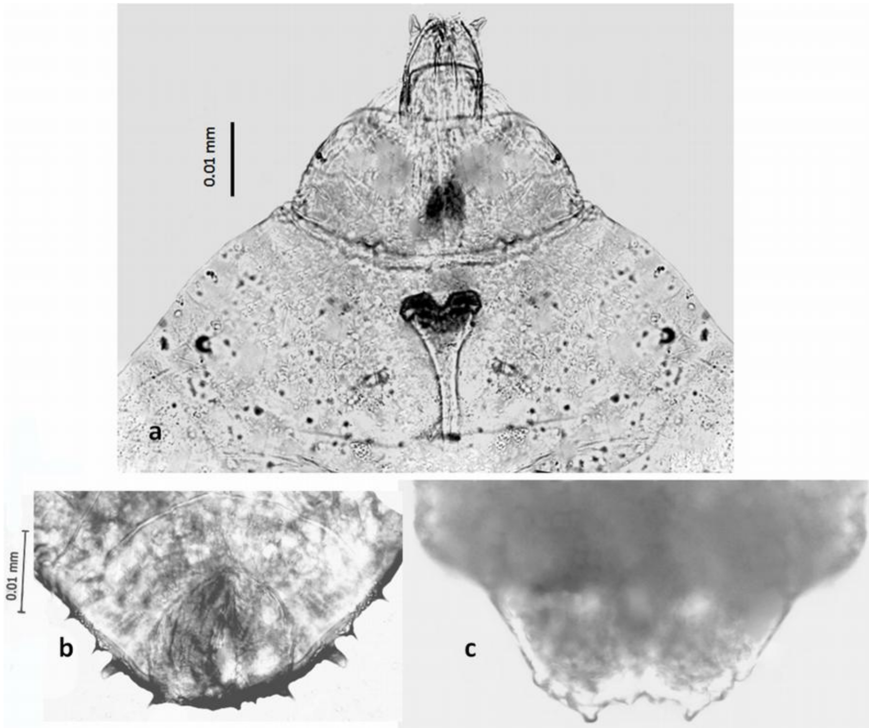

Figure 3. *Contarinia pruniflorum* Coutin & Rambier, 1955. Larva. a. head and sternal spatulae; b. terminal segments , in ventral view; c. terminal segments , in dorsal view.

CONFIRMATION OF *ENOCHRUS AFFINIS* IN TURKEY, SOME NOTES ON THE *ENOCHRUS POLITUS* (KUSTER, 1849) (COLEOPTERA: HYDROPHILIDAE)

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[**Bektaş, M., Polat, A., İncekara, Ü. & Taşar, G. E.** 2014. Confirmation of *Enochrus affinis* in Turkey, some notes on the *Enochrus politus* (Küster, 1849) (Coleoptera: Hydrophilidae). Munis Entomology & Zoology, 9 (2): 770-773]

ABSTRACT: This article is intented to present both to confirm of *Enochrus affinis* Thunberg 1794 (Hydrophilidae: Cleoptera) and to inform more about distirbution of *Enochrus politus* Küster 1849 (Hydrophilidae: Cleoptera) in Turkey. Specimens of *Enochrus* were collected from seven provinces of Turkey (Adana, Gaziantep, Hatay, Kahramanmaraş, Kilis, Mersin and Osmaniye) in different survey between 2012 and 2013 years (May-October) through in shallow areas of various lakes, rivers, watercourses, spring and ponds. Also, it has been added the examples which had been collected same places in 2011 year. *Enochrus affinis* Thunberg 1794 and *Enochrus politus* Küster 1849 are recorded from research area for first time.

KEY WORDS: Coleoptera, aquatic beetles, *Enochrus*, Turkey.

Enochrus is a large genus of Hydrophilid bettles containing abundant species in all zoogeographical regions. Most *Enochrus* species are common and occur in many kinds of vegetated, stagnant and slowly running water bodies. Although they are frequently collected and present in the largest beetle collections, both their taxonomy and phylogenetic relationships are stil insufficiently known. The status on numerous taxa is unresolved and particularly for the Palearctic and Oriental Realms it is obvious that there are fewer valid species than have ben described in the past (Hansen, 1991; Schödl, 1998).

MATERIAL AND METHODS

Specimens of aquatic Coleoptera were collected from seven province of Turkey (Adana, Gaziantep, Hatay, Kahramanmaraş, Kilis, Mersin and Osmaniye) in different survey between 2012 and 2013 years (May-October) through the vegetations in shallow areas of various lakes, rivers, watercourses, spring and ponds. Also, it has been added the samples which had been collected same places in 2011 year.

The beetles were killed using ethyl acetate or in 70% alcohol solution. Aedeagophores of the beetles clened with burshes were dissected under a stereo microscope and left in 10%KOH solution for 1-2 hours. The figure of the aedeagophore was taken photographed using a Nikon type 104 microscope.

The recorded species was described and photographs of important aedeagus showing diagnostic taxanomic characters were taken. Zoological Museum of Biology Department (Ataturk University / Science Faculty) is used for collections where material is located.

RESULTS

Enochrus affinis (Thunberg, 1794)

Material Examined: Adana: Ceyhan, 12♂♂, 4♀♀, 36°59'26N 35°49'44 E, 25 m, 25.IV.2012; Yumurtalık Road, 4♂♂, 2♀♀, 36°59'27N 35°49'44 E, 29 m, 29.V.2012; İmamoğlu, Koyuneri, 8♂♂, 6♀♀, 37°17'23N 35°42'16 E, 67 m, 16.V.2013; Karataş, 1♂, 36°08'20N 35°22'15 E, 76 m, 16.V.2013; Yumurtalık, 3♂♂, 2♀♀, 36°39'56N 35°30'17 E, 33 m, 15.V.2013; Bebeli, 6♂♂, 5♀♀, 36°39'01N 35°30'35 E, 4 m, 26.VI.2013; Deveciuşağı, 14♂♂, 14♀♀, 36°45'28N 35°37'33 E, 0 m, 26.VI.2013; Küçük Yumurtalık, 12♂♂, 11♀♀, 36°46'04N 35°43'47 E, 16 m, 18.IV.2013; Mehtap Housing, 6♂, 36°46'35N 36°45'01 E, 15 m, 25.IV.2012; Narlık, 1♂, 1♀, 36°54'11N 35°52'06 E, 78 m, 15.V.2013; Yumurtalık Lagoon (Rear Entrance), 6♂, 36°39'43N 35°33'49 E, 4 m, 25.IV.2012; Yumurtalık Lagoon, 5♂♂, 4♀♀, 36°46'04N 35°38'39 E, 15 m, 29.VI.2012; 4♂♂, 3♀♀, 36°40'31N 35°33'17 E, 0 m, 15.V.2013; ; 4♂♂, 5♀♀, 36°45'24N 35°38'05 E, 0 m, 26.VI.2013; Yumurtalık (Lagoon Exit), 13♂♂, 15♀♀, 36°46'36N 35°44'56 E, 11 m, 18.IV.2013; Yüreğir, Doğankent, 1♂, 1♀, 36°52'02N 35°20'59 E, 20 m, 29.VIII.2013. **Gaziantep:** Merkez, Yolbaşı, 5♂♂, 7♀♀, 36°50'42N 36°39'26 E, 385 m, 15.IV.2013; Islahiye, Çınarbaşı, 9♂♂, 2♀♀, 36°50'42N 36°39'25 E, 375 m, 27.V.2012; Hanağzı, 13♂♂, 2♀♀, 37°04'36N 36°37'33 E, 516 m, 14.V.2013. **Hatay:** Dörtyol, 3♂, 36°48'06N 36°11'31 E, 0 m, 27.VI.2012; Erzin, Dörtyol Road, 15♂♂, 26♀♀, 37°01'56N 36°08'19 E, 74 m, 24.IV.2012; Hassa, 1♂, 36°48'30N 36°32'02 E, 390 m, 15.IV.2013; Kumlu, Karaçamlık, 1♂, 36°22'25N 36°24'55 E, 81 m, 16.IV.2013; Güventaşı, 11♂♂, 10♀♀, 36°24'24N 36°24'17 E, 80 m, 16.IV.2013; Terzihüyük, 6♂♂, 4♀♀, 36°18'01N 36°24'38 E, 82 m, 16.IV.2013; Reyhanlı, Varışlı Village, 1♂, 1♀, 36°15'25N 36°23'07 E, 93 m, 01.IX.2013. **Kahramanmaraş:** Merkez, Avcılar Dam (Süleymanlı), 1♂, 37°49'38N 36°48'05 E, 668 m, 24.VI.2013; Andırın, Gökçeli, 1♂, 37°35'58N 36°22'20 E, 1115 m, 26.IV.2012; Ekinözü, Taşburun, 4♂♂, 6♀♀, 38°09'34N 37°12'20 E, 1238 m, 04.IX.2013; Nurhak: Barış Township, Ayçoşar, 5♂♂, 7♀♀, 38°02'38N 37°18'19 E, 1523 m, 27.IV.2012; Pazarcık, Bağlama Small Lake, 1♂, 37°17'35N 37°07'53 E, 535 m, 05.IX.2013. **Kilis:** Merkez, Hassa Road, 12♂♂, 5♀♀, 36°51'24N 36°37'44 E, 382 m, 01.IX.2013; Yolbaşı (Hassa Road), 9♂♂, 4♀♀, 36°50'42N 36°38'28 E, 382 m, 12.V.2013; Çınarbaşı, 1♂, 34°54'56N 36°03'09 E, 410 m, 24.IV.2012; Musabeyli, Üçpınar, 10♂, 36°52'29N 36°57'43 E, 618 m, 22.IV.2012. **Mersin:** Erdemli, Karakız Creek, 3♂♂, 4♀♀, 36°39'00N 34°23'00 E, 5 m, 15.IV.2012. **Osmaniye:** Merkez, Cevdediye, 1♂, 1♀, 37°07'27N 36°13'33 E, 99 m, 30.VIII.2013; Selimiye, 16♂♂, 12♀♀, 37°14'23N 36°02'25 E, 40 m, 19.IV.2013; Tecirli (Bird Sanctuary), 2♂♂, 3♀♀, 37°09'47N 36°07'19 E, 54 m, 16.V.2013; Tecirli, Kasabala Valley (Wetland Protection Area), 2♂♂, 3♀♀, 37°10'36N 36°08'42 E, 49 m, 30.VIII.2013; Hasanbeyli, Kayalı, 1♂, 37°10'13N 36°27'34 E, 624 m, 27.VII.2011; Kadirli, Yukarı Çiyanlı, 1♂, 37°21'26N 36°10'23 E, 417 m, 19.IV.2013.

Remark: A widespread Palaearctic species, more common especially in central and northern Europe but reaching as far as the Russian Far East (Hansen, 1999, 2004). According to Darılmaz and İncekara (2011), *Philhydrus marginellus* var. *minutus* F. was recorded from İçel by Peyron (1858), but his record is in need of confirmation.

Enochrus politus (Küster, 1849)

Material Examined: Adana: Ceyhan, Yumurtalık Road, 6♂♂, 3♀♀, 37°25'20N 36°15'26 E, 151 m, 26.IV.2012; Yumurtalık, Yumurtalık Lagoon, 1♂, 36°07'49N

35°36'48 E, 0 m, 25.IV.2012; 2♂♂, 36°44'51N 35°38'03 E, 1 m, 18.IV.2013; 1♂, 1♀, 36°44'50N 35°38'03 E, 0 m, 15.V.2013. **Gaziantep:** Islahiye, Çınarbaşı, 8♂♂, 11♀♀, 36°54'07N 36°34'12 E, 446 m, 14.V.2013; 1♂, 36°50'43N 36°38'16 E, 380 m, 15.IV.2013. **Hatay:** Dörtyol, 1♂, 36°48'06N 36°11'31 E, 0 m, 27.VI.2012; Erzin, Yumurtalık Entrance, 7♂♂, 2♀♀, 36°56'14N 36°03'47 E, 10 m, 15.V.2013; Hassa, Sapanözü, 1♂, 36°50'42N 36°38'21 E, 379 m, 23.IV.2012. **Kahramanmaraş:** Afşin, Yazıbelen, 1♂, 2♀♀, 38°19'38N 36°57'55 E, 1173 m, 18.V.2013; Tanır, Altınelma, 1♂, 38°21'41N 36°54'37 E, 1216 m, 27.IV.2012; Andırın, Dereağzı (Gözdağı) village, 1♂, 37°53'21N 36°26'58 E, 1553 m, 26.VI.2012; Ekinözü, 1♂, 38°04'26N 37°12'47 E, 1310 m, 31.V.2012; Göksun, Andırın Road, 1♂, 1♀, 38°00'03N 36°29'27 E, 1341 m, 24VI.2013; Fındıklıkoyak, 1♂, 37°56'20N 36°27'53 E, 1383 m, 26.VI.2012; Kireçköy, 1♂, 1♀, 37°58'46N 36°29'58 E, 1345 m, 30.V.2012; Değirmendere, 1♂, 37°55'06N 36°27'44 E, 1430 m, 26.VI.2012. **Kilis:** Elbeyi, Alahan, 1♂, 1♀, 36°40'22N 37°27'00 E, 520 m, 27.V.2012; Yağızköy, 1♂, 1♀, 36°39'58N 37°22'00 E, 500 m, 27.V.2012. **Osmaniye:** Hasanbeyli, Kayalı, 1♂, 37°10'13N 36°27'34 E, 624 m, 27.VII.2011.
Distribution in Turkey: Bitlis, Muş, Uşak and Van (Darılmaz & Kıyak, 2009; Darılmaz & Incekara, 2011; Aydoğan, 2011; Türken, 2011).
Remark: Afghanistan, Algeria, Canary Islands, Cyprus, Egypt, Fas, Israel, Italy, Lebanon, Madeira Islands, Portugal, Spain, Tunusia, Turkey (Bitlis, Muş, Uşak and Van) and Oman (Löbl & Smatana, 2004; Darılmaz & Kıyak, 2009; Darılmaz & İncekara, 2011). *E. politus* is here recorded from the region the first time.

DISCUSSION

In study, 404 samples (224♂, 180♀) of *Enochrus affinis* Thunberg 1794 and 63 samples (39♂, 24♀) of *Enochrus politus* Küster 1849 were collected and evaluated. Besides, two species are recorded from research area for first time.

Enochrus politus Küster 1849 was identify from Uşak, Bitlis ve Muş provinces (İncekara & Darılmaz, 2011) and have been determined for the second time from Turkey.

Even if the water beetle fauna of Turkey known, more studies are required to better understand the overall distirbution. Because of different cilmate conditions and wide range geographical regions, the number of Enochrus species is indisputable much higher than that recorded so far. So, new studies should be conducted acutely on this group of insects.

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SALIVARY ALPHA-AMYLASE ACTIVITY OF THE STRIPPED BUG, *GRAPHOSOMA LINEATUM*: CHANGES DURING DEVELOPMENT

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ABSTRACT: Studying the digestive enzymes of true bugs is important in understanding the physiology of the digestive system and manner of injury to plants by these insects. In this study, the salivary α-amylase activity of the adults and nymphs was measured by using a special diagnostic kit and an autoanalyzer. Protein concentrations in all enzyme samples were determined by using bicinchoninic acid method and bovine serum albumin as the standard. The method of Yazdanian et al. used for removing the salivary glands under a stereomicroscope, and enzyme samples were prepared by the method of Cohen. In eggs (newly oviposited and 1- to 4-days old ones), no enzyme activity was observed. In different nymphal stages, enzyme activity in third instars (12.45 U/mg protein) had the highest mean that differed significantly from other means. Enzyme activity did not observe in enzyme samples of first instars. Age and sex of adult insects had a significant effect on enzyme activity, so that it was higher in females than males, and in 15- and 30-days old adults it was higher than those of other ages, especially in 20-days old adult females which had the highest value (44.57 U/mg protein). In addition, it found that salivary α-amylase activity in adults was correlated with their reproductive activities.

KEY WORDS: *Graphosoma lineatum*, salivary α-amylase, activity, developmental changes.

Insect diets and their feeding behaviors are very different and their digestive enzymes have evolved with respect to the foods they consume (Takanona & Hori, 1974; Hori, 1975). In true bugs, one of the most important aspects of feeding is the injection of salivary enzymes into the host plant tissues (Miles, 1968; Miles, 1972; Hori, 1973b). The survival of phytophagous insects depends on digestive enzymes, especially α-amylases that are produced by the insects' guts and especially salivary glands. These enzymes are also present and active in the gut but they are less active than salivary enzymes. Studying the insect digestive enzymes would lead to recognition of their alimentary canal physiology (Hori, 1970a,b, 1972, 1973a, 1975; Takanona & Hori, 1974) and the damages caused by them on plants. Studying the insect digestive system also helps to recognize different enzymes and their characteristics including optimum pH, optimum temperature, and kinds of enzymes present in different species; and to evaluate the effects of various factors such as developmental stages, food regimes, geographical conditions, etc. on the enzyme activity. In 1987, the results of studies on characteristics of digestive enzymes reached to the practical aspect of them. In this year, with producing transgenic plants (tobacco) containing the genes of trypsin inhibitors from broad bean and inducing resistance to the tobacco budworm *Heliothis virescens*, a new control method was introduced. This work continued in other plant species via using different toxic proteins such as lectins, protease inhibitors, α-amylase inhibitors, and δ-endotoxin of *Bacillus thuringiensis* (Botter & Jongsma, 1995; Schroeder et al, 1995; Hinks & Hupka, 1995; Morton et al. 2000; Silva et al. 2001). Introducing the transgenic plants containing the genes of enzyme inhibitors needs co-working of entomologists and plant breeders; and in the first step, entomologists begin to evaluate the biochemical characteristics of the enzymes and to recognize effective inhibitors.

α-amylases (α-1,4-glucan-4-glucanohydrolases; EC 3.2.1.1) are hydrolytic enzymes that are wide distributed and are found in microorganisms, plants and animals (Applebaum, 1985; Strobl et al., 1997; Strobl et al., 1998a,b; Barbosa Pereira et al., 1999; Titarenko & Chrispeels, 2000; Carlini & Grossi-de-Sa, 2002). These enzymes catalyze the hydrolysis of α-(1,4)-D-glucan bonds in starch, glycogen and other related carbohydrates (Franco et al., 2002; Strobl et al., 1998b). This enzyme converts starch to maltose, which is then hydrolyzed to glucose by an α-glucosidase. In insects, it has been shown that α-(1,4)-D-glucan bonds in long chain carbohydrates such as starch or glycogen are hydrolyzed only by α-amylases (Terra et al., 1996). Salivary and gut α-amylase activity has been described from several insect orders including Coleoptera, Hymenoptera, Diptera, Lepidoptera and Hemiptera (Hori; 1971; Baker & Woo, 1985; Strobl et al., 1998b; Zeng & Cohen, 2000b; Mendiola-Olaya et al., 2000; Oliveira-Neto et al., 2003; Mehrabadi & Bandani, 2009a).

In order to develop new strategies for controlling the herbivorous insects, such as the use of enzyme inhibitors and transgenic plants that express these inhibitors, we need to understand how digestive enzymes work (Bandani et al., 2001; Ghoshal et al., 2001; Maqbool et al., 2001). For nearly all of these strategies, having a strong understanding of the target pest's feeding is important (Mehrabadi & Bandani, 2009b). Furthermore, having knowledge about the biochemistry and physiology of feeding adaptation is of great importance (Mehrabadi & Bandani, 2009b).

In this study, we evaluated the effect of developmental changes on α-amylase activity of the stripped bug *Graphosoma lineatum* (L.) in order to approach a better understanding of the digestive physiology of this insect.

MATERIALS AND METHODS

Insects

All developmental stages of *G. lineatum* were reared at 28 ± 2 °C Temp., 60-70% R.H., and 16L: 8D. Parsley seeds were used for rearing the nymphs and adults. Water provided from dishes containing distilled water, through filter papers.

Preparing the Enzyme Solution

In the case of eggs, newly oviposited and 1- to 4-days old ones were selected. 40 eggs of each group were homogenized in a 1.5 ml microtube containing 1 ml of cold phosphate buffer (4 °C, pH = 6.95). The method of Yazdanian et al. (2006) was used for removing the salivary glands under a stereomicroscope (except for the first instars that head and thorax were homogenized). First to fifth instars and adult insects sampled randomly and starved for 24 hours before dissection to accumulate enzymes in the salivary glands (Boyd et al., 2002; Zeng & Cohen, 2000a, 2000b; Cohen 1993). Adults and nymphs placed at –20 °C for 4 minutes to become motionless before dissection and then transferred to ice-cold phosphate buffer. At the next step, the 10 pairs of exposed salivary gland complex (including principal and accessory glands and principal and accessory ducts) homogenized in a 1.5 ml microtube containing 1 ml of cold phosphate buffer. The homogenates centrifuged at 15000 rpm for 20 min at 4 °C. The supernatants (or the enzyme solutions) were stored at –20 °C for subsequent analyses.

Enzyme Activity Assay

α-amylase activity in salivary glands of the adults and nymphs was measured by a special diagnostic kit (Amylase kit, Pars Azmoon Co., IRAN), using an autoanalyzer (Alcyon 300, Abbott, USA). Protein concentration in all enzyme samples was determined by using bicinchoninic acid method and bovine serum albumin (BSA) (Sigma-Aldrich, USA) as the standard. Finally, the specific activity of enzyme calculated as U/mg protein. The experiments repeated four times.

Statistical Analysis

Data were statistically analyzed by one-way analysis of variance (ANOVA). Means were separated by Duncan's multiple range test when significant differences were found at $p < 0.01$.

RESULTS

1. Activity of α-Amylase in Embryonic Stage

In any of enzyme solutions obtained from eggs (newly oviposited and 1- to 4-days old ones) no enzyme activity was observed.

2. Activity of α-Amylase in Different Instars

Average enzyme activity in different nymphal stages significantly differed from each other (df = 4, F = 12.38, P = 0.00001) (Fig. 1). Enzyme activity in first instars did not observe. Enzyme activity in third instars had the highest value (12.45 U/mg protein) and differed significantly from other means. After third instar, enzyme activities in forth and fifth instars had the highest amounts (6.71 and 4.45 U/mg protein, respectively) with no significant difference from each other but significantly differed from third instar. Mean of enzyme activity in second instar was 1.85 U/mg protein and had no significant difference with first and fifth instars but differed significantly from means of third and forth instars.

3. Activity of α-Amylase in Adults with Different longevities

Age and sex of adult insects and interaction between them affected the enzyme activity (age: df = 6, F = 18.24, P = 0.0001; sex: df = 1, F = 18.51, P = 0.0; interaction: df = 6, F = 8.92, P = 0.00001). Results of means comparison are shown in Fig. 2. Enzyme activities in females were higher than males in most cases with significant differences. Age of adult insects had a significant effect on enzyme activity. Enzyme activities in 15-, 20- and 25-days old males and females were considerable that are correlated with maximum reproductive activities of adults (Fig. 3). Increasing of the enzyme activity in female adult insects was more than that in adult males and the amount of the increase in enzyme activity at the maximum rate were 22.7 units in males and 43.29 units in females. Figs. 4 and 5 show the comparisons of means between nymphs and adults. Results obtained from some orthogonal comparisons are shown in Table 1.

DISCUSSION

It has reported that salivary enzyme activity in Heteroptera differs in different developmental stages (Nuorteva, 1954, 1956a,b; Saxena, 1955; Hori, 1968, 1970c, 1973a). Hori (1968) in a study on the effect of developmental stages of *Eurydema rugosa* on the salivary α-amylase activity showed that enzyme activity in second instars was low but in third, forth and fifth instars was higher and in forth instar was at maximum level. Enzyme activity in third instars was more than that of fifth instar. Variation in enzyme activity at different developmental stages attributed to the variations between these stages. Hori (1970c) reported that in *L. disponsi*, in each developmental stage, the salivary α-amylase activity in younger nymphs was lower but with ageing of nymphs and just before molting was at maximum rate. After molting, enzyme activity reduced considerably although its amount was higher than that in previous instars joust before molting. Comparison of enzyme activities in different instars just before molting showed that the enzyme activity in second instar was equal to that in third instar while the enzyme activities of forth and fifth instars were three and ten times greater than second instar, respectively. Activity of α-amylase in newly emerged adult insects were $^1/_{10}$ activity of that in fifth instar, then the activity of enzyme in adults rapidly increased and reached to the maximum level in 10-days old adults. Activity of enzyme in 30-days old adults was more than that of newly emerged insects but it was less than enzyme activities in 3- and 5-days old adults. Considerable enzyme activity just before molting may be resulted from high feeding of insects for getting energy for molting (Hori, 1970c, 1973a). Hori (1970c) reported that the reason for high enzyme activity in 10-days old female adults was their need for high amounts of proteins to produce eggs. Such reasons suggested in the case of crop proteases of *Miris dolabratus* (Nuorteva, 1956a,b) and *Calliphora erythrocephala* (Hori, 1973a). However, there must probably be other reasons for this phenomenon because enzyme activity was high in 10-days old adult males, too (Hori, 1970c, 1973a). No enzyme activity in first instars of the stripped bug can explained by the fact that they do not feed.

In *Prostephanus truncatus*, activity of crop α-amylase in adult insects and first to third instars were similar. Maximum and minimum enzyme activities were observed in second instars and pupae, respectively. Enzyme activity reduced with ageing of adult insects (Mendiola-Olaya et al., 2000). Hori (1973a) reported that activity of crop α-amylase in *B. mori* changed due to the growth of insects. Activity of crop α-amylase in *B. mori* gradually increased from first instar to fifth instar. Activity of crop proteases in this species increased from forth to fifth instars and in the early of fifth instar had the maximum activity. Enzyme activity decreased after few days then increased. Crop protease activity in *Galleria mellonella* increased at successive instars, but decreased at the time of molting (Hori, 1973a). Mehrabadi & Bandani (2009b) reported that the midgut α-amylase activity in the immature stages of the *Eurygaster maura* increased constantly up to the third instar. There were no significant differences of enzyme activity between third, fourth, and fifth instars and adults (0.071-0.083 U/insect). α-amylase activity in first instars was observed but it was very low (0.0046 U/insect). Enzyme activity in second instars was 0.030 U/insect and had a significant difference with other means. Comparing these results with our results shows that α-amylase activity in different instars of true bugs could be different depending on the instar and the site of enzyme production.

Female insects need more foods for reproduction. It is one of the reasons for more activity of α-amylase in adult females compared to the adult males. In addition, considerable activity of the enzyme in 15-, 20- and 20-days old adults (Fig. 3, top) can explained with attention to the pre-oviposition and oviposition periods in adult females (Fig. 3, bottom) and the reproductive activities of both sexes. The more reproductive activities, the more feeding activities; and this may be an important reason for increasing the α-amylase activity in mature adults. As Hori (1968c) has stated, variation in α-amylase activity in different developmental stages can attributed to the variations in the stages. This is the first report on the effects of reproductive activities on the α-amylase activity in insects.

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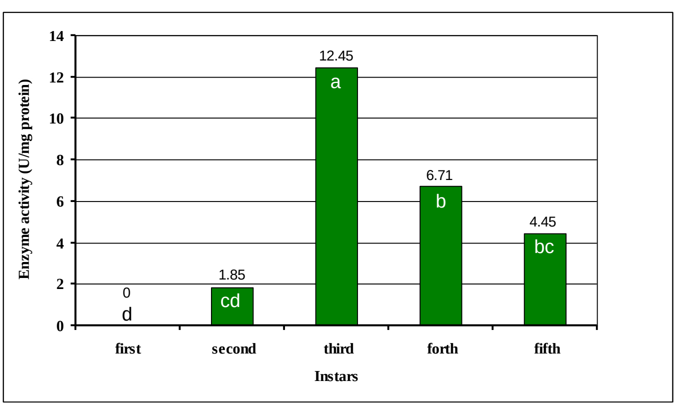

Figure 1. Comparison of means of salivary α-amylase activity in different instars of the stripped bug, *Graphosoma lineatum* (37 °C, pH = 6.95).

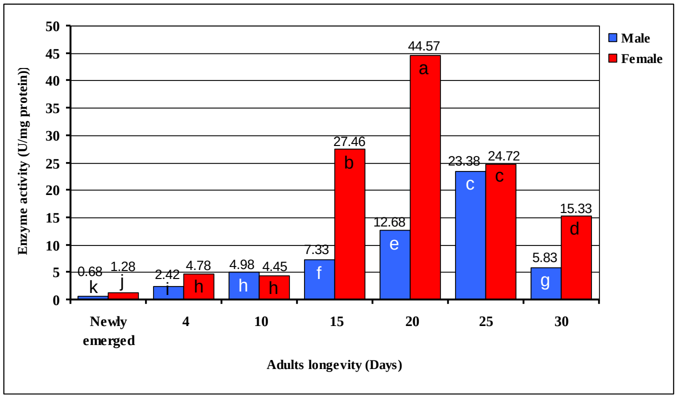

Figure 2. Comparison of means of salivary α-amylase activity in male and female adults of the stripped bug, *Graphosoma lineatum*, with different longevities (37 °C, pH = 6.95).

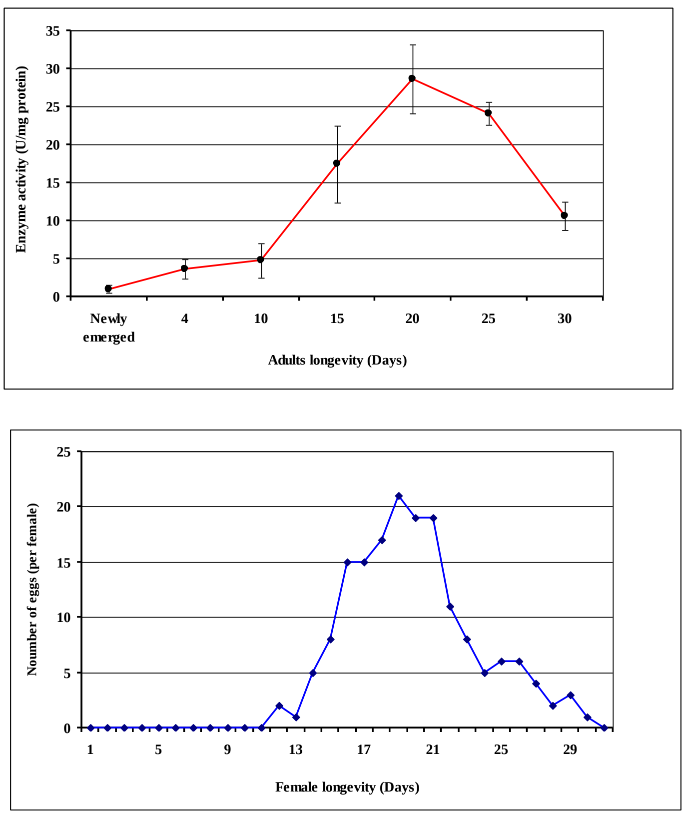

Figure 3. Total salivary α-amylase activity in adults of the stripped bug, *Graphosoma lineatum*, with different longevities (top) and oviposition trend in females (bottom) which show the correlation between the enzyme activity and reproductive activities (37 °C, pH = 6.95).

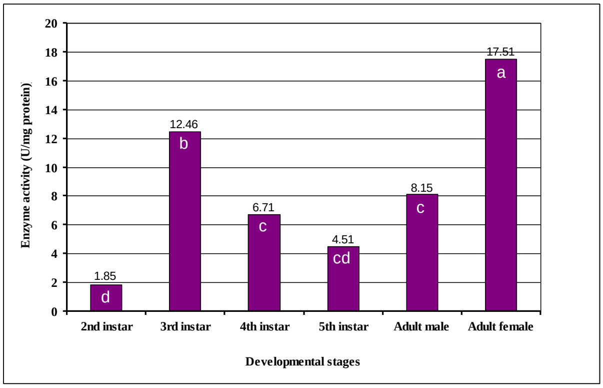

Figure 4. Comparisons of salivary α-amylase activity in nymphs, and male and female adults of the stripped bug, *Graphosoma lineatum* (37 °C, pH = 6.95).

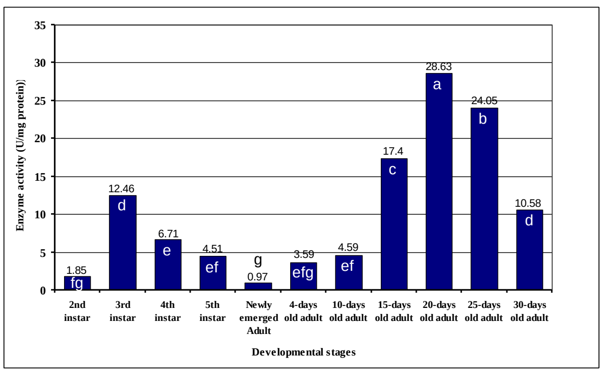

Figure 5. Comparisons of salivary α-amylase activity in nymphs and adults with different longevities in the stripped bug, *Graphosoma lineatum* (37 °C, pH = 6.95).

Table 1. Orthogonal comparisons of salivary α-amylase activities in nymphs and adults of the stripped bug, *Graphosoma lineatum*.

Kind of comparision			**MS**	**Mean**	
				Left group	**Right group**
Nymph	*vs*	Adults	221.772^{**}	6.39^{b}	12.83^{a}
Nymph	*vs*	Female adult	396.463^{**}	6.39^{b}	17.51^{a}
Nymph	*vs*	Male adult	9.981^{ns}	6.39^{a}	7.85^{a}
2nd instar	*vs*	Adults	321.429^{**}	1.85^{b}	12.83^{a}
3rd instar	*vs*	Adults	0.366^{ns}	12.45^{a}	12.83^{a}
4th instar	*vs*	Adults	100.087^{**}	6.71^{b}	12.83^{a}
5th instar	*vs*	Adults	184.508^{**}	4.51^{b}	12.83^{a}

^{ns} and ** show non-significant, and significant differences at 1% level, respectively.

VERBASCUM GAILLARDOTII BOISS. AND ITS NATURAL ENEMY COMPLEX IN HATAY PROVINCE, TURKEY

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ABSTRACT: *Verbascum gaillardotii* Boiss. and its natural enemy complex in Hatay province, Turkey have been studied. Diagnostic characters and distribution in Turkey was given. The natural enemy complex of the flat-margined mullein was given for the first time from Hatay, Turkey. The natural enemies are: *Rhinusa tenuirostris* (Stierlin, 1888), *Rhinusa tetra* (Fabricius, 1792) (Coleoptera: Curculionidae), *Melitaea trivia* (Denn. & Schiff.) (Lepidoptera: Nymphalidae), *Cucullia verbasci* L., the mullein moth, (Lepidoptera: Noctuidae), *Asphondylia verbasci* (Vallot, 1827) (Diptera: Cecidomyiidae). The hymenopter parasites of plant-feeders are: *Entedon sparetus* Walker (Eulophidae), *Calosota* sp. (Eupelmidae), and 2 spp. of Ichneumonidae (reared from galls of *R. tenuirostris*), *Torymus verbasci* Ruschka, 1921 (Torymidae) (reared from galls of *A. verbasci*).

KEY WORDS: *Verbascum gaillardotii* natural enemies, Hatay, Turkey.

The gaillardot's mullein, *Verbascum gaillardotii* Boissier, 1959, (Scrophulariaceae) was first described from Lebanon. The species was recorded from Turkey by Özçelik & Çetinkaya (2002 in Isparta, and TÜBİVES in Hatay). Nesom (2012) recorded the species as *Verbascum sinuatum* L., ssp. *gaillardotii* (Boissier) Bornmueller from Syria, Lebanon and Palestine, gave the differences from *Verbascum sinuatum* L., ssp. *sinuatum*.

There is not any record on natural enemy of the gaillardot's mullein, however Caldara et al. (2012) stated that *Rhinusa* spp. in the *R. tetra* species group feeding on several species of *Verbascum*, and gave an identification key for 5 species. Sert & Çağatay (1999) gave *Rhinusa tenuirostris* (Stierlin, 1888) as a synonym of *Gymnetron asellus* Gravenhorst, 1807. Caldara et al. (2010) carried out a phylogenetic analysis of the species belonging to the weevil genus *Rhinusa* Stephens, 1829 (Coleoptera: Curculionidae: Curculioninae: Mecinini), and transferred *Gymnetron bodenheimeri* H. Wagner, 1926 to *Rhinusa* as a distinct species, later Caldara (2013) synonymized it under *R. tenuirostris*.

Gokman & Gumovsky (2013) gave *Entedon sparetus* Walker as parasitoid of *Rhinusa asellus* (Gravenhorst) on mullein, *Verbascum* sp.

Anonymous (2014) gave diagnostic characters, hosts and biological data of *Melitaea trivia* (Denn. & Schiff.) and *Cuculia verbasci* L.

Larvae of *Asphondylia verbasci* (Vallot, 1827) change the flower buds of *Verbascum nigrum* L. and *V. sinuatum* (Scrophulariaceae) to galls (Tavares, 1902, 1905; Cogolludo, 1921; Vilarrubia, 1936; Sukuhrava et al., 2006).

Aim of the current work is to find out the diagnostic characters of *V. gaillardotii*, and the species in its natural enemy complex in Hatay province, Turkey, and to give some morphological and biological aspects of the species which will be helpful in biological control of *V. gaillardotii*,

MATERIALS AND METHOD

The gaillardot's mullein was collected to obtain the several stages in development periods in 2012 and 2013, and their photos were taken for taxonomic works.

In the period from September, 2012 to March, 2013, the galls of *R. tenuirostris* on *V. gaillardotii* were collected from several regions of Hatay province of Turkey. The regions are: Hatay: Altınözü, Hanyolu and Yanıkpınar villages, Antakya, Yayladağ, Şenköy. The galls collected were brought to laboratory, placed in the cages and kept under the conditions of 50-60% relative humidity and about 15-20 °C. Some of galls were dissected to obtain specimens of larvae and pupae. To rear adult midges in the bud galls of *V. gaillardotii* galls were collected in April and May, 2013, and were brought to laboratory, placed in the plastic bags under same conditions stated above. The adults came out of the galls were killed in 97% ethanol and put into vials with ethanol. Taxonomic works were carried out under microscopes, and photographs of diagnostic characters of the species were taken by using a stereo-microscope with a digital camera attached to it.

The identification of the gaillardot's mullein was done by following the key of Nesom (2012) by the second author; *Rhinusa tenuirostris* was identified by Dr. Roberto Caldara (via Lorenteggio 37, 20146 Milano, Italy. E-mail roberto.caldara@gmail.com); the other plant feeder species were identified by Dr. Ivo Tosevski (Institute for Plant Protection and Environment, Banatska 33, 11080 Zemun, SERBIA, E-mail: tosevski_ivo@yahoo.com); the parasitoids were identified by the first author.

RESULTS AND DISCUSSION

Verbascum gaillardotii Boissier, 1859

Syn. *Verbascum sinuatum* L., ssp. *gaillardotii* (Boissier) Bornmueller (Nesom, 2012).

The species very similar to *Verbascum sinuatum* L., the description of which was given in detail by Nesom (2012). The plants in Hatay province should be *V. gaillardotii* having narrower bracts and bracteoles, slightly smaller corollas, 4(--5) stamens and flat-margined leaves (in *V. sinuatum* with broader bracts and bracteoles, bigger corollas, 5(--4) stamens and wavy leaves) (Fig. 1).

The habitus, inflorescences and seed capsules as seen in Fig. 2.

Distribution: In Turkey: Hatay. In the world: Syria, Lebanon, Palestine.

Syn. *Verbascum sinuatum* L., ssp. *gaillardotii* (Boissier) Bornmueller (Nesom, 2012).

Natural enemy complex *Verbascum gaillardotii*

Rhinusa tenuirostris (Stierlin, 1888)

Syn. *Gymnetron bodenheimeri* H. Wagner, 1926. (Caldara, 2013)

Sert & Çağatay (1999) gave *Rhinusa tenuirostris* (Stierlin, 1888) as a synonym of *Gymnetron asellus* Gravenhorst, 1807. Caldara et al. (2010) transferred

Gymnetron bodenheimeri H. Wagner, 1926 to *Rhinusa* as a distinct species, later Caldara (2013) synonymized it under *R. tenuirostris.*
Diagnosis: body with long rostrum (Figs. 3a,b); rostrum of male in lateral and dorsal views of the same width from base to apex (Figs. 3a,b and 8-9 of Caldara et al., 2012), in dorsal view striate-punctate without larger median sulcus; rostrum of female in lateral and dorsal views parallel-sided (Fig. 3c); antenna clubbed with 4+3 flagellar segments (Fig. 3d); abdomen with 6 sternits (Fig. 3f); uncus of metatibiae of male pointed at apex, and tibiae with outer margin distinctly curved outwards near apex (Fig. 3e). Legs with claws fused basally (Fig. 3g); spiculum ventrale almost Y-shaped (Fig. 4a); aedeagus very long, parallel-sided to near apex (Fig. 4b); spermatheca and tip of gaster as in figs. 4c,d.
Material studied: Hatay, Turkey: 12 females; 7 males, Altınözü, Hanyolu, 05-23 March, 2012, 15 females, 11 males, Yanıkpınar villages, 27 February- 13 March, 2013; 3 females, 2 males, Center of Antakya, 10- 22 March, 2013. All of the specimens were reared from galls on *V. gaillardotii* by M. Doğanlar.
Biology: Up to now there was not any biological data about this species under both names. By this work its biology in Hatay province, Turkey was studied. The results as follows:

The adults overwintered under shelters of debris. In early spring adults started to feed on newly developed stems and branches by inserting very long rostrum and open deep holes (Fig. 5).

After copulation the matured eggs were laid onto opening of the feeding holes. Later hatching take place, the first instar larvae (5-12) start to feed on sides of the hole, and induce gall, than stem thickening (Fig. 6a) which later become a globular gall in several shapes (Figs. 6b-d).

Many weevil larvae in different stages can be found in the galls. Development of the larvae has continued in Summer and Autumn. At the end of Autumn the larvae have pupated and diaposed in Winter. The galls with pupae were collected and brought to the laboratory in February. At the beginning of March, after a few days the adults of *R. tenuirostris* come out from the galls by opening an exit hole, 3-4 mm in diameter (Fig. 7). The emergence of adults from galls has continued up to the end of April. At the beginning of March the adults can also be seen on the newly developed *Verbascum* stems in the field.
Parasitoids: *Entedon sparetus* Walker (Eulophidae), *Calosota* sp. (Eupelmidae), and 2 spp. of Ichneumonidae. *Entedon sparetus* was also reared from *Rhinusa asellus* (Gravenhorst, 1807) (Gokman & Gumovsky, 2013).

Rhinusa tetra (Fabricius, 1792)

Synonyms were given by Caldara et al. (2012).

Diagnosis: Rostrum of male in lateral and dorsal views gradually but distinctly tapering from base to apex, moderately elongate (length/width at base 3.8–4.4, average 4.0; rostrum length/pronotum length male 0.84–0.97, average 0.90 (Figs. 8a,b), in dorsal view at least at antennal insertion with large median sulcus deeper than lateral ones; rostrum of female in lateral and dorsal views either gradually narrowing from base to apex or parallel-sided, length/width of rostrum at base 4.3–5.2, average 4.6; rostrum length/pronotum length 0.95–1.07, (average 1.01) (Fig. 8c); aedeagus shorter, sinuous at middle and then gradually narrowing to apex (Fig. 8d); female with scrobe distinctly visible in dorsal view (Fig. 8c).
Biology: Larva and adult were quoted to be collected on various species of *Verbascum*. Such as: *V. blattaria*, *V. boerhavii*, *V. creticum*, *V. lychnitis*, *V.*

nigrum, *V. phlomoides*, *V. phoeniceum*, *V. pulverulentum*, *V. speciosum*, *V. thapsiforme*, *V. thapsus* Sometimes adult *R. tetra* were collected also on *Scrophularia* (*S. auriculata*, *S. canina* (Caldara et al. 2012). Introduced in North America where it was proposed as a potential candidate for the biological control of invasive common mullein, *Verbascum thapsus* L. (O'Brien & Wibmer 1982).
Distribution. Europe, Siberia, North Africa, Middle East, central Asia, northern India (R. Caldara, pers. comm.).
Material studied: 6 females, 2 males, Hatay, Altınözü, Hanyolu village, 02 June, 2013, feeding on seed capsules of *V. gaillardotii,* by M. Doğanlar.

Asphondylia verbasci (Vallot, 1827)

Fedotova (2004) gave description of adults and the figures of diagnostic characters.

Skuhrava et al. (2012) stated that larvae change the flower buds into galls of *Verbascum nigrum* L. and *V. sinuatum* (Scrophulariaceae). In Hatay province the midges lay its eggs on buds, after hatching the larva enter into the bud and feed on the generative organs. The bud form the gall (Fig. 9) and larva pupated and adult emerged from the gall. Infestation by *A. verbasci* was not so high, about 5-10%.
Distribution: Hatay, Altınözü, Hanyolu village; Antakya and Harbiye; Yayladağ, Şenköy.
Parasitoids: *Torymus verbasci* Ruschka, 1921 was reared on 11 females and 7 males from 70 galls collected from Harbiye. Parasitism level was about 25%, but in other regions parasitism was not higher than 5%.

Beside of those species the following species of Lepidoptera feeding on leaves and buds of *V. gaillardotii* in several parts of Hatay province: *Melitaea trivia* (Dennis. & Schiffer.) (Lesser Spotted Fritillary), and *Cucullia verbasci*, The mullein moth, (Lepidoptera: Noctuidae).

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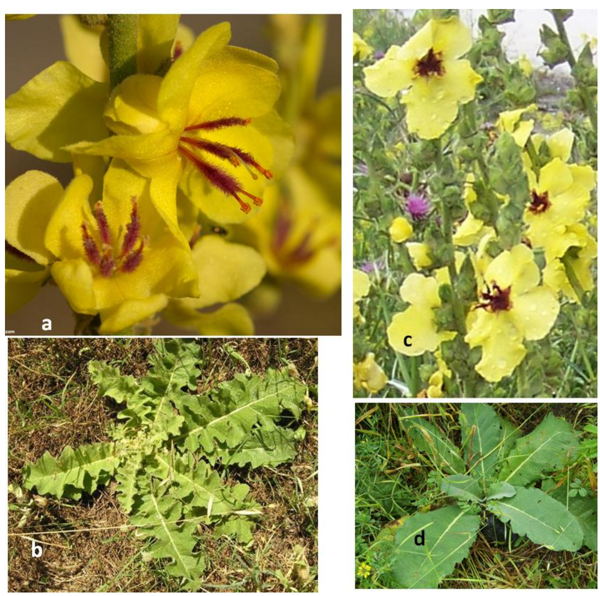

Figure 1. *Verbascum* spp. a, b. *V. sinuatum* L., 1753, a. flowers with 5 anthers, b. first year of plant with wavy leaves; c, d. *V. gaillardotii* Boissier, 1859, a. flowers with 4 anthers, b. first year of plant with flat-margined leaves

Figure 2. Several stages of *Verbascum gaillardotii* Boissier, 1859.

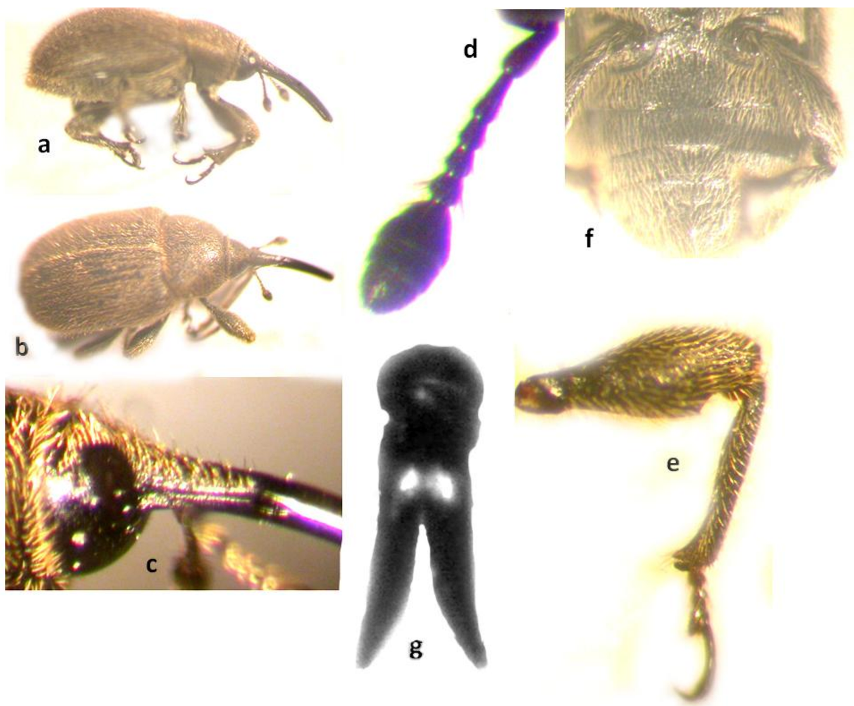

Figure 3. *Rhinusa tenuirostris* (Stierlin, 1888). Female. a, b. body. a. in lateral view, b. in dorsal view; c. base of rostrum; d. antenna; e. fore leg, except coxa, in lateral view; f. abdomen, in ventral view; g. claws, in dorsal view.

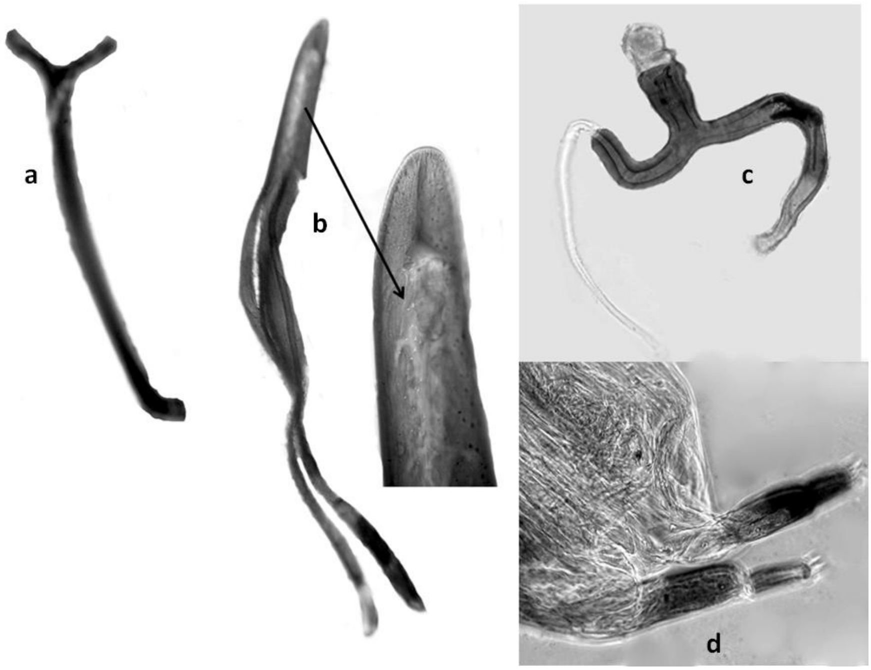

Figure 4. *Rhinusa tenuirostris* (Stierlin, 1888). a-b. male. a. spiculum ventrale; b. aedeagus in lateral view, with apical part in dorsal view; c-d. female. *c.* spermatheca; d. tip of gaster.

Figure 5. Feeding holes of *Rhinusa tenuirostris* (Stierlin, 1888). a, b. base of stem; c. apical part of stem.

Figure 6. Several stages of gall formation by *Rhinusa tenuirostris* (Stierlin, 1888). a. early stage to f. mature galls.

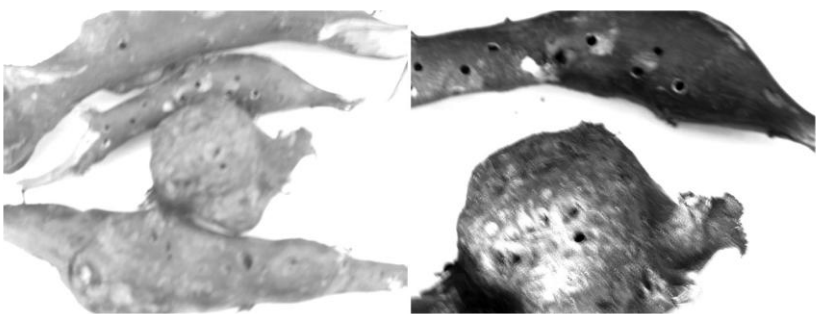

Figure 7. Several galls with exit holes of *Rhinusa tenuirostris* (Stierlin, 1888).

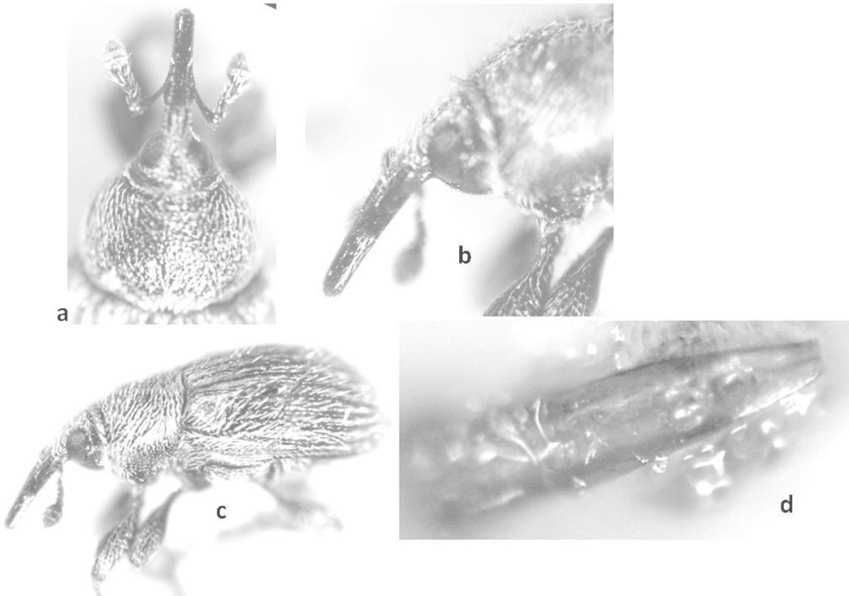

Figure 8. *Rhinusa tetra* (Fabricius, 1792). a, b. pronotum and head, a. in dorsal view, b. in lateral view; c. body, in lateral view; d. apical part of aedeagus, in dorsal view.

Figure 9. Several galls developed by larva of *Asphondylia verbasci* (Vallot, 1827) on *Verbascum gaillardotii* Boissier, 1859.

A SHORT NOTE ON NON-TARGET FAUNA COLLECTED BY PHEROMONE TRAPS OF THE RED PALM WEEVIL, *RHYNCHOPHORUS FERRUGINEUS* (OLIVIER, 1790) (COLEOPTERA: DRYOPHTHORIDAE) IN İZMİR PROVINCE OF TURKEY

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ABSTRACT: In this study, information is given on non-target fauna collected by pheromone traps of the Red palm weevil, *Rhynchophorus ferrugineus* (Olivier, 1790) (Coleoptera: Dryophthoridae) in Izmir province of Turkey.

KEY WORDS: *Rhynchophorus ferrugineus*, Fauna, Pheromone trap, Turkey.

The red palm weevil *Rhynchophorus ferrugineus* (Olivier, 1790) (Coleoptera: Dryophthoridae) is a devastating pests of palm species belonging to 18 different genera and three families. The weevil affects approximately 29 palm species and the spread of this species to all continents (Africa, Americas, Asia, Australia together with Oceania, and Europe) except Antarctica (Hussain et al., 2013).

This species reported from Mersin, southern Turkey in 2005 (Karut & Kazak, 2005; Atakan & Yüksel, 2008) and from Izmir in 2006 (Anonymous, 2013). In order to control this species, cultural and sanitary measures, insect pheromones and insecticides were applied in Turkey.

In this paper a short note on non-target fauna collected by pheromone traps of the Red palm weevil, *Rhynchophorus ferrugineus* in Izmir province of Turkey was aimed at.

MATERIAL AND METHODS

Material were collected in 12 locations of [Seferihisar: Doğanbey (3), Ürkmez (2); Menderes: Gümüldür (3), Özdere (4)] Izmir, western Turkey, during the years of 2010-2012 (Fig. 1). Materials were collected by pheromone traps. Containing 4-methyl-5-nonanol and 4-methyl-5-nonanone capsules known by the brand name RHYFER® were used in traps (Figure 2) and they were cleared in two weeks intervals from March to November and monthly intervals from December to February.

RESULTS

The total number of the specimens of *R.ferrugineus* collected in the study area was 408 (28.04%) in 2010, 497 (34.16%) in 2011, and 550 (37.80%) in 2012.

At the end of this study, a total of 975 non-target specimens belonging to five classes were evaluated (Table 1).

Those belonging to Hexapoda were 727 (74.56%); and the others respectively were: 121 specimens (12.41%) belonging to Crustacea; 99 specimens (10.15%) belonging to Chelicerata and 28 specimens (2.87%) belonging to Gastropoda.

The dominant class was Insecta of Hexapoda. Distribution of specimens within Insecta was given in Table 2.

Those belonging to Coleoptera were 259 (35.63%), and the others respectively were: 182 specimens (25.03%) belonging to Hemiptera; 94 specimens (12.93%) belonging to Diptera; 77 specimens (10.59%) belonging to Hymenoptera; 72 specimens (9.90%) belonging to Dermaptera. Dominant families of Coleoptera were Buprestidae, Carabidae, Cetoniidae, Chrysomelidae, Coccinellidae, Curculionidae, Dermestidae, Dytiscidae, Elateridae, Lampyridae, Meloidae, and Oedemeridae. Specimens belonging to the families of Cicadellidae and Cicadidae of Cicadomorpha; Coreidae, Cydnidae, Lygaeidae, Nabidae, Pentatomidae, Pyrrhocoridae, Tingidae of Heteroptera of Hemiptera; Muscidae and Tabanidae of Diptera; Apidae, Mutillidae and Vespidae of Hymenoptera; Forficulidae of Dermaptera; Noctuidae of Lepidoptera; Gryllidae of Orthoptera were collected. Environmental factors such as rain affected some specimens of material in traps.

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Table 1. Distribution of trapped non-target organisms and their taxonomic categories in Izmir province of Turkey during the years of 2010-2012.

Filum	**Subfilum**	**Class**	**Order**	**2010**	**2011**	**2012**	**Total**	**Rate (%)**
Arthropoda	Hexapoda	Insecta	9 orders	282	243	202	727	**74.56**
Arthropoda	Crustacea	Malacostraca	Isopoda	44	65	12	121	**12.41**
Arthropoda	Chelicerata	Arachnida	Araneae	57	35	7	99	**10.15**
Mollusca	-	Gastropoda	Pulmonata	14	11	3	28	**2.87**
Total				**397**	**354**	**224**	**975**	

Table 2. Distribution of trapped non-target insects and their orders / suborders in Izmir province of Turkey during the years of 2010-2012.

Order / Suborder	2010	2011	2012	Total	Rate (%)
ORTHOPTERA	1	3	7	11	1.51
DICTYOPTERA (Blattodea)	0	0	2	2	0.28
DERMAPTERA	23	36	13	72	9.90
HEMIPTERA (Heteroptera)	34	80	29	143	19.67
HEMIPTERA (Cicadomorpha)	29	6	4	39	5.36
NEUROPTERA	0	3	0	3	0.41
COLEOPTERA	140	59	60	259	35.63
LEPIDOPTERA	11	11	5	27	3.71
DIPTERA	12	30	52	94	12.93
HYMENOPTERA	32	15	30	77	10.59
Total	**282**	**243**	**202**	**727**	

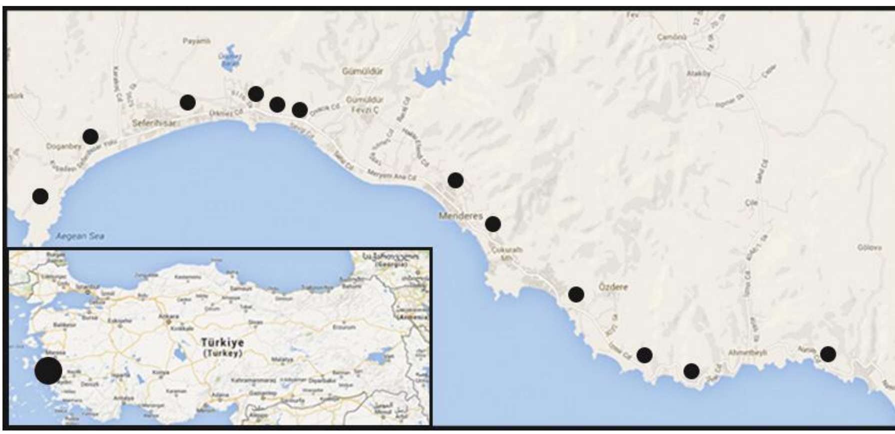

Figure 1. Map of studied area.

Figure 2. Pheromone trap used for material collection.

BIOECOLOGY OF PYRROCHORID PLANT BUG *IPHITA LIMBATA* (STAL).

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[Gomathy, Christudhas, A. & Mathai, M. T. 2014. Bioecology of pyrrochorid plant bug *Iphita limbata* (Stal). Munis Entomology & Zoology, 9 (2): 795-803**]**

ABSTRACT: *Iphita limbata* is a macropterous but flightless, phytophagous bug feeding on the seeds of *Sterculia foetida*. The studies on bio-ecology, activity pattern and sexual dimorphism in *Iphita limbata* from specified areas of Madras Christian College, Tambaram reveals that the occurrences of males were more than the females. Predominant mating behavior was found during the months of late December, January and February during which females were in mated condition. *Iphita limbata* prefers a relatively high humidity and an optimum temperature of 36.1°C for the population to flourish. The activity of *Iphita limbata* was found to be closely correlated to environment parameters especially temperature. The males are smaller than females. The reproductive organs of males consist of a pair of testis connected with paired seminal vesicle and a median ejaculatory duct; females consist of 7 pairs of teleotrohic ovarioles on either side of the alimentary canal with a spermatheca.

KEY WORDS: Bioecology, Hemiptera, Pyrrohoridae, *Iphita limbata*, Tambaram.

The reproduction in insects pronounces a remarkable adaptive radiation in the ecology of habitat, including host plant or host materials to maintain their population. It plays an important role in making them as successful group of organism in this world. All kinds of ecological resources and habitats in this universe are well exploited for their survival.

The pyrrochorid plant bug *Iphita limbata* is a bicolor, terrestrial, harmless, elegant bug, belongs to the suborder Heteroptera of the order Hemiptera. The bug is abundant and seasonal.

Here an attempt has been made to study the bioecology of *I. limbata* with reference to their habitat, host selection, distribution, reproduction and life cycle. The detailed study include identifying the host plant and their distribution, the daily activity pattern, sexual dimorphism, biology and the morphology of male and female internal reproductive organs of *I. limbata*.

MATERIAL AND METHODS

Population study was conducted for a period of one year from June 2008-May 2009. Survey of the vegetations in MCC present in the specific area was done to know about the habitat, which provided suitable environment and diet *ad libitum* to work out the entire life cycle. Live mating individuals of *I. limbata* where collected *en mass* using an insect net from the scrub jungle of Madras Christian College (MCC) campus, situated 40 kilometers away from Chennai. Studies on ecology and activity pattern were carried out primarily in specific area where *Iphita limbata* were predominantly present. The live samples collected were transferred to laboratory for further studies.

Female collected after mating where reared *en mass* in a glass trough filled with soil and dry litters. The seeds of *Sterculia foetida* were provided as food along with water in soaked cotton. The trough was covered with fine muslin cloth as to prevent the escape of insects and provide air. Pairs of *I. limbata* where maintained separately to understand the mating behavior and longevity.

The ovaries and testis of *I. limbata* were dissected along with copulatory organ and preserved in 70% alcohol; later mounted by counter staining technique. The reproductive organs were allowed to be in 95% alcohol for 10 minutes and then stained with 2-3 drops of hematoxine for 3-5 minutes. Add 95% alcohol to remove excess stain and after resting for 2-5 minutes 2-3 drops of eosin was added. The excess stain was washed by xylene. The samples were mounted on a slide with a drop of DPX and viewed under microscope. Microphotographs were taken using Nikon D200 camera fixed to Nikon Alphaphot YS2 microscope.

RESULTS

Habitat

The scrub Jungle of MCC campus extends about 365 acres and *I. limbata* is found to be present only on the north western side of the campus. *I. limbata* was found wandering and aggregated on plants including teak tree (*Tectona grandis*), Indian ash tree (*Linnea coromandelica*) and yellow lidnder (*Thevitia neirifolia*). They feed extensively on the fruits of wild almond (*Sterculia foetida*). During warmer days the insect were found on *Hemidesmus indicus* and *Jasminum sessilibforum*.

