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A PROPOSE TO NEW ARRANGEMENTS ON SOME DORCADIONINI (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT: The Turkish endemic subgenus *Dorcadion* (*Megalodorcadion*) Pesarini & Sabbadini is upgraded to genus level. In accordance with, two new subgenera are proposed for *Megalodorcadion* Pesarini & Sabbadini stat. n.. And also two new subgenera are proposed for the genus *Neodorcadion* Ganglbauer too. A short key to the genus group taxa of Dorcadionini for Turkey is also proposed.

KEY WORDS: Cerambycidae, Dorcadionini, *Dorcadion*, *Megalodorcadion*, *Neodorcadion*, new subgenera.

The name *Megalodorcadion* was proposed by Pesarini & Sabbadini (1999) with the type species *Dorcadion ledereri* J. Thomson, 1865 by original designation as a subgenus of *Dorcadion* Dalman, 1817. The subgenus, *Dorcadion* (*Megalodorcadion*), included 5 species in their work as *Dorcadion escherichi* Ganglbauer, 1897; *Dorcadion glabrofasciatum* K. Daniel, 1900; *Dorcadion ledereri* J. Thomson, 1865; *Dorcadion parallelum* Küster, 1847 and *Dorcadion walteri* Holzschuh, 1991 which were placed by Breuning (1962) in the subgenus *Dorcadion* (*Pedestredorcadion*) Breuning, 1943. Also, Özdikmen (2010) stated 6 species (including *D. angorensis*) on the base of Pesarini & Sabbadini (1999). The same 5 species (except *D. angorensis* that is accepted as a synonym of *D. escherichi*) were also given by Danilevsky in Palaearctic catalogue of Löbl & Smetana (2010) in the subgenus *Dorcadion* (*Megalodorcadion*) Pesarini & Sabbadini, 1999 again. Later, Özdikmen & Kaya (2013) was described a new species of *Dorcadion* (*Megalodorcadion*) from Çorum province of Turkey. So the number of species in the subgenus was raised to 6. All species of the subgenus are endemic to Turkey now.

Pesarini & Sabbadini (1999) stated that “*The species in the subgenus can be divided into two distinct groups, although related to one another: the first consists D. ledereri* Thomson, *D. parallelum* Küster and taxa closely related to *D. escherichi* Ganglbauer (*escherichi* Ganglbauer, *angorensis* Ganglbauer and *walteri* Holzschuh), the second by only *D. glabrofasciatum* Daniel. The first group is characterized by the shape particularly elongated and parallel or almost parallel sides of elytra in ♂♂ that have a composed coating of condensed showy white pubescence into bands; in *D. glabrofasciatum*, however, the elytra of ♂ are less distinctly elongated, and have bands of black velvety pubescence alternating hairless bands” in his work with original description of the subgenus.

Otherwise, Özdikmen & Kaya (2013) in simple terms stated the subgenus has three different groups. “*First group includes three species as D. escherichi, D. ledereri and D. walteri. Second group includes only 1 species as D. parallelum. Third group includes two species as D. glabrofasciatum and D. dombilicoides*”. Although they never described the groups in their work. Anyway, the subgenus, *Dorcadion* (*Megalodorcadion*), has different groups clearly.

Consequently, we propose that *Megalodorcadion* Pesarini & Sabbadini, 1999

stat. n. is a separate genus. Moreover, the genus has three different groups. So we also propose two new subgenera for the genus.

Genus *MEGALODORCADION* Pesarini & Sabbadini, 1999: 58 stat. n.

[Type sp.: *Dorcadion ledereri* J. Thomson, 1865]

As mentioned by Pesarini & Sabbadini (1999), the genus is essentially characterized by the shape of the apex of the hind tibiae and pronotum. The hind tibiae have the two spines that are much smaller and less divergent. Pronotum has a discal gibbosity on the both sides of the base. The gibbosity lined on the inside by a dimple more or less prolonged forward. The dimple, clearly visible in the denuded specimens, is generally covered by a band of dense black hairs that makes it less obvious.

As expected, the genus is closely related with *Dorcadion* (*Cribridorcadion*) Pic, 1901. The genus is easily distinguished it by above mentioned characters. In *Dorcadion* (*Cribridorcadion*), the hind tibiae have a highly developed inner apical spine, approximately how long the thickness tibial apex, and strongly divergent (at nearly right angles) from the apical external spine, shorter but equally highly developed. Pronotum has not a discal gibbosity.

Subgenus *MEGALODORCADION* Pesarini & Sabbadini, 1999: 58

(Figs. 1a, b, c)

[Type sp.: *Dorcadion ledereri* J. Thomson, 1865]

The subgenus is essentially characterized by the shape elongated and subparallel sides of elytra in $\sigma\sigma$ that have a composed coating of condensed showy white pubescence into bands. Moreover, bands of elytra not fused and pronotum always clothed with a complete median band of condensed pubescence. Legs more or less reddish.

It is represented by three species as *Megalodorcadion escherichi*, *M. ledereri* and *M. walteri* now.

***Megalodorcadion escherichi* (Ganglbauer, 1897: 54)**

Orig. comb.: *Dorcadion escherichi* Ganglbauer, 1897: 54

Type loc.: Ankara prov. (Turkey)

Synonyms: *Dorcadion egregium* Ganglbauer, 1897: 56; *Dorcadion angorense* Ganglbauer, 1897: 57; *Dorcadion escherichi* var. *obliquesignatum* Pic, 1900: 12; *Dorcadion escherichi* var. *posticedisjunctum* Pic, 1909: 99; *Dorcadion ledereri* var. *cappadocicum* Breuning, 1946: 132.

Records in Turkey: Amasya, Ankara, Bilecik, Cappadocia, Konya, Tokat.

Distribution: Turkey.

Chorotype: Anatolian.

Remarks: This species is endemic to Turkey. It is distributed in Central Anatolian Region and C & W parts of Northern Anatolia for Turkey.

***Megalodorcadion ledereri* (Thomson, 1865: 548)**

Orig. comb.: *Dorcadion ledereri* Thomson, 1865: 548

Type loc.: Turkey ("Russia or." definitely mistaken information)

Synonyms: *Dorcadion ledereri* m. *discoseparatum* Breuning, 1946: 132 [Turkey: Amasya]; *Dorcadion ledereri* m. *preconjunctum* Breuning, 1946: 132 [Turkey: Amasya]; *Dorcadion ledereri* m. *presuturenigrum* Breuning, 1970: 98 [Turkey: Tokat]

Records in Turkey: Amasya, Çorum, Samsun.

Distribution: Turkey.

Chorotype: Anatolian.

Remarks: This species is endemic to Turkey. It is distributed only in C parts of Northern Anatolia for Turkey.

***Megalodorcadion walteri* (Holzschuh, 1991: 55)**

Orig. comb.: *Dorcadion walteri* Holzschuh, 1991: 55

Type loc.: Bolu prov. (Turkey)

Records in Turkey: Bolu.

Distribution: Turkey.

Chorotype: Anatolian.

Remarks: This species is endemic to Turkey. It is distributed only in NW part of Northern Anatolia for Turkey.

Subgenus *FUSODORCADION* subgen. n.

(Fig. 1d)

[Type sp.: *Dorcadion parallelum* Küster, 1847]

The new subgenus is essentially characterized by the shape particularly elongated and parallel sides of elytra in $\sigma\sigma$ that have a composed coating of condensed showy white pubescence into bands. Moreover, bands of elytra fused and pronotum always clothed with a complete median band of condensed pubescence. Legs black, not reddish.

Etymology: The name derived from Latin word “fusus” (meaning in English “fuse”).

It is represented only by one species as *M. parallelum* now.

***Megalodorcadion parallelum* (Küster, 1847: 79)**

Orig. comb.: *Dorcadion parallelum* Küster, 1847: 79

Type loc.: Turkey

Synonym: *Dorcadion parallelum* m. *rufinimembre* Breuning, 1946: 132 [?Syria, undoubtedly mislabeled].

Records in Turkey: , Amasya, Ankara, ÇorumTokat, Yozgat.

Distribution: Turkey.

Chorotype: Anatolian.

Remarks: This species is endemic to Turkey. It is distributed in N part of Central Anatolia, and C parts of Northern Anatolia for Turkey.

Subgenus *ANATOLODORCADION* subgen. n.

(Figs. 1e, f)

[Type sp.: *Dorcadion dombilicoides* Özdikmen & Kaya, 2013]

The new subgenus is essentially characterized by pronotum never clothed with a complete median band of condensed pubescence. So, the dimple on the median line of pronotum clearly visible, at most with very much sparse short pubescence. Moreover, elongated and subparallel or less distinctly elongated and more widened sides of elytra in $\sigma\sigma$ that have a composed coating of condensed showy white pubescence into bands or, more or less hairless bands. Bands of elytra not fused. Legs more or less reddish.

Etymology: The name derived from Anatolia that is distribution area of the taxa.

It is represented by two species as *M. glabrofasciatum* and *M. dombilicoides* now.

Megalodorcadion dombilicoides* Özdikmen & Kaya, 2013: 494*Orig. comb.:** *Dorcadion dombilicoides* Özdikmen & Kaya, 2013: 494**Type loc.:** Çorum (Turkey)**Records in Turkey:** Çorum.**Distribution:** Turkey.**Chorotype:** Anatolian.**Remarks:** This species is endemic to Turkey. It is distributed only in C part of Northern Anatolia for Turkey.***Megalodorcadion glabrofasciatum* Daniel, 1900: 140****Orig. comb.:** *Dorcadion glabrofasciatum* Daniel, 1900: 140**Type loc.:** Bithynia (Turkey)**Synonyms:** *Dorcadion glabrofasciatum* var. *imparivittatum* K. Daniel, 1900: 140 [Turkey]; *Dorcadion glabrofasciatum* m. *parivittatum* Breuning, 1946: 98 [Turkey: İzmir: Bozdağ]; *Dorcadion glabrofasciatum* m. *glabroseparatum* Breuning, 1962: 310 [Turkey: Eskişehir]**Records in Turkey:** Afyon, Bilecik, Eskişehir, İzmir, Uşak.**Distribution:** Turkey.**Chorotype:** Anatolian.**Remarks:** This species is endemic to Turkey. It is distributed in NW part of Central Anatolia, W part of Northern Anatolia, and W Anatolia for Turkey.

Besides, when the genus *Neodorcadion* Ganglbauer was erected included the species from Balkans and Asia. Then, the genus *Eodorcadion* Breuning was established for Asian species. So, the genus *Neodorcadion* Ganglbauer includes only the species from Balkans and Italy (Calabria) now. The genus has three different groups clearly. Therefore, we also propose two new subgenera for the genus.

Genus *NEODORCADION* Ganglbauer, 1884: 437[Type sp.: *Lamia bilineata* Germar, 1824]

The genus is essentially characterized by the shape of frons and clypeus. Frons with the clypeus are not melted in the members of the genus.

Subgenus *NEODORCADION* Ganglbauer, 1884: 437

(Fig. 2a)

[Type sp.: *Lamia bilineata* Germar, 1824]

The subgenus is essentially characterized by absence any sutural strip on elytra in $\sigma\sigma$, but always elytra with strips of condensed pubescence and also disc of pronotum and elytra with ground pubescence.

The subgenus is represented by eight species only in Balkans as *Neodorcadion bilineatum* (Germar, 1824); *Neodorcadion exornatoides* Breuning, 1962; *Neodorcadion exornatum* (Frivaldszky von Frivald, 1835); *Neodorcadion fallax* (Kraatz, 1873); *Neodorcadion laqueatum* (Waltl, 1838); *Neodorcadion orientale* Ganglbauer, 1884; *Neodorcadion pelleti* (Mulsant & Rey, 1863) and *Neodorcadion virleti* (Brullé, 1832). In Turkey, it is represented by six species as *Neodorcadion bilineatum* (Germar, 1824); *Neodorcadion exornatoides* Breuning, 1962; *Neodorcadion exornatum* (Frivaldszky von Frivald, 1835); *Neodorcadion laqueatum* (Waltl, 1838); *Neodorcadion orientale* Ganglbauer, 1884 and *Neodorcadion pelleti* (Mulsant & Rey, 1863).

Subgenus CALABRODORCADION subgen. n.

(Fig. 2b)

[Type sp.: *Neodorcadion calabricum* Reitter, 1889]

The subgenus is essentially characterized by present a distinct sutural strip of condensed pubescence on elytra in $\sigma\sigma$ and at least disc of pronotum (except median line) and elytra without ground pubescence.

The subgenus is represented only by one species in Italy as *Neodorcadion calabricum* Reitter, 1889.

Etymology: The name derived from Calabria in Italy that is type locality of the type species.

Subgenus VACARODORCADION subgen. n.

(Fig. 2c)

[Type sp.: *Dorcadion virleti* Brullé, 1832]

The subgenus is essentially characterized by only present ground pubescence on elytra, but also absence any strip of condensed pubescence on elytra in $\sigma\sigma$ and disc of pronotum and elytra with ground pubescence.

The subgenus is represented only by one species in Greece as *Neodorcadion virleti* (Brullé, 1832).

Etymology: The name derived from Latin word “vacare” (meaning in English “be vacant”).

A short key for the genus group taxa of Dorcadionini for Turkey

1. Frons with the clypeus melted.....**2**
 -. Frons with the clypeus not melted.....***Neodorcadion (s.str.)***
2. 3rd antennal segment longer than 4th, much shorter than 1st segment.....**3**
 -. 3rd antennal segment about as long as the 4th, much shorter than 1st segment.....**6**
3. The hind tibiae have a highly developed inner apical spine, approximately how long the thickness tibial apex, and strongly divergent (at nearly right angles) from the apical external spine, shorter but equally highly developed. Pronotum without any discal gibbosity.....
***Dorcadion (Cribridorcadion)***
 -. The hind tibiae have the two spines that are much smaller and less divergent. Pronotum with a discal gibbosity.....**4**
4. Pronotum clothed with a complete median band of condensed pubescence.....**5**
 -. Pronotum never clothed with a complete median band of condensed pubescence.....
***Megalodorcadion (Anatolodorcadion) subgen. n.***
5. Elongated and subparallel sides of elytra in $\sigma\sigma$ that have a composed coating of condensed showy white pubescence into bands; bands of elytra not fused; legs more or less reddish.....***Megalodorcadion (s.str.)***
 -. Particularly elongated and parallel sides of elytra in $\sigma\sigma$ that have a composed coating of condensed showy white pubescence into bands; bands of elytra fused; legs black.....
***Megalodorcadion (Fusodorcadion) subgen. n.***
6. Apical half of the 3-5 or 3-6th segments strongly thickened; Aedeagus broad basally, apical warts mid-grade narrowed, apical considerably broad rounded, lower lamella laterally flattened and very broadly rounded.....***Dorcadion (Maculatodorcadion)***
 -. Apical half of the 3-5 or 3-6th segments not strongly thickened; Aedeagus broad, apical warts no or only slightly narrowed, apical much rounded, lower lamella not flattened.....
***Dorcadion (Carinatodorcadion)***

CONCLUSION

After this work, the tribe Dorcadionini includes six genera and seventeen subgenera (including nominate subgenera) worldwide now. These are listed as follows:

- Genus *Dorcadion* Dalman, 1817: 397** [type species *Cerambyx glycyrrhizae* Pallas, 1773]
Subgenus *Acutodorcadion* Danilevsky, Kasatkin & Rubenyan, 2005: 135 [type species *Dorcadion acutispinum* Motschulsky, 1860]
Subgenus *Carinatodorcadion* Breuning, 1943: 524 [type species *Cerambyx carinatus* Pallas, 1771]
Subgenus *Cribridorcadion* Pic, 1901: 12 [type species *Dorcadion mniszehi* Kraatz, 1873]
Pedestredorcadion Breuning, 1943: 526 [type species *Lamia pedestris* Poda von Neuhaus, 1761]
Autodorcadion Plavilstshikov, 1958: 45 [type species *Cerambyx arenarius* Scopoli, 1763]
Dzhungarodorcadion Danilevsky, 1993: 47 [type species *Dorcadion jacobsoni* Jakovlev, 1899]
Bergerianum Pesarini & Sabbadini, 2004: 150 [type species *Dorcadion chrysochroum* Breuning, 1943]
subgenus *Dorcadion* Dalman, 1817a: 397 [type species *Cerambyx glycyrrhizae* Pallas, 1773]
Compsodorcadion Ganglbauer, 1884: 437 [type species *Dorcadion gebleri* Kraatz, 1873]
subgenus *Maculatodorcadion* Breuning, 1943: 525 [type species *Dorcadion quadrimaculatum* Küster, 1848]
- Genus *Eodorcadion* Breuning, 1947: 142** [type species *Lamia carinata* Fabricius, 1781]
Subgenus *Eodorcadion* Breuning, 1947: 142 [type species *Lamia carinata* Fabricius, 1781]
Subgenus *Humerodorcadion* Danilevsky, Kasatkin & Rubenian, 2005: 133 [type species *Dorcadion humerale* Gebler, 1823]
Subgenus *Ornatodorcadion* Breuning, 1947: 142 [type species *Dorcadion ornatum* Faldermann, 1833]
- Genus *Iberodorcadion* Breuning, 1943: 524** [type species *Cerambyx fuliginator* Linnaeus, 1758]
Subgenus *Baeticodorcadion* Vives, 1976: 166 [type species *Dorcadion mus* Rosenhauer, 1856]
Subgenus *Hispanodorcadion* Vives, 1976: 166 [type species *Dorcadion hispanicum* Mulsant, 1851]
Subgenus *Iberodorcadion* Breuning, 1943: 524 [type species *Cerambyx fuliginator* Linnaeus, 1758]
- Genus *Megalodorcadion* Pesarini & Sabbadini, 1999: 58** [type species *Dorcadion ledereri* J. Thomson, 1865]
Subgenus *Anatolodorcadion* subgen. n. [type species *Dorcadion dombilicoides* Özdikmen & Kaya, 2013]
Subgenus *Fusodorcadion* subgen. n. [type species *Dorcadion parallelum* Küster, 1847]
Subgenus *Megalodorcadion* Pesarini & Sabbadini, 1999: 58 [type species *Dorcadion ledereri* J. Thomson, 1865]
- Genus *Neodorcadion* Ganglbauer, 1884: 437** [type species *Lamia bilineata* Germar, 1824]
Subgenus *Calabrodorcadion* subgen. n. [type species *Dorcadion calabricum* Reitter, 1889]
Subgenus *Neodorcadion* Ganglbauer, 1884: 437 [type species *Lamia bilineata* Germar, 1824]
Subgenus *Vacarodorcadion* subgen. n. [type species *Dorcadion virleti* Brullé, 1832]
- Genus *Politodorcadion* Danilevsky, 1996: 407** [type species *Dorcadion politum* Dalman, 1823]

It is clear that this group is very problematic. Only two of six known genera of Dorcadionini were described as genera originally. These are *Dorcadion* Dalman, 1817 and *Eodorcadion* Breuning, 1947. The remaining genera were described as subgenera of *Dorcadion* Dalman. These are *Iberodorcadion* Breuning, 1943; *Megalodorcadion* Pesarini & Sabbadini, 1999; *Neodorcadion* Ganglbauer, 1884 and *Politodorcadion* Danilevsky, 1996.

The genus *Eodorcadion* Breuning includes only Asian species which were placed in the subgenus *Dorcadion* (*Neodorcadion*) Ganglbauer, 1884. So, the genus *Neodorcadion* Ganglbauer includes only the species from Balkans and Italy (Calabria) now. Frons with the clypeus not melted in both genera. So we agree with today's approach.

The genus *Iberodorcadion* Breuning is distributed only in Western Europe.

The genus *Megalodorcadion* Pesarini & Sabbadini stat. n. is distributed only in Turkey.

According to original description, the genus *Politorcadion* Danilevsky, 1996 that was described as a subgenus of *Dorcadion* Dalman, was separated from *Dorcadion* (s.str.) only by the usual absence of dark ground body pubescence, so head, thorax, elytra and abdomen are strongly shining with some rare exceptions. Therefore, this genus seems to be more closely related with *Dorcadion* (s.str.) from already subgenera in the genus *Dorcadion* Dalman (except only *Acutodorcadion* Danilevsky et al., 2005).

Consequently, this group has still many systematic problems. Other arrangements in the group needs detailed works in the future. For example, all subgenera (except *Acutodorcadion* Danilevsky et al.) which are accepted for the present day, of *Dorcadion* Dalman, 1817 seems to be sufficiently different from the "true" *Dorcadion* [*Dorcadion* (s.str.)].

Moreover, *Cribridorcadion* Pic that has very rich taxon, includes many different groups.

From point of view, we think that as a simple arrangement of the group can be given as follows:

Genus *Carinatodorcadion* Breuning, 1943: 524 [type species *Cerambyx carinatus* Pallas, 1771]

Genus *Cribridorcadion* Pic, 1901: 12 [type species *Dorcadion mniszehi* Kraatz, 1873]

Pedestredorcadion Breuning, 1943: 526 [type species *Lamia pedestris* Poda von Neuhaus, 1761]

Autodorcadion Plavilstshikov, 1958: 45 [type species *Cerambyx arenarius* Scopoli, 1763]

Dzhungarodorcadion Danilevsky, 1993: 47 [type species *Dorcadion jacobsoni* Jakovlev, 1899]

Bergerianum Pesarini & Sabbadini, 2004: 150 [type species *Dorcadion chrysochroum* Breuning, 1943]

Genus *Dorcadion* Dalman, 1817: 397 [type species *Cerambyx glycyrrhizae* Pallas, 1773]

Subgenus *Acutodorcadion* Danilevsky, Kasatkin & Rubenyan, 2005: 135 [type species *Dorcadion acutispinum* Motschulsky, 1860]

subgenus *Dorcadion* Dalman, 1817a: 397 [type species *Cerambyx glycyrrhizae* Pallas, 1773]

Compsodorcadion Ganglbauer, 1884: 437 [type species *Dorcadion gebleri* Kraatz, 1873]

Genus *Eodorcadion* Breuning, 1947: 142 [type species *Lamia carinata* Fabricius, 1781]

Subgenus *Eodorcadion* Breuning, 1947: 142 [type species *Lamia carinata* Fabricius, 1781]

Subgenus *Humerodorcadion* Danilevsky, Kasatkin & Rubenian, 2005: 133 [type species *Dorcadion humerale* Gebler, 1823]

Subgenus *Ornatodorcadion* Breuning, 1947: 142 [type species *Dorcadion ornatum* Faldermann, 1833]

Genus *Iberodorcadion* Breuning, 1943: 524 [type species *Cerambyx fuliginator* Linnaeus, 1758]

Subgenus *Baeticodorcadion* Vives, 1976: 166 [type species *Dorcadion mus* Rosenhauer, 1856]

Subgenus *Hispanodorcadion* Vives, 1976: 166 [type species *Dorcadion hispanicum* Mulsant, 1851]

Subgenus *Iberodorcadion* Breuning, 1943: 524 [type species *Cerambyx fuliginator* Linnaeus, 1758]

Genus *Maculatodorcadion* Breuning, 1943: 525 [type species *Dorcadion quadrimaculatum* Küster, 1848]

Genus *Megalodorcadion* Pesarini & Sabbadini, 1999: 58 [type species *Dorcadion ledereri* J. Thomson, 1865]

Subgenus *Anatolodorcadion* subgen. n. [type species *Dorcadion dombilicoides* Özdikmen & Kaya, 2013]

Subgenus *Fusodorcadion* subgen. n. [type species *Dorcadion parallelum* Küster, 1847]

Subgenus *Megalodorcadion* Pesarini & Sabbadini, 1999: 58 [type species *Dorcadion ledereri* J. Thomson, 1865]

Genus *Neodorcadion* Ganglbauer, 1884: 437 [type species *Lamia bilineata* Germar, 1824]

Subgenus *Calabrodorcadion* subgen. n. [type species *Dorcadion calabricum* Reitter, 1889]

Subgenus *Neodorcadion* Ganglbauer, 1884: 437 [type species *Lamia bilineata* Germar, 1824]

Subgenus *Vacarodorcadion* subgen. n. [type species *Dorcadion virleti* Brullé, 1832]

Genus *Politodorcadion* Danilevsky, 1996: 407 [type species *Dorcadion politum* Dalman, 1823]

Finally, even the tribe Dorcadionini can be divided at least four main groups.

Group I includes two genera as *Dorcadion* Dalman (the subgenera as *Acutodorcadion* Danilevsky et al. and s. str.) and *Politodorcadion* Danilevsky.

Group II includes four genera as *Carinatodorcadion* Breuning, *Cribridorcadion* Pic, *Iberodorcadion* Breuning (the subgenera as *Baeticodorcadion* Vives, *Hispanodorcadion* Vives and s. str.) and *Maculatodorcadion* Breuning.

Group III includes only one genus as *Megalodorcadion* Pesarini & Sabbadini (the subgenera as *Anatolodorcadion* subgen. n., *Fusodorcadion* subgen. n. and s. str.).

Group IV includes two genera as *Eodorcadion* Breuning (the subgenera as s. str., *Humerodorcadion* Danilevsky et al. and *Ornatodorcadion* Breuning) and *Neodorcadion* Ganglbauer (the subgenera as *Calabrodorcadion* subgen. n., s. str. and *Vicarodorcadion* subgen. n.).

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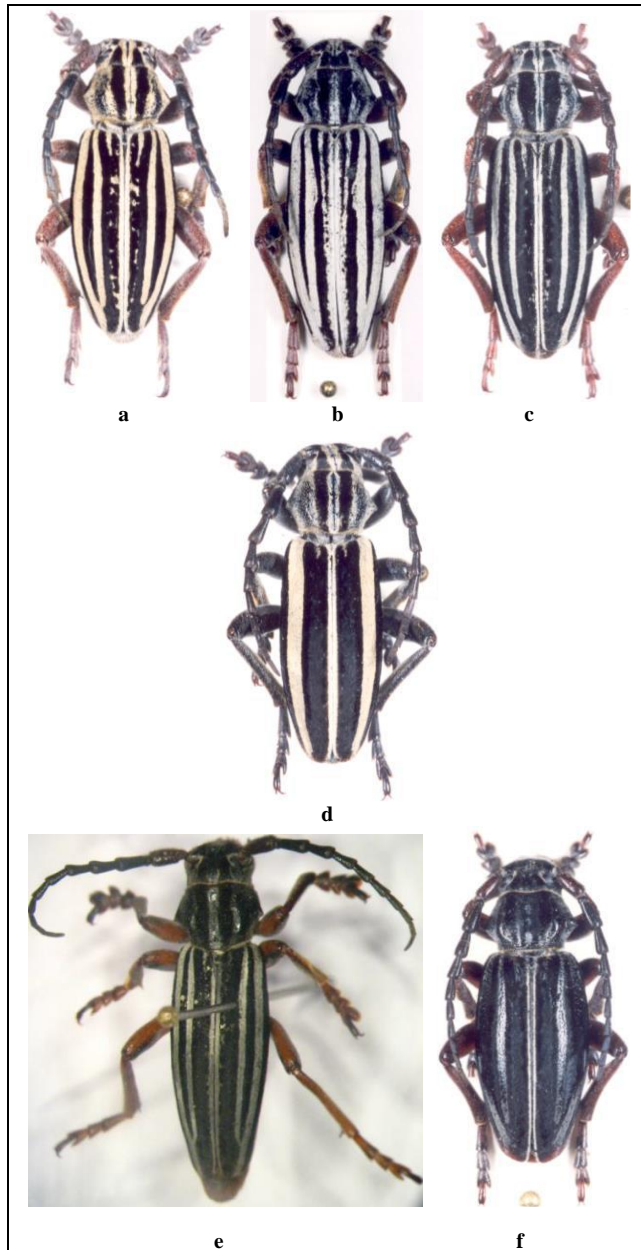


Figure 1. *Megalodorcadion* Pesarini & Sabbadini, 1999 stat. n., a) *Megalodorcadion* (s.str.) *escherichi* (Ganglbauer, 1897), b) *Megalodorcadion* (s.str.) *ledereri* (Thomson, 1865), c) *Megalodorcadion* (s.str.) *walteri* (Holzschuh, 1991), d) *Megalodorcadion* (*Fusodorcadion*) *parallelum* (Küster, 1847), e) *Megalodorcadion* (*Anatolodorcadion*) *dombilicoides* (Özdikmen & Kaya, 2013), f) *Megalodorcadion* (*Anatolodorcadion*) *glabrofasciatum* (Daniel, 1900) [*M. dombilicoides* from Özdikmen & Kaya (2013) and the remaining figures from <http://www.zin.ru/Animalia/Coleoptera/eng/megalodn.htm>].

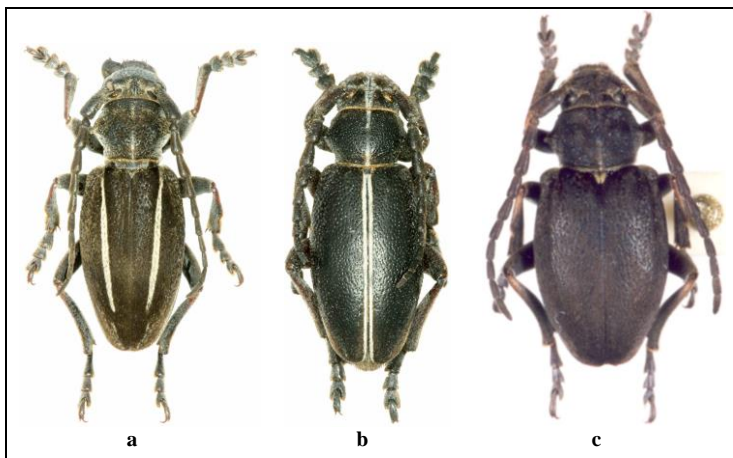


Figure 2. *Neodorcadion* Ganglbauer, 1884, a) *N.* (s.str.) *bilineatum* (Germar, 1824) [from <http://r.a.r.e.free.fr/dorcadion/bilineatum%20M%2014.jpg>], b) *N.* (*Calabrodorcadion*) *calabricum* (Reitter, 1889) [from <http://r.a.r.e.free.fr/dorcadion/calabricum%20M%2014.jpg>], c) *N.* (*Vacarodorcadion*) *virleti* (Brullé, 1832) [from <http://www.zin.ru/Animalia/Coleoptera>].

**LYGISTOPTERUS ESCALERAI PIC, 1942 STAT. NOV., AND
OTHER NOTES ON THE GENUS *LYGISTOPTERUS*
MULSANT, 1838 IN THE PALAEARCTIC REGION
(COLEOPTERA: LYCIDAE)**

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ABSTRACT: The Palaearctic species of *Lygistoropterus* Mulsant, 1838 are examined, giving a detailed iconography of the main diagnostic characters. The subspecies *L. sanguineus escaleraei* Pic, 1942 is elevated to the rank of species (*L. escaleraei* stat. nov.). Lectotypus and Paralectotypi of *Lygistoropterus anorachilus* Ragusa, 1883 are designated.

KEY WORDS: *Lygistoropterus*, *Lygistoropterus escaleraei*, *Lygistoropterus anorachilus*, Lectotypus.

The genus *Lygistoropterus* Mulsant, 1838 (type species *Cantharis sanguineus* Linnaeus, 1758) is represented in the Palaearctic Region by three species: *L. anorachilus* Ragusa, 1883, *L. cobosi* Pardo-Alcaide, 1961, and *L. sanguineus* (Linnaeus, 1758); the last taxon being subdivided into two subspecies, the nominal one and *L. s. escaleraei* Pic, 1942.

This genus has recently been studied by Fanti & Vitali (2013), who analyzed dozens of specimens from Italy, France (including Corsica), and Luxembourg and who have for the first time drawn some anatomical parts, confirming that *Lygistoropterus anorachilus* and *L. sanguineus* are valid species.

We examined about 200 specimens, mainly from the entire Western Palaearctic distribution of the genus (several countries of Europe, plus Caucasus, and Armenia). Due to the considerable variability of some morphological aspects and of the pigmentation of some anatomical parts, we provide a large iconographical set, representing series of epistomia, pronota, and aedeagi. We are able to confirm the separation of *L. anorachilus* and *L. sanguineus*, and also to make some considerations about *L. sanguineus escaleraei* Pic, 1942. Concerning *L. cobosi*, this taxon is known only for a single specimen from Morocco, preserved in the Pardo-Alcaide collection; however, notwithstanding the willingness of some Spanish colleagues, it has been impossible to find this type.

MATERIALS AND METHODS

The studied material comes from the entomological collections of the Natural History Museum of the University of Florence, Zoological Section (= MZUF), of the Natural History Museum of Milan (= MSNM), from the one of one of the Authors (Filippo Ceccolini = FC), and the Ragusa collection preserved in the Department of Animal Biology of the University of Catania (= CR).

All the genitalia of male specimens have been extracted and examined under a stereomicroscope. In some cases, we illustrate some anatomical parts that we

consider fundamental for the diagnostic of the different taxa (rostrum, pronotum, aedeagus). Through words "m" and "f" we indicate respectively male and female.

Names of places are written as in the original labels (only the names of states are translated in English). In square brackets some our explications are added.

STUDIED MATERIAL

Lygistorus anorachilus Ragusa, 1883

ITALY: Molise: passo di Rionero Sannitico (IS), 11.8.2010, F. Ceccolini & E. Paggetti leg., 1 m, FC; Lazio: Capo Circeo (Quarto medio basso) (LT), 9.7.1940, 1 m [without aedeagus], MSNM; Capo Circeo (Quarto freddo alto) (LT), 11.7.1940, 1 m; Calabria: Sila Grande, Fossiatto (CS), m 1300, 13.8.1970, F. Terzani leg., 1 m, MZUF; Sila Grande (CS), f. Cecita, m 1150, 17.8.1970, F. Terzani leg., 1 m, MZUF; Sila Grande, Colle Napoletano, m 1300-1350, Camigliatello Silano (CS), 5.8.1970, F. Terzani leg., 1 m, MZUF; Sila Grande, La Corsonara, m 1300, Camigliatello Silano (CS), 3.8.1970, F. Terzani leg., 1 m, MZUF; Sila Grande, recinto dei Daini [= fence of fallow deers], m 1170, Camigliatello Silano (CS), 24.8.1970, F. Terzani leg., 1 m, MZUF; Sicilia: Ficuzza [Wood of the] (PA), E. Ragusa leg., 4 m, CR.

Lygistorus sanguineus (Linnaeus, 1758)

AUSTRIA: Carinzia: Dobratsch territory, A. Sazmaier leg., 2 m, MSNM; Stiria: H.-Schwab St. [= Hochschwab], 7.1905, 1 m 4 f, MSNM; Umgb. [= surroundings] Graz, Messa leg., 1 m, MSNM. Wien: Umgeb. [= surroundings] Wien, 7.1910, 1 m, MSNM.

BOSNIA-HERZEGOVINA: Rataj, 1.7.1911, Neuhaus leg., 2 m, MSNM; Poda, 28.7.1911, Neuhaus leg., 1 m, MSNM; Ravna Gor, 28.7.1911, Neuhaus leg., 1 m 1 f, MSNM; Stambolcic [= Stambolcic], 17.7.1910, Neuhaus leg., 1 m 4 f, MSNM.

FRANCE: Corsica: between Col di Bavella and M. Velaco, m 1300, 5.8.1972, A. Bucciarelli, E. Granchi, B. Lanza leg., 3 m 1 f, MZUF; Rio d'Agnone, Vizzavona, m 900, 3.8.1977, B. Lanza; 1 f, MZUF; Gironde: Blaye, 6.1952, P. Ardoin leg., 1 f, MZUF; Alvernia: Chatel Guyon, 7.1913, 1 m, MZUF.

GERMANY: Sassonia, 1 m, MSNM.

GREECE: Macedonia: Mont Athos, 1 m, MSNM.

ITALY: Alpi Italiane, L. Usslaub leg., 1 m 1 ex. [without abdomen], MZUF; Calabria: Monte Scuro, Sila (CS), 5.7.1939, E. Moltoni leg., 7 m 1 f, MSNM; Sila (CS/CZ), 5.8.1949, E. Busolini & M. Etonti leg., 2 m 1 f, MSNM; Gamberia [= Gamberie], Aspromonte (RC), 26.6.1993, R. Lisa leg., 10 m 4 f, MZUF; Sila Grande, S. Barbara (CS), m 1400, 5.8.1970, F. Terzani leg., 3 m 1 f, MZUF; Liguria: Baiardo, M. Ceppo (IM), 31.7.1948, S. Failla leg., 1 f, MZUF; Lombardia: Val Furva (SO), 29.7.1894, 2 m, MSNM; Marche: Avellana (PU), G. Cavanna leg., 2 m, MZUF; Piemonte: M. Rosa, Macugnaga (VB), 20.7.?, Borca leg., 2 m, MSNM; Macugnaga (VB), 1.8.1911, V. Ronchetti leg., 5 f, MSNM; Meana (TO), Alpi Cozie, 28.6.1953, A. Fabiani leg., 3 m, MSNM; Val di Susa (TO), 8.1950, G. Loro leg., 1 m, MSNM; Malesco (VB), 5.1921, T. Castellani leg., 1 m, MSNM; Sicilia: Dintorni [= surroundings] Palermo, 1.1918, F. Muzzi leg., 1 m, MSNM; Sicilia, E. Ragusa leg., 1 m, MSNM; Toscana: S. Margherita, Firenze, 13.6.1936, A. Martelli leg., 2 m, MSNM; dint. [= surroundings] Firenze, 4.1926, M. Lombardi leg., 2 m, MSNM; dint. [= surroundings] Firenze, 6.1926, M. Lombardi leg., 1 m 1 f, MSNM; Gamberaia, Firenze, 6.1936, B. Lanza leg., 3 m 1 f, MZUF; S. Margherita a Montici, Firenze, 10 m 1 f, MZUF; Cont. [= surroundings] di Firenze, Pucci leg., 2 m, MZUF; Cont. [= surroundings] Firenze, F. Piccioli leg., 1 m, MZUF; Cascine [Park], Cont. [= surroundings] Firenze, F. Piccioli leg., 1 m, MZUF; Cascine [Park], Firenze, 6.1939, A. Martelli leg., 5 m, MZUF; Cascine [Park], Firenze, 23.6.1961, S. Failla leg., 1 f, MZUF; torrente Ema, Galluzzo, Firenze, 5.7.1972, F. Terzani & A. Zanotti leg., 1 m, MZUF; Pieve S. Lazzaro a Lucardo, Montespertoli (FI), 10.7.1988, B. Cecchi leg., 1 f, MZUF; [Bagno a] Ripoli, Valdarno (FI), 6.1898, O. Beccari leg., 9 m 3 f, MZUF; Firenze, 10.7.1959, 4 m 1 f, MZUF; Cave di Maiano, Firenze, 22.6.1963, S. Failla leg., 1 m, MZUF; Pisa, G.L. Carrara leg., 2 f, MZUF; Lucignano (AR), 10.7.1921, A. Marchi leg., 1 f, MZUF; Torrita [di Siena], 6.1912, A. Marchi leg., 1 m, MZUF; Trentino-Alto Adige: Val d'Ultimo (BZ), 9.7.1934, M. Barajon leg., 1 m, MSNM; Canazei (TN), 8.1951, S. Failla leg., 1 m 1 f, MZUF; Valle d'Aosta: Brusson (AO), 7.1952, 2 m, MSNM, 1 f, MZUF; Colle d'Joux [= di Joux], Saint Vincent (AO),

3.8.1957, A. Porta leg., 1 f, MSNM; Entrève (AO), 7.1946, F. Solari leg., 1 f, MSNM; La Thuile (AO), 8.1953, 1 m, MSNM; Valsavaranche (AO), A. Gagliardi leg., 2 m, MSNM; Valsavaranche (AO), 7.1995, C. Tendi leg., 3 m 2 f, MZUF; Cogne (AO), Alpi Graje, 18.7.1935, A. Schatzmayr & Tasso leg., 3 m, MSNM; Cogne (AO), 4.8.1971, S. Failla leg., 1 f, MZUF; Verres (AO), 6.7.1952, 1 f, MZUF.

POLAND: Bassa Slesia: Schweidnitz [= Swidnica], A. Porta leg., 1m 2 f, MSNM.

CZECH REPUBLIC: Moravia-Slesia: Hnojník [= Gnjník = Hoiník], 5 m 2 f, MSNM; Moravia: Prossnitz [= Prostejov], R. Heilig leg., 1 m, MZUF.

ROMANIA: Maramureş: Marmaros (Hungaria bor.) [= Sighetu Marmatiei], E. Reitter, 1 m, MZUF.

RUSSIA: Sibirien, E. Reitter & H. Leder leg., 1 m, MZUF.

SPAIN: Cantabria: Espinama, Hi. s. Cord. Cantabr., 24.6.1934, C. Koch leg., 2 m 1 f, MSNM.

SWITZERLAND: Grigioni: Davos, 8.1894, 2 m 1 f, MSNM; Ticino: Airolo, 26.VI.1938, G. Pozzi leg., 1 f, MSNM; Vallese: M. Bianco, Ferret, 16.7.1935, Tasso, A. Schatzmayr & K. Koch leg., 1 f, MSNM.

***Lygistopterus escalerai* Pic, 1942 stat. nov. (see below)**

ARMENIA: Nor Arachadzor lake, Artsvanik, 4.7.2005, L. & M. Bartolozzi leg., 1 f, MZUF.

RUSSIA: Ossezia del Nord [= North Ossetia]: Rekom, 16.7.1910, V. Ronchetti leg., 5 m 5 f, MSNM.

The specimens chosen for the iconographical representation are listed in table 1.

DISCUSSION

The analysis of the characters performed by Fanti & Vitali (2013) is essentially referred to these parts: pronotum, III-IV antennomeres, epistomium, and aedeagus. Since these Authors consider "an illusory character" the one referred to the antennomeres, we have analyzed the other ones.

As concerning the epistomium (anterior margin of rostrum) of *L. anorachilus*, we observed strong uniformity in the shape (Fig. 1) which is bisinuate, as seen by the precedent Authors (Ragusa, 1883, 1884; Pardo-Alcaide, 1961a; Fanti & Vitali, 2013), while we observed high morphological variability in *L. s. sanguineus* (Figs. 2-8). As far as we known, our figures are the first ones referred to the epistomia of these two species of *Lygistopterus*.

Our analysis confirms that the ratio between the rostrum width (taken at the basis of antennae) and the rostrum length (taken from the median point of the imaginary line connecting the antennae to the end of the rostrum) is different in the two species. In fact, the ratio value is $1,9 \div 2,0$ in *L. anorachilus*, while it is $1,4 \div 1,5$ in *L. s. sanguineus*, with the exception of a male of Cantabria (Spain) in which it is $\sim 1,2$.

The pronotum tends to have a trapezoidal shape in both species with a larger hind part; nevertheless, in *L. anorachilus* it is always present a basal enlargement and the central dark band is constantly very wide, while in *L. s. sanguineus* the pronotum shape and the dark band are much more variable (Figs. 10-18). As a matter of fact, one specimen from Switzerland has a nearly rectangular pronotum (Fig. 17), whereas in some cases we can observe an asymmetrical irregularity of lateral rims (Fig. 18). The variability of the pronotum colour in *L. s. sanguineus* is remarkable too: the width of the central band can be as large as it is in *L. anorachilus* (Fig. 12) or very reduced (Fig. 15).

Considering the aedeagus, the parameres are a distinctive character because in *L. anorachilus* the ratio between length and width is about 3:1, while as a rule in *L. s. sanguineus* it is about 2:1 (Figs. 21-26), even if a specimen of Bosnia-Herzegovina shows a ratio value of 2.6 (Fig. 26). Moreover, in *L. anorachilus* the

parameres are compressed at the mid-length, whilst in *L. s. sanguineus* they are usually slightly enlarged.

The values of the body length fit well with those given by Fanti & Vitali (2013).

Among the specimens of *L. anorachilus* that we studied, there are 4 males from Ragusa's collection. The typical series described by Ragusa consists of 2 females and 2 males, discriminated by the length of antennae (Ragusa, 1883). Dissecting those specimens, we verified that they are all males. Moreover, only one of these specimens is labelled "Sicilia, Ficuzza, E. Ragusa" (Fig. 28); another specimen is labelled "*Lygistropterus* sp. nov." and "♀"; a third one is determined "*Lygistropterus sanguineus* L., ♂"; the last one is lacking labels. Making a calligraphic comparison, we noted that only the label of the first specimen was written by Ragusa himself, while the other labels are written with a different handwriting. We believe that the analyzed series is actually the typical one, notwithstanding the mistakes in sex and species determination, because the total number of individuals is the same and sex discrimination was made by Ragusa (1883) accordingly to the length of the antennae, a character which is not useful for this purpose. So, according to these considerations, we designate as Lectotypus the specimen with the label with the locality, and as Paralectotypi the three other specimens of the series.

We have also observed some male specimens of *L. s. escaleraei* from Armenia and North Ossetia (Russia) and we compared them with the description of this taxon made by Pic: "*Lygistropterus sanguineus* v. n. *Escaleraei* [Malac.]. *Niger, torace luteo, postice medio late nigro maculato, antice nigrosulcato, elytris luteo-rufis*. Asie Mineure" (Pic, 1942). Even if we could not examine the material seen by Pic, the morphology of our specimens perfectly fits with the description made by the French entomologist and we can attribute these individuals to the taxon "*escaleraei*".

The dimensional ratios of the rostrum are consistent with those registered for *L. s. sanguineus*, but the shape of the epistomium is more curved (Fig. 9). As far as the pronotum is concerned, even if showing a certain variability, it has always a central band equal to that described by Pic (1942) (Figs. 19-20). We have also extracted aedeagi of these samples. While the dimensional ratios of the aedeagi are similar to those of *L. anorachilus*, the morphology is different both from *L. sanguineus* and *L. anorachilus*, because it is more slender at the apex (Fig. 27). Thus, we came to the conclusion that the taxon described by Pic should be elevated to the rank of species: *Lygistropterus escaleraei* Pic, 1942 stat. nov.

Concerning *L. cobosi*, the description by Pardo-Alcaide (1961b), based on a single specimen, considers only morphological characters which are too variable in this genus. As we had not the possibility to study the typus and so to examine the aedeagus, we can not express an opinion of the validity of this taxon.

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Table 1. List of all specimens chosen for the iconographical representation. For each one the anatomical part figured and region or state of capture are reported.

N° fig.	Taxon	Anat. part	Place	N° fig.	Taxon	Anat. part	Place
1	<i>L. anorachilus</i>	Rostrum	Lazio	15	<i>L. sanguineus</i>	Pronotum	Valle d'Aosta
2	<i>L. sanguineus</i>	Rostrum	Calabria	16	<i>L. sanguineus</i>	Pronotum	Toscana
3	<i>L. sanguineus</i>	Rostrum	Sicilia	17	<i>L. sanguineus</i>	Pronotum	Switzerland
4	<i>L. sanguineus</i>	Rostrum	Valle d'Aosta	18	<i>L. sanguineus</i>	Pronotum	Austria
5	<i>L. sanguineus</i>	Rostrum	Corsica	19	<i>L. escaleraei</i>	Pronotum	Armenia
6	<i>L. sanguineus</i>	Rostrum	Corsica	20	<i>L. escaleraei</i>	Pronotum	North Ossetia
7	<i>L. sanguineus</i>	Rostrum	Switzerland	21	<i>L. anorachilus</i>	Aedeagus	Calabria
8	<i>L. sanguineus</i>	Rostrum	Bosnia-Herz.	22	<i>L. sanguineus</i>	Aedeagus	Valle d'Aosta
9	<i>L. escaleraei</i>	Rostrum	North Ossetia	23	<i>L. sanguineus</i>	Aedeagus	Calabria
10	<i>L. anorachilus</i>	Pronotum	Calabria	24	<i>L. sanguineus</i>	Aedeagus	Cantabria
11	<i>L. anorachilus</i>	Pronotum	Calabria	25	<i>L. sanguineus</i>	Aedeagus	Austria
12	<i>L. sanguineus</i>	Pronotum	Calabria	26	<i>L. sanguineus</i>	Aedeagus	Bosnia-Herz.
13	<i>L. sanguineus</i>	Pronotum	Calabria	27	<i>L. escaleraei</i>	Aedeagus	North Ossetia
14	<i>L. sanguineus</i>	Pronotum	Valle d'Aosta				

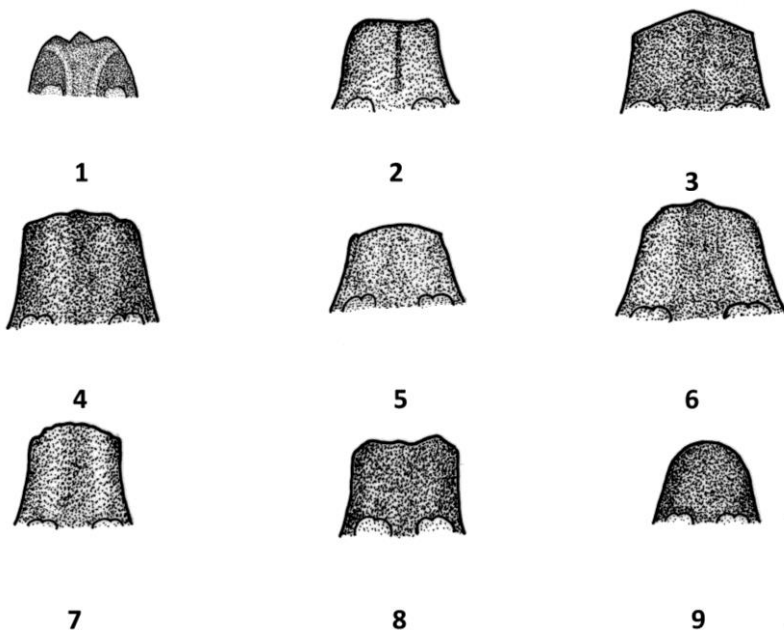


Plate I. 1. Rostrum of *Lygostopterus anorachilus* (Lazio), 2. Rostrum of *L. sanguineus* (Calabria), 3. Rostrum of *L. sanguineus* (Sicilia), 4. Rostrum of *L. sanguineus* (Valle d'Aosta), 5. Rostrum of *L. sanguineus* (Corsica), 6. Rostrum of *L. sanguineus* (Corsica), 7. Rostrum of *L. sanguineus* (Switzerland), 8. Rostrum of *L. sanguineus* (Bosnia-Herzegovina), 9. Rostrum of *L. escaleraei* (North Ossetia). Scale bar = 1 mm.

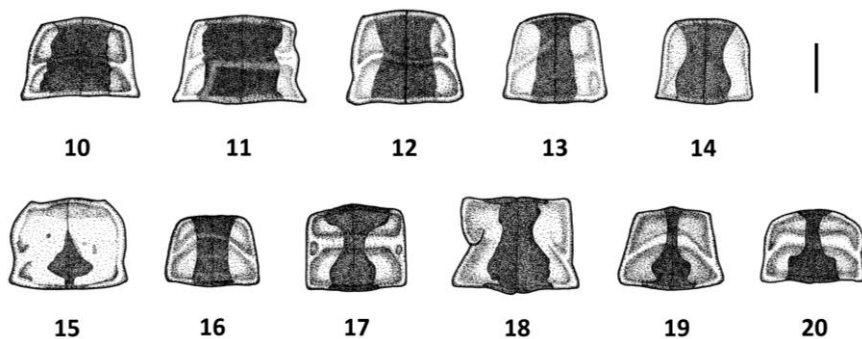


Plate II. 10. Pronotum of *L. anorachilus* (Calabria), 11. Pronotum of *L. anorachilus* (Calabria), 12. Pronotum of *L. sanguineus* (Calabria), 13. Pronotum of *L. sanguineus* (Calabria), 14. Pronotum of *L. sanguineus* (Valle d'Aosta), 15. Pronotum of *L. sanguineus* (Valle d'Aosta), 16. Pronotum of *L. sanguineus* (Toscana), 17. Pronotum of *L. sanguineus* (Switzerland), 18. Pronotum of *L. sanguineus* (Austria), 19. Pronotum of *L. escaleraei* (Armenia), 20. Pronotum of *L. escaleraei* (North Ossetia). Scale bar = 1 mm.

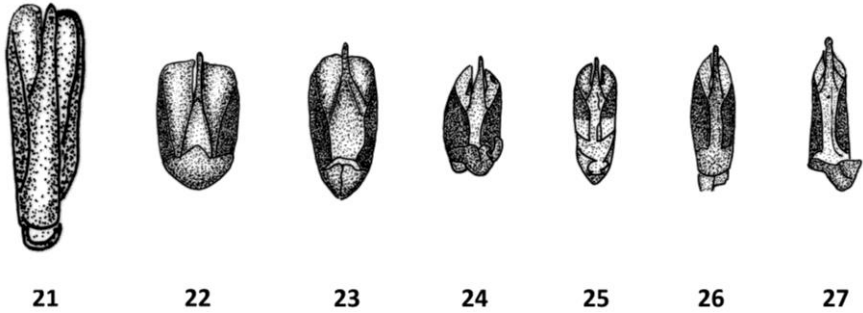


Plate III. 21. Aedeagus of *L. anorachilus* (Calabria), 22. Aedeagus of *L. sanguineus* (Valle d'Aosta), 23. Aedeagus of *L. sanguineus* (Calabria), 24. Aedeagus of *L. sanguineus* (Cantabria), 25. Aedeagus of *L. sanguineus* (Austria), 26. Aedeagus of *L. sanguineus* (Bosnia-Herzegovina), 27. Aedeagus of *L. escalerai* (North Ossetia). Scale bar = 1 mm.

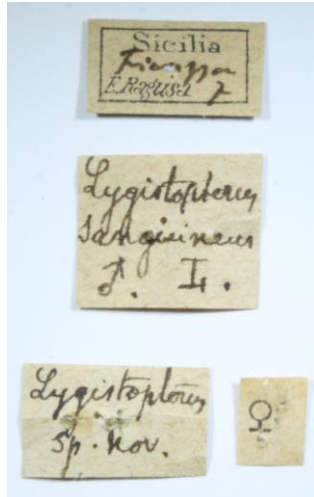


Figure 28. Original labels of the specimen of *Lygistopterus anorachilus* Ragusa, 1883 designated as *lectotypus*.

**ON THE TAXONOMY OF SCARABAEINE FAUNA
(COLEOPTERA: SCARABAEIDAE) OF BUXA TIGER
RESERVE (BTR), WEST BENGAL, INDIA**

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ABSTRACT: The present study is devoted to the systematics of 19 scarabaeine species under 6 genera recorded from Buxa Tiger Reserve, Dooars, West Bengal. The generated data is the outcome of long term faunistic investigations of the authors. The present discourse includes detail description, illustration and distributional pattern of each of the taxa. Further, keys to genera and species are also provided.

KEY WORDS: Scarabaeinae, New records, Dooars, Buxa Tiger Reserve, India.

Scarabaeinae globally is supposed to include members of 13 tribes represented by over 5,000 described species in 234 genera (Ratcliffe & Jameson 2013). Indian coprine species are now considered within the tribes Scarabaeini and Coprini. The entire perception of the taxa is from Lawrence & Newton (1995). Eventhough informations on the new world species are largely available, our knowledge with the members of the old world is still scanty and is limited to the monographic works of Arrow (1931) and Balthasar (1963). A concise knowledge on total number of species described or reported from India is not available till date. However, regional works on Indian Scarabaeinae were done by Biswas (1978a,b), Biswas & Chatterjee (1985, 1995), Biswas et al. (1997), Chatterjee & Biswas (2000a,b, 2003, 2004), Saha & Raychaudhuri (2000), Chandra (1988, 2000, 2004), Chandra & Singh (2004), Chandra & Ahirwar (2005), Chandra & Uniyal (2007), Sewak (1985, 1986, 1991, 2004a,b, 2005, 2006, 2009), Sarkar et al. (2010).

Extensive survey for the scarab beetles of Dooars (for details visit: <http://en.wikipedia.org/wiki/Dooars>), north Bengal saving the hilly regions was wanting till the initiatives taken in 1993 by the Entomology Laboratory, University of Calcutta. The study was confined primarily in the reserve forests of the area. In the process a total of 76 species are recorded from Buxa Tiger Reserve (for details visit: http://en.wikipedia.org/wiki/Buxa_Tiger_Reserve).

Present communication is on the detail taxonomy of the members belonging to Scarabaeini and Coprini. The taxa are considered sensu Ratcliffe & Jameson (2013).

Out of the 19 recorded species *Helicopraxis tyrannus* (Thomson) were reported as new record from the country, while *Catharsius javanus* Lansberge, *Copris corpulentus* Gillet, *C. doriae* Harold and *C. sarpedon* Harold from the state (Sarkar et al., 2010). However, the said study did not include the taxonomy.

All the species are described and illustrated hereunder. Necessary keys for the taxa, together with their distribution are also provided.

MATERIAL AND METHODS

Both extensive and intensive surveys were conducted during 1993 – 2005 in different beats under different ranges of Buxa Tiger Reserve. Field visits were made in every month of each calendar year during the period of survey (except 15th June to 15th September when the forest remains closed). For collection of scarabs sweep nets, bush beating and collection in inverted umbrella, hand picking techniques were used. Several pit fall traps were laid in the collection localities of the Reserve to trap ground dwelling scarabs. Dung of various animals was also examined to make collections. In the evening hours UV light trap was used to collect nocturnal scarabs. Samples after collection were killed in chloroform and preserved in 70% alcohol in glass vials. Necessary data regarding locality, date of collection, collector's name was noted in a note book in the field. They were then brought to the laboratory where stretching, pinning and labeling is done as per the guidelines laid down by Zoological Survey of India. Part of the male samples stored in 70% alcohol were kept separately in order to dissect out the genitalia. This was met out under the microscope with the help of very sharp scalpel, forceps, needles and brush. After dissection the genital capsule containing parameres was cleared in clove oil. The genital capsule was then boiled in 10% KOH for 5-10 minutes to remove muscles. After study, the male genitalia were preserved in a micro vial containing 70% alcohol along with the adult specimen.

The collected samples were studied under Sterozoom Binocular Microscopes Zeiss SV6, SV11 and Olympus SZ 30. Drawings were made with the aid of necessary accessories attached to the microscopes SV6 and SV11. Photographs were taken by a digital camera attached to the microscopes. All measurements are in millimeters, made with an eye piece graticule and each scale bar represents 1mm, if not otherwise mentioned.

All materials are in the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, Kolkata, India.

RESULTS

Systematic account of the scarabaeine beetles of BTR is presented hereunder

Subfamily SCARABAEINAE Latreille, 1802

Key to tribes:

1. Elytra cut away behind shoulders; mid tibia with one terminal spur..... Scarabaeini
- Elytra not cut away behind shoulders; mid tibia with two terminal spurs.....Coprini

Tribe Scarabeini

Genus *Gymnopleurus* Illiger

Gymnopleurus Illiger, 1803, Mag. Ins. Vol. ii, p.199.

Type species: *Ateuchus flagellatus* Fabricius, 1787.

Diagnosis: Body short, broad and flat; opaque; antennae 9 segmented; head broad, transverse; clypeus broad, front margin medially acutely notched and toothed; pronotum transverse, sides medially angulate and convergent to front; elytra with 7 striae, 7th carinate anteriorly, sides strongly cut away behind shoulders; pygidial apex round; fore tibia tridentate with many denticles, mid and hind tibiae carinate externally and truncate at extremity, mid with 1 and hind with 2 long terminal spurs.

Distribution: Africa, Asia and East Europe (Arrow 1931; Ratcliffe & Jameson 2013; GBIF 2013).

***Gymnopleurus sinuatus* Olivier, var. *assamensis* Watson**

(Pl. IA, Fig. 1)

Gymnopleurus sinuatus var. *assamensis* Watson, 1890, Ann. Mag. Nat. Hist., (6) v, p. 411.

Gymnopleurus sinuatus var. *assamensis* Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 63.

Description: Male

Length 16.6mm, **humeral width** 12 mm. Body short, broad and flat.

Colour and markings (Pl. IA, Fig. 1a): Dark coppery black with club of antenna yellow; opaque above and beneath.

Head (Figs. 1a,b): Broad; transverse; rugosely granular.

Clypeus (Figs. 1a,b): Broad; rugosely granular; front margin medially acutely notched forming sharp tooth on each side.

Fronto-clypeal suture (Figs. 1a,b): Marked by a transverse straight carina.

Interocular width: 7.5 × transverse eye diameter.

Antenna (Fig. 1c): 9 segmented; club 0.63 × stem.

Pronotum (Fig. 1a): Transverse; finely and densely punctured; front angles acutely and hind angles obtusely produced; sides medially angulate and convergent to front.

Scutellum (Fig. 1a): Not visible from above.

Elytra (Fig. 1a): Finely punctate striate, punctures remote; striae 7 on each disc, 7th carinate anteriorly; intervals flat and coriaceous; sides strongly cut away behind shoulders; margins elevated; humeral and apical angles acute; humeral hump not evident, apical hump raised.

Pygidium (Fig. 1d): Finely and scantily punctured; sides and apex round.

Mesosternum (Fig. 1e): Laterally coarsely punctured, medially smooth; front margin round.

Fore tibia (Fig. 1f): Tridentate with many denticles; elongate and slender; terminally with a long and apically bidentate blunt spur.

Mid and hind tibiae (Figs. 1g,h): Carinate externally, outer edge serrate; truncate at extremity; mid with 1 and hind with 2 long terminal spurs.

Tarsi (Figs. 1f,g,h): 5 segmented.

Claws (Figs. 1f,g,h): Equal; curved internally and separately movable.

Parameres (Figs. 1i,j): Short, elongate; base nearly equal to apex; sides sinuate; inner margin curved; apex blunt, inner angle acute.

Female: Fore tibia broad, terminal spur slender and acute.

Material examined: 1 male, Rajabhatkhawa, 22.v.95, coll. S. Saha; 1 male, Nimati, 22.v.97, coll. S. Saha; 1 male, South Rydak, 25.v.02, coll. S. K. Sarkar; 1 male, Rajabhatkhawa, 29.iii.02, coll. S. K. Sarkar; 1 female, Nimati, 07.vi.03, coll. S. K. Sarkar.

Distribution: India: Karnataka, Madhya Pradesh, Maharashtra, Tamilnadu and West Bengal (Arrow, 1931; Saha & Raychaudhuri, 2000; Chandra & Ahirwar, 2005).

Tribe Coprini

Key to genera:

1. Elytra with two lateral carina.....2
- Elytra with one lateral carina.....3

2. Sides of pronotum serrate and medially little angulate; fore tibia quadridentate.....*Heliocopriss* Burmeister
- Sides of pronotum smooth and medially round; fore tibia tridentate..... *Catharsius* Hope

3. Pronotum with a strong basal groove.....*Copriss* Geoffroy
- Pronotum without basal groove.....4

4. Pronotum with two medial impressions near base.....*Onitiss* Fabricius
- Pronotum without medial impressions near base.....*Onthophagus* Latreille

Genus *Heliocopris* Burmeister

Heliocopris Hope, 1837, Col. Man., 1, p. 23.

Type species: *Copris pirkal* Fabricius, 1798.

Diagnosis: Body broadly oval and strongly convex; shiny; antennae 9 jointed; head broad, transverse, vertex with a median horn and a short tubercle on each side of it; clypeus broad and nearly semicircular, front margin straight and reflexed; pronotum transverse, sides serrate and medially angulate; elytra with 8 striae, 7th and 8th carinate anteriorly; pygidial apex round; fore tibia quadridentate, mid and hind tibiae carinate externally and digitate at extremity.

Distribution: Africa and Asia (Arrow 1931; Ratcliffe & Jameson 2013; GBIF 2013).

Heliocopris tyrannus (Thomson)

(Pl. IA, Fig. 2)

Copris tyrannus Thomson, 1858, Arch. Ent. ii, p.49.

Heliocopris tyrannus Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 87.

Description: Female

Length 48 mm, **humeral width** 28 mm. Body broadly oval and strongly convex.

Colour and markings (Pl. IA, Fig. 2a): Brownish black; shiny above; venter with patches of red hairs.

Head (Figs. 2a,b): Broad; transverse; strigose in front and granulate behind; vertex with a sharp, short median horn and a short tubercle on each side of it.

Clypeus (Figs. 2a,b): Broad; nearly semicircular; completely margined; strigose; front margin straight and reflexed.

Fronto-clypeal suture (Figs. 2a,b): Marked by the horn and tubercles.

Interocular width 6.16 × transverse eye diameter.

Antenna (Fig. 2c): 9 segmented; club 1.05 × stem.

Pronotum (Fig. 2a): Transverse; divided by a strong, sinuate and steep carina into anterior and posterior halves; anterior half coarsely and posterior half finely granular; front angles bluntly produced, hind angles obtuse; sides medially angulate; base margined and nearly round.

Scutellum (Fig. 2a): Not visible from above.

Elytra (Fig. 2a): Finely punctate striate; striae 8 on each disc, 7th and 8th carinate anteriorly; intervals convex and nearly smooth, sutural one raised; margins elevated; humeral angle not formed, apical angle acute; humeral and apical humps not evident.

Pygidium (Fig. 2d): Finely and scantily punctured; sides and apex round.

Mesosternum (Fig. 2e): Laterally coarsely punctured; medially smooth with a shallow depression near base.

Fore tibia (Fig. 2f): Bluntly quadridentate; terminally with a single long and blunt spur.

Mid and hind tibiae (Figs. 2g,h): Strongly carinate externally with few stout spines at outer edge; digitate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 2f,g,h): 5 segmented.

Claws (Figs. 2g,h): Equal; curved internally and separately movable.

Material examined: 1 female, Rajabhatkhawa, 04.vi.02, coll. S. K. Sarkar.

Distribution: India: Indonesia, Malaysia, Myanmar, West Bengal (Arrow, 1931; Sarkar et al., 2010).

Genus *Catharsius* Hope

Catharsius Hope, 1837, Col. Man. i, p. 21.

Type species: *Scarabaeus molossus* Linnaeus, 1758

Diagnosis: Body broad, oval and strongly convex; more or less shiny; antennae 9 jointed; head transverse; clypeus broad and semicircular, front margin round or medially little notched and bilobed; base of pronotum completely margined, sides round; elytra with 8 striae, 7th and 8th carinate anteriorly; pygidial apex round; fore tibia tridentate, mid and hind tibiae carinate externally and digitate at extremity.

Distribution: Africa and Southern Asia (Arrow 1931; Ratcliffe & Jameson, 2013; GBIF 2013).

Key to species:

1. Base of pronotum medially angulate; pygidium granular.....2
- Base of pronotum round; pygidium minutely punctured.....*birmanensis* Lansberge
2. Head basally coriaceous; pronotum with a transverse, sinuate carina; sides of pronotum without pit.....*molossus* (Linnaeus)
- Head basally smooth; pronotum without transverse carina; sides of pronotum with pit.....3
3. Head granular, vertex with a transverse raised carina; mid-longitudinal depression of pronotum shallow..... *capusinus* Fabricius
- Head rugose, vertex with an apically bidentate short horn; mid-longitudinal depression of pronotum deep.....*javanus* Lansberge

***Catharsius birmanensis* Lansberge**

(Pl. IA, Fig. 3)

Catharsius birmanensis Lansberge, 1874, Col. Hefte, xii, p.11.*Catharsius birmanensis* Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 97.**Description: Male****Length** 19.6 mm, **humeral width** 11.6 mm. Body short, oval, compact and strongly convex.**Colour and markings (Pl. IA, Fig. 3a):** Pitchy black and more or less shiny; legs red.**Head (Figs. 3a,b):** Transverse; granular, basally smooth; vertex medially with an erect, long slender horn just in front of eyes, little dilated behind in its basal half and gently curved at end.**Clypeus (Figs. 3a,b):** Broad; semicircular; completely margined; weakly rugose; front margin reflexed, medially little notched and bilobed.**Fronto-clypeal suture (Figs. 3a,b):** Marked by an oblique carina on each lateral side.**Interocular width** 12.5 × transverse eye diameter.**Antenna (Fig. 3c):** 9 segmented; club 1.52 × stem.**Pronotum (Fig. 3a):** Transverse; partly granular with a short sharp conical protuberance on each side of middle at about midway of front and hind margins; surface between protuberances gently hollowed, smooth and flattened; sides gradually round; base margined and gently round.**Scutellum (Fig. 3a):** Not visible from above.**Elytra (Fig. 3a):** Punctate striate with the intervals smooth except near base; striae 8 on each disc, the 7th and 8th carinate anteriorly; suture with a membranous fringe apically; margins elevated; humeral angle not formed apical angle acute and produced; humeral and apical humps not evident.**Pygidium (Fig. 3d):** Minutely and scantily punctured; sides and apex gradually round.**Mesosternum (Fig. 3e):** Laterally minutely punctured, medially smooth with a longitudinal groove and a shallow pit near base; anteriorly bluntly and conically produced.**Fore tibia (Fig. 3f):** Bluntly tridentate, with a single long terminal spur.**Mid and hind tibiae (Figs. 3g,h):** Strongly carinate externally forming 2 sharp teeth; digitate at extremity; terminally with 2 long unequal, blunt spurs.**Tarsi (Figs. 3f,g,h):** 5 segmented.**Claws (Figs. 3f,g,h):** Equal; curved internally and separately movable.**Parameres (Figs. 3i,j):** Long; base broad; sides straight; inner margin little curved near apex; apex conical, inner angle acute.**Female:** Vertex of head bears a transverse median elevation, granules more dense.**Material examined:** 1 female, Rajabhatkhawa, 20.v.95, coll. D. Raychaudhuri; 1 female, Raimatang, 30.v.96, coll. S. Saha; 1 male, Rajabhatkhawa, 16.ix.96, coll. S. Saha; 1 male, Rajabhatkhawa, 17.iii.03, coll. S. K. Sarkar.**Distribution:** India: Sikkim, West Bengal; Bhutan; Myanmar (Arrow, 1931; Saha & Raychaudhuri, 2000).

***Catharsius molossus* (Linnaeus)**

(Pl. IB, Fig. 4)

Scarabaeus molossus Linnaeus, 1758, Syst. Nat. ed. x, p. 347.*Catharsius molossus* Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 94.**Description: Male****Length** 23 mm, **humeral width** 13.3 mm. Body short, oval, compact and strongly convex.**Colour and markings (Pl. IA, Fig. 4):** Pitchy black and more or less opaque.**Head (Figs. 4a,b):** Transverse; granular, basally coriaceous; armed with a basally dilated, recurved, apically blunt, strong and stout horn.**Clypeus (Figs. 4a,b):** Broad; semicircular; completely margined; granular with the granules coalesce at regions to form strigosity; front margin medially little notched and bilobed.**Fronto-clypeal suture (Figs. 4a,b):** Marked by an oblique carina on each lateral side, medially concealing with the horn of head.**Interocular width** 8 × transverse eye diameter.**Antenna (Fig. 4c):** 9 segmented; club 1.7 × stem.**Pronotum (Fig. 4a):** Transverse; coarsely granular with a median longitudinal line and a transverse, strongly sinuate carina, the edges of which are projected into blunt processes, anteriorly sloping and depressed on each side; sides gradually round; base margined with the margin elevated and medially angulate.**Scutellum (Fig. 4a):** Not visible from above.**Elytra (Fig. 4a):** Coriaceous, with 8 longitudinal striae, 7th and 8th transformed into carinae; suture apically with a membranous fringe; margins elevated; humeral angle not formed, apical angle nearly right angle; humeral and apical humps not evident.**Pygidium (Fig. 4d):** Granular; sides and apex gradually round.**Mesosternum (Fig. 4e):** Both coarsely and minutely punctured; anteriorly conically produced and with a median longitudinal line.**Fore tibia (Fig. 4f):** Bluntly tridentate; terminally with a single long spur.**Mid and hind tibiae (Figs. 4g,h):** Strongly carinate externally forming 2 sharp teeth; digitate at extremity; terminally with 2 long unequal spurs.**Tarsi (Figs. 4f,g,h):** 5 segmented.**Claws (Figs. 4f,g,h):** Equal; curved internally and separately movable.**Parameres (Figs. 4i,j):** Long; base broad; sides nearly straight; inner margin sinuate; apex narrow, inner angle acute.**Female:** Horn of head short and thin.**Material examined:** 2 females, Rajabhatkhawa, 20.v.95, coll. S. Saha; 1 male, Raimatang, 30.v.96, coll. S. Saha; 1 female, Rajabhatkhawa, 16.ix.96, coll. S. Saha; 2 males 1 female, Rajabhatkhawa, 17.ix.96, coll. S. Saha; 2 males 1 female, Rajabhatkhawa, 04.vi.02, coll. S. K. Sarkar; 1 male, Rajabhatkhawa, 09.ix.02, coll. S. K. Sarkar; 1 female, Panbari, 04.iv.03, coll. S. K. Sarkar; 1 female, Jayanti, 21.iv.03, coll. S. K. Sarkar.**Distribution:** India: Andaman, Assam, Bihar, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Sikkim, Uttarakhand, West Bengal; Sri Lanka (Arrow, 1931; Saha & Raychaudhuri, 2000; Chandra & Ahirwar, 2005).***Catharsius capusinus* Fabricius**

(Pl. IB, Fig. 5)

Catharsius capusinus Fabricius, 1781, Spec. Ins. i, p. 25.*Catharsius capusinus* Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 99.**Description: Female****Length** 18.6mm, **humeral width** 10.4mm. Body short, oval, compact and strongly convex.**Colour and markings (Pl. IB, Fig. 5):** Pitchy black and more or less opaque.**Head (Figs. 5a,b):** Transverse; granular, base smooth; vertex with a transverse raised carina, medially elevated into a horn like process.**Clypeus (Figs. 5a,b):** Broad; semicircular; completely margined; granular with the granules coalesce at regions to form strigosity; front margin medially little notched and bilobed.

Fronto-clypeal suture (Figs. 5a,b): Marked by an oblique carina on each side, medially concealing with the carina.

Interocular width: 8 × transverse eye diameter.

Antenna (Fig. 5c): 9 segmented; club 1.33 × stem.

Pronotum (Fig. 5a): Transverse; medially smooth with a longitudinal shallow depression, rest granular with a tubercle at about 1/3rd of length from the front margin and a shallow pit on each lateral side; sides gradually round; base margined with the margin elevated and angular at middle.

Scutellum (Fig. 5a): Not visible from above.

Elytra (Fig. 5a): Punctate striate, intervals smooth; striae 8 on each disc, 7th and 8th carinate anteriorly; suture apically with a membranous fringe; margins elevated; humeral angle not formed apical angle nearly right angle; humeral and apical humps not evident.

Pygidium (Fig. 5d): Granular; sides and apex gradually round.

Mesosternum (Fig. 5e): Laterally coriaceous, rest minutely punctured; midlongitudinally grooved and a shallow pit near base; anteriorly conically produced.

Fore tibia (Fig. 5f): Bluntly tridentate, with a single long terminal spur.

Mid and hind tibiae (Figs. 5g,h): Strongly carinate externally forming 2 sharp teeth; digitate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 5f,g,h): 5 segmented.

Claws (Figs. 5f,g,h): Equal, curved internally & separately movable.

Material examined: 1 female, Rajabhatkawa, 17.iii.03, coll. S. K. Sarkar.

Distribution: India: Bihar, Kerala, Orissa, Tamilnadu, West Bengal; Sri Lanka (Arrow, 1931; Sarkar et al., 2010).

Catharsius javanus Lansberge

(Pl. IB, Fig. 6)

Catharsius javanus Lansberge, 1886, Tijds. Ent. xxix, p. 7.

Catharsius javanus Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 96.

Description: Male

Length 17 mm, **humeral width** 10 mm. Body short, broadly oval and strongly convex.

Colour and markings (Pl. IB, Fig. 6): Pitchy black except red antennae and mouth organs; opaque above and shiny beneath.

Head (Figs. 6a,b): Transverse; rugose; vertex with a basally dilated, short and apically bidentate horn.

Clypeus (Figs. 6a,b): Broad; semicircular; completely margined; granular with the granules coalesce at regions to form strigosity; front margin evenly round.

Fronto-clypeal suture (Figs. 6a,b): Marked by an oblique carina on each lateral side, medially concealing with the horn of head.

Interocular width: 4.8 × transverse eye diameter.

Antenna (Fig. 6c): 9 segmented; club 1.6 × stem.

Pronotum (Fig. 6a): Transverse; medially smooth with a deep longitudinal depression, rest granular with a tubercle at about 1/3rd of length from the front margin and a shallow pit laterally on each side; sides gradually round; base margined with the margin elevated and angular at middle.

Scutellum (Fig. 6a): Not visible from above.

Elytra (Fig. 6a): Punctate striate, striae 8 on each disc, 7th and 8th carinate anteriorly; intervals smooth; suture apically with a membranous fringe; margins elevated; humeral angle not formed apical angle nearly right angle; humeral and apical humps not evident.

Pygidium (Fig. 6d): Granular, sides and apex gradually round.

Mesosternum (Fig. 6e): Laterally coarsely punctured, medially smooth with a longitudinal line and a shallow pit near base; anteriorly conically produced.

Fore tibia (Fig. 6f): Bluntly tridentate; terminally with a long spur.

Mid and hind tibiae (Figs. 6g,h): Strongly carinate externally forming 2 sharp teeth; digitate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 6f,g,h): 5 segmented.

Claws (Figs. 6f,g,h): Equal; curved internally and separately movable.

Parameres (Figs. 6i,j): Long; base broad; sides straight; inner margin curved; apex conical, inner angle acute.

Material examined: 1 male, Damanpur, 18.iv.02, coll. S. K. Sarkar.

Distribution: India: Assam, West Bengal; China, Indonesia, Malaysia (Arrow, 1931; Sarkar et al., 2010).

Genus *Copris* Geoffroy

Copris Geoffroy, 1762, Ins. Des. Env. De Paris, p. 87.

Type species: *Scarabaeus lunaris* Linnaeus, 1758

Diagnosis: Body compact, convex or depressed; more or less shiny; antennae 9 jointed; head broad; clypeus semicircular, front margin medially little notched and bilobed; pronotum broad, medially with a longitudinal groove; elytra with 8 striae, 8th carinate anteriorly; pygidial apex round; fore tibia quadridentate, mid and hind tibiae carinate externally and digitate at extremity.

Distribution: Africa, Asia, Europe (Arrow, 1931; Ratcliffe & Jameson, 2013; GBIF 2013).

Key to species:

1. Pronotum with a short conical prominence on each side of the midlongitudinal groove.....
.....*corpulentus* Gillet
- Pronotum without any prominence on each side of the mid-longitudinal groove.....2
2. Front margin of clypeus reflexed; front angles of pronotum truncate.....3
- Front margin of clypeus not reflexed; front angles of pronotum produced.....*doriae* Harold
3. Pronotum with a transverse sinuate carina little behind the front margin and a shallow pit laterally on each side.....
.....*sarpedon* Harold
- Pronotum without any carina behind the front margin and without any pit laterally on each side.....*magicus* Harold

Copris corpulentus Gillet

(Pl. IC, Fig. 7)

Copris corpulentus Gillet, 1910, Notes Leyd. Mus., xxxii, p. 13.

Copris corpulentus Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 118.

Description: Male

Length 18.6 mm, **humeral width** 10.4mm. Body elongate, oval and moderately convex.

Colour and markings (Pl. IC, Fig. 7): Black and more or less shiny with the antennae, mouth organs red; venter with scanty bristles.

Head (Figs. 7a,b): Transverse; nearly smooth; medially with a sharp, pointed, basally dilated and backwardly curved horn.

Clypeus (Figs. 7a,b): Broad; semicircular; completely margined; minutely punctured; front margin reflexed, medially little notched and bilobed.

Fronto-clypeal suture (Figs. 7a,b): Marked by an oblique carina on each lateral side.

Interocular width: 10 × transverse eye diameter.

Antenna (Fig. 7c): 9 segmented; club 1.4 × stem.

Pronotum (Fig. 7a): Transverse; minutely and scantily punctured; medially grooved, narrow behind and broadly dilated in front; on each side of groove the top of declivity forms a short conical prominence; front margin steep; sides nearly round; front and hind angles obsolete; base margined and medially gently produced.

Scutellum (Fig. 7a): Not visible from above.

Elytra (Fig. 7a): Punctate striate; striae 8 on each disc, 8th carinate anteriorly; intervals slightly convex, minutely and scantily punctured; margins elevated; humeral angle not formed, apical angle acute; humeral and apical humps not evident.

Pygidium (Fig. 7d): Coarsely and densely punctured; sides and apex gradually round.

Mesosternum (Fig. 7e): Laterally minutely punctured, medially smooth with a longitudinal groove and a shallow pit near base; anteriorly bluntly and conically produced.

Fore tibia (Fig. 7f): Bluntly quadridentate; terminally with a single long and blunt spur.

Mid and hind tibiae (Figs. 7g,h): Strongly carinate externally with the hind forming 2 sharp teeth; digitate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 7f,g,h): 5 segmented.

Claws (Figs. 7f,g,h): Equal; curved internally and separately movable.

Parameres (Figs. 7i,j): Long; base broad; sides sinuate; inner margin bisinuate forming a tooth near apex; apex flat, inner angle acute.

Material examined: 1 male, Cheko, 20.x.03, coll. S. K. Sarkar.

Distribution: India: Assam, Gujarat, West Bengal; Myanmar; Vietnam (Arrow, 1931; Sewak, 2009; Sarkar et al., 2010).

***Copris doriae* Harold**

(Pl. IC, Fig. 8)

Copris doriae, Harold, 1877, Ann. Mus. Genova, x, p. 49.

Copris doriae, Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 119.

Description: Male

Length 17.6 mm, **humeral width** 8.4 mm. Body short, oval and moderately convex.

Colour and markings (Pl. IC, Fig. 8): Black and shiny with the antennae, mouth organs red; venter with scanty red bristles.

Head (Figs. 8a,b): Broad; transverse; coarsely and densely punctured; vertex medially with a short, slender and recurved horn.

Clypeus (Figs. 8a,b): Broad; semicircular; completely margined; scantily but coarsely punctured; front margin notched medially and bilobed.

Fronto-clypeal suture (Figs. 8a,b): Marked medially by the horn.

Interocular width: 4.6× transverse eye diameter.

Antenna (Fig. 8c): 9 segmented; club 1.18 × stem.

Pronotum (Fig. 8a): Transverse; laterally coarsely punctured; medially nearly smooth with a longitudinal groove at posterior half, groove broadly dilated in front; front angles bluntly produced, hind angles obtuse; sides gradually round; front margin steep; base margined and gently produced at middle.

Scutellum (Fig. 8a): Not visible from above.

Elytra (Fig. 8a): Punctate striate; striae 8 on each disc, 8th carinate anteriorly; intervals slightly convex, minutely and scantily punctured; margins elevated; humeral angle not formed, apical angle acute; humeral and apical humps not evident.

Pygidium (Fig. 8d): Coarsely and scantily punctured; sides and apex gradually round.

Mesosternum (Fig. 8e): Laterally coarsely punctured; medially smooth.

Fore tibia (Fig. 8f): Bluntly quadridentate; terminally with a single long and blunt spur.

Mid and hind tibiae (Figs. 8g,h): Strongly carinate externally; digitate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 8f,g,h): 5 segmented.

Claws (Figs. 8f,g,h): Equal; curved internally and separately movable.

Parameres (Figs. 8i,j): Long; base broad; sides sinuate; inner margin nearly straight; apex conical, inner angle acute.

Material examined: 2 males, Rajabhatkhawa, 17.iii.03, coll. S. K. Sarkar.

Distribution: India: Assam, Manipur, West Bengal; Indonesia; Malaysia; Myanmar (Arrow, 1931; Sarkar et al., 2010).

***Copris sarpedon* Harold**

(Pl. IC, Fig. 9)

Copris sarpedon Harold, 1868, Col. Hefte, iv, p. 104.

Copris sarpedon, Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 110.

Description: Female

Length 16mm, **humeral width** 8.8mm. Body short, oval and highly convex.

Colour and markings (Pl. IC, Fig. 9): Black and very shiny with antennae, mouth organs red; venter with scanty red bristles.

Head (Figs. 9a,b,c): Transverse; coarsely and moderately closely punctured; medially with a short, transverse and apically bilobed horn.

Clypeus (Figs. 9a,b,c): Broad; coarsely punctured; semicircular; entirely margined; front margin reflexed, medially notched and bilobed.

Fronto-clypeal suture (Figs. 9a,b): Marked by an oblique carina on each lateral side.

Interocular width: $6 \times$ transverse eye diameter.

Antenna (Fig. 9d): 9 segmented; club $1.5 \times$ stem.

Pronotum (Fig. 9a): Transverse; coarsely and densely punctured; midlongitudinally grooved, on each side of which the punctures are fine and sparse; laterally with a shallow median pit on each side; front margin steep with a transverse sinuate carina little behind it; front angles truncate, hind angles obsolete; sides gradually round; base margined.

Scutellum (Fig. 9a): Not visible from above.

Elytra (Fig. 9a): Punctate striate; striae 8 on each disc, 8th carinate anteriorly; intervals slightly convex and minutely punctured; margins elevated; humeral angle not formed, apical angle acute; humps not evident.

Pygidium (Fig. 9e): Coarsely and densely punctured; sides and apex gradually round.

Mesosternum (Fig. 9f): Laterally coarsely and scantily punctured, medially smooth with a longitudinal posteriorly broad groove and a shallow pit near base; anteriorly bluntly and conically produced.

Fore tibia (Fig. 9g): Bluntly quadridentate; terminally with a long and blunt spur.

Mid and hind tibiae (Figs. 9h,i): Strongly carinate externally with the hind forming 2 sharp teeth; digitate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 9g,h,i): 5 segmented.

Claws (Figs. 9g,h,i): Equal; curved internally and separately movable.

Material examined: 1 female, Sankosh, 10.vi.03, coll. S. K. Sarkar.

Distribution: India: Arunachal Pradesh, Assam, Punjab, Uttarakhand, Uttar Pradesh, West Bengal; Nepal; Thailand (Arrow, 1931; Sarkar et al., 2010).

***Copris magicus* Harold**

(Pl. ID, Fig. 10)

Copris magicus, Harold, 1881, Mitth. Munch. Ent. Ver. V, p. 88.

Copris magicus Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 112.

Description: Female

Length 15.4 mm, **humeral width** 8.2 mm. Body short, oval and strongly convex.

Colour and markings (Pl. ID, Fig. 10): Black and very shiny with antennae, mouth organs red; venter with scanty red bristles.

Head (Figs. 10a,b): Transverse; coarsely and moderately closely punctured; medially with a short, transverse and apically bilobed process.

Clypeus (Figs. 10a,b): Broad; rugose; semicircular; entirely margined; front margin reflexed, medially notched and bilobed.

Fronto-clypeal suture (Figs. 10a,b): Marked by an oblique carina on each lateral side.

Interocular width: $9 \times$ transverse eye diameter.

Antenna (Fig. 10c): 9 segmented; club $1.33 \times$ stem.

Pronotum (Fig. 10a): Transverse; coarsely punctured; mid-longitudinally grooved; front angles broadly truncate, hind angles obsolete; sides straight in front and strongly rounded behind; base margined and gently produced medially.

Scutellum (Fig. 10a): Not visible from above.

Elytra (Fig. 10a): Punctate striate; striae 8 on each disc, 8th carinate anteriorly; intervals convex and finely punctured; margins elevated; humeral angle not formed apical angle acute; humeral and apical humps not evident.

Pygidium (Fig. 10d): Coarsely and densely punctured; sides and apex gradually round.

Mesosternum (Fig. 10e): Nearly smooth; medially smooth with a longitudinal groove and a deep pit near front margin; anteriorly bluntly and conically produced.

Fore tibia (Fig. 10f): Bluntly quadridentate; terminally with a long, gently curved and blunt spur.

Mid and hind tibiae (Figs. 10g,h): Strongly carinate externally with the hind forming 2 sharp teeth; digitate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 10f,g,h): 5 segmented.

Claws (Figs. 10f,g,h): Equal; curved internally and separately movable.

Material examined: 1 female, South Rydak, 20.v.97, coll. S. Saha; 1 female, South Rydak, 22.iii.05, coll. S. K. Sarkar.

Distribution: India: Assam, Manipur, Nagaland, Sikkim, West Bengal; China; Myanmar; Vietnam (Arrow, 1931; Saha & Raychaudhuri, 2000; Sarkar et al., 2010).

Genus *Onitis* Fabricius

Onitis Fabricius, 1798, Ent. Syst., Suppl., p. 2.

Type species: *Scarabaeus inuus* Herbst, 1789

Diagnosis: Body elongate, more or less flat and shiny; antennae 9 jointed; head small and not very broad; clypeus elliptical and separated from ocular lobes by a carinate suture, front margin round; pronotum broad, base medially with a shallow pit on each side and angularly produced; elytra punctate striate in channels, striae 7 on each disc; pygidium flat, apex round; fore tibia quadridentate, mid and hind tibiae carinate externally and digitate at extremity.

Distribution: Africa, Asia and Europe (Arrow, 1931; Ratcliffe & Jameson, 2013; GBIF 2013).

Key to species:

1. Head granular; pronotum with a median transverse depression on each side of middle.....
.....*subopacus* Lansberge
- Head rugulose; pronotum with a median transverse depression on each side of middle.....
.....*virens* Lansberge

Onitis subopacus Lansberge

(Pl. ID, Fig. 11)

Onitis subopacus Lansberge, 1875, Ann. Soc. Ent. Belg. iviii, p. 133.

Onitis subopacus Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 395.

Description: Male

Length 19.4 mm, **humeral width** 8.4 mm. Body elongate, oval and flat.

Colour and markings (Pl. ID, Fig. 11): Black and shiny, with feeble metallic lusture.

Head (Figs. 11a,b): Elongate; granular; vertex medially with a short conical tubercle and a transverse carina above and a tubercle on each side of it.

Clypeus (Figs. 11a,b): Elliptical; transversely rugulose; entirely margined.

Fronto-clypeal suture (Figs. 11a,b): Marked by a medially interrupted transverse carina.

Interocular width: $7.33 \times$ transverse eye diameter.

Antenna (Fig. 11c): 9 segmented; club $2.1 \times$ stem.

Pronotum (Fig. 11a): Transverse; coarsely and densely punctured; mid-longitudinally with a narrow, incomplete line; front and hind angles obtuse; disc with a median transverse depression on each side of middle; sides medially roughly angulate; base medially with a shallow pit on each side and angularly produced.

Scutellum (Fig. 11a): Not visible from above.

Elytra (Fig. 11a): Punctate striate in channels; striae 7 on each disc; intervals nearly smooth; margins elevated; humeral and apical angles acute and little produced; humeral and apical humps not evident.

Pygidium (Fig. 11d): Flat; nearly smooth; apex round.

Mesosternum (Fig. 11e): Nearly smooth; broad; front margin sinuate.

Fore tibia (Fig. 11f): Long; quadridentate; strongly curved towards the end; terminally with a long, gently curved and blunt spur.

Mid and hind tibiae (Figs. 11g,h): Strongly carinate externally forming 4 sharp teeth; digitate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs 11f,g,h): 5 segmented.

Claws (Figs. 11f,g,h): Equal; curved internally and separately movable.

Parameres (Figs. 11i,j): Long and narrow; sides inwardly curved near base; inner margin little curved near apex; apex conical, inner angle acute.

Female: Fore tibia short; mid and hind tibiae without tooth.

Material examined: 1 female, Ghoramara, 17.v.02, coll. S. K. Sarkar; 1 male, Cheko, 17.vi.02, coll. S. K. Sarkar; 1 male, Poro, 17.vii.02, coll. D. Dutta; 1 female, Rajabhatkhawa, 26.ix.02, coll. S. K. Sarkar; 1 female, Jayanti, 17.iii.03, coll. S. K. Sarkar.

Distribution: India: Andhra Pradesh, Assam, Bihar, Kashmir, Madhya Pradesh, Uttarakhand, West Bengal; Malaysia; Myanmar; Sri Lanka; Thailand (Arrow, 1931; Sarkar et al., 2010).

***Onitis virens* Lansberge**

(Pl. ID, Fig. 12)

Onitis virens Lansberge, 1875, Ann. Soc. Ent. Belg. iviii, p. 135.

Onitis virens Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 396.

Description: Male

Length 21 mm, **humeral width** 10 mm. Body elongate, oval and flat.

Colour and markings (Pl. ID, Fig. 12): Black with feeble metallic lusture; shiny except dull elytra.

Head (Figs. 12a,b): Elongate; transversely moderately rugulose; vertex medially with a short, conical tubercle and a transverse carina above it on each side.

Clypeus (Figs. 12a,b): Elliptical; transversely rugulose; entirely margined.

Fronto-clypeal suture (Figs. 12a,b): Marked by a medially interrupted transverse carina.

Interocular width: $8.2 \times$ transverse eye diameter.

Antenna (Fig. 12c): 9 segmented; club $2.4 \times$ stem.

Pronotum (Fig. 12a): Transverse; coarsely and densely punctured; mid-longitudinally with a narrow, incomplete line in front and a narrow groove behind; front angles obtuse and hind angles obsolete; sides medially roughly angulate; base medially with a shallow pit on each side and angularly produced.

Scutellum (Fig. 12a): Not visible from above.

Elytra (Fig. 12a): Punctate striate in channels; striae 7 on each disc; intervals minutely punctured, sutural one elevated; margins elevated; humeral and apical angles acute and little produced; humeral and apical humps not evident.

Pygidium (Fig. 12d): Flat; finely and scantily punctured; apex round.

Mesosternum (Fig. 12e): Nearly smooth; broad; front margin sinuate.

Fore tibia (Fig. 12f): Long; quadridentate; strongly curved towards the end; terminally with a long, gently curved and blunt spur.

Mid and hind tibiae (Figs. 12g,h): Strongly carinate externally forming 4 sharp teeth; digitate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 12f,g,h): 5 segmented.

Claws (Figs. 12f,g,h): Equal; curved internally and separately movable.

Parameres (Fig. 12i,j): Long and narrow; sides inwardly curved; inner margin little curved near apex; apex conical, inner angle acute.

Female: Fore tibia short; mid and hind tibiae without tooth.

Material examined: 1 male 1 female, Rajabhatkhawa, 09.v.94, coll. B. Kundu; 1 female, Rajabhatkhawa, 19.v.95, coll. S. Saha; 1 female, Rajabhatkhawa, 22.v.95, coll. S. Saha; 1 female, South Bholka, 09.v.97, coll. S. Saha; 1 female, Rajabhatkhawa, 29.iii.02, coll. S. K. Sarkar; 1 male, Rajabhatkhawa, 17.iii.03, coll. S. K. Sarkar; 1 female, Jayanti, 29.iv.03, coll. S. K. Sarkar.

Distribution: India: Assam, Bihar, Kerala, Madhya Pradesh, Maharashtra, Tamilnadu, Uttarakhand, West Bengal; China; Myanmar; Vietnam (Arrow, 1931; Saha & Raychaudhuri, 2000).

Genus *Onthophagus* Latreille

Onthophagus Latreille, 1802, Hist. Nat. Crust. et Ins. iii, p. 141.

Type species: *Scarabaeus taurus* Schreber, 1759

Diagnosis: Body short, oval and usually convex; dull or shiny; antennae 9 or 8 jointed; head short; clypeus fused with the ocular lobes, front margin round or bilobed; pronotum transverse, sides medially angulate, front angles acutely or bluntly produced, hind angles obsolete; elytra punctate striate, striae 8 on each disc, 8th carinate; pygidium with a

transverse ridge parallel to base; fore tibia tridentate, mid and hind tibiae carinate externally and truncate at extremity.

Distribution: World-wide (Arrow, 1931; Ratcliffe & Jameson, 2013; GBIF 2013).

Key to species:

1. Front margin of clypeus medially bilobed.....2
- Front margin of clypeus not bilobed.....5
2. Base of pronotum medially angulate.....3
- Base of pronotum medially round.....4
3. Clypeus entirely margined; antenna 9 segmented; forehead medially provided with an acute horn*bonusus* Fabricius
- Clypeus not entirely margined; antenna 8 segmented; forehead not provided with horn.....
.....*falcifer* Harold
4. Forehead medially with an elevated process; fore tibial teeth sharp; sides of pronotum feebly sinuate.....*dama* Fabricius
- Forehead without any elevated process; fore tibial teeth blunt; sides of pronotum round.....
.....*tragus* Fabricius
5. Vertex of head bears a median tubercle; clypeus transversely rugose; fronto-clypeal suture marked by a curved carina.....6
- Vertex of head bears a pair of horn; clypeus coarsely punctured; fronto-clypeal suture marked by a feeble straight carina..... *triceratops* Arrow
6. Front margin of clypeus straight and excised; fore tibia quadridentate.....
.....*armatus* Blanchard
- Front margin of clypeus round; fore tibia tridentate..... *bison* Boucomont

Onthophagus bonusus Fabricius

(Pl. IE, Fig. 13)

Onthophagus bonusus Fabricius, 1775, Syst. Ent., p. 23.

Onthophagus bonusus Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 231.

Description: Female

Length 13 mm, **humeral width** 8 mm. Body short, broadly oval, compact and strongly convex.

Colour and markings (Pl. IE, Fig. 13): Testaceous brown with head, pronotum except the sides and base, elytral suture and venter dark green, hairy and suffused with a metallic lustre.

Head (Figs. 13a,b): Transverse; moderately rugose near base and sparsely granular near front; forehead medially with a short, acute and erect horn; vertex bears a pair of backwardly directed horns, bases of which little flattened and granulate, and each with a slight basal tooth at the inner edge.

Clypeus (Figs. 13a,b): Semicircular; rugose; entirely margined; front margin strongly reflexed, medially feebly raised and bilobed.

Fronto-clypeal suture (Figs. 13a,b): Marked by a medially curved carina.

Interocular width: 6.86 × transverse eye diameter.

Antenna (Fig. 13c): 9 segmented; club 0.8 × stem.

Pronotum (Fig. 13a): Transverse; medially granulate with a feeble longitudinal groove; rest nearly smooth; front angles acutely produced, hind angles obsolete; sides feebly sinuate near hind angles; margins raised; base medially angulate.

Scutellum (Fig. 13a): Not visible from above.

Elytra (Fig. 13a): Punctate striate; intervals with few minute and setigerous punctures; margins elevated; humeral angle not formed, apical angle acute; humps not evident.

Pygidium (Fig. 13d): Minutely and setigerously punctured and bears an angulate basal carina; sides and apex gradually round.

Mesosternum (Fig. 13e): Nearly smooth; mid-longitudinally grooved and a deep pit near front margin; anteriorly produced into a long and downwardly curved median process.

Fore tibia (Fig. 13f): Long; bluntly quadridentate; terminally with a short and blunt spur.