Life-Cycle

The survey of the campus reveals that *S. foetida* are localized only in one pocket of the scrub jungle and *I. limbata* being flightless and feeds on fruits particularly on the seeds of *S. foetida,* are often seen aggregating exclusively in this area. Aggregated feeding during nymphal stages is well noticed in *I. limbata* and the adult as well as the nymphs are voracious feeders. The nymphs were noticed during the months of December and February in the crevices. They don’t seem to feed during the first instar.

Sexual Dimorphism

The adults of both sexes are macropterous, but flightless. The gravid females have remarkably enlarged abdomen than males. Morphometrics of nine different regions of the body is shown in table 1. It is evident that the body length, the length and width of the abdomen, wing length show significant size variation between the adult male and female apart from external genetalia like an aedeagus and the ovipositor. Other characters however, do not show any significant size variation.

Male Internal Reproductive Organ

The testis of *I. limbata* are paired, white, more or less spherical structures lying ventrally in the region of the fifth abdominal segment, beneath the digestive system and are held in position by surrounding tracheae and fat bodies (Figure 3). Each testis is a compact structure consisting of typically seven follicles, bounded externally by a thin membranous peritoneum. Each follicle has a length of 0.32 ± 0.4mm and a width of 0.3 ± 0.5mm. The total length of testis is 0.8 ± 1.2mm (Table 2).

Each vas efference from the follicle are not externally visible and opens independently into vas deferens, which is a minute construction externally between the testis and seminal vesicle. These very small ducts are differentiated from seminal vesicle by their smaller size measuring 0.08 ± 0.03mm in length and 0.16 ± 0.25mm in width. The vesicular seminis are transparent in the day 0 male and later are filled with the seminal fluid and appear gorged. The vesicular seminis measures 0.4 ± 0.5mm in length and 0.32 ± 0.45mm in width (Table 2). The walls of seminal vesicle are lined with single layered epithelium and their terminal region run along the upper margin of the multi-lobed mesadene or mesodermal accessory reproductive gland. The median unpaired ectadene has two lobes and is laterally question mark shaped. The lower lobe is continued as the ejaculatory duct that ends in gonopore.

Female Internal Reproductive Organ

I. limbata consists of 7 pairs of teleotrophic ovarioles on either side of the alimentary canal along with a paired lateral oviduct and a median oviduct with a definite highly chitinised "horse-shoe shaped bulbous spermatheca (Figure 4). The length of the ovariole calyx is comparatively shorter than the lateral and median oviduct.

Each ovariole distally produces an independent terminal filament that later unite to form a suspensory ligaments attached to the body wall of the first abdominal segment. Each filament consists of a syncytial core bounded by the tunical propria and measures 0.25 ± 0.35mm in length and 0.2 ± 0.32mm in width (Table 2). The germarium occupies more than two third the length of the ovariole and their trophic cells are randomly distributed in groups and a definite trophic core is absent. The nutritive cord was not evident. The ovariole has a length of 0.45 ± 0.5mm and width of 0.35 ± 0.42mm. The lateral oviduct measures 0.3 ± 0.4mm in length and 0.25 ± 0.3mm in width. The median oviduct in *I. limbata* exhibits a thin inner lining of cuticle, which extends upto a genital opening.

In *I. limbata*, the well matured oocyte occupies the proximal end of the ovariole. Inter-follicular epithelial cells are well noticed between the developing and developed oocytes and also, as the oocytes increases in size the follicular epithelial cells which are cuboidal or columnar shape on the developing oocyte are stretched over the mature oocyte as a single layer of flattened, rectangular squamous epithelium. The oocyte nucleus is very predominant and is situated near the periphery of the oocyte.

Activity Pattern

Activity of the insect was found to be closely correlated to environmental parameters especially temperature (Table 3; Figure 1). These bugs are primarily diurnal and have a range of optimum activity between 27 to 29°C. The inactive adult starts emerging out for foraging during early 800hrs. As temperature rises after 900hrs the insects enter the crevices or hide under dry leaves there by a reduction in the activity of feeding. At 1500hrs temperature falls and the insects emerges back from the niches. The peak activity was noticed at about 0100 hrs when the temperature was 28°C. Again when the light intensity drops towards the end of the day, they settle back into their niches. Thus *I. limbata* show two peaks in their activity during the day.

Population

The population study was conducted for a period of one year. The meteorological data during the period of study is given in Figure 2. The temperature ranged from 19.5-42°C and the relative humidity of the atmosphere was between 77 and 98%. The maximum rainfall was 724.6mm. The number of *I. limbata* was maximum when the temperature was between 31 to 42°C and relative humidity between 77 and 98%. These suggest that *I. limbata* prefers a optimum temperature of 36.1°C and a relatively high humidity for the population to flourish.

The number of *I. limbata* was found to be at maximum during December to February, with a decline of population during January. The occurrences of males were more than the females throughout the period. The mating behavior was found predominantly during the mating period (Late January and early February) during which females were in mated condition.

The bugs were found in large numbers on the leaves of *T. grandis* and were gregarious on the leaves of *L. coromandelica* where a maximum of 22 insects were found on a single leaf. But towards the beginning of January the insects decent to the ground and were abundant in the gutters and fallen dry leaves feeding on the fruits and seeds of *S. foetida*.

DISCUSSION

In the present investigation on *I. limbata*, it was observed that during the months of December and early January insects were seen in large numbers even on the peripheral areas of the site and beyond the experimental areas too. But later there was a general movement of the insects towards more denser, shady interiors indicating the preference of *I. limbata* for lower temperature and high humidity, moist soil and shows maximum reproductive activity as in *Dysdercus cingulatus* (Srivastava & Bahadur, 1958). The first nymphal instars could not be located and even when noticed they were always in the crevices, mainly because they do not feed during this stage (Nayar, 1968).

I. limbata exhibits marked differences in the male reproductive tract compared to other groups of insects in the cellular organization of each testis follicle, the structure of vas deferens, seminal vesicle and in the organization of the mesadenia and ectadenia. The milky-white testis are richly supplied with trachea and covered by well pronounced outer envelope of fat tissue as reported in other heteropterans (Livingstone, 1967). Sperm tubules or testicular follicles measure 7 in number and are visible externally. The number varies from 4-7 in other heteropterans (Woodward, 1950; Bhatnagar & Singh, 1968). There are 6 follicles in *D. cingulatus* (Ambika & Prabhu, 1978) and *Phyrrhocoris apterus* (Aysev & Sisli, 1979). An exception is *Tingis buddleia* having only 2 follicles in each testis (Livingstone, 1967). In sections, *I. limbata* however has 7 pairs of vas efferentia opening individually into the vas deferens on each side similar to *Odontopus nigricornis* (Sharma & Livingstone, 1978). In *I. limbata* vas efferens are the extensions of each follicle at its posterior end. The vas deferens lacks the muscular coat hence the observation that the sperms are inactive in the vas deferens and are carried along by peristaltic movements of the walls of the tubes (Payne, 1934) remains not applicable in *I. limbata*. The external appearance of the ejaculatory bulb which undergoes modification as an unpaired glandular ectadane shows close resemblance to the condition in *O. nigricornis* (Sharma & Livingstone, 1978).

The ovaries of *I. limbata* are provided with 7 pairs of ovarioles. The ovarioles vary greatly in numbers: 2 ovarioles in each ovary (*Ipstypographus, Hylobius abietus* and *Sitona lineatus*), 6-7 (*Ocypus olens*), 4 (*Dorcus*), 12 (*Saperda charcharias*), 13 (*Cicindela campestris*) (Jaglarz, 1989), 20 (*Bhyrrus pilula*), extremely short and numerous in Meloidea (Richards & Davies, 1977). In some hymenopterans and dipterans the number may be increased to 100 or even 200 (Snodgrass, 1935) and 3000 or more in Isopterans (Truckenbrodt, 1973).

Generally accessory glands are associated with the female reproductive system but in *I. limbata*, no external accessory glands are present. It appears as though the glandular walls of the ovarian ducts are secretory in function. The secretions perform various functions as in Mallophaga the cement secretion is used for attaching the eggs (Richards & Davies, 1977), in Acridoidea, secretions makeup the pod in which eggs are laid (Lauverjat, 1965; Baccetti, 1972), in *Glossina* it secretes a milky fluid which serves to nourish the intra uterine larva (Richards & Davies, 1977).

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Table 1. Morphometry of Live male and female *I. limbata* in cm.

Sr no	Part of the body	Male		Female	
		Range	Average	Range	Avereage
1	Body length	1.86-2.12	1.97	2.17-2.52	2.34
2	Head length	0.24-0.35	0.29	0.32-0.37	0.35
3	Head width	0.22-0.29	0.27	0.30-0.33	0.32
4	Thorax length	0.56-0.66	0.62	0.79-0.78	0.74
5	Thorax width	0.41-0.47	0.44	0.49-0.53	0.51
6	Abdomen length	1.30-1.44	1.39	1.58-1.74	1.66
7	Abdomen width	0.67-0.82	0.94	0.88-1.12	0.94
8	Wing length	1.15-1.33	1.48	1.38-1.57	1.48
9	Antennal length	1.02-1.20	1.31	1.27-1.35	1.31

Table 2. Measurements of reproductive organs of *I. limbata* using micrometer.

Reproductive Organ		Length (mm)	Width (mm)
Male	Testis	0.32±0.4	0.3±.05
	Vas deference	0.08±0.03	0.16±0.25
	Seminal Vesicle	0.4±0.5	0.32±0.45
	Total length	0.8±1.2	-
Female	Terminal Filament	0.25±0.35	0.2±0.32
	Ovarioles	0.45±0.5	0.35±0.45
	Calyx	0.25±0.32	0.1±0.25
	Lateral Oviduct	0.3±0.4	0.25±0.3
	Total length	1.25±1.57	-

Table 3. Activity pattern of *I. limbata*.

Time	Temperature	Adult %	Nymph %
6:00	22.5	14.5	27
7:00	25	43	50.5
8:00	27.5	71.5	75
9:00	28	96.5	99
10:00	28.5	78.5	89.5
11:00	29	75	72
12:00	30	68	61.5
13:00	30.5	64	54
14:00	31.5	61	55
15:00	30.5	68	63.5
16:00	29.5	89	69
17:00	29	86	68
18:00	28	75	65.5

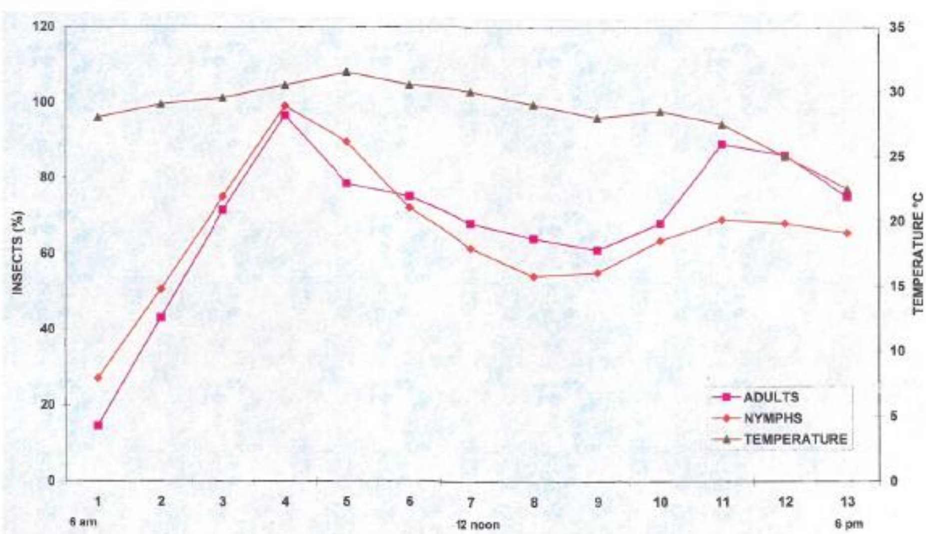

Figure 1. Daily Activity pattern of *I. limbata*.

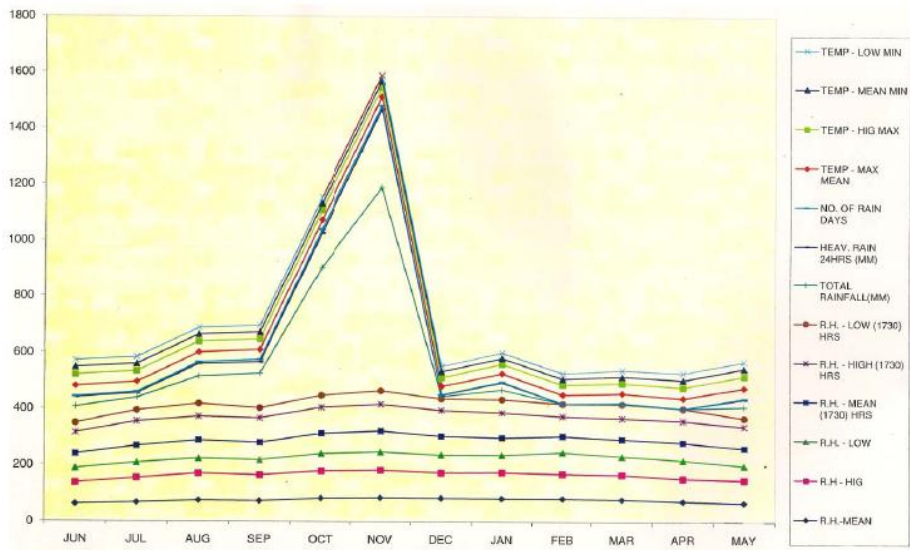

Figure 2. Meterological data during the study.

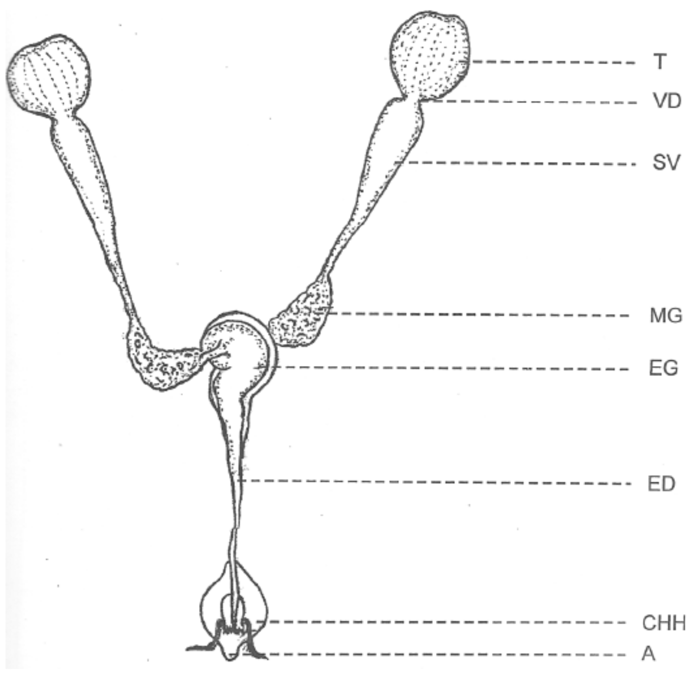

Figure 3. Structure of male reproductive organ. (T-Testis; VD- Vas Deferens; SV- Seminal Vesicle; MG- Mesodermal Gland; EG- Ectodermal Gland; ED- Ejaculatory Duct; CHH Chitinous Hooks; A- Aedeagus).

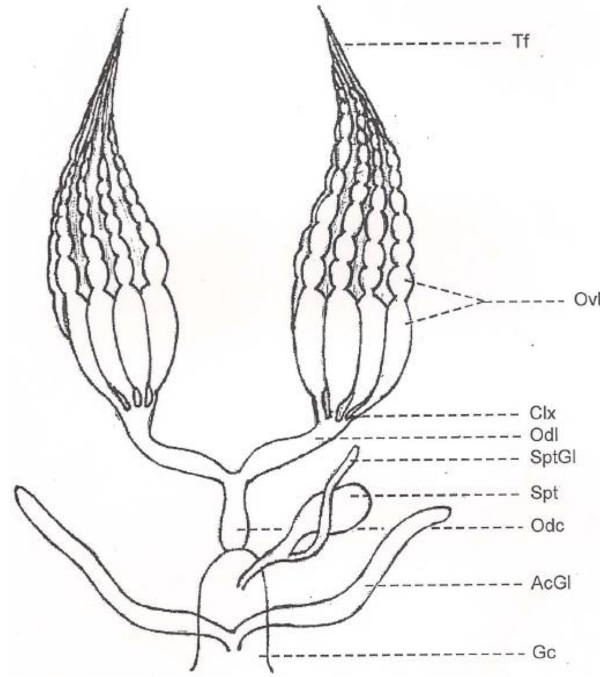

Figure 4. Structure of female reproductive organ. (TF- Terminal Filament; Ovl- Ovariole; Clx- Calyx; Odl- Oviducts lateralis; SptGl- Spermatheca Gland; Spt- Spermatheca; Odc- Oviducts Communis; AcGl- Accessory Gland; Gc- Genital Chamber).

INVESTIGATION OF HOSTING STATUS OF BARNYARD GRASS [*ECHINOCHLOA CRUS GALLI* (L.)] AND SMALL FLOWER UMBRELLA SEDGE (*CYPERUS DIFFORMIS* L.) TO RICE WHITE TIP NEMATODE (*APHELENCHOIDES BESSEYI* CHRISTIE, 1942) IN RICE GROWING AREAS OF TURKEY#

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[Tülek, A., Kepenekci, İ., Elekçioğlu, İ. H. & Çobanoğlu, S. 2014. Investigation of hosting status of barnyard grass [*Echinochloa crus galli* (L.)] and small flower umbrella sedge (*Cyperus difformis* L.) to rice white tip nematode (*Aphelenchoides besseyi* Christie, 1942) in rice growing areas of Turkey. Munis Entomology & Zoology, 9 (2): 804-809**]**

ABSTRACT: In this study, it has been investigated that barnyard grass [*Echinocloa crus galli* (L.) P. Beauv. Poaceae] and small flower umbrella sedge (*Cyperus difformis* L., Cyperaceae) which are major weeds in rice growing fields are the host plants for rice white tip nematode (*Aphelenchoides besseyi)* or not. For this purpose, barnyard grass and small flower umbrella sedge were collected in fields planted to Halilbey rice variety which is susceptible to white tip nematode and having 77% white tip symptoms on flag leaf at flowering and average 324 *A.besseyi* per panicle. In analysis against nematode, while no nematode was found in small flower umbrella sedge, average 30 *A.besseyi*/10 g seeds, 400 *A.besseyi*/plant with 15 tiller (flag leaf + panicle), 435 *A.besseyi*/plant with 6 tiller (flag leaf + panicle) were found in barnyard grass. These results are the first recorded research data in Turkey.

KEY WORDS: Rice, rice white tip nematode, *Aphelenchoides besseyi*, *Echinocloa crus galli*, *Cyperus difformis*, Turkey.

The study conducted a series of research on two species of different weed families which could be host for nematode and thus problematic in the field of rice planted fields. It was determined whether plants such as barnyard grass (*Echinochloa crus galli*, Poaceae) and small flower umbrella sedge (*Cyperus difformis* L., Cyperaceae) could be hosts for *Aphelenchoides besseyi* or not in the rice field infected by rice white tip nematode.

The rice white tip nematode, *A.besseyi*, first described by Christie (1942), belongs to the class Aphelenchida and family Aphelenchoididae. It was discovered by Kakuta in 1915 (Mc Gawley et al. 1984). According to Franklin & Siddiqi (1972), the species is a synonym of the pest *Aphelenchoides oryzae* Yokoo, 1948.

Major source of inoculums for rice is seeds. When seeds have been planted, nematodes grow active and move towards stems, branches, leaves where growth points exist. Rice white tip nematode feed on branches and leaves, meristem tissues and flower organs as an ectoparasite (Yoshii & Yamamoto, 1950).

This study is presented in the *31th International Symposium of the European Society of Nematologists* and just published as abstract.

Sections on leaves of tillers (stem) in affected rice plant have whitening in a distance of 3-5cm whose signs are often confused with those of lack of zinc and magnesium. Later, whitened sections recoil, preventing panicle from shooting out of leaf sheath. Infected panicle seems shorter and flower sections at ends have been atrophied. Flowers can be infertile and weak and amorphous seeds incapable of germination are obtained (Tamura & Kegasewa, 1959).

Rice white tip nematode is the second species to be quarantined in rank according to international quarantine regulations, by which *Globodera rostochiensis* is the first in 106 and *Aphelenchoides besseyi* in 70 nations (Anonymous, 2011a). Rice white tip nematode has been in the list A2 of pests under quarantine since 1981 according to OEPP/EPPO.

Rice white tip nematode was first discovered in Ipsala (Edirne) and Gönen (Balıkesir) in Turkey in 1995 (Öztürk & Enneli, 1997). The study by Tülek et al. (2011) in 2008-2009 attempted to explore effect of rice white tip nematode on yielding and its related components in rice cv. Halilbey. In the first year *A.besseyi* infected plots showed decreases of 57.91%, 22.35% and 12.78% in yielding, in weight of 1000 kernel and rice output (milled rice yield) respectively ($P<0.01$). In the second year falls occurred in 28.11% in yielding and 12.11% in weight of 1000 kernel ($P<0.01$).

Water grass (*Echinocloa spp.*) is the most competitive and difficult weed to control in Turkish rice fields. The principal grasses are *Echinochloa crus-galli, Echinochloa conunum*, and *Echinochloa oryzoides*. Annual and perennial sedges and broadleaf weeds also infest rice fields in Turkey. The most important sedges are *Cyperus difformis*, *Scirpus mucranatus* and *Scirpus maritimus* (Sürek, 2011).

Barnyard grass (*Echinochloa crus-galli*) is a monocot weed in the Poaceae family. Barnyard grass is an annual weed that is native to Asia and found throughout the world. The broad ecological tolerance and competitive ability of *E. crus-galli* makes it most important weed species in rice growing areas (Kaya, 2007).

Small flower umbrella (*Cyperus difformis*) grows well in flooded or moist fertile soils and common in lowland rice. Also found on poorer sandy or clay soils in fallow lands but cannot tolerate deep flooding. It has a short life span; propagates by seeds and produces seeds throughout the year (Anonymous, 2011b).

Barnyard grass and small flower umbrella sedge were found to be widespread with 94.56% and 80.88%, respectively, in Edirne rice fields which have more than 50% rice plantation areas in Turkey. Considering square meter density of weeds, barnyard grass was the most problematic species by 7.13 plant/m^2 followed by small flower umbrella in 5.66 plant/m^2 (Damar, 2006). In addition, 29.4% of rice seed samples in 2007 and 2008 in the same province were found to have been infected by rice white tip nematode (Tülek, 2010).

MATERIALS AND METHODS

Weeds used in the study were collected from the farmer field where Halilbey rice cultivar was planted and infected by rice white tip nematode in Ipsala, Edirne in 2008. In the field where the study was conducted, percentage of infection by white tip nematode (rice plants with evidence of white tip symptoms on flag leaves) in the unit area using 0.25m^2 frames during rice flowering. Halilbey cultivar of rice infected by a 77% nematode provided us with 324 *A. besseyi* per panicle. Plants of barnyard grass (*Echinochloa crus galli*) and small flower umbrella sedge (*Cyperus difformis* L.) collected from the present field were brought to the laboratory for inspection during flowering and seed filling.

Baermann funnel method was used to isolate nematodes from weeds for barnyard grass while whitehead and Baermann funnel methods were used for in small flower umbrella (Whitehead & Hemming, 1965) Samples in by Baermann funnel were removed 3 days after the process and water involving nematodes precipitated on the bottom and eliminated from seeds and green parts on the bottom of the Baermann funnel in 20ml glass tubes.

Whitehead method used 40cmx20cmx5cm plate to obtain nematodes and filtering papers were placed in them to for nematodes to pass through. Then 20 micron filter and vacuum pump were employed to collect nematodes with in approximately 20ml water volume.

RESULTS AND DISCUSSION

Some previously conducted studies managed to determine plants which are hosts for *A.besseyi*. It follows from the list by Fortuner &Williams (1975) that *Cyperus iria* L. (Yoshii & Yamamoto, 1950), *Echinochloa crus-galli* Syn. *Panicum crus-galli* (Ino, 1971) in Japan and *Cyperus* sp. (Vuong & Rabarijoela, 1968) in the Comoro Islands are reported to be hosts for *A.besseyi*.

The present study examined and discussed barnyard grass (*Echinochloa crus galli*, Poaceae) and small flower umbrella sedge (*Cyperus difformis* L., Cyperaceae) as weeds that could host for *A.besseyi* and therefore lead to losses of crops of great economic value importance in terms of rice planted fields.

From the study on a plant with 15 tiller of barnyard grass during flowering and seed filling, it was clear that some 400 *A.besseyi*/plant were obtained from examination of flag leaf and panicle of the plant. It is important to note that only flag leaf and panicle were studied in particular. In addition, of 6 tillers, 2 were infected by barnyard grass to obtain 435 *A.besseyi* individuals.

Six panicle of barnyard grass were randomly collected from different places of the same field. Every panicle was separately analyzed under microscopy in terms of presence of nematodes with 2 of 6 panicles being infected with 12 and 35 individuals of *A.besseyi* respectively. Another study on 10gr barnyard grass seeds among the plants collected from the infected field showed a total of 30 nematode individuals.

Samples of small flower umbrella sedge (*Cyperus difformis* L.) plants collected from the same rice field heavily infected by *A.besseyi* during flowering stage. Laboratory analyses found no infection with *A.besseyi* both in seeds and green plant sections.

Nematodes obtained from weeds were morphometrically and morphologically identified. From examination of the results, it follows that hosting of weed species of *Echinochloa crus galli* for *A.besseyi* is the first record for Turkey. The same plant was reported to be host for *A.besseyi* by Ino (1971) in Japan. Fortuner & Williams (1975) put together various studies by different researchers in different nations on plants which are hosts for rice white nematode (Table 1). The present study also presents geographic distribution of rice white tip nematode. The consequence of the study showed that barnyard grass plant hosts for rice white tip nematode, which is an important evidence for Turkey. Both rice white tip nematode and barnyard grass plant are one of the most important problems seen in rice plantations at home and across the world. The study proved that barnyard grass plant can cause significant losses of rice harvest and also hosts for rice white tip nematode, which means that losses of rice harvest increase exponentially. It is therefore of great importance that the weed with host has been discovered and identified as the first record for Turkey to develop pest controlling strategies against the pest itself. From the studies concerned, it is reported that *Echinochloa crus galli* is the alternative host for Tungro virus disease (vector insect *Nephotettix impicticeps*) (Aluko, 1976), in addition, *Echinochloa crus galli* is an important disease factor of rice in rice planting as an alternative host for rice blast (*Pyricularia oryzae*) as well (Qu, 1972). Accordingly what is to be thought first is that battle against barnyard grass plant should be made in particular in terms of preventing rice white tip nematode and other pests or diseases from spreading.

ACKNOWLEDGEMENTS

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Table 1. Host list of white-tip nematodes (Fortuner & Williams, 1975).

Plant	Common name	Author	Country
Allium cepa L.	Onion	Tim,1965	Thailand
Boehinevia nivea Gaudich.	Ramie	Fortuner, 1970	Philippines
Brassica pekinensis Lour	Chinese cabbage	Tim, 1965	Philippines
Chrysanthemum maximum Ram.		Sher, 1954	Hawaii
Chrysantheinum morifolium Ram.		Sher, 1954	Hawaii
Coleus blumei Benth.		Sher, 1954	Hawaii
Cyperus iria L.		Yoshii & Yamamoto 1950b	Japan
Cyperes sp.		Vuong Huu Hai, 1968	Comoro Isles
Dahlia variabilis Desf.		Sher, 1954	Hawaii
Digitaria adscendes (H.B.K) Henrard	Summergrass	Ino, 1971	Japan
Digitaria sanguinalis (L.) Scop.		Yoshii & Yamamoto 1950b	Japan
Dioscerea trifida L.	Yam	Kermarrec & Anais, 1973	Guadeloupe
Erechtites praealta Raf.		Sher, 1954	Hawaii
Ficus elestica Roxb. (var. decora)		Marlatt, 1966	U.S.A.
Fragaria chiloensis Duch. (var. Ananassa)	Strawberry	Christie, 1942	U.S.A.
Glycine hispida Max	Soybean	Barat et al., 1966a	Hawaii
Hibiscus brachenridgii Gray		Raabe & Holtzmann 1966	Hawaii
Hydrangea macrophylla Ser.		Sher, 1954	Hawaii
Impatiens balsamina L.		Sher, 1954	Hawaii
Imperata cylindrica Beauv.		Vuong Huu Hai & Rabarijoela, 1968	Comoro Isles
Ipomoea batatas Lam.	Sweet potato	Timm & Ameen, 1960	Pakistan
Panicum bisulcatum		Tno, 1971	Japan
Panicum cruss-galli var. Frumentaceum		Tno, 1971	Japan
Pennisetum typhoides (burm. F.) Stapf. F.C.E. Hubbard		Hashioka, ,1964	-
Pluchea odorata Cass.		Sher, 1954	Hawaii
Polianthes tuberosa L.		Holtzmann, 1968	Hawaii
Pycreus ploystahyus		Vuong Huu Hai & Rabarijoela, 1968	Comoro Isles
Saccharum officinarum L.	Sugar cane	Fernandez & Diaz Silveira, 1967	Cuba
*Saintpaulia ionantha*Wendl.	African violet	Allen, 1952	U.S.A.
Seteria italica Beauv.	Italian millet	Yoshii & Yamamoto, 1950a	Japan
Seteria viridis (L.) Beauv.		Yoshii & Yamamoto, 1950b	Japan
Sporobolus poirettii (Roem & Schult.)		Marlatt, 1970	U.S.A.
Tagetes sp.		Sher, 1954	Hawaii
Tithonia diversifolia A.Gray		Sher, 1954	Hawaii
Torenia fournieri Linden		Sher, 1954	Hawaii
Vanda sp. x Miss Joaquim		Allen, 1952	Hawaii
Vanda sp. x Rose Marie		Sher, 1954	Hawaii
Vanda sp. x Miss Deum		Sher, 1954	Hawaii
Vanda sp. x Trimeril		Sher, 1954	Hawaii
Vanda sp. x Luma		Sher, 1954	Hawaii
Vanda sp. x Miss Joaquim x Kapoho		Sher, 1954	Hawaii
Zea mays L.	Sweet corn	Tim, 1965	Thailand
Zinnia elegans L.		Sher, 1954	Hawaii

TSCHIGOVANA, NEW NAME FOR THE GENUS *AMICUS* TSCHIGOVA, 1977 (OSTRACODA), JUNIOR HOMONYM OF *AMICUS* KOROLEVA, 1967 (TRILOBITA)

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[**Kempf, E. K.** 2014. *Tschigovana*, new name for the genus *Amicus* Tschigova, 1977 (Ostracoda), junior homonym of *Amicus* Koroleva, 1967 (Trilobita). Munis Entomology & Zoology, 9 (2): 810-811**]**

ABSTRACT: The genus name *Amicus* Tschigova, 1977 (Ostracoda) represents a junior homonym of *Amicus* Koroleva, 1967 (Trilobita). *Tschigovana* is proposed as a new substitutional name. There are reasons that *Tschigovana complanata* (Kummerow, 1939) should now function as the type species, and not *Tschigovana primaris* (Tschigova, 1977).

KEY WORDS: *Amicus*, Ostracoda, nomenclatural changes, junior homonym, replacement name, new combinations.

Class Ostracoda Latreille, 1802
Order Kloedenellocopida Scott, 1961
Suborder Kloedenellocopina Scott, 1961
Superfamily Kloedenelloidea Ulrich & Bassler, 1908
Family Knoxitidae Egorov, 1950

Genus *Tschigovana* nom. nov.
Amicus Tschigova, 1977. Stratigrafiya i korrelyatsiya: 167 (Arthropoda: Crustacea: Ostracoda). Preoccupied by *Amicus* Koroleva, 1967. Paleontologicheskiy Zhurnal 1967 (1): 79 (Arthropoda: Trilobita).

Remarks on nomenclatural change: The genus *Amicus* was established by Koroleva (1967) which is still widely used as an available valid genus name in Trilobita (Jell & Adrain 2002). Subsequently, a generic name *Amicus* was also proposed as new by Tschigova (1977) for fossil ostracods from marine Lower Carboniferous deposits. Thus, the genus name *Amicus* Tschigova, 1977 is a primary junior homonym of the valid genus name *Amicus* Koroleva, 1967. In accordance with article 60.3 of the International Code of Zoological Nomenclature (1999), herewith is proposed to replace *Amicus* Tschigova, 1977 with the new substitutional name *Tschigovana*.

Overview of the species (according to Kempf, 1986 and later):
Type species: *Tschigovana primaris* (Tschigova, 1977) **comb. nov.**
Original binomen: *Amicus primaris* Tschigova, 1977
Conspecific according to Coen (1995):
Tschigovana complanata (Kummerow, 1939) **comb. nov.**
Original binomen: *Jonesina complanata* Kummerow, 1939
Other species:
Tschigovana archedensis (Tschigova, 1960) **comb. nov.**
Original binomen: *Knoxiella ? archedensis* Tschigova, 1960

Tschigovana redkinensis (Tschigova, 1960) **comb. nov.**
Original binomen: *Knoxiella ? redkinensis* Tschigova, 1960

Remarks on the type species: *Amicus primaris* had originally been designated as the type species for the genus *Amicus* by Tschigova (1977). Type locality of the holotype is the famous section at Feluy in Belgium. Type horizon is zone Tn 1b of the Lower Tournaisian, Lower Carboniferous.

The specimens of *Jonesina complanata* Kummerow, 1939 had also been described from the same type locality and type horizon. Coen (1995) documented his renewed study of Kummerow's type material with excellent scanning electron micrographs. He came to the conclusion that *Amicus primaris* Tschigova, 1977 and *Amicus complanatus* (Kummerow, 1939) are not only congeneric, but also conspecific. As a consequence, according to the priority rule *Tschigovana complanata* (Kummerow, 1939) should now be regarded as the type species with *Tschigovana primaris* (Tschigova, 1977) as a synonym.

Etymology: The new name is honoring Vera Alekseevna Tschigova in recognition of her valuable contributions to ostracodology and biostratigraphy.

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AN EVALUATION ON THE PITFALL TRAP COLLECTED SCARABAEOIDEA (COLEOPTERA) SPECIES IN WESTERN TURKEY

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ABSTRACT: Scarabaeoidea species collected by pitfall traps at five areas in Balıkesir (Madra Mountain, Çağıs campus and Değirmen Boğazı), Çanakkale (Karabiga) and Denizli provinces, western Turkey, throughout the years of 2007-2012 have been evaluated. It has been determined a total of 29 species and 9 subspecies of 21 genera belonging to seven families of Scarabaeoidea at five sampling area. Totally 142 specimens have been collected. Of these, *Oxythyrea* (s.str.) *cinctella* (Schaum, 1841), *Sisyphus* (s.str.) *schaefferi* (Linnaeus, 1758), *Tropinota* (*Epicometis*) *hirta* (Poda, 1761), *Pentodon* (s.str.) *idiota* (Herbst, 1789) and *Onthophagus* (*Furcontophagus*) *furcatus* (Fabricius, 1781) were the most abundant species in this study with percentages of 15.5, 9.9, 9.9, 7.8 and 6.3%, respectively.

KEY WORDS: Scarabaeoidea, pitfall trap, Madra Mountain, Karabiga, Turkey.

Turkey, which at the centre of Asia, Africa and Europe continent, is located between 26°- 45° East longitude and 36°- 42° North altitude. A large portion of the country belongs to Asia continent, is called Asian Minor, the other part belongs to Europe continent (Trakya region). In addition, Turkey is associated to Africa continent so it has a very diverse faunistic in terms of geological, ecological and climate with a connection between Europe and Asia. Pitfall trapping is a method used effectively in the sampling of insects living on soil surface or in soil and under stones. With this method, it is likely to catch species of useful, harmful and neutral insects in soil layers. Pitfall traps are used generally for the survey of ground beetles, especially of Carabidae and Tenebrionidae. Only they often yield by catches such as Cerambycidae, Curculionidae, Silphidae, Staphylinidae and Scarab beetles. So our understanding of insect biodiversity is increasing by being informed about the seasonal fluctuations of this species in ecosystems. Also pitfall trap may catch ground-dwelling like *Lethrus* (*Lethrus*) *apterus* (Laxmann, 1770), species flying close to ground like *Cetonia aurata pallida* (Drury, 1770), *Protaetia* (*Cetonischema*) *speciosa* (Adams, 1817), *P.*(*Netocia*) *subpilosa* (Desbrochers des Loges, 1869), *P.*(*Netocia*) *vidua* (Gory & Percheron, 1833), *P.*(*Netocia*) *afflicta* (Gory & Percheron, 1833), *P.*(*Netocia*) *ungarica ungarica* (Herbst, 1790), *P.*(*Netocia*) *cuprina* (Motschulsky, 1849), *Tropinota* (*Tropinota*) *squalida* (Scopoli, 1783), *T.*(*Epicometis*) *hirta* (Poda, 1761), *Oxythyrea* (s.str.) *funesta* (Poda, 1761), *O.*(s.str.) *cinctella* (Schaum, 1841), occasionaly in traps with rotten bait necrophageous dung beetles like *Onthophagus* (*Palaeonthophagus*) *vacca* (Linnaeus, 1767) and *O.*(*Furconthophagus*) *furcatus* (Fabricius, 1781). The superfamily Scarabaeoidea comprises worldwide more than 35 000 species

(Ratcliffe & Paulsen, 2008). Scarabaeoidea species was divided into two basic groups based on the position of the abdominal spiracles; The Laparosticti and Pleurosticti. Turkey is consisting of nearly 700 Scarabaeoidea species and Laparosticiti and Pleurosticti is being equally represented. Just 20% of the Laparosticti and over than 50% of the Pleurosticti are considered endemic to Turkey (Carpaneto et al., 2000; Löbl & Smetana, 2006). The scarabs were found mainly in dung, in burrow of small mammals, sometimes in ground beetle traps or, more rarely, under stones. With this study is to interpret the ecological relationship and the prevalance of the Scarabaeoidea species at four locations at diverse altitude in western Turkey.

MATERIAL AND METHODS

Studies have been conducted at five areas in three province of western Turkey (Figure 1 and Table 1). Detailed information on sampling areas were given below.
1. Karabiga sampling biotope: Karabiga peninsula is located the zone of olive-pine-evergreen oak. It is included in plant species such as *Erica arborea* L. and especially *Erica verticillata* L., *Arbutus unedo* L., *Arbutus andarchne* L., *Phillyrea latifolia* L., *Genista luncea* L., *Quercus coccifera* L. and *Olea europoae* L., *Cistus parvivolius* L., *Cistus monspeliensis* L., *Lavandula stoechas* L ., *Pinus pinea* L., *P.brutia* Ten., *P. pinaster* Aiton., *Cedrus* spp.
2. Çağış Campus sampling biotope**:** The sampling zone (235 m) consist of two vegetation types. These are forest vegetation, *Poliuro-Quercetum infectoriae* unity, and shrub vegetation, *Phillyreo-Pinetum brutiae* unity. *Onopordum illyricum* L., *Centaurea solstitialis* L., *Asparagus tenifolius* Lam., *Linum olympicum* Boiss. *P. brutia* Ten., and *P. latifolia* L. are the common plant species.
3. Değirmen Boğazı sampling biotope: The sampling zone was forested between 1957 and 1963. During the forestration period, a total of 329 741 trees were planted, composed of 51 species, 29 of which were deciduous and 22 were coniferous. The plant species located in the sampling zone are *P. brutia* Ten., *P. nigra* Arn., *P. pinea* L., *P. slyvestris* L., *P.pinaster* Aiton., *Alnus glutinosa* L., *Ulmus* spp., *Acer* spp., *Platanus* spp., *Quercus* spp. and *Salix* spp.
4. Madra Mountain sampling biotope: The sampling zone is located near İvrindi county (1006 m). The most abundant species are *P. brutia* Ten., *P. nigra* Arn., *P. pinea* L., *Quercus* spp. and *Castanea* spp.
5. Servergazi (Denizli) sampling biotope: *Pinus pinea* L., *P.brutia* Ten., *Quercus* spp. *Castanaeum* spp., *Platanus* spp., *Fraxinus* spp. and *Alnus* spp. are the most abundant plant species.

Sampling

In each area, a total of seven pitfall traps consisted of 100 ml cups half filled with ethylen glycol and water mixture as 1 : 1 ratio were used. These cups burried in the soil in such a way that the lip of the trap was at ground level not closer than 25 meters to each other. The beetles were collected and the traps cleared at 15 days intervals from April to September After collecting the material, the places of the traps were changed in the same area (Surgut & Varlı, 2012). Materials were determined by Prof. Dr. Erol Yıldırım (Ataturk University, Faculty of Agriculture, Department of Plant Protection, Erzurum) and Assoc. Prof. Dr. Marco Uliana (Museo di Storia Naturale Di Venezia, Italy). Materials were housed in the collection of Entomology Laboratory of Biology Department of Faculty of Science and Literature of Balıkesir University.

RESULTS

At the end of this study, 142 specimens of 29 species, 9 subspecies belonging to seven families of Scarabaeoidea have been collected by pitfall traps at five areas in Balıkesir (Madra Mountain, Çağış Campus and Değirmen Boğazı), Çanakkale (Karabiga) and Denizli (Servergazi) provinces of western Turkey, throughout the years of 2007-2012 have been evaluated (Table 2). These species and subspecies recorded in study areas are *Scarabaeus* (*Scarabaeus*) *pius* (Illiger, 1803), *S.* (*Scarabaeus*) *typhon* (Fischer, 1824), *Copris hispanus cavolinii* (Petagna, 1792), *C. lunaris* (Linnaeus, 1758), *Lethrus* (*Lethrus*) *apterus* (Laxmann, 1770), *Onthophagus* (*Palaeonthophagus*) *vacca* (Linnaeus, 1767), *O.* (*Furconthophagus*) *furcatus* (Fabricius, 1781), *Sisyphus schaefferi* (Linnaeus, 1758), *Chaetopteroplia segetum velutina* (Erichson, 1847), *Anoxia* (*Anoxia*) *asiatica* Desbrochers, 1871, *Anoxia* (*Protanoxia*) *orientalis* (Krynicky, 1832), *Pentodon bidens sulcifrons* Kuster, 1848, *P. idiota* (Herbst, 1789), *P. algerinus dispar* Baudi, 1870, *Cetonia aurata pallida* (Drury, 1770), *Melolontha albida* Frivaldszky, 1835, *Protaetia* (*Cetonischema*) *speciosa* (Adams, 1817), *P.* (*Netocia*) *subpilosa* (Desbrochers des Loges, 1869), *P.* (*Netocia*) *vidua* (Gorry & Percheron, 1833), *P.* (*Netocia*) *afflicta* (Gorry & Percheron, 1833), *P.* (*Netocia*) *ungarica ungarica* (Herbst, 1790), *P.* (*Netocia*) *cuprina* (Motschulsky, 1849), *Blitopertha lineolata* (Fischer von Waldheim, 1824), *Eulasia* (*Vittateulasia*) *pareyssei* (Brullé, 1832), *E.* (*Vittateulasia*) *vittata vittata* (Fabricius, 1775), *Oryctes* (*Oryctes*) *nasicornis kuntzeni* Minck, 1914, *Oxythyrea funesta* (Poda, 1761), *O. cinctella* (Schaum, 1841), *Aplidia turcica* (Kraatz, 1882), *A. vagepuctata* (Kraatz, 1882), *A. lodosi* Baraud, 1990, *Anomala affinis* Ganglbauer, 1882, *Tropinota* (*Tropinota*) *squalida* (Scopoli, 1783), *T.* (*Epicometis*) *hirta* (Poda, 1761), *Amadotrogus truncatus anatolicus* Keith, 2006, *Pygopleurus* (*Pygopleurus*) *foina* (Reitter, 1890), *P.* (*Pygopleurus*) *mithridates* Petrovitz, 1962, *Omaloplia* (*Acarina*) *spireae* (Pallas, 1776).

Those belonging to Cetoniidae was 49 (34.50%) of eleven species (28.94%); and the others respectively were: 46 specimens (32.4%) of seven species (18.4%) belonging to Scarabaeidae; 21 specimens (14.8%) of four species (10.5%) belonging to Dynastidae; 18 specimens (12.7%) of eight species (21.0%) belonging to Melolonthidae; 10 specimens (7.0%) of three species (7.9%) belonging to Rutelidae; 8 specimens (5.6%) of four species (10.5%) belonging to Glaphyridae and 1 specimen (0.70%) of one species (2.7%) belonging to Geotrupidae. The dominant species and their relative abundances were *O. cinctella* (15.49%), *T. hirta* (9.85%), *S. schaefferi* (9.85%), *P. idiota* (7.74%) and *O. furcatus* (6.33%). The relative abundances of other eighteen species changed between 1.41-5.63% and fifteen species changed less than 1%.

As a result of this study, totally 24 species and 8 subspecies namely, *Scarabaeus pius, S.typhon, Copris hispanus cavolinii, C.lunaris, Lethrus apterus, Onthophagus vacca, Chaetopteroplia segetum velutina, Anoxia asiatica, A. orientalis, P. bidens sulcifrons, P. idiota, P. algerinus dispar, Cetonia aurata pallida, Melolontha albida, P. subpilosa, P. vidua, P. afflicta, Protaetia ungarica ungarica, P. cuprina, Blitopertha lineolata, Eulasia pareyssei, E.vittata vittata, Oryctes nasicornis kuntzeni, Oxythyrea funesta, O. cinctella, Aplidia turcica, Anomala affinis, Tropinota squalida, T. hirta, Pygopleurus foina*, *P. mithridates* and *Omaloplia spireae* were present in meadow biotopes.

In addition, four species were found in oak biotopes. These species were *Onthophagus furcatus*, *Pentodon idiota*, *P.bidens sulcifrons* and *Blitopertha lineolata*. Only a species, *O.furcatus*, was found in plantation biotope. Three species were found in chestnut biotope. These species were *O.furcatus*, *S.schaefferi* and *M.albida*. Nine species, *B.lineolata*, *C.segetum velutina*, *P.speciosa*, *E.vittata vittata*, *O.cinctella*, *Aplidia vegepunctata*, *Amadotrogus truncatus anatolicus*, *P.mithridates*, *T.hirta* were found in pine biotopes. As we compare each sampling province according to the total number of the specimens and the species, the total number of the specimens present as the result of a two year studies in Çağış campus, Madra Mountain, Değirmen bogazı, Karabiga and Servergazi county was 64 (45.0%), 27 (19.0%), 23 (16.2%), 25 (17.6%), 3 (2.1%), respectively. As for the species evaluated in this study, twenty-one species and six subspecies in Çağış Campus, six species in Madra Mountain, four species and two subspecies in Değirmen Bogazı, eight species and three subspecies in Karabiga county and one species and one subspecies in Servergazi county were determined. The majority of the species, with thirty-three species, were recorded from Balıkesir province (86.84%). Secondly, eleven species were recorded from Çanakkale (Karabiga) province (28.94%). Finally, only two species were recorded from Denizli (Servergazi) province (5.26%).

DISCUSSIONS

At the end of this study, a total of 29 species, 9 subspecies belonging to seven families of Scarabaeoidea were collected. Among these thirty species belonging to five families (Cetoniidae, Melolonthidae, Dynastidae, Rutelidae and Glaphyridae) are phytophagous while eight species belonging to two families (Scarabaeidae and Geotrupidae) are coprophagous. *Pentodon idiota* (Dynastidae), *Anoxia orientalis* (Melolonthidae), *Melolontha albida* (Melolonthidae), *Blitopertha lineolata* (Rutelidae) and *Anomala affinis* are harmful species. Some species of Geotrupidae are useful species for agricultural and forest ecosystems by species decomposing dung for benefit both to pasture and animal health. But *Lethrus apterus* belonging to Geotrupidae is a destructive species on plants, especially *Vitis* L. spp. and wild plants (Lodos et al., 1989). Among 38 species, *Scarabaeus pius*, *S. typhon*, *Copris hispanus cavoliini*, *Copris lunaris*, *Onthophagus vacca*, *O. furcatus* and *Sisyphus schaefferi* are corpophagous and useful species. These species live in dung of animal. As taking into account the harmful and useful species, the number of specimens belonging to harmful species was 27, whereas the number of specimens belonging to useful species was 35 and some of the species collected in our study were evaluated as neutral.

Tezcan & Pehlivan (2001) reported a total of 17 species belonging to seven families of Scarabaeoidea by bait traps, pitfall traps as well as knock down methods from ecological cherry orchards in western Turkey. In this study, four species are identical with which of our study *Oxythyrea cinctella, Tropinota hirta*, *Pygopleurus foina, Onthophagus furcatus*. In their study, *Caccobius histeroides* was collected as the most abundant species by using pitfall traps. Anlaş et al., (2011) reported a total of 17 species belonging to six families of Scarabaeoidea by pitfall traps in Bozdağlar Mountain of western Turkey. In this study, six species are identical with which of our study *O. cinctella, T. hirta*, *Blitopertha lineolata*, *Copris lunaris*, *O. furcatus, Sisyphus schaefferi*. Among them, *S.schaefferi* was collected as the most abundant by using pitfall traps.

Studies on beetles belonging to Scarabaeoidea are very important for agricultural and forest ecosystems. It is expected that our knowledge on the species belonging to these group of insects will rise with further studies.

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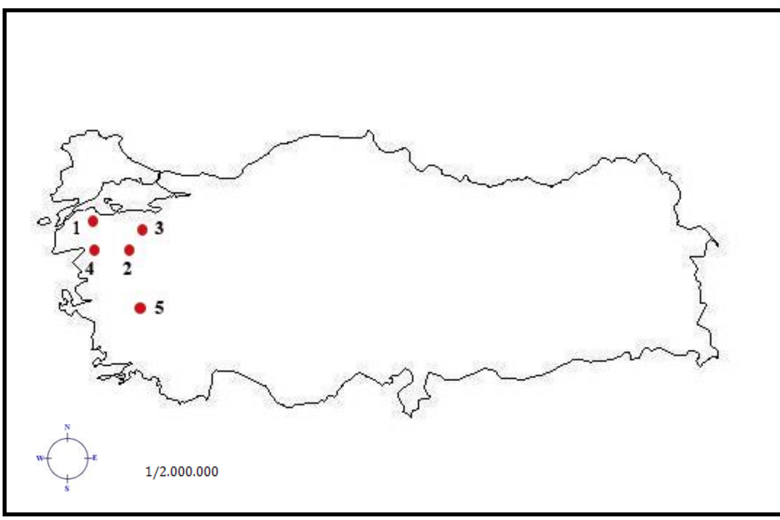

Figure 1. Map of studied areas in western Turkey.

Table 1. Detailed information on the ecological conditions, altitude, coordinates and sampling period of the examined biotopes using pitfall trapping.

Sampling Biotope Number	Province	County	Sampling period	Biotopes	Altitude (m)	Coordinates
1	Çanakkale	Karabiga	2010 & 2011	Oak forest	101	40°24'56"91 N 27°16'14"05 E
				Meadow	2	40°22'33"15 N 27°18'10"98 E
				Plantation	135	40°25'11"86 N 27°15'59"57 E
2	Balıkesir	Çağış Campus	2008 & 2009	Meadow	169	39°53'95"43 N 28°00'39"25 E
3		Değirmen Boğazı	2010 & 2011	Pine forest	225	39°69'90"10 N 27°96'61"57 E
4		Madra Mountain	2007 & 2012	Chestnut forest	792 m	39°23'33"56 N 27°14'10"39 E
				Pine forest	1006 m	39°23'08"42 N 27°15'00"56 E
5	Denizli	Servergazi	2007 & 2008	Pine forest	533	37°39'52"54 N 29°02'50"80 E

Table 2. The number of the specimens collected by pitfall traps in the sampling zones and their rates.

Taxa	Province and county					Year	Sum	Rates (%)
	Balıkesir			Çanakkale	Denizli			
	Çağış Campus	Madra Mountain	Değirmen Boğazı	Karabiga	Servergazi			
SCARABAEIDAE								
Scarabaeus (Scarabaeus) pius (İlliger, 1803)	4	0	0	0	0	2008	4	2.8
S. (Scarabaeus) typhon (Fischer, 1824)	1	0	0	1	0	2008/2010	2	1.4
Copris hispanus cavoliini (Petagna, 1792)	4	0	0	0	0	2008	4	2.8
C. (s.str.) *lunaris* (Linnaeus, 1758)	0	1	0	0	0	2012	1	<1
Onthophagus (Palaeonthophagus) vacca (L, 1767)	0	0	0	1	0	2010	1	<1
O. (Furconthophagus) furcatus (Fabricius, 1781)	0	5	0	4	0	2010/2012	9	6.3
Sisyphus (s.str.) *schaefferi*(Linnaeus, 1758)	0	14	0	0	0	2012	14	9.9
CETONIIDAE								
Cetonia aurata pallida (Drury, 1770)	3	0	0	0	0	2008/2009	3	2.1
Protaetia (Cetonischema) speciosa (Adams, 1817)	0	0	1	0	0	2011	1	<1
P. (Netocia) subpilosa (D. des Loges, 1869)	1	0	0	0	0	2008	1	<1
P. (Netocia) vidua (Gorry & Percheron, 1833)	1	0	0	0	0	2008	1	<1

P. (*Netocia*) *afflicta* (Gorry & Percheron, 1833)	1	0	0	1	0	2008/2009	2	1.4
O. (*s.str.*) *cinctella* (Schaum, 1841)	8	0	14	0	0	2009/2011	22	15.5
Oxythyrea (s.str.) *funesta* (Poda, 1761)	0	0	0	1	0	2009	1	<1
P. (*Netocia*) *ungarica ungarica* (Herbst, 1790)	0	0	0	1	0	2009	1	<1
P. (*Netocia*) *cuprina* (Motschulsky, 1849)	1	0	0	0	0	2008	1	<1
Tropinota (*Tropinota*) *squalida* (Scopoli, 1783)	1	0	0	1	0	2008/2010	2	1.4
T. (*Epicometis*) *hirta* (Poda, 1761)	10	0	4	0	0	2008/2011	14	9.9
MELOLONTHIDAE								
Anoxia (*Anoxia*) *asiatica* Desbrochers, 1871	3	0	0	0	0	2008	3	2.1
A. (*Protanoxia*) *orientalis* (Krynicky, 1832)	5	0	0	0	0	2008	5	3.5
Melolontha (s.str.) *albida* Frivaldszky, 1835	2	2	0	0	0	2008/2011	4	2.8
Aplidia (*s.str.*) *turcica* (Kraatz, 1882)	1	0	0	0	0	2008	1	<1
A. (s.str.) *vagepunctata* (Kraatz, 1882)	0	0	0	0	1	2008	1	<1
A. (s.str.) *lodosi* Baraud, 1990	0	1	0	0	0	2012	1	<1
GLAPHYRIDAE								
Eulasia (*Vittateulasia*) *pareyssei* (Brullé, 1832)	2	0	0	0	0	2008/2009	2	1.4
E.(*Vittateulasia*) *vittata vittata* (Fabricius, 1775)	1	0	1	0	0	2008/2011	2	1.4
Pygopleurus (*Pygopleurus*) *foina* (Reitter, 1890)	2	0	0	0	0	2008	2	1.4
P. (*Pygopleurus*) *mithridates* Petrovitz, 1962	1	0	1	0	0	2009/2011	2	1.4
DYNASTIDAE								
Pentodon bidens sulcifrons Kuster, 1848	2	0	0	6	0	2008/2009/2010	8	5.6
P. (s.str.) *idiota* (Herbst, 1789)	5	0	0	6	0	2008/2009	11	7.8
P. algerinus dispar Baudi, 1870	0	0	0	1	0	2009	1	<1
Oryctes (*Oryctes*) *nasicornis kuntzeni* Minck, 1914	1	0	0	0	0	2008	1	<1
RUTELIDAE								
Chaetopteroplia segetum velutina (Erichson 1847)	2	0	2	0	0	2008/2009	4	2.8
Blitopertha (s.str.) *lineolata* (F.von Waldheim, 1824)	1	1	0	2	0	2008/2010/2012	4	2.8
Anomala (s.str.) *affinis* Ganglbauer, 1882	2	0	0	0	0	2008	2	1.4
Total	**67**	**24**	**23**	**25**	**3**		**142**	**100**
		114		**25**	**3**			

RECORD OF SOME HEMIPTERAN INSECT PESTS OF *LITCHI CHINENSIS* FROM JAMMU DISTRICT (J& K), INDIA.

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ABSTRACT: Litchi occupies an important place among the fruits grown in Jammu district. Therefore keeping in view, the dietary and economic importance of litchi, the work was initiated in Jammu district to study the diversity of different insect pests attacking litchi plantations. Of the various insect pests recorded, pentatomid bugs belonging to order Hemiptera and family Pentatomidae causing serious damage to the litchi plantations. Adults and nymphs both cause damage to the trees by sucking sap from the tender leaves and cause damage on fruits by hard brownish punctures or black spots. These punctures affect the fruit's edible quality and lower its market value.

KEY WORDS: Litchi, pentatomid bugs, damage, Jammu.

Litchi (*Litchi chinensis* Sonn.) is one of the important subtropical fruit crops known for its delicious fragrant, juicy and quality fruits contributing significantly to the nation's economy. Among many factors affecting production and productivity, insect pests and post-harvest losses are a major constraint. Litchi crop suffers heavy damage due to large number of insect pests in the present area under investigation. Stink bugs (Hemiptera : Pentatomidae) are important economic pests of many agricultural crops and have become one of the most difficult pest complexes to control in field crops, vegetables and fruit trees (McPherson & McPherson, 2000).The paper deals with morphology and mode of damage to *Litchi chinensis* in Jammu district by pentatomid bugs.

MATERIAL AND METHODS

The field investigations were carried out during December 2012 to July 2013 in district Jammu of J&K state where litchi plantations were grown. The insects along with their immature stages were collected from the various methods such as handpicking, stem beating and also with the help of entomological nets. Later, collected specimens, eggs, larvae, pupae and adults were preserved by traditional methods for further studies. General morphological studies were made under different magnifications of the stereoscope microscope. Photographs have been taken with Canon Power shot, Digital Still Camera with 8x optical zoom having 16.0 effective mega pixels with inbuilt macro function for extreme close up.

OBSERVATIONS AND DISCUSSIONS

During the period of observation, a total of 05 insect pests belonging to family Pentatomidae were recorded by the investigator from the Jammu district of J& K state. These insects were found to be sap suckers. A general description of each insect species along with their damage pattern is discussed below:

1) *Halys dentatus* Fabricius, 1803

Distribution: It is distributed throughout Pakistan (Yasmin et al; 1991) and India (Yousuf & Gaur, 1993).

Description: Body coarse, darkly punctate, 21mm long and 9mm wide between pronatal angles. Antennae 5 segmented, antennal segments uniformly cylindrical. Head longer than pronotum; rostrum extends beyond the fifth abdominal segment. Compound eyes dark brown ; thorax brown with black spots; scutellum brown with dark spots; wing membrane dark brown from where basal vein of the membrane arises; femur with dark brown spots.

Damage: The insects were seen sucking sap from leaves and fruits. Thereby causing severe damage to the plantation.

2) *Dolycoris baccarum* Linnaeus, 1758

Distribution: From India recorded from Tamil Nadu, Bihar, and Kolkata; besides India also recorded from Denmark, Ireland, England, USSR, Poland and Italy.

Description: Body large, distinctive oval, shield shaped, long hairs with a length of about 10-12mm. Head roughly triangular, closely punctuate. Compound eyes large, bulged, laterally placed lying between the postero lateral margin of the head and anterolateral margin of the pronotum. Ocelli present, oval, inwardly directed, located at the base of the head. Antennae 5 segmented, longer than the head. Scutellum very prominent, convex and punctuate. Elytra broader anteriorly, narrow and slightly pointed posteriorly, longer than the abdomen. Legs distinctly hairy; hind legs long; tibia cylindrical; claws thin; tarsi 3 segmented.

Damage: Adult bugs were found feeding on the shoots, leaves and flowers.

3) *Nezara viridula* Linnaeus, 1758

Distribution: Distributed in tropical and subtropical regions of the America, Africa and Asia. Also reported from West Bengal, Assam and Himachal Pradesh.

Description: Body light green, spotless and shield shaped. Head closely punctate. Antennae 5 segmented, ventrally located. Compound eyes large and bulged. Stink gland pores short and broad located on sternum between meso and meta leg. Scutellum with black dot in each basal corner. Femora with a single blunt spine at its distal end. Tibia cylindrical and posterior angle of each abdominal segments have black dots.

Damage: The bugs feed by piercing plant tissue with needle like stylets. Young fruit growth is retarded and it often withers and drops from the plant.

4) *Halyomorpha picus* Fabricius, 1794

Distribution: Oriental region and Formosa (Miyamoto, 1965).

Description: Body light brown with dark brown punctate spots. Head freely movable not fused with the thorax. Compound eyes large bulged and laterally placed. Antennae 5 segmented and filiform. Scutellum large and convex. Legs unequal; meta legs are longer than meso legs. Tarsi 3 segmented. Abdominal margins slightly visible dorsally through the wings.

Damage: The pest is a sap sucker found feeding on leaves and twigs. The insect was also found damaging the fruit there by causing the rottening of fruits.

5) *Eusacocoris ventralis* Westwood, 1837

Distribution: India, Japan, Pakistan, Cuttack, Bankura (Bishnpur), Medinipur (Digha).

Description: Body 5 to 7 mm in length. Body colour faint brown like the milk tea, dorsal surface dark chocolate brown. Head small and triangular in shape. Compound eyes large bulged, laterally placed lying between the posterolateral margin of the head and anterolateral margin of the pronotum. Antennae 5 segmented, hairy and dull brown in colour. Legs simple creamish yellow with dark brown spots scattered all over the legs. Tarsi 3 segmented and thin claws present.

Damage: Bugs cause significant damage by piercing plant tissue and removing plant juice. Damaged leaves sometimes become pale yellow, dry, shrivelled and fall out prematurely.

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Table 1. Description of insect pests on *Litchi chinensis*.

S.no.	Scientific name	Order	Family	Pest status
1	*Halys dentatus*	Hemiptera	Pentatomidae	Abundance
2	*Dolycoris baccarum*			Less
3	*Nezara viridula*			Abundance
4	*Halyomorpha picus*			Abundance
5	*Eusacoris ventralis*			Less

BLACK FLIES (DIPTERA: SIMULIIDAE) RECORDS FROM EAST MARMARA REGION

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ABSRACT: This paper presents 17 species of black flies recorded from 99 lotic sites in East Marmara Region in summer of 2001, 2002 and 2003. All species are recorded from this region for the first time and distributional remarks both in Turkey and World are given for each species.

KEY WORDS: Black flies, Simuliidae, Turkey, biodiversity, fauna.

Black flies are medically, economically and ecologically important insects belonging to the family Simuliidae, suborder Nematocera order Diptera (Crosskey, 1990). Adult females of most simuliid species feed on vertebrate blood. As a consequence, some are among the most importatnt insect pests of humans and animals. They are the sole vectors responsible for human onchocerciasis, or river blindness, which causes visual impairment and skin problems. Furthermore, many species, especially in the genera *Simulium*, transmit other filarial worms, protozoans or arboviruses to livestock, wild mammals and birds. Black fly attacks on humans, livestock and poultry can reduce productivity (Crosskey 1990; Adler et al., 2004). The immature stages develop in running water ecosystems where they often are a dominant component of the benthos. They have very important roles as prey and, through larval filter-feeding, in the removal of organic mater from the water column (Malmqvist et al., 2004). A total of 2,142 living, formally described species of black flies are currently recognized as valid, with new species continuing to be discovered at a rapid rate (Adler & Crosskey, 2014).

Turkish Simuliidae fauna is still not well known although the investigations have been much more increased in the last fifteen years. After the first report about the family in Anatolia made by Austen with describing *Simulium pulchripes* from Asiatic part of Çanakkale Province in 1925, the main researches contributed to the knowledge of Turhish black flies fauna can be classified as fallow; Jedlicka (1975), Zwick (1978), Kazancı & Clergue–Gazeau (1990), Clergue-Gazeau & Kazancı (1992), Balık et al. (2002), Şirin & Şahin (2005), Crosskey & Zwick (2007), Kazancı a& Ertunç (2008), Çağlar & İpekdal (2009), Kalafat & Şirin (2011) and Adler & Şirin (2014). As a result of them, the numbers of the Turkish black flies species are 52 according to the latest version of "Inventory of World Blackflies" published by Adler & Crosskey (2014), wheras about 650 species are known in Palearctic. Concerning with its biodiversity and zoologeographical status, it is expected that there are upwards of black flies speices living in Turkey. This paper reports 17 blackflies species from East Marmara Region for the first time.

MATERIAL AND METHODS

The study material was based on mostly the aquatic stages collected from the 99 different lotic habitats which are rivers, streams and springs in the region and also on adults rearing from pupae. The material includes 2052 specimens (852 larvae, 953 pupae, 198 pharate adults and 49 reared adults) and was deposited in simuliid collection in Entomology Laboratory of Eskişehir Osmangazi University, Eskişehir.

Larvae and pupae were collected into and are preserved in 80% ethanol and reared flies with their pupal exuviae also were fixed in alchohol. For each species the number of larvae, pupae and adults obtained at a sampling site on a given date is recorded in the examined material list below. All examinations in conformity with methods described by Bass (1998) were made with the aid of a stereo microscope (Leica MZ 16).

Identifications were made using the keys and descriptions by Rubtsov (1956), Knoz (1965), Terteryan (1968), Crosskey (1991, 1998, 2002), Bass (1998), Crosskey & Malicky (2001), Yankovsky (2003) and Crosskey & Zwick (2007). In addition, papers by Jensen (1997), Crosskey & Crosskey (2000), Jedlicka & Stloukalova (1997) and Jedlicka et al. (2004), Belqat & Dakki (2004) were also used. The nomenclature used in this text follows Adler & Crosskey (2014), from which distribution data of the species is taken.

The positions of the collecting sites are shown on the map in Figure 1. Numbers on the map and in the following list provide correlation with the site records listed for each species in the text. All co-ordinates are given in east/north sequence.

Sampling sites

1. Bilecik Province, Osmaneli District, Selçik Village, *Sakarya River* [40° 22' N/ 29° 57' E 380 m].
2. Sakarya Province, Geyve District, Dereköy Village, *Sakarya River* [40° 35' N/ 30° 19' E 79 m].
3. Sakarya Province, Sapanca District, Akçay Village, *Akçay Stream* [40° 40' N/ 30° 19' E 109 m].
4. Sakarya Province, Sapanca District, Mahmudiye Village, *Mahmudiye Stream*. [40° 41' N/ 30° 14' E 99 m].
5. Sakarya Province, Sapanca District, Muradiye Village, *Muradiye Stream* [40° 40' N/ 30° 13' E 156 m].
6. Sakarya Province, Sapanca District, *Kurtköy Stream* [40° 41' N/ 30° 10' E 98 m].
7. Sakarya Province, Arifiye District, Fuadiye Village, *Fuadiye Stream* [40° 42' N/ 30° 25' E 54 m].
8. Sakarya Province, Erenler District, Kayalar Village, *Kayalar Stream* [40° 41' N/ 30° 27' E 64 m].
9. Sakarya Province, Akyazı District, Kepekli Village, *Kanlı Stream* [40° 40' N/ 30° 32' E 71 m].
10. Sakarya Province, Akyazı District, Harmanlı Village, *Uludere Stream* [40° 40' N/ 30° 34' E 67 m].
11. Sakarya Province, Akyazı District, *Mudurnu Brook* [40° 40' N/ 30° 37' E 82 m].
12. Sakarya Province, Akyazı District, Yağcılar Village, *Yağcılar Stream* [40° 40' N/ 30° 39' E 55 m].
13. Sakarya Province, Akyazı District, Altındere Town, *Akar Stream* [40° 40' N/ 30° 41' E 81 m].
14. Sakarya Province, Akyazı District, Altındere Town, *Bıckıdere Stream* [40° 41' N/ 30° 42' E 53 m].
15. Sakarya Province, Hendek District, Çakallık Village, *Çakallık Stream* [40° 44' N/ 30° 43' E 74 m].
16. Sakarya Province, Hendek District, Sarıyer Village, *Sarıyer Stream* [40° 43' N/ 30° 43' E 70 m].
17. Sakarya Province, Hendek District, Kazımiye Village, *Kazımiye Stream* [40° 48' N/ 30° 41' E 116 m].
18. Sakarya Province, Hendek District, Sivritepe Village, *Hacıkışla Stream* [40° 51' N/ 30° 38' E 55 m].
19. Sakarya Province, Hendek District, *Dereköy Stream* [40° 56' N/ 30° 37' E 169 m].
20. Sakarya Province, Ferizli District, Aktefe Village, *Aktefe Stream* [40° 54' N/ 30° 36' E 42 m].
21. Sakarya Province, Kaynarca District, Sarıbeyli Village, *Sarıbeyli Stream* [40° 01' N/ 30° 20' E 52 m].
22. Kocaeli Province, Kandıra District, 5 km to Kandıra, *Duraçalı Stream* [41° 04' N/ 30° 10' E 58 m].
23. Kocaeli Province, Kandıra District, Kandıra-İzmit Road 3. km, *Kandıra Stream* [41° 03' N/ 30° 08' E 41 m].
24. Kocaeli Province, Kandıra District, Sofalı Village, *Safalı Stream* [41° 05' N/ 30° 05' E 26 m].
25. Kocaeli Province, Kandıra District, Akçaova Village, *Akçaova Stream* [41° 02' N/ 29° 56' E 93 m].
26. İstanbul Province, Ağva District, Çelebi Village, *Çelebi Stream* [41° 05' N/ 23° 59' E 40 m].
27. İstanbul Province, Ağva District, Bucaklı Village, *Yeşilçay Stream* [41° 07' N/ 29° 51' E 17m].

28. İstanbul Province, Şile District, Ğöce (Göksu) Village, *Göksu Kurudere Stream* [41° 06’ N/ 29° 51’ E 20m].
29. İstanbul Province, Ağva District, İsaköy Village, *Şelale -Göksu Stream* [41° 06’ N/ 29° 48’ E 23m].
30. İstanbul Province, Şile District, Yazımanayır Village, *Bıçkı Stream* [41° 04’ N/ 29° 42’ E 67m].
31. İstanbul Province, Şile District, Erenler Village, *Hacizli Stream* [41° 07’ N/ 29° 33’ E 38 m].
32. İstanbul Province, Sultanbeyli District, *Ömerli Stream* [40° 58’ N/ 29° 19’ E 91 m].
33. Kocaeli Province, Çayırova District, Sultanbeyli-Göçbeyli Road 6. km, *Göçbeyli Stream* [40° 56’ N/ 29° 23’ E 136 m].
34. Kocaeli Province, Çayırova District, Göçbeyli Village, *Göçbeyli Stream* [40° 58’ N/ 29° 27’ E 110 m].
35. Kocaeli Province, Gebze District, Mollafeneri Village, *Mollafeneri Stream* [40° 52’ N/ 29° 28’ E 128 m].
36. Kocaeli Province, Körfez District, Sevindikli Village, *Sevindikli Stream* [40° 53’ N/ 29° 46’ E 237 m].
37. Kocaeli Province, Gölcük District, Yazlık Location, *Yeniköy Stream* [40° 41’ N/ 29° 52’ E 78 m].
38. Kocaeli Province, Gölcük District, İhsaniye Village, *Şirinköy Stream* [40° 41’ N/ 29° 49’ E 59 m].
39. Kocaeli Province, Gölcük District, İhsaniye-Ümmiye Road 3 km, *Ümmiye Stream* [40° 40’ N/ 29° 50’ E 87 m].
40. Kocaeli Province, Gölcük District, Lütfiye Village, *Kavaklı Stream* [40° 39’ N/ 29° 43’ E 306 m].
41. Kocaeli Province, Karamürsel District, Avcıköy Village, *Avcıköy Stream* [40° 35’ N/ 29° 43’ E 140 m].
42. Kocaeli Province, Karamürsel District, Hürriyet Village, *Yalakdere Stream* [40° 36’ N/ 29° 33’ E 139 m].
43. Yalova Province, Altınova District, Fevziye Village, *Fevziye Stream* [40° 36’ N/ 29° 29’ E 124 m].
44. Yalova Province, Altınova District, Fevziye Village, Akar *Stream* [40° 37’ N/ 29° 27’ E 122 m].
45. Yalova Province, Çiftlikköy District, Çukuyköy Village, *Çukurköy Stream* [40° 36’ N/ 29° 25’ E 165 m].
46. Yalova Province, Çiftlikköy, LalekötVillage , *Laledere Stream* [40° 36’ N/ 29° 23’ E 99 m].
47. Yalova Province, Merkez District, Elmalık-Çiftlikköy Road 4 km, *Elmalık Stream* [40° 37’ N/ 29° 18’ E 89 m].
48. Yalova Province, Merkez District, Safran Village, *Safran Stream* [40° 36’ N/ 29° 14’ E 49 m].
49. Yalova Province, Merkez District, Soğucak Village, *Soğucak Stream* [40° 36’ N/ 29° 16’ E 90 m].
50. Yalova Province, Merkez District, Kadıköy Village, *Kadıköy Stream* [40° 37’ N/ 29° 13’ E 30 m].
51. Yalova Province, Çınarcık District, Çalıca Village, *Çalıca Stream* [40° 38’ N/ 29° 10’ E 36 m].
52. Yalova Province, Çınarcık District, Kocadere Village, *Kocadere Stream* [40° 37’ N/ 29° 01’ E 51 m].
53. Yalova Province, Armutlu District, Kaplıcalar Location, *Kaplıca Stream* [40° 32’ N/ 28° 50’ E 80 m].
54. Bursa Province, Gemlik District, Büyükkumla Town, *Akar Stream* [40° 28’ N/ 29° 05’ E 23 m].
55. Bursa Province, İznik District, Çakırca Village, *Karasu Stream* [40° 28’ N/ 29° 40’ E 105 m].
56. Kocaeli Province, Kartepe District, Yeşiltepe Village, *Uzuntarla Stream* [40° 43’ N/ 30° 08’ E 64 m].
57. İstanbul Province, Beykoz District, *Çavuşbaşı Stream* [41° 05’ N/ 29° 08’ E 108 m].
58. İstanbul Province, Beykoz District, Polonez Village, *Polonezköy Stream* [41° 06’ N/ 29° 10’ E 121 m].
59. İstanbul Province, Beykoz District, Cumhuriyet Village, *Cumhuriyet Stream* [41° 07’ N/ 29° 14’ E 121 m].
60. İstanbul Province, Çekmeköy District, Hüseyinli Village, *Hüseyinli Stream* [41° 06’ N/ 29° 18’ E 37 m].
61. İstanbul Province, Şile District, Ovacık Village, *Ovacık Stream* [41° 07’ N/ 29° 28’ E 48 m].
62. İstanbul Province, Şile District, Yeniköy Village, *Yeniköy Stream* [41° 07’ N/ 29° 29’ E 68 m].
63. İstanbul Province, Ağva District, YağcılarVillage, *Yağcılar Stream* [41° 05’ N/ 29° 52’ E 31 m].
64. İstanbul Province, Ağva District, Küçüklü Village, *Küçüklü Stream* [41° 04’ N/ 29° 55’ E 48 m].
65. Kocaeli Province, Kandıra District, Akçaova Village, Koca Stream, [41° 01’ N/ 29° 57’ E 216 m].
66. Kocaeli Province, Kandıra District, Hediyeli Village, *Hediyeli Stream* [41° 03’ N/ 30° 02’ E 62 m].
67. Kocaeli Province, Kandıra District, Ferizli Village, *Ferizli Stream*, [41° 00’ N/ 30° 11’ E 73 m].
68. Kocaeli Province, Kandıra District, Kanatlar Village, *Karaağaç Stream* [41° 00’ N/ 30° 14’ E 77 m].
69. Sakarya Province, Kaynarca District, Yeniçam Village, *Çoban Stream* [40° 59’ N/ 30° 15’ E 104 m].
70. Sakarya Province, Kaynarca District, Salmanlı Village, *Akmeşe Stream* [40° 53’ N/ 30° 18’ E 100 m].
71. Sakarya Province, Söğütlü Distric, Akgöl Village, *Akgöl Stream* [40° 52’ N/ 30° 26’ E 28 m].
72. Sakarya Province, Hendek Distric, Aşağı Çalıca Village, *Aşağı Çallık Stream* [40° 49’ N/ 30° 38’ E 41 m].
73. Sakarya Province, Hendek Distric, Hacıkışla Village, *Hacıkışla Stream* [40° 51’ N/ 30° 38’ E 64 m].
74. Sakarya Province, Hendek District, Soğuksu Village, *Soğuksu Stream* [40° 53’ N/ 30° 37’ E 63 m].
75. Sakarya Province, Karasu District, Darıçayırı Village, *Karasu Stream* [41° 01’ N/ 30° 38’ E 28 m].
76. Kocaeli Province, Kartepe District, *Yanıkköy Stream* [40° 41’ N/ 30° 09’ E 109 m].
77. Kocaeli Province, Kartepe District, Aşağı Eşme Village, *Eşme Stream* [40° 44’ N/ 30° 13’ E 58 m].
78. Kocaeli Province, Kartepe District, KetencilerVillage, *Ketenciler Stream* [40° 45’ N/ 30° 08’ E 56 m].
79. Kocaeli Province, İzmit District, Sepetçi Village, *Bıçkıdere Stream* [40° 48’ N/ 29° 59’ E 58 m].

80. Kocaeli Province, İzmit District, Sepetçi Village, *Bıçkıdere 2 Stream* [40^o 49' N/ 29 ^{o} 59' E 60 m].
81. Kocaeli Province, İzmit District, Emirhan Village, *Emirhanlar Stream* [40^o 48' N/ 30 ^{o} 03' E 79 m].
82. Kocaeli Province, Derince District, Kayalar Village, *Kayalar Stream* [40^o 52' N/ 29 ^{o} 51' E 231 m].
83. İstanbul Province, Şile District, Yaka Village, *Meşeli Stream* [40^o 59' N/ 29 ^{o} 39' E 121 m].
84. Kocaeli Province, Gebze District, Ballıkaya Canyon, *Ballıkaya Stream* [40^o 50' N/ 29 ^{o} 30' E 50 m].
85. Yalova Province, Çiftlikköy District, Gacık Village, *Gacık Stream* [40^o 36' N/ 29 ^{o} 19' E 113 m].
86. Yalova Province, Armutlu District, Hayriye Village, *Hayriye Stream* [40^o 30' N/ 28 ^{o} 58' E 413 m].
87. Yalova Province, Armutlu District, Fıstıklı Village, *Fıstıklı Stream* [40^o 29' N/ 28 ^{o} 53' E 15 m].
88. Yalova Province, Armutlu District, *Çaldere Stream* [40^o 34' N/ 28 ^{o} 54' E 38 m].
89. Yalova Province, Çınarcık District, Esenköy Village, *Esenköy Stream* [40^o 36' N/ 28 ^{o} 56' E 19 m].
90. Yalova Province, Çınarcık District, Teşvikiye Village, *Karpuz Stream* [40^o 38' N/ 29 ^{o} 04' E 4 m].
91. Kocaeli Province, Başiskele District, Kullar Village, *Kullar Stream* [40^o 43' N/ 29 ^{o} 59' E 45 m].
92. Bilecik Province, Osmaneli District, Oğulpaşa Village, *Yeşilçimen Stream* [40^o 26' N/ 29 ^{o} 54' E 395 m].
93. Bursa Province, İznik District, Çamdibi Village, *Kaynarca Stream* [40^o 24' N/ 29 ^{o} 43' E 170 m].
94. Bursa Province, İznik District, Boyalıca Village, *Kurudere Stream* [40^o 29' N/ 29 ^{o} 35' E 98 m].
95. Yalova Province, Altınova District, Örencik Village, *Keramet Stream* [40^o 36' N/ 29 ^{o} 27' E 150 m].
96. Bursa Province, İznik District, Gürmüzlü Village, *Gürmüzlü Stream* [40^o 30' N/ 29 ^{o} 46' E 513 m].
97. Sakarya Province, Geyve District, Bağlarbaşı Village, *Sakarya River* [40^o 33' N/ 30 ^{o} 20' E 310 m].
98. Sakarya Province, Geyve District, Koruköy Village, *Koru Stream* [40^o 31' N/ 30 ^{o} 26' E 742 m].
99. Sakarya Province, Taraklı District, Çayköy Village, *Çayköy Stream* [40^o 27' N/ 30 ^{o} 27' E 537 m].

RESULTS

A total of 17 species belonging to 5 different subgenus (*Wilhelmia, Nevermannia, Eusimulium, Boophthora, Simulium*) were determined from study sites. The list of species, collecting sites and dates, Turkey and World distribution are given at below.

Simulium (*Boophthora*) *erythrocephalum* (De Geer, 1776)

Material examined: Site 8- 1 ♂ pharate adult, 7 pupae, 4 larvae, 24.v.2002; 24.st- 4 pupae, 5 larvae, 16.vi.2002.
Distribution in World: Armenia, Austria, Belarus, Belgium, Britain, China, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Kazakhstan, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Siberia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, Mongolia (Adler & Crosskey, 2014).
Distribution in Turkey: Büyük Menderes River Basin, Sakarya Nehir Sistemi (Kazancı & Ertunç, 2008).

Simulium (*Eusimulium*) *petricolum* (Rivosecchi, 1963)

Material examined: Site 10- 1 ♂ pharate adult, 6 pupae, 6 larvae, 16.vi.2002; Site 17- 2 ♂♂ pharate adult, 8 pupae, 11 larvae, 17.vi.2002; Site 19- 2 ♂♂ pharate adult, 9 pupae, 10 larvae, 14.ix.2001; Site 20- 1 ♂ pharate adult, 5 pupae, 8 larvae, 17.vi.2002; Site 75- 2 ♂♂ pharate adult, 1 ♀ pharate adult, 3 pupae, 14 larvae, 17.vi.2002; Site 76- 4 ♂♂ pharate adult, 7 pupae, 3 larvae, 19.vi.2002; Site 79- 1 ♂ pharate adult, 2 pupae, 19.vi.2002; Site 92- 1 ♂ pharate adult, 1 pupae, 18.v.2003; Site 96- 1 ♂ pharate adult, 4 pupae, 4 larvae, 19.v.2003.
Distribution in World: Algeria, Austria, Bosnia, Britain, Cyprus, Czech Republic, France, GreeceIreland, Italy, Libya, Madeira, Morocco, Portugal, Serbia, Spain, Turkey, Russia (Adler & Crosskey, 2014).
Distribution in Turkey: Afyon (Kalafat and Şirin, 2011)

Simulium (*Eusimulium*) *velutinum* (Santos Abreu, 1922)

Material examined: Site 41- 2 ♂♂ pharate adult, 2 ♀♀ pharate adult, 6 pupae, 6 larvae, 16.ix.2001; Site 42- 1 ♂ pharate adult, 2 ♀♀ pharate adult, 5 pupae, 22.vi.2002; Site 43- 1 ♂ pharate adult, 1 ♀ pharate adult, 4 pupae, 8 larvae, 22.vi.2002; Site 84.st- 1 ♂, 3 ♂♂ pharate adult, 1 ♀ pharate adult, 8 pupae, 10 larvae, 20.vi.2002; Site 90- 2 ♂♂ pharate adult, 1 ♀

pharate adult, 7 pupae, 5 larvae, 22.vi.2002;Site 91- 1 ♂ pharate adult, 3 ♀♀ pharate adult, 3 pupae, 7 larvae, 22.vi.2002.
Distribution in World: Canary Islands (La Palma, Gomera); Algeria, Andorra, Balearic Islands (Majorca, Minorca), Bosnia, Britain (En, Sc, Wa), Cyprus, Czech Republic, Finland, France (incl. Corsica), Germany, Greece (incl. Corfu, Crete, Lésbos, Páros, Rhodes), Hungary, Ireland, Israel, Italy (incl. Sardinia, Sicily), Jordan, Libya, Macedonia, Majorca, Malta, Morocco, Norway, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Tunisia, Turkey, Ukraine (Crosskey & Howard, 1996; Zwick, 1978; Kazancı & Ertunç, 2008; Adler & Crosskey, 2014).
Distribution in Turkey: Büyük Menderes Riever Basin, Namnam Stream (Kazancı & Ertunç, 2008).

Simulium (*Nevermannia*) *angustitarse* (Lundström, 1911)
Material examined: Site 24- 3 pupae, 8 larvae, 14.ix.2001; Site 37- 6 pupae, 9 larvae, 23.vi.2002; Site 57- 7 pupae, 4 larvae, 12.vi.2002.
Distribution in World: Finland; Algeria, Austria, Belarus, Bosnia, Britain, China, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Ireland, Italy, Kyrgyzstan, Latvia, Letonia, Lithuania, Luxembourg, Macedonia, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Siberia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine (Adler & Crosskey, 2014).
Distribution in Turkey: Büyük Menderes River Basin, Sakarya River Basin (Kazancı & Ertunç, 2008).

Simulium (*Nevermannia*) *cryophilum* (Rubtsov, 1959)
Material examined: Site 13- 8 pupae, 7 larvae, 16.vi.2002; Site 46- 6 pupae, 4 larvae, 20.vi.2002; Site 49- 5 pupae, 7 larvae, 21.vi.2002; Site 85- 1 ♀, 4 pupae, 6 larvae, 21.vi.2002; Site 86- 1 ♂, 1 ♀, 7 pupae, 5 larvae, 21.vi.2002; Site 89- 6 pupae, 7 larvae, 22.vi.2002; Site 92- 1 pupae, 2 larvae, 18.v.2003; Site 95- 9 pupae, 19.v.2003.
Distribution in World: Algeria, Andorra, Armenia, Austria, Balearic Islands (Majorca), Belgium, Bosnia, Britain, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, Francei Germany, Greece, Ireland, Italy, Latvia, Lebanon, Luxembourg, Morocco, Netherlands, Norway, Poland, Portugal, Russia, Scotland, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tunisia, Turkey, Ukraine (Adler & Crosskey, 2014).
Distribution in Turkey: Büyük Menderes River Basin, Esen River Basin (Kazancı & Ertunç, 2008).

Simulium (*Nevermannia*) *lundstromi* (Enderlein, 1921)
Material examined: Site 12- 5 pupae, 14 larvae, 14.vi.2002; Site 16.- 7 pupae, 6 larvae, 16.vi.2002.
Distribution in World: Britain; Algeria, Austria, Belarus, Belgium, Bulgaria, China, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Kazakhstan, Latvia, Lebanon, Lithuania, Morocco, Netherlands, Norway, Poland, Portugal, Russia, Serbia, Slovakia, Spain, Sweden, Switzerland, Turkey, Ukraine (Adler & Crosskey, 2014).
Distribution in Turkey: Sakarya River Basin, Zamantı River Basin (Kazancı & Ertunç, 2008).

Simulium (*Simulium*) *noelleri* Friederichs, 1920
Material examined: Site 29- 11 pupae, 12 larvae, 13.vi.2002; Site 31.st- 1 ♂ pharate adult, 7 pupae, 10 larvae, 15.ix.2001.
Distribution in World: Armenia, Austria, Belarus, Belgium, Bosnia, Britain, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Kazakhstan, Latvia, Lithuania, Luxembourg, Mongolia, Netherlands, Norway, Poland, Romania, Russia, Serbia, Siberia, Slovakia, Slovenia, Sweden, Switzerland, Turkey, Ukraine, USA (Alaska) (Adler & Crosskey, 2014).
Distribution in Turkey: Sakarya River Basin (Kazancı & Ertunç, 2008).

***Simulium* (*Simulium*) *variegatum* Meigen, 1818**
Material examined: Site 76- 5 pupae, 4 larvae, 19.vi.2002.
Distribution in World: Algeria, Andorra, Armenia, Austria, Azerbaijan, Belgium, Bosnia, Britain,Bulgaria, China, Croatia, Czech Republic, Denmark, France, Germany, Greece, Hungary, Iran, Ireland, Italy, Kazakhstan, Lebanon, Morocco, Pakistan, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, Uzbekistan (Adler & Crosskey, 2014).
Distribution in Turkey: Altındere Stream (in Trabzon), Ceyhan River Basin, Çoruh River Basin, Dicle River Basin, Fırat River Basin, Fırtına Stream, Köyceğiz Protected Area, Sakarya River Basin, Salda Lake Basin, Zap River (Kazancı & Ertunç, 2008).

***Simulium* (*Simulium*) *bezzii* (Corti, 1914)**
Material examined: Site 95- 3 pupae, 19.v.2003; Site 96- 7 pupae, 1 larvae, 19.v.2003.
Distribution in World: Algeria, Andorra, Armenia, Austria, Azerbaijan, Bosnia, Bulgaria, Cyprus, France, Georgia, Germany, Greece, Iran, Iraq, Israel, Italy, Lebanon, Macedonia, Morocco, Poland, Romania, Russia, Serbia, Spain, Sweden, Switzerland, Turkey, Ukraine, Uzbekistan (Adler & Crosskey, 2014).
Distribution in Turkey: Ceyhan River Basin, Çoruh River Basin, Göksu River Basin, Fırat River Basin, Kızılırmak River Basin Sakarya River Basin, Streams in Eastern Blacksea Region, Yuvarlakçay Stream, Yeşilırmak Stream (Kazancı & Ertunç, 2008).

***Simulium* (*Simulium*) *reptans* (Linnaeus, 1758)**
Material examined: Site 28- 4 pupae, 7 larvae, 14.vi.2002; Site 29- 8 pupae, 3 larvae, 15.ix.2001.
Distribution in World: Austria, Belarus, Belgium, Bosnia, Britain, Bulgaria, China, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Siberia, Slovakia, Spain, Sweden, Switzerland, Turkey, Ukraine, Uzbekistan (Adler & Crosskey, 2014).
Distribution in Turkey: Büyük Menderes Nehir Sistemi (Kazancı & Ertunç, 2008).

***Simulium* (*Simulium*) *kerisorum* (Rubtsov, 1956)**
Material examined: Site 71- 3 pupae, 15.vi.2002.
Distribution in World: Azerbaijan, Bulgaria, Kyrgyzstan, Turkey (Adler & Crosskey, 2014).
Distribution in Turkey: Sakarya River Basin, Fırat River Basin (Kazancı & Ertunç, 2008).

***Simulium* (*Simulium*) *argyreatum* Meigen, 1838**
Material examined: Site 13- 8 pupae, 7 larvae, 16.vi.2002; Site 62- 7 pupae, 2 larvae, 13.vi.2002; Site 98- 2 pupae, 2 larvae, 20.vi.2003; Site 99- 2 pupae, 4 larvae, 20.vi.2003.
Distribution in World: Andorra, Austria, Belgium, Bosnia, Britain, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Ireland, Italy, Luxembourg, Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tırkey, Ukraine, Kazakhistan (Adler & Crosskey, 2014).
Distribution in Turkey: Sakarya River Basin (Kazancı & Ertunç, 2008).

***Simulium* (*Simulium*) *kiritshenkoi* Rubtsov, 1940.**
Material examined 4. st.- 7 pupae, 6 larvae (11.ix.2001, 19.vi.2002); 13. st.- 8 pupae (12.ix.2001, 16.vi.2002); 14. st.- 13 pupae, 11 larvae, (12.ix.2001, 16.vi.2002); 30. st.- 10 pupae, 9 larvae, (15.ix.2001, 14.vi.2002); 33. st.- 7 pupae, 12 larvae, (15.ix.2001); 38. st.- 6 pupae, 10 larvae, (16.ix.2001); 55. st.- 4 pupae, 7 larvae, (17.ix.2001); 57. st.- 6 pupae, 7 larvae (12.vi.2002); 58. st.- 4 pupae, 8 larvae (12.vi.2002); 59. st.- 5 pupae, 10 larvae (13.vi.2002); 60. st.- 6 pupae, 8 larvae (13.vi.2002); 64. st.- 5 pupae, 6 larvae (14.vi.2002); 66. st.- 8 pupae, 3 larvae (14.vi.2002); 67. st.-1 ♂, 3 pupae, 3 larvae (15.vi.2002); 68. st.- 7 pupae, 4 larvae (15.vi.2002); 77. st.- 6 pupae, 2 larvae (19.vi.2002); 81. st.- 1 ♂, 1 ♀, 5 pupae, 9 larvae (19.vi.2002).

Distribution in World: Iran; Armenia, Azerbaijan, Bulgaria, Cyprus, Iraq, Pakistan, Romania, Russia, Tajikistan Turkey, Ukraine (Adler & Crosskey, 2014).
Distribution in Turkey: Ceyhan River Basin, Fırat River Basin, Kızılırmak River Basin, Sakarya River Basin, Yeşilırmak River Basin, Zamantı River Basin (Kazancı & Ertunç, 2008).

Simulium (*Wilhelmia*) *lineatum* (Meigen, 1804)
Material examined: Site 71- 8 pupae, 14 larvae, 15.vi.2002.
Distribution in World: Germany; Afghanistan, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia, Britain (En, Wa), Bulgaria, China, Czech Republic, Denmark, France (incl. Corsica), Greece, Hungary, Iran, Iraq, Ireland, Italy (incl. Sardinia, Sicily), Kazakhstan, Kyrgyzstan, Latvia, Lebanon, Lithuania, Netherlands, Pakistan, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan (Adler & Crosskey, 2014).
Distribution in Turkey: Büyük Menderes River Basin, Çoruh River Basin, Kızılırmak River Basin, Sakarya River Basin, Yeşilırmak River Basin, Köyceğiz Protected Area (Muğla), Esen River Basin (Kazancı & Ertunç, 2008).

Simulium (*Wilhelmia*) *balcanicum* (Enderlein, 1924)
Material examined: Site 2- 6 pupae,12 larvae, 11.ix.2001; Site 3- 8 pupae,10 larvae, 18.vi.2002; Site 6- 5 pupae, 11.ix.2001; Site 8- 4 pupae, 2 larva, 16.vi.2002; Site 9- 1 ♂, 1 ♀, 1 ♂ pharate adult, 3 pupae, 5 larvae, 16.vi.2002; Site 10- 9 pupae, 3 larvae, 16.vi.2002; Site 15- 2 ♀♀ pharate adult, 7 pupae, 2 larvae, 16.vi.2002; Site 28- 6 pupae, 12 larvae, 14.vi.2002; Site 70- 1 ♂, 11 pupae, 15 larvae, 15.vi.2002; Site 75- 13 pupae, 5 larvae, 17.vi.2002; Site 78- 1 ♂ pharate adult, 5 pupae, 6 larvae, 19.vi.2002.
Distribution in World: Austria, Bulgaria, Belarus, Bosnia, Germany, Greece, Hungary, Italy, Lithuania, Macedonia, Poland, Romania, Russia Serbia, Slovakia, Slovenia, Turkey, Ukraine (Adler & Crosskey, 2014).
Distribution in Turkey: Büyük Menderes River Basin, Esen Çayı Sistemi, Kızılırmak River Basin, Sakarya River Basin, Yeşilırmak River Basin (Kazancı & Ertunç, 2008).

Simulium (*Wilhelmia*) *paraequinum* Puri, 1933
Material examined: Site 28- 2 ♂♂ pharate adult, 1 ♀ pharate adult, 8 pupae, 14 larvae, 14.vi.2002; Site 29- 2 ♂♂ pharate adult, 6 pupae, 4 larvae, 15.ix.2001; Site 48- 3 ♂♂ pharate adult, 2 ♀♀ pharate adult, 7 pupae, 6 larvae, 21.vi.2002.
Distribution in World : Pakistan; Armenia, Azerbaijan, Bulgaria, Greece Hungary, Iran, Iraq, Israel, Italy, Jordan, Lebanon, Romania, Serbia, Turkey, Ukraine (Crimea) (Adler & Crosskey, 2014).
Distribution in Turkey: Ceyhan River Basin, Büyük Menderes River Basin, Esen River Basin, Sakarya River Basin, Western Mediterranean Streams, Zamantı River (Kazancı & Ertunç, 2008).

Simulium (*Wilhelmia*) *pseudequinum Seguy, 1921*
Material examined: Site 1- 1 ♂ pharate adult; 4 pupae, 12 larvae, 10.ix.2001; Site 3- 2 ♂♂ pharate adult; 11 pupae, 18 larvae, 18.vi.2002; Site 5- 4 ♂♂ pharate adult; 2 ♀♀ pharate adult; 15 pupae, 8 larvae 11.ix.2001; Site 6- 1 ♂ pharate adult; 7 pupae, 3 larvae, 11.ix.2001; Site 7- 1 ♂ pharate adult; 8 pupae, 15 larvae, 16.vi.2002; Site 8- 3 ♂♂ pharate adult, 2 ♀♀ pharate adult, 14 pupae, 22 larvae, 16.vi.2002; Site 9- 5 ♂♂, 6 ♀♀, 1 ♂ pharate adult; 9 pupae, 5 larvae, 16.vi.2002; Site 10- 1 ♂, 1 ♀, 1 ♂ pharate adult;1 ♀ pharate adult, 11 pupae, 10 larvae, 16.vi.2002; Site 11- 1 ♂ pharate adult, 3 pupae, 12.ix.2001; Site 12- 2 ♂♂ pharate adult; 7 pupae, 13 larvae, 16.vi.2002; Site 13- 1 ♂ pharate adult; 8 pupae, 16.vi.2002; Site 14- 2 ♀♀ pharate adult; 13 pupae, 11 larvae, 16.vi.2002; Site 15.- 3 ♂♂ pharate adult; 9 pupae, 12 larvae, 13.ix.2001; Site 16- 2 ♂♂, 1 ♀, 2 ♂♂ pharate adult; 5 pupae, 7 larvae, 16.vi.2002; Site 17- 1 ♂, 1 ♀, 2 ♂♂ pharate adult; 18 pupae, 9 larvae, 17.vi.2002; Site 18- 2 ♂♂ pharate adult; 3 ♀ ♀ pharate adult, 12 pupae, 7 larvae, 13.ix.2001; Site 19- 2 ♂♂ pharate adult; 4 pupae, 12 larvae, 14.ix.2001; Site 20- 1 ♂, 2 ♀♀, 3 ♂♂ pharate adult; 18 pupae, 5 larvae, 17.vi.2002; Site 21- 1 ♂ pharate adult; 3 pupae, 14.ix.2001; Site 22- 5 pupae, 14.ix.2001; Site 23- 1 ♂ pharate adult; 14.ix.2001; Site 25- 1 ♂ pharate adult; 8 pupae, 15 larvae, 16.vi.2002;

Site 30- 3 ♂♂ pharate adult; 12 pupae, 13 larvae, 14.vi.200); Site 31- 1 ♂, 1 ♀, 1 ♂ pharate adult; 7 pupae, 15 larvae, 15.ix.2001; Site 32- 11 pupae, 15.ix.2001; Site 33- 2 ♂♂ pharate adult; 4 pupae, 13 larvae, 15.ix.2001; Site 34- 4 ♂♂ pharate adult; 8 pupae, 13 larvae, 15.ix.2001; Site 35- 3 ♂♂ pharate adult; 12 pupae, 9 larvae, 15.ix.2001; Site 36- 4 ♂♂ pharate adult; 9 pupae, 11 larvae, 20.vi.2002; Site 38- 1 ♂ pharate adult, 2 ♀♀, 9 pupae, 13 larvae, 16.ix.2001; Site 39- 2 ♂♂ pharate adult; 12 pupae, 3 larvae, 16.ix.2001; Site 40- 12 pupae, 8 larvae, 16.ix.2001; 42. st.- 2 ♂♂ pharate adult, 2 ♀♀ pharate adult, 7 pupae, 15 larvae, 22.vi.2002; Site 43- 5 ♂♂ pharate adult, 9 pupae, 17 larvae, 22.vi.2002; Site 44- 2 ♂♂ pharate adult, 2 pharate adult ♀♀, 7 pupae, 15 larvae, 22.vi.2002; Site 45- 3 ♂♂ pharate adult, 1 pharate adult ♀, 7 pupae, 22.vi.2002; Site 46- 1 ♂ pharate adult, 6 pupae, 20.vi.2002; Site 47- 1 ♂ pharate adult, 1 ♀ pharate adult, 11 pupae, 12 larvae, 16.ix.2001; Site 48- 3 ♂♂ pharate adult, 12 pupae, 4 larvae, (16.ix.2001, 21.vi.2002); Site 49- 2 ♂♂ pharate adult, 4 pupae, 18 larvae, 21.vi.2002; Site 50- 2 ♀♀ pharate adult, 6 pupae, 5 larvae, 17.ix.2001; Site 51- 2 ♂♂ pharate adult, 1 ♀ pharate adult, 3 pupae, 17.ix.2001; Site 52- 2 ♂♂ pharate adult, 3 ♀♀ pharate adult, 7 pupae, 22.vi.2002; Site 53- 1 ♂ pharate adult, 8 pupae, 13 larvae 17.ix.2001; Site 54- 4 ♂♂ pharate adults, 9 pupae, 11 larvae, 21.vi.2002; Site 55- 1 ♂ pharate adult, 4 pupae, 2 larvae, 17.ix.2001; Site 56- 3 ♂♂ pharate adult, 2 ♀♀ pharate adult, 11 pupae, 10 larvae, 19.vi.2002; Site 61- 1 ♂ pharate adult, 4 pupae, 11 larvae, 13.vi.2002; Site 63- 1 ♂, 2 ♂♂ pharate adult, 7 pupae, 13 larvae, 14.vi.2002; Site 65- 1 ♂, 1 ♀, 1 ♂ pharate adult, 6 pupae, 14 larvae, 14.vi.2002; Site 69- 1 ♂ pharate adult, 4 pupae, 15.vi.2002; Site 70- 1 ♂ pharate adult, 1 ♀ pharate adult, 6 pupae, 8 larvae, 15.vi.2002; Site 72- 1 ♂, 2 ♂♂ pharate adult, 8 pupae, 3 larvae, 17.vi.2002; Site 73- 1 ♂, 3 ♂♂ pharate adult, 1 ♀ pharate adult, 5 pupae, 9 larvae, 17.vi.2002; Site 74- 2 ♂♂ pharate adult, 6 pupae, 7 larvae, 17.vi.2002; Site 75- 1 ♂ pharate adult, 1 ♀ pharate adult, 3 pupae, 17.vi.2002; Site 77- 2 ♂♂, 1 ♂ pharate adult, 8 pupae, 12 larvae, 19.vi.2002; Site 78- 3 ♀♀, 1 ♂ pharate adult, 6 pupae, 19.vi.2002; Site 80- 1 ♂ pharate adult, 1 ♀ pharate adult, 5 pupae, 9 larvae, 19.vi.2002; Site 82.- 2 ♂♂, 1 ♂ pharate adult, 3 pupae, 19.vi.2002; Site 83- 1 ♂ pharate adult, 6 pupae, 4 larvae, 20.vi.2002; Site 84- 1 ♂, 1 ♀, 1 ♂ pharate adult, 1 ♀ pharate adult, 3 pupae, 20.vi.2002; Site 87- 1 ♂ pharate adult, 6 pupae, 21.vi.2002; Site 88- 2 ♂♂ pharate adult, 6 pupae, 13 larvae, 22.vi.2002; Site 90- 3 ♂♂ pharate adult, 3 pupae, 22.vi.2002; Site 93- 1 ♂ pharate adult, 1 pupae, 18.v.2003; Site 94- 1 ♂ pharate adult, 10 pupae, 19.v.2003; Site 97- 2 ♂♂ pharate adult, 2 pupae, 3 larvae, 20.v.2003.

Distribution in World: Canary Islands (Gran Canaria, Gomera, Tenerife); Algeria, Armenia, Austria, Azerbaijan, Bosnia, Britain (En), China (Sx, Xi), Cyprus, France, Greece (incl. Andros, Chíos, Crete, Ikaría, Lésbos, Náxos, Georgia, India (Kashmir, Pu), Iran, Iraq, Israel, Italy (incl. Sardinia, Sicily), Jordan, Kazakhstan, Kyrgyzstan, Lebanon, Libya, Macedonia, Morocco, Pakistan, Portugal, Romania, Russia (Caucasus), Serbia, Slovakia, Slovenia, Spain, Tajikistan, Tunisia, Turkey, Turkmenistan, Ukraine (incl. Crimea), Uzbekistan, Czech Republic (Adler & Crosskey, 2014).

Distribution in Turkey: Altındere Stream (İn Trabzon province Maçka), Büyük Menderes River Basin, Çoruh River Basin, Esen River Basin, Fırat River Basin, Kızılırmak River Basin, Köyceğiz Protected Area, Namnam Stream, Sakarya River Basin, Seyhan River Basin, Yeşilırmak River Basin, Tarsus River, Zamantı River (Kazancı & Ertunç, 2008).

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Figure 1. Map of collecting sites in East Marmara Region.

ASSESSMENT OF NATURAL AND ARTIFICIAL BREEDING SITES OF MOSQUITOES IN RURAL AND URBAN AREAS OF ABEOKUTA, OGUN STATE, NIGERIA

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[Idowu, O. A., Adeleke, M. A. & Oriaku, E. C. 2014. Assessment of natural and artificial breeding sites of mosquitoes in rural and urban areas of Abeokuta, Ogun State, Nigeria. Munis Entomology & Zoology, 9 (2): 832-837**]**

ABSTRACT: The frequent surveillance of the mosquito breeding sites has been identified as one of the veritable tools towards planning effective anti-mosquito measures. This study assesses the occurrence and the distribution of the natural and artificial breeding sites of mosquitoes in the rural and urban areas of Abeokuta, Ogun State, Nigeria. Ten different larval habitats were encountered of which bamboo stumps and block moulds constituted the most abundant breeding sites in the rural areas while discarded car batteries constituted the most important breeding sites in the urban areas. The species encountered were *Aedes aegypti, Ae. albopictus, Ae. longipalpis, Ae. simpsoni, Ae. vittatus, Anopheles gambiae complex, Culex quinquefasciatus, Cx. tigripes, Eretmapodite chrysogaster, Ae. domesticus, Coquilletidia maculipennis*. There was no significant difference in the distribution of mosquito species in the rural and urban areas ($p>0.05$), but the species occurrence was significantly higher in the artificial breeding sites relative to the natural breeding sites ($p<0.05$). The high occurrence of the mosquito vectors in the artificial breeding sites, most importantly the discarded materials calls for the mass public health awareness on the human activities that promote the breeding of mosquito vectors in the study area.

KEY WORDS: Mosquitoes, breeding sites, rural, urban, Nigeria.

Malaria and other mosquito-borne diseases still remain the challenging public health problems in Africa (Banjon et al., 2009). One of the factors probably promoting the persistent transmission of the diseases in the region is premised on the vast larval habitats available for mosquito vectors which ensure prolific and continuous breeding of the vectors (Adebote et al., 2008). Mosquitoes exploit varying aquatic habitats for breeding depending on the species of mosquitoes and the conduciveness of the habitats (Mafiana et al., 1998). These habitats, which consist of natural and artificial sites, are most often neglected while colossal resources are being channeled towards controlling the adult mosquitoes (Aigbodion & Anyiwe, 2005).

The increasing rate of urbanization and agricultural development in both rural and urban parts of Nigeria has been inundated with many public health problems (Amusan et al., 2005). These problems, most often emanate from inadequate waste disposal, irrigation, poor drainage and many others. The presence of one or a combination of these factors may lead to the creation of congenial environment for the breeding of mosquitoes which are responsible for the transmission of many deadly and life-threatening diseases such as malaria, filariasis, dengue and yellow fever (Anyanwu et al., 1999). Thus, the proper environmental audit is germane for effective control of mosquito vectors (Adebote et al., 2008).

Though, previous studies on mosquito fauna in Abeokuta had shown that the environmental and climatic conditions of the town offer ample opportunity for the survival of diverse species of mosquitoes (Mafiana et al., 1998; Adeleke et al., 2008), the species composition and the breeding habitats of mosquito fauna in rural areas adjoining the metropolis are still largely unknown in the literature. Mosquitoes are great fliers and rural -urban disease transmission is possible (Amusan et al., 2005). Therefore, the planning of successful anti- mosquito measures in the area encompasses the complete knowledge of the potential breeding sites in the town and the adjoining rural areas. It is against this background that the present study was designed to assess the breeding sites and the species composition of mosquito fauna in rural and urban areas of Abeokuta, Ogun State, Nigeria.

MATERIALS AND METHODS

Study area

The study was conducted in Abeokuta (7° 10N, 3°21E) and the adjourning rural areas. Abeokuta lies in the transitional zone between the tropical rainforest and derived savannah zone in the Southwest, Nigeria. The area experiences two seasons, the dry season (November to March) and the wet season (April to October).

Larval sampling

The larval sampling of all accessible breeding sites was carried out once weekly between July and October, 2010 in five rural areas; Alabata, Isolu, Odeda, Osiele and Olugbo and five randomly selected areas in Abeokuta metropolis ; Isale-Igbein, Isale Ake, Obantoko, Lafenwa and Idi –Aba . The locations represent different divisions in the city. The microhabitats surveyed include puddles, vehicle tyres, septic tank, gutters, domestic plastic containers, bamboo stumps, old discarded vehicle batteries, run-offs, block moulds and the polythene bags. The mosquito larvae were collected with plastic scoopers and sieves of about 0.55mm mesh –size. In occasions that the larvae were not identified immediately, the samples were stored in 70% alcohol and kept in 4°C.

Larval identification

All larvae were identified with the aid of dissecting microscope (Cole Parmer) using the keys described by Hopkins (1953). Some larvae were allowed to emerge into adult inside mosquito cage and later identified using the keys described by Gillet (1972).

Data analysis

The data obtained were analyzed using SPSS. Student t-test and Analysis of Variance were used to determine the significant differences in habitat and species distribution at the study sites.

RESULTS

Distribution of the breeding sites in both rural and urban areas

Table 1 shows the distribution of the breeding sites encountered in both rural and urban areas during the study. Of 693 breeding sites encountered (384 in the rural and 309 in the urban), 327 (54.83%) were positive for mosquito larvae. The breeding sites encountered include puddles, vehicle tyres, septic tank, gutters, domestic plastic containers, bamboo stumps, old discarded vehicle batteries, run-offs, block moulds and the polythene bags. Bamboo stumps and block moulds constituted the most important breeding sites in the rural area (100% positive) followed by discarded tyres (96.92%) and the discarded batteries (90.69%). The plastic containers contributed the least (30%). In the urban areas, old discarded batteries were the predominant breeding sites (59.385), followed by discarded tyres (50.76%) while old discarded plastic was the least (13.92%). There was significant difference in the distribution of mosquito breeding sites in both rural and urban areas ($p<0.05$). However, the tadpoles and some species of crusteaceans were encountered at the negative sites.

Species occurrence at the breeding sites in both rural and urban areas

A total of eleven species were encountered in the artificial and natural breeding sites in both rural and urban areas. The species encountered were *Aedes aegypti, Ae. albopictus, Ae. longipalpis, Ae. simpsoni, Ae. vittatus, Anopheles gambiae complex, Culex quinquefasciatus, Cx. tigripes, Eretmapodite chrysogaster, Ae. domesticus, Coquilletidia maculipennis*. All the species were found in both rural and urban areas with exception of *Cq. maculipennis* which was only found in the urban area. There was no significant difference in the species distribution in both rural and urban areas ($p>0.05$). The species composition was significantly higher ($p<0.05$) in the artificial breeding sites as compared with natural breeding sites. The artificial breeding sites harboured all the species encountered at the rural and the urban areas. The natural breeding sites harboured only seven (7) species namely *Ae. aegypti, Ae. longipalpis, Ae. simpsoni, Ae. vittatus, Cx. quinquefasciatus, Cx. tigripes and Er. chrysogaster* in the rural area. Four species of mosquitoes namely, *Ae. aegypti, Ae. longipalpis, Er. chrysogaster* and *An. gambiae* complex were encountered in the natural breeding sites in the urban area. There was significant variation ($p<0.05$) in species occurrence of mosquitoes encountered at the breeding sites. *Ae. aegypti* was the most abundant species and had over 80% occurrence in all the breeding sites followed by *Cx. quinquefasciatus* which was also found in all the breeding sites but at lower occurrence. However, apart from *Ae. aegypti* and *Cx. quinquefasciatus* which occurred at all the breeding sites, other mosquito species were restricted to some breeding sites. *An. gambiae* complex was found only in the septic tank and the puddles (Table 2). Domestic plastics and water storage facilities harboured the highest number of species (9 out of 11) followed by tyres, old discarded batteries and gutters (8) while polythene bags harboured the least (1) species. The variation observed in the number of species encountered at the different breeding sites was statistically significant ($p<0.05$).

DISCUSSION

The proper assessment of mosquito breeding sites becomes necessary in the recent event of the persistent transmission of mosquito-borne diseases in different parts of the world. Some of the major determinants of the mosquito larval distribution are the size and nature of the breeding sites, physico-chemical parameters of the sites, rainy pattern and the presence/ absence of the predators (Adebote et al., 2008). The average number (54.83%) of productive (positive) sites recorded among the potential breeding sites sampled could be due to the flooding and the presence of predators such as tadpoles and crustaceans observed in many of the unproductive breeding sites. However, the significant difference in species occurrence in the artificial and the natural breeding sites may not be unconnected with the differences in the number of the breeding sites encountered and/or the breeding habitat selection of the mosquitoes (Adebote et al., 2008; Adeleke et al., 2008). The latter factor would have plausibly accounted for the low occurrence of the *An. gambiae* complex recorded in this study since the species usually prefers ground pools and other natural breeding sites (Adeleke, 2003; Adeleke et al., 2008). Apart from *Ae. aegypti* which breeds indiscriminately, other species of *Aedes* have been known to prefer man-made (artificial) breeding sites. The breeding of *Cx quinquefasciatus* in all the breeding sites shows that most of the breeding sites are polluted since the species had been known to breed exclusively in polluted water (Mafiana et al., 1998).

The preponderance of the artificial breeding sites, most importantly the discarded materials in the present study revealed the poor sanitary conditions of Abeokuta metropolis. This is similar to the earlier observations by Adeleke et al. (2008). The effects of these attitudes, if remain unabated, could culminate in outbreak of some re-emerging mosquito-borne diseases when considering the vectorial capacities of most of the species encountered. *Aedes* mosquitoes have been implicated in the transmission of dengue and yellow fever (Anyanwu et al., 1999; Adebote et al., 2008, 2009; Adeleke et al., 2010) while *Cx. quinquefasciatus* is an efficient transmitter of bancroftian filariasis in Africa (Adeleke et al., 2010).

Though, the occurrence of *An. gambiae* complex (the principal vector of malaria in Africa) encountered in this study is low, the breeding of the species in the septic tank (man-made) is remarkable as such site is less targeted for source reduction of malaria vector during larval control activities. The constant surveillance of such unexpected breeding sites is imperative for source reduction (larval reduction) in other to stem the high transmission of malaria of which Abeokuta has been known to be hyperendemic to the disease (Ojo & Mafiana, 2001). Apart from transmitting malaria, *An gambiae* complex has also been implicated in the transmission of bancroftian filariasis in many rural areas of Africa (Anosike et al., 2003). Though the sizeable distribution of *Cq. macullipennis* and *Er. chysogaster* was observed in this study, the two species had never been reported to transmit any disease in Africa.

Conclusion and recommendation

The present study reported the prolific breeding of mosquito vectors in artificial breeding sites, most importantly the unwanted receptacles due to the poor sanitary conditions in both rural and urban areas. There is therefore need for mass public health education for the improved environmental sanitation so as to reduce the breeding sites of potential mosquito vectors in Abeokuta and the adjoining rural communities.

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Table 1. Occurrence of the mosquito breeding sites in the rural and urban areas of Abeokuta.

Breeding sites	Rural No sampled No(%) positive		Urban No sampled No(%) positive		Total No sampled No(%) positive	
Puddles	50	23(46)	40	9(22.5)	90	32(35.55)
Vehicle tyres	65	63(96.92)	65	33(50.76)	130	96(73.85)
Septic tanks	71	54(76.06)	55	15(27.27)	126	69(54.76)
Gutters	15	10(66.66)	28	13(46.42)	43	23(53.48)
Discarded plastic containers	70	21(30)	79	11(13.92)	149	32(21.48)
Bamboo stumps	14	14(100)	0	0	14	14 (100)
Discarded vehicle batteries	43	39(90.69)	32	19(59.38)	75	58(77.33)
Polythene bags	0	0	10	3(30)	10	3(30)
Block moulds	33	33(100)	0	0	33	33(100)
Run-offs	23	20(86.96)	0	0	23	20(86.96)
Total	384	277(72.13)	309	103(33.33)	693	380(54.83)

Table 2. Species composition and occurrence of mosquito species at the productive breeding sites in both rural and urban areas of Abeokuta.

Breeding sites	Species	No of positive sites	No (%) of occurrence
Puddles	*Aedes aegypti*	32	32 (100)
	Ae.vittatus		10 (31.25)
	Ae simpsoni		3(9.38)
	Ae. longipalpis		13(40.63)
	Anopheles gambiae complex		6(18.75)
	Culex quinquefasciatus		14(43.75)
	Eretmapodite chrysogaster		11(34.38)
Gutters	*Ae. aegypti*	23	19(82.26)
	Ae.vittatus		9(39.10)
	Ae simpsoni		5(21.74)
	Ae. longipalpis		4(17.39)
	Ae. domesticus		3(13.04)
	Cx. quinquefasciatus		17(73.91)
	Cx. tigripes		7(30.43)
	Er. Chrystogaster		12(52.17)

Tyres	*Ae. aegypti* *Ae.vittatus* *Ae simpsoni* *Ae. longipalpis* *Ae. albopictus* *Cx. quinquefasciatus* *Er. Chrysogaster*	96	86(89.58) 72(75.00) 17 (17.71) 20(20.83) 2(2.08) 58(60.42) 29(30.21)
Septic tanks	*Ae. aegypti* *Ae.vittatus* *Ae simpsoni* *Ae. longipalpis* *Ae domesticus* *An. gambiae complex* *Cx. quinquefasciatus* *Er. Chrysogaster*	69	69(100) 28(40.57) 6(8.69) 36(52.17) 2(2.89) 2(2.89) 69(100) 7(10.14)
Discarded plastic containers	*Ae. aegypti* *Ae.vittatus* *Ae simpsoni* *Ae. longipalpis* *Ae. albopictus* *Ae. domesticus* *Cx. quinquefasciatus* *Er. Chrysogaster* *Coq macullipennis*	32	28(87.96) 23(71.88) 13(46.87) 22(68.75) 8(25.00) 3(9.38) 13(46.87) 7(21.88) 2(6.25)
Discarded batteries	*Ae. aegypti* *Ae.vittatus* *Ae simpsoni* *Ae. longipalpis* *Ae. domesticus* *Cx. quinquefasciatus* *Er. Chrysogaster* *Coq macullipennis*	58	47(81.03) 34(58.62) 3(19.33) 20(34.48) 6(0.34) 22(37.93) 19(32.75) 11(18.97)
Bamboo stumps	*Ae. aegypti* *Cx quinquefasciatus*	14	14(100) 13(92.81)
Run-offs	*Ae.aegypti* *Ae. vittatus* *Ae. Albopictus* *Cx. quinquefasciatus* *Cx. tigripes* *Er. Chrystogaster*	23	20(86.96) 19(82.61) 5(21.74) 8(34.78) 9(39.91) 19(82.61)
Polythene bags	*Ae. aegypti* *Cx. quinquefasciatus*	3	3(100) 3(100)
Block moulds	*Ae. aegypti* *Ae.vittatus* *Ae. simpsoni* *Cx. quinqurfasciatus* *Er. Chrysogaster*	33	33(100) 13(39.39) 5(15.15) 21(63.64) 18(54.55)

SPECIES COMPOSITION AND SEASONAL ABUNDANCE OF MOSQUITO VECTORS IN A RICE GROWING COMMUNITY IN KWARA STATE, NORTH CENTRAL, NIGERIA

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[Ajao, A. M. & Adeleke, M. A. 2014. Species composition and seasonal abundance of mosquito vectors in a rice growing community in Kwara State, North Central, Nigeria. Munis Entomology & Zoology, 9 (2): 838-841**]**

ABSTRACT: Studies were carried out to determine the species composition and seasonal abundance of mosquito fauna in Lafiagi, a swampy rice growing community in Kwara State, Nigeria. Adult mosquitoes were collected weekly by both indoor and outdoor methods using human landing catches and residual spray techniques between August 2009 and July 2010. Four species of mosquitoes namely, *Anopheles gambiae sensu lato, Culex quinquefasciatus, Mansonia africana and Aedes aegypti* were caught during the study. *Anopheles gambiae* s.l accounted for the highest number of mosquitoes caught (39.61%). Though, there was no significant difference in species abundance ($p>0.05$), the seasonal abundance showed significant variation with more mosquitoes during the wet season than the dry season. The preponderance of the mosquito vectors (most importantly the malaria vector) in the community signifies the need for planning effective mosquito control measures to maintain the healthy living of the residents at the study area towards ensuring food security.

KEY WORDS: Mosquitoes, seasonal abundance, rice growing community, Nigeria.

Mosquitoes are important vectors of most deadly and life threatening diseases such as malaria, lymphatic filariasis, yellow fever and many others (Lindsay et al. 1998; Mbanugo & Okpalaonuju, 2003). Malaria and other mosquito-borne diseases still remain the challenging public health problems in Africa. The continued transmission of the mosquito borne-diseases was perhaps due to the vast larval habitats available for mosquito vectors which ensure prolific and continuous breeding of the vectors (Amusan et al., 2003).

Food security constitutes one of the cardinal programmes of Kwara State Government, and the programme has been receiving boost from both Government and International organizations. Lifiagi is a major rice growing community in Kwara state with swampy areas. Mutero et al. (2000) reported that the swampy areas are conducive for the cultivation of rice and sugar canes. Previous study in Southwestern Nigeria indicated that the swampy environment in Mokoloki (a rice growing area) usually support the breeding of different species of mosquito vectors (Amusan et al., 2005). It however, becomes imperative to investigate the impact of the rice cultivation on species composition and seasonal abundance of mosquito fauna in Lafiagi and its environs with the underlying aim of planning effective mosquito control strategies and ensuring healthy leaving of the rice-growing farmers towards realization of the food security.

MATERIALS AND METHODS

Study area

Lifiagi is the headquarters of the Edun Local Government Council in Kwara State. It is located on the South bank of the Niger River with a population of about

30,976 inhabitants. The town serves as production point for rice, sugar cane and many other farm produce due to the flooding plane of the area. For research convenience, the town was divided into three zones namely;

i. The College of Education (Technical) campus/Tsodo/Gbugbu zone.

ii. Taiwo area/Egua river area/ Likpata zone, and

iii. Abiola farm area/Bindofu area zone.

Each of the zones covers an area of about 8 kilometers. Each area also has an expanse of land for swampy rice and sugar cane cultivation. Ten houses were however selected in each zone.

Sampling of mosquito fauna

Adult mosquitoes were collected once per week indoor between 5:30hr and 7:00 hr and at night between 20:00hr and 22:00hr in each of the selected houses using human landing collectors and insecticide spray technique. Mosquitoes from the knock down effect were collected, kept in paper cups and labeled accordingly. The collection was carried out for twelve (12) months between August 2009 and July 2010. All adult mosquitoes collected were identified using the keys described by Gillet (1972).

Statistical analysis

The data were subjected to chi-square using SPSS version 17.0

RESULTS AND DISCUSSION

A total of 9,910 and four species of mosquitoes namely *Anopheles gambiae* complex, *Culex quinquefasciatus, Mansonia africana* and *Aedes aegypti* were collected during the study. There was a preponderance of *An. gambiae* complex (39.61%) over other four species, even though the difference was not significant ($p>0.05$) (Table 1). The dominance of *An. gambiae* complex may be due to the fact that the species thrives in shallow pools in rice fields during tilling, transplanting and growing period of rice plant (Dolo et al., 1997; Mutero et al., 2000; Klinkenberg et al., 2003). The appreciable number of *A. aegypti* (29.78 %) may also be due to its indiscriminate breeding habit (Mafiana *et al.*, 1998; Adeleke et al., 2008).

However, there was significant difference in the population of the mosquitoes collected with higher abundance during the wet season. The highest peak of mosquito abundance was recorded in the month of August (*Anopheles* spp., 502; *Culex* spp. 205; *Mansonia* spp. 101 and *Aedes* spp. 401) followed by September and October (Table 2). Earlier studies have shown that the population of mosquitoes has positive correlation with rainfall, and wet season usually creates avalanche of breeding sites conducive for mosquito breeding and survival (Amusan et al., 2005; Adeleke et al., 2010). The tilling of the land for rice cultivation usually creates shallow pools that retain sufficient amount of water during rainfall (Klinkenberg et al., 2003).

It should be stressed that all the four species of mosquitoes collected in the present study are known vectors of deadly and life threatening diseases. *An. gambiae* complex is an efficient transmitter of malaria and filariasis in Africa (Gillet, 1972; Adeleke et al., 2013). Its dominance at the study area signifies that the residents at the study area are at high risk of malaria and bancroftian filariasis coupled with the abundance of *Cx. quinquefasciatus* and *M. africana* which are known as transmitters of filariasis. The entrant of *A. aegypti* in the transmission of bancroftian filariasis aside arboviruses which is known for gave impetus for the urgent surveillance of malaria and bancroftian filariasis in the study communities. Neglect of these community can in-turn impede productivity and life span of the residents and causes food shortage in the area and in Kwara State in general. Therefore, efforts should be made by all stakeholders for the utilization of all available strategies to stem the man-mosquito contact in the area.

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Table 1. Abundance of Mosquito Species collected at Lafiagi during the study.

Mosquito species	No of adult collected	% Occurrence
Anopheles gambiae complex	3925	39.61
Culex quiquefascitans	1694	17.09
Mansonia africana	1340	13.52
Aedes aegypti	2951	29.78
Total	9910	100.0

Table 2. Monthly Seasonal Abundance of Mosquito Species in the study area between August 2009 and July 2010.

Mosquito sp	AUG	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MARCH.	APRIL	MAY	JUN.	JULY	TOTAL
An. gambiae complex Gambiae	502	603	742	580	331	46	50	101	111	115	324	420	392 5
Culex quiquefas citans	205	258	310	215	180	08	20	50	58	66	134	190	1694
Mansonia africana	101	210	243	281	115	06	14	45	49	54	102	120	1340
Aedes aegypti	401	480	550	490	311	08	18	35	60	71	228	299	251
Total	1209	1551	1845	1566	937	68	102	231	278	306	788	1029	9910

A CONTRIBUTION ON ZOOGEOGRAPHICAL DISTRIBUTION OF HYDROPHILIDAE SPECIES IN TURKEY

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ABSTRACT: This study was conducted out as a final project in order to determine Hydrophilidae species of Hatay and Hakkari provinces of Turkey. In the research areas totally, 11 species and one subspecies belonging to Hydrophilidae have been determined. The distributions of these species in Turkey are presented.

KEY WORDS: Coleoptera, Mediterranean, Southeastern Anatolia, Hatay, Hakkari, 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. Representatives of the subfamily Hydrophilinae, comprising more than 1784 described species, are mostly aquatic. In contrast, Sphaeridiinae, comprising more than 929 described species, are mostly terrestrial and aquatic species are found only in the tribe Coleostomatini and in the Megasternine genus *Cercyon* Leach, 1817 (Fikácek, 2006). A total number of 34 genera of aquatic Hydrophilidae is known from the Palearctic region. So far, 19 genera and 99 species of Hydrophilidae have been recorded from Turkey (Gentili & Chiesa, 1975; Wooldridge, 1978; Hansen, 1987, 1999, 2004; Schödl, 1991, 1993, 1997, 1998; Hebauer, 1994, 2004; Hebauer & Klausnitzer, 1998; Gentili, 1974, 1979, 1981, 1988, 1991, 2000; Gentili & Whitehead, 2000; Incekara et al., 2003, 2005, 2009, 2010; Darılmaz & Kıyak, 2006; Kıyak et al., 2006; Mart, 2009; Mart et al., 2006, 2009, 2010; Darılmaz & Incekara, 2011).

MATERIAL AND METHODS

In summer seasons between 2012 and 2013, specimens of Hydrophilidae were collected by means of a sieve, ladle and net with 1 mm pores from the shallow areas of various springs, streams, lakes and ponds in Hatay and Hakkari provinces of Turkey. 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 made using a Olympus SZX16 microscope. All samples have been deposited in the Zoological Museum, Bingöl University, Science and Arts Faculty, Department of Biology, Bingöl, Turkey.