Mid and hind tibiae (Figs. 13g,h): Strongly carinate externally with the mid forming 4 and hind forming 2 sharp teeth; truncate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 13f,g,h): 5 segmented.

Claws (Figs. 13f,g,h): Equal; curved internally and separately movable.

Material examined: 1 female, South Bholka, 09.v.97, coll. S. Saha; 1 female, Rajabhatkhawa, 29.iii.02, coll. S. K. Sarkar.

Distribution: India: Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Tamilnadu, Uttarakhand, West Bengal; Cambodia; Myanmar; Pakistan; Sri Lanka; Thailand; Vietnam (Arrow, 1931; Saha & Raychaudhuri, 2000; Chandra & Ahirwar, 2005; Sewak, 2009).

***Onthophagus falcifer* Harold**

(Pl. IE, Fig. 14)

Onthophagus falcifer Harold, 1880, Deutsche Ent. Zeits. XXiv, p. 31.

Onthophagus falcifer Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 270.

Description: Male

Length 11.25 mm, **humeral width** 5.37 mm. Body short, oval, and moderately convex.

Colour and markings (Pl. IE, Fig. 14): Black; dorsum opaque except pronotum, venter shiny.

Head (Figs. 14a,b): Transverse, broad; coarsely punctured near base and rugose in front; vertex bears a pair of curved, divergent and backwardly inclined horns.

Clypeus (Figs. 14a,b): Semicircular; coarsely punctured; front margin medially feebly raised and bilobed.

Fronto-clypeal suture (Figs. 14a,b): Marked laterally by an oblique carina on each side.

Interocular width: 6× transverse eye diameter.

Antenna (Fig. 14c): 8 segmented; club 0.9 × stem.

Pronotum (Fig. 14a): Transverse; very coarsely and confluent punctured except at sides; front angles bluntly produced, hind angles round; sides feebly sinuate near hind angles; margins raised; base medially sharply angulate.

Scutellum (Fig. 14a): Not visible from above.

Elytra (Fig. 14a): Punctate striate, striae 7 on each disc, 7th carinate anteriorly; intervals flat and coriaceous; margins elevated; humeral and apical angles acute; humps not evident.

Pygidium (Fig. 14d): Rugose.

Mesosternum (Fig. 14e): Medially finely and laterally coarsely punctured.

Fore tibia (Fig. 14f): Bluntly quadridentate, third smallest; terminally with a short and blunt spur.

Mid and hind tibiae (Figs. 14g,h): Carinate externally; truncate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 14f,g,h): 5 segmented.

Claws (Figs. 14f,g,h): Equal; curved internally and separately movable.

Parameres (Figs. 14i,j): Short; base broad; sides nearly straight, little projected near base and apex; inner margin angulate; apex conical, inner angle acute.

Female: Vertex of head with a transverse carina.

Material examined: 1 male, Rajabhatkhawa, 18.v.95, coll. S. Saha; 1 female, Rajabhatkhawa, 21.v.95, coll. S. Saha; 1 male, Rajabhatkhawa, 22.v.95, coll. B. Kundu; 1 male 2 females, Raimatang, 30.v.96, coll. S. Saha; 4 males 2 females, Rajabhatkhawa, 16.ix.96, coll. S. Saha; 1 female, Rajabhatkhawa, 19.v.97, coll. S. Saha; 1 female, Ghoramara, 09.v.02, coll. S. K. Sarkar; 1 male, Rajabhatkhawa, 29.iii.02, coll. S. K. Sarkar; 1 female, Damanpur, 10.iv.02, coll. S. K. Sarkar; 1 female, Rajabhatkhawa, 04.iv.03, coll. S. K. Sarkar; 2 females, Rajabhatkhawa, 03.v.03, coll. S. K. Sarkar.

Distribution: India: Sikkim, West Bengal (Arrow, 1931; Saha & Raychaudhuri, 2000).

***Onthophagus dama* Fabricius**

(Pl. IE, Fig. 15)

Onthophagus dama Fabricius, 1798, Ent. Syst. Suppl., p. 32.*Onthophagus dama* Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 280.**Description:** Male**Length** 9.22 mm, **humeral width** 4.77 mm. Body short, oval, compact and convex.**Colour and markings (Pl. IE, Fig. 15):** Black with head, pronotum, elytral suture and venter greenish black; shiny, elytra opaque.**Head (Figs. 15a,b):** Transverse; coarsely punctured near base and front; forehead medially with a short, basally dilated, elevated process; vertex bears a pair of erect, outwardly curved, basally flat and dilated horns.**Clypeus (Figs. 15a,b):** Semicircular; minutely punctured; front margin medially feebly raised and bilobed.**Fronto-clypeal suture (Figs. 15a,b):** Marked laterally by oblique carina on each side and medially by the elevated process.**Interocular width:** 6.75 × transverse eye diameter.**Antenna (Fig. 15c):** 9 segmented; club 1.07 × stem.**Pronotum (Fig. 15a):** Transverse; minutely and densely punctured; front angles bluntly produced, hind angles obsolete; sides feebly sinuate; margins raised; base round.**Scutellum (Fig. 15a):** Not visible from above.**Elytra (Fig. 15a):** Punctate striate, striae 7 on each disc, 7th carinate anteriorly; intervals flat with few minute and setigerous punctures; margins elevated; humeral angle not formed, apical angle acute; humps not evident.**Pygidium (Fig. 15d):** Both coarsely and minutely punctured punctured; sides and apex gradually round.**Mesosternum (Fig. 15e):** Nearly smooth.**Fore tibia (Fig. 15f):** Sharply quadridentate, third smallest; terminally with a short and blunt spur.**Mid and hind tibiae (Figs. 15g,h):** Carinate externally; truncate at extremity; terminally with 2 long unequal spurs.**Tarsi (Figs. 15f,g,h):** 5 segmented.**Claws (Figs. 15f,g,h):** Equal; curved internally and separately movable.**Parameres (Figs. 15i,j):** Short; base broad; sides straight and acutely toothed near base and apex; inner margin angulate; apex conical, inner angle obsolete.**Female:** Clypeus transversely rugose; vertex of head bears a flattened and truncate tubercle.**Material examined:** 1 male, Rajabhatkhawa, 22.v.95, coll. S. Saha; 4 females 1 male, Raimatang, 30.v.96, coll. S. Saha; 2 males, Raimatang, 19.v.97, coll. S. Saha; 1 male 2 females, Rajabhatkhawa, 29.iii.02, coll. S. K. Sarkar; 2 females, Damanpur, 10.iv.02, coll. S. K. Sarkar; 2 males, Damanpur, 18.iv.02, coll. C. Ray; 2 males 2 females, Hatipota, 19.iv.02, coll. S. K. Sarkar; 3 females 1 male, Newlands, 10.v.02, coll. S. K. Sarkar; 2 females 1 male, Cheko, 07.vi.02, coll. S. K. Sarkar; 2 males, Rajabhatkhawa, 31.x.02, coll. S. K. Sarkar; 1 female, South Rydak, 09.iii.03, coll. S. K. Sarkar; 1 male 1 female, Nimati, 13.iii.03, coll. D. Dutta; 2 females 1 male, Rajabhatkhawa, 17.iii.03, coll. S. K. Sarkar; 1 male 2 females, Poro, 18.iii.03, coll. S. K. Sarkar; 1 male, Poro, 28.iii.03, coll. S. K. Sarkar.**Distribution:** India: Bihar, Karnataka, Madhya Pradesh, Maharashtra, Sikkim, Tamilnadu, Uttarakhhand, West Bengal; Nepal; Bhutan; Sri Lanka (Arrow, 1931; Saha & Raychaudhuri, 2000).***Onthophagus tragus* Fabricius**

(Pl. IF, Fig. 16)

Onthophagus tragus Fabricius, 1792, Ent. Syst. 1, p. 56.*Onthophagus tragus* Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 303.**Description:** Male**Length** 11.25 mm, **humeral width** 5.37 mm. Body short, broadly oval and moderately convex.

Colour and markings (Pl. IF, Fig. 16): Black, with mouth organs and antennae yellow; smooth and shiny.

Head (Figs. 16a,b): Transverse and broad; finely and sparsely punctured; vertex bears a pair of long, straight, slightly compressed and backwardly inclined horns, outer edge of which toothed near tip.

Clypeus (Figs. 16a,b): Semicircular; finely punctured; front margin medially feebly raised and bilobed.

Fronto-clypeal suture (Figs. 16a,b): Marked by a curved carina.

Interocular width: $6 \times$ transverse eye diameter.

Antenna (Fig. 16c): 9 segmented; club $0.9 \times$ stem.

Pronotum (Fig. 16a): Transverse; finely but distinctly punctured; front angles bluntly produced, hind angles round; sides round; margins raised; base gently round.

Scutellum (Fig. 16a): Not visible from above.

Elytra (Fig. 16a): Punctate striate, striae 7 on each disc, 7th carinate anteriorly; intervals flat and minutely punctured; margins elevated; humeral angle acute, apical angle nearly right angle; humps not evident.

Pygidium (Fig. 16d): Finely and scantily punctured.

Mesosternum (Fig. 16e): Coarsely but scantily punctured.

Fore tibia (Fig. 16f): Bluntly quadridentate, third smallest; terminally with a short and blunt spur.

Mid and hind tibiae (Figs. 16g,h): Carinate externally; truncate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 16f,g,h): 5 segmented.

Claws (Figs. 16f,g,h): Equal; curved internally and separately movable.

Parameres (Figs. 16i,j): Moderately long; base broad; sides sinuate and acutely toothed near apex; inner margin sinuate; apex conical, inner angle obsolete.

Female: Clypeus rugose; vertex of head bears a blunt median tubercle.

Material examined: 1 female, Rajabhatkhawa, 11.v.94, coll. B. Kundu; 1 female, Rajabhatkhawa, 19.v.95, coll. B. Kundu; 2 females, Rajabhatkhawa 16.ix.96, coll. S. Saha; 2 females, South Bholka, 19.v.97, coll. S. Saha; 2 males, Damanpur, 10.iv.02, coll. S. K. Sarkar; 1 male 1 female, Poro, 17.vii.02, coll. S. K. Sarkar; 1 male, Ghoramara, 30.iv.02, coll. S. K. Sarkar; 1 female, Jayanti, 03.iii.03, coll. S. K. Sarkar; 1 male 1 female, South Rydak, 09.iii.03, coll. S. K. Sarkar; 1 male 2 females, Poro, 28.iii.03, coll. S. K. Sarkar; 1 male, Rajabhatkhawa, 07.vi.03, coll. C. Ray.

Distribution: India: Maharashtra, West Bengal; China; Indonesia; Myanmar; Vietnam (Arrow, 1931; Saha & Raychaudhuri, 2000).

***Onthophagus triceratops* Arrow**

(Pl. IF, Fig. 17)

Onthophagus triceratops Arrow, 1913, Rec. Ind. Mus. Viii, p. 195.

Onthophagus triceratops Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 301.

Description: Male

Length 8.6 mm, **humeral width** 4.9 mm. Body short, broadly oval and moderately convex.

Colour and markings (Pl. IF, Fig. 17): Black metallic, with mouth organs, antennae and tarsi reddish; smooth and shiny.

Head (Figs. 17a,b): Transverse, broad and angularly dilated in front of eyes; moderately coarsely and densely punctured; vertex bears a pair of basally broad and flat, inwardly strongly curved and convergent horns.

Clypeus (Figs. 17a,b): Gradually narrow anteriorly; moderately coarsely and densely punctured; front margin medially nearly straight and strongly reflexed.

Fronto-clypeal suture (Figs. 17a,b): Marked by a feeble straight carina.

Interocular width: $5.71 \times$ transverse eye diameter.

Antenna (Fig. 17c): 9 segmented; club $1.25 \times$ stem.

Pronotum (Fig. 17a): Transverse; finely and densely punctured; front margin medially narrowly raised; front angles bluntly produced, hind angles round; sides nearly straight and feebly sinuate near hind angles; margins raised; base medially bluntly angulate.

Scutellum (Fig. 17a): Not visible from above.

Elytra (Fig. 17a): Punctate striate, striae 7 on each disc, 7th carinate anteriorly; intervals flat and minutely punctured; margins elevated; humeral and apical angles acute; humps not evident.

Pygidium (Fig. 17d): Finely and irregularly punctured.

Mesosternum (Fig. 17e): Medially finely and laterally coarsely punctured.

Fore tibia (Fig. 17f): Bluntly quadridentate, third smallest; terminally with a short and blunt spur.

Mid and hind tibiae (Figs. 30g,h): Carinate externally; truncate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 17f,g,h): 5 segmented.

Claws (Figs. 17f,g,h): Equal; curved internally and separately movable.

Parameres (Figs. 17i,j): Short; base nearly equal to apex; sides straight and acutely toothed near apex; inner margin curved from base to upto 2/3rd of length; apex flat, inner angle nearly right angle.

Material examined: 2 males, Rajabhatkhawa, 22.v.95, coll. S. Saha; 1 male, Nimati, 21.v.97, coll. S. Saha.

Distribution: India: Assam, Gujarat, West Bengal (Arrow, 1931; Saha & Raychaudhuri, 2000; Sewak, 2009).

***Onthophagus armatus* Blanchard**

(Pl. IF, Fig. 18)

Onthophagus armatus Blanchard, 1853, Voy. Au Pole Sud. p. 98.

Onthophagus armatus Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 293.

Description: Female

Length 10.25 mm, **humeral width** 5.5 mm. Body broadly oval, compact and moderately convex.

Colour and markings (Pl. IF, Fig. 18): Black, with mouth organs and antennae yellow, tarsi reddish; smooth and shiny.

Head (Figs. 18a,b): Transverse, large and broad; coarsely and densely punctured near base and rugose in front; vertex bears a strongly elevated carinate tubercle.

Clypeus (Figs. 18a,b): Semicircular; transversely rugose; front margin medially straight and feebly excised.

Fronto-clypeal suture (Figs. 18a,b): Marked by a curved carina.

Interocular width: 3.66 × transverse eye diameter.

Antenna (Fig. 18c): 9 segmented; club 1.13 × stem.

Pronotum (Fig. 18a): Transverse; finely and moderately closely punctured; front margin medially narrowly raised; front angles bluntly produced, hind angles round; sides nearly straight and feebly sinuate near hind angles; margins raised; base medially bluntly angulate.

Scutellum (Fig. 18a): Not visible from above.

Elytra (Fig. 18a): Punctate striate, striae 7 on each disc, 7th carinate anteriorly; intervals flat and minutely punctured; margins elevated; humeral and apical angles acute; humps not evident.

Pygidium (Fig. 18d): Finely and moderately closely punctured.

Mesosternum (Fig. 18e): Medially finely and laterally coarsely punctured.

Fore tibia (Fig. 18f): Bluntly quadridentate, third smallest; terminally with a short and blunt spur.

Mid and hind tibiae (Figs. 18g,h): Carinate externally; truncate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 18f,g,h): 5 segmented.

Claws (Figs. 18f,g,h): Equal; curved internally and separately movable.

Material examined: 2 females, Jayanti, 16.ix.96, coll. S. Saha.

Distribution: India: Assam, West Bengal; Indonesia; Myanmar; Philippines (Arrow, 1931; Saha & Raychaudhuri, 2000).

***Onthophagus bison* Boucomont**

(Pl. IF, Fig. 19)

Onthophagus bison Boucomont, 1919, Ann. Soc. Ent. France, xxiii, p. 309.

Onthophagus bison Arrow, 1931, The fauna of British India including Ceylon and Burma (Col: Lamellicornia: Coprinae), iii, p. 302.

Description: Female

Length 6.64 mm, **humeral width** 3.93 mm. Body short, broadly oval and convex.

Colour and markings (Pl. IF, Fig. 19): Black, with mouth organs yellow and venter reddish; smooth and shiny.

Head (Figs. 19a,b): Transverse; short and broad; coarsely and densely punctured; vertex bears a short conical tubercle.

Clypeus (Figs. 19a,b): Semicircular; transversely rugose; front margin round.

Fronto-clypeal suture (Figs. 19a,b): Marked by a curved carina.

Interocular width: 7.4× transverse eye diameter.

Antenna (Fig. 19c): 8 segmented; club 1.22 × stem.

Pronotum (Fig. 19a): Transverse; closely and coarsely punctured; front angles bluntly produced, hind angles obsolete; sides feebly sinuate near hind angles; margins raised; base medially angulate.

Scutellum (Fig. 19a): Not visible from above.

Elytra (Fig. 19a): Punctate striate, striae 7 on each disc, 7th carinate anteriorly; intervals flat and finely punctured; margins elevated; humeral and apical angles acute; humps not evident.

Pygidium (Fig. 19d): Coarsely punctured.

Mesosternum (Fig. 19e): Medially smooth, laterally finely punctured.

Fore tibia (Fig. 19f): Bluntly tridentate; terminally with a short and blunt spur.

Mid and hind tibiae (Figs. 19g,h): Carinate externally; truncate at extremity; terminally with 2 long unequal spurs.

Tarsi (Figs. 19f,g,h): 5 segmented.

Claws (Figs. 19f,g,h): Equal; curved internally and separately movable.

Material examined: 1 female, South Bholka, 19.v.97, coll. S. Saha.

Distribution: India: West Bengal; Myanmar (Arrow, 1931; Saha & Raychaudhuri, 2000).

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PLATE -1A



Male Dorsal habitus Female Dorsal habitus Genital capsule Parameres

Gymnopleurus sinuatus Olivier var. *assamensis* Watson

Female Dorsal habitus

Helicocpris tyrannus (Thomson)

Male Dorsal habitus Female Dorsal habitus Genital capsule Parameres

Catharsius birmanensis Lansberge

PLATE - 1B



Male Dorsal habitus Female Dorsal habitus Genital capsule Parameres

Catharsius molossus (Linnaeus)



Female Dorsal habitus

Catharsius capusinus Fabricius



Male Dorsal habitus



Genital capsule

Catharsius javanus Lansberge



Parameres

PLATE - 1C



Male Dorsal habitus



Genital capsule

Copris corpulentus Gillet



Parameres



Male Dorsal habitus



Genital capsule

Copris doriae Harold



Parameres



Female Dorsal habitus
Copris sarpedon Harold

PLATE - 1D



Female Dorsal habitus

***Copris magicus* Harold**



Male Dorsal habitus



Female Dorsal habitus



Genital capsule



Parameres

***Onitis subopacus* Lansberge**



Male Dorsal habitus



Female Dorsal habitus



Genital capsule



Parameres

***Onitis virens* Lansberge**

PLATE - 1E



Female Dorsal habitus

***Onthophagus bonasus* Fabricius**



Male Dorsal habitus



Female Dorsal habitus



Genital capsule



Parameres

***Onthophagus falcifer* Harold**



Male Dorsal habitus



Female Dorsal habitus



Genital capsule



Parameres

***Onthophagus dama* Fabricius**

PLATE – I F



Male Dorsal habitus Female Dorsal habitus Genital capsule Parameres

Onthophagus tragus Fabricius



Male Dorsal habitus Genital capsule Parameres

Onthophagus triceratops Arrow



Female Dorsal habitus Female Dorsal habitus
Onthophagus armatus Blanchard *Onthophagus bison* Boucomont

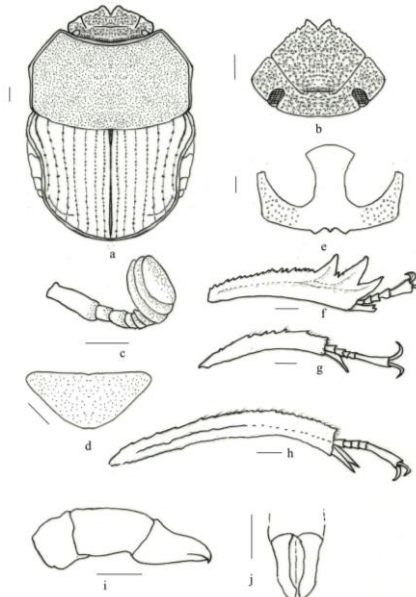


Figure 1a-j. *Gymnopleurus sinuatus* Olivier, var. *assamensis* Watson: Male: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.

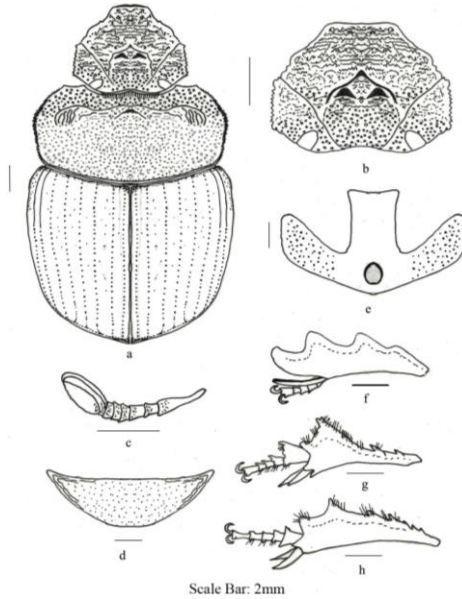


Figure 2a-h. *Helicopriss tyrannus* (Thomson): Female: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws.

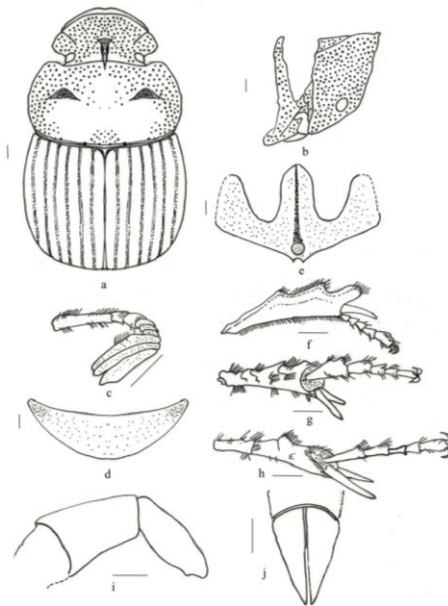


Figure 3a-j. *Catharsius birmanensis* Lansberge: Male: a. Dorsal habitus; b. Head & Clypeus, lateral view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.

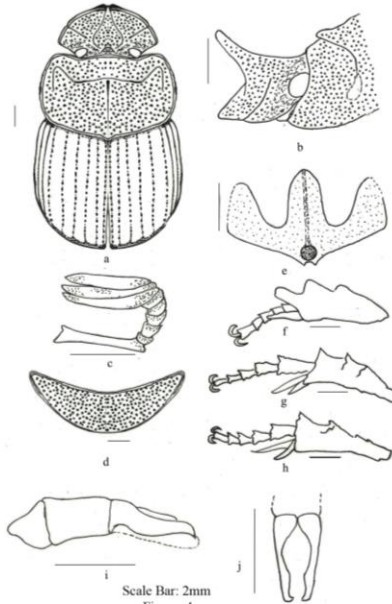


Figure 4a-j. *Catharsius molossus* (Linnaeus): Male: a. Dorsal habitus; b. Head & Clypeus, lateral view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.

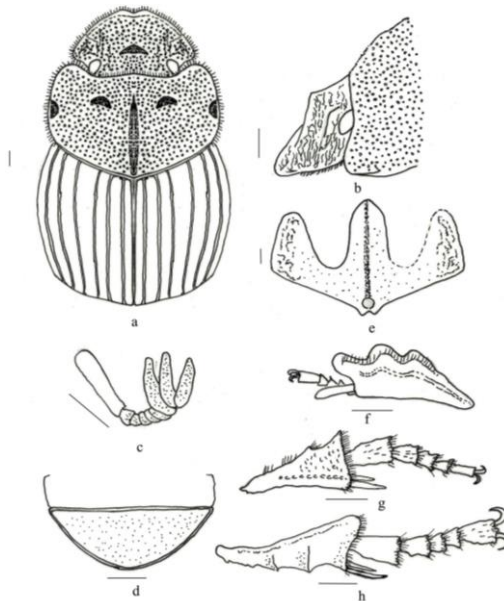


Figure 5a-h. *Catharsius capusinus* Fabricius: Female: a. Dorsal habitus; b. Head & Clypeus, lateral view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws.

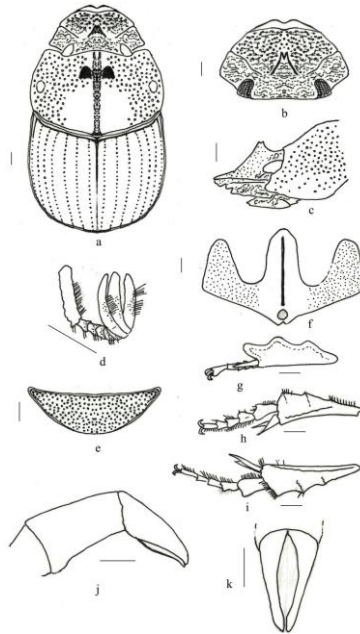


Figure 6a-k. *Catharsius javanus* Lansberge: Male: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Head & Clypeus, lateral view; d. Antenna, lateral view; e. Pygidium, dorsal view; f. Mesosternum, ventral view; g. Fore tibia, tarsi & claws; h. Mid tibia, tarsi & claws; i. Hind tibia, tarsi & claws; j. Genital capsule, lateral view; k. Parameres, dorsal view.

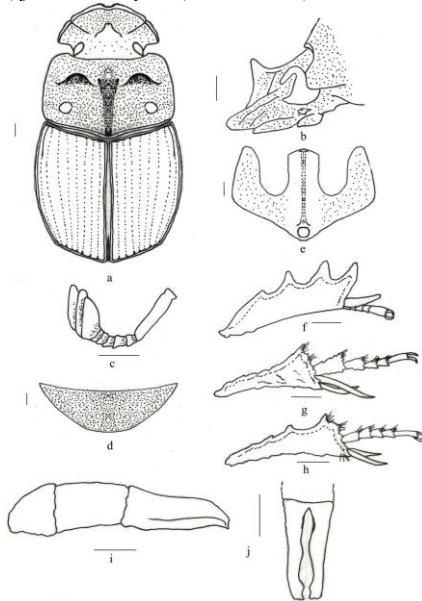


Figure 7a-j. *Copris corpulentus* Gillet: Male: a. Dorsal habitus; b. Head & Clypeus, lateral view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.

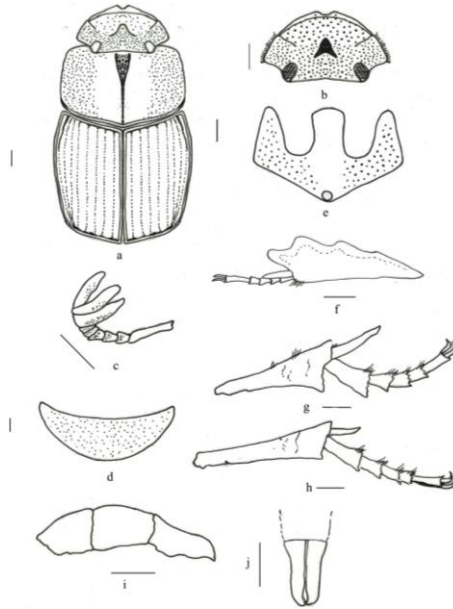


Figure 8a-j. *Copris doriae* Harold: Male: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.

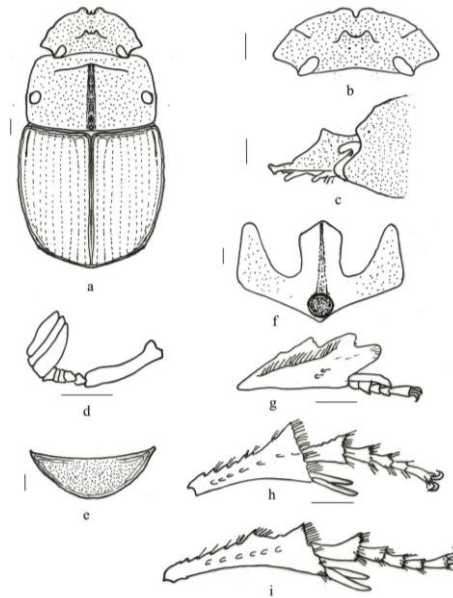


Figure 9a-i. *Copris sarpedon* Harold: Female: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Head & Clypeus, lateral view; d. Antenna, lateral view; e. Pygidium, dorsal view; f. Mesosternum, ventral view; g. Fore tibia, tarsi & claws; h. Mid tibia, tarsi & claws; i. Hind tibia, tarsi & claws.

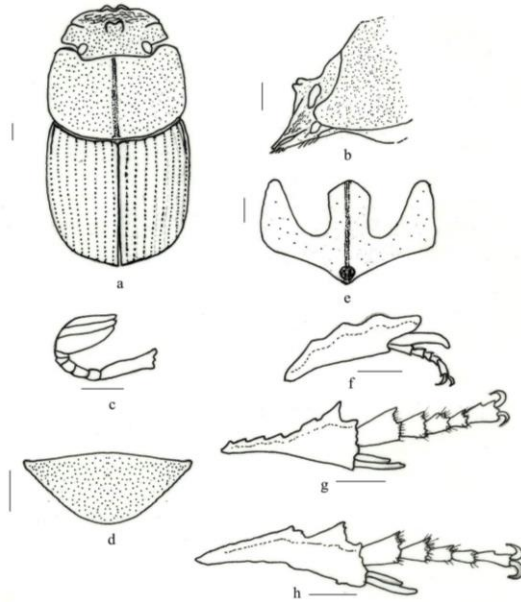


Figure 10a-h. *Copris magicus* Harold: Female: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws.

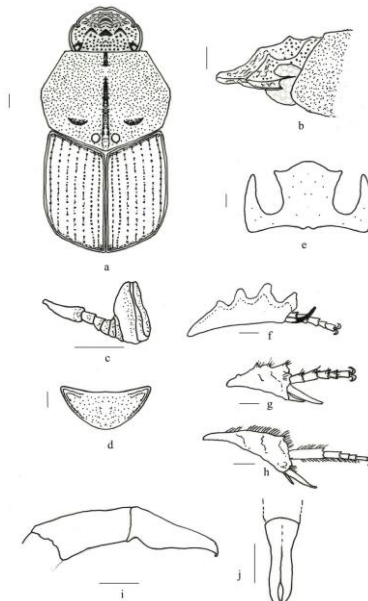
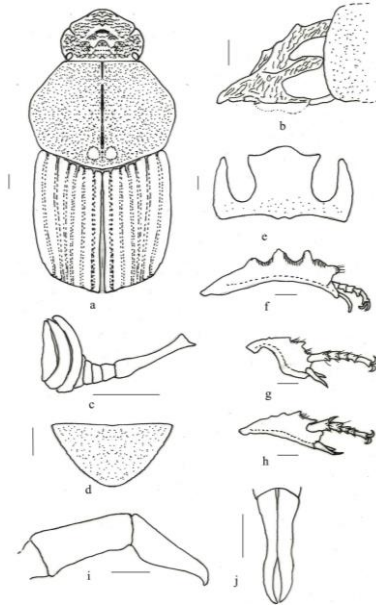
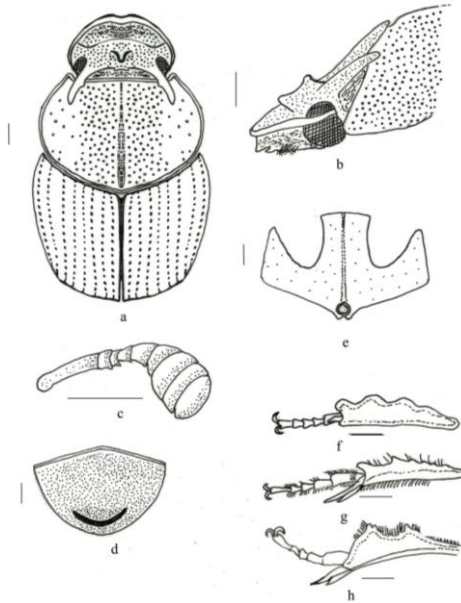


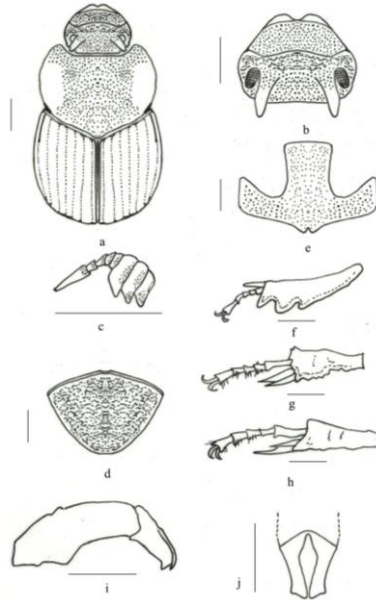
Figure 11a-j. *Onitis subopacus* Lansberge: Male: a. Dorsal habitus; b. Head & Clypeus, lateral view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.



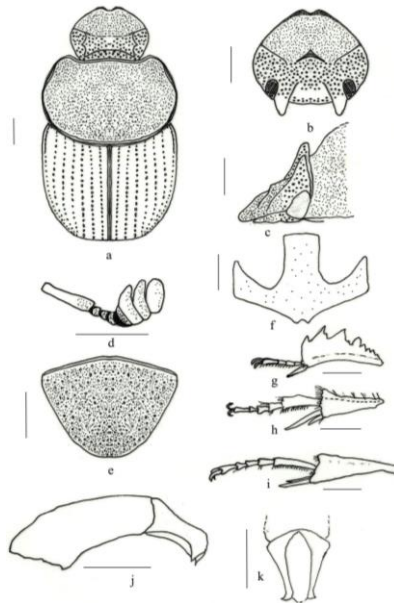
Figures 12a-j. *Onitis virens* Lansberge: Male: a. Dorsal habitus; b. Head & Clypeus, lateral view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.



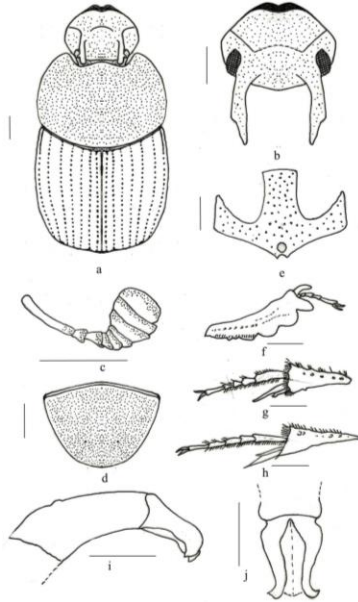
Figures 13a-h. *Onthophagus bonasus* Fabricius: Female: a. Dorsal habitus; b. Head & Clypeus, lateral view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws.



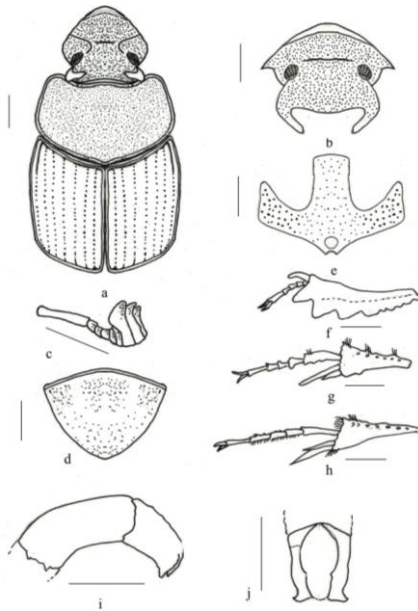
Figures 14a-j. *Onthophagus falcifer* Harold: Male: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.



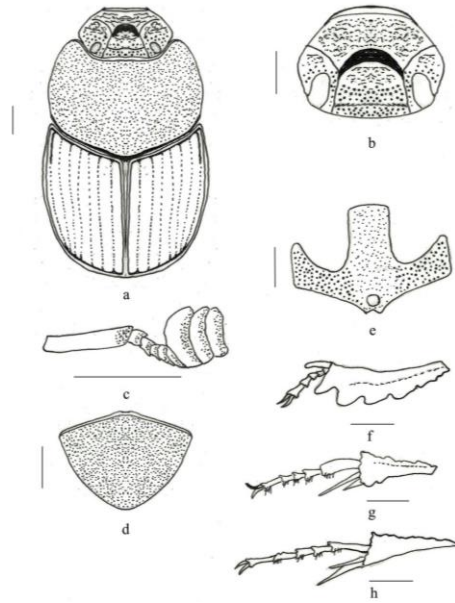
Figures 15a-j. *Onthophagus dama* Fabricius: Male: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.



Figures 16a-j. *Onthophagus tragus* Fabricius: Male: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.



Figures 17a-j. *Onthophagus triceratops* Arrow: Male: a. Dorsal habitus; b. Head & Clypeus, dorsal view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws; i. Genital capsule, lateral view; j. Parameres, dorsal view.



Figures 18a-h.: *Onthophagus armatus* Blanchard: Female: a. Dorsal habitus; b. Head & Clypeus, lateral view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws.

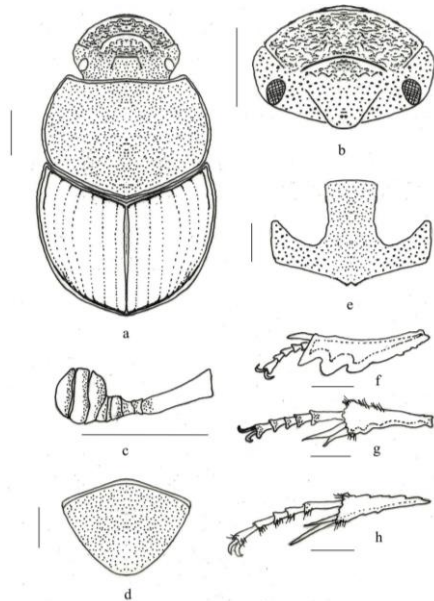


Figure 19a-h. *Onthophagus bison* Boucomont: Female: a. Dorsal habitus; b. Head & Clypeus, lateral view; c. Antenna, lateral view; d. Pygidium, dorsal view; e. Mesosternum, ventral view; f. Fore tibia, tarsi & claws; g. Mid tibia, tarsi & claws; h. Hind tibia, tarsi & claws.

A NEW SUBGENUS TO *CONIZONIA* FAIRMAIRE, 1864 (CERAMBYCIDAE: LAMIINAE: PHYTOECIINI)

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[Özdikmen, H. 2015. A new subgenus to *Conizonia* Fairmaire, 1864 (Cerambycidae: Lamiinae: Phytoeciini). *Munis Entomology & Zoology*, 10 (1): 49-52]

ABSTRACT: A new subgenus to *Conizonia* Fairmaire, 1864 is described as *Conizonioides* subgen. n. from Turkey and Armenia. Moreover, some taxonomic problems of the genus *Conizonia* Fairmaire, 1864 are discussed.

KEY WORDS: *Conizonia*, *Conizonioides*, Phytoeciini, Lamiinae, Cerambycidae.

Chiefly, the Palaearctic genus *Conizonia* Fairmaire, 1864 has two problems taxonomically.

Firstly: Sama in Löbl & Smetana (2010) gave *Conizonia* Fairmaire, 1864, *Eurycoptosia* and *Iranocoptosia* as separate genera. According to Danilevsky (2014), however, *Eurycoptosia* Reitter, 1913 and *Iranocoptosia* Villiers, 1967 are subgenera of the genus *Conizonia* Fairmaire, 1864. We accept that the taxa are separate genera by adhere to the original description of *Conizonia* Fairmaire, 1864.

Original description of *Conizonia* Fairmaire, 1864:

G. 81. *CONIZONIA* Fairm. (Pl. 34, fig. 236, *C. vittigera* Fabr.)
Phytoecia, Muls. Col. de Fr. Longic., 1^{re} éd., 199, et 2^e éd., 401.

Corps oblong, épais, déprimé en dessus. Tête assez courte, un peu plus étroite que le prothorax, faiblement convexe en avant, à peine creusée entre les antennes. Yeux médiocres, fortement échanrés. Labre court, sinué et fortement replié à l'extrémité. Mandibules robustes. Mâchoires des *Opsilia* un peu plus courtes. Palpes courts, ne dépassant pas la bouche, à dernier article fusiforme. Menton trapézoïdal. Languette transversale, peu rétrécie à la base, faiblement sinuée en avant, avec les angles latéraux arrondis; coriacée, avec la partie antérieure plus membraneuse, garnie de quelques soies. Antennes courtes, ne dépassant guère les deux tiers de la longueur du corps chez les femelles, un peu plus courtes seulement que le corps chez les mâles; 4^{er} article épais, à peine atténué vers la base, aussi long que le 5^e, le 4^e un peu plus court que le 3^e, les suivants presque égaux. Prothorax transversal oblusément arrondi sur les côtés. Ecusson semi-circulaire. Élytres déprimées en dessus, élargies aux épaules chez les mâles, et notablement rétrécies en arrière, moins sensiblement chez les femelles, obtusément tronquées à l'extrémité, percées de gros points. Prosternum très-étroit. Mésosternum assez large, presque parallèle, tronqué, plus large chez les femelles. Pattes courtes, assez robustes; crochets des tarsi profondément divisés, à lobes presque égaux.

L'unique espèce de ce genre se distingue des *Phytoecia* par son mésosternum presque parallèle et obtusément tronqué, par sa languette presque entière, dépourvue de courtes spinules, par ses palpes plus courts et ses antennes bien plus épaisses, avec le 4^{er} article égal au 3^e. C'est un insecte remarquable par la pubescence très serrée qui recouvre le corps et par les gros points enfoncés des élytres.

Secondly: Sama in Löbl & Smetana (2010) mentioned eight species group taxa for the genus *Conizonia* as *C. allardi allardi* Fairmaire, 1866; *C. allardi guyi* Sama, 2005; *C. aresteni* Pic, 1951; *C. detrita* (Fabricius, 1793); *C. guerini* (Breme, 1840); *C. mounai* Sama, 2005; *C. simia* Sama, 2005 and *C. warnieri* (P. H. Lucas,

1847). According to Danilevsky (2014), however, the genus *Conizonia* includes ten species group taxa with *C. anularis* Holzschuh, 1984 and *C. kalashiani* Danilevsky, 1992. Sama in Löbl & Smetana (2010), however, gave the species *C. anularis* and *C. kalashiani* in *Coptosia* (*Barbarina*). We agree with the approach of Danilevsky (2014) by adhere to the original description of the subgenus *Coptosia* (*Barbarina*) Sama in Löbl & Smetana, 2010.

Consequently, all mentioned taxa can be listed as follows to us:

Genus *Conizonia* Fairmaire, 1864a: 176

[type species *Saperda vittigera* Fabricius, 1801 (= *Saperda detrita* Fabricius, 1793)]

- allardi allardi* Fairmaire, 1866a: 68
- allardi guyi* Sama, 2005a: 37
- anularis* Holzschuh, 1984a: 160
- aresteni* Pic, 1951a: 11
- detrita* Fabricius, 1793: 308 (*Saperda*)
- guerini* Breme, 1840: 277 (*Saperda*)
- kalashiani* Danilevsky, 1992b: 113
- mounai* Sama, 2005a: 40
- simia* Sama, 2005a: 38
- warnieri* P. H. Lucas, 1847: pl. 43 (*Phytoecia*)

Genus *Eurycoptosia* Reitter, 1913d: 666

[type species *Phytoecia bodoani* Pic, 1912]

- bodoani* Pic, 1912a: 10 (*Phytoecia*)

Genus *Iranocoptosia* Villiers, 1967: 340

[type species *Iranocoptosia balachowskyi* Villiers, 1967 (= *Phytoecia fausti* Ganglbauer, 1886)]

- fausti* Ganglbauer, 1886c: 521 (*Phytoecia*)

On the other side, the genus *Conizonia* has two different species group chiefly. The first species group includes the species *C. allardi* Fairmaire, 1866; *C. aresteni* Pic, 1951; *C. detrita* (Fabricius, 1793); *C. guerini* (Breme, 1840); *C. mounai* Sama, 2005; *C. simia* Sama, 2005 and *C. warnieri* (P. H. Lucas, 1847). The second species group includes only the species *C. anularis* Holzschuh, 1984 and *C. kalashiani* Danilevsky, 1992.

From this point of view, I propose a new subgenus for the species *C. anularis* Holzschuh, 1984 and *C. kalashiani* Danilevsky, 1992.

Genus *Conizonia* Fairmaire, 1864

Subgenus *Conizonioides* Özdikmen subgen. n.

Type sp.: *Conizonia kalashiani* Danilevsky, 1992

The new subgenus can be easily distinguished from the nominotypical subgenus by relatively more thickened antennae, mottled ground pubescence of elytra and the semirecumbent pubescence of the upperside of the body (very recumbent in nominotypical subgenus) (Fig. 1). Moreover, the members of nominotypical subgenus are distributed only in North Africa, while *C. anularis* Holzschuh, 1984 and *C. kalashiani* Danilevsky, 1992 are endemic taxa for Turkey and Armenia respectively.

The new subgenus can be easily distinguished from *Eurycoptosia* Reitter, 1913 by absence lateral expansions of pronotum, and from *Iranocoptosia* Villiers, 1967 by more widened stature (Fig. 2).

Finally, all mentioned taxa can be listed catalogically as follows:

family CERAMBYCIDAE Latreille, 1802
subfamily Lamiinae Latreille, 1825
tribe Phytoeciini Mulsant, 1839

genus *Conizonia* Fairmaire, 1864a: 176 type species *Saperda vittigera* Fabricius, 1801 (= *Saperda detrita* Fabricius, 1793)

subgenus *Conizonia* Fairmaire, 1864a: 176 type species *Saperda vittigera* Fabricius, 1801 (= *Saperda detrita* Fabricius, 1793)

allardi allardi Fairmaire, 1866a: 68 **N: AG**

elegantula Fairmaire, 1871: 402

leprieuri Pic, 1892g: 104

allardi guyi Sama, 2005a: 37 **N: MO**

aresteni Pic, 1951a: 11 **N: MO**

detrita Fabricius, 1793: 308 (*Saperda*) **N: AG MO TU**

maculosa Mulsant, 1839: 201 (*Phytoecia*)

vittigera Fabricius, 1801b: 318 (*Saperda*)

guerini Breme, 1840: 277 (*Saperda*) **N: AG TU**

glauca Erichson, 1841: 189 (*Saperda*)

luteopubens Pic, 1918d: 17

lineata Pic, 1918d: 11

mounai Sama, 2005a: 40 **N: MO**

simia Sama, 2005a: 38 **N: AG**

warnieri P. H. Lucas, 1847: pl. 43 (*Phytoecia*) **N: AG MO TU**

aumontiana P. H. Lucas, 1851b: xli (*Phytoecia*)

bicoloricornis Pic, 1942a: 1

cinerea Guérin-Méneville, 1841: 9 (*Saperda*) [HN]

coquerelii Fairmaire, 1873b: 353

fuscicornis Heyden, 1863: 130 (*Phytoecia*)

henoni Pic, 1891b: 49

heterogyna Fairmaire, 1871: 402

inlateralis Pic, 1942d: 3

invittata Pic, 1942a: 1 [DA]

mimauri Pic, 1950d: 93

poweli Pic, 1941a: 13

pygidialis Pic, 1911a: 9

vittithorax Pic, 1900d: 16

subgenus *Conizonioides* Özdikmen subg. n. type species *Conizonia kalashiani* Danilevsky, 1992

anularis Holzschuh, 1984a: 160 **A: TR**

anulifera Löbl & Smetana, 2013: 41 [unjustified emendation]

kalashiani Danilevsky, 1992b: 113 **A: AR**

genus *Eurycoptosia* Reitter, 1913d: 666 type species *Phytoecia bodoani* Pic, 1912 *bodoani* Pic, 1912a: 10 (*Phytoecia*) **A: AB IN**

genus *Iranocoptosia* Villiers, 1967: 340 type species *Iranocoptosia balachowskyi* Villiers, 1967 (= *Phytoecia fausti* Ganglbauer, 1886)

fausti Ganglbauer, 1886c: 521 (*Phytoecia*) **A: IN TM**

balachowskyi Villiers, 1967: 340

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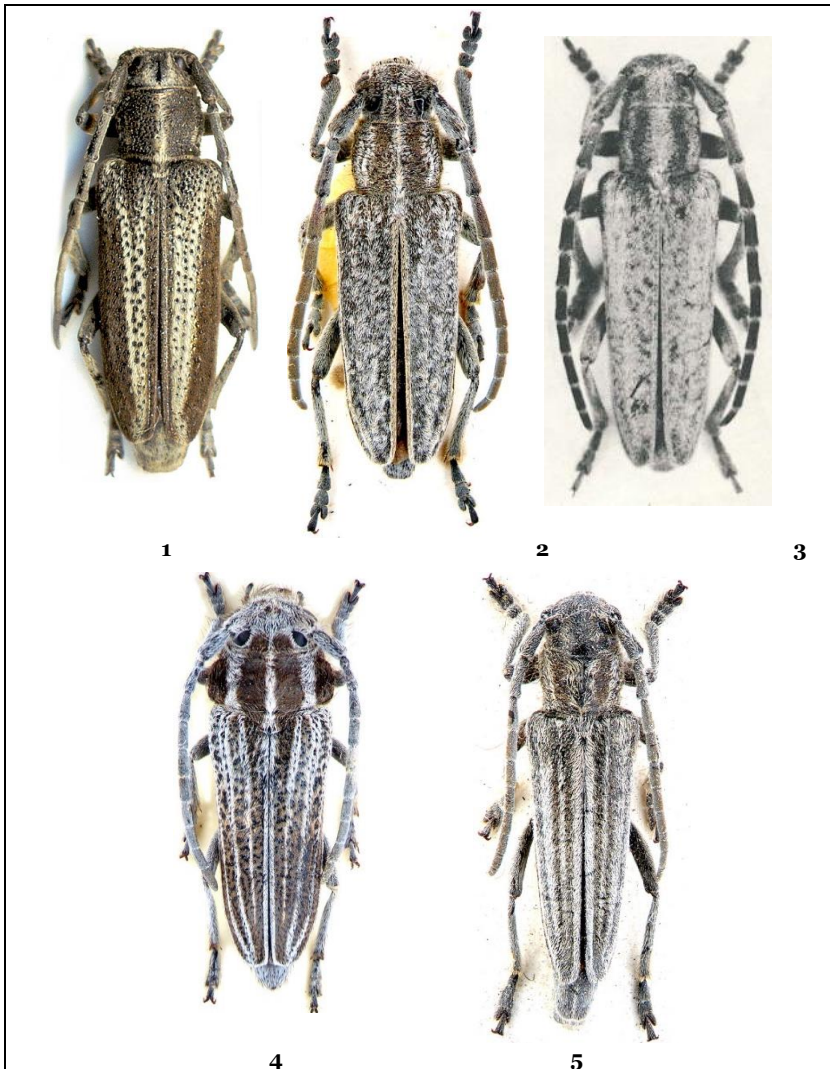


Figure 1. 1. *Conizonia (Conizonia) detrita* (Fabricius, 1792) (Photo by J. Kurzawa, from <http://www.zin.ru/animalia/coleoptera/eng/condetjk.htm>), 2. *Conizonia (Conizonioides) kalashiani* Danilevsky, 1992 (Photo by K. V. Makarov, from <http://www.zin.ru/animalia/coleoptera/eng/conkaldm.htm>), 3. *Conizonia (Conizonioides) anularis* Holzschuh, 1984 (from Holzschuh, 1984), 4. *Eurycoptosia bodoani* (Pic, 1912) (Photo by K. V. Makarov, from <http://www.zin.ru/animalia/coleoptera/eng/eurboddm.htm>), 5. *Iranocoptosia fausti* (Ganglbauer, 1885) (Photo by K. V. Makarov, from <http://www.zin.ru/animalia/coleoptera/eng/irafaudm.htm>).

**PATHOGENICITY OF THE ENTOMOPATHOGENIC FUNGUS,
PURPUREOCILLIUM LILACINUM TR₁ AGAINST THE BLACK
CHERRY APHID, MYZUS CERASI FABRICUS
(HEMIPTERA: APHIDIDAE)**

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[**Kepenekci, İ., Yesilayer, A., Atay, T. & Tulek, A.** 2014. Pathogenicity of the entomopathogenic fungus, *Purpureocillium lilacinum* TR₁ against the Black Cherry Aphid, *Myzus cerasi* Fabricus (Hemiptera: Aphididae). *Munis Entomology & Zoology*, 10 (1): 53-60]

ABSTRACT: *Myzus cerasi* (Fabricus) as a cosmopolitan species chooses plants from such families as Cruciferae, Plantaginaceae, Rosaceae, Rubiaceae and Scrophulariaceae as hosts. This pest species, which is widespread in our country, causes curling and distortion of the leaves by establishing large colonies on growing shoots. Besides, they cause the growth of black sooty fungi on account of the honeydew they secrete. It is known that this species can transmit several viruses including *Bean yellow mosaic virus* (BYMV), *Celery mosaic virus* (CeMV) and *Onion yellow dwarf virus* (OYDV) in a non-persistent manner. In this study, it is searched the effects of entomopathogenic fungi, [*Purpureocillium lilacinum* TR₁ (syn.: *Paecilomyces lilacinus*)] on the black cherry aphid (BCA) adults in three conidial suspension (10^6 , 10^7 and 10^8 cfu ml⁻¹) and at two different temperatures (15 and 25°C) in laboratory conditions. The data for mortality was recorded after 2, 4, 6, 8 and 10 days intervals. At the end of the study highest effect was found at 25 °C 10^8 cfu ml⁻¹. The mortality rate were found respectively after 6 and 8 days %73,48, %83,64 and the data was remained stable after 10 days. It will be appropriate that the results obtained from this first study performed in laboratory conditions should also to be tried in the field conditions for the control of *M. cerasi*. It is hoped that the study will be helpful in the control strategies of this aphid species that will be put forward in a future time. It is seen that after having obtained hopeful results from this study, making similar works on the other aphid species are also necessary.

KEY WORDS: Entomopathogenic fungi, *Purpureocillium lilacinum*, Black Cherry Aphid, *Myzus cerasi*.

Black cherry aphid (BCA) sucks sap from the foliage of cherries of *Prunus cerasus*, *P. avium* and *P. padus* during late spring and early summer. BCA feeds on the undersides of the leaves and the shoot tips. After the feeding, leaves become severely crumpled and curled and damaged leaves may dry up and turn brown. They are excreted honeydew then foliage becomes sticky with the sugary and a black sooty mould may develop (Anonymous, 2014).

Myzus cerasi is widespread in our country causes the growth of black sooty fungus on account of the honeydew they secrete. This aphid is considered to be the most important vector of plant viruses throughout the world. (Kennedy et al., 1962; Namba & Sylvester, 1981; Blackman & Eastop, 1984, 2000).

Chemical pesticides have been the main control methods for these pests in crop production both world and Turkey. *M. cerasi* has got natural enemies but, these do not adequately control high populations. Several mycopenicides have been developed and used in several countries. An entomopathogenic fungus can act as a parasite of insects and kills or seriously disables them. Naturally

occurring entomopathogenic fungi (EPFs) are considered to be one of the best alternative to existing chemicals (Hajek & Leger, 1994). Entomopathogenic fungi such as *Lecanicillium* sp. (Jung et al., 2006), *Beauveria bassiana* (Quesada et al., 2006; Wakil et al., 2011a), *Metarhizium anisopliae* (Wright et al., 2004), *Paecilomyces* spp. (Shia & Feng, 2004) and *Nomuraea rileyi* (Devi et al., 2003; Wakil et al., 2011b) are being used for the control of aphids, mites and other insect pests.

Purpureocillium lilacinum (Thom) Luangsaard, Hywel-Jones, Houbraeken and Samson (syn: *Paecilomyces lilacinus*) (Sordariomycetes: Hypocreales) is a soil fungus with a good potential for biological control. This species has been described as being as efficient as the commonly used nematicides (Dube & Smart, 1987; Schenck, 2004; Mendoza et al., 2007); it is also a controller of insects (Posada et al., 1998; Suh et al., 2002; Gökçe & Er, 2005; Wakil et al., 2012) and others arthropods (Fiedler & Sosnowska 2007; Shin et al., 2011; Angelo et al., 2012). According to Bellows (2001), Headrik & Goden (2001) and other authors, the use of entomopathogenic fungi is an excellent method for the biological control of insects. Entomopathogenic fungi have been used successfully to control aphids, according to Milner (1997) *Verticillium lecanii* isolates controlled aphids on chrysanthemum and whitefly on cucumber and tomato.

After Entomopathogenic Fungus, *Purpureocillium lilacinum* TR1 was determined and identified (Kepenekci et al., 2013a), pre studies were done on the some important pests in Turkey and effective results were gathered. These results showed that detailed in *in vivo* and in *in vitro* studies had to be done (Kepenekci, et al., 2013b,c; Kepenekci et al., 2014a,b).

Purpureocillium lilacinum TR1 was isolated from root-knot nematodes in the tomato plant roots in Sarıcakaya (Eskisehir) within the scope of the project "Determination of fungal and bacterial pathogens of root-knot nematodes, a problem for greenhouse vegetable growing in the cities of Burdur, Isparta and Eskisehir", which was carried out between 2002 and 2007. As a result of the study conducted to determine the fungal pathogens of root-knot nematodes in our country, the Turkey isolate of *P. lilacinus* was attained (Kepenekci et al., 2009).

In diagnosis of *P. lilacinum* TR1, DNA extraction was performed using DNeasy Blood and Tissue Kit (Qiagen, Germany), and 123 bp bands were attained using primer set specific to species. By the same study, this fungus was defined in details (morphologically and morphometrically) (Kepenekci et al., 2013a). Also, cDNA sequences of PCR products attained using general ITS primers were derived, and these cDNA sequences were compared with NCBI data. cDNA sequences of the isolate diagnosed molecularly were entered in GenBank and their access number were received. The isolate was stored in GenBank.

In this paper, we evaluated the control potential of *P. lilacinum* TR1 against adults of *Myzus cerasi* in the laboratory.

MATERIALS AND METHODS

Fungi Sources

The culture of *Purpureocillium lilacinum* TR1 was provided by the Plant Protection Central Research Institute, Ankara, Turkey. It was firstly isolated from the eggs of root-knot nematode [*Meloidogyne incognita* (Kofoid & White)] collected from the greenhouse in Sarıcakaya (Eskişehir, Turkey) (Kepenekci et al., 2009; Kepenekci et al., 2013a).

Insect Sources

Myzus cerasi adults were obtained from the laboratory colony maintained at the entomology division, Plant Protection Central Research Institute in Ankara, Turkey. *M. cerasi* adults were collected from the plums orchard from Ankara (Turkey).

Mass-Culturing of *Purpureocillium lilacinum*

The fungi was subcultured on Potato Dextrose Agar with the help of sterilized bacteriological loop and the plates were closed by parafilm at $25\pm 1^\circ\text{C}$ for 14 days. The conidia were harvested using sterilized rubber loop attached to 1 ml borosilicate pipette at the angle of 45° . The scraped material was shifted into sterilized petri plates and stored at 4°C in refrigerator. The harvested fungal conidia were incorporated in to sterile 0.05% Tween-80 solution and the material were stirred for complete homogeneity.

The serial dilutions were prepared and the number of conidia was measured to achieve the 10^6 , 10^7 and 10^8 cfu ml^{-1} concentration under haemocytometer.

Effect of Temperature and Fungi Concentration on Mortality of *Myzus cerasi* Adults

Detached leaf-disc bioassay

The detached leaf disc method was adopted and the healthy cherry leaf discs (5cm in diameter) were placed in 9cm petri-plates (Wakil et al., 2012). The leaf discs were dipped in *P. lilacinum* conidial suspension (10^6 , 10^7 and 10^8 cfu ml^{-1}) for treatments. The leaf discs were air-dried in the clean bench and at room temperature for 1 hour. The leaf discs treated with 0.05% Tween-80 served as control. Each petri plate with leaf discs was provided with moistened filter paper on the bottom with 1cm hole on lid covered with fine mesh for aeration. Ten black cherry aphid were released in each petri plate using camel's hair brush and the petri plates were then placed in growth chamber maintained at 15 and 25°C and $>70\%$ relative humidity at 16L:8D photoperiod. The data for mortality was recorded after 2, 4, 6, 8 and 10 days intervals. Each treatment and bioassay was repeated independently for three times. Dead individuals were removed and considered as dead if they did not move when prodded with needle. The dead *M. cerasi* were examined under microscope to determine whether mortality was because of entomopathogenic fungus, and micelle development was checked. When required, these cadavers were placed in petri dishes to follow up potential mycosis development (Fig. 1).

Statistics

One-way ANOVA was used to compare the mortality of *M. cerasi*. Means were compared at the $P=0.05$ level, and Tukey's test was used to separate means (SPSS, 1999). Arcsine transformation was carried out on mortality (%) before analyses.

RESULTS

The data generally showed that all concentration were effective against the *M. cerasi* adults (Figs. 2, 3). When we look overall results of this study, at 25°C , 10^8 cfu concentration had the highest effect on the 8th day. This effect cannot show any changes on the tenth day and remained constant. This effect is 2.5 times of a lower concentration (10^7 cfu) (to 83,64% from 33,25%) (Figs. 2, 3).

When it was compared to effect of the concentrations used (10^6 , 10^7 ve 10^8 cfu) according to temperature (15°C and 25°C), at the end of the 2nd and 4th days at 15°C in 10^6 cfu concentration, the effect did not reach 10% (1,14% and 6,69%). At the end of the 6th and 8th days, effect increased slightly and at tenth day remained constant (13,01%, 19,99% and 19,99%) ($F= 6,78$; $df=5,17$; $P<0.003$). At 10^7

concentration, at the same temperature on 2nd, 4th and 6th days, the effect increased in a small amount (4,53, 13,01 and 16,35%), at the end of the 8th day, the effect was recorded as 19,99%. At the end of the tenth day, effect has emerged to 23,17% with very little an increase. At this concentration, between 4th, 6th and 8th days, statistically a significant difference wasn't found ($F= 12,28$; $df=5,17$; $P<0.000$). The situation is similar in the highest concentration (10^8 cfu), but on the 8th day mortality reached the highest value (39,85%) and *M. cerasi* death has not been observed on the 10th day and the death rate has remained stable. At this concentration, between 4th, 6th and 8th day, statistically a significant difference wasn't found ($F= 8,44$; $df=5,17$; $P<0.001$). At the end of the experiment, in 10^6 ve 10^7 concentrations (the 10th day counts 10^7 concentrations excluding) effect cannot over of 20%.

Analyzing trial established at 25°C, *P. lilacinum* has caused more deaths in adults of *M. cerasi*. When we look at the concentrations applied, 10^6 cfu was found to have minimal influence again (mortality didn't rise above 30%) and mortality above of 20% was recorded on the 6th, 8th and 10th days (23,17%, 26,52% and 29,99%). At this concentration, between 4th, 6th and 8th days, statistically a significant difference wasn't found ($F= 18,20$; $df=5,17$; $P<0.000$). At 10^7 cfu concentration, effect has outpaced over an amount of 30% on the only 10th day (33,25%). At this concentration, between 4th, 6th and 8th days, statistically a significant difference wasn't found ($F= 9,03$; $df=5,17$; $P<0.001$). At 10^8 concentration after from 4th day mortality in *M. cerasi* increased significantly. At the end of the 8th day mortality rate reached to 83,64% and at the 10th day remained constant. At this concentration, with 2nd and 4th, between 6th, 8th and 10th days statistically a significant difference wasn't found ($F= 44,39$; $df=5,17$; $P<0.000$). At this temperature the end of the experiment, concentrations of 10^6 and 10^7 (counts of the 10th day except at concentration of 10^7) mortality didn't rise above 30% (Fig. 2B).

When it was evaluated according to the time (2nd, 4th, 6th, 8th and 10th days) effects of the application concentrations (10^6 , 10^7 and 10^8 cfu), in the counting of the 2nd day; at 15°C at 10^6 and 10^7 cfu concentrations mortality didn't rise above 5% (1,14% and 4,53%) (Fig. 3A), at the same concentrations at 25°C mortality didn't rise above 10% (4,53 and 9,99%) (Fig. 3B). At 15°C and 25°C, at 10^8 cfu, deaths, in the end of the 2nd day, was recorded as 26,52% and 15,72% ($F= 3,98$; $df=3,11$; $P<0.053$) (Fig. 3). At the end of the 4th day at concentration of 10^8 cfu the death rate was found (33,25% and 22,45%) higher than other concentrations in 15°C and 25°C. Same day, in other concentrations mortality of *M. cerasi* increased with the temperature but it did not exceed 20%. At end of the 4thday counts statistically a significant difference wasn't found ($F= 6,67$; $df=3,11$; $P<0.014$) (Fig. 3). In the 6th and 8th days at 15°C, at concentrations of 10^6 and 10^8 cfu mortality rates remained constant (13,01 and 33,25) (Fig. 3A); at 25°C at concentrations of 10^6 and 10^7 cfu mortality rates remained virtually unchanged. But it increased in 10^8 cfu from 33,25% to 73,48% (Fig. 3B) ($F= 45,07$; $df=3,11$; $P<0.000$ and $F= 79,01$; $df=3,11$; $P<0.000$). At the end of the 10th day at 15°C at concentrations of 10^6 and 10^7 cfu, death rates remained unchanged (19,99%), in 10^8 was recorded as 39,85% (Fig. 3A). At the end of the same day at 25°C at concentrations of 10^6 and 10^7 cfu mortality was recorded as 33,25% and 29,99%. At 10^8 mortality was found as 83,64% ($F= 15,13$; $df=3,11$; $P<0.001$) (Fig. 3B). At 25°C, 6th, 8th and 10th days, concentrations of 10^6 and 10^7 , a statistically significant difference wasn't found (Fig. 3B). At the end of the trial, at the same temperature effect increased in parallel to the increase of time exposure. This rise

was recorded as the highest at 10^8 concentration and on 6th day (from 33,25% to 73,48) (Fig. 3B).

The data regarding the effect of different treatments on the aphid in cherry leaf discs at different intervals showed highly significant difference (Fig. 2, 3). The maximum mortality 83,64% of aphid was recorded in 8th day and 10^8 cfu ml⁻¹ concentration of 25°C. The lowest effect on aphid was recorded 10^6 cfu ml⁻¹ concentration 2nd and 4th day; 10^7 cfu ml⁻¹ concentration 2nd day; 1,14%, 6,69% and 4,53% of 15°C, respectively (Fig. 2A, 3A). It is observed that the effectiveness of all the treatments showed an increasing trend up to 10 days of post application.

DISCUSSION

The entomopathogenic fungi are extensively evaluated for the control of aphid on various crops as Steinkraus (1999) controlled cotton aphid by applying aerial conidia of *Neozygites fresenii*.

The significant control of aphid on cotton seedlings was also observed by the application of *Colletotrichum orbiculare* (Russo et al., 1997) which is in line with the present work. Similarly, Kim et al. (2008) tested the effectiveness of the commercial formulation of *Lecanicillium longisporum* (Vertalec) for the control of cotton aphid and reported the noteworthy reduction in the aphid number compared to untreated control.

The pathogenicity of different isolates of *Beauveria bassiana*, *Paecilomyces* spp. and *Lecanicillium attenuatum* were evaluated against cotton aphid (Kim & Kim, 2008) where mortality reached up to 100% after 5 days when treated either with conidia or blasto-spores of the fungi.

Wakil (2012) tested the efficacy of *Paecilomyces lilacinus* (2.3×10^9 conidia ml⁻¹), *Azadirachta indica* (10ml L⁻¹) and the formulation of diatomaceous earth (PyriSec) (DE) (3g L⁻¹) for the control of cotton aphid, *Aphis gossypii* (Insecta: Homoptera: Aphididae) both under laboratory and semi-natural conditions. All the tested treatments gave significant control of aphid; however, *P. lilacinus* in combination with Neem showed the best control of aphids in detached leaf bioassay and semi-natural conditions. The applications of *P. lilacinus* and DE showed weak knock down effect on the insect pest. Furthermore, an increasing trend in mortality of aphids was observed in all the treatments with an increase in the time intervals. The results of the study clearly indicated that the *P. lilacinus* may give effective control of the aphids in combination with other eco-friendly agricultural practices.

According to Özçelik et al. (2013) at 10^8 cfu concentration, while *Isaria farinosa* caused 47% mortality of green peach aphid, *Myzus persicae* in 75% humidity, *Purpureocillium lilacinum* caused 96% mortality of same aphids in 95% humidity. Similarly in our study, the highest effect was found at 25°C, 10^8 cfu ml⁻¹. In the another study, Satar & Koç (2004), emphasized that at 25°C *Fusarium subglutinans* caused significantly mortality.

The data generally showed that all fungal concentration had higher effect at 25°C than 15°C against the *M. cerasi* adults. At 15°C, no entomopathogenic fungi caused over than 40% mortality. Ansari et al. (2004) also found that mortality depend on the concentration of conidial suspension, exposure time and temperature. The another study relevant to effect of different conidial concentrations *Verticillium lecanii*, *Paecilomyces fumosoroseus*, *Metarhizium anisopliae* against *Brevicoryne brassicae* L. showed that aphids mortality increased with increase in spore concentration and exposure time (Asi et al., 2009). In another study, virulence of *Beauveria bassiana* against *Myzus persicae*

was examined, and the results showed that aphids had higher mortality rates at 28 and 21°C than those at 16 and 11°C (Yinquan et al., 2000). These results were similar to our study.

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Figure 1. *Myzus cerasi* adults infected by entomopathogenic fungus, *Purpureocillium lilacinum* TR₁ (syn: *Paecilomyces lilacinus*).

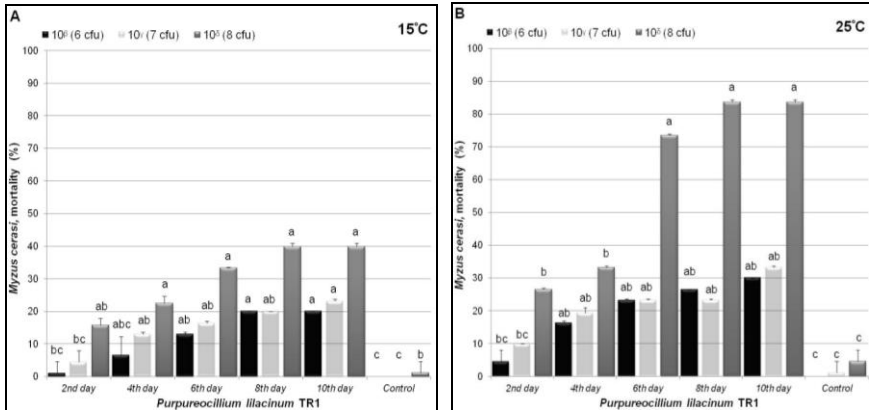


Figure 2. Mortality (%) of *Myzus cerasi* adults following application of entomopathogenic fungi *Purpureocillium lilacinus* TR1 (isolated from Turkey) at 10⁶, 10⁷ and 10⁸cfu ml⁻¹ concentration at different temperatures [15°C (A) and 25°C (B)]. Data are expressed as mean±SEM. The same letter above the error bars indicates no significant difference (P>0.05; Tukey test).

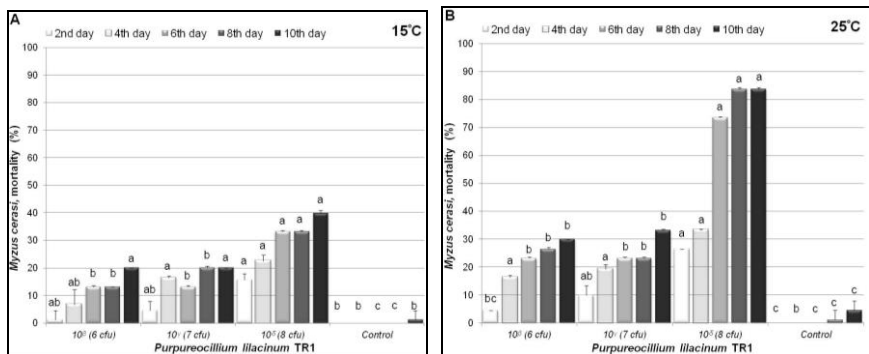


Figure 3. Mean adult mortality (%±SEM) of *Myzus cerasi* exposed for 2nd, 4th, 6th, 8th and 10th days on detached leaf discs treated with *Purpureocillium lilacinus* TR1 (isolated from Turkey) (10⁶, 10⁷ and 10⁸cfu ml⁻¹ concentration) at different temperatures [15°C (A) and 25°C (B)] (means followed by the same letters are not significantly different at P=0.05).

**A NEW *LINYPHIA* LATREILLE, 1804
(ARANEAE: LINYPHIIDAE) FROM WEST BENGAL, INDIA**

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ABSTRACT: *Linyphia bilobata* sp. nov. recorded from the tea estates and forest reserves of Dooars, West Bengal, India is described and illustrated.

KEY WORDS: *Linyphia bilobata* sp. nov., Tea Estates, Forest Reserves, Dooars, India.

Linyphiids, the sheet weavers, spin flat, dome or hammock shaped sheet webs. This cosmopolitan family is known by 4490 species under 591 genera (Platnick, 2014). These include 68 Indian species belonging to 36 genera (Keswani et al., 2012).

Five out of the 68 species are known to compose the genus *Linyphia* Latreille, 1804 of India (O. P.-Cambridge, 1885; Tikader, 1970, 1977). Indian *Linyphia* are highly endemic (Platnick, 2014).

During our sustained survey on spiders of the tea ecosystem and forest reserves of Dooars, West Bengal, we came across with a *Linyphia* species from Kailashpur Tea Estate, Gorumara National Park and Chapramari Wildlife Sanctuary. The species after critical examination is considered as new to science and accordingly described and illustrated.

MATERIAL AND METHODS

Linyphiids were collected and preserved following Tikader (1987) and Barrion & Litsinger (1995). The material were studied under Stereo Zoom Binocular Microscopes, model Olympus SZX-7 and Zeiss SV-11. The measurements indicated in the text are in millimeters, made with an eye piece graticule. Leg measurements are shown as: total length (femur, patella, tibia, metatarsus, tarsus).

Abbreviations used: AL= abdominal length, ALE= anterior lateral eye, AME= anterior median eye, AW= abdominal width, CL= cephalothoracic length, CW= cephalothoracic width, PLE= posterior lateral eye, PME= posterior median eye, TL= total length, KTE= Kailashpur tea estate, CWLS= Chapramari Wildlife Sanctuary, GNP= Gorumara National Park, WB= West Bengal.

TAXONOMY**Family** Linyphiidae Blackwall, 1859**Genus** *Linyphia* Latreille, 1804***Linyphia bilobata*** sp. nov.

(Figs. 1-7)

Type material: Holotype: 1 female, KTE, Dooars, 31.I.2010, coll. T. K. Roy; Paratypes: 1 female, Gorumara, GNP, 18.III.2007, coll. S. Sen; 1 female, Gorumara, GNP, 18.III.2007, coll. D. Raychaudhuri; 2 females, Khunia, GNP, 05.V.2008, coll. S. Saha; 1 female, Dhupjhora, GNP, 20.IX.2009, coll. S. Sen; 2 females, Chapramari, CWLS, 03.XI.2007, coll. D. Raychaudhuri.

Description:

Female (Holotype):

CL - 1.79, CW - 1.43, AL - 3.58, AW - 2.64, TL - 5.38. Cephalothorax (Fig. 1) yellow brown, elongate oval, cephalic region raised, convex, cervical furrows well marked by red brown, thoracic region round, somewhat flat with fovea broadly U shaped, radii distinct. Eyes 8, homogenous, transparent, arranged in 2 rows, anterior strongly recurved, posterior weakly so or straight as viewed dorsally, ocular quad nearly square, weakly wider in front, laterals contiguous, eye diameter: AME > PME > ALE ≥ PLE. Interocular distances: AME - AME = 0.32, ALE - AME = 0.25, ALE - ALE = 0.70, PME - PME = 0.17, PLE - PME = 0.26, PLE - PLE = 0.66, ALE - PLE = 0.11, AME - PME = 0.21. Clypeus reddish brown, broad, sub rectangular. Chelicerae (Fig. 2) red brown, moderate, dorsum with small, brown hairs, both pro and retromargin with 1 tooth, fang brown, curved, sharp and stout. Labium (Fig. 3) close, brown, wider than long, constricted sub basally, apically broad, triangular, margins pale, truncate and scopulate. Maxillae (Fig. 3) brown, converging, nearly twice longer than wide, outer margins weakly concave, inner margins constricted basally, apically pale scopulate. Sternum (Fig. 3) long triangular, red brown, margins more red, clothed with fine, moderate, brown hairs, lateral margins weakly indented at each coxae, tip produced between coxae IV, blunt, margin straight. Legs long, stout, yellow brown, banded, clothed with pale brown, moderate hairs, at times in rows and spines, tarsi with 2 superior claws, 1 inferior claw and many accessory claws, superior claws pectinate throughout, inferior claw also pectinate, leg measurements: I 15.00 (4.60, 0.80, 4.00, 4.20, 1.40); II 8.40 (2.60, 0.80, 1.80, 2.20, 1.00); III 5.60 (1.80, 0.60, 1.00, 1.40, 0.80); IV 9.00 (2.80, 0.80, 2.00, 2.40, 1.00). Leg formula 1423.

Abdomen (Figs. 1 & 4) off white, sub pentagonal, converging at both ends, widest at the middle, each end marked by a black hump, tip black, blunt and round. Dorsum decorated with silvery white specks, anteriorly with few irregular black patches, entirely clothed with long, erect, shiny white hairs. Venter off white with silvery white specks, shiny white hairs and a black band enclosing the spinnerets at the middle.

Epigynum - Internal genitalia (Figs. 5-6): Epigynal plate marked by 2 transverse, nearly parallel lines, spermatheca bilobed, fertilisation duct short, anteriorly projected, hood like, copulatory duct long, convergent.

Type deposition: Entomology Laboratory, Department of Zoology, University of Calcutta, registration no. **EZC 0034-14**.

Distribution: India: West Bengal. The species is so far known from the type locality.

Etymology: The species name is derived from the bilobed nature of spermatheca.

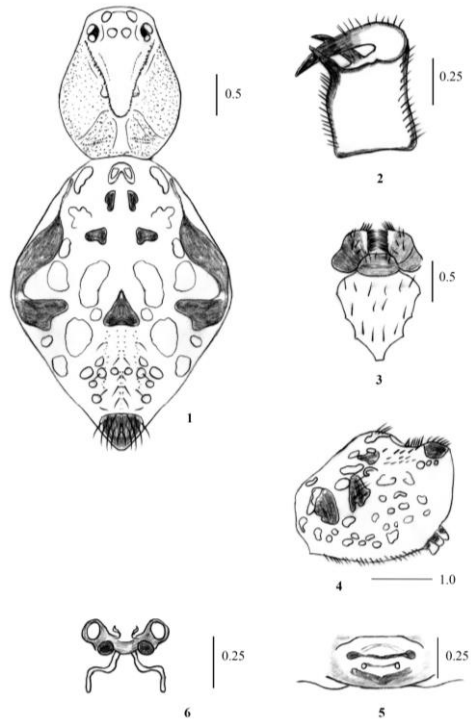
Remarks: The closest ally of the species is *Linyphia urbanasae* Tikader, 1970 but can be separated by i) sternum long, triangular, tip blunt, produced between coxae IV (sternum cordate, acute between coxae IV in *L. urbanasae*); ii) abdomen sub pentagonal, widest ends marked by black humps, tip black, blunt and round (abdomen elongate oval, without any hump, dorsum otherwise decorated); iii) epigynal plate marked by 2 transverse, nearly parallel lines (epigynal plate with 2 black markings in *L. urbanasae*); iv) spermatheca bilobed, fertilization duct short, anteriorly projected, hood like, copulatory duct long, convergent (aforesaid features absent in *L. urbanasae*). Such differences appear to justify the erection of a new species. The species is therefore recognized as new to science.

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Figures 1-6. *Linyphia bilobata* sp. nov. (Holotype): 1. Dorsal habitus; 2. Chelicerae, ventral view; 3. Maxillae, labium and sternum, ventral view; 4. Abdomen, lateral view; 5. Epigynum, ventral view; 6. Internal genitalia, dorsal view.



Fig. 7

Figure 7. Photographic image: *Linyphia bilobata* sp. nov. (Holotype): General habitus.

**A SHORT NOTE ON NON-TARGET LEPIDOPTERA SPECIES
COLLECTED BY PHEROMONE TRAPS OF *RHYNCHOPHORUS
FERRUGINEUS* (OLIVIER, 1790) (COLEOPTERA:
DRYOPHTHORIDAE) IN İZMİR PROVINCE OF TURKEY**

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[Çıtırıkaya, B., Okyar, Z., Tezcan, S. & Gülperçin, N. 2015. A short note on non-target Lepidoptera species collected by pheromone traps of *Rhynchophorus ferrugineus* (Olivier, 1790) (Coleoptera: Dryophthoridae) in İzmir province of Turkey. *Munis Entomology & Zoology*, 10 (1): 65-68]

ABSTRACT: Eight species belonging to two families of Lepidoptera were recorded as a non-target species from pheromone traps of the Red palm weevil, *Rhynchophorus ferrugineus* (Olivier, 1790) (Coleoptera: Dryophthoridae) in İzmir province of Turkey.

KEY WORDS: *Rhynchophorus ferrugineus*, Pheromone trap, Non-target species, Lepidoptera, Turkey.

The red palm weevil *Rhynchophorus ferrugineus* (Olivier, 1790) (Coleoptera: Dryophthoridae) is a devastating pest 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) and from Izmir in 2006 (Anonymous, 2013). Recently a general information is given on non-target fauna collected by pheromone traps of the Red palm weevil, *Rhynchophorus ferrugineus* in Izmir province of Turkey (Çıtırıkaya et al., 2014). In this paper, giving a short note on non-target Lepidoptera species collected by this pheromone traps was aimed at.

MATERIAL AND METHODS

Material were collected by pheromone traps in 12 locations of [Seferihisar: Doğanbey (3), Ürkmez (2); Menderes: Gümüldür (3), Özdere (4)] Izmir, western Turkey (Figure 1), during the years of 2010-2012. Containing 4-methyl-5-nonanol and 4-methyl-5-nonanone capsules known by the brand name RHYFER® were used in traps and they were cleared in two weeks intervals from March to November and monthly intervals from December to February (Çıtırıkaya et al., 2014).

RESULTS

At the end of this study, a total of eight species belonging to two families of Lepidoptera were recorded.

Crambidae

Spilomelinae

Palpita vitrealis (Rossi, 1794)

Note: This species reported from *Olea europaea* Linnaeus, 1753 in Aegean and the Marmara Regions, Antalya, Aydın (Kuşadası), Bursa, Izmir (Bergama, Bornova), Kocaeli (Darıca) and Muğla by Nizamhoğlu & Gökmen (1964). It was cited from *O.europaea* in Bursa [Mudanya (Kumyaka), Nilüfer (Gölyazı), Osmangazi (Gündoğdu)] by Kovancı et al. (2006). It was also collected from Kocaeli (Yuvacık Dam) by Beşkardeş (2012).

The larvae feed on *O. europaea*, *Arbutus unedo*, *Fraxinus* sp., *Jasminum* sp., *Ligustrum* sp.. Adults of this species collected by pheromone traps in October.

Noctuidae

Catocalinae

Catocala nymphagoga (Esper, 1787)

Note: This species listed from Güzelçamlı (Aydın) by Anonymous (2014).

The larvae live on *Quercus* spp.. Adults of this species collected by pheromone traps in this study in October.

Noctuinae

Agrochola lychnidis (Denis & Schiffermüller, 1775)

Note: This species was collected by bait traps and reported from organic cherry orchards in Muradiye (Manisa) and Izmir (Kemalpaşa, Ören) by Okyar & Tezcan (2001). Adults were collected by light traps from *Crataegus* sp., *Salix* sp., *Ranunculus* sp. and *Trifolium* sp. in Adana (Balcalı) by Demirezer (2006).

The larvae are polyphagous on herbs and also shrubs. Adults of this species were collected by pheromone traps in November.

Dryobota labecula (Esper, 1788)

Note: This species was collected by light traps and reported from *Q.ilex* in Adana (Balcalı) by Demirezer (2006).

The larvae live on *Quercus* spp. Adults of this species were collected by pheromone traps in November.

Peridroma saucia (Hübner, 1808)

Note: This species was collected by bait traps and reported from organic cherry orchards in Muradiye (Manisa) by Okyar & Tezcan (2001). It was cited from *Abies* sp., *Pinus* sp., meadow in Kastamonu (Şenpazar-Isırganlı Mountain-950 m) by Okyar (2012). It was collected from Kocaeli (Yuvacık Dam) by Beşkardeş (2012).

The larvae are polyphagous on herbs and also shrubs and trees. Adults of this species were collected by pheromone traps in October.

Spodoptera littoralis (Boisduval, 1833)

Note: This species was collected by bait traps and reported from organic cherry orchards in Izmir (Kemalpaşa, Ören) by Okyar & Tezcan (2001). Adults of this species were collected by light traps and reported from herbaceous plants and vegetables in Adana (Balcalı) by Demirezer (2006).

The larvae are polyphagous. Adults of this species were collected by pheromone traps in October.

***Xylena exsoleta* (Linnaeus, 1758)**

Note: This species cited from *Rheum ribes* and *Euphorbia* sp., in Adana, Amasya, Ankara, Aydın, Burdur, Eskişehir, Kahramanmaraş, Kars, Manisa, Mersin, Van (Erek Mountain, Sarnaç 2200 m), Yozgat (Kemal et al., 2008).

The larvae are polyphagous on herbs and also shrubs and deciduous trees. Adults of this species were collected by pheromone traps in March.

Plusiinae

***Chrysodeixis chalcites* (Esper, 1789)**

Note: This species was reported from Istanbul by Graves (1925), Istanbul (Çıldır Lake) by De Lattin (1951), Izmir by Zümreoğlu (1972), Istanbul, Sakarya, Kocaeli by Keyder (1978), Tekirdağ (Malkara) by Hacker (1987), Ankara by Ronkay et al. (1990), Edirne (Thrace University Merkez Campus, 41 m), Kırklareli (Demirköy, İğneada) by Okyar & Kornoşor (1997), Kocaeli (Yuvacık Dam) by Beşkardeş (2012). It was collected by bait traps in organic cherry orchards in Muradiye (Manisa) by Okyar & Tezcan (2001). It was collected by light traps and reported from *Convolvulus* sp., *Cytisus* sp., *Heliotropium* sp., *Parietaria* sp., *Solanum* sp. and *Urtica* sp. in Adana (Balcalı) by Demirezer (2006), and cited from *Pinus* sp. and graminaceous plants in Bolu (Gölcük, Aladağ, 1250 m) by Okyar (2012).

The larvae are polyphagous on herbs, fruits, ornamental plants and vegetables. Adults of this species were collected by pheromone traps in this study in October.

At the end of this study a total of eight species were collected as a non-target Lepidoptera species by pheromone traps of the Red palm weevil. They are not known as pests of palm trees. Generally, their larvae are polyphagous on herbs, fruits, ornamental plants and vegetables.

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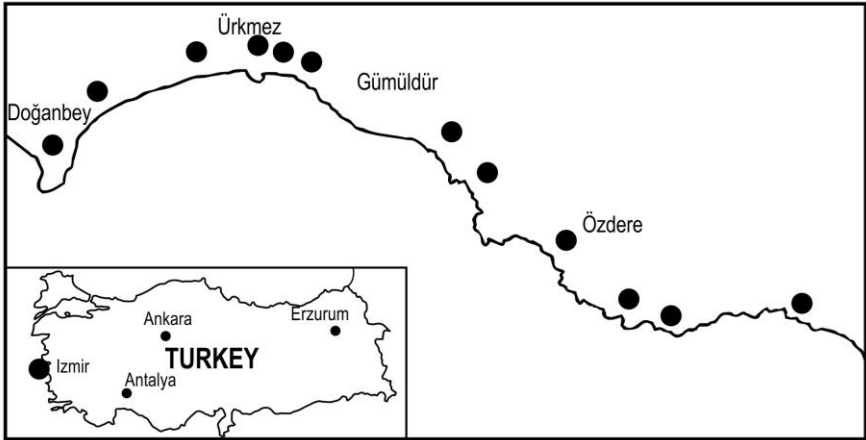


Figure 1. Map of studied area.

**COROLOGICAL NOTES ON SOME SPECIES OF
PYGOLEURUS (COLEOPTERA: GLAPHYRIDAE)
FROM THE GREEK ISLAND OF LESBOS**

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[Bollino, M. & Ruzzante, G. 2015. Corological notes on some species of *Pygopleurus* (Coleoptera: Glaphyridae) from the Greek Island of Lesbos. Munis Entomology & Zoology, 10 (1): 69-74]

ABSTRACT: The authors report the presence of five species of *Pygopleurus* from Lesbos Island (Greece), of which *Pygopleurus kareli* (Petrovitz, 1962), *Pygopleurus labaumei* (Petrovitz, 1971) and *Pygopleurus medius* (Petrovitz, 1957) are new for Greece and therefore for Europe. They also made some observations on intraspecific variability of *Pygopleurus labaumei* (Petrovitz, 1971), *Pygopleurus medius* (Petrovitz, 1957) and *Pygopleurus vulpes* (Fabricius, 1781).

KEY WORDS: *Pygopleurus*, Lesbos, taxonomy, chorology, Glaphyridae.

The Glaphyridae are one of the main components of the antophilous fauna of the Eastern Mediterranean islands during springtime, but, in spite of their abundance and ease of sampling, the faunistic composition of the Aegean islands is poorly known. Apart from occasional reports for single localities, and the description of a *Pygopleurus* from the island of Kos, so far only known from the type series (Piattella & Sabatinelli, 1992), no comprehensive data on the presence of members of this family in the area are available.

To the best of our knowledge, up to now only three species of *Pygopleurus* are recorded (Baraud, 1989) from the Island of Lesbos: *Pygopleurus foina* (Reitter, 1890), *Pygopleurus anemoninus* (Brullé, 1832), and *Pygopleurus vulpes* (Fabricius, 1781).

During a visit to Lesbos in the second half of March 2014, G. Ruzzante had the opportunity to sample the local populations of Glaphyridae, collecting 198 *Pygopleurus* specimens. The study of such specimens (presently preserved in the authors' collections, and in the collections of Guido Sabatinelli and Marco Uliana) allowed us to ascertain the presence of five species of the genus *Pygopleurus*, three of them being new to Aegean Greece and therefore to Europe.

The species are listed below in alphabetical order, without consideration of the groups proposed by Baraud (1989).

***Pygopleurus foina* (Reitter, 1890)** (plate 1: A)

This species was previously recorded from the Island (Baraud, 1989). Only a few specimens were collected in central Lesbos: Halinados archeological site, ~ 39°13'N 26°18'E, 19-20.III.2014 – m 70 (2♂♂); near Polichnitos, ~ 39°04'N 26°10'E, 22.III.2014 – m 100 (2♂♂, 1♀). The low frequency of this usually common species is probably related to its late phenology compared to that of other collected species.

***Pygopleurus kareli* (Petrovitz, 1962)** (plate 1: B)

This species had never been recorded from Lesbos, while the sibling species

Pygopleurus anemoninus (Brullé, 1832) was reported from this Island by Baraud (1989). After study of a long series of both taxa from various localities of Greece and Turkey, we noticed that the two taxa are quite close morphologically in the color of the integuments and setae, while the subjective evaluation of the shape of the parameres, especially when compared with the drawings by Baraud (1989), may cast doubts on the identification of some specimens and their records. However, as observed with other Glaphyridae species (Uliana & Sabatinelli 2010), we noticed that the structure of the endophallus shows a more stable species-specific shape, thus permitting an unambiguous identification. Applying the Berti-Vachon method (Bontems, 2013) we obtained a full eversion of the endophallus of Greek specimens of *Pygopleurus anemoninus* (Fig. 1) and of Turkish specimens of *Pygopleurus kareli* (Fig. 2). Comparing them with the same structure of specimens from Lesbos (Fig. 3), we concluded that the specimens from the Greek Island belong to the Anatolian taxon *P. kareli*. In fact, the endophallus of *Pygopleurus* species, when fully everted, consists of multiple diverticula whose shape is diagnostic at species level. The most important species-specific characters are found in the dorsal and flagellar (or apical) diverticula, while the lateral and apico-ventral ones are usually, but not always, less diagnostic. In the case of *Pygopleurus kareli* and *P. anemoninus*, the dorsal diverticulum of *P. kareli* shows, in lateral view, a quadrangular shape, while in *P. anemoninus* the same diverticulum is subtriangular.

When we had to decide which term should be used to indicate the genitalic everted structure, we realized that the same is indicated by different authors in at least two ways: "endophallus" and "internal sac".

Without claiming to be exhaustive, the term "endophallus" is used in reference to the Carabidae (Berlov, 1992, Angus et al., 2000), Cerambycidae (Danilevsky et al., 2005; Dascalu & Fusu, 2012), Curculionoidea (Hamilton, 1979; Van Dam, 2014), Chrysomelidae (De Monte, 1948; Döngelhof & Schmitt, 2006; Leonardi & Sassi, 2001), Glaphyridae (Uliana & Sabatinelli, 2010), Lucanidae (Imura, 2007) and Scarabaeidae (Sabatinelli, 1984; Montreuil, 2000; Coca-Abia, 2007), while the term "internal sac" is used to refer to Curculionidae (Anderson, 1988), Cerambycidae (Kasatkin, 2006), Chrysomelidae (Bontems, 2013) and Glaphyridae (Li, Wang & Chen, 2011). The use of one of the two terms by multiple authors and for the same families led us to assume that "endophallus" and "internal sac" can be regarded as synonyms of the same structure. By applying, although in a very improper sense, the principle of the maintenance of prevailing usage, we decided to use the term endophallus.

Lastly, the presence of *Pygopleurus kareli* on Lesbos is more likely, due to the strict faunistic affinities between the Island and the Anatolian landmass. On the other hand, we are tempted to exclude the presence in the same area of *Pygopleurus anemoninus*, which is most likely restricted to Peloponnesus (Bollino, Uliana & Sabatinelli, in prep.).

Specimens of both sexes were collected in central and southern Lesbos: near church 1 km W of Keramia, ~ 39°07'N 26°24'E, 22.III.2014 – m 25 (10♂♂, 10♀♀); Agios Efstratios, ~ 39°06'N 26°22'E, 22.III.2014 – m 170 (3♀♀); Tarti, ~ 38°58'N 26°29'E, 24.III.2014 – m 10 (9♂♂, 7♀♀).

New to Aegean Greece, and the European fauna.

***Pygopleurus labaumei* (Petrovitz, 1971) (plate 1: C)**

P. labaumei is another species rarely present in collections, and is apparently restricted to Western Turkey. The species seems to have an early phenology: in early May only few worn females were collected near Aphrodisia (Turkey, Denizli

Prov.), leading to the assumption that the Turkish specimens were found well past the peak of emergence of the species.

As underlined by Baraud (1989), males have a truncated elytral apex without any trace of a sutural tooth, while females have a well marked sutural tooth. We noticed some variability in the shape of the apical edge of the females' elytras, being truncated or concave in various degrees (Fig. 4).

Several specimens of both sexes were collected in three localities in central and southern Lesbos: near church 1 km W of Keramia, ~ 39°07'N 26°24'E, 22.III.2014 – m 25 (1♀); Agios Efstratios, ~ 39°06'N 26°22'E, 22.III.2014 – m 170 (4♂♂, 4♀♀); Tarti, ~ 38°58'N 26°29'E, 24.III.2014 – m 10 (45♂♂, 24♀♀). The species had already been collected in Lesbos, although no records have been published: Hagiasos S., 500m, 7/8.5.1933, leg. A. d'Orchymont (2♂♂, 1 ♀, coll. G. Sabatinelli); Mt Olimbos, 1200m, 15.4.65, leg. Cerruti & Henrot, det. Baraud 1991 (1 ♂, coll. G. Sabatinelli); env. Sikounda, 120-205 m, 39°06.2' N 26°24.5'E, in olive orchard, 21.IV.2007, leg. T. Ruzicka (1♂, 1♀, coll. M. Uliana).

New to Aegean Greece, and to the European fauna.

***Pygopleurus medius* (Petrovitz, 1957)** (plate 1: D-E)

P. medius is a rarely collected species, which is known only from a few scattered localities in Southern and Western Turkey (Petrovitz, 1957, 1962; Rozner & Rozner, 2009). The species was described from “Kleinasien: Cilic. Taurus, Smyrna”. To the best of our knowledge, *Pygopleurus* species ranging from “Cilician Taurus” (Adana province) to NW Turkey (Aydin, Izmir, Manisa provinces, among others) are rare. Moreover none of the females collected on Lesbos correspond to the original description, since the apical third of their elytras are blackish in color, thus fitting the infrasubspecific female form *nigroapicalis* described by Petrovitz (1962) from Cilician Taurus. For such reasons we were hesitant to refer the population from Lesbos to *Pygopleurus medius*, but, on the other hand, the male genitalia perfectly match the drawing by Petrovitz (1957: pg 54, fig. 18), so we concluded that our specimens belong to this taxon. At last, Uliana (pers. comm.) directly compared the specimens from Lesbos with the holotype of *Pygopleurus medius*, and confirms that the former perfectly match the type.

Several specimens of both sexes were collected in two localities in central Lesbos: Halinados archeological site, ~ 39°13'N 26°18'E, 19-20.III.2014 – m 70 (17♂♂, 21♀♀); near Polichnitos, ~ 39°04'N 26°10'E, 22.III.2014 – m 100 (3♂♂, 2♀♀). Also this species had already been collected in Lesbos, although no records have been published: Mt Olimbos, 1200m, 15.4.65, leg. Cerruti & Henrot, det. Baraud 1991 (1 ♂, 1 ♀, coll. G. Sabatinelli).

New to Aegean Greece, and to the European fauna.

***Pygopleurus vulpes* (Fabricius, 1781)** (plate 1: F)

P. vulpes is a widespread but usually localized species, which was reported from Lesbos by Baraud (1989). Within the genus, *Pygopleurus vulpes* is perhaps the species with the widest distribution, ranging from Macedonia and North-Eastern Greece eastward to Central Asia (Kazakhstan) (Nikodym & Bezdek, 2006). The species shows little variability of integuments and setae, an exception being their occasional tendency to be of reddish color instead of the straw-yellow color observed in most specimens. So we were a little bit surprised in finding that all our specimens from Lesbos have the same dark orange color. We are not in the position to establish if the populations of the Island always and everywhere show

the same pattern or not, so we only report the pattern of our specimens.

The species was observed in northern and central Lesbos: Andissa – cross road to Eresos, ~ 39°13'N 25°57'E, 17.III.2014 – m 300 (1♂); Halinados archeological site, ~ 39°13'N 26°18'E, 19-20.III.2014 – m 70 (31 ♂♂, 1♀).

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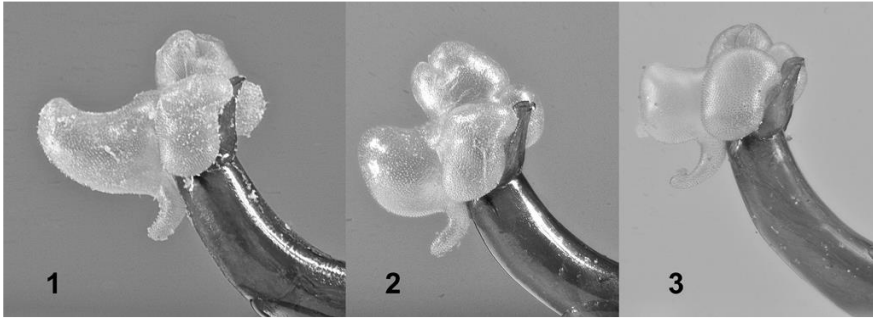
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Figures 1-3. 1. *Pygopleurus anemoninus* (Greece, Peloponnesus), endophallus in lateral view; 2. *Pygopleurus kareli* (Turkey, Aydin), endophallus in lateral view; 3. *Pygopleurus kareli* (Lesbos), endophallus in lateral view.

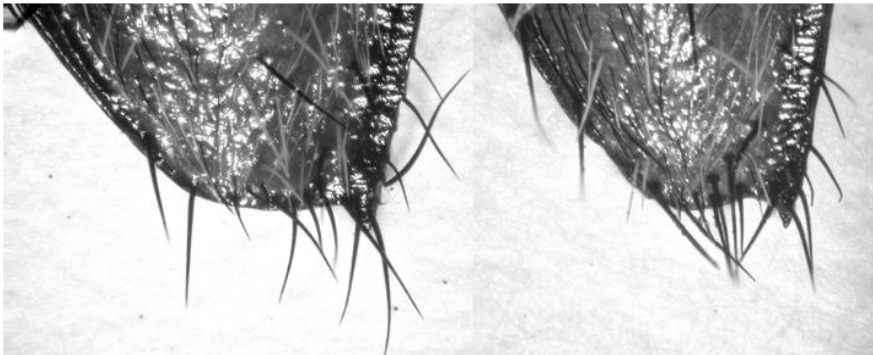


Figure 4. Different shape of elytral apex in *Pygopleurus labaumei* females.

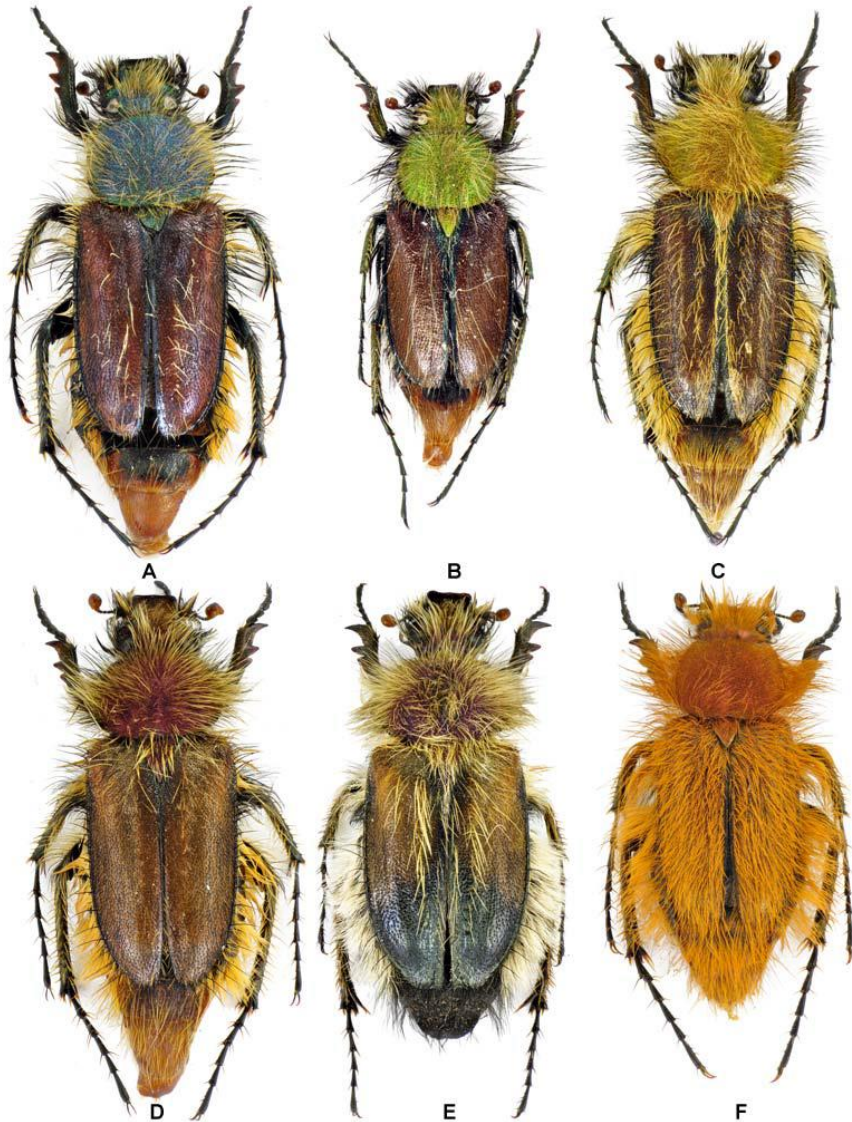


Plate 1 - A: *Pygopleurus foina* male; B: *Pygopleurus kareli* male; C: *Pygopleurus labaumei* male; D: *Pygopleurus medius* male; E: *Pygopleurus medius* female; F: *Pygopleurus vulpes* male. Specimens A-D-E-F with data: Greece, Lesbos Island, Halinados archeological site, ~ 39°13'N 26°18'E, 19-20.III.2014 – m 70; specimen B with data: Greece, Lesbos Island, near church 1 km W of Keramia, ~ 39°07'N 26°24'E, 22.III.2014 – m 25; specimen C with data: Greece, Lesbos Island, Tarti, ~ 38°58'N 26°29'E, 24.III.2014 – m 10.

**PARASITIDS COMPLEX IN SUMMER POPULATIONS OF
ASPHONDYLIA PUNICA MARCHAL, 1897 (DIPTERA:
CECIDOMYIIDAE) ON THE MEDITERRANEAN SALTBUSH,
ATRIPLEX HALIMUS L. (CHENOPODIACEAE) IN EGYPT,
WITH DESCRIPTIONS OF NEW SPECIES FROM EUPELMIDAE
AND EULOPHIDAE (HYMENOPTERA: CHALCIDOIDEA)**

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[Doğanlar, M. & Elsayed, A. K. 2015. Parasitoids complex in summer populations of *Asphondylia punica* Marchal, 1897 (Diptera: Cecidomyiidae) on the Mediterranean Saltbush, *Atriplex halimus* L. (Chenopodiaceae) in Egypt, with descriptions of new species from Eupelmidae and Eulophidae (Hymenoptera: Chalcidoidea). Munis Entomology & Zoology, 10 (1): 75-85]

ABSTRACT: Parasitoids complex in summer populations of *Asphondylia punica* Marchal, (Diptera: Cecidomyiidae) on the Mediterranean Saltbush, *Atriplex halimus* L. (Chenopodiaceae) in Egypt was studied. The hymenopterous parasitoids are: Eupelmidae: *Neanastatus misirensis* n. sp.; Eulophidae: *Kolopterna aymani* Doğanlar, 2013, *Aprostocetus alexandrianensis* n. sp., *Neochrysocharis formosa* (Westwood, 1833); Eurytomidae: *Eurytoma dentata* Mayr, 1878; Ormyridae: *Ormyrus monegricus* Askew, 1994; Torymidae: *Microtontomerus annulatus* (Spinola, 1808) and Platygasteridae (Proctotripoidea): *Platygaster* sp. The descriptions and biological data of each species were given.

KEY WORDS: Parasitoids, *Asphondylia punica*, *Atriplex halimus*, Egypt.

The larvae of *Asphondylia punica* Marchal, 1897 (Diptera: Cecidomyiidae) cause large galls up 40 mm long on the stems and flower buds Mediterranean Saltbush, *Atriplex halimus* L. (Chenopodiaceae) in the Mediterranean region (Tavares, 1931; Skuhrava et al., 1993; Skuhravy & Skuhrava, 1999; Skuhrava et al., 2006; Elsayed et al., 2014, in preparation).

Doğanlar & Elsayed (2013) studied on the parasitic complex of *A. punica* on the *A. halimus* in Egypt in winter population and found 5 parasitoids species of Chalcidoidea.

Besides of those works, Dixon et al. (1998) studied on gall morphology and community composition in *Asphondylia floccosa* (Cecidomyiidae) galls on *Atriplex polycarpa* (Chenopodiaceae) in Arizona, USA and it was found that "The community of natural enemies also varied significantly among populations and more markedly between seasons. Both *A. floccosa* and its parasitoid, *Rileyia tegularis* Gahan (Hym.: Eurytomidae) were much more abundant in spring samples than in autumn samples. In contrast, *Torymus cappilacetus* (Hüber) (Hym.: Torymidae) and an undescribed species of *Galeopsomyia* (Hym.: Eulophidae) were abundant in the autumn samples but almost non-existent in the spring samples. The first 2 species tended to emerge from relatively large galls while the latter 2 species tended to emerge from small galls. *Torymus umbilicatus* (Gahan) (Hym.: Torymidae) was the only parasitoid abundant in samples from both seasons."

Gibson (2009) stated that most species of *Neanastatus* Girault, 1913 are

primary or hyperparasitoids of the gall midges (Cecidomyiidae: Diptera), and gave diagnostic characters of *Neanastatus* and compared it with the morphological characters of closely related genera of Neanastatinae (Hymenoptera: Eupelmidae). Ferriere (1938) revised the 34 species of *Neanastatus* all over the world, eight of them were from Africa, and designed an identification key and gave their diagnostic characters. Narendran et al. (2006) make a revision of *Neanastatus* species of India and provided an identification key for 13 species of Oriental Region.

Systematic and taxonomy of *Aprostocetus* spp. (Hymenoptera: Eulophidae) was studied by Graham (1987), of *Neochrysocharis* spp. (Hymenoptera: Eulophidae) by Hanson (1990), of *Eurytoma* spp. (Hymenoptera: Eurytomidae) by Zerova (2010), of *Ormyrus* spp. (Hymenoptera: Ormyridae) by Doğanlar (1991a,b); Askew (1994), of *Microdontomerus* spp. (Hymenoptera: Torymidae) by Zerova & Seregina (1999) and of *Platygaster* spp. (Hymenoptera: Platygasteridae) by Buhl (2007). Distributions, synonyms and hosts of chalcidoid species were recorded by Noyes (2013).

By this work the parasitoids of the gall midge, *A. punica* on the stems and flower buds of the Mediterranean Saltbush, *A. halimus* was collected in Summer, 2013 were studied, the new species were described, and the effectiveness of the parasitoids in Summer and Winter generations in Alameria District, Egypt were discussed.

MATERIALS AND METHOD

The study was conducted in the period from May to October, 2013 in Alameria District, 30°59'54"N, 29°49'70"E, Alexandria, Egypt by the second author. The methods for rearing parasitoids and mounting slides were followed the methods as given by Doğanlar & Elsayed (2013). To differentiate between the primary and hyper parasitoids, the galls were dissected after emergence of the adult parasitoids. The contents of the empty galls were temporary mounted on slides in glycerin medium, then examined under microscope. If it contained only one pair of larval mandibles, it will be considered as primary parasitoid, while if it contained more than one pair of larval mandibles, it will be considered as hyperparasitoid.

Morphological terminology follows Graham (1987). The study is based on the specimens reared from the host. The new taxa were identified by following the keys of Graham (1987), and compared with the species of the genera from the Palearctic Region. The examined specimens were deposited in the collection of the Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC). Photographs of diagnostic characters of the species were taken by using a stereo-microscope (LEIKA GM 500, Germany) with a digital camera (LEIKA ICC50 HD) attached to it.

Abbreviations used: C1-C3: claval segments 1 to 3; EL: Eye length; EW: Eye width; F1-F5: Funicular segments 1 to 5; MV: Marginal vein; MS: Malar space; OAL: Minimum distance between the posterior ocellus and anterior ocellus; OCL: Minimum distance between the posterior ocellus and occipital margin; OOL: Ocellular distance; PMV: Postmarginal vein; POL: Postocellar distance; SMV: Submarginal vein; STV: Stigmal vein.

RESULTS AND DISCUSSION

By the work conducted in the Summer of 2013 showed that the parasitic complex of *A. punica* in the newly developed galls are mostly differs from the ones developed in winter populations which were published by Doğanlar & Elsayed (2013). The hymenopterous parasitoids are: Eupelmidae: *Neanastatus misirensis* n. sp., Eulophidae: *Kolopterna aymani* Doğanlar, *Aprostocetus alexadrianensis* n. sp., *Neochrysocharis formosa* (Westwood, 1833); Eurytomidae: *Eurytoma dentata* Mayr, 1878; Ormyridae: *Ormyrus monegricus* Askew, 1994; Torymidae: *Microtontomerus annulatus* (Spinola, 1808) and Platygasteridae (Proctotripodea): *Platygaster* sp. The descriptions and biological data of the studied species were given as follows:

***Neanastatus misirensis* Doğanlar n. sp.**

(Figs. 1a-h, 2a,b)

Diagnosis: Body yellow, except as follows: mandible pale yellow with teeth brown; antennae apically pale brown; along the sutures between pronotum and propleuron with pale brown band, acropleuron anteriorly pale brown, towards posterior become darker with metallic blue reflection, other pleura and sterna pale brown, metanotum and propodeum brown, forewing hyaline with veins and setae black, fore and mid leg yellow, the latter with tibial spurs and one row of mesotarsal pegs along each ventrolateral margin of the mesotarsus brown; hind leg black, except apical 2/3 of hind coxa and first three segments of tarsus white, gaster black with metallic blue reflection, except dorsal 2/3 of 1st tergum yellow to brown; POL= 15; OOL= 4; OCL= 5; OAL= 10 ; Antenna with funicular segments in both sexes at most 2.5 times as long as width; pronotum shorter than mesoscutum. Forewing with PMV about 3.6x length of STV; mid tibial spur as long as combined length of 3 basal tarsal segments; hind basitarsus 1.5x as long as combined length of 2 following tarsal segments together. Gaster about 3.3x as long as width, 1.75x longer than mesosoma.

Description:

Female: Body (Fig. 1a). Length 2.2-3.2 mm. Color patterns as given diagnosis.

Head (Fig. 1b): Width in anterior view subequal to its length, distinctly punctate-reticulate on frons and vertex; mandibles bidentate; toruli oval; interantennal projection slightly convex, not narrow; MS=12, 0.52x EL; EW: EL= 14: 23; antennae inserted a little below lower ocular line; POL= 15; OOL= 4; OCL=5; OAL= 10; vertex sharply margined posteriorly; occiput steeply declined; antenna (Fig. 1 d) with 11153; scape 0.33x of rest of antenna, a little expanded towards apex. Relative length: width of antennal segments: scape= 45: 11; pedicel= 15:11; anellus= 3: 7; F1= 17: 10; F2= 15: 11; F3= 13: 11; F4= 13: 12; F5= 12: 15 ; clava= 43: 20.

Mesosoma (Fig. 1c): twice as long as width ; with pronotum large, subtriangle, 1.75x as wide as long, half length of mesoscutum, posterior margin broadly concave; mesoscutum slightly wider than pronotum, almost quadrate; scutellum half length of mesoscutum (18: 40); its maximum width at base a little less than 2x its length (15: 18), narrower towards apex, medially divided by a longitudinal sulcus; the axillar carina, which separates the dorsal and lateral axillar surfaces, developed more distinctly into a flange; mesopleura with finely lineolate-reticulate sculpture anteriorly, posterior half finely longitudinally striate, propodeum with plical region linear in the form of vertical strip, concealed by scutellar apex. Macropterous, forewing (Fig. 1e) 3x as long as wide, 0.87x as long as gaster, strongly pilose, except for a long hairless streak curved from anal area

towards anterior edge of wing at about middle of MV; Hind wing (Fig. 1f) 3.67x as long as width. Relative lengths of veins: SMV= 93; MV=70; PMV=50; STV=14. Mid tibial spur (Fig. 1g) as long as combined length of basal 3 tarsal segments; hind basitarsus (Fig. 1h) 1.5x as long as combined length of 2 following tarsal segments together.

Gaster (Fig. 1a): about 3.3x as long as width, 1.75x longer than mesosoma; posterior margin of T1 deeply incised medially; last tergite narrow conical, slightly wider than length, ovipositor sheath hardly extended.

Male (Fig. 2a): Length 1.4-2.5 mm. Similar to female except as follows: head with occiput, behind eyes black, antenna pale brown, eyes white, ocelli dark brown, pronotum with narrow black band laterally, mesosonotum with anterior margin, side lobes, and lateral margins black, scutellum with sutures brown, gaster with terga having apical margin yellow; Antenna (Fig. 2b) with relative length: width of antennal segments: scape= 35: 11; pedicel= 10:11; anellus= 2: 7; F1= 22: 14; F2= 18: 16; F3= 18: 16; F4= 17: 17; F5= 17: 17; clava= 43: 17. Mesosoma about twice as long as width, and as long as metasoma, the latter 3x as long as width.

Material examined: Holotype: Female, EGYPT: Alameria District, Alexandria, 30°59'54"N, 29°49'70"E, 23rd June, 2013, reared from galls of *A. punica* on the stems and flower buds of the Mediterranean Saltbush, *A. halimus*, leg. Elsayed, deposited in the collection of the Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC).

Paratypes: 86 females, 84 males, same data as holotype, except collected in June to September, 2013 and 10 females and 10 males paratypes were deposited in the collection of Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Egypt.

Comments: *Neanastatus misirensis* n. sp. is similar to *Neanastatus reksonus* Narendran, 1996 and *Neanastatus turneri* Ferriere, 1938 in having pale colored body, but it differs from *N. reksonus* in having POL 3x OCL (in *N. reksonus* POL equal to OCL); apical 2 segments of hind tarsus black (in *N. reksonus* only apical segment black); mandible two-teethed (in *N. reksonus* mandible tridentate); POL 3x OOL (in *N. reksonus* POL 0.6 OOL); from *N. turneri* in having forewing hyaline (in *N. turneri* forewing with a discal cloud); funicular segments short, F1 1.7x, F2 1.4x as long as width, clava about as long as 3 preceding segments together (in *N. turneri* funicular segments long, F1 3.6x, F2 2.7x as long as width, clava distinctly shorter than 3 preceding segments together); POL 3x OCL (in *N. turneri* POL 2x OCL); PMV 3.6x STV (in *N. turneri* PMV more than 4x STV); mid tibial spur as long as combined length of basal 3 tarsal segments; hind basitarsus 1.5x as long as combined length of 2 following tarsal segments together (in *N. turneri* mid tibial spur shorter than combined length of basal 3 tarsal segments; hind basitarsus longer than combined length of 3 following tarsal segments together).

***Kolopterna aymani* Doğanlar, 2013**

Kolopterna aymani Doğanlar, 2013: 1800-1804, in Doğanlar & Elsayed, 2013, Holotype female and some paratypes in IMRSBC, some female and males paratypes in the collection of Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Egypt.

Material examined: EGYPT: 36 Females, 83 males, Alameria District, Alexandria, 30°59'54"N, 29°49'70"E, June to September, 2013, reared from galls of *A. punica* on the stems and flower buds of the Mediterranean Saltbush, *A. halimus*, leg. El Sayed, deposited in the collection of the Insect Museum of

Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC) and (10 females and 10 males were deposited in the collection of Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Egypt).

***Aprostocetus alexandrianensis* Doğanlar n. sp.**

(Figs. 3a-f)

Diagnosis: Very small squat body black, including tegulae and legs, body length 0.8-1.5 mm; head nearly 1.13x as wide as long, OOL about 1.3 OD; antenna of female with F1 1.62x, F2 1.33x, F3 1.2x and clava 2.0x as long as width; mid lobe of mesoscutum without median line, or only slightly indicated; scutellum about 1.6x as wide as long, anterior setae of scutellum 3.33x far from front edge of scutellum as from posterior setae, and propodeum medially 0.6 length of dorsellum; spur of mid tibia at least 1.3x as long as basitarsus; fourth segment of mid and hind tarsi about 1.5x basitarsus; forewing with marginal vein having its front edge with 7 setae; gaster long, 1.3x as long as width. In male antenna F1 1.54x and clava 3.75x as long as width.

Female: Body (Fig. 3a). Length 0.8-1.5 mm. Head nearly 1.13x as wide as long; POL about 1.8 OOL, OOL about 1.3 OAL. Eyes 1.7x as long as width, separated by 1.25 their length. Malar space about 0.5 length of eye. Mouth equal to malar space. Antenna (Fig. 3c) with scape 0.88x eye length, reaching lower edge of median ocellus; pedicellus plus flagellum almost as long as breadth of mesoscutum; pedicellus slightly longer than F1 (15:13); 1.87x as long as width; funicle proximally slightly stouter than pedicellus, thickening a little distad, its segment decreasing slightly in length, F1 1.62x, F2 1.33x, F3 1.2x as long as width; clava distinctly wider than F3, 2.0x as long as width, rather obtuse, with C1 about as long as width, C2 and C3 progressively shorter, spine about 0.3 length of C3; sensilla 3-4 on each funicular segments, 5-6 on claval segments in one row.

Thorax (Fig. 3a) about 1.25x as long as width, strongly arched dorsally. Mid lobe of mesoscutum 1.4x wider than long, shiny, reticulation fine, and superficial, with most areoles about 2.5-3.0x as long as width, median line absent or slightly indicated, 3 adnotaular setae on each side. Scutellum about 1.6x as wide as long, strongly convex, more finely reticulate than mesoscutum; submedian lines not, or only slightly, nearer to sublateral lines than to each other, enclosed space 2.10x as long as width; anterior setae behind the middle and about 3.33x as far from front edge of scutellum as from posterior setae. Propodeum rather strongly transverse, rather broadly emarginated posteriorly, medially 0.6 length of dorsellum; median carina sharp, thin and weakly foveate in front but rapidly expanding caudad. Legs of medium length and thickness; hind coxae oblique, about 1.4x as long as width; hind femora 3.8x as long as width; spur of mid tibia 1.27x length of basitarsus; fourth segment of mid and hind tarsi about 1.5x basitarsus.

Forewing (Fig. 3e) 2.33x as long as width, with costal cell shorter than MV, 10x as long as width; SMV with 3 dorsal setae; MV 3.86x length of STV, its front edge with 7 setae; PMV a short stub; STV at about 60° slightly curved, rather thin proximally but expanding beyond half its length to form a small stigma which is longer than high; speculum broad, open at base, extending below MV, wing just beyond it rather sparsely pilose, more thickly distad; cilia almost as length of STV. Hind wing obtuse; cilia 0.51 breadth of wing.

Gaster (Fig. 3a) lanceolate, 1.55x as long as thorax, 1.3x as long as width, about 1.2x as wide as thorax; last tergite 1.9x as long as broad; longest seta of each cercus 1.5-1.6x length of next longest; ovipositor sheaths projecting very slightly.

Color. Body black with bluish metallic tint; antenna fuscous to black with scape beneath, pedicellus beneath and apex, testaceous. Coxae coloured like body;

trochanters partly pale; femora black with tips rather narrowly testaceous; fore tibia pale or partly infusate, mid and hind tibiae broadly infusate medially or mainly black, their bases and tips testaceous; fore tarsi fuscous, mid and hind tarsi pale with fourth segment fuscous. Tegulae black with metallic tint. Wings hyaline, venation yellowish.

Male: Body (Fig. 3b). Length 0.7- 1.2 mm. Antenna (Fig. 3d) with scape 0.83x length of eye, reaching level of vertex, 3.2x as long as width, with ventral plaque 0.23 length of scape; pedicellus plus flagellum 1.26x breadth of mesoscutum; pedicellus 1.8x as long as width, slightly longer than F1; funicle proximally only slightly stouter than pedicellus, hardly tapering distad; F1 slightly shorter than F2 (17: 20), 1.54x as long as width; F2 twice, F3 2.5x, F4 2.3x as long as width. Clava slightly broader than F4, slightly shorter than F3 plus F4, 3.75x as long as width, with C1 1.5x as long as width, C2 almost equal to C1, 1.36x as long as width, C3 short, as long width; whorled setae long, those of F1 reaching about to half of F3. Gaster oblong, as long, and wide as thorax, with ventral plica. Genitalia (Fig. 3f) 3.8x as long as width, with one digitus.

Color: Body black, except as follows: eye red, ellipsoidal area around ocelli, circular area around toruli, trochanters, apical 1/4 of femora, tibia, 1-3 tarsal segments, 1st tergum and basal segments of sterna yellow; antenna pale brown, except scape dorsally and plaque black.

Material examined: Holotype: Female, EGYPT: Alameria District, Alexandria, 30°59'54"N, 29°49'70"E, June, 2013, reared from galls of *A. punica* on the stems and flower buds of the Mediterranean Saltbush, *A. halimus*, leg. Elsayed, deposited in the collection of the Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC).

Paratypes: 9 females, 17 males, same data as holotype, except collected in June to September, 2013 (3 females and 7 males paratypes were deposited in the collection of Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Egypt).

Comments: *Aprostocetus alexandrianensis* n. sp. by following the key of Graham (1987) for females of species of *Aprostocetus* it goes to the couplet 145 in having small black body, including tegulae and legs; anterior setae of scutellum at least twice far from front edge of scutellum as from posterior setae, and propodeum almost as long as dorsellum. In this group there are 3 species, *A. artemisicola*, *A. brachycerus* and *A. epilobii*, as associated with galls of Cecidomyiidae species. *Aprostocetus alexandrianensis* n. sp. is close to *A. artemisicola* in having very small squat body, 0.8-1.5 mm, and long gaster 1.3x as long as width, but it differs in having anterior setae about 3.33x as far from front edge of scutellum as from posterior setae (in *A. artemisicola* anterior setae about less than twice as far from front edge of scutellum as from posterior setae); propodeum medially 0.6 length of dorsellum (in *A. artemisicola* propodeum a little shorter than dorsellum). *Aprostocetus alexandrianensis* n. sp. is similar to *A. brachycerus* and *A. epilobii* in having gaster 1.3x as long as width, anterior setae at least twice far from front edge of scutellum as from posterior setae and antenna with, F1 1.62x, F2 1.33x, F3 1.2x as long as width; clava 2.0x as long as width but it differs from both of them in having spur of mid tibia at least 1.3x as long as basitarsus (in the both species spur of mid tibia as long as basitarsus), head nearly 1.13x as wide as long, OOL about 1.3 OD (in the both species head 2.3-2.4x as wide as long, OOL 1.8-2.0x OD), mid lobe of mesoscutum without median line, or only slightly indicated (in the both species median line of mesoscutum distinct), scutellum about 1.6x as wide as long, (in the both species scutellum about 1.35-1.40x as wide as long), forth segment of mid and hind tarsi about 1.5x

basitarsus (in the both species forth segment of mid and hind tarsi slightly shorter than basitarsus), forewing with marginal vein having its front edge with 7 setae (in the both species forewing with marginal vein having its front edge with 10-14 setae. In male antenna with F1 1.54x as long as width (in the both species F1 quadrate), clava 3.75x as long as width (in the both species clava at least 4.3x as long as width).

***Neochrysocharis formossus* (Westwood, 1833)**

Closterocerus formosus Westwood, 1833: 420.

Material examined: EGYPT: 3 Females, Alameria District, Alexandria, 30°59'54"N, 29°49'70"E, June to September, 2013, reared from galls of *A. punica* on the stems and flower buds of the Mediterranean Saltbush, *A. halimus*, leg. Elsayed, deposited in the collection of the Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC) and (2 females were deposited in the collection of Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Egypt).

Comments: *Neochrysocharis formossus* was recorded for the first time from Egypt and Africa, and *A. punica* was recorded as new host of *N. formossus*. Up to now it has been recorded many species of insects including leaf miner Diptera, Lepidoptera and some Hymenoptera (Noyes, 2013), but only one species of gall midges, *Cystiphora schmidti* (Rubsaaen) (Diptera, Cecidomyiidae) in the eastern Mediterranean region (Caresche & Wapshere, 1975).

***Eurytoma dentata* Mayr, 1878**

Material examined: EGYPT: 115 Females, 181 males, Alameria District, Alexandria, 30°59'54"N, 29°49'70"E, June to September, 2013, reared from galls of *A. punica* on the stems and flower buds of the Mediterranean Saltbush, *A. halimus*, leg. Elsayed; 10 females, 12 males, same data, except, March 2013. All of the specimens were deposited in the collection of the Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC) and (10 females and 10 males were deposited in the collection of Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Egypt).

Comments: *Eurytoma dentata* was recorded for the first time from Egypt and Africa, and *A. punica* was recorded as new host of *E. dentata*. Doğanlar & Elsayed (2013) recorded it as *Eurytoma* sp. nr. *coleophorae* Zerova as a parasitoid of *A. punica*. *Eurytoma dentata* has been recorded as a parasitoid of several species of *Asphondylia* (Diptera: Cecidomyiidae) from several countries of Europe and Asia (Noyes, 2013).

***Ormyrus monegricus* Askew, 1994**

Material examined: EGYPT: 2 Females, 3 males, Alameria District, Alexandria, 30°59'54"N, 29°49'70"E, June, 2013, reared from galls of *A. punica* on the stems and flower buds of the Mediterranean Saltbush, *A. halimus*, leg. Elsayed; 10 females, 12 males, same data, except, March 2013. One specimen was deposited in the collection of the Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC) and (one female and one male were deposited in the collection of Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Egypt).

Comments: *Ormyrus monegricus* was recorded for the first time from Egypt and Africa, and *A. punica* was recorded as new host of *O. monegricus*. It was recorded as a parasitoid of *Stefaniola salsolae* (Diptera: Cecidomyiidae) on *Salsola arbuscula* (Chenopodiaceae) in Spain by Askew (1994).

***Microtontomerus annulatus* (Spinola, 1808)**

Diplolepis annulata Spinola, 1808: 215.

Material examined: EGYPT: 6 Females, 5 males, Alameria District, Alexandria, 30°59'54"N, 29°49'70"E, June, 2013, reared from galls of *A. punica* on the stems and flower buds of the Mediterranean Saltbush, *A. halimus*, leg. Elsayed; 10 females, 12 males, same data, except, March 2013. Some of the specimens were deposited in the collection of the Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC) and (3 females and 2 males were deposited in the collection of Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Egypt).

Comments: *Microtontomerus annulatus* was recorded for the first time from *A. punica* as parasitoid. Up to now only the genus, *Microtontomerus*, has been recorded as parasitoid of Cecidomyiidae such as: blossom midge, *Contarinia* sp. (Diptera: Cecidomyiidae) on *Jasminum sambac* in Tamil Nadu, India (David et al., 1990), and *Psectrosema reticulatum* (Diptera: Cecidomyiidae) reared from galls on *Tamarix* spp. in Pakistan (Habib, 1983). *Microtontomerus annulatus* has been recorded from Egypt as a parasitoid of *Acanthiophilus helianthi* (Rossi) (Diptera: Tephritidae) (Hegazi & Moursi, 1983), and several countries of Africa (Masi, 1921; Steffan, 1952; Noyes, 2013).

***Platygaster* sp.**

Material examined: EGYPT: 5 Females, 10 males, Alameria District, Alexandria, 30°59'54"N, 29°49'70"E, June, 2013, reared from galls of *A. punica* on the stems and flower buds of the Mediterranean Saltbush, *A. halimus*, leg. Elsayed; 10 females, 12 males, same data, except, March 2013. Some of the specimens were deposited in the collection of the Insect Museum of Research Station of Biological Control Yüreğir, Adana, Turkey (IMRSBC) and (3 females and 5 males were deposited in the collection of Department of Applied Entomology, Faculty of Agriculture, Alexandria University, Egypt).

Comments: Several species of *Platygaster* were recorded as parasitoid of Cecidomyiidae species (Buhl, 2007).

CONCLUSION

Elsayed et al. (2014, in preparation) stated that *Asphondylia punica* has two generations per year on *Atriplex halimus* in Egypt, the first generation (winter generation) from November to April while the second generation (summer generation) from May to October. As shown in table (1), the percentage of parasitism at the beginning of the first generation was lower than the summer generation, while both generations reached high levels of parasitism at their ends.

The parasitoid complex of the winter generation of *A. punica* was previously studied by the authors (Doğanlar & Elsayed, 2013), and consists of five species, viz., *Kolopterna aymani* Doğanlar, 2013, *Neochrysocharis conglomeratae* Doğanlar, 2013, *Torymus egypticus* Doğanlar, 2013, *Torymus phillyreae* Ruschka, 1921, *Eurytoma dentata* Mayer, 1878. They mentioned that *T. egypticus* and *T. phillyreae* were rare during the period from January to April, while *N. conglomeratae* was dominant at the period of mid March to the end of April.

Regarding to the summer generation that the present study indicates, it consists of 8 species. The hyper parasitoid *N. misirensis* was present with high level of parasitism during June and July, while the primary parasitoid *M. annulatus* and the hyperparasitoid *A. alexadrianensis* were present from June to September with low level of parasitism. The rest of parasitoids, except *E. dentata*

and *K. aymani*, were not identified to be primary or hyper parasitoid and they had low percentage of parasitism during the season of study.

The primary parasitoids were common in both generations, *K. aymani* and *E. dentata*. *K. aymani* had high level of parasitism in February and March, and moderate level in the period from June to September. *E. dentata* had a moderate level of parasitism from January to April, while it had very high level of parasitism during the period from June to September.

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Table 1. The percentage of parasitism in the first generation and second generation of *A. punica* on *A. halimus* in Egypt in 2013.

The 1 st generation				The 2 nd generation			
Date of inspection	Dissected galls No.	No. of parasitised larvae/pupae	% parasitism	Date of inspection	Dissected galls No.	No. of parasitised larvae/pupae	% parasitism
18-2-2013	23	5	21.7%	8-7-2013	32	14	43.75%
6-3-2013	35	18	51.4%	24-7-2013	55	48	87.3%
13-3-2013	30	18	60%	13-8-2013	20	17	85%
3-4-2013	20	20	100%	28-8-2013	20	16	80%
15-4-2013	30	30	100%	17-9-2013	22	18	82%

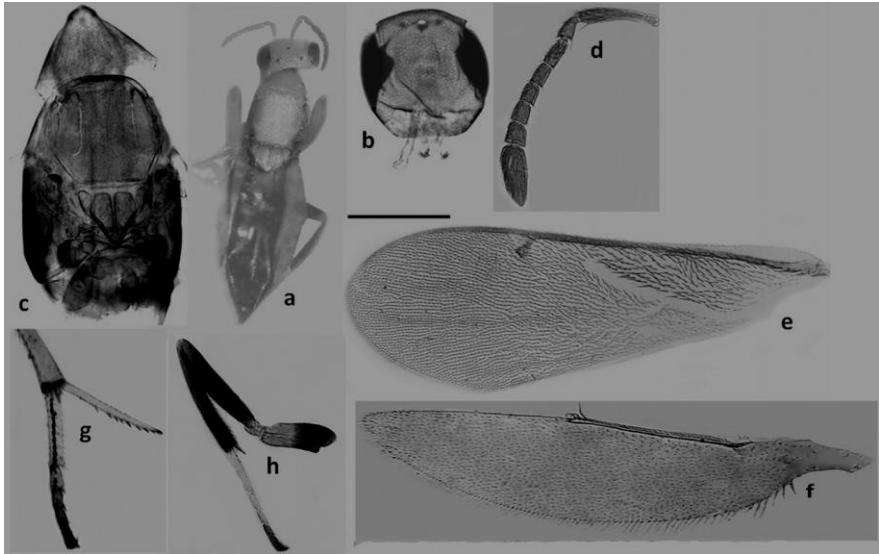


Figure 1. *Neanastatus misirensis* n. sp. Female. a. body, in dorsal view; b. head, in frontal view; c. mesosoma, in dorsal view; d. antenna; e. forewing; f. hind wing; g. apical part of mid tibia and tarsal segments; h. hind leg. Scale bar for a= 1mm; for b and c= 0.5 mm; for d= 0.35 mm; for e and h= 0.30 mm.



Figure 2. *Neanastatus misirensis* n. sp. Male. a. body, in dorsal view; b. antenna. Scale bar for a= 0.5 mm; for b= 0.25 mm.

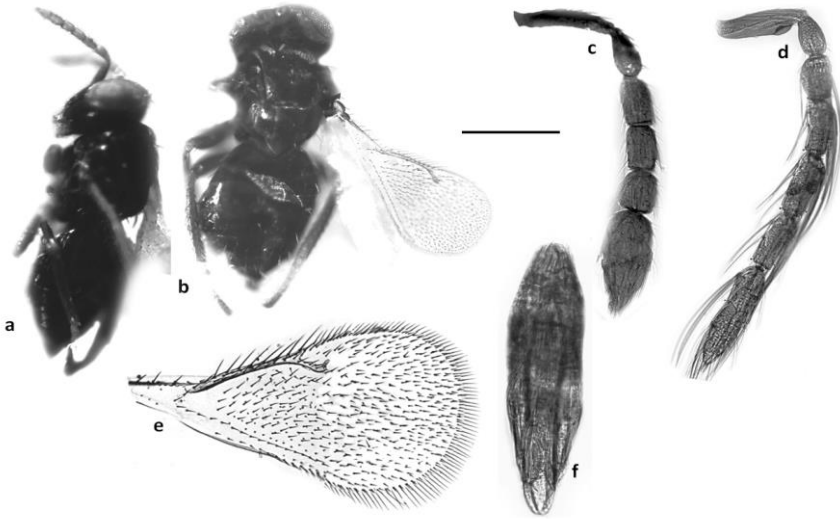


Figure 3. *Aprostocetus alexandrianensis* n.sp. a, b. body, a. female, in lateral view, b. male, in dorsal view; c, d. antennae, c. female, d. male; e. forewing; f. male genitalia. Scale bar for a= 0.50 mm; for b= 0.35 mm; for c and d= 0.16 mm; for e= 0.25 mm; for f= 0.08 mm.

PREDATION ON RECENT MARINE AND FRESH-WATER OSTRACOD POPULATIONS OF THE CENTRAL REGION OF THE REPUBLIC ARGENTINA

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ABSTRACT: The presence of evidence of depredation in ostracods valves from marine and freshwater environments of the central region of the republic Argentina are studied in this paper. In samples from intertidal environment (Puerto Rosales) a total of 800 shells of ostracods were recovered of which only 0.50% (4 valves) presented evidence of predation. In freshwater environments (Laguna Don Tomás) a total of 1447 valves were recovered of which only 1.10% (16 valves) presented evidence of predation. Two types of depredation fossil traces were determined: *Oichnus simplex* Bromley and *Oichnus paraboloides* Bromley. *Oichnus simplex* Bromley predominate over drilling *Oichnus paraboloids* Bromley attributed to predatory gastropods activity, both marine and continental environments. There was not relationship between the borehole diameter and the size of the predated valves. The ornamentation of the valves is not a character that conditions predation, since the species predated have different type of ornamentation from thin ribs to crosslinks with very prominent ribs.

KEY WORDS: Ostracodes, Puerto Rosales, Santa Rosa, predation.

The ostracods are microcrustaceans with calcareous shell, mainly benthic, which have a wide ecological range (inhabit freshwater environments, brackish, marine and hypersaline) (Horne et al., 2002). These microcrustaceans are predated by various organism such as gastropods, bivalves carnivores, echinoderms and fish, although they constitute a very small percentage of the diet of the mentioned groups (Leal, 2008). Such predation is recorded through perforations caused by the erosive action on the surface of the vales of these invertebrates. There are several studies analyzing the importance of bioerosiones recorded in the fossil shells of molluscs as indicators mainly paleoecological (Farinati et al., 2006). Evidence of predation in shells of ostracods are recorded from the Cambrian, studies comprise populations of marine and freshwater ostracods come from both recent and fossil sediments (Reyment, 1963, Reyment et al., 1987; Ruiz, 1997; Ruiz et al., 2010; 2011; Kihn et al., 2011).

In this paper evidence of predation are studied in recent populations of freshwater and marine ocracods; and compared with the results obtained in holoceno sediments.

Study area

Don Tomás lagoon

The "Laguna Don Tomas" (36 ° 18 '18.31" S and 64 ° 18' 49.02" W) is a highly modified shallow hypereutrophic water-body located west of the city of Santa

Rosa (Figs. 1 and 2). It is surrounded by three basins that were built to prevent flooding of the surrounding city. It has an average depth of 2.3 m, which varies according to the rainy season, and covers an area of 135.2 ha. Maximum length and width are 1565 and 1181 m, respectively (Echaniz et al., 2008).

In the vicinity of the lagoon there are sites that have been anthropogenically modified and where the vegetation composition is variable, i.e., halophiles in flood areas, and psammophile in the grasslands. It lies within the eastern subhumid-dry climate physiographic region, where the average annual rainfall is 600 mm (Pall et al., 2011).

Puerto Rosales

Puerto Rosales integrates one of the most important port complexes deep waters of Argentina. It is located on the north coast of the Main Canal estuary of Bahía Blanca in the province of Buenos Aires, Argentina, between 38°40' and 39°45' S and 61°45' and 62°30' W (Figs. 3 and 4). The region is crossed by numerous canals that drain into the Canal Principal and separate extensive tidal flats, salt marshes, salt low and islands (Perillo & Piccolo, 1991). The system is semi-diurnal tide, with a range varying from 2.3 to 1.4 m in the mouth and between 3.8 and 2.7 m at the head of the estuary during spring and neap tides, respectively (Gómez et al., 2005).

The climatic characteristics of the area corresponding to dry and temperate climate, with average annual values of temperature comprised between 14 and 20 °C and thermal distinct seasons (Piccolo & Diez, 2004).

MATERIALS AND METHODS

Puerto Rosales

El muestreo fue realizado en los meses de enero, marzo, julio y octubre de 2011 desde una embarcación durante marea subiente a lo largo de una transecta perpendicular a la línea de marea. Se establecieron 5 estaciones de muestreo, correspondiendo la E1 al sector intermareal inferior y la E5 al superior (Fig. 5).

Laguna Don Tomás

Sediment samples were taken using a 10 cm diameter and 2 cm high metal ring. The northern shore basin was sampled, because it is the site subject to less human action and lacks a wire mesh on the shore that prevents the deposition of sediment, as occurs with the other two basins. Sampling was conducted in July and October 2011 and January 2012 (Fig. 6).

All samples were wet sieved with a sieve of 63 µm and then dried in oven at 50° C. Whenever possible, at least 150 individuals was extracted from each sample. Furthermore, the number of individuals per 10 g of dry sediment was calculated. If the number of ostracods was less than 150, the total number of individuals recovered.

A total of 40 samples were studied, 20 corresponding to marine environments and 20 freshwater environments. 2,247 shells were analyzed, which were considered only specimens with evidence of predation.

Finally, the external diameter or the major axis was measured, as were circular or elliptical perforations respectively. These measurements were compared with the length and height of the leaflets that contain them. The location of the perforations was classified according Ruiz (1997) and Ruiz et al. (2010).

RESULTS

Samples of marine environments

In samples from intertidal environment (Puerto Rosales) a total of 800 shells of ostracods were recovered of which only 0.50% (4 valves) presented evidence of predation. All specimens were retrieved with holes corresponding to a marsh with *Spartina alterniflora* (E4). Species that show evidence of predation are: *Cushmanidea echevarriae* Bertels y Martínez, 1997, *Xestoleberis* sp. and *Cytheretta punctata* Sanguinetti, 1979. Only perforated specimens relevant to ontogenetic stages 3-5 were found.

Samples of freshwater environments

A total of 1447 valves assigned to four species were recovered. *Limnocythere* sp., *Cypridopsis vidua* (OF Müller, 1776), *Heterocypris similis* (Wierzejski in Ramirez, 1967) and *Kapcypridopsis* sp.. Of the specimens recovered 1.10% (16 valves) presented evidence of predation. *Heterocypris similis* was the only species that presented perforations (Fig. 7). The ontogenetic stages that showed evidence of predation were 5-7.

Analysis of the perforations

It was possible distinguish two types of perforations:

***Oichnus paraboloides* Bromley, 1981** is elliptical perforations or subparabólicas in external view, with a greater outer diameter than the inner. These perforations are usually attributed to the action of naticid gastropods (Reyment, 1966; Jonkers, 2000), although other groups should be considered gastropods as potential predators (Ruiz et al., 2010, 2011; Kihn et al., 2011).

***Oichnus simplex* Bromley, 1981** includes cylindrical perforations with internal and external opening of similar diameter attributed to the action of muricid gastropods or eulimínidos (Reyment, 1963; Donovan & Pickerill, 2004; Ruiz et al., 2010, 2011; Kihn et al., 2011).

Comparing the diameter of the perforations and the dimensions of the perforated shells reflects an absence of correlation. As for the location of the perforations are in the front, back and central region of the valve, but are most frequent of which are in the front area.

In samples from freshwater environments the evidence of predation were observed only in *Heterocypris similis*. In marine environments the valves of species showed evidence of predation have very different characteristics of ornamentation: Smooth valves (*Xestoleberis* sp., *Heterocypris similis*); crosslinked and ribs (*Cytheretta punctata*); with scores (*Cushmanidea echevarriae*). In general all the valves had a single perforation; only one specimen of the Laguna Don Tomas presented two perforations.

DISCUSSION

In marine samples from Puerto Rosales only presented perforations some valves retrieved of the E4 corresponding to *Spartina alterniflora* marshes, which is attributed to the presence of *Spartina* provides greater diversity of ecological niches and reduces environmental energy providing suitable conditions for the development of predators; gastropods since his early ontogenetic stages associated living vegetation (Reyment, 1987). This coincides with that found in marine samples Holocene southern province of Buenos Aires where it is concluded that as many leaflets with evidence of predation was recorded in environments of lower energy and abundant vegetation (Kihn et al., 2011).

In other sampling stations in this town are not were recorded shells with evidence of predation; the E5 located in the upper intertidal resulted sterile ostracods, this may be due to the frequent air show which makes environment it little conducive to the development of ostracofauna. At E3, E2 and E1 the absence of leaflets with evidence of predation is due to the reduced availability of nutrients, lack of vegetation and possibly the conditions of energy from the environment.

Contrary to the claims by Kihn et al. (2011) and Ruiz et al. (2010, 2011); species what presented valves with evidence of predation did not correspond to species that occurred in dominant form in different environments studied. Therefore, it can be deduced that predation not related to the abundance of a kind, but the total abundance of the present ostracofauna.

The ornamentation is not a limiting factor for the predation, since there have been completely smooth shells and ornamented shells. In the case of the specimens with smooth valves predation evidence correspond to sub-adult or adult stages; whereas in the ornate species specimens belong to youth punched one the first ontogenetic stages.

The dominance of adult shells with holes in the fossil samples studied in previous works (Kihn et al., 2011) may be due to less chance of preserving the juveniles or losses minors ontogenetic stages during processing of samples, since in the present work done on current samples have been recovered juveniles with perforations. The fact that only *Heterocypris similis* present evidence of predation on freshwater samples can be attributed to the larger size of the shell and possess valves without ornamentation what makes drilling easier by predators.

CONCLUSIONS

The highest percentage of signs of predation were recorded in samples of the lagoon Don Tomás due to ambient energy low, high levels of available nutrients and the highest density of ostracods; only the last stages otogenéticos present evidence of predation. In intertidal environments samples decreases the percentage of perforated shells. Factors influencing predation ostracod fauna are the development of populations, environmental energy, depth (in shallow environments percentage of predation is higher) and the availability of nutrients. The cylindrical bores (*Oichnus simplex* Bromley) predominate over drilling *paraboloid* type (*Oichnus paraboloids* Bromley) attributed to predatory gastropods activity, both marine and continental environments. The ornamentation of the valves is not a character that conditions predation, since the species predated have different type of ornamentation from thin ribs to crosslinks with very prominent ribs. This work is a first contribution to the study of traces on actual samples ostracods of Argentina, it is important to deepen this knowledge from future studies.

ACKNOWLEDGEMENTS

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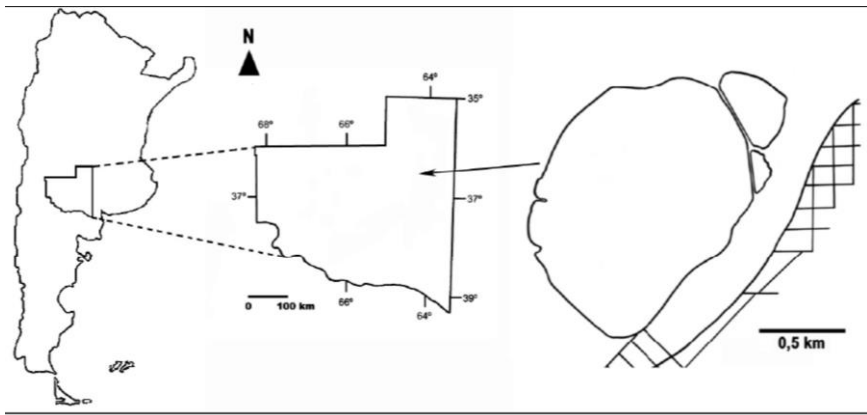


Figure 1. Geographical location of the Lagoon Don Thomas in the province of La Pampa, central Argentina.



Figure 2. Satellite image taken from google earth of the Lagoon Don Thomas.

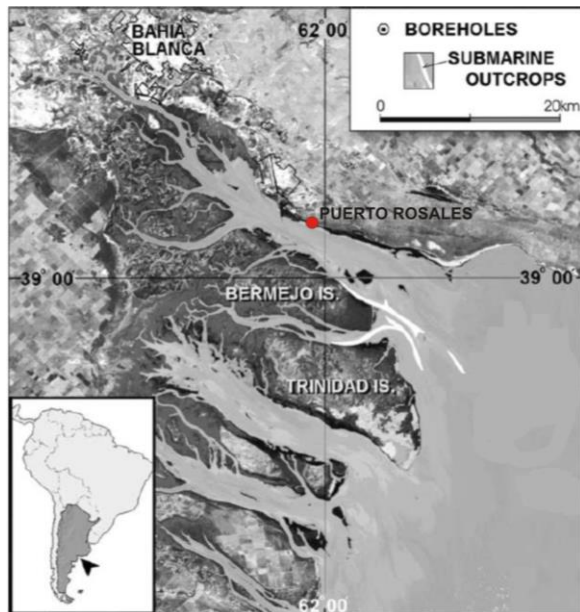


Figure 3. Location of the town of Puerto Rosales in Bahia Blanca Estuary.

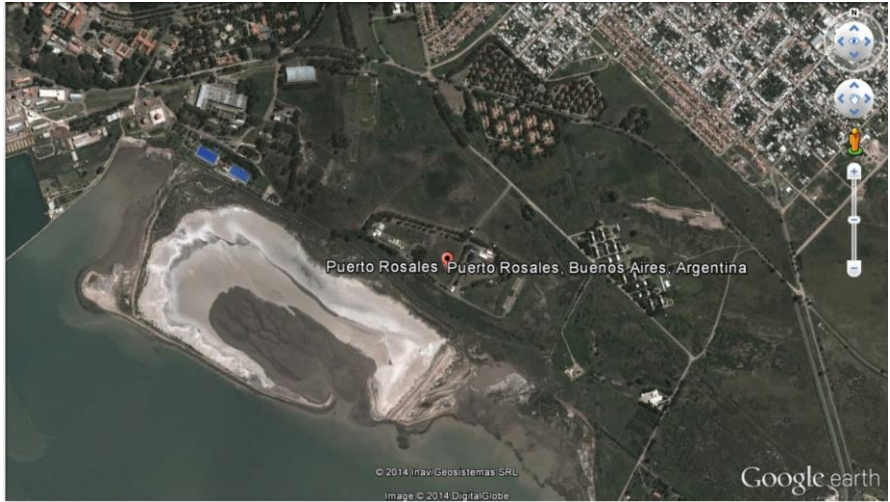


Figure 4. Satellite image taken from google earth of the Puerto Rosales.



Figure 5. Sampling points on Puerto Rosales.



Figure 6. Location of the North basin and sampling sites (red) in Laguna Don Thomas (near the city of Santa Rosa) in the province of La Pampa, Argentina.

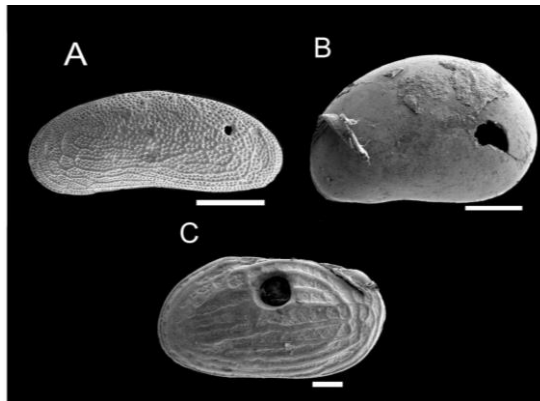


Figure 7. Specimens with evidence of predation from Puerto Rosales. A-B: *Oichnus simplex*, C: *Oichnus paraboloides* (scale= 100 μm).

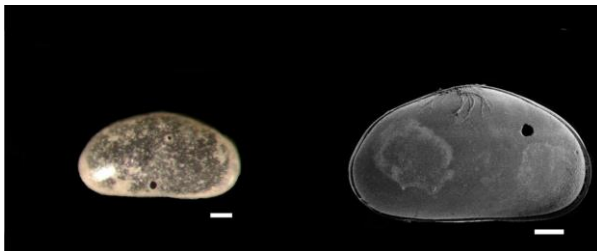


Figure 8. Samples of *Heterocypris similis* with evidence of predation (scale= 100 μm).

A CONTRIBUTION TO WEST AEGEAN REGION TABANIDAE FAUNA (INSECTA: DIPTERA)

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[Altunsoy, F. & Kılıç, A. Y. 2015. A contribution to West Aegean Region Tabanidae Fauna (Insecta: Diptera). Munis Entomology & Zoology, 10 (1): 94-100]

ABSTRACT: This study conducted to determine West Aegean Region Tabanidae fauna in 2012 to 2013. As a result 3 subfamilies, 10 genera and 52 species were explored. 16 species were firstly reported from the region. These species are *Atylotus loewianus* Villeneuve, 1920, *Theriopteles tunicatus* Szilady, 1927, *Hybomitra caucasi* Szilady, 1923, *Tabanus cordiger* Meigen, 1820, *Tabanus fraseri* Austen, 1924, *Tabanus maculicornis* Zetterstedt, 1842, *Tabanus miki* (Brauer, 1880), *Tabanus nemoralis* Meigen, 1820, *Tabanus oppugnator* Austen, 1925, *Tabanus portschinskii* Olsufjev, 1937, *Tabanus spodopteroideus* Olsufjev, Moucha & Chvála, 1969, *Tabanus sudeticus* Zeller 1842, *Tabanus tergestinus* Egger, 1859, *Tabanus unifasciatus* Loew, 1858, *Haematopota italica* Meigen, 1804, *Philipomyia aprica* (Meigen, 1820). As a conclusions number of species which are distributing the region reach to 67 species.

KEY WORDS: West Aegean, fauna, horse fly, Tabanidae, Diptera.

Female horse fly species during the blood-feeding period frequently change hosts between mammals including human. They have great importance in terms of medical and veterinary, because they are potential mechanical vectors for the diseases caused by viruses, bacteria and protozoans and the economic significance of stress resulting directly from bites, or indirect secondary infections such as anemia through blood loss, allergic responses, etc. (Chvala et al., 1972; Krinsky, 1979; Foil, 1989).

Studies about Tabanidae fauna of Turkey have begun in the 19th century (Walker, 1854; Loew, 1856a,b,c; 1858; 1859) and still continue. Many studies were report about distribution, seasonality and habitat preferences of Turkish horse fly species (Kılıç, 1992, 1993, 1996a,b,c, 1999, 2001a,b,c, 2002, 2003, 2004, 2005a,b, 2006; Kılıç & Schacht, 1995; Altunsoy & Kılıç, 2011a,b, 2012, 2014; Altunsoy, 2011). Newertheless these studies are not adequate for the put forth of Turkish horse fly fauna.

Based on reports of recent studies, Turkish horse fly fauna is representing with 3 subfamilies, 9 genera, 171 species and 15 subspecies (Kılıç, 1999; Kılıç, 2006; Altunsoy & Kılıç, 2014) and previously 51 species were reported from Aegean region (Schacht, 1984, 1985, 1987). In this study, totally 1672 samples collected and 52 species identified and 16 species were first time reported from study area. As a result, the number of species, which are distributed in Aegean region reached 67 species.

MATERIAL AND METHOD

Adult female horse flies were collected from different habitats in West Aegean Region (Aydın, Denizli, İzmir, Manisa and Muğla) with Malaise and Nzi Traps, which were baited with 1-octen-3-ol, and water traps.

Collection and preparation of samples were been done according to the principles of Chvala et al. (1972) and Olsufjev (1977). Tabanids were killed by ethyl-acetat jars. The specimens were brought to the laboratory in 70 degree

alcohol solution and were pinned with insect pins.

Samples were identified according to Chvala et. al. (1972), Olsufjev (1977), Peus (1980), Yücel (1987), Schacht (1987), Leclercq (1966a,b, 1967a,b) and Rubio (2002).

Identificated samples preserved in the Zoological Museum of Anadolu University (AUZM).

Because of given in previous studies to distributions of species in Turkey and worldwide, not presented here again (Kılıç, 1999, 2006; Schacht, 1983, 1984, 1985, 1987; Andreeva et al., 2009; Altunsoy & Kılıç, 2010).

RESULTS AND DISCUSSION

Totally 52 species belonging to 9 genera and 3 subfamily were identified and 16 species were first time recorded from Aegean Region.

Family: TABANIDAE

Subfamily: PANGONINAE

Tribus: Pangoniini

1. *Pangonius fulvipes* (Loew, 1859)

Material examined: İzmir (Kemalpaşa), 10.05.2012, 2♀♀.

2. *Pangonius pyritosus* Loew, 1859

Material examined: İzmir (Kemalpaşa), 10.05.2012, 2♀♀.

Subfamily: CHRYSOPSINAE

Tribus: Chrysopsini

3. *Chrysops caecutiens* (Linne, 1761)

Material examined: Muğla (Fethiye-Köyceğiz), 07.05.2012, 5♀♀, 1♂; Muğla (Marmaris), 10.06.2012, 1♀♀; Uşak (Karaağaç), 15.06.2012, 10♀♀; Uşak (Merkez), 12.06.2012, 3♀♀; Uşak (Çamyuva), 15.06.2012, 4♀♀; İzmir (Kiraz), 13.07.2012, 13♀♀.

4. *Chrysops flavipes* (Linne, 1761)

Material examined: Uşak (Güre), 09.06.2013, 3♀♀; 11.06.2013, 12♀♀; Uşak (Derbent), 09.09.2013, 2♀♀; Marmaris (Çamlı), 16.05.2013, 3♀♀.

5. *Silvius alpinus* Scopoli, 1763

Material examined: Manisa (Demirci), 07.07.2013, 1♀♀.

Subfamily: TABANINAE

Tribus: Tabanini

6. *Atylotus fulvus* (Meigen, 1820)

Material examined: Denizli (Buldan), 14.07.2012, 2♀♀.

7. *Atylotus loewianus* Villeneuve, 1920

Material examined: Denizli (Buldan), 14.07.2012, 1♀♀.

8. *Theriopectes tricolor* Zeller, 1842

Material examined: Muğla (Fethiye-Köyceğiz), 07.05.2012 2♀♀; Muğla (Marmaris), 07.05.2012, 1♀; 10.06.2013, 2♀♀; Marmaris (Çamlı), 16.05.2013, 2♀♀; Kuşadası, 12.05.2013 2♀♀; Uşak (Güre), 16.05.2013, 1♀♀.

9. *Theriopectes tunicatus* Szilady, 1927

Material examined: Muğla (Dalaman), 16.05.2013, 1♀♀.

10. *Hybomitra acuminata* (Loew, 1858)

Material examined: Denizli (Merkez), 25.05.2012, 5♀♀, Denizli (Buldan), 15.05.2013, 8♀♀.

11. *Hybomitra caucasi* Szilady, 1923

Material examined: Denizli (Merkez), 25.05.2012, 4♀♀, 2♂♂.

12. *Hybomitra caucasica* (Enderlein, 1925)

Material examined: Manisa (Merkez), 23.05.2012, 3♀.

13. *Hybomitra ciureai* (Séguy, 1937)

Material examined: Denizli (Buldan), 14.07.2012, 15♀, 2 ♂; Muğla (Fethiye), 16.05.2013, 2♀; Muğla (Dalaman), 16.05.2013, 3♀; Muğla (Köyceğiz), 16.05.2013, 5♀; Muğla (Marmaris), 10.06.2012, 1♀.

14. *Tabanus autumnalis* (Linne, 1761)

Material examined: Muğla (Fethiye-Köyceğiz), 07.05.2012, 1♀ 11.05.2013, 1♀, 16.05.2013, 1♀; Muğla (Köyceğiz), 16.05.2013, 1♀; Muğla (Datça), 11.06.2012, 1♀; Muğla (Dalaman), 16.05.2013, 1♀; Uşak (Karaağaç), 15.06.2012, 4♀, 11.05.2013 2♀ ; Uşak (Ulubey), 09.07.2012, 2♀; Uşak (Eşme), 17.05.2013, 1♀; Uşak (Merkez), 20.07.2012, 1♀; Denizli (Çal), 10.07.2012, 3♀; Denizli (Buldan), 14.07.2012, 2♀; 14.05.2013, 8 ♀♀.

15. *Tabanus bifarius* Loew, 1858

Material examined: Denizli (Cankurtaran), 09.06.2012, 15♀ 12.05.2013 5♀, 12.08.2013 3♀; Denizli (Pamukkale), 08.06.2012, 7♀; Uşak (Merkez), 11.06.2012, 4♀; 20.07.2012, 6♀; Uşak (Eşme), 09.06.2013, 2♀; 20.07.2012 1♀; 17.05.2013 1♀; Uşak (Çamyuva), 15.06.2012, 4 ♀♀; Uşak (Güre), 09.06.2013, 4♀; Uşak (Karaağaç), 15.06.2012, 1♀; Manisa (Merkez), 11.06.2012, 3♀ 10.06.2013 3♀; Manisa (Demirci), 07.07.2013, 1♀; Denizli (Honaz Dağı), 12.06.2012, 5♀; 10.06.2013, 4♀; Muğla (Fethiye-Köyceğiz), 07.05.2012, 4♀; 05.06.2012 2♀; 16.05.2013 1♀; Muğla (Marmaris), 07.05.2012, 1♀; 10.06.2012, 9♀; 11.05.2013 2♀, 13.08.2013 2♀, 11.06.2013, 4♀; Marmaris (Değirmen), 16.05.2013, 1♀; Muğla (Fethiye), 16.05.2013, 4♀; Muğla (Köyceğiz), 16.05.2013, 1♀; Muğla (Datça), 11.06.2012, 2♀; Muğla (Değirmen), 16.05.2013, 1♀; Kuşadası, 15.05.2013, 14♀; Aydın (Karacasu), 16.05.2013, 1♀; İzmir (Ödemiş, Bozdağ), 08.07.2013, 2♀.

16. *Tabanus bromius* Linne, 1761

Material examined: Uşak (Merkez), 14.07.2012, 3♀; 10.06.2013, 4♀; 07.07.2013, 4♀; 13.08.2013, 6♀; Muğla (Fethiye-Köyceğiz), 11.08.2012, 8♀, 08.07.2013 5♀, 14.08.2013, 6♀; İzmir (Ödemiş), 12.08.2012, 5♀, 10.06.2013, 4♀, Manisa (Salihli), 12.08.2012, 23♀; Denizli (Buldan), 14.07.2012, 17♀; İzmir (Kiraz), 13.07.2012, 2 3♀; Denizli (Honaz Dağı), 10.07.2012, 2♀ 12.06.2013 5♀; Denizli (Honaz), 10.07.2012, 1♀; Denizli (Çameli), 10.07.2012, 8♀; Muğla (Ula), 11.07.2012, 18♀, 06.07.2013 10♀; İzmir (Beydağı), 13.07.2012, 2♀; Uşak (Merkez), 11.06.2012, 4♀; 20.07.2012, 1♀; Uşak (Karaağaç), 15.06.2012, 10♀, 16.08.2013 7♀; Uşak (Çamyuva), 15.06.2012, 14 ♀♀; 16.06.2013, 10♀, 11.05.2013, 9♀; Muğla (Milas) , 10.06.2012, 5♀, 11.06.2013, 2♀; Denizli (Honaz Dağı), 12.06.2012, 10♀; Uşak (Ulubey) , 09.07.2012, 5♀; Denizli (Çal) , 10.07.2012, 5♀, Kuşadası 12.05.2013, 2♀; Aydın (Horsunlu), 10.06.2013, 8♀; Muğla (Ören), 12.06.2013, 8 ♀♀; 09.07.2013, 12 ♀♀; Muğla (Marmaris), 10.06.2012, 1♀; Muğla (Kale), 12.09.2013, 1♀; Muğla (Fethiye, Çameli Yolu), 10.05.2012, 3♀.

17. *Tabanus cordiger* Meigen, 1820

Material examined: Uşak (Karaağaç), 15.06.2012, 3♀; Manisa (Merkez), 11.06.2012, 3♀; İzmir (Spil Dağı), 13.07.2013, 2♀; Muğla (Marmaris), 10.06.2012, 3♀; Muğla (Fethiye, Çameli Yolu), 10.05.2012, 1♀.

18. *Tabanus exclusus* Pandelle, 1883

Material examined: Denizli (Buldan), 14.07.2012, 1♀; Denizli (Honaz), 10.07.2012, 13♀; Denizli (Buldan), 14.07.2012, 1♀; Uşak (Merkez), 20.07.2012, 1♀; Muğla (Fethiye, Çameli Yolu), 10.05.2012, 21♀; Muğla (Marmaris-Fethiye, Ula Yolu), 11.07.2012, 6♀; Muğla (Fethiye-Köyceğiz), 25.04.2012, 3♀.

19. *Tabanus fraseri* Austen, 1924

Material examined: Uşak (Derbent), 09.09.2013, 8♀; Muğla (Kavaklıdere), 11.09.2013, 1♀; İzmir (Ödemiş, Bozdağ), 01.09.2013, 2♀; İzmir (Beydağ), 11.09.2013, 1♀; Aydın

(Bazdoğan), 11.09.2013, 1♀; Muğla (Merkez), 12.09.2013, 2 ♀♀; İzmir (Beydağ, Çamedli-Alısu), 11.09.2013, 1♀.

20. *Tabanus glaucopis* Meigen, 1936

Material examined: İzmir (Dikili), 16.07.2012, 5♀♀; Denizli (Buldan) 10.07.2012 15♀♀; 14.07.2012, 4♀♀; Uşak (Merkez), 12.07.2012, 11♀♀; 20.07.2012, 2♀♀; Aydın (Nazilli), 12.07.2013, 11♀♀.

21. *Tabanus indrae* Hauser, 1939

Material examined: Muğla (Datça), 17.06.2012, 4 ♀♀.

22. *Tabanus leleani* Austen, 1920

Material examined: Uşak (Derbent), 09.09.2013, 2♀♀.

23. *Tabanus laetitinctus* Becker, 1912

Material examined: Muğla (Datça), 17.06.2012, 6 ♀♀.

24. *Tabanus lunatus* Fabricius, 1794

Material examined: Muğla (Ortaca), 11.07.2012, 15♀♀, 13.07.2013 10♀♀; Deniz (Kale), 12.07.2012, 6♀♀, Uşak (Merkez), 14.07.2012, 5♀♀; 20.07.2012, 2♀♀; İzmir (Kiraz), 13.07.2012, 32♀♀, Denizli (Honaz Dağı), 10.07.2012, 25♀♀; Denizli (Honaz), 10.07.2012, 3♀♀; Denizli (Çameli), 10.07.2012, 30♀♀; Muğla (Ula), 11.07.2012, 14♀♀; Aydın (Karacasu), 13.07.2012, 10♀♀, İzmir (Beydağı), 13.07.2012, 5♀♀, Muğla (Milas), 10.06.2012, 5♀♀ 10.06.2013 6♀♀, 09.07.2013 4♀♀; 11.06.2013, 3♀♀; Muğla (Marmaris), 10.06.2013, 7♀♀; Muğla (Fethiye, Çameli Yolu), 10.05.2012, 16♀♀; Denizli (Çal), 10.07.2012, 18♀♀; Muğla (Marmaris-Fethiye, Ula Yolu), 11.07.2012, 5♀♀; Manisa (Demirci), 07.07.2013, 3♀♀.

25. *Tabanus maculicornis* Zettersted, 1842

Material examined: Muğla (Marmaris, Değirmen), 16.05.2013, 1♀♀.

26. *Tabanus miki* (Brauer, 1880)

Material examined: Denizli (Kiraz), 13.07.2012, 1♀♀; Denizli (Honaz Dağı), 10.07.2012, 8♀♀; Denizli (Honaz), 10.07.2012, 4♀♀; Denizli (Buldan), 14.07.2012, 2♀♀; Aydın (Horsunlu), 10.06.2013, 2♀; İzmir (Beydağı), 13.07.2012, 5♀♀; İzmir (Beydağ, Çamedli-Alısu), 11.09.2013, 1♀♀; Uşak (Merkez), 14.07.2012, 3♀♀; 20.07.2012, 1♀♀; Muğla (Fethiye-Köyceğiz), 11.08.2012, 8♀♀; İzmir (Ödemiş), 12.08.2012, 15♀♀, Manisa (Salihli), 12.08.2012, 5♀♀; Muğla (Fethiye, Çameli Yolu), 10.05.2012, 1♀♀.

27. *Tabanus nemoralis* Meigen, 1820

Material examined: Uşak (Eşme), 09.06.2013, 1♀♀.

28. *Tabanus obsolescens* (Pandelle, 1883)

Material examined: Manisa (Turgutlu) 15.06.2012, 4 ♀♀; Denizli (Buldan) 12.06.2012 2♀♀; Denizli (Honaz), 10.07.2012, 2♀♀; İzmir (Ödemiş, Bozdağ), 01.09.2013, 4♀♀; 11.09.2013, 1♀♀; İzmir (Beydağ), 11.09.2013, 1♀♀; İzmir (Beydağ, Çamedli-Alısu), 11.09.2013, 17♀♀; Muğla (Merkez), 12.09.2013, 43♀♀; Muğla (Kale), 12.09.2013, 21♀♀; Muğla (Kavaklıdere), 11.09.2013, 27♀♀; Aydın (Bazdoğan), 11.09.2013, 21♀♀; Uşak (Derbent), 09.09.2013, 3♀♀; Muğla (Milas, Labranda), 09.07.2013, 1♀♀.

29. *Tabanus oppugnator* Austen, 1925

Material examined: Uşak (Güre), 08.06.2013, 2♀♀.

30. *Tabanus prometheus* Szilady, 1923

Material examined: Uşak (Merkez), 11.06.2012, 2♀♀.

31. *Tabanus portschinskii* Olsufjev, 1937

Material examined: Uşak (Merkez), 15.07.2012, 8♀♀; Denizli (Buldan) 10.07.2012 2♀♀.

32. *Tabanus quatuornotatus* Meigen, 1820

Material examined: Denizli (Pamukkale), 06.05.2012, 8♀♀, 1♂; 08.06.2012, 4♀♀; Denizli (Honaz), 10.05.2012, 5♀♀; Muğla (Datça-Kinidos), 07.05.2012, 6♀♀; Muğla (Marmaris-Knidos), 09.05.2012, 5♀♀; Muğla (Dalaman), 16.05.2013, 1♀♀; Muğla (Datça), 11.06.2012, 2♀♀; Muğla (Marmaris), 10.06.2012, 5♀♀; Denizli (Merkez), 25.05.2012, 5♀♀, 2♂♂; İzmir (Spil Dağı), 14.06.2012, 9♀♀; Aydın (Kuşadası), 12.05.2013, 5♀♀; Aydın (Karacasu),

16.05.2013, 12♀♀; Uşak (Eşme), 17.05.2013, 7♀♀; 20.07.2012, 6♀♀; Uşak (Merkez), 11.06.2012, 3♀♀; 20.07.2012, 12♀♀; Uşak (Güre), 09.06.2013, 1♀♀; Uşak (Karaağaç), 15.06.2012, 1♀♀.

33. *Tabanus regularis* Jaennicke, 1866

Material examined: İzmir (Kemalpaşa), 10.05.2012, 2♀♀; Muğla (Fethiye-Köyceğiz), 07.05.2012, 2♀♀; Denizli (Kiraz), 13.07.2012, 1♀♀; Muğla (Milas, Labranda), 09.07.2013, 4♀♀; Muğla (Fethiye, Çameli Yolu), 10.05.2012, 3♀♀; Muğla (Gökova), 11.07.2013, 1♀♀.

34. *Tabanus rupium* (Brauer & Bergenstamm, 1880)

Material examined: Denizli (Honaz Dağı), 10.07.2012, 1♀; Denizli (Honaz), 10.07.2012, 1♀♀; Uşak (Karaağaç), 15.06.2012, 5♀♀; Uşak (Çamyuva), 15.06.2012, 4 ♀♀; Uşak (Eşme), 17.05.2012, 2♀♀; 20.07.2012, 16♀♀; Muğla (Marmaris), 10.06.2012, 2♀♀; Muğla (Datça), 11.06.2012, 2♀♀; Uşak (Merkez), 20.07.2012, 6♀♀; Aydın (Karacasu), 16.05.2013, 1♀♀; Uşak (Güre), 09.06.2013, 1♀♀; Uşak (Güney), 17.05.2013, 1♀♀.

35. *Tabanus spodopterus* Meigen, 1820

Material examined: Denizli (Honaz Dağı), 10.07.2012, 4♀♀; Denizli (Çameli), 10.07.2012, 4♀♀; Denizli (Buldan) 12.07.2012 12♀♀. Muğla (Ula), 11.07.2012, 4♀♀; Muğla (Ortaca), 11.07.2012, 2♀♀; Denizli (Kale), 12.07.2012, 1♀; Aydın (Karacasu), 13.07.2012, 4♂♂; İzmir (Beydağı), 13.07.2012, 2♀♀; İzmir (Kiraz), 13.07.2012, 6♀♀; Uşak (Merkez), 14.07.2012, 2♀♀; Muğla (Fethiye-Köyceğiz), 11.08.2012, 2♀♀; Muğla (Marmaris-Fethiye, Ula), 2♀♀; Muğla (Fethiye-Köyceğiz), 20.04.2012, 1♀♀; Muğla (Fethiye, Çamedli), 2♀♀; Muğla (Milas, Labranda), 09.07.2013, 1♀♀.

36. *Tabanus spodopteroides* Olsufjev, Moucha & Chvála, 1969

Material examined: Denizli (Honaz Dağı), 10.07.2012, 11♀♀; Denizli (Çameli), 10.07.2012, 4♀♀; Uşak (Güre), 09.06.2013, 1♀♀; Muğla (Fethiye-Çameli Yolu), 10.05.2012, 1♀♀.

37. *Tabanus sudeticus* Zeller 1842

Material examined: Denizli (Buldan) 12.07.2012 2♀♀.

38. *Tabanus tunicatus* Szilady, 1927

Material examined: Muğla (Fethiye) 17.05.2013, 2 ♀♀

39. *Tabanus tinctus* (Walker, 1850)

Material examined: Denizli (Buldan) 12.07.2012 2♀♀; Aydın (Karacasu), 13.07.2012, 4♂♂; 2♀♀; Uşak (Merkez), 14.07.2012, 3♀♀.

40. *Tabanus tergestinus* Egger, 1859

Material examined: Muğla (Köyceğiz), 07.05.2012, 15♀♀; 16.05.2013, 1♀; Muğla (Fethiye) 15.05.2013, 10 ♀♀; Kuşadası, 15.05.2013, 14♀♀.

41. *Tabanus unifasciatus* Loew, 1858

Material examined: Uşak (Çamyuva), 15.06.2012, 4 ♀♀; Uşak (Karaağaç), 15.06.2012, 6♀♀; Uşak (Merkez), 20.07.2012, 7♀♀; Muğla (Fethiye) 15.05.2013, 4 ♀♀; Muğla (Datça), 11.06.2012, 2♀♀; Uşak (Eşme), 20.07.2012, 2♀♀; Muğla (Marmaris), 10.06.2012, 4♀♀.

Tribus: Haematopotini

42. *Haematopota bigoti* Gobert, 1880

Material examined: İzmir (Dikili), 16.07.2012 1♀♀.

43. *Haematopota longeantennata* (Olsufjev 1937)

Material examined: Aydın (Karacasu), 10.06.2013, 2♀♀.

44. *Haematopota grandis* Meigen 1820

Material examined: Muğla (Datça), 17.06.2012, 6 ♀♀.

45. *Haematopota ocelligera* (Krober 1922)

Material examined: Muğla (Fethiye), 08.06.2013 9 ♀♀.

46. *Haematopota pallens* Loew 1871

Material examined: İzmir (Dikili), 16.07.2012 2♀♀.

47. *Haematopota subcylindrica* Pandelle, 1883

Material examined: Uşak (Merkez), 12.06.2012, 5♀♀.

48. *Haematopota italica* Meigen, 1804

Material examined: Muğla (Fethiye- Köyceğiz), 07.05.2012, 5♀♀, Muğla (Marmaris), 07.05.2012, 1♀.

Tribus: Diachlorini**49. *Dasyrhamphis carbonarius* (Meigen, 1820)**

Material examined: Muğla (Marmaris), 07.05.2012, 1♀; 10.06.2012, 2♀♀; Marmaris (Çamlı), 16.05.2013, 2♀♀; Muğla (Dalaman), 16.05.2013, 1♀♀; Denizli (Honaz Dağı), 12.06.2012, 2♀♀; Uşak (Merkez), 12.06.2012, 2♀♀; 14.06.2013, 4 ♀♀; Uşak (Eşme), 20.07.2012, 1♀♀; Aydın (Karacasu), 10.06.2013, 2♀♀.

50. *Dasyrhamphis umbrinus* (Meigen, 1820)

Material examined: Denizli (Pamukkale), 06.05.2012, 1♀, Muğla (Fethiye- Köyceğiz), 07.05.2012, 2♀♀; Muğla (Marmaris), 07.05.2012, 6♀♀; Muğla (Köyceğiz), 16.05.2013, 2♀♀; Muğla (Fethiye), 16.05.2013, 2♀♀; Marmaris (Çamlı), 16.05.2013, 1♀♀; Muğla (Datça-Kinidos), 07.05.2012, 1♀; Muğla (Dalaman), 16.05.2013, 1♀♀; Denizli (Honaz Dağı), 12.06.2012, 5♀♀; İzmir (Spil Dağı), 14.06.2012, 7♀♀; Aydın (Kuşadası), 12.05.2013, 1♀♀; Uşak (Güney), 17.05.2013, 1♀♀.

51. *Philipomyia aprica* (Meigen, 1820)

Material examined: Uşak (merkez), 15.07.2012, 12♀; Uşak (Güre), 09.06.2013, 6♀♀; Kuşadası, 15.05.2013, 12♀♀; Muğla (Fethiye), 16.05.2013, 1♀; 08.06.2013 9 ♀♀, 6 ♂♂; İzmir (Ödemiş, Bozdağ), 08.07.2013, 9♀♀.

52. *Philipomyia graeca* (Fabricius, 1794)

Material examined: Muğla (Fethiye- Köyceğiz), 07.05.2012, 12♀♀; 13.06.2013, 22 ♀♀; Muğla (Marmaris), 07.05.2012, 12♀♀; Marmaris (Çamlı), 16.05.2013 2♀♀; Muğla (Datça-Kinidos), 07.05.2012, 3♀♀, Muğla (Milas), 10.06.2012, 25♀♀, Milas (Labranda), 11.06.2013, 2♀♀; Muğla (Köyceğiz), 16.05.2013, 5♀♀; Muğla (Dalaman), 16.05.2013, 2♀♀.

Totally, in the previous studies, 51 species were reported from Aegean Region, based on this study 16 species firstly reported from this region; *Atylotus loewianus* Villeneuve, 1920, *Hybomitra caucasi* Szilady, 1923, *Tabanus cordiger* Meigen, 1820, *Tabanus fraseri* Austen, 1924, *Tabanus miki* (Brauer, 1880), *Tabanus maculicornis* Zetterstedt, 1842, *Tabanus nemoralis* Meigen, 1820, *Tabanus oppugnator* Austen, 1925, *Tabanus portschinskii* Olsufjev, 1937, *Tabanus spodopteroideus* Olsufjev, Moucha & Chvála, 1969, *Tabanus sudeticus* Zeller 1842, *Tabanus tergestinus* Egger, 1859, *Tabanus tunicatus* Szilady, 1927 *Tabanus unifasciatus* Loew, 1858 ve *Haematopota italica* Meigen, 1804.

Results of the study indicated that the *Tabanus bromius* as the most abundant species with 18%. It was determined in previous studies that *Tabanus bromius* most abundant species in the any habitats (Kılıç, 1992; 2001c; 2004; 2005b; Yücel 1987). This species followed by *Tabanus lunatus* (%13,3) and *Tabanus obsolescens* (%8,8). These tree species made up 40.1 % of the horse fly fauna on the study area.

This study not contains all species for west aegean region, but shows the importance of periodic studies and isolated areas for faunistic studies. In addition, can be inferred that the species, which known as unique can be observed in many different areas.

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**IDENTIFICATION OF THE INTESTINAL MICROBIAL
COMMUNITY OF *EISENIA ANDREI* (ANNELIDA:
LUMBRICIDAE) RAISED IN DIFFERENT SUBSTRATES**

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ABSTRACT: Earthworms actions are favored by microbial activity of communities living in the gut of these organisms. Identification of the microbial flora of the digestive tract of *Eisenia andrei*, was performed in order to find differences that can be attributed to the different food substrates and similarities by the presence of endogenous microorganisms. The food substrates: goat manure (95%) + corn stubble (5%) and chicken manure (85%) + corn stubble (15%), composted for 1 month. Strains were isolated and identified by the use of biochemical tests in the key of Bergey's Manual. In animals bred in goat manure substrate, 11 strains were isolated: 1 strain of *Micrococcus* sp., *Pseudomonas* sp., *Neisseria* sp. and *Sporolactobacillus* sp.; 4 strains of *Oscillospira* spp.; and 3 dubious strains. In animals bred in substrate with chicken manure and corn residue 12 strains were isolated: 1 strain of *Oscillospira* sp., *Bacillus* sp. and *Syntrophospora* sp.; 3 strains of *Beijerinckia* spp.; 4 strains of *Pseudomonas* spp.; and 2 dubious strains. The differences in species of microorganisms found are attributed to the different diets. *Pseudomonas* and *Oscillospira* strains matched on both treatments, so that could be part of the endogen communities of the intestinal track of this species of earthworm.

KEY WORDS: Intestinal microorganisms, diversity, Lumbricidae, *Eisenia andrei*, different substrates, vermiculture.

Earthworms (Annelida, Oligochaeta) play an important role in terrestrial ecosystems, they contribute to soil fertility modifying the physical, chemical and biological properties such as texture, organic matter decomposition and the regulation of biogeochemical cycles (Edwards & Lofty, 1972; Springgett Syers, 1984; Krishnamoorthy, 1985; Hoogertkamp et al., 1983; Lavelle, 1983; Lavelle & Martin, 1992; Egert et al., 2004). These modifications are evident when finding large amounts of organic Carbon, Nitrogen, inorganic Phosphorus, Magnesium, Potassium among others, in excreta or "casts" of earthworms (Burk et al., 1999; Schrader & Zhang, 1997; Brussaard et al., 1996; Kolmans & Vasquez, 1996). With these findings, it has been attempted to use earthworms for practical purposes, improving fertility in cultivated soils (Stockdill, 1982), stimulating pedogenesis in soil recovery (Hoogertkamp et al., 1983), evaluating the changes and identifying the different types of soil (Römbke & Jänsch, 2004).

It is also known, that in order to conduct the actions of earthworms, the relationship with other components of the soil ecosystem, such as the microflora (bacteria, fungi, etc.) are necessary. This relationship is not only limited to detritivorous food, but there are microorganisms which are not affected by the earthworms digestive enzymes and probably some of the digestive enzymes are produced by the microorganisms themselves in the intestine, giving it greater ability to degrade complex substances found in soil organic matter (Lee, 1985;

Edwards & Fletcher, 1988; Vinotha et al., 2000; Fukatsu & Nikot, 1998; Santiago, 1995; Alonzo et al., 1999).

Studies have demonstrated the presence of bacteria in the digestive tract of earthworms and some of the strains were not found in the surrounding soil, thus it has been suggested the existence of a mutual relationship between a particular species of earthworm and soil microorganisms, proposing that this would allow the annelid to adapt to different habitats (Hubers, 1993). From these researches, several authors have analyzed each fraction of the digestive tube for greater understanding of this relationship and therefore their ecological function (Parle, 1963; Márialigeti, 1979; Toyota & Kimura, 1994, 2000; James, 1995).

More recent researches have been conducted to determine the communities of micro organisms that are specific or endogenous of each species of earthworm (Toyota & Kimura, 2000; Idowu et al., 2006) to distinguish them from those that could be ingested or inoculated with the soil they inhabit. It has been recently identified the bacterial flora of two species of earthworms found in the same plot of sugar cane cultivation; found that each species has a characteristic and exclusive microflora, despite sharing some species of bacteria among themselves and with the surrounding soil (Picón & Teisaire, 2008, 2009, 2012). Other observations showed that earthworms can act as vectors of bacteria and promote the re colonization of sterilized soil (Teisaire & Picón, 2010).

These results reinforced the idea that both in the intestine and the "casts" there is a great microbiological density and diversity. These organisms also have high activity in the soil, which would be very useful in the recovery or transformation of the waste substrate of agricultural practices.

The purpose of this work is to isolate and identify the microbial flora of the digestive tract of *Eisenia andrei*. Since this species is used in earthworm hatcheries or vermiculture in which different food substrates are used, some of these objectives is to isolate bacterial strains in different feeding conditions to establish differences in microbial populations attributable to different substrates and to identify the presence of endogenous strains of this species of earthworm.

MATERIALS AND METHODS

Specimens of *Eisenia andrei* of the family Lumbricidae, were raised in the laboratory and were fed with different substrates for 4 months. Food substrates corresponded to: (1) goat manure (95%) + corn stubble (5%) and (2) chicken manure (85%) + corn stubble (15%), composted for 1 month. Each substrate was placed in boxes of 40 x 30 x 15 cm. The substrates were watered daily for the first two weeks in order to maintain the wet litter to stabilize the pH, remove the soluble material and plant worms in each one of them. The pH was measured every week and the substrate was removed, so that the washing was homogeneous. At 30 days into the trial, 100 worms were seeded to each substrate. When selecting earthworms it was taken into account the size and the presence of clitellar ring developed and visible, which indicates reproductive maturity. From that moment the level of watering to the substrate bed was reduced and it was covered with a mesh of 80% greenhouse shade. *Eisenia andrei* was fed for four months with the named substrates. The worms were started to be provided food for 15 days after the start of the trial.

We proceeded to separate adult specimens from the different substrates; dissection was performed to 5 exemplars of each substrate to remove the portions of intestine. The procedure was made under anesthesia by cold in refrigerator at 7 °C, once immobilized a cut was made in the ventral area of about 15 segments

long from the clitellum towards the back part of the body, allowing to expose the gut. Then, a section of the digestive tract of approximately 10 segments long was dissected. Once removed the sections of the digestive tract, with its content were macerated into physiological solution and proceeded to carry out successive dilutions.

Colonies were isolated in petri dishes, with general medium solid nutrient agar according to the technique of striatum and finally incubations were carried in oven at 30 °C. These strains were signaled and then were exposed to different tests for identification according to the keys of Bergey's Manual of Determinative Bacteriology (Holt et al., 1994).

RESULTS

In worms raised in substrate (1), with goat manure and corn stubble, 11 stumps of bacteria in total were isolated, from which the following have been identified: 1 strain *Micrococcus* sp.; *Pseudomonas* sp.; *Neisseria* sp. And *Sporolactobacillus* sp.; 4 strains of *Oscillospira* spp.; and 3 strains which identification is uncertain.

In worms raised in substrate (2), with chicken manure and corn stubble, 12 strains in total were isolated and were identified: 1. *Oscillospira* sp. strain; *Bacillus* sp. and *Syntrophospora* sp.; 2 strains *Beijerinckia* spp.; 4 strains of *Pseudomonas* spp.; and 2 strains of doubtful identification.

When comparing the results obtained in the intestinal contents of *Eisenia andrei*, raised on both substrates, it was possible to differentiate the strains that are provided by the substrate from those which are endogenous to this species of earthworms.

Pseudomonas and *Oscillospira* strains are present in samples from both tests or substrates, so that they could be part of the endogenous gut communities of this earthworm species. On the other hand, the other strain found, would be coming or provided by the substrate. For the test substrate prepared with goat manure, the strains *Micrococcus* sp., *Neisseria* sp. and *Sporolactobacillus* sp. would come from the substrate. In the case of worms raised in substrate prepared with chicken manure, the strains: *Bacillus* sp., *Beijerinckia* spp. and *Syntrophospora* sp. would come from this substrate.

DISCUSSION

The results of this work show that there is a wide variety of bacterial genus in *E. andrei*, when compared with the results of other authors' researches, such as those made by Santiago (1995) on the intestinal bacterial flora of *Onychochaeta borincana*, the Glossoscolecidae family, who has only identified the genus *Bacillus* with 7 different species, being this genus a common inhabitant of the soil where it is *O. borincana*. Valle Molinares (2006) identified in the intestinal microflora of *O. Borincana* to *Bacillus cereus* species. This same genus *Bacillus* was found by Picón and Teisaire (2012) in the intestinal contents of *Enantiodrilus borelli* together with other strains, in this case the genus *Bacillus* is considered endogenous, since it is not found in the surrounding soil.

This study found the strain *Bacillus* sp. in the digestive tract of *E. andrei*, raised in the substrate (2) prepared with chicken manure and corn stubble, and it is considered as given by the substrate.

The results set forth above and to our findings in these studies highlight the differences there are between different species of worms, some species may have

endogenous strains and others take it from the substrate they inhabit. This comparison would strengthen the idea of endogenous strains of each species of earthworm, being opposed to the views of Brito-Vega and Espinosa-Victoria (2009) who analyzed the results of several authors and concluded that the bacterial communities of the digestive tract of earthworms are variable, depending on climate, type of soil and organic matter. In this paper we evidence the presence of endogenous strains of the *Eisenia andrei* and strains that are introduced by the substrate where they are raised, expanding in this way the concepts of endogenous strains.

In other researches among which we mention Máriaiget (1979) who found with some frequency exemplars of *Vibrio* sp. and *Aeromonas hydrophila* in the guts of *Eisenia lucens*. Like Toyota and Kimura (1994), also found *Aeromonas hydrophila* while working with the genus *Pheretima*. These same authors (Toyota & Kimura, 2000) had similar results in the digestive tract of *Eisenia fetida*, identifying the same bacterial species *Aeromonas hydrophila*. These results led to the interpretation that endogenous bacterial flora is not necessarily specific since the species *A. hydrophila* has been found in different species of earthworms and in the digestive tract of other animals such as leeches and juvenile salmonids, which function and ecological significance still remain to be elucidated.

Our results are similar to those of Mendez et al. (2003) who supports the concept that bacteria are present in the gut considered as endogenous bacteria that are not in the ground in which they live, these authors also show that with a pre-wash of the gut these bacteria continue to be closely associated to the inner wall of the intestine.

All this leads to the interpretation that there is not a proper bacterial flora of each species and therefore the current research could not conclude that the endogenous micro flora is specific to each species of earthworms. Yet today there are few scattered studies and so it is possible that with more knowledge and more advanced methodologies this concept is reviewed.

Bacteria that were identified in this work have different functions, for example: *Pseudomonas* sp., *Micrococcus* sp., and *Bacillus* sp. among others, promote germination, vegetative growth and development, nitrogen fixation, and increase the absorption of nutrients such as nitrogen, phosphorus and potassium, are also able to produce phytohormone in order to serve as biocontrol of phytopathogenic fungi. These strains are considered of great importance for its potential as biofertilizers for plants of agricultural importance (Diaz Vargas et al., 2001; Beringe, 1984; Ferrera-Cerrato, 1995; Rodríguez, 1995; Chanway et al., 1989; Knudson, 1922; Peter et al., 1987; Alexander, 1981; Asea et al., 1988; Salih et al., 1989; Wilkinson et al., 1989, 1994; Frankenberger & Arshad, 1995; Fuentes et al., 2003; Tsawkelova et al., 2004a,b; Jimenez Salgado et al., 2004). Specifically, we found that the amylolytic function in soil and water bodies is in charge of the genus *Bacillus* sp., as well as the proteolytic and lipolytic function is in charge of the genus *Pseudomonas* sp., which is often found in environments which are rich in organic matter (Cárdenas, 1995).

Everything that was expressed by the different authors merely highlights the important role of earthworms in the decomposition and degradation of waste which derives from intensive agricultural activities.

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RESEARCH OF AQUATIC COLEOPTERA FAUNA OF THE INNER WESTERN ANATOLIA, PART - I (ADEPHAGA)

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ABSTRACT: 4327 specimens belonging to the adepghan water beetles were collected by area studies between April-September in 2007-2009 in provinces of Afyon, Denizli, Kütahya and Uşak locate in Inner Western Anatolia of Turkey. As a result of identification of these specimens, 77 species group taxa (72 species and 5 subspecies) of 25 genera of 4 families belong to the order Coleoptera were determined (Gyrinidae: 9 species; Haliplidae: 8 species; Noteridae: 1 species; Dytiscidae: 54 species and 5 subspecies).

KEY WORDS: Aquatic Coleoptera, Fauna, Inner Western Anatolia, Turkey.

Water beetles are important members of many freshwater aquatic ecosystems. Some adepghan aquatic beetles from the region were recorded by Guéorguiev (1981), Wewalka (1989), Fery & Hosseinie (1998), Fery & Petrov (2005) and Kiyak et al. (2006; 2007). This study is a part of PhD thesis research of Darılmaz (2010). In this study, aquatic beetles of the families Gyrinidae, Haliplidae, Noteridae, and Dytiscidae, were sampled in the Afyon, Denizli, Kütahya and Uşak in Western Anatolia in 2007 and 2009.

MATERIAL AND METHODS

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

The list of localities is shown in Table 1 and Figure 1.

RESULTS

Gyrinidae Latreille, 1810

***Gyrinus caspius* Ménériés, 1832**

Material examined: BE138: 5 ex.; BE208: 3 ex.; BE212: 1 ex.; BE235: 1 ex.; BE239: 4 ex.; BE250: 2 ex.; BE252: 1 ex.

***Gyrinus colymbus* Erichson, 1837**

Material examined: BE81: 4 ex.; BE220: 2 ex.

***Gyrinus dejeani* Brullé, 1832**

Material examined: BE212: 8 ex.

***Gyrinus distinctus* Aubé, 1838**

Material examined: BE102: 1 ex.; BE168: 30 ex.; BE235: 7 ex.; BE239: 10 ex.; BE247: 1 ex.; BE252: 1 ex.

***Gyrinus paykulli* G. Ochs, 1927**

Material examined: BE243: 2 ex.

***Gyrinus substriatus* Stephens, 1828**

Material examined: BE1: 4 ex.; BE33: 1 ex.; BE54: 12 ex.; BE58: 4 ex.; BE59: 1 ex.; BE194: 2

ex.; BE249: 3 ex.

***Gyrinus suffriani* W. Scriba, 1855**

Material examined: BE138: 3 ex.; BE220: 4 ex.; BE235: 3 ex.; BE261: 2 ex.

***Gyrinus urinator* Illiger, 1807**

Material examined: BE138: 1 ex.; BE212: 1 ex.

***Orectochilus villosus* (O.F. Müller, 1776)**

Material examined: BE25: 2 ex.; BE191: 1 ex.

Haliplidae Kirby, 1837

***Haliplus (Haliplus) heydeni* Wehncke, 1875**

Material examined: BE3: 1 ex.; BE54: 3 ex.; BE78: 9 ex.; BE118: 1 ex.; BE192: 17 ex.; BE201: 1 ex.; BE221: 12 ex.

Remarks: This species has been published as a exact locality for the fauna of Turkey (Darılmaz & Kiyak, 2010).

***Haliplus (Haliplus) ruficollis* (De Geer, 1774)**

Material examined: BE138: 18 ex.; BE153: 9 ex.; BE186: 2 ex.; BE199: 1 ex.; BE212: 9 ex.; BE250: 6 ex.

***Haliplus (Liaphlus) flavicollis* Sturm, 1834**

Material examined: BE26: 22 ex.

Remarks: This species has been published as a exact locality for the fauna of Turkey (Darılmaz & Kiyak, 2010).

***Haliplus (Liaphlus) fulvus* (Fabricius, 1801)**

Material examined: BE7: 1 ex.; BE131: 3 ex.; BE138: 1 ex.

***Haliplus (Liaphlus) laminatus* (Schaller, 1783)**

Material examined: BE55: 1 ex.

Remarks: This species has been published as a new record for the fauna of Turkey (Darılmaz & Kiyak, 2010).

***Haliplus (Liaphlus) mucronatus* Stephens, 1828**

Material examined: BE139: 5 ex.; BE208: 3 ex.

***Haliph (Neohaliph) lineatocollis* (Marsham, 1802)**

Material examined: BE108: 3 ex.

***Peltodytes caesus* (Duftschmid, 1805)**

Material examined: BE3: 1 ex.; BE7: 1 ex.; BE77: 1 ex.; BE78: 3 ex.; BE98: 1 ex.; BE104: 2 ex.; BE124: 4 ex.; BE127: 1 ex.; BE136: 1 ex.; BE138: 2 ex.; BE161: 1 ex.; BE162: 12 ex.; BE167: 1 ex.; BE170: 2 ex.; BE174: 1 ex.; BE199: 4 ex.; BE201: 8 ex.; BE212: 5 ex.; BE221: 7 ex.; BE224: 3 ex.; BE235: 1 ex.; BE236: 1 ex.; BE245: 1 ex.; BE250: 10 ex.