RESULTS

In the freshwater habitat of Hakkari and Hatay provinces, 11 aquatic beetle species and one subspecies belonging to Hydrophilidae were recorded. One of these species has been recorded in both the Mediterranean and Southeast Anatolia regions. And one of them, too, has been recorded only in the Mediterranean region for the first time. Four out of the rest of them covered in the study have been recorded in Hatay province and Southeastern Anatolia region, and the five species remained in the study, have only been recorded in Hatay province for the first time.

Subfamily Hydrophilinae

Anacaena rufipes (Guillebeau, 1896)

Material examined: Hatay-Yayladağ: 2♂♂ 4♀♀, Yaylıca dam pond, 36°10'06K 36°01' 38D, 197m, 04.IX.2012, leg. Aydoğan. Yayladağ dam, 3♂♂, 35°57'09K 36°03'05D, 485m, 05.VII.2012, leg. Aydoğan. Hakkari-Şemdinli: 2♂♂ 1♀, Çalışkanlar, 37°15'28N 44°38'12E, 1488m, 13.05.2013, leg. Fırat.

Distribution in Turkey: Bayburt, Bingöl, Bitlis, Giresun, Gümüşhane, Isparta, İstanbul, Muş, Ordu, Samsun, Sivas, Tokat, Trabzon and Van (Mart, 2009; Polat et al., 2010; Darılmaz & Incekara, 2011; Aydoğan, 2011; Bayram, 2011; Türken, 2011; Yılmaz, 2011).

Remark: Newly recorded from Hatay province and the Southeast Anatolia Region.

Berosus (s.str.) *signaticollis* (Charpentier, 1825)

Material examined: Hatay-Yayladağ: 2♂♂ 10♀♀, Yaylıca dam pond, 36°10'06N 36°01'38E, 197m, 01.VIII.2012, leg. Aydoğan; 2♂♂ 2♀♀, Yayladağ dam, 35°57'09N 36°03'05E, 485m, 05.VII.2012, leg. Aydoğan.

Distribution in Turkey: Amasya, Antalya, Aydın, Bayburt, Bingöl, Erzincan, Isparta, İzmir, Kars, Kastamonu, Kayseri, Ordu, Samsun and Sivas (Incekara et al., 2003, 2009, 2010; Mart, 2009; Polat et al., 2010; Darılmaz & Incekara, 2011; Bayram, 2011; Yılmaz, 2011).

Remark: Newly recorded from Hatay province.

Enochrus (*Lumetus*) *politus* (Küster, 1849)

Material examined: Hatay-Merkez: 2♂♂ 8♀♀, Alaattin, 36°14'58N 36°14'16E, 85m, 05.VIII.2012, leg. Aydoğan. Hatay-Kırıkhan: 2♂♂ 7♀♀, Madenli, 36°28'48N 35°59'53E, 22m, 05.VII.2012, leg. Aydoğan. Hatay-Samandağ: 4♂♂ 2♀♀, Samandağ road, 36°09'08N 36°05'52E, 46m, 04.IX.2012, leg. Aydoğan.

Distribution in Turkey: Bitlis, Muş, Uşak and Van (Darılmaz & Kıyak, 2009; Darılmaz & Incekara, 2011; Aydoğan, 2011; Türken, 2011).

Remark: Newly recorded from the Mediterranean region.

Enochrus (*Lumetus*) *fuscipennis* (Thomson, 1884)

Material examined: Hatay-Yayladağ: 21♂♂ 13♀♀ Yaylıca dam pond, 36°10'06N 36°01'38E, 197m, 03.VII.2012, leg. Aydoğan. Hatay-Kırıkhan: 2♂♂ 13♀♀, Madenli, 36°28'48N 35°59' 53E, 22m,04.VII.2012, leg. Aydoğan. Hatay-Yayladağ: 12♂♂ 10♀♀, Yaylıca dam pond, 36° 10'06N 36°01'38E, 197m, 04.IX.2012, leg. Aydoğan. Hakkâri-Merkez: 5♂♂, 1♀, 37°34'27N 43°44'32E, 1700m, 09.08.2012; 1♀, 37°34'02N 43°43'28E, 1773 m, 10.07.2012, leg. Fırat.

Distribution in Turkey: Artvin, Aksaray, Ankara, Bayburt, Bingöl, Bitlis, Bursa, Çanakkale, Çorum, Denizli, Erzincan, Erzurum, Giresun, Gümüşhane, Isparta, İzmir, Kayseri, Kütahya, Muş, Ordu, Rize, Sivas and Van (Incekara et al., 2005; Kıyak et al., 2006; Darılmaz & Kıyak, 2006b; Ertorun & Tanatmış 2009; Hızarcıoğlu et al., 2010; Darılmaz, et al., 2010; Darılmaz & Incekara, 2011; Aydoğan, 2011; Bayram, 2011; Türken, 2011; Yılmaz, 2011).

Remark: Newly recorded from Hatay province and the Southeast Anatolia Region.

Helochares lividus (Forster, 1771)

Material examined: Hatay-Altınözü: 7♂♂ 9♀♀, Yarseli dam, 36°11'39N 36°18'56E, 135m, 02VII.2012, leg. Aydoğan. Hatay-Yayladağ: 4♂♂ 4♂♂, Yaylıca dam pond 36°10'06N 36° 01'38E, 197m 04.IX.2012, leg. Aydoğan.

Distribution in Turkey: Adana, Afyon, Aksaray, Ankara, Bingöl, Bitlis, Çorum, Denizli, Erzurum, Edirne, Isparta, İzmir, Kütahya, Muş, Ordu, Samsun, Sivas, Tokat and Trabzon (Mart, 2009; Darılmaz & Kıyak, 2006a; Karaman et al., 2008; Topkara & Balık, 2008; Hızarcıoğlu et al., 2010; Mart et al., 2010; Polat et al., 2010; Darılmaz et al., 2010; Darılmaz & Incekara, 2011; Aydoğan, 2011; Bayram, 2011; Yılmaz, 2011).

Remark: Newly recorded from Hatay province.

Helochares (s.str.) *obscurus* (Müller, 1776)

Material examined: Hatay-Merkez: Alaattin, 3♂♂ 9♀♀, 36°14'58K 36°14'16D, 85m, 04.IX. 2012, leg. Aydoğan. Hatay-Yayladağ: 1♂, Yaylıca dam pond, 36°10'06N 36°01'38E,

197m, 05.VII.2012, leg. Aydoğan.
Distribution in Turkey: Adana, Ankara, Balıkesir, Bayburt, Bingöl, Bursa, Canakkale, Giresun, Gümüşhane, İzmir, Isparta, Kayseri, Sakarya, Samsun, Sivas and Ordu (Mart, 2009; Ertorun & Tanatmış, 2009; Incekara, et al., 2009, 2010; Hızarcıoğlu et al., 2010; Mart et al., 2010; Darılmaz & Incekara, 2011; Bayram, 2011; Yılmaz, 2011).
Remark: Newly recorded from Hatay province.

Hydrobius fuscipes (Linnaeus, 1758)

Material examined: Hatay-Kırıkhan: 1♂ 2♀♀, Madenli, 36°28'48N 35°59'53E, 22m, 04.VII. 2012, leg. Aydoğan. Hatay-Reyhanlı: 1♂, Göktepe, 31°17'01N 36°29'34E, 95m, 02.VII.2012, leg. Aydoğan. Hatay-Samandağ: 1♂, Samandağ road, 36°09'08N 36°05'52E, 46m, 03.VII. 2012, leg. Aydoğan. Hakkari-Şemdinli: 1♀, Üçgöze, 37°16'29N 44°36'42E 1396m, 13.05. 2013, leg. Fırat.
Distribution in Turkey: Afyon, Artvin, Ankara, Bayburt, Bilecik, Bingöl, Bitlis, Çorum, Denizli, Erzincan, Erzurum, Giresun, Gümüşhane, Isparta, İçel, İzmir, Konya, Kütahya, Muş, Ordu, Rize, Samsun, Sivas, Tokat, Trabzon and Van (Incekara et al., 2003, 2009, 2010; Mart, 2009; Topkara & Balık, 2008; Polat et al., 2010; Darılmaz & Incekara, 2011; Aydoğan, 2011; Bayram, 2011; Türken, 2011; Yılmaz, 2011).
Remark: Newly recorded from Hatay province and the Southeast Anatolia Region.

Hydrochara dichroma (Fairmaire, 1982)

Material examined: Hatay- Samandağ: 1♂ 15♀♀, Samandağ road, 36°09'08N 36°05'52E, 46m, 03.VII.2012, leg. Aydoğan. Hatay-Kırıkhan: 1♂ 3♀♀, Madenli, 36°28'48N 35°59'53E, 22m, 6.VIII.2012, leg. Aydoğan. Hatay-Reyhanlı: 1♂ 3♀♀, Göktepe, 31°17'01N 36°29'34E, 95m, 01.IX.2012, leg. Aydoğan. Hatay-Altınözü: 11♂♂ 2♀♀, Yarseli dam, 36°11'39N 36° 18'56E, 135m, 01.IX.2012, leg. Aydoğan. Hakkari-Şemdinli: 1♂, Korgan, 37°23'47N, 44°29'36 E,1724 m, 11.05.2013, leg. Fırat.
Distribution in Turkey: Adana, Ankara, Amasya, Balıkesir, Bayburt, Bingöl, Çanakkale, Erzincan, Erzurum, Giresun, Gümüşhane, İstanbul, İzmir, Kayseri, Muş, Ordu, Rize, Samsun, Sivas, Tokat, Trabzon and Van (Incekara et al., 2003, 2009; Mart, 2009; Darılmaz & Incekara, 2011; Bayram, 2011; Türken, 2011).
Remark: Newly recorded from Hatay province and the Southeast Anatolia Region.

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

Material examined: Hatay-Yayladağ: 10♂♂ 17♀♀, Yayladağ dam, 35°57'09N 36°03'05E, 485m, 04.VII. 2012, leg. Aydoğan.
Distribution in Turkey: Adana, Afyon, Ağrı, Aksaray, Ankara, Antalya, Artvin, Aydın, Balıkesir, Bayburt, Bingöl, Bitlis, Bolu, Bursa, Çanakkale, Çorum, Denizli, Edirne, Erzincan, Erzurum, Giresun, Gümüşhane, Hakkari, Isparta, İçel, İstanbul, İzmir, Kahramanmaraş, Kars, Kayseri, Kırklareli, Kırşehir, Kütahya, Manisa, Muğla, Muş, Niğde, Ordu, Osmaniye, Samsun, Sivas, Trabzon, Toros dağları, Uşak, Van, and Yozgat (Incekara et al., 2003; Darılmaz & Kıyak 2006; Karaman et al., 2008; Mart, 2009; Ertorun & Tanatmış 2009; Hızarcıoğlu et al., 2010; Polat et al., 2010; Darılmaz et al., 2010; Darılmaz & Incekara, 2011; Aydoğan, 2011; Bayram, 2011).
Remark: Newly recorded from Hatay province.

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

Material examined: Hatay-Reyhanlı: 4♂♂ 9♀♀, Göktepe, 31°17'01N 36°29'34E, 95m, 02. VII.2012, leg. Aydoğan. Hatay-Samandağ: 11♂♂ 4♀♀, Samandağ road, 36°09'08N 36° 05' 52E, 46m, 03.VII.2012, leg. Aydoğan. Hatay-Yayladağ: 2♂♂ 2♀♀, Yaylıca dam pond, 36° 10'06N 36°01'38E, 197m, 04.IX.2012, leg. Aydoğan. Hakkari-Merkez: 2♂♂ 1♀, Merzan, 37°34'02N, 43°43'28E, 1773m, 20.09.2012, leg. Fırat. Hakkari-Yüksekova: 3♂♂ 4♀♀, Vezirli, 37°31' 36N, 44°15'21E, 1854m, 13.07.2012, leg. Fırat. Hakkari-Şemdinli: 5♂♂ 3♀♀, Çatalca, 37° 23' 36N, 44°34'43E, 175m, 05.07.2012, leg. Fırat. 2♂♂ 2♀♀, Karşıyaka, 37°18' 12N, 44°34' 32E, 1379m, 20.09.2012, leg. Fırat. 4♂♂ 4♀♀, Güzelkonak, 37°25'00N, 44°29' 15E, 1691 m, 07.07.2012, leg. Fırat. 10♂♂ 10♀♀, Güvenli, 37°23'35N, 44°35'17E, 1782m, 07.07.2012, leg. Fırat. 4♂♂ 5♀♀, Korgan, 37°23'47N, 44°29'36E, 1838m, 08.08.2012, leg. Fırat. 6♂♂ 8♀♀, Çalışkanlar, 37°15'28N, 44°38'12E, 1488 m, 13.05.2013, leg. Fırat. Hakkari-Çukurca: 5♂♂ 5♀♀, Geçimli, 37°23'35N, 43°32'02E, 1441 m, 11.05.2013, leg. Fırat.
Distribution in Turkey: Adana, Afyon, Aksaray, Ankara, Antakya, Antalya, Artvin, Aydın, Balıkesir, Bayburt, Bingöl, Bilecik, Bitlis, Bolu, Burdur, Bursa, Çorum, Denizli, Diyarbakır, Edirne, Erzincan, Erzurum, Gaziantep, Giresun, Gümüşhane, Hakkâri, Hatay, Isparta,

İzmir, Kahramanmaraş, Kars, Kayseri, Kastamonu, Konya, Mardin, Mersin, Muğla, Muş, Ordu, Osmaniye, Rize, Sakarya, Samsun, Sinop, Sivas, Şanlıurfa, Tokat, Trabzon and Van (Mart, 2009; Darılmaz & Kıyak, 2006b; Ertorun & Tanatmış, 2009; Darılmaz et al., 2010; Polat et al., 2010; Darılmaz & Incekara, 2011; Aydoğan, 2011; Bayram, 2011; Türken, 2011; Yılmaz, 2011).

Laccobius (Dimorpholaccobius) obscuratus Rottenberg, 1874

Laccobius (Dimorpholaccobius) obscuratus aegaeus Gentili, 1974

Material examined: Hatay-Reyhanlı: 1♂ 1♀, Göktepe, 31°17'01N 36°29'34E, 95m, 05.VIII.2012, leg. Aydoğan. Hatay-Yayladağ: 2♂♂ Yayladağ dam, 35°57'09N 36°03' 05E, 485m, 05.VII.2012, leg. Aydoğan. 1♂, Yaylıca dam pond, 36°10'06N 36°01'38E, 197m, 04. IX.2012, leg. Aydoğan.

Distribution in Turkey: Adana, Afyon, Ankara, Antalya, Artvin, Aydın, Balıkesir, Bingöl, Bitlis, Bolu, Burdur, Bursa, Çanakkale, Çorum, Denizli, Erzincan, Erzurum, Gebze, Gümüşhane, Isparta, İstanbul, İzmir, İzmit, Kastamonu, Kırklareli, Konya, Kütahya, Manisa, Mersin, Muğla, Muş, Ordu, Osmaniye, Rize, Samsun, Sinop, Sivas, Tokat, Toros dağları, Trabzon, Uşak and Van (Incekara et al., 2003, 2010; Mart, 2009; Karaman et al., 2008; Ertorun & Tanatmış, 2009; Hızarcıoğlu et al., 2010; Polat et al., 2010; Darılmaz & Incekara, 2011; Aydoğan, 2011; Bayram, 2011; Türken, 2011; Yılmaz, 2011).

Remark: Newly recorded from Hatay province.

Paracymus chalceolus (Solsky, 1874)

Material examined: Hatay-Kırıkhan: 2♂♂ 2♀♀, Madenli, 36°28'48N 35°59'53E, 22m, 08.IX. 2012, leg. Aydoğan. Hakkari-Şemdinli: 1♂ 1♀, Korgan, 37°23'47N 44°29'36E, 1838m, 08. 08.2012, leg. Fırat.

Distribution in Turkey: Bayburt, Bingöl, Bitlis, Muş and Van (Mart et al., 2006; Mart, 2009; Darılmaz & Incekara, 2011; Aydoğan, 2011; Türken, 2011).

Remark: Newly recorded from the Mediterranean and Southeast Anatolia region.

DISCUSSION

In this study, totally 11 species and one subspecies of aquatic Coleoptera belonging to 8 genera of the Hydrophilidae were determined in Hatay and Hakkari province. Of these, *Paracymus chalceolus* (Solsky, 1874) has been recorded in both the Mediterranean and Southeast Anatolia regions, and *Enochrus* (*Lumetus*) *politus* (Küster, 1849) has been recorded only in the Mediterranean region for the first time. *Hydrochara dichroma* (Fairmaire, 1982), *Enochrus (Lumetus) fuscipennis* (Thomson, 1884), *Hydrobius fuscipes* (Linnaeus, 1758) and *Anacaena rufipes* (Guillebeau, 1896) have been recorded in Hatay province and the Southeast Anatolia region for the first time. *Berosus* (s.str.) *signaticollis* (Charpentier, 1825), *Laccobius (D.) simulatrix* d'Orchymont, 1932, *Laccobius (D.) obscuratus aegaeus* Gentili, 1974, *Helochares lividus* (Forster, 1771) and *Helochares* (s.str.) *obscurus* (Müller, 1776) have only been recorded in Hatay province for the first time.

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CONTRIBUTIONS TO THE STUDIES ON PRIONINAE (COLEOPTERA: CERAMBYCIDAE) OF CENTRAL INDIA WITH CHECKLIST OF INDIAN SPECIES

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ABSTRACT: The present paper presents the information on genital and morphological character of 4 species belonging to 4 genera and 3 tribes of the subfamily Prioninae (Cerambycidae) so far reported from Central India. Except *Prionomma* (*Prionomma*) *atratum* (Gmelin), other 3 species are newly recorded from Central Indian landscape. First consolidated checklist of Indian Prioninae including 47 species belonging to 23 genera and 9 tribes has also been provided.

KEY WORDS: Chhattisgarh, Central India, Cerambycidae, Madhya Pradesh, male genitalia, Prioninae.

The beetles of Prioninae subfamily belonging to the Cerambycidae family are mostly borers, whose larvae feed on rotting wood or roots. Few members of the subfamily make tunnel freely in the soil alongside the roots of trees. These beetles fall in the group of heartwood borers and thus reflecting its immense importance in the timber economy of the country. They are cosmopolitan in distribution and include many of the largest species of the Coleoptera order. Prioninae may be readily recognized by the prothoracic possession of the sharp lateral margins. The Indian genera generally bear coarsely facetted eyes, and the species, more or less, are restricted in their range of coloration between black and lighter shades of brown which verge on red and yellow.

In 2012, Norbert Delahaye has published a world catalogue of prioninae. Till date, the most comprehensive information on Indian Prioninae is provided in '*The Fauna of British India including Ceylon and Burma*' by Gahan in 1906. Subsequently, Stebbing (1914) and Beeson (1941) published literatures on biology and ecology of these beetles. Except few scattered publications, this group is poorly represented in recent literatures. In 2005, Sen et al. reported a prioninae species from Goa. Prabhakar et al. (2012) published new record of a prioninae species from India including its biology and natural history. Chandra et al. (2010) published the only literature which includes some information on the prioninae of Central India.

The present communication aims at discussing detailed taxonomy of the prioninae species collected during faunal surveys in Madhya Pradesh and Chhattisgarh by Zoological Survey of India. Moreover, this paper provides a consolidated checklist of the subfamily prioninae recorded in India after Norbert Delahaye (2012) 'World Catalogue of Prioninae'.

MATERIALS AND METHODS

Study period**:** The specimens were collected from different parts of Madhya Pradesh and Chhattisgarh since 2001.

***Study Area*:** Madhya Pradesh lies more or less at the center of India covering an area of 308.252 square kilometer and extending between 21.2°- 26.87° N Latitude and 74.033°- 82.81° E Longitude. Nearly, 30.9 % of the total geographic area of the state is covered by the forest. The forest types mainly include sub tropical hill forests, moist deciduous forest, dry deciduous forest and thorny vegetation. Most of the forests are Sal dominated interspersed with mixed vegetation and bamboo patches. Major rivers include Chambal, Narmada and Tapti. Chhattisgarh is a newly carved out state from Madhya Pradesh in 2001. The state extends between 17°46' - 24°8' N latitude and 80°15' - 84°24' E longitude in the central Indian landscape having a total area of 1. 35.194 sq. Km. Nearly 44 % of the state area is covered by forests and a major part (35736.239 sq. Km.) is outside Protected Areas. Area of these two states lies on the table land of Central India surrounded by Gangetic plains in the North and Godavari valley in the South, the plains of Gujarat in the West and Orissa and Bihar in the East. Biogeographically, both the states belong to the Deccan Plateau and include provinces, 6D- Chota Nagpur Plateau, 6C- Eastern Highland and 6E- Central Highland (Rodgers et al., 2002).
***Methods*:** Cerambycid beetles are collected generally at night with the help of light trap. Mercury bulbs (160 Watt) were used to attract insects on a white sheet of cloth measuring approximately 2 X 2 m. The coordinates of the collection sites were recorded using GPS (Garmin Oregon 550), which were further used in preparing maps of the survey sites in DIVA-GIS. Specimens were studied under Leica EZ4 HD binocular microscope for identification on morphological basis. Morphological photographs were taken with Nikon D300s and 105mm lens. For genital study, the whole abdominal segment was cut out and the genital parts were removed very carefully with the help of fine forceps, then the remaining abdominal exoskeleton was fixed in its old position with the use of gum. The genital parts were keptin 10% KOH solution overnight. Genital parts were studied and photographed in Leica stereo zoom microscope M205A. The genitalia were preserved in 70% alcohol. The identified specimens were deposited in the National Zoological Collection, Zoological Survey of India, Kolkata.

ABBREVIATIONS USED

WLS: Wildlife Sanctuary; NP: National Park; BR: Biosphere Reserve; TR: Tiger Reserve; RH: Rest House; Coll.: Collected by.; ex./s.: Example/s.

RESULTS

The present taxonomic study of the collected prioninae reveals the presence of 4 species belonging to 4 genera and 3 tribes from Central India. Among these, 3 are recorded for the first time from the Central Indian landscape. The consolidated Indian checklist shows the presence of 47 prioninae species belonging to 23 genera and 9 tribes (Table 1).

Subfamily PRIONINAE Latreille

1869. *Prionides*, Lacordair. *Gen. Coleopt*. Viii, p. 16.

***Diagnostic characters*:** Typically large (25–70 mm) in size and usually dorsally brown or black and red brown ventrally. The head of the members of this subfamily usually oblique, forwarded anteriorly, antennae inserted more or less close to base of mandibles; pronotum with complete lateral margins, frequently toothed or spined along the margin; procoxae strongly transverse; mesonotum lacking striadulatory area; coxal cavities open behind, inner lobe of maxillae lacking or vestigial [Dillon & Dillon, 1952].

Key to the Tribes of subfamily PRIONINAE Gahan

1. Prothorax with lateral margins one to four strong marginal teeth or spines on each side...2
-- Prothorax with lateral margins entire or nearly so, or else provided each with a series of several irregular teeth or spines...**Macrotomini**

2. First antennal joint one-third at least longer than broad, labrum not triangular..**Prionini**
-- First antennal joint short, short, obconic, scarcely longer than broad, labrum triangular...**Acanthophorini**

[I] Tribe Prionini Latreille

Prionomma (*Prionomma*) *atratum* (Gmelin)

1789. *Prionus atratum* Gmelin, *Syst. Nat.*, I (4): 1818 (S. India, Ceylon).
1910. *Prionoma* (*Prionomma*) *atratum*: Lameere, *Annls. Soc. ent.Belg.*, 54: 279.
***Material examined*:** Chhattisgarh, Bilaspur, Achanakmar WLS, ChaparwaRH, 14.vi.2004,1ex., coll. A. Singh; Bastar, KangerValley NP, 18.vii.2011, 1 ex.,coll. R. P. Gupta and party; Raipur, Barnwapara WLS, 6.vii.2011, 1 ex., coll. Sunil Gupta and party.
***Diagnostic character*:** Body pitchy black throughout; antenna twelve segmented, smaller than body (Fig. 2A); segment one small, stumpy, globular, smooth, outer margin of segment three to segment eleven angulated apically (Fig. 2Q); head, gena almost covered by eyes, eyes finely faceted not divided, deep sulcation between two eyes (Fig. 2E); pronotum broader than long, two large spines on the antero-lateral margin; lower one more longer, stronger and acute than upper one, surface smooth glossy, one poorly raised portion on either side of the pronotum (Fig. 2I); scutellum broadly "U" shaped (Fig. 2I); elytra elongated, gradually narrowed towards apex, basally strongly punctate, apex of elytra broadly rounded (Fig. 2A); prosternal process raised above the height of coxae, forwarded anteriorly, coxal cavity closed (Fig. 2M); legs robust, punctate, warty (Fig. 2U), tibia with apical spine, tarsal claws long,less than 90° angle (Fig. 2Y).
***Genitalia*:** Apex of the median lobe strongly projected (Fig. 3D). Ring portion of lateral lobe almost parallel and converging towards apex (Fig. 3B). The lobes of the parameres apart and densely covered with setae (Fig. 3D). Internal sac or the endophallus attached between the bifurcated parts of median lobe (Fig. 3C). Tip of the endophallus triangular shaped with a very distinct black marking (Fig. 3A) (Ehara, 1954).
***Distribution*:** India: Chhattisgarh, Maharashtra, Odisha and Tamil Nadu. *Elsewhere*: Sri Lanka.

Dorysthenes (*Lophosternus*) *huegelii* (Redtenbacher)

1848. *Cyrtognathus huegelii* Redtenbacher, *Hiigel's Kaschmir*, 4 (2):550.
1981. *Dorysthenes (Lophosternus) huegelii*: Hayashi &Makihara, *ESAKIA*, (17): 183-200.
***Material examined*:** Madhya Pradesh, Hosangabad, Panchmari BR, Churna RH, 17.vi.2003, 1 ex., coll. K.Chandra.
Diagnostic characters: Body large,robust, chestnut brown in color (Fig. 2B); antenna smaller than body, chestnut brown, segments small, stout, squarish, anteriorly angled, segment-3 longest (Fig. 2R); head chestnut red, eyes finely faceted not divided golden black in color, deep groove between two eyes, clypeus with golden hairs (Fig. 2F); pronotum red brown, squarish, medially concave, gradually slopped laterally, anterior lateral margin flattened with two acute spines, posterior margin wavy, punctuate (Fig. 2J); elytra large, red brown, generally converged toward apex, longitudinal striae, basally prominent, obsolete near the apex, lateral margins margined, outer angle broadly rounded, sutural angle ended with blunt out curved (Fig. 2B); legs elongate, femur flattened, serrated (Fig. 2V), tibia serrated, with apical spine, 3rd tarsal segments bilobed, claws more than 90° angle (Fig. 2Z).
***Genitalia*:** Apex of the median lobe long and sharply pointed (Fig. 3H). Ring portion of lateral lobe converging throughout (Fig. 3F). The lobes of the parameres very close and very densely covered with long setae (Fig. 3 H). Internal sac or the endophallus attached with the

median lobe. The endophallus throughout elongated, suddenly swelled at the tip and formed a small rounded structure (Fig. 3G) (Ehara, 1954).
***Distribution*:** India: Madhya Pradesh and Tamil Nadu. *Elsewhere:* Nepal.

[II] Tribe Macrotomini Thomson
Bandar pascoei pascoei (Lansberge)

1869. *Macrotoma luzonum* Pascoe, *Trans. ent. Soc. Lond*., (3)3: 666.
1884. *Macrotoma pascoei*: Lansberge, *Notes Leyden Mus*., 6: 144.
1912. *Macrotoma* (*Bander*) *pascoei*: Lameere, *Mem. Soc.ent. Belg*., 21: 144.
1981. *Bander pascoei pascoei*: Quentin & Villiers, *Ann. Soc. Ent. Fr*. (N. S.), 17(1): 363.
***Material examined*:** Madhya Pradesh, Seoni, Pench TR, Karmajhiri, 10.vi.2001, 1ex., coll. K. Chandra. Chhattisgarh, Bilaspur, Achanakmar WLS, Atariya FRH, 18.vi.2004, 2exs.,Chaparwa FRH 22.vii.2004, 1 ex., coll. A.singh; Durg, Devinavgaon, 14.xii.2012, 1 ex., coll. Sunil Gupta and Party.
***Diagnostic character*:** Body robust, elongated, head, pronotum, antennae and legs dark brown, elytra yellow brown in male (Fig. 2C), dark brown in female; antenna eleven segmented smaller than body, hardly surpassing the hind leg (Fig. 2C), segment one small, anteriorly broadened, dorso-ventrally compressed, segment one to three dark brown, gradually paler towards segment eleven, segment three longest, inner margin serrated (Fig. 2S); head deep blackish brown, densely punctate, median incision throughout, eyes finely faceted black not divided, gena very small, clypeus with golden hairs (Fig. 2G); pronotum sub squarish, gradually widened towards basal region, lateral margins with series of small spines, surface rusty brown in color, warty, strongly, densely, deeply punctuate, scutellum large dark brown, tongue shaped (Fig. 2K); elytra elongated, basal one-third rusty brown, rest gradually paler towards apex, roughly densely punctate, surface with fey longitudinal indistinct ridges from basal to apical margin, apex of elytra broadly rounded with strong sutural spines (Fig. 2C); coxal cavities open (Fig. 2O), legs rusty brown to dark brown, warty throughout, femur elongated, robust, serrated more in first leg (Fig. 2W), tibia slender elongated and spined; tarsal claw more than 90° angle, tarsal pad two pairs (Fig. 2Aa).
***Genitalia*:** Apex of the median lobe bluntly projected and small in size (Fig. 3L). Ring portion of lateral lobe converging throughout (Fig. 3J). The lobes of the parameres almost close, quite broader and very sparsely covered with small setae (Fig. 3L). Internal sac or the endophallus attached with the median lobe. Tip of the endophallus round, expanded and larger than the other parts (Fig. 3K) (Ehara, 1954).
***Distribution*:** India: Chhattisgarh, Madhya Pradesh and Tripura. *Elsewhere:* Banga Island, Billiton Island, Borneo, Hainan Island, Java, Laos, Malay Peninsula, Myanmar, Nepal, South China, Sri Lanka,Sumatra, Thailand, Tibet and Vietnam.

[III] Tribe Acanthophorini Thomson
Acanthophorous serraticornis (Olivier)

1795. *Prionus serraticornis* Olivier, *Ent.,* 4 (66):14.
1906. *Acanthophorus serraticornis*: Gahan,C.J. *Fauna. Brit. India*, 1:23.
***Material examined*:** Madhya Pradesh, Seoni, Pench TR, Karmajhiri, 6.vi.2001, 1 ex., 10.vi.2001, 1 ex., 11.vi.2001, 1ex., coll. K. Chandra. Chhattisgarh, Raipur, Barnwapara WLS, 23.vi.2012, 1ex., 21.vi.2012, 1ex. coll. Sunil Gupta and party.
***Diagnostic character*:** Body large, elongated, robust, glossy dark brown to black in color (Fig. 2D); antenna twelve segmented, smaller than body (Fig. 2D), segment one small, globular, segment three largest, segments three to eleven lateral margin apically angulated, which gradually more angulate towards segment eleven (Fig. 2T); head globular, punctate, eyes large almost covering the gena, frons and clypeus covered with golden hairs (Fig. 2H); pronotum large, much broader than long, glossy dark brown, strongly punctuate, two raised portion on either side of pronotum, apico-lateral margins with small acute spine on either side, the second one large, acute spine little behind the previous one, the third blunt spine on the postero lateral margins (Fig. 2L); elytra basally strongly punctuate, gradually finer towards apex, lateral margins with fine yellowish pubescence, apex of the elytra broadly sub rounded (Fig. 2D); coxal cavities closed (Fig. 2P), femur robust flattened (Fig. 2X), tibia elongated, with sharp spines on the anterior margin; tarsal claw more than 90° angle (Fig. 2Ab).

***Genitalia*:** Apex of the median lobe weakly projected, tip almost blunt and broader (Fig. 3P). Ring portion of lateral lobe converging throughout (Fig. 3N). The lobes of the parameres almost close, elongated and broad and the tip bluntly pointed, very sparsely covered with small setae (Fig. 3P). Internal sac or the endophallus attached with the median lobe. Tip of the endophallus balloon shaped with constricted hind part (Fig. 3O) (Ehara, 1954).
***Distribution*:** India: Chhattisgarh, Andaman, Bihar, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Sikkim and Tamil Nadu. *Elsewhere:* Sri Lanka.

DISCUSSION

In spite of its immense economical and ecological importance, Cerambycidae is one of the least studied families of the order Coleoptera. The family attracted the attention of several forest entomologists of the pre-independent India, like Stebbing and Beeson, who studied their taxonomy, biology and ecology in details. The family Cerambycidae is represented by approximately 1200 species in India. Some subfamilies are well studied, while the subfamily Prioninae is poorly studied in India. The present study examined 13 prionine specimens collected from different forests of Central India. It reveals the presence of 4 species within 4 genera and three tribes. Except *Prionomma (Prionomma) atratum* (Gmelin), remaining 3 species are new addition to the fauna of Madhya Pradesh, where as all the species are recorded for the first time from Chhattisgarh. A first consolidate checklist of Indian prioninae has also been prepared compiling information from past literatures and present study. Altogether 47 species belonging to 23 genera of 9 tribes are provided in the checklist.

This paper reports four species based on detailed morphological characters along with illustrations. The male genitalia of all the species have also been studied and provided in the manuscript with illustrations. Detailed taxonomic studies will not only help in the proper identification of pests but also help in the management process based on the biology and ecology of the concerned species.

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Table 1. Consolidated checklist of the subfamily Prioninae recorded from India.

Sl. No.	SPECIES
	Subfamily: PRIONINAE
I	**Tribe: Acanthophorini**
1	*Acanthophorus serraticornis* (Olivier)
2	*Anthracocentrus rugiceps* (Gahan)
II	**Tribe: Aegosomatini**
3	*Aegolipton gahani* (Lameere)
4	*Aegolipton marginale* (Fabricius)
5	*Aegosoma ornaticolle* White
6	*Baralipton maculosum* Thomson
7	*Dandamis nigropunctata* (Aurivillius)
8	*Dandamis tricostata* (Duffy)
9	*Dinoprionus cephalotes* Bates
10	*Nepiodes bowringi* (Gahan)
11	*Nepiodes costipennis* (White)
12	*Nepiodes sulcipennis* (White)
13	*Spinimegopis buckleyi* (Gahan)
14	*Spinimegopis mediocostata* (Gressitt)
15	*Spinimegopis nepalensis* (Hayashi)
16	*Spinimegopis tibialis* (White)
III	**Tribe: Anacolini**
17	*Sarmydus antennatus* Pascoe
IV	**Tribe: Cantharocnemini**
18	*Cantharocnemis (Cantharoprion) downesii* Pascoe
V	**Tribe: Macrotomini (Macrotomina)**
19	*Anomophysis confusa* Quentin & Villiers
20	*Anomophysis ellioti* (Waterhouse)
21	*Anomophysis inscripta* (Waterhouse)
22	*Anomophysis majerorum* Lackerbeck
23	*Anomophysis plagiata* (Waterhouse)
24	*Anomophysis spinosa* (Fabricius)
25	*Anomophysis katoi* (Gressitt)
26	*Bandar pascoei pascoei* (Lansberge)
27	*Chalybophysis aeneipennis* (Waterhouse)
28	*Zooblax elateroides* Thomson
29	*Zooblax nicobarensis* Lackerbeck
VI	**Tribe: Remphanini**
30	*Remphan hopei* Waterhouse
31	*Rhaphipodus andamanicus* Gahan
32	*Rhaphipodus gahani* Lameere

33	*Rhaphipodus subopacus* Gahan
VII	**Tribe: Meroscelisini**
34	*Anoeme andrewesi* Gahan
VIII	**Tribe: Prionini**
35	*Dorysthenes montanus* (Guérin- Méneville)
36	*Dorysthenes rostratus* (Fabricius)
37	*Dorysthenes (Dissosternus) pertii* (Hope)
38	*Dorysthenes (Lophosternus) buquetii* (Guérin-Méneville)
39	*Dorysthenes (Lophosternus) huegelii* (Redtenbacher)
40	*Dorysthenes (Lophosternus) indicus* (Hope)
41	*Dorysthenes (Lophosternus) zivetta* (Thomson)
42	*Dorysthenes (Paraphrus) granulosus* (Thomson)
43	*Prionomma atratum* (Gmelin)
44	*Prionomma (Ancyloprotus) bigibbosum* (White)
45	*Prionus corpulentus* Bates
46	*Priotyrannus mordax* (White)
IX	**Tribe: Eurypodini**
47	*Eurypoda (Neoprion) parandraeformis* (Lacordaire)

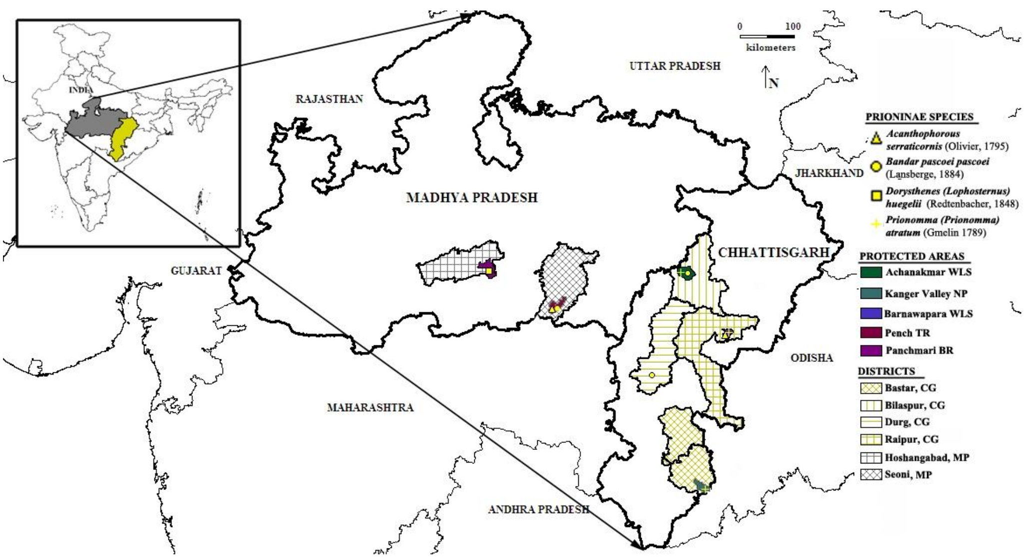

Figure 1. Showing map and the distribution of collected specimens.

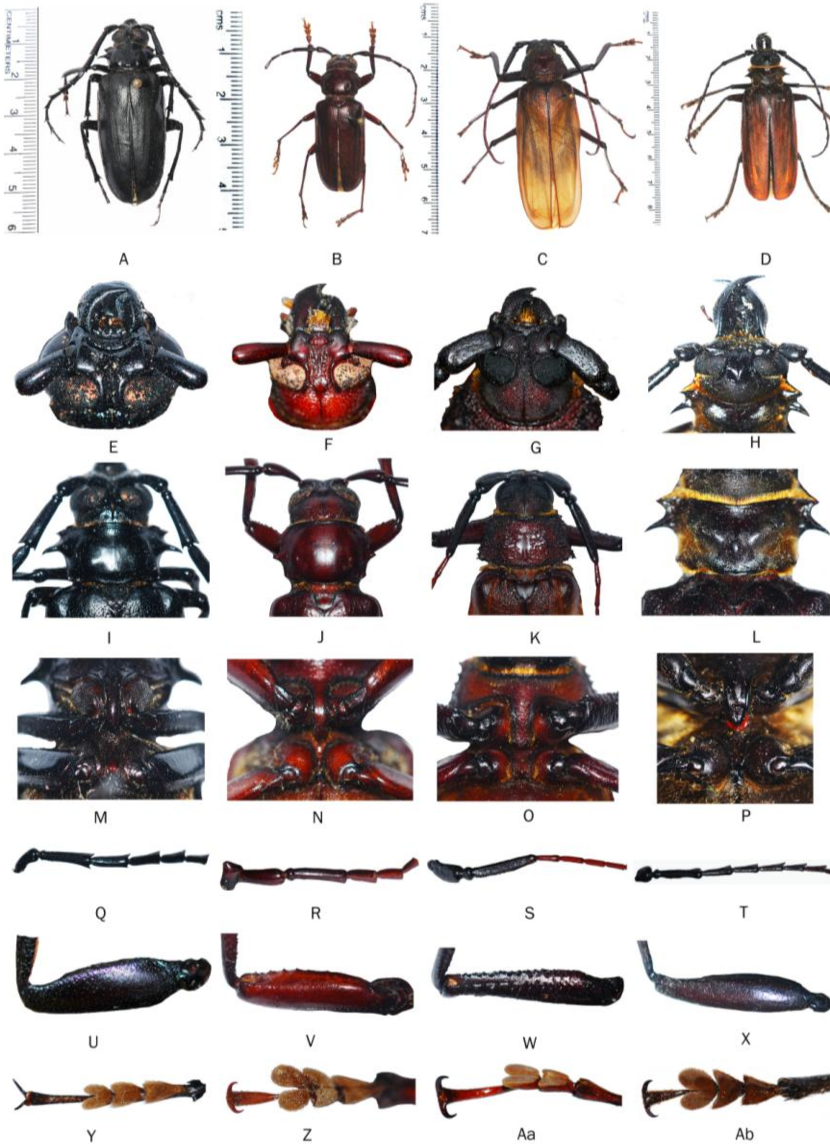

Figure 2. Showing Morphological Characteristics of the different species: *Prionomma* (*Prionomma*) *atratum* (Gmelin) A- Dorsal view, E- Head, I- Pronotum with scutellu, M- Coxal Cavities, Q- Antenna, U- Femur, Y- Tarsal claw; *Dorysthenes (Lophosternus) huegelii* (Redtenbacher) B- Dorsal view, F- Head, J- Pronotum with scutellu, N- Coxal Cavities, R- Antenna, V- Femur, Z- Tarsal claw; *Bandar pascoei pascoei* (Lansberge) C- Dorsal view, G- Head, K- Pronotum with scutellu, O- Coxal Cavities, S- Antenna, W- Femur, Aa- Tarsal claw; *Acanthophorous serraticornis* (Olivier) D- Dorsal view, H- Head, L- Pronotum with scutellu, P- Coxal Cavities, T- Antenna, X- Femur, Ab- Tarsal claw.

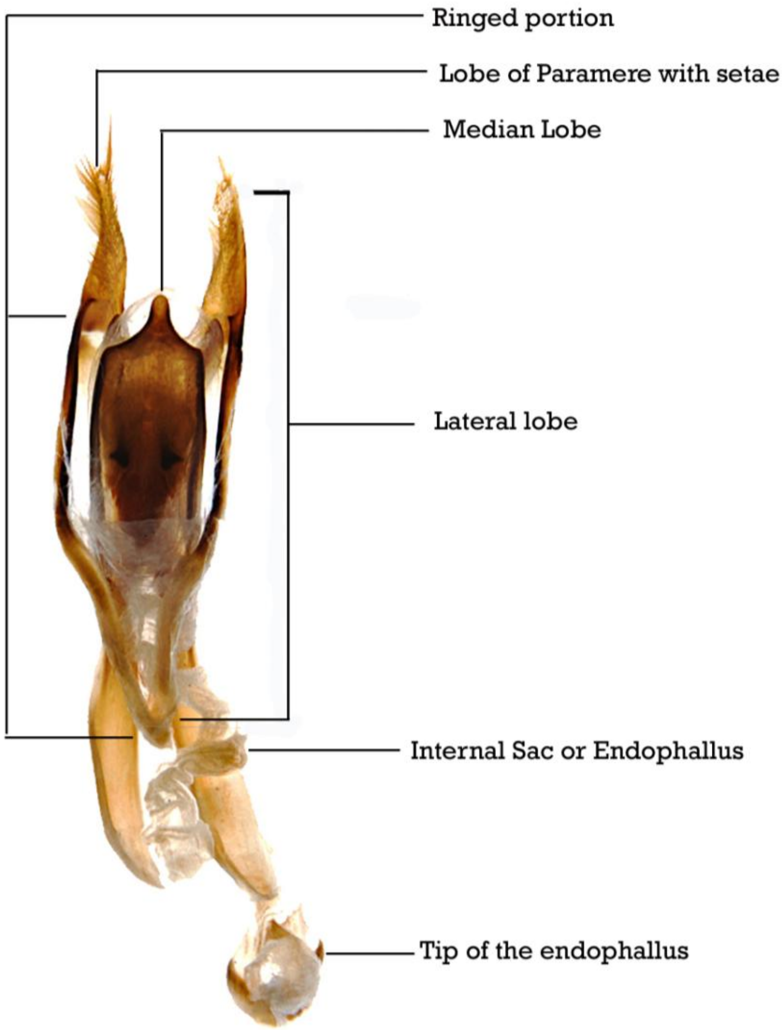

Figure 3. General male genital structure of Prioninae .

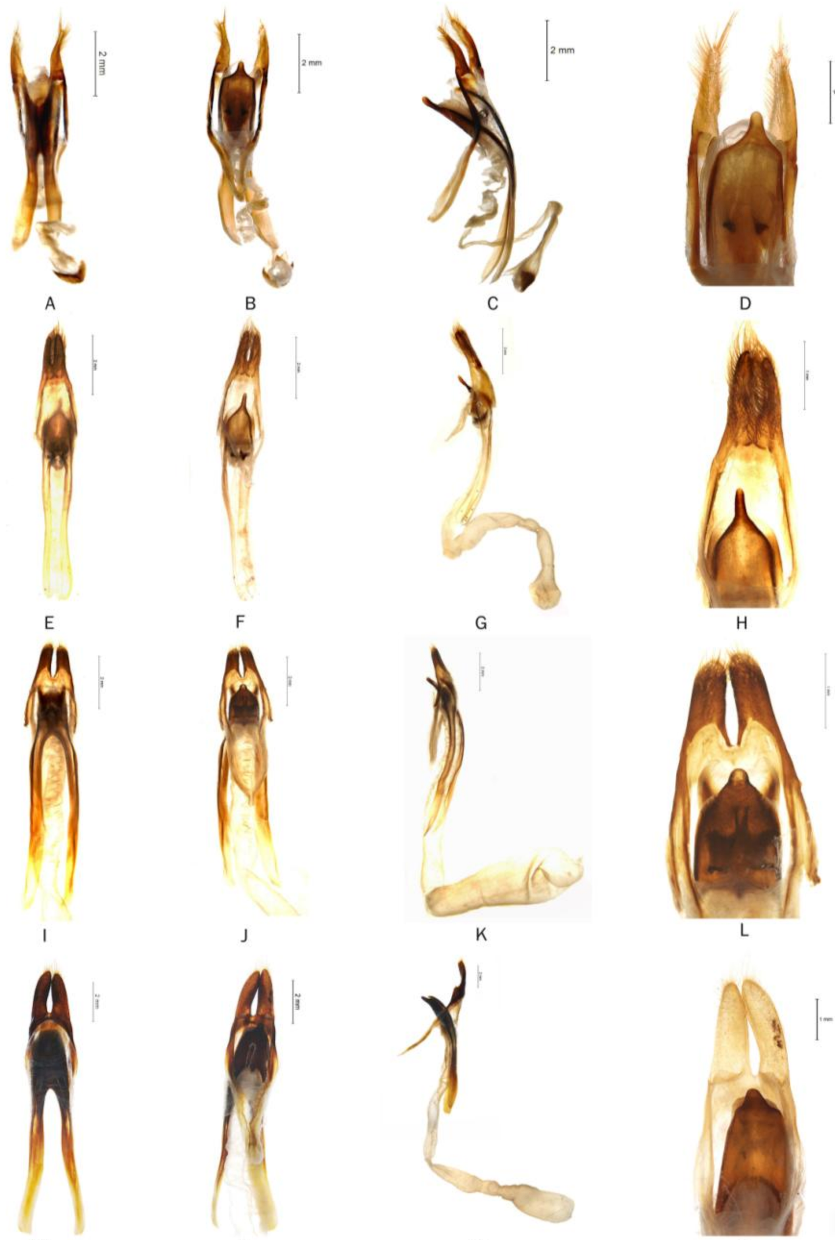

Figure 4. Showing Genital Parts: *Prionomma* (*Prionomma*) *atratum* (Gmelin) A- Dorsal, B- Ventral, C- Lateral, D- Tip of Median Lobe and Paramere; *Dorysthenes (Lophosternus) huegelii* (Redtenbacher) E- Dorsal, F- Ventral, G- Lateral, H- Tip of Median Lobe and Paramere; *Bandar pascoei pascoei* (Lansberge) I- Dorsal, J- Ventral, K- Lateral, L- Tip of Median Lobe and Paramere; *Acanthophorous serraticornis* (Olivier) M- Dorsal, N- Ventral, O- Lateral, P- Tip of Median Lobe and Paramere.

INSECT SUCCESSION ON DOG (*CANIS LUPUS FAMILIARIS* L.) CARCASSES IN SAMSUN PROVINCE, TURKEY

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[Kökdener, M. & Polat, E. 2014. Insect succession on dog (*Canis lupus familiaris* L.) carcasses in Samsun province, Turkey. Munis Entomology & Zoology, 9 (2): 858-869**]**

ABSTRACT**:** This field study was carried out succession of insect in the Taflan at Samsun province (Turkey) in the period from June 2009 to May 2010 by using dog (*Canis lupus familiaris* L.) carcasses as a human model. Eight dog carcasses (20–35 kg) were employed in this field in four seasons. The aim of this study was to determine the forensically significant insect succession and seasonal distribution in Samsun province. In our study five decomposition stages were observed (fresh, bloated, active decay, advanced decay, dry). The carcasses decomposed more rapidly in summer and autumn but carcasses decayed slowly in winter and spring. Carcasses attracted 25 species of insect in our study. During this period, a lot of insects belonging to the following orders and families were collected: Diptera: Calliphoridae, Sarcophagidae; Coloeptera: Staphylinidae, Histeridae, Dermesitidae, Cleridae, Nitidulidae, Silphidae. In spring and autumn carcasses attracted a more different community of insects than winter-placed carrion. No Coloepter species were collected in the winter. Insect fauna and its seasonal differences in Samsun on dog carcasses were reported for the first time in this study, strengthening the need of further experiments in different regions of Turkey in order to forensic practice.

KEY WORDS*:* Forensic entomology, Insect succession, Decomposition, Turkey.

Decomposition is a main part of all life cycles and a natural process, which is happening all around everyday and responsible for the recycling of organic material to the ecosystem on earth (Kocarek, 2003). Following death, insects are usually the first to reach a corpse and colonize in a predictable sequence (George et al., 2012; Kyerematen et al., 2012). Insects are the most important and essential components of the decomposition process. Every decomposition stage is attractive to diverse species of insect and (Horensteın & Linhares, 2011; Horenstein et al., 2010) and each group of Insects plays different roles during decomposition (Galal et al., 2009). Insect successions on carcass are usually the source of information with criminal events (Horenstein et al., 2010; Horenstein & Linhares, 2011; Kumar et al., 2011). Insect may be classified into four ecological categories comprising: necrophages; parasites and predators of necrophagous species; omnivores, and incidentals (Horenstein & Linhares, 2011; Horenstein et al., 2010). Forensic entomology is the use of the insects that feed on carcass to aid criminal investigations (Galal et al., 2009; Okiwelu et al., 2008; Mello & Coelho, 2009; Stefano, 2004; Wolff et al., 2001). Entomological evidence is useful for estimating postmortem interval (PMI) (Rodriguez & Bass, 1983; Kulshrestha & Chandra, 1987; Greenberg, 1991; Anderson, 1995; Benecke, 1998; Amendt et al., 2004), determining manner and cause of death, place of death, post-mortem transfer (Pai et al., 2007; Eberhardt & Eliot, 2008; Bonacci et al., 2009), toxicological investigations (Bonacci et al., 2009; Eberhardt & Eliot, 2008; Pai et al., 2007; Manhoff et al., 1991; Nolte et al., 1992; Introna et al., 2001; Bourel et al., 2001) and estimating period of neglect in the elderly or children (Bonacci et al., 2009; Eberhardt & Eliot, 2008; Fieguth et al., 1999; Benecke & Lessig, 2001).

Patterns of insect succession and decomposition may chance according to the geographical region and environmental conditions (like temperature and humidity) and environmental conditions such as temperature and humidity (Horenstein & Linhares, 2011; Horenstein et al., 2010). As such, succession data obtained from corpses at one geographic location cannot be carried out to other locations because every site has different ecological characteristics (Okiwelu et al., 2008; Sharanowski et al., 2008; Tabor et al., 2005; Wang et al., 2008).

Several studies of arthropods on carrion have been applied in some regions of the world for forensic purposes (Wolff et al., 2001; Anderson, 1995; Eberhardt et al., 2008; Sharanowski et al., 2008; Tabor et al., 2005; Wang et al., 2008; Sukontason et al., 2001; Sabanoğlu & Sert, 2010; Ozdemir & Sert, 2009) but studies in Turkey are rare. However, there are no published data on the insects' succession in Samsun. The objective of this work was to determine insect succession and seasonal differences in insect activity on carrion decomposing in the four different seasons of the year in Samsun, Turkey. This entomological information may be used as reference data in forensic investigations

MATERIALS AND METHODS

Study Site

Samsun province is located in north of (Turkey) and big urban city. Samsun has Mediterranean climate. The province has four distinct seasons: winter, spring, auntumn, summer. According to the weather station, summers are hot and dry, winters are cool and rainly, spring and auntumn are mild and rainly. Annual rainfall is 800-850 mm/year. The experiments were carried out in four different seasons between June 2009 and July 2010. The study area was at Taflan, Samsun, Turkey (41° 26' N; 36° 0.8' E) and the area is sea level and 500 m away from sea side. In its native form, experimental area is characterized by, broad-leaved herbs, mixed grasses and deciduous shrubs. There are agricultural areas around the study site. The animal model used for this study was the dog (canis lupus familiaris l.) that had died of natural causes from animal shelter of municipality. We used 8 dog (*Canis lupus familiaris* L.) carcasses, weighing between 20 and 35 kg (mean±25.5 kg). Carcass were weighted and put in semi-transparent garbage bags to prevent entry by arthropods. Within 1h, the carcasses were transported to the study site, removed from their respective bags and placed directly on the ground. To prevent disturbance by scavengers, the carcasses were enclosed within a removable 1.30 cm×90 cm×90 cm wooden cage covered with wire mesh 2.5 cm mesh 2.5 cm wide all sides except the underside. Air temperatures were measured in the study area and digital thermometers were used record body temperature of carcass. Data on temperature and humiditywere obtained from local weather station. All dogs were placed on study site in four seasons (Table 1), two dogs were used every seasons and left to decompose naturally.

Sampling and Identification

The study sites were visited daily in summer and autumn and three times a week in winter and spring. The studies were conducted at the warmest time of the day when insects are most active. During each visit, the state of the carcass, weather conditions and insect activity were observed and recorded. A photographic record was also maintained for the duration of the study. Representative samples of adult and immature were collected daily from on, in and under the carcasses and using the forseps, spoons and hand. Samples of larvae were divided in two where half were killed at the site by immersion in near-boiling water and preserved in 70% ethanol and half were taken to the laboratory for rearing. The rearing of larvae was for confirmatory identification purposes. Larvae were placed on a small piece of raw chicken liver (approximately 10 g) and then a 3 cm layer of vermiculite was added to 200 ml clear plastic containers. Pieces of furnished with small holes for air circulation, were used to cover containers. Containers were held at room temperature (i.e., 22–24◦C) with a light: dark regime of 12:12 hours. Containers were checked twice daily for the presence of adult blow flies. Some of adult specimens were put in 70% ethanol. The remainder was directly killed in cyanide jars. Ethanol-killed insects were preserved in plastic specimen containers and cyanide killed insects were pinned and put in the collection for identification and observation. Each sample box was labeled accordingly. Taxonomic determination was made by using current keys (Whitworth et al., 2006; Riberio & Carvello, 1998; Carvalho & Mello-Patiu, 2008; Pape, 1996; Dekeirsschieter et al., 2011; Dillon & Dıllon, 1972; Hall, 1977; White, 1985; Almeida & Mise, 2009; Háva, 2004).

RESULTS

The Decomposition Process of the Carcasses

Climatological data was obtained from a weather station. During the working periods, average air temperature and relative humidity were recorded as shown in Table 2. Average daily air temperatures and relative humidity were 23.0±2.0°C and 73.0±6.3%, respectively during summer months, 16.8±7.9°C and 73.9±0.7% during auntum months, 10.6±2.6°C and 62.3±17.6% during winter months, 13.5±7.9°C and 79.4±10.1% during spring months. The highest air temperature was 27.1°C in summer, 25.6°C in auntum, 20.0°C in winter and 21.7°C in spring (Table 2). In this study, five stages of decomposition were recognized (fresh, bloated, active decay, advanced decay and dry) from descriptions provided by Carvalho et al. (de Carvalho et al., 2004).

The fresh stage lasted on average 1 day in summer, 1.5 days in autumn, 4.5 days in spring and 5 days in winter (Fig. 1). The bloated stage lasted on average 1.5 days in summer and autum, 7 days in winter and 6 days in spring. The active decomposition stage lasted on average 8 days in summer, 30 days in winter, 26 days in spring and 10 days in autumn. Advanced decomposition stage lasted on average 35 days in spring, 12 days in summer and 30 days in autumn (Fig. 1). Carcasses decayed at a faster rate in summer and autumn seasons in Samsun (Table 2, Fig. 1). In summer, carcasses took only 23 days to reach the dry stages when average daily temperatures were more than 25°C (Table 2, Fig. 1). In contrast, during winter, 86 days were required for carcasses to reach the dry stage under the lowest daily temperature for the year (Table 2, Fig. 1). As it is known that the decay process of carcasse at different rates and the patterns of insect succession in different season (Sabanoğlu & Sert, 2010; Ozdemir & Sert, 2009; de Carvalho et al., 2004; Prado et al., 2012; Tantawi et al., 1996).

Insect Succession

In this study, a total of 20 species of Coleoptera, belonging to 6 families and total of 5 species of Diptera, belonging to 2 families, were collected from carcasses during one-year period. The following species were identified: Coloeptera: *Creophilus maxillosus (*Staphylinidae), *Philonthus concinnus*, (Staphilinidae), *Philonthus politus* (Staphilinidae)*, Aleochara intricata* (Staphilinidae), *Aleochara lata* (Staphilinidae), *Ontholestes murinus* (Staphilinidae), *Dermestes frischii* (*Dermesi*dae). *Dermestes maculatus, Dermestes undulatus* (*Dermesi*dae), *Margarinotus brunneus* (Histeridae), *Saprinus subnitescens* (Histeridae), *Saprinus vermiculatus* (Histeridae), *Saprinus caerulescens* (Histeridae), *Necrobia rufipes, Necrobia violacea, Necrobia ruficollis* (Cleridae), *Thanatophilus rugosus* (Silphidae), *Thanatophilus sinuatus* (Silphidae), *Necrodes littoralis* (Silphidae), *Nitidula flavomaculata* (Nitidulidae) and Diptera: *Lucilia sericata* (Calliphoridae), *Chrysomya albiceps* (Calliphoridae), *Calliphora vomitera* (Calliphoridae), *Calliphora vicina* (Calliphoridae), *Sarcophaga argyrostoma* (Sarcophagidae). The succession patterns for forensically significant insects on carcasses are depicted in Table 3. Most of the insects were found all throughout the year and there was obviously difference in species between the four seasons, although Coloeptera taxa were absent in winter.

The summer experiment was carried out from Jully 18 to September 10 2009. Species of Diptera increased from the fresh stage, reached a maximum in the active decomposition stage and declined in the middle of advanced stage and they were absent in dry stage. Within an hour, blow flies (Calliphoridae) and flesh flies (Sarcophagidae) were observed visiting the dog carcass. *Chrysomya albiceps* was the dominant species on carcasses in summer and autumn, showing low incidence during spring and constituted the primary factor in the decomposition process. Other early colonisers, *Sarcophaga argyrostoma* arriving during fresh stages of decomposition in summer. *Sarcophaga argyrostoma* was observed only summer season in Taflan. In active decomposition stage, more Dipteran groups were present (Calliphoridae and Sarcophagidae) (Tables 4 and 5). Some characteristic Coleoptera appeared (Dermesidae, Staphylinidae and Histeridae) during active decomposition stage. *Creophilus maxillosus* and *Dermestes frischii* started to appear; on day 3. *Saprinus subnitescens Dermestes maculatus* and *Dermestes undulatus* started to appear; on day 8 after death. In the advanced decomposition stage Diptera decrease significantly (Tables 4 and 5). Staphylinidae, Histeridae and Dermesidae were Coleoptera, continued to be present this stage. *Margarinotus brunneus* started to appear; on day 15. On day 18, *Necrobia rufipes, Necrobia violacea* were first collected on carcass and peresent during dry stage. Genereally and species of Coloeptera that was observed in active and continued to be present in dry stage (Table 3) but some species of Coloeptera were collected during advanced decomposition (except of winter season). The beginning of the dry stage in summer was difficult to distinguish from the end of the advanced decay stage.

The autumn experiment was carried out from September 11 to November 20 2009. Two species from Calliphoridae family were identified on the dog carcasses; *Lucilia*. *sericata* and *Chyrosmya albiceps* within fresh and bloated stage (Tables 4 and 6). *Lucilia sericata* was seen only this season. *Chyrosmya albiceps* was an abundant primary coloniser of carcases. In the active decomposition stage Dipteran and Coloepteran groups were peresent. The number of Coleopterans increased considerably during the active decomposition stage. On day 3, Staphilinidae, Cleridae, Histeridae and Dermesidae started to appear (Tables 3, 4 and 6). *Creophilus maxillosus*, *Philonthus concinnus*, *Philonthus politus, Aleochara intricata, Saprinus vermiculatus* and *Margarinotus burunnes Saprinus caerulescens, Dermestes frischii*, *Dermestes undulatus, Necrobia rufipes, Necrobia violacea* and *Necrobia ruficollis* were observed during the active decomposition stage and continued to be found during dry stage (Tables 4 and 6).

The winter experiment was carried out from November 22 to March 20 2010. In fresh and bloated stage, *Calliphora vicina* were observed on the carcasses. In the active decomposition stage *Calliphora vicina* continued to be found and *Calliphora vomitoria* started to appear; on day 30. Calliphoridae were peresent during advanced decomposition stage. During the dry stage two Calliphorids disappeared. *Calliphora vicina* was the dominant species on carcasses in winter. No Coloepter samples were observed on carcasses in winter (Tables 4 and 7).

The spring experiment was carried out from March 24 to July 15 2010. *Calliphora vicina* were collected during the fresh stage. In bloated stage, *Calliphora vicina* were collected and *Calliphora vomitoria* started to appear; on day 9. In the active decomposition stage Calliphoridae were peresent. On day 13 *Creophilus maxillosus, Aleochara lata*, *Dermestes frischii*, *Saprinus vermiculatus*, *Necrobia violacea, Necrobia rufipes, Thanatophilus rugosus, Thanatophilus sinuatus, Necrodes littoralis*, *Nitidula flavomaculata* species started to appear. In the study, *Nitidula flavomaculata* is the only Nitiduladae species detected. *Chyrosmya albiceps* started to appear on day 30 but it collected lower frequencies. Fly activity decreased in advanced decomposition stage. Staphylinidae, Histeridae and Dermesidae continued to be present this stage. On day 60 *Saprinus caerulescens*, *Ontholestes murinus, Philonthus concinnus* started to appear (Tables 4 and 8). All species of Coloeptera were observed during dry stage. But insect diversity decreased during the dry stage.

DISCUSSION

Internationally, decomposition studies have been carried out on cats (Rodriguez & Bass, 1983), dogs (Introna, 2001; Sabanoğlu & Sert, 2010; Ozdemir & Sert, 2009; Anderson, 1996), pigs (Sabanoğlu & Sert, 2010), guinea pigs (Bourel et al., 2001), mice (Whitworth , 2006), foxes (Riberio & Carvello, 1998; Carvalho & Mello-Patiu, 2008), lizards and toads (Pape, 1996), turtels (Bonacci et al., 2009), rabbits (Manhoff et al., 1991), elephants (Pai et al., 2007), impala (Eberhardt & Eliot 2008) and humans (Benecke, 1998; Anderson & Van Laerhoven 1996). Field study on the process of decomposition and insects' succession was conducted, for the first time in Samsun. The results indicate that carrion decays very quickly in summer but quite slowly in winter. It could be said that decomposition rates are directly proportional to temperature (Goyal, 2012).