Noteridae C.G. Thomson, 1860

***Noterus clavicornis* (De Geer, 1774)**

Material examined: BE2: 22 ex.; BE3: 5 ex.; BE7: 2 ex.; BE8: 4 ex.; BE18: 5 ex.; BE26: 10 ex.; BE27: 23 ex.; BE34: 3 ex.; BE36: 4 ex.; BE37: 22 ex.; BE43: 1 ex.; BE47: 7 ex.; BE50: 1 ex.; BE76: 4 ex.; BE77: 12 ex.; BE78: 3 ex.; BE79: 2 ex.; BE80: 8 ex.; BE87: 17 ex.; BE88: 7 ex.; BE97: 3 ex.; BE106: 1 ex.; BE108: 12 ex.; BE116: 9 ex.; BE117: 11 ex.; BE124: 4 ex.; BE131: 4 ex.; BE135: 19 ex.; BE137: 7 ex.; BE138: 9 ex.; BE139: 12 ex.; BE142: 9 ex.; BE143: 4 ex.; BE148: 1 ex.; BE152: 12 ex.; BE153: 10 ex.; BE155: 8 ex.; BE156: 8 ex.; BE157: 2 ex.; BE159: 1 ex.; BE162: 8 ex.; BE163: 4 ex.; BE164: 3 ex.; BE167: 2 ex.; BE169: 4 ex.; BE170: 11 ex.; BE178: 3 ex.; BE180: 4 ex.; BE186: 4 ex.; BE193: 4 ex.; BE199: 1 ex.; BE201: 5 ex.; BE208: 40 ex.; BE209: 40 ex.; BE211: 10 ex.; BE212: 28 ex.; BE217: 1 ex.; BE219: 16 ex.; BE220: 36 ex.; BE221: 12 ex.; BE228: 14 ex.; BE231: 13 ex.; BE232: 43 ex.; BE235: 38 ex.; BE236: 3 ex.; BE237: 5 ex.; BE240: 7 ex.; BE244: 2 ex.; BE250: 8 ex.; BE251: 2 ex.; BE253: 9 ex.; BE254: 1 ex.; BE260: 2 ex.; BE261: 5 ex.

Dytiscidae Leach, 1815

***Agabus (Agabus) labiatus* (Brahm, 1790)**

Material examined: BE235: 1 ex.; BE241: 8 ex.; BE246: 8 ex.

Agabus (Gaurodytes) biguttatus (Olivier, 1795)

Material examined: BE5: 3 ex.; BE128: 1 ex.; BE140: 4 ex.; BE234: 4 ex.; BE235: 2 ex.

Agabus (Gaurodytes) bipustulatus (Linnaeus, 1767)

Material examined: BE12: 3 ex.; BE24: 1 ex.; BE35: 2 ex.; BE37: 1 ex.; BE40: 1 ex.; BE52: 9 ex.; BE59: 3 ex.; BE64: 10 ex.; BE65: 8 ex.; BE73: 28 ex.; BE75: 6 ex.; BE87: 10 ex.; BE96: 20 ex.; BE98: 1 ex.; BE99: 26 ex.; BE100: 1 ex.; BE106: 13 ex.; BE120: 3 ex.; BE138: 1 ex.; BE146: 1 ex.; BE157: 3 ex.; BE159: 15 ex.; BE179: 9 ex.; BE180: 2 ex.; BE190: 2 ex.; BE192: 1 ex.; BE193: 1 ex.; BE201: 7 ex.; BE212: 3 ex.; BE240: 1 ex.; BE246: 19 ex.; BE255: 23 ex.; BE256: 1 ex.

Remarks: Some *A. bipustulatus* samples were recorded by Darılmaz & Kiyak (2010) as *A. striolatus* because of similarities between these species.

Agabus (Gaurodytes) conspersus (Marsham, 1802)

Material examined: BE11: 2 ex.; BE14: 1 ex.; BE28: 1 ex.; BE37: 1 ex.; BE38: 1 ex.; BE41: 1 ex.; BE57: 2 ex.; BE64: 5 ex.; BE71: 2 ex.; BE73: 7 ex.; BE96: 1 ex.; BE99: 19 ex.; BE100: 1 ex.; BE128: 2 ex.; BE150: 1 ex.; BE151: 1 ex.; BE155: 12 ex.; BE158: 1 ex.; BE159: 5 ex.; BE160: 15 ex.; BE162: 3 ex.; BE179: 1 ex.; BE216: 1 ex.; BE235: 3 ex.; BE246: 17 ex.; BE255: 4 ex.

Agabus (Gaurodytes) didymus (Olivier, 1795)

Material examined: BE27: 1 ex.; BE29: 1 ex.; BE55: 1 ex.; BE58: 6 ex.; BE59: 5 ex.; BE64: 4 ex.; BE90: 1 ex.; BE99: 2 ex.; BE194: 1 ex.

Agabus (Gaurodytes) guttatus (Paykull, 1798)

Material examined: BE11: 3 ex.; BE33: 1 ex.; BE35: 1 ex.; BE40: 1 ex.; BE60: 1 ex.; BE99: 7 ex.; BE101: 5 ex.; BE128: 1 ex.; BE134: 2 ex.; BE140: 3 ex.; BE158: 2 ex.; BE166: 2 ex.; BE179: 4 ex.; BE234: 16 ex.; BE235: 1 ex.; BE239: 9 ex.

Agabus (Gaurodytes) nebulosus (Forster, 1771)

Material examined: BE20: 1 ex.; BE36: 1 ex.; BE47: 1 ex.; BE99: 3 ex.; BE128: 2 ex.; BE149: 2 ex.; BE159: 2 ex.; BE165: 3 ex.; BE230: 12 ex.; BE231: 2 ex.; BE234: 1 ex.; BE236: 1 ex.; BE241: 9 ex.; BE246: 4 ex.; BE247: 6 ex.; BE255: 2 ex.

Ilybius ater (De Geer, 1774)

Material examined: BE77: 1 ex.; BE159: 2 ex.; BE186: 2 ex.; BE199: 1 ex.; BE220: 2 ex.; BE226: 1 ex.; BE235: 6 ex.; BE251: 3 ex.; BE261: 2 ex.

Remarks: This species has been published as a new record for the fauna of Turkey (Darılmaz & Kiyak, 2009).

Ilybius chalconatus (Panzer, 1796)

Material examined: BE229: 29 ex.; BE235: 1 ex.; BE239: 1 ex.; BE246: 22 ex.

Ilybius fuliginosus (Fabricius, 1792)

Material examined: BE54: 9 ex.; BE118: 4 ex.; BE186: 2 ex.; BE199: 2 ex.

Ilybius quadriguttatus (Lacordaire, 1835)

Material examined: BE159: 1 ex.; BE220: 3 ex.; BE235: 5 ex.; BE251: 2 ex.

Platambus lunulatus (Fischer von Waldheim, 1829)

Material examined: BE102: 1 ex.; BE122: 4 ex.; BE168: 2 ex.

Platambus maculatus (Linnaeus, 1758)

Material examined: BE25: 2 ex.; BE51: 1 ex.; BE65: 3 ex.; BE83: 9 ex.; BE123: 9 ex.; BE171: 2 ex.; BE175: 11 ex.; BE191: 3 ex.

Colymbetes fuscus (Linnaeus, 1758)

Material examined: BE40: 1 ex.; BE47: 1 ex.; BE58: 3 ex.; BE64: 1 ex.; BE127: 1 ex.; BE157: 1 ex.; BE159: 9 ex.; BE186: 4 ex.; BE192: 1 ex.; BE193: 38 ex.; BE197: 1 ex.; BE201: 5 ex.; BE237: 1 ex.; BE239: 2 ex.; BE245: 1 ex.; BE246: 3 ex.; BE247: 7 ex.; BE250: 1 ex.; BE253: 1 ex.; BE261: 3 ex.

Rhantus (Nartus) grapii (Gyllenhal, 1808)

Material examined: BE220: 1 ex.; BE235: 13 ex.; BE251: 1 ex.

Remarks: This species has been published as a new record for the fauna of Turkey (Darılmaz & Kiyak, 2010).

Rhantus (Rhantus) suturalis (W.S. MacLeay, 1825)

Material examined: BE54: 1 ex.; BE118: 2 ex.

Liopterus haemorrhoidalis (Fabricius, 1787)

Material examined: BE157: 12 ex.; BE159: 4 ex.; BE235: 2 ex.; BE251: 2 ex.

***Graphoderus austriacus* (Sturm, 1834)**

Material examined: BE140: 1 ex.; BE220: 3 ex.; BE251: 4 ex.

Remarks: This species has been published as a new record for the fauna of Turkey (Darılmaz & Kiyak, 2010).

***Graphoderus cinereus* (Linnaeus, 1758)**

Material examined: BE142: 1 ex.; BE186: 1 ex.; BE193: 1 ex.; BE214: 1 ex.; BE220: 13 ex.; BE235: 24 ex.; BE251: 6 ex.; BE261: 2 ex.

***Cybister (Cybister) lateralimarginalis torquatus* (Fischer von Waldheim, 1829)**

Material examined: BE7: 2 ex.; BE34: 2 ex.; BE77: 5 ex.; BE79: 3 ex.; BE80: 1 ex.; BE137: 3 ex.; BE138: 2 ex.; BE156: 3 ex.; BE186: 1 ex.; BE193: 1 ex.; BE213: 1 ex.; BE220: 1 ex.; BE226: 4 ex.; BE227: 9 ex.; BE235: 1 ex.; BE236: 3 ex.; BE242: 16 ex.; BE243: 15 ex.; BE251: 5 ex.; BE261: 1 ex.

***Dytiscus dimidiatus* Bergsträsser, 1778**

Material examined: BE220: 3 ex.; BE235: 6 ex.; BE251: 1 ex.

***Dytiscus marginalis* Linnaeus, 1758**

Material examined: BE90: 1 ex.; BE156: 1 ex.; BE189: 2 ex.; BE201: 1 ex.

***Dytiscus semisulcatus* O.F. Müller, 1776**

Material examined: BE73: 1 ex.; BE96: 1 ex.

***Hydaticus (Hydaticus) seminiger* (DeGeer, 1774)**

Material examined: BE98: 2 ex.; BE201: 1 ex.

Remarks: This species has been published as a new record for the fauna of Turkey (Darılmaz & Kiyak, 2009).

***Hydaticus (Hydaticus) transversalis laevisculptus* Zaitzev, 1910**

Material examined: BE57: 1 ex.; BE70: 1 ex.; BE156: 2 ex.; BE170: 1 ex.; BE186: 1 ex.; BE199: 1 ex.; BE212: 2 ex.; BE220: 10 ex.; BE235: 25 ex.; BE251: 11 ex.; BE261: 5 ex.

***Bidessus calabricus* Guignot, 1957**

Material examined: BE60: 1 ex.; BE106: 6 ex.; BE108: 1 ex.; BE113: 1 ex.; BE183: 1 ex.

***Bidessus nasutus* Sharp, 1887**

Material examined: BE18: 1 ex.; BE34: 1 ex.; BE77: 15 ex.; BE131: 1 ex.; BE159: 5 ex.; BE169: 1 ex.; BE181: 1 ex.; BE199: 1 ex.; BE211: 3 ex.; BE261: 1 ex.

***Bidessus unistriatus* (Goeze, 1777)**

Material examined: BE201: 9 ex.

***Hydroglyphus geminus* (Fabricius, 1792)**

Material examined: BE1: 1 ex.; BE7: 5 ex.; BE11: 1 ex.; BE18: 1 ex.; BE24: 1 ex.; BE25: 1 ex.; BE26: 1 ex.; BE27: 3 ex.; BE34: 29 ex.; BE103: 3 ex.; BE104: 2 ex.; BE105: 2 ex.; BE106: 1 ex.; BE107: 2 ex.; BE108: 1 ex.; BE115: 2 ex.; BE116: 2 ex.; BE118: 5 ex.; BE120: 8 ex.; BE135: 1 ex.; BE137: 1 ex.; BE142: 2 ex.; BE146: 1 ex.; BE148: 2 ex.; BE149: 1 ex.; BE152: 1 ex.; BE154: 2 ex.; BE162: 2 ex.; BE163: 1 ex.; BE167: 10 ex.; BE169: 2 ex.; BE175: 3 ex.; BE178: 1 ex.; BE181: 2 ex.; BE188: 11 ex.; BE193: 16 ex.; BE195: 3 ex.; BE196: 2 ex.; BE197: 1 ex.; BE198: 14 ex.; BE209: 2 ex.; BE221: 1 ex.; BE230: 1 ex.; BE231: 5 ex.; BE240: 30 ex.; BE241: 1 ex.; BE246: 6 ex.; BE247: 3 ex.; BE250: 1 ex.; BE253: 1 ex.; BE256: 9 ex.; BE259: 10 ex.; BE260: 1 ex.; BE32: 4 ex.; BE33: 4 ex.; BE36: 1 ex.; BE42: 1 ex.; BE43: 3 ex.; BE44: 1 ex.; BE50: 5 ex.; BE55: 1 ex.; BE60: 1 ex.; BE63: 4 ex.; BE69: 4 ex.; BE71: 2 ex.; BE73: 11 ex.; BE76: 1 ex.; BE80: 2 ex.; BE81: 4 ex.; BE82: 1 ex.; BE86: 2 ex.; BE87: 2 ex.; BE96: 4 ex.; BE98: 1 ex.

***Hydroglyphus signatellus* (Klug, 1834)**

Material examined: BE17: 4 ex.

***Deronectes parvicollis* (Schaum, 1864)**

Material examined: BE158: 44 ex.; BE238: 34 ex.

***Deronectes sahlbergi* Zimmermann, 1932**

Material examined: BE158: 1 ex.

***Graptodytes bilineatus* (Sturm, 1835)**

Material examined: BE206: 5 ex.

***Graptodytes sedilloti phrygius* Guignot, 1942**

Material examined: BE37: 1 ex.; BE58: 2 ex.; BE97: 2 ex.; BE130: 1 ex.; BE141: 1 ex.; BE197: 1 ex.; BE241: 1 ex.

***Graptodytes veterator behningi* Zaitzev, 1927**

Material examined: BE80: 1 ex.; BE162: 17 ex.; BE167: 10 ex.; BE240: 13 ex.

***Hydroporus angustatus* Sturm, 1835**

Material examined: BE37: 53 ex.; BE77: 5 ex.; BE201: 12 ex.; BE212: 5 ex.; BE228: 1 ex.; BE235: 5 ex.; BE245: 1 ex.; BE251: 3 ex.; BE253: 5 ex.; BE261: 1 ex.

Remarks: This species has been published as a new record for the fauna of Turkey (Darılmaz & Kiyak 2010).

***Hydroporus discretus* Fairmaire & Brisout, 1859**

Material examined: BE33: 3 ex.; BE52: 10 ex.; BE100: 2 ex.

***Hydroporus marginatus* (Duftschmid, 1805)**

Material examined: BE229: 5 ex.; BE230: 1 ex.

***Hydroporus palustris* (Linnaeus, 1761)**

Material examined: BE54: 22 ex.; BE90: 4 ex.; BE141: 4 ex.; BE164: 3 ex.; BE185: 3 ex.; BE240: 1 ex.

***Hydroporus planus* (Fabricius, 1782)**

Material examined: BE33: 5 ex.; BE37: 6 ex.; BE73: 54 ex.; BE96: 24 ex.; BE146: 2 ex.; BE149: 10 ex.; BE157: 11 ex.; BE159: 5 ex.; BE160: 26 ex.; BE192: 4 ex.; BE241: 4 ex.; BE245: 1 ex.; BE246: 38 ex.; BE247: 2 ex.; BE250: 1 ex.; BE251: 1 ex.

***Hydroporus pubescens* (Gyllenhal, 1808)**

Material examined: BE256: 8 ex.; BE230: 1 ex.

***Hydroporus thracicus* Guéorguiev, 1966**

Material examined: BE70: 3 ex.

***Hydroporus transgrediens* Gschwendtner, 1923**

Material examined: BE99: 34 ex.

***Nebrioporus (Nebrioporus) airumlus* (Kolenati, 1845)**

Material examined: BE38: 21 ex.

***Nebrioporus (Nebrioporus) stearinus suavis* (Sharp, 1882)**

Material examined: BE11: 3 ex.; BE16: 3 ex.; BE74: 3 ex.; BE168: 2 ex.; BE182: 15 ex.; BE183: 4 ex.; BE202: 19 ex.; BE235: 3 ex.

***Porhydrus lineatus* (Fabricius, 1775)**

Material examined: BE77: 233 ex.; BE79: 63 ex.; BE153: 13 ex.; BE186: 23 ex.; BE199: 13 ex.; BE201: 103 ex.

***Scarodytes halensis* (Fabricius, 1787)**

Material examined: BE1: 1 ex.; BE5: 3 ex.; BE11: 3 ex.; BE12: 1 ex.; BE33: 1 ex.; BE40: 3 ex.; BE55: 2 ex.; BE58: 4 ex.; BE59: 13 ex.; BE60: 13 ex.; BE64: 2 ex.; BE83: 7 ex.; BE89: 11 ex.; BE90: 15 ex.; BE106: 6 ex.; BE107: 5 ex.; BE109: 23 ex.; BE120: 9 ex.; BE121: 10 ex.; BE126: 1 ex.; BE158: 1 ex.; BE163: 1 ex.; BE165: 2 ex.; BE171: 4 ex.; BE174: 8 ex.; BE175: 10 ex.; BE176: 1 ex.; BE182: 12 ex.; BE183: 24 ex.; BE186: 1 ex.; BE188: 4 ex.; BE189: 8 ex.; BE195: 2 ex.; BE196: 4 ex.; BE229: 1 ex.; BE235: 13 ex.; BE239: 4 ex.; BE248: 2 ex.; BE259: 2 ex.

***Hydrovatus cuspidatus* (Kunze, 1818)**

Material examined: BE18: 8 ex.; BE36: 2 ex.; BE70: 1 ex.; BE76: 2 ex.; BE77: 10 ex.; BE78: 3 ex.; BE79: 1 ex.; BE88: 2 ex.; BE108: 1 ex.; BE131: 1 ex.; BE138: 6 ex.; BE139: 9 ex.; BE162: 2 ex.; BE167: 3 ex.; BE186: 7 ex.; BE192: 2 ex.; BE208: 6 ex.; BE212: 7 ex.; BE220: 4 ex.; BE250: 1 ex.; BE261: 1 ex.

***Herophydrus musicus* (Klug, 1834)**

Material examined: BE116: 1 ex.; BE178: 1 ex.

Remarks: This species has been published as a exact locality for the fauna of Turkey (Darılmaz and Kiyak 2010).

***Hygrotus (Coelambus) confluens* (Fabricius, 1787)**

Material examined: BE112: 1 ex.; BE181: 26 ex.; BE246: 1 ex.

***Hygrotus (Coelambus) impressopunctatus* (Schaller, 1783)**

Material examined: BE77: 3 ex.; BE97: 1 ex.; BE159: 4 ex.; BE240: 8 ex.

***Hygrotus (Coelambus) lernaeus* (Schaum, 1857)**

Material examined: BE116: 1 ex.; BE201: 9 ex.; BE208: 2 ex.; BE220: 1 ex.; BE221: 1 ex.; BE224: 1 ex.; BE232: 3 ex.; BE235: 1 ex.; BE237: 2 ex.; BE240: 69 ex.; BE251: 12 ex.; BE254: 4 ex.; BE261: 2 ex.

Hygrotus (Coelambus) parallelogrammus (Ahrens, 1812)

Material examined: BE87: 1 ex.; BE162: 2 ex.; BE201: 2 ex.; BE240: 1 ex.

Hygrotus (Coelambus) saginatus (Schaum, 1857)

Material examined: BE37: 1 ex.; BE151: 5 ex.; BE201: 1 ex.; BE240: 19 ex.; BE241: 1 ex.; BE261: 3 ex.

Hygrotus (Hygrotus) inaequalis (Fabricius, 1777)

Material examined: BE34: 1 ex.; BE37: 24 ex.; BE54: 3 ex.; BE70: 14 ex.; BE71: 5 ex.; BE77: 39 ex.; BE79: 26 ex.; BE80: 7 ex.; BE98: 4 ex.; BE108: 1 ex.; BE117: 3 ex.; BE131: 5 ex.; BE138: 16 ex.; BE153: 6 ex.; BE159: 6 ex.; BE164: 17 ex.; BE169: 17 ex.; BE170: 5 ex.; BE178: 1 ex.; BE186: 3 ex.; BE199: 10 ex.; BE201: 13 ex.; BE212: 36 ex.; BE214: 1 ex.; BE220: 27 ex.; BE228: 9 ex.; BE232: 10 ex.; BE235: 48 ex.; BE241: 16 ex.; BE245: 17 ex.; BE250: 9 ex.; BE251: 4 ex.; BE253: 6 ex.; BE261: 3 ex.

Hyphydrus ovatus (Linnaeus, 1761)

Material examined: BE98: 2 ex.; BE159: 1 ex.; BE181: 3 ex.; BE241: 1 ex.; BE247: 37 ex.

Laccophilus hyalinus (DeGeer, 1774)

Material examined: BE3: 5 ex.; BE5: 1 ex.; BE6: 13 ex.; BE23: 20 ex.; BE26: 6 ex.; BE30: 2 ex.; BE40: 11 ex.; BE50: 9 ex.; BE54: 2 ex.; BE55: 5 ex.; BE67: 2 ex.; BE74: 1 ex.; BE83: 2 ex.; BE86: 1 ex.; BE88: 1 ex.; BE90: 1 ex.; BE117: 4 ex.; BE123: 7 ex.; BE127: 22 ex.; BE133: 6 ex.; BE136: 6 ex.; BE142: 1 ex.; BE180: 3 ex.; BE181: 8 ex.; BE182: 1 ex.; BE183: 1 ex.; BE191: 1 ex.; BE192: 2 ex.; BE194: 2 ex.; BE195: 6 ex.; BE196: 3 ex.; BE201: 4 ex.; BE208: 1 ex.; BE259: 2 ex.

Laccophilus minutus (Linnaeus, 1758)

Material examined: BE1: 1 ex.; BE2: 6 ex.; BE8: 3 ex.; BE18: 1 ex.; BE33: 1 ex.; BE34: 2 ex.; BE41: 1 ex.; BE58: 1 ex.; BE59: 1 ex.; BE60: 3 ex.; BE76: 2 ex.; BE77: 13 ex.; BE78: 4 ex.; BE79: 15 ex.; BE80: 5 ex.; BE82: 2 ex.; BE94: 1 ex.; BE98: 2 ex.; BE104: 1 ex.; BE106: 1 ex.; BE107: 3 ex.; BE108: 1 ex.; BE116: 1 ex.; BE120: 2 ex.; BE131: 4 ex.; BE135: 3 ex.; BE137: 1 ex.; BE141: 2 ex.; BE162: 1 ex.; BE163: 2 ex.; BE164: 3 ex.; BE165: 1 ex.; BE175: 8 ex.; BE180: 2 ex.; BE183: 1 ex.; BE188: 3 ex.; BE193: 6 ex.; BE197: 7 ex.; BE198: 2 ex.; BE208: 1 ex.; BE214: 15 ex.; BE220: 2 ex.; BE226: 1 ex.; BE228: 3 ex.; BE230: 4 ex.; BE236: 1 ex.; BE237: 4 ex.; BE239: 1 ex.; BE240: 1 ex.; BE241: 5 ex.; BE245: 4 ex.; BE246: 1 ex.; BE247: 16 ex.; BE250: 4 ex.; BE251: 3 ex.; BE255: 31 ex.; BE258: 1 ex.

Laccophilus poecilus Klug, 1834

Material examined: BE36: 8 ex.; BE50: 1 ex.; BE76: 1 ex.; BE77: 2 ex.; BE78: 2 ex.; BE79: 1 ex.; BE80: 1 ex.; BE97: 2 ex.; BE116: 1 ex.; BE131: 3 ex.; BE135: 4 ex.; BE138: 5 ex.; BE139: 3 ex.; BE153: 5 ex.; BE155: 8 ex.; BE159: 2 ex.; BE169: 9 ex.; BE186: 4 ex.; BE193: 3 ex.; BE199: 2 ex.; BE201: 2 ex.; BE209: 1 ex.; BE211: 1 ex.; BE212: 10 ex.; BE214: 4 ex.; BE219: 4 ex.; BE220: 2 ex.; BE250: 1 ex.

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Table 1. List of localities.

BE1: AFYON: Emirdağ (Eskişehir Yolu 5.km Köprünün altı), 39°03'610"K 31°09'854"D, 933 m, 23.04.2007

BE2: AFYON: İsehisar (Seydiler Belediyesi), Yol kenarı Gölet), 38°53'846"K 30°50'142"D, 1201 m, 23.04.2007

- BE3: KÜTAHYA: Altıntaş (Oluklu dere- köprünün altı), 39°04'860"K 30°07'557"D, 1018 m, 24.04.2007
 BE4: KÜTAHYA: Altıntaş-Dumlupınar arası (Genişler köyü çıkışı-Oluklu deresi), 38°58'749"K 30°06'800"D, 1064 m, 24.04.2007
 BE5: AFYON: Hocalar (Devlethan köyü-Gözü deresi), 38°31'764"K 29°58'608"D, 1011 m, 24.04.2007
 BE6: DENİZLİ: Çivril (Akdağ-Küf çayı), 38°21'633"K 29°51'107"D, 896 m, 25.04.2007
 BE7: DENİZLİ: Çivril (Işık gölü, 1. İstasyon), 38°16'077"K 29°55'498"D, 827 m, 25.04.2007
 BE8: DENİZLİ: Buldan (Süleymanlı gölü), 38°03'035"K 28°46'291"D, 1157 m, 26.04.2007
 BE9: DENİZLİ: Çal (Karapınar Köyü-Karapınar göleti), 37°46'104"K 29°07'715"D, 350 m, 26.04.2007
 BE10: DENİZLİ: Acıpayam (Akalan kasabası Barajdan gelen dere), 37°22'793"K 29°17'521"D, 1100 m, 27.04.2007
 BE11: DENİZLİ: Acıpayam (Akalan kasabası Barajdan giderken yol kenarı su birikintisi), 37°21'878"K 29°20'292"D, 985 m, 27.04.2007
 BE12: DENİZLİ: Acıpayam (Çakırköyü -Dalaman çayına dökülen dere), 37°18'298"K 29°20'730"D, 821 m, 27.04.2007
 BE13: DENİZLİ: Pamukkale, 37°55'150"K 29°07'262"D, 280 m, 28.04.2007
 BE14: DENİZLİ: Karahayıt (Kırmızı su), 37°58'048"K 29°06'108"D, 335 m, 28.04.2007
 BE15: DENİZLİ: Denizli (Akköy-Sarayköy arası-Aksu Çayı), 37°56'381"K 28°59'523"D, 146 m, 28.04.2007
 BE16: DENİZLİ: Babadağ (Gündoğdu Mh. Babadağ çayı), 37°47'943"K 28°51'363"D, 749 m, 28.04.2007
 BE17: DENİZLİ: Çardak (Gemiş köyü çıkışı -Çeşme, su birikintisi), 37°46'367"K 29°50'622"D, 847 m, 29.04.2007
 BE18: DENİZLİ: Çardak (Acıgöl kenarı), 37°47'960"K 29°53'625"D, 848 m, 29.04.2007
 BE19: AFYON: Emirdağ (Çatallı Köyüne 2 km kala), 38°57'260"K 31°07'676"D, 1074 m, 19.05.2007
 BE20: AFYON: Emirdağ (Çatallı Köyü Çıkışı-Uçarken yakalandı), 38°55'662"K 31°08'748"D, 1235 m, 19.05.2007
 BE21: AFYON: Emirdağ (Çatallı Köyü-Çeşme), 38°56'496"K 31°08'075"D, 1116 m, 19.05.2007
 BE22: AFYON: Afyon- Kütahya yolu 2.km. (Akar Çay), 38°50'487"K 30°25'925"D, 1031 m, 20.05.2007
 BE23: KÜTAHYA: Altıntaş-Dumlupınar arası (Genişler köyü çıkışı-Oluklu deresi), 38°58'749"K 30°06'800"D, 1064 m, 20.05.2007
 BE24: KÜTAHYA: Tavşanlı-Domaniç arası (Karasu deresi), 39°34'921"K 29°27'852"D, 817 m, 21.05.2007
 BE25: KÜTAHYA: Tavşanlı-Domaniç arası (Karaköy-Kocasu deresi), 39°43'665"K 29°31'457"D, 708 m, 21.05.2007
 BE26: KÜTAHYA: Tavşanlı (Güzelyurt göleti), 39°29'007"K 29°34'480"D, 850 m, 21.05.2007
 BE27: KÜTAHYA: Simav (Gölcük Yayla gölü), 39°09'975"K 29°05'108"D, 1309 m, 22.05.2007
 BE28: KÜTAHYA: Simav (Demirci Köy Su birikintisi), 39°06'094"K 28°55'457"D, 825 m, 22.05.2007
 BE29: KÜTAHYA: Şaphane (Karamanca Köyü çıkışı Yol kenarındaki dere), 39°00'905"K 29°09'631"D, 899 m, 22.05.2007
 BE30: UŞAK: Ulubey (Giney yolu-Hamam Çayı), 38°17'910"K 29°08'479"D, 528 m, 23.05.2007
 BE31: UŞAK: Eşme (İsalar Göleti), 38°28'316"K 29°01'503"D, 800 m, 23.05.2007
 BE32: AFYON: Hocalar-Banaz 10. km. (Sulama kanalının oluşturduğu su birikintisi), 38°39'043"K 29°48'955"D, 997 m, 23.05.2007
 BE33: AFYON: Hocalar (Devlethan Köyü Belağı Yaylası Ayan Çeşmesi), 38°32'444"K 29°54'556"D, 1200 m, 24.05.2007
 BE34: DENİZLİ: Çivril (Işık gölü, 1. İstasyon), 38°16'077"K 29°55'498"D, 827 m, 24.05.2007
 BE35: DENİZLİ: Honaz Dağı Milli Parkı, 37°39'660"K 29°14'779"D, 1215 m, 25.05.2007
 BE36: DENİZLİ: Honaz (Yukarı dağdere köy -Saklı Göl), 37°46'621"K 29°21'901"D, 959 m, 25.05.2007
 BE37: DENİZLİ: Bozkurt (Çambaşı Köyü-Karagöl), 37°44'084"K 29°29'530"D, 1266 m, 26.05.2007
 BE38: DENİZLİ: Bozkurt (Çambaşı Köyü-Emir Çayı), 37°43'084"K 29°28'530"D, 1250 m, 26.05.2007
 BE39: AFYON: Bayat (Çalboğazi deresi), 38°59'267"K 30°56'650"D, 1045 m, 18.06.2007
 BE40: AFYON: Bayat (Bayat Göleti-Çalboğazi deresi), 38°58'194"K 30°53'394"D, 1138 m, 18.06.2007
 BE41: AFYON: Bayat (Bayat göletinin yolu üzerinde yağmur suyu birikintisi), 38°58'581"K 30°53'871"D, 1162 m, 18.06.2007
 BE42: AFYON: Bayat (Bayat göleti), 38°58'536"K 30°53'970"D, 1145 m, 18.06.2007
 BE43: AFYON: İscehisar (Avşar deresi), 38°47'931"K 30°48'844"D, 1053 m, 18.06.2007
 BE44: AFYON: İscehisar (İscehisar Barajı), 38°47'393"K 30°48'221"D, 1044 m, 19.06.2007
 BE45: AFYON: İhsaniye (Uçarken Yakalandı), 39°03'605"K 30°24'056"D, 1110 m, 19.06.2007
 BE46: AFYON: İhsaniye (Üçlerkayası Göleti), 39°04'785"K 30°25'553"D, 1136 m, 19.06.2007
 BE47: AFYON: İhsaniye (Döğer Köyü Emre Göleti), 39°06'607"K 30°26'403"D, 1154 m, 19.06.2007
 BE48: KÜTAHYA: Söğüt (Söğüt Barajı), 39°25'264"K 30°11'380"D, 1134 m, 19.06.2007
 BE49: KÜTAHYA: Söğüt (Söğüt çayı), 39°26'896"K 30°10'212"D, 1069 m, 19.06.2007
 BE50: KÜTAHYA: Tavşanlı (Kuruçay Köyü-Kuruçay göleti), 39°28'660"K 29°30'358"D, 902 m, 20.06.2007
 BE51: KÜTAHYA: Domaniç (Domaniç-İnegöl Yolu 5. km. Çakıl deresi), 39°50'709"K 29°38'346"D, 1126 m, 20.06.2007
 BE52: KÜTAHYA: Domaniç (Domaniç-Bursa Yolu, Çeşme), 39°50'709"K 29°38'346"D, 1126 m, 20.06.2007
 BE53: KÜTAHYA: Domaniç (Domaniç-Bursa Yolu 8.km Palazoğlu Balık tesisleri göleti), 39°51'823"K 29°38'393"D, 1333 m, 20.06.2007
 BE54: KÜTAHYA: Çavdarhisar (Çavdarhisar barajı), 39°10'728"K 29°35'377"D, 1023 m, 20.06.2007
 BE55: KÜTAHYA: Gediz (Gümeleköy Barajı), 38°55'385"K 29°28'411"D, 796 m, 21.06.2007
 BE56: KÜTAHYA: Gediz (Murat Dağı, Çeşme), 38°57'319"K 29°37'248"D, 1470 m, 21.06.2007
 BE57: KÜTAHYA: Gediz (Muratdağı 15.km-Muratdağı deresi), 38°58'353"K 29°34'025"D, 884 m, 21.06.2007
 BE58: KÜTAHYA: Merkez (Kuşu Köyü-Kuşu göleti), 38°59'796"K 29°00'101"D, 1008 m, 22.06.2007
 BE59: KÜTAHYA: Şaphane (Şaphane girişindeki dere), 39°00'880"K 29°09'997"D, 876 m, 22.06.2007
 BE60: UŞAK: Eşme (Bozlar deresi), 38°35'415"K 29°01'627"D, 600 m, 22.06.2007
 BE61: UŞAK: Eşme (Takmak Köyü-Takmak Göleti), 38°26'486"K 28°57'047"D, 831 m, 22.06.2007
 BE62: UŞAK: Eşme (Yeleşen Köyü-Yeleşen Göleti), 38°18'450"K 28°55'551"D, 817 m, 22.06.2007
 BE63: UŞAK: Eşme (Yeşilkavak Köyü-Yeşilkavak Göleti), 38°18'162"K 28°57'947"D, 753 m, 22.06.2007
 BE64: UŞAK: Banaz (Ahat Köyü-Çeşme), 38°39'331"K 29°46'825"D, 958 m, 23.06.2007
 BE65: UŞAK: Banaz (Yeşilyurt Köyü-Kaynarca mevkii), 38°48'104"K 29°40'475"D, 1076 m, 23.06.2007
 BE66: UŞAK: Banaz (Yeşilyurt Köyü-Kaynarca dere), 38°48'385"K 29°40'703"D, 1024 m, 23.06.2007
 BE67: UŞAK: Banaz (Küçükler Barajı), 38°52'588"K 29°36'597"D, 1265 m, 23.06.2007
 BE68: AFYON: Hocalar-Banaz 10. km. (Sulama kanalının oluşturduğu su birikintisi), 38°39'043"K 29°48'955"D, 997 m, 23.06.2007
 BE69: AFYON: Hocalar (Devlethan Köyü-İmamkızı mevkii çeşme), 38°33'444"K 29°56'556"D, 1138 m, 23.06.2007
 BE70: DENİZLİ: Çardak (Beylerli Kasabası-Değirmendere), 37°41'294"K 29°37'290"D, 921 m, 24.06.2007
 BE71: DENİZLİ: Çardak (Söğüt Köyü-Söğüt göleti ve çeşmesi), 37°39'479"K 29°33'505"D, 1349 m, 24.06.2007
 BE72: DENİZLİ: Beyağaç (Kartal Gölü yolu 7.km çeşme), 37°11'593"K 28°51'962"D, 1070 m, 25.06.2007
 BE73: DENİZLİ: Beyağaç (Kartal Gölü), 37°05'761"K 28°50'975"D, 1903 m, 25.06.2007
 BE74: DENİZLİ: Beyağaç (Kartal Gölü yolu19.km dere), 37°07'701"K 28°50'313"D, 1414 m, 25.06.2007

- BE75: DENİZLİ: Honaz Dağı Milli Parkı, 37°39'660"K 29°14'779"D, 1215 m, 26.06.2007
 BE76: AFYON: Çay (Çayıryazı Köyü Göleti), 38°22'468"K 30°44'550"D, 1112 m, 27.06.2007
 BE77: AFYON: Çay (Eber Gölü), 38°36'875"K 31°09'611"D, 973 m, 27.06.2007
 BE78: AFYON: Emirdağ (Pınarbaşı Göleti), 39°02'877"K 31°19'605"D, 899 m, 09.07.2007
 BE79: AFYON: Çay (Eber Gölü), 38°36'875"K 31°09'611"D, 973 m, 09.07.2007
 BE80: AFYON: Çay (Karamık Sazlığı), 38°25'271"K 30°53'090"D, 1014 m, 10.07.2007
 BE81: AFYON: Çay (Yağdıoğlu Köyü girişi Yol kenarı su birikintisi), 38°22'574"K 30°46'226"D, 1013 m, 10.07.2007
 BE82: KÜTAHYA: Porsuk Barajı, 39°34'309"K 30°07'072"D, 888 m, 10.07.2007
 BE83: KÜTAHYA: Frig vadisi (Sabuncupınar deresi), 39°33'601"K 30°12'806"D, 960 m, 11.07.2007
 BE84: KÜTAHYA: Çavdarhisar (Çavdarhisar yolu 2.km-Porsuk Çayı), 39°21'750"K 30°02'934"D, 958 m, 11.07.2007
 BE85: KÜTAHYA: Merkez (Pullar Köyü-Pullar Göleti), 39°20'643"K 29°49'711"D, 1213 m, 11.07.2007
 BE86: KÜTAHYA: Çavdarhisar (Bedir Çayı), 39°12'052"K 29°36'718"D, 1020 m, 11.07.2007
 BE87: KÜTAHYA: Simav (Gölcük Yayla gölü), 39°09'975"K 29°05'108"D, 1309 m, 12.07.2007
 BE88: KÜTAHYA: Pazarlar (Pazarlar göleti), 38°59'782"K 29°05'175"D, 949 m, 12.07.2007
 BE89: KÜTAHYA: Pazarlar (Yakuplar Köyü-Yakuplar Göleti sulama deresi), 38°55'887"K 29°08'545"D, 918 m, 12.07.2007
 BE90: UŞAK: Merkez (Gögem Göleti), 38°43'200"K 29°33'351"D, 958 m, 13.07.2007
 BE91: UŞAK: Ulubey (Kazançı Deresi), 38°22'750"K 29°18'315"D, 543 m, 13.07.2007
 BE92: UŞAK: Ulubey (Banaz Çayı), 38°21'967"K 29°19'688"D, 543 m, 13.07.2007
 BE93: DENİZLİ: Çivril (Gülpinar Kaynak Çıkışı), 38°25'265"K 29°43'029"D, 973 m, 13.07.2007
 BE94: DENİZLİ: Buldan (Süleymanlı gölü), 38°03'035"K 28°46'291"D, 1157 m, 13.07.2007
 BE95: DENİZLİ: Çal (Belevi Köyü-çeşme), 37°54'661"K 29°33'659"D, 954 m, 14.07.2007
 BE96: DENİZLİ: Beyağaç (Kartal Gölü), 37°05'761"K 28°50'975"D, 1903 m, 15.07.2007
 BE97: AFYON: Emirdağ (Pınarbaşı Göleti), 39°02'877"K 31°19'605"D, 899 m, 10.08.2007
 BE98: AFYON: Çay (Çayıryazı Köyü Göleti), 38°22'468"K 30°44'550"D, 1112 m, 10.08.2007
 BE99: DENİZLİ: Tavas (Yorga Köyü-Gökçeşirar Mevkii-Kaynak Gözeleri), 37°19'951"K 29°07'478"D, 1164 m, 11.08.2007
 BE100: DENİZLİ: Serinhisar (Yatağan-Kefe Yaylası Yolu-Yol Kenarı Çeşme), 37°36'669"K 29°23'078"D, 1301 m, 12.08.2007
 BE101: DENİZLİ: Serinhisar (Kocapınar-Karaçay Arası, Karaçay), 37°40'187"K 29°24'045"D, 1100 m, 12.08.2007
 BE102: DENİZLİ: Babadağ (Gündoğdu Mh. Babadağ çayı), 37°47'943"K 28°51'363"D, 749 m, 13.08.2007
 BE103: DENİZLİ: Babadağ (Kelleci Köyü Sulama Göleti), 37°49'601"K 28°54'829"D, 687 m, 13.08.2007
 BE104: DENİZLİ: Çivril (Çatak-Karaköy Arası, Büyük Menderes), 38°09'413"K 29°38'405"D, 809 m, 14.08.2007
 BE105: DENİZLİ: Çivril (Işıkli Gölü, 1. İstasyon), 38°16'077"K 29°55'498"D, 827 m, 14.08.2007
 BE106: AFYON: Sandıklı (Karaçören Köyü-Karaçören göleti deresi), 38°29'340"K 30°17'954"D, 1212 m, 15.08.2007
 BE107: AFYON: Sincanlı (Tınaztepe Göleti), 38°43'123"K 30°23'023"D, 1135 m, 15.08.2007
 BE108: AFYON: Sinanpaşa (Kırka Göleti Çıkışı), 38°42'444"K 30°13'875"D, 1204 m, 15.08.2007
 BE109: UŞAK: Banaz (Kuşdemir Köyü-Kuşdemir Göleti), 38°44'778"K 29°43'050"D, 991 m, 15.08.2007
 BE110: UŞAK: Eşme (Ahmetler Köyü-Ahmetler Göleti), 38°24'645"K 29°05'618"D, 804 m, 16.08.2007
 BE111: UŞAK: Eşme (Kolonkaya Köyü-Kolonkaya Göleti), 38°28'067"K 29°01'105"D, 782 m, 16.08.2007
 BE112: UŞAK: Eşme (Güneyköy-Güneyköy Göleti), 38°23'375"K 28°51'720"D, 862 m, 16.08.2007
 BE113: UŞAK: Eşme (Güneyköy Yolu 2.km), 38°23'501"K 28°56'960"D, 835 m, 16.08.2007
 BE114: KÜTAHYA: Gediz (Gölcük Köyü-Gediz Nehri), 38°53'877"K 29°17'767"D, 647 m, 17.08.2007
 BE115: KÜTAHYA: Gediz (İlca Kaphıcaları), 38°56'436"K 29°15'418"D, 697 m, 17.08.2007
 BE116: KÜTAHYA: Simav (Örenli Köyü-Örenli Göleti), 39°11'741"K 28°53'382"D, 819 m, 17.08.2007
 BE117: KÜTAHYA: Simav (Gölcük Yayla gölü), 39°09'975"K 29°05'108"D, 1309 m, 17.08.2007
 BE118: KÜTAHYA: Hisarlık (Emet Çayı), 39°16'510"K 29°13'647"D, 736 m, 18.08.2007
 BE119: KÜTAHYA: Emet (Yenice Köyü girişi-çeşme), 39°17'941"K 29°10'887"D, 915 m, 18.08.2007
 BE120: KÜTAHYA: Tavşanlı (Köpricek köyü-Köpricek göleti), 39°34'809"K 29°20'961"D, 1026 m, 18.08.2007
 BE121: KÜTAHYA: Tavşanlı (Harmanlık yolu 5.km-Kocası Deresi), 39°35'164"K 29°24'425"D, 873 m, 18.08.2007
 BE122: KÜTAHYA: Domanıç (Domanıç-İnegöl Yolu 5. km, Çakıl deresi), 39°30'709"K 29°38'346"D, 1126 m, 18.08.2007
 BE123: KÜTAHYA: Frig vadisi (Sabuncupınar deresi), 39°33'601"K 30°12'806"D, 960 m, 19.08.2007
 BE124: AFYON: Emirdağ (Pınarbaşı Göleti çıkışı), 39°02'877"K 31°19'605"D, 899 m, 19.04.2008
 BE125: AFYON: Emirdağ (Başkonak Köyü Çıkışı-Uçarken Yakalandı), 38°55'207"K 31°06'350"D, 1207 m, 19.04.2008
 BE126: AFYON: Bolvadin (Özburun Kasabası-Kapaklı Sekmesi Yol Kenarı), 38°51'207"K 31°03'350"D, 1203 m, 19.04.2008
 BE127: AFYON: Çay (Eber Gölü), 38°36'875"K 31°09'611"D, 973 m, 19.04.2008
 BE128: AFYON: Sultandağ (Yakasenek Köyü Üstü), 38°32'156"K 31°10'778"D, 1282 m, 19.04.2008
 BE129: AFYON: Sultandağ (Dereçine-Kapı Deresi), 38°28'226"K 31°14'964"D, 1148 m, 20.04.2008
 BE130: AFYON: Sultandağ (Nadir Köyü Akşehir gölü kenarı Kiraz bahçesi su birikintisi), 38°25'885"K 31°22'563"D, 966 m, 20.04.2008
 BE131: AFYON: Çay (Karamık Sazlığı), 38°25'271"K 30°53'090"D, 1014 m, 20.04.2008
 BE132: KÜTAHYA: Altıntaş-Dumlupınar arası (Genişler köyü çıkışı-Oluklu deresi), 38°58'749"K 30°06'800"D, 1064 m, 20.04.2008
 BE133: KÜTAHYA: Altıntaş (Gediz yolu 17.km-Murat çayı), 38°58'574"K 29°34'457"D, 1073 m, 21.04.2008
 BE134: KÜTAHYA: Altıntaş (Gediz yolu 42. km), 38°59'920"K 29°42'246"D, 1189 m, 21.04.2008
 BE135: KÜTAHYA: Simav (Örenli Köyü-Örenli Göleti), 39°11'741"K 28°53'382"D, 819 m, 21.04.2008
 BE136: DENİZLİ: Çivril (Akdaz-Küf çayı), 38°21'633"K 29°51'107"D, 896 m, 22.04.2008
 BE137: DENİZLİ: Çivril (Işıkli Gölü, 1. İstasyon), 38°16'077"K 29°55'498"D, 827 m, 22.04.2008
 BE138: DENİZLİ: Çivril (Gökçöl Köyü-Işıkli Gölü 2. istasyon), 38°12'375"K 30°02'332"D, 1118 m, 22.04.2008
 BE139: AFYON: Başmakçı (Acıgöl), 37°50'127"K 29°57'454"D, 851 m, 22.04.2008
 BE140: DENİZLİ: Çardak (Beylerli Kasabası-Değirmendere), 37°41'294"K 29°37'290"D, 921 m, 22.04.2008
 BE141: AFYON: Bayat (Bayat göleti), 38°58'536"K 30°53'970"D, 1145 m, 03.05.2008
 BE142: AFYON: İhsenisar (İsceshan Barajı), 38°47'393"K 30°48'221"D, 1044 m, 03.05.2008
 BE143: AFYON: İhseniyi (Döğür Köyü Emre Göleti), 39°06'607"K 30°26'403"D, 1154 m, 04.05.2008
 BE144: KÜTAHYA: Söğüt (Frig vadisi mağaraları-yağmur suyu birikintisi), 39°26'445"K 30°10'569"D, 1082 m, 04.05.2008
 BE145: KÜTAHYA: Kozluca-Yumaklı arası (Türkmen dağı), 39°25'410"K 30°16'608"D, 1305 m, 04.05.2008
 BE146: KÜTAHYA: Bayram-Sabuncupınar Yolu (Doğuluşah Deresi), 39°30'932"K 30°09'867"D, 984 m, 04.05.2008
 BE147: KÜTAHYA: Domanıç (Domanıç-Bursa Yolu 8.km Palazoğlu Balık tesisleri göleti), 39°51'823"K 29°38'393"D, 1333 m, 05.05.2008

- BE148: KÜTAHYA: Tavşanlı (Güzelyurt göleti), 39°29'007"K 29°34'480"D, 850 m, 05.05.2008
 BE149: KÜTAHYA: Tavşanlı (Kayaboğazı Barajı), 39°25'151"K 29°36'727"D, 927 m, 05.05.2008
 BE150: KÜTAHYA: Çavdarhisar (Çetre göleti çıkışı dere), 39°15'890"K 29°28'407"D, 1165 m, 05.05.2008
 BE151: KÜTAHYA: Simav (Gölcük Yayla gölü), 39°09'975"K 29°05'108"D, 1309 m, 06.05.2008
 BE152: KÜTAHYA: Simav (Örenli Köyü-Örenli Göleti), 39°11'741"K 28°53'382"D, 819 m, 06.05.2008
 BE153: DENİZLİ: Çivril (Gökgöl Köyü-Işıkli Gölü 2. İstasyon), 38°12'375"K 30°02'332"D, 1118 m, 07.05.2008
 BE154: DENİZLİ: Kalkık (Kalkık Mağarası Su havuzu), 37°51'364"K 29°23'135"D, 517 m, 07.05.2008
 BE155: DENİZLİ: Honaz (Yukarı dağdere köy -Saklı Göl), 37°46'621"K 29°21'901"D, 959 m, 07.05.2008
 BE156: AFYON: Dinar (Karakuyu gölü), 38°04'587"K 30°16'505"D, 1020 m, 08.05.2008
 BE157: AFYON: Çay (Eber Gölü), 38°36'875"K 31°09'611"D, 973 m, 08.05.2008
 BE158: AFYON: Emirdağ (Kemer kaya Beldesi), 38°54'014"K 31°07'498"D, 1232 m, 10.06.2008
 BE159: AFYON: Çay (Eber Gölü), 38°36'875"K 31°09'611"D, 973 m, 10.06.2008
 BE160: AFYON: Sultandağ (Yakasenek Köyü Çeşmesi), 38°32'370"K 31°09'695"D, 1542 m, 11.06.2008
 BE161: AFYON: Sultandağ (Dereçine-Kapı Deresi), 38°28'226"K 31°14'964"D, 1148 m, 11.06.2008
 BE162: AFYON: Çay (Pazarağaç Kasabası-Devrendöğü çiftlik mevkii sulak alan yol kenarı), 38°36'867"K 30°51'268"D, 996 m, 11.06.2008
 BE163: AFYON: İhsaniye (Döğür Köyü Emre Göleti), 39°06'607"K 30°26'403"D, 1154 m, 11.06.2008
 BE164: AFYON: İhsaniye (Döğür Köyü Emre Göleti 2. İstasyon), 39°06'607"K 30°26'403"D, 1154 m, 11.06.2008
 BE165: KÜTAHYA: Inli Köyü (Frig vadisi yolunda), 39°27'726"K 30°11'603"D, 1097 m, 12.06.2008
 BE166: KÜTAHYA: Domanç (Heyelanlı Bölge-Çakıl Deresi), 39°50'177"K 29°38'605"D, 966 m, 12.06.2008
 BE167: AFYON: Emirdağ (Pınarbaşı Göleti), 39°02'877"K 31°19'605"D, 899 m, 16.08.2008
 BE168: AFYON: Sultandağ (Dereçine-Kapı Deresi), 38°28'226"K 31°14'964"D, 1148 m, 16.08.2008
 BE169: AFYON: Çay (Karamak Sazlığı), 38°25'271"K 30°53'090"D, 1014 m, 17.08.2008
 BE170: AFYON: İhsaniye (Döğür Köyü Emre Göleti 2. İstasyon), 39°06'607"K 30°26'403"D, 1154 m, 17.08.2008
 BE171: KÜTAHYA: Türkmen Dağı (Söğüt Yaylası-dere), 39°23'713"K 30°19'218"D, 1373 m, 17.08.2008
 BE172: KÜTAHYA: Türkmen Dağı (Güllüdere-Gölcük), 39°26'572"K 30°22'090"D, 1639 m, 18.08.2008
 BE173: KÜTAHYA: Yumaklı-Bayat Köyü Arası 2.km (dere), 39°25'911"K 30°16'100"D, 1269 m, 18.08.2008
 BE174: KÜTAHYA: Inli-Doğuluşah Yolu (Doğuluşah deresi), 39°29'534"K 30°12'506"D, 1051 m, 18.08.2008
 BE175: KÜTAHYA: Frig vadisi (Sabuncupınar deresi), 39°33'601"K 30°12'806"D, 960 m, 18.08.2008
 BE176: KÜTAHYA: Altıntaş (Oysu Köyü-dere), 38°58'218"K 29°53'815"D, 1113 m, 18.08.2008
 BE177: KÜTAHYA: Gediz (Çukuroren Köyü-dere), 38°59'030"K 29°41'225"D, 1180 m, 18.08.2008
 BE178: KÜTAHYA: Simav (Gölcük Yayla gölü), 39°09'975"K 29°05'108"D, 1309 m, 19.08.2008
 BE179: KÜTAHYA: Demirci (Söğütli Köyü-Güldürek), 39°08'010"K 28°36'122"D, 1195 m, 19.08.2008
 BE180: KÜTAHYA: Demirci (Türkmen Dağı-Sarıcaayır Yangın göleti), 39°07'322"K 28°35'288"D, 1376 m, 19.08.2008
 BE181: KÜTAHYA: Selendi (Havvağul Köyü-Sülükli Göl), 38°51'687"K 28°46'940"D, 630 m, 630 m, 19.08.2008
 BE182: AFYON: Sandıklı (Sorkun Akdağ Tabiat Alan Koruma Parkı 6.km Dere), 38°24'006"K 30°01'760"D, 1131 m, 20.08.2008
 BE183: AFYON: Sandıklı (Sorkun Yaylası), 38°21'146"K 30°01'398"D, 1464 m, 20.08.2008
 BE184: AFYON: Sandıklı (Akdağ Yangın Gözetleme kulesi yamı Çeşme), 38°20'508"K 29°59'607"D, 1800 m, 20.08.2008
 BE185: DENİZLİ: Akdağ (Cumalar Köyü İstifi Sığırkuymu mevkii Dere), 38°20'492"K 29°58'451"D, 1710 m, 20.08.2008
 BE186: DENİZLİ: Çivril (Gökgöl Köyü-Işıkli Gölü 2. İstasyon), 38°12'375"K 30°02'332"D, 1118 m, 20.08.2008
 BE187: AFYON: Dinar (Karakuyu gölü), 38°04'587"K 30°16'505"D, 1020 m, 20.08.2008
 BE188: AFYON: Bayat (Gözü Yolu 3.km Yol kenarı dere), 38°59'981"K 30°58'211"D, 1027 m, 15.09.2008
 BE189: KÜTAHYA: Türkmen Dağı (Söğüt Yaylası üzeri yol kenarı dere), 39°23'672"K 30°18'941"D, 1414 m, 16.09.2008
 BE190: KÜTAHYA: Yumaklı-Bayat Köyü Arası 2.km (dere), 39°25'911"K 30°16'100"D, 1269 m, 16.09.2008
 BE191: KÜTAHYA: Alayunt Köyü (Kocaköprü dere), 39°24'839"K 30°03'630"D, 930 m, 16.09.2008
 BE192: KÜTAHYA: Çavdarhisar (2.km Porsuk çayı), 39°21'463"K 30°02'552"D, 976 m, 16.09.2008
 BE193: KÜTAHYA: Simav (Örenli Köyü-Örenli Göleti), 39°11'741"K 28°53'382"D, 819 m, 16.09.2008
 BE194: UŞAK: Merkez (Göğem Göleti), 38°43'200"K 29°33'351"D, 958 m, 17.09.2008
 BE195: UŞAK: Altıntaş (Mesudiye göleti çıkışı), 38°43'017"K 29°30'240"D, 930 m, 17.09.2008
 BE196: UŞAK: Eşme (1.km yol kenarı dere), 38°38'549"K 29°03'084"D, 554 m, 17.09.2008
 BE197: UŞAK: Banaz (Ahat göleti), 38°38'684"K 29°46'653"D, 1025 m, 17.09.2008
 BE198: UŞAK: Banaz-Hocalar yolu (Ahat Köyü çıkışı sulama kanalı su birikintisi), 38°39'110"K 29°48'751"D, 1003 m, 17.09.2008
 BE199: DENİZLİ: Çivril (Gökgöl Köyü-Işıkli Gölü 2. İstasyon), 38°12'375"K 30°02'332"D, 1118 m, 18.09.2008
 BE200: DENİZLİ: Beyağaç (Eşen Göleti), 37°12'468"K 29°00'550"D, 1017 m, 18.09.2008
 BE201: AFYON: Çay (Çayır yazı Köyü Göleti), 38°22'468"K 30°44'550"D, 1112 m, 19.09.2008
 BE202: AFYON: Sultandağ (Dereçine-Kapı Deresi), 38°28'226"K 31°14'964"D, 1148 m, 19.09.2008
 BE203: KÜTAHYA: Merkez-Frig Vadisi (Muratboğazı Köyü-Çinili Çeşme), 39°20'668"K 30°12'679"D, 1100 m, 27.04.2009
 BE204: KÜTAHYA: Türkmen Dağı (Söğüt Yaylası-dere), 39°23'713"K 30°19'218"D, 1373 m, 27.04.2009
 BE205: KÜTAHYA: Türkmen Dağı (Güllüdere-Gölcük), 39°26'572"K 30°22'090"D, 1639 m, 27.04.2009
 BE206: KÜTAHYA: Merkez (Yumaklı-Organize Sanayi Yarı-Bataklık Alan), 39°23'255"K 30°06'607"D, 939 m, 28.04.2009
 BE207: KÜTAHYA: Kozluca-Yumaklı arası (Türkmen dağı), 39°25'410"K 30°16'608"D, 1305 m, 28.04.2009
 BE208: KÜTAHYA: Simav (Gölcük Yayla gölü), 39°09'975"K 29°05'108"D, 1309 m, 28.04.2009
 BE209: KÜTAHYA: Simav (Örenli Köyü-Örenli Göleti), 39°11'741"K 28°53'382"D, 819 m, 28.04.2009
 BE210: KÜTAHYA: Simav (Simav Gölü), 39°10'549"K 28°55'586"D, 789 m, 28.04.2009
 BE211: DENİZLİ: Çivril (Işıkli Gölü, 1. İstasyon), 38°16'077"K 29°55'498"D, 827 m, 29.04.2009
 BE212: DENİZLİ: Çivril (Gökgöl Köyü-Işıkli Gölü 2. İstasyon), 38°12'375"K 30°02'332"D, 1118 m, 29.04.2009
 BE213: DENİZLİ: Çivril (Gökgöl Köyü-Işıkli Gölü 3. İstasyon), 38°11'656"K 30°03'523"D, 830 m, 29.04.2009
 BE214: DENİZLİ: Buldan (Süleymanlı gölü), 38°03'035"K 28°46'291"D, 1157 m, 29.04.2009
 BE215: DENİZLİ: Beylerli (Çaltı Gölü-1. İstasyon), 37°43'458"K 29°41'070"D, 853 m, 30.04.2009
 BE216: DENİZLİ: Beylerli (Çaltı Gölü-2. İstasyon), 37°43'676"K 29°41'301"D, 851 m, 30.04.2009
 BE217: DENİZLİ: Çardak (Gemiş köyü çıkışı -Çeşme su birikintisi), 37°46'367"K 29°50'622"D, 847 m, 30.04.2009
 BE218: DENİZLİ: Çardak (Acıgöl-1. İstasyon), 37°47'759"K 29°53'378"D, 849 m, 30.04.2009
 BE219: DENİZLİ: Çardak (Acıgöl-2. İstasyon), 37°49'054"K 29°55'619"D, 826 m, 30.04.2009
 BE220: AFYON: Dinar (Karakuyu gölü), 38°04'587"K 30°16'505"D, 1020 m, 30.04.2009
 BE221: AFYON: Emirdağ (Pınarbaşı Göleti), 39°02'877"K 31°19'605"D, 899 m, 19.05.2009
 BE222: AFYON: Sultandağ (Yakasenek Köyü Çeşmesi), 38°32'370"K 31°09'695"D, 1542 m, 19.05.2009
 BE223: AFYON: Sultandağ (Gölköy-Akşehir Gölü), 38°29'200"K 31°20'746"D, 953 m, 19.05.2009

- BE224: AFYON: Çay (Eber Gölü-2. İstasyon), 38°36'828"K 31°08'467"D, 968 m, 19.05.2009
 BE225: AFYON: Çay (Eber Gölü-1. İstasyon), 38°36'875"K 31°09'611"D, 973 m, 19.05.2009
 BE226: AFYON: Çay (Karamık Sazlığı-1. İstasyon), 38°25'271"K 30°53'090"D, 1014 m, 20.05.2009
 BE227: AFYON: Çay (Karamık Sazlığı-2. İstasyon), 38°26'956"K 30°50'248"D, 1009 m, 20.05.2009
 BE228: AFYON: İhsaniye (Döğür Köyü Emre Göleti 2. istasyon), 39°06'607"K 30°26'403"D, 1154 m, 20.05.2009
 BE229: KÜTAHYA: Simav (Söğüt Köyü-Gökçeler Köyü Arası 4.km Yol kenarı dere), 39°06'322"K 29°03'129"D, 898 m, 21.05.2009
 BE230: KÜTAHYA: Simav (Gökçeler Köyü-Sılama Göleti), 39°06'124"K 29°02'179"D, 834 m, 21.05.2009
 BE231: KÜTAHYA: Simav (Örenli Köyü-Örenli Göleti), 39°11'741"K 28°53'382"D, 819 m, 21.05.2009
 BE232: DENİZLİ: Çivril (Gökçöl Köyü-Işıklı Gölü 2. istasyon), 38°12'375"K 30°02'332"D, 1118 m, 21.05.2009
 BE233: DENİZLİ: Çivril (Gökçöl Köyü-Işıklı Gölü 3. istasyon), 38°11'656"K 30°03'523"D, 830 m, 21.05.2009
 BE234: DENİZLİ: Honaz (Kızılyer Kasabası Yol Kenarı dere), 37°45'842"K 29°22'108"D, 804 m, 22.05.2009
 BE235: AFYON: Dinar (Karakuyu gölü-1. İstasyon), 38°04'587"K 30°16'505"D, 1020 m, 22.05.2009
 BE236: AFYON: Dinar (Gökçeler Köyü-Karakuyu gölü-2. İstasyon), 38°03'999"K 30°14'776"D, 1004 m, 22.05.2009
 BE237: AFYON: Emirdağ (Pınarbaşı Göleti), 39°02'877"K 31°19'605"D, 899 m, 17.06.2009
 BE238: AFYON: Emirdağ (Kemer kaya Kasabası, Pancarlı Deresi), 38°51'874"K 31°10'088"D, 1435 m, 17.06.2009
 BE239: AFYON: Emirdağ (Kemer kaya Kasabası-Yapraklı Mh. Altı Yol kenarı dere), 38°54'040"K 31°07'468"D, 1236 m, 17.06.2009
 BE240: AFYON: Çay (Pazarağaç Kasabası-Devrendöğü çiftlik mevkii sulak alan yol kenarı), 38°36'867"K 30°51'268"D, 996 m, 17.06.2009
 BE241: AFYON: Çay (Eber Gölü-1. İstasyon), 38°36'875"K 31°09'611"D, 973 m, 17.06.2009
 BE242: AFYON: Çay (Karamık Sazlığı-1. İstasyon), 38°25'271"K 30°53'090"D, 1014 m, 18.06.2009
 BE243: AFYON: Çay (Karamık Sazlığı-2. İstasyon), 38°26'956"K 30°50'248"D, 1009 m, 18.06.2009
 BE244: AFYON: İhsaniye (Döğür Köyü Emre Göleti), 39°06'607"K 30°26'403"D, 1154 m, 18.06.2009
 BE245: AFYON: İhsaniye (Döğür Köyü Emre Göleti 2. istasyon), 39°06'607"K 30°26'403"D, 1154 m, 18.06.2009
 BE246: KÜTAHYA: Türkmen Dağı (Söğüt Yaylası-dere), 39°23'713"K 30°19'218"D, 1373 m, 18.06.2009
 BE247: KÜTAHYA: Tavşanlı (Dereli Köyü Girişi-Yol kenarı gölet), 39°29'283"K 29°14'820"D, 603 m, 19.06.2009
 BE248: KÜTAHYA: Tavşanlı (Ormanlı Köyü-Emet Çayı), 39°29'234"K 29°11'633"D, 498 m, 19.06.2009
 BE249: UŞAK: Ulubey (Ulubey kanyonları içindeki dere), 38°24'306"K 29°18'487"D, 563 m, 20.06.2009
 BE250: DENİZLİ: Çivril (Gökçöl Köyü-Işıklı Gölü 2. istasyon), 38°12'375"K 30°02'332"D, 1118 m, 20.06.2009
 BE251: AFYON: Dinar (Karakuyu gölü-1. İstasyon), 38°04'587"K 30°16'505"D, 1020 m, 20.06.2009
 BE252: DENİZLİ: Çardak (Acıgöl-1. İstasyon), 37°47'759"K 29°53'378"D, 849 m, 20.06.2009
 BE253: DENİZLİ: Bozkurt (Çambaşı Köyü-Karagöl), 37°44'084"K 29°29'530"D, 1266 m, 21.06.2009
 BE254: DENİZLİ: Honaz (Yukarıdağdere köy -Saklı Göl), 37°46'621"K 29°21'901"D, 959 m, 21.06.2009
 BE255: DENİZLİ: Tavas (Kızılcaabölük Kasabası-Çakıroluk Mevkii), 37°41'412"K 29°02'884"D, 1664 m, 21.06.2009
 BE256: DENİZLİ: Çameli (Kınıkyeri köyü 8.km yol kenarı çeşme), 37°13'640"K 29°26'770"D, 1303 m, 22.06.2009
 BE257: KÜTAHYA: Merkez (Organize Sanayi Yanı-Bataklık Alan), 39°23'255"K 30°06'607"D, 939 m, 17.07.2009
 BE258: KÜTAHYA: Türkmen Dağı Yolu (Ürünli Çiftliği Altı-Su arki), 39°20'737"K 30°11'633"D, 1044 m, 17.07.2009
 BE259: KÜTAHYA: Hisarcık (Dereli Köyü-Dere), 39°09'208"K 29°17'130"D, 835 m, 18.07.2009
 BE260: DENİZLİ: Çardak (Acıgöl-2. İstasyon), 37°49'054"K 29°55'619"D, 826 m, 19.07.2009
 BE261: AFYON: Dinar (Karakuyu gölü-1. İstasyon), 38°04'587"K 30°16'505"D, 1020 m, 20.07.2009

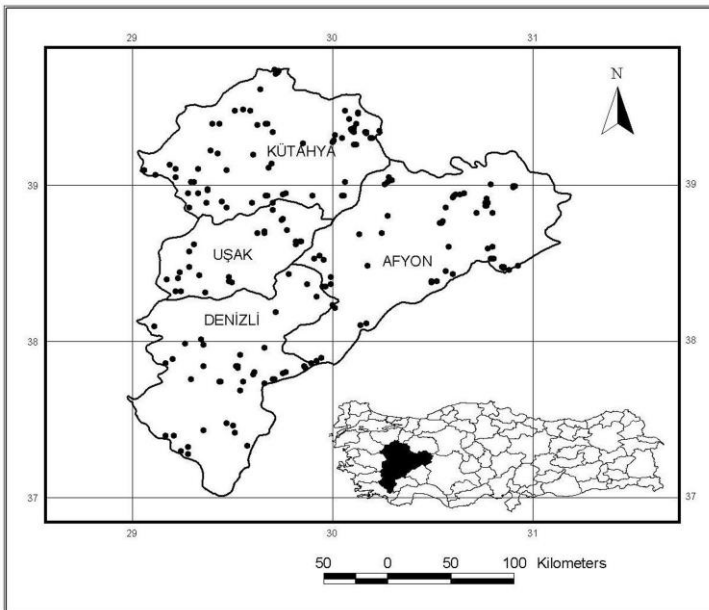


Figure 1. Map of study area showing sample localities (black dot).

DESCRIPTION OF A NEW SPECIES OF *HARMOCHIRUS* SIMON (ARANEAE: SALTICIDAE) FROM SOUTH INDIA

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[Caleb, J. T. D. & Mathai, M. T. 2015. Description of a new species of *Harmochirus* Simon (Araneae: Salticidae) from South India. *Munis Entomology & Zoology*, 10 (1): 117-121]

ABSTRACT: A new species of jumping spiders from the genus *Harmochirus* Simon, namely *Harmochirus exaggeratus* sp.nov. is described from Chennai, India. Morphological characters and illustrations of the genitalia are provided.

KEY WORDS: *Harmochirus exaggeratus* sp. nov., new species, Salticidae, South India.

Genus *Harmochirus* has been placed under the group Harmochireae (Zabka, 1991; Logunov, 2001). Genus *Harmochirus* is currently known by eight species worldwide (WSC, 2014) of which three species are known from India namely *Harmochirus brachiatus* (Thorell, 1877), *Harmochirus lloydi* Narayan, 1915 and *Harmochirus zabkai* Logunov, 2001 (Keswani et al., 2012). See Logunov (2001) for diagnostic characters of this genus.

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 *Harmochirus exaggeratus* sp. nov. is being described from Chennai, South India.

MATERIALS AND METHODS

Live specimens were photographed using DSLR Nikon D60, 18-55mm. Specimens were preserved in 70% alcohol and later examined using a Leica S8APO stereoscopic microscope, photographs were obtained using Leica MC120 HD camera with LAS core software. Male palps were detached, examined and studied. Female genitalia were excised using fine surgical scalpel. The epigyne was then cleared in 10% KOH aqueous solution. USB digital microscope with micro-measure software was used for making measurements. All specimens are deposited in National Centre for Biological Sciences (NCBS), Bangalore, Karnataka, India. Descriptions are based on fresh specimen. All measurements are in mm (millimeters). Leg measurements are given as total length (femur, patella, tibia, metatarsus, tarsus).

Abbreviations used: ALE - anterior lateral eyes, AME - anterior median eyes, PLE - posterior lateral eyes, PME - posterior median eyes, AME-AME - mutual distance between eyes, E - embolus, MP - membranous peak, RTA - retrolateral tibial apophysis, S - spermathecae, SD - sperm duct, CO - copulatory opening, CD - copulatory duct, FD - fertilization ducts.

RESULTS

Genus *Harmochirus* Simon *Harmochirus exaggeratus* sp. nov.

(Figs. 1-26)

Type material: Holotype - male, Scrub jungle regions, Madras Christian

College, Tamil Nadu, India (12°91'60.41" N, 80°12'59.61" E, 32m), 27.ii.2014, coll. John Caleb T.D. (NCBS-QA471).

Allotype: female, 12.viii.2013 (NCBS-QA472) coll. John Caleb T.D. (GPS data same as holotype).

Paratypes: 1 male, 10.vi.2013 (NCBS-QA468); 1 male 19.vii.2013 (NCBS-QA470); 1 female 27.vi.2013 (NCBS-QA473) coll. John Caleb T.D. (GPS data same as holotype).

Diagnosis: This species is related to *H. brachiatus* (Thorell) and *H. zabkai* Logunov but can be distinguished by the palp structure with short and slightly thick embolus (Figs. 21, 24) (whereas longer in *H. brachiatus* and *H. zabkai*), position of the membranous peak on tegulum situated at retrolateral region (Figs. 21, 24) (whereas near base of origin of sperm duct in *H. brachiatus* and *H. zabkai*) and by structure of spermathecae and path of copulatory ducts in females (Fig. 26). General body morphology differs in coloration, the carapace with two spots of shining scales dorsally (Figs. 1-3, 7-8) (absent in other known species). Abdomen with faint chevron shaped markings (Figs. 2, 8). Femur I with transverse white stripe ventrally (Figs. 4, 10). In males, clypeus covered with sparse, loose golden scales, devoid of white hairs (Figs. 4, 5) (white hairs present in *H. luculentus* Simon, 1885); metatarsus I almost as long as femur I (Figs. 17, 18) (metatarsus comparatively shorter in other known species); retrolateral spines on tibia I placed distally (whereas arranged across tibia in *H. brachiatus*).

Etymology: Specific name refers to the 'exaggerated' characters of the genus *Harmochirus* which the species bears.

Description:

Male: Carapace: 1.68 long, 1.60 wide; Abdomen: 1.68 long, 1.55 wide; Total length: 3.36

Cephalothorax: Short and broad, blackish covered with iridescent hairs and scales (Fig. 1). Clypeus covered with loose golden scales. Anterior eyes surrounded by whitish scales (Figs. 4, 5). Two pale spots, which shine in golden yellow under bright light, present each behind AME's in line with PME's (Figs. 1, 3). Eye size and inter distance between AME 0.36, ALE 0.17, PME 0.07, PLE 0.18; AME-AME 0.03, AME-ALE 0.03, PME-PME 1.39, PME-PLE 0.33, ALE-PLE 0.83. Clypeus height 0.15. Chelicerae black, 2 promargin and 1 retromargin teeth, sternum oval shaped. Leg I robust, long and dark; femur and tibia puffed; femur, patella and tibia with long scale like bristles; metatarsus and tibia thin and long. Femur I with transverse white stripe at its base ventrally (Fig. 4). Tibia I almost as long as Femur I (Figs. 17, 18). Tibia and patella of legs II, III & IV with two longitudinal white stripes, one dorsally and other ventrally (Fig. 1). Leg measurements: I 5.19 (1.41, 0.71, 0.94, 1.37, 0.76); II 2.82 (0.86, 0.37, 0.54, 0.57, 0.48); III 2.90 (1.02, 0.39, 0.56, 0.54, 0.39); IV 3.07 (1.06, 0.32, 0.68, 0.59, 0.42). Leg formula: 1432. Palp reddish brown, covered with paler hairs; palpal patella covered with short white stripes; bulbous almost regular oval, membranous tegular region laterally placed, adjacent to RTA; embolus short and thick; RTA long, strong (Figs. 21, 22).

Abdomen: short, oval with hardened tegument, compressed, covered with sparse white scales. Mid-anterior border with small depression. Faint chevron shaped markings seen on the mid-dorsal line (Figs. 1, 2 & 6).

Female: Carapace: 1.95 long, 1.50 wide; Abdomen 2.43 long, 1.76 wide; Total length 4.38.

Eye measurements: AME 0.43, ALE 0.18, PME 0.07, PLE 0.18, AME-AME 0.05; AME-ALE 0.03; PME-PME 1.52; PME-PLE 0.41; ALE-PLE 1.04; Clypeus height: 0.23. Leg measurements: I 3.94 (1.18, 0.49, 0.78, 0.94, 0.55); II 2.62 (0.77, 0.44,

0.56, 0.53, 0.32); III 2.80 (0.82, 0.54, 0.52, 0.60, 0.32); IV 3.14 (0.96, 0.46, 0.60, 0.74, 0.38) Leg formula: 1432. Coloration pattern as in male but differs in the following (Figs. 7, 8). Clypeus covered by yellowish white hairs, chelicerae with golden scales, sparsely distributed (Fig. 10). Anterior region of abdomen covered with longer hairs. A thin golden line of hairs run along the lateral edge, starting from antero-lateral region to spinnerets (Fig. 11). Epigyne open up in wide pockets leading to long-winded copulatory ducts leading to the spermathecae (Figs. 16, 26)

Distribution: Chennai, India.

Natural History: Found among grass and litter in the scrub regions of MCC campus.

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Special thanks to Dr. Jerzy Proszynski for his valuable comments. We are thankful to Dr. Krushenmegh Kunte, Lab 8, NCBS, Bangalore for allowing us to use the Stereo microscope. Thanks to the department of Zoology MCC, for providing DSLR camera for documenting.

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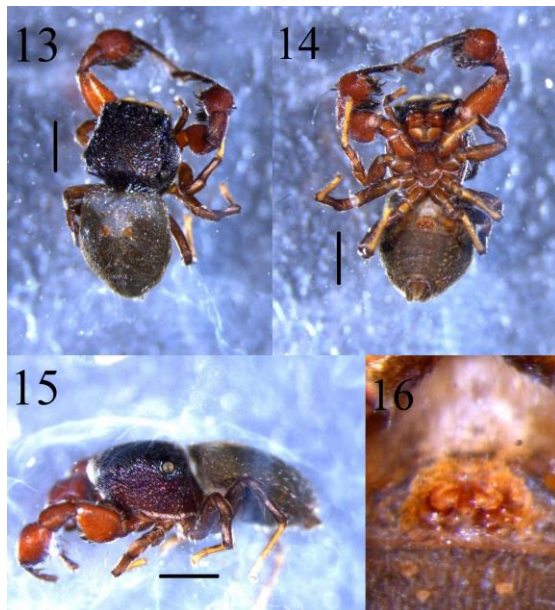
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Figures 1-6. *Harmochirus exaggeratus* sp. nov., 1. Dorsal view of male, 2 & 3. Dorso-lateral view, 4 & 5. Frontal view, 6. Lateral View.



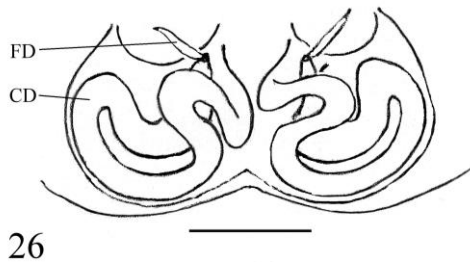
Figures 7-12. *Harmochirus exaggeratus* sp. nov., 7 – 9. Dorsal view of female, 10. Frontal view, 11. Lateral View, 12. Dorso-lateral view of old female.



Figures 13-16. *Harmochirus exaggeratus* sp. nov., 13. Dorsal view of female, 14. Ventral view, 15. Lateral View, 16. Epigyne. Scale bars for Figs. 13-15, 1 mm.



Figures 17-20. *Harmochirus exaggeratus* sp. nov., 17. Male leg I retrolateral view, 18. Male leg I prolateral view, 19. Female leg I retrolateral view, 20. Female leg I prolateral view. Scale bars for Figs. 17-20, 1 mm.



Figures 21-26. *Harmochirus exaggeratus* sp. nov., 21. Male palp ventral view, 22. Palp retro-lateral view, 23. Palp dorsal view, 24. Palp ventral view, 25. Palp retrolateral view, 26. Female, Vulva dorsal view. Scale bars for Figs. 21-26, 0.1 mm.

A CONTRIBUTION OF TURKISH LONGHORNED BEETLES FAUNA FROM BURSA (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT: The work presents new faunistical data for Turkish longhorned beetles fauna from Bursa province in NW Anatolia. The fauna of Bursa province is also given with old and newly recorded species in the text.

KEY WORDS: Cerambycidae, new data, Bursa, İnegöl, Turkey.

Bursa province is in South Marmara Part of Marmara Region in NW Anatolia. It is located between 40° W longitude and 29° N latitude. It is limited Marmara Sea and Yalova province in the North, Kocaeli and Sakarya provinces in the North-East, Bilecik province in the East, Kütahya province in the South and Balıkesir province in the West.

Bursa has 17 counties as Osmangazi, Nilüfer, Büyükşehir, Yıldırım, Gemlik, Gürsu, Harmançık, İnegöl, İznik, Karacabey, Keles, Kestel, Mudanya, Mustafakemalpaşa, Orhaneli, Orhangazi and Yenişehir (Fig. 1).

In this work, all specimens, except *Agapanthia kirbyi* (Gyllenhal, 1817) from Uludağ, were collected from İnegöl county of Bursa province in NW Anatolia in the years of 2011-2014.

İnegöl county is in the East parts of Bursa province and connected with Bilecik and Kütahya provinces.

As a result of identification of collected specimens, 40 species belonging to 26 genera of 6 subfamilies were determined. Among the determined taxa, 27 species are the first record for both Bursa province and 37 species are the first record for İnegöl county. The remaining 3 species are known from the research areas.

Knowledge about longicorn beetles of Bursa province is far from satisfaction. The planned work on this subject is also absent. In any work, the recorded information has not also been reviewed yet. Besides even information related faunistical composition of Bursa province has not been determined yet. This scattered information can be obtained from cited references (Acatay, 1943, 1968; Adlbauer, 1988, 1992; Alkan, 2000; Braun, 1978, 1979; Breuning & Villiers, 1967; Çanakçıoğlu, 1956, 1983, 1993; Defne, 1954; Demelt, 1963; Erdem & Çanakçıoğlu, 1977, Ganglbauer, 1884; Gfeller, 1972; Gül-Zümreoğlu, 1975; Kanat, 1998; Krätschmer, 1987; Lodos, 1998; Önalp, 1988, 1989, 1990; Öymen, 1987; Özdikmen, 2006, 2007; Özdikmen & Şahin, 2006; Peks, 1992; Pesarini & Sabbadini, 1998; Schmitschek, 1944; Sekendiz, 1974, 1981; Tazuin, 2000; Tezcan & Rejzek, 2002; Tozlu et al., 2002, 2003; Villiers, 1967).

Clearly, there is no any work on Cerambycidae of Bursa related the whole territories of it. Previous works were either short notes on shortlived expeditions or about at most a province and its environment. Also, works including description of new taxa are sometimes encountered.

In this work, all specimens, except *Agapanthia kirbyi* (Gyllenhal, 1817) from Uludağ, were collected from İnegöl county of Bursa province in NW Anatolia in the years of 2011-2014. As a result of identification of them, 39 species belonging

to 26 genera of 6 subfamilies were determined. Among the determined taxa, 26 species are the first record for both Bursa province and 36 species are the first record for İnegöl county. The remaining 3 species are known from the research areas.

In the following list, known taxa from Bursa are only given the taxon name simply. Among them, only *Rhagium inquisitor* is also distributed İnegöl county.

LONGHORNED BEETLES FAUNA OF BURSA PROVINCE

SUPERFAMILY CERAMBYCOIDEA Latreille, 1802

FAMILY CERAMBYCIDAE Latreille, 1802: 211

SUBFAMILY PRIONINAE Latreille, 1802: 212

GENUS *ERGATES* Audinet-Serville, 1832: 143

SPECIES *E. faber* Linnaeus, 1760: 187 (*Cerambyx*)

SUBSPECIES *E. f. faber* (Linnaeus, 1760: 187)

GENUS *MESOPRIONUS* Jakovlev, 1887: 323

SPECIES *M. besikanus* (Fairmaire, 1855: 318)

Material examined: İnegöl, Alanyurt, 15.VIII.2011, 1 specimen.

Remarks: The species was recorded from Bursa (Nilüfer: Çalı village). So, it is the first record for İnegöl county.

SUBFAMILY LEPTURINAE Latreille, 1802: 218

GENUS *RHAMNUSIUM* Latreille, 1829: 130

SPECIES *R. bicolor* (Schrank, 1781: 132)

SUBSPECIES *R. b. juglandis* Fairmaire, 1866: 276

Material examined: İnegöl, N Hamzabey village, 10.VI.2011, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *RHAGIUM* Fabricius, 1775: 182

SUBGENUS *RHAGIUM* Fabricius, 1775: 182

SPECIES *R. inquisitor* (Linnaeus, 1758: 393)

SUBSPECIES *R. i. inquisitor* (Linnaeus, 1758: 393)

GENUS *DINOPTERA* Mulsant, 1863: 494

SUBGENUS *DINOPTERA* Mulsant, 1863: 494

SPECIES *D. collaris* (Linnaeus, 1758: 398)

Material examined: İnegöl, NE Sarpınar village, 09.VI.2012, N 40° 04' - E 29° 46', 443 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *CORTODERA* Mulsant, 1863: 572

SPECIES *C. flavimana* (Waltl, 1838: 471)

SUBSPECIES *C. f. flavimana* (Waltl, 1838: 471)

Material examined: İnegöl, W Akhisar village, 28.IV.2012, N 40° 10' - E 29° 46', 288 m, 1 specimen.

Remarks: The species was recorded from Bursa (Osmangazi: Uludağ). So, it is the first record for İnegöl county.

SPECIES *Cortodera rufipes* (Kraatz, 1876: 344)

Material examined: İnegöl, W Akhisar village, 28.IV.2012, N 40° 10' - E 29° 46', 288 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *GRAMMOPTERA* Dejean, 1835: 356

SUBGENUS *GRAMMOPTERA* Dejean, 1835: 356

SPECIES *G. ruficornis* (Fabricius, 1781: 247)

SUBSPECIES *G. r. ruficornis* (Fabricius, 1781: 247)

GENUS *PSEUDOVARADONIA* Lobanov, Danilevsky & Murzin, 1981: 787

SPECIES *P. livida* (Fabricius, 1777: 233)

SUBSPECIES *P. l. livida* (Fabricius, 1777: 233)

Material examined: İnegöl, N Şehitler, 19.VI.2011, 496 m, 1 specimen, NW Çavuş village, 28.VI.2011, N 40°17' - E 29°47', 330 m, 1 specimen, SE Dömez village, 05.VII.2011, N 40°10' - E 29°60', 578 m, 2 specimens, N Hamamlı village, 05.V.2012, N 40°03' - E 29°59', 313 m, 1 specimen, E Yenice, 23.VI.2013, N 40°09' - E 29°13', 319 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS ANOPLADERA Mulsant, 1839: 285

SUBGENUS ANOPLADERA Mulsant, 1839: 285

SPECIES *A. rufipes* (Schaller, 1783: 296)

SUBSPECIES *A. r. rufiventris* Tournier, 1872: 348

GENUS STICTOLEPTURA Casey, 1924: 280

SUBGENUS STICTOLEPTURA Casey, 1924:280

SPECIES *S. cordigera* (Fuessly, 1775: 14)

SUBSPECIES *S. c. cordigera* (Fuessly, 1775: 14)

Material examined: İnegöl, N Akhisar, 25.VI.2012, N 40°11' - E 29°47', 286 m, 1 specimen, S Karakadı village, 10.VII.2011, N 40°00' - E 29°49', 690 m, 2 specimens, S Deydinler village, 11.VII.2011, N 40°03' - E 29°52', 435 m, 3 specimen, E Kestanealan village, 11.VII.2011, N 40°00' - E 29°51', 650 m, 1 specimen, NW Muratbey village, 13.VII.2011, N 40°00' - E 29°57', 400 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SPECIES *S. fulva* (DeGeer, 1775: 137)

GENUS ANASTRANGALIA Casey, 1924: 280

SPECIES *A. sanguinolenta* (Linnaeus, 1760: 196)

Material examined: İnegöl, S Kiran village, 19.VI.2011, 795 m, 1 specimen, E Kestanealan village, 11.VII.2011, N 40°00' - E 29°51', 650 m, 1 specimen, Uludağ, 2 specimens.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS JUDOLIA Mulsant, 1863: 496

SPECIES *J. cerambyciformis* (Schrank, 1781: 154)

SPECIES *J. erratica* (Dalman, 1817: 490)

Material examined: İnegöl, W Sungurpaşa, 28.VI.2011, N 40°18' - E 29°48', 380 m, 1 specimen, S Tokuş village, 16.VI.2011, 284 m, 1 specimen, N Cerrah, 19.VI.2011, 459 m, 1 specimen, SE Dömez village, 05.VII.2011, N 40°10' - E 29°60', 578 m, 1 specimen, NW Çavuş village, 28.VI.2011, N 40°17' - E 29°47', 330 m, 1 specimen, S Hocaköy village, 28.VI.2013, N 40°05' - E 29°47', 380 m, 1 specimen, N Sarpınar village, 28.VI.2013, N 40°04' - E 29°46', 420 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS STENURELLA Villiers, 1974: 214

SUBGENUS PRISCOSTENURELLA Özdikmen, 2013: 516

SPECIES *S. bifasciata* (O. F. Müller, 1776: 93)

SUBSPECIES *S. b. bifasciata* (O. F. Müller, 1776: 93)

Material examined: İnegöl, S Kiran village, 19.VI.2011, 795 m, 2 specimens, E Kulaca village, 04.VII.2011, N 40°07' - E 29°58', 310 m, 1 specimen, SE Dömez village, 05.VII.2011, N 40°10' - E 29°60', 578 m, 1 specimen, SW Kurşunlu, 07.VII.2011, N 40°04' - E 29°64', 335 m, 1 specimen, N Karakadı village, 10.VII.2011, N 40°02' - E 29°50', 560 m, 1 specimen, S Karakadı village, 10.VII.2011, N 40°00' - E 29°49', 690 m, 1 specimen, Uludağ, 3 specimens, S Deydinler village, 11.VII.2011, N 40°03' - E 29°52', 435 m, 1 specimen, W Dipsizgöl village, 11.VII.2011, N 40°02' - E 29°52', 500 m, 1 specimen, W Yenice, 22.VI.2013, N 40°10' - E 29°41', 387 m, 1 specimen, SW Yenice, 22.VI.2013, N 40°09' - E 29°40', 500 m, 4 specimens, E Yenice, 23.VI.2013, N 40°09' - E 29°13', 319 m, 4 specimens, N Sarpınar village, 28.VI.2013, N 40°04' - E 29°46', 420 m, 2 specimens, E Sarpınar village, 28.VI.2013, N 40°03' - E 29°47', 622 m, 1 specimen.

Remarks: The species was recorded from Bursa (İnegöl and Gürsu Forest).

SPECIES *S. septempunctata* (Fabricius, 1792: 346)

SUBSPECIES *S. s. latenigra* (Pic, 1915:5)

Material examined: İnegöl, N Cerrah, 19.VI.2011, 459 m, 3 specimens.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SUBFAMILY SPONDYLIDINAE Audinet-Serville, 1832

GENUS SPONDYLIS Fabricius, 1775: 159

SPECIES *S. buprestoides* (Linnaeus, 1758: 388)

SUBFAMILY CERAMBYCINAE Latreille, 1802: 211

GENUS *TRICHOFERUS* Wollaston, 1854: 427**SPECIES *T. fasciculatus* (Faldermann, 1837: 266)**SUBSPECIES *T. f. fasciculatus* (Faldermann, 1837: 266)GENUS *STROMATIUM* Audinet-Serville, 1834: 80**SPECIES *S. auratum* (Böber, 1793: 135)**GENUS *CERAMBYX* Linnaeus, 1758: 388SUBGENUS *CERAMBYX* Linnaeus, 1758: 388**SPECIES *C. cerdo* Linnaeus, 1758: 392**SUBSPECIES *C. c. cerdo* Linnaeus, 1758: 392**SPECIES *C. dux* (Faldermann, 1837: 264)****SPECIES *C. nodulosus* Germar, 1817: 220**GENUS *PURPURICENUS* Dejean, 1821: 105SUBGENUS *PURPURICENUS* Dejean, 1821**SPECIES *P. budensis* (Götz, 1783: 70)**

Material examined: İnegöl, W Hamzabey village, 15.VI.2011, 1 specimen, NW Çavuşköy, 28.VI.2011, N 40°17' - E 29°47', 330 m, 1 specimen, NE Şipalı village, 05.VII.2011, N 40°09' - E 29°56', 310 m, 1 specimen, NW Akbaşlar village, 05.VII.2011, N 40°10' - E 29°58', 414 m, 1 specimen.

Remarks: The species was recorded from Bursa (Orhaneli). So, it is the first record for İnegöl county.

GENUS *AROMIA* Audinet-Serville, 1834: 559**SPECIES *A. moschata* (Linnaeus, 1758: 391)**SUBSPECIES *A. m. moschata* (Linnaeus, 1758: 301)

Material examined: İnegöl, W Yeniörük village, 25.V.2013, N 40°14' - E 29°59', 512 m, 1 specimen.

Remarks: The species was recorded from Bursa (near Soğukpınar, Baraklı village and Uludağ). So, it is the first record for İnegöl county.

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

Material examined: İnegöl, W Cerrah, 26.VI.2013, N 40°07' - E 29°44', 318 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *PENICHTROA* Stephens, 1839: 270**SPECIES *P. fasciata* (Stephens, 1831: 250)**

Material examined: İnegöl, Boğazköyü dam, 25.VIII.2014, N 40°17' - E 29°52', 280 m, 1 specimen, Cerrah, 29.VIII.2017, N 40°07' - E 29°43', 452 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *CERTALLUM* Dejean, 1821: 111**SPECIES *C. ebulinum* (Linnaeus, 1767: 637)**

Material examined: İnegöl, NW Hamzabey village, 04.V.2013, N 40°14' - E 29°52', 400 m, 1 specimen, Hocaköy, 21.VIII.2014, N 40°06' - E 29°46', 319 m, 1 specimen.

Remarks: The species was recorded from Bursa (İzmit). So, it is the first record for İnegöl county.

GENUS *HYLOTRUPES* Audinet-Serville, 1834: 77**SPECIES *H. bajulus* (Linnaeus, 1758: 396)**GENUS *ROPALOPUS* Mulsant, 1839: 40SUBGENUS *ROPALOPUS* Mulsant, 1839: 40**SPECIES *R. clavipes* (Fabricius, 1775: 188)**

Material examined: İnegöl, E Cerrah, 25.VI.2013, N 40°06' - E 29°44', 340 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *PHYMATODES* Mulsant, 1839: 47SUBGENUS *MELASMETUS* Reitter, 1913: 39**SPECIES *P. femoralis* (Ménétriés, 1832: 228)**SUBSPECIES *P. f. demelti* Heyrovský, 1962: 41SUBGENUS *PHYMATODES* Mulsant, 1839: 47**SPECIES *P. testaceus* (Linnaeus, 1758: 396)**

Material examined: İnegöl, S Hamzabey village, 10.VI.2011, 2 specimens, N Hamamlı village, 05.V.2012, N 40°03' - E 29°59', 313 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS PARACLYTUS Bates, 1884: 234

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

GENUS PLAGIONOTUS Mulsant, 1842: 1

SUBGENUS ECHINOCERUS Mulsant, 1862: 143

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

Material examined: İnegöl, N Tokuş village, 16.VI.2011, 354 m, 1 specimen, S Yeniörük village, 21.VI.2011, N 40°13' - E 29°58', 378 m, 1 specimen, SE Çavuşköy, 28.VI.2011, N 40°16' - E 29°46', 440 m, 1 specimen, SE Akhisar, 29.VI.2011, N 40°11' - E 29°47', 280 m, 1 specimen, S Kulaca village, 04.VII.2011, N 40°06' - E 29°56', 310 m, 3 specimens, NE Şipalı village, 05.VII.2011, N 40°09' - E 29°56', 310 m, 1 specimen, NW Akbaşlar village, 05.VII.2011, N 40°10' - E 29°58', 414 m, 1 specimen, SE Akbaşlar village, 05.07.2011, N 40°09' - E 29°59', 488 m, 1 specimen, SW Hasanpaşa village, 06.VII.2011, N 40°05' - E 29°58', 312 m, 1 specimen, N Kurşunlu, 07.VII.2011, N 40°03' - E 29°67', 375 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS CHLOROPHORUS Chevrolat, 186: 290

SUBGENUS CHLOROPHORUS Chevrolat, 1863: 290

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

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

Material examined: İnegöl, SW Şipalı village, 05.VII.2011, N 40°08' - E 29°54', 300 m, 1 specimen, N İsaören village, 26.VI.2012, N 40°05' - E 29°50', 320 m, 2 specimens, N Sarıpınar village, 28.VI.2013, N 40°04' - E 29°46', 420 m, 1 specimen.

Remarks: The species was recorded from Bursa (İnegöl: Mezit village).

SUBGENUS CRASSOFASCIATUS Özdikmen, 2011: 538

SPECIES *C. hungaricus* Seidlitz, 1891: 828

Material examined: İnegöl, NE Sarıpınar village, 09.VI.2012, N 40°04' - E 29°46', 443 m, 2 specimens.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SUBGENUS PERDEROMACULATUS Özdikmen, 2011

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

Material examined: İnegöl, W Yenice, 22.VI.2013, N 40°10' - E 29°41', 387 m, 1 specimen.

Remarks: The species was recorded from Bursa (Uludağ, Karacabey). So, it is the first record for İnegöl county.

GENUS XYLOTRECHUS Chevrolat, 1860: 456

SUBGENUS XYLOTRECHUS Chevrolat, 1860: 456

SPECIES *X. antilope* (Schoenherr, 1817: 465)

SUBSPECIES *X. antilope antilope* (Schoenherr, 1817: 465)

SPECIES *X. arvicola* (Olivier, 1795: 64)

Material examined: İnegöl, NW Akıncılar village, 18.VI.2012, N 40°11' - E 29°41', 341 m, 1 specimen, N Çeltikçi village, 25.VI.2013, N 40°07' - E 29°48', 310 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SUBGENUS RUSTICOCLYTUS Vives, 1977: 130

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

Material examined: İnegöl, SE Yiğit village, 04.VII.2011, N 40°07' - E 29°60', 360 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS CLYTUS Laicharting, 1784: 88

SPECIES *C. rhamnii* Germar, 1817:223

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

Material examined: İnegöl, SE Halhalca village, 03.VII.2011, N 40°15' - E 29°42', 614 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SUBFAMILY STENOPTERINAE Gistel, 1848: [9] (unnum. section)

GENUS STENOPTERUS Illiger, 1804: 120

SPECIES *S. rufus* (Linnaeus, 1767: 642)

SUBSPECIES *S. r. geniculatus* Kraatz, 1863: 104

Material examined: İnegöl, S Karakadı village, 10.VII.2011, N 40°00' - E 29°49', 690 m, 1 specimen, NW Paşaören village, 13.VI.2012, N 40°03' - E 29°40', 595 m, 1 specimen, W Yenice, 22.VI.2013, N 40°10' - E 29°41', 387 m, 2 specimens, S Hocaköy village, 28.VI.2013, N 40°05' - E 29°47', 380 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *DOLOCERUS* Mulsant, 1862: 230

SPECIES *D. reichii* Mulsant, 1862: 231

GENUS *CALLIMUS* Mulsant, 1846: [5]**SUBGENUS *LAMPROPTERUS* Mulsant, 1862: 214**

SPECIES *C. femoratus* (Germar, 1824: 519)

SUBFAMILY DORCADIONINAE Swainson, 1840: 290**GENUS *DORCADION* Dalman, 1817: 397****SUBGENUS *CRIBRIDORCADION* Pic, 1901: 12**

SPECIES *D. bithyniense* Chevrolat, 1856: 88

SPECIES *D. catenatum* Waltl, 1838: 469

SUBSPECIES *D. c. catenatum* Waltl, 1838: 469

SPECIES *D. micans* J. Thomson, 1867: 61

SUBSPECIES *D. m. micans* J. Thomson, 1867: 61

SPECIES *D. olympicum* Ganglbauer, 1882: 228

SUBSPECIES *D. o. flavosuturale* Krätschmer, 1987: 340

SUBSPECIES *D. o. olympicum* Ganglbauer, 1882: 228

SPECIES *D. praetermissum* Pesarini & Sabbadini, 1999: 47

SUBSPECIES *D. p. praetermissum* Pesarini & Sabbadini, 1999: 47

SPECIES *D. rolandmenradi* Peks, 1992: 197

SPECIES *D. scabricolle* (Dalman, 1817: 174)

SUBSPECIES *D. s. uludaghicum* Breuning, 1970: 98

SPECIES *D. septemlineatum* Waltl, 1838: 469

SUBSPECIES *D. s. octolineatum* Kraatz, 1873: 61

Material examined: İnegöl, S Boğazköy village, 24.IV.2012, N 40°17' - E 29°52', 267 m, 1 specimen.

Remarks: The species was recorded from Bursa. So, it is the first record for İnegöl county.

SUBGENUS *MACULATODORCADION* Breuning, 1943: 525

SPECIES *D. triste* Frivaldszky von Frivald, 1845: 184

SUBSPECIES *D. t. triste* Frivaldszky von Frivald, 1845: 184

GENUS *NEODORCADION* Ganglbauer, 1884: 437

SPECIES *N. laqueatum* (Waltl, 1838: 469)

SUBFAMILY LAMIINAE Latreille, 1825: 401**GENUS *MONOCHAMUS* Dejean, 1821: 106****SUBGENUS *MONOCHAMUS* Dejean, 1821: 106**

SPECIES *M. galloprovincialis* (Olivier, 1795: No. 67: 125)

SUBSPECIES *M. g. pistor* (Germar, 1818: 242)

GENUS *HEROPHILA* Mulsant, 1863: 273

SPECIES *H. tristis* (Linnaeus, 1767: 629)

SUBSPECIES *H. t. tristis* (Linnaeus, 1767: 629)

GENUS *MORIMUS* Brullé, 1832: 258

SPECIES *M. fumereus* Mulsant, 1863: 279

SPECIES *M. orientalis* Reitter, 1894: 43

Material examined: İnegöl, Alanyurt, 15.VIII.2011, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *AEGOMORPHUS* Haldeman, 1847: 45

SPECIES *A. clavipes* (Schrank, 1781: 135)

Material examined: İnegöl, S Hamzabey village, 10.VI.2011, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *ACANTHOCINUS* Dejean, 1821: 106**SUBGENUS *ACANTHOCINUS* Dejean, 1821: 106**

SPECIES *A. aedilis* (Linnaeus, 1758: 392)

SPECIES *A. griseus* (Fabricius, 1793: 261)**GENUS *SAPERDA* Fabricius, 1775: 184****SUBGENUS *SAPERDA* Fabricius, 1775: 184****SPECIES *S. carcharias* (Linnaeus, 1758: 394)****SUBGENUS *COMPSIDIA* Mulsant, 1839: 182****SPECIES *S. populnea* (Linnaeus, 1758: 394)****GENUS *OXYLIA* Mulsant, 1862: 398****SPECIES *O. argentata* (Ménétriés, 1832: 227)****SUBSPECIES *O. a. argentata* (Ménétriés, 1832: 227)**

Material examined: İnegöl, S Karakadı village, 10.VII.2011, N 40°00' - E 29°49', 690 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

GENUS *PHYTOECIA* Dejean, 1835: 351**SUBGENUS *COPTOSIA* Fairmaire, 1865: 177****SPECIES *P. bithynensis* Ganglbauer, 1884: 573****SUBGENUS *HELLADIA* Fairmaire, 1864: 176****SPECIES *P. humeralis* (Waltl, 1838: 471)****SUBSPECIES *P. h. humeralis* (Waltl, 1838: 471)**

Material examined: İnegöl, S Kozluca, 17.VI.2011, 1 specimen, S Kalaca village, 02.V.2012, N 40°07' - E 29°56', 297 m, 1 specimen, NW Hamzabey village, 04.V.2013, N 40°14' - E 29°52', 400 m, 2 specimens.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SUBGENUS *MUSARIA* J. Thomson, 1864: 121**SPECIES *P. tuerki* Ganglbauer, 1884: 575****SUBGENUS *PHYTOECIA* Dejean, 1835: 351****SPECIES *P. geniculata* Mulsant, 1862: 420****SUBSPECIES *P. g. geniculata* Mulsant, 1862: 420**

Material examined: İnegöl, W Akhisar village, 28.IV.2012, N 40°10' - E 29°46', 288 m, 2 specimens.

Remarks: The species was recorded from Bursa (Karacabey). So, it is the first record for İnegöl county.

SPECIES *P. virgula* (Charpentier, 1825: 225)

Material examined: İnegöl, SE Halhalca village, 03.VII.2011, N 40°15' - E 29°42', 614 m, 1 specimen, NW Alibey village, 19.V.2012, N 40°06' - E 29°56', 310 m, 1 specimen, N Kozluca village, 20.V.2013, N 40°12' - E 29°56', 295 m, 1 specimen, N Sungurpaşa village, 26.V.2013, N 40°18' - E 29°48', 308 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SUBGENUS *OPSILIA* Mulsant, 1863: 387**SPECIES *P. coerulecens* (Scopoli, 1763: 49)****GENUS *CALAMOBIOUS* Guérin-Méneville, 1847: xvii****SPECIES *C. filum* (Rossi, 1790: 152)****GENUS *AGAPANTHIA* Audinet-Serville, 1835: 35****SUBGENUS *SYNTHAPSIA* Pessarini & Sabbadini, 2004****SPECIES *A. kirbyi* (Gyllenhal, 1817: 186)**

Material examined: Uludağ, 3 specimens.

Remarks: The species was recorded from Bursa (Uludağ, Karacabey).

SUBGENUS *EPOPTES* Gistel, 1857: 93**SPECIES *A. cynarae* (Germar, 1817: 222)****SUBSPECIES *A. c. cynarae* (Germar, 1817: 222)**

Material examined: İnegöl, S Boğazköy, 24.VI.2011, N 40°17' - E 29°52', 270 m, 2 specimens, NW Halhalca village, 03.VII.2011, N 40°16' - E 29°43', 600 m, 1 specimen, W Yiğit village, 04.VII.2011, N 40°07' - E 29°59', 337 m, 1 specimen, SE Yiğit village, 04.VII.2011, N 40°07' - E 29°60', 360 m, 1 specimen, NE Şipali village, 05.VII.2011, N 40°09' - E 29°56', 310 m, 1 specimen, SW Kurşunlu, 07.VII.2011, N 40°04' - E 29°64', 335 m, 1 specimen.

Remarks: The species was recorded from Bursa (Uludağ). So, it is the first record for İnegöl county.

SPECIES *A. dahli* (C. F. W. Richter, 1820: pl. 12)**SUBSPECIES *A. d. walteri* Reitter, 1898: 132**

SPECIES A. *lateralis* Ganglbauer, 1884: 541

Material examined: İnegöl, SW Cerrah, 12.VI.2012, N 40°06' - E 29°43', 395 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SPECIES A. *villosoviridescens* (DeGeer, 1775: 76)**SUBGENUS AGAPANTHIA Audinet-Serville, 1835: 35****SPECIES A. *cardui* (Linnaeus, 1767: 632)**

Material examined: İnegöl, N Kozluca village, 17.VI.2011, 335 m, 1 specimen.

Remarks: The species was recorded from Bursa (Karacabey). So, it is the first record for İnegöl county.

SPECIES A. *suturalis* (Fabricius, 1787: 149)

Material examined: İnegöl, S Kiran village, 19.VI.2011, 795 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SUBGENUS SMARAGDULA Pesarini & Sabbadini, 2004: 128**SPECIES A. *frivaldszkyi* Ganglbauer, 1884: 546**

Material examined: İnegöl, N Boğazköy, 24.VI.2011, N 40°16' - E 29°52', 280 m, 1 specimen.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SPECIES A. *pesarini* Sama & Rapuzzi, 2010: 177

Material examined: İnegöl, SW Akbaşlar village, 01.V.2012, N 40°10' - E 29°58', 400 m, 7 specimens, E Akbaşlar village, 01.V.2012, N 40°09' - E 29°59', 480 m, 5 specimens, SE Dömez village, 01.V.2012, N 40°10' - E 29°60', 610 m, 1 specimen, SW Cerrah, 12.VI.2012, N 40°06' - E 29°43', 395 m, 4 specimens, N Hamzabey village, 01.V.2013, N 40°14' - E 29°53', 310 m, 1 specimen, NE Boğaz village, 04.V.2013, N 40°76' - E 29°77', 280 m, 5 specimens, NE Boğaz village, 18.V.2013, N 40°16' - E 29°52', 274 m, 1 specimen, S Boğaz village, 18.V.2013, N 40°17' - E 29°52', 307 m, 3 specimens.

Remarks: The species is the first record for Bursa province and thereby İnegöl county.

SPECIES A. *violacea* (Fabricius, 1775: 187)**CONCLUSION**

Consequently, the longhorned beetles fauna of Bursa province consist of 81 species belonging to 44 genera of 7 subfamilies.

54 of them are old records. Among the old records, 41 species are only known from available references. And 13 of them, are known from both the available references and the present work.

27 of 80 species are new records to the fauna according to the present work.

Note: This work is derived a part of master thesis of the first author.

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Figure 1. The counties of Bursa province and the location of Bursa province in NW Turkey.

**OBSERVATIONS ON DISTRIBUTION AND BIOLOGY
OF *AGLAIS CASHMIRENSIS* KOLLAR (INDIAN
TORTOISESHELL) (LEPIDOPTERA: NYMPHALIDAE)
FROM KASHMIR VALLEY, J&K (INDIA)**

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[Qureshi, A. A. & Bhagat, R. C. 2015. Observations on distribution and biology of *Aglais cashmirensis* Kollar (Indian Tortoiseshell) (Lepidoptera: Nymphalidae) from Kashmir Valley, J&K (India). Munis Entomology & Zoology, 10 (1): 131-143]

ABSTRACT: Both extensive field and laboratory observations conducted for the first time from April 2008 to November 2011 revealed that *Aglais cashmirensis* (Kollar) commonly called as Indian Tortoiseshell is very commonly distributed species found in diverse habitats like agricultural land, forests, gardens, household lawns, hilly places, open fields, orchids, parks, roads, vegetable gardens, neglected land, etc in Kashmir Valley. Being holometabolous, this Himalayan nymphalid completed its life cycle in 32 to 49 days in which egg stage lasted 4-5, larval 21-30, pre-pupa 1-2, pupa 4-6 and adult 2-6 days respectively. The larvae were monophagous feeding on *Urtica dioica* (Urticaceae) whereas adults were polyphagous visiting flowers of many families. Except during winter season (December to February), it was active from March to November within an altitudinal range from 1200-3000m. Description on its immature stages, wing venation, flight and distribution with distribution map is being given for the first time from the Kashmir Valley.

KEY WORDS: *Aglais cashmirensis*, Kashmir Valley, field observations, distribution, biology, wing venation.

The nature of vegetation, humidity, sunshine, and availability of water, etc, are factors that determine the survival of a given species in a particular area. Information on such habitat preferences is very useful in developing appropriate conservation strategies for the various species in future. The availability of having such type of data from yet to be fully un-explored but biodiversity rich regions like Kashmir Valley further adds to its importance and justification of such studies. Among insects, butterflies are ecologically very important Mathew and Rahamathulla (1993) and have a wide distribution, are relatively easy to sample and identify, and both as individuals and as species they show important numbers in different ecosystems Blair (1999) and Ricketts et al. (2002). Among all the insects, butterflies are highly sensitive to habitat disturbance Malabika (2011) and are known to respond fast to environmental changes compared to other taxa like birds and vascular plants and have been used commonly as an indicator taxon for ecological research and conservation Kremen (1994) and Thomas et al. (2004). The butterfly diversity is known to be related to the diversity of other faunal groups such as birds and mammals Wilson (1997) and also of vegetation Kunte et al. (1999).

The Indian Tortoise Shell, *Aglais cashmirensis* (Kollar) (Lepidoptera: Nymphalidae) is the commonest Himalayan species found in all kinds of terrains Haribal (1990). It was previously placed in the genus *Vaneesa*, however it has been now placed in the genus *Aglais* Dalman Mandal (1987). The genus is represented by four species in the world in which 3 species namely *Aglais*

cashmirensis Kollar, *A. ladakensis* Moore and *A. urticae* Linnaeus, occur in India including Kashmir Himalayas Varshney (1994). Besides Kashmir, it is distributed in some other parts of India (Fig 18) (like Arunachal Pradesh, Himachal Pradesh, Nagaland, Sikkim, and Western Himalayas), Afghanistan, Bhutan, China, Nepal, Pakistan, and Tibet, Bingham (1905), Evans (1932), Thomas-Glover (1936), Wynter-Blyth (1957), Malik et al. (1972), Haribal (1992), Varshney (1994), Abbas (2002), Joshi et al. (2008), Kehimkar (2008), Greeshma (2010), Naro (2012). Malik et al. (1972) reported it a pest of Knettle grasses occurring from March to October in Kashmir Valley. However, these authors have not studied the biology of this species. Both *A. ladakensis* and *A. urticae* have been declared as Endangered in the India Varshney (1994). Recently Qureshi et al. (2013) gave a list of 25 host-plants (24 adult and 1 larval) distributed in 13 families which include 10 new records of adult host-plants for *A. cashmirensis* from the Kashmir Valley. Albeit considerable research work has been carried out on many aspects including biology and distribution of butterflies from other regions/parts of India however no serious attention has been paid on these magnificent creatures of Kashmir Valley. Even the details pertaining to current status, distribution, immature stages, hosts, etc of common species like *Aglaia cashmirensis* are not fully known, hence this study was undertaken.

STUDY AREA:

The Jammu and Kashmir State is situated in the north of the Indian subcontinent and forms the north western range. Geographically, the state is divided into three regions, viz. Jammu, Kashmir and Ladakh, Qureshi (2007). The administrative capital of the state is Srinagar (Kashmir) in summer and Jammu (Jammu) in winter. Kashmir commonly called as the Kashmir Valley lies between 33°20' and 43°54' N Latitude and 73°55' and 75°35' E Longitude covering an area of 15,948 Sq. Kms with 64% of the total area being mountainous. Politically, the Valley is an important part of the state, accommodating much of its population and economic activity. Being an integral but geographically younger part of the main Himalayan Range, the Valley possess a central position in Asia, and also acts as a doorway in between Palaearctic and Indo-Malayan (=Oriental) region in the Northern India Dar et al. (2002). The Valley is divided into ten administrative districts viz., Anantnag, Bandipora, Baramulla, Budgam, Ganderbal, Kulgam, Kupwara, Pulwama, Shopian, and Srinagar Anonymous (2009) and has four seasons namely Winter (December to February), Spring (March to May), Summer (June to August) and Autumn (September to November). Also called the 'paradise on earth' the Valley possesses a rich and unique floral & faunal wealth including butterflies. In spite being a playground of biodiversity, its biological wealth which provides numerous benefits, directly or indirectly to the people of the region is still fully unexplored and poorly documented.

MATERIALS AND METHODS

The present study was carried out at Entomological Research Laboratory, Department of Zoology, University of Kashmir during the years of 2008-2011 in different areas/localities of Kashmir Valley. Random surveys were conducted in different months/seasons of the year, depending on the prevailing weather conditions and butterfly activity. Only a limited number of adult specimens were collected with the help of traditional insect collecting/butterfly net, killed in killing bottles saturated with ethyl-acetate and identified with the help of

standard references like Evans (1932), Wynter-Blyth (1957), and Haribal (1992). Wing venation was studied as per Borrer et al. (1976) with few modifications. Wings were discoloured or bleached by putting in Petri dishes, containing 95% alcohol for 1 to 2 minutes and then were transferred to 10% Hydrochloric acid (HCL) for up to 1 minute. After this they were placed in the mixture of sodium chloride and sodium hypochlorite (having both the chemicals in equal proportion) until the colour was removed. The wings were continuously cleared with a soft brush. They were rinsed in distilled water to remove the excess bleach and dehydrated by running successively increasing concentrations of different grades of alcohol, stained with eosin, cleared twice in xylol (xylene) and mounted in commercially available DPX or Canada balsam and covered with a cover slip and labelled properly. For biological observation, eggs, larvae or pupae along with the parts of host-plant were collected and transferred to rearing cages. Fresh and soft food was provided to larvae and rearing cages were regularly cleaned and continuously monitored Borrer et al. (1976) and Bhate (2005) and Harry (2005). The distribution map was prepared using ArcGIS 9.3 software at Eco-informatics lab, Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalore. For nomenclature of wings Pajni et al. (2006) was followed whereas that of larva & pupa is as per Talbot (1939) and Kunte (2006).

OBSERVATION AND DISCUSSION

Biology: It completed its life cycle from egg laying to emergence of adult in 31 to 44 days depending upon the climatic conditions in four stages namely egg, larva, pupa and adult. Its monophagous larvae feed on *Urtica dioica* Linn. (Urticaceae) which is commonly called 'stinging nettle' or 'bull nettle' and locally as 'Soi' and is highly distributed both at low land and high-altitude areas of Kashmir Valley. Although, its green parts have stinging hairs and can cause painful stings, they are rarely seriously harmful and are mostly avoided by herbivores, so they provide long-term shelter for various insects including larvae of many butterflies. The plant has medicinal properties and its extract of young leaves and inflorescence has anti-diuretic and stomachic properties. The life cycle of this species on this host-plant is described for the first time from Kashmir Valley.

Usually mid-day was found as preferred time for oviposition however it was not a rule because egg laying was observed during late morning hours in the warmest months of June, July and August. The eggs were laid in clusters, usually on the upper areas on the under surface of the leaves. The egg laying was preferred at places where larval host-plants were in abundance and was avoided on isolated plants. The eggs were mostly laid on the centrally located plants, which seemed to avoid the easy attention of predators.

The first instar larvae were visible from the transparent chorion of the egg. The larvae were gregarious however this phenomenon was highest in first and second instars and least in fifth (last) instar. The fourth and fifth instars were seen on adjoining plants like grasses, however we could not notice any larval feeding behavior on these plants. Being in swarms, the first instar with least moving ability feed on the upper tender leaves of the plant and consume nearly most of the plant area and leave network of vein of the leaf.

The web making behavior was seen in first to fourth instars. The larvae excreted pellets of blackish faecal matter. In case of exigencies like danger, external disturbance, etc the second, third and fourth instar larvae secreted a green coloured fluid and also raised their body irregularly and shake their heads.

Eggs: They are laid mostly in groups on the upper portion of the plant. They are brownish to yellowish brown in colour and dome or oval shaped. They eat the egg shell and changed into first instar larvae in 4-6 days.

Larva: There are five larval instars and the total larval period/duration varies from 21 to 30 days. The larvae excreted blackish faecal matter in pellets.

First instar: Head black to brownish black, frons brownish black and shining, vertex and cheeks blackish. Ground colour yellowish to lemonish or greenish yellow, upper side/surface light lemonish or yellowish green and first 5-6 segments more densely coloured. First thoracic segment has a brownish spot on the upper side which is not found in other segments. Thoracic legs are small, blackish, developed and functional. Abdominal legs and anal clasper/legs are light lemonish or colourless, not fully developed and functionless. Mid-dorsal line visible, complete and black to brownish black in colour. All body segments except anal segment covered with small brownish to blackish hairs. Anal segment covered with yellowish hairs. They are slow movers and live in groups, mostly on the upper part of the plant. They eat soft and tender leaves. They also secreted a whitish silken like substance and make cocoon or web like structures in which they live until they change into next instar. The silken web is used as a bridge to move from one place or plant to another while as silken covering seems to provide protection from sunlight, heat, rainfall, winds and enemies (Size 4-6 mm, Duration 3-5 days, Figs. 1, 2).

Second instar: Head more prominent, vertex and frons turn more shining, cheeks brownish black or black and covered with small brownish hairs. Body colour starts changing to black. Hairs on body start growing and increase in size and number. The greenish areas or colouration on the body start disappearing. First segment is smaller than others. The larva comes out of the silken cocoon and starts living mostly in groups or singly. Thoracic legs increase in size and are more blackish, fully developed and functional. Both abdominal and anal legs increase in size. Abdominal legs are lemonish yellow and become fully functional. Anal legs also start functioning and start changing to brownish. The larva becomes quicker and increases in size and shape. Mid-dorsal line becomes more prominent (Size, 9-14 mm, Duration 4-6 days, Fig. 3).

Third instar: Head brownish black, vertex and frons more brownish. Anal legs increase in size, turn brownish and become fully functional. Thoracic legs are blackish, developed and functional. Abdominal legs increase in size and are more yellowish. Head and first thoracic segment are of same size but smaller than other body segments. The larva shows drastic increase in size and becomes more quicker and voracious eater. It starts living singly but can also be seen with other instars, eats nearly any part of the plant and moves freely from one place to another. The larva sticks itself to the object on which it is placed or on which it rests. Hairs on the body increase in size and number. The hairs on the lower side are yellowish and on upper side are black with few yellowish in between (Size 16-22 mm, Duration 5-7 days, Fig. 3).

Fourth instar: Head brownish or blackish brown, smaller than other segments; cheeks and frons complete brownish. Thoracic legs blackish, abdominal legs yellowish and anal legs brownish. All legs are fully functional. Upper side of the body black, ground surface black to brownish black. Mid-dorsal line is prominent

and black. It becomes less quick and eats less as compared to the previous instars (Size 20-26 mm, Duration, 4-6 days, Fig. 4).

Fifth instar: Head blackish brown, cheeks and frons brownish. Thoracic legs blackish, abdominal legs yellowish and anal legs brownish and all legs are fully functional. It is a very slow mover and lives mostly singly. Upper side of the body black, ground surface black to brownish black. Mid-dorsal is prominent and black. It stops feeding during its last larval stages of development and moves to a suitable place usually upper part of the plant where it pupates (Size 26-32 mm, Duration 5-6 days, Fig. 5).

Pre-Pupa: The larva stops feeding and shrinks its size which varies from 18-22 mm. It sticks itself to the substratum with its anal end. The cremaster is whitish. Wing case is light brown to light green (Duration, 1-2 days, Fig. 6).

Pupa: Pupa is variously coloured (brownish, dark brown and greenish brown). When the pupation takes place in dim light the pupa is usually dark brown and if it takes place in bright light the pupa is light brown to greenish brown. Eyes, palpus and antenna are golden brown. Wing case dark brown and spiracles on the wing case golden to golden brown. Pupa is free and hanging. A reddish coloured meconium is ejected (Fig. 12), pupa breaks from lower side and adult comes out. Our findings matched with Dimock (1978) who reported it in the *Vanessa annabella* (Field) (Nymphalidae) from southern California. Immediately after emerging from pupa, the adult can sit on any object even on human hands (Fig. 13) (Size 17-20 mm, Duration 4-6 days, Figs. 7, 8, 9, 10, 11).

Adult/Imago: Antennae black, club elongated, tip creamish brown; Head small, brown; Thorax upper side brownish and covered with silky brownish hairs, underside dull blackish brown covered with dull blackish hairs; Abdomen brownish on upper side and dull creamish on the underside; Forewing upperside with basal part yellow, irrodated with golden scales, marginal area black with light brown colouration in between, rest of wing orange red with various black spots and traces of yellow, cell with a quadrate black bar across the middle, a large black discocellular spot which touches the costal margin, another large but irregular black spot above it towards apex, yellowish bars between these black spots, a large black spot between 1A+2A and Cu1b with some part touching Cu1a, one small black spot between Cu1b and Cu1a, another one between Cu1a and M₃, a whitish spot near apex; underside forewing brown, basal half clouded with dark purplish-brown, the outer margin of the dark portion defined by a highly sinuous jet-black transverse line, most distinct on the hind wing, upperside black, yellow and orange-red colouration represented only by impressions. Hindwing with upperside basal area dusky brown, covered posteriorly with light brown, shining hairs, inner margin light brown and dusted with golden scales, marginal area light brown with an irregular blackish band centered with blue from tornus upto vein R_s and Sc+R₁, a light brown submarginal band, a broad red band turning yellow towards costal margin; underside similar to that of forewing. The adults reared under controlled condition lived up to 2 to 6 days (Wing span: 42-60 mm, Figs. 14, 15).

Field Investigations: The present field observations revealed that besides being very common, this butterfly was active from March to November both in groups as well as singly but was most active from May to August. While Wynter-

Blyth (1957) gave its range from low elevation upto 4570m and Haribal (1992) from 900-4800m, the present study observed its altitudinal range from 1200-3000m (meter above sea level). There was no butterfly activity during the months of January, February and December. Among Nymphalidae, it was first to arrive after a very cold winter and was found widely distributed in different habitats like forests, gardens, hilly places, orchids, parks, roads, agricultural land, vegetable gardens and open fields etc in various localities/areas of all the administrative districts of Kashmir Valley (Table 1, Figs. 17, 18).

They mostly took slow to moderate flight and occasionally it was fast, quick and very high. It preferred to fly during mid-days mostly near the ground and was seen taking uneven, zig-zag and discontinuous flight and chasing its own members. At many occasions it was seen chasing other nymphalids like Painted Lady, *Cynthia cardui* (Linnaeus) and Indian Red Admirable, *Vanessa indica* (Herbst) and was itself seen chased by few like the Silver Strip, *Childrena childreni* (Gray) (Nymphalidae). They love to bask in the sun mostly on rocks, stones, open fields, grasses (Fig. 16) etc, by keeping their wings fully or partially open. The adults are difficult to locate when they keep their wings closed, are attracted to rocks, open dusty roads, dead plants, twigs or leaves, moist and damp soil and animal excreta and showed a prominent mud puddling behaviour.

During the present field investigations, the adults were seen visiting plants belonging to various families like Asteraceae (*Taraxacum officinale*), Compositae (*Tagetes patula*), and Verbenaceae (*Lantana camara*, *Verbena bonariensis*) for nectar sucking and this behavior was highest seen on *T. patula*.

In the field, insects like ants and aphids were seen associated with the larvae on the *Urtica* plant, but no damage to larvae was observed from these organisms. Birds like Common Crow, Indian Mynah, Sparrow, some unidentified hymenopteran, etc were seen acting as predators, devouring both larvae and adults.

CONCLUSION

So far, almost 70% of the country's land area has been surveyed and around 46,000 species of plants and 89,000 species of animals have been described. It is estimated that about 400,000 more species may exist in India which need to be recorded and described. The baseline data on species and genetic diversity, and their macro-and micro-habitats, is inadequate, Anonymous (2007). In spite of being indicators of environmental quality, important food chain components of various animals and possessing great aesthetic values, the life history of 70% of Indian butterflies is still unknown, Haribal (1992). Further, the information on the biology of butterflies of Kashmir Valley is more dilapidated and still very poorly touched. The present preliminary observations besides adding the knowledge and information on the butterflies of Kashmir Valley, provides the basis for further laboratory and field studies on the biology, ecology, impact of weather and natural enemies, nature of larvae, population dynamics, taxonomy etc of this and other butterfly fauna. Hence such type of studies will be of immense value and great contribution for exploring the biodiversity of this key Himalayan region.

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Table 1. Details of various places where *Aglais cashmirensis* was reported during 2008-2011 in Kashmir Valley.

S.No	Place	District	Latitude	Longitude
1	Achhabal	Anantnag	33.6833	75.2333
2	Aish Muqam	Anantnag	33.8666	75.2833
3	Anantnag	Anantnag	33.7333	75.1500
4	Arau	Anantnag	34.1000	75.2666
5	Banihal Pass	Anantnag	33.5166	75.2166
6	Khanabal	Anantnag	33.7500	75.1333
7	Kulgam	Kulgam	33.6500	75.0166
8	Lidder River	Anantnag	34.0166	75.3166
9	Pahalgam	Anantnag	34.0333	75.3333
10	Qazigund	Anantnag	33.6333	75.1500
11	Budgam	Budgam	34.0166	74.7166
12	Dal Lake	Srinagar	34.1166	74.8666
13	Ajas	Bandipora	34.3333	74.6833
14	Bandipora	Bandipora	34.4166	74.6500
15	Ganderbal	Ganderbal	34.2333	74.7833
16	Gurais	Baramulla	34.6333	74.8333
17	Gushi	Kupwara	34.5166	74.2333
18	Hajan	Bandipora	34.3000	74.6166
19	Handwara	Kupwara	34.4000	74.2833
20	Lolab	Kupwara	34.5000	74.4000
21	Nagin Lake	Srinagar	34.1166	74.8333
22	Pattan	Baramulla	34.1666	74.5666
23	Safapura	Bandipora	34.2500	74.6666
24	Shalimar Garden	Srinagar	34.1500	74.8666
25	Sogam	Kupwara	34.5000	74.3833
26	Sopore	Kupwara	34.3000	74.4666
27	Watlab	Baramulla	34.3666	74.5166
28	Panzgam	Kupwara	34.4833	74.0833
29	Tangdhar	Kupwara	34.4000	73.8666
30	Trehgam	Kupwara	34.5000	74.1333
31	Awantipora	Pulwama	33.9166	75.0166



Figure 1. Bunch of first instar larvae causing damage.



Figure 2. First instar larvae.



Figure 3. Bunch of second and third instar larvae.



Figure 4. Fourth instar larva.



Figure 5. Fifth instar larva.



Figure 6. Pre-pupae.



Figure 7. Pupa.



Figure 8. Pupa is opening for the emergence of adult.



Figure 9. Pupa is ready for opening like a door for the arrival of adult.



Figure 10. Pupa breaks & adult arrives.



Figure 11. Broken pupa after emergence of adult.

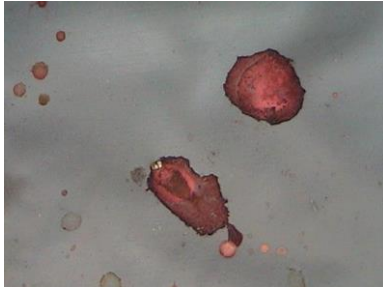


Figure 12. Release of red coloured mecomin before the emergence of adult.



Figure 13. Adult rests on any object like hands after emergence.

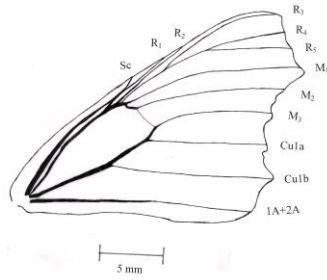


Figure 14. Forewing venation of *Aglais cashmirensis*.

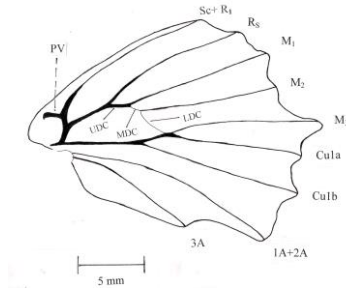


Figure 15. Hindwing venation of *Aglais cashmirensis*.



Figure 16. Adult basking in the sun.

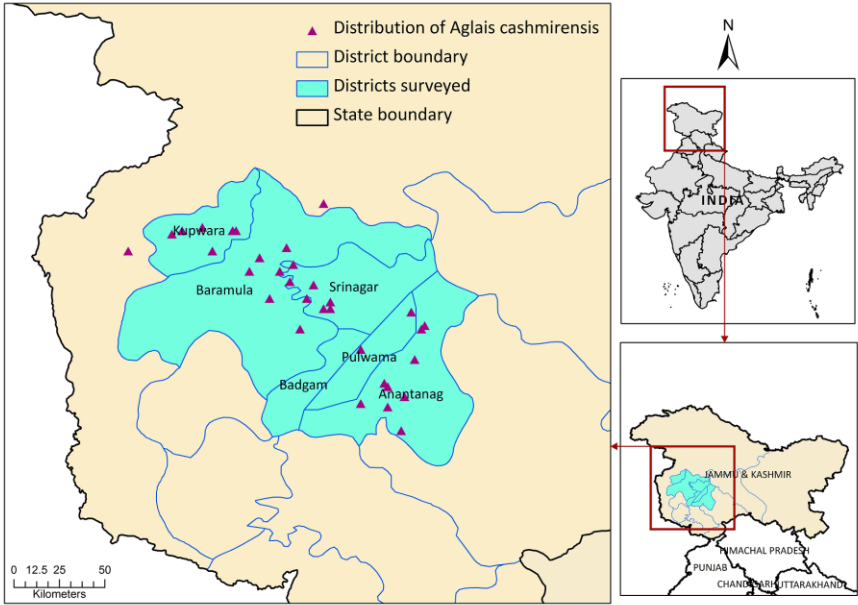


Figure 17. Distribution of *Aglais cashmirensis* in Kashmir Valley.

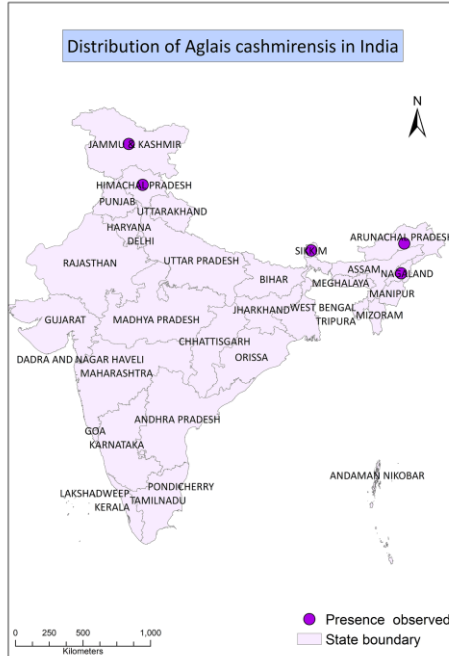


Figure 18. Distribution of *Aglais cashmirensis* in India.

INVASIVE PLANT PESTS (INSECTA AND ACARINA) OF TURKEY

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ABSTRACT: Turkey with its geographical location and favorable climate has very rich fauna terms of biodiversity, and has been invaded by a number of harmful exotic plant pests. For the invasion of pest, four steps are required to complete; introduction, establishment, spread and naturalization. The invasive plant pests recorded by several works in Turkey are: 12 species from Lepidoptera; 12 species from Coleoptera; 23 species from Hemiptera; 10 species from Diptera; 17 species from Thysanoptera; 3 species from Hymenoptera; 1 species from Orthoptera; 15 species from Acarina. Their origine, introduction area, distribution in Turkey and worldwide were given in the study.

KEY WORDS: Invasive, plant pests, Turkey.

Insects can live in almost all ecosystems due to their highest chance of survival and ability to adapt to changing conditions. As in many countries of the world, the insects identified as invasive or exotic are quite high in Turkey. Invasive species can be defined as for any reason added afterwards to from outside of an ecosystem, and then after a certain period they have directly or indirectly affected by biological diversity in ecosystems and become a dominant species. Turkey has a rich geography at the crossroads of three continents; Asia, Europe and Africa, and is a potential of containing the appropriate properties to the establishment and spread of invasive species in terms of biological diversity. Invasive species are spread by natural and human activities. They spread with agricultural trade between countries and continents. There are also distinct pathways for aquatic and terrestrial species. Terrestrial invasive species are introduced and move around in a number of ways such as cargo shipments and containers, transport of infested plant materials, wood products, ornamental plants and pet trade. Invasive species compete with native species for habitat and food, and adversely affect biodiversity, cause to reduction or extinction of native or endemic species and disruption of ecosystems. Invasive species, as well as the ecological damage they also cause of economic loss in agricultural activities. It was reported that economic and environmental losses caused by invasive species in six countries of the world was to be 314 billion dollars per year (GISP, 2007). In addition, adversely affect human health with toxic organisms and the spread of germs and pathogens. Understanding the mechanisms of invasive species into new ecosystems, distribution of species and the effects of natural species are compulsory to combating invasive species in order to be protected from all of these negative effects. Determination of measures to solve the problem, the preparation and implementation of action plans is very important.

In Turkey, whole society including especially farmers should be informed in terms of biodiversity and trained for conservation of biological diversity and the data should be transferred to future generations. The creation of databases associated with invasive and native species, endemic and endangered species will be an important step for the future of any of countries. For this purpose, in this study some common species were listed below as preliminary work. The

introduced species will be added, once they found in the future.

Table 1. Invasive plant pests of Turkey.

Family	Scientific Name	Origin Country	First Entry in Turkey	Distribution in Turkey	World Distribution	Reference
Lepidoptera						
Gelechiidae	<i>Tuta absoluta</i> Povolny	South America	2009-Aegean; Izmir Mugla, Marmara; Canakkale	All Regions	Africa Africa Asia Central America	Urbanaja et al. (2007), Desneux et al. (2010), Kiliç (2010), EPPO (2011)
Gracillariidae	<i>Phyllocnistis citrella</i> Stainton	Asia; India, North China	1994- Mediterranean; Hatay (Samandag, Dortyol)	Mediterranean Aegean	Africa Australia Europe North America Central America and Caribbean South America Oceania; Japan, Philippines, China	Stainton (1856), Slosser (1915), Fletcher (1920), Clausen (1927,1931, 1933), Badawy (1967), (CAB 1970), Heppner (1993), Uygun et al. (1995), Jones (2001), Beattie & Hardy (2004), CABI/EPPO (2003, 2013)
Arctiidae	<i>Hyphantria cunea</i> (Drury)	North America	1975 - Edirne, Istanbul (Catalca, Silivri), Tekirdag	Marmara Black Sea North Aegean	Europe Canada Asia; China, North Korea, Japan	Bovey (1954), Morris (1963), İren (1977), Bas (1982)
Gracillariidae	<i>Cameraria ohridella</i> Deschka & Dumić	1984- Balkans; Macedonia 1879-Greece	Istanbul	Marmara-Thrace basin	Europe Asia	Deschka & Dumić (1986), Lack (2000, 2002), Cebeci & Acer (2007), Cebeci et al. (2011), Lees et al. (2011), CABI/EPPO (2012), EPPO (2013)
Crambidae	<i>Cydalima perspectalis</i> (Walker)	East Asia	2011- Istanbul; Sarıyer	Marmara; Istanbul	Asia Europe	Mally & Nuss (2010), Hizal (2012), Hizal et al. (2012)
Crambidae	<i>Ostrinia nubilalis</i> (Hübner)	Europe	?	All Regions	Europe Asia	Brindley & Dicke (1963), Mutunura & Munroe (1970), EPPO (2013)
					Africa North America	
Tortricidae	<i>Grapholita molesta</i> (Busck)	East Asia; Northwest China	?	All Regions	Africa Europe Asia North America South America Oceania; Australia	CIE (1990), CABI & EPPO (1998), EPPO (2013)
Tortricidae	<i>Lobesia botrana</i> Denis & Schiffermüller	Central Africa; Ethiopia, Eritrea, Kenya	1938-1941- Ankara	All Regions	North and West Africa Europe Asia North America South America	Gunaydin (1972), Kısakurek (1972), İren (1972, 1976), Otacı (1972), CIE (1974), Kacar (1982), Zeki (1996), CABI/EPPO (2012), EPPO (2013)
Gelechiidae	<i>Phthorimaea operculella</i> (Zeller)	America	Marmara; Bolu	All Regions	Africa Europe Asia North America Central America and Caribbean South America Oceania	Keyder & Ataman (1965), Goksu et al. (1971), CABI & EPPO (2012), EPPO (2013)
Pieridae	<i>Pieris rapae</i> L.	Europe	?	All Regions	Asia Africa Europe Mediterranean Basin North America Oceania	(CIE 1952), Keyder (1953)
Noctuidae	<i>Mythimna unipuncta</i> Haworth	America Canada	?	Mediterranean	Asia Africa Europe North America Central America and Caribbean South America	Karsholt & Razowski (1996), CIE (1967)
Tortricidae	<i>Rhyacionia buoliana</i> (Denis & Schiffa)	Europe	?	Regions of pine tree	Asia Africa	EPPO (2013)
					North America South America Europe	

Coleoptera						
Cerambycidae	<i>Phoracantha recurva</i> Newman	Australia Papua New Guinea	?	?	Asia Africa North America South America Europe Oceania	Wang (1995), Ozdikmen & Caglar (2004), CABI/Eppo (2009), Eppo (2013)
Cerambycidae	<i>Phoracantha semipunctata</i> (Fabricius)	Australia	1957- Mediterranean; Mersin, Tarsus	Mediterranean Aegean Southeast Anatolia; Sanliurfa	Europe Asia Africa Latin America Middle East North America South America Oceania	Acatay (1960), Demelt & Alkan (1964), Sekendiz & Yildiz (1969), Yildiz et al. (1981), CIE (1985), Guler (1990), CABI/Eppo (1998,2007), Tavakilian & Chevillotte (2013), Eppo (2013)
Bostrichidae	<i>Rhyzopertha dominica</i> (Fabricius)	Asia; India, Bangladesh	1957-Central Anatolia	Central Anatolia Marmara Aegean Mediterranean Southeast Anatolia	Asia Africa Europe North America Central America and Caribbean South America Oceania	Ozer (1957), Erakay (1967), Aydin & Soran (1987), Yucel (1988), Sinha & Sinha (1990)
Curculionidae	<i>Ceutorhynchus assimilis</i> (Paykull)	Europe	1989- Central Anatolia, Ankara	Mediterranean Central Anatolia	Asia Africa Europe North America	McLeod (1962), Sert & Cagatay (1999), Lodos et al. (2003), Colonelli (2004), Sert (2005)
Bruchidae	<i>Callosobruchus maculatus</i> (Fabricius)	Africa	1952-Aegean	Aegean; Usak, Denizli Marmara Southeast and Central Anatolia	Africa Europe Asia North America Central America and Caribbean South America Oceania	Ozer (1957), Alkan (1966), Karman et al. (1967), Kalkan (1972), Yucel (1985) Ozer & Yucel (1989), Ozar & Genc (1993), Mergen & Cagatay (1996), Eppo (2013)
Dermestidae	<i>Trogoderma granarium</i> Everts	South Asia; India	1954-Aegean	Central, South and Southeast Anatolia Aegean	Africa Europe Asia North America South America Oceania	Hinton (1945), Esin (1955,1959,1967,1968), Alkan (1956), Ernak (1956), Kansu (1961,1962), Cakillar (1963), Kalkan (1963), Ozer & Kalkan (1963), Bank (1977), Lodos (1998), Eppo (2013)
Curculionidae	<i>Ips typographus</i> (L.)	Europe Asia; China	East Black Sea- 1971-Artvin East Anatolia- 1966-Kars	Black Sea; Artvin, Giresun, Ordu, Rize, Trabzon East Anatolia; Ardahan, Erzurum Marmara; Sakarya	Europe Asia North America	Alkan (1985), Coskun et al. (2010), Eppo (2013)
Curculionidae	<i>Pissodes castaneus</i> (De Geer)	Europe Africa	East Anatolia; Kars	East Anatolia East Black Sea East Mediterranean	Europe Asia Africa South America	Abgrall et al. (1999), Tozlu (2001), Gomez & Hartel (2010), Panzavolta & Tiberi (2010), Avgin & Colonelli (2011), CABI (2011), Eppo (2013)
Curculionidae	<i>Lymantor coryli</i> (Perris)	?	2008- Central and East Black Sea; Rize, Giresun, Samsun Ordu, Trabzon	Central and East Black Sea	Central, South and North Europe South Iskandinavia, Caucasia, Romania, Rusia, Far East	Ural et al. (1973), Grune (1979), Kurt (1982), Selmi (1998), Mandelstam & Popovichev (2000), Ak (2004), Ak et al. (2004, 2010)
Curculionidae	<i>Dendroctonus micans</i> (Kugel.)	Asia	1966- Black Sea; Artvin	East Black Sea; Artvin, Giresun, Ordu, Rize, Trabzon East Anatolia; Ardahan	Asia Europe Australia	Serez (1979) Grune (1979), Wood (1982), Alkan (1985), Grégoire (1988) DROA (2001), Eppo (2013)
Curculionidae	<i>Rhynchophorus ferrugineus</i> (Olivier)	1891- Southeast Asia; India	2005-Mediterranean; Mersin	All Regions	Asia Africa Europe South America Central America and Caribbean Oceania	Lefroy (1906), IPPC (2007), Booth et al. (1990), Karut & Kazak (2005), CABI/Eppo (2010), El-Mergawy & Al Ajlan (2011), Eppo (2013)
Chrysomelidae	<i>Leptinotarsa decemlineata</i>	West	1963-Marmara;	All Regions	Europe	Atak (1973), OEEP/Eppo
	Say.	America; 1863- Mexico, 1867- Colorado	Edirne		Africa Asia North America Central America and Caribbean Canada	(1990), Capinera (2001)

Hemiptera						
Monophlebidae (Margarodidae)	<i>Icerya purchasi</i> Maskell	1868- Australia	1912-Sakiz island 1922-Istanbul	Mediterranean Aegean Marmara East Black Sea	Europe Asia North America Central America and Caribbean South America Oceania	CIE (1971), Duzgunes (1970), Lodos (1986), Canakcioglu (1977,1993), EPPO (2013)
Aphididae (Pemphigidae)	<i>Eriosoma lanigerum</i> (Hausmann)	Northeast America	? 1972-Aegean	All Regions	Europe Africa Asia North America Central America and Caribbean South America Oceania	CIE (1975), APPPC (1987), Gul-Zumreoglu (1972)
Aphididae	<i>Aphis spiraeicola</i> Patch	Far East	1955-Mediterranean, Adana	Mediterranean; Adana, Antalya, Mersin, Hatay, K.Maras Marmara; Istanbul Southeast Anatolia; Diyarbakir Central Anatolia; Ankara, Nigde Aegean; Denizli West Black Sea; Bartin	Asia Africa Europe North America Central America and Caribbean South America Oceania	Tuatay & Remaudiere (1964), Canakcioglu (1978), Lodos (1982), Duzgunes et al. (1982), Uygun et al. (1987, 1992), Yuncuyurek & Uygun (1994), Blackman & Eastop (2000), Olmez (2000), CABI/EPPO (2001), Bayindir (2003), Cota (2007)
Diaspididae	<i>Quadraspidiotus pernicius</i> (Comstock)	Northeast Asia; China, Korea	1962- Black Sea; Samsun 1963-Marmara; Kocaeli, Gebze	Marmara;Trakya, Istanbul Black Sea; Artvin, Samsun, Tokat, Amasya, Rize, Zonguldak, Gumushane	Europe Africa Asia North America Central America and Caribbean	Altay et al. (1968), Giray (1969), Gunaydin & Pekyer (1970), Iren & Okul (1972), Tuncyurek (1976), Bozan et al. (1979), Erden (1979), Kozar et al. (1979),
				Aegean; Afyonkarahisar, Izmir, Aydin, Manisa Central Anatolia; Ekişehir, Cankiri, Corum, Kayseri, Konya East Anatolia; Erzurum, Erzincan, Mus, Kar,, Iğdır, Elazığ, Hakkari Marmara; Canakkale, Bursa, Sakarya, Kocaeli, Balıkesir Mediterranean; Adana, Mersin, Antalya, Burdur, Isparta	South America Oceania; Australia, New Zeland	OEPP/EPPO (1981), CIE (1986), Kozar & Konstantinova (1981), Kozar (1990), CABI (2009), EPPO (1998), Yasar et al. (2003), Tanyurek (2006)
Aphelinidae	<i>Eremocerus debachi</i> Rose & Rosen	Japan	1986- East Mediterranean; Adana Aegean; Izmir	Mediterranean Aegean	North America Europe Asia Africa	Uygun et al. (1990), Rose & Rosen (1992), Rose & DeBach (1992), LaSalle (1993) Sengonca et al. (1993), Yoldas & Oncuer (1994)
Aleyrodidae	<i>Dialeurodes citri</i> (Achmead)	Asia, India America, ?Florida	1965-Black Sea, Hopa	Mediterranean Aegean Black Sea Southeast Anatolia	North America Central America and Caribbean South America South Europe Asia Africa	Achmead (1885), Morrill & Black (1911), Soylu & Urel (1977), Lodos (1982), Uygun et al. (1990), Martin (1999), Jensen (2001), EPPO (2013)
Aleyrodidae	<i>Parabemisia myricae</i> (Kuwana)	Japan	1982- East Mediterranean	1988-Aegean, Izmir	North America Europe Asia Africa Oceania	Rose et al. (1981), Rose & DeBach (1982), CIE (1986), Uygun & Sekeroglu (1987) Uygun et al. (1990), Sengonca et al. (1993)
Coccidae	<i>Pulvinaria floccifera</i> (Westwood)	East Asia, Australia	East Black Sea	Marmara Black Sea	Asia Europe Africa South America North America Oceania, Australia	Bodenheimer (1952), Canakcioglu (1977), Selmi (1979), Ben-Dov (1993), Malumphy (2013)
Coreidae	<i>Leptoglossus occidentalis</i> (Heidemann)	North America	2009-Istanbul	Marmara; Edirne, Istanbul, Kizilirmak Aegean; Izmir	North America Europe Asia	McPherson et al. (1990), Dursun (2011), Arslangundogdu & Hizal (2010), Hizal & Inan (2012)
Ricanidae	<i>Ricania simulans</i> (Walker)	1956- Georgia	2006-East Black Sea, Rize	East Black Sea	Asia; China Africa Australia	Guclu et al. (2010)
Phoenicococcidae	<i>Phoenicococcus marletti</i> Cockerell	North Africa Middle East	2008-Mediterranean; Hatay, Adana, Antalya	Mediterranean	North America Asia Europe North America South America Central America and Caribbean	Avidov & Harpaz (1969), Zaid et al. (2002), Miller et al. (2007), Ben-Dov (2008), Doganiar & Yigit (2008)

Psyllidae	<i>Blattopsylla occidentalis</i> Taylor	South and West Australia	2004- Mediterranean; Tarsus, Karabucak	Mediterranean Aegean	North America; California, Mexico, South America Africa Asia New Zeland, China Europe	Taylor (1985), Hodkinson (1991), Gill (1998), Brennan & Gill (1999)
Tingidae	<i>Corythucha ciliata</i> Say	North America, Canada	2007-Marmara; Bolu, Tekirdag	Marmara East Black Sea	Asia Europe North America South America Oceania	CABI & EPPO (2007), Mutun (2009), EPPO (2013)
Diaspididae	<i>Pseudaulacaspis pentagona</i> (Targioni Tozzetti)	East Asia; Japan, China	1912- Istanbul	All Regions	Africa Europe Asia North America Central America and Caribbean South America Oceania	MacGillivray (1921), Bodenheimer (1949, 1958), Keyder (1952), Kiroglu (1981), Kosztarab & Kozar (1988), Kozar (1990), EPPO (2013)
Aphididae	<i>Macrosiphum euphorbiae</i> Thomas	North America	Istanbul	All Regions	Africa Europe Asia	Tuatay & Remaudiere (1964), Giray (1974), Canakcioglu (1975), CIE (1984),
					North America Central America and Caribbean South America Oceania	Toros et al. (2002), Gorur (2004), Ozdemir (2004), EPPO (2013)
Pseudococcidae	<i>Phenacoccus solenopsis</i> Tinsley	North America; 1897-New Mexico 1990-Texas Arizona, California, Colorado	2012- Mediterranean, Adana	Mediterranean, Adana	Africa Europe Asia North America Central America and Caribbean South America Oceania	Tinsley (1898), Fuches et al. (1991), Williams & Granara de Willink (1992), Ben-Dov (1994), Williams (2004), Kaydan et al. (2008, 2013)
Pseudococcidae	<i>Phenacoccus solani</i> Ferris	North America; California, Mexico, Texas	2012- Mediterranean, Adana	Mediterranean; Adana, Hatay	Africa Europe Asia North America Central America and Caribbean South America Oceania	Ben-Dov (1994), Ben-Dov et al. (2005), Kaydan et al. (2008, 2013)
Pseudococcidae	<i>Phenacoccus madeirensis</i> Green	North America; Mexico	2012- Mediterranean; Adana, Antalya Marmara; Canakkale	Mediterranean Marmara	Africa Europe Asia North America Central America and Caribbean South America Oceania	Williams & Granara de Willink (1992), Ben-Dov (1994), Williams (1987, 2004), Ben-Dov et al. (2012), Kaydan et al. (2012)
Aleyrodidae	<i>Aleurothrixus floccosus</i> (Maskell)	South America	1994- Mediterranean; Hatay 1996- Aegean; Izmir	Mediterranean; Hatay, Mersin, Antalya Aegean; Izmir, Aydin	Africa Europe Asia North America Central America and Caribbean South America Oceania	Mound & Halsey (1978) Liotta & Maniglia (1983), Barbagallo et al. (1986), Vatansover & Ulusoy (2005), EPPO (2013)
Coccidae	<i>Saissetia oleae</i> (Olivier)	North Africa	Marmara 1938- Aegean	Marmara Aegean	Africa Europe	Bodenheimer (1941, 1953), De Lotto (1965), Tuncyurek (1970), CIE (1973), Tuncyurek & Yalcin (1979), Gokmen & Seckin (1979), Duzguner (1982), Ben-Dov (1993), EPPO (2013)
Pseudococcidae	<i>Planococcus citri</i> (Risso)	Asia; China	?	Mediterranean Aegean Marmara Central Anatolia	Africa Europe Asia North America Central America and Caribbean South America Oceania	Ferris (1950), Bodenheimer (1953), Soylu & Urel (1977), Bartlett (1978), Uygun et al. (1987), CABI & EPPO (1999), EPPO (2013)
Homotomidae	<i>Macrohottoma gladiata</i> Kuwayama	Asia	Aegean, Aydin	Aegean Mediterranean Marmara	Asia; China, Japan, Taiwan, Indonesia Australia Europe Africa	Crawford (1911), Wiebes (1979), Hollis & Broomfield (1989), Gencer et al. (2007), Li (2011), Martin & Lau (2011), Shalva et al. (2011), Mifud & Porcelli (2011)

Phylloxeridae	<i>Viteus vinifoliae</i> (Fitch)	North America	1881-Istanbul 1885-Izmit 1888 -Izmir	West, North, Central and South Anatolia ? All Regions	Africa Europe Asia North America Central America and Caribbean South America Oceania	Bodenheimer (1958), CIE (1975), Lodos (1986), CABI/EPPO (1998), EPPO (2013)
Diptera						
Agromyzidae	<i>Liriomyza sativae</i> Blanchard	America	Aegean; Mugla	Aegean	Asia Africa Europe North America Central America and Caribbean South America Oceania	Blanchard (1938), Freeman (1958) Spencer (1973), Parelle (1982), Civelek (2002), EPPO (2013)
Agromyzidae	<i>Liriomyza huidobrensis</i> (Blanchard)	Central and South America, 1926- Argentina	1985- Aegean	Mediterranean	Africa	Blanchard (1926), Spencer (1973), Deeming (1992), CABI & EPPO (1997, 2012), EPPO (2013)
Agromyzidae	<i>Agromyza albipennis</i> Meigen	America Canada	Saniurfa (Birecik)	Southeast Anatolia	America, Canada Asia; Japan Sibuna Europe	Spencer (1976, 1980), Cikman (2003)
Agromyzidae	<i>Agromyza reptans</i> Fallen	America Canada	Saniurfa, (Ceylanpinar, Koruklu) ?	Southeast Anatolia	America, Canada, Northern Europe	Spencer (1976), Giray (1980), Cikman (2003)
Agromyzidae	<i>Agromyza rondensis</i> Strobl	Northern Europe	Izmir Saniurfa (Halfeti, Hilvan, Siverek)	Aegean Southeast Anatolia	Northern European countries	Spencer (1976), Civelek (1998), Cikman (2003)
Agromyzidae	<i>Melanagromyza vignalis</i> Spencer	Sothern Africa	Saniurfa (Viransehir)	Southeast Anatolia	Sothern African countries	Spencer (1976), Cikman (2003)
Agromyzidae	<i>Cerodontha denticornis</i> (Panzer)	Northern Europe	Saniurfa ?	Southeast Anatolia	Northern European countries	Spencer (1976), Giray (1980), Cikman (2003)
Agromyzidae	<i>Phytomyza affinis</i> Fallen	Northern Europe	Saniurfa (Halfeti) ?	Southeast Anatolia	Northern European countries	Spencer (1976), Bodenheimer (1958), Cikman (2003)
Agromyzidae	<i>Phytomyza chelonae</i> Spencer	America	Saniurfa (Siverek) ?	Southeast Anatolia	America	Spencer (1969, 1990), Cikman (2003)
Tephritidae	<i>Ceratitis capitata</i> (Wiedemann)	Africa	Nearly a century ago	Mediterranean Aegean Central Anatolia	Africa Europe Asia North America Central America and Caribbean South America Oceania, Australia	CIE (1988), Fumiani (1989), CABI/EPPO (1999), EPPO (2013)
Thysanoptera						
Thripidae	<i>Frankliniella occidentalis</i> (Pergande)	Northwest America, Canada	1993- Mediterranean, Antalya	Mediterranean Southeast Anatolia	Europe Africa Asia North America	Tunc & Gocmen (1994), CABI/EPPO (1999), Kirk & Terry (2003), Doganlar & Aydın (2009), EPPO (2013)
Thripidae	<i>Retithrips zyracus</i> Mayet	Central Africa; India	2001-Mediterranean; Hatay (Center, Samandag, Iskenderun)	Mediterranean	Asia; India Africa America; Florida Brazil	Bodenheimer (1939), Avidov & Harpaz (1969), Hamas Avaz & Edward (1994), Doganlar & Yigit (2002)
Thripidae	<i>Heliothrips haemorrhoidalis</i> (Bouché)	South America	East Black Sea; Rize	East Black Sea South and West Anatolia	North America Central America and Caribbean South America Oceania; Australia, New Zealand Asia Africa Europe	Bodenheimer (1958), CSIRO (2009), Ulgenturk et al. (2011), CABI (2014)
Thripidae	<i>Dendrothrips saltatrix</i> Uzel	Europe, NW India, Iran	?	Aegean; Izmir	Europe, Asia; NW India, Iran	Strassen (2003), Tunc et al. (2012)
Thripidae	<i>Eremiothrips taghitadehi</i> (zur Strassen)	Spain, Iran	?	Aegean; Izmir	Europe; Spain, Asia; Iran	Strassen (2003), Tunc et al. (2012)
Thripidae	<i>Limothrips angulicornis</i> Jablonowski	West-Paleartic	?	Aegean	West Palearctic	Strassen (2003), Tunc et al. (2012)

Thripidae	<i>Limothrips cerealium</i> Haliday	Atlantic West Europe	?	Aegean, Eastern Mediterranean, Southeastern Anatolia	Atlantic, West Europe	Strassen (2003), Aydin (2010), Tunc et al. (2012)
Thripidae	<i>Limothrips denticornis</i> Haliday	Euro-Siberia	?	Aegean, Eastern Mediterranean, Southeastern Anatolia	Euro-Siberia	Strassen (2003), Aydin (2010), Tunc et al. (2012)
Thripidae	<i>Neohydatothrips gracilicornis</i> (William)	Japan	?	Aegean, Eastern Mediterranean, Southeastern Anatolia	Asia; Japan, China, Siberia Europe; Spain Africa; Morocco	Strassen (2003), Aydin (2010), Tunc et al. (2012)
Thripidae	<i>Oxythrips halidayi</i> Bagnall	Europe; Germany Crimea	?	Aegean; Usak	Crimia, Germany, England, France	Strassen (2003), Tunc et al. (2012)
Thripidae	<i>Rubiothrips validus</i> (Karuy)	North & East Europe	?	Aegean; Usak	North & East Europe	Strassen (2003), Tunc et al. (2012)
Thripidae	<i>Thrips australis</i> (Bagnall)	Australia	2005- Mediterranean; Adana, Mersin, Antalya	Mediterranean Aegean Marmara Southeastern Anatolia	North America; California South America Africa Asia	Doganlar (2007), Vierbergen et al. (2010) Aytar et al. (2011), Hazir et al. (2011)
Thripidae	<i>Thrips angusticeps</i> Uzel	West-Palaearctic	?	Aegean, Eastern Mediterranean, Southeastern Anatolia	West-Palaearctic	Strassen (2003), Aydin (2010), Tunc et al. (2012)
Thripidae	<i>Thrips atratus</i> Haliday	North Africa South America	?	Aegean	North Africa South America	Strassen (2003), Tunc et al. (2012)
Thripidae	<i>Thrips fedorovi</i> (Priesner)	Europe; Ukraine	?	Aegean; Usak	Europe; Romania, Bulgaria, Ukraine	Strassen (2003), Tunc et al. (2012)
Thripidae	<i>Thrips fuscipennis</i> Haliday	North Africa	?	Aegean; Izmir Marmara; Yalova Black Sea; Ordu, Samsun	North Africa America	Strassen (2003), Tunc et al. (2012)
Thripidae	<i>Thrips viminalis</i> Uzel	West Siberia	Ankara	Ege, Central Anatolia	West Siberia	Strassen (2003), Tunc et al. (2012)
Hymenoptera						
Eulophidae	<i>Leptocybe invasa</i> Fisher & LaSalle	Australia	1885-Mediterranean; Adana, Mersin	Mediterranean Aegean	Europe Asia and Pacific Africa North America Middle East	Adali (1944), Acatay (1960), Aytar (2003), Mendel et al. (2004), Protasov et al. (2008)
Eulophidae	<i>Ophelimus maskeli</i> (Ashmead)	Australia	2004-Mediterranean, Adana	Mediterranean; Adana, Hatay, Mersin Aegean; Mugla	Mediterranean Basin Europe Africa Asia Middle East Oceania	Aytar (2006), Boucek (1988), CABI (2005), Tilbury & Jukes (2006), EPPO (2006), Protasov et al. (2007), Doganlar & Mendel (2007)
Eulophidae	<i>Quadrastichodella nova</i> (Girault)	Australia	2006-Mediterranean, Aegean	Mediterranean Aegean	Canary Islands, Europe Asia South Africa America, California	Flock (1957), Timberlake (1957), LaSalle (1994), Boucek (1977, 1988), Doganlar (2007) Doganlar & Doganlar (2008), Aytar (2008), Aytar et al. (2011)
Orthoptera						
Acrididae	<i>Schistocerca gregaria</i> (Forsk.)	Old World, New World, America West Africa	1915-Mediterranean, Adana	East Mediterranean Southeast Anatolia	North Africa Southwest Asia; India Middle East North America Central America; South America Mexico gulf islands; Cuba Europe Iberian peninsula	Scudder (1899), Uvarov (1928), Erkilic & Balamir (1946) Dirsh (1974), Kevan (1989), Song (2004)
Acarina						
Eriophyidae	<i>Acalitus phloeocoptes</i> (Nalepa)	Austria	Central Anatolia, Ankara Aegean, Izmir	Central Anatolia; Ankara Aegean; Izmir	Asia Europe Africa North America	Nalepa (1890), Karaca (1951, 1954), Denizhan (2007)
Eriophyidae	<i>Coptophylla lamimani</i> (Keifer)	America	?	Central Anatolia; Ankara Black Sea	Europe and Balkans; Bulgaria, Greece, Hungary, Yugoslavia, Italy, Poland, Portugal, Spain America; California	Ozman & Cobanoglu (2001), Denizhan (2007)
Eriophyidae	<i>Phyllocoptes abaemus</i> Keifer	America	?	Central Anatolia; Ankara	Europe; Germany, Greece, Bulgaria, Hungary, Yugoslavia Italy, Poland, Switzerland, Spain, Bosnia and Herzegovina, Asia; Armenia, Lebanon America; Chile Canada, Oceania; New Zeland	Denizhan (2007)

Eriophyidae	<i>Phyllocoptes didelphis</i> Keifer	America, California	?	Central Anatolia; Ankara	Turkiye	Denizhan (2007)
Eriophyidae	<i>Platypytopus sabinitanae</i> Keifer	America, California	?	Central Anatolia; Ankara Camlidere	Asia; Turkiye, Ukraine Europe; Hungary, Italy, Poland, Portugal America	Denizhan (2007)
Eriophyidae	<i>Vazates immigrans</i> Keifer	America,	?	Central Anatolia; Ankara	America	Denizhan (2007)
Eriophyidae	<i>Calepitrimerus baileyi</i> (Keifer)	California America, California	?	Center, Kalecik Central Anatolia; Ankara East Anatolia; Erzurum Black Sea; Amasya	Asia; India, Turkiye Palaeartic, Nearctic, Australian	Denizhan (2007)
Eriophyidae	<i>Aceria calaceris</i> Keifer	America	?	Central Anatolia; Ankara	Nearctic Turkiye	Denizhan (2007)
Eriophyidae	<i>Aculus ligustri</i> (Keifer)	America	?	Central Anatolia; Ankara	America Asia; China, Japonya Europe; Hungary, Italy, Poland, Yugoslavia	Denizhan (2007)
Eriophyidae	<i>Aculops rhodensis</i> (Keifer)	America	?	Central Anatolia; Ankara	America Europe; Hungary, Italy Asia; Turkiye	Denizhan (2007)
Eriophyidae	<i>Tetra concava</i> (Keifer)	America, California, Washington	?	Central Anatolia; Ankara Kalecik	America Europe; Italy, Hungary Asia; China, Turkiye	Denizhan (2007)
Eriophyidae	<i>Tegolophus califraximi</i> (Keifer, 1938)	America, California	?	Central Anatolia; Ankara	America Europe; Italy, Hungary Asia; Turkiye	Denizhan (2007)
Eriophyidae	<i>Shetchenkella brevisetosa</i> (Hodgkiss)	America	?	Central Anatolia; Ankara	America; Canada Europe; Italy, Hungary Poland, Yugoslavia	Denizhan (2007)
Diptilomiopidae	<i>Rhyncaphytoptus ficifoliae</i> Keifer	America, California	?	Central Anatolia; Ankara	Europe and Balkans; Bulgaria, Greece, England, Italy, Portugal, Yugoslavia, Bosnia and Herzegovina, Croatia, Macedonia, Asia; Armenia, India, Iraq, Iran Africa; Egypt America; Chile	Denizhan (2007)
Diptilomiopidae	<i>Brevulacus reticulatus</i> Manson	New Zeland	?	Central Anatolia; Ankara	Asia; Turkiye, China Europe; Poland Oceania; New Zeland	Denizhan (2007)

CONCLUSION

Turkey has many different climates and microclimates in several parts of the regions. Due to this reason any exotic insect can find a place in which there is at least a suitable host and ecological condition to grow and distribute there.

On the other hand Turkey is an old country and placed between three continents, and during the periods of the Roman and Ottoman Empires different kind of pupil with their special food plants came into Turkey from many regions, including Asia (Far East), Europe, Africa, India, South Asian countries, New Zealand and Australia.

In 20th Century Turkey have received many exotic insects by transfers of many nursery stocks from different continents without good quarantine control, because of this reason Turkey has had many new introductions in the last decade. Our list given above includes many new exotic pests came into Turkey and become very injurious pest and distribute all most all over the country, such as *Tuta absoluta*, *Frankliniella occidentalis*, *Leptocybe invasa*, *Ophelimus mascelli*, etc.

The list still needs many new names of exotic pests to be added in the future, once the new research to be conducted and completed in different parts of Turkey for obtaining the new ones and their distributions and damage levels.

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COMPARATIVE ECONOMICS OF COMMERCIAL YOUNG SILKWORM REARED WORMS PER 100 DFLS IN SOUTH INDIA

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ABSTRACT: Rearing of young age silkworms up to II moult is called chawki rearing, which usually last up to 8 days. In sericulturally advanced countries, young age larvae are supplied to the farmers by Silkworm Seed Production Centres through well organized co-operative Commercial “Young Silkworm Rearing Centres” or “Chawki Rearing Centres”. The present investigation was carried out by data obtained from the Commercial Chawki Rearing Centres (CRCs) in Southern India comprising three states namely Karnataka, Andhra Pradesh and Tamil Nadu during 2006. The data were analysed using budgetary method and cost concepts. Detailed study of the economics per 100 dfls (disease free layings) revealed that the major economic factor contributing for the total cost of production was recurring cost, which was found to be 94.3%, 82% and 91% in Karnataka, Andhra Pradesh and Tamil Nadu states respectively. Another important item was cost of chawki rearing equipment, which was worked out to about 5.7% (Karnataka), 18% (Andhra Pradesh) and 9% (Tamil Nadu). Cost of production, sale of chawki worms and net income were found to be higher in Tamil Nadu than the other two states.

KEY WORDS: Chawki worms, Chawki Rearing Centre, Cost of Production, dfls (disease free layings) and South India.

Sericulture is spread over 60,000 villages throughout the sub continent but is mostly concentrated in South India among three states viz.; Karnataka, Andhra Pradesh and Tamil Nadu, almost raising 90 per cent of mulberry silk and West Bengal and Kashmir contributing the rest 10 per cent (Datta & Mahesh Nanavaty, 2005). Young age silkworm rearing which is considered critical for successful harvest of cocoon is popularly known as chawki rearing. Young silkworm rearing in South India is popularized by Central Silk Board (CSB) by establishing Chawki rearing Centres (CRC). In recent years, many cocoon producers have started buying chawki worms from CRCs considering less labour involvement and increased cocoon yield (Umesh et al., 2001). Hence, the present study is aimed for the comparative commercial economics of chawki reared worms per 100 dfls in South India.

MATERIALS AND METHODS

Data were collected from South Indian sericulture states Karnataka, Andhra Pradesh and Tamil Nadu each 15 CRCs from 3 states during 2006. The economic performance was collected by personal interview method with a structured schedule designed to meet the objectives of the study. The cost of production of chawki rearing, fixed cost, operational cost and the contribution of the cost in percentages of the total cost, net return were calculated per 100 dfls.

Fixed costs (Non recurring cost): The fixed cost is calculated by considering all the items used for chawki rearing. A depreciation charge on each of the

equipment used for each individual farmer was calculated as mentioned below (Acharya et al., 1993).

$$\text{Annual depreciation} = \frac{\text{Purchase value of the equipment}}{\text{Expected life of the equipment (years)}}$$

The average life span of the asset that has been informed by the individual sample farmer was taken for computing the depreciation value.

Equipments used in chawki rearing: Rearing trays, rearing stands, feeding stands, heaters and humidifiers, leaf chopping board/machine, plastic appliances and generator.

Rearing house: Most of the farmers are conducting rearing in separate rearing house and the value is calculated based on the actual cost of the building.

Recurring cost (Operational costs): The operational cost includes the leaf cost, cost on disinfectants and chemicals (Acharya et al., 1993). The inputs utilized in chawki rearing *viz.*, labour cost and disinfectants (chlorine dioxide, formalin, bleaching powder, lime powder and Vijetha), have been considered. The cost incurred on paraffin paper, cost of transportation of chawki reared worms to the farmers' house *etc.*, were calculated on the basis of actual cost. The cost of mulberry leaf utilized for rearing of young silkworms was computed on the basis of cost of production of mulberry leaf. Similarly, the value of the mandays was calculated based on the prevailing wage rates in the study area for male and female labour.

Interest on the working capital: The interest rate was calculated at 10% per annum on the actual cost incurred by the respondents.

Chawki charge (Rate): The actual price realized for the chawki reared worms/100 dfls was assessed from the cost of production of chawki worms.

Net-income: The net income from the chawki rearing was estimated by deducting the total cost of chawki rearing from the gross income (Jagannathan, 1995).

RESULTS AND DISCUSSION

The average chawki charge per 100 dfls in Karnataka, Andhra Pradesh and Tamil Nadu has been worked out. The cost of production per 100 dfls was calculated by including the cost of leaf utilized to rear 100 dfls and depreciation cost of rearing equipments.

Fixed cost for 100 dfls: The cost incurred on equipment and rearing house utilized for chawki rearing were taken into consideration (Table 1). The cost incurred on rearing trays was Rs.2.41 in Karnataka, Rs.10.41 for Andhra Pradesh and Rs.9.39 in Tamil Nadu. Rearing tray was the major cost component irrespective of the states. It was due to the cost spent on rearing trays was maximum because of more number of trays utilized by the Chawki Rearing Centres (CRC). The recommended numbers of trays per 100 dfls were 8 trays (2'x3') up to 2nd moult. Whereas, Karnataka utilized less number of trays, thus the

cost incurred on trays was less in Karnataka. The next major share of cost was found to be incurred on the electrical appliances such as, heater, humidifier, cooler to maintain required temperature and humidity in the chawki building. It was found to be Rs.0.83, Rs.3.10, and Rs.2.04 in Karnataka, Andhra Pradesh and Tamil Nadu respectively. Andhra Pradesh CRCs were equipped fully to maintain the temperature and humidity in the chawki building. This was due to the involvement of Japan International Co-operation Agency (JICA), where CRC equipments were adequately supplied during the project period. The depreciation value on rearing equipment for these states was Rs.6.36, Rs.20.00 and Rs.17.41. The results revealed that the CRC's of Andhra Pradesh spend more on fixed cost as compared to their counter parts in Tamil Nadu and Karnataka.

The percentage share of non-recurring and recurring cost of chawki rearing per 100 dfls is depicted in Table 3. The major share is occupied by the recurring cost (94.3%) the non recurring (5.7%) in Karnataka. In the non recurring expenditure (Fig. 4) the major share was occupied by rearing trays (37%), electric appliances (33%), rearing equipments (22%), plastic items (5%) and disinfection tank (3%).

In case of Andhra Pradesh the share of recurring cost was 82% and the non recurring cost was 18% (Table 3). The major share of non recurring cost was occupied by (Fig. 4) electric appliances (49.78%) followed by rearing trays (35%), rearing equipment (11.7%), disinfection tank (2.02%) and plastic item (1.5%).

The major recurring and non recurring cost was found to be 91% and 9% in case of Tamil Nadu (Table 3). In non recurring cost (Fig. 4) components were that of rearing trays (53.94%), electric appliances (25.84%), rearing equipments (14.28%), plastic items (3.46%) and disinfection tank (2.48%).

Recurring cost for 100 dfls: Karnataka incurred a recurring cost of Rs.104.10, Andhra Pradesh Rs.151.91 and for Tamil Nadu Rs.173 per 100 dfls (Table 2). The cost of chawki leaf was the major cost component irrespective of the state. It was estimated to be Rs.41.7 for Karnataka, Rs.45.3 for Andhra Pradesh and Rs.53.5 for Tamil Nadu. The consumption of leaf was more in Tamil Nadu followed by Andhra Pradesh and Karnataka. Tamil Nadu and Andhra Pradesh CRCs chawki reared up to 2nd moult, where as in Karnataka chawki worms reared up to 1st moult. This was clearly confirmed the consumption of leaf and cost of leaf were maximum in Tamil Nadu and Andhra Pradesh as compared to Karnataka.

The next major cost component was that of labour wages in chawki rearing, which was found to be Rs.12.7, Rs.34.5 and Rs.50.9 in Karnataka, Andhra Pradesh and Tamil Nadu respectively. Involvement of human labour was high in Tamil Nadu followed by Andhra Pradesh and Karnataka. Tamil Nadu and Andhra Pradesh CRCs conducted chawki rearing up to 2nd moult (8 days). Karnataka is an exception to this system as the chawki worms were found distributed after the 2nd moult, after first moult (3 days) and even after just hatching (Balasubramanian, 2006). Hence, the labour cost was found to be less in Karnataka compared to other two states. The cost of disinfectants used per 100 dfls was Rs.11.4 (Karnataka), Rs.31.5 (Andhra Pradesh) and Rs.20.3 (Tamil Nadu). In case of Karnataka disinfection was carried out once in a month (5-6 crops) because of continuous and overlapping batches. Where as, in Andhra Pradesh and Tamil Nadu, the number of batches was three per month and it reflected on the cost of disinfectants in Andhra Pradesh and Tamil Nadu. The cost incurred on paraffin paper was Rs.10.4, Rs.14.4 and Rs.15.9 in Karnataka Andhra Pradesh and Tamil Nadu respectively. The cost of transportation of chawki worms was Rs.5.5 in Karnataka. Andhra Pradesh and Tamil Nadu farmers lift the chawki worms on

their own. Interest on working capital estimated was Rs.9.46, Rs.13.81 and Rs.15.73 respectively. The total recurring cost was high in Tamil Nadu (Rs.173) compared to Andhra Pradesh (Rs.151.91) and Karnataka (Rs.104.10).

The percentage wise recurring cost components per 100 dfls of Karnataka is presented in Fig. 1. The maximum share was accounted for chawki leaf cost (39) followed by disinfectant cost (13.4), rearing man days (11.77), paraffin paper cost (9.65), interest on working capital (9), building (6), other cost (5.5) and transportation (5.25). The percentage wise recurring cost components per 100 dfls of CRCs of Andhra Pradesh is depicted in Fig. 2. The maximum share accounted for chawki leaf (41.7) followed by rearing man days (20.1), disinfectant cost (12.4), interest on working capital (9), paraffin paper cost (7.1), other cost (6.1) and building (3.26). In case of Tamil Nadu (Fig. 3) the maximum percentage of share was occupied by chawki leaf cost (30.9) followed by rearing man days (29.4), disinfectant cost (13.4), paraffin cost (9.21), interest on working capital (9.09), other cost (5.2) and building (2.9).

Cost of production per 100 dfls of chawki larvae: The total cost of 100 dfls was estimated for Rs.110.47 in Karnataka Rs.171.92 in Andhra Pradesh and Rs.190.41 for Tamil Nadu (Table 3). Overall the cost of production per 100 dfls was more in Tamil Nadu followed by Andhra Pradesh and Karnataka. The sale price of chawki worms per 100 dfls was estimated Rs.249.20 in Karnataka, Rs.273.95 in Andhra Pradesh and Rs.390 in Tamil Nadu. The sale price of chawki worms was high in Tamil Nadu because of high production cost. It maybe due to less number of CRCs, that the demand was more. Where as, in Andhra Pradesh, fixed sale price at medium rate, though Karnataka CRCs supplied chawki worms up to 1st moult they fixed the sale price nearer to Andhra Pradesh sale price. Hence, economically there is a large gap in cost of production, sale price and net returns between the three states. Similar observations were made by Acharya et al. (1993). The net returns per 100 dfls were accounted to Rs.138.73, Rs.102.03 and Rs.199.59 in case of Karnataka, Andhra Pradesh and Tamil Nadu respectively. These results are in conformity with Umesh et al. (1999). The results indicated that cost of production, sale price of chawki worms and net returns were high in Tamil Nadu than the other two states. Sale price of chawki larvae found significant association with the net returns, irrespective of the state. Sale price of chawki larvae is sensitive variable; a slight increase in the sale of chawki worms would imbalance the net returns of CRC. Hence, Karnataka and Andhra Pradesh CRCs should follow the effective measures which were taken up by the Tamil Nadu CRCs to get higher net returns per 100 dfls.

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Fig:4 Percentage of various cost components of non recurring cost of 100 dfls in three states

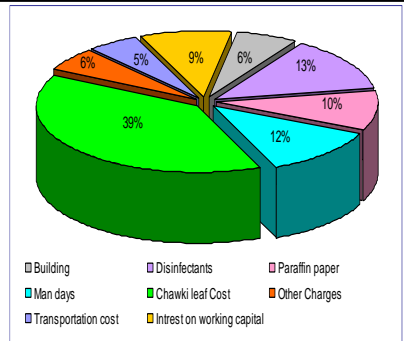
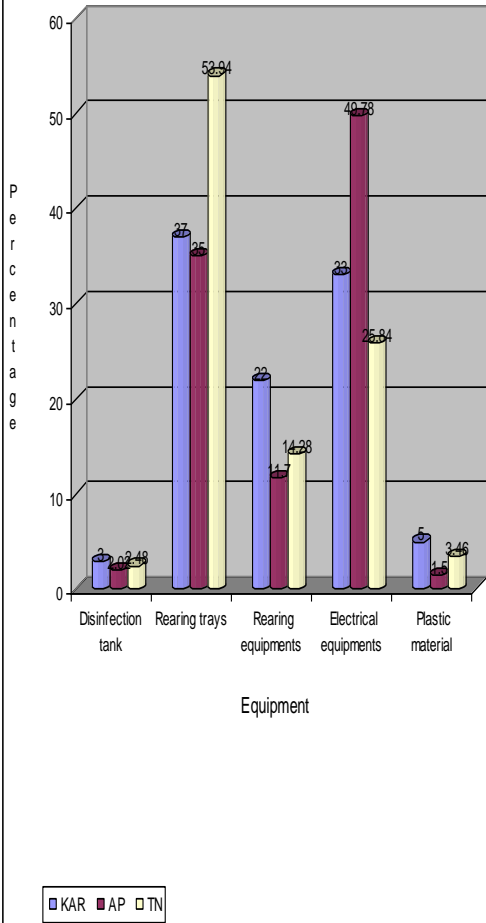


Fig. 1: Percentage of various cost components in recurring cost of 100 dfls in Karnataka

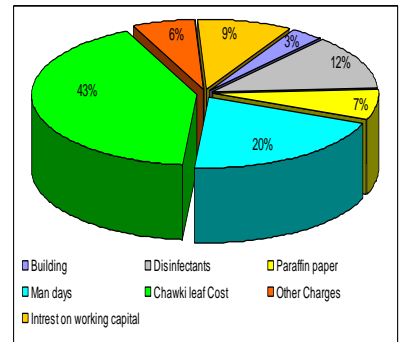


Fig:2: Percentage of various cost components in recurring cost of 100 dfls in Andhra Pradesh

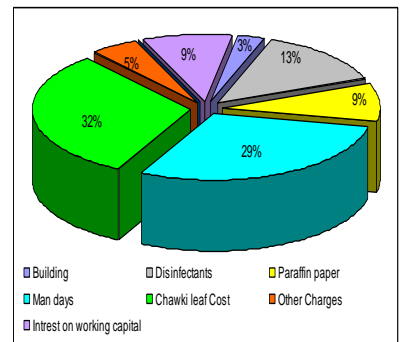


Table 1. Estimated fixed cost for chawki rearing of silkworms of 100 dfls.

Particulars	Cost (Rupees)		
	Karnataka	Andhra Pradesh	Tamil Nadu
1. Disinfection tank	0.18	0.40	0.43
2. Plastic rearing trays	2.41	10.41	9.39
3. Rearing stands	1.02	0.60	0.80
4. Incubation frame	0.09	0.40	0.27
5. Feeding stands	0.04	0.50	0.09
6. Leaf chopping machine	0.10	0.60	0.68
7. Room heater + humidifier + Aircooler	0.83	3.10	2.04
8. Power sprayer and mask	0.40	0.70	0.87
9. Thermometer	0.04	0.05	0.04
10. Plastic items (Litter basket/bags)	0.26	0.04	0.59
11. Chopping board + Knives	0.07	0.20	0.00
12. Bed cleaning net	0.13	0.50	0.66
13. Generator	0.61	2.60	1.55
14. Ant-wells	0.19	0.00	0.00
Total fixed cost (Rs)	6.36	20.01	17.41

Table 2. Estimated variable cost for chawki rearing of silkworms of 100 dfls.

Particulars	Cost (Rupees)		
	Karnataka	Andhra Pradesh	Tamil Nadu
1. Building rent/Apportioned cost	6.3	3.5	5.0
2. Disinfectants	11.4	31.50	20.3
3. Paraffin paper	10.4	14.4	15.9
4. Man days	12.7	34.5	50.9
5. Bed Disinfectant	1.9	3.1	2.9
6. Chawki leaf cost	41.7	45.3	53.5
7. Electricity Charges of CRC	3.2	3.8	7.4
8. Supervision Cost	1.5	2.0	1.6
9. Transportation cost	5.5	0.0	0.0
Total Variable Cost	94.61	138.10	157.5
10. Interest on Variable Cost (@ 10%)	9.46	13.81	15.73
Grand total of Variable cost for Chawki rearing	104.1	151.91	173.0

Table 3. Cost of production for chawki rearing of silk worms of 100 dfls.

Particulars	Cost (Rupees)					
	Karnataka		Andhra Pradesh		Tamil Nadu	
	Rupees	Percentage	Rupees	Percentage	Rupees	Percentage
Non-Recurring (Fixed cost)	6.37	5.7	20.01	18.0	17.41	9.0
Recurring (Operational cost)	104.10	94.3	151.91	82.0	173.00	91.0
Total cost of production	110.47	100.0	171.92	100.0	190.41	100.0
Sale of Chawki larvae	249.20	--	273.95	--	390.00	--
Net Returns	138.73	--	102.03	--	199.59	--

***DORCADION (CRIBRIDORCADION) JAVETI* KRAATZ, 1873
REST. NOV. (CERAMBYCIDAE)**

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ABSTRACT: With the present work, *Dorcadion (Cribridorcadion) javeti* Kraatz, 1873 rest. nov. is discussed and regarded as a separate species again.

KEY WORDS: *Dorcadion (Cribridorcadion) javeti*, rest. nov., Cerambycidae, Turkey.

***Dorcadion javeti* Kraatz, 1873 rest. nov.**

Dorcadion javeti was originally described by Kraatz (1873) from Syrian Akbez (now in Hatay province of Turkey). Then, it was regarded as a subspecies of *Dorcadion saulcyi* J. Thomson, 1865. Finally, Löbl & Smetana (2010) gave the taxon as a subspecies.

However, known distribution patterns of *Dorcadion saulcyi saulcyi* and *Dorcadion saulcyi javeti* in Turkey are overlapped clearly. Both taxa are distributed central parts of South Turkey and North Syria (see below).

Therefore, we propose that *Dorcadion javeti* should be as a separate species necessarily.

***Dorcadion saulcyi* J. Thomson, 1865: 549** (Holotype ♂, ex collection J. Thomson > R. Oberthür, Muséum National d'Histoire Naturelle, Paris) [type locality “?Syria”] A: SY TR

simile Kraatz, 1884: 234 [Turkey: Malatya]

fenestratum Pic, 1895: cclxxxiv [Turkey: Gaziantep (“Ain-Tab”), not Syria]

adanense Pic, 1904: 4 (*Dorcadion destinoi* var.) [Turkey: Adana]

bilatevittatum Pic, 1927: 167 (*Dorcadion saulcyi* var.) [Syria: Aleppo]

subelongatum Pic, 1931: 1 (*Dorcadion destinoi* var.) [Turkey: Hatay: Akbez]

Known distribution of *D. saulcyi* J. Thomson, 1865 in Turkey: Malatya prov. as *D. simile* (Ganglbauer, 1886; Aurivillius, 1921); Adana prov. as *D. destinoi* v. *adanense* (Aurivillius, 1921); Adana prov. as *D. destinoi* v. *adanense* Pic, 1905 (Winkler, 1924-1932); Malatya prov. as *D. simile* (Kraatz, 1884); Anatolia as *D. saulcyi* v. *simile* (Winkler, 1924-1932); Cilicia: İçel prov.: Gülek, Malatya prov. (Breuning, 1962); Hatay prov.: İskenderun, Osmaniye prov.: Hasanbeyli (Demelt, 1963); Osmaniye prov.: Hasanbeyli, Amanos Mountain as *D. saulcyi fenestratum* (Fuchs et Breuning, 1971); Osmaniye prov.: Toprakkale, Hatay prov.: Antakya (Yayladağı) (Braun, 1978); Anatolia (Önalp, 1990); Hatay prov.: Antakya (Harbiye) (Adlbauer, 1992); Turkey (Lodos, 1998); Gaziantep prov.: İslahiye (Özdikmen et al., 2005); Anatolia (Danilevsky in Löbl & Smetana, 2010) (Fig. 1).

***Dorcadion javeti* Kraatz, 1873: 91** (Syntypes ♂♂ & ♀♀, ex collection G. Kraatz, Deutsches Entomologisches Institut, Eberswalde) [type locality “Syria: Akbez”, should be “Akbez” (Turkey: Hatay)] A: SY TR

destinoi Fairmaire, 1884: 173 [Turkey: Hatay: Akbez]

univestitum Pic, 1903: 5 (*Dorcadion destinoi* var.) [Turkey: Hatay: Akbez]

tabense Pic, 1931: 1 (*Dorcadion allepense* var.) [Turkey: Gaziantep ("Ain-Tab"), not Syria]

Known distribution of *D. javeti* Kraatz, 1873 in Turkey: Hatay prov.: Akbez as *D. destinoi* (Fairmaire, 1884); Turkey: İçel prov. as *D. saulcyi* v. *javeti* (Ganglbauer, 1884; Aurivillius, 1921); Hatay prov.: Akbez as *D. destinoi* (Ganglbauer, 1886; Aurivillius, 1921); Anatolia as *D. saulcyi* v. *javeti* (Winkler, 1924-1932); Osmaniye prov.: Hasanbeyli, Amanos Mountains *D. saulcyi javeti* (Fuchs et Breuning, 1971); Hatay: Akbez, Amanos Mountains *D. saulcyi javeti* (ex Önalp, 1990); Hatay prov.: Akbez, Adana prov. as *D. destinoi* (Önalp, 1990); Turkey as *D. destinoi* (Lodos, 1998); Anatolia (Danilevsky in Löbl & Smetana, 2010) (Fig. 2)

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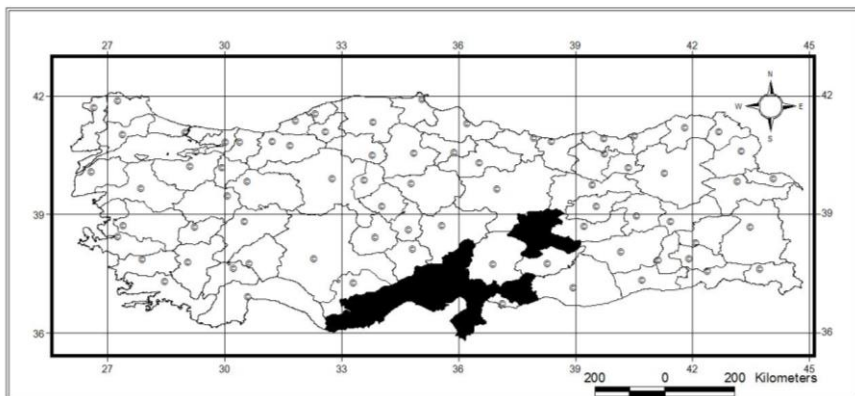


Figure 1. The distribution of *Dorcadion saulcyi* in Turkey.

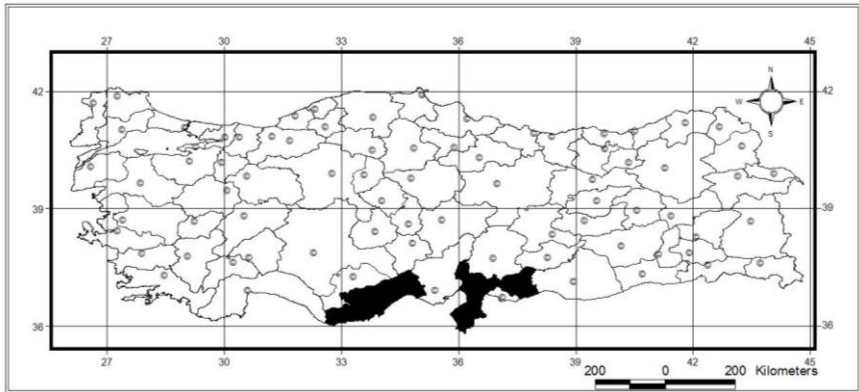


Figure 2. The distribution of *Dorcadion javeti* in Turkey.

DIVERSITY OF PYRRHOCOROIDEA (HEMIPTERA: HETEROPTERA) OF MADHYA PRADESH, INDIA

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[Chandra, K., Biswas, B. & Kushwaha, S. 2015. Diversity of Pyrrhocoroidea (Hemiptera: Heteroptera) of Madhya Pradesh, India. *Munis Entomology & Zoology*, 10 (1): 169-171]

ABSTRACT: The present paper deals with the study of 11 species pertaining to two families Largidae and Pyrrhocoridae of the superfamily Pyrrhocoroidea from Madhya Pradesh. Of these, two species of the family Largidae and three species of the family Pyrrhocoridae are new addition to the fauna of the state.

KEY WORDS: Pyrrhocoroidea, Largidae, Pyrrhocoridae, Madhya Pradesh, New records.

Pyrrhocoridae is one of the smaller families of the order Hemiptera having around 446 species under 46 genera throughout the world (Henry, 2009) and nearly 45 species under 15 genera from India (Saha and Bal, 2010). They are red coloured and are known as red bugs and some species of the genus *Dysdercus* are also called as cotton strainers. The family is characterized by the large robust body with brighter in colour, corium broader without appendix, membrane generally with minimum four and maximum five veins. Most of the members of this family are phytophagous.

Southwood (1956) studied the eggs of the Heteroptera and suggested that the families Largidae and Pyrrhocoridae together formed a separate superfamily Pyrrhocoroidea with two families i.e. Largidae and Pyrrhocoridae. Largidae can be distinguished from Pyrrhocoridae by the pronotum laterally reflexed and the abdominal sternum seven of female split medially, whereas pronotum is laterally reflexed and the abdominal sternum seven entire in female in case of Pyrrhocoridae. Previously Chandra (2008, 2009), Chandra & Kushwaha (2013) and Chandra et al. (2010, 2012) reported 6 species from Madhya Pradesh.

Altogether 11 species of the superfamily Pyrrhocoroidea belonging to two families viz. Largidae (5 species) and Pyrrhocoridae (6 species) are reported from Madhya Pradesh. Of these, two species of the family Largidae and three species of the family Pyrrhocoridae are new record to the fauna of the state.

MATERIAL AND METHODS

The specimens of the superfamily Pyrrhocoroidea are collected either by sweeping or light trap methods from various districts and protected areas of Madhya Pradesh. Collected specimens are killed by using of benzene in killing jars and after that those insects are set and pinned and preserved in the laboratory. The pinned and labelled specimens are identified with the help of various literatures as well as Distant (1902). Photography and morphology of bug was studied by Leica microscope M 205-A (Plate 1).

Table.1 List of superfamily Pyrrhocoroidea studied from Madhya Pradesh.

S. N.	Suborder / Superfamily / Family / Species	No. of exs.	Collection localities (Area / WLS / National Park / Biosphere Reserve)	Districts	Date of Collection
	Order : HEMIPTERA Suborder: HETEROPTERA Superfamily: PYRRHOCOROIDEA Family: LARGIDAE				
1	<i>Physopelta quadrigutta</i> (Bergr.,1894)	1	PBR	Hoshangabad	07.vi.2099
		2	PBR	Hoshangabad	06.iv.2001
		5	ZSI Quarters Colony	Jabalpur	12.iv.2012
2	<i>Physopelta schlanbuschi</i> (Fabr.,1787)*	10	SWLS	Raisen	14.iv.2011
3	<i>Physopelta trimaculata</i> Stehlik, 2008	1	SWLS	Raisen	10.iv.2011
4	<i>Physopelta gutta</i> (Burmeister,1834)	1	VDWLS	Damoh	13.iii.2011
		2	SWLS	Raisen	10.iv.2011
		1	PBR	Hoshangabad	06.iv.2001
5	<i>Antilochus coqueberti</i> Fabr.,1803	8	SWLS	Raisen	01.iv.2011
		2	VDWLS	Damoh	23.vi.2009
		8	ZSI office	Jabalpur	14.ii.2010
		3	PBR	Hoshangabad	10.iv.2001
		10	RH Sarsala	Narsinghpur	08.iii.2014
	Family: PYRRHOCORIDAE				
6	<i>Euscopus albatus</i> Distant, 1909*	1	VDWLS Vijay Nagar	Damoh Jabalpur	11.iii.2011 11.iv.2010
7	<i>Deltocephalus infirmus</i> Melichar, 1903	1	Chandia Village	Shahdol	03.xi.2007
8	<i>Dysdercus koenigii</i> (Fabr.,1775)	5	SWLS	Raisen	11.ii.2010
		2	VDWLS	Damoh	18.xi.2009
		1	PBR	Hoshangabad	25.x.2002
		3	Vijay Nagar	Jabalpur	15.ii.2012
		2	RH Sarsala	Narsinghpur	12.iii.2014
9	<i>Scantius pallens</i> (Distant, 1903)	1	Barha	Katni	08.vi.2009
10	<i>Scantius volucris</i> Gerstaecker, 1873*	1	Karmajhiri, PTR	Seoni	23.vi.2001
11	<i>Dermatinus lugubris</i> Distant, * 1903	1	SWLS	Raisen	21.ix.2011

Abbreviations used: PBR- Pachmarhi Biosphere Reserve; SWLS- Singhori Wildlife Sanctuary; VDWLS- Veerangana Durgavati Wildlife Sanctuary; PTR- Pench Tiger Reserve; RH- Rest House; ZSI-Zoological Survey of India; * -New record to state.

RESULTS

Altogether 11 species were identified belonging to two families of superfamily Pyrrhocoroidea from Madhya Pradesh are reported from Madhya Pradesh. Of these, 2 species of family Largidae and 3 species of family Pyrrhocoridae are new addition to state fauna.

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Plate 1



Physopelta trimaculata Stehlik



Physopelta gutta (Burmeister)



Physopelta schlanbuschi (Fabr.)



Euscopus albus Distant



Antilochus coqueberti Fabricius



Dysdercus koenigii (Fabricius)

**STAPHYLINIDAE, SCARABAEIDAE, DERMESTIDAE AND
CURCULIONIDAE (INSECTA: COLEOPTERA) FIRST RECORD,
FROM KARGIL (LADAKH), J&K-INDIA**

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ABSTRACT: Kargil is one of the two districts of Ladakh region known as Cold desert of the country (India) and falls in the Transhimalayan Mountain system. This study is the very first attempt to study Staphylinidae (Rove beetles), Scarabaeidae (dung beetles), Dermestidae (carpet beetles) and curculionidae (weevils) from Kargil district. A total of 6 Taxa belonging to 4 different families were recorded and described for the first time from the area under study.

KEY WORDS: Coleoptera, High Altitude, first record, Kargil.