Insects arrive on a corpse in a predictable sequence depending on the stages of decomposition. Diptera is the first insect group to be attracted (Ozdemir & Sert, 2009; Byrd & Castner, 2001) and the Coleoptera appeared later, continued to be present dry stage, as was declerad by Anderson and VanLaerhoven (1996), Wolff et al. (2001), Carvalho et al. (2004).

In spring, summer and auntum Diptera and Coloeptera were the most abundant groups and Coleoptera were prevalent in the active and advanced decomposition stage in all season except of winter season (Table 4). In winter, insect diversity was reduced, only two species (Calliphoridae) were found. Calliphoridae family was the first colonizers and played a major role in carcasses decay (Table 7). Four species of Calliphoridae were observed in all seasons. Among the two Calliphorid species that were best-represented during the summer and auntum in Samsun. *Chrysomya albiceps* was the most abundant Calliphorid species during the summer and auntum, especially in the summer, followed by autumn. The species was first seen at the on May 20 and existed until November 26. *Chrysomya albiceps* females did not lay egg in winter and it was observed low frequency during the spring in Samsun (Table 4). *Calliphora vicina* and *Chrysomya albiceps* were the species that had the longest duration on the dog carcasses in this study Lucilla sericata was seen auntumn but absent in other seasons. Other the two Calliphorid species are *Calliphora vicina* and *Calliphora vomitoria* that are a typical species of cold habitats. Therefore *Calliphora vicina* was the dominant species during winter followed by spring in Samsun. *Calliphora* *vicina* was present on the dog carcasses from November 10, 2009 until May 10, 2010. The seasonal distribution of *Calliphora vicina* showed that it is a species adapted to low temperatures, reaching a peak in winter, disappearing during the summer and reappearing in autumn and spring in low percentages. *Calliphora vomitoria* was collected during the winter and spring and it was collected lower frequencies than *Calliphora vicina* during this season (Table 5). Other Diptera species of *Sarcophaga argystoma* was collected during the summer but it was absent in other seasons. The similiar observation was also made by Tantawi et al. (1996), Sabanoğlu (2010), Introna et al. (1991). *Calliphora vomitoria* and *Calliphora vicina* was observed during winter, auntum and spring. Introna et al. (1991) stated that *Calliphora vicina* was observed during autumn.

20 species of Coloeptera were observed in our study. Among Coleoptera, Staphylinids were the first attracted group, followed by Clerids, Dermestids and Histerids during all season. In addition these species, Nitidulids and Silphids were observed during spring in our study. Species of Coloeptera were observed during the active, advanced decay stages and dry stage but some of species that appeared in active and advanced decomposition stage were absent in dry.

Staphylinidae was the family having the most abundant of species on carcasses and six Staphylinidae were recorded. Three Silphidae, Cleridae, Dermesidae and four Histeridae species were recorded in this study during three seasons (Table 4). These findings are consistent with the findings of Reed (1958), Carvalho et al (2004), Özdemir (2009), and Tantawi et al. (1996). Some species of Coloeptera were observed only in particular season *Philonthus pollitus, Saprinus subnitescens* and *Necrobia ruficollis* only appeared in auntum, *Dermestes maculatus* in summer, *Ontholestes murinus, Necrodes littoralis, Thanatophilus sinuatus, Thanatophilus rugosus, Nitidula flavomaculata* in spring. Other species of Coloepter were observed during summer, spring and auntumn.

CONCLUSIONS

Insect succession is a helpful tool in forensic investigations. In this study we recorded succession of insects on dog carcases and seasonal distribution; this succession is determined by two orders, Diptera and Coloeptera. Diptera colonize the carcass from initial stages of decomposition to dry stages, Coloeptera were present during later stages of decomposition. We observed that climate factors effect insect succession. Our findings about the stage of decay and insect succession are similar to the results obtained in other studies (Sabanoğlu & Sert, 2010; Prado et al., 2012; Reed, 1958). This is the first study done in Turkey on the Coleopteran and Diptera fauna of carcasses in same time during one year and this study provides helpful data on forensic entomology in Samsun. Turkey have different types of geoclimatic region, more detailed and comprehensive work are required to determine species and seasonal distrubition in each geografic region in the future.

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Table 1. Date of placement of dog carcasses.

Season	**Date**	**Dogs**
Summer	**Jully 18, 2009**	**1**
	August 15, 2009	**1**
Autumn	**September 11, 2009**	**1**
	October 6, 2009	**1**
Winter	**November 22, 2009**	**1**
	December 23, 2009	**1**
Spring	**March 24, 2010**	**1**
	April 5, 2010	**1**

Table 2. Climatological data (mean ± SE) recorded during experimental periods.

		Temperature(◦C)			Humidity (%)		
Season	Carcasses	Max.	Min.	Ave[†].	Max.	Min.	Ave
Summer	2	27.1	18.9	23.0±2.0	86.7	48	73.0±6.3
Autumn	2	25.6	8.6	16.8±7.9	92.3	42.3	73.9±0.7
Winter	2	20.0	0.8	10.6±2.6	91	18	62.3±17.6
Spring	2	21.7	4.6	13.5±7.9	89.3	58	79.4±10.1

[†]Ave. is the daily average temperature.
[‡]Means in a row followed by the same letters are

Table 3. Insects of forensic importance species collected on carcasses in Samsun.

Order	**Family**	**Species**
Diptera	Calliphoridae	*Chrysomya albiceps* (Wiedemann, 1819)
		Lucilia sericata (Meigen, 1826)
		Calliphora vomitoria (Linnaeus, 1758)
		Calliphora vicina Robineau-Desvoidy, 1830
	Sarcophagidae	*Sarcophaga argyrostoma*)(Robineau-Desvoidy, 1830)
Coloeptera	Staphylinidae	*Creophilus maxillosus* (Linnaeus, 1758)
		Ontholestes murinus (Linnaeus, 1758)
		Aleochara lata (Gravenhorst nec Kirby 1832, 1802)
		Philonthus concinnus (Gravenhorst, 1802)
		Philonthus politus (Linnaeus, 1758)
		Aleochara intricata (Mannerheim, 1830)
	Silphidae	*Thanatophilus sinuatus* (Fabricius, 1775)
		Necrodes littoralis (Linné, 1758)
		Thanatophilus rugosus (Linnaeus, 1758)
	Histeridae	*Saprinus vermiculatus* (Reichardt, 1923)
		Saprinus caerulescens (Hoffmann, 1803)
		Margarinotus burunnes (Fabricius, 1775)
		Saprinus subnitescens (Bickhardt, 1909)
	Dermestidae	*Dermestes frischii* (Kugelann, 1792)
		Dermestes undulatus (Brahm, 1790)
		Dermestes maculatus (DeGeer, 1774)
	Cleridae	*Necrobia rufipes* (De Geer, 1775)
		Necrobia violacea (Linnaeus, 1758)
		Necrobia ruficollis Fabricius, 1775
	Nitidulidae	*Nitidula flavomaculata* Rossi, 1790

Table 4. Insect groups in the different seasons and in every decomposition stage.

Seasons	Summer					Auntumn					Winter					Spring				
Species	F	B	Ac	Ad	DR	F	B	Ac	Ad	DR	F	B	Ac	Ad	DR	F	B	Ac	Ad	DR
Chrysomya albiceps	×	×	×	×		×	×	×	×											
Lucilla cericata						×	×	×	×											
Calliphora vicina											×	×	×	×		×	×	×	×	
Calliphora vomitera													×	×			×	×	×	
Sarcophaga argyrostoma	×	×	×	×																
Creophilus maxillosus			×	×	×			×	×	×								×	×	×
Philonthus concinnus								×	×	×									×	×
Philonthus politus								×	×	×										
Aleochara intricata								×	×	×										
Aleochara lata																		×	×	×
Ontholestes murinus																			×	×
Dermestes frischii			×	×	×			×	×									×	×	×
Dermestes maculatus			×	×	×															
Dermestes undulatus			×	×	×			×	×											
Saprinus subnitescens			×	×	×			×	×	×										
Margarinotus brunneus				×	×			×	×	×										
Saprinus vermiculatus								×	×	×								×	×	×
Saprinus caerulescens								×											×	×

Necrobia violacea				×	×			×	×									×	×	×
Necrobia rufipes				×	×			×	×									×	×	×
Necrobia ruficollis								×	×											
Thanatophilus rugosus																		×	×	×
Thanatophilus sinuatus																		×	×	×
Necrodes littoralis																		×	×	×
Nitidula flavomaculata																		×	×	×

F: fresh stage, B: bloated stage, AD: active decay stage, AdD: advanced decay stage, DR: dry stage.

Table 5. Distribution of identified species during summer.

Species	**June**				**July**				**August**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
C.albiceps												
S. argyrostoma												
C. maxillosus												
D. frischii												
D.maculatus												
D. undulatus												
N. violacea												
N. rufipes												
M brunneus												
S.subtinescens												

Table 6. Distribution of identified species during autumn.

Species	**September**				**October**				**November**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
C.albiceps												
L. sericata												
P. concinnus												
C. maxillosus												
P. politus												
A. intricata												
D. frischii												
D. undulatus												
M. brunneus												
N. violacea												
N. rufipes												
N.ruficollis												

Table 7. Distribution of identified species during winter.

Species	**December**				**January**				**February**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
C. vicina												
C. vomitera												

Table 8. Distribution of identified species during spring.

Species	March				April				May			
	1	2	3	4	1	2	3	4	1	2	3	4
C.albiceps												
C. vicina												
C. vomitera												
C. maxillosus												
A. lata												
P. concinnus												
O.murinus												
D. frischii												
S. caerulescens												
S. vermiculatus												
M. brunneus												
N. violacea												
N. rufipes												
T. sinuatus												
T. rugosus												
N. flavomaculata												

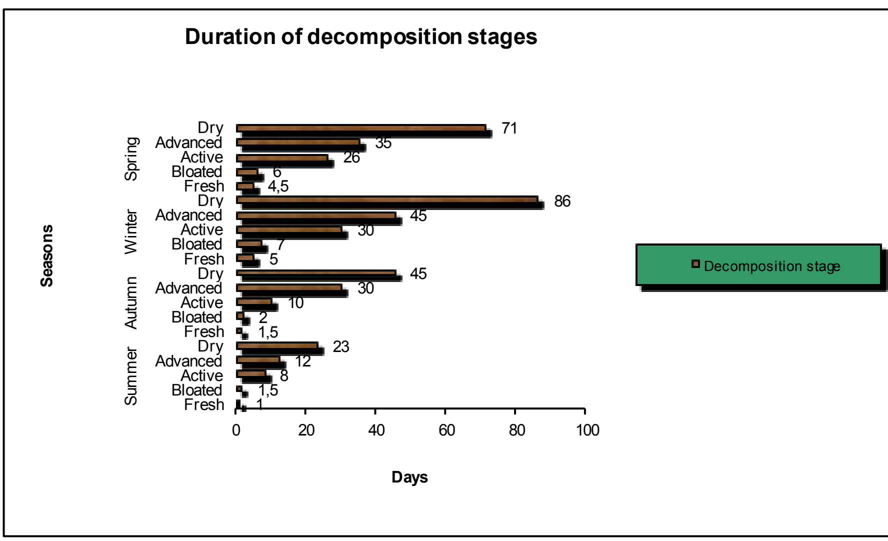

Figure 1. Decomposition stage with duration in season.

FUNGAL DISEASE OF WHITE MUSCARDINE IN SILKWORM, *BOMBYX MORI* L.

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[Nirupama, R. 2014. Fungal disease of white muscardine in Silkworm, *Bombyx mori* L.. Munis Entomology & Zoology, 9 (2): 870-874**]**

ABSTRACT: White muscardine is a fungal disease, it is most common and more prevalence during rainy and winter seasons. Usually silkworm diseases are prevalent throughout the year in all sericultural areas/countries. Silkworm *Bombyx mori* L. are affected by major diseases, such as grasserie, flacherie, muscardine and microspordian. White muscardine disease is most dangerous, virulent in silkworm and mainly caused by entomo-pathogenic fungi of *Beauveria bassisana* also named as mycosis. This disease is highly infectious in larval and pupal stages and inflicts heavy loss to cocoon crop every year. Low temperature and high humidity plays big role for the occurrence of muscardine, fungus grows well in relatively high humidity 90 to 95% and low temperature below 25°C. The study result revealed that, diseased larvae die within four to five days of infection. Larva mummified after 24 hrs of death, the whole body covered with white fungi conidia, and survival diseased larvae spun the cocoon and dead inside due to severe/secondary infection and fail to emerge as moth. Disease is transmitted through developed germination spores by diseased larvae after its death and consequently high humidity and low temperature plays a strong role for spread of muscardine disease inside the rearing tray/bed. In the present paper study has been made to understand in relation to the white muscardine disease in silkworm and its nature of morphological symptoms role have been discussed.

KEY WORDS: Silkworm *Bombyx mori* L., Fungual *Beauveria bassiana* and symptoms of muscardine disease.

Silk production is the ultimate goal of sericulture and mulberry silkworm, *Bombyx mori* L. is an economically important to primary producer of tradable form of silk, it is a class of fiber of excellence grace and luster (Nataraju et al., 2005). India has unique distinction of being the only country in the world bestowed by nature with all the four known species of silkworm viz., Mulberry, Eri, Muga and Tasar. Especially mulberry sericulture is practiced in Karnataka, Tamilnadu, Kerla, Andhrapradesh, Assam, Bihar, Madhya Pradesh, Uttar Pradesh, Maharastra, Punjab, Rajasthan, Gujarat, Orissa, Himachal Pradesh, Nagaland, Meghalaya, Mizoram, Arunchal Pradesh and Tripura. The bulk of world silk production is 95% of mulberry silk origin, China, India and Japan occupy top three positions in mulberry raw silk production. The diseases are one of the main constraints in cocoon production, the outbreak of diseases and crop failures in silkworm rearing are common under tropical countries. Mulberry silkworm, *Bombyx mori* L. is affected by number of disease. In 1950 Dasgupta, reported major silkworm diseases caused by Grasserie (viruse), Flacherie (bacteria), Muscardine (fungi) and Pebrine (protozoan /microspordian). Silkworm diseases are considered as a major one and its prevalence through out the year in all sericulture areas cause of high mortality at various stages due to different diseases. In India the annual cocoon crop losses estimated around 30 to 40% due to different silkworm diseases like, virus, bacteria, fungi and microsporidian, out of these 10 to 40% loss recorded for white muscardine disease (Janakiraman, 1961).

Muscardine caused by various saprophytic fungi, but white muscardine mainly caused by entomo-pathogenic fungai of *Beauveria bassiana*. The word muscardine originated from "Italian, moscardino" meaning musk, confit, grape "Calcino" refers to the white powder like efforscence of the white muscardine. The Agostino Basi Italian entomologist was the first reporter of the diseases white muscardine in 1763. later in 1835 demonstrated the name of muscardine. In Karnataka white muscardine is named as Sunnakaddi or Sunnakattu roga (Janakiraman, 1961) and Chuna-Kete in West Bengal (Mukerji, 1912). Classifiacation of white muscardine belongs to scientific name: *Beauveria bassiana*. Kingdom: Fungi, Division: Eumycota, Class: Hypomycetes, Order: Moiliales, Family: Monoiliaceae, Genus: *Beauveria*, Species: *bassiana* (Balsamo Vuillemin). Also there are different types of muscardine named according to the colors of the conidia formed on the dead body of silkworm larva namely, white, green, yellow brown and black. More than one thousands species of fungi exists known as causative agent of muscardine (Yokohama, 1954). Silkworm diseases are mainly caused by microbial pathogens, among the four major diseases, fungal disease are recognized as muscardine or mycosis, is the most fatal and disastrous one, which is highly contagious and inflict heavy loss to cocoon crop every year in the world (Steinhaus, 1949).

In Karnataka, white muscardine occurrence is extremely high in winter season (Anonymous, 1975) and rainy season in West Bengal (Mukherji, 1912). The history of diseases in India during the last four decades and it may vary from season to season and different agro climatic conditions reported by (Pringle, 1984). A condition of low temperature and high humidity is congenial for the development of the disease is more in winter season (Jayaramaiah et al., 1986). The loss due to white muscardine varies from 5-50% in different countries (Jayaramaiah & Kuberappa, 1987). The fungus infects primarily the third and fourth instars silkworm and disease symptoms appear at late stage of infection and affect all stages of life cycle of silkworm. In Several reports from farmer of different Sericultural areas in India reported that, the cocoon crop loss is mainly due to silkworm diseases (Samson et al., 1990).

MATERIALS AND METHODS

Experimental materials:

Silkworm larvae of *B.mori*, Mulberry leaves, Fungal pathogen (conidia), Chemicals, Glass wares and Rearing equipments.

Preparation of media, culture method, stock dilution and rearing techniques:

The required quantities of Potato Dextrose Agar medium was slightly dissolved in double distilled water and molten the media in a steam pressure cooker at 121°C for 45 min, media was poured into sterilized Petri plates and kept it an hour for solidification. The conidia was scrapped from dead mummified larva of silkworm with the help of sterilized inoculation wooden loop and cultured on solidified medium, and plates were kept at 25°C in room temperature for fungal growth. The fungus was again cultured and purified by monohyphal tip method and whole experiment was conducted under aseptic condition of Laminar Air Flow Chamber. The inoculum was prepared by a fresh conidium of fungus Beauveria bassiana, harvested by pure culture and diluted in sterilized distilled water to get required concentration. The stock inoculum suspension was quantified by standard procedure of Neubauer haemocytometer and counting the conidia followed by (Cant well, 1973). Experiment was done on newly ecdysed

IIIrd moult out of 1st day 4th instars larvae. The dose of 1x10^6 conidial suspension/1ml/100 larvae were inoculated per cutaneous by spraying on the body of larvae. Treated/inoculated larvae were reared in plastic trays with polythin blue sheets, under optimum temperature at 25^{o}c±1^{o}c and wet paper folds/wet foam pad kept inside the rearing trays to maintain the high humidity of 90 to 95% RH followed by (Chandrashekaran & Nataraju, 2008).

Diagnosis of disease: A drop of conidia spore suspension was onto glass slide and stained with lacto phenol cotton blue with cover-slip and germinated conidia spores was observed under Electronic Microscope. Cultured PDA fungi and microscopic conidia of Beauveria bassiana has been given in the Figures 1 and 2.

RESULTS AND DISCUSSION

Disease is a condition of abnormality resulting from physical or physiological derangements the whole systems of the body injure with an insect. The unfavorable climatic condition provides opportunity to the pathogens to infect the silkworm by causing weak, also higher humidity and low temperature enhance the susceptibility of silkworm to infection and increases multiplication of pathogen results in the spread and development of disease. The source of pathogenic micro organisms are normally diseased silkworms and severity of the disease is due to secondary infection. A progressive infection symptom was observed every day after treatment and symptoms was found after 4th day of inoculation. The way of infection by fungus *B. bassiana* conidia contact through the integument of the body of silkworm larva.

Visual diagnosis: diseased larvae loose appetite, become sluggish, ceases to move and loses elasticity as the disease advances moist oily specks appear on the body surface, larva vomits and die within five days. Diseased dead larvae body initially soft, corpses gradually stretches become rubbery, turn to harden and finally mummify due to white powdery fungi conidia cover the body surface and mummified within 48hrs of death. Mummified larva looks like white chalky piece, different stages of diseased, healthy and dead larvae have been presented in the figures 3, 4, and 5. The mummified stage considered as highly contagious and dreaded, the whole body covered with white powdery mycelium and produces millions of conidia except the chitinous parts of the head region. Mummified larva remains hard, do not decay, spoil or smell, unlike other diseased larvae of grasserie, flacherie and pebrine. Infected survival larvae were spun the cocoons and unable to emerge as silk moth due to secondary infection was found in pupal stage. These infectious microbes cause secondary infection and spread diseases stated by (Ishikawa & Miyajima, 1964). In the pupae stage of infection, infected pupae slowdown their reaction to outside stimuli and died inside the cocoon, dead pupal thorax shrinks and abdomen is wrinkled, body covered with aerial hyphae of white conidia have been given in figure 6 and infected dead pupae fail to emerge as moth.

Microscopic diagnosis: Haemolymph of the diseased worms and mummified samples were collected, placed onto glass slide and stained with lacto phenol cotton blue with cover-slip was observed under Electronic Microscope. Microscopic examination showed the presence of mycelia hyphae and cylindrical blastopores of conidia branches have been presented in the figures 7 and 8.

Muscardine infection is caused due to body contamination by fungus and direct penetration by germ tube. This disease is acute with young worms and chronic with grownup worms. Disease is mainly transmitted by the germination of spores which are formed on the outside of diseased larvae after its death. Many studies were carried out in India and other sericulture countries on white muscardine based on silkworm. Among different types of muscardine, white muscardine is the most common, caused by *Beauveria bassiana* (Bals.) Vuillemin. The muscardine of *B. bassiana* is a well known entomopathogen of world wide distribution (Bulmer & Formtling, 1983). In 1835, Bassi reported that, infectious nature of the Beauveria bassiana not only attack the silkworm, but also occur in other insects. Low temperature and relatively high humidity plays a great role for spread and development of muscardine disease in the rearing bed. Highest rate of infection and mortality was found during rearing, similarly there is possibility for larvae to get infected either through food or other sources of contamination. Sometimes few worms are infected, it spreads within the host and affected worms release pathogens either through excreta or by direct contact leading to the secondary infection. This may ultimately lead to the spread of diseases in the rearing bed. The incidence of muscardine disease caused by high humidity and low temperature (Samson et al., 1990; Anon, 1992b). The source of infection mainly due to mummified larva, alternate hosts, contaminated mulberry leaves, infected insects and rearing appliances.

White muscardine disease can be managed by strictly disinfections of rearing house, rearing appliance, surrounding areas and bed disinfectants. Similarly, providing optimum temperature and humidity in the silkworm rearing room, proper ventilations, spacing in the bed, periodically bed cleaning and fed good nutrient leaves ensure to avoid spread of diseases. Use of heater during rainy and winter seasons helps to reduce high humidity in the silkworm rearing room. The main reason for outbreak of muscardine is due to its wide host range and faster rate of spreading nature, improper disinfections, and non hygienic condition and irregular rearing management cause for diseases. In 1999 and 2002, Nataraju and his team worker of CSR&TI, Mysore has been made an effort to develop an integrated technology against control of silkworm diseases and used chlorine dioxide, Anukush and Vijetha as main components. Use of white muscardine bed disinfectants like Vijeth, Ankush, as well as timely application of lime powder after every moult and maintenance of hygiene condition ensure the prevent of muscardine disease.

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Figure 1. Cultured fungi *Beauveria bassiana* on PDA.

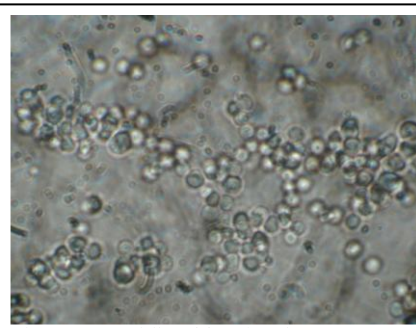

Figure 2. Conidia of fungi *B. bassiana*.

SIGHTING OF BLUE-SPOTTED CROW *EUPLOEA MULCIBER MULCIBER* (CRAMER, 1777) (LEPIDOPTERA: NYMPHALIDAE: DANAINAE) IN PUNJAB, INDIA

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[**Shrama, N.** 2014. Sighting of Blue-Spotted Crow *Euploea mulciber mulciber* (Cramer, 1777) (Lepidoptera: Nymphalidae: Danainae) in Punjab, India. Munis Entomology & Zoology, 9 (2): 875-878]

ABSTRACT: Recently, while conducting a 'General Faunistic Survey' of Punjab in the districts of Pathankot, Hoshiarpur, Rupnagar (Ropar) and Ludhiana, one specimen of *Euploea mulciber mulciber* (Cramer) was taken in the scrubby habitat at Takhni-Rehmapur Wildlife Sanctuary in district Hoshiarpur, Punjab in the forenoon of 10th November, 2013. The present record of *E. mulciber mulciber* from Takhni-Rehmapur WLS can be treated as an addition to the butterfly fauna of Punjab.

KEY WORDS: *Euploea mulciber*, Danainae, Takhni-Rehmapur WLS, Punjab.

The butterflies of the subfamily Danainae are commonly known as Milkweed butterflies. The Danaids are generally of moderate to large size, tough and leathery butterflies possessing an unpleasant smell and unpalatable juices. The odor and unpleasant taste has been evolved to protect them from their natural enemies like birds and lizards. These butterflies are distasteful to predators due to accumulation of toxic chemicals in their bodies derived from their larval food plants: distasteful, milky latex-bearing plants like milkweeds, dogbanes and figs. That is why Danaids are known as Milkweed butterflies. In fact, the Danaids have assumed the status of "Models" for protective mimicry and several species of different families like Papilionidae, Pieridae, Satyridae and Nymphalidae have mimicked them and gain protection. None of the Danaids exhibits seasonal variation.

Different workers have given different taxonomic treatment to this subfamily for example Marshall & de Niceville (1883), Bingham (1905), Haribal (1992) Kehimkar (2008), classified it as a subfamily Danainae under family Nymphalidae; Evans (1932), Talbot (1947), Wynter-Blyth (1957), Arora et al. (2009) treated it as a independent family Danaidae.

The family Danaidae is represented by six genera from India viz., *Idea* Fabricius, *Ideopsis* Horsfield, *Parantica* Moore, Tirumala Moore, *Danaus* Kluk, and *Euploea* Fabricius. Of these, the genera *Ideopsis* and *Idea* are not reported to occur in North-West India. Butterflies belonging to this genus *Euploea* are commonly known as 'Crows'. The genus *Euploea* is represented by 18 species from India (Varshney, 2010) of which only three species viz., *E. core* (Cramer) *E. mulciber* (Cramer), *E. midamus* (Linnaeus) are reported from North-West India. This genus is subcentered on Sundaland (Indonesia) and represented widely in the Oriental region. The different species of the genus *Euploea* are generally uniform in size, large long-winged, glossy-brown or glossy-black butterflies, often beautifully shot with blue. The forewings are usually marked with blue, white or mauve marginal and terminal spots and streaks. Discal and other spots and streaks may be present. The hindwings generally have a marginal and terminal series of spots.

MATERIAL AND METHODS

While conducting a 'General Faunistic Survey' of Punjab under the mandates of the Zoological Survey of India in the districts of Pathankot, Hoshiarpur, Rupnagar (Ropar) and Ludhiana, one female specimen of *Euploea mulciber mulciber* (Cramer) was collected in the scrubby habitat at Takhni-Rehmapur WLS in district Hoshiarpur, Punjab in the forenoon of 10th November, 2013. The specimen was deposited as the National Zoological Collection (NZC) at the Northern Regional Centre, Zoological Survey of India Dehradun.

OBSERVATION AND RESULTS

In India, the subspecies *E. mulciber mulciber* (Cramer) is found from Shimla (Himachal Pradesh) to Burma while *E. mulciber kalinga* Doh is found from Madras to Bengal (Evans, 1932). It extends from Burma as far the north as the Kulu Valley where, however, it is very rare and down the Eastern Ghats as far as Madras, where also it is extremely scarce. In Assam and Bengal it is common and is found in the hills and on the plains. It is found upto 2500 m and flies about 1-6 m above the ground. The species is found in almost all types of terrain although preferably adjacent to forest areas. The adults are attracted to flowers of *Ageratum conyzoides*, *Lantana camara* and many other nectar sources.

Its method of flight and habits are not different from the other species of the genus, but it is the only Indian *Euploea* species in which the female is markedly dissimilar from the male. The males of this species is easily recognized by forewing upperside with blue gloss and with discal, marginal and submarginal spots, spot in the cell present; uppserside hindwing unspotted, apical half has greyish scales and a small yellow patch of specialized scales. Females are similar to male except hindwing upperside with narrow white discal streaks, forewing upperside blue glossed area smaller.

Recently, while conducting a 'General Faunistic Survey' of Punjab under the mandates of the Zoological Survey of India in the districts of Pathankot, Hoshiarpur, Rupnagar (Ropar) and Ludhiana, one specimen of *E. mulciber* was taken in the scrubby habitat at Takhni-Rehmapur WLS in district Hoshiarpur, Punjab in the forenoon of 10th November, 2013. Being tough, the species need a prolonged pressure at thorax while killing them. Often these feign death and fly away immediately as soon as the pressure is released at thorax. Observations were made in Takhni-Rehmapur WLS with GPS reading on Oregon 550 GPS of Garmin make N 31^{o} 38.985'; E 075^{o}55.494'; Accuracy 20'; Elevation 1200'.

The species was not seen in other districts, viz., Pathankot (7-9 November- 6 localities); Hoshiarpur (10-11 Nov.-4 localities); Rupnagar (12-14 Nov.- 5 localities); Ludhiana (15 Nov., 2013- 2 localities) of Punjab that were surveyed during the same month.

The vegetation of the sanctuary mainly consists of Amb, *Mangifera indica,* Amla *Emblica officinalis,* Arjun *Terminalia arjuna,* Bargad *Ficus bengalensis,* Bamboo *Dendrocalamous strictus,* Dhak *Butea monosperma,* Khair *Acacia catechu,* Kikar *Acacia nilotica,* Krembal *Lemna grandis,* Mesquite *Prosopis juliflora,* Neem *Azadirachata indica,* Pipal *Ficus religiosa,* Chilbil Papri *Holoptelia integrifolia,* Shisham *Dalbergia sissoo,* Siris *Albizia lebbeck,* Subabul *Leucaena leucocephala* and a variety of shrubs, herbs and weeds.

Material examined: District Hoshiarpur: Takhni-Rehmapur WLS, 1 Female, 10.xi.2011 (Coll. N. Sharma & party). The material has been deposited in the National Zoological Collections (NZC), Zoological Survey of India, Dehradun.

Further, although butterfly fauna of Punjab have been studied from different localities by the workers such as: Rose and Sidhu (2001), Arora *et al.* (2006), Sharma and Joshi (2009); including a checklist of butterflies of Punjab available on the website of Punjab ENVIS Centre and also the above quoted workers. But none of them made any mention of this species in their studies, therefore, the present record of *E. mulciber mulciber* from Takhni-Rehmapur WLS (Distt. Hoshiarpur) can be treated as an addition to the butterfly fauna of Punjab.

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Figure 1. *Euploea mulciber mulciber* (Cramer) (Female) at Takhni-Rehmapur WLS .

CONSTRAINS IN MANAGEMENT FOR CONSERVATION OF MUGA SILKWORM (*ANTHEREA ASSAMENSIS* HELFER)

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[Das, R., Das, K. & Giridhar, K. 2014. Constrains in management for conservation of muga silkworm (*Antherea assamensis* Helfer). Munis Entomology & Zoology, 9 (2): 879-883**]**

ABSTRACT: Non mulberry silk Muga – Golden silk produced only in Brahmaputra valley of Assam province in NE Region. The ranges of biological resources including their genetic resources are renewable in nature or in similar *ex- situ* conservation with their proper management can fulfill human needs in larger extent. Developing and strengthening of *in situ* mechanism for seri-biodiversity conservation in the protected areas is the need of the hour. Diseases and pests are the main constrains in management for conservation of muga silkworm.. Flacherie, muscardine, uzi and yellow fly are the most common diseases and pests on muga silkworm which cause significant yield loss in the vanya silk industry. The aerial and ground spraying of bio-control insecticides like *Beauveria bassiana* and *Bacillus thuringiensis* to eradicate various kinds of moth caterpillars is an increasingly widespread practice throughout the world. These bio-control agents severely affect the vanya silkworms *ie*. the non target insects through different mode of transmission. Aspergilosis in muga silk moth during "Bhodia" (August) seed crop causes 35-40% loss in seed production. Therefore to understand the main constrains in management for conservation of vanya silk are discussed in the study.

KEY WORDS: Constrain, disease, pest, vanya silkworm.

North East India is considered as hot spot of seri-biodiversity particularly in case of non-mulberry (*vanya*) silk sector which play a significant role in sustainable rural livelihood and poverty alleviation in the country. The vanya silk cultivation is an eco friendly and women friendly occupation that provides high employment, vibrancy to village economies and ideal programme for weaker section of the society. Muga, golden silk produced only in Brahmaputra valley of Assam province in NE Region. The ranges of biological resources including their genetic resources are renewable in nature or in similar *ex- situ* conservation with their proper management can fulfill human needs in larger extent. Anthropogenic climate change is an important issue which needs to be taken seriously in the context of Lepidoptera conservation and pest research (Porter, 1995; Woiwod, 1997; Watt & Woiwod, 1997). The term conservation refers to the preservation, restoration, or protection of the planet's natural resources and ecosystems. Muga silkworm is an insect which needs proper conservation. There are many constrains in conservation of muga silkworm. The abiotic and biotic factors of the environment during different seasons greatly influence the growth and development of muga silkworm in the form of cocoon weight, pupa weight, shell percentage, potential fecundity, reelability and denier of the silk (Chiang, 1985; Yadav, 2000)The aerial and ground spraying of bio-control insecticides like *Beauveria bassiana* and *Bacillus thuringiensis* to eradicate various kinds of moth caterpillars is an increasingly widespread practice throughout the world. These bio-control agents severely affect the muga silkworms i.e. the non target insects through different mode of transmission. Therefore to understand the main constrains in management for conservation of vanya silk are discussed in the study.

MATERIAL AND METHODS

Geography of the study area:

The study was conducted in different muga growing districts of Assam, India. The state experiences a very hot–humid weather during summer with an average temperature of 30°C (max. 38.5°C. min. 7°C). The annual rainfall ranges between 1,500 and 2,600 mm with moderate humidity (75%). The disease survey was conducted in the farmers filed of Goalpara, Kamrup, Jorhat, Golaghat, Sivsagar, Lakhimpur and Dibrugarh during the rearing period and the infected larvae were collected for isolation of the pathogen.

Collection of data:

The diseased larvae showing typical symptoms of muscardine and flacherie disease were collected from muga growing areas for isolation of the pathogens from all the districts. The typical diseased larvae were collected from the rearing sites in sterile polythene bags and brought to the laboratory immediately for isolation of the pathogens. The diseased samples were collected in the different crop seasons viz. Chatua Seed crop (March-Apri) Jethua commercial crop(May-June), Aherua Pre-seed crop (June-July), Bhodia Seed crop (August-September), Katia commercial(October-November) and Jarua Preseed crop (December-February. The diseased cadavers were treated with 70-90% ethyl alcohol for 2 minutes, then 5.25% Sodium Hypochloride for 3-5 minutes, 19% Sadium thiosulphate for 3-5 minutes and later three successive washing with sterile water. The surface sterilized muga silkworms were homogenized aseptically. A loop- full homogenate were streaked on potato dextrose agar and nutrient agar plates and the plates were incubated for 48 hours at 25° ± 2° C and 30° ± 2°C separately. The growths of microbial colonies were observed and mycelium and conidia were studied. Pure culture was maintained for the isolates on potato dextrose agar and nutrient agar slant. At the same time the pests were also collected to know the constrains for conservation of muga silkworm.

RESULTS AND DISCUSSION

Fungal diseases

Three different species of entomogenous fungi viz., *Beauveria bassiana, Aspergillus niger* and *Fusarium moniliforme* are found to cause White muscardine, Aspergillosis and Fusarosis diseases of muga silkworm.

White muscardine

White fluffy and frosty mycelial growth emerging out through inter-segments, lateral as well as ventral sides of whole body, ultimately covering the whole body and appendages. Initially the larvae loose appetite, become inactive and on death, gradually, they become harder and finally mummified (Das, *et al.*, 2007). The infected worms become harder, paler and completely inactive followed by bending of the body dorsally. It dies in about 72-96 hours of infection. Dead worms are compressed, reduced body fluid and spongy with fragile skin. A white encrustation appears round the body becomes laterally compressed, dry, hard, and brittle and, mummified.. Continuous cloudy and foggy weather for 3-4 days, medium temperature (22 ± 1 0C) with high humidity (>80%) are congenial for white muscardine disease.

Aspergillosis

This disease is found in almost all the growing season. White fluffy and frosty mycelial growth emerging out through inter-segments, lateral as well as ventral sides of whole body, ultimately covering the whole body and appendages.

Initially the larvae loose appetite, become inactive and on death, gradually, they become harder and finally mummified (Das, *et al.*, 2007). The infected worms become harder, paler and completely inactive followed by bending of the body dorsally. It dies in about 72-96 hours of infection. Dead worms are compressed, reduced body fluid and spongy with fragile skin. A white encrustation appears round the body becomes laterally compressed, dry, hard, and brittle and, mummified.. Aspergillosis generally infect early instar silkworm. The early instar silkworm becomes inactive and dies without clear morphological symptoms. Late instar silkworm develops black spot at the site of infection and dies due to Aflatoxin produced by the fungus.

Fusarosis

Fusarosis is found to occur severely in the month of Feb-March.. Fusarosis mostly infect 3rd, 4th and early 5th stage silkworm. The infected worms become lethargic and die suddenly. After 24 hrs of dyeing dirty white mycelial growth appear on the cadavars later the infected and died worms turns to black colour.

Though Aspergillosis and Fusarosis may occur in all type of weather but high temperature (30 ± 2 oC) with high humidity (>85%) are congenial for the disease development of infection. These funguses can over winter on soil and plant debris or as epiphytes by producing chlamydospore and on reaching favourable they germinate, multiply, spread and cause infection to considerable ranges. The continuous use of bio-pesticides e.g. Baba also responsible for fungal diseases in muga silkworm.

Flacherie or bacterial disease

Flacherie is a generic name for the syndrome represented by flaccidity of silk worm. This disease infects the alimentary tract of the worms but blood cells, hypodermis and fat bodies also infected. Severe infection can cause yield loss up to 80-90% in summer and rainy seasons. It is a flaccid condition symptomatically showing softness, dullness and lethargicity in the larvae. Occurrence of the disease was in peak during last stage of the worms, *i.e.*, mid 4th to 5th instar and the worms died before spinning. Maximum mortality was reported in February-March, November-December followed by June-July and July-August (CMER&TI & AAU Project progress report, 2007).

Three bacteria associated with flacherie disease are identified as *Bacillus thuringensis, Aeromonas salmonicida* and *Streptococcus bombycis*. Bacterial septicemia (*Bacillus thuringensis*) and Bacterial toxicosis (*Aeromonas salmonicida*) are the two most devastating bacteria. *Streptococcus bombycis is non pathogenic.* (CMER&TI & AAU Project progress report, 2007).

Factors affecting disease development

Sudden fluctuation of weather, *viz.,* temperature, relative humidity and rainfall is the main cause of flacherie disease. High temperature (36 OC and above), high humidity (above 75%) is suitable for disease development. Bio-pesticides e.g using of Bt in the adjacent area accelerate the bacterial diseases of muga silkworm.

Uzifly:

Exorista sorbillans and *Blepharipa zebina* are major pests of muga silkworm. These pests complete their life cycle in muga silkworm and occurred in winter and post winter during pre-seed and seed crop of Jethua commercial brood. It caused the considerable lost of muga sill worm crop loss 20-90 % in pre-seed (Jarua, Dec-Jan) and seed (Chatua, Feb-Mar) crop.

Yellow fly:

The muga cocoons are infested by yellow fly. The fly completely fed on head region of the pupae and emerged from the same by making a hole which is about 1cm diameter.

During the time of conservation of muga silkworm the adjacent area should be free from alternate host of the diseases causing agents and pests. People of the adjacent area should be aware about the knowledge of muga culture along with its enemies. From this study, it is understood that the white muscardine disease pathogen *B. bassiana* might have disseminated from the other crop fields as now a days these bio pesticides are commonly used in tea gardens, rice fields vegetable fields etc. The native strains of *B. bassiana* are not so infective and infection percentage was lower than the commercial strains. It is reported that muscardine diseases in muga silkworm were not found in earlier days (Choudhury, 1981). The bio-pesticides were not available in those days although the native strains of *B. bassiana* were present in soils. Climate change may have also some effect on the infection capability of microbes as pathogens. Climate change is recognized as a major threat to the survival of species and integrity of ecosystems worldwide. The commercial bio-pesticides agents prepared by *B. bassiana*, *B. thuriengiensis* etc. are infective and can easily disseminate by air, water or by other medium. Again, these are applied in the other crop filed very frequently which increase the chance of more dissemination in a wide area. In muga silkworm, effect of pests and diseases also are more intense, being reared outdoor and it affects the economy directly. Hence long term sustainability measures needs to be taken. Conservation measures both in-situ and ex-situ accounts a vital role in maintaining the muga silkworm sustenance.

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Table 1. Various diseases of Muga silk worm and their field occurrence.

Diseases	Field occurrence (%)					
	Season 1 (Dec-Jan)	Season 2 (Feb-Mar)	Season 3 (May-Jun)	Season 4 (Jun-Jul)	Season 5 (Jul-Aug)	Season 6 (Oct-Nov)
White muscardine	38.98	24.00	0.00	0.00	0.00	13.13
Aspergillosis	28.47	0.00	0.00	2.56	11.11	17.19
Fusarosis	23.73	17.65	0.00	0.00	12.44	20.11
Bacillus thuringensi	84.74	81.17	68.18	0.00	72.22	0.00
Aeromonas salmonicida	22.03	11.76	10.60	43.75	16.66	57.81
Uzi fly *E. sorbillans B. zebina*	13.7	23.8	1.2	0.4	0.3	0.2
Yellow fly	0	0	5.0	4.0	0	0

TERRESTRIAL HEMIPTERA (HETEROPTERA) COLLECTED IN SOUTH-EAST ANATOLIA (DIYARBAKIR, MARDIN AND ELAZIĞ PROVINCES) (TURKEY): SECOND LIST

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[Matocq, A., Pluot-Sigwalt, D. & Özgen, İ. 2014. Terrestrial Hemiptera (Heteroptera) collected in South-East Anatolia (Diyarbakır, Mardin and Elazığ provinces) (Turkey): second list. Munis Entomology & Zoology, 9 (2): 884-930**]**

ABSTRACT: The terrestrial true bugs Heteroptera collected in three provinces of the South-East part of Anatolia (Diyarbakır, Mardin, Elazığ) are listed. It is based on a short but intensive collecting trip made in May-June 2010. Two hundred eighty six species and subspecies belonging to 19 families and 178 genera are reported: Ochteridae (1), Saldidae (2), Leptopodidae (1), Tingidae (16), Miridae (103), Nabidae (5), Anthocoridae (5), Reduviidae (12), Aradidae (1), Berytidae (7), Lygaeidae (53), Pyrrhocoridae (2), Stenocephalidae (1), Alydidae (1), Coreidae (10), Rhopalidae (12), Cydnidae (6), Scutelleridae (10), Pentatomidae (37). The species list includes remarks on taxonomy, nomenclature, biology or distribution. Fourteen species are recorded from Turkey for the first time; all of them are mirid plant bugs except three species belonging respectively to anthocorid, reduvid and lygaeid families. Some of them are illustrated.

KEY WORDS: Heteroptera, south-eastern Turkey, Diyarbakır, Mardin, Elazığ, faunistic, Alydidae, Anthocoridae, Aradidae, Berytidae, Coreidae, Cydnidae, Leptopodidae, Lygaeidae, Miridae, Nabidae, Ochteridae, Pentatomidae, Pyrrhocoridae, Reduviidae, Rhopalidae, Saldidae, Scutelleridae, Stenocephalidae, Tingidae.

The Heteroptera fauna of the southeastern part of Turkey is still badly known compared to the one of other parts of Anatolia much more studied and investigated, like Turkish Thrace, Mediterranean, Aegean and Black sea regions, and even Central Anatolia. The recent work of Fent et al. (2011) gave an excellent review of the studies realized in this field. The papers dedicated to the Heteroptera fauna of Turkey are numerous, since the pioneer investigations of Puton (1892) and Puton & Noualhier (1895), followed by Horváth (1901, 1905), Gadeau de Kerville (1939), Hoberlandt (1956), Wagner (1966) and Seidenstücker (1957, 1958, 1961, 1962), until the major contributions of Lodos and Önder and the numerous faunistic studies realized during the last decades (among other: Lodos & Önder, 1982, 1983; Lodos et al., 1998, 2003; Önder et al., 2006; Serban, 2010).

Knowledge of the heteropteran species of the southeastern regions of Turkey is in fact scattered in various papers (such as Wagner, 1959; Linnavuori , 1965; Önder & Adiguzel, 1979; Önder, 1980; Lodos & Önder, 1982; Fent et al., 2010a; Yildirim et al., 2011), or is focused on Heteroptera of economic importance for agriculture (such as Akkaya, 2004; Çinar et al., 2004; Özgen et al., 2005a,b; Bolu et al., 2006). Apparently, southeastern Anatolian provinces have never been seriously prospected.

The present paper, is the continuation of a preliminary investigation done in 2009 (Matocq & Özgen, 2010) listing 58 species and subspecies collected in the Mardin and Siirt Provinces. We list here 286 species and subspecies of terrestrial true bugs caught during a short but intensive collecting trip in May-June 2010, in Diyarbakır, Mardin and Elazığ provinces. Some other specimens given later to the authors for identification were also added to the list. The species previously recorded from Siirt and Mardin (Matocq & Ozgen, 2010) are included. From the sampling made in 2010 was discovered a new species of *Psallus* (Miridae) on *Fraxinus* (Oleaceae), *Psallus inancozgeni* Matocq & Pluot-Sigwalt, 2011. Other possible new or rare Heteroptera species are still studying and will be the purpose of a further paper.

MATERIAL AND METHODS

Investigated area and localities prospected. Sampling was performed in three provinces Mardin, Diyarbakir and Elazığ. The prospecting sites included stations in different environments (urban, rural and sylvan). The name of the localities with the geographic coordinates and altitude in Table 1.

Period of collect. Sampling was carried out from 22 may to 1 June 2010.

Methods for capture. True bugs were mainly collected by hand and visual sampling. Specimens were caught by sweep-netting the herbaceous vegetation, or collected by beating the branches of trees and shrubs over a white net. Tree litter, bark of tree and grassclumps were also investigated. Light trap was not used but in rare occasions we have been able to collect some specimens at night around street lighting. Specimens were killed with ethyl acetate.

Identification material and depositery of the specimens. More than 1000 specimens were collected by the three coauthors, then prepared and labelled. Identifications were performed by the first author using mainly the volumes of "Faune de France" (Wagner & Weber, 1964; Péricart, 1983, 1984, 1987, 1990, 1999, 2010; Moulet, 1995; Derjanschi & Péricart, 2005; Heiss & Péricart, 2007), the volumes on Mediterranean mirid fauna (Wagner, 1974a, b, 1975; Wagner & Weber, 1978), several recent generic revisions (Göllner-Scheiding, 1986, 1987; Drapolyuk, 1993; Matocq, 1993; Rosenzweig, 1997; Chérot, 1997; Lis, 2000, Matocq, 2004; Namyatova, 2009; Matocq & Pluot-Sigwalt, 2012). We have also used the Heteroptera collections in MNHN (Museum national d'Histoire naturelle, Paris) where are housed, among others, the Puton, Noualhier, Gadeau de Kerville and Péricart collections. In several cases, mainly for the specimens belonging to the Anthocoridae, Miridae, Nabidae, Cydnidae, Scutelleridae families, examination of the genitalia was necessary.

Specimens are preserved into three collections: The Fırat University Baskil Vocational School, Elazıg/Turkey), Museum national d'Histoire naturelle (Paris, France), Matocq collection (Paris, France).

Nomenclature and classification are based on the five volumes of the Catalogue of the Heteroptera of the Palaearctic Region (Aukema & Rieger, 1995-2006).

LIST OF SPECIES

Species and subspecies are shortly commented (general distribution, distribution in Turkey in particular in the South region, biological data when known). Only some species considered as new for Turkey are illustrated (Fig. 1).

1. General distribution: information is based on the Catalogue of the Heteroptera of the Palaearctic Region (Aukema & Rieger (1995-2006).

2. Anatolian distribution: data are mainly based on the Catalogue of Turkish Heteroptera by Önder et al. (2006). However, as stated by Fent et al. (2011), some of these data could be not entirely reliable or called into question, and they are given with caution especially for the groups for which examination of genitalia is necessary. Other more reliable sources have been also used, in particular the various volumes of the Faune de France, in which precise ascertained Anatolian localities can be occasionally found for several species. When possible, species distribution in the Southeast part of Turkey and adjacent provinces is precised. Anatolian localities found in the literature are given below only under the name of the corresponding province, not under the name of the locality. For example, "Namrun" and "Akbès" [= Ekbaz], two localities frequently cited in the ancient literature, are respectively indicated by "Mersin" and "Hatay".

3. Biological data: host plants or preys when known are mainly taken from different authors in the serie Faune de France (Péricart, 1983, 1984, 1987, 1990, 1999, 2010; Moulet, 1995; Derjanschi & Péricart, 2005; Heiss & Péricart, 2007).

In the list below, *asterisks indicate species not recorded from Turkey in the Palaearctic Catalogue (Aukema & Rieger, 1995-2006), even if subsequent papers recorded recently the species from this country; references of these papers are therefore given.

I. - NEPOMORPHA

Family OCHTERIDAE Kirkaldy, 1906 (1815)

Ochterus (Ochterus) marginatus marginatus (Latreille, 1804). ELAZIĞ (Station 11): 1 female.

Widely distributed (Euro Mediterranean, African, Asian regions) (see Polhemus, 1995). TURKEY: reported from Adana, Elazığ, Nigde (Önder et al., 2006; see also Fent et al., 2011).

II. – LEPTOPODOMORPHA

Saldoidea

Family SALDIDAE Amyot & serville, 1843

Saldula sp. SIIRT (Merkez) (Matocq & Özgen, 2010).

Saldula pallipes (Fabricius, 1794): DIYARBAKIR (Hazro-düzevler), 3-VIII-2010, M. Mehmet & I. Özgen leg.: 2 males.

Holarctic (Lindskog, 1995a). TURKEY: cited from several provinces, none located in southeast Anatolia (Önder et al., 2006; Fent et al., 2011). The most ubiquitous species of the genus (Péricart, 1990).

Leptopodoidea

Family LEPTOPODIDAE Brullé, 1836

Subfamily LEPTOPODINAE Brullé, 1836

Patapius spinosus (Rossi, 1790). SIIRT (Aydınlar) (Matocq & Özgen, 2010).

Mediterranean extending to Middle Asia (Lindskog, 1995b; Péricart, 1990). TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979); Adana, Bursa, Izmir (Önder et al., 2006).

III. – CIMICOMORPHA

Tingoidea

Family TINGIDAE Laporte, 1832

Subfamily TINGINAE, Laporte de Castelnau, 1832

Agramma atricapillum (Spinola, 1837). DIYARBAKIR (çimar-Kuyuluhöyük), 6-VII-2010, M. Duman & I. Özgen leg.: 1 specimen (sex unknown).

Ponto-Mediterranean extending to Middle East and Mongolie (Péricart, 1983; Péricart & Golub, 1996). TURKEY: probably widely distributed according to Péricart (1983) who reported the species from various provinces including Adana, Diyarbakir, Mardin, Sanliurfa, Kahramanmaras provinces; see also Seidenstücker (1954), Hoberlandt (1956), Önder et al. (2006).

Catoplatus crassipes (Fieber, 1861). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 3, 4, 7, 11, 12, 13, 15, 16): several specimens.

Ponto-East Mediterranean (Péricart & Golub, 1996). TURKEY: widespread (Péricart, 1983; Önder et al., 2006); in South East part of Anatolia: Diyarbakir, Gaziantep, Malatya, Mardin, Sanliurfa, Kahramanmaras.

Catoplatus hilaris Horváth, 1906. DIYARBAKIR, ELAZIĞ (Stations 11, 17): 6 specimens.

Known from Iran, Near East, Transcaucasia, Turkey (Péricart & Golub, 1996). TURKEY: mainly reported from southeastern provinces: Gaziantep, Hakkäri, Hatay, Kahramanmaras, Mardin (Seidenstücker, 1954; Péricart, 1983; Önder et al., 2006).

Copium teucrii teucrii (Host, 1788). DIYARBAKIR (Stations 6, 16): 3 females.

Euro-Mediterranean extending to Sahara and Iran (Péricart & Golub, 1996). TURKEY: reported from several provinces in Turkey (Péricart & Golub, loc.cit.), including Gaziantep, Malatya, Hakkâri, Elazığ, Siirt. A gallicolous species on *Teucrium polium* and *T. montanum* (Lamiaceae) (Péricart, 1983).

Dictyla echii (Schrank, 1781). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 8, 13, 16): several specimens.

Nearly Holopalaearctic (Péricart & Golub, 1996). TURKEY: widely distributed (Önder et al., 2006). Mainly on Boraginaceae (Péricart, 1983). Considered as a potential agent of biological control against *Echium plantagineum* (Boraginaceae) an invasive weed pastures in Europe (see Neal & Schaefer, 2000).

Dictyla nassata (Puton, 1874). DIYARBAKIR, ELAZIĞ (Stations 4, 7, 8, 9): several specimens.

Ponto-Holomediterranean, also present in Africa, India, meridional China (Péricart & Golub, 1996). TURKEY: widespread in most parts of Anatolia (Péricart, 1983; Önder et al., 2006). A xerophilous species associated with various Boraginaceae (Péricart, 1983).

Dictyla sima Seidenstücker, 1975. DIYARBAKIR, ELAZIĞ (Stations 8, 9, 18): 12 males, 5 females.

TURKEY: only known from Turkey (Péricart & Golub, 1996); recorded from the provinces of Ankara, Nigde (Seidenstücker, 1975), Tokat and Malatya (Péricart, 1983). Péricart (1983) expressed some doubts about the validity of the species which could represent a form of *D. echii* (Schrank, 1781); however, at the same time, he added that both taxa are quite distinct in Turkey.

* ***Elasmotropis testacea selecta*** (Horváth, 1891). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 1, 4, 14, 16): several specimens.

Known from Azerbaijan, Armenia, Georgia, Iran, Syria (Péricart & Golub, 1996) and not recorded from Turkey. **New for TURKEY**. According to Péricart (1983) and Péricart & Golub (1996), this subspecies shows a more oriental and restricted distribution compared to the widespread nominal subspecies *E. testacea testacea* (Herrich-Scheffer, 1830) (Central Europe and Ponto-Mediterranean region). In southeastern Anatolia, the two forms (nominal and subspecies) could be sympatric. On various *Echinops* (Asteraceae) (Péricart, 1983).

Hyalochiton multiseriatus (Reuter, 1888). DIYARBAKIR (Station 4): 4 specimens.

Known from Armenia, Iran, Iraq, Syria, Turkey, Israel (Péricart & Golub, 1996). TURKEY: widespread in Turkey and recorded among other provinces from Gaziantep and Hakkäri (Péricart, 1983); cited from central, south and south east Anatolia (Seidenstücker, 1957 ; Önder et al., 2006). On *Phlomis* (Lamiaceae) (Seidenstücker, 1957).

Kalama lugubris (Fieber, 1861). ELAZIĞ (Station 7): 1 male.

East Mediterranean (Péricart, 1983; Péricart & Golub, 1996). TURKEY: recorded from various provinces, Bursa, Gaziantep, Hatay, Istanbul, Mersin, Osmaniye (Péricart, 1983); from Istanbul (Önder et al., 2006) as *Dictyonota lugubris* (Fieber, 1861). According to Péricart (1983), this Mediterranean species is apparently rare and seems to form in Anatolia several local "races".

Monosteira unicostata (Mulsant & Rey, 1852). ELAZIĞ, MARDIN (Stations 10, 15): several specimens.

Mediterranean and Black see regions, and Middle East (Péricart & Golub, 1996). TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979); widely distributed (Önder et al., 2006). A well known common pest to fruit trees (*Prunus*, *Pyrus*, etc…) (Péricart, 1983; Neal & Schaefer, 2000).

Physatocheila municeps Horváth, 1903. DIYARBAKIR, ELAZIĞ (Stations 7, 16): 5 specimens.

Distributed in Maghreb, South Balkans, Asia Minor (Turkey, Syria, Lebanon, Jordania) (Péricart & Golub, 1996). TURKEY: Among other Anatolian provinces, Péricart (1983) recorded the specie from Mardin and Bingöl; widespread in Turkey according Önder et al. (2006). Uusually collected on *Prunus amygdalus* and *P. armeniaca* (Rosaceae) in Turkey (Péricart, 1983).

Stephanitis* (*Stephanitis*) *oshanini Vasiliev, 1935. DIYARBAKIR, ELAZIĞ, MARDIN (Stations 2, 7, 13, 14, 15): 23 specimens males and females.

S. oshanini can be easily confused with *Stephanitis pyri* (Fabricius, 1775) a very similar species. Moreover, it has been synonymized by Kiritschenko (1955) and rehabilited only recently as a valid species by Golub (2002); Golub recognized that former records of *S. pyri* from Tanscaucasia and Middle East, belong to *S. oshanini* (Hoberlandt 1953: Iraq; Hoberlandt, 1956 and Štusák, 1959: Turkey). The known distribution of *oshanini* is the following (see Golub, 2002; Lis, 2002, Kment & Jindra, 2005): Afghanistan, Armenia, Azerbaijan, Georgia, Iran, Iraq, Israel (Palestine), Kirgizia, Tadzhikistan, Turkey (Asian part), Turkmenistan, and Uzbekistan. TURKEY: Diyarbakir (Önder & Adiguzel, 1979) as *Stephanitis pyri* (Fabricius, 1775); Gaziantep and Osmaniye (Önder et al., 2006). It is not known if *S. oshanini* is a pest as *S. pyri,* the most important tingid pest in Europe with *Monosteira unicostata* (Péricart, 1983). In the Péricart collection preserved in MNHN, a specimen from Israel is labelled "on *Crataegus aromia*" (Rosaceae).

Tingis* (*Tingis*) *angustata (Herrich-Schaeffer, 1838). DIYARBAKIR (Station 4): several specimens.

Euro-Mediterranean region and Transcausasia (Péricart & Golub, 1996). TURKEY: widespread (Péricart, 1983; Önder et al., 2006). Collected on *Anthemis* (Asteraceae) in Bulgaria by Štusák (Péricart, 1983).

Tingis* (*Tingis*) *auriculata (Costa, 1847). DIYARBAKIR (Station 5): 1 specimen.

Mediterranean and Black See regions, Tanscaucasia, Iran, Middle East (Péricart & Golub, 1996). TURKEY: widespread (Péricart, 1983; Önder et al., 2006). The only known species of the genus living on various Apiaceae (Umbelliferae) (Péricart, 1983).

Tingis* (*Tropidocheila*) *hellenica hellenica (Puton, 1877). DIYARBAKIR (Station 16): 1 female.

East Mediterranean and Black See regions (Péricart & Golub, 1996). TURKEY: widely distributed and also recorded from southeastern Turkey (Diyarbakir, Mardin) (Péricart, 1983; Önder et al., 2006). Mainly on Lamiaceae.

Miroidea
Family MIRIDAE Hahn, 1833
Subfamily DERAEOCORINAE Douglas & Scott, 1865
Tribe Deraeocorini Douglas & Scott, 1865

Alloeotomus cyprius (Wagner, 1953). DIYARBAKIR (Station 2); SIIRT (Aydnlar) (Matocq & Özgen, 2010): 35 males, 6 females.

Only known from Cyprus and Turkey (Kerzhner & Josifov 1999). TURKEY: Önder et al. (2006) reported the species as *Deraeocoris cyprius* Wagner, 1953 from Hatay and Mardin. Kerzhner & Matocq (1997) transferred the species *cyprius* Wagner to the genus *Alloeotomus*. All the known *Alloeotomus* species live on *Pinus* spp. (Pinaceae) (Schuh, 1995) but it is assumed that they are predator, as the other Deraeocorinae (Wheeler, 2001).

Deraeocoris* (*Camptobrochis*) *pallens pallens (Reuter, 1904). SIIRT (Merkez) (Matocq & Özgen, 2010).

Known from south and southeastern Anatolia, and from Iran, Iraq, Syria, Israel, Afganistan. (Kerzhner & Josifov 1999). TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979); from Diyarbakir, Gaziantep, Hatay, Kahramanmaras, Kilis, Mardin among other provinces (Wagner, 1954b; Hoberlandt, 1956; Önder et al., 2006). In Israel, *D. pallens* feeds on immature stages of the whitefly *Bemisia* (Aleyrodidae) (Wheeler, 2001).

Deraeocoris* (*Camptobrochis*) *punctulatus Fallén, 1807). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 4, 6, 7, 12): several specimens; SIIRT (Aydnlar) (Matocq & Özgen, 2010).

Holarctic (Kerzhner & Josifov 1999). TURKEY: widely distributed (Hoberlandt, 1956; Önder et al., 2006). Preys on whitefly and thrips (Wheeler, 2001).

Deraeocoris (Camptobrochis) serenus (Douglas & Scott, 1868). ELAZIĞ (Station 8): 2 females.

Mediterranean extending to Central Asia (Kerzhner & Josifov, 1999). TURKEY: Diyarbakir (Önder & Adiguzel, 1979); widely distributed (Hoberlandt, 1956; Önder et al., 2006). Preys on whitefly and thrips (Wheeler, 2001) and collected on various plants (*Quercus*, *Juniperus, Olea*, *Salsola*, *Sarothmanus*, *Artemisia*) (Carapezza, 1997).

Deraeocoris (Deraeocoris) rutilus (Herrich-Schäffer, 1838). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 1, 2, 4, 7, 12, 13, 15): several specimens.

Ponto-Mediterranean (Kerzhner & Josifov, 1999). TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979); widely distributed (Hoberlandt, 1956; Önder et al., 2006).

Deraeocoris (Deraeocoris) trifasciatus (Linné, 1767). ELAZIĞ (Stations 7, 8): 3 males, 2 females.

Euro-Mediterranean species; also known from Turkey and Georgia (Kerzhner & Josifov, 1999). TURKEY: reported from several provinces including Elazığ (Önder et al., 2006).

Deraeocoris (Knightocapsus) lutescens (Schilling, 1837). ELAZIĞ (Station 8): 1 male.

Widely distributed (Europe, North Africa, Near East) (Kerzhner & Josifov, 1999). TURKEY: reported from Ege, Marmara and Black Sea regions (Önder et al., 2006). Lives on various trees. In Iran, collected on *Ulmus* (Ulmaceae) and *Quercus* (Fagaceae) (Linnavuori, 2009).

Subfamily BRYOCORINAE Kirkaldy, 1903
Tribe Dicyphini Reuter, 1883

* ***Macrolophus epilobii*** V.G. Putshkov, 1978. MARDIN (Station 15): 3 females collected on *Epilobium* sp. (Onagraceae) along a small brook.

Known from Azerbaijan and Armenia (Kerzhner & Josifov, 1999). Recently collected in Iran (Linnavuori, 2007). **New for TURKEY**. Several species of *Macrolophus* show well known predatory tendencies, some species preying on aphids, thrips, whitefly. Other species are strictly phytophagous, but most are omnivorous (Wheeler, 2001). Feeding habits of *M. epilobii* are unknown; however it is collected on *Epilobium hirsutum* (Putshkov V.G., 1978; Linnavuori, 2007).

Macrolophus melanotoma (A. Costa, 1853). MARDIN (Station 13): 1 female.

Euro-Mediterranean (Kerzhner & Josifov, 1999). TURKEY: cited from Ankara, and also, as "*M. caliginosus* Wagner, 1950" a synonym (see Carapezza, 1997), from several provinces including Diyarbakir, Hatay, Mardin, Van (Önder et al., 2006). In Tunisia, collected on *Inula* (Asteraceae) (Carapezza, 1997). Predator on aphids, leafoppers, thrips and whitefly (Wheeler, 2001).

Macrolophus pygmaeus (Rambur, 1839).). DIYARBAKIR, MARDIN (Stations 1, 3, 15):): several specimens; SIIRT (Merkez) (Matocq & Özgen, 2010.

Widespread in Europe, North Africa, Near and Middle East (Kerzhner & Josifov 1999). TURKEY: widely distributed, including Gaziantep, Hatay, Kahramanmaras, Kilis provinces; Önder et al. (2006) cited the species under its previous name "*M. nubilus* (Herrich-Schäffer, 1835)". The original name *Capsus nubilus* H.S. being a junior primary homonym of *Capus nubilis* Say, 1832, the name was turned into *M. pygmaeus* (Rambur, 1839). Occasionally injures tomato flowers; however, it is also a predator on aphids and whitefly (Wheeler, 2001). The species can be found on *Saponaria* (Caryophyllaceae), *Geranium* (Geraniaceae), *Salvia* and *Stachys* (Lamiaceae) (Schuh, 1995).

Subfamily ISOMETOPINAE Fieber, 1860
Tribe Isometopini Fieber, 1860

Isometopus diversiceps Linnavuori, 1962. MARDIN (Station 13): 1 male, 1 female.

TURKEY: only known from Turkey (Kerzhner & Josifov, 1999); described from the Hatay province, it is also cited from Gaziantep (Önder et al., 2006). Lives on various trees (Schuh, 1995). As other Isometopinae, the two collected *Isometopus* species could be predator of scale insects.

Isometopus mirificus Mulsant & Rey, 1879. DIYARBAKIR (Station 3): 1 male.

Known from Bulgaria, France, Greece, Hungary, Italy, Romania, Ukraine, Yougoslavia, Turkey (Kerzhner & Josifov, 1999). TURKEY: reported from Izmir and Manisa provinces (Önder et al., 2006).

Subfamily MIRINAE Hahn, 1833
Tribe Mirini Hahn, 1833

Brachycoleus bolivari Horváth, 1901. DIYARBAKIR, MARDIN (Stations 4, 12, 16, 17): several specimens.

Only known from Turkey, Greece, Israel (Kerzhner & Josifov, 1999). TURKEY: seems restricted to south Turkey: Adana, Bingöl, Hatay, Kahramanmaras (Seidenstücker, 1962; Lodos et al., 2003; Önder et al., 2006).

Brachycoleus decolor Reuter, 1887. DIYARBAKIR (Station 16): several specimens.

Euro-Mediterranean extending to Siberia and Central Asia (Kerzhner & Josifov 1999). TURKEY: reported from Hatay and Kahramanmaras provinces among other (Önder et al., 2006).

Brachycoleus lineellus Jakovlev, 1884. DIYARBAKIR, MARDIN (Stations 4, 12): several specimens.

Known from Turkey, Armenia, Georgia, Iran, Iraq, Syria, Israel (Kerzhner & Josifov 1999). TURKEY: cited from various provinces, including Nigde, Kayseri (Seidenstücker, 1958), Gazianteps, Kilis (Önder et al., 2006). On *Artemisia* (Asteraceae) and *Phlomis* (Lamiaceae) (Seidenstücker, 1958).

Brachycoleus thoracicus Puton, 1892. DIYARBAKIR, ELAZIĞ, MARDIN (Stations 4, 11, 12): several specimens.

Only known from Iraq and Turkey (Hatay) (Kerzhner & Josifov 1999). TURKEY: mainly cited from south and southeastern Turkey (Diyarbakir, Gaziantep, Hatay, Kahramanmaras, Mardin) (Lodos et al., 2003; Önder et al., 2006).

Calocoris roseomaculatus angularis (Fieber, 1864). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 6, 9, 12): 3 males, 4 females.

Ponto-Mediterranean (Kerzhner & Josifov, 1999). Recently recorded from Iran (Linnavuori, 2009). TURKEY: according to Önder et al. (2006) "*C. roseomaculatus* (De Geer, 1773)" is everywhere distributed; moreover, these authors cited also the species as "*C. angularis*" from numerous provinces including Elazığ, Gaziantep, Hatay. Rosenzweig (1997) revised the *Calocoris* complex and he concluded that *C. roseomaculatus* (De Geer, 1773) is a polytypic species including four subspecies.

* ***Calocoris roseomaculatus saucius*** Linnavuori, 1951. DIYARBAKIR, ELAZIĞ (Stations 4, 7, 8): 6 males, 10 females collected by sweeping herbaceous vegetation.

Known from Iraq, Iran, Israel (Kerzhner & Josifov, 1999). **New for TURKEY**. *C. roseomaculatus saucius* can be distinguished from the other subspecies by the coloration (pink color more pronunced), a smaller size and the genitalia.

Charagochilus gyllenhalii (Fallén, 1807). MARDIN (Station 13): 1 male; SIIRT (Aydınlar) (Matocq & Özgen, 2010).

Holopalaearctic (Kerzhner & Josifov, 1999). TURKEY: cited from various provinces including Hatay, Kahramanmaras, Malatya (Önder et al., 2006). On *Galium* (Rubiaceae) (Schuh, 1995).

Closterotomus kroesus (Seidenstüker, 1977). DIYARBAKIR (Stations 6, 17): 5 males, 3 females.

TURKEY: only known from south Turkey (Kerzhner & Josifov, 1999) and recorded from Adana, Hatay, Kahramanmaras, Mersin (Seidenstücker, 1977). On Apiaceae (Seidenstücker, 1977).

Closterotomus trivialis (A. Costa, 1853). DIYARBAKIR, ELAZIĞ (Stations 6, 7): 3 males, 7 females.

Holomediterranean (Kerzhner & Josifov, 1999). TURKEY: cited as *Calocoris trivialis* (Costa) from several provinces, none in southeastern part of Anatolia (Önder et al., 2006). Known as an occasional pest on citrus and olive trees in the Mediterranean region (Wheeler, 2001).

* ***Cyphodema humbaba*** Linnavuori, 1984. MARDIN (Station 12): 1 male.

Only known from Iraq (Kerzhner & Josifov, 1999). **New for TURKEY**. In Iraq, collected in "mountain meadows" by Linnavuori.

Cyphodema instabilis (Lucas, 1849). DIYARBAKIR, ELAZIĞ (Stations 11, 16, 17): 1 male, 3 females.

Holomediterranean (Kerzhner & Josifov, 1999). TURKEY: cited from various provinces (Horváth, 1901; Lodos et al., 2003; Önder et al., 2006). On *Helianthemum* (Carapezza, 1997).

* ***Cyphodema rubrica*** Seidenstücker, 1954. DIYARBAKIR (Station 3): 3 males collected by sweeping herbaceous vegetation.

Only known from Syria and Iraq (Kerzhner & Josifov 1999). TURKEY: it was cited from Istanbul province (Önder et al., 2006), however this record needs verification. Seidenstücker (1954) decribed the species from Syria (Baniyas), he found it on *Hypericum russeggeri* (Clusiaceae).

Grypocoris (Grypocoris) fieberi Douglas & Scott, 1868. DIYARBAKIR, ELAZIĞ (Stations 3, 4, 6, 11, 17): several specimens.

East Mediterranean (Azerbaijan, Turkey, Iran, Syria, Israel) (Kerzhner & Josifov 1999). TURKEY: reported from several provinces, including Diyarbakir, Elazığ, Gaziantep, Kahramanmaras, Siirt, Van (Önder et al., 2006).

Horistus (Primihorisrus) orientalis (Gmelin, 1790). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 3, 6, 7, 8, 9, 12): several specimens.

Holomediterranean; in Asia, only known in Turkey and Israel (Kerzhner & Josifov, 1999). TURKEY: recorded from Adana, Ankara, Bursa, Gaziantep, Kayseri, Konya (Chérot, 1997); not cited by Önder et al. (2006).

Liocoris tripustulatus (Fabricius, 1781). DIYARBAKIR, MARDIN (Stations 13, 16): several specimens.

Widely distributed in Europe and Asia (Kerzhner & Josifov 1999). TURKEY: widespread (Önder et al., 2006). Specialized on inflorescences of herbs; feeds on the buds and fruits of *Urtica* sp. (Schuh, 1995; Wheeler, 2001; Linnavuori, 2009).

Lygus gemellatus gemellatus (Herrich-Schaeffer, 1835). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 2, 12, 15): several specimens; SIIRT (Merkez) (Matocq & Özgen, 2010.

Widely distributed in Europe, North-Africa, Asia (Kerzhner & Josifov 1999). TURKEY: cited as *Exolygus gemellatus* from numerous provinces, including Diyarbakir and Elazığ (Önder et al., 2006). On *Artemisia* (Asteraceae) and *Ononis* (Fabaceae) (Schuh, 1995). *Lygus* bugs are also facultative predator (Wheeler, 2001).

Lygus pratensis (Linné, 1758). DIYARBAKIR, MARDIN (Stations 1, 4, 13, 16): several specimens.

Widely distributed in Europe and Asia (Kerzhner & Josifov 1999). TURKEY: recorded by Hoberlandt (1956); reported as *Exolygus pratensis* (L.) from Diyarbakir (Önder & Adiguzel, 1979) and from most parts of Turkey (Önder et al., 2006). Wheeler (2001) indicated that the species is considered as an olive pest in Turkey, but he added that Önder (1972) was unable to find the species from olive trees. Collected on various plants (Asteraceae, Euphorbiaceae, Fabaceae, Lamiaceae, Polygonaceae, Solanaceae) (Schuh, 1995).

Phytocoris sp. SIIRT (Aydnlar) (Matocq & Özgen, 2010).

A damaged specimen unfit to identification.

Phytocoris (Exophytocoris) parvulus Reuter, 1880. DIYARBAKIR, MARDIN (Station 2, 14): 8 females.

Euro-Mediterranean (Kerzhner & Josifov, 1999). TURKEY: reported from three western provinces (Önder et al., 2006).

* ***Phytocoris (Knetocoris) ulmi*** (Linné, 1758). DIYARBAKIR (Stations 3, 17): 1 male, 1 female.

Widely distributed in Europe; in Asia, only known from Azerbaijan, Armenia, Iraq (Kerzhner & Josifov 1999). TURKEY: it is however reported by Lodos *et al.* (2003) and Önder et al. (2006) from five Anatolian provinces, none of them in the southeastern region. The large genus *Phytocoris* being in need of revision, these records should be verified. On Fagaceae (*Quercus*), Rosaceae (*Rubus*), Salicaceae (*Salix*) (Schuh, 1995).

Phytocoris (Leptophytocoris) extensus Reuter, 1904. DIYARBAKIR (Station 6): 1 specimen.

TURKEY: restricted to Turkey (Kerzhner & Josifov, 1999) and only known from two provinces: Izmir (Hermos river) (Reuter, 1904) and Aydin (Madran) (Wagner, 1976). Wagner cited also the locality "Bordy" (not found by us).

* ***Phytocoris (Stictophytocoris) meridionalis*** Herrich-Schäffer, 1835. MARDIN (Station 13): 2 males.

Mediterranean and widely distributed; in Asia restricted to Georgia and (?)Iraq (Kerzhner & Josifov 1999). TURKEY: it is however cited from Anatolia (Kahramanmaras) by Lodos et al. (2003) Önder et al. (2006); these records need verification. Lives usually on *Quercus* (Fagaceae) and *Corylus* (Betulaceae) (Reichling, 1985).

Polymerus (Poeciloscytus) vulneratus (Panzer, 1806). SIIRT (Merkez) (Matocq & Özgen, 2010).

Holopalaearctic (Kerzhner & Josifov, 1999). TURKEY: widespread but not cited from southeastern provinces (Hoberlandt, 1956; Önder et al., 2006). A pest of alfalfa seed crops during warm years in Hungary (Wheeler, 2001). In Iran collected on *Galium* (Linnavuori, 2009).

* ***Rauniella ishtar*** (Linnavuori, 1984). DIYARBAKIR, ELAZIĞ (Stations 3, 7, 11): 7 males, 13 females collected by sweeping herbaceous plants.

Only known from Iraq (Kerzhner & Josifov 1999). **New for TURKEY**. Originally described in the genus *Calocoris*, Rosenzweig (1997), erected the new genus *Rauniella* for the species.

Rhabdomiris striatellus wagneri Kerzhner & Schuh 1998. Station 8: several specimens on *Quercus* (Fagaceae).

TURKEY: the subspecies is only known from Turkey (Ankara province) (Kerzhner & Josifov 1999). Not cited by Onder et al. (2006).

Tribe Herdoniini Distant, 1904

Camponotidea fieberi Reuter, 1879. DIYARBAKIR, ELAZIĞ (Stations 4, 6, 7, 9, 16, 17): several specimens.

East Mediterranean: Greece, Turkey, Iraq, Israel(?) (Kerzhner & Josifov, 1999); recently recorded from Iran (Linnavuori, 2009). TURKEY: widespread (Hoberlandt, 1956; Önder et al., 2006) and in southern Anatolia cited from Adiyaman and Hatay provinces (Hoberlandt & Jordan, 1944), Mersin (Seidenstücker, 1958). On *Salvia* (Lamiaceae) and *Vicia* (Fabaceae) (Seidenstücker, 1958).

Tribe Stenodemini China, 1943

Stenodema (Brachystira) calcarata (Fallén, 1807). DIYARBAKIR (Stations 2, 4, 6): several specimens.

Holopalaearctic (Kerzhner & Josifov, 1999). TURKEY: cited from Mersin (Seidenstücker, 1961), from Diyarbakir (Önder & Adiguzel, 1979); widespread in Anatolia (Önder et al., 2006). On Fagaceae (*Quercus, Ononis*) (Schuh, 1995).

Stenodema (Stenodema) turanica (Reuter, 1904). SIIRT (Merkez) (Matocq & Özgen, 2010).

East Mediterranean and Irano-Turanian species extending to China (Kerzhner & Josifov, 1999). TURKEY: cited from Diyarbakir (Önder & Adiguzel, 1979); widespread in Anatolia (Önder et al., 2006).

Trigonotylus pulchellus (Hahn, 1834). SIIRT (Merkez) (Matocq & Özgen, 2010): 3 males, 3 females.

Palaearctic (Kerzhner & Josifov, 1999). TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979); widely distributed and cited in particular, in south east part of Anatolia, from Diyarbakir, Gaziantep, Hatay, Kahramanmaras, Osmaniye cited from Diyarbakir (Önder et al., 2006). On *Ononis* (Fabaceae), *Corynephorus*, *Cynodon* (Poaceae) (Schuh, 1995); a phytophagous and also occasional predatory mirid as other representatives of the genus (Wheeler, 2001).

* ***Trigonotylus ruficornis*** (Geoffroy, 1785). DIYARBAKIR (Station 5): 1 female; SIIRT (Merkez) (Matocq & Özgen, 2010).

The species is widely distributed in Europe. According to Kerzhner & Josifov (1999) the Asian records (from Turkey, Cyprus, Iran, Israel, Syria) need confirmation; records from Transcausacia and east Asia are based on misidentification. TURKEY: we can confirm here the presence of the species in southeastern Anatolia (Diyarbakir and Siirt provinces). The previous records must be confirmed: Hoberlandt (1956: Edirne, Ankara); Önder & Adiguzel (1979: Diyarbakir); Önder et al. (2006: numerous provinces). Usually collected on Poaceae (*Corynephorus*, *Cynodon*) (Schuh, 1995).

Trigonotylus tenuis Reuter, 1893. ELAZIĞ (Station 11): 1 specimen (lost).

Widely distributed (South Europe, North Africa, Middle East (Kerzhner & Josifov, 1999). TURKEY: reported as *T. pallidicornis* Reuter, 1899 (now a synonym) from the Ankara province (Önder et al., 2006). On Poaceae (*Chloris*, *Cynodon*, *Eleusine*) (Schuh, 1995). A phytophagous and predatory mirid (Wheeler, 2001).

Subfamily ORTHOTYLINAE Van Duzee, 1916
Tribe Halticini A. Costa, 1853

Barbarosia decalvata (Seidenstücker, 1962). ELAZIĞ (Station 7): several specimens (brachypterous).

TURKEY: only known from Turkey (Ankara and Nigde provinces) (Kerzhner & Josifov 1999). According to Seidenstücker (1962), it lives on grass.

* ***Halticus saltator*** (Geoffroy, 1785). MARDIN (Station 15): several specimens.

Widely distributed in Europe; in Asia, only cited from Kazakhstan (Kerzhner & Josifov, 1999). TURKEY: Önder et al. (2006) reported the species from Izmir province. Known to cause possible foliar chlorosis on bean, potato, phlox (Wheeler, 2001).

Orthocephalus fulvipes Reuter, 1904. DIYARBAKIR, MARDIN (Stations 5, 12): several specimens.

Mediterranean (Kerzhner & Josifov, 1999). TURKEY: reported by Önder et al. (2006) and other authors as *O. tenuicornis* (Mulsant & Rey, 1852), a junior primary homonym of *Capsus tenuicornis* Say, 1832 (see Kerzhner & Josifov, 1999); cited among other provinces from Gaziantep and Sanliurfa.

Piezocranum corvinum Puton, 1895. DIYARBAKIR (Station 6): 1 male.

Known from Yugoslavia (Serbia, Montenegro), Turkey, Iran, Irak (Kerzhner & Josifov, 1999). TURKEY: described from Gaziantep and recorded from Adana, Agri, Erzurum, Kahramanmaras provinces (Önder et al., 2006).

Platyporus dorsalis Reuter, 1890. DIYARBAKIR, ELAZIĞ (Stations 6, 7): 3 females.

Known from Armenia, Iran, Turkey (Kerzhner & Josifov, 1999). TURKEY: described from Igdir, widely distributed according to Önder et al. (2006); in South Anatolia cited from Kahramanmaras province; and from Nigde and Adana (Seidenstücker, 1958).

Strongylocoris niger (Herrich-Schäffer, 1835). ELAZIĞ (Station 11): 4 females.

Widely distributed in Europe and Asia (Kerzhner & Josifov, 1999). TURKEY: reported from Edirne and Kars provinces (Hoberlandt, 1956; Önder et al., 2006). On Apiaceae (*Meum*, *Peucedanum*, *Falcaria*) (Rieger, 1996).

Tribe Orthotylini Van Duzee, 1916

* ***Brachynotocoris cyprius cyprius*** Wagner, 1961. MARDIN (Station 14): several specimens collected on olive trees (*Olea europaea*, Oleaceae).

Known from Cyprus, Iraq, Israel, Jordan; not from Turkey (Kerzhner & Josifov, 1999). TURKEY: however, the subspecies is cited from four provinces, including Gaziantep and Hatay (Önder et al., 2006). Also recorded from olive tree in Israel by Linnavuori (1961).

Dryophilocoris (Camarocyphus) persimilis (Puton, 1895). ELAZIĞ (Station 8): 1 male.

TURKEY: only known from Turkey and only recorded from the Hatay province by Kerzhner & Josifov (1999); however Seidenstücker (1958) recorded the species from the Konya province, and Önder et al. (2006) from nine other Anatolian provinces, none in southeastern regions. On *Quercus* (Seidenstücker, 1958). Predation is common within the genus (Wheeler, 2001).

Globiceps (Globiceps) sphaegiformis (Rossi, 1790). DIYARBAKIR (Stations 3, 4): 2 male, 1 female.

Widely distributed in Europe; in Asia, recorded from Azerbaijan, Cyprus, Georgia, Turkey (Kerzhner & Josifov, 1999). TURKEY: reported from numerous provinces, none in southeastern Anatolia (Önder et al., 2006). On *Quercus* and *Fagus* (Fabaceae) (Schuh, 1995). Predation is common within the genus (Wheeler, 2001).

Globiceps (Kelidocoris) syriacus syriacus Wagner, 1969. DIYARBAKIR (Station 17): 1 male, 1 female.

Only known from Turkey, Iraq, Syria (Kerzhner & Josifov, 1999). TURKEY: described from Mersin and reported from Hatay and Mugla provinces (Wagner, 1969; Önder et al., 2006).

Orthotylus* (*Parapachylops*) *junipericola armoricanus Ehanno & Matocq, 1990 or ***O.* (*P.*) *junipericola balcanicus*** Josifov, 1974. SIIRT (Aydnlar) (Matocq & Özgen, 2010).

The two subspecies cannot be accurately distinguished. Carapezza (1997) has shown that both possess very similar habitus and genitalia. Lives on Cupressaceae.

* ***Pseudoloxops sangrudanus*** Linnavuori, 2006. SIIRT (Aydınlar) (Matocq & Özgen, 2010).

Recently described from Iran and collected on trees in mountain forests (Linnavuori, 2006, 2009). TURKEY: only known from Siirt province. Predation is common within the genus (Wheeler, 2001).

* ***Pseudoloxops coccineus*** (Meyer-Dür, 1843). DIYARBAKIR (Stations 1, 2): numerous males and females collected on *Fraxinus* sp. (Oleaceae).

Euro-Mediterranean; in Asia: only reported from Armenia and Israel (Kerzhner & Josifov 1999). TURKEY: recorded from Diyarbakir (Önder & Adiguzel, 1979); from Ankara and Izmir provinces (Önder et al., 2006). Lives on *Fraxinus* spp. (Schuh, 1995).

Reuteria sp. SIIRT (Merkez) (Matocq & Özgen, 2010).

The *Reuteria* species live on various trees and have predatory tendancies as other Orthotylinae.

Subfamily PHYLINAE Douglas & Scott, 1865
Tribe Hallodapini Van Duzee, 1916 (1865)

* ***Acrorrhinium atricorne*** Linnavuori, 2006. SIIRT (Merkez) (Matocq & Özgen, 2010).

Recently described from Iran and collected in mountain forests (Linnavuori, 2006, 2009). TURKEY: only known from Siirt province.

Acrorrhinium conspersum Noualhier, 1895. SIIRT (Aydnlar) (Matocq & Özgen, 2010).

Known from Bulgaria, Turkey, Iran, Iraq, Israel (Kerzhner & Josifov, 1999). TURKEY: described from Hatay province and cited from several other Anatolian provinces, none in southeastern region (Önder et al., 2006). Collected on *Juniperus* (Cupressaceae) by Linnavuori (1965) in Turkey (Mersin province).

* ***Glaphyrocoris ebikh*** Linnavuori, 1984. SIIRT (Merkez) (Matocq & Özgen, 2010).

Previously only known from Iraq (Kerzhner & Josifov, 1999). TURKEY: only known from the Siirt province. Collected at lamp (Linnavuori, 1984).

* ***Hallodapus pseudoconcolor*** (Linnavuori, 1984). SIIRT (Merkez) (Matocq & Özgen, 2010).

Previously only known from Iraq (Kerzhner & Josifov 1999) and Iran (Linnavuori, 2009). TURKEY: only known from the Siirt province. Collected at lamp (Linnavuori, 1984).

Tribe Phylini Douglas & Scott, 1865

Amblytylus concolor Jakovlev, 1877. DIYARBAKIR (Stations 4, 5, 6): several specimens.

Common and widely distributed in South East Europe, North Africa and in Asia extending to Tadzikistan (Kerzhner & Josifov, 1999). TURKEY: cited from numerous provinces including Gaziantep, Kahramanmaras in the south Anatolia (Önder et al., 2006). On various Poaceae as other species of the genus (Schuh, 1995; Matocq & Pluot-Sigwalt, 2012).

* ***Aphaenophyes richteri richteri*** (Wagner, 1957). DIYARBAKIR (Station 2): several specimens on *Tamarix*.

A widely distributed subspecies (Kerzhner & Josifov, 1999) extending from North Africa to the middle East Turcmenistan and Africa. **New for TURKEY**. In Iran and Iraq, it lives on *Tamarix* (Tamaricaceae) (Linnavuori 1993b, 2010).

* ***Asciodema obsoleta*** (Fieber, 1864). DIYARBAKIR (Station 7): 1 male, 2 females.

Widely distributed in Europe and Morocco; previously unknown in Asia. **New for TURKEY**. Lives on various Poaceae (*Calicotome*, *Sarothamnus*, *Ulex*) (Schuh, 1995). A facultative egg predator (Wheeler, 2001).

Atractotomus amygdali Wagner, 1960. ELAZIĞ (Station 11): 1 male, 1 female.

Only known from Turkey, Macedonia, Spain (Kerzhner & Josifov 1999). TURKEY: described from Ankara; not cited by Önder et al. (2006). On *Amygdalus* (Rosaceae) (Wagner, 1975). A plant feeder and an occasional predator.

Atractotomus mali (Meyer-Dür, 1843). DIYARBAKIR (Stations 3, 4): several specimens.

Widely distributed in Europe; in Asia, only known from Turkey, Georgia, Israel (Kerzhner & Josifov, 1999). TURKEY: cited from numerous provinces including Gaziantep, Kahramanmaras (Önder et al., 2006). Mainly on various Rosaceae (*Crataegus*, *Prunus*, *Pyrus, Malus*) (Schuh, 1995). As other representatives of the genus, it can be a pest and also a useful predator of plant pests occurring on the same host. The species is known as an apple and a pear pest, and also as predator of aphids, psyllids, larvae of Lepidoptera (Wheeler, 2001).

Auchenocrepis reuteri Jakovlev, 1876. ELAZIĞ (Station 9): 2 specimens; SIIRT (Merkez) (Matocq & Özgen, 2010.

Ponto-Mediterranean extending to Central Asia (Kerzhner & Josifov, 1999). TURKEY: cited from several provinces, including Gaziantep, Kahramanmaras (Önder et al., 2006). Strictly associated with *Tamarix* (Tamaricaceae) as the other species of the genus (Schuh, 1995).

* ***Badezorus signaticornis*** (Reuter, 1904). SIIRT (Merkez) (Matocq & Özgen, 2010).

A widely distributed species (Asia Minor, Afrotropical and Oriental regions) (Kerzhner & Josifov, 1999). TURKEY: only recorded from the Siirt province. According to Schuh (1995) and Linnavuori (2010) mainly on Boraginaceae (*Arnebia*, *Heliotropium*).

Camptotylus linae (Puton, 1881). DIYARBAKIR (Stations 2, 16): several specimens.

Eastern Europe (European Russia and Ukraine); in Asia: Azerbaidjan, Turkey, Georgia, Israel, Jordan (Kerzhner & Josifov, 1999). TURKEY: cited from several provinces including Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006).

Campylomma annulicorne (Signoret, 1865). DIYARBAKIR, MARDIN (Stations 1, 12): 1 male, 1 female.

Distributed in Europe and Middle East (Kerzhner & Josifov, 1999). TURKEY: cited from Diyarbakir (Önder & Adiguzel, 1979); from five provinces, none in southeastern Anatolia (Önder et al., 2006). On Salicaceae (*Salix*, *Populus*) (Schuh, 1995).

* ***Campylomma celatum*** Wagner, 1969. SIIRT (Merkez) (Matocq & Özgen, 2010).

Restricted to North Africa (Libya, Tunisia) (Kerzhner & Josifov, 1999). TURKEY: only known from Siirt province. On *Zizyphus* (Rhamnaceae) and *Ballota* (Lamiaceae) (Carapezza, 1997).

Campylomma verbasci (Meyer-Dür, 1843). SIIRT (Merkez) (Matocq & Özgen, 2010).

A common species widely distributed in Europa, North Africa, Asia; introduced in North America (Kerzhner & Josifov, 1999). TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979); widely distributed including in Gaziantep and Hatay (Önder et al., 2006); the species is also reported by Hoberlandt (1956), Önder & Adiguzel (1979), Önder et al. (2006) as *C. nicolosi* Puton & Reuter, 1883, a synonym (see Carapezza, 1997). Mainly on *Verbascum* (Scrophulariaceae) (Schuh, 1995). Considered as an occasional pest of apple, but also a predator on aphid, mealybug and psyllid (Wheeler, 2001).

* ***Chlorillus pictoides*** Wagner, 1963. DIYARBAKIR, ELAZIĞ (Stations 6, 7, 8): several specimens.

Only known from Iraq, Israel, Syria (Kerzhner & Josifov, 1999). **New for TURKEY**. On *Salvia* (Lamiaceae) (Wagner, 1963, 1975).

Ectagela guttata Schmidt, 1939. MARDIN (Station 14): 1 female; SIIRT (Aydnlar) (Matocq & Özgen, 2010).

Known from North Africa, Asia Minor and tropical Africa (Kerzhner & Josifov, 1999). TURKEY: reported from three provinces including Gaziantep (Önder et al., 2006). In Iraq, collected on *Zizyphus* (Rhamnaceae) (Linnavuori, 1993b).

Eurycolpus aureolus Seidenstücker, 1961. DIYARBAKIR (Station 5): several specimens.

TURKEY: only known from Turkey (Nigde province) (Kerzhner & Josifov, 1999). It is also reported from Adana, Ankara, Kahramanmaras, Kirsehir, Mersin, Nigde (Önder et al., 2006). Collected on *Euphorbia* (Euphorbiaceae) (Seidenstücker, 1961).

Eurycolpus enslini Seidenstücker, 1959. DIYARBAKIR (Station 3): 1 male, 1 female.

Only known from Turkey (Kahramanmaras province) and Syria (Kerzhner & Josifov, 1999). TURKEY: Önder et al. (2006) reported also the species from Antalya, Kahramanmaras and Nigde provinces.

Icodema infuscata (Fieber, 1861). DIYARBAKIR, ELAZIĞ (Stations 6, 8): several specimens.

Widely distributed in Europa; in Asia, only known in Turkey and Syria (Kerzhner & Josifov, 1999). TURKEY: reported from several provinces, but none from the southeastern region (Önder et al., 2006). On *Quercus* (Fagaceae) (Schuh, 1995).

Lepidargyrus ancorifer (Fieber, 1858). DIYARBAKIR (Station 1): several specimens.

Widely distributed in Europe; in Asia, only known in Turkey. TURKEY: cited by Önder et al. (2006) as *Psallus ancorifer*, widely distributed in Anatolia. Imported in North America where it is an occasional pest (onion, pistachio) (Wheeler, 2001).

Lepidargyrus syriacus (Wagner, 1956). DIYARBAKIR, MARDIN (Stations 2, 5, 13, 16): several specimens.

Ponto-East Mediterranean (Kerzhner & Josifov 1999); recently recorded from Iran (Linnavuori, 2010). TURKEY: Although recorded from Turkey by Kerzhner & Josifov (1999), the localities in Turkey are not known (Drapolyuk, 1993) or doubtfull (Wagner, 1975); the species is not cited by Lodos et al. (2003) and Önder et al. (2006). On *Alyssum* (Brassicaceae) (Putshkov, 1959).

Macrotylus* (*Alloeonycha*) *ancyranus Seidenstücker, 1969. ELAZIĞ (Station 9): 4 males.

TURKEY: only known from the Asian part of Turkey (Kerzhner & Josifov, 1999) and reported from Ankara, Mersin and Nevsehir provinces (Önder et al., 2006). On *Salvia* (Lamiaceae) according to Seidenstücker (1969) and the present authors.

Macrotylus* (*Alloeonycha*) *dentifer Wagner, 1969. ELAZIĞ (Station 9): 6 males, 3 females.

Restricted to Bulgaria, Macedonia, Turkey (Kerzhner & Josifov, 1999). TURKEY: described from Ankara province and only reported from this province by Önder et al. (2006). On *Silene* (Caryophyllaceae) (Schuh, 1995).

Macrotylus* (*Macrotylus*) *galatinus Seidenstücker, 1968. ELAZIĞ (Station 7): 5 males.

TURKEY: only known from Turkey (Kerzhner & Josifov, 1999) and reported from Ankara and Corum provinces (Önder et al., 2006). Associated with *Salvia* (Lamiaceae) (Seidenstücker, 1968; present authors).

Macrotylus* (*Macrotylus*) *perdictus Kiritshenko, 1938. DIYARBAKIR, ELAZIĞ, MARDIN (Stations 1, 4, 5, 6, 10, 13): several specimens on *Eryngium* (Apiaceae).

Distributed in Armenia, Azerbaijan, Cyprus, Iraq, Iran, Syria, (Kerzhner & Josifov, 1999). TURKEY: reported from several provinces including Gaziantep, Hatay, Kahramanmaras, Kilis and Mardin (Önder et al., 2006).

* ***Macrotylus* (*Macrotylus*) *syriacus*** Wagner, 1963. DIYARBAKIR, ELAZIĞ, MARDIN (Stations 6, 8, 15): several specimens.

Only known from Syria (Kerzhner & Josifov, 1999). **New for TURKEY**. On *Salvia* (Lamiaceae) (Wagner, 1963).

* ***Megalocoleus molliculus*** (Fallén, 1807). DIYARBAKIR (Station 5): several specimens.

Widely distributed in Europe; in Asia, Kerzhner & Josifov (1999) recorded the species with doubt. Matocq (2004) confirmed the presence of the species in Armenia, Azerbaijan, Cyprus, Georgia, Iran, Israel and Kirgizia and Turkey. TURKEY: previously reported from Ankara and Kars (Hoberlandt, 1956); from Diyarbakir (Önder & Adiguzel, 1979); from numerous Anatolian provinces including Diyarbakir and Sanliurfa (Önder et al., 2006); from Gaziantep (Matocq, 2004). A pollen feeder (Wheeler 2001); on Asteraceae (*Achillea*, *Anthemis*, *Tanacetum*) (Schuh, 1995).

Nanopsallus carduellus (Horváth, 1888). MARDIN (Station 13): several specimens; SIIRT (Merkez) (Matocq & Özgen, 2010).

East Mediterranean; in Asia known from Turkey, Cyprus, Iraq, Israel. TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979); from several provinces including Gaziantep and Karamanmaras (Önder et al., 2006). On *Cirsium* (Asteraceae) (Linnavuori, 1993b).

Oncotylus (Cylindromelus) setulosus (Herrich-Schaeffer, 1837). DIYARBAKIR (Station 2): 1 male.

A Ponto-Mediterranean species extending to Central Asia according to Linnavuori (2010) who found it in Iran; see also Kerzhner & Josifov (1999). TURKEY: cited from Diyarbakir (Önder & Adiguzel, 1979); from numerous provinces including Diyarbakir, Elazığ, Gaziantep, Kahramanmaras (Önder et al., 2006). Known on *Centaurea* (Asteraceae) (Schuh, 1995).

Oncotylus (Oncotylus) viridiflavus longipes Wagner, 1954. DIYARBAKIR (Stations 5, 17): several specimens.

The subspecies *longipes* is known from Turkey (Kerzhner & Josifov, 1999) and Iran (Linnavuori (2010). TURKEY: only known from southern Turkey according to Wagner (1954a) and Hoberlandt (1956). The nominal subspecies *O. viridiflavus viridiflavus* (Goeze, 1778), cited by Önder et al. (2006) from Hatay and Kahramanmaras provinces, could be the subspecies *longipes*; also it could be reported from Diyarbakir (Önder & Adiguzel, 1979) as *O. (O.) viridiflavus* (Gz). The two subspecies are found on *Centaureae* (Asteraceae) (Schuh, 1995).

Opisthotaenia (Opisthotaenia) fulvipes Reuter, 1901. DIYARBAKIR (Station 6): 1 female.

Ponto-Mediterranean species described from Turkey and in Asia also known from Armenia, Azerbaijan, Iraq (Kerzhner & Josifov, 1999). TURKEY: cited from various Anatolian provinces, in particular Nigde (Seidenstücker, 1961), Malatya (Önder et al., 2006). On *Onosma* (Boraginaceae) (Schuh, 1995).

Orthonotus fraudatrix (Reuter, 1904). DIYARBAKIR, MARDIN (Stations 2, 6, 13, 15): several specimens.

East Mediterranean; in Asia: only recorded from Turkey and Lebanon (Kerzhner & Josifov, 1999). TURKEY: described from Mersin and also reported from Gaziantep among other provinces (Önder et al., 2006). On *Urtica* (Urticaceae) (Wagner, 1975). Several species of the genus are both phytophagous and predator on small arthropods (Wheeler, 2001).

Plagiognathus* (*Plagiognathus*) *bipunctatus Reuter, 1883. DIYARBAKIR, MARDIN (Stations 5, 12): several specimens; SIIRT (Aydınlar) (Matocq & Özgen, 2010).

Widely distributed in Europe and Asia (Kerzhner & Josifov, 1999). TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979); widespread (Önder et al., 2006). Collected on *Verbascum* (Scrophulariaceae) (Hoberlandt, 1956).

Plagiognathus* (*Plagiognathus*) *chrysanthemi (Wolff, 1804). DIYARBAKIR (Stations 1, 2): several specimens.

Widely distributed in Europe and Asia (Kerzhner & Josifov, 1999). TURKEY: also widely distributed including in Diyarbakir, Gaziantep, Hatay, Kahramanmaras, Sanliurfa provinces (Önder et al., 2006).

Plagiognathus* (*Plagiognathus*) *fulvipennis (Kirschbaum, 1856). DIYARBAKIR (Stations 1, 5, 16, 17).

Widely distributed (Kerzhner & Josifov, 1999). TURKEY: seems also widely distributed, and cited in particular from Diyarbakir (Önder & Adiguzel, 1979), Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006). Collected on *Echium* (Boraginaceae) (Hoberlandt, 1956).

* ***Plagiognathus* (*Plagiognathus*) *marivanensis*** Linnavuori, 2010. DIYARBAKIR, ELAZIĞ (Stations 1, 3, 4, 5, 7): several specimens, in sweping dry herbs.

Recently described from Iran (West Azerbaijan: near Sardasht). **New for TURKEY.**

* ***Psallus inancozgeni*** Matocq & Pluot-Sigwalt, 2011. DIYARBAKIR (Stations 1, 2): several specimens on *Fraxinus* sp.

Presently only known from Diyarbakir.

* ***Psallus* (*Apocremnus*) *skylla*** Linnavuori, 1994. ELAZIĞ (Stations 7, 8): 6 males, 15 females.

Only known from Syria (Kerzhner & Josifov, 1999). Described from Israel (Mt. Hermon) and collected at 1500 m. **New for TURKEY**. On *Crataegus* (Rosaceae) (Linnavuori, 1994).

Psallus* (*Hylopsallus*) *perrisi (Mulsant & Rey, 1852). DIYARBAKIR, ELAZIĞ (Stations 4, 6, 8): several specimens.

Widely distributed in Europe; in Asia, only known from Turkey, Georgia, Israel (Kerzhner & Josifov, 1999). TURKEY: reported from several provinces, not cited from southeastern Anatolia (Önder et al., 2006). Mainly on *Quercus* (Fagaceae) (Schuh, 1995). A facultative predator of small arthropds as other species of the genus (Wheeler, 2001).

Psallus* (*Phylidea*) *nigripilis (Reuter, 1888). DIYARBAKIR (Station 3): several specimens.

Euro-Mediterranean species; in Asia, only known from Turkey (Kerzhner & Josifov, 1999). TURKEY: not reported by Önder et al. (2006) or reported as *Stenarus ocularis nigripilis* (Reuter, 1888).

Psallus* (*Phylidea*) *quercus (Kirschbaum, 1856). DIYARBAKIR (Station 6): 3 females collected on *Quercus* sp.

European species; in Asia, only known from Turkey and Georgia (Kerzhner & Josifov, 1999). TURKEY: cited from various Anatolian provinces by Önder et al. (2006) including Kahramanmaras.

* ***Psallus* (*Psallus*) *pseudopunctulatus*** Linnavuori, 1984. DIYARBAKIR (Station 4): 2 males, 2 females collected on *Quercus*.

Previously only known from Iraq (Kerzhner & Josifov, 1999). **New for TURKEY**.

* ***Tinicephalus picticornis*** Wagner, 1966. DIYARBAKIR, MARDIN (Stations 13, 17): several specimens.

Previously only known from Cyprus (Kerzhner & Josifov, 1999). Recently recorded from Aydin province (Matocq, 2007).

Tuponia* (*Chlorotuponia*) *hippophaes (Fieber, 1861). DIYARBAKIR, ELAZIĞ (Station 8, 9, 16): several specimens.

Holomediterranean species with numerous recognized synonyms (Kerzhner & Josifov, 1999; Carapezza, 1997). This polymorphic species is reported from various Anatolian provinces by Önder et al. (2006) (also as *T. michalki* Wagner, 1951 and as *T. seidenstuckeri* Wagner, 1955, two synonyms) including Hatay and Kahramanmaras. On Tamaricaceae (*Tamarix*, *Myricaria*, *Reaumuria*) (Hoberlandt, 1956; Schuh, 1995; Carapezza, 1997).

Tuponia* (*Tuponia*) *ayasensis Wagner, 1963. SIIRT (Merkez) (Matocq & Özgen, 2010).

Described from Turkey (Central Anatolia) and also known from Azerbaidjan, Iraq, Israel, Jordanie (Kerzhner & Josifov 1999). TURKEY: cited from four Anatolian provinces, none in the southeastern part of Anatolia (Önder et al., 2006). On *Tamarix* (Tamaricaceae) (Wagner, 1963; Linnavuori, 1993b, 2010).

* ***Yotvata pulcherrima*** Linnavuori, 1984. SIIRT (Merkez) (Matocq & Özgen, 2010).

Known from Iraq (Kerzhner & Josifov, 1999) and recently recorded from Iran (Linnavuori, 2010). **New for TURKEY**. On *Quercus* (Fabaceae) and *Vitex* (Verbenaceae) (Linnavuori, 1993a, 2010).

Cimicoidea
Family NABIDAE A. Costa, 1853
Subfamily NABINAE A. Costa, 1853
Tribe Nabini A. Costa, 1853

Himacerus* (*Aptus*) *mirmicoides (O. Costa, 1834). ELAZIĞ (Station 7): 1 female.

Widely distributed in Europa, North Africa, Middle East (Kerzhner, 1996). TURKEY: Önder et al. (2006) cited the species as *Aptus mirmicoides* Costa, 1834 and widespread in Turkey. A rather polyphagous species (aphid, insect egg and larva) (Péricart, 1987).

Nabis* (*Aspilaspis*) *viridulus Spinola,1837. ELAZIĞ (Station 8): 1 female.

Holomediterranean extending to Central Asia (Kerzhner, 1996). TURKEY: widespread (Önder et al., 2006). Strictly associated with *Tamarix* (Tamarindaceae) preying on jassids (Péricart, 1987).

Nabis* (*Tropiconabis*) *capsiformis Germar, 1838. MARDIN (Station 13): 1 female; SIIRT (Aydnlar) (Matocq & Özgen, 2010).

Pantropical and subtropical, circummediterranean, common in North Africa, Middle East (Kerzhner, 1996). TURKEY: widespread including in south and southeastern Turkey (Önder et al., 2006). A termophilous and migratory species (Péricart, 1987).

Nabis* (*Nabis*) *punctatus punctatus A. Costa, 1847. DIYARBAKIR, ELAZIĞ, MARDIN (Stations 2, 11, 13): several specimens.

Mediterranean and Euro-Siberian (Kerzhner, 1996). TURKEY: a widespread (Önder et al., 2006), and useful predator of the larval stage of the pest *Ostrinia nubilalis* (Hübner) (Lepidoptera) (Kayapinar & Kornosor, 1993). A xerophilous species preying on various small insects (Péricart, 1987).

Nabis (Nabis) pseudoferus orientarius Remane, 1962. DIYARBAKIR, MARDIN (Stations 5, 13): 4 females; SIIRT (Merkez) (Matocq & Özgen, 2010).

The subspecies is restricted to East Turkey, Cyprus, Iran, Iraq, Lebanon (Kerzhner, 1996). TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979) as “*N. pseudoferus* Rm.”.

Family ANTHOCORIDAE Fieber, 1836
Subfamily LYCTOCORINAE Reuter, 1884
Tribe Xylocorini Carayon, 1972

* ***Xylocoris* (*Stictosynechia*) *lativentris*** (J. Sahlberg, 1870). MARDIN (Station 15): 2 females.

Widely distributed in oriental Europe extending to the North, and toward the East reaching Mongolia (Péricart 1996a). In Asia, it was also cited from Azerbaijan, Israel, Kazakhstan, Kirgizia, Tadzhikistan; suspected but not recorded from Turkey (Péricart, 1972). **New for TURKEY**.

Subfamily ANTHOCORINAE Van Duzee, 1916
Tribe Anthocorini Carayon 1958

Anthocoris nemoralis (Fabricius, 1794). MARDIN (Station 14): 4 males.

Widely distributed in Europe, North Africa and Middle East (Péricart, 1996a). TURKEY: Péricart (1972) recorded the species from Bursa and Kayseri provinces.

* ***Anthocoris minki minki*** Dohrn, 1860. DIYARBAKIR (Stations 1, 2): 4 males, 6 females.

Widely distributed in occidental Europe. TURKEY: not recorded from Turkey by Péricart (1996a); however, *A. minki* is cited from almost all regions except Thrace by Önder et al. (2006) and other authors. Péricart (1972, 1996a) distinguished *A. minki minki* Dohrn and *A. minki pistaciae* Wagner, 1957, the later having smaller size and a more oriental distribution in the Middle East. However, on the basis of the Turkish material, Önder (1982) considered that there was no serious argument to distinguish a meridional subspecies. Our specimens from Diyarbakir fit well with the description of the nominal species. *A. minki* is usually associated with various species of *Populus* (Salicaceae) on which it preys on gallicolous aphids (Péricart, 1972). In Turkey, according to Yanik & Ünlü (2011) it preys on psyllid and aphid pests on pistachio orchards.

Tribe Oriini Carayon, 1958

Orius* (*Orius*) *laevigatus laevigatus (Fieber, 1860). MARDIN (Station 15): 1 female.

Holomediterranean, extending to Central Europe and Middle East (Péricart, 1996a).

Orius* (*Orius*) *niger (Wolff, 1811). DIYARBAKIR, ELAZIĞ (Stations 1, 2, 4, 9): several specimens.

Holopalaearctic (Péricart, 1996a). TURKEY: cited from Diyarbakir (Önder & Adiguzel, 1979); widespread (Hoberlandt, 1956; Önder et al., 2006). A common predator living on various herbaceous plants searching aphids, thrips, acari, insect eggs (Péricart, 1972).

Reduvioidea
Family REDUVIIDAE Latreille, 1807
Subfamily PEIRATINAE Amyot & serville, 1843

* ***Ectomocoris (Ectomocoris) caucasicus*** Linnavuori, 1972. MARDIN (Ömerli) (Matocq & Özgen, 2010).

Known from South Russia to Central Asia; present in Azerbaijan, Armenia, Georgia, Iran, Iraq (Putshkov & Putshkov, 1996; Putshkov & Moulet, 2009). TURKEY: only known from Mardin province; not reported by Önder et al. (2006).

Peirates hybridus (Scopoli, 1763). SIIRT (Merkez) (Matocq & Özgen, 2010).

Turanico-Mediterranean (Putshkov & Putshkov, 1996; Putshkov & Moulet, 2009). TURKEY: Bursa (Horváth, 1883); Hatay (Puton & Noualhier, 1895); Eskisehir (Hoberlandt, 1956); Diyarbakir (Önder & Adiguzel, 1979); cited from Diyarbakir, Gaziantep among other provinces (Önder et al., 2006). Preys mainly on heteroptera species, particularly on *Eurygaster integriceps* and *Dolicoris penicillum* (Stehlik & Vavrinova, 1997).

Subfamily REDUVIINAE Latreille, 1807

* ***Holotrichius tenebrosus*** Burmeister, 1835. DIYARBAKIR (Station 2): 1 male (macropterous).

Known from the Balkan peninsula and Israel (Putshkov & Moulet, 2009). These authors added that the species would be probably encountered in Turkey; so, it is now done. **New for TURKEY**. As in other representatives of the genus, females are always apterous, males either apterous or macropterous.

Reduvius ciliatus Jakovlev, 1879. MARDIN (Ömerli) (Matocq & Özgen, 2010).

A Central Asia element (Putshkov & Putshkov, 1996). TURKEY: only reported from Agri, Gaziantep and Hatay provinces (Puton & Noualhier, 1895; Hoberlandt, 1956; Önder, 1980; Önder et al., 2006).

Reduvius pallipes Klug, 1830. SIIRT (Aydnlar) (Matocq & Özgen, 2010).

A Ponto-Mediterranean species (Putshkov & Putshkov, 1996). TURKEY: reported from: West Anatolia (Wagner, 1966); Gaziantep (Hoberlandt, 1956); Diyarbakir (Önder & Adiguzel, 1979); south and southeastern Anatolia (Önder et al., 2006); Elazığ (Harput) (Yildirim et al., 2010).

Subfamily HARPACTORINAE Amyot & Serville, 1843

Tribe Harpactorini Amyot & Serville, 1843

Callistodema fasciata (Kolenati, 1857). ELAZIĞ (Station 8): 4 females.

East Mediterranean species with limited distribution (Putshkov & Putshkov, 1996). TURKEY: widespread (Hoberlandt, 1956; Seidenstücker, 1958; Önder et al., 2006) and recorded in particular from Adiyaman, Hakkari, Malatya provinces (Önder, 1980). Strictly associated to *Tamarix* (Tamarindaceae) on which it preys on small hemipterous and true bugs such as mirids (Putshkov & Moulet, 2009).

Coranus tuberculifer Reuter, 1881. DIYARBAKIR (Station 17): 1 male, 3 females.

East Mediterranean species, also present in Italy (Putshkov & Putshkov, 1996). TURKEY: described from Bursa and known from several provinces: Istanbul, Edirne (Putshkov & Moulet, 2009); Bursa (Reuter, 1881); Kahramanmaras (Horváth, 1901); Afyonkarahisar (Hoberlandt, 1956); Izmir (Önder, 1980); from several provinces including Kahramanmaras (Önder et al., 2006).

Nagusta goedelii (Kolenati, 1857). ELAZIĞ (Station 10): 1 female.

East Meditarranean species extending towards Central Europe and Turkmenistan (Putshkov & Putshkov, 1996). TURKEY: Bursa (Reuter, 1909); Artvin, Agri (Kiritchenko, 1918); Konya (Hoberlandt, 1956); widespread (Önder et al., 2006) and reported particularly from Hakkari, Mardin, Sanliurfa (Önder, 1980). Lives on the canopy of various trees (Putshkov & Moulet, 2009), and in Turkey on many fruit trees (Önder, 1980).

Rhynocoris iracundus (Poda, 1761). DIYARBAKIR, MARDIN (Stations 2, 6, 13, 17): 2 males, 2 females.

Widely distributed (Europe, Caucase, Central Asia) (Putshkov & Putshkov, 1996). A species showing a great variation of coloration and several “forms”. TURKEY: widespread (Hoberlandt, 1956; Önder, 1980; Önder et al., 2006) and recorded in particular from Diyarbakir, Mardin, Malatya provinces; the subspecies *R. iracundus picta* Kolenati, 1857 also cited by Önder et al. (2006), as *R. iracundus pictus* Kolenati, 1856, is a snynonym (see Putshkov & Putshkov, 1996). The species preys on various insects including true bugs (*Graphosoma*, *Aelia*, *Eurygaster*, *Carpocoris*, etc.) (Putshkov & Moulet, 2009).

Rhynocoris punctiventris (Herrich-Schaeffer, 1846). DIYARBAKIR (Station 16): 1 male, 2 females.

East Mediterranean (Putshkov & Putshkov, 1996). TURKEY: widespread (Önder, 1980; Önder et al., 2006). Feeds on a variety of insects, and in captivity particularly on true bugs (Putshkov & Moulet, 2009).

Sphedanolestes pulchellus (Klug, 1830). DIYARBAKIR (Station 16): 1 male.

A pontic element, extending to Balkans and Algeria (Putshkov & Putshkov, 1996). TURKEY: reported from several provinces (Reuter, 1890b; Horváth, 1901, 1918; Hoberlandt, 1956; Linnavuori, 1969) including Hatay, Kahramanmaras and Malatya provinces (Önder, 1980; Önder et al., 2006).

Vachiria natolica Stal, 1859. DIYARBAKIR (Station 2): 1 male.

Saharo-Sudmediterranean (Putshkov & Putshkov, 1996). TURKEY: described from “Anatolia” and reported from various provinces, including Diyarbakir and Mardin (Önder et al., 2006). In North Africa and Turkey lives often on *Tamarix* (Tamarindaceae) but not excluvisely (Hoberlandt, 1956; Putshkov & Moulet, 2009).

IV. – PENTATOMOMORPHA

Aradoidea

Family ARADIDAE Brullé, 1836

Subfamily ARADINAE Brullé, 1836

Aradus flavicornis Dalman, 1823. SIIRT (Merkez) (Matocq & Özgen, 2010).

Widely distributed: South Europe, North Africa, Afrotropical region (Heiss, 2001). TURKEY: reported from Edirne, Seyhan (Hoberlandt, 1956), Antalya provinces (Önder et al., 2006). Biology unknown; usually collected at light (Heiss & Péricart, 2007).

Coreoidea
Family BERYTIDAE Fieber, 1851
Subfamily BERYTINAE Fieber, 1851
Tribe Berytini Fieber, 1851

Neides brevipennis Puton, 1895. DIYARBAKIR, ELAZIĞ (Stations 7, 16): 4 males, 1 female.

Transcaucasia and adjacent regions (Azerbaijan, Iran, Iraq, Israel, Lebanon, Syria, Turkey, Turkmenistan) (Péricart, 2001a). TURKEY: widely distributed and reported in particular from Mardin and Elazığ provinces (Seidenstücker, 1958; Péricart, 1984). Erroneously considered as endemic to Anatolia by Önder et al. (2006). Collected on *Echium* and *Astralagus* in Turkey (Péricart, 1984).

Tribe Berytinini Southwood & Leston, 1959

Berytinus (Berytinus) hirticornis nigrolineatus (Jakovlev, 1903). DIYARBAKIR (Station 2): 1 female.

The nominal subspecies *B. hirticornis hirticornis* (Brullé, 1836) is an Euro-Mediterranean element, and this subspecies (pilosity of the antennae greatly developped forming four rows) is restricted to the Ponto-Mediterranean region (Péricart, 1984, 2001a). TURKEY: recorded as *B. nigrolinatus* Jak. 1903 from the Hatay province (Seidenstücker, 1957) and from "Turkey" without precise locality (Önder et al., 2006). Under *Artemisia* (Seidenstücker, 1957).

Berytinus (Lizinus) striola (Ferrari, 1874). DIYARBAKIR (Station 2): 1 female.

Mediterranean and Ponto-Pannonian (Péricart, 1984, 2001a). TURKEY: recorded from several provinces (Adana, Bursa, Hatay, Izmir, Kahramanmaras, Mugla) (Péricart, 1984); not cited by Önder et al. (2006).

Berytinus (Lizinus) montivagus (Meyer-Dür, 1841). DIYARBAKIR (Station 6): 1 male.

Euro-Mediterranean species extending until Central Asia (Péricart, 1984, 2001a). TURKEY: common and recorded from several provinces (Adana, Afyonkarahisar, Ankara, Balikesir, Bursa, Canakkale, Içel, Izmir, Manisa, Sanliurfa, Tekirdag) (Péricart, 1984); and also from Denizli (Linnavuori, 1953), Ankara, Aydin, Izmir (Önder et al., 2006). Associated with Fabaceae (particularly *Medicago*).

Subfamily GAMPSOCORINAE Southwood & Leston, 1959
Tribe Gampsocorini Southwood & Leston, 1959

Gampsocoris punctipes pallidus Hoberlandt, 1951. DIYARBAKIR (Station 4): 4 females by scratching the ground around the foot of plants (probably *Ononis* sp., Fabaceae).

According to Péricart (2001a), the subspecies is known from the Middle East (and particularly in Turkey, Syrie, Iraq) wheras the nominal form *G. punctipes punctipes* (Germar, 1822) is widely distributed in Europa, some Asian countries (Armenie, Azerbaijan, Georgia, Kazakhstan) and not recorded from Turkey. Nevertheless, of the four specimens, only one fits well with the description of Hoberlandt (1951), the other fits with the description of the nominal subspecies (see also Péricart 1984). Both subspecies can be distinguished by minute characters and could correspond to two forms of a variable species.

Subfamily METACANTHINAE Douglas & Scott, 1865
Tribe Metacanthini Douglas & Scott, 1865

Metacanthus (Cardopostethus) annulosus (Fieber, 1859). ELAZIĞ (Station 10): 1 female.

Mediterranean (North and East) and Pannonian extending to Central Europe (Péricart, 2001a). TURKEY: Péricart (1984) considered the species as rare and recorded specimens from four provinces (Adiyaman, Hatay, Içel, Izmir); cited as *Cardopostethus annulosus* Fieber, 1859 by Önder et al. (2006).

Metacanthus (Metacanthus) meridionalis (A. Costa, 1843). MARDIN (Station 13): 1 male, 3 females.

North Mediterranean and Pontic element, extending to Transcaucasia, Iraq, Iran, Yemen (Péricart, 2001a). TURKEY: recorded by Péricart (1984) from several provinces (Ankara, Balikesir, Bitlis, Hakkari, Izmir, Kizilcahamam, Manisa, Mardin), and by Horváth (1883) and Reuter (1890) from the Bursa province. The species could be uncorrectly cited by some authors under the name "*Megalomerium meridionale* (Costa, 1838)". It lives in damp places mainly on Onagrariaceae.

Family LYGAEIDAE Schilling, 1829
Subfamily ARTHENEINAE St l, 1872
Tribe Artheneini St l, 1872

Artheneis balcanica (Kormilev, 1938). DIYARBAKIR, ELAZIĞ (Stations 8, 10, 16): several specimens.

A Pontic element extending to Central Asia (Péricart, 1999, 2001b). TURKEY: according to Péricart (1999) it is present in the peninsular part of Anatolia (except, maybe, along the wet northern coast); towards east, until the river Euphrates; Önder et al. (2006) reported the species from 6 provinces, including Gaziantep. Lives on *Tamarix* (Tamaricaceae).

Artheneis hyrcanica (Kolenati, 1845). ELAZIĞ (Stations 8, 10): several specimens.

A pontic element (Péricart, 1999, 2001b). TURKEY: recorded from Ankara (Hoberlandt, 1956), Amasya, Tuneli and Kahramanmarash (Péricart, 1999); Önder et al. (2006) cited six Anatolian provinces, none in the south east part of Turkey. Lives probably on *Salix* (Salicaceae).

Subfamily BLISSINAE St l, 1862

Ischnodemus genei (Spinola, 1837). MARDIN (Station 15): 1 male.

Holomediterranean; in Asia, present in Turkey, Iraq, Syria (Péricart, 1999, 2001b). TURKEY: Önder et al. (2006) cited the species without detailed localities. Collected on *Typha* (Typhaceae) (see Péricart, 1999).

Subfamily CYMINAE Baerensprung, 1860
Tribe Cymini Baerensprung, 1860

Cymus melanocephalus Fieber, 1861. DIYARBAKIR (Hazro-düzevler) 3-VIII-2010; (Ergani-demirli) 13-VII-2010, M. Duman & I. Özgen leg.: 1 female.

Turanico Euro Mediterranean (Péricart, 1999, 2001b). TURKEY: widely distributed (Péricart, 1999; Önder et al., 2006), but not reported from southeastern provinces.

Subfamily LYGAEINAE St l, 1862

Lygaeus creticus Lucas, 1853. MARDIN (Station 14): 1 male.

Ponto-Mediterranean (Péricart, 2001b). TURKEY: Seidenstücker (1958), Péricart (1999) and Çagatay (1995) recorded the species from several Anatolian provinces including Adana, Malatya, Hatay, Hakkari; Önder et al. (2006) cited the species from various provinces including Gaziantep and Hatay. Collected on *Nerium* (Apocynaceae).

Lygaeus equestris (Linné, 1758). DIYARBAKIR (Stations 4, 6, 16, 17): several specimens.

Holopalaearctic (Péricart, 1999, 2001b). TURKEY: widespread according Önder et al. (2006). Lives on various plants with somes preferences for *Vincetoxicum* (Apocyncaceae) and *Taraxacum* (Asteraceae) (Péricart, 1999).

Spilostethus pandurus (Scopoli, 1763). ELAZIĞ, MARDIN (Stations 10, 14): 2 males, 1 female.

Ponto-Mediterranean and Paleotropical (Péricart, 1999, 2001b). TURKEY: widepread (Péricart, 1999); reported as *Lygaeus pandurus* (Scopoli, 1763) from various Anatolian provinces, including Antalya, Elazığ, Gaziantep, Hatay, Kahramanmaras (Hoberlandt, 1956; Önder et al., 2006). On various plants.

Spilostethus saxatilis (Scopoli, 1763). DIYARBAKIR (Station 6): 1 male.

Turanico-Euro-Mediterranean (Péricart, 1999, 2001b). TURKEY: widespread (Hoberlandt, 1956; Çagatay, 1995; Önder et al., 2006), including in south east Anatolia (Gaziantep, Hatay; Hakkari). On various plants.

Subfamily GEOCORINAE Bärensprung, 1860

Geocoris* (*Geocoris*) *megacephalus (Rossi, 1790). DIYARBAKIR (çimar-Kuyuluhöyük), 6-VII-2010, M. Mehmet & I. Özgen leg.: 1 male.

Mediterranean extending to Central Asia (Péricart, 1999, 2001b). TURKEY: Adana, Ankara, Hatay, Mersin (Hoberlandt 1956; Çagatay, 1989; Péricart, 1999), south and southeastern Anatolia (Önder et al., 2006).

Geocoris* (*Geocoris*) *phaeopterus (Germar, 1838). MARDIN (Station 12): 1 female.

A Saharo-Sindian element (East Mediterranean, North-Africa, probably present in most part of Africa and tropical Asia) (Péricart, 1999, 2001b); recently recorded from the Basque Country (North Spain) (Pagola-Carte & Zabalegui, 2009) and from South France (Maurel & Streito, 2012). TURKEY: recorded from Adana, Hatay and Sanliurfa provinces (Péricart, 1999); not cited by Önder et al. (2006). Predaceous as the other *Geocoris*. Collected on *Gossypium* (Malvaceae) in Anatolia (Péricart, 1999).

Geocoris* (*Piocoris*) *erythrocephalus (Lepeletier & Serville, 1825). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 4, 6, 9, 15, 16): several specimens.

Holomediterranean, extending to Iran and Kazakstan (Péricart, 2001b). TURKEY: widely distributed in Anatolia (Hoberlandt, 1956; Péricart, 1999); not cited by Önder et al. (2006). Preys on small insects on various plants (Lamiaceae, Fabaceae, Boraginaceae) (Péricart, 1999).

* ***Geocoris* (*Piocoris*) *luridus luridus*** (Fieber, 1844). ELAZIĞ (Stations 8, 9): 4 males, 3 females.

A Saharo-Sindian deserticolous element (Péricart, 1999, 2001b). TURKEY: not explicitly recorded from Turkey by Péricart; it must be remind that the Fieber's type specimen (lost) is known unprecisely from "Iraq or Anatolia" (Péricart, 2001b). However, Puton & Noualhier (1895) recorded it from Hatay (Ekbaz), Seidenstücker (1958), from Kahramanmaras and Osmaniye, Çagatay (1989) from Ankara, Adiyaman, Gaziantep, Izmir, Mardin, Sanliurfa; and Önder et al. (2006) from south and southeastern Anatolia. Mainly on *Tamarix* (Tamaricaceae) or *Acacia* (Fabaceae) preying on aphids and small hemiptera (Péricart, 1999).

* ***Geocoris* (*Piocoris*) *putonianus*** Bergroth, 1892. DIYARBAKIR, ELAZIĞ, MARDIN (Stations 3, 4, 8, 12, 13): 2 males, 6 females.

Previously only known in Armenia, Iran, Kazakhstan, Tadzhikistan, Turcmenistan, Uzbekistan (Péricart, 1999, 2001b). **New for TURKEY**: not cited by Önder et al. (2006).

Subfamily ORSILLINAE St l, 1872

Tribe Nysiini Uhler, 1876

Nysius cymoides (Spinola, 1837). DIYARBAKIR (Station 17): 2 males, 2 female; SIIRT (Aydnlar) (Matocq & Özgen, 2010).

Turanico-Mediterranean, extending towards Africa and Central Asia (Péricart, 1999, 2001b). TURKEY: Igdir (Kiritschenko, 1918); several provinces (Hoberlandt, 1956); Aksaray (Linnavuori, 1960); Diyarbakir (Önder & Adiguzel, 1979); Sanliurfa (Péricart, 1999); numerous provinces including Hatay (Önder et al., 2006). On various plants; in Turkey, collected on *Gossypium* (Malvaceae) (Péricart, 1999).

Nysius thymi thymi (Wolff, 1804). ELAZIĞ (Station 8): 1 male, 1 female.

Holopalaearctic, often confused with *N. ericae* (Schilling, 1829) (Péricart, 1999, 2001b). TURKEY: reported from Diyarbakir (Önder & Adiguzel, 1979); from many provinces, including Diyarbakir, Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006). Feeds on various seeds (Fabaceae, Caryophyllaceae, Asteraceae, Poaceae, etc.) (Péricart, 1999).

Tribe Orsillini Stål, 1872

Ortholomus carinatus (Lindberg, 1932). DIYARBAKIR, MARDIN (Stations 12, 13, 16): 3 males, 4 females.

South West Europe, North Africa; in Asia: Turkey, Iran, Iraq (Péricart, 2001b). TURKEY: recorded from Edirne (Hoberlandt, 1956); Diyarbakir (Önder & Adiguzel, 1979) as *Nysius carinata* (Lb); Balikesir (Péricart, 1999); five provinces, including Diyarbakir (Önder et al., 2006) as *Ortholomus carinatus* and as *Nysius carinatus* Lindberg, 1932.