Insects especially the beetles (Order: Coleoptera) was studied throughout the world on large basis as it is the largest order among the insects comprising 3,50,000 species world wide and comprises the major component of the world's biodiversity. Over one and a half million living and about 12,000 species of fossil insects have been identified and described all over the world (Uniyal, 2001). About 1,5088 species of beetles are known from Indian region (Kazmi & Ramamurthy, 2004). Nearly one tenth of the insect species are still unidentified. Several species are believed to become extinct without even being identified. The adaptability of the coleopterans to a wide variety of dietary habits coupled with their generally hidden nature has also led to the invasion of many specialized habitats such as fungus and decaying vegetation, carrion and dung. The fact that helps the coleopterans to exploit these with perhaps greater efficiency than even the flies is that both larval and adult beetles tend to live and feed in the same place. Economically, beetles are pests of many agricultural, forestry, and household insect. *Altica* species was found to be a serious pest of *Salix* species (Pandey et al., 2007) in cold arid region of ladakh. Cerambycids e.g., *Batocera rufomaculata* (Tara, 1983), *Aeolesthes holosericea* (Gupta, 2007) are the other major group of pests attacking Mulberry and Apple plants in Jammu region, *Scolytus nitidus* Schedl (Scolytidae) (Buhroo & Lakatos 2007) a pest attacking apple trees in Kashmir. Weevils cause a considerable damage to wild as well as cultivated plants by feeding on them (Tara et al., 2009; Azam et al., 2010). Not all beetles are pests, some groups of beetles are beneficial such as larvae and adults of some ladybird (Family Coccinellidae) feed on scale insects, mealy bugs and aphids. In case of scarcity of food they may feed on small caterpillars, young plant bugs, honeydew and nectar. Ground beetles (Family Carabidae) are common predators of many insects and other arthropods, including fly eggs, caterpillars, wireworms and others. Beetles of the Dermestidae family are often used in

taxidermy to clean bones of remaining flesh. Very few workers have worked on the high altitude entomology such as Von Hugel, Kollar & Redtenbacher (1848), Colonel Stoliczka, Singh (1983), M. S. Mani (1954), Mani & Singh (1955), Mani (1962), Khan & Sahni (1978), Kulshrestha (1978), Uniyal & Mathur (1998, 2000), Uniyal (1999), Uniyal et al. (2001), Maheshwari (1989), Pandey et al. (2007), Tara & Feroz (2009) and Feroz & Tara (2010).

Thus, keeping in view the importance of beetles as well as the lack of literary evidence of the particular group in the area under study, the present work was initiated in district Kargil.

MATERIALS AND METHODS

Area of Study: The study area located in Ladakh region of the J&K State at an altitudinal range of 2,636 meters above sea level lying in between 34°36' North Latitude and 76°06' East Longitude. Topography variable, ranging from 2,636 meters up to 7,135 meters, comprises of a maze of valleys. Most of the area is barren with high slopes ranging from 60-80%. Only areas with water sources and human habitation are seen with good amount of vegetation. Average rain fall is very low and mostly in the form of snow during winter months. The study area experienced both arctic and desert climate and commonly known as "Cold Desert" of the country. The vegetation cover of the area under study comprises of Agricultural Land, Forest Trees (Poplar sp. and Salix Sp.), Herbs, Shrubs and Grasses.

Collection and Identification: In order to ensure maximum catch of Beetles from various habitats, wide variety of collecting and trapping methods were used such as hand collection, butterfly nets were used for flying beetles, Light traps, visual observation and collection using forcep etc. After collection the insects were killed by using ethyl acetate either in the killing bottle or by introducing cotton balls dipped and subsequently squeezed in ethyl acetate in closed polythene bags. After killing the beetles were pinned/cardened, stretched and dried in oven. The killed specimen were sent to Entomological section IARI, New Delhi for identification. The insects were photographed using Sony Cyber Shot T-30 Digital Camera with Macro option and 8MP picture quality.

Sampling: Random sampling of the area was done from Agricultural land, herbs, Shurbs, Forest Trees (Salix sp. & Poplar sp.) & River banks, Area predominant with Alfalfa fields and wheat fields.

RESULT

During the study a total of 6 taxa under 4 families, 5 subfamilies and 6 tribes were recorded and their characteristic features were described in details. They are listed below.

FAMILY STAPHYLINIDAE (ROVE BEETLES)

***Creophilus maxilosus* Linnaeus 1758 (Figs. 1a-d)**

Material examined: 4 ex. 04.iv.2007, 10.iv.2008, 03.v.2007.

Host: Found on decaying carcasses all over the Hawaiian Islands (Blackburn & Sharp (1885); Nishida (1994) (c.f. Newton, 1997). In the study area found running on ground covered with alfalfa plant.

Distribution: Northern Iceland (Gudleifsson & Bjarnadottir, 2002), Louisiana (Watson, 2004), New Zealand (Leschen et al., 2003), Hawaii (Newton, 1997). In

the area of study recorded from Poyen and Kurbathang area at altitudinal range of 2,626 m to 2,878.78 m.

Size: Length 17.0 mm and breadth 5.0 mm. **Shape:** Elongated and parallel sided. **General Body Colour:** Black with white patch of hairs. **Head:** Prognathus, large, slightly convex dorsally, flattened ventrally, finely punctate, pubescent marginally, glabrous centrally, two supra orbital setae one on each side, at base slightly constricted forming a small neck, clypeus small and yellowish. **Eyes:** Black, large, flat, oval, dorsal, slightly towards anterior end. **Antennae:** Clubbed (clavate), pubescent; 11 segmented, segments variable, scape large with constricted base and broad apex, pedicel and 1st flagellar segments similar to scape but small, 2nd to 4th flagellar segments spherical, 5th to 8th slightly disc shaped and large, last segment small and pointed; antennae inserted under clypeal ridge in front of eyes. **Mouth parts:** Labrum small with apical fringe of hairs; mandibles large, sickle shaped, produced in front and placed across each other; maxilla with three segmented maxillary palp; labium small with three segmented labial palp. **Thorax:** Pronotum punctate, punctures prominent, hairs marginally with glabrous centre, broader anteriorly, slightly narrow posteriorly with round ends, anterior end slightly sinuate, antero lateral margins obtuse and proclinate. Scutellum large, pubescent, black, triangular with pointed tip. Ventrally prosternum small, transverse, punctate, pubescent, slightly raised in the middle, anterior margin straight; mesosternum punctate, pubescent, posteriorly rounded; metasternum large, densely pubescent, raised, sinuate posteriorly. **Legs: Pro-thoracic legs:** Coxa large, stout, conical, punctate and pubescent; trochanter small, pubescent, punctate, attached completely to base of femur; femur long, punctate, pubescent, stout, broad at base, narrow apically with groove; tibia large, broad apically, basally constricted, pubescent, punctate, fringe of spines present apically as well as marginally, tibial spurs large and apical; tarsi broad, 5 segmented, 1st to 4th segment decrease in size gradually, lobed, pubescent, ventrally tuft of pale hairs, laterally setate, last segment enlarged, pubescent, claws apical. **Meso-thoracic leg:** Coxa comparatively small, dorso ventrally flattened, pubescent and grooved; trochanter small, slightly triangular, pubescent, attached to base of femur obliquely; femur large, stout, pubescent, broad at base, narrow apex, slightly curved dorsally; tibia long, cylindrical, pubescent, spinose, two prominent tibial spurs; tarsi 5 segmented, pubescent, 1st segment large, intervening segments decrease gradually in size, claws apical. **Meta-thoracic leg:** Coxa small, globular, pubescent; trochanter small, slightly triangular, pubescent, attached obliquely to femur; femur long, cylindrical, almost parallel, basal end oblique, tibial groove present; tibia long, constricted at base, broad apex, pubescent, spinose, tibial spur prominent and ventral; tarsi 5 segmented, pubescent, 1st and last segment large, intervening segments gradually decrease in size, setose ventrally, claws apical. **Elytra:** Very short, truncate, exposing six abdominal terga, pubescent (patch of pale hairs present slightly towards posteriorly), punctate, humeral angles obtuse, hind wing present and completely folded under elytra. **Abdomen:** Exposed dorsally, 6 segmented, pubescent (hairs black and pale coloured), slightly broad in the middle; 6th segment small, rounded, two apical bunch of hairs forming bifurcated tail; pleura slightly raised than terga thus forming a depression on the sides; ventrally 6 abdominal sterna visible, 1st to 4th covered by pale hairs, 5th and 6th by black hairs, last segment small.

FAMILY: SCARABAEIDAE (DUNG BEETLES)***Melolontha furcicauda* (Ancy) (Figs. 2a-d)**

Material examined: 2 ex. 05.vii.2007, 21.vii.2008.

Distribution: Outside India reported from China (Chandra & Uniyal, 2007). In India reported from Himachal Pradesh and Kashmir (Chandra & Uniyal, 2007). During the present study recorded from Poyen and Kurbathang area of Kargil district at an altitudinal range of 2,636.36 m to 2,878.78 m. Uniyal (2001) collected *Melolontha bifurcicaudata* from Diskit at 3,000-3,200 m.

Size: Length 34.0 mm and breadth 16.0 mm. However Chandra & Uniyal (2007) recorded 32.0 mm in length and 15.0 mm in breadth of *Melolontha bifurcicaudata*.

Shape: Elongate and convex. **General Body Colour:** Reddish brown, covered all over with pale white scales; pronotum and head dark brown.

Head: Closely setose, densely and unevenly punctate, broad at the base with a rectangular apex; clypeus rectangular, anterior margin extending upward and backward in the middle with slightly raised lateral margins. **Eyes:** Large, prominent, spotted, latero ventrally towards the base of the head capsule.

Antenna: 10 segmented, flabellate, brown, club seven segmented, long and sheet like, arising in front of the eyes beneath the frons; scape dark brown, narrow at base with a bunch of setae on the posterior margin; pedicel small with few setae, 1st segment of flagellum with narrow base and broader apex, setae on anterior margin. **Mouth parts:** Labrum large, indented and setose; mandibles dark brown; maxilla setose, four segmented maxillary palps with last segment large and pointed at the tip; labium setose with three segmented short labial palps.

Thorax: Pronotum large, dark brown, broad at base and slightly narrow anteriorly, finely punctate, scales present densely on sides and sparsely in the middle, antero lateral angles pointed, lateral margins greatly rounded and notched at intervals with setae in each notch, postero lateral angle also pointed, anterior margins slightly sinuate but the posterior angle strongly sinuate. Scutellum small, dark brown and triangular. Ventrally pro, meso, and metasternum completely covered by long golden silky hairs which are more on sides of metasternum than in the middle, metasternum unevenly punctate.

Legs: Legs different in size and shape provided with pale scales. **Pro-thoracic leg:** Coxa, trochanter and femur punctate and covered by fine and long hairs; tibia long, tridentate, teeth becoming progressively longer towards apex, tibial spur apical; tarsi 5 segmented with toothed apical claws. **Meso-thoracic leg:** Coxa and trochanter covered by dense fine and long hairs; femur long, cylindrical covered by dense, long and fine hairs; tibia almost parallel, cylindrical with transverse ridges provided with spines, single row of fine hairs on the posterior margin, two apical tibial spurs present, apex with fringe of spines unequal in length; tarsi 5 segmented with toothed apical claws. **Meta-thoracic leg:** Coxa produced horizontally, narrow and extends posteriorly, provided with dense hairs; trochanter small, roughly triangular, setose; femur long, stout, broad and convex anteriorly, slightly concave posteriorly, covered by fine and long hairs; tibia long, slightly narrow basally, punctate with two apical tibial spurs; tarsi 5 segmented with toothed apical claws.

Elytra: Hard, brown, flat and densely covered by scaly intervals which are raised and narrow, antero lateral angles obtuse, lateral margins parallel, does not cover whole of the abdomen.

Abdomen: Broad at base, constricted posteriorly, ventrally dark, covered with pale scales, 6 abdominal sternum visible, 1st four segments long, narrow, 5th segment slightly small and broad, last segment roughly triangular, pygidium long and projected behind into a bifurcated tail.

Aphodius Illiger, 1798 (Figs. 3a-d)

Material examined: 10 ex. 18.iv.2007, 04.ix.2008.

Distribution: Outside India from Brazos county, Texas (Blume & Aga, 1979), Central Uruguay, South America (Moreli & Gonzalez-vainer, 1997), Western Rhodopes, South-Central Bulgaria (Lobo et al., 2007), New Zealand (Leschen et al., 2003), Nebraska, Lincoln (Ratcliffe, 1988; Paulsen, 2006), Italy, Alps and the Apennines, Central Europe, Northern Spain to Caucasus, Northern Europe, Siberia upto Vladivostok, Southern Europe, North America, Australia, Lesser Asia, North Africa, Central Asia and Sardina (Borghesio et al., 2001), Kamenyuki, Brest province, Belarus, Minsk suburbs, Domzheritr, Vitebsk province, Usha-Aral, South Kazakhstan, Korfovskiyui, Khabarovsk territory, Russia, Kolochava, Carpathian Mountains, Ukarine (Frolov & Akhmetova, 2006), Ceylon, Transvaal, East Africa and Madagascar (Bose, 1953). Bose (1953) also reported it from India. During the present study reported from Poyen area of Kargil district at an altitudinal range of 2,636.36 m to 2,727.27 m where as, Borghesio et al. (2001) collected from altitude ranging from 900 m to 2,800 m.

Size: Length varies from 6.0 to 6.5 mm and breadth from 2.0 to 3.0 mm. However Medvedev, 1964 and Dellacasa, 1983 (c.f. Frolov and Akhmetova, 2005) recorded average length of Palearctic *Aphodius* species from 2.5 mm to 20.0 mm, Borghesio *et al.* (2001) studied 19 different *Aphodius* species and recorded size from 3.5 to 13 mm in length, Ratcliffe (1980) measure length 4.7 mm of a new *Aphodius* species. **Shape:** Elongate, widest in the middle and slightly convex.

General Body Colour: Head, pronotum and elytra dark brown ventrally; pronotal margins, elytral suture, legs, abdomen and antennae light brown. **Head:** Clypeus angulate, narrow on sides, median emargination, angulations pointed, margins indent, surface tuberculate; fronto clypeal suture obsolete, frons punctate with three weakly developed ridges. **Eyes:** Small, black, situated laterally towards the base of head capsule, dorsally covered by pronotum and can be seen ventrally.

Antenna: Small, segmented, lamellate (3 segmented); lamella pubescent.

Mouth parts: Labrum, mandibles not visible, maxillary palps large; labium large, punctate, long hairs present; labial palps small, 3 segmented not extending beyond clypeus anteriorly. **Thorax:** Pronotum sub-rectangular, lateral margins slightly convex, postero lateral margin obtuse, surface densely punctate, punctures everywhere, mixed fine and large, weakly explanate. Scutellum small, triangular and punctate. Ventrally prosternum narrow, prosternal lobe weakly developed, anterior and posterior margins provided with fine, long hairs; mesosternum roughly triangular, punctate; metasternum large, punctate, pubescent anteriorly, slightly directed outward. **Legs: Pro-thoracic leg:** Coxa large, broad, almost equal to femur in length, punctate, punctures fine, hairs present; trochanter small, with few punctures; femur stout, punctate, flat anteriorly and broad with converging apex, pubescent anteriorly; tibia impunctate, tridentate; protibial spur long, robust, bent externally at apex, postero lateral rows of setae present; tarsi narrow, cylindrical, 1st segment small, last segment large, claws apical, each tarsus with apical setae. **Mesothoracic leg:** Coxa large, flat, broad in the middle, ends converging comprised a patch of hairs latero ventrally; trochanter small; femur broad basally, narrow apex, slightly flattened dorso ventrally, finely punctate; tibia short, broad, distinct transverse apical ridges present provided with fringe of spines unequal in length, apical fringe of spines, short apical spur; tarsi narrow, 1st segment large, intervening segments gradually becomes small, last segment enlarged, claws apical. **Metathoracic leg:** Coxa large, rectangular, punctate and finely pubescent; trochanter small, broad at base; femur broad, stout, dorso ventrally flattened, provided with few setae; tibia large, narrow basally, distinct

transverse ridges, two apical spurs, apical fringe of unequal spines also present; tarsi 5 segmented, 1st segment large, 2nd to 4th gradually becomes small, last segment enlarges, claws apical. **Elytra:** Shining, alutaceous, intervals regularly punctate, punctures fine, shallow, striae moderately impressed, moderately punctate, punctures as wide as striae, sides parallel in basal third, converging posteriorly, ends rounded, suture complete. **Abdomen:** Small, broad basally, tapering end, 6 visible abdominal sterna, finely punctate, finely pubescent on both sides, 1st segment covered by coxa, last sternum small, slightly triangular.

FAMILY : DERMESTIDAE (CARPET BEETLES)

***Anthrenus* Muller, 1764 (Figs. 4a-d)**

Material examined: 5 ex. 25.vi.2007, 15. Vi.2008.

Host: *Cherophyllum reflexum* in the area of study. However found feeding on pollen and nectar of flowers in nature (Ayappa et al., 1958; Blake (1959); Woodroffe & Southgate 1955), it also feeds on hairs, feathers, bristles, fur, horn and tortoise shell (Hinton, 1945) (c.f. Hassan et al., 2007). **Distribution:** Recorded throughout the world (Anon, 2003), United States, Algeria, Spain, Greece, Southern Russia, Mesopotamia and the East Indies (Back, 1931), Sudan (Annon, 1918) c.f. Hasan et al. (2007), from South Carolina to Eastern Texas, Pennsylvania ad Southern Illinois, Foo Chow, China, England, Canada, Alabama, Colorado, Utah and Oregon (Beal, Jr., 1983), Bangladesh (Hasan et al., 2007), New Zealand (Leschen et al., 2003), South Africa, Namibia, Zimbabwe (Kadej & Hava, 2006). India (Cotes, 1980) c.f. Hasan et al. (2007). In the area of present study reported from Poyen area at an altitude ranging from 2,636.36 m to 2,727.27 m.

Size: Length varies from 3.0 to 4.0 mm and breadth 2.0 to 2.5 mm. However **Hasan et al. (2007)** recorded 3.00 to 3.50 mm (3.22±1.02 mm) in length and 2.00 to 2.50 mm (2.20±0.69 mm) in breadth. **Shape:** Elongate, oval. **General Body Colour:** Brownish black covered with scales forming patterns of white, yellow and brown. **Head:** Hypognathus, small, retracted into prothorax, triangular, covered with scales in between eyes. **Eyes:** Large, prominent, entire, present on either side of head towards the base of head capsule. **Antenna:** 10 segmented, short, brown, capitate, fitting into sharply defined cavity on hypomeron. **Mouth parts:** Labrum small, black, pubescent, punctate, without scales; mandibles small, black; maxilla small with short maxillary palp; labium small with short labial palp. **Thorax:** Pronotum transverse, covered with yellow, dark brown and white scales, broad posteriorly, antero lateral margin deflexed; posterior margin produced into a median lobe almost covering scutellum. Scutellum very small, black, triangular covered by pronotum and only a small portion is visible. Ventrally prosternum transverse, narrow, covered by white scales, posteriorly prosternal lobe extends behind between the fore coxa, mesosternum small, emarginated and covered by scales; metasternum large, finely punctate, shield like, raised in the middle with longitudinal groove and covered by white scales. **Legs: Pro-thoracic leg:** Coxa large, oval, slightly curved backward, covered with white scales; trochanter small, covered with white scales; femur large, cylindrical, grooved, dark brown, covered with both dark brown and white scales; tibia long, narrow, spinose, brown, without scales; tarsi 5 segmented, small, last segment long, claws apical. **Meso-thoracic leg:** Coxa small, completely covered with scales; trochanter small, also covered with scales; femur large, broad at base, narrow apically, grooved, covered with scales; tibia long, constricted at base, spinose (small spines), brown; tarsi 5 segmented, claws apical. **Meta-thoracic leg:** Coxa large, transverse, covered with white scales;

trochanter small, covered with white scales; femur large, long, broad at base, slightly narrows apically; tibia long, narrow, spinose; tarsi 5 segmented, claws apical. **Elytra:** Short, not covering whole of the abdomen, covered completely with dark brown, yellow and white scales, patches of yellow scales present anteriorly and posteriorly, a patch of white scales present almost mid dorsally surrounded from both sides (anterior and posterior) by dark brown scales, suture complete, antero lateral angles obtuse, sides parallel in the anterior $1/3^{\text{rd}}$ and slightly constricted posteriorly. **Abdomen:** Pygidium pointed and pubescent, without scales, ventrally five sternum visible, basal sternite broad with postcoxal line, covered with scales, apical sternite small with round end, a patch of dark brown scale at middle of posterior margin of apical sternite, all the sternites covered with white scales.

***Dermestes* Linnaeus, 1758 (Figs. 5a-d)**

Material examined: 2 ex. 11.vi.2007, 06.v.2008.

Host: In normal conditions found feeding on pollen and nectar of flowers in nature (Ayappa et al., 1958; Blake, 1959; Woodroffe & Southgate, 1955). Also feeding on hairs, feathers, bristles, fur, horn and tortoise shell (Hinton, 1945) c.f. Hassan et al. (2007). Distribution: Recorded from New Zealand (Leschen et al., 2003). During the study reported from Kurbathang area at an altitudinal range of 2,757.57 m to 2,878.78 m.

Size: Varies from 7.0 to 8.0 mm in length and 3.0 mm in breadth. **Shape:** Elongate, elliptical and hairy. **General Body Colour:** Dark brown with golden yellow, black and white hairs. **Head:** Hypognathus, small, roughly triangular, punctuate, pubescent (golden yellow), clypeus with apical fringe of hairs. **Eyes:** Large, globular, black, lateral, towards the base of the head capsule. **Antenna:** 10 segmented, brown, capitate, club, 3 segmented, large, pubescent; scape large, punctate, intervening segments small with very few hairs, apical segment pointed. **Mouth parts:** Labrum small, punctate, pubescent; mandibles black, pubescent, with pointed black tip; maxilla brown, small, with 3 segmented small maxillary palp; labium small, pubescent, with very short labial palp. **Thorax:** Pronotum broad punctate, pubescent (golden yellow and black), anterior end deflexed gradually from centre towards sides, antero lateral margin greatly deflexed, posterior margin sinuate. Scutellum small, pubescent (white hairs). Ventrally prosternum punctate, pubescent (black hairs), centrally narrow with broad sides, prosternal lobe extends between fore coxae; mesosternum small, with lobe extending behind between mid coxae, pubescent (dense white hairs); metasternum large, shield like, covered by dense white hairs, anterior margin sinuate with a lobe extending upward between mid coxae, posterior margin slightly straight. **Legs:** **Pro-thoracic leg:** Coxa conical, pubescent, black, large with apical fringe of hairs; trochanter small, pubescent; femur large, broad at base, narrow apex, grooved, pubescent; tibia long, narrow, setose, tibial spurs small, apical and black; tarsi 5 segmented, last segment large, claws apical and together. **Meso-thoracic leg:** Coxa globular, pubescent (white apical, black basal); trochanter small, triangular, pubescent (patch of white hairs apically); femur long, broad at base, narrow apex, pubescent (white patch of hairs, transverse and middle), grooved; tibia long, narrow basally, apex broad, setose, apical fringe of setae, spur apical; tarsi 5 segmented, pubescent, last segment large, claws apical. **Meta-thoracic leg:** Coxa large, flat ventrally, slightly triangular, pubescent (white hairs); trochanter small, slightly triangular, densely covered with white pubescence; femur large, broad at base, narrow apex, stout, a patch of white transverse hairs in the middle; tarsi long, pubescent, setose bears

apical fringe of setae, spur apical; tarsi 5 segmented, last segment large with apical claws. **Elytra:** Long, covering whole of the abdomen dorsally, pubescent (basal small portion golden brown, rest with white and black hairs), suture complete, lateral sides parallel, slightly constricted apically with round apex and slightly separated. **Abdomen:** Long, broad basally, narrow apex, 5 visible abdominal sternites, basal segment large with median patch of white hairs along with black marginal hair, 2nd, 3rd and 4th segment with small patch of black hairs marginally with median white hairs, 5th segment slightly triangular and completely covered by black hairs.

FAMILY: CURCULIONIDAE (WEEVILS/ SNOUT BEETLES)

***Hypera postica* (Gyllenhal) 1813 (Figs. 6a-d)**

Material examined: 10 ex. 18.iv.2007, 21.vi.2008.

Host: Alfalfa (*Medicago sativa*) however, Weiss & Gillot (1993) found *Hypera* species on red clover, *Trifolium pretense* L., in North eastern Saskatchewan, the weevil mainly infests legumes (Essig & Michelbacher, 1933), it is rarely of economic importance in its original range (Clausen, 1977; Essig & Michelbacher, 1933, c.f. Shoubu et al., 2005), Chinese milk vetch, *Astragalus sinicus* L. (Shoubu et al., 2005). In addition to alfalfa, host plants include white clover, red clover, bur clover, yellow sweet clover, white sweet clover, and a few other clovers. However alfalfa is the preferred host and economic damage to other crops is very rare.

Distribution: The genus *Hypera* reported from Saskatchewan, Canada (Weiss & Gillot, 1993), world wide (Blatchley & Leng, 1916; Rockwood, 1920; Markula & Timila, 1956; c.f. Weiss & Gillot, 1993), Kansas, Asia (Clausen, 1977). In the US, this weevil was first discovered in Utah in 1904 (Titus, 1910); c.f. Shoubu et al. (2005), United States (Alfalfa production handbook, 1998). In the area of study found from Poyen and Kurbathang area of Kargil district at an altitudinal range of 2,636.36 m to 2,878.78 m.

Size: Varies from 4.0 mm to 6.0 mm in length and 2.0 mm to 3.0 mm in breadth. However, 5.0 to 6.0 mm has also been recorded from other parts of the world. (http://ipm.ncsu.edu/ag271/forages/alfalfa_weevil.html). **Shape:** Oblong, convex and heavily pubescent. **General Body Colour:** Brown to blackish with three clear bands formed of bifid scales. Newly emerged weevil is light brown with a distinct, dark line down the center of its back. After few days, it becomes entirely dark brown or black, (http://ipm.ncsu.edu/ag271/forages/alfalfa_weevil.html). **Head:** Prognathus, punctate, densely pubescent, longer than pronotum; elongate in front into a long, slender, almost straight brown snout, rostrum at the junction of eyes slightly narrow, basally head globular, lateral scrobe on rostrum. **Eyes:** Large, laterally at the base of rostrum. **Antenna:** Brown, 11 segmented; geniculate with compact three segmented, densely pubescent club; scape large, sub apical reaching to the middle of eyes. **Mouthparts:** Labrum indistinguishable, mandibles not usually toothed on outer edge; maxilla with lacinia and galea fused to form mala, 2-3 segmented very short and rigid palpi, often entirely concealed. **Thorax:** Pronotum broad near the middle, lacks lateral carina, post ocular lobe absent, emarginated anteriorly, smoothly deflexed laterally, provided with three long stripes of bifid golden scales (two lateral and broad, one median narrow) along with two brown stripes one on either side of median stripe. Scutellum very small and completely covered over by scales. Ventrally prosternum small, transverse, deeply emarginate anteriorly, pubescent, bifid golden scales, prosternal lobe small; mesosternum large, punctate, pubescent, mesosternal lobe densely pubescent, extends backward between mid

coxae; metasternum large, shield like, raised in the middle, grooved behind anterior coxal margin, densely covered with bifid scales. **Legs: Pro-thoracic leg:** Coxa slightly conical, covered by bifid scales, brown; trochanter small, triangular with bifid scales; femur short, stout, broadest in middle, dilated in apical half, narrow at base, excavate, densely pubescent; tibia long, sub cylindrical, pubescent, uncinata; tarsi pseudotetramerous, pubescent, 3rd segment strongly bilobed, claws connate basally and diverged apically. **Meso-thoracic leg:** Coxa globular, small, pubescent and brown; trochanter small, triangular, pubescent; femur long, broad in middle, narrow at base, stout, excavate, pubescent; tibia long, pubescent, sub cylindrical, uncinata; tarsi similar to fore tarsi. **Meta- thoracic leg:** Coxa roughly oval, pubescent, brown; trochanter small, triangular, pubescent; femur longer than pro-thoracic leg, brown, pubescent, narrow basally, dilated apically, excavate; tibia long, narrow, pubescent, brown, uncinata; tarsi similar to fore tarsi. **Elytra:** Elongate, striate (striae 10 usually punctate with long hairs), anterior margin slightly concave, antero laterally round, deflexed laterally and firmly holds abdomen latero ventrally, sides parallel and constricted basally, rounded apex, each elytron separated by suture; three distinct longitudinal stripes of scales, two marginal golden yellow, one brown and central; broad at base, constricted towards apex. **Abdomen:** Large, convex, broad at base, narrow apex, covered with bifid golden scales; basal segment large, connate; apical segment triangular.

CONCLUSION

This study showed that the beetle fauna exist in this cold desert region of India and need more comprehensive works to record other families as well. Moreover, the economic importance and roles played by the recorded species occurring in different ecosystems of Kargil is unclear. So in addition to further faunistic surveys, detailed biological and ecological studies are waiting to be carried out.

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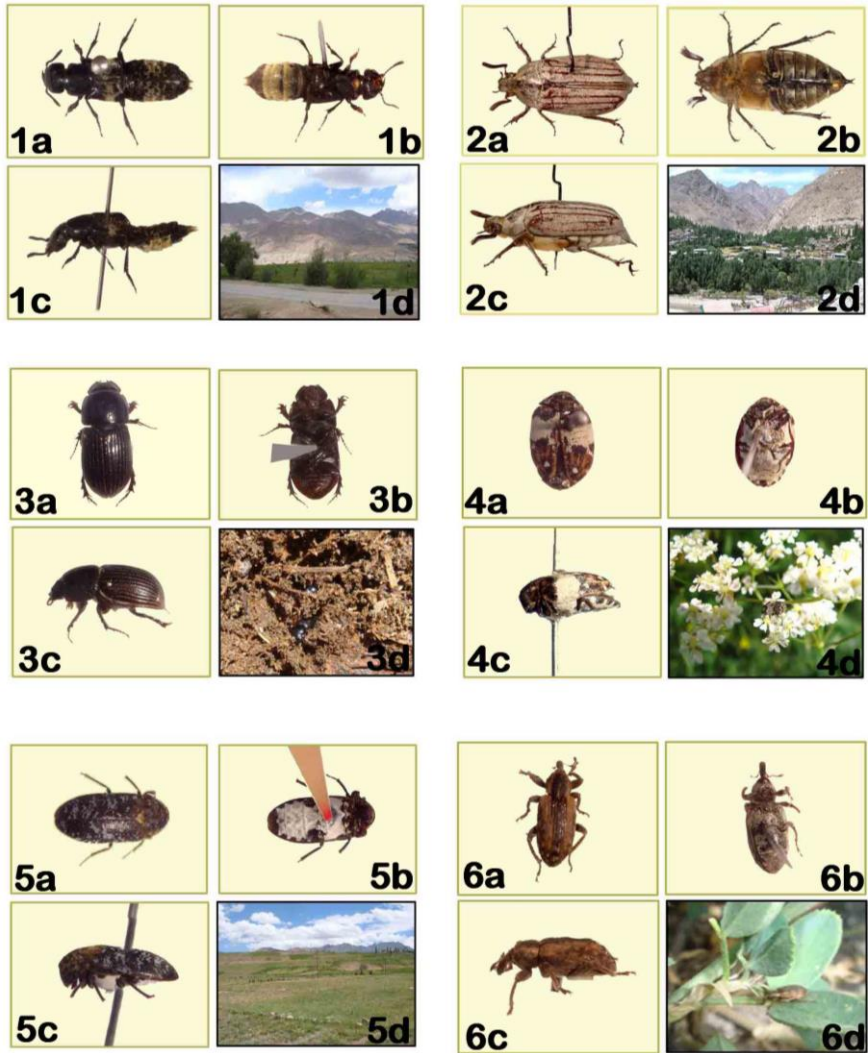
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Table 1. Showing the Taxonomic status of the beetles recorded from Kargil.

Superfamily	Family	Subfamily	Tribe	Taxa
Staphylinoidea	Staphylinidae	Staphylininae	Staphylinini	<i>Creophilus maxilosus</i>
Scarabaeoidea	Scarabaeidae	Melolonthinae	Melolonthini	<i>Melolontha furcicauda</i>
		Aphodiinae	Aphodiini	<i>Aphodius</i>
Dermestoidea	Dermestidae	Dermestinae	Dermestini	<i>Dermestus</i>
			Anthrenini	<i>Anthrenus</i>
Curculionoidea	Curculionidae	Hyperinae	Hyperini	<i>Hypera</i>



Figures. 1a-1d. *Creophilus maxilosus*, 2a-2d. *Melolontha furcicauda*, 3a-3d. *Aphodius* sp., 4a-4d. *Dermestes* sp., 5a-5d. *Anthrenus* sp., 6a-6d. *Hypera postica* (a, dorsal; b, ventral; c, lateral view and d, site of collection).

**SIGHTING OF BLUE-SPOTTED CROW *EUPLOEA*
MULCIBER MULCIBER (CRAMER), 1777 (LEPIDOPTERA:
NYMPHALIDAE: DANAINAE) IN PUNJAB, INDIA**

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[Shrama, N. 2015. Sighting of blue-spotted crow *Euploea mulciber mulciber* (Cramer), 1777 (Lepidoptera: Nymphalidae: Danainae) in Punjab, India. Munis Entomology & Zoology, 10 (1): 183-185]

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 and 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; upperside 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° 38.985'; E 075° 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 *Embllica officinalis*, Arjun *Terminalia arjuna*, Bargad *Ficus bengalensis*, Bamboo *Dendrocalamus 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 lebeck*, 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 & Sidhu (2001), Arora et al. (2006), Sharma & 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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Euploea mulciber mulciber (Cramer) (Female) at Takhni-Rehmapur WLS.

***DORCADION (CRIBRIDORCADION) GEBZEENSE*
BREUNING, 1974 REST. NOV. (CERAMBYCIDAE)**

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[Özdikmen, H. & Kaya, G. 2015. *Dorcadion (Cribridorcadion) gebzeense* Breuning, 1974 rest. nov. (Cerambycidae). *Munis Entomology & Zoology*, 10 (1): 186-187]

ABSTRACT: With the present work, *Dorcadion (Cribridorcadion) gebzeense* Breuning, 1974 rest. nov. is discussed and regarded as a separate species again.

KEY WORDS: *Dorcadion (Cribridorcadion) gebzeense*, rest. nov., Cerambycidae, Turkey.

***Dorcadion gebzeense* Breuning, 1974 rest. nov.**

The taxon was originally described by Breuning (1974) as a separate species of the genus *Dorcadion*. Firstly, it was attributed by Braun (1975) to *Dorcadion punctipenne* Küster, 1852. And Braun (1978) gave it as a morpha of *D. punctipenne*. Then, Sama (1982) presented it as a subspecies of *D. punctipenne*. He reported it from Kastamonu province (İlgaz: Tosya) and stated that this specimen was labelled by Breuning's hand writing as "*Dorcadion tosyense* mihi, type". Sama's specimen was identified by Braun in his work. Later, Löbl & Smetana (2010) gave the taxon as a synonym of *D. punctipenne*.

Dorcadion gebzeense, however, is easily distinguished from *D. punctipenne* by very strong, dense similarly punctuation of pronotum and elytra, and different shaped lateral process of pronotum chiefly. Besides, Breuning (1974) stated that *D. gebzeense* is closely related *D. ferruginipes* Ménétré, 1836 in the original description.

Consequently, we propose that the Turkish endemic taxon *Dorcadion gebzeense* should be regarded as a separate species.

***Dorcadion punctipenne* Küster, 1852: 94** (Holotype, ex collection Heinrich Carl Küster > Johann Menzel, Naturhistorisches Museum, Nürnberg) [type locality "Kleinasien" (Turkey)] **E:** GR TR **A:** TR
distinguendum Pic, 1931c: 10 (*Dorcadion olympicum* var.) [Greece]

Known distribution of *D. punctipenne* in Turkey: Turkey as the type locality (Küster, 1852); İstanbul prov. and near (Breuning, 1962); Anatolia (Danilevsky in Löbl & Smetana, 2010) (Fig. 1).

***Dorcadion gebzeense* Breuning, 1974: 148** (Holotype ♂, Collection Carolus Holzschuh, Villach) [type locality "Gebze" (Turkey: Kocaeli)] **A:** TR
tosyense Breuning in Sama, 1982: 223 [Turkey: Kastamonu: Tosya]

Known distribution of *D. gebzeense*: Kocaeli prov.: İzmit: Gebze as the type locality (Breuning, 1974); Kocaeli prov.: İzmit: Gebze (Braun, 1978); Kastamonu prov.: İlgaz: Tosya as *D. punctipenne gebzeense* (Sama, 1982) (Fig. 2).

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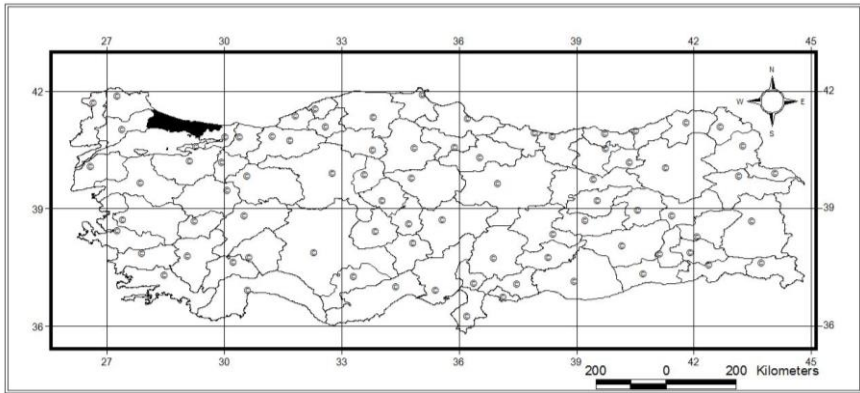


Figure 1. The distribution of *Dorcadion punctipenne* in Turkey.

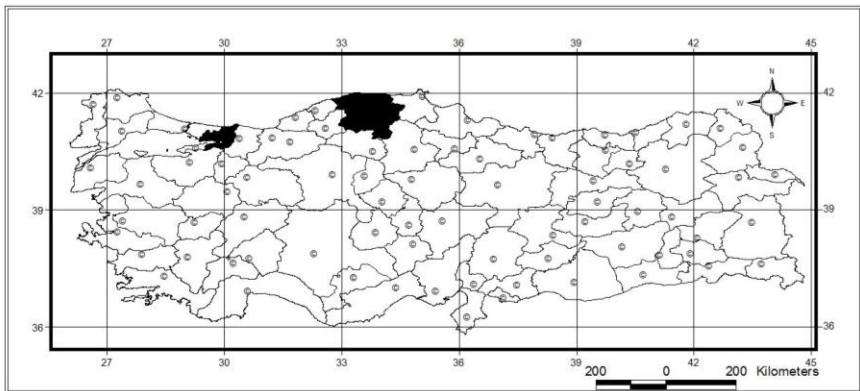


Figure 2. The distribution of *Dorcadion gebzeense*.

**NEW INFORMATION ON *ANNANDALIELLA TRAVANCORICA*
HIRST, 1909 FROM WESTERN GHATS OF INDIA
(ARANEAE: THERAPHOSIDAE)**

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[Sunil, J. K. & Prasanth, M. T. 2015. New information on *Annandaliella travancorica* Hirst, 1909 from Western Ghats of India (Araneae: Theraphosidae). Munis Entomology & Zoology, 10 (1): 188-193]

ABSTRACT: Male of *Annandaliella travancorica* Hirst, 1909 (Fam: Theraphosidae) is recorded from Kozhikode, India. Detailed morphological characters and illustrations of body and copulatory organs of the species are presented. Information on new localities are also mentioned.

KEY WORDS: *Annandaliella travancorica* Hirst, 1909, Kerala, India.

Family Theraphosidae is characterized by larger spiders which live in burrows in the trees or ground. 800 species in 13 sub families are recorded from different parts of the world. In India, 42 species of theraphosids are recorded from various regions. The genus *Annandaliella* is endemic to Western Ghats of India, and represented by only three species: *A. travancorica* Hirst, 1909, *A. pectinifera* Gravely, 1935 and *A. ernakulamensis* Jose & Sebastian, 2008. They are mostly characterized by sluggish spiders which live under stones or fallen tree trunks. The *A. travancorica* Hirst, 1909 is the most known species of this genera, but the original description lacks detailed illustrations and photographs which makes its identification difficult. Here we describe and illustrate the male of this species based on a male specimen collected from Kozhikode with detailed photographs.

MATERIALS AND METHODS

The specimen is deposited at the Arachnological Collections of Deva Matha College, Kuravilangad, Kerala (DMCK 05/114). All measurements are given in millimeters. Microphotographs were taken by Canon EOS 600D Digital Camera, attached to Labomed CZM6 Stereozoom Microscope using Remote Capture Software. Measurements of leg and pedipalps were taken from their dorsal aspect. The eye measurements were taken by calibrated ocular micrometer and expressed in millimeters. Claws are not included in the measurement of tarsi. Total body length excludes chelicerae. Plates were prepared in Photoshop CS2. Description was compared with available literature by Hirst (1909), Gravely (1935), Jose et al. (2008).

Abbreviations: ALE= anterior lateral eye; AME= anterior median eye; DMCK= Deva Matha College, Kuravilangad, PME= posterior median eye; PLE= posterior lateral eye; MOQ= median ocular quadrangle; PLS= posterior lateral spinnerets; PMS= posterior median spinnerets.

TAXONOMYFAM. **THERAPHOSIDAE** Thorell, 1869Gen. **Annandaliella** Hirst, 1909TYPE SPECIES: *Annandaliella travancorica* Hirst, 1909

Diagnosis: A row of stouts spines present on the inner side of chelicerae in mature females, the feet of first leg slender, the division of their tarsal scopulae more or less obsolete especially in male; the male with tibial apophysis of first leg.

***Annandaliella travancorica* Hirst, 1909**

(Fig. 1-4)

Material examined: I Male from Kozhikode, Kerala, 31 July 2006, 11.25°N 75.77°E, Elevation 10 m, DMCK No. AR00114, Coll. Sunil Jose K.

Diagnosis: Differs from *A. ernakulamensis* Jose & Sebastian, 2008 by the absence of tibial comb and two lateral spines at the distal end of tibia I, from *A. pectinifera* Gravely, 1935 it differs by the absence of tibial comb, and one lateral spine at the distal end of tibia I. Stridulating spines on the inner surface of chelicerae absent in *A. travancorica* Hirst, 1909. The style of palpal organ more strongly and evenly curved than in other two species. The tarsi and metatarsi of leg I & II; tarsi and distal half of metatarsi in leg III & IV and tarsi of palp white in *A. travancorica* Hirst, 1909.

Total length 20.1 mm. Carapace 10.4 mm long, 8.2 wide; chelicerae 5.3 long; abdomen 9.3 long, 4.6 wide. Spinneret: PMS, 0.51 long, 0.23 wide, 0.1 apart. PLS, 1.1 basal, 0.8 middle, 1.4 apical, mid width 0.58, 0.48, 0.432 respectively, 3.3 total length.

Colour in alcohol: Margin of carapace and fovea dark brown, caput light brown in colour. Carapace, coxae, femur, metatarsus and tarsus contain a mat of white hairs. Legs reddish brown with white and dark brown hairs. Dorsum of abdomen yellowish brown, covered with golden brown and long hairs, its proximal region dark brown and distal region pale; ventrally yellowish brown with golden brown hairs, basal region of these hairs brown. Sternum reddish brown with three pairs of reddish sigilla. Coxae of all legs golden brown in colour.

Carapace: Length to width ratio 1.26; reddish brown, longer than wide, more or less circular. Carapace covered with a thick mat of white hairs, more concentrated on the anterior and marginal areas of caput, fovea, carapace. The hairs radiate from fovea to the margin of carapace. Long and short curved bristles present along the lateral and posterior margin of carapace. Cephalic region slightly raised. Fovea deep, slightly procurved.

Eyes: Group occupies 3.84 of head width; ratio of group width to length 1.62. Ocular tubercle wider than long. ALE larger than rest; PME slightly smaller than PLE. Anterior region of ocular tubercle dark brown, posterior region light brown; eyes with black surrounds. Eye diameter: ALE, 0.512; AME, 0.448; PLE, 0.368; PME, 0.192. Distance between eyes: AME-AME, 0.192, PME-PLE, 0.064; AME-ALE, 0.176; PME-PME, 0.736. MOQ: length, 0.720; front width, 0.864; back width, 1.216.

Maxillae: 3.1 long in front, 3.9 long in back, 1.9 wide. Reddish brown in colour.

Posterior edge near heel concave; anterior lobe distinct and more pointed. Ventrally short and long bristle like hairs present. Spines, setae not present on the prolateral face. Prolateral suture dark brown in colour. Horizontally arranged pale hairs present above and below the suture. Retrolateral face reddish brown, glabrous in center. Distal portion contains golden brown hairs. Cuspules ca. 150-180, sparsely arranged in anterior corner in triangle region.

Labium: 0.7 long, 1.8 wide, anterior region light brown, posterior edge dark brown. Band of cuspules similar in size to those on maxillae, occupy one third length of labium. Labiosternal groove convex. Large brown sigilla present in labiosternal groove but not meeting in center. Anterior region with a distinct groove.

Chelicerae: 5.3 long, intercheliceral spines absent, cheliceral lyra absent, thick mat of long and short bristles present on dorsal side. Rastellum absent. Few bands of silvery hairs present on dorso-lateral side. Retrolateral side reddish brown, glabrous; prolateral face not smooth, with pale hairs. 17 promarginal and 2-3 rows of 32 baso-mesal teeth on the left chelicerae, 16 pro marginal and 2-3 rows of 30 baso-mesal teeth on the right chelicerae, promarginal and retromarginal scopulae present of which retromarginal scopulae is thick.

Sternum: 4.2 long, 3.4 wide. Oval in shape, high in centre, sloping gradually. Light brown in colour, margins dark brown. Ventrum with a mat of white hairs along with short and thick brown hairs, more concentrated along the margin. Posterior angle pointed, not separating the coxae of leg 4. Posterior edge clearly seen.

Sigilla: Three pairs of sigilla present, posterior sigilla oval, 0.2 diameter, 1.9 apart, reddish brown, easily seen from above; median and posterior sigilla not seen properly from above, marginal and oval in shape. Posterior pair is largest, anterior pair smallest.

Legs: Reddish brown in colour; dorso retrolateral side of coxae, trochanter and proximal portion of femur I-IV densely covered with silvery hairs. All segments contain golden brown hairs along with bristles. The basal region of these bristles dark brown in colour and distal one-third pale. Basifemoral thorns absent on all. Tarsus and metatarsus of legs contains silvery hairs thickly packed on the dorsal side. Tibial apophysis of first leg consists of a single spur, present on ventro retrolateral surface with apical dark brown spine. Spur is long, curved, gradually narrowing towards apex. Secondary spur absent.

Scopulae: Entire on all tarsi, not so thick, with some hairs intermixed in tarsal scopulae. Tarsal scopulae of leg I & II not divided, distal end of metatarsus I & II contains scopulae. Distal $\frac{1}{4}$ of scopulae divided by pale hairs in leg III, metatarsal by setae. Tarsal scopulae of leg IV divided by 5- 6 rows of hairs, division broaden distally.

Spines: A small spine present on the ventro-retrolateral surface, near to the base of tibial spur; a long spine on the ventro-prolateral face apart from the base of spur. Metatarsus of leg II distally contains 1 ventral spine and 2 ventro-lateral spines; tibia of the same leg distally contains 1 ventral, 1 ventro-lateral, 1 dorsolateral and 1 mid ventral spine. Leg III and IV heavily armed with spines.

Abdomen: Dorsum covered by long dark brown, bristle like hairs with pale tip intermixed with a thick mat of golden brown hairs. The golden brown hairs appear darker towards the posterior end. Two pairs of digitiform, brown spinnerets, covered with golden brown hairs.

Palp: Tarsi divided distally but not deep. Bulb large and twisted on cymbium with long embolus. Embolus emerges from posterior ventral area of tegulum, embolus curved and tapering towards the tip.

Distribution: INDIA: Kozhikode, Travancore, Kulathupuzha, Trichur, between 10th and 14th miles of former Cochin Forest Tram Way, Kerala.

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Table 1. Measurements of leg segments.

Parts of leg	1	2	3	4	Palp
Femur	8.1	7.6	6.7	8.9	5.2
Patella	4.52	3.8	3.2	4.3	3.2
Tibia	6.79	5.1	4.1	7.1	4.3
Metatarsus	5.4	4.9	5.4	9.2	1.9
Tarsus	3.4	3.3	4.3	3.9	-
Total	28.21	24.7	23.7	33.4	14.6
Mid width					
Femur	2.7	2.6	2.79	2.67	2.14
Tibia	1.65	1.49	1.51	1.72	1.42

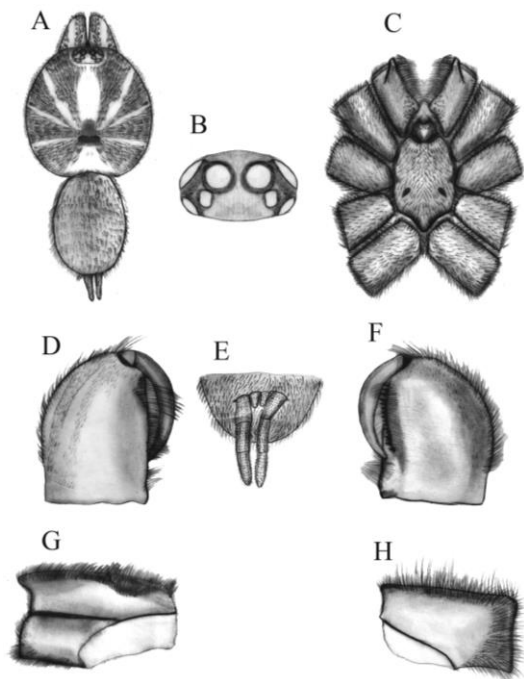


Figure 1. Diagrammatic sketch of Male: A - Dorsal view; B - Ocular group; C - Sternum with maxilla and labium; D - Chelicerae prolateral view; E - Spinnerets; F - Chelicerae retrolateral view; G - Maxillae, prolateral view; H - Maxillae retrolateral view.

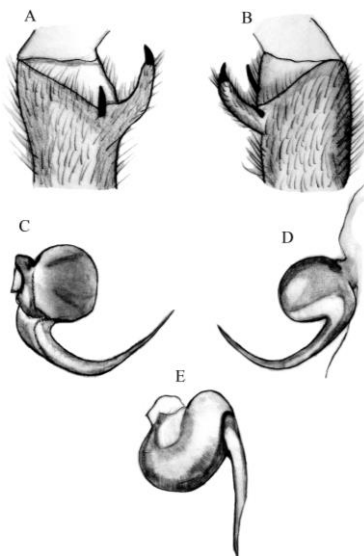


Figure 2. Diagrammatic sketch of Male: A - Tibial spur prolateral view, B - Tibial spur retrolateral view; C - E - Chelicerae lateral views.

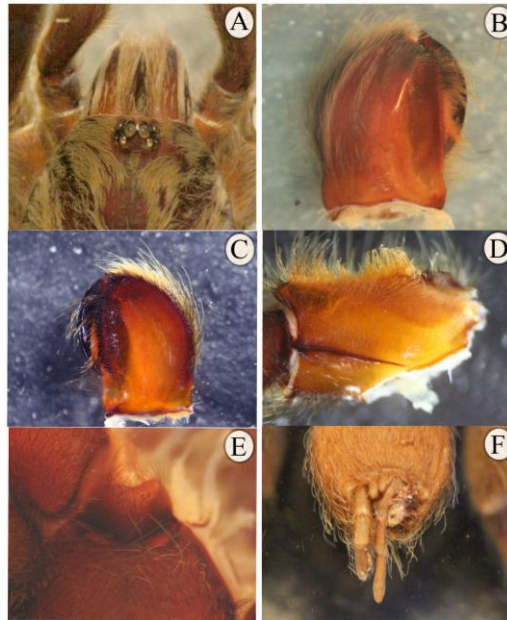


Figure 3. Microphotographs: A - Dorsal view; B - Chelicerae prolateral view; C - Chelicerae retrolateral view; D - Maxillae Dorsal view. E - Labio-sternal groove; F - Spinnerets.



Figure 4. Microphotographs: A - Tibial spur retrolateral view; B - Tibial spur prolateral view; C - Tibial spur ventral view; D-E Palp lateral views; F - Palp ventral view.

FIRST RECORD OF *GREENIDEA FICICOLA* (TAKAHASHI, 1921) (HEMIPTERA: APHIDIDAE) FROM TARTOUS, SYRIA**Ali Yaseen Ali***

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[Ali, A. Y. 2015. First record of *Greenidea ficicola* (Takahashi, 1921) (Hemiptera: Aphididae) from Tartous, Syria. *Munis Entomology & Zoology*, 10 (1): 194-195]

ABSTRACT: We report the aphid species *Greenidea ficicola* (Takahashi, 1921) (Hemiptera: Aphididae) for the first time in the rolled leaf of the weeping fig tree *Ficus benjamina* L. in the coastal area of Tartous, Syria. Detailed description, distribution and biology of *G. ficicola* is provided in this paper.

KEY WORDS: aphid, *Greenidea ficicola*, first time, *Ficus benjamina*, Tartous, Syria.

The genus Greenidae comprise about 64 species, which are recorded mainly for west Asia (Sugimoto, 2008). *G. ficicola* belongs to the order Hemiptera and family Aphididae and subfamily Greenideinae (Ben Halima-Kamel, 2009). The most aphid species of this subfamily are characterized by having long siphunculi with correspondingly long setae (Halbert, 2004).

G. ficicola has been found in Bangladesh, China, India, Indonesia, Japan, Australia Malaysia, Nepal, Pakistan, Philippines, eastern Russia, and Taiwan (Blackman & Eastop, 2000, 1994) and in Afrotropical Region (Burundi) (Remaudière et al., 1992). This aphid was also reported from Italy (Barbagallo et al., 2005), Malta (Mifsud, 2008) and Tunisia (Ben Halima-Kamel, 2009).

There is no records of *G. ficicola* in countries of West Asia, therefore the aim of this report is to record the new species of this aphid for the first time for Syria and Western Asia.

MATERIAL AND METHODS

Rolled leaves of 18 year-old *F. benjamina* trees were sampled in January 2014, the samples were taken from Tartous area, Al Jemaseh Center 34N 43' 55.20, 35E 58' 38.14. The Aphids were removed using a fine brush and preserved in 95% alcohol. Specimens are deposited at the Laboratory of Entomology in the Center of Tartous for Agricultural Research. The Morphology of Aphids were studied by OPTIKA stereomicroscope and aphid species were identified according to the morphological features and the provided keys from (Halbert, 2004).

RESULTS AND DISCUSSION

Were collected 2 apterae forms of *G. ficicola* on the leaves of *F. benjamina*. These aphid species was readily recognized by the presence of setae on the siphunculi and this morphological character distinguishes all members of the Greenideini (Mifsud, 2008). The color of apterae forms is yellowish-brown to dark-brown and the body is pear-shaped, the siphunculi are dark brown, curved outwards distally and the dorsum of body covered by conspicuous. Alatae forms have an elongate body with dark-brown abdomen, and siphunculi up two-thirds of body length (Blackman & Eastop, 2000; Mifsud, 2008).

These results indicate, that *G. ficicola* was responsible to cause the damage on

the leaves of *F. benjamina* in the coastal area in Syria. The infested leaves were rolled and covered with honeydew. Similar symptoms were observed by Ben Halima-Kamel (2009) caused by the pest on the leaves of *F. nitida* in Tunisia.

The occurrence of *G. ficicola* in the coastal area in Tartous, Syria could be attributed to the wide plantation and use of *F. benjamina* for ornamentation of parks and streets and the international horticultural with Asian and Europe countries has increased in the last years increasing the probability of transporting this aphid in or on goods to new regions in the world.

G. ficicola colonize *Ficus* spp., including the common fig *F. carica* L (Blackman & Eastop, 1994, 2000), but the species were recorded from other host plants belonging to different families, including guava *Psidium guajava* L. (Myrtaceae) in India (Blackman & Eastop, 2000; Halbert, 2004) and other host plants belonging to Moraceae, Betulaceae, Juglandaceae (Ben Halima-Kamel, 2009), therefore *G. ficicola* could become a pest on fig- or guava orchards in the coastal area in Syria. For that reason, it is recommended to carry out further studies about this aphid.

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**A LITTLE KNOWN SPECIES *PONTANIA PROXIMA*
(SERVILLE, 1823) (HYMENOPTERA, SYMPHYTA,
TENTHREDINIDAE) FROM TURKEY**

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[Katılmış, Y. & Kiyak, S. 2015. A little known species *Pontania proxima* (Serville, 1823) (Hymenoptera: Symphyta: Tenthredinidae) from Turkey. *Munis Entomology & Zoology*, 10 (1): 196-198]

ABSTRACT: In this study we report a little known species *Pontania proxima* (Serville, 1823) on *Salix alba* L. in the inner Western Anatolian. We give details on geographical distribution, host and pictures of the gall.

KEY WORDS: Hymenoptera, *Pontania proxima*, *Salix alba*, Tenthredinidae, Turkey.

The family Tenthredinidae (Symphyta, Hymenoptera) are known "Typical Sawflies". It is the largest family of Symphyta, including more than seven to eighths of all members of the Symphyta (Comstock, 1964). About 6000 species in 360 genera are known in temperate regions of the Northern Hemisphere (Liston, 1995; Goulet & Huber, 1993; Medvedev, 1994; Lacourt, 1999; Taeger & Blank, 1998). The number of valid species recorded from Europe more than 900 (Liston, 1995). Historically, the fauna of Tenthredinidae of Turkey has been poorly studied despite its zoogeographic interest. The first study on the sawfly fauna of Turkey was reported by Guichard & Harvey (1967). Benson (1966, 1968), studied about the Symphyta of Turkey, and described new taxa and gave keys to some genera and species found in Turkey. Published studies concern mostly sawflies (Suborder: Symphyta), either as forest and cultivated pests in Turkey (Bodenheimer, 1941; Alkan, 1952; Baş, 1973; Özbek, 1986; Erden, 1988; Güçlü & Özbek, 1999; Çalmaşur & Özbek, 2004a). Wolf (1968) and Chevin & Chenon (1982), recorded some sawfly species from Turkey. Three sawflies species from Tenthredinidae family were given as new to Turkey with some new host records (Özbek, 1986; Güçlü & Özbek, 1999; Çalmaşur & Özbek, 2004a). Çalmaşur & Özbek, (2004b; 2004c) listed totally 104 species from predominantly eastern of Turkey. Of these, 18 species were new for Turkey fauna. Çalmaşur (2006), recorded 4 species for the first time from North Eastern of Anatolia, Turkey.

Bodenheimer (1941), reported the first record of *Pontania proxima* from Turkey but location of specimens was not given. Second record of this species was reported on *Salix alba* from Kastamonu and İstanbul (Alkan, 1952). Recently this species was also reported on *Salix alba* in Cyprus (Liston & Jacobs, 2012).

MATERIALS AND METHODS

The white willow galls were collected in different localities from Inner western of Anatolia (Afyon, Denizli, Kütahya and Uşak provinces). We also recorded localities and collected time. The galls identified according to the available literature sources (Alkan, 1952; Taeger & Blank, 1998; Medvedev, 1994; Lacourt, 1999). The gall specimens are deposited in the Zoology Museum of Gazi

University.

RESULTS

Pontania proxima (Serville, 1823)

Materials: AFYON, between Afyon-Kütahya way to Kütahya, 4.km 38°50'N, 30°25'E, 1031m, 20.05.2007, 10 galls; Bayat, 38°59'N, 30°56'E, 1045m, 18.06.2007, 7 galls; Bayat, surrounding Bayat dam, 38°58'N, 30°53'E, 1139m, 18.06.2007; 14 galls; İncehisar, surrounding İncehisar dam, 38°48'N, 30°48'E, 1050m, 19.06.2007, 3 galls; İhsaniye, between İhsaniye-Döğer surrounding Üçler dam, 39°04'N, 30°25'E, 1107m, 19.06.2007, 11 galls; Çay, Çayırızı village, 38°22'N, 30°44'E, 1112m, 27.06.2007, 10 galls; Çay, Eber village, surrounding Eber lake, 38°36'N, 31°09'E, 973m, 09.07.2007, 13 galls; Emirdağ, Aşağıkepen village surrounding Pınarbaşı dam, 39°02'N, 31°19'E, 973m, 09.07.2007, 12 galls; Çay, Koçbeyli town, surrounding Karamık lake, 38°25'N, 30°53'E, 1014m, 10.07.2007, 16 galls; Çay, Aydoğmuş village, 38°22'N, 30°46'E, 1014m, 10.07.2007, 11 galls; Çay, Pazaragaç town, 38°36'N, 30°51'E, 996m, 11.06.2008, 3 galls; DENİZLİ, above Cankurtaran town Honaz Mountain, 37°40'N, 29°13'E, 1207m, 26.06.2007, 3 galls; Cankurtaran town Honaz Mountain, 37°39'N, 29°14'E, 1100m, 26.06.2007, 3 galls; Çivril, Gülpınar village, 38°24'N, 29°43'E, 968m, 13.07.2007, 6 galls; Çardak, Beylerli town, 37°41'N, 29°37'E, 921m, 22.04.2008, 3 galls; KÜTAHYA, Altıntaş, Genişler village, 38°58'N, 30°06'E, 1064m, 20.05.2007, 8 galls; Tavşanlı, between Tavşanlı-Domaniç way to Domaniç 4.km, 39°34'N, 29°27'E, 815m, 21.05.2007, 4 galls; Tavşanlı, between Tavşanlı-Domaniç way to Domaniç 20.km, 39°43'N, 29°31'E, 706m, 21.05.2007, 17 galls; Kütahya, Söğüt village, 39°26'N, 30°10'E, 1075m, 19.06.2007, 8 galls; Domaniç, between Domaniç-Tahtaköprü way to Tahtaköprü 3.km, 39°59'N, 29°38'E, 930m, 20.06.2007, 5 galls; Domaniç, Berçin village, 39°46'N, 29°34'E, 864m, 20.06.2007, 2 galls; Kütahya, Frigian valley above Fındık village, 39°33'N, 30°12'E, 960m, 11.07.2007, 5 galls; Kütahya, between Kütahya-Çavdarhisarı way to Çavdarhisarı bank of Bedir stream, 39°12'N, 29°36'E, 1020m, 11.07.2007, 14 galls; Pazarlar, Yakuplar town surrounding Yakuplar dam, 39°55'N, 29°08'E, 918m, 12.07.2007, 14 galls; İhsaniye, Döğer town surrounding Emre lake, 39°01'N, 31°00'E, 1067m, 03.05.2008, 4 galls; UŞAK, between Eşme-Uşak way to Eşme 13.km, 38°35'N, 29°01'E, 600m, 22.06.2007, 7 galls; Eşme, Takmak village surrounding Takmak dam, 38°26'N, 28°57'E, 831m, 22.06.2007, 5 galls; Banaz, Yeşilyurt village, 38°48'N, 29°40'E, 1024m, 23.06.2007, 4 galls; Ulubey, between Ulubey-Karahallı way to Karahallı 8.km, 38°21'N, 29°19'E, 543m, 13.07.2007, 5 galls (Fig. 1).

Host: *Salix alba*.

DISCUSSION

Pontania proxima was recorded on *S. alba*, *S. alba* x *S. fragilis* L., *S. fragilis*, *S. babylonica* L. in Europa, Sardinia, Cyprus, Crete, Caucasia, Siberia, Central Asia and North America (Lacourt, 1999). Alkan (1952), recorded on *S. alba* from Kastamonu and İstanbul in Turkey. In this study, we presented new locations of *Pontania proxima* which are recorded from Turkey at the third time on *S. alba* in the inner Western Anatolian. We estimate that *Pontania proxima* distributed throughout Anatolian region with *S. alba* or mentioned other *Salix* species. The objective of our study is to contribute to the knowledge of Tentredinidae fauna of Turkey. Çalmaşur (2006), expressed that the number of the species of Turkish sawfly fauna rised up to 222. We estimate that number of species of Turkey Tentredinidae fauna will increase following local faunistic studies in the future.

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Figure 1. The gall pictures of the *Pontania proxima*.

***DORCADION (MACULATODORCADION) PHRYGICUM* PEKS,
1993 STAT. NOV. (CERAMBYCIDAE)**

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[Özdikmen, H. & Kaya, G. 2015. *Dorcadion (Maculatodorcadion) phrygicum* Peks, 1993 stat. nov. (Cerambycidae). Munis Entomology & Zoology, 10 (1): 199-200]

ABSTRACT: With the present work, *Dorcadion (Maculatodorcadion) phrygicum* Peks, 1993 stat. nov. is discussed and proposed as a separate species.

KEY WORDS: *Dorcadion (Maculatodorcadion) phrygicum*, stat. nov., Cerambycidae, Turkey.

***Dorcadion phrygicum* Peks, 1993 stat. nov.**

The Turkish endemic species, *Dorcadion triste*, was originally described by Frivaldszky von Frivald (1845) from İzmir province in W Turkey.

Then in 1993, *Dorcadion phrygicum* was originally described by Peks (1993) from Antalya province Kaş county in SW Turkey as a subspecies of *Dorcadion triste* Frivaldszky von Frivald, 1845. Also, it is endemic to Turkey.

Later, it was given by Löbl & Smetana (2010) as a subspecies of *Dorcadion triste* normally. Namely, the South-Eastern populations of *Dorcadion triste* is named *Dorcadion triste phrygicum*.

However, known distribution patterns of *Dorcadion triste triste* and *Dorcadion triste phrygicum* are shown that the taxa do not be subspecies of the same species. As known the South-Eastern populations, *Dorcadion triste phrygicum*, is also distributed in North-Western Anatolia (see below).

Therefore, we propose that *Dorcadion phrygicum* should be as a separate species necessarily.

***Dorcadion triste* Frivaldszky von Frivald, 1845: 184** (Syntypes ♂♂ & ♀♀, ex collection Imre Frivaldszky, Magyar Természettudományi Múzeum, Budapest) [type locality “Smyrna” (Turkey: İzmir)] **A:** TR

vittipenne Breuning, 1946: 97 (*D. triste* m.) [Turkey: İzmir]

postmedioreductum Breuning, 1946: 97 (*D. triste* m.) [Turkey: İzmir]

Known distribution of *D. triste*: İzmir prov. As the type locality (Frivaldszky von Frivald, 1845); Bursa prov. (Ganglbauer, 1884); İzmir prov., Bursa prov. (Aurivillius, 1921); Bursa prov., Balıkesir prov., İzmir prov. (Breuning, 1962); İzmir prov.: Dikili (Makaron) (Demelt, 1963; Gül-Zümreoğlu, 1972); Balıkesir prov.: Balya (Braun, 1978); İzmir prov.: Dikili (Kratschmer, 1985); İzmir prov., Balıkesir prov.: Susurluk, Bursa prov.: Mustafa Kemal Paşa, Karacabey (Önalp, 1990); Anatolia (Danilevsky in Löbl & Smetana, 2010) (Fig. 1).

***Dorcadion phrygicum* Peks, 1993: 8 stat. nov.** (Holotype ♂, collection Heinz Peks, Schwanfeld) [type locality “Kaş: Ova” (Turkey: Antalya)] **A:** TR

Known distribution of *D. phrygicum*: Antalya prov.: Kaş: Ova as the type locality and Bakacak beli N Saklıkent (Peks, 1993); Antalya (Adalia) (Breuning, 1962); Anatolia as *D. triste phrygicum* (Danilevsky in Löbl & Smetana, 2010); Antalya prov.: Aspendos (personal communication with Chris Bruggeman

(Belgium), 2010); Düzce prov.: Kalcı Konutlar, Kent forest road return, Kent forest (Özdikmen et al., 2012); Çanakkale: Biga: Karabiga, Bursa prov.: Uludağ Üniversitesi (Campus of Görükle) (personal data, 2014) (Fig. 2).

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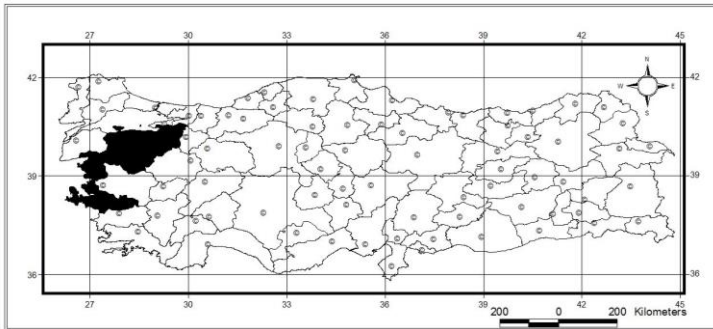


Figure 1. The distribution of *Dorcadion triste*.

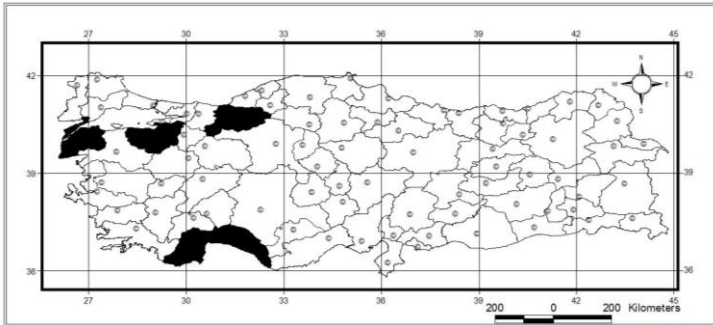


Figure 2. The distribution of *Dorcadion phrygicum*.

**FOUR NEW RECORDS OF OAK GALL WASP
(HYMENOPTERA: CYNIPIDAE, CYNIPINI)
FROM TURKEY**

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[Azmaz, M. & Katılmış, Y. 2015. Four new records of Oak Gall Wasp (Hymenoptera: Cynipidae, Cynipini) from Turkey. *Munis Entomology & Zoology*, 10 (1): 201-204]

ABSTRACT: This study was carried out to contribute the oak gall wasps fauna (Hymenoptera: Cynipidae, Cynipini) of Turkey. Oak gall wasp specimens were collected in 2012 and 2013 from Istanbul, Turkey were examined for revealing the oak gall wasp species diversity. Finally four new records of oak gall wasp, *Andricus glandulae* (Hartig, 1840); *Andricus serotinus* (Giraud, 1859); *Cynips longiventris* Hartig, 1840 and *Trigonaspis megaptera* (Panzer, 1801) (Hymenoptera: Cynipidae, Cynipini) from Turkey were recorded. Data on host oak and phenology are given.

KEY WORDS: Cynipidae, Istanbul, new records, oak gall wasps, Turkey.

The Cynipidae is one of the largest families of the Cynipoidea and about 1400 species are known worldwide (Ronquist, 1999). The number of valid species recorded from Europe and contiguous territories including North Africa and Turkey is fewer than 300 (Dalla-Torre & Kieffer, 1910; Nieves-Aldrey, 2001; Stone et al., 2001; Melika, 2006). The western Palearctic contains around 140 species of oak cynipids (Abe et al., 2007).

Initially published studies concern mostly oak gall wasps (tribe Cynipini), as forest pests in Turkey (Fahringier, 1922; Bodenheimer, 1958; Acatay, 1943; Schimitschek, 1944; Alkan, 1952; Karaca, 1956; Çanakçıoğlu, 1956; Baş, 1973; Erdem, 1975).

In the south western of Turkey (Antalya, Burdur, Isparta, Denizli, Aydın, Muğla) 30 species of oak gall wasps (Cynipini) were found (Kıyak et al. 2008). Katılmış & Kıyak (2008) listed 81 gall-inducing wasps (Hymenoptera: Cynipidae), with a new record from Turkey (*Dryocosmus cerriphilus*). Ten galls inducing wasps on oaks were recorded as new to Turkey (Katılmış & Kıyak, 2009a, 2009b; Kıyak & Katılmış, 2010; Katılmış & Kıyak, 2011). Kemal & Koçak (2010) reported 87 gall wasp species with a new record (*Andricus moreae*) in South Van Lake area, Turkey. Mete & Demirsoy (2012) determined 24 species belonging to 5 genera from Kemal. Mutun & Dinç (2011) reported 17 oak gall wasps with a new record (*Cynips korsakovi*).

In the last decades, three new oak gallwasp species were described from Turkey: *Andricus askewi* Melika & Stone (Melika & Stone, 2001), *A. megalucidus* Melika (Melika et al., 2004), *A. shuhuti* Melika, Mutun & Dinç (Dinç et al., 2014). Tavakoli et al. (2008) described a new species (*Andricus megalatronicolus* Melika) from Iran and its Turkey distribution (Beybeşli, Erzurum) was mentioned. Additionally, Mutun et al. (2014) described four new species (*Andricus ahmeti*, *A. anatolicus*, *A. bakrachus* and *A. turcicus*) also they listed two new records (*Andricus stoneli* and *Aphelonyx kordestanica*) from Turkey.

MATERIAL AND METHODS

All oak gall specimens were collected from Istanbul in 2012 and 2013. The coordinates and altitudes were recorded using a Garmin 62S model Geographic Positioning System (GPS). After collecting galls they were put in a plastic bag and brought into the laboratory. All oak gall specimens were taken photos. All oak gall specimens are deposited in the Pamukkale University, Faculty of Science & Letters, Department of Biology, Zoology Laboratory, Denizli, Turkey.

RESULTS

***Andricus glandulae* (Hartig, 1840)**

Material examined: ISTANBUL, Beykoz, Cumhuriyet, 41°07' N, 29°15' E, 27 m, 29.IV.2013, 4 asexual galls; Beykoz, between Mahmutşevketpaşa-Öğümce 2. km, 41°08' N, 29°11' E, 120 m, 21.X.2012, 9 asexual galls; Beykoz, Polonezköy, Polonezköy Nature Park, 41°06' N, 29°11' E, 207 m, 29.IV.2013, 5 asexual galls; Silivri, between Seymen-Sinekli 6. km, 41°12' N, 28°09' E, 227 m, 25.XI.2012, 3 asexual galls; Şile, between Hasanlı-Sarıkavak 1. km, 41°01' N, 29°39' E, 189 m, 24.XI.2012, 6 asexual galls; Şile, between Sortullu-Hacıllı 1. km, Doğan Yuvası Fire Watch-Tower, 41°03' N, 29°43' E, 308 m, 24.XI.2012, 5 asexual galls; Şile, between Yeniköy-Yaylalı 2. km, Yeniköy creek, 41°07' N, 29°40' E, 61 m, 24.XI.2012, 4 asexual galls; Şile, between Yeniköy-Yaylalı 5. km, 41°06' N, 29°40' E, 150 m, 24.XI.2012, 5 asexual galls.

Host oak: *Quercus petraea* and *Quercus robur*.

Phenology: The asexual gall (Fig.1a) develops through the summer, matures in autumn and falls from the tree. At least some of the asexual adults overwinter and emerge the following April (Melika, 2006).

***Andricus serotinus* (Giraud, 1859)**

Material examined: ISTANBUL, Şile, Darlık, surroundings of Darlık cemetery, 41°02' N, 29°34' E, 263 m, 24.XI.2012, 3 asexual galls.

Host oak: *Quercus robur*.

Phenology: The gall (Fig. 1b) matures in the autumn. Some adults emerge the following June (Melika, 2006).

***Cynips longiventris* Hartig, 1840**

Material examined: ISTANBUL, Arnavutköy, Tayakadın, 41°16' N, 28°42' E, 112 m, 21.X.2012, 7 asexual galls; Sarıyer, Bahçeköy, Belgrad Forest, Falih Rıfka Atay, 41°11' N, 28°57' E, 115 m, 20.X.2012, 3 asexual galls.

Host oak: *Quercus robur*.

Phenology: The asexual generation (Fig. 1c) matures at the end of the summer, and falls with the leaves; the adult emerges in early spring (Melika, 2006).

***Trigonaspis megaptera* (Panzer, 1801)**

Material examined: ISTANBUL, Beykoz, Mahmutşevketpaşa, 41°08' N, 29°11' E, 66 m, 21.X.2012, 13 asexual galls; Beykoz, between Mahmutşevketpaşa-Öğümce 2. km, 41°08' N, 29°11' E, 120 m, 21.X.2012, 18 asexual galls.

Host oak: *Quercus robur*.

Phenology: The asexual gall (Fig. 1d) falls with the leaf, and can be collected from fallen leaves in the spring. Adults emerge in May and June, or after a year's diapause (Melika, 2006).

DISCUSSION

This study carried out in Istanbul contributed Cynipidae Fauna of Turkey with 4 new records. In this study, 4 species belonging to 3 genus from tribe Cynipini, are recorded first time in Turkey. Now, Cynipidae Fauna of Turkey have got 66

species belonging to genus *Andricus* Hartig and 8 species belonging to genus *Cynips* Linnaeus and 2 species belonging to genus *Trigonaspis* Hartig. We hope that number of species of Turkey cynipid fauna will increase following local faunistic studies in the future.

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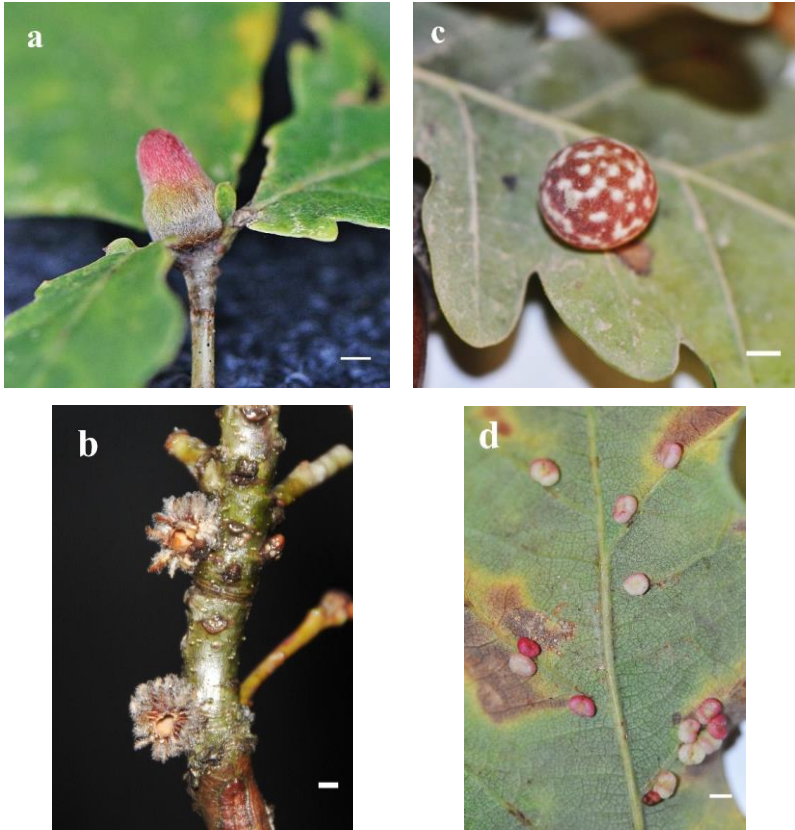


Figure 1. Oak galls (a scale bar 5 mm): a. *Andricus glandulae* asexual gall, b. *A. serotinus* asexual gall, c. *Cynips longiventris* asexual gall, d. *Trigonaspis megaptera* asexual gall.

**PENTATOMIDAE (HEMIPTERA: HETEROPTERA)
OF ARAS FREE ZONE AND VICINITY, NW IRAN**

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[**Havaskary, M., Farshbaf Pourabad, R. & Khajeh, R. S.** 2015. Pentatomidae (Hemiptera: Heteroptera) of Aras Free Zone and vicinity, NW Iran. *Munis Entomology & Zoology*, 10 (1): 205-208]

ABSTRACT: Pentatomids may cause direct and indirect damage to important crop plants but some are as natural enemies in agricultural ecosystems (predators of pests). During 2011-2013 several sampling was conducted to study of Pentatomidae fauna from Aras free zone and its vicinity (East Azarbaijan Province, North West of Iran). Totally 29 species from 24 genera and 3 subfamilies including Asopinae, Pentatominae, Podopinae were determined.

KEY WORDS: Hemiptera, Heteroptera, Pentatomidae, Fauna, Aras Free Zone, Iran.

Aras Free Zone with an area of 51,000 hectares including three parts of Jolfa , Nardoz and Khodafarin is located in northwest of Iran at the border neighboring Nakhchivan Autonomous Republic, Armenia and Azerbaijan countries. This reserve is adjoined with Arasbaran region in Khodafarin town (Fig. 1). Arasbaran protected area contains mountains up to 2,200 meters (altitude between 250 and 2 887 meters above sea level), high alpine meadows, semi-arid steppes, meadows and forests, rivers and springs.

The Stink Bugs (Hemiptera: Heteroptera: Pentatomidae) are world wide in distribution which may cause direct and indirect damage to important agricultural plants (Silva & Oliveira, 2010), but some species developed predatory habits and they are common during insect outbreaks (Ferreira et al., 2008; Zanuncio et al., 2008; Holtz et al., 2009). However, some of the pentatomid predators can feed on plant that also can benefit then (Azevedo et al., 2007; Guedes et al., 2007; Holtz et al., 2009).

Pentatomids are easily recognized from other true bugs by their round or ovoid shape and five - segmented antenna, three tarsal segmented, Scutellum narrowed behind, more or less triangular in shape, rarely almost covering the abdomen (Borror et al., 1989). Although a few species have 4-3 antennal segments and scutellum covered specially Asopinae and Podopinae (Rider, 2006).

MATERIAL AND METHOD

Specimens were collected by sweeping net, light trap and directly with forceps from different regions of Aras Free Zone and its vicinity (East Azarbaijan Province, North west Iran). Collected materials were put in ethanol 70% for identification in suitable time. Specific name, author and description date, locality and date of collection are provided. The system and nomenclature follow principally Aukema & Rieger (2006).

RESULTS

In the current survey totally 29 species of three subfamilies were collected from Aras free Zone and its adjacent area.

Family Pentatomidae Leach, 1815 **Subfamily Pentatominae Leach, 1815**

***Aelia acuminata* (Linnaeus, 1758)**

Material examined: Golibaglo of Khodafarin (3 specimens) 22 May 2012; Jolfa grasslands (5 specimens), 1 June 2013; Siah Rod (4 specimens), 25 July 2013.

***Aelia rostrata* Boheman, 1852**

Material examined: Marand (5 specimens), 23 August 2013; Siah Rod (2 specimens), 30 April 2011; Nordoz (4 specimens), 10 June 2012.

***Carpocoris* (*Carpocoris*) *coreanus* Distant, 1899**

Material Examined: Marand (3 specimens), 23 August 2013; Alamdar (1 specimen), 5 June 2011; Scent Stepanus Church grasslands (2 specimens), 18 June 2013; Kordasht (8 specimens), 13 May 2011.

***Carpocoris* (*Carpocoris*) *fuscispinus* (Boheman, 1849)**

Material examined: Khodafarin (5 specimens), 4 August 2013; Marand (6 specimens), 26 May 2013; Near of Scent Stepanus Church (6 specimens), 15 June 2013.

***Codophila varia* (Fabricius, 1787)**

Material Examined: Jananlo of Khodafarin (4 specimens), 6 August 2011.

***Dolycoris baccarum* (Linnaeus, 1758)**

Material Examined: Oshtobin (3 specimens), 1 July 2011; Marand (5 specimens), 10 July 2013; Golan (5 specimens), 12 June 2012; Oshtobin (6 specimens), 7 July, 2011. Jolfa (1 specimen), 25 August 2011; Nordoz (7 specimens), 10 June 2012; Misan (3 specimens), 30 May 2011; Kordasht (2 specimens), 28 May 2011.

***Dolycoris penicillatus* Horváth, 1904**

Material examined: Oshtobin (1 specimen), 1 July 2011; Siah Rod (7 specimens), 30 May 2011; Misan (1 specimen) 3 June 2012; Eshgali ojagi of Khodafarin (5 specimens), 7 July, 2011; Jolfa grasslands (3 specimens), 1 June 2013.

***Neottiglossa* (*Neottiglossa*) *leporina* (Herrich-Schaeffer, 1830)**

Material examined: Eshgali ojagi of Khodafarin (2 specimens), 7 July, 2011; Aynalo forests of Khodafarin (3 specimens), 20 May 2013; Golan (1 specimen), 12 June 2012; Oshtobin (1 specimen), 7 June, 2011.

***Anthemina lunulata* (Goeze, 1778)**

Material examined: Oshtobin (1 specimen), 1 July 2011; Siahrod (2 specimens), 2 July 2012; Golan (3 specimens), 1 June 2012.

***Holcostethus strictus vernalis* Wolf, 1804**

Material Examined: Siah Rod (2 specimens), 30 May 2011; Marand (5 specimens), 10 July 2013; Oshtobin (1 specimen), 7 July, 2011.

***Eysarcoris ventralis* (Westwood, 1837)**

Material Examined: Khomarlo of Khodafarin (1 specimen), 2 July 2013; Marand (5 specimens), 10 July 2013; Haras (4 specimens) 4 June 2012.

***Apodiphus amygdali* (Germar, 1817)**

Material Examined: Oshtobin (1 specimen), 1 July 2011; Siah Rod (7 specimens), 30 May 2011; Kordasht (1 specimen), 13 May 2011; Haras (2 specimens) 4 June 2012; Alamdar (2 specimens), 5 June 2011; Near Scent Stepanus Church (2 specimens) 18 June 2013; Marand (4 specimens), 26 May 2013.

***Mustha spinosula* (Lefebvre, 1831)**

Material Examined: Jananlo of Khodafarin (1 specimen), 12 August 2013; Oshtobin (3 specimens), 7 July, 2011.

***Brachynema germarii* (Kolenati, 1846)**

Material Examined: Mardanagum (2 specimens), 30 June 2013; Alamdar (2 specimens), 5 June 2011.

***Brachynema signatum* Jakovlev, 1879**

Material Examined: Marzabad (1 specimen); Siah Rod (1 specimen), 30 May 2011.

***Nezara viridula* (Linnaeus, 1758)**

Material Examined: Larijan Gharmadoz (4 specimens), 5 July 2012; Misan (1 specimen), 3 July 2011.

***Acrosternum breviceps* (Jakovlev, 1889)**

Material Examined: Jolfa grasslands (2 specimens), 1 July 2013; Aynalo forests of Khodafarin (2 specimens), 5 June 2012.

***Palomena prasina* (Linnaeus, 1761)**

Material Examined: Golan (2 specimens), 1 June 2012.

***Pentatoma (Pentatoma) rufipes* (Linnaeus, 1758)**

Material Examined: Aynalo forests of Khodafarin (2 specimens), 20 August 2013; Kiamaki (2 specimens), 15 June 2012.

***Rhaphigaster nebulosa* (Poda, 1761)**

Material Examined: Kordasht (2 specimens), 28 May 2011.

***Sciocoris (Sciocoris) sulcatus* Fieber, 1851**

Material Examined: Kordasht (2 specimens), 13 May 2011; Misan (1 specimen), 30 May 2011; Marand (4 specimens), 20 May 2012; Oshtobin (3 specimen), 7 July, 2011.

***Bagrada (Nitilia) stolidia* (Herrich-Schaeffer, 1839)**

Material Examined: Ayanlo forests grasslands (2 specimens) 4 June 2013; Oshtobin (1 specime), 7 July, 2011.

***Eurydema fieberi* Fieber, 1837**

Material Examined: Ayanlo forests grasslands (2 specimens) 4 June 2013; Near of Scent Stepanus Church (4 specimens) 18 June 2013.

***Eurydema ornata* (Linnaeus, 1758)**

Material Examined: Oshtobin (5 specimens), 1 July 2011; Marand (25 specimens), 10 July 2013; Golan (7 specimens), 12 June 2012; Jolfa 25 August 2011 (1 specimen); Nordoz (7 specimens), 10 June 2012; Misan (3 specimens), 30 May 2011; Kordasht (22 specimens), 28 May 2011; Near of Scent Stepanus Church (12 specimens) 18 June 2013.

***Eurydema putoni* Jakovlev, 1877**

Material examined: Aynalo grasslands (2 specimens), 3 May 2011; Jolfa grasslands (3 specimens), 1 June 2013.

Subfamily Asopinae Amyot & Serville, 1843***Picromerus bidens* (Linnaeus, 1758)**

Material examined: Kordasht (3 specimens), 13 May 2011.

Subfamily Podopinae Amyot & Serville, 1843***Derula flavoguttata* Mulsant & Rey, 1856**

Material Examined: Aynalo forest grasslands of Khodafarin (5 specimens), 18 June 2010.

Comment: This species was reported for the first time from Iran by Havaskary (2012), Havaskary et al. (2014).

***Graphosoma lineatum lineatum* (Linnaeus, 1758)**

Material Examined: Golan (3 specimens) 2 June 2011; Oshtobin (2 specimens), 1 July 2011; Marand (2 specimens), 10 July 2013; Golan (1 specimen), 12 June 2012.

***Tholagmus flavolineatus* (Fabricius, 1798)**

Material examined: Khodafarin (1 specimen), 29 August 2013.

***Ventocoris fischeri* (Herrich-Schaeffer, 1851)**

Material Examined: Jolfa grasslands (2 specimens), 1 June 2013.

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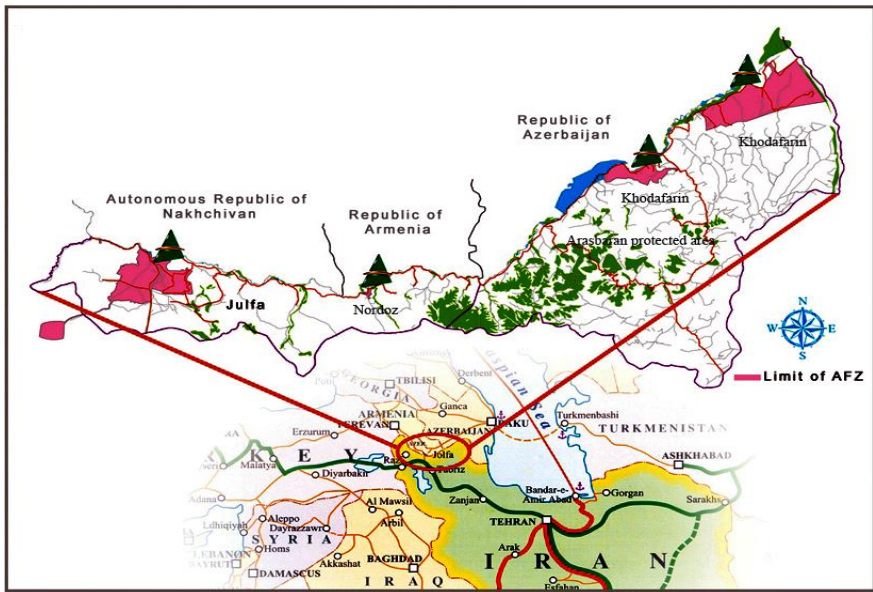


Figure 1. Map of Aras Free Zone limited area in Julfa, Nordoz and Khodafarin towns (Red portions which marked by green triangle with red line cutter as logo of AFZ official organization) at the border of Autonomous Republic of Nakhchivan, Armenia and Azerbaijan countries with Islamic Republic of Iran.

**OBSERVATIONS ON THE OVERWINTERING FORMS OF
SCOLYTUS AMYGDALI (COLEOPTERA: CURCULIONIDAE)
IN TUNISIA**

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[**Zeiri, A., Ayberk, H., Buhroo, A. A., Braham, M. & Braham, M.** 2015. Observations on the overwintering forms of *Scolytus amygdali* (Coleoptera: Curculionidae) in Tunisia. *Munis Entomology & Zoology*, 10 (1): 209-214]

ABSTRACT: The almond bark beetle, *Scolytus amygdali* is an economically important insect pest of many cultivated species of stone fruit trees grown in the Mediterranean region. During the winter in the center region of Tunisia, the activity of this beetle pest decreases and it overwinters in larval forms. The mean number of entrance holes during the winter was 31 (\pm 27.155). The attack number gradually decreased from October to December and it was significantly different during the sampling dates. The attack number and the date of sampling are negatively related. Same observation was noticed for the number of oviposition. The composition of the overwintering population of *S. amygdali* showed that the most available forms were; young larvae followed by old larval stages and pupal stages. Larvae of *S. amygdali* entered into overwintering behavior from late November. The life cycle of *S. amygdali* restarts when temperature goes warmer (late February).

KEY WORDS: Overwintering population, *Scolytus amygdali*, Tunisia.

The cultivated almond tree, *Prunus dulcis* (Mill.) is planted in all regions of Tunisia but has the greatest economic importance in the centre and south regions (Demangeon, 1932). This tree is attacked by many pests and diseases, among them the bark beetle *Scolytus amygdali* Geurin-Meneville 1847 (Coleoptera: Curculionidae) is considered as a serious insect pest (Cherif & Trigui, 1990; Zeiri et al., 2010; Zeiri et al., 2011a,b). The damage caused to infested trees is usually destruction of the phloem which results in death of the host tree (Avidov & Harpaz, 1969; Elzinga, 1997). This bark beetle is an economic insect pest of many cultivated species of stone fruit trees especially peach, plum, apricot, and almond throughout the Mediterranean region but only a few studies on this beetle have been carried out in Tunisia (Cherif & Trigui, 1990; Zeiri et al., 2010; Zeiri et al., 2011a,b). In Morocco, Benazoun (1983) gave a detailed study on its biology. However, despite the various studies of *S. amygdali* performed throughout the Mediterranean region few gave any specific information about the exact number of larval instars (Benazoun, 1983) or the forms of the overwintering population of this pest.

The aim of this study was to investigate the overwintering forms of *S. amygdali* and composition of the population during winter as a data gathering exercise to improve effective pest management.

MATERIAL AND METHODS

Insects and host material

We set up the experimental material for this study in an orchard in the center of Tunisia [09G29'00"; 39G59'40"] during the winter of 2010. Host trees were chosen randomly covering the entire orchard. Five healthy branches (50–60 cm long) were cut from different trees every week during the early winter starting from 23rd October 2010 until 29th November 2010 (when we found the active period of attack by *S. amygdali* stopped). We then installed the cut branches 1m from ground level on a randomly selected tree. The cutted experimental branches were spaced with equal distances between them and left for possible attack by *S. amygdali* in the field on different arbitrary trees. We recorded meteorological data for the experimental field daily.

Branch dissection

After fifteen days, the material was returned to the laboratory for dissection. Every week, three branches of each observation date were examined. At each examination the branches were examined for beetle entrance holes, each of which corresponded to one attack by a new pest insect. The attack rate was calculated by subtracting the initial hole count from the final hole count. This accumulation of entrance holes was converted to an estimation of pest density per unit area, based upon the assumption that the sample branch was a cylinder of measured circumference and height 50 to 60 cm.

For a descriptive analysis, the hole density was compared across dates by means of ANOVA tests, and probable correlation was studied using SPSS version 17.0.

The attack number (AN) was given to represent the number of maternal galleries. As there was no previous work about the precise number of larval instars of *S. amygdali*, analyzed larvae were divided into two groups: young larvae and mature larvae, based on size and distribution in the gallery system. The female fecundity (oviposition rate), the percentage of young larvae, the percentage of mature larvae, and the percentage of pupae under the bark were calculated for all dates.

RESULTS

Temperature and precipitation conditions of the experimental almond orchard

During October the temperatures ranged between a maximum of 26.7 °C and a minimum of 24.4 °C. The temperature started decreasing from November (21.6 °C) to January (17.5 °C). It started to rise again from February until it reached 20.5 °C in March.

Variation of entrance holes during the winter

The variation of the mean number of holes per branch counted by date of observation with the temperatures and the precipitation are shown in the Figure 1. The cumulative number of holes and its variation with date of observation shown in Figure 1 indicate that the rate of attack decreased as the winter progressed. The mean number of entrance holes during the winter was 31 (\pm 27.15) with a minimal and maximal values of 0 and 63 respectively. A sum of 155 holes has been counted in total.

Attack number and fecundity

The attack number (AN) per week ranged from a mean of 20.95 (\pm 0.78) on 23 October to 11.69 (\pm 4.36) on the 3rd November (Fig. 2). It again increased on 10

November and decreased by the end of the month until it reached 0 in December. The results shows a statistical difference for the number of attacks ($F = 61.10$; df (6); $P = 0.000$) and the fecundity represented by the number of eggs/female during the winter ($F = 7.10$; df (6); $P = 0.000$) over 6 months of sampling. There was a negative correlation between the sampling date and the number of attacks ($R = -0.24$; $P = 0.002$). The same observation was noted for the fecundity ($R = -0.15$; $P = 0.000$). On both criteria the level of infestation decreased through the winter as temperatures became lower.

Composition of the hibernation population of *S. Amygdali*

The composition of the overwintering population of *S. amygdali* in terms of percentage (Fig. 3) shows that the most abundant forms were young larvae followed by mature larval stages. We found pupal stages appearing from February onwards into March, when the temperature became warmer than the winter. Starting from March, adults of the winter generation began to emerge and search for suitable hosts for feeding and reproduction. Some pupal forms of the almond bark beetle were found during the winter (Fig. 4a) but it seems that most overwinter as young larvae or mature larvae (Figs. 4b,c,d) in hibernation tunnels (Fig. 5).

DISCUSSION

During the winter of 2010/2011, we found that larvae of *S. amygdali* entered into overwintering behavior from late November until February when pupal forms started to appear. The adult beetle attack activity estimated by the number of new entrance holes stopped during December, and there were no flying adults observed. A similar observation was made in the relation to the behavior of females in terms of the number of maternal galleries and fecundity, as measured by the number of larval side galleries. Both parameters decreased as temperatures became colder. The most commonly encountered overwintering forms were larval stages, which remained inactive throughout the winter and only resumed their activity from the second week of February of the following year when the temperature started to increase a little. Pupation occurred, and the first swarming adults appeared, from the end of March into the first week of April. Similar observations were reported for this pest in Tunisia in the region of Sfax (Cherif & Trigui, 1990). These authors noted that the overwintering forms were mainly larvae, with a few pupae and emergence of overwintering forms was in March (Cherif & Trigui, 1990). In Morocco, the winter generation of *S. amygdali* was seen to fly in February (or early March) to the end of April (Benazoun, 1983). Buhroo & Lakatos (2007) noticed similar behavior in the related *Scolytus nitidus* which overwinters in its larval stages from the last week of November to the end of February, with the first swarming adults appearing in the third week of April. Observations of *S. scolytus* on elm (Beaver, 1967) and of *S. mali* on apple (Rudinsky et al., 1978), also recorded overwintering in the larval stages. However, Masood et al. (2009) revealed that the mango bark beetle, *Hypocryphalus mangiferae* overwintered as an immature adult under the phloem from late November to early February to avoid temperatures as low as 15 °C resuming its activity in mid-January. Another strategy is found in the banded elm bark beetle, *Scolytus schevyrewi*, which overwinters as pupae or as newly eclosed adults under the bark that then emerge from April to May (Li et al., 1987; Yang et al., 1988; Wang, 1992; Liu & Haack, 2003).

It is likely that the differences in the overwintering behavior of bark beetle species can be explained by a combination of species-specific variation and

different environmental factors as well the variation of the biochemical composition of host trees (Ayberk & Cebeci, 2010). Information on the timing of hibernation and the life stages involved should help in programs to control the almond bark beetle. This work suggests that more detailed studies are needed in order to understand better its biology and to prepare a strong database to fight this pest attacking many important economic trees and also forest trees.

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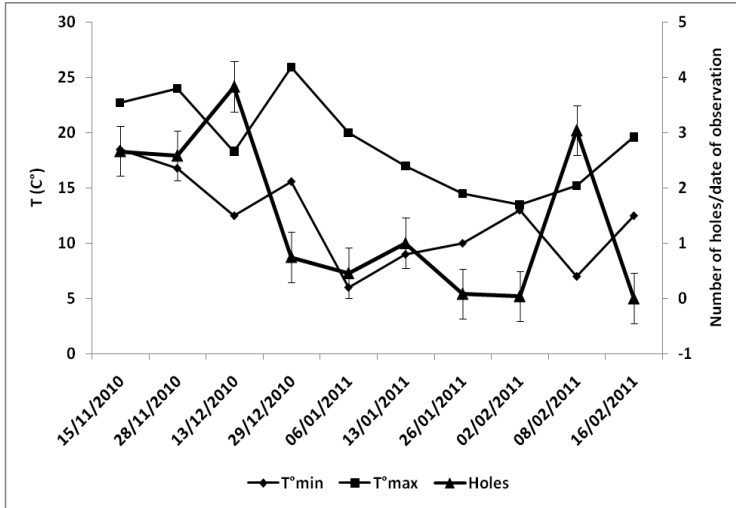


Figure 1. Evolution of cumulated holes, entrance holes of *S. amygdali* with temperature and precipitation during the winter.

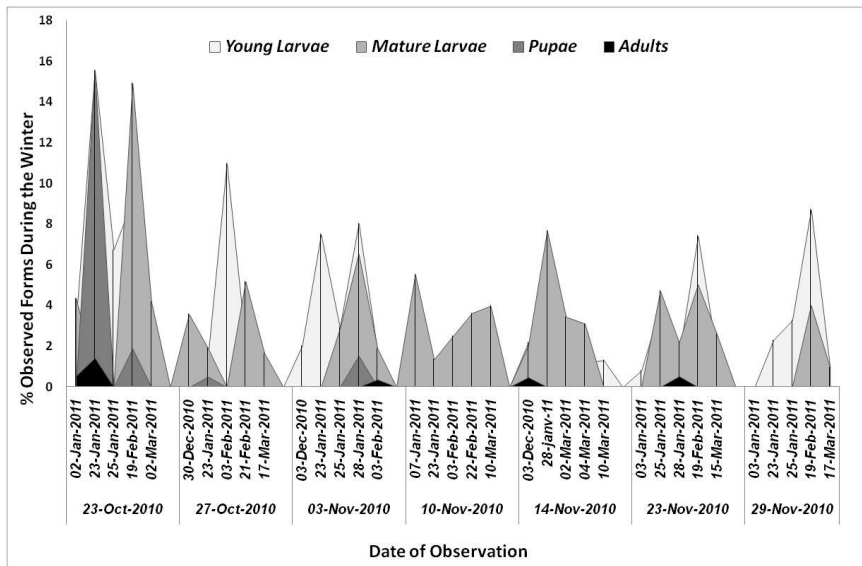


Figure 2. Variation of the attack number and fecundity during the winter.

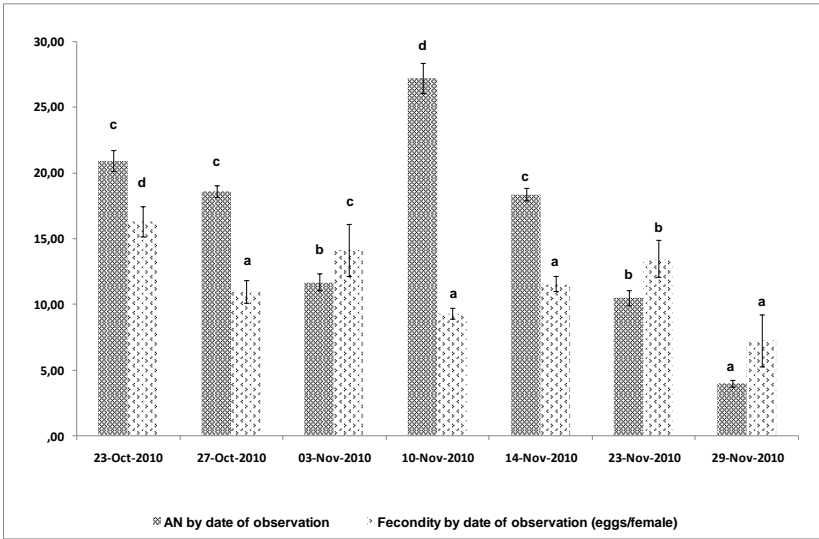


Figure 3. Composition of the overwintering population of *S. amygdali* (in percentage).



Figure 4. Hibernation forms of *S. amygdali* under the Scanning Electron Microscope: a. pupa in dorsal view, b. larva in ventral view, c. larva in lateral view, d. larval cephalic capsule in lateral view.

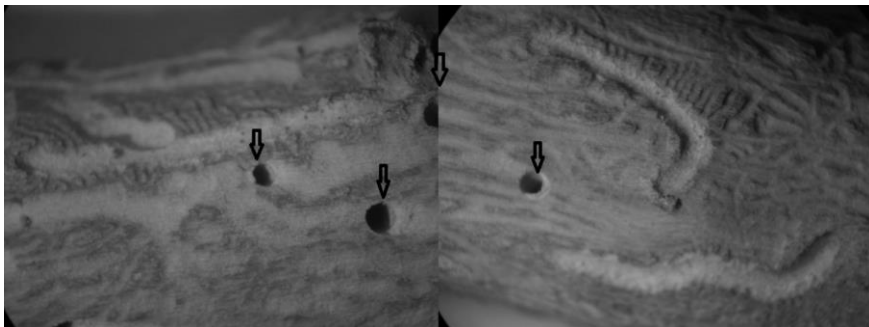


Figure 5. Hibernation tunnels of *S. amygdali* in the sapwood of host.

**BIOLOGY AND MORPHOMETRY OF *SPODOPTERA LITURA*
FABRICUS, A SERIOUS DEFOLIATOR OF MANGO
(*MANGIFERA INDICA*) IN JAMMU REGION (J&K)**

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[Gupta, M., Tara, J. S., Sharma, S. & Bala, A. 2015. Biology and morphometry of *Spodoptera litura* Fabricus, a serious defoliator of Mango (*Mangifera indica*) in Jammu Region (J&K). Munis Entomology & Zoology, 10 (1): 215-221]

ABSTRACT: *Spodoptera litura* is an important polyphagous pest in India. It is serious pest of various economically important crops including mango and biology of *Spodoptera litura* was studied in detail on mango during the period of March, 2012 to February, 2013 in Jammu. *Spodoptera litura* underwent the holometabolous type of development and the studies on biology of *S. litura* indicated that on an average female moth laid 200-250 eggs in her life span. The duration of egg, larvae, and pupa lasted for an average of 5.0±0.00 days, 15.45±1.14 and 9.37±1.37 days. The Adult male and female survived for a period of 7-9 days with an average of 8.32±0.20 days. The total life cycle from egg laying to adult emergence completes in 27-31 days with an average of 28.81±1.99 days. The adult female and male are hairy. The female is pale brown while the male is darker. The female is bigger with a stout abdomen while the male is narrower and tapering towards the tip.

KEY WORDS: Mango, *Spodoptera litura*, biology and morphometry.

India is basically an agro-based country where more than 80% of Indian population depends on agriculture. Mango (*Mangifera indica* L.) is known as "king of fruits". It belongs to family Anacardiaceae (Singh, 1968; Litz, 1997). It is one of the most important trees on the earth and is now consumed worldwide. Mango is an important tropical fruit, which is being grown in more than 100 countries of the world (Sauco, 1997). But its original home is South Asia where it has been grown for the last four thousand years (Salunkhe & Desai, 1984). It is an ancient fruit of Indo-Pakistan sub-continent and is of great importance for millions (Singh, 1968; Litz, 1997). It is nutritionally rich in carbohydrates and vitamins A and C. Insects are known to cause significant damage to mango and affect agricultural productivity. One of them is *Spodoptera litura* which is an important pest of mango in India. It is also a serious pest of various other economically important crops such as cotton, groundnut, chilli, tobacco, castor, bendy and pulses etc. (Armes et al., 1997; Niranjankumar & Regupathy, 2001). It was found to cause 26 - 100 % yield loss in ground nut (Dhir et al., 1992).

MATERIAL AND METHODS

The study was conducted during the year 2012-13 in the laboratory at room temperature at Jammu University campus, (J&K), India. The insect larvae were collected from mango plantations of the area and reared in the laboratory. After emergence of adults, they were allowed to copulate separately in wire meshed cages. Each pair was observed for pre-mating, mating, pre-oviposition and oviposition behaviour and duration. Longevity of adults was also recorded. The moths have the characteristic feature of laying eggs in masses. The egg was measured and their diameter was measured by means of an ocular micrometer

after calibration. Egg was kept under laboratory conditions for incubation in Petri dishes.

Newly hatched larvae were then transferred to sterile paired petri dishes, lined with moist filter paper and provided with fresh mango leaves. The food and filter paper lining were changed after every third day during the first and second larval instars and later on food was changed daily and filter paper lining on alternate days. Larvae were observed daily and data was recorded with regards to moulting, duration and size of each larval instar, pupation and pupal period. All life stages were recorded morphometrically. Observations were recorded with regards to emergence and fecundity. Morphometric measurements were recorded using standard graphic paper method. For the study of different instars, the head capsule width was measured with the help of an oculometer. Data gathered during the experiment was analyzed statistically for calculating mean, standard deviation and standard error.

RESULTS AND DISCUSSIONS

Distribution

S. litura is distributed widespread in Asia, Oceania, North America (USA: Hawaii only) (EPPO, n.d.), Russia and UK (Aitkenhead et al., 1974).

Hosts

Spodoptera litura was first recorded from New Zealand as a pest of tobacco and it has appeared in significant numbers in home garden and on crops (Cottier & Gourlay, 1955). It is a member of the economically important polyphagous pest that a serious attack many crop plants. The host range of this species covers over 40 families of economic importance crop species (Salama et al., 1970). Among the main crop species attacked in the tropics are *Colocasia esculenta*, cotton, flax, groundnuts, jute, lucerne, maize, rice soybeans, tea, tobacco, vegetables (aubergines, *Brassica*, Capsicum, cucurbit vegetables, *Phaseolus*, potatoes, sweet potatoes, *Vigna* etc.). Other hosts include ornamentals, wild plants, weeds and shade trees (e.g. *Leucaena leucocephala*, the shade tree of cocoa plantations in Indonesia).

LIFE CYCLE OF *SPODOPTERA LITURA*

Mating behavior

Prior to mating, male actively initiates the activity. It flies several times above the female. When it stops flying, it lands close to the female. The male gradually moves by walking close to the female. Using the antennae, the male touches the female. The male quickly mounts the female and soon there is a downward movement of the insect antennae. Before a successful mating, the male courts the female for a period of 10 to 20 minutes. The male uncoiled the proboscis during mating but returns to its original form as soon as the copulation is finished. Copulation lasts for 2-3 hours.

Oviposition

The oviposition site is first located by the female. After the site was identified, the insect cleans the leaf surface area by wiping using the tip of the abdomen. The eggs are laid in mass under the shade near the petiole. A way of protecting the egg from possible predators and adverse weather factors, the mass of egg is covered by a scales which according to Paris (1968) come from the mother abdomen during the act of oviposition. The eggs are deposited in layers of 2-3. When disturbed, oviposition stops and again continues after few minutes.

Egg (Fig. 1)

The freshly laid eggs by the female are ovoid pale yellow in color slightly flattened on one side. The egg measures about 0.5 mm in diameter and 0.3 mm in height. The number of eggs per mass varies considerably but is often 100 to 200 in batches and covered with hairy scales from the tip of the abdomen of the female moth. Duration of the egg stage is only two to three days. When the eggs are about to hatch the egg turns blackish which is the developing head of the larvae.

Incubation period and hatching

One day prior to hatching, the dark head of the young larva was observed inside the egg shell. Incubation period varies from 6-8 days with an average of 7.38 ± 1.09 . Tara (1983) recorded 2 days as the incubation period, Cardona et al. (2007) recorded the incubation period as 5.0 days and Shukla and Patel (2011) reported 4.0 in the laboratory.

Larvae and number of instars**1st instar larvae (Fig. 3)**

Freshly hatched larvae are cylindrical, soft, pale yellow with many papillae on its body. Head black in colour, orthognathus, distinct, prominent. Body consists of 3 thoracic and 10 abdominal segments. Mouth parts small, biting and chewing type. The larva is hairless, sides of body with dark and light longitudinal bands; dorsal side with two dark semilunar spots laterally on each segment, except for the prothorax; spots on the first and eighth abdominal segments larger than others, interrupting the lateral lines on the first segment. Though the markings are variable, a bright-yellow stripe along the length of the dorsal surface is characteristic of *S. litura* larvae. The length of the newly hatched larvae varies between 1.82-2.35 mm with an average of 2.05 ± 0.26 , width varies between 0.30-0.38 mm and the head capsule measured 0.24-0.27 mm with an average of 0.25 ± 0.00 mm (Table 1). The 1st instar takes 2-3 days with an average of 2.5 ± 0.5 days to enter into next instar (Table 2).

2nd instar (Fig. 4)

The 2nd instars are smooth-skinned with a pattern of red, yellow and green lines, and with a dark patch on the mesothorax. They initially only eat the flesh of mango leaves, leaving the veins intact. They become brown with three thin yellow lines down the back (one in the middle and one on each side). During the 2nd instar, the body length of the larva measures 3.52-5.38 mm with an average of 4.3 ± 0.96 mm, width varies between 0.87-1.15 mm with an average of 1.07 ± 0.07 mm and the head capsule measured 0.36-0.40 mm with an average of 0.40 ± 0.00 mm (Table 1). The 2nd instar takes 3-5 days with an average of 3.75 ± 1.08 days to enter into next instar (Table 2).

3rd instar (Fig. 5)

As it grew bigger the larva became black in color with three thin yellow lines down the back, one in the middle and one on each side. A row of black dots run along its side and conspicuous row of dark triangle decorated its sides. During the third instar, the body length of the larva measures 7.00-13.10 mm with an average of 9.34 ± 2.81 mm, width varies between 2.00 -2.76 mm with an average of 2.45 ± 0.23 mm and the head capsule measured 0.63-0.74 mm with an average of 0.67 ± 0.00 mm (Table 1). The 3rd instar takes 2-4 days with an average of 3 ± 0.9 days to enter into next instar (Table 2).

4th instar (Fig. 6)

The larva became brown in color with three thin yellow lines down the back one in the middle and one on each side. A row of black dots run along its side and conspicuous row of dark triangle decorate its sides. During the fourth instars, the body length of the larva measures 22.60-25.93 mm with an average of 24.02 ± 1.52

mm, width varies between 3.20-4.20 mm with an average of 3.70 ± 0.70 mm and the head capsule measured 1.10-1.20 with an average of 1.14 ± 0.00 mm (Table 1). The 4th instar takes 3-5 days with an average of 3.95 ± 0.75 days to enter into next instar (Table 2).

5th instar (Fig. 7)

The larva gets bigger in size and secretes green colored fluid when disturbed. It is brown in color with three thin yellow lines down the back, one in the middle and one on each side. A row of black dots run along its side and conspicuous row of dark triangle decorated its sides. When disturbed, the caterpillar curls into a tight spiral with the head protected in the centre. During the fourth instar, the body length of the larva measures 26.0-33.00 mm with an average of 29.33 ± 3.01 mm, width varies between 5.20-6.43 mm with an average of 5.81 ± 0.86 mm and the head capsule measured 1.40-1.60 mm with an average of 1.52 ± 0.84 mm (Table 1). The 5th instar takes 4-5 days with an average of 4.87 ± 0.85 days to enter into prepupal and then pupal stage (Table 2).

Pupa (Fig. 10)

The pupa is elongated and oval in shape. The eyes and antennal case is prominent. The pupa is red in colour. The abdomen is movable. Tara (1983) has recorded the color of the prepupa as pale yellowish. The normal prepupal period lasts for one day. The freshly formed pupa was yellowish and gradually reached to dark brown. The total pupal duration ranged between 8-11 days with an average of 9.37 ± 1.37 days in the laboratory. The pupal length measures about 11.0-15.49 mm and a body width of 15.36 ± 4.91 mm. Pupa takes 8-11 days with an average of 9.37 ± 1.37 days to enter into adult stage (Table 2).

Adult stage (Figs. 11, 12)

The adult is hairy and brown in colour. The head, thorax, and abdomen are distinct. The antennae and legs are light brown. It has a very prominent rounded bluish black eyes occupying almost 1/3 of the facial head. Two long segmented antennae are located dorsally on the head and close to the compound eyes. It has grey to brown margins with pale veins. The lower edges of the wings are surrounded with hairs.

The female is generally bigger than the male. The abdomen of female is blunt while the abdomen of male is narrower and pointed. In terms of body color, the female is pale brown and the male was darker in color (Fig. 11, 12).

Nature of damage

The larvae feed voraciously and cause significant damage to the tree thereby affecting growth and vigour of the plant. The larva on hatching feeds on the soft parenchyma of the young leaves but acquires soon the power of biting through the smaller veins and cuts a small semicircular or rectangular flap out of the edge of the leaf which it pulls over and fastens to the upper leaf surface. The later instar larvae are voracious feeders. The whole of the green leaf tissue is destroyed by the larvae, only the largest ribs being left, with small portions of uneaten green tissue. In Jammu conditions, the larvae remain active in field from March- August with peak activity period observed during mid April- July. During this period, it causes maximum damage to the tree.

Tara (1983) has also reported the extent of damage made by *Spodoptera litua* on mulberry plantations in Jammu region. Cordona et al. (2007) has also reported that the first and second instar larvae were found to skeletonise the leaf, whereas third instar larvae consume the tender leaves entirely. The fourth and fifth instar larvae were found to feed entire leaf leaving only veins. Shukla & Patel (2011) has also found the similar damage on banana plantations.

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The authors are greatly thankful to Professor K.K.Sharma Head, Department of Zoology, and University of Jammu for providing necessary facilities to work.

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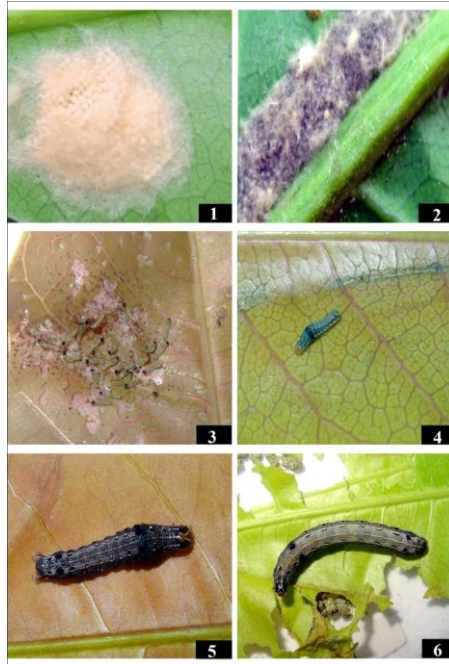
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Table 1. Body length of each instar immediately after ecdysis and head capsule width.

Developmental stages	Length (mm)		Width (mm)		Head capsule width (mm)	
	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE
Egg	0.5-0.6	0.55±0.07	0.2-0.3	0.25±0.07		
Larvae						
1 st instar						
2 nd instar	1.82-2.35	2.05± 0.26	0.30- 0.38	0.34± 0.03	0.24-0.27	0.25± 0.00
3 rd instar	3.52-5.38	4.3±0.96	0.87 -1.15	1.07 ±0.07	0.36-0.40	0.40 ±0.00
4 th instar						
5 th instar	7.00-13.10	9.34±2.81	2.00 -2.76	2.45 ±0.23	0.63-0.74	0.67 ±0.00
Pupa	22.60-25.93	24.02±1.52	3.20-4.20	3.70 ±0.70	1.10-1.20	1.14 ±0.00
Adult	26.0-33.00	29.33±3.01	5.20-6.43	5.81± 0.86	1.40-1.60	18.2 ±0.84
Male	11.0-15.49	15.36±4.91				
Female						
	5-7	6.00±0.79				
	6-10	7.75±1.54				

Table 2. Duration of *spodoptera litura* development.

Developmental stages	Duration(days)	
	Range	Mean±S.E
Egg	5-6	5.5±0.5
Larval instars		
1 st instar	2-3	2.5±0.5
2 nd instar	3-5	3.75±1.08
3 rd instar	4-6	4.87±0.85
4 th instar	2-4	3±0.91
5 th instar	3-5	3.95±0.75
Total larval period	14-17	15.45±1.14
Pre pupal period	2-3	2.5±0.5
Pupa	8-11	9.37±1.37
Adult longevity	7-9	8.32±0.20
Total life cycle	36-50	28.81±1.99



Figures 1. Freshly laid egg of *spodoptera litura*, 2. Eggs ready for hatching, 3. 1st instar larva, 4. 2nd instar larva, 5. 3rd instar larva, 6. 4th instar larva.



Figures 7. 5th instar larva, 8. Prepupation (dorsal view), 9. Prepupation (ventral view), 10. Pupa, 11. Adult male, 12. Adult female.

DORCADION (CRIBRIDORCADION) OBSOLETUM KRAATZ, 1873 REST. NOV. (CERAMBYCIDAE)

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[**Özdikmen, H. & Kaya, G.** 2015. *Dorcadion (Cribridorcadion) obsoletum* Kraatz, 1873 rest. nov. (Cerambycidae). *Munis Entomology & Zoology*, 10 (1): 222-224]

ABSTRACT: With the present work, *Dorcadion (Cribridorcadion) obsoletum* Kraatz, 1873 rest. nov. is discussed and regarded as a separate species again.

KEY WORDS: *Dorcadion (Cribridorcadion) obsoletum*, rest. nov., Cerambycidae, Turkey.

***Dorcadion obsoletum* Kraatz, 1873 rest. nov.**

The taxon was originally described by Kraatz (1873) as a variety of *Dorcadion graecum* Kraatz, 1873. According to Breuning (1962), it is a separate species. Recently, it is accepted as a synonym of *Dorcadion olympicum olympicum* Kraatz, 1873 (e.g. Löbl & Smetana, 2010).

Dorcadion olympicum has three subspecies as the nominotypical subspecies, *D. olympicum convexum* Breuning, 1943 and *D. olympicum flavosuturale* Krätschmer, 1987 now. All taxa were originally described from Bursa province and near in NW Anatolia. Each taxon is endemic to Turkey now.

Ganglbauer (1882) stated that its type locality is Bursa in NW Turkey due to mislabeled type specimen. And then, he gave a replacement name, "*olympicum*", for the homonym name "*graecum*" Kraatz, 1873 (not Waltl, 1838). According to original description of Kraatz (1873), however, type locality of *Dorcadion graecum* is İstanbul (Turkey) and Greece (not Bursa). Therefore, *Dorcadion obsoletum* never distributes in Anatolia for Turkey. It is distributed only in European Turkey and NE Greece and also Bulgaria.

Consequently, *Dorcadion obsoletum* should be a separate species, not synonym of *Dorcadion olympicum*.

***Dorcadion obsoletum* Kraatz, 1873: 78** (*graecum* var.) (Holotype ♂, ex collection G. Kraatz, Deutsches Entomologisches Institut, Eberswalde) [type locality "Bursa" (Turkey), but not Bursa, according to Kraatz with İstanbul (Turkey) and Greece] E: BU GR TR

obsoletoides Breuning, 1946: 111 (*D. obsoletum* m.) [Greece: Thrace: Ferre]

Known distribution of *D. obsoletum* Kraatz, 1873 in Turkey: İstanbul prov. As the type loc. of *Dorcadion graecum* (Kraatz, 1873); İstanbul prov.: Belgrad Forest, Alem Mt. as *D. olympicum* (Bodemeyer, 1906).

***Dorcadion olympicum* Ganglbauer, 1882: 228**

***Dorcadion olympicum convexum* Breuning, 1943: 90** (Holotype ♂, ex collection S. Breuning, Muséum d'Histoire Naturelle de Genève) [type locality "Achu Dagh (Simav: Akdağ)" (Turkey: Kütahya)] A: TR

Known distribution of *D. olympicum convexum* Breuning, 1943 in Turkey: Kütahya prov.: Simav: Akdağ (Breuning, 1943, 1962); Anatolia (Danilevsky in Löbl & Smetana, 2010).

***Dorcadion olympicum flavosuturale* Krätschmer, 1987: 340** (Holotype ♂, collection Otto Erich Krätschmer, München) [type locality “Mustafakemalpaşa: Gölyazi: Uluabat Lake” (Turkey: Bursa)] A: TR

Known distribution of *D. olympicum flavosuturale* Krätschmer, 1987 in Turkey: Bursa prov.: Mustafakemalpaşa: Uluabat lake as the type locality of *D. olympicum flavosuturale* (Krätschmer, 1987); Anatolia (Danilevsky in Löbl & Smetana, 2010).

***Dorcadion olympicum olympicum* Ganglbauer, 1882: 228** (Lectotype ♂, ex collection G. Kraatz, Deutsches Entomologisches Institut, Eberswalde) [type locality “Bursa” (Turkey)] A: TR

subalpinum Kraatz, 1873a: 78 [Turkey: Bursa: Osmangazi: Uludağ]

oreophilum Ganglbauer, 1884: 500 (*D. olympicum* var.) [Turkey: Bursa: Uludağ]

brussense Breuning, 1946: 112 (*D. olympicum* m.) [Turkey: Bursa]

quinquefasciatum Breuning, 1946: 112 (*Dorcadion olympicum* m.) [Turkey: Bilecik]

Known distribution of *D. olympicum olympicum* Kraatz, 1873 in Turkey: Bursa prov. (Ganglbauer, 1884; Aurivillius, 1921); Bursa prov. as *D. olympicum* v. *oreophilum* (Ganglbauer, 1884); Anatolia (Winkler, 1924-1932); Bursa prov.: Uludağ, Bilecik prov. (Breuning, 1962); Bursa prov.: Uludağ as *D. olympicum* m. *oreophilum* Ganglbauer (Demelt, 1963); Bursa prov.: Uludağ (Braun, 1978; Adlbauer, 1988); Turkey (Lodos, 1998); Anatolia (Danilevsky in Löbl & Smetana, 2010).

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Figure 1. Known type localities of *Dorcadion obsoletum* (hegzagonal sign), *Dorcadion olympicum convexum* (square sign), *Dorcadion olympicum flavosuturale* (star sign), *Dorcadion olympicum olympicum* (circle sign) (The satellite map from google earth).

REGULATION OF TWEEDLE CUTICULAR PROTEIN GENE EXPRESSION AT THE PRE-PUPAL STAGE IN WING DISCS OF *BOMBYX MORI*

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ABSTRACT: The present study was undertaken to clarify the regulatory mechanism of *Bombyx mori* tweedle cuticular protein gene expressed in wing discs at pre-pupal stage with special emphasis to developmental expression and hormonal responsiveness. The tweedle cuticular protein genes *BmorCPT2* and *BmorCPT3* were selected for the study. The expression of *BmorCPT2* was observed from the W3E stage and peaked at pupation when the ecdysteroid titer declined. After pupation suddenly expression decreased. Whereas the transcripts of *BmorCPT3* increased from the W3M stage, peaked at W3L, and then decreased rapidly from P0 when the ecdysteroid titer decreasing. *BmorCPT3* was induced by the ecdysone pulse, and its expression peaked 18h after transfer to a hormone free medium. *BmorCPT2* was also induced by the ecdysone pulse, and its expression peaked 24 h after transfer to a hormone free medium. The peak of *BmorCPT2* expression was observed later than that of *BmorCPT3* both in vivo and in vitro. Both genes, *BmorCPT2* and *BmorCPT3* transcripts were not observed after the 20E pulse treatment in the presence of cycloheximide. Transcripts of *BmorCPT3* increased by the addition of 20E in V4 wing discs. On contrary, *BmorCPT2* transcript was not observed after the addition of 20E in V4 wing discs which is different from the case of *BmorCPT3*. The expression profiles of *BmorCPT2* are different from those of *BmorCPT3*. The present findings showed different regulation of tweedle cuticular protein genes at the pre-pupal stage in wing discs of *Bombyx mori*.

KEY WORDS: Tweedle cuticular protein, ecdysone, wing disc, gene expression, *Bombyx mori*.

Insect cuticle is composed of many kinds of cuticular proteins with different temporal and spatial patterns (Willis, 1996). Stage specific expression of the cuticle protein genes is induced by the fluctuation of hormones. Ecdysone up-regulates (Braquart et al., 1996; Noji et al., 2003) and down-regulates (Hiruma et al., 1991) or ecdysone pulse induces (Apple and Fristrom, 1991; Suzuki et al., 2002; Noji et al., 2003; Zhong et al., 2006) different ecdysone responsive cuticle protein genes (Riddiford, 1982; Bouhin et al., 1992; Krämer & Wolbert, 1998; Zhou & Riddiford, 2002). β FTZ-F1 has been suggested to be a regulator responsible for the stage-specific expression of cuticle protein genes during the prepupal stage (Kawasaki et al., 2002). The timing of β FTZ-F1 expression has been reported to be affected by DHR3 and Blimp-1 (Lam et al., 1997; White et al., 1997; Agawa et al., 2007). After being expressed, β FTZ-F1 has also been found to positively regulate the pupal cuticle protein gene, *Edg84A*, during the mid- to late- prepupal period (Murata et al., 1996). Studies with mutants have shown that β FTZ-F1 was required for normal larval cuticle production (Yamada et al., 2000). Bm β FTZ-F1, an ortholog of β FTZ-F1 of the silkworm *Bombyx mori*, was expressed during larval, pupal molts and adult development, in coincidence with an ecdysone pulse (Sun et al., 1994; Nita et al., 2009). Although an earlier study proposed that Bm β FTZ-F1 was a possible

factor directing the stage-specific expression of the peptide gene *BmACP-6.7* (Shiomi et al., 2000), but the detailed role of *BmbFTZ-F1* in tweedle cuticular protein gene expression regulation has not been elucidated.

In *Manduca*, E74A was induced by the ecdysone pulse and was expressed before larval and pupal ecdysis (Stilwell et al. 2003). Target genes of E74 were identified by the confirmation of E74 binding to the upstream region of the L71-6 gene (Urness & Thummel 1995), or by the inhibition of the vitellogenine gene expression by E74B RNAi (Sun et al. 2005). A relationship of E74 to cuticular protein gene expression was suggested using E74 mutation (Fletcher & Thummel 1995).

Insect genomic sequences also brought about the comprehensive analysis of cuticular-protein gene expression (Togawa et al., 2008) and the analysis of its regulation by transcription factors (Ali et al., 2012a; Ali et al., 2012b; Ali et al., 2013). Cuticular protein genes have different expression profiles (Togawa et al., 2008) and regulatory systems by ecdysone-responsive transcription factors (Ali et al., 2013). From this, insect cuticular protein genes are suggested to be the suitable material to clarify the regulatory mechanism of ecdysone-responsive transcription factors.

The majority of cuticular proteins have the Rebers and Riddiford Consensus (R&R Consensus), which in an extended form is known to bind chitin (Rebers and Willis, 2001; Togawa et al., 2004; Willis et al., 2005). Proteins with R&R Consensus can be split into three groups, RR-1, RR-2, and RR-3, with some correlation to the type or region of the cuticle. Recently, other motifs of cuticular proteins have been reported. In *Drosophila melanogaster*, the Tweedle motif was found by identification of a body shape mutant (Guan et al., 2006). Because Tweedle proteins are predicted to form β -strands, and because a barrel structure formed by multiple β -strands provides an interface for aromatic residues to stack with and bind to chitin (Iconomidou et al., 1999; Hamodrakas et al., 2002), studies have postulated that Tweedle proteins interact directly with chitin (Guan et al., 2006). The present study was conducted on *Bombyx mori* tweedle cuticular protein genes, *BmorCPT2* and *BmorCPT3* expression and ecdysone responsiveness in wing discs at the pre-pupal stage to analyze their regulatory mechanism.

MATERIALS AND METHODS

Insects

The *B. mori* larvae were reared at 25°C under a 12-h light: dark cycle. Larvae began wandering after the sixth day of the fifth larval instar, and pupation occurred 3 days later. The first day of the fifth larval instar was designated as V0 with the following feeding phases from V1 to V6 correspondingly until the beginning of wandering, which is W0. The following three days before pupation was designated as W1–W3. The W3 stage was divided into three different stages, W3 early (W3E), W3 mid (W3M), and W3 late (W3L). The W3 stages are determined on the time and visible shortening of the length of the leg. The newly emerged pupa was designated as P0 and the following consecutive days were designated as P1–P9.

BLAST search of genomic sequences of cuticular protein genes

The cDNA sequences of *BmorCPT2* and *BmorCPT3* were used for BLAST search analysis. BLASTsearch was operated using genomic database of *B. mori* (<http://kaikoblast.dna.affrc.go.jp/>). The binding sites of β FTZ-F1 and E74 were identified through the sequences by referring to previous studies (Ueda & Hirose 1990; Urness & Thummel 1990) and a website (<http://www.genomatix.de/en/index.html>).

***In vitro* culture of wing discs**

Wing discs of larvae at the V4 and W2 stages were prepared for the *in vitro* culture. For wing disc preparation, the fat body and trachea were carefully removed under a microscope. The culture was carried out according to a previous report (Kawasaki, 1989) at 25 °C under sterile conditions. We conducted *in vitro* induction at various times following administration of 2 µg/ml 20E to V4 wing discs and after cessation of a 12 h pulse of 2 µg/ml 20E to discs from W2. The necessity of protein synthesis for induction was tested in the cultured discs by administration of 50 µg/ml cycloheximide from the start of culture (V4) or at the time of 20E removal (W2).

RNA sample preparation and first-strand cDNA synthesis

To determine the expression levels of the CP genes and transcription factors, total RNA was extracted at distinct stages from wing discs using RNAiso (Takara, Japan) and quantified by spectrophotometry at 260 nm. First-strand cDNA was synthesized from 1 µg total RNA in a 10 µl reaction mixture using ReverTra Ace (Toyobo, Japan).

Real-Time PCR

Real-Time PCR was conducted on an ABI7500 real-time PCR machine (Applied Biosystems) using the FastStart Universal SYBR Green Master (Roche). Each amplification reaction was performed in a 25 µl qRT-PCR reaction under the following conditions: denaturation at 95 °C for 10 min followed by 40 cycles of treatment at 95 °C for 10 sec and at 60 °C for 1 min. Ribosomal protein S4 (*Bmrpl*: GenBank accession no. NM_001043792) was used as a control gene. The data were normalized by determination of the amount of *Bmrpl* in each sample to eliminate variations in mRNA and cDNA quality and quantity. The transcript abundance value of each individual was the mean of three replicates. Each pair of primers was designed using Primer3 software (<http://frodo.wi.mit.edu/>). The specificity of the primers was confirmed using NCBI BLAST (BLASTN) algorithms. The primers used were

BmorCPT2: 5′-GTGGTACTCGCCTGTGTGG-3′

and 5′-GCCGCTGATAGAGGAAGAGC-3′

BmorCPT3: 5′-TTCTTGGTATTAGCTGCCGTTG-3′

and 5′-CTCCCGGCGCATTGTAAG-3′

Rpl: 5′-GATTCACAATCCACCGTATCACC-3′

and 5′-CCATCATGCGTTACCAAGTACG-3′

Gene Bank accession No. of these genes are follows;

BmorCPT2: BR000651, *BmorCPT3*: BR000652 *Rpl*: nm_001043792.

RESULTS

In the present study we examined the induction of cuticular protein *BmorCPT3* and *BmorCPT2* in several ways. We examined mRNA levels during normal development; we monitored induction *in vitro* at various times following administration of 20E to V4 wing discs and after cessation of a 12 h pulse of 20E to discs from W2. The necessity of protein synthesis for induction was tested in the cultured discs by administration of cycloheximide from the start of culture (V4) or at the time of 20E removal (W2).

BmorCPT3 transcripts increased gradually after the beginning of wandering W3M stage and peaked at W3 late stage (Fig. 1A) when the ecdysteroid titer decreasing. A similar expression peak was induced by the ecdysone pulse *in vitro* (Fig. 2A). *BmorCPT3* transcripts increased 12 h after removal of 20E, peaked at 18

h, and then decreased. An increase of *BmorCPT3* transcripts was not observed after 20E pulse treatment in the presence of cycloheximide (Fig. 2A), which indicates that the induction of *BmorCPT3* requires 20E-inducible factors. To determine whether the induction of *BmorCPT3* mRNA was mediated directly or indirectly by 20E, wing discs were cultured with 20E in the presence or absence of the protein translation inhibitor cycloheximide, and *BmorCPT3* mRNA was assessed by real-time PCR. *BmorCPT3* transcripts increased after 20E addition (Fig. 3). Induction was not observed in the presence of cycloheximide. Thus, *BmorCPT3* gene was upregulated by the 20E addition (Fig. 3).

Previously (Ali et al., 2013) reported that the transcripts of *E74A* increased from the W₃M stage, peaked at W₃L, and then decreased rapidly from P₀. Transcripts of *E74A* increased by the addition of 20E and were slightly inhibited by the addition of cycloheximide in the 20E-containing medium. *E74A* transcripts was induced by ecdysone pulse, which were not observed by the addition of cycloheximide. *E74A* transcripts showed expression peak at 18h after 20E removal (Ali et al., 2013). So, the expression pattern of *BmorCPT3* resembled that of *E74A*.

We compared the expression of *BmorCPT2* using the same conditions as above. Expression of *BmorCPT2* was observed from the W₃E stage and peaked at pupation when the ecdysteroid titer decreased; it then suddenly decreased after pupation (Fig. 1B). *BmorCPT2* was also induced by the ecdysone pulse, and its expression peaked 24 h after transfer to a hormone free medium (Fig. 2B). The peak of *BmorCPT2* expression was observed later than that of *BmorCPT3* both in vivo and in vitro. The *BmorCPT2* transcript was not observed after the 20E pulse treatment in the presence of cycloheximide. It was not observed either after the addition of 20E in V₄ wing discs (data not shown), which is different from the case of *BmorCPT3*.

Cuticular protein gene, *BmorCPT2* showed a similar expression pattern with β FTZ-F1 (Ali et al., 2013); Transcripts of β FTZ-F1 was increased from the W₃E stage, peaked at the P₀ stage, increased 6 h after 20E removal, and peaked at 24 h in vitro (Ali et al., 2013). The timing of peak expression was similar to that of *BmorCPT2*. *BmorCPT2* was not expressed by the addition of 20E in the V₄-stage wing discs or by the ecdysone pulse treatment in the presence of cycloheximide. This *BmorCPT2* responsiveness is same to that of β FTZ-F1 shown in previous reports (Sun et al., 1994; Zhong et al., 2006; Ali et al., 2013). Thus, the developmental expression and ecdysone-responsiveness of *BmorCPT3* and *BmorCPT2* resembled *E74A* and β FTZ-F1, respectively.

The expression of *BmorCPT3* and *BmorCPT2* was compared schematically in Fig. 4. As observed, *BmorCPT3* transcripts appeared, increased and peaked earlier than those of *BmorCPT2*.

As the developmental expression and ecdysone-responsiveness of *BmorCPT3* and *BmorCPT2* resembled *E74A* and β FTZ-F1, respectively. Then we performed searching upstream region of cuticular protein genes, *BmorCPT3* and *BmorCPT2* derived from wing disc ESTs to compare the upstream regulatory sequences and whether there is present or not *E74A* and β FTZ-F1 binding sites in the upstream promoter region of *BmorCPT3* and *BmorCPT2* respectively. These promoter region for different cuticular protein genes were performed and made clear the regulatory mechanism of cuticular protein genes by ecdysone responsive transcription factor (Ali et al., 2013; Ali et al., 2012a; Ali et al., 2012b). By this, we found *BmorCPT3* that has five putative *E74A* binding sites and *BmorCPT2* that has two putative β FTZ-F1 binding sites in the 2 kb upstream region (Fig. 5). From the above circumstances there is a possibility to regulate *BmorCPT3* by *E74A* and *BmorCPT2* by β FTZ-F1 in a stage specific manner in the wing discs of *Bombyx mori*.

DISCUSSION

Cuticle protein genes have been annotated and classified in *Anopheles*, *Drosophila*, *Tribolium*, and *Bombyx*, and many reports have revealed that the cuticle protein genes show a variety of spatial and temporal expression patterns. However, reports concerning the transcription and regulation of the transcriptional level are few. Therefore, in the present study, we analyzed the expression and regulation of *BmorCPT3* and *BmorCPT2* in wing disc using real-time PCR assay system. In *Bombyx* wing disc some of cuticular protein genes were expressed in the early fifth larval stage, while most cuticular protein genes were expressed at pre-pupal stage (Futahashi et al., 2008). Among the cuticular protein genes that are expressed at the pre-pupal stage, *BmorCPH5* and *BmorCPR34* were induced by BHR3 and BHR4 respectively (Ali et al., 2013). The present paper reported cuticular protein genes that were expressed at the pre-pupal stage, but were expressed later than and differently from *BmorCPH5* and *BmorCPR34*. The expression profile of *BmorCPT3* was similar to that of *E74A* and the expression profile of *BmorCPT2* was similar to that of β FTZ-F1. From this, it is suggested that the possibility to induce *BmorCPT3* by *E74A* and *BmorCPT2* by β FTZ-F1 respectively.

E74A transcription was induced by 20E in the existence of cycloheximide suggested direct induction by 20E (Ali et al., 2013). The induction of *E74A* was also observed by ecdysone pulse treatment, which was inhibited by the addition of cycloheximide (Ali et al., 2013). This result of pulse treatment indicated the existence of other factors affecting the expression of *E74A*. Thus, *E74A* is induced by ecdysone directly and pulse treatment through other factors (Karim & Thummel, 1991; Stillwell et al., 2003). *E74A* is inducible by ecdysone (Karim & Thummel, 1991) and ecdysone pulse (Stillwell et al., 2003). Transcripts of *E74A* showed peak at W3L stage, when the hemolymph ecdysteroid titer decreased after its peak (Ali et al., 2013). The induction of expression peak at this stage suggests to be brought about by the interaction of BHR3 (White et al., 1997) and β FTZ-F1 from the previous study (Woodard et al., 1994; Broadus et al., 1999; Yamada et al., 2000). *BmorCPT3* expression showed similar profile to that of *E74A*, except that *BmorCPT3* was not induced by 20E in the medium containing cycloheximide. In correspondence with expression of *E74A*, *BmorCPT3* expression peaked at W3L stage. Together with the result of the expression in the wing disc, the strong relatedness of *BmorCPT3* and *E74A* is suggested. Thus, the expression of cuticular protein gene *BmorCPT3* indicates to be regulated by *E74A* transcription factor.

The expression profile and ecdysone responsiveness of *BmorCPT3* is similar to that of *E74A* but different from that of *BmorCPT2* which resembled to β FTZ-F1. Thus, the expression of these cuticular protein genes indicates different type of regulation by different transcription factors.

β FTZ-F1 transcription was neither induced by 20E nor in the existence of cycloheximide (Ali et al., 2013). *BmorCPT3* was also not induced by 20E in V4 wing disc cultured system. The induction of β FTZ-F1 was observed by ecdysone pulse treatment, which was inhibited by the addition of cycloheximide (Ali et al., 2013). This result of pulse treatment indicated the existence of other factors affecting the expression of β FTZ-F1. Thus, β FTZ-F1 is induced by pulse treatment through other factors. β FTZ-F1 is inducible ecdysone pulse (Ali et al., 2013). Transcripts of *β FTZ-F1* showed peak at P0 stage, when the hemolymph ecdysteroid titer decreased (Ali et al., 2013). *BmorCPT2* expression showed similar profile to that of *β FTZ-F1*. In correspondence with expression of *β FTZ-F1*, *BmorCPT2* expression peaked at P0 stage. Together with the result of the expression in the

wing disc, the strong relatedness of *BmorCPT2* and β FTZ-F1 is suggested. Thus, the expression of cuticular protein gene *BmorCPT2* indicates to be regulated by β FTZ-F1 transcription factor.

Bm β FTZ-F1 was suggested to function in the induction of *BmorCPT2*, since Bm β FTZ-F1 was inducible by decline in the ecdysteroid titer and was induced by a 6-h exposure to 20E followed by 6 h in the hormone-free medium (Sun et al., 1994). In *Drosophila*, β FTZ-F1 has shown to positively regulate the pupal cuticle protein genes, *EDG84A* and *EDG78E*, during the mid to late prepupal period (Murata et al., 1996; Kayashima et al., 2005). A functional β FTZ-F1 binding site has been described in one adult cuticular-peptide gene of *B. mori* (Shiomi et al., 2000). β FTZ-F1 has been reported to bind to the upstream of a target gene (Murata et al., 1996; Shiomi et al., 2000), to form a complex with MBF1 and MBF2 (Liu et al., 2000), to recruit a coactivator (Zhu et al., 2007), and to interact with MHR4 (Hiruma and Riddiford, 2001). Furthermore, a mutation of β FTZ-F1 has also been reported to inhibit the expression of ecdysone responsive genes, resulting in a defect of pupal and adult morphogenesis (Broadus et al., 1999). The transcriptional activity by the β FTZ-F1 binding on the cuticle protein gene has recently reported with *BMWCP2* (Nita et al., 2009). From these reports and the present findings, it is suggested that β FTZ-F1 functions as the primary factor in response to the ecdysone pulse and binds with or recruits other factors, resulting in the regulation of the stage specific expression of target genes, such as *BmorCPT2*.

From the recent result (Ali et al., 2013, Ali et al., 2012a; Ali et al., 2012b) of the cuticular protein gene expression regulation by ecdysone responsive transcription factors regarding binding sites position analysis in the upstream cuticular protein genes, it was reported that one functional BHR3 binding site was found in 2kb upstream promoter region of *BmorCPH5* and the expression pattern of *BmorCPH5* resembled to ecdysone responsive transcription factor BHR3. Through site-directed mutagenesis of the binding site and a transient reporter assay system it was proved that the ecdysone responsive transcription factor BHR3 regulated *BmorCPH5* gene expression. By the same experimental procedure proved *BMWCP9* regulation by β FTZ-F1, *BmorCPG11* by BR-Z2. In the present experiment there are five E74A binding sites found in the 2kb upstream region of *BmorCPT3* gene and two β FTZ-F1 binding sites found in the 2kb upstream region of *BmorCPT2* gene (Fig. 5). The developmental expression and ecdysone responsiveness resembled to the tweedle cuticular protein genes with each of their binding site related transcription factors. It may be suggested that the expression of *BmorCPT2* and *BmorCPT3* genes was regulated by ecdysone responsive transcription factor β FTZ-F1 and E74A respectively.

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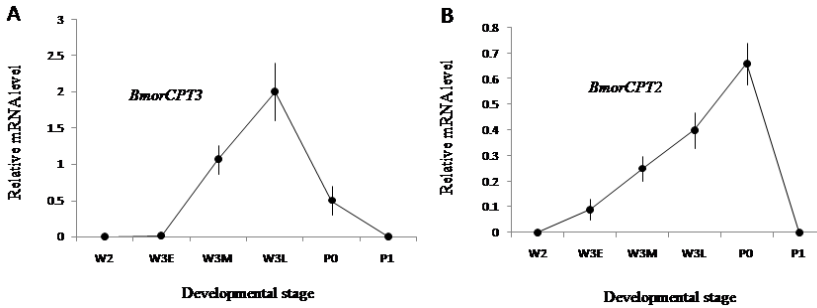


Figure 1. Developmental profile of cuticular protein genes. RNA was extracted from wing discs and reverse-transcribed to cDNA for use in Real-Time PCR. (A), Level of *BmorCPT3* mRNA from W1 to P1. (B), Level of *BmorCPT2* mRNA from W1 to P1. Values represent the mean \pm S.E.M. of results from three independent experiments.

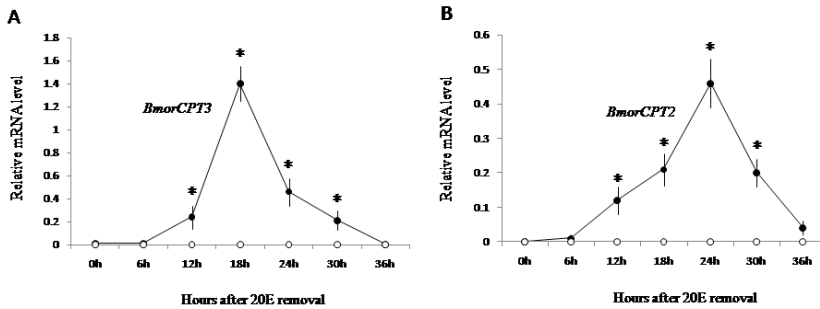


Figure 2. Effect of ecdysone pulse treatment of *BmorCPT3* (A) and *BmorCPT2* (B). RNA was extracted from wing discs and reverse-transcribed to cDNA for use in Real-Time PCR. Level of mRNA after ecdysone pulse treatment. Wing discs of the W2 stage were incubated 12 h in a medium containing 2 μ g/ml 20E and then transferred to a hormone-free medium with or without cycloheximide (50 μ g/ml) for the indicated time. Values represent the mean \pm S.E.M. of results from three independent experiments. Asterisks indicate $p < 0.05$ significance by the student's t-test.

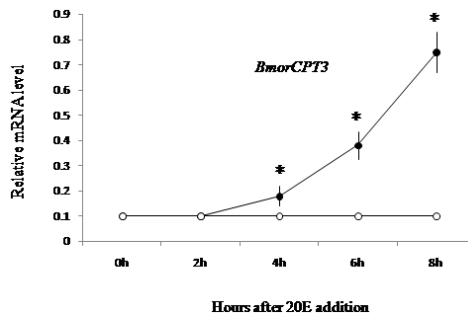


Figure 3. Effect of 20E addition of *BmorCPT3*. RNA was extracted from wing discs and reverse-transcribed to cDNA for use in Real-Time PCR. Level of mRNA of the ecdysone treatment. V4 wing discs were incubated for the indicated time in a medium containing 2 μ g/ml 20E with (open circle) or without (closed circle) cycloheximide (50 μ g/ml). Values represent the mean \pm S.E.M. of results from three independent experiments. Asterisks indicate $p < 0.05$ significance by the student's t-test.

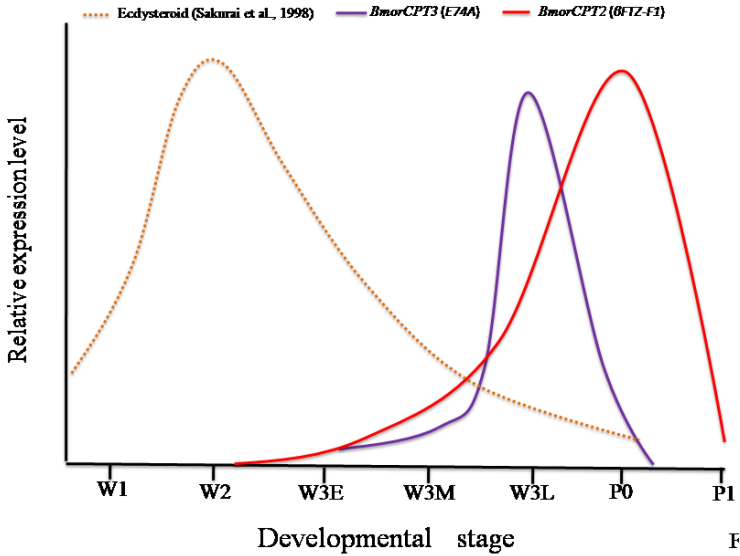


Figure 4. Schematic representation of cuticular protein genes and related ecdysone-responsive transcription factors in parentheses expressed in wing discs of *B. mori* in the late fifth larval instar. Ecdysteroid titer (Sakurai et al., 1998), E74A and βFTZ-F1 (Ali et al., 2013), *BmorCPT3* and *BmorCPT2* (this paper) are indicated.

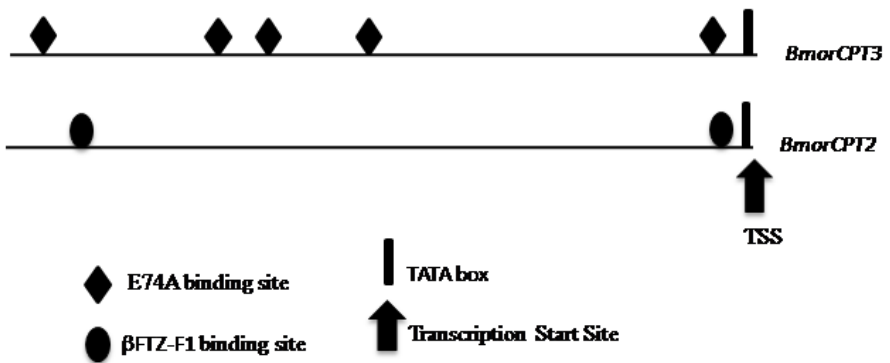


Figure 5. Schematic representation of the putative binding sites of the ecdysone-responsive transcriptional factor located on the upstream of indicated cuticular protein genes. The βFTZ-F1 and E74A binding sites are shown. Bars indicate 2kb upstream region from the transcription start site.

FAUNA OF PLANT BUGS (HEMIPTERA: HETEROPTERA: MIRIDAE) FROM JOLFA AND VICINITY, NW IRAN

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[**Havaskary, M., Farshbaf Pourabad, R. & Rafiee, A.** 2015. Fauna of plant bugs (Hemiptera: Heteroptera: Miridae) from Jolfa and vicinity, NW Iran. *Munis Entomology & Zoology*, 10 (1): 234-237]

ABSTRACT: The fauna of plant bugs (Hemiptera:Heteroptera: Miridae) from Jolfa county (East Azarbaijan province, Iran) and its vicinity is studied in this paper. Base on different sampling projects conducted during 2010-2012, totally 30 species from 18 genera and 5 subfamilies including Bryocorinae, Deraeocorinae, Mirinae, Orthotylinae, Phylinae were identified.

KEY WORDS: Heteroptera, Miridae, Fauna, Jolfa, Iran.

Heteroptera (Hemiptera) with more than 40,000 described species are part of the most successful radiation of nonholometabolous insects (Weirauch & Schuh 2011). Within the Heteroptera the plant bugs or Miridae constitute the largest family with more than 10,000 described species (Schuh 1995). It is expected that the family may contain twice as many species (Schaefer & Panizzi 2000). Plant bugs are commonly phytophagous, but some species are generalist predators of plant-feeding insects and mites and are associated with many common pests of ornamental trees and shrubs (Schuh & Slater 1995). Even though the mirids contain many economically important species, its taxonomy and systematic contains some problems. This is a result of the large number of included taxa and the uniformity of external morphology of many genera (Wyniger, 2004).

The fauna of Iranian Plant bugs (Hemiptera: Heteroptera: Miridae) studied rather well in some provinces by Linnavuori (1997, 1998, 2007, 2010), Linnavuori and Modarres Awal (1998) and Hosseini (2013) but Jolfa and its vicinity has been not deliberated so far, Thus the present research focused to determine of leaf bugs in this area. Jolfa is one of the most important border towns for the Islamic Republic of Iran where is situated between "Kiamaki" mountains and Aras river littorals in the East Azarbaijan province that is surrounded by Marand and Varzeghan cities in the south, Khodafarin county in the east (East Azarbaijan Province), West Azarbaijan Province in the west, Armenia and Azerbaijan counties in the north.

MATERIALS AND METHODS

The specimens of this research were collected through the years 2010-2012, mainly by sweeping of vegetation and light trapping. Collected materials were put in ethanol 70% for identification in suitable time. These data have also been included in this paper. Specific name, author and description date, locality and date of collection are provided. The system and nomenclature follow principally Aukema & Rieger (1999).

RESULTS

A total of 30 species in 18 genera of plant bugs (Hemiptera: Heteroptera: Miridae) are listed in this paper, which are given alphabetically in below.

Subfamily Bryocorinae

***Macrolophus pygmaeus* Rambur, 1839**

Material examined: Kordasht (3 specimens), 13 May 2011.

Subfamily Deraeocorinae

***Deraeocoris lutescens* Schilling, 1837**

Material examined: Jolfa grasslands (3 specimens), 1 June 2010.

***Deraeocoris punctulatus* Fallén, 1807**

Material examined: Marand (5 specimens), 26 May 2010; Siah Rod (2 specimens), 30 May 2011; Nordoz (4 specimens), 10 June 2012.

***Deraeocoris serenus* Douglas & Scott, 1868**

Material examined: Marand (2 specimens), 26 May 2010; Golan (3 specimens), 12 June 2012; Osh Tobin (1 specimen), 7 July, 2011.

Subfamily Mirinae

***Adelphocoris lineolatus* Goeze, 1778**

Material examined: Marand (45 specimens), 10 July 2010; Golan (21 specimens), 12 June 2012; Osh Tobin (19 specimen), 7 July, 2011. Jolfa 25 August 2011 (25 specimens), 13 September 2010 (32 specimens); Nordoz (17 specimens), 10 June 2012; Misan (11 specimens), 30 May 2011; Varzeghan (14 specimens) 4 June 2010; Kordasht (22 specimens), 28 May 2011.

***Adelphocoris vandalicus* Rossi, 1790**

Material examined: Siah Rod (10 specimens), 30 May 2011; Misan (3 specimens) 3 June 2012; Osh Tobin (8 specimens), 7 July, 2011; Jolfa grasslands (4 specimens), 1 June 2010.

***Charagochilus gyllenhali* Fabricius, 1807**

Material examined: Near of Scent Stepanus Church (4 specimens) 18 June 2010.

***Eurystylus bellevoeyi* Reuter, 1879**

Material Examined: Marand (3 specimens), 26 May 2010.

***Lygus gemellatus* Herrich-Schaeffer, 1835**

Material Examined: Siahrod (7 specimens), 2 July 2012; Golan (6 specimens), 1 June 2012; Alamdar (3 specimens), 5 June 2011.

***Lygus pratensis* Linnaeus, 1758**

Material Examined: Alamdar (12 specimens), 5 June 2011; Near of Scent Stepanus Church (7 specimens) 18 June 2010; Kordasht (5 specimens), 13 May 2011.

***Lygus rugulipennis* Poppius, 1911**

Material Examined: Siah Rod (8 specimens), 30 May 2011; Osh Tobin (6 specimens), 7 July, 2011.

***Orthops frenatus* Horváth, 1894**

Material Examined: Marand (5 specimens), 10 July 2010; Haras (4 specimens) 4 June 2012.

***Orthops kalmii* Linnaeus, 1758**

Material Examined: Kordasht (7 specimens), 13 May 2011; Haras (2 specimens) 4 June 2012.

***Orthops pilosulus* Jakovlev, 1877**

Material Examined: Osh Tobin (3 specimens), 7 July, 2011.

***Phytocoris varipes* Boheman, 1852**

Material Examined: Alamdar (12 specimens), 5 June 2011.

***Polymerus brevicornis* Reuter, 1879**

Material Examined: Near of Scent Stepanus Church (9 specimens) 18 June 2010; Marand (8 specimens), 26 May 2010; Siah Rod (11 specimens), 30 May 2011.

***Polymerus cognatus* Fieber, 1858**

Material Examined: Siahrod (4 specimens), 2 July 2012; Misan (7 specimens), 30 May 2011.

***Polymerus vulneratus* Panzer, 1806**

Material Examined: Jolfa grasslands (6 specimens), 1 June 2010; Golan (8 specimens), 1 June 2012.

***Stenodema calcarata* Fallén, 1807**

Material Examined: Nordoz (2 specimens), 10 June 2012.

***Stenodema turanica* Reuter, 1904**

Material Examined: Misan (15 specimens), 30 May 2011; Kordasht (6 specimens), 13 May 2011; Marand (9 specimens), 20 May 2012; Oshtobin (10 specimen), 7 July, 2011.

***Trigonotylus pulchellus* Hahn, 1834**

Material Examined: Kordasht (2 specimens), 28 May 2011.

Subfamily Orthotylinae***Blepharidopterus diaphanus* Kirschbaum, 1856**

Material Examined: Golan (2 specimens), 1 June 2012.

***Orthotylus flavosparsus* (C. R. Sahlberg, 1841)**

Material Examined: Varzeghan (4 specimens) 4 June 2010; Oshtobin (19 specimen), 7 July, 2011.

***Orthotylus minutus* Jakovlev, 1877**

Material Examined: Siahrod (3 specimens), 2 July 2012; Near of Scent Stepanus Church (5 specimens) 18 June 2010.

Subfamily Phylinae***Campylomma diversicorne* Reuter, 1878**

Material Examined: Oshtobin (5 specimens), 7 July, 2011; Near of Scent Stepanus Church (4 specimens) 18 June 2010.

***Campylomma verbasci* Meyer-Dür, 1843**

Material examined: Misan (2 specimens), 30 May 2011; Jolfa grasslands (4 specimens), 1 June 2010.

***Oncotylus setulosus* Herrich-Schaeffer, 1837**

Material Examined: Near of Scent Stepanus Church (3 specimens) 18 June 2010.

***Oncotylus viridiflavus longipes* Wagner, 1954**

Material Examined: Golan (3 specimens) 2 June 2011.

***Pilophorus confusus* Kirschbaum, 1856**

Material examined: Kordasht (2 specimens), 28 May 2011.

***Plagiognathus bipunctatus* Reuter, 1883**

Material Examined: Oshtobin (3 specimens), 7 July, 2011.

***Tuponia elegans* Jakovlev, 1881**

Material Examined: Jolfa grasslands (2 specimens), 1 June 2010.

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**OBEREA ERYTHROCEPHALA AMANICA HOLZSCHUH, 1993
REST. NOV. (CERAMBYCIDAE: LAMIINAE)**

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[Özdikmen, H. & Cihan, N. 2015. *Oberea (Amaurostoma) erythrocephala amanica* Holzschuh, 1993 rest. nov. (Cerambycidae: Lamiinae). Munis Entomology & Zoology, 10 (1): 238-240]

ABSTRACT: With the present work, *Oberea (Amaurostoma) erythrocephala amanica* Holzschuh, 1993 rest. nov. is discussed and regarded as a separate subspecies again.

KEY WORDS: *Oberea (Amaurostoma) erythrocephala amanica*, rest. nov., Lamiinae, Cerambycidae, Turkey.

***Oberea erythrocephala amanica* Holzschuh, 1993 rest. nov.**

The subspecies was given by Löbl & Smetana (2010) as a synonym of *Oberea erythrocephala* (Schrank, 1776).

Leafy spurge, the host plant of *Oberea erythrocephala*, is an Eurasian perennial that was introduced into North America in the 19th century. *Oberea erythrocephala* was initially approved for introduction into the United States in November 1979. Through 1999, *O. erythrocephala* has been released in 15 states and over 25 counties across the northern U.S.A and in western Canada. The insect also has a limited distribution in central and western Canada (Hansen, 2014).

The Nearctic populations show that the species, *Oberea (Amaurostoma) erythrocephala* (Schrank, 1776), has at least two different color forms as the typical form and another form which was described by Heyrovský (1962) as a new subspecies under the name *Oberea erythrocephala schurmanni* from Antitoros Mountains in Turkey. Therefore, *Oberea erythrocephala schurmanni* Heyrovský, 1962 should be accepted as a synonym of *Oberea erythrocephala* (Schrank, 1776).

Besides, another unique color form (upper side completely black) of the species was described by Holzschuh (1993) as a new subspecies under the name *Oberea erythrocephala amanica* from Adana province (Nurdağı pass) in south Turkey. I know that the subspecies is also distributed in neighboring province Osmaniye. And it can be distributed other parts of SE Turkey. This form never see among the Nearctic, European or Asian populations. Therefore, *Oberea erythrocephala amanica* Holzschuh, 1993 should be accepted as a separate subspecies.

Consequently, *Oberea erythrocephala* (Schrank, 1776) has three subspecies as follows now:

Genus *Oberea* Dejean, 1835: 351

[type species *Cerambyx linearis* Linnaeus, 1760]

Subgenus *AMAUROSTOMA* J. Müller, 1906: 223

[type species *Cerambyx erythrocephalus* Schrank, 1776]

***erythrocephala* Schrank, 1776: 67 (*Cerambyx*)**

***erythrocephala amanica* Holzschuh, 1993: 50 A: TR**

***erythrocephala bicolor* Reiche, 1878: cxlix E: PT SP N: MO**
***erythrocephala erythrocephala* Schrank, 1776: 67 (*Cerambyx*) E:**
 AN AU BH BU BY CR CT CZ FR GE GR HU IT LS LT MC MD PL PT RO SK SL
 SP SZ TR UK YU A: AB AR GG IN KZ LE SY TR WS NARi

cincta Gebler, 1830: 186 (*Saperda*) [Russia: Siberia: Altai]

luteicollis Gebler, 1833: 303 (*Saperda*) [Russia: Siberia: Altai]

insidiosa Mulsant, 1863: 396 [Croatia]

melitana Reiche, 1878: cxlix [Malta: Melita Island]

richteri Bau, 1888: 425 (*Oberea erythrocephala* var.) [?]

anatolica Pic, 1901: 19 (*Oberea erythrocephala* var.) [Turkey: Konya]

hungarica Pic, 1914: 11 (*Oberea erythrocephala* var.) [Hungary]

montandoni Pic, 1914: 11 (*Oberea erythrocephala* var.) [Romania]

theophilei Pic, 1914: 11 (*Oberea erythrocephala* var.) [Armenia]

erivanica Pic, 1917: 11 (*Oberea erythrocephala* var.) [Armenia: Erivan]

planeti Pic, 1945: 5 (*Oberea erythrocephala* var.) [France]

sinuatesignata Pic, 1945: 7 (*Oberea erythrocephala* var.) [Caucasus]

calvescens G. Müller, 1948: 15 (*Oberea erythrocephala* ssp.) [Italy: Alberoni]

rufoscapus Breuning, 1960: 23 (*Oberea erythrocephala* m.) [Turkey: İçel: Silifke]

schurmanni Heyrovský, 1962: 42 (*Oberea erythrocephala* ssp.) [Turkey: Antitoros]

In Turkey, the distribution of *Oberea erythrocephala erythrocephala* and *Oberea erythrocephala amanica* are presented as Figures 1, 2.

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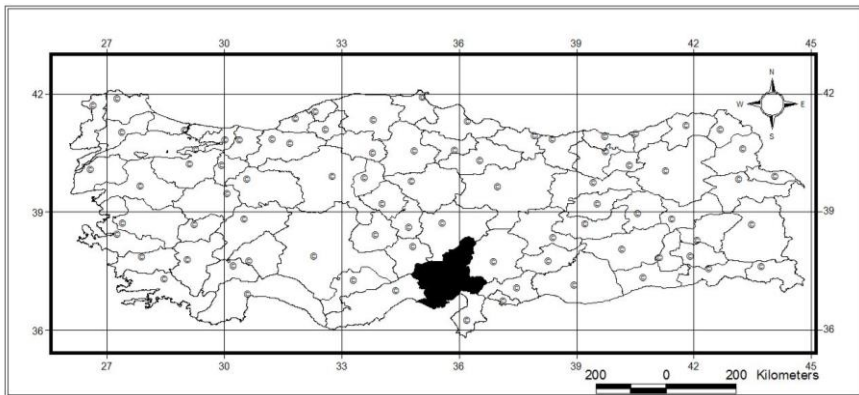


Figure 1. The distribution of *Oberea erythrocephala amanica*.

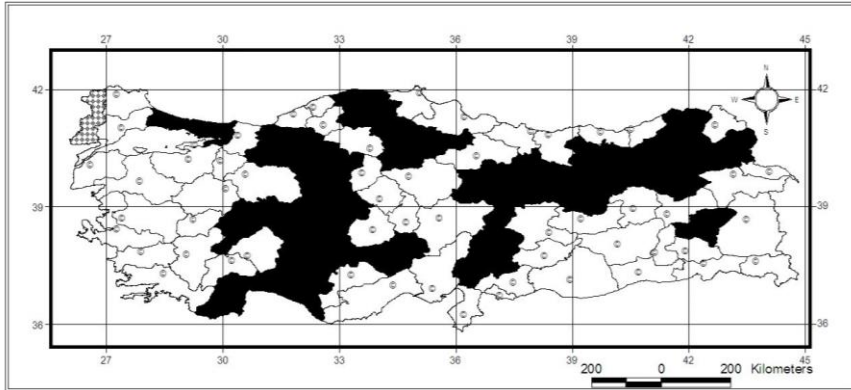


Figure 2. The distribution of *Oberea erythrocephala erythrocephala* in Turkey.

EVALUATION OF EGG PRESERVATION SCHEDULES FOR BIVOLTINE BREEDS OF THE MULBERRY SILKWORM, *BOMBYX MORI* L.

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[Singh, R., Vemananda Reddy, G., Vijaya Kumari, K. M., Angadi, B. S. & Sivaprasad, V. 2015. Evaluation of egg preservation schedules for bivoltine breeds of the mulberry silkworm, *Bombyx mori* L.. Munis Entomology & Zoology, 10 (1): 241-245]

ABSTRACT: Two newly developed bivoltine silkworm breeds SK₆ and SK₇ were evaluated at Silkworm Seed Technology Laboratory, Kodathi, Bangalore by preserving the eggs for 4, 6, 8 and 10 months preservation schedules following 10, 20, 40 and 60 days aestivation period respectively. The results indicated that fecundity ranged from 519 to 574 and 531 to 573, hatching percentage ranged from 92.39 to 96.30 % and 92.99 to 97.60, effective rate of rearing (ERR) ranged from 9075 to 9560 and 8941 to 9445, pupation percentage ranged from 91.70 to 96.88 and 89.70 to 95.99 %, cocoon weight ranged from 1.528 to 1.647 and 1.584 to 1.626 g, cocoon shell weight ranged from 0.244 to 0.284 and 0.269 to 0.279 g and cocoon shell percentage ranged from 15.97 to 17.53 and 16.65 to 17.61 % in SK₆ and SK₇ respectively. The hatchability and rearing performance of SK₆ and SK₇ were almost similar in 4, 6, 8 and 10 months preserved eggs. Both bivoltine silkworm breeds SK₆ and SK₇ were test verified in the field through Basic Seed Farms of National Silkworm Seed Organization (NSSO), Central Silk Board and the cocoon yield ranged from 50 to 75 kg and 51 to 71.840 kg/100 dfls in SK₆ and SK₇, respectively.

KEY WORDS: Bivoltine breeds, *Bombyx mori*, Egg preservation, Evaluation, SK₆ and SK₇.

Studies on long-term preservation schedules have been carried out in diapause (Reddy et al., 2004; Shirota, 2004; 2005; Khatri et al., 2005; Machida, 2007; 2009; Iizuka et al., 2008; Rajanna et al., 2008; Banno et al., 2013; Ravindra Singh et al., 2014;) and non - diapause eggs (Kumareshan et al., 2004; Ravindra Singh et al., 2010; Rajanna et al., 2009; 2011) of the mulberry silkworm, *Bombyx mori* L. Two bivoltine silkworm breeds SK₆ and SK₇ developed at CSRTI, Berhampore, West Bengal, do not have the full-fledged seed technology aspects so as to handle these breeds with proper approaches at different stages. The foundation cross SK₆ x SK₇ is being used in East and North-east India for commercial cocoon production as well as preparation of cross breed eggs. Studies on these breeds will help in the development of suitable seed handling techniques and facilitate the sericulturists to produce quality cocoons. In South India, 4 and 6 months schedules are commonly used for the preservation of bivoltine seed. Whereas, in the temperate or sub-temperate zones of North India, one year schedule is being used to conduct silkworm rearing only during spring season. The present study has been undertaken to know the performance of two bivoltine breeds SK₆ and SK₇ following 4, 6, 8 and 10 months egg preservation schedules to obtain quality silk and sustainable cocoon crops in the northeastern regions of India.

MATERIALS AND MEHODS

Eggs of two bivoltine breeds SK₆ and SK₇ were generated and preserved for 4, 6, 8 and 10 months preservation schedules following 10, 20, 40 and 60 days

aestivation period. Eggs of SK₆ and SK₇ were released as per the schedule and rearing was conducted. Three replications were maintained with 250 larvae in each replication. Data were recorded for seven economic characters *viz.*, fecundity, hatching percentage, effective rate of rearing, pupation percentage, cocoon weight, cocoon shell weight and cocoon shell percentage. Besides, data pertaining SK₆ and SK₇ for seven economic characters *viz.*, fecundity, hatching percentage, cocoon yield/100dfls, pupation percentage, cocoon weight, cocoon shell weight and cocoon shell percentage reared at different units of NSSO were also collected. Different egg preservation schedules have been depicted in Figs. 1-4.

RESULTS AND DISCUSSION

Performance of bivoltine breed SK₆ during different preservation schedules has been given in Table 1. Maximum fecundity (574) was observed following 6 months preservation schedule followed by 8 months hibernation schedule (568). Hatching percentage was recorded maximum (96.30%) during 4 months schedule followed by 6 months schedule (94.48%). Effective rate of rearing (ERR) was observed maximum (9560) followed by 6 months hibernation schedule (9293) whereas pupation was recorded maximum (96.88%) during 4 months hibernation schedule followed by 10 months schedule (93.86). Maximum cocoon weight was observed during 4 months schedule (1.647 g) followed by 6 months schedule (1.621 g). Cocoon shell weight was recorded maximum (0.284 g) in 4 months hibernation schedule followed by 6 months schedule (0.282 g) and maximum cocoon shell percentage (17.53 %) was observed during 10 months hibernation schedule followed by 4 months schedule (17.24 %).

Mean performance of bivoltine breed SK₇ during different preservation schedules has been given in Table 2. Maximum fecundity (573) was observed following 4 months preservation schedule followed by 6 months hibernation schedule (566). Hatching percentage was recorded maximum (97.60 %) during 4 months schedule followed by 6 months schedule (95.01 %). Effective rate of rearing (ERR) was observed maximum (9445) during 4 months hibernation schedule followed by 6 months hibernation schedule (9401) whereas pupation was recorded maximum (95.99 %) during 4 months hibernation schedule followed by 10 months schedule (94.97 %). Maximum cocoon weight was observed during 8 months schedule (1.626 g) followed by 6 months schedule (1.615 g). Cocoon shell weight was maximum (0.279 g) in 10 months hibernation schedule followed by 4 months schedule (0.278 g) and maximum cocoon shell percentage (17.61 %) was recorded during 10 months hibernation schedule followed by 4 months schedule (17.28 %). Larval and cocoon photographs of SK₆ and SK₇ have been depicted in Plate 1.

Rearing performance of SK₆ and SK₇ reared from March, 2012 to March, 2014 utilizing 1000 dfls of each breed at 5 units of NSSO namely, P3, BSF, Majra, P3, BSF, Mysore, P2, BSF, Gavimata, P2, BSF, Nagamangala, and P1, Madakasira have been given in Table 3 and 4 respectively. The results indicated that fecundity ranged from 420 to 563 and 451 to 550, hatching ranged from 90.11 to 97.00 % and 94.10 to 98.30, cocoon yield/100dfls ranged from 50.000 to 75.000 kg and 51.000 to 71.840 kg, pupation ranged from 89.50 to 96.20 and 81.40 to 98.00 %, cocoon weight ranged from 1.401 to 1.800 g and 1.356 to 1.795 g, cocoon shell weight ranged from 0.232 to 0.377 g and 0.235 to 0.375 g and cocoon shell percentage ranged from 16.13 to 20.94 % and 16.32 to 20.89 % in SK₆ and SK₇ respectively. The mean fecundity was 501 and 497, hatching 95.00 and 95.62, cocoon yield/100 dfls 64.502 and 62.489 kg, pupation 92.52 and 92.14 %, cocoon weight 1.563 and

1.524 g, cocoon shell weight 0.283 and 0.285 g and cocoon shell percentage was 18.03 and 18.68 % in SK₆ and SK₇, respectively.

Studies on long-term preservation schedules have been carried out in tropical univoltine "Barpat" (Ravindra Singh et al., 2014), bivoltine eggs (Reddy et al., 2004; Rajanna et al., 2008) and non - diapause eggs (Kumareshan et al., 2004). The study on these breeds helps in the development of suitable seed handling techniques which will facilitate the sericulturists to produce quality cocoons. Silkworm Seed Technology Laboratory, NSSO, CSB, Bangalore has developed suitable schedules for preservation of bivoltine silkworm eggs under Indian conditions and were evolved for pure as well as hybrid eggs by following these schedules, eggs could be preserved from 110 ~ 335 days without causing any weakness to the embryos of the mulberry silkworm, *B. mori* (Reddy, et al. 2004; Ravindra Singh et al., 2010; Rajanna et al., 2009; 2011).

Optimum temperature for chilling (Shirota, 2004) and suppression of diapause development at -5°C and 0°C during long-term preservation of diapause eggs of silkworm, *B. mori* have been studied (Shirota, 2005). Khatri et al. (2005) have studied preservation schedules for silkworm seed under north Indian condition. Several attempts have been made to develop long-term preservation schedule for diapause eggs in silkworm, *B. mori* (Matsuno & Shimizu, 1979; Machida, 2007; Machida et al., 2009; Iizuka et al., 2008). Recently, Banno et al. (2013) have developed a method for long-term preservation of silkworm strains using frozen ovaries.

Exploitation of SK₆ and SK₇ possessing quality silk coupled with hardiness character will not only improve the quality of silk but also will facilitate to obtain sustainable silkworm crops. Study on egg preservation schedule of these breeds would be an added advantage in order to obtain silkworm eggs as and when required.

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Table 1. Performance of bivoltine breed SK₆ during different hibernation schedules.

Preservation schedule	Fecundity (No.)	Hatching %	Effective Rate of Rearing (ERR)	Pupation (%)	Cocoon Weight (g)	Cocoon shell weight (g)	Cocoon shell %
4 months	536 ± 43	96.30 ± 2.03	9560 ± 128	96.88 ± 1.39	1.647 ± 0.03	0.284 ± 0.007	17.24 ± 0.33
6 months	574 ± 7	94.48 ± 1.38	9293 ± 185	91.70 ± 2.94	1.621 ± 0.04	0.277 ± 0.004	17.08 ± 0.33
8 months	568 ± 25	94.45 ± 0.79	9190 ± 496	93.59 ± 2.21	1.528 ± 0.13	0.244 ± 0.03	15.97 ± 1.01
10 months	519 ± 12	92.39 ± 1.61	9075 ± 245	93.86 ± 0.03	1.608 ± 0.03	0.282 ± 0.01	17.53 ± 0.64

Data mean ± SD of six replications

Table 2. Performance of bivoltine breed SK₇ during different hibernation schedules.

Preservation schedule	Fecundity (No.)	Hatching %	Effective Rate of Rearing (ERR)	Pupation (%)	Cocoon Weight (g)	Cocoon shell weight (g)	Cocoon shell %
4 months	573 ± 50	97.60 ± 1.15	9445 ± 182	95.99 ± 1.76	1.608 ± 0.03	0.278 ± 0.01	17.28 ± 0.33
6 months	566 ± 21	95.01 ± 2.46	9401 ± 459	94.27 ± 1.65	1.615 ± 0.06	0.269 ± 0.01	16.65 ± 0.72
8 months	554 ± 47	94.85 ± 2.90	8941 ± 740	89.70 ± 3.81	1.626 ± 0.20	0.277 ± 0.04	17.03 ± 0.75
10 months	531 ± 26	92.99 ± 2.04	9214 ± 215	94.97 ± 0.83	1.584 ± 0.10	0.279 ± 0.02	17.61 ± 0.35

Data mean ± SD of six replications

Table 3. Performance of bivoltine breeds SK₆ evaluated at different units of NSSO.

Unit	Season	Fecundity (No.)	Hatching %	Cocoon yield/100 dffs (kg)	Pupation (%)	Cocoon Weight (g)	Cocoon shell weight (g)	Cocoon shell %
P3, Majra	Mar, 12	560	95.80	73.000	96.00	1.800	0.377	20.94
P3, Mysore	Mar, 12	541	93.30	70.600	90.70	1.460	0.263	18.01
-do-	Jun, 12	420	95.80	55.000	92.10	1.519	0.261	17.18
-do-	Aug, 12	522	95.50	73.000	90.30	1.595	0.285	17.87
-do-	Oct, 12	493	95.90	71.200	89.50	1.678	0.307	18.30
-do-	Dec, 12	469	96.10	60.000	94.50	1.505	0.282	18.74
-do-	May, 13	504	93.70	68.000	90.50	1.761	0.320	18.17
-do-	Aug, 13	563	96.70	75.000	90.90	1.486	0.257	17.27
P2, Gavimata	May, 12	493	95.20	70.500	96.20	1.584	0.274	17.30
-do-	May, 13	500	97.00	56.300	90.00	1.520	0.287	18.88
P2, Nagamangla	Feb, 13	495	94.90	60.920	95.00	1.575	0.280	17.78
-do-	Jul, 13	475	90.11	50.000	96.00	1.438	0.232	16.13
P1, Madakasira	Jul, 13	477	95.00	55.000	91.06	1.401	0.249	17.77
Mean ± SD		501 ±39	95.00 ±1.80	64.502 ±8.54	92.52 ±2.59	1.563 ±0.12	0.283 ±0.03	18.03 ±1.13

Table 4. Performance of bivoltine breeds SK₇ evaluated at different units of NSSO.

Unit	Season	Fecundity (No.)	Hatching %	Cocoon yield/100 dfls (kg)	Pupation (%)	Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell %
P3, Majra	Mar, 12	550	94.50	71.840	95.00	1.795	0.375	20.89
P3, Mysore	Mar, 12	530	96.95	68.800	90.10	1.433	0.279	19.47
-do-	Jun, 12	451	95.00	56.000	91.20	1.437	0.278	19.35
-do-	Aug, 12	460	96.90	58.670	91.70	1.599	0.299	18.70
-do-	Oct, 12	528	95.10	71.200	90.70	1.655	0.300	18.13
-do-	Dec, 12	463	95.50	52.500	94.70	1.356	0.266	19.62
-do-	May, 13	473	94.10	54.000	81.40	1.538	0.296	19.25
-do-	Aug, 13	548	96.10	71.000	90.40	1.404	0.241	17.17
P2, Gavimata	May, 12	516	94.90	65.500	96.40	1.675	0.337	20.12
-do-	May, 13	506	98.30	67.170	90.00	1.530	0.274	17.91
P2, Nagamangla	Feb, 13	519	96.80	70.820	98.00	1.592	0.288	18.09
-do-	Jul, 13	470	94.89	53.860	97.00	1.440	0.235	16.32
P1 Madakasira	Jul, 13	451	94.00	51.000	91.27	1.353	0.239	17.66
Mean ± SD		497 ±37	95.62 ±1.29	62.489 ±8.22	92.14 ±1.30	1.524 ±0.13	0.285 ±0.03	18.68 ±1.26



1



2



3



4

Plate I. Larval and cocoon photographs of bivoltine breed SK₆ and SK₇: 1. Larvae of SK₆ 2. Larvae of SK₇, 3. Cocoon of SK₆ and 4. Cocoon of SK₇.

BIODIVERSITY OF THYSANOPTERA IN THE SISTAN REGION OF IRAN

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ABSTRACT: The *Thrips* (Thysanoptera) fauna of Sistan region, Iran, was studied during (2009-2010). A total of 17 species representing 8 genera belonging to 3 families were collected and identified. *Aeolothrips eremicola* Priesner, 1938 is a new record for Iran fauna. In *A. eremicola* middle and hind tibiae are white at tips. Cross-bands of fore wings are narrowly united at posterior margin of fore wings. In male, abdominal segment IX without claspers. For the fauna of Iran, locality and date of collection, host(s) and distribution data for each species are provided.

KEY WORDS: Sistan, Iran, Fauna, *Thrips*, Thysanoptera.

Southeastern Asia is one of the most biologically diverse parts of the world, and agricultural production in this area is affected by a wide diversity of pest insects. Despite this, identification literature and general overviews of particular insect groups are surprisingly absent from this region, and this is particularly true of the order Thysanoptera (Reyes, 1994). Sistan and Baluchestan province is the largest province and located in south of Iran, bordering Pakistan and Afghanistan. This province comprise two sections, Sistan in the north and Baluchestan in south. More than 6000 recognised species in the insect order Thysanoptera (Mound, 2011). The traditional classification of the Order Thysanoptera is adopted, recognising nine Families for living species (plus three fossil families), with two subfamilies in the Phlaeothripidae (the only Family in suborder Tubulifera), and four subfamilies in the Thripidae (one of eight Families comprising suborder Terebrantia) (Mound, 2008). The thrips in Iran has been a subject of special investigations only in the last few years. There are 177 nominal species of Thysanoptera reported in Iran, including 132 species of Terebrantia in 47/49 genera, and 45 species of Tubulifera in 15 genera (Bhatti et al., 2009).

MATERIALS AND METHODS

In order to study of biodiversity of Thysanoptera in Sistan region some specimens randomly in different areas of the province during November to June 2007-2009 were collected. Two general techniques were used for collecting thrips: 1- individuals occurring on stages before start of shooting were directly collected on the leaves, 2-beating leaves, sheaths and spikes was used for subsequent stages. Different cultivated plants were beaten over a small white plastic tray. From the tray surface, the specimens were removed with a fine brush. Collected thrips were kept in plastic 1.5 ml Eppendorf tubes in AGA solution, a mixture of ten parts of 60% ethyl alcohol, one part of glycerine and one part of acetic acid. This mixture helps to distend the body of most thrips and keeps the limbs supple. Stored specimens were transferred to 60% alcohol and kept in the dark at the temperature

about 0°C to prevent loss of colour (Palmer et al., 1989). Most of collected adult thrips were mounted on microscope slides using Hoyer's medium.

RESULT AND DISCUSSION

Further research on the distribution of Thysanoptera in Iran should be carried out, because of various geographical region and vegetable zone in Iran, the number of species probably will increase in the future. With attention to the prior papers and 1 new records of this paper, the total number of Iranian thrips reaches to 186 species. In order to study of biodiversity of Thysanoptera in Sistan region during 2007 some specimens were collected. A total of 17 species belonging to 3 families and 8 genera were determined. Among them *Aeolothrips eremicola* Priesner 1938 is new record for Iran fauna. In *A. eremicola* middle and hind tibiae are white at tips. Cross-bands of fore wings are narrowly united at posterior margin of fore wings. In male, abdominal segment IX without claspers. In this survey species *Aeolothrips eremicola* Priesner, *Aeolothrips mongolicus* Pelikan, *Ataliothrips reuteri* (Bagnall), *Haplothrips aculeatus* (Fabricius), *Haplothrips eragrostidis* Priesner, *Haplothrips reuteri* (Karny), *Haplothrips tritici* (Kurdjumov), *Anaphothrips sudanensis* Trybom, *Chirothrips manicatus* (Haliday), *Eremiothrips efflatouni* (Priesner), *Eremiothrips similis* Bhatti, *Eremiothrips zurstrasseni* Bhatti, Bagheri & Ramezani, *Frankliniella occidentalis* (Pergande), *Thrips atratus* Haliday, *Thrips meridionalis* (Priesner), *Thrips tabaci* Lindeman, *Scirtothrips mangiferae* Priesner collected.

Suborder Terebrantia

Family Aeolothripidae

Aeolothrips eremicola Priesner, 1938

Material examined: Pole-nahr-ab, 33m, 9 ♀ on Wheat, 13. IV. 2010.

Hosts: Poaceae.

Distribution: New record for Iran fauna.

Aeolothrips mongolicus Pelikan, 1985

Material examined: Sad-e-Sistan, 9m, 1♀ on Alfalfa, 14. VIII. 2009.

Hosts: *Saxaul* sp., *Nitraria* sp., *Tamarix* sp. (Alavi et al., 2007).

Distribution: Eastern Palaearctic. Iranian records: reported for first time from Golestan Province by (Cheraghian & Hojat, 1998), Golestan Province (Alavi 2004; Alavi et al., 2007), Khorasan-e-Shomali province (Alavi & Kamali, 2003) (Alavi et al., 2007), Fars province (Fallah zadeh et al., 2011).

Family Thripidae

Anaphothrips sudanensis Trybom, 1911

Material examined: Banmak: 12m, 2 ♀ on Bean, 8. VII. 2010.

Hosts: Poaceae.

Distribution: Semi-Cosmopolitan. Iranian records: reported For first time From Golestan Province by (Cheraghian & Hojat, 1998), Khorasan-e-Shomali Province (Alavi & Kamali, 2003), Fars Province (Minaei & Alich, 2000a; Minaei et al., 2002), Golestan Province (Gilasian et al., 2000; Alavi & zur Strassen, 2002; Alavi et al., 2007), Kerman Province (Kheyrandish Koshkoei et al., 2000a; Teraz & Kheyrandish Koshkoei, 2002), Khuzestan Province (Behdad, 1996; Cheraghian & Hojat, 1998; Bagheri et al., 2005a; Alavi et al., 2007).

Chirothrips africanus Priesner, 1932

Material examined: Pole-nahr-ab, 33m, 1♀ on wheat, 13. IV. 2010.

Hosts: Poaceae.

Distribution: Indo-Mediterranean, North Afraca. Iranian records: This species was reported as new record for Iran by Alavi (2000) from Golestan Province. Golestan Province (Alavi et al., 2007).

***Chirothrips manicatus* (Haliday, 1836)**

Material examined: Zabol university, 17m, 1♀ on Wheat, 16. III. 2010. Pole-nahr-ab, 33m, 1♀ on wheat; 1♀ on barely, 13 IV. 2010.

Hosts: Poaceae.

Distribution: Semi-Cosmopolitan. Iranian record: this species was reported as new for the fauna of Iran by (Alavi & Kamali, 1995) from Bojnourd (now in Khorasan-e-Shomali Province; Alavi & Kamali, 2003). Kerman Province (Kheyrandish Koshkoei et al., 2000a; Teraz & Kheyrandish Koshkoei 2002), Khuzestan Province (Cheraghian, 1996; Cheraghian & Hojat, 1998; Bagheri et al., 2005a), Yazd Province (Mohaghegh & Kheyrandish Koshkoei, 2002; Alavi et al., 2007).

***Eremiothrips efflatouni* (Priesner, 1964)**

Material examined: Pole-nahr-ab: 33m, 4♀ on Barley, 13. IV. 2010.

Hosts: Chenopodiaceae (zur Strassen et al., 2003).

Distribution: Egypt, Canary Islandz, Israel, Iran (Bhatti et al., 2003).

***Eremiothrips similis* Bhatti, 1988**

Material examined: pole-nahr-ab, 33m, 1♀ on wheat, 13. IV. 2010, 1♀ On Barley, 13. IV. 2010.

Hosts: Poaceae

Distribution: Iraq (Bhatti et al., 2003), reported first time in Khuzestan Province (Ramezani et al., 2009).

***Eremiothrips zurstrasseni* Bhatti, Bagheri & Ramezani, 2009**

Material examined: Mianangi: 17m, 1♀+2♂ On Melon, 7. VIII. 2010.

Hosts: Poaceae

Distribution: Reported first time from Khuzestan Province by (Bhatti et al., 2009).

***Frankliniella occidentalis* (Pergande, 1895)**

Material examined: Zabol: 14m, 1♀ On Turnip; 2♀ On Common Plantain; 1♀ On Curely dock; 1♀ on Camels thorn, 1♀ On Clove, 22. IV. 2011.

Hosts: Western flower thrips have a board host range of more than 500 species in 50 plant families and are associated with many cultivated crops and ornamentals.

Distribution: Native to North America, The western flower thrips is widespread from sea Level to sub-alpine altitudes. It is the most common thrips species of California (Bryan & smith, 1989) and Arizona (Bibby, 1958). Iranian record: Reported first time from Tehran & Mahallat (Jalili Moghadam & Azmayesh Fard, 2004), Khuzestan province (Alavi & Behnamfar, 2005; Bhatti et al., 2009).

***Scirtothrips mangiferae* Priesner, 1932**

Material examined: Pole-Nahr-Ab, 33m, 1♀ On Wheat, 13. IV. 2010.

Hosts: *Citrus*, *Ficus*, *Caria*, *Mango*, *Myrtus communis*, *Vitis vinifera* (zur Strassen et al. 2003).

Distribution: Iran, Yemen, Sudden, Gabun (zur Strassen et al., 2003), In Iran reported from: Fars Province (Minaei & Alich, 2000b), Esfahan Province (Etebari, 2002), Khuzestan Province (Bagheri et al. 2002), Khuzestan Province (Alavi & Behnamfar, 2005; Bhatti et al., 2009).

***Thrips atratus* Haliday, 1836**

Material examined: Zabol university, 17m, 3♀ On Wheat, 16. III. 2010.

Hosts: On flower of many plants particularly Caryophyllaceae (Mound et al., 1976).

Distribution: Europe and Britain (Mound et al., 1976). Iranian record: Reported first time from Gorgen Province by (Gilasian et al., 2000), Province Kermanshah (Mohaghegh & Kheyrandish Koshkoei, 2002), Tehran Province (Jalili & Azmayesh fard, 2004).

***Thrips meridionalis* (Priesner, 1926)**

Material examined: Zabol university, 17m, 2♀ On Wheat, 16. III. 2010.

Hosts: On a wide range of plant species including deciduous trees and shrubs.

Distribution: Mediterranean, Caucasia, Central Asia. Iranian records: *T. meridionalis* was first reported from Iran by Priesner (1954) who recorded the species from Shiraz mountains (Fars Province) based on six females collected on flowers of Prangosferulaceae (L.). Fars Province (Minaei & Alich, 2000a; Minaei, 2002; Minaei et al., 2002; Alememansour & Fallahzadeh, 2004), Golestan Province (Mortazawiha & Dern, 1997; Gilasian et al., 2000), Kerman Province (Kheyrandish Koshkoei et al., 2000a; Teraz & Kheyrandish Koshkoei,

2002), Khorasan-e-shomali Province (Alavi & Kamali, 2003), Khuzestan Province (Cheraghian & Hojat, 1998), Lorestan Province (Jafari & Fallahzadeh, 2004), Tehran Province (Mortazawiha & Dern, 1977; Jalili Moghadam & Azmayesh Fard, 2004), Yazd Province (Mohaghegh & Kheyrandish Koshkoei, 2002; Alavi et al., 2007).

***Thrips tabaci* Lindeman, 1889**

Material examined: Zabol university, 17m, 3♀ On Wheat, 16. III .2010. Banmak: 12m, 5♀ on Bean, 8. VII. 2010. Pole-nahr-ab, 33m, 9♀ on Wheat, IV. 2010. Mianangi, 17m, 9♀ on Melon, 7. VI. 2010. Mianangi: 17m, 6♀ on Water melon, 7. VI. 2010. Pole-nahr-ab, 17m, 5♀ on Barely, 13. IV. 2010. Sade Sistan, 9m, 7♀ on Alfalfa, 14. V. III. 2009. Zabol: 14m, 1♀ on Chamomile; 1♀ on Drill, 22. IV. 2011.

Hosts: Polyphagous on Large numbers of plants.

Distribution: Cosmopolitan. In Iran: *T. tabaci* was first reported from Iran by Afshar (1938) on Tobacco, Cotton, Cucumber, Potato, Onion and Cabbage. *T. tabaci* is wide-spread in Iran and has been reported from most of areas in Iran (Salavatian, 1959; Farahbakhsh, 1961; Shojai, 1971; Zahedi, 1992; Modarres Awal, 1994), Azarbaijan-e-Gharbi Province (Akbarzadeh Shokat & Rezvani, 1998; Akbarzadeh Shoukat & Shayesteh, 2006), Azarbaijane-Sharghi Province (Hassan-Zadeh Salmasi, 1997; Mashhadi Jafarlo & Malkeshi, 2000; Mansouri et al., 2004; Taghizadeh et al., 2004), Fars Province (Javan Moghadam et al., 2000; Noori et al., 2000; Minaei et al., 2002; Alemansour & Fallahzadeh, 2004), Gilan Province (Etebari et al., 2000), Golestan Province (Gilasia, 2000; Alavi & zur Strassen, 2002; Mojeni, 2002; Alavi, 2004; Khormaly, 2004), Hamadan Province (Khanjani & Mirab Baluo, 2005a,b), Isfahan Province (Seyedoleslami & Naderi, 1993; Etebari & Hesami, 2002; Kalafchi et al., 2002; Saeidi et al., 2002) Kerman Province (Moharramipour et al., 2000; Teraz & Kheyrandish Koshkoei., 2002) Khorasan-e-Janubi Province (Moodi, 2002; Shahrokhi & Rahimi, 2003; Rahimi et al., 2004), Khorasan-e-Razavi Province (Abbasifar, 2004), Mazandaran Province (Farahbakhsh, 1961), Tehran Province (Davatchi, 1949; Farahbakhsh, 1961; Shojai, 1989; Javan Moghadamet al., 2000; Mirkarimi, 2000; Noori et al., 2000; Hosseininna & Malkeshi, 2004; Jalili Moghadam & Azmayesh Fard, 2004; Khani et al., 2004; Yazd Province (Mohaghegh & Kheyrandish Koshkoei, 2002). (Noori et al., 2000; Javan Moghadam et al., 2000), Khorasan-e-Shomali Province (Alavi & Kamali, 2003), Khuzestan Province (Cheraghian, 1996; Cheraghian & Hojat, 1998; Bagheri & Mosadegh, 2000; Bagheri et al., 2002; Bagheri et al., 2005b,c), Lorestan Province (Jafari & Fallahzadeh, 2004; Alavi et al., 2007).

Suborder Tubulifera

Family Phlaeothripidae

***Ataliothrips reuteri* (Bagnall, 1913)**

Material examined: Pole-nahr-ab, 33m, 1♂ on Wheat, 13. IV. 2010. Zabol: 14m, 1♀+2♂ on French Tamarik; 1♀+2♂ on Common Mallow, 22. IV. 2011.

Distribution: Iranian record: Reported first time from Kerman Province By (Barkhordari et al., 1981). Kerman Province (Mortazaviha & Dern, 1967), Kerman Province (Behdad, 1988), Jirift Province (Teraz & Kheirandish Koshkoei, 2002; Bhatti et al., 2009).

***Haplothrips aculeatus* (Fabricius, 1803)**

Material examined: pole-nahr-ab, 33m, 3♀ on Wheat, 13. IV. 2010.

Hosts: Poaceae.

Distribution: Palaearctic. Iranian records: This species was reported coincidently as a new record for Iran from Golestan province by Alavi (2000). Golestan province (Gilasian et al., 2000), Kerman Province (Kheyrandish Koshkoei et al., 2000b), Fars Province (Minaei & Alich, 2001; Alavi et al., 2007).