Subfamily OXYCARENINAE St l, 1862

Brachyplax tenuis (Mulsant & Rey, 1852): ELAZIĞ (Stations 7, 9): 1 male, 1 female.

Turanico-Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from Edirne (Hoberlandt, 1956); according to Péricart (1999) widely distributed in the peninsular part of the Anatolia until the river Euphrates; cited by Önder *et al.* (2006) from several Anatolian provinces, including Gaziantep and Hatay (Önder et al., 2006). Mainly on Papaveraceae (Seidenstücker, 1958; Péricart, 1999).

Leptodemus minutus (Jakovlev, 1876). SIIRT (Aydnlar) (Matocq & Özgen, 2010).

Turanico-South Mediterranean and Saharo-Sindian (Péricart, 1999, 2001b). TURKEY: recorded from: Gaziantep (Seidenstücker, 1961); Afyonkarahisar, Isparta, Manisa, Izmir, Sanliurfa (Çagatay, 1985); Önder et al., (2006) reported the species from the Ege, Marmara and Mediterranean regions.

Macroplax fasciata fasciata (Herrich-Schaeffer, 1835). MARDIN (Station 13): several specimens.

Holomediterranean (Péricart, 1999, 2001b). TURKEY: widespread in the peninsular part of the Anatolia, except possibly along the Black see coast (Önder et al., 2006); cited from Elazığ among other provinces (Çagatay, 1985). On Cistaceae (*Cistus*, *Helianthemum*) (Péricart, 1999).

Metopoplax origani (Kolenati, 1845). DIYARBAKIR, MARDIN (Stations 4, 5, 13, 14): several specimens.

Turanico-Mediterranean extending to Central Europe (Péricart, 1999, 2001b). TURKEY: widespread in Anatolia (Péricart, 1999; Hoberlandt, 1956; Önder et al., 2006); Diyarbakir (Önder & Adiguzel, 1979). On Asteraceae.

Microplax interrupta (Fieber, 1837). MARDIN (Station 14): several specimens.

Turanico-Mediterranean, extending to Africa and India (Péricart, 1999, 2001b). TURKEY: Edirne (Hoberlandt, 1956); especially distributed in the oriental part of the Anatolia (Péricart, 1999); reported from many provinces, including Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006). Mainly on Asteraceae (Péricart, 1999).

Microplax limbata Fieber, 1864. DIYARBAKIR (Stations 2, 4, 16): several specimens.

East Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from Adana, Ankara, Gaziantep, Hatay, Kayseri, Mersin, Nigde (Péricart, 1999); also from several provinces including Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006).

Oxycarenus (Euoxycarenus) pallens (Herrich-Schaeffer, 1850). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 1, 4, 7, 10, 12, 16, 17): several specimens; SIIRT (Merkez) (Matocq & Özgen, 2010).

Turanico-Mediterranean extending in Africa and India (Péricart, 1999, 2001b). TURKEY: cited from Diyarbakir (Önder & Adiguzel, 1979); from Diyarbakir, Elazığ, Van, among other (Çagatay, 1985); from numerous provinces, including Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006). Mainly on Asteraceae (see Péricart, 1999).

Subfamily PACHYGRONTHINAE St l, 1862

Cymophyes ochroleuca Fieber, 1870. DIYARBAKIR, ELAZIĞ (Stations 5, 7): 1 male, 1 female.

East Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from Konya, Mersin, Kahramanmaras, Hatay (Péricart, 1999); from various provinces, including Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006). On Poaceae (Péricart, 1999).

Subfamily RHYPAROCHROMINAE Amyot & Serville, 1843
Tribe Antillocorini Ashlock, 1964

Tropistethus lanternae Linnavuori, 1960. SIIRT (Merkez) (Matocq & Özgen, 2010).

Turanico-East Mediterranean extending to Tadzhikistan (Péricart, 1999, 2001b). TURKEY: reported from: Seyhan as *T. fasciatus* Ferrari, 1874 (Hoberlandt, 1956); Diyarbakir as *T. holocericus* (Scholtz, 1846) (Çagatay, 1985); Adana, Adiyaman, Gaziantep, Hatay, Karaman, Mersin (Péricart, 1999); not cited by Önder et al. (2006). According to Péricart (loc. cit), the species is often confused with other species of the genus.

Tribe Drymini St l, 1872

Drymus* (*Drymus*) *pilipes Fieber, 1861. DIYARBAKIR, MARDIN (Stations 15, 17): 1 male, 1 female.

Euro-Mediterranean and Pontic (Péricart, 1999, 2001b). TURKEY: recorded from: Adana, Hatay (Seidenstücker, 1961), Mugla (Çagatay, 1985) (Péricart, 1999); not cited by Önder et al. (2006). On moss and litter (Péricart, 1999).

Drymus* (*Sylvadrymus*) *brunneus confinis Reuter, 1893. DIYARBAKIR (Station 16): 1 male, 2 females.

Restricted to Maghreb, Cyprus, Turkey, Pakistan (Péricart, 1999, 2001b). TURKEY: from the map distribution given by Péricart, 1999), the subspecies is confined to the south east peninsular part of Anatolia; reported as *D. brunneus* (Sahlberg, 1848) from Hatay and Kahramanmaras provinces (Önder et al., 2006).

Eremocoris fenestratus (Herrich-Schaeffer, 1839). DIYARBAKIR (Station 2): 5 males, 4 females.

Turanico-Ponto-Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from Ankara, Bitlis, Karaman (Hoberlandt, 1956), Mersin, Mugla (Péricart, 1999); cited from Adana, Antalya, Izmir, Kahramanmaras (Önder et al., 2006). Often at the foot of *Juniperus* and *Cupressus* (Cupressaceae) (Péricart, 1999).

Scolopostethus thomsoni Reuter, 1875. ELAZIĞ (Station 15): 3 males, 2 females.

Holarctic (Péricart, 1999, 2001b). TURKEY: recorded from Ankara, Bitlis, Van (Péricart, 1999); not cited by Önder et al. (2006). Polyphagous with preference for some plants, *Urtica* (Urticacae), *Mentha* (Lamiaceae), *Calluna* (Ericaceae), etc. (Péricart, 1999).

Scolopostethus sp. Mardin (Ömerli) (Matocq & Özgen, 2010).

Tribe Gonianotini St l, 1884

Aphanus rolandri (Linné, 1758). MARDIN (Station 13, 14): 2 males, 6 females.

Euro-Mediterranean and Pontic (Péricart, 1999, 2001b). TURKEY: reported from: Aksehir, Ulukishla, Adana, Pozanti, Kayseri, Konya, Kizilcahamam, Samsun, Bingöl, Fethiye, Yanklar, Engizek dag, Sarikanis (Péricart, 1999); Ankara (Hoberlandt, 1956), Malatya (Çagatay, 1987), Kars (Kiritshenko 1918); from several provinces, including Elazığ, Kahramammaras (Önder et al., 2006); these authors cited also *A. rolandri aethiops* (Douglas & Scott, 1868), now a simple form without any taxonomic signification (Péricart, 1999).

Emblethis angustus Montandon, 1890. SIIRT (Merkez) (Matocq & Özgen, 2010).

Turanico-Ponto-Mediterranean (Péricart, 1999, 2001b). TURKEY: widespread in Anatolia (Seidenstücker, 1963; Çagatay, 1987; Péricart, 1999); cited from nine provinces, none in the south east Anatolia (Önder et al., 2006).

Emblethis denticollis Horváth, 1878. SIIRT (Merkez) (Matocq & Özgen, 2010).

Holopalaearctic (Péricart, 1999, 2001b). TURKEY: recorded from Ankara, Hatay, Kayseri, Konya (Péricart, 1999); cited from 15 provinces including Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006).

Emblethis setifer Seidenstücker, 1966. MARDIN (Station 13): 1 male, 1 female.

Known from Turkey, Transcaucasia, Iraq, Iran, Uzbekistan, Tadzhikistan (Péricart, 1999, 2001b). TURKEY: recorded from Ankara, Konya, Eregli, Ulukishla, Nigde, Gaziantep, Malatya, Kayseri (Péricart, 1999); only cited from Adana (Önder et al., 2006). In Armenia, collected at the foot of *Atraphaxis* (Polygonaceae) (Seidenstücker, 1967).

Emblethis verbasci (Fabricius, 1803). MARDIN (Station 13): 1 male, 2 females.

Europe, Asia Minor, Kazakhstan (Péricart, 1999, 2001b). TURKEY: cited from Diyarbakir (Önder & Adiguzel, 1979); from the European part of Turkey, Adana, Artvin, Bursa (Péricart, 1999); cited from 11 Anatolian provinces, including Kahramanmaras (Önder et al., 2006). Polyphagous, on Lamiaceae, Asteraceae, Scrophulariaceae, and other plants (Péricart, 1999).

***Emblethis* sp**. DIYARBAKIR (Station 4): 3 femelles.

Females of the genus *Emblethis* cannot be accurately identified.

Ischnopeza pallipes Puton, 1892. MARDIN (Station 13): 1 male.

South and East Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from Ankara, Gaziantep, Hatay, Tokat, Malatya (Péricart, 1999); Adana, Hatay, Mersin (Önder et al., 2006), and also cited from Adana as *I. taborskyi* Hoberlandt, 1956 synonymized by

Péricart (1996b). Péricart (1999) expressed some doubts about the specific status of *I. pallipes*, very similar to *I. hirticornis* (Herrich-Schaeffer, 1850).

Neurocladus brachiidens (Dufour, 1851). DIYARBAKIR (city center): several specimens (at light), 1-VI-2010, A. Matocq leg.; DIYARBAKIR, Silvan Dibalew (Kögek Mountain [N38°11' E41°00'], alt.1184 m, 15-IV-2010, I. Özgen leg.): 4 females.

Turanico-Ponto-Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from several provinces, including Elazığ, Hatay, Malatya (Péricart 1999; Önder et al., 2006). Biology unknown.

Tribe Lethaeini St l, 1872

Camptocera glaberrima (Walker, 1872). Siirt (Merkez) (Matocq & Özgen, 2010).

Saharo-Sindian (Péricart, 1999, 2001b). TURKEY: recorded from Adana and Hatay provinces (Seidenstücker, 1958), from Diyarbakir (Önder & Adiguzel, 1979; Çagatay, 1985); widespread in the peninsular part of the Anatolia (Hoberlandt, 1956; Péricart, 1999); reported from 7 provinces, including Gaziantep, Kahramanmaras (Önder et al., 2006).

Lethaeus cribratissimus (Stål, 1859). DIYARBAKIR (Station 2): 1 male.

Ponto-East Mediterranean (Péricart, 1999, 2001b). TURKEY: Istanbul province and almost all peninsular part of Anatolia (Péricart, 1999); cited from 10 provinces, including Gaziantep, Hatay and, as *L. syriacus* Horváth, 1883, from Adana, Aydin, Bursa (Önder et al., 2006).

Lethaeus picipes (Herrich-Schaeffer, 1850). SIIRT (Merkez) (Matocq & Özgen, 2010).

Turanico-East Mediterranean (Péricart, 1999, 2001b). TURKEY: Hatay (Puton & Noualhier, 1895); Mardin (Reuter, 1890); Diyarbakir (Önder & Adiguzel, 1979); Artvin, Hatay, Konya, Malatya, Mardin, Nigde (Péricart, 1999); cited from Hatay, Mardin (Önder et al., 2006).

Tribe Megalonotini Slater, 1957

Lamprodema maura (Fabricius, 1803). SIIRT (Aydnlar) (Matocq & Özgen, 2010).

Turanico Ponto-Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from Hatay (Puton & Noualhier, 1895); Kars (Kiritshenko, 1918); Erzincan (Kiritshenko, 1924); Ankara (Hoberlandt, 1956); Diyarbakir (Önder & Adiguzel, 1979); Ankara, Balikesir, Izmir, Diyarbakir (Çagatay, 1988); Kayseri, Konya (Péricart, 1999).

Lasiocoris anomalus (Kolenati, 1845): DIYARBAKIR, SILVAN, Dibalew, Kocaş Mountain, N 38° 11, E 41° 00 ; alt.1184 m,15-IV-2010, I. Özgen leg.: 1 male.

Ponto-Mediterranean (Péricart, 1999, 2001b). TURKEY: Ankara, Aksehir, Bursa, Gaziantep, Hakkari, Igdir, Karaman, Malatya, Nigde, Tokat (Péricart, 1999); cited from Adana, Agri, Elazığ (Önder et al., 2006).

Megalonotus colon Puton, 1874. DIYARBAKIR (Station 2, 16): 2 males, 4 females; SIIRT (Aydınlar) (Matocq & Özgen, 2010).

Turanico-East Mediterranean (Péricart, 1999, 2001b). TURKEY: reported from: Adana and Hatay province (Seidenstücker, 1958); Diyarbakir, Izmir (Çagatay, 1988); Adana, Afyonkarahisar, Ankara, Bingöl, Bursa, Canakkale, Gaziantep, Hatay, Sanliufa (Péricart, 1999); Ankara, Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006).

Megalonotus maximus (Puton, 1895). SIIRT (Merkez) (Matocq & Özgen, 2010).

East Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from East and South-East Anatolia (Bingöl, Hatay, Kahramanmarash, Sanliurfa) (Péricart, 1999); from Ankara, Hatay, Konya (Önder et al., 2006).

Megalonotus praetextatus (Herrich-Schaeffer, 1835). DIYARBAKIR (Station 16): 1 female.

Turanico-Euro-Mediterranean (Péricart, 1999, 2001b). TURKEY: widespread, extending to Armenia (Péricart, 1999); cited from 12 provinces, including Gaziantep, Hatay, Kahramanmaras (Önder et al., 2006). A polyphagous species.

Tribe des Rhyparochromini Amyot & Serville, 1843

Aellopus atratus (Goeze, 1778). DIYARBAKIR (Station 2): 2 males, 1 nymph.

Turanico Ponto Euro-Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from Hatay province (Puton & Noualhier, 1895); European Turkey (Sienkiewicz, 1964); Aydin, Bursa, Ankara, Adana, Kayseri, Tokat, Ulukishla (Péricart, 1999); Afyonkarahisar

(Hoberlandt, 1956); cited from Afyonkarahisar, Ankara, Aydin, Hatay (Önder et al., 2006). Associated to various Boraginaceae, in particular to the genus *Echium* (Péricart, 1999).

Beosus quadripunctatus (Müller, 1766). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 9, 13, 17): 4 males, 2 females. SIIRT (Merkez) (Matocq & Özgen, 2010).

Turanico-Ponto-North Mediterranean (Péricart, 1999, 2001b). TURKEY: cited from Ankara (Hoberlandt, 1956); from Diyarbakir (Önder & Adiguzel, 1979); widespread including in the eastern part of Anatolia (Péricart, 1999; Önder et al., 2006).

Peritrechus flavicornis Jakovlev, 1877. SIIRT (Merkez) (Matocq & Özgen, 2010).

Middle East, Arabia (Péricart, 1999, 2001b). TURKEY: recorded from Adana (Hoberlandt, 1956); from Adana and Hatay (Önder et al., 2006).

Peritrechus rhomboidalis Puton, 1877. SIIRT (Merkez) (Matocq & Özgen, 2010).

Turanico-Ponto-Mediterranean (Péricart, 1999, 2001b). TURKEY: Ankara, Hatay provinces (Péricart, 1999); not cited by Önder et al. (2006).

Rhyparochromus (s. str.) sanguineus (Douglas & Scott, 1868). DIYARBAKIR, MARDIN (Stations 12, 16, 17): several specimens.

Ponto-Euro-Mediterranean (Péricart, 1999, 2001b). TURKEY: recorded from Ankara, Eskisehir, Gaziantep, Hatay, Kayseri, Kizilcahamam, Ulukishla (Péricart, 1999); not cited by Önder et al., 2006); Péricart (1999) indicated that *R. sanguineus* and *R. phoeniceus* (Rossi, 1794), are two very similar species, often confused, even in the recent literature.

Xantochilus minusculus (Reuter, 1885). SIIRT (Merkez) (Matocq & Özgen, 2010): 1 female.

Ponto-Mediterranean (Péricart, 1999, 2001b). TURKEY: widespread, recorded from Adana, Ankara, Aksehir, Aydin, Balikesir, Bursa, Gaziantep, Hatay, Istanbul, Izmir, Kayseri, Kizilcahamamn, Malatya, Mersin, Ulukishla (Péricart, 1999); cited from Ankara as *Rhyparochromus minusculus* (Reuter, 1885) (Önder et al., 2006).

Xanthochilus saturnius (Rossi, 1790). SIIRT (Merkez) (Matocq & Özgen, 2010).

Turanico-Holomediterranean (Péricart, 1999, 2001b). TURKEY: Izmir (Hoberlandt, 1956); Diyarbakir (Wagner, 1959); Adana, Bursa, Gaziantep, Hatay, Istanbul, Osmaniye (Péricart, 1999); cited in addition from Elazığ, Kahramanmaras, Mersin, as *Rhyparchromus saturnius* (Rossi, 1790) (Önder et al., 2006).

Family PYRRHOCORIDAE Amyot & Serville, 1843

Pyrrhocoris apterus (Linné, 1758). MARDIN (Station 15): 1 female.

Palaearctic (Kerzhner 2001). TURKEY: widespread (Önder et al., 2006). Mainly on Malvaceae and Tiliaceae (Moulet, 1995).

Scantius aegyptius aegyptius (Linné, 1758). MARDIN (Station 13): 1 female.

North Africa and Middle East (Kerzhner, 2001). TURKEY: According to Carapezza *et al.* (1999), the nominal subspecies is present in south east Turkey, whereas *S. aegyptius rossii* Carapezza et al., 1999 is present in north and west Turkey. Associated with Malvaceae as other Pyrrhocoridae.

Family STENOCEPHALIDAE Dallas,1852

Dicranocephalus albipes (Fabricius, 1781). ELAZIĞ (Station 8): 2 males.

Euro-Mediterranean, also known in the Near East and Caucasia (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed (Önder et al., 2006). Lives on *Euphorbia* (Euphorbiaceae) (Moulet, 1995).

Family COREIDAE Leach, 1815
Subfamily PSEUDOPHLOEINAE Stål, 1868
Tribe Pseudophloeini Stål, 1868

Anoplocerus luteus (Fieber, 1861). ELAZIĞ (Station 8): 1 female.

West Mediterranean, also known in Morroco, Tunisia and the Pontic region (Moulet, 1995; Dolling, 2006). TURKEY: probably widely distributed; the species is erroneously considered as endemic to Anatolia by Önder et al. (2006), and it is also cited by these authors as *A. subinermis* (Puton, 1888) now a synonym (see Dolling, 2006).

Arenocoris waltlii (Herrich-Schaeffer, 1835). DIYARBAKIR (Stations 2, 4, 5): 3 males, 1 female.

Holomediterranean and also known in the Middle East and Caucasia (Moulet, 1995; Dolling, 2006). TURKEY: probably widely distributed (Hoberlandt, 1956; Önder et al., 2006). On *Erodium cicutarium* (Geraniaceae) (see Moulet, 1995).

Coriomeris affinis (Herrich-Schaeffer, 1839). DIYARBAKIR (Hazro-düzevler), 3-VIII-2010, M. Duman & I. Özgen leg.: 1 male.

Ponto-Euro-Mediterranean (Moulet, 1995; Dolling, 2006). TURKEY: cited from Hatay and Mus provinces (Puton & Noualhier, 1995, Kiritschenko, 1924; Önder et al., 2006).

Coriomeris hirticornis (Fabricius, 1794). DIYARBAKIR, Silvan Dibalew Kocaş Moutain , 1184 m, 15-IV-2010. I. Özgen leg.: 1 female.

Euro-Mediterranean (Dolling, 2006). TURKEY: widely distributed, and cited in particular from Diyarbakir (Önder & Adiguzel, 1979) and Elazığ provinces (Önder et al., 2006).

Coriomeris subglaber Horváth, 1917. ELAZIĞ (Stations 7, 11): 2 males.

Only known from Greece, Turkey, Iran, Afganistan (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed and cited among other provinces from Gaziantep, Malatya (Moulet, 1995) and Elazığ (Önder et al., 2006).

Coriomeris vitticolis Reuter, 1900. DIYARBAKIR (Station 2): 1 male.

Mediterranean, also known in Middle East (Moulet, 1995; Dolling, 2006). TURKEY: only cited from Erzincan, Izmir and Mus provinces (Önder et al., 2006). Usually collected on Asteraceae (Moulet, 1995).

Subfamily COREINAE Leach, 1815
Tribe Coreini Leach, 1815

Centrocoris spiniger (Fabricius, 1781). DIYARBAKIR, MARDIN (Stations 4, 6, 12): 5 males, 2 females.

Holomediterranean (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed, and in south east Anatolia only cited from Hatay province (Hoberlandt, 1956, Önder et al., 2006).

Coreus marginatus (Linné, 1758). ELAZIĞ, MARDIN (Stations 9, 15): 1 male, 2 females.

Holopalaearctic (Moulet, 1995; Dolling, 2006). TURKEY: cited from various provinces including: Elazığ, Hatay, Mus (Hoberlandt, 1956; Önder et al., 2006). A polyphagous species (Asteraceae, Polygonaceae, Rosaceae, etc.) (Moulet, 1995).

Tribe Gonocerini Mulsant & Rey, 1870

Gonocerus insidiator (Fabricius, 1787). ELAZIĞ (Station 9): 1 female.

Holomediterranean and present in Anatolia (Moulet, 1995; Dolling, 2006). TURKEY: not recorded by Önder et al. (2006). Mainly on Cistaceae, Fagaceae, Thymelaeaceae, Lamiaceae (Moulet, 1995).

Tribe Prionotylini Puton, 1872

Prionotylus brevicornis (Mulsant & Rey, 1852). ELAZIĞ (Station 7): 1 female.

Holomediterranean and present in Anatolia (Dolling, 2006). TURKEY: recorded from Hatay (Puton & Noualhier, 1895); not recorded by Moulet (1995) and Önder et al. (2006). On various plants (Moulet, 1995).

Family ALYDIDAE Amyot & Serville, 1843
Subfamily ALYDINAE Amyot & Serville, 1843

Camptopus lateralis (Germar, 1817). ELAZIĞ (Station 8): 2 females.

South Palaearctic extending to the Oriental Region (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed and reported from various provinces (Önder et al., 2006) including in south east Anatolia (see Dursun et al., 2010). On various plants (Moulet, 1995); on *Hypericum* (Hypericaceae), *Astralagus* (Fabaceae), *Sambucus* Adoxaceae) (Dursun et al., 2010).

Family RHOPALIDAE Amyot & Serville, 1843
Subfamily RHOPALINAE Amyot & Serville, 1843
Tribe Rhopalini Amyot & Serville, 1843

Brachycarenus tigrinus (Schilling, 1829). DIYARBAKIR, ELAZIĞ (Stations 7, 17): 4 males.

Holopalaearctic (Moulet, 1995; Dolling, 2006). TURKEY: cited from Diyarbakir (Önder & Adiguzel, 1979); widely distributed (Önder et al., 2006). Mainly on Brassicaceae (Moulet, 1995).

Corizus brevicornis Horváth, 1917. DIYARBAKIR (Station 17): 1 male.

TURKEY: Only known from Turkey (Moulet, 1995; Dolling, 2006). Described from the Ezurum province by Horváth and recorded from Konya (Göllner-Scheiding, 1980), Malatya and Kayseri provinces (Seidenstücker, 1961; Moulet, 1995). Lives on *Morina persica* (Dipsacaceae) (Moulet, 1995).

Corizus hyoscyami hyoscyami (Linné, 1758). DIYARBAKIR, MARDIN (Stations 2, 4, 6, 11, 12, 13, 15, 17): several specimens.

Holopalaearctic (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed (Hoberlandt, 1956; Önder et al., 2006). On various plants; *Hyoscyamus niger* (Solanaceae) being the true host plant (see Moulet, 1995).

Liorhyssus hyalinus (Fabricius, 1794). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 2, 3, 4, 5, 13, 15): several specimens; MARDIN (Ömerli) (Matocq & Özgen, 2010).

Cosmopolitan (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed (Hoberlandt, 1956; Önder et al., 2006); cited from Diyarbakir (Önder & Adiguzel, 1979). On various plants.

Maccevethus errans caucasicus (Kolenati, 1845). DIYARBAKIR (Station 5): 1 male; SIIRT (Merkez) (Matocq & Özgen, 2010).

Euro-Mediterranean, also present in Middle East (Moulet, 1995; Dolling, 2006). Kerhzner (1998) considered this taxon as a subspecies of *M. errans* (Fabricius, 1794); however Kment & Baňař (2010) considered that it should be upgraded to species rank. TURKEY: cited from Diyarbakir (Önder & Adiguzel, 1979); widely distributed (Önder et al., 2006). On Asteraceae (Moulet, 1995).

Maccevethus sp. DIYARBAKIR (Stations 5, 17): 6 females.

Within this genus, females cannot be accurately identified.

Rhopalus (Aeschyntelus) maculatus (Fieber, 1837). DIYARBAKIR (Station 16): 2 males, 4 females.

Palaearctic (Europe, Middle East) (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed including in Adiyaman, Diyarbakir, Gaziantep and Siirt provinces (Hoberlandt, 1956; Önder et al., 2006). Lives mainly on *Epilobium* (Oenotheraceae) and other various plants (Moulet, 1995).

Rhopalus (Rhopalus) parumpunctatus Schilling, 1829. DIYARBAKIR, ELAZIĞ, MARDIN (Stations 2, 9, 11, 12): 3 males, 2 females.

Holopalaearctic (Europe, Middle East) (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed (Hoberlandt, 1956; Önder et al., 2006). A polyphagous species living on various plants, mainly on Asteracea and Fabaceae (Moulet, 1995).

Rhopalus (Rhopalus) subrufus (Gmelin, 1790). ELAZIĞ, MARDIN (Stations 7, 8, 13, 15): 2 males, 2 females.

Palaearctic (Europe, Middle East) (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed (Hoberlandt, 1956; Önder et al., 2006). A polyphagous species (Moulet, 1995).

Stictopleurus abutilon (Rossi, 1790). DIYARBAKIR, MARDIN (Stations 2, 4, 12): 3males, 2 females.

Euro-Siberian extending to Central Asia (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed (Hoberlandt, 1956; Önder et al., 2006). A polyphagous species (Moulet, 1995).

Stictopleurus subtomentosus (Rey, 1888). ELAZIĞ (Station 9): 1 male.

Euro-Mediterranean extending to Middle East (Moulet, 1995; Dolling, 2006). TURKEY: cited as *Stictopleurus riveti* (Royer, 1923) from Diyarbakir (Önder & Adiguzel, 1979) and several Anatolian provinces including Diyarbakir, Hakkari, Siirt, Sanliufa, Van (Önder et al., 2006). *S. riveti* is now a synonym of *S. submentosus* (see Göllner Scheiding, 1975; Moulet, 1991).

Tribe Chorosomatini Fieber, 1860

Chorosoma schillingii (Schilling, 1829). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 6, 9, 12): 2 males, 3 females.

Euro-Mediterranean extending to Central Asia (Moulet, 1995; Dolling, 2006). TURKEY: widely distributed (Moulet, 1995; Önder et al., 2006); cited from Hatay (Puton & Noualhier, 1895); Diyarbakir (Önder & Adiguzel, 1979); among other provinces, Moulet (1995) cited also Malatya and Diyarbakir. On Poaceae and various other plants.

Pentatomoidea
Family CYDNIDAE Billberg, 1820
Subfamily SEHIRINAE Amyot & Serville, 1843
Tribe Sehirini Amyot & Serville, 1843

Ochetostethus sp. SIIRT (Merkez) (Matocq & Özgen, 2010).

Females cannot be accurately identified, even when genitalia are examined (see Magnien, 2006; Magnien & Ponel, 2011).

Legnotus limbosus (Geoffroy, 1785). MARDIN (Station 15): several specimens.

Euro Mediterranean extending to Uzbekistan (Lis, 2006). TURKEY: reported from various provinces (Lodos & Önder, 1980; Önder et al., 2006), including Hatay (Puton, 1892), Gaziantep, Osmaniye. Mainly on *Galium* (Rubiaceae) (Magnien, 1998).

Tritomegas delagrangei (Puton, 1888). ELAZIĞ (Station 11): 1 male.

Only known from Azerbaidjan, Israel, Lebanon, Syria, Turkey (Lis, 2006). TURKEY: reported as *Sehirus delagrangei* (Puton) by Lodos & Önder (1980), Önder et al. (2006) and other authors; described from Izmir and recorded from several provinces: Hatay (Horváth, 1901), Gaziantep (Hoberlandt, 1956), Diyarbakir, Mardin (Lodos & Önder, 1980).

Tribe Geotomini Wagner, 1963

Geotomus sp. SIIRT (Merkez) (Matocq & Özgen, 2010).

Female specimens of the genus *Geotomus* cannot be accurately identified.

Macroscytus brunneus (Fabricius, 1803). DIYARBAKIR (Station 2): several specimens (at light).

Widespread in Europe, Africa, Middle East, Central Asia (Lis, 1994, 2006). TURKEY: reported from several provinces, most in the south and southeast part, including Hatay (Puton & Noualhier, 1895), Adana (Hoberlandt, 1956), Diyarbakir (Önder & Adiguzel, 1979), Gaziantep, Diyarbakir (Lodos & Önder, 1980), Sanliurfa (Lis, 2000).

Tribe Amaurocorini Wagner, 1963

Amaurocoris curtus (Brullé, 1838). SIIRT (Merkez) (Matocq & Özgen, 2010).

Eremian, from North Africa to the Middle East, Central Asia and Pakistan (Lis, 1994, 2006). TURKEY: reported from South Turkey: Hatay (Puton & Noualhier, 1895), Gaziantep (Hoberlandt, 1956), Adiyaman (Lodos & Önder, 1980). The tribe Amaurocorini has been recently upgraded to a separate subfamily Amaurocorinae (Pluot-Sigwalt & Lis, 2008).

Family SCUTELLERIDAE Leach, 1815
Subfamily ODONTOSCELINAE Amyot & Serville, 1843

Odontoscelis (Odontoscelis) litura (Linné, 1775). ELAZIĞ (Station 7): 1 male.

Only known from Egypt, Turkey, Cyprus, Iraq, Syria (Göllner-Scheiding, 2006). TURKEY: Göllner-Scheiding (1986, 1987) indicated "eastern Turkey"; not cited by Önder et al. (2006).

Subfamily EURYGASTRINAE Amyot & Serville, 1843
Tribe Eugastrini Amyot & Serville, 1843

Eurygaster integriceps Puton, 1881. DIYARBAKIR, ELAZIĞ, MARDIN (Stations 1, 4, 5, 13, 14, 16, 17): several specimens.

Ponto-Mediterranean extending to the Middle East, Central Asia and Pakistan (Göllner-Scheiding, 2006). TURKEY: widespread (Önder et al., 2006), particularly in southeastern region. On Poaceae; one of the most important Sunn Pest (Javahery et al., 2000).

Eurygaster maura (Linné, 1758). ELAZIĞ (Station 8): 1 female.

Palaearctic (Göllner-Scheiding, 2006). TURKEY: widespread (Önder et al., 2006). On Poaceae; causes damage to wheat and barley (Javahery et al., 2000).

Tribe Psacastini Mulsant & Rey, 1865

Psacasta (Cryptodontus) tuberculata (Fabricius, 1781). ELAZIĞ (Station 9): 1 female.

Holomediterranean (Göllner-Scheiding, 2006). TURKEY: reported from several provinces, including Gaziantep, Hatay (Önder et al., 2006). On *Echium* (Boraginaceae) (Hoberlandt, 1956).

Psacasta* (*Psacasta*) *exanthematica exanthematica (Scopoli, 1763). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 6, 8, 15): several specimens.

Holomediterranean extending to Central Europe, Middle East and Central Asia (Göllner-Scheiding, 2006). TURKEY: widespread and also reported as *P. herculeana* (Horváth, 1891 and *P. pallida* Reuter, 1902, two synonyms (see Göllner-Scheiding, 2006); cited in particular from Elazığ, Gaziantep, Hatay, Kahramanmaras provinces (Önder et al., 2006). On *Anchusa* (Boraginaceae) (Hoberlandt, 1956).

Subfamily ODONTOTARSINAE Mulsant & Rey, 1865
Tribe Odontotarsini Mulsant & Rey, 1866

Odontotarsus impictus Jakovlev, 1886. DIYARBAKIR, ELAZIĞ (Stations 8, 17): 3 females.

Irano-turanian extending to Central Asia (Göllner-Scheiding, 2006). TURKEY: reported from several provinces, including Diyarbakir, Hatay, Mardin, Siirt, Sanliurfa, Sirnak (Önder et al., 2006).

Odontotarsus crassus Kiritshenko, 1966. DIYARBAKIR, MARDIN (Stations 6, 13): 2 males, 5 females.

Restricted to Iran in the Palaearctic Catalogue (Göllner-Scheiding, 2006). However, *O. latissimus* Göllner-Scheiding, 1990 described from Diyarbakir was recently synonymized with *O. crassus* by Carapezza (2008); thus, the general distribution is now: Greece (Crete), Iraq, Iran, Syria, Turkey (Carapezza, 2008). TURKEY: Only recorded from the European part of Turkey (Göllner-Scheiding, 2006) and Diyarbakir (Göllner-Scheiding, 1990).

Odontotarsus plicatulus Horváth, 1906. MARDIN (Station 12): 3 males.

East Mediterranean (Göllner-Scheiding, 2006). TURKEY: cited from several provinces, including Elazığ, Gaziantep, Kahramanmaras, Kilis, Mardin, Siirt (Önder et al., 2006). *O. confraginosus* Hoberlandt, 1956, described from Ankara is a synonym of *O. plicatulus*. On Centaurae (Hoberlandt, 1956).

Odontotarsus robustus Jakovlev, 1884. DIYARBAKIR, ELAZIĞ, MARDIN (Stations 8, 12, 13, 17): several specimens.

Holomediterranean extending to Turkmenistan (Göllner-Scheiding, 2006). TURKEY: widespread (Hoberlandt, 1956; Önder *et al.*, 2006), including in south east Anatolia, Diyarbakir, Gaziantep, Hatay, Kahramanmaras, Mardin. On Centaureae (Hoberlandt, 1956; Linnavuori 2008).

Odontotarsus rufescens Fieber, 1861. ELAZIĞ (Station 10): 3 males, 1 female.

Ponto-Mediterranean (Göllner-Scheiding, 2006). *O. irroratus* Horváth, 1906 described from Bursa and *O. karatasensis* Hoberlandt, 1956 described from Seyhan are two synonyms of *O. rufescens* (see Göllner-Scheiding, 2006). TURKEY: reported from numerous provinces including Elazığ, Gaziantep, Hatay, Kahramanmaras, Mardin (Önder et al., 2006). On Centaureae (Hoberlandt, 1956).

Family PENTATOMIDAE Leach, 1815
Subfamily ASOPINAE Amyot & Serville, 1843

Jalla dumosa (Linné, 1758). DIYARBAKIR (Station 3): 1 male; (Silvan Dibalew, Kocaş Moutain), 1184 m, 15-IV-2010, I. Özgen leg.: 1 female. Transpalaearctic (Rider, 2006; Péricart, 2010). TURKEY: cited from several provinces, none in south east part of Anatolia (Önder et al., 2006). Preys on various larvae of coleoptera and lepidopera (Péricart, 2010).

Subfamily PENTATOMINAE Leach, 1815
Tribe Aeliini Douglas & Scott, 1865

Aelia acuminata (L, 1758.). DIYARBAKIR, MARDIN (Stations 2, 5, 14, 16): several specimens.

Holopalaearctic (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: widespread (Önder et al., 2006), also recorded as *A. turanica* Horváth, 1895 synonymized by Voegelé (1968); cited from Diyarbakir, Mardin and Sirnak provinces on wheat (Özgen et al., 2005a). Mainly on wild Poaceae and a pest on cereal crops (Panizzi et al., 2000; Derjanschi & Péricart, 2005).

Aelia albovittata Fieber, 1868. DIYARBAKIR (Station 6, 8): 2 males, 3 females.

TURKEY: only known from Turkey (Derjanschi & Péricart, 2005; Rider, 2006). Collected in various provinces (see Hoberlandt, 1956; Brown, 1962b; Derjanschi & Péricart, 2005; Önder et al., 2006) including Hatay, Diyarbakir, Gaziantep. On Poaceae (*Heteranthelium*, *Aegilops*, *Taeniatherum*) (Brown 1962a).

Aelia alticola Kiritshenko, 1914. ELAZIĞ (Station 11): 1 male, 1 female.

A turanico-caucasian species extending to Iran and Turkmesnistan (Derjanschi & Péricart, 2005; Rider, 2006). In the literature often identified under the name *A. satunini* Kiritshenko, 1930, now a synonym of *A. alticola* (see Derjanschi & Péricart, 2005). TURKEY: it is cited as *A. satunini* by Hoberlandt (1956) and Önder et al. (2006) from Konya and Igdir provinces.

Aelia rostrata Boheman, 1852. ELAZIĞ (Station 8): 3 females.

Palaearctic (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: widespread (Önder et al., 2006); also recorded as *A. cognata* Fieber, 1868 and as *A. syriaca* Horváth, 1903 synonymized by Derjanschi & Péricart (2005); cited from Diyarbakir, Mardin and Sirnak provinces on wheat (Özgen et al., 2005a). A dangerous pest particularly in southeastern part of Turkey (Panizzi et al., 2000; Derjanschi & Péricart, 2005); on wild and cultivated Poaceae (cereal crop).

Tribe Carpocorini Mulsant & Rey, 1866

Carpocoris coreanus Distant, 1899. DIYARBAKIR, MARDIN (Stations 13, 16): 2 males, 1 female.

Asia Minor, Eastern Palaearctic Asia extending to Southern Russia and Pakistan (Rider, 2006). TURKEY: reported as *C. iranus* Tamanini, 1958, a synonym, only from south and southeastern Turkey (Adiyaman, Diyarbakir, Gaziantep, Hatay, Kahramanmaras, Mardin, Sanliurfa) (Önder et al., 2006).

Carpocoris pudicus (Poda, 1761). DIYARBAKIR, ELAZIĞ (Stations 6, 10): 2 males, 2 females.

Central and South Europe, Egypte, Middle East extending to Pakistan (Rider, 2006). TURKEY: widespread (Hoberlandt, 1956; Önder et al., 2006); cited from Mardin, Sanliurfa, Diyarbakir and Elazığ provinces on wheat (Özgen et al., 2005a), cherry tree (Özgen et al., 2005b) and almond tree (Bolu et al., 2006); on Asteraceae (Linnavuori 2008).

Codophila varia varia (Fabricius, 1787). MARDIN (Stations 12, 13): 6 males, 1 female.

Holomediterranean, Central Europe, Middle East, Central Asia (Rider, 2006). TURKEY: widely distributed in Anatolia and cited in particular from several southeastern provinces: Diyarbakir, Gaziantep, Hatay, Mardin, Siirt (Hoberlandt, 1956; Önder et al., 2006). On Apiaceae (Hoberlandt, 1956).

Dolycoris baccarum (Linné,1758). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 3, 4, 6, 11, 13, 16, 17): several specimens.

Holarctic (Rider, 2006). TURKEY: widespread in Anatolia (Hoberlandt, 1956; Önder et al., 2006); cited from Elazığ, Sanliurfa and Diyarbakir provinces on pistachio and cherry tree (Özgen et al., 2005b), and almond tree (Bolu et al., 2006). On *Lonicera* (Caprifoliaceae), *Genista* (Fabaceae), *Styrax* (Styracacea) (Hoberlandt, 1956). When the populations are hight, can cause damage on a variety of crops (cereal, sunflower, tobacco, cherry, bean, potato, artichoke (Panizzi et al., 2000).

Holcogaster exilis Horváth, 1903. ELAZIĞ (Station 7): numerous specimens.

Mediterranean (Rider, 2006). TURKEY: cited from several provinces (Önder et al., 2006) including Hatay; these authors and others (Puton, 1892; Horváth, 1918; Hoberlandt, 1956) cited also *H. fibulata* (Germar, 1831) from Istanbul, Gaziantep and Hatay, a probable misidentification: *H. fibulata* is not recorded from Turkey (Rider, 2006) and could be confused with *H. exilis*. On *Juniperus*, *Cupressus* (Cupressaceae).

Holcostethus (Holcostethus) strictus strictus (Fabricius, 1803). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 5, 13, 15): 4 males, 4 females.

Holomediterranean extending to Central Europe and Middle East (Rider, 2006). TURKEY: Önder et al. (2006) reported *H. strictus* from several provinces, including Gaziantep, Hatay, Mardin; they reported also *H. strictus vernalis* (Wolff, 1804). Both subspecies are sympatric in Turkey, *strictus* inhabits preferably in plain, *vernalis* in highland.

Staria lunata (Hahn, 1835). DIYARBAKIR, ELAZIĞ (Stations 2, 3, 8, 17): several specimens.

Holomediterranean species extending to Central Europe and Middle East (Rider, 2006). TURKEY: cited from various provinces (Önder et al., 2006) including Gaziantep and Hatay. On *Verbascum*, *Scrofularia* (Scofulariaceae), *Thymus* (Lamiaceae), *Galium* (Rubiaceae), *Centaurea* (Asteraceae) (Hoberlandt, 1935; Linnavuori, 2008).

Tribe Piezodorini Atkinson, 1888

Piezodorus lituratus (Fabricius, 1794). DIYARBAKIR, ELAZIĞ (Stations 1, 2, 5, 10, 16): several specimens.

Holomediterranean extending to Central Europe, Middle East, Central Asia and China (Rider, 2006). TURKEY: widely distributed (Önder et al., 2006); cited from Diyarbakir, Sanliurfa, Elazığ, Malatya and Mardin provinces on wheat (Özgen et al., 2005a), apricot and cherry tree (Özgen et al., 2005b) and almond tree (Bolu et al., 2006). Mainly on wild and cultivated Fabaceae (*Lupinus, Medicago, Melilotus, Sarothamus, Trifolium, Ulex*) (Panizzi et al., 2000).

Tribe Eysarcorini Mulsant & Rey, 1865

Eysarcoris ventralis (Westwood, 1837). DIYARBAKIR (Çınar-Kuyuluhöyük), 6-VII-2010, M. Duman & I. Özgen leg. On rice: 1 male, 1 female.

Euro-Siberian and Afro-Turanico-Mediterranean extending far into the Ethiopian and Oriental regions (Derjanschi & Péricart, 2005; Rider, 2006)). TURKEY: reported as *E. inconspicuous* (H.-S.), from Diyarbakir (Önder & Adiguzel, 1979) and from numerous provinces, including Adiyaman, Diyarbakir, Gaziantep, Hatay, Kahramanmaras, Sirnak (Wagner, 1966; Önder et al., 2006).

Stagonomus (Stagonomus) amoenus (Brullé, 1832). ELAZIĞ (Station 8): 2 males.

Euro-Mediterranean and Ponto-Turanian, extending in Asia to Oriental Kazakstan (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: cited from various provinces, in particular Hatay and Gaziantep (Önder et al., 2006). Mainly on *Salvia* spp. (Lamiaceae).

Tribe Halyini Amyot & Serville, 1843

Apodiphus amygdali (Germar, 1817). MARDIN (Station 14): 2 females.

Ponto-Mediterranean extending to the Middle East (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: cited from Diyarbakir, Mardin, Sanliurfa, Elazığ and Malatya provinces on apricot and cherry trees (Özgen et al., 2005b) and almond tree (Bolu et al., 2006). Lives on various trees and may produce some damage in orchards (on *Prunus*, *Pistacia*, *Olea*, *Ficus*, etc.). Widespread in Turkey, see the general distribution and the numerous host plants in Fent et al. (2010a).

Mustha vicina Hoberlandt, 1997. (Station 3): 3 females.

Previously only known from Iran (Rider, 2006). TURKEY: recently recorded from Turkey (Gaziantep) by Fent et al. (2010a). According to Fent et al. (loc. cit.), the specimens identified as "*M. longispinis*" Reuter, 1890 recorded from Şanlıurfa province by Özgen et al. (2005) and from Diyarbakır, Elazığ and Mardin by Bolu et al. (2006) belong in reality to *M. vicina*. The distribution in Turkey is until now restricted to South East Turkey.

Mustha spinosula (Lefebvre, 1831). (Station 3): 3 males.

Ponto-East Mediterranean (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: Widespread (Fent et al., 2010a) including in south east Anatolia (Diyarbakir, Elazığ, Gaziantep, Kahramanmaras, Kilis, Malatya, Hatay, Mardin). Host plants: see Fent et al. (2010a).

Tribe Pentatomini Leach, 1815

Acrosternum breviceps (Jakovlev, 1889). (Station 1): 1 female.

Irano Touranian, from Middle East to Central Asia (Rider, 2006). TURKEY: cited from Diyarbakir (Önder & Adiguzel, 1979; Önder et al., 2006) and possibly restricted to southeastern Anatolia.

Rhaphigaster nebulosa (Poda, 1761). MARDIN (Station 15): 1 male.

Euro-Mediterranean and Turanian (Rider, 2006). TURKEY: recorded from several provinces, none from south east Anatolia (Hoberlandt, 1956; Önder et al., 2006), except Hatay, Kahramanmaras, Kilis (Lodos et al., 1998).

Tribe Sciocorini Amyot & Serville, 1843

Dyroderes umbraculatus (Fabricius, 1775). ELAZIĞ, MARDIN (Stations 7, 10, 15): several specimens.

Ponto- and Holomediterranean (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: widespread in Anatolia (Önder et al., 2006), but apparently more rare in the East according to Derjanschi & Péricart (2005). On *Galium* spp. (Rubiaceae).

Sciocoris* (*Aposciocoris*) *luteolus Fieber, 1861. ELAZIĞ (Station 8): 1 female.

Mediterranean extending to Iran and Afganistan (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: cited from various provinces (Derjanschi & Péricart, 2005; Önder et al., 2006), in particular from Diyarbakir, Elazığ, Gaziantep, Hatay, and Mardin.

Sciocoris* (*Aposciocoris*) *macrocephalus Fieber, 1851. DIYARBAKIR, MARDIN (Stations 12, 16): 2 males, 3 females.

Euro-Siberian and Ponto-Mediterranean (Derjanschi & Péricart, 2005; Rider, 2006); recently recorded from Iran (Linnavuori, 2008). TURKEY: widely distributed, and in south east Anatolia known from Adiyaman, Diyabakir, Gaziantep, Kahramanmaras, Siirt, Van (Önder et al., 2006). Host plants: *Knautia* and *Scabiosa* (Dipsacaceae) (Derjanschi & Péricart, 2005).

Sciocoris* (*Sciocoris*) *cursitans cursitans (Fabricius, 1794). ELAZIĞ (Station 7): 1 female.

Euro-Siberian, reaching in the South, Caucasia, Transcaucasia, Cyprus (Derjanschi & Péricart, 2005; Rider, 2006); recently recorded from Iran (Linnavuori, 2008). TURKEY: cited among other provinces from Diyarbakir, Elazığ, Hatay (Önder et al., 2006). A polyphagous species (Derjanschi & Péricart, 2005; Rider, 2006).

Sciocoris* (*Sciocoris*) *deltocephalus Fieber, 1861. DIYARBAKIR, MARDIN (Stations 13, 17): 1 male?, 1 female.

Ponto-Nord East Mediterranean (Derjanschi & Péricart, 2005, Rider, 2006). TURKEY: widely distributed and present in Diyarbakir and Van provinces (Önder et al., 2006).

Sciocoris* (*Sciocoris*) *ochraceus Fieber 1861. DIYARBAKIR (Station 2): 2 females.

East and South-Mediterranean (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: cited from several provinces (Seidenstücker, 1958; Önder et al., 2006), in particular from Hatay, Diyarbakir, Mardin, Elazığ, Siirt, Sirnak and Van.

Tribe Strachiini Mulsant & Rey, 1865

Bagrada* (*Nitilia*) *abeillei Puton, 1881. DIYARBAKIR, ELAZIĞ (Stations 1, 4, 8, 9, 17): 8 males, 11 females.

East-Mediterranean species (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: only recorded from south and southeastern provinces (Önder et al., 2006; Fent et al., 2010b): Adiyaman, Batman, Diyarbakir, Gaziantep, Hatay, Kilis; Siirt, Sanliurfa.

Bagrada* (*Nitilia*) *stolida (Herrich-Schaeffer, 1839). DIYARBAKIR, ELAZIĞ (Stations 1, 2, 8): 4 males, 3 females.

Mediterranean (Northeastern part), Black see regions, Middle Asia (Rider, 2006). TURKEY: cited from Izmir by Hoberlandt (1956) as *B. confusa* Horváth, 1936 and, *B. stolata var. quadrimaculata* Horváth, 1936; and by Önder et al. (2006) as *B. cicur* Horváth, 1936 and *B. stolata* Horváth, 1936, now synonymized (see Derjanschi & Péricart, 2005; Rider, 2006). On *Artemisia* spp. (Asteraceae) (Derjanschi & Péricart, 2005).

Eurydema* (*Eurydema*) *laticollis Horváth, 1907. DIYARBAKIR (Station 17): 2 males, 9 females.

Restricted to South Russia, Turkey (Asian part), Iran (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: Wagner (1959) cited the species from Diyarbakir, and Önder et al. (2006) from Diyarbakir and Igdir.

Eurydema* (*Eurydema*) *ornata (Linné, 1758). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 1, 2, 3, 5, 7, 13, 15, 17): several specimens.

Holopalaearctic, North Africa, Middle East (Derjanschi & Péricart, 2005, Rider, 2006). TURKEY: widely distributed (Önder et al., 2006) and cited particularly from Gaziantep and Hatay; in southeastern Anatolia also cited from Batman province on wheat (Özgen et al., 2005a). Host plant: mainly Brassicaceae.

Eurydema* (*Eurydema*) *putoni (Jakovlev, 1877). DIYARBAKIR, ELAZIĞ, MARDIN (Stations 3, 7, 13): 4 males, 16 females.

Middle East (Azerbaijan, Afganistan, Armenia, Turkey, Iran, Israel, Iraq, Syria) (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: only cited from southeastern Turkey (Diyarbakir, Hatay, Gaziantep, Mardin) by Önder et al. (2006) as *E. formosum* (Puton, 1895) synonymised by Péricart (2004).

Eurydema* (*Horvatheurydema*) *fieberi Fieber, 1837. ELAZIĞ (Station 8): 1 male, 5 females.

Holomediterranean (rare in North Africa) extending to Middle Asia (Derjanschi & Péricart, 2005, Rider, 2006). TURKEY: cited as "*E. fieberi* (Schummel, 1836)" from various provinces, in particular Gaziantep, Hatay (Önder et al., 2006).

Eurydema* (*Horvatheurydema*) *rugulosa (Dohrn, 1860). DIYARBAKIR, ELAZIĞ (Stations 3, 7): 2 males, 2 female.

East-Mediterranean extending to Iran, Afganistan, Ethiopia (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: recorded from various provinces (Horváth, 1901; Hoberlandt, 1956; Önder et al., 2006), in particular from Hatay (Puton, 1892), Diyarbakir (Derjanschi & Péricart, 2005), Hatay and Gaziantep (Önder et al., 2006).

Trochiscocoris hemipterus (Jakovlev, 1879). DIYARBAKIR (Station 5): 1 male.

South West Europe, North Africa, Anatolia and Caucase (Derjanschi & Péricart, 2005; Rider, 2006). TURKEY: recorded from Adana, Karaman, Konya by Önder et al. (2006) (in Adana province as *T. sanguinolentus* Horváth, 1895, synonymized by Kerzhner, 1964).

Subfamily PODOPINAE Amyot & Serville, 1843
Tribe Graphosomatini Mulsant & Rey, 1865

Ancyrosoma leucogrammes (Gmelin, 1789). DIYARBAKIR (Stations 4, 16): 3 males, 1 female.

Ponto Turanian and circummediterranean, extending to the East (Caucase, Middle East, Mongolia) (Rider, 2006; Péricart, 2010). TURKEY: widespread (Hoberlandt, 1956; Önder et al., 2006). Mainly on Apiaceae (Péricart, 2010).

Derula flavoguttata Mulsant & Rey, 1856. ELAZIĞ (Station 10): 2 males, 1 female.

North and East-Mediterranean, extending to Turkey, Transcaucasia, South Russia (Rider, 2006; Péricart, 2010). TURKEY: cited from several provinces including Hatay and Gaziantep (Önder et al., 2006). Somewhat polyphagous (Apiaceae, Rubiaceae) (Péricart, 2010); collected on *Nigella* (Ranunculaceae) in Turkey (Hoberlandt, 1956).

Graphosoma semipunctatum (Fabricius, 1775). ELAZIĞ (Station 10): 2 males, 1 female.

Holomediterranean Turanian (Rider, 2006; Péricart, 2010). TURKEY: cited from numerous provinces including Diyarbakir, Elazığ, Gaziantep, Hatay and Mardin (Hoberlandt, 1956; Önder et al., 2006); also cited from Elazığ on almond tree (Bolu et al., 2006). According to Péricart (2010), the species lives on various Apiaceae and the numerous forms and varieties described until now do not have any systematic value.

COMMENTS

A total number of 286 species and subspecies belonging to 178 genera and 19 families are reported from the three prospected provinces (Mardin, Diyarbakir, Elazığ); the list also includes some 40 species previously recorded from Siirt and Mardin (Matocq & Ozgen 2010) and not collected again in 2011. This list brings, for the first time, some indications on the terrestrial heteropteran fauna in southeastern part of Turkey. However, given that our results have been mostly obtained in just two weeks during the spring, they remain obviously very incomplete and cannot lead to any serious conclusions. Here we can make only some general remarks.

We must first point out that, in our sample, adult representatives of the following families are missing (Plataspidae, Acanthosomatidae) or very poorly represented (Nabidae, Anthocoridae, Aradidae, Stenocephalidae, Alydidae) (Table 2). This is probably due to the fact that most of the representatives of these families are not yet in activity in the spring period. It is the case for some families (Alydidae, Stenocephalidae, Plataspidae, Acanthosomatidae), for which development and reproduction usually take place more late. It is true also for most predators (Nabidae, Anthocoridae, Reduviidae) much more abundant in late summer or even in autumn when preys are common. The phytophagous Lygaeidae, Scutelleridae, and Pentatomidae, mostly seed-feeders, are also more abundant later, in summer and autumn.

It is not surprising to note that Miridae constitutes the most abundant species group collected (Table 2). As we know, Miridae is the largest heteropteran family (with more than 10 000 described species) (Schuh & Slater, 1995); in addition, many plant bugs species are active and present right from early spring.

We must also notice that most of the species collected are common, widespread and previously recorded in other parts of Turkey. However some 35 species and subspecies appear to be not recorded in the Palaearctic Catalogue (Aukema & Rieger, 1995-2006) (Table 3). More than half of these taxa were indeed not taken into account in the Catalogue being described or recorded from Anatolia only recently; other records were probably deliberately ignored, the corresponding specimens being not available for further verifications. At least, we believe that 14 species and subspecies are here new for Turkey (Table 3).

Plant bug mirid species represent the most part of the species considered as new for Turkey. Once again, it is not surprising: compared to other families, for instance pentatomoid families, Miridae is still a badly known heteropteran family, a taxonomically difficult group in great need of generic revisions, and for this reason not frequently collected and identified. To tell the truth, in Anatolian faunistic studies, it is often a neglected family, with however some notable exceptions such as Önder (1981) and Lodos et al. (2003).

Thirteen species collected are considered until now as endemic for Turkey (Table 4), most of them are just mirid plant bugs.

Several species, known from different parts of Turkey, seem recorded from south or south east Anatolian region for the first time. Once more, it is the case for various mirid species (see for instance species belonging to the genera *Closterotomus, Polymerus, Barbarosia, Dryophilocoris, Globiceps, Acrorrhinium, Campyloma, Eurycolpus, Icodema, Macrotylus, Psallus, Tuponia*). It is also the case for some Lygaeidae (*Artheneis*, *Cymus*, *Emblethis*), one Coreidae (*Coriomeris*), two Pentatomidae (*Jalla*, *Raphigaster*). If we consider their distribution in Turkey, some of these species and other as well are probably restricted to southeastern region (see Table 5 species in bold). This hypothesis needs of course to be confirmed by further faunistic Anatolian investigations.

The present list of true bugs, gives a first insight into the heteropteran fauna in south east Anatolian region during spring. This fauna consists mainly of Euro-Ponto- and Mediterranean faunal elements; East Mediterranean elements are also well represented. A group of some 50 species shows a clear Irano Anatolian distribution being present in Turkey and adjacent countries (Armenia, Azerbaijan, Georgia, Iraq, Iran, Turkmenistan); some of these species are also Touranian elements, extending their distribution to Central Asia. As we know, the Irano Anatolian region is considered as a biodiversity hotspots and it is important to continue the faunistic investigations in the southeastern Anatolian region.

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Table 1. List of the prospected localities.

Station number:	**Localities, geographic coordinates, date, altitude (m)**
Station 1	DIYARBAKIR: Diyarbakir, Plant Protection Institute [37°56'56N 40°15'30E], 22-23 May 2010, 598 m
Station 2	DIYARBAKIR: Diyarbakir, Plant Protection Institute [37°56'45N 40°15'30E], 29-30 May 2010, 628 m
Station 3	DIYARBAKIR: Egil [38°10'04N 40°04'66E], 23 May 2010, 832 m
Station 4	DIYARBAKIR: Ergani Boraez [38°17'24N 39°56'42E], 24 May 2010, 977 m
Station 5	DIYARBAKIR: Diyarbakir, Dicle University [37°56'56N 37°56'56E], 24-25 May 2010, 610 m
Station 6	DIYARBAKIR: Hazro [36°14'43N 40°47'72E], 25 May 2010, 953 m
Station 7	ELAZIĞ: Harput castle [38°42'62N 39°15'95E], 26-27 May 2010, 1407 m
Station 8	ELAZIĞ: Keban çakmak [38°42'39N 38°56'17E], 26 May 2010, 1395 m
Station 9	ELAZIĞ: Birvan [38°43'92N 38°49'82E], 26 May 2010, 1000 m
Station 10	ELAZIĞ: Hazar lake [38°27'22N 38°27'76E], 27 May 2010, 1247 m
Station 11	ELAZIĞ: Maden [38°22'59N 39°41'22E], 27 May 2010, 916 m
Station 12	MARDIN: Ömerli [37°25'32N 40°59'00E], 28 May 2010, 1070 m
Station 13	MARDIN: Mazidagi [37°32'94N 40°32'32E], 31 May 2010, 940 m
Station 14	MARDIN: Derik [37°22'05N 40°15'76E], 31 May 2010, 821 m
Station 15	MARDIN: Gürgözeküdü [37°29'16N 40°31'06E], 31 May 2010, 948 m
Station 16	DIYARBAKIR: Çüngüs [38°13'34N 39°14'89E], 01 June 2010, 954 m
Station 17	DIYARBAKIR: Çermik Artukluköyü [38°08'86N 39°31'33E], 01 June 2010, 775 m

Table 2. Heteropteran families and number of species collected in the present study.

Family	Nb of species or subspecies
Ochteridae	1
Saldidae	2
Leptopodidae	1
Tingidae	16
Miridae	103
Nabidae	5
Anthocoridae	5
Reduviidae	12
Aradidae	1
Berytidae	7
Lygaeidae	53
Pyrrhocoridae	2
Stenocephalidae	1
Alydidae	1
Coreidae	10
Rhopalidae	12
Cydnidae	6
Scutelleridae	10
Pentatomidae	37

Table 3. Species and subspecies of Heteroptera new for Turkey or recently cited or described in the literature and not recorded from this country in the Palaearctic Catalogue (Aukema & Rieger, 1995-2006).

Tingidae	
Elasmotropis testacea selecta	present record
Miridae	
Macrolophus epilobii	present record
Calocoris roseomaculatus saucius	present record
Cyphodema humbaba	present record
Cyphodema rubrica	recorded by Önder *et al.* (2006)
Phytocoris (Knetocoris) ulmi	recorded by Önder *et al.* (2006)
Phytocoris (Stictophytocoris) meridionalis	recorded by Önder *et al.* (2006)
Rauniella ishtar	present record
Trigonotylus ruficornis	recorded by Önder & Adiguzel (1979)
Halticus saltator	recorded by Önder *et al.* (2006)
Brachynotocoris cyprius cyprius	recorded by Önder *et al.* (2006)
Pseudoloxops sangrudanus	recorded by Matocq & Özgen (2010)
Pseudoloxops coccineus	recorded by Önder & Adiguzel (1979)
Acrorrhinium atricorne	recorded by Matocq & Özgen (2010)
Glaphycoris ebikh	recorded by Matocq & Özgen (2010)
Hallodapus pseudoconcolor	recorded by Matocq & Özgen (2010)
Aphanophyes richteri richteri	present record
Asciodema obsoleta	present record
Badezorus signaticornis	recorded by Matocq & Özgen (2010)
Campylomma celatum	recorded by Matocq & Özgen (2010)
Chlorillus pictoides	present record
Macrotylus (Macrotylus) syriacus	present record
Megalocoleus molliculus	recorded by Matocq (2004)
Plagiognathus (Plagiognathus) marivanensis	described by Linnavuori (2010)
Psallus inancozgeni	described by Matocq & Pluot-Sigwalt (2011)
Psallus (Apocremnus) skylla	present record
Psallus (Psallus) pseudopunctulatus	present record
Tinicephalus picticornis	recorded by Matocq (2007)
Yotvata pulcherrima	recorded by Matocq & Özgen (2010)
Anthocoridae	
Xylocoris (Stictosynechia) lativentris	present record
Anthocoris minki minki	recorded by Önder *et al.* (2006)
Reduviidae	
Ectomocoris (Ectomocoris) caucasicus	recorded by Matocq & Özgen (2010)
Holotrichius tenebrosus	present record
Lygaeidae	
Geocoris (Piocoris) luridus luridus	recorded by numerous authors
Geocoris (Piocoris) putonianus	present record
Pentatomidae	
Mustha vicina	recorded by Fent *et al.* (2010a)

Table 4. True bugs species collected considered as endemic to Turkey.

Tingidae
Dictyla sima
Miridae
Alloeotomus cyprius
Isometopus diversiceps
Closterotomus kroesus
Phytocoris (Leptophytocoris) extensus
Rhabdomiris striatellus wagneri
Barbarosia decalvata
Dryophilocoris (Camarocyphus) persimilis
Eurycolpus aureolus
Eurycolpus enslini
Macrotylus (Alloeonycha) ancyranus
Macrotylus (Macrotylus) galatinus
Rhopalidae
Corizus brevicornis

Table 5. List of collected true bugs showing a Touranian or Irano Anatolian distribution. In bold: species presumably restricted, in Turkey, to the south east part of Anatolia.

Tingidae
Catoplatus hilaris
Elasmotropis testacea selecta
Hyalochiton multiseriatus
Stephanitis (Stephanitis) oshanini
Miridae
Deraeocoris (Camptobrochis) pallens pallens
Isometopus diversiceps
Macrolophus epilobii
Brachycoleus lineellus
Brachycoleus thoracicus
Calocoris roseomaculatus saucius
Cyphodema humbaba
Cyphodema rubrica
Grypocoris (Grypocoris) fieberi
Rauniella ishtar
Platyporus dorsalis
Brachynotocoris cyprius cyprius
Globiceps (Kelidocoris) syriacus syriacus
Pseudoloxops sangrudanus
Acrorrhinium atricorne
Acrorrhinium conspersum
Glaphyrocoris ebikh
Hallodapus pseudoconcolor
Camptotylus linae
Chlorillus pictoides
Eurycolpus enslini
Macrotylus (Macrotylus) perdictus
Macrotylus (Macrotylus) syriacus
Oncotylus (Oncotylus) viridiflavus longipes
Plagiognathus (Plagiognathus) marivanensis
Psallus inancozgeni
Psallus (Apocremnus) skylla
Psallus (Psallus) pseudopunctulatus
Tinicephalus picticornis

Tuponia (Tuponia) ayasensis
Yotvata pulcherrima

Nabidae
Nabis (Nabis) pseudoferus orientarius

Reduviidae
Ectomocoris (Ectomocoris) caucasicus
Reduvius ciliatus

Berytidae
Neides brevipennis
Gampsocoris punctipes pallidus

Lygaeidae
Geocoris (Piocoris) putonianus
Emblethis setifer

Cydnidae
Tritomegas delagrangei

Scutelleridae
Odontoscelis (Odontoscelis) litura
Odontotarsus impictus

Pentatomidae
Aelia alticola
Carpocoris coreanus
Mustha vicina
Acrosternum breviceps
Bagrada (Nitilia) abeillei
Eurydema (Eurydema) putoni

Eurydema putoni	*Holotrichius tenebrosus*	*Opistholaenia fulvipes*

Rauniella ishatar

Stephanitis oshanini

Rhabdomiria striatellus wagneri

Xlocoris lativentris

Acrosternum breviceps

Calocoris roseamaculatus saicus

Elasmotrophis testacea

Chlorillus pictoides

Brachynotocoris cyprius

Eurycolpus aureolus

Geocoris putonianus

Macrotylus syriacus

Plagiognathus marivanensis

LONGICORN BEETLES OF ÇANKIRI PROVINCE IN TURKEY (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT: This work is the first attempt for entire longhorned beetles fauna of Çankırı. All known taxa from Çankırı province are given with some new faunistical data in the present text. 28 of them are recorded for the first time for Çankırı's fauna. 11 of them are recorded from Çankırı in old references only.