***Haplothrips eragrostidis* Priesner, 1931**

Material examined: Zabol: Zabol university, 17m, 6♀ +1♂ on Wheat, 16. III . 2010. Banmak: 12m, 3♀+2♂ on Bean, 8. VIII. 2010. Pole-nahr-ab: 15m, 3♀ On Alfalfa, 14. VIII .2009. Mianangi: 17m, 3♀ + 1♂ On Melon, 7. V. III. 2010. Mianangi: 7m, 1♀ on Water Melon, 7. VIII. 2010.

Hosts: Poaceae (zur Strassen et al. 2003).

Distribution: Egypt, Palestine (zur Strassen et al., 2003), Golestan Province (Alavi & zur Strassen, 2002).

***Haplothrips reuteri* (Karny, 1907)**

Material examined: Mianangi: 17m, 4♀ +2♂ on Melon, 7. VIII. 2010. Sade Sistan, 9m, 1♀ on Alfalfa, 14. VIII. 2009.

Hosts: Flowers of various plants.

Distribution: Mongolo-Mediterranean. Iranian records: *H. reuteri* was first reported from Iran by Priesner (1954) who recorded the thrips from Shiraz (Fars Province). Fars Province (Minaei & Alich, 2001), Ghazwin Province (Mortazawiha & Dern, 1977), Ghom Province (Mortazawiha & Dern, 1977), Kerman Province (Kheyrandish Koshkoei, 2000; Kheyrandish Koshkoei et al., 2000b; Moharrampour et al., 2000; Teraz & Kheyrandish Koshkoei, 2002), Khorasan-e-Janubi province (Rahimi et al., 2003; Rahimi et al., 2004), Khorasan-e-Shomali Province (Alavi & Kamali, 2003), Khuzestan Province (Cheraghian & Hojat, 1998; Bagheri et al., 2002; Bagheri et al., 2005c), Lorestan Province (Jafari & Fallahzadeh, 2004), Mazandaran Province (Cheraghian & Barimani Varandi, 2000), Tehran Province (Mortazawiha & Dern, 1977; Jalili Moghadam & Azmayesh Fard, 2004), Zanjan Province (Mortazawiha & Dern, 1977), Yazd Province (Mohaghegh & Kheyrandish Koshkoei, 2002; Alavi et al., 2007).

***Haplothrips tritici* (Kurdjumov, 1912)**

Material examined: Zabol: Zabol university, 17m, 1♀ On Wheat, 16. III. 2010. Wheat, 13. IV. 2010. Zabol: 14m, 2♀ on Earth Smoke; 1♀ On Common Mallow, 1♀ on Barley, 13. IV. 2010.

Pole-nahr-ab, 33m, 1♀ On 22. IV. 2011.

Hosts: Poaceae.

Distribution: West Palaearctic. Iranian records: *H. tritici* was first reported from Iran by Davatchi (1949) on wheat from Tehran (Tehran Province), Yazd Province, Rafsanjan and Kerman (Kerman Privanice). Azarbaijan-e-Gharbi Province (Farahbakhsh, 1961; Behdad, 1982), Azarbaijan-e-Sharghi Province (Farahbakhsh, 1961; Behdad, 1982; Hassan-Zadeh Salmasi, 1997), Chaharmahal-Bakhtiary Province (Behdad, 1982; Rowshandel, 2002), Fars province (Minaei & Alich, 2001), Isfahan Province (Bagheri & Radjabi, 2000; Behdad, 1982), Kerman Province (Davatchi, 1954; Behdad, 1982), Kheyrandish Koshkoei, 2000; Takaloozadeh & Zohdi, 2000; Teraz & Kheyrandish Koshkoei, 2002), Kermanshah Province (Farahbakhsh, 1961; Behdad, 1982), Khorasan-e-Shomali Province (Alavi & Kamali, 2003), Khuzestan Province (Behdad, 1982; Cheraghian, 1996; Cheraghian & Hojat, 1998), Kordestan Province (Kamangar & Radjabi, 2000), Lorestan Province (Shekarian & Rajabi, 2004), Tehran Province (Farahbakhsh, 1961; Behdad, 1982; Azmayesh Fard & Faridi, 1993), Semnan Province (Behdad 1982), Yazd Province (Devatchi, 1954; Behdad, 1982; Mohaghegh & Kheyrandish, Koshkoei, 2002; Teraz & Kheyrandish, Koshkoei 2002), Zanjan province (Azmayesh Fard & Faridi, 1993; Alavi et al., 2007).

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Table 1. The list of *Aeolothrips* species reported in Iran (Bhatti et al. 2009; Azarmi et al. 2010; Alavi et al. 2011).

	Species
1	<i>Aeolothrips afghanus</i> Jensen, 1984
2	<i>A. collaris</i> Priesner, 1919
3	<i>A. deserticola</i> Priesner, 1929
4	<i>A. albicinctus</i> Haliday, 1836
5	<i>A. faciatus</i> (Linnaus, 1758)
6	<i>A. gloriosus</i> Bagnall, 1914
7	<i>A. heinzi</i> zur Strassen, 1990
8	<i>A. intermedius</i> Bagnall, 1934
9	<i>A. mongolicus</i> Pelikan, 1985
10	<i>A. tenuicornis</i> Bagnall, 1926
11	<i>A. versicolor</i> Uzel, 1895
12	<i>A. balati</i> Pelikan, 1956
13	<i>A. citricinctus</i> Bagnall, 1993
14	<i>A. modestus</i> zur Strassen, 1965
15	<i>A. wittmeri</i> Priesner, 1935
16	<i>A. eremicola</i> Priesner, 1938



Figure 1. (A) *A. eremicola* ♂, (B) *A. eremicola* ♀, (C) Antennal segments ♀, (D) Antennal segments ♂, (E) Tergite IV-X ♂.

***DORCADION (CRIBRIDORCADION) PARACINERARIUM*
BREUNING, 1974 REST. NOV. (CERAMBYCIDAE)**

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[Özdikmen, H. & Kaya, G. 2015. *Dorcadion (Cribridorcadion) paracinerarium* Breuning, 1974 rest. nov. (Cerambycidae). Munis Entomology & Zoology, 10 (1): 252-254]

ABSTRACT: With the present work, *Dorcadion (Cribridorcadion) paracinerarium* Breuning, 1974 rest. nov. is discussed and regarded as a separate species again.

KEY WORDS: *Dorcadion (Cribridorcadion) paracinerarium*, rest. nov., Cerambycidae, Turkey.

***Dorcadion paracinerarium* Breuning, 1974 rest. nov.**

Dorcadion paracinerarium was originally described by Breuning (1974) from İçel province in South Turkey. Firstly, Braun (1979) was accepted it as a synonym of *Dorcadion cinerarium* (Fabricius, 1787). Then, however, Lazarev (2009) stated that *Dorcadion cinerarium* does not occur in Turkey. Later, Danilevsky in Löbl & Smetana (2010) gave it as a synonym of *Dorcadion micans* J. Thomson, 1867.

However, the original descriptions of *Dorcadion micans* and *Dorcadion paracinerarium* are more or less different. Probably from this point of view, Braun (1979) compared *Dorcadion paracinerarium* with *Dorcadion cinerarium* (In particular almost all described taxa are found under it, female *cinerarium* varieties, as for example *perroudi* Pic, *subobesum* Pic, *cinerarium* F. etc. or the male forms of *micans* Thoms., *densevestitum* Breun. etc.) and he decided that *Dorcadion paracinerarium* is as the same as the typical form of *Dorcadion cinerarium*, not *micans*.

Now, *Dorcadion micans* has two subspecies and the nominotypical subspecies with at least nine synonyms except *Dorcadion paracinerarium*.

All described forms of Turkish endemic *Dorcadion micans micans* and *Dorcadion micans susheriense* are distributed only in Northern and Western Anatolia. However, *Dorcadion paracinerarium* is distributed only in Southern Anatolia.

Therefore, we propose that *Dorcadion paracinerarium* should be as a separate species necessarily.

***Dorcadion paracinerarium* Breuning, 1974: 149** (Holotype ♂, Collection Carolus Holzschuh, Villach) [type locality “Mut: Sertavul pass” (Turkey: İçel)]
A: TR

Known distribution of *Dorcadion paracinerarium*: Southward to Bolkar Mountains as *D. c. m. micans* (Breuning, 1962); Şanlıurfa prov. as *D. sericatum micans* (Gül & Zümreoğlu, 1972); İçel prov.: Mut, Sertavul pass as the type locality of *D. paracinerarium* (Breuning, 1974); İçel prov.: Sertavul pass, Silifke, Karaman prov. (Braun, 1978 and 1979); Karaman prov. (personal data) (Fig. 1).

***Dorcadion micans* J. Thomson, 1867: 61**

***Dorcadion micans micans* J. Thomson, 1867: 61** (Holotype ♂, ex collection J. Thomson > R. Oberthür, Muséum National d'Histoire

Naturelle, Paris) [type locality "Armenien" undoubtedly mislabeled, should be Turkey] A: TR

macropus Kraatz, 1873a: 99 [Turkey: Amasya]

sericatum Kraatz, 1873a: 98 [Caucasus]

obscurans Pic, 1892f: 91 (*Dorcadion macropus* var.) [Turkey: Amasya]

amasinum Pic, 1898h: 58 [Turkey: Amasya]

atripes Reitter, 1900a: 88 (*Dorcadion sericatum* var.) [Turkey: Amasya]

tokatense Pic, 1901b: 12 (*Dorcadion impressicolle* var.) [Turkey: Tokat]

corallicorne Pic, 1904a: 4 (*Dorcadion sericatum* var.) [Turkey: Ankara]

subreductum Pic, 1942a: 2 (*Dorcadion sericatum* var.) [Turkey]

subobesum Pic, 1942a: 2 [Turkey: Amasya]

Known distribution of *Dorcadion micans micans*: Amasya prov. as *D. amasinum* (Aurivillius, 1921); Amasya prov. and Ankara prov. as *D. c. m. corallicorne*, Ankara prov. and Bursa prov. as *D. c. m. sericatum*, Amasya prov. and Tokat prov. as *D. c. m. macropus*, North Turkey as *D. c. m. subobesum* and *D. c. m. subreductum*, *D. c. m. perroudi*, *D. c. m. Amasinum* (Breuning, 1962); Ankara prov.: Elmadağ as *D. c. micans* (Demelt, 1963); Ankara prov.: Gölbaşı as *D. c. micans* (Perissinotto & Luchini, 1966); Çorum prov.: Boğazkale as *D. cinerarium m. amasinum* (Perissinotto & Luchini, 1966); Amasya as *D. c. micans* (Breuning et Villiers, 1967); Yozgat prov.: Central as *D. cinerarium amasinum* (Fuchs et Breuning, 1971); İzmir prov.: Bornova, Çanakkale prov.: Ezine as *D. cinerarium m. corallicorne* (Gül-Zümreoğlu, 1975); Yozgat prov.: Central as *D. c. micans* (Ex. Holzschuh, 1980); Anatolia (Danilevsky in Löbl & Smetana, 2010) (Fig. 2).

***Dorcadion micans susheriense* Breuning, 1970: 97 (*D. sinopense* ssp.)** (Holotype ♂, Muséum National d'Histoire Naturelle, Paris) [type locality "Suşehri" (Turkey: Sivas)] A: TR

Known distribution of *Dorcadion micans susheriense*: Sivas prov. as the type locality of *D. cinerarium susheriense* (Breuning, 1970); Anatolia (Danilevsky in Löbl & Smetana, 2010) (Fig. 3).

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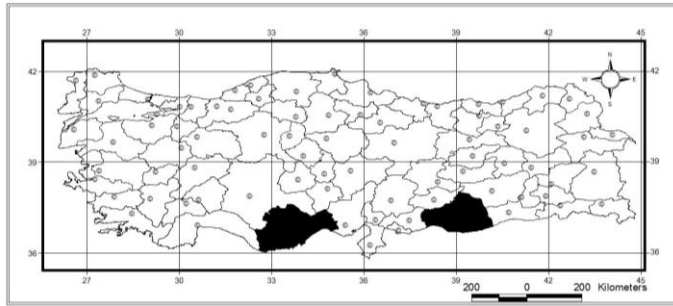


Figure 1. The distribution of *Dorcadion paracinerarium*.

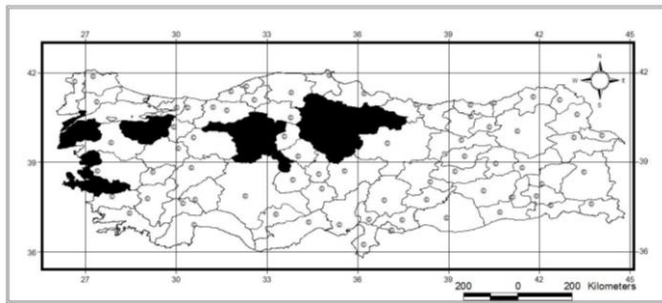


Figure 2. The distribution of *Dorcadion micans micans*.

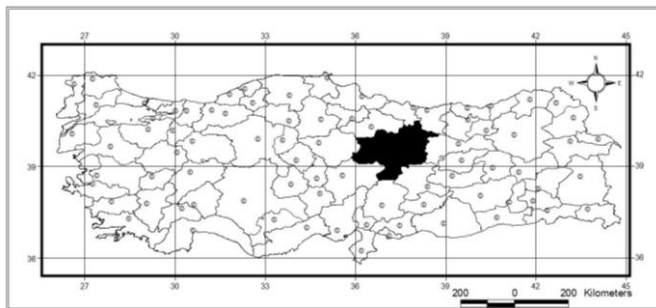


Figure 3. The distribution of *Dorcadion micans susheriense*.

SELECTION OF PROMISING BIVOLTINE BREEDS AND HYBRIDS OF THE MULBERRY SILKWORM, *BOMBYX MORI* L.

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[Singh, R., Gangopadhyay, D. & Nirupama, R. 2015. Selection of promising bivoltine breeds and hybrids of the mulberry silkworm, *Bombyx mori* L. Munis Entomology & Zoology, 10 (1): 255-258]

ABSTRACT: Selection of promising bivoltine breeds and hybrids of the mulberry silkworm, *Bombyx mori* L. was carried out utilizing subordinate function indices method of Gower (1971). Out of six bivoltine breeds, DNB₁ ranked first exhibiting maximum cumulative subordinate function indices value of 8.94 for eleven characters followed by DNB₆ which exhibited higher cumulative subordinate function indices value of 7.14. Among twenty five bivoltine hybrids, DNB₆ × CSR₂ ranked first exhibiting maximum cumulative subordinate function indices values of 8.66 followed by DNB₁ × CSR₂ exhibiting cumulative subordinate function indices values of 8.53. Four bivoltine hybrids viz., DNB₁ × CSR₄, DNB₇ × CSR₂, CSR₂ × CSR₄ and DNB₄ × CSR₄ were found promising which exhibited cumulative subordinate function indices values of 8.40, 7.94, 7.34 and 7.24, respectively. Application of subordinate function indices method for the selection of silkworm breeds and hybrids has been discussed.

KEY WORDS: Bivoltine hybrids, *Bombyx mori*, performance, silkworm breed, subordinate function indices.

In the mulberry silkworm, *Bombyx mori* L., identification of promising silkworm breeds and hybrids has been carried out through application of subordinate function index method of Gower (1971) by several workers (Ramesh Babu et al., 2002; Rao et al., 2001, 2004, 2006; Lakshmi & Chandrashekharaiyah, 2007; Nirupama et al., 2008). Silkworm breeds and hybrids can be selected on the basis of cumulative effect of several economic characters (Narayanawamy et al., 2002). Short-listing of silkworm breeds and hybrids has been conducted utilizing several statistical tools (Singh & Nirupama, 2012; Singh & Gangopadhyay, 2013). In the present study, an attempt has been made to select promising bivoltine breeds developed utilizing artificial parthenogenesis coupled with conventional breeding techniques and bivoltine hybrids through subordinate function index method.

MATERIALS AND METHODS

In the present study, six bivoltine breeds viz., DNB₁, DNB₂, DNB₃, DNB₄, DNB₆ and DNB₇ and twenty five bivoltine hybrids were prepared utilizing four bivoltine breeds viz., CSR₂, CSR₄, CSR₁₇ and NB₄D₂. Three replications were reared in each hybrid and 250 larvae were retained after IIIrd moult. The performance of bivoltine breeds is presented in Table 1. Data were recorded for eleven characters viz., fecundity, hatching percentage, pupation percentage, cocoon yield/10,000 larvae by weight, cocoon weight, cocoon shell weight, cocoon shell percentage, filament length, reelability, raw silk percentage and neatness. Data were analyzed through subordinate function index method (Gower, 1971). Subordinate function index method is used to short list breeds / hybrids showing a character with a small range of variation contribute as much as another character with a large variation range. In ranging the smallest value for the character is subtracted from each value

and the results are divided by range. The subordinate function is calculated by utilizing the following formula –

$$X_u = (X_i - X_{\min}) / (X_{\max} - X_{\min})$$

Where,

X_u = Sub ordinate function,

X_i = Measurement of trait of tested breed,

X_{\min} = Minimum value of the trait among all the tested breeds,

X_{\max} = Maximum value of the trait among all the tested breeds.

RESULTS

Mean rearing performance of six bivoltine silkworm breeds has been presented in Table 1. Data demonstrated variation for various characters among the different bivoltine breeds. Subordinate function index values in bivoltine breeds for eleven characters are given in Table 2. Two breeds DNB_1 and DNB_6 recorded higher subordinate function index values of 1.00 for six and three characters respectively. DNB_1 and DNB_6 showed their superiority by exhibiting cumulative subordinate function index value of 8.94 and 7.14 respectively. Mean rearing performance of twenty five bivoltine hybrids is given in Table 3. Three hybrids namely, $DNB_1 \times CSR_2$, $DNB_1 \times CSR_4$ and $DNB_6 \times CSR_2$ exhibited higher performance for most of the economic characters. Subordinate function index values in twenty five bivoltine hybrids for eleven characters are given in Table 4. As per the subordinate function index method, $DNB_6 \times CSR_2$ exhibited maximum cumulative subordinate function index value (8.66) followed by $DNB_1 \times CSR_2$ (8.53) and $DNB_1 \times CSR_4$ (8.40). In addition, four bivoltine hybrids *viz.*, $DNB_1 \times CSR_4$, $DNB_7 \times CSR_2$, $CSR_2 \times CSR_4$ and $DNB_4 \times CSR_4$ were found promising which exhibited cumulative subordinate function indices values of 8.40, 7.94, 7.34 and 7.24, respectively.

DISCUSSION

Data pertaining to this study revealed superiority of three bivoltine hybrids $DNB_1 \times CSR_2$, $DNB_1 \times CSR_4$ and $DNB_6 \times CSR_2$ exhibiting significant increase in most of the characters over the control $CSR_2 \times CSR_4$. No hybrid was found to excel in all the eleven characters under study. Therefore, it is necessary to adopt reliable statistical method to identify promising breeds / hybrids which give weight-age to all the economic characters. In this direction, efforts have been made to identify promising silkworm hybrids utilizing subordinate function index method (Ramesh Babu et al., 2002; Rao et al., 2001, 2004, 2006; Lakshmi & Chandrashekharaiiah, 2007; Nirupama et al., 2008).

In the present study, the indices obtained from subordinate function index method were worked out both for bivoltine silkworm breeds and bivoltine hybrids. Recently, short-listing of silkworm breeds and hybrids has been carried out by using several statistical tools (Singh & Nirupama, 2012; Singh & Gangopadhyay, 2013). The results demonstrated the superiority of two bivoltine silkworm breeds DNB_1 and DNB_6 among six breeds and three bivoltine hybrids $DNB_1 \times CSR_2$, $DNB_1 \times CSR_4$ and $DNB_6 \times CSR_2$ which excelled among twenty five hybrids and exhibited high subordinate cumulative index values (8.53, 8.40 and 8.66). In view of the results obtained, DNB_1 and DNB_6 can be further utilized in future breeding programmes for the development of outstanding bivoltine breeds and three promising bivoltine hybrids $DNB_1 \times CSR_2$, $DNB_1 \times CSR_4$ and $DNB_6 \times CSR_2$ may be recommended for commercial exploitation in the field.

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Table 1. Performance of bivoltine breeding lines of the silkworm, *Bombyx mori* L.

Breeds	Fecundity (no)	Hatching (%)	Pupation rate (%)	Yield/10,000 larvae (kg)	Cocoon wt (g)	Cocoon shell wt (g)	Cocoon shell (%)	Filament length (m)	Reelability (%)	Raw silk (%)	Neatness (p)
DNE ₁	547	96.28	94.33	15.500	1.759	0.373	21.22	870	80.6	15.70	92
DNE ₂	644	93.69	85.07	13.260	1.706	0.341	20.01	796	81.1	13.96	90
DNE ₃	558	93.07	85.33	13.253	1.590	0.345	19.79	805	76.6	14.30	91
DNE ₄	588	92.41	82.60	12.580	1.573	0.347	20.13	846	75.7	15.27	87
DNE ₅	612	76.36	82.00	15.627	1.973	0.380	19.26	835	82.7	13.98	91
DNE ₆	540	47.44	83.20	14.680	1.860	0.341	18.32	771	83.5	13.71	91
Max	644	96.28	94.33	15.627	1.973	0.380	21.22	870	83.5	15.70	92
Min	547	47.44	82.00	12.580	1.573	0.345	18.32	771	75.7	13.71	87
Mean	577	83.21	84.92	14.150	1.744	0.345	19.79	821	80.0	14.49	90
SD	47.25	18.92	3.41	1.290	0.160	0.030	0.96	36.34	3.2	0.81	1.75

Table 2. Subordinate index value of bivoltine breeding lines of the silkworm, *Bombyx mori* L.

Breeds	Fecundity	Hatching	Pupation rate	Yield/10,000 larvae	Cocoon wt	Cocoon shell wt	Cocoon shell	Filament length	Reelability	Raw silk	Neatness	Cumulative subordinate index value
DNE ₁	0.00	1.00	1.00	0.96	0.47	0.89	1.00	1.00	0.63	1.00	1.00	8.94
DNE ₂	1.00	0.95	0.33	0.22	0.33	0.40	0.58	0.25	0.69	0.13	0.60	5.48
DNE ₃	0.32	0.93	0.36	0.22	0.04	0.00	0.51	0.34	0.12	0.30	0.80	3.94
DNE ₄	0.56	0.92	0.06	0.00	0.00	0.03	0.62	0.76	0.00	0.78	0.00	3.74
DNE ₅	0.75	0.59	0.00	1.00	1.00	1.00	0.32	0.65	0.90	0.14	0.80	7.14
DNE ₆	0.18	0.00	0.13	0.69	0.72	0.40	0.00	0.00	1.00	0.00	0.80	3.92

Table 3. Performance of bivoltine hybrids of the silkworm, *Bombyx mori* L.

Hybrids	Fecundity (no)	Hatching (%)	Pupation rate (%)	Yield/10,000 larvae (kg)	Cocoon wt (g)	Cocoon shell wt (g)	Cocoon shell (%)	Filament length (m)	Reelability (%)	Raw silk (%)	Neatness (p)
DNE ₁ × CSR ₁	501	94.99	92.33	16.968	1.809	0.390	21.54	977	78.3	17.10	92
DNE ₁ × CSR ₂	503	95.83	93.87	16.920	1.816	0.381	21.00	930	78.2	17.05	93
DNE ₁ × CSR ₃	534	96.13	91.20	16.160	1.867	0.371	19.89	929	75.4	14.53	90
DNE ₁ × NB ₁ D ₁	550	93.03	94.27	16.747	1.849	0.377	20.38	844	73.3	15.67	88
DNE ₂ × CSR ₁	549	93.25	96.80	16.600	1.893	0.368	19.44	836	75.5	14.56	88
DNE ₂ × CSR ₂	563	96.15	92.40	15.747	1.789	0.346	19.36	954	80.4	14.45	92
DNE ₂ × CSR ₃	532	95.88	85.33	14.547	1.854	0.360	19.43	891	81.3	14.52	91
DNE ₃ × NB ₁ D ₁	485	94.45	90.27	14.747	1.715	0.342	19.92	834	79.3	14.56	87
DNE ₃ × CSR ₁	472	94.47	93.20	17.107	1.902	0.363	19.07	867	84.4	14.51	91
DNE ₃ × CSR ₂	488	94.57	86.00	13.413	1.551	0.306	19.73	754	80.0	14.63	89
DNE ₃ × CSR ₃	470	94.78	81.87	15.307	1.962	0.383	19.52	864	74.5	14.28	89
DNE ₄ × NB ₁ D ₁	471	93.83	86.67	14.320	1.723	0.320	18.56	776	72.9	13.33	92
DNE ₄ × CSR ₁	409	95.27	89.20	15.520	1.841	0.367	19.92	870	84.2	14.64	88
DNE ₄ × CSR ₂	457	97.11	94.80	16.427	1.837	0.372	20.24	925	75.7	16.23	91
DNE ₄ × CSR ₃	524	94.91	84.80	14.760	1.863	0.372	19.98	866	82.0	15.75	92
DNE ₅ × NB ₁ D ₁	557	95.24	91.80	15.307	1.817	0.351	19.29	913	81.8	14.61	91
DNE ₅ × CSR ₁	555	95.60	98.80	17.227	1.883	0.379	20.11	963	84.9	15.32	91
DNE ₅ × CSR ₂	592	96.06	85.20	14.400	1.665	0.318	19.13	826	82.1	14.51	92
DNE ₅ × CSR ₃	626	95.87	87.60	14.533	1.686	0.338	20.04	906	72.9	15.10	88
DNE ₆ × NB ₁ D ₁	630	95.24	95.60	15.840	1.652	0.323	19.54	779	73.4	14.66	90
DNE ₆ × CSR ₁	539	97.32	97.73	16.627	1.827	0.359	19.65	928	86.1	15.63	90
DNE ₆ × CSR ₂	519	95.40	83.20	12.920	1.693	0.332	19.62	778	79.7	14.42	91
DNE ₆ × CSR ₃	501	90.00	82.00	14.453	1.913	0.382	19.97	871	76.7	14.55	88
DNE ₇ × NB ₁ D ₁	562	95.52	90.00	15.667	1.833	0.347	18.94	925	72.7	14.12	87
CSR ₁ × CSR ₁	550	95.56	90.27	16.640	1.912	0.380	19.88	932	75.3	15.43	92
Max	630	97.32	98.80	17.227	1.962	0.390	21.54	977	86.1	17.10	93
Min	409	90.00	82.00	12.920	1.551	0.306	18.56	754	72.7	13.33	87
Mean	526	95.06	90.29	15.556	1.806	0.357	19.77	878	78.4	14.97	90
SD	51.67	1.46	4.78	1.190	0.100	0.020	0.63	62.53	4.2	0.88	1.81

Table 4. Subordinate index value of bivoltine hybrids of the silkworm, *Bombyx mori* L.

Hybrids	Fecundity	Hatching	Pupation rate	Yield/10,000 larvae	Cocoon wt	Cocoon shell wt	Cocoon shell	Filament length	Reelability	Raw silk	Neatness	Cumulative subordinate index value
DNE ₁ × CSR ₁	0.42	0.68	0.61	0.94	0.63	1.00	1.00	1.00	0.42	1.00	0.83	8.53
DNE ₁ × CSR ₂	0.43	0.80	0.71	0.93	0.64	0.89	0.82	0.79	0.41	0.99	1.00	8.40
DNE ₁ × CSR ₃	0.57	0.84	0.55	0.75	0.77	0.77	0.45	0.78	0.20	0.32	0.50	6.50
DNE ₁ × NB ₁ D ₁	0.64	0.41	0.73	0.89	0.73	0.85	0.61	0.40	0.04	0.62	0.17	6.09
DNE ₂ × CSR ₁	0.61	0.44	0.88	0.85	0.83	0.74	0.30	0.37	0.21	0.33	0.17	5.75
DNE ₂ × CSR ₂	0.70	0.84	0.62	0.66	0.58	0.48	0.27	0.90	0.57	0.30	0.83	6.74
DNE ₂ × CSR ₃	0.56	0.80	0.20	0.38	0.74	0.64	0.29	0.61	0.64	0.32	0.67	5.85
DNE ₃ × NB ₁ D ₁	0.34	0.61	0.49	0.42	0.40	0.43	0.46	0.36	0.49	0.33	0.00	4.33
DNE ₃ × CSR ₁	0.29	0.61	0.67	0.97	0.85	0.68	0.17	0.51	0.87	0.31	0.67	6.60
DNE ₃ × CSR ₂	0.36	0.62	0.24	0.11	0.00	0.00	0.39	0.00	0.34	0.34	0.33	2.95
DNE ₃ × CSR ₃	0.28	0.65	0.11	0.55	1.00	0.92	0.32	0.49	0.13	0.25	0.33	5.05
DNE ₄ × NB ₁ D ₁	0.28	0.52	0.28	0.33	0.42	0.17	0.00	0.10	0.01	0.00	0.83	2.94
DNE ₄ × CSR ₁	0.00	0.72	0.43	0.60	0.71	0.73	0.46	0.52	0.86	0.35	0.17	5.53
DNE ₄ × CSR ₂	0.22	0.97	0.76	0.81	0.70	0.79	0.56	0.77	0.22	0.77	0.67	7.24
DNE ₄ × CSR ₃	0.52	0.67	0.17	0.43	0.76	0.79	0.48	0.50	0.69	0.64	0.83	6.48
DNE ₅ × NB ₁ D ₁	0.67	0.72	0.58	0.55	0.55	0.54	0.24	0.71	0.68	0.34	0.67	6.35
DNE ₅ × CSR ₁	0.66	0.77	1.00	1.00	0.81	0.87	0.52	0.94	0.91	0.53	0.67	8.66
DNE ₅ × CSR ₂	0.83	0.83	0.19	0.34	0.28	0.14	0.19	0.32	0.70	0.31	0.83	4.97
DNE ₅ × CSR ₃	0.88	0.80	0.33	0.37	0.33	0.38	0.50	0.68	0.01	0.47	0.17	5.03
DNE ₆ × NB ₁ D ₁	1.00	0.72	0.81	0.68	0.25	0.20	0.33	0.11	0.05	0.35	0.50	5.00
DNE ₆ × CSR ₁	0.59	1.00	0.94	0.86	0.67	0.63	0.37	0.78	1.00	0.61	0.50	7.94
DNE ₆ × CSR ₂	0.50	0.74	0.07	0.00	0.35	0.31	0.26	0.11	0.52	0.29	0.67	3.90
DNE ₆ × CSR ₃	0.42	0.80	0.00	0.36	0.88	0.90	0.47	0.52	0.30	0.32	0.17	4.24
DNE ₇ × NB ₁ D ₁	0.69	0.75	0.48	0.64	0.69	0.49	0.13	0.77	0.00	0.21	0.00	4.84
CSR ₁ × CSR ₁	0.64	0.76	0.49	0.86	0.88	0.88	0.44	0.80	0.19	0.56	0.83	7.34

**BIostatISTICS OF *TRISSOLCUS VASSILIEVI* (HYM.,
SCELIONIDAE) DEVELOPED ON SUNN PEST EGGS COLD-
STORED FOR DIFFERENT DURATIONS**

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ABSTRACT: The common sunn pest (CSP) *Eurygaster integriceps* Puton is the most important pest of wheat and barley in Iran. A few egg parasitoid from *Trissolcus*, *Telenomus*, *Ooencyrtus*, etc. attack CSP eggs. Often the host eggs are stored in cold temperatures for subsequent use with negative effects on the parasitoids which increases by time. This study focused on quantitative changes of biostatistics including parasitism rate, emergence rate, sex ratio, fecundity, immature development, longevity and body size of *Trissolcus vassilievi* (Mayr) reared on host eggs stored for different periods in $5\pm 1^{\circ}\text{C}$. The results revealed that all above mentioned statistics were affected by storing with an increasing intensity by duration. Parasitism rate and sex ratio decreased more strongly than adult emergence rate. A maximum 35% decrease in fecundity was also observed with stronger effect in long term storages. An increasing effort to compensate the initial lag however was observed in first week of the reproductive life of those wasps that accessed to older eggs. Developmental time increased by a sigmoid trend by storage time. Head capsule width and hind tibia length as measurements of body size both decreased suddenly in those wasps that obtained from >2 week old eggs, but the width of the head capsule decreased more rapidly in females than males that may imply stronger fitness loss in females. As a conclusion host eggs stored < 1 month may use with negligible negative effects on the parasitoid efficacy, while longer storage times may cause serious negative syndromes.

KEY WORDS: *Trissolcus vassilievi*, *Eurygaster integriceps*, host storage, body size, sex ratio.

One basic problem in augmentation biological control programs is storage of biocontrol agents for subsequent use. Cold temperatures often are used in this purpose (van Driesche & Bellows, 1996). However holding egg parasitoids (Hym., Scelionidae) in cold conditions whether as pupa or as adult has no impressive results regarding high mortality during a short period (Asgari, 1995; Foerster et al. 2004; Kodan & Gurkan, 2004; Foerster & Doetzer, 2006). Storing host eggs and continuous rearing of these parasitoids from *Trissolcus*, *Telenomus*, *Gryon*, and *Ooencyrtus* spp. upon them has been an alternative method with better results (Sklyarov, 1970; Gusev & Shmettser, 1975; Asgari, 1995; Kivan & Kilic, 2005). Unfortunately target host, the common sunn pest *Eurygaster integriceps* Puton (Hem., Scutelleridae) has obligatory reproductive diapause and may not lay eggs continuously in laboratory (Alexandrov, 1947). Alternative hosts have been a solution in some cases (Safavi, 1973; Asgari, 1995; Shahrokhi, 1997; Kivan & Kilic, 2005). However, storing sunn pest eggs in cold temperatures for subsequent use both for augmentation and research purposes has been frequently adopted by scientists (Sklyarov, 1970; Safavi, 1973; Gusev & Shmettser, 1975; Asgari, 1995; Kivan & Kilic, 2005). This makes timing of research events very strict. Some researchers (e. g. Asgari, 1995, Iranipour, 1996, Kivan & Kilic, 2005) stored host eggs for a few months and could catch and rear egg parasitoids successfully. Nevertheless gradual reduction in host quality occurs during storage. However few

quantitative data is present (Asgari, 1995; Kivan & Kiliç, 2005) about time horizon in which host eggs may use without any adverse impact on parasitoids' biostatistics. On the other hand, reaction of different egg parasitoids to duration of host storage may be different. For example it seems that *Ooencyrtus* species are less sensitive to host availability (Bazavar, 2013) or quality (*i.e.* they easily accept previously parasitized hosts both for superparasitism and multiparasitism; see Safavi, 1973, Iranipour, 1996, Ahmadpour et al. in press) than *Trissolcus* species or as another example *Trissolcus grandis* (Thomson) show behavioral flexibility in harsh conditions (Iranipour, 1996). Therefore, if we are going to use stored hosts for rearing or research purposes we need beware of reaction of the subjected species. Indeed every species is likely to have its own special characteristics in this relation (van Driesche & Bellows, 1996).

Although a relatively long list of natural enemies with special emphasize on egg parasitoids has been published by scientists (Safavi, 1973; Kozlov & Kononova, 1983; Radjabi & Amir Nazari, 1989; Iranipour, 1996; Modarres Awal, 1997; Radjabi, 2000; Sakenin et al., 2008; Samin et al., 2010a,b,c,d, 2011a,b), only a few of them have potential of using in applied biological control. *T. grandis* as dominant species of many parts of Iran (Radjabi & Amir Nazari, 1989) as well as *T. vassilievi*, the dominant species of Varamin - a typical region of sunn pest aggressions (Iranipour et al., 2011) - are the most obvious chooses. Both species have been used in augmentation programs in research scale (Asgari, 1995, 2011; Shahrokhi, 1997).

Safavi (1973) stated that keeping host eggs in 2-4°C may cease embryogenesis and continuation of the cold condition causes the fetus to kill. Such eggs can be used for parasitoid augmentation. In these temperatures eggs may store for several months and parasitic wasp may develop as long as their vitellus is intact.

Sklyarov (1970) obtained poor results in biological control of sunn pest due to using one year old stored eggs for rearing parasitoids. Gusev & Shmettser (1975) studied the optimum conditions for rearing *T. grandis* and *T. semistriatus* (Nees) in laboratory. Their results showed that storing host eggs caused an increase in male fraction to 37, 52, 84 and 97% following 1, 1.5, 2 and 2.5 months storing in cold conditions while no more than 20% of control wasps were males. On the other hand adult emergence rate from host eggs declined to 22% at the end of this duration compared to 86% in control. Depositing *E. integriceps* eggs at 4, 6 and -23°C and further offering them to *T. grandis* and *Telenomus chloropus* (Thomson), showed that adult emergence was high enough after 4.5 months and no significant differences in emergence rate was present from 3 to 7 months (Asgari, 1995). In other part of this study time horizon in which *Graphosoma lineatum* L. eggs remain acceptable for *T. grandis* and *T. vassilievi* following deposition in 4, 5 and 6°C was determined to be 2.5 months. The maximum parasitism rate was 96% for both species. Storing parasitized eggs in pupal stage of *T. grandis* in 6°C was led to 97.2% mortality after 1.5 months. On the other hand preserving female *T. grandis* in 4°C caused 69 and 95% mortality after 1 and 2 months respectively. Thus Asgari concluded that host egg storage is the best method of lengthening mass production duration of *Trissolcus* spp.

Kivan & Kiliç (2005) compared fresh and stored eggs of *E. integriceps*, *Dolycoris baccarum* (L.), *G. lineatum* and *Eurydema ornatum* (L.) in regards of *T. semistriatus* development and parasitism rate. Two low-temperature regimes (+6 and -20°C) were used in this study and 50 eggs per host species were exposed to females once a month. The results showed that those host eggs that stored at 6°C remained acceptable up to 2 months, while those ones stored at -20°C continued to support parasitism up to 4 months, although a decrease was observed in the

parasitoid performance with time as a lag in development. The greenhouse release of *T. basalis* (Wollaston) adults hatched from fresh eggs of *N. viridula* (L.) as well as eggs frozen at -25°C led to similar results by Ramos & Ferre (2010).

MATERIALS & METHODS

I- Stock cultures of the insects: Two populations of *T. vassilievi* were used in this study; one from northwest of Iran, Tabriz (38°N , 46°E with 1360 m AMSL) and the other one from Varamin (35°N , 51°E with 918 m AMSL) in center of Iran with a 600 km distance between the two. Both populations obtained by field collections, as parasitized eggs of the host. The parasitized egg masses were transferred to glass tubes (1.5×10 cm) and maintained in laboratory ($26 \pm 1^{\circ}\text{C}$, $50 \pm 5\%$ RH and 16L: 8D photoperiod) up to when adults were emerged. After discrimination of the mentioned species a stock culture was established providing honey droplets as food and host eggs for augmentation.

Adult bugs of *E. integriceps* also were collected from wheat fields by a sweep net and maintained at the same condition in 50 pairs in rectangular plastic dishes ($30 \times 20 \times 9$ cm, L: W: H) containing wheat kernels, water supplies and folded papers as ovipositing substrate (Zomorodi, 1961).

II- The experiments: The host egg clutches were removed daily from stock cultures and immediately were transferred to a refrigerator (277 liter internal capacity, Pars Company, Iran) with temperature settings of $5 \pm 1^{\circ}\text{C}$. Those eggs that stored for 1, 2, 4, 6 and 8 weeks accompanying with a control (fresh eggs) were exposed in glass tubes (1.5×10 cm) in 20 replications to one day old inexperienced mated female individuals of *T. vassilievi* for 24 h. Each replication was bearing one clutch including 14 host eggs. After this period female wasps were removed and host egg clutches were kept in a growth chamber (model IKH.RH Iran Khodsaz Company, Iran).

Parasitism rate (number of parasitized eggs per 14 eggs initially exposed), emergence rate (number of emerged wasps per parasitized hosts), immature development time (number of days spent within host egg) separately for females and males, and sex ratio (female% of the wasps emerged) was measured for overall individuals developed in the experimental environment. Then 20 pairs of females and males were selected randomly among the emerged wasps and adult longevity (number of days living after emergence) separately for females and males, and total fecundity of females (number of parasitized eggs in adult life span) as well as its distribution in three day intervals were recorded. All the experiments were carried out at $26 \pm 1^{\circ}\text{C}$, $50 \pm 5\%$ RH, 16L: 8 D h photoperiod. Finally the parasitoid size was measured after death as width of head capsule from dorsal view and right hind tibia length (mm) using a stereomicroscope (Olympus, CH30, Japan) only for the chosen wasps. A scaled calibration slide (made by Graticules LTD. England, $100 \times 0.01 = 1$ mm) was used for converting number of divisions of a scaled ocular lens to unite length in mm.

III- The stable population growth parameter approximations: In order to make some predictions about the results of augmentation we required some estimates about stable population growth parameters. Fortunately in this study 3 day interval information of fecundity was present. So a rough approximation of net replacement rate (R_0), mean generation time (T) and intrinsic rate of increase (r_m) values obtained as:

$$R_0 = SR.F \quad (\text{eq. 1})$$

$$T = D + \frac{\sum f_i x_i}{\sum f_i} \quad (\text{eq. 2})$$

$$r_m = \ln(R_0)/T \quad (\text{eq. 3})$$

The SR, F, D, f_i and x_i are sex ratio, total fecundity, mean developmental time, three day fecundity of the i 'th interval, and midpoint of the interval i respectively. All these components were estimated in the experiment condition, but no variance of them was available for statistical analysis. Two additional parameters including finite rate of increase (λ) and doubling time (DT) also were estimated as $\exp(r_m)$ and $\ln(2)/r_m$.

IV- Data analysis: A factorial experiment was performed on the basis of a completely randomized design (CRD) with two factors including the wasp populations in two levels (Tabriz and Varamin populations) and cold-storage durations of the *E. integriceps* eggs in six levels (fresh eggs or control, 1, 2, 4, 6 and 8 week stored eggs in 5 ± 1 °C). A third factor *i. e.* gender in two levels (female and male) was also included when body size, development or longevity were analyzed. Finally in fecundity analysis an additional split plot in time design was adopted for including 3-day interval fecundities as main plot and both the wasp population and storing duration as subplots. The mean comparisons were done using Tukey's HSD test ($\alpha = 0.05$). Data analysis was done by SPSS.

RESULTS

I- Parasitism rate: No significant difference was observed in number of parasitized eggs between the two populations of the wasp ($F=0.071$; $df=1, 228$; $P=0.791$). So a common mean was estimated for both populations in each storing level. Nevertheless the number of host eggs attacked by wasps decreased with increasing duration of storage ($F=45.38$; $df=5, 228$; $P<0.01$; Fig. 1a). No significant decline however was observed until two weeks, but a significant decrease first time was observed in 1 month stored eggs and continuing the storage caused a further decline in parasitism in 8 week-old eggs. It seems that a significant decrease occurs in parasitism each month. The overall trend of this decline is so that one less egg will parasitize per 1.2 weeks (8.5 days) storing in cold condition. This trend will lead to zero parasitism after 16 weeks (4 months).

II-Emergence rate: The number of host eggs from which an adult wasp successfully was emerged decreased with increasing duration of storage ($F=7.48$; $df=5, 218$; $P<0.01$). The fall in emergence rate was observed only at the end of the experiment (the week 8) with a 12% decrease proportional to fresh eggs (fig. 1b). Difference between wasps of the two population also was significant ($F=6.03$; $df=1, 218$; $P=0.015$). The difference between wasps was negligible (<3%) up to two weeks, then increased in weeks 4 and 6 (7.6-10.1%) with more sever response of Tabriz wasps and then converged again in week 8 by a delayed response of Varamin wasps. In spite of different pattern of response of the two populations, the interaction between wasps and storing period was not significant ($F=1.20$; $df=5, 218$; $P=0.308$).

III-Sex ratio: The sex ratio was not significantly different between the populations ($F=0.159$; $df=1, 218$; $P=0.690$), but influenced by storage periods ($F=17.18$; $df=5, 218$; $P<0.01$). The general pattern of sex ratio changes with storing duration in both populations of wasps was so that 80-90% of progeny were female in ≤ 1 month stored hosts while it significantly declined to 50-60% in longer storage periods (Fig. 1c).

IV-fecundity: The total fecundity of wasps of the two populations was largely similar in all treatments ($F=0.291$; $df=1, 228$; $P=0.590$), but considerably influenced by storage duration ($F=210.92$; $df=5, 228$; $P<0.01$). A gradual

decreasing trend was obvious even in 2 week old eggs and fecundity continued to decline with longer storage. The total fecundity reached to 2/3 of the fresh eggs 1.5 months after storing in cold condition. It means 182 reached to 118. The inspection of parasitism trend of *T. vassilievi* in 3 day intervals of oviposition period revealed that those wasps that encountered ≤ 1 week old eggs showed their maximum performance in the first 3 day interval followed by a non-significant change in the second one. The fecundity of the remaining intervals of these wasps had a decreasing trend by time. Those wasps that encountered to older host eggs, revealed a different pattern. Depending on storing time of host eggs, they revealed 55-80% performance of the control wasps in the first 3-day interval of their oviposition period, but they further enhanced their reproductive efforts to compensate their lower initial performance. As a result they performed 11.5-19% higher parasitism in the second interval and 12.5-39% in the 3rd one in comparison to the first interval. Hence their reproductive curve reached to a peak at the third interval while exceeding that of the control, followed by a further decline afterward (Fig. 2). These patterns were similar in both populations.

V-development: The developmental time of immature stages of *T. vassilievi* was significantly different between parasitoid populations ($F=15.90$; $df=1$, 2346; $P<0.01$), genders ($F=758.09$; $df=1$, 2346; $P<0.01$) and storage periods ($F=1873$; $df=5$, 2346; $P<0.01$). Neither two-way nor three-way interactions were significant (wasp \times sex: $F=0.111$; $df=1$, 2346; $P=0.740$, wasp \times storage: $F=0.130$; $df=5$, 2346; $P=0.986$, sex \times storage: $F=1.924$; $df=5$, 2346; $P=0.087$, wasp \times sex \times storage: $F=0.577$; $df=5$, 2346; $P=0.718$). The developmental time increased with a sigmoid trend with increasing duration of storage in all treatments (both sexes of both populations). As a result difference between all treatments (except 6 and 8 weeks) placed in different groups of Tukey's HSD. The maximum lengthening in development time was 32% in 8 week stored eggs proportional to control (Fig. 3). Development time of both populations was very near to each other in all treatments but the minor differences were still significant. Thus Tabriz wasps developed slightly slower than Varamin wasps. Moreover males developed nearly one day sooner than females.

VI- longevity: Like previous variable, longevity also was affected by all factors included in the experiment ($F=18.91$; $df=1$, 456; $P<0.01$ for population, $F=81.54$; $df=1$, 456; $P<0.01$ for gender and $F=19.04$; $df=5$, 456; $P<0.01$ for storage period). No interaction was significant again (wasp \times sex: $F=1.465$; $df=1$, 456; $P=0.227$, wasp \times storage: $F=0.577$; $df=5$, 456; $P=0.718$, sex \times storage: $F=1.782$; $df=5$, 456; $P=0.115$, wasp \times sex \times storage: $F=0.218$; $df=5$, 456; $P=0.955$). The longevity was decreased 10-15 days during 8 weeks of host storage both in males and females. The females' mean longevity was 3-15 days longer than males in different treatments. On the other hand longevity in Varamin wasps was 1-8 days (average 3 days for females and 5 days for males) longer than Tabriz wasps (Table 1).

VII-body size: One probable effect of host quality on parasitoid is in its body size that in turn affects the fitness components like fecundity, development rate etc. Right hind tibia length as well as head capsule width were measured in this context. Both variables were affected by all the experiment factors ($F=75.28$; $df=1$, 456; $P<0.01$; $F=152.81$; $df=1$, 456; $P<0.01$; $F=274.51$; $df=5$, 456; $P<0.01$ for tibia length of the two populations, genders and storing periods and $F=39.35$; $df=1$, 456; $P<0.01$; $F=247.95$; $df=1$, 456; $P<0.01$; $F=81.48$; $df=5$, 456; $P<0.01$ for width of the head capsule for the same factors respectively). Interaction between sex and both factors of wasp population and storing duration also were significant for both variables ($F=19.83$; $df=1$, 456; $P<0.01$; and $F=12.89$; $df=1$, 456; $P<0.01$ for sex \times population respectively for tibia length and head capsule width and $F=2.58$; $df=5$,

456; $P=0.025$; and $F=25.12$; $df=5$, 456; $P<0.01$ for the same variables for sex \times duration). General pattern of these changes was so that head width was broader and tibia length shorter in females, body size decreased -in females more- by storing duration and Varamin wasps were a little larger than Tabriz wasps. Head capsule width was around 0.6 mm in females of control wasps (0.596 and 0.610 mm in Tabriz and Varamin wasps respectively) and 0.05-0.06 mm less broad in males. Storing host eggs for two months lead to head capsule decrease 14.7-16.0% in females and 4.3-5.5% in males. This may imply a stronger effect on females. Trend in hind tibia shortening was more similar between females and males of both populations (12-13% decrease in all treatments at the end of 8 weeks). It must be pointed out that a sharp decline in body size appeared in those wasps that emerged from host eggs stored more than 2 weeks (Fig. 4).

VIII- stable population growth parameters: The stable population growth parameters values are summarized in table 2. A 2.5 time difference in R_0 , 40% in r_m and 17% in T was observed among treatments.

DISCUSSION

Cold storage is a common action for maintaining natural enemies produced over demand for subsequent use with varying results in different species (van Driesche & Bellows, 1996). Such efforts have had poor results in telenomin egg parasitoids (Asgari, 1995; Foerster et al., 2004; Kodan & Gurkan, 2004; Foerster & Doetzer, 2006). Alternatively host egg storage under such a condition has shown more desirable results (Lazarov et al., 1969; Sklyarov, 1970; Popov, 1974; Gusev & Shmettser, 1975; Correa-Ferreira & Moscardi, 1993; Asgari, 1995; Awadalla, 1996; Kivan & Kilic, 2005). In this study the effect of the recent action was explored on *T. vassilievi* egg parasitoid of *E. integriceps*. As expected this action caused negative effects on produced wasps with increasing intensity with longer storages, as earlier scientists also reported for the other species (above mentioned references). Our main focus was on research purposes rather than mass rearing so we had special emphasize on evaluation of quantitative impacts on the parasitoid biostatistics. Yet the results can exploit for applied purposes. Indeed many statistics estimated here are used as criteria in quality control of biocontrol agents. For example body size is an indicator of a parasitoid quality (larger parasitoid higher parasitism) (King, 1987; Godfray, 1994; Arakawa et al., 2004). Many entomologists have shown that body size is related to fitness indices such as fecundity, survival and development time (Sagarra et al., 2001; Allahyari et al., 2004; Silva et al., 2011). This is also true with respect to *T. vassilievi*. Also some researchers showed that host quality is related to sex allocation in female parasitoids (Pak & Oatman, 1982; Waage, 1986; Awadalla et al. 1996). The general pattern of this decision for a foraging parasitoid is so that she allocates more suitable hosts to her daughters (Waage, 1986). The tendency of *T. vassilievi* to produce more sons in longer stored host eggs confirms such a pattern that already also has been seen in *T. grandis* and *T. semistriatus* with higher intensity (Gusev & Shmettser, 1975). However in contrast to *Anastatus bifaciatus* Forcroy (Hym., Eupelmidae) this tendency is not absolute. No female progeny has been obtained on sunn pest eggs attacked by the later species apparently due to small size of the host egg (Iranipour et al., 1998). The reason of such discrimination between hosts in sex allocation has been stated that is higher fitness loss in females over males (van Driesche & Bellows, 1996). Body size measurements of *T. vassilievi* support this hypothesis.

An interesting point in our results is avoiding of *T. vassilievi* females from maximum clutch in stored host eggs. Taking into account that *T. vassilievi* can

parasitize more than one host clutch (each one including 14 eggs) per day (unpublished data; also may be deducted by averaging three day fecundities), we will find her exploitation has been reduced actually to less than half a clutch in the longest storage treatment. This may suggest presence of a suppressant or alternatively absence or reduction of a stimulant that may percept by receptors of ovipositor tip (Okuda & Yeargan, 1988). The compensatory effort of a parasitoid to regain her lost opportunity observed by Bazavar (2013) both in *T. grandis* and *Ooencyrtus fecundus* Ferriere & Voegelé in response to no-access durations which is in full agreement to our results on *T. vassilievi*. Nozad Bonab & Iranipour (2012) showed that development rate of *T. grandis* is a function of total protein content of host eggs. Hence, reducing speed of development of *T. vassilievi* in older eggs also may suggest a parallel decrease in protein content of the cold-stored eggs maybe via breaking protein molecules. Interestingly emergence rate less effectively influenced by cold-storing. This may imply that sufficient nutrient although with worse quality is still present for entire development. These results are in partial agreement to Asgari (1995) and Kivan & Kiliç (2005) statements on *Telenomus chloropus*, *Trissolcus grandis*, and *T. semistriatus*.

All previous studies (Bazavar, 2013; Rafat et al., 2013; Ahmadpour et al., in press; Nozad Bonab et al., in press) reveal a characteristic type I survivorship curve of the egg parasitoids of sunn pest. High emergence rates may confirm this generalization in *T. vassilievi* too. So no immature mortality is necessary to include in calculating R_0 values. In exact estimations of R_0 on the other hand both age specific survivals and sex ratios have to include. In this study however due to no access to these data minor biases are possible. First source of bias is a common sex ratio used as average of the total cohort. This corresponds to equal sex ratios in all ages *i. e.* $S_x = S_{x+1} = \dots S_{\omega-1} = S_{\omega}$. Previous works show that the sex ratio decreases by age. This is not however an important case because common sex ratio is a weighted mean of all ages and because fecundity itself declines sharply at senescence, later sex ratios contribute small weights. The second source of bias is recording fecundity data in 3 day intervals instead daily records. This corresponds to equal fecundities in all three days of an interval. Although this may create bias in estimates, this bias may not be important because fecundity of a day more likely resembles that of yesterday or tomorrow. This explanation also may be true in the T calculations. As a result we expect only minor biases in r_m estimates as well. Comparison to results of the other scientists confirms accuracy of our estimates. For example R_0 estimates as SR.F in *O. fecundus* lead to 0.5-4% bias in different treatments (Ahmadpour et al., in press). Developmental time and T estimates are also very similar in both species. As a result r_m estimates are also the same in both.

As a conclusion we may result that cold-storing for a week has no negative effect on biostatistic of *T. vassilievi* except a minor significant increase in development time that is less than 0.2 days, although this negligible difference has been significant. In this sense we can use one week old stored eggs for experiments with negligible bias in results. Continuing storing host eggs one week more will lead to significant fecundity loss (5%) in addition to one day delay in development. No statistic was affected >10% in this treatment, therefore 2-week old eggs also may use in research studies with less than 10% bias in results. However longer storage may cause considerable bias in majority of the statistics. These deviations are considerable in research contexts, because high precision and accuracy is needed.

In terms of mass production with particular reference to inundation programs the situation will be deeply different. To demonstrate this claim we will follow a simple model bellow. First let's we consider only one wasp population (Tabriz

population) because the results for both are deeply similar. Regarding the r_m value in a stable population no more than 5% change will occur monthly in number of wasps produced between control and those wasps that continuously has been reared in 1 week old eggs, while this difference will be 1.7, 3.7, 8 and 8.8 times in remaining treatments in similar horizon of time. Of course this is provided that no resource limiting factor such as density is present *i. e.* the rate of parasitoid/ host is low enough to prevent interference or exploitation competition (Maybe in mass production condition these forces are more critical than host-storage effects). Since sunn-pest egg parasitoids have a short releasing interval in field (Shahrokhi, 1997; Asgari, 2011), a seasonal activity of a biofabric rather may be expected. Hence a stable population is rarely possible in biofabric. The most common situation then is holding a small population semi-active out of season and starting mass production in an appropriate time to obtain a population large enough for inundative release in a determined time. Now we come back again to our model. In the mentioned situation we will have separate generations rather than overlapped stable populations. Let's the initial number of female wasps for beginning augmentation be N_0 . Each female in a generation will increase R_0 -times through T days. If desired number of females at the end of production assumed to be N_e and number of generation required to achieve this be n , then the time required for satisfying the above condition will be nT and the final population after this period will be $N=N_0R_0^n$. N is the number of females that are available for release that will be satisfactory if $N>N_e$. Because in inundation release no transition to the next generation is expected (van Driesche & Bellows, 1996), both male and female progeny are of the same value in terms of host egg mortality. The only thing that must be further considered is that the older eggs (8 week-old) will led to 2/3 parasitism after release, so if 8 week-old eggs are used in mass production the mentioned condition must be changed to: $N>1.5N_e$. The calculations based on the above mentioned model were illustrated in Figure 5 that may use for decision making. This reveals a maximum 100-times difference in number of female wasps produced in biofabric after five generations which will take 106 and 124 days respectively for control and 8-week old eggs.

Now suppose that we need 500 million wasps for release in 10 May. Further suppose we are going to start rearing only with a stock of 200 fertile females. The decision algorithm will be drawn by following this instruction. Because all figures in figure 5 are calculated per an individual initial female, so they will multiply by 200 when we are going to calculate number per 200 initial females. So it is better the desired number (500 million) divide by 200 for converting calculations to *per capita* counts. It means 2.5 million per an individual female is needed that corresponds to 500 million per 200 females. So we now may refer to figure 5 to decide how many generations are needed to achieve this. This amount of females are available in < 2 week-stored treatments only after three generations, while in other treatments we need to continue rearing a generation more with many extra females produced over demand. In order to manage additional costs due to further generations and extra females two options are available. The first one is handling initial number of females to reach 500 million after a determined number of generations (*i. e.* keeping number of generations constant). If initial number available is less than required, then we have to start a generation sooner with a small number to achieve the expected number. For example in above instance we need respectively 109, 115, 161, 300, 1314 and 1635 primary females in control, 1, 2, 4, 6 and 8-week old host eggs to achieve 500 million parasitic females after three generations. It is obvious that this amount is available for first three treatments (< 2 week old eggs), but in the other cases a further generation with small numbers is

needed. In this example however difference between 4 week old eggs is not considerable compared to previous treatments, but imposes additional costs for producer. Holding stock culture as large as 300 females/ generation will resolve the problem without increasing mass production costs. The difference of the two other treatments is however very more considerable as they need ≥ 5 times larger initial population to start. So, as long as the host eggs are not > 1 month-old the costs do not increase largely.

The second option is starting with any initial numbers of females available and stop whenever the concerned number or more is available. Extra females also may avoid again with handling initial number. The major difference between the two alternatives is number of generations in mass production. For example if we have to use the older eggs we can start with 1635 females and achieve the considered number of females after three generations or alternatively start with 25 females and gain the same number after four generations. It depends on producer decision and of course primarily to economic evaluations. The time required for both is $4T=99.2$ days, with this major difference that in the first situation the first generation is rather a small scale culture for achieving 1635 females rather than a mass production. So we need start our production 100 days earlier *i. e.* at the end of January. If fresh eggs were always available we could start $3T=63.4$ days earlier *i. e.* around the second week of March.

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Table 1. Adult longevity (\pm SE) of *T. vassilievi* on cold-stored eggs of sunn pest for different durations.

Period of storage (week)	Adult longevity (day) \pm SE			
	Tabriz		Varamin	
	female	male	female	male
0	62.3 \pm 3.27a*	48.45 \pm 2.50a	65.95 \pm 2.56a	56.0 \pm 3.31a
1	62.15 \pm 2.11a	47.25 \pm 1.60a	65.25 \pm 2.16a	55.55 \pm 2.73a
2	52.8 \pm 1.08b	46.55 \pm 2.23b	54.65 \pm 3.17b	51.5 \pm 1.57b
4	53.2 \pm 3.02b	46.2 \pm 1.20b	54.3 \pm 2.87b	47.45 \pm 1.38b
6	50.7 \pm 1.62bc	43.75 \pm 2.69bc	54.1 \pm 2.44bc	47.25 \pm 1.45bc
8	47.15 \pm 1.88c	39.0 \pm 0.83c	51.55 \pm 0.65c	44.45 \pm 2.52c

*Means bearing the same lowercase letter in a column are not significantly different (Tukey's HSD, $\alpha=0.05$).

Table 2. Stable population growth parameters of *T. vassilievi* progeny developed in cold-stored eggs of sunn pest for different durations.

population	treatment	Parameter				
		R_0	Γ_m	λ	DT	T
Tabriz	Fresh egg	166.24	0.2421	1.274	2.86	21.12
	1 week old egg	163.35	0.2405	1.272	2.88	21.19
	2 week old egg	145.85	0.2251	1.252	3.08	22.14
	4 week old egg	118.63	0.1986	1.220	3.49	24.05
	6 week old egg	72.48	0.1730	1.189	4.01	24.76
	8 week old egg	67.37	0.1697	1.185	4.08	24.80
Varamin	Fresh egg	165.34	0.2434	1.276	2.85	20.98
	1 week old egg	144.80	0.2353	1.265	2.95	21.14
	2 week old egg	150.50	0.2267	1.254	3.06	22.12
	4 week old egg	125.23	0.2014	1.223	3.44	23.98
	6 week old egg	68.91	0.1729	1.189	4.01	24.48
	8 week old egg	64.74	0.1689	1.184	4.10	24.70

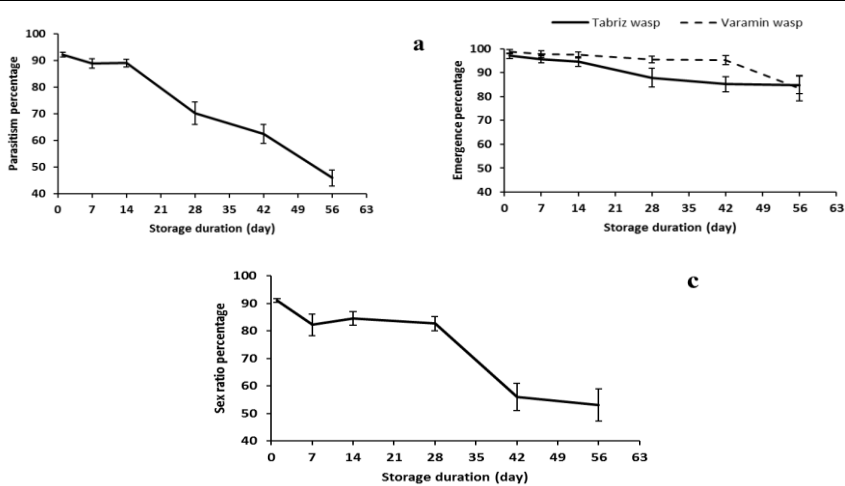


Figure 1. (a) Parasitism percentage, (b) emergence percentage and (c) progeny sex ratio (females %) of *T. vassilievi* on cold-stored eggs of sunn pest for different durations. Notice that parasitism rate and sex ratio curves have been pooled for both wasp populations due to non-significance.

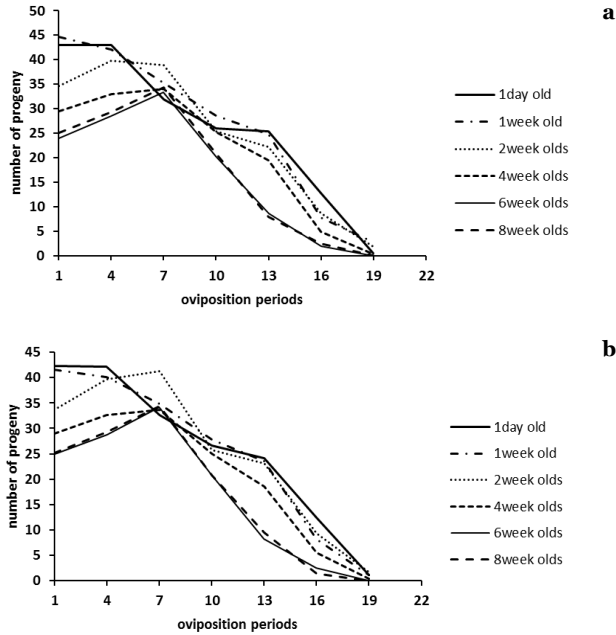


Figure 2. Fecundity distribution of *T. vassilievi* emerged from cold-stored sunn pest eggs over 3 day intervals of life span, a) Tabriz population b) Varamin population.

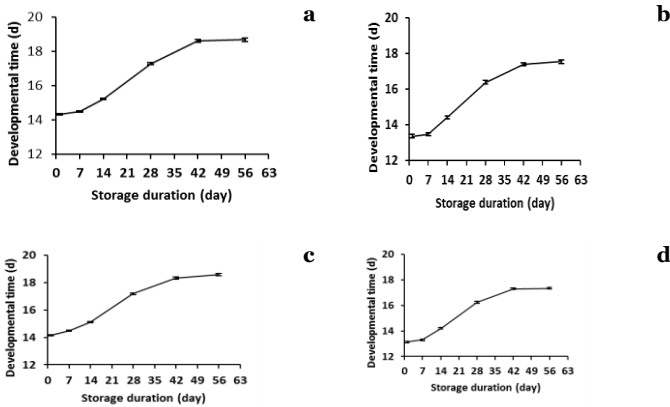


Figure 3. Developmental time of *T. vassilievi* on cold-stored sunn pest eggs for different durations. a) Tabriz females, b) Tabriz males, c) Varamin females, d) Varamin males.

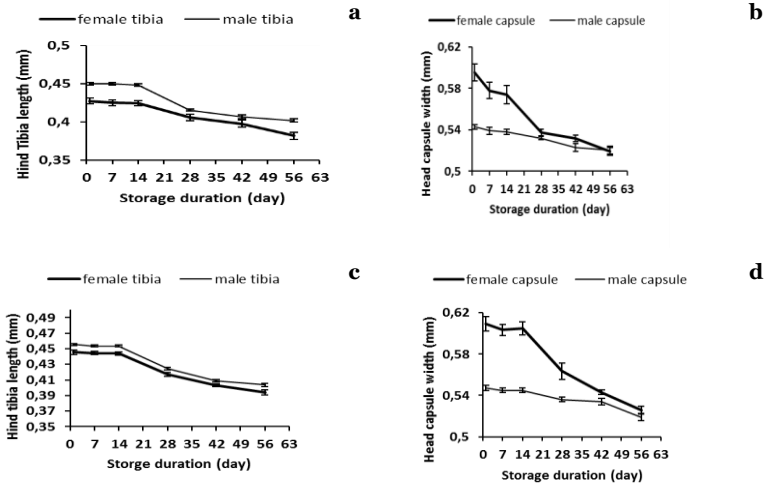


Figure 4. Body size of *T. vassilievi* obtained from cold-stored eggs of sunn pest, measured as right hind tibia length and head capsule width (mm \pm SE). a) Tabriz population's tibia length, b) Tabriz population's head capsule width, c) Varamin population's tibia length, d) Varamin population's head capsule width.

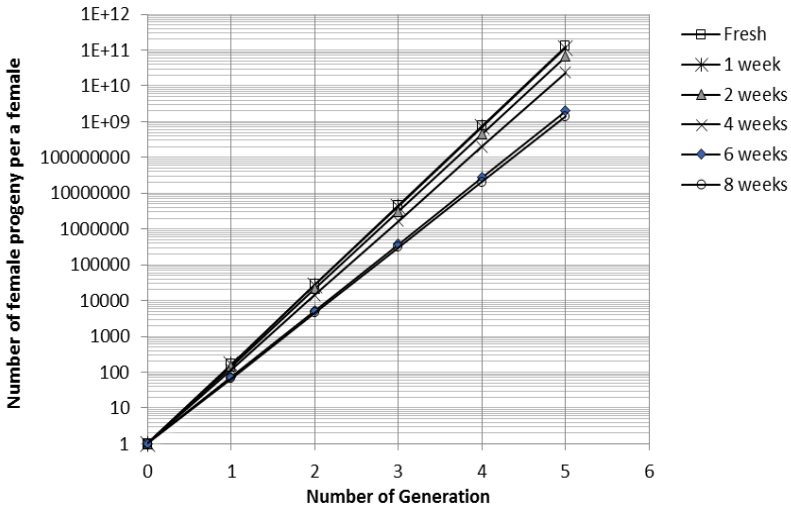


Figure 5. Hypothetical number of female progeny available per a single fertile female of *T. vassilievi* following rearing in biofabric through several generations.

***DORCADION MUCHEI* BREUNING, 1962 REST. NOV. AND
DORCADION SUBATRITARSE BREUNING, 1966 REST. NOV.
(CERAMBYCIDAE)**

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[Özdikmen, H. & Kaya, G. 2015. *Dorcadion muchei* Breuning, 1962 rest. nov. and *Dorcadion subatritarse* Breuning, 1966 rest. nov. (Cerambycidae). Munis Entomology & Zoology, 10 (1): 272-276]

ABSTRACT: With the present work, *Dorcadion muchei* Breuning, 1962 rest. nov. and *Dorcadion subatritarse* Breuning, 1966 rest. nov. are discussed and regarded as separate species again.

KEY WORDS: *Dorcadion muchei*, *Dorcadion subatritarse*, rest. nov., Cerambycidae, Turkey.

***Dorcadion muchei* Breuning, 1962 rest. nov.
and
Dorcadion subatritarse Breuning, 1966 rest. nov.**

We realized expeditions to Çorum province in Central Black Sea Region of Turkey in 2013. As a result of this, many Cerambycidae specimens were collected from the province. Especially, Boğazkale (Çorum: Alcahöyük) stood out as a very interesting area for *Dorcadion* species. Many *Dorcadion* specimens of different species were obtained from such a small area. One of them, we think, is a new species that will be published. A total of four *Dorcadion* species (including sp. n.) were identified from the small area. These are: *Dorcadion bangi heinzorum*, *D. iconiense*, *D. piochari*, *D. scabricolle paphlagonicum* and a new species.

As known, firstly described species is *Dorcadion iconiense* in 1900 for this related group. Secondly, *Dorcadion semisetosum* was described by Jakovlev (1901) from the same locality with *Dorcadion iconiense*. According to Breuning (1962a), it accepted as a synonym of *Dorcadion iconiense*. Then, *Dorcadion iconiense* var. *fulvovestitum* was described by Pic (1903) and *Dorcadion iconiense* m. *posticeapertum* was described by Breuning (1946) from the same locality too. Also Breuning (1962a) placed them under the species *Dorcadion iconiense*. However, Breuning (1962a) gave *Dorcadion albicolle* that was described by Breuning (1943) also from Konya province, as a separate species wrongly. Since the diagnostic characters of *Dorcadion albicolle* are in the variation wideness of *Dorcadion iconiense* absolutely.

Besides, *Dorcadion muchei* was described by Breuning (1962b) with the morpha *Dorcadion muchei* m. *plurivittipenne* from Çankırı province. Then, Breuning (1966) described *Dorcadion parescherichi* from Yazılıkaya (Çorum province: Boğazkale). Braun (1975) accepted it as a synonym of *Dorcadion muchei*. Also *Dorcadion subatritarse* was described by Breuning (1966) from Çorum province (Boğazkale). Braun (1978) accepted it as a synonym of *Dorcadion iconiense*. Since he regarded *Dorcadion muchei* as a morpha of *Dorcadion iconiense*. And the approach was published Braun (1979) that accepted *Dorcadion muchei* as a synonym of *Dorcadion iconiense*.

Probably as a result of Braun's works, Löbl & Smetana (2010) gave all

described taxa as synonyms of one species *Dorcadion iconiense*.

The collected specimens (27 males and 14 females) that regarded as *D. iconiense* revealed some important results for Turkish fauna as seen below. Among them, mainly 4 different forms can be determined: 1) Black velvety spots on elytral light bands present; so the especially dorsal bands interrupted, not complete; ground pubescence of elytra present (1 male and 7 females), 2) Black velvety spots on elytral light bands absent; so the bands complete; ground pubescence of elytra present (10 males and 2 females), 3) Black velvety spots on elytral light bands absent; so the bands complete, but dorsal band free, not connected with humeral band posteriorly; ground pubescence of elytra present (1 female), 4) Ground pubescence of elytra more or less reduced, so elytra more or less glanced; elytral light bands entirely absent (at most dorsal band into a trace only in apical part, trace of humeral band absent or present) or if present, more or less reduced and into traces (16 males and 4 females).

In real, all forms had been described by authors as separate taxa.

The first form was described by K. Daniel (1900) as *Dorcadion iconiense* from Konya province in Central Anatolian Region of Turkey.

The second form was described by Breuning (1962a) as *Dorcadion muchei* from Çankırı province in Western Black Sea Region in North Anatolia.

The third form was described by Breuning (1966) as *Dorcadion parescherichi* from Çorum province in Central Black Sea Region in North Anatolia.

And also the fourth form was described by Breuning (1966) as *Dorcadion subatritarse* from Çorum province in Central Black Sea Region in North Anatolia.

All forms were accepted by Braun (1978) as variations of *Dorcadion iconiense* (Fig. 1).

Consequently, *Dorcadion iconiense* from Konya province and *Dorcadion muchei* from Çankırı province are closely related species clearly. Both have as the same as variations. For example, *Dorcadion iconiense* m. *posticeapertum* for *Dorcadion iconiense* and *Dorcadion parescherichi* for *Dorcadion muchei* are the same type variations for their species. In both described taxa, dorsal band is free ending, not connected with humeral band posteriorly. Also some undescribed variations for *Dorcadion muchei* are known as *Dorcadion albicolle* for *Dorcadion iconiense*.

As a result of the present work, we decided *Dorcadion iconiense* and *Dorcadion muchei* that have the same variations, are separate species. And also *Dorcadion subatritarse* should be regarded as a separate species. Moreover, according to Braun's works, *Dorcadion subatritarse* never collected from Konya province that is the type locality of *Dorcadion iconiense* and neighbour province Aksaray.

Finally, we proposed a new arrangement for this group as follows:

***Dorcadion iconiense* K. Daniel, 1900: 140** (Syntypes ♂♂, ex collection K.

Daniel, Deutsches Entomologisches Institut, Eberswalde) [type locality "Asia Minor" (Turkey)] A: TR

semisetosum Jakovlev, 1901: 85 [Turkey: Konya]

fulvovestitum Pic, 1903: 5 (*Dorcadion iconiense* var.) [Turkey]

albicolle Breuning, 1943: 89 [Turkey: Konya]

posticeapertum Breuning, 1946: 109 (*Dorcadion iconiense* m.) [Turkey: Konya]

Material examined: Çorum prov.: Boğazkale, Alacahöyük National Park, N 40° 01' E 34° 37', 1234 m, 30.III.2013, 1 male and 6 females; Çorum-Sungurlu road, 25 km to Sungurlu, 660 m, 30.III.2013, 1 female.

Known distribution of *Dorcadion iconiense*: Turkey (Asia minor) (K.

Daniel, 1900); Turkey: Konya as the type locality of *D. semisetosum* (Jakovlev, 1901; Lazarev, 2011); Konya prov. (Breuning, 1943, 1962a); Aksaray prov., Kırşehir prov.: Mucur, Kayseri prov.: Çallıgedik pass, Yozgat prov.: Çiçekdağı (Braun, 1978); Yozgat prov.: Çiçekdağı pass, Aksaray prov., Kırşehir prov.: Mucur, Kayseri prov.: Çallıgedik pass, Konya prov. (Braun, 1979); Anatolia (Löbl & Smetana, 2010) (Fig. 2).

***Dorcadion muchei* Breuning, 1962: 38** (Holotype ♂, collection H. Mucur)

[type locality “Çankırı” (Turkey)] A: TR

plurivittipenne Breuning, 1962: 39 (*Dorcadion muchei* m.) [Turkey: Çankırı]

paraescherichi Breuning, 1966: 146 [Turkey: Çorum: Boğazkale]

Material examined: Çorum prov.: Boğazkale, Alacahöyük National Park, N 40° 01' E 34° 37', 1234 m, 30.III.2013, 9 males and 1 female, 27.IV.2013, 1 male and 1 female.

Known distribution of *Dorcadion muchei*: Çankırı as the type locality (Breuning, 1962); Kastamonu prov.: Ilgaz Mt. as *D. iconiense* m. *muchei* (Demelt, 1967); Çankırı prov.: Kızılırmak, Çorum prov.: Yazılıkaya as *D. iconiense* m. *muchei* (Braun, 1978); Yozgat prov.: Çandır, Çankırı prov., Kayseri prov.: Çallıgedik (Braun, 1979); Çorum prov.: Yazılıkaya as *D. paraescherichi* (Breuning, 1966; Braun, 1979); Yozgat prov. (Holzschuh, 1980) (Fig. 3).

***Dorcadion subatritarse* Breuning, 1966: 146** (Holotype ♂, collection

Antonella Perissinotto) [type locality “Boğazkale” (Turkey: Çorum)] A: TR

Material examined: Çorum prov.: Boğazkale, Alacahöyük National Park, N 40° 01' E 34° 37', 1234 m, 30.III.2013, 10 males and 1 female, 27.IV.2013, 6 males and 3 females.

Known distribution of *Dorcadion subatritarse*: Çorum prov.: Boğazkale (Breuning, 1966; Perissinotto & Lucini, 1966); Çorum prov.: Boğazkale, Kırşehir prov.: Mucur (Braun, 1978) (Fig. 4).

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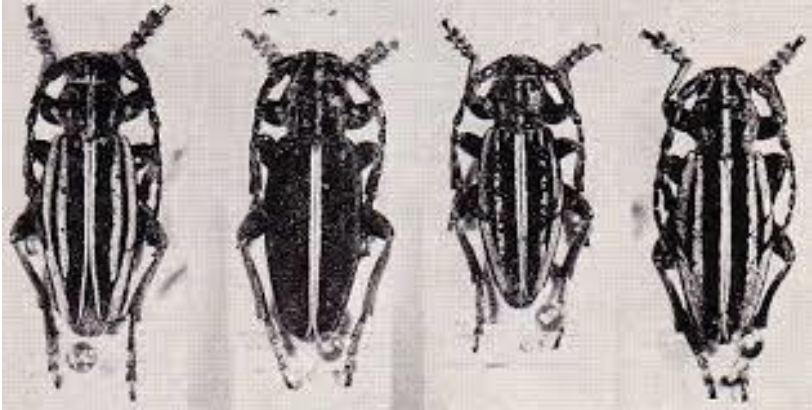


Figure 1. Variations of *Dorcadion iconiense* according to Braun (1978, 1979) [left to right: *D. parescherichi*, *D. subatritarse*, *D. iconiense*, *D. muchei*] (From Braun, 1978).

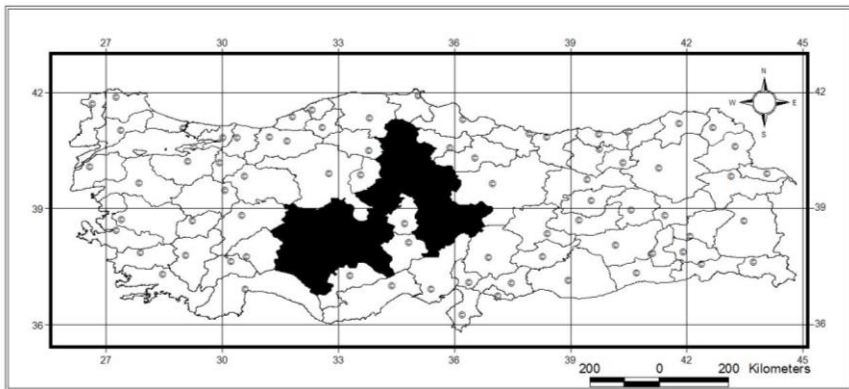


Figure 2. The distribution patterns of *Dorcadion iconiense*.

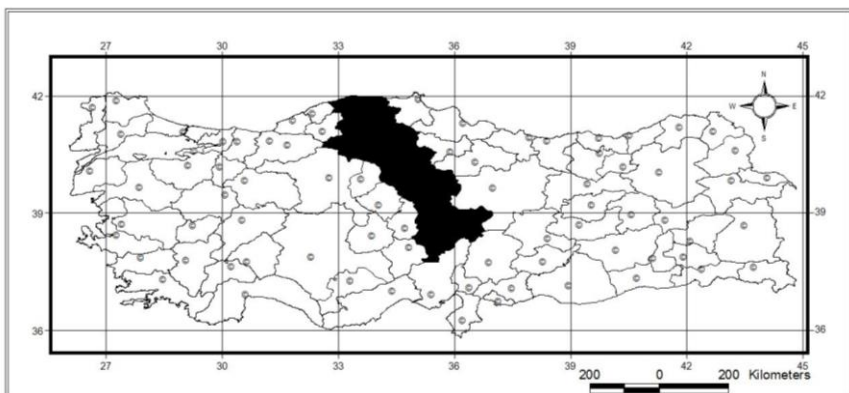


Figure 3. The distribution patterns of *Dorcadion muchei*.

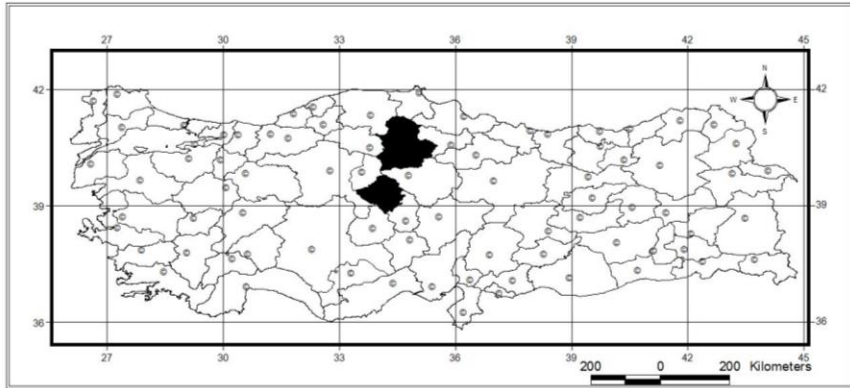


Figure 4. The distribution patterns of *Dorcadion subatritarse*.

**IDENTIFICATION OF MULTIVOLTINE BREEDS AND
MULTIVOLTINE × BIVOLTINE HYBRIDS OF THE SILKWORM,
BOMBYX MORI L. THROUGH SUBORDINATE FUNCTION
INDEX METHOD**

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[Singh, R., Gangopadhyay, D. & Nirupama, R. 2015. Identification of multivoltine breeds and multivoltine × bivoltine hybrids of the silkworm, *Bombyx mori* L. through subordinate function index method. Munis Entomology & Zoology, 10 (1): 277-280]

ABSTRACT: A study was conducted for the identification of multivoltine breeds and multivoltine × bivoltine hybrids of the mulberry silkworm, *Bombyx mori* L. utilizing subordinate function indices method of Gower (1971). Out of four multivoltine breeds, DNP₁ ranked first exhibiting maximum cumulative subordinate function indices value of 9.36 for eleven characters followed by DNP₃ which exhibited higher cumulative subordinate function indices value of 9.07. Among seventeen multivoltine × bivoltine hybrids, DNP₁ × CSR₂ ranked first exhibiting maximum cumulative subordinate function indices values of 8.03 followed by DNP₁ × CSR₁₇ exhibiting cumulative subordinate function indices values of 7.68. Besides, seven multivoltine × bivoltine hybrids viz., DNP₃ × CSR₁₇, DNP₂ × CSR₁₇, DNP₃ × CSR₂, DNP₂ × NB₄D₂, DNP₂ × CSR₂, DNP₁ × NB₄D₂ and DNP₂ × CSR₄ were also found promising which exhibited cumulative subordinate function indices values of 6.73, 6.63, 6.58, 6.53, 6.31, 6.24 and 6.11, respectively. Application of subordinate function indices method for the identification of silkworm breeds and hybrids has been discussed.

KEY WORDS: *Bombyx mori*, performance, multivoltine × bivoltine hybrids, silkworm breeds, subordinate function indices.

Several statistical methods like analysis of combining ability (Kempthorne, 1957), subordinate function index method (Gower, 1971), Duncan's multiple range test (Gomez & Gomez, 1984), evaluation index method (Mano et al., 1993) have been employed for the identification of promising silkworm breeds and hybrids. Silkworm breeds and hybrids are judged on the basis of cumulative effect of several economic characters (Narayanaswamy et al., 2002). In the mulberry silkworm, *Bombyx mori* L., subordinate function index method of Gower (1971) has been employed for the identification of promising silkworm hybrids (Ramesh Babu et al., 2002; Rao et al., 2001, 2004, 2006; Lakshmi & Chandrashekharaiah, 2007; Nirupama et al., 2008). Recently, studies have been carried out on short-listing of silkworm breeds and hybrids (Ravindra Singh & Nirupama, 2012; Ravindra Singh & Gangopadhyay, 2013). In the present study, an attempt was made to identify promising polyvoltine breeds developed utilizing parthenogenesis coupled with conventional breeding techniques and multivoltine × bivoltine hybrids through subordinate function index method.

MATERIALS AND METHODS

In the present study, four multivoltine breeds viz., DNP₁, DNP₂, DNP₃ and DNP₄ and Pure Mysore (PM) and seventeen multivoltine × bivoltine hybrids were prepared utilizing four bivoltine breeds viz., CSR₂, CSR₄, CSR₁₇ and NB₄D₂. Three replications were reared in each hybrid and 250 larvae were retained after IIIrd moult. The performance of multivoltine breeds is presented in Table 1. Data were recorded for eleven characters viz, fecundity, hatching percentage, pupation

percentage, cocoon yield/10,000 larvae by weight, cocoon weight, cocoon shell weight, cocoon shell percentage, filament length, reelability, raw silk percentage and neatness. Data were analyzed through subordinate function index method (Gower, 1971). Subordinate function index method is used to shortlist breeds / hybrids showing a character with a small range of variation contribute as much as another character with a large variation range. In ranging the smallest value for the character is subtracted from each value and the results are divided by range. The subordinate function is calculated by utilizing the following formula –

$$X_u = (X_i - X_{\min}) / (X_{\max} - X_{\min})$$

Where,

X_u = Sub ordinate function,

X_i = Measurement of trait of tested breed,

X_{\min} = Minimum value of the trait among all the tested breeds,

X_{\max} = Maximum value of the trait among all the tested breeds.

RESULTS

Data presented in Table 1 showed variation for various characters among the different multivoltine breeds. Two breeds DNP₁ and DNP₃ recorded higher values for six and three out of eleven characters respectively. Subordinate function index values in multivoltine breeds for eleven characters are given in Table 2. DNP₁ and DNP₃ showed their superiority by exhibiting cumulative subordinate function index value of 9.36 and 9.07 respectively. Mean rearing performance of seventeen multivoltine × bivoltine hybrids is given in Table 3. Two hybrids namely, DNP₁ × CSR₂ and DNP₃ × CSR₁₇ exhibited maximum performance for four and three characters respectively. As per the subordinate function index method, DNP₁ ranked first exhibiting maximum cumulative subordinate function indices value of 9.36 for eleven characters followed by DNP₃ which exhibited higher cumulative subordinate function indices value of 9.07. Among seventeen multivoltine × bivoltine hybrids, DNP₁ × CSR₂ ranked first exhibiting maximum cumulative subordinate function indices values of 8.03 followed by DNP₁ × CSR₁₇ exhibiting cumulative subordinate function indices values of 7.68. In addition, seven multivoltine × bivoltine hybrids *viz.*, DNP₃ × CSR₁₇, DNP₂ × CSR₁₇, DNP₃ × CSR₂, DNP₂ × NB₄D₂, DNP₂ × CSR₂, DNP₁ × NB₄D₂ and DNP₂ × CSR₄ were also found promising which exhibited cumulative subordinate function indices values of 6.73, 6.63, 6.58, 6.53, 6.31, 6.24 and 6.11, respectively.

DISCUSSION

Analysis of data indicated superiority of the hybrid DNP₁ × CSR₂ exhibiting maximum performance for four economic characters followed by DNP₃ × CSR₁₇ exhibiting maximum performance for three characters. No single hybrid excelled in all the eleven characters under study. Therefore, it is necessary to adopt reliable statistical method to identify promising breeds / hybrids which give weight-age to all the economic characters. In this direction, efforts have been made to identify promising silkworm hybrids utilizing subordinate function index method (Ramesh Babu et al., 2002; Rao et al., 2001, 2004, 2006; Lakshmi & Chandrashekharaiiah, 2007; Nirupama et al., 2008).

It was interesting to note that eight out of seventeen multivoltine × bivoltine hybrids recorded significant increase for five characters namely, pupation percentage (>95%), cocoon weight(>1.900 g), cocoon shell weight (>0.370 g),

filament length (>850 m) and neatness (90 - 91 p). In the present study, the indices obtained from subordinate function index method were worked out both for multivoltine silkworm breeds and multivoltine × bivoltine hybrids. The results demonstrated the superiority of two breeds DNP₁ and DNP₃ among four breeds and two hybrids DNP₁ × CSR₂ and DNP₁ × CSR₁₇ which excelled among seventeen hybrids. The hybrids exhibited high subordinate cumulative index values (8.03 and 7.68). In view of the results obtained, DNP₁ and DNP₃ can be further utilized in future breeding programmes for the development of outstanding multivoltine breeds and two promising multivoltine × bivoltine hybrids DNP₁ × CSR₂ and DNP₁ × CSR₁₇ may be recommended for commercial exploitation.

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Table 1. Performance of multivoltine breeding lines of the silkworm, *Bombyx mori* L.

Breeds	Fecundity (no)	Hatching (%)	Pupation rate (%)	Cocoon yield/10,000 larvae (kg)	Cocoon wt. (g)	Cocoon shell wt. (g)	Cocoon shell (%)	Filament length (m)	Reelability (%)	Raw silk (%)	Neatness (p)
DNP ₁	450	91.73	92.56	12.516	1.349	0.225	16.71	573	79.3	12.38	89
DNP ₂	470	87.83	81.78	10.742	1.328	0.214	16.11	546	74.6	12.29	86
DNP ₃	484	91.45	91.94	12.504	1.368	0.219	16.01	556	83.2	12.21	89
DNP ₄	451	91.85	83.27	9.322	1.249	0.199	15.93	516	74.5	11.89	89
Max	484	91.85	92.56	12.516	1.368	0.225	16.71	573	83.2	12.38	89
Min	450	87.83	81.78	9.322	1.249	0.199	15.93	516	74.5	11.89	86
Mean	464	90.72	87.39	11.271	1.324	0.214	16.19	548	77.9	12.19	88
SD	16.34	1.93	5.65	1.54	0.05	0.01	0.35	23.92	4.18	0.21	1.50

Table 2. Subordinate index value of multivoltine breeding lines of the silkworm, *Bombyx mori* L.

Breeds	Fecundity	Hatching	Pupation rate	Yield/10,000 larvae	Cocoon wt.	Cocoon shell wt.	Cocoon shell (%)	Filament length	Reelability	Raw silk (%)	Neatness	Cumulative subordinate index value
DNP ₁	0.00	0.97	1.00	1.00	0.84	1.00	1.00	1.00	0.55	1.00	1.00	9.36
DNP ₂	0.59	0.00	0.00	0.44	0.66	0.58	0.23	0.53	0.01	0.82	0.00	3.86
DNP ₃	1.00	0.90	0.94	1.00	1.00	0.77	0.10	0.70	1.00	0.65	1.00	9.07
DNP ₄	0.03	1.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.17

Table 3. Performance of multivoltine × bivoltine hybrids of the silkworm, *Bombyx mori* L..

Multivoltine × bivoltine Hybrids	Fecundity (no)	Hatching (%)	Pupation rate (%)	Yield/10,000 larvae (kg)	Cocoon wt. (g)	Cocoon shell wt. (g)	Cocoon shell (%)	Filament length (m)	Reelability (%)	Raw silk (%)	Neatness (p)
DNP ₁ × CSR ₂	457	94.63	95.50	18.193	1.950	0.402	20.62	878	83.0	15.99	91
DNP ₁ × CSR ₄	485	92.15	94.60	17.420	1.883	0.371	19.70	854	72.7	14.59	89
DNP ₁ × CSR ₇	455	93.91	96.20	19.360	1.936	0.396	20.45	927	83.8	15.12	90
DNP ₁ × NB ₁ D ₂	478	94.51	97.80	17.560	1.831	0.362	19.77	854	81.0	14.54	91
DNP ₂ × CSR ₂	566	95.25	86.20	16.300	2.059	0.384	18.63	914	82.1	14.42	91
DNP ₂ × CSR ₄	509	93.76	94.40	17.372	1.900	0.369	19.42	885	84.2	14.45	90
DNP ₂ × CSR ₇	551	94.25	93.50	18.570	1.955	0.375	19.14	998	83.1	13.73	89
DNP ₂ × NB ₁ D ₂	492	94.33	89.80	17.529	1.985	0.391	19.70	933	82.8	15.48	89
DNP ₃ × CSR ₂	434	94.20	95.20	18.817	1.994	0.389	19.49	916	83.0	14.09	90
DNP ₃ × CSR ₄	461	93.73	96.80	18.360	1.946	0.372	19.12	823	80.9	13.83	90
DNP ₃ × CSR ₇	548	91.72	97.20	19.920	2.135	0.385	18.02	862	85.5	13.75	90
DNP ₃ × NB ₁ D ₂	474	92.98	93.60	18.220	1.935	0.369	19.07	798	82.7	14.17	89
DNP ₄ × CSR ₂	474	97.42	87.60	16.440	1.798	0.366	20.37	896	81.1	14.77	89
DNP ₄ × CSR ₄	389	97.03	92.80	16.960	1.808	0.368	20.37	868	81.7	15.10	89
DNP ₄ × CSR ₇	425	96.24	96.80	16.580	1.800	0.343	19.04	854	75.5	13.77	88
DNP ₄ × NB ₁ D ₂	424	93.90	98.20	15.640	1.719	0.318	18.50	802	80.5	13.89	88
PM × CSR ₂	528	92.89	91.07	16.437	1.872	0.399	18.11	807	81.0	13.42	88
Max	566	97.42	98.20	19.920	2.135	0.402	20.62	998	85.5	15.99	91
Min	389	91.72	86.20	15.640	1.719	0.318	18.02	798	72.7	13.42	88
Mean	479	94.29	93.96	17.628	1.913	0.374	19.38	875	81.4	14.42	89
SD	49.07	1.54	3.51	1.17	0.10	0.02	0.02	53.08	3.11	0.70	1.01

Table 4. Subordinate index value of multivoltine × bivoltine hybrids of the silkworm, *Bombyx mori* L..

Multivoltine × bivoltine hybrids	Fecundity	Hatching	Pupation rate	Yield/10,000 larvae	Cocoon wt.	Cocoon shell wt.	Cocoon shell	Filament length	Reelability	Raw silk	Neatness	Cumulative subordinate index value
DNP ₁ × CSR ₂	0.38	0.51	0.78	0.60	0.56	1.00	1.00	0.40	0.80	1.00	1.00	8.03
DNP ₁ × CSR ₄	0.54	0.68	0.70	0.42	0.39	0.63	0.66	0.28	0.00	0.46	0.33	4.47
DNP ₁ × CSR ₇	0.37	0.38	0.83	0.87	0.52	0.93	0.93	0.65	0.87	0.66	0.67	7.68
DNP ₁ × NB ₁ D ₂	0.50	0.49	0.97	0.45	0.37	0.52	0.67	0.28	0.65	0.44	1.00	6.24
DNP ₂ × CSR ₂	1.00	0.62	0.00	0.15	0.82	0.79	0.23	0.58	0.73	0.39	1.00	6.31
DNP ₂ × CSR ₄	0.68	0.36	0.68	0.40	0.44	0.61	0.54	0.44	0.90	0.40	0.67	6.11
DNP ₂ × CSR ₇	0.92	0.44	0.61	0.68	0.59	0.69	0.43	1.00	0.81	0.12	0.33	6.63
DNP ₂ × NB ₁ D ₂	0.58	0.46	0.30	0.44	0.64	0.87	0.65	0.68	0.79	0.80	0.33	6.53
DNP ₃ × CSR ₂	0.25	0.44	0.75	0.74	0.66	0.85	0.57	0.59	0.80	0.26	0.67	6.58
DNP ₃ × CSR ₄	0.41	0.35	0.88	0.64	0.55	0.64	0.42	0.13	0.64	0.16	0.67	5.48
DNP ₃ × CSR ₇	0.90	0.60	0.92	1.00	1.00	0.80	0.00	0.32	1.00	0.13	0.67	6.73
DNP ₃ × NB ₁ D ₂	0.48	0.22	0.62	0.60	0.52	0.61	0.40	0.00	0.78	0.29	0.33	4.86
DNP ₄ × CSR ₂	0.48	1.00	0.12	0.19	0.19	0.57	0.90	0.49	0.66	0.53	0.33	5.45
DNP ₄ × CSR ₄	0.00	0.93	0.55	0.21	0.21	0.60	0.90	0.35	0.70	0.65	0.33	5.54
DNP ₄ × CSR ₇	0.20	0.79	0.88	0.22	0.19	0.30	0.39	0.28	0.22	0.14	0.00	3.62
DNP ₄ × NB ₁ D ₂	0.20	0.38	1.00	0.00	0.00	0.00	0.18	0.02	0.61	0.18	0.00	2.58
PM × CSR ₂	0.79	0.21	0.41	0.19	0.37	0.96	0.03	0.05	0.65	0.00	0.00	3.64

**A NEW SYNONYM OF *CORTODERA RUFIPES* (KRAATZ, 1876)
(CERAMBYCIDAE: LEPTURINAE)**

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ABSTRACT: With the present work, *Cortodera flavimana corallipes* Pesarini & Sabbadini, 2009 syn. nov. is discussed and regarded as a synonym of *Cortodera rufipes* (Kraatz, 1876).

KEY WORDS: *Cortodera rufipes*, *Cortodera flavimana corallipes*, syn. nov., Cerambycidae, Turkey.

***Cortodera rufipes* (Kraatz, 1876)**

Cortodera flavimana corallipes Pesarini & Sabbadini, 2009 **syn. nov.**

The subspecies *Cortodera flavimana corallipes* was described by Pesarini & Sabbadini (2009) from Erzurum province (Aşkale) in NE Turkey. The subspecies was described on the base of all legs red colored and not securiform terminal segment of maxillary palp etc.. They stated some characters of the subspecies as different from typical subspecies of *Cortodera flavimana* as follows:

a) Maxillary palps with only weakly widened towards the apex, almost transversally truncated, not securiforme terminal segment, b) 2. antennal segment more robust, sometimes slightly transverse, c) The short smooth longitudinal line on the center of the pronotal disc distinctly enlarged at the center, d) Elytra with fairly robust punctuation in the basal portion, but individual points rather superficial, strongly weakened and confused towards the apex, the surface of elytra quite