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

Çankırı is a province in the North of Central Anatolian Region of Turkey. Northern towns of the province are in Black Sea Region. It is bordered by Karabük and Kastamonu provinces in the North, Çorum province in the East, Kırıkkale province in the South-East, Ankara province in the South and Bolu province in the West. It is situated about 800 m above sea level. It has a total of 12 towns (incl. Central town) (Map 1).

The data on this fauna has accumulated in a piecemeal fashion over the twentieth century and this century especially. Various authors have reported some partial data on the fauna in their different works. However, most of works were completed in a short time and their works did not focus on fauna of Çankırı generally. So the longhorned beetles fauna of Çankırı has not been studied completely until now.

In this work, some new faunistical data are presented. Besides, according to cited literatures, all known taxa from Ankara province are also given in the text.

We determined that the longhorned beetles fauna of Çankırı province consists of 58 species.

SUPERFAMILY CERAMBYCOIDEA Latreille, 1802
FAMILY CERAMBYCIDAE Latreille, 1802: 211
SUBFAMILY LEPTURINAE Latreille, 1802: 218
TRIBE RHAGIINI Kirby, 1837: 178
GENUS *RHAGIUM* Fabricius, 1775: 182
SUBGENUS *RHAGIUM* Fabricius, 1775: 182
SPECIES *R. inquisitor* (Linnaeus, 1758: 393)
SUBSPECIES *R. i. inquisitor* (Linnaeus, 1758: 393)

Material examined: Çankırı: 4 km to Ilgaz, wood store of Dörtler, 11.05.2013, N 40° 54'- E 33° 38', 894 m, 24°C, on wood, 1 specimen; Kırkpınar plateau road, 30.06.2013, N 41° 0'- E 33° 39', pheromon trap, 1 specimen.
Remarks: New to Çankırı province.

GENUS *DINOPTERA* Mulsant, 1863: 494
SUBGENUS *DINOPTERA* Mulsant, 1863: 494
SPECIES *D. collaris* (Linnaeus, 1758: 398)

Material examined: Çankırı: Ilgaz-Kastamonu road, 30.06.2013, N 41° 2'- E 33° 43', 28°C, on plant, 1 specimen.

GENUS *CORTODERA* Mulsant, 1863: 572

SPECIES *C. discolor* Fairmaire, 1866: 277

Material examined: Çankırı: exit of Akçavakıf, Çankırı-Kastamonu road, 11.05.2013, N 40° 41'- E 33° 33', 866 m, 20°C, on plant, 1 specimen.
Remarks: New to Çankırı province.

SPECIES *C. flavimana* (Waltl, 1838: 471)

SUBSPECIES *C. f. flavimana* (Waltl, 1838: 471)

Material examined: Çankırı: Şabanözü-Orta road, exit of Çerçi vill., 04.05.2013, N 40° 31'- E 33° 12', 1202 m, 26°C, on plant, 21 specimens; Şabanözü-Orta road, entry of Elmalık, 04.05.2013, N 40° 32'- E 33° 8', 1318-1381 m, 24-26°C, on plant, 55 specimens; Orta-Çerkeş road, Güzelyurt vill., N 40° 44'- E 33° 1', 1283 m, 27°C, on *Ranunculus*, 6 specimens; Güldürecek Dam env., entry of Dodurga, 08.06.2013, N 40° 26'- E 32° 59', on plant, 19 specimens.

SPECIES *C. rufipes* (Kraatz, 1876: 344)

Material examined: Çankırı: Şabanözü-Orta road, exit of Çerçi vill., 04.05.2013, N 40° 31'- E 33° 12', 1202 m, 26°C, on plant, 18 specimens; Şabanözü-Orta road, entry of Elmalık, 04.05.2013, N 40° 32'- E 33° 8', 1318 m, 24°C, on plant, 31 specimens; Bulduk pass env., 04.05.2013, N 40° 33'- E 33° 11', 1409 m, 25°C, on plant, 3 specimens; Orta-Çerkeş road, Güzelyurt vill., N 40° 44'- E 33° 1', 1283 m, 27°C, on *Ranunculus*, 2 specimens; Güldürecek Dam env., entry of Dodurga, 08.06.2013, N 40° 26'- E 32° 59', on plant, 8 specimens.

TRIBE LEPTURINI Latreille, 1802: 218

GENUS *VADONIA* Mulsant, 1863: 559

SPECIES *V. moesiaca* (Daniel & Daniel, 1891: 6)

From references.

SPECIES *V. unipunctata* (Fabricius, 1787: 157)

SUBSPECIES *V. u. unipunctata* (Fabricius, 1787: 157)

Material examined: Çankırı: Çerkeş-Atkaracalar road, 5 km to Atkaracalar, 08.06.2013, N 40° 48'- E 33° 0', 1 specimen.

GENUS *PSEUDOVADONIA* Lobanov et al., 1981: 787

SPECIES *P. livida* (Fabricius, 1777: 233)

SUBSPECIES *P. l. livida* (Fabricius, 1777: 233)

Material examined: Çankırı: Eldivan-Şabanözü road, 5 km to Bakırlı vill., 29.06.2013, N 40° 39'- E 33° 30', 6 specimens; Şabanözü-Orta road, Elmalık, in cemetery, 29.06.2013, N 40° 37'- E 33° 5', 4 specimens; Ilgaz-Kastamonu road, 30.06.2013, N 41° 2'- E 33° 43', 28°C, on plant, 6 specimens; Kırkpınar plateau road, Ilgaz-Kastamonu road, 30.06.2013, N 41° 0'- E 33° 40', 31°C, on plant, 3 specimens.

GENUS *STICTOLEPTURA* Casey, 1924: 280

SUBGENUS *STICTOLEPTURA* Casey, 1924: 280

SPECIES *S. fulva* (DeGeer, 1775: 137)

Material examined: Çankırı: Kırkpınar plateau road, Ilgaz-Kastamonu road, 30.06.2013, N 41° 0'- E 33° 40', 31°C, on plant, 3 specimens.
Remarks: New to Çankırı province.

GENUS *ANASTRANGALIA* Casey, 1924: 280

SPECIES *A. dubia* (Scopoli, 1763: 47)

SUBSPECIES *A. d. dubia* (Scopoli, 1763: 47)

From references.

SPECIES *A. sanguinolenta* (Linnaeus, 1760: 196)

Material examined: Ilgaz-Kastamonu road, 30.06.2013, N 41° 3'- E 33° 44', 27°C, pheromon trap, 2 specimens.
Remarks: New to Çankırı province.

GENUS *JUDOLIA* Mulsant, 1863: 496

SPECIES *J. erratica* (Dalman, 1817: 490)

Material examined: Çankırı: Eldivan-Şabanözü road, 5 km to Bakırlı vill., 29.06.2013, N 40° 39'- E 33° 30', on folwers, 36 specimens; Ilgaz-Kastamonu road, 30.06.2013, N 41° 2'- E 33° 43', 28°C, on plant, 4 specimens.

GENUS *RUTPELA* Nakani & Ohbayashi, 1957: 242

SPECIES *R. maculata* (Poda, 1761: 37)

SUBSPECIES *R. m. maculata* (Poda, 1761: 37)

From references.

GENUS *STENURELLA* Villiers, 1974: 217

SPECIES *S. bifasciata* (Müller, 1776: 93)

SUBSPECIES *S. b. limbiventris* (Reitter, 1898: 21)

Material examined: Çankırı: Ilgaz-Kastamonu road, 30.06.2013, N 41° 2'- E 33° 43', 28°C, on plant, 4 specimens; Kırkpınar plateau road, Ilgaz-Kastamonu road, 30.06.2013, N 41° 0'- E 33° 40', 31°C, on plant, 25 specimens.

SPECIES *S. septempunctata* (Fabricius, 1792: 346)

SUBSPECIES *S. s. latenigra* (Pic, 1915: 5)

Material examined: Çankırı: Eldivan-Şabanözü road, 5 km to Bakırlı vill., 29.06.2013, N 40° 39'- E 33° 30', on flowers, 29 specimens; Kırkpınar plateau road, Ilgaz-Kastamonu road, 30.06.2013, N 41° 0'- E 33° 40', 31°C, on plant, 5 specimens.

Remarks: New to Çankırı province.

SUBFAMILY ASEMINAE Thomson, 1861: 139

TRIBE ASEMINI Thomson, 1861

GENUS ASEMUM Eschscholtz, 1830: 66

SPECIES *A. striatum* (Linnaeus, 1758: 396)

Material examined: 4 km to Ilgaz, wood store of Dörtler, 05.05.2013, N 40° 54'- E 33° 38', 894 m, 27°C, in bark, 1 specimen; Kırkpınar plateau road, 30.06.2013, N 41° 0'- E 33° 39', pheromon trap, 1 specimen.

Remarks: New to Çankırı province.

SUBFAMILY SPONDYLIDINAE Audinet-Serville, 1832: 123

TRIBE SPONDYLIDINI Audinet-Serville, 1832: 123

GENUS *SPONDYLIS* Fabricius, 1775: 159

SPECIES *S. buprestoides* (Linnaeus, 1758: 388)

Material examined: Çankırı: Kırkpınar plateau road, 30.06.2013, N 41° 0'- E 33° 39', pheromon trap, 2 specimens.

Remarks: New to Çankırı province.

SUBFAMILY CERAMBYCINAE Latreille, 1802: 211

TRIBE TRACHYDERINI Dupont, 1836: 1

SUBTRIBE TRACHIDERINA Dupont, 1836: 1

GENUS *PURPURICENUS* Dejean, 1821: 105

SPECIES *P. budensis* (Götz, 1783: 70)

Material examined: Çankırı: Çankırı-Eldivan road, 29.06.2013, N 40° 34'- E 33° 31', on plant, 2 specimens.

Remarks: New to Çankırı province.

TRIBE CERTALLINI Fairmaire, 1864: 149

GENUS *CERTALLUM* Dejean, 1821: 111

SPECIES *C. ebulinum* (Linnaeus, 1767: 637)

Material examined: Çankırı: 26 km to Kızılırmak, entry of Bayanpınarı vill., 21.04.2013, N 40˚ 27'- E 33˚ 59', 588 m, 17˚C, on plant, 1 specimen; Çankırı-Korgun road, entry of Akçavakıf vill., 05.05.2013, N 40^{o} 40'- E 33^{o} 35', 877 m, 23^{o}C, on plant, 5 specimens; Çankırı-Yapraklı road, 05.05.2013, N 40^{o} 38'- E 33^{o} 42', 910 m, 29^{o}C, on plant, 2 specimens; entry of Yukarı Pelitözü vill., 05.05.2013, N 40^{o} 28'- E 33^{o} 39', 691 m, 31^{o}C, on plant, 4 specimens; Çankırı-Kızılırmak road, 05.05.2013, N 40^{o} 26'- E 33^{o} 42', 692 m, 36^{o}C, 14 specimens; Çankırı-Kızılırmak road, 05.05.2013, N 40^{o} 27'- E 33^{o} 48', 639 m, 34^{o}C, on plant, 4 specimens; Çankırı border, 11.05.2013, N 40^{o} 19'- E 33^{o} 30', 809 m, 21^{o}C, 1 specimen; Ankara-Çankırı road, 30 km pass to Kalecik, 41 km to Çankırı, 11.05.2013, N 40^{o} 19'- E 33^{o} 31', 789 m, 18^{o}C, on plant, 4 specimens; Çankırı road, Tuz stream bridge, 11.05.2013, N 40^{o} 23'- E 33^{o} 33', 725 m, 17^{o}C, on plant, 5 specimens; Forest store, 11.05.2013, N 40^{o} 54'- E 33^{o} 38', 894 m, 24^{o}C, on wood, 3 specimens; Çankırı-Eldivan road, entry of Aşağıyanlar vill., 09.06.2013, N 40^{o} 33'- E 33^{o} 32', on plant, 2 specimens; Eldivan, wood store, 09.06.2013, N 40^{o} 32'- E 33^{o} 30', in bark of *Pinus*, 9 specimens; Çankırı-Kızılırmak road, 18 km to Kızılırmak, 5 km to İskilip return, 09.06.2013, N 40^{o} 27'- E 33^{o} 48', on plant, 9 specimens.

TRIBE CALLIDIINI Kirby, 1837: 170

GENUS *ROPALOPUS* Mulsant, 1839: 40

SUBGENUS *ROPALOPUS* Mulsant, 1839: 40

SPECIES *R. clavipes* (Fabricius, 1775: 188)

Material examined: Çankırı: Eldivan, wood store, 29.06.2013, N 40^{o} 32'- E 33^{o} 30', in bark of *Pinus*, 2 specimens.

GENUS *PHYMATODES* Mulsant, 1839: 47

SUBGENUS *PHYMATODES* Mulsant, 1839: 47

SPECIES *P. testaceus* (Linnaeus, 1758: 396)

Material examined: Çankırı: Eldivan, wood store, 29.06.2013, N 40^{o} 32'- E 33^{o} 30', in bark of *Pinus*, 1 specimen.

Remarks: New to Çankırı province.

TRIBE ANAGLYPTINI Lacordaire, 1868: 404

GENUS *ANAGLYPTUS* Mulsant, 1839: 91

SUBGENUS *ANAGLYPTUS* Mulsant, 1839: 91

SPECIES *A. arabicus* (Küster, 1847: 95)

From references.

TRIBE CLYTINI Mulsant, 1839: 70

GENUS *PLAGIONOTUS* Mulsant, 1842: 1

SUBGENUS *ECHINOCERUS* Mulsant, 1862: 143

SPECIES *P. floralis* (Pallas, 1773: 724)

Material examined: Çankırı: Çankırı-Kızılırmak road, 30 km to Kızılırmak, 09.06.2013, N 40^{o} 26'- E 33^{o} 42', on plant, 3 specimens; Çankırı-Kızılırmak road, 18 km to Kızılırmak, 5 km to İskilip return, 09.06.2013, N 40^{o} 27'- E 33^{o} 48', on plant, 22 specimens; Kızılırmak-Çankırı road, Çankırı border, 09.06.2013, N 40^{o} 19'- E 34^{o} 4', on flowers, 1 specimen; Çankırı-Ankara road, 38 km to Kalecik, 09.06.2013, N 40^{o} 22'- E 33^{o} 31', on plant, 1 specimen; Şabanözü-Orta road, Elmalık return, 29.06.2013, N 40^{o} 37'- E 33^{o} 9', 29^{o}C, on plant, 1 specimen; Şabanözü-Orta road, Elmalık road, 29.06.2013, N 40^{o} 33'- E 33^{o} 8', 31^{o}C, on plant, 85 specimens; Ilgaz-Kastamonu road, 30.06.2013, N 41^{o} 2'- E 33^{o} 43', 28^{o}C, on plant, 10 specimens; Kırkpınar plateau road, Ilgaz-Kastamonu road, 30.06.2013, N 41^{o} 0'- E 33^{o} 40', 31^{o}C, on plant, 5 specimens.

SUBGENUS *NEOPLAGIONOTUS* Kasatkin, 2005: 51

SPECIES *P. bobelayei* (Brullé, 1832: 253)

Material examined: Çankırı: Çankırı-Kızılırmak road, 18 km to Kızılırmak, 5 km to İskilip return, 09.06.2013, N 40° 27'- E 33° 48', on plant, 3 specimens; Kızılırmak-Çankırı road, Çankırı border, 09.06.2013, N 40° 19'- E 34° 4', on flowers, 4 specimens; Çankırı-Ankara road, Çankırı-Kızılırmak return, Kızılırmak road, 09.06.2013, N 40° 26'- E 33° 39', on plant, 1 specimen; Çankırı-Ankara road, 42 km Ankara, Hacıbey district, 09.06.2013, N 40° 23'- E 33° 32', on plant, 6 specimens.

Remarks: New to Çankırı province.

GENUS *CHLOROPHORUS* Chevrolat, 186: 290

SUBGENUS *CHLOROPHORUS* Chevrolat, 1863: 290

SPECIES *C. varius* (Müller, 1766: 188)

SUBSPECIES *C. v. varius* (Müller, 1766: 188)

Material examined: Çankırı: Çankırı-Eldivan road, 29.06.2013, N 40° 34'- E 33° 31', on plant, 1 specimen.

SUBGENUS *CRASSOFASCIATUS* Özdikmen, 2011: 538

SPECIES *C. aegyptiacus* (Fabricius, 1775: 194)

Material examined: Çankırı: Kırkpınar plateau road, Ilgaz-Kastamonu road, 30.06.2013, N 41° 0'- E 33° 40', 31°C, on plant, 4 specimens.

Remarks: New to Çankırı province.

SUBGENUS *PERDEROMACULATUS* Özdikmen, 2011: 537

SPECIES *C. sartor* (Müller, 1766: 188)

From references.

GENUS *RUSTICOCLYTUS* Vives, 1977: 130

SPECIES *R. rusticus* (Linnaeus, 1758: 398)

Material examined: Çankırı: Eldivan, wood store, 29.06.2013, N 40° 32'- E 33° 30', in bark of *Pinus*, 5 specimens.

GENUS *CLYTUS* Laicharting, 1784: 88

SPECIES *C. arietis* (Linnaeus, 1758: 399)

SUBSPECIES *C. a. arietis* (Linnaeus, 1758: 399)

From references.

SPECIES *C. rhamni* Germar, 1817: 223

SUBSPECIES *C. r. temesiensis* (Germar, 1824: 519)

From references.

SPECIES *C. schurmanni* Sama, 1996: 108

Material examined: Çankırı: Eldivan-Şabanözü road, 5 km to Bakırlı vill., 29.06.2013, N 40° 39'- E 33° 30', on flowers, 1 specimen; Ilgaz-Kastamonu road, 30.06.2013, N 41° 2'- E 33° 43', 28°C, on plant, 1 specimen.

SUBFAMILY STENOPTERINAE Gistel, 1848: [9] (unnumbered section)

TRIBE STENOPTERINI Gistel, 1848: [9]

GENUS *STENOPTERUS* Illiger, 1804: 120

SPECIES *S. rufus* (Linnaeus, 1767: 642)

SUBSPECIES *S. r. geniculatus* Kraatz, 1863: 104

Material examined: Çankırı: Çankırı-Eldivan road, 29.06.2013, N 40° 34'- E 33° 31', on plant, 2 specimens; Eldivan-Şabanözü road, 5 km to Bakırlı vill., 29.06.2013, N 40° 39'- E 33° 30', on flowers, 5 specimens; Kırkpınar plateau road, Ilgaz-Kastamonu road, 30.06.2013, N 41° 0'- E 33° 40', 31°C, on plant, 1 specimen.

SUBFAMILY DORCADIONINAE Swainson, 1840: 290

TRIBE DORCADIONINI Swainson, 1840: 290

GENUS *DORCADION* Dalman, 1817: 397

SUBGENUS *CRIBRIDORCADION* Pic, 1901: 12

SPECIES *D. cinerarium* (Fabricius, 1787: 140)

From references.

SPECIES *D. muchei* Breuning, 1962: 38

From references.

SPECIES *D. rufipenne* Breuning, 1946: 118

SUBSPECIES *D. r. rufipenne* Breuning, 1946: 118

Material examined: Çankırı: between Şabanözü-Orta, Bulduk pass, 20.04.2013, N 40˚ 33'- E 33˚ 11', 1442 m, 12˚C, 87 specimens; Şabanözü-Orta road, exit of Çerçi vill., 04.05.2013, N 40˚ 31'- E 33˚ 12', 1202 m, 26˚C, 1 specimen; Elmalık vill., 04.05.2013, N 40˚ 32'- E N 33˚ 8', 1381 m, 26˚C, 8 specimens; between Şabanözü-Orta, Bulduk pass, 04.05.2013, N 40˚ 33'- E 33˚ 11', 1442 m, 25˚C, 18 specimens; Şabanözü-Orta road, 20 km to Şabanözü, 04.05.2013, N 40° 35'- E 33° 8', 1327 m, 30°C, 32 specimens.

SPECIES *D. scabricolle* (Dalman, 1817: 174)

SUBSPECIES *D. s. paphlagonicum* Breuning, 1962: 459

Material examined: Çankırı: Eldivan-Şabanözü road, 16 km to Şabanözü, 20.04.2013, N 40˚ 30'- E 33˚ 25', 1332 m, 17˚C, 2 specimens; between Şabanözü-Orta, Bulduk pass, 20.04.2013, N 40˚ 33'- E 33˚ 11', 1442 m, 12˚C, 46 specimens; Şabanözü-Orta road, exit of Çerçi vill., 04.05.2013, N 40˚ 31'- E 33˚ 12', 1202 m, 26˚C, 1 specimen; between Şabanözü-Orta, Bulduk pass, 04.05.2013, N 40˚ 33'- E 33˚ 11', 1442 m, 25˚C, 3 specimens; Orta-Çerkeş road, exit of Orta, 04.05.2013, N 40° 38'- E 33° 4', 1373 m, 26°C, 1 specimen.

Remarks: New to Çankırı province.

SPECIES *D. septemlineatum* Waltl, 1838: 469

SUBSPECIES *D. s. abanti* Braun, 1976: 54

Material examined: Çankırı: exit of Çerkeş, Aytaç fabric env., 04.05.2013, N 40° 49'- E 32° 50', 1151 m, 30°C, 21 specimens.

Remarks: New to Çankırı province.

SPECIES *D. subsericatum* Pic, 1901: 12

SUBSPECIES *D. s. subsericatum* Pic, 1901: 12

From references.

SPECIES *D. yilmazi* Özdikmen & Kaya, 2014

Material examined: Çankırı: Eldivan-Şabanözü road, 16 km to Şabanözü, 20.04.2013, N 40˚ 30'- E 33˚ 25', 1332 m, 17˚C, 1 specimen; İkizören road, 5 km to Topuzsaray vill., 21.04.2013, N 40˚ 39' – E 33˚ 50', 1023 m, 18˚C, 12 specimens; Hayder vill., pass to Topuzsaray, 21.04.2013, 2 specimens.

Remarks: New to Çankırı province.

SUBFAMILY LAMIINAE Latreille, 1825: 401

TRIBE LAMIINI Latreille, 1825: 401

GENUS *MORIMUS* Brullé, 1832: 258

SPECIES *M. orientalis* Reitter, 1894: 43

Material examined: Çankırı: Eldivan, wood store, 09.06.2013, 29.06.2013, N 40° 32'- E 33° 30', in bark of *Pinus*, 3 specimens.

Remarks: New to Çankırı province.

TRIBE POGONOCHERINI Mulsant, 1839: 151

GENUS *POGONOCHERUS* Dejean, 1821: 107

SUBGENUS *PITYPHILUS* Mulsant, 1862: 302

SPECIES *P. fasciculatus* (DeGeer, 1775: 71)

SUBSPECIES *P. f. fasciculatus* (DeGeer, 1775: 71)

Material examined: Çankırı: 4 km to Ilgaz, wood store of Dörtler, 11.05.2013, N 40° 54'- E 33° 38', 894 m, 24°C, on wood, 1 specimen.

Remarks: New to Çankırı province.

TRIBE ACANTHOCININI Blanchard, 1845: 154

GENUS *ACANTHOCINUS* Dejean, 1821: 106

SPECIES *A. aedilis* (Linnaeus, 1758: 392)

Material examined: Çankırı: 4 km to Ilgaz, wood store of Dörtler, 11.05.2013, N 40° 54'- E 33° 38', 894 m, 24°C, on wood, 3 specimens.

Remarks: New to Çankırı province.

GENUS *LEIOPUS* Audinet-Serville, 1835: 86

SPECIES *L. nebulosus* (Linnaeus, 1758: 391)

SUBSPECIES *L. n. nebulosus* (Linnaeus, 1758: 391)

Material examined: Çankırı: 4 km to Ilgaz, wood store of Dörtler, 30.06.2013, N 40° 54'- E 33° 38', 894 m, 25°C, in bark, 1 specimen.

Remarks: New to Çankırı province.

TRIBE PHYTOECIINI Mulsant, 1839: 191

GENUS *OBEREA* Dejean, 1835: 351

SUBGENUS *AMAUROSTOMA* Müller, 1906: 223

SPECIES *O. ressli* Demelt, 1963: 150

From references.

GENUS *OXYLIA* Mulsant, 1862: 398

SPECIES *O. argentata* (Ménétriés, 1832: 227)

SUBSPECIES *O. a. argentata* (Ménétriés, 1832: 227)

Material examined: Çankırı: Çankırı-Yapraklı road, 10 km to flour industry, 11 km to Yapraklı, 09.06.2013, N 40° 40'- E 33° 46', on flowers, 5 specimens; between Çankırı-Yapraklı, entry of Yapraklı, 09.06.2013, N 40° 42'- E 33° 50', on plant, 11 specimens; Çankırı-Eldivan road, entry of Aşağıyanlar vill., 09.06.2013, N 40° 33'- E 33° 32', on plant, 1 specimen; Kızılırmak-Çankırı road, Çankırı border, 09.06.2013, N 40° 19'- E 34° 4', on flower, 1 specimen; Çankırı-Eldivan road, 29.06.2013, N 40° 34'- E 33° 31', on plant, 1 specimen; Şabanözü-Orta road, Elmalık return, 29.06.2013, N 40° 37'- E 33° 9', 29°C, on plant, 1 specimen; Orta-Çerkeş road, 35 km to Çerkeş, 29.06.2013, N 40° 40'- E 33° 6', 31°C, on plant, 1 specimen.

Remarks: New to Çankırı province.

GENUS *PHYTOECIA* Dejean, 1835: 351

SUBGENUS *HELLADIA* Fairmaire, 1864: 176

SPECIES *P. humeralis* (Waltl, 1838: 471)

SUBSPECIES *P. h. humeralis* (Waltl, 1838: 471)

Material examined: Çankırı: 26 km to Kızılırmak, entry of Bayanpınarı vill., 21.04.2013, N 40° 27'- E 33° 59', 588 m, 17°C, on plant, 18 specimens; Çankırı-Yapraklı road, 05.05.2013, N 40° 38'- E 33° 42', 910 m, 29°C, on plant, 1 specimen; Çankırı-Kızılırmak road, 05.05.2013, N 40° 26'- E 33° 42', 692 m, 36°C, 6 specimens; Çankırı-Kızılırmak road, 05.05.2013, N40° 27'- E 33° 48', 639 m, 34°C, on plant, 2 specimens; Çankırı border, 11.05.2013, N 40° 19'- E 33° 30', 809 m, 21°C, 1 specimen; Çankırı road, Tuz stream bridge, 11.05.2013, N 40° 23'- E 33° 33', 725 m, 17°C, on plant, 2 specimens; between Çankırı-Yapraklı, entry of Yapraklı, 09.06.2013, N 40° 42'- E 33° 50', on plant, 1 specimen.

Remarks: New to Çankırı province.

SUBGENUS *MUSARIA* Thomson, 1864: 121

SPECIES *P. wachanrui* Mulsant, 1851: 120

Material examined: between Şabanözü-Orta, Bulduk pass, 04.05.2013, N 40˚ 33'- E 33˚ 11', 1442 m, 25˚C, on plant, 1 specimen.

Remarks: New to Çankırı province.

SUBGENUS *NEOMUSARIA* Plavilstshikov, 1928: 123

SPECIES *P. merkli* Ganglbauer, 1884: 560

Material examined: Çankırı: Bulduk pass env., 08.06.2013, N 40° 37'- E 33° 8', 1445 m, on flowers, 6 specimens.

Remarks: New to Çankırı province.

SPECIES *P. pauliraputii* (Sama, 1993: 295)

Material examined: Çankırı: Bulduk pass env., 08.06.2013, N 40° 37'- E 33° 8', 1445 m, on flowers, 5 specimens.

SUBGENUS *PHYTOECIA* Dejean, 1835: 351

SPECIES *P. caerulea* (Scopoli, 1772: 102)

SUBSPECIES *P. c. caerulea* (Scopoli, 1772: 102)

Material examined: Çankırı: Çankırı-Ankara road, 2 km to Akören vill., 20.04.2013, N 40˚ 23'- E 33˚ 34', 733 m, 14˚C, on plant, 1 specimen; 26 km to Kızılırmak, entry of Bayanpınarı vill., 21.04.2013, N 40˚ 27'- E 33˚ 59', 588 m, 17˚C, on plant, 11 specimens; Çankırı-Yapraklı road, 05.05.2013, N 40° 38'- E 33° 42', 910 m, 29°C, on plant, 2 specimens; entry of Yukarı Pelitözü vill., 05.05.2013, N 40° 28'- E 33° 39', 691 m, 31°C, on plant, 2 specimens; Çankırı-Yapraklı road, 100 m to flour industry, 11 km to Yapraklı, 09.06.2013, N 40° 40'- E 33° 46', on flowers, 3 specimens; between Çankırı-Yapraklı, entry of Yapraklı, 09.06.2013, N 40° 42'- E 33° 50', on plant, 1 specimen.

Remarks: New to Çankırı province.

SPECIES *P. pubescens* Pic, 1895: 64

Material examined: Çankırı: 4 km to Ilgaz, wood store of Dörtler, 11.05.2013, N 40° 54'- E 33° 38', 894 m, 24°C, on wood, 1 specimen.

Remarks: New to Çankırı province.

SPECIES *P. rufipes* (Olivier, 1795: 25)

SUBSPECIES *P. r. rufipes* (Olivier, 1795: 25)

Material examined: Çankırı: Çankırı-Yapraklı road, 05.05.2013, N 40° 38'- E 33° 42', 910 m, 29°C, on plant, 1 specimen.

Remarks: New to Çankırı province.

SPECIES *P. virgula* (Charpentier, 1825: 225)

Material examined: Çankırı: Çankırı-Kızılırmak road, 05.05.2013, N 40° 26'- E 33° 42', 692 m, 36°C, on plant, 1 specimen; Çankırı-Kızılırmak road, 05.05.2013, N40° 27'- E 33° 48', 639 m, 34°C, on plant, 2 specimens; Ankara-Çankırı road, 30 km pass to Kalecik, 41 km to Çankırı, 11.05.2013, N 40° 19'- E 33° 31', 789 m, 18°C, on plant, 1 specimen; Çankırı road, Tuz stream bridge, 11.05.2013, N 40° 23'- E 33° 33', 725 m, 17°C, on plant, 5 specimens; Şabanözü-Orta road, 24 km to Orta, 08.06.2013, N 40° 28'- E 33° 16', 1300 m, on plant, 2 specimens; between Çerkeş-Aytaç, 08.06.2013, N 40° 49'- E 32° 52', 1 specimen; Çerkeş, 08.06.2013, N 40° 48'- E 32° 53', on plant, 2 specimens; between Çankırı-Yapraklı, 9 km to Yapraklı, 09.06.2013, N 40° 42'- E 33° 48', on plant, 2 specimens; Çankırı-Eldivan road, entry of Aşağıyanlar vill., 09.06.2013, N 40° 33'- E 33° 32', on plant, 1 specimen; Çankırı-Ankara road, 12 km pass to Eldivan return, 60 km to Kalacik, 09.06.2013, N 40° 29'- E 33° 38', on plant, 3 specimens; Orta-Çerkeş road, 35 km to Çerkeş, 29.06.2013, N 40° 40'- E 33° 6', 31°C, on plant, 1 specimen.

Remarks: New to Çankırı province.

SUBGENUS *OPSILIA* Mulsant, 1862: 387

SPECIES *P. coerulescens* (Scopoli, 1763: 49)

Material examined: Çankırı: Kurşunlu, 08.06.2013, N 40° 50'- E 33° 16', on plant, 1 specimen; Çankırı-Yapraklı road, 100 m to flour industry, 11 km to Yapraklı, 09.06.2013, N 40° 40'- E 33° 46', on flowers, 15 specimens; between Çankırı-Yapraklı, entry of Yapraklı, 09.06.2013, N 40° 42'- E 33° 50', on plant, 8 specimens; Çankırı-Eldivan road, entry of Aşağıyanlar vill., 09.06.2013, N 40° 33'- E 33° 32', on plant, 13 specimens; Çankırı-Kızılırmak road, 30 km to Kızılırmak, 09.06.2013, N 40° 26'- E 33° 42', on plant, 2 specimens; Çankırı-Kızılırmak road, 18 km to Kızılırmak, 5 km to İskilip return, 09.06.2013, N 40° 27'- E 33° 48', on plant, 2 specimens; Kızılırmak-Çankırı road, Çankırı border, 09.06.2013, N 40° 19'- E 34° 4', on flowers, 8 specimens; Çankırı-Ankara road, Çankırı-Kızılırmak return, 09.06.2013, N 40° 26'- E 33° 39', on plant, 8 specimens; Çankırı-Ankara road, 42 km to Ankara, Hacıbey district, 09.06.2013, N 40° 23'- E 33° 32', on plant, 3 specimens; Ankara-Çankırı road, 40 km to Çankırı, 29.06.2013, N 40° 22'- E 33° 31', on plant, 1 specimen; Çankırı-Eldivan road, 29.06.2013, N 40° 34'- E 33° 31', on plant, 7 specimens; Çankırı-Eldivan road, 5 km to Eldivan, 29.06.2013, N 40° 34'- E 33° 30', on plant, 5 specimens; Şabanözü-Orta road, Elmalık return, 29.06.2013, N 40° 37'- E 33° 9', 29°C, on plant, 1 specimen; Orta-Çerkeş road, 35 km to Çerkeş, 29.06.2013, N 40° 40'- E 33° 6', 31°C, on plant, 2 specimens.

TRIBE AGAPANTHIINI Mulsant, 1839: 172

GENUS *AGAPANTHIA* Audinet-Serville, 1835: 35

SUBGENUS *EPOPTES* Gistel, 1857: 93

SPECIES *A. lateralis* Ganglbauer, 1884: 541

Material examined: Çankırı: Çankırı-Kızılırmak road, 05.05.2013, N 40° 26'- E 33° 42', 692 m, 36°C, on plant, 2 specimens; Çankırı-Kızılırmak road, 05.05.2013, N40° 27'- E 33° 48', 639 m, 34°C, on plant, 3 specimens; Çankırı border, 11.05.2013, N 40° 19'- E 33° 30', 809 m, 21°C, 19 specimens; Çankırı road, Tuz stream bridge, 11.05.2013, N 40° 23'- E 33° 33', 725 m, 17°C, on plant, 9 specimens; exit of Akçavakıf, Çankırı-Kastamonu road, 11.05.2013, N 40° 41'- E 33° 33', 866 m, 20°C, on plant, 6 specimens; Buzluk pass env., 08.06.2013, N 40° 37'- E 33° 8', 1445 m, on flower, 1 specimen; Çankırı-Yapraklı road, 100 m to flour industry, 11 km to Yapraklı, 09.06.2013, N 40° 40'- E 33° 46', on flowers, 2 specimens; between Çankırı-Yapraklı, 9 km to Yapraklı, 09.06.2013, N 40° 42'- E 33° 48', on plant, 11 specimens; between Çankırı-Yapraklı, entry of Yapraklı, 09.06.2013, N 40° 42'- E 33° 50', on plant, 1 specimen; Çankırı-Eldivan road, 5 km to Eldivan, 09.06.2013, N 40° 33'- E 33° 35', on plant, 1 specimen; Çankırı-Eldivan road, entry of Aşağıyanlar vill., 09.06.2013, N 40° 33'- E 33° 32', on plant, 1 specimen; Çankırı-Ankara road, 12 km pass to Eldivan return, 60 km to Kalecik, 09.06.2013, N 40° 29'- E 33° 38', on plant, 1 specimen; Çankırı-Kızılırmak road, 30 km to Kızılırmak, 09.06.2013, N 40° 26'- E 33° 42', on plant, 1 specimen; Çankırı-Kızılırmak road, 18 km to Kızılırmak, 5 km to İskilip return, 09.06.2013, N 40° 27'- E 33° 48', on plant, 1 specimen; Çankırı-Eldivan road, 29.06.2013, N 40° 34'- E 33° 31', on plant, 9 specimens; Orta-Çerkeş road, 35 km to Çerkeş, 29.06.2013, N 40° 40'- E 33° 6', 31°C, on plant, 5 specimens.

SUBGENUS *AGAPANTHIA* Audinet-Serville, 1835: 35

SPECIES *A. cardui* (Linnaeus, 1767: 632)

Material examined: Çankırı: Şabanözü-Orta road, 24 km to Orta, 08.06.2013, N 40° 28'- E 33° 16', 1300 m, on plant, 2 specimens; Çankırı-Yapraklı road, 100 m to flour industry, 11 km to Yapraklı, 09.06.2013, N 40° 40'- E 33° 46', on flowers, 9 specimens; between Çankırı-Yapraklı, 9 km to Yapraklı, 09.06.2013, N 40° 42'-

E 33º 48', on plant, 2 specimens; between Çankırı-Yapraklı, entry of Yapraklı, 09.06.2013, N 40º 42'- E 33º 50', on plant, 10 specimens; Çankırı-Eldivan road, entry of Aşağıyanlar vill., 09.06.2013, N 40º 33'- E 33º 32', on plant, 1 specimen; Çankırı-Kızılırmak road, 30 km to Kızılırmak, 09.06.2013, N 40º 26'- E 33º 42', on plant, 5 specimens; Çankırı-Eldivan road, 29.06.2013, N 40º 34'- E 33º 31', on plant, 1 specimen.

SPECIES *A. suturalis* (Fabricius, 1787: 149)

Material examined: Çankırı: Çankırı border, 11.05.2013, N 40º 19'- E 33º 30', 809 m, 21ºC, on plant, 2 specimens; Çankırı road, Tuz stream bridge, 11.05.2013, N 40º 23'- E 33º 33', 725 m, 17ºC, on plant, 6 specimens; Şabanözü-Orta road, 24 km to Orta, 08.06.2013, N 40º 28'- E 33º 16', 1300 m, on plant, 1 specimen; Bulduk pass env., 08.06.2013, N 40º 37'- E 33º 8', 1445 m, on flowers, 2 specimens; Çankırı-Yapraklı road, 100 m to flour industry, 11 km to Yapraklı, 09.06.2013, N 40º 40'- E 33º 46', on flowers, 15 specimens; between Çankırı-Yapraklı, 9 km to Yapraklı, 09.06.2013, N 40º 42'- E 33º 48', on plant, 3 specimens; between Çankırı-Yapraklı, entry of Yapraklı, 09.06.2013, N 40º 42'- E 33º 50', on plant, 23 specimens; Eldivan, wood store, 09.06.2013, N 40º 32'- E 33º 30', in bark of *Pinus*, 4 specimens; Çankırı-Ankara road, 12 km pass to Eldivan return, 60 km to Kalecik, 09.06.2013, N 40º 29'- E 33º 38', on plant, 1 specimen; Çankırı-Kızılırmak road, 18 km to Kızılırmak, 5 km to İskilip return, 09.06.2013, N 40º 27'- E 33º 48', on plant, 1 specimen.

Remarks: New to Çankırı province and thereby to North half of Turkey..

SUBGENUS *SMARAGDULA* Pesarini & Sabbadini, 2004: 128

SPECIES *A. violacea* (Fabricius, 1775: 187)

Material examined: Çankırı: Buzluk pass env., 08.06.2013, N 40º 37'- E 33º 8', 1445 m, on flowers, 4 specimens; Çerkeş, Göletler district, 08.06.2013, on plant, 1 specimen; Çankırı-Yapraklı road, 100 m to flour industry, 11 km to Yapraklı, 09.06.2013, N 40º 40'- E 33º 46', on flowers, 1 specimen.

Remarks: New to Çankırı province.

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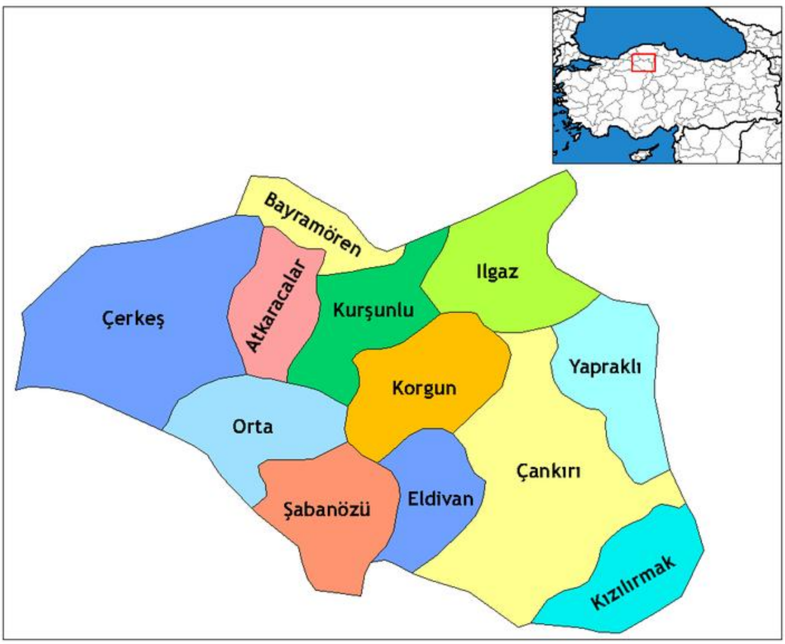

Map 1. Çankırı province.

RECIPROCAL EFFECT IN HYBRIDS BETWEEN UNIVOLTINE AND MULTIVOLTINE BREEDS OF THE SILKWORM, *BOMBYX MORI* L.

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[**Ravindra Singh, Vemananda Reddy, G., Vijaya Kumari, K. M., Angadi, B. S. & Sivaprasad, V.** 2014. Reciprocal effect in hybrids between univoltine and multivoltine breeds of the silkworm, *Bombyx mori* L.. Munis Entomology & Zoology, 9 (2): 942-946**]**

ABSTRACT: Reciprocal effects were studied in F_1 hybrids involving three indigenous multivoltine silkworm breeds and one tropical univoltine race. Superiority of straight crosses between univoltine and multivoltine breeds has been shown for cocoon yield /10,000 larvae by number and weight, cocoon weight, cocoon shell weight and cocoon yield/100 dfls whereas, reciprocal crosses of univoltine × multivoltine were found superior only for fecundity and cocoon shell percentage. Among the hybrids, Barpat × PM was adjudicated as the best hybrid exhibiting maximum average evaluation index values of 60.30 and >50 index values for all the economic characters except ERR by number and ranked first followed by Nistari × Barpat (50.76) and Sarupat × Barpat (49.44) which were ranked second and third exhibiting >50 evaluation index values for six and five characters respectively.

KEY WORDS: *Bombyx mori* L., multivoltine and univoltine breeds, reciprocal effect, straight and reciprocal hybrids.

In India, maximum silk production is from multivoltine × bivoltine hybrids but their reciprocal crosses *i.e.,* bivoltine × multivoltine are not practiced due to known genetic reasons (Nagatomo, 1942; Nakada, 1970; 1972; Benchamin et al., 1988; Tazima, 1988). Studies on reciprocal effects in the mulberry silkworm have been carried out by several workers (Petkov et al., 1977; Murakami and Ohtsuki, 1989; Chattopadhyay et al., 1996; Rajanna and Puttaraju, 1998; Mal Reddy et al., 2003). The reciprocal differences are caused primarily by sex linkage and maternal effects (Durrant, 1965; Crusio, 1987). Singh et al. (2006) have studied reciprocal effect in multivoltine, multivoltine × bivoline and bivoltine hybrids. No information is available on reciprocal effect in hybrids involving indigenous multivoltine and univoltine silkworm breeds. Hence, the present study was undertaken to know the effect of reciprocal crossing in hybrids between multivoltine and univoltine breeds of the silkworm, *Bombyx mori* L.

MATERIAL AND METHODS

Three indigenous multivoltine race *viz.,* Pure Mysore, Sarupat and Nistari and one tropical univoltine race Barpat were utilized in the present study. Three multivoltine × univoltine hybrids *viz.,* PM × Barpat, Sarupat × Barpat and Nistari × Barpat and their reciprocals were tested. Rearing was conducted with three replications in each hybrid where 250 larvae were retained after 3^{rd} moult. Data were recorded for ten characters namely, fecundity, hatching percentage, weight of ten larvae, yield / 10,000 larvae by number and weight, cocoon weight, cocoon shell weight, cocoon shell percentage cocoon yield/100 dfls and filament length.

Evaluation of the hybrids has been carried out through multiple traits evaluation index method of Mano et al. (1993). Evaluation Index (E. I.) for different characters was calculated using the following formula:

$$E. I. = A – B / C \times 10 + 50$$

Where,

A = value obtained for a particular hybrid combination.
B = mean value of particular trait of all the hybrid combinations.
C = standard deviation of particular trait of all the hybrid combinations.
10 = standard unit.
50 = fixed value.

RESULTS

Performance of F_1 hybrids between univoltine and multivoltine breeds and their reciprocals is given in Table 1. Cocoons of straight and reciprocal crosses have been depicted in Plate I. Character-wise results are briefly mentioned below.

Fecundity: Among the six hybrids, maximum fecundity (536) was observed in Barpat × PM followed by Nistari × Barpat (498) and Barpat × Sarupat (497).

Hatching percentage: Hatching percentage was recorded maximum 96.33 % in Barpat × PM followed by PM × Barpat and Barpat × Nistari (95.66 %).

Weight of 10 larvae: Weight of ten larvae was found maximum in Barpat × PM (33.50 g) followed by PM × Barpat and Barpat × Nistari (32.43 g).

Cocoon yield / 10,000 larvae by number: Cocoon yield/10,000 larvae by number was observed maximum in Nistari × Barpat (9880) followed by PM × Barpat and Barpat × Nistari (9840).

Cocoon yield / 10,000 larvae by weight (kg): Variation was observed in cocoon yield / 10,000 larvae by weight. In hybrid Sarupat × Barpat, maximum cocoon yield / 10,000 larvae by weight (14.320 kg) was observed followed by Barpat × PM (14.027 kg) and Nistari × Barpat (13.280 kg).

Cocoon weight (g): Higher cocoon weight was observed in Sarupat × Barpat (1.455 g) followed by Barpat × PM (1.448 g) and Nistari × Barpat (1.409 g).

Cocoon shell weight (g): Cocoon shell weight was observed higher in Barpat × PM (0.227 g) followed by Nistari × Barpat (0.219 g) and Barpat × Nistari (0.213 g).

Cocoon shell percentage: Cocoon shell percentage was found higher in Barpat × Nistari (15.89 %) followed Barpat × PM (15.69 %) and Nistari × Barpat (15.56%) respectively.

Cocoon yield/100 dfls (kg): Cocoon yield/ 100 dfls was recorded higher in PM × Barpat (57.493 kg) followed by Sarupat × Barpat (57.280 kg) and Barpat × PM (56.106 kg) respectively.

Filament length (m): Longest filament length of 603 m was observed in Barpat × PM followed by Sarupat × Barpat (563 m) and Barpat × Sarupat (512 m) respectively.

Average Evaluation Index values: Among the six hybrids, Barpat × PM was adjudicated as the best hybrid exhibiting maximum average evaluation index value (60.30) and >50 index values for all the economic characters except ERR by number and ranked first followed by Nistari × Barpat (50.76) and Sarupat × Barpat (49.44) which were ranked second and third exhibiting >50 evaluation index values for six and five out of ten characters respectively.

DISCUSSION

Multivoltine hybrids are not economical for commercial exploitation as they possess less fecundity and moreover qualitative and quantitative characters are low both in straight and reciprocal crosses. Straight crosses of multivoltine × bivoltine hybrids are commonly used for commercial exploitation whereas the reciprocal crosses (bivoltine × multivoltine) are disadvantageous in terms of cocoon yield / 10,000 larvae by weight, cocoon weight, cocoon shell weight, cocoon shell percentage and filament length. Similar observations were reported by Tazima (1988) and Benchamin et al. (1988). Utilization of reciprocal crosses would be advantageous in increasing fecundity. The study is in agreement with that of Mal Reddy et al. (2003). In this study, possibility of utilizing multivoltine breeds with one tropical univoltine race "Barpat" has been explored. The striking feature of PM × Barpat and its reciprocal Barpat × PM is that there was no significant difference for most of the characters between straight and reciprocal cross. Less effect in the reciprocal cross may be due to diapausing nature of the eggs of the univoltine parent Barpat utilized. It is interesting to note that cocoon weight and cocoon shell weight in univoltine × multivoltine hybrids are low as compared to the straight cross except in Barpat × PM where they are higher than the straight cross. High or low cocoon weight may be due to the presence of sex linked maturity genes like late maturity genes (Lm) found in univoltine and early maturity genes (Lm^e) in multivoltine (Morohoshi, 1949). Univoltine breeds are assumed to possess dominant genes on Z chromosome. In the straight cross, both male and female F_1 progeny produce high quantitative characters whereas in the reciprocal cross, the genetic constitution of male favours to possess high quantitative characters as depicted in Figure 1.

Straight cross

Multivoltine (♀) × Univoltine (♂)
(Z^qW) (Z^QZ^Q)

Z^QW (♀) × Z^QZ^q (♂)
Both possessing high quantitative characters

Reciprocal cross

Univoltine (♀) × Multivoltine (♂)
(Z^QW) (Z^qZ^q)

Z^qW (♀) × Z^QZ^q (♂)
Low quantitative characters | High quantitative characters

Figure 1. Genetic constitution of straight and reciprocal crosses between univoltine and multivoltine breeds.

In this study, high cocoon yield / 10,000 larvae, cocoon weight and cocoon shell weight were observed in straight crosses. In the reciprocal crosses, the quantitative characters are low in terms of cocoon yield, cocoon weight and cocoon shell weight except the hybrids involving PM and Barpat. Low quantitative characters in reciprocal cross of multivoltine and univoltine breed may be due to recombination of sex-linked genes (Nagatomo, 1942; Murakami and Ohtsuki, 1989; Mal Reddy et al., 2003).

In the present study, reciprocal effects were pronounced in the hybrids involving silkworm breeds with different voltinism and straight crosses between univoltine and multivoltine silkworm breeds exhibited their superiority for several economic characters like cocoon yield, cocoon weight and cocoon shell weight. PM × Barpat and its reciprocal Barpat × PM may be recommended for large scale exploitation in the field as the quantitative characters are on par in straight as well as in the reciprocal cross.

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Table 1. Performance of straight and reciprocal crosses between univoltine and multivoltine breeds of the silkworm, *Bombyx mori* L..

Hybrid	Fecundity	Hatching (%)	Weight of 10 larvae (g)	Yield / 10,000 larvae		Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell (%)	Cocoon yield/100 dfls (kg)	Filament length (m)	Average Evaluation Index
				By No.	By Wt. (kg)						
PM × Barpat	487 (46.08)	95.36 (56.02)	32.43 (42.66)	9733 (58.10)	14.373 (44.06)	1.434 (44.85)	0.209 (46.00)	14.57 (37.67)	57.493 (60.56)	443 (37.79)	47.38 (V)
Barpat × PM	536 (67.39)	96.33 (62.67)	33.50 (66.44)	9547 (45.19)	14.027 (59.85)	1.448 (59.28)	0.227 (64.00)	15.69 (57.67)	56.106 (55.64)	603 (64.91)	60.30 (I)
Sarupat × Barpat	468 (37.82)	92.35 (35.41)	33.04 (56.22)	9346 (36.34)	14.320 (64.73)	1.455 (60.28)	0.212 (49.00)	14.57 (36.67)	57.280 (59.80)	563 (58.13)	49.44 (III)
Barpat × Sarupat	497 (50.43)	93.52 (43.42)	32.37 (41.33)	9480 (42.24)	12.827 (39.85)	1.289 36.57)	0.197 (34.00)	15.31 (50.89)	50.773 (36.73)	512 (49.49)	42.49 (VI)
Nistari × Barpat	498 (50.87)	93.97 (46.50)	32.73 (50.66)	9880 (59.86)	13.280 (47.40)	1.409 (53.71)	0.219 (56.00)	15.56 (55.36)	53.120 (45.05)	469 (42.20)	50.76 (II)
Barpat × Nistari	487 (46.08)	95.36 (56.02)	32.43 (42.66)	9840 (58.10)	13.080 (44.06)	1.347 (44.85)	0.213 (44.85)	15.83 (60.17)	52.320 (42.21)	498 (47.11)	48.61 (IV)

Values in parentheses indicate evaluation index value.

1

2

3

4

5

6

Plate I. Photographs of hybrid cocoons between univoltine and multivoltine silkworm breeds: 1. PM × Barpat 2. Barpat × PM 3. Sarupat × Barpat 4. Barpat × Sarupat 5. Nistari × Barpat and 6. Barpat × Nistari.

SCIENTIFIC NOTES

A NEW PEST: *CONTARINIA PRUNIFLORUM* COUTIN & RAMBIER (DIPTERA: CECIDOMYIIDAE) ON APRICOT (*PRUNUS ARMENIACA*) IN MALATYA PROVINCE, TURKEY

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[Kaplan, M. 2014. A new pest: *Contarinia pruniflorum* Coutin & Rambier (Diptera: Cecidomyiidae) on apricot (*Prunus armeniaca*) in Malatya province, Turkey. Munis Entomology & Zoology, 9 (2): 947-949**]**

In this study, were determined in buds and flowers on apricot trees in the harmful new specimen *Contarinia pruniflorum* Coutin & Rambier (Diptera: Cecidomyiidae) in Malatya province. The species that create significant losses in the early period at Battalgazi and the Kale district with the Lake basin flights in the fields of apricots between January-March. It was determined that laid to leaving 20-30 eggs on the flower buds.

Apricot which can be processed into many different products and besides being a tasty fruit is a fruit with a very high nutritional value. It also needs both production and marketing stage with the use of labor intensive to create large employment opportunities, Due to a significant increase in foreign income; it is in ranks second fruit in our country after raisins (Olgun, 2001).

Malatya province where situated in Eastern Anatolia Region, acess 54.8% of country's assets apricot tree. 100 - 110 thousand tons of dried apricots are obtained from about 8 million apricot trees in Malatya. Approximately 55% of Turkey's apricot production and 85% of the production of dried apricots is produced in the province of Malatya (Anonymous, 2011).

In studies conducted in the fields of apricots in Malatya province, there are many factors affecting adversely the yield and quality In terms of plant protection.

In the studt were identified 41 species of insect pests a surveys study for the determination of pests In Malatya province apricots (Ulusoy et al., 2001).

At the beginning of intense complaints from apricot producer in recent years is to determine the pests, causing significant losses in yield apricots feeding apricot flowers and had beeen intended whereas the methods to be used in the fight to reveal.

This study area was carried out in Malatya province apricots areas in 2009-2014 and *Contarinia pruniflorum* Coutin & Rambier (Diptera: Cecidomyiidae) was determined as a new pest species.

MATERIALS AND METHODS

The main material of study had consisted of in the province of Malatya apricot orchards, Japanese umbrella, sweep net and various laboratory equipments.

This study was conducted in order to determine the type of pests that cause significant yield losses, by feeding in the flower buds in apricot orchards Battalgazi and Kale district of Malatya Province in 2009-2014 years. The survey were made weekly from in February and up to the second week of April. It were sent abroad to be diagnosed by relevant specialists adults obtained as well as pests in the flower buds of the larvae in surveying.

RESULTS AND DISCUSSION

Pest species was determined to be *Contarinia pruniflorum* Coutin & Rambier (Diptera: Cecidomyiidae) that cause significant yield losses, by feeding in the flower buds In apricot orchards Battalgazi and Kale district of Malatya province. This pest has been identified for the first time apricot areas of our country through this work. Between the months of February and March of this type is seen in nature.

This species was reared and described on the basis of adults reared from swollen flower buds of *Prunus spinosa* and *Prunus mahaleb* in France (Western Europe) by Coutin & Rambier in 1955.

Later this species was found on *Prunus domestica* and other species of the genus *Prunus*. Subsequently important damage on *Prunus armeniaca* was observed 1999-2001 by E. Pierre in Department Drome in southern France (Pierre & Chauvin-Buthaut, 2001; Skuhravá et al., 2005).

It has been reported galled flower buds of *Prunus spinosa* caused by *Contarinia pruniflorum* also in the Czech Republic and in Slovakia at several places). The gall midges *Contarinia pruniflorum* may develop on several species of *Prunus*. Wild trees of this genus growing in nature may serve as fundamental host plants and source of expanding of gall midges in surroundings. Females emerging from these wild plants may lay their eggs also on developing flower buds of other related species of *Prunus* when environmental conditions are suitable. The population of gall midges may grow up several years gradually but inobservable up to the situation when damage of agricultural trees is large and gall midges cause serious loss of yield (Skuhravá, 1991, 1994).

In these studies; In parallel with the above-specified working It has been reported that the first output of adult nature had been begun after the second week of February and mated approximately 7-10 day period and left between 20-30 eggs on the flower buds. Larvae from eggs laid after feeding in the flower buds 15-20 days, As the larvae mature throw themselves to the ground. Pest species; pupae in the soil becomes, next year give back to nature is determined that the adult offspring of a year.

The fight against determined in this pest species to be made in the coming years will constitute the basic data for the project. The fight which will be held for against harmful pest in the framework of integrated will have a positive effect in terms of both human and environmental health.

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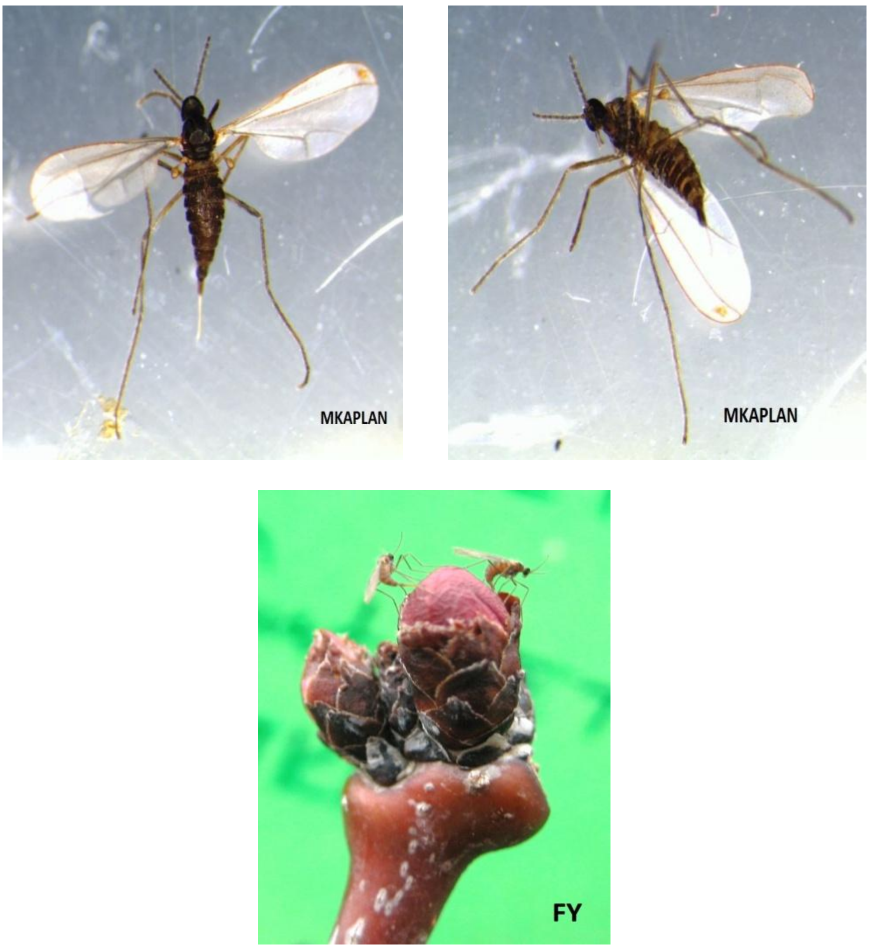

Figure 1. *Contarinia pruniflorum* Coutin & Rambier.

SCIENTIFIC NOTES

FAUNISTIC STUDY ON ODONATA (INSECTA) OF GÖLBEL LAKE, NORTHERN TURKEY

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It is tried to uncover the composition of fauna by making additions in this study that is aimed to determine Odonata species of Gölbel Lake in Osmancık district of Çorum Province and their distribution. In addition, other studies on the subject are scanned and it is noticed that there is no study about Odonata fauna of Gölbel Lake in Osmancık district, Çorum Province (Salur & Mesci, 2007; Demirsoy, 1982, 1995; Kalkman et al., 2006). This study is the first about Odonata fauna of Gölbel Lake in Osmancık district.

Gölbel Lake of Osmancık district which is choosed for study area is located in 41 06' 164'' North latitute- 034 55' 837'' East longitute coordinates. Lake is located in a high region at 1360 m altitude and at the border of provinces of Çorum and Samsun. Area of the lake is about 150 decar. Field studies were made in June, July and August of 2010 and in July of 2011 and 307 samples were collected from this area. As a result of diagnostic procedures of these examples, it is determined that 13 genus of 5 families of Odonata order belong to 17 species group taxa. All of these species are new for fauna of Osmancık district and Gölbel Lake.

After collected samples were being killed in killing jars, they were kept in protective envelopes within the insect boxes. All of the samples are at the Zoology Museum of Hitit University.

RESULTS

Family: Lestidae

Lestes sponsa (Hansemann, 1823)

Materials Examined: 31♂♂, 17♀♀, 14/06/2010; 10♂♂, 20/07/2010; 2♂♂, 29/07/2011.

Lestes barbarus (Fabricius, 1798)

Material Examined: 1♂, 29/07/2011.

Sympecma fusca (Vander Linden, 1820)

Materials Examined: 19♂♂, 3♀♀, 14/06/2010.

Family: Coenagrionidae

Coenagrion puella (Linnaeus, 1758)

Materials Examined: 51♂♂, 9♀♀, 14/06/2010; 15♂♂, 2♀♀, 20/07/2010.

Enallagma cyathigerum (Charpentier, 1840)
Materials Examined: 26♂♂, 1♀, 14/06/2010; 6♂♂, 1♀, 20/07/2010; 1♂, 1♀, 29/07/2011.

Ischnura elegans ebneri (Schmidt, 1938)
Materials Examined: 3♂♂, 2♀♀, 14/06/2010; 2♂♂, 4♀♀, 20/07/2010; 1♂, 29/07/2011.

Pyrrhosoma nymphula (Sulzer, 1776)
Material Examined: 1♂, 14/06/2010.

Family: Aeshnidae

Anax imperator Leach, 1815
Materials Examined: 5♂♂, 4♀♀, 14/06/2010; 2♂♂, 20/07/2010; 1♂, 1♀, 29/07/2011.

Family: Corduliidae

Cordulia aenea Linnaeus, 1758
Materials Examined: 9♂♂, 1♀, 14/06/2010; 1♂, 20/07/2010.

Family: Libellulidae

Crocothemis erythraea (Brulle, 1832)
Materials Examined: 1♂, 14/06/2010; 1♂, 20/07/2010. 1♂, 29/07/2011.

Leucorrhinia pectoralis (Charpentier, 1840)
Materials Examined: 2♂♂, 14/06/2010.

Libellula depressa (Linnaeus, 1758)
Materials Examined: 8♂♂, 1♀, 14/06/2010; 2♂♂, 20/07/2010.

Libellula quadrimaculata Linnaeus, 1758
Materials Examined: 9♂♂, 2♀♀, 14/06/2010.

Orthetrum brunneum (Fonscolombe, 1837)
Materials Examined: 1♀, 14/06/2010; 6♂♂, 1♀, 20/07/2010.

Orthetrum albistylum (Sélys, 1848)
Material Examined: 1♂, 29/07/2011.

Sympetrum fonscolombei (Sélys, 1840)
Materials Examined: 15♂♂, 14♀♀, 20/07/2010.

Sympetrum sanguineum (Müller, 1764)
Materials Examined: 1♀, 3♂♂, 20/07/2010. 5♂♂, 29/07/2011.

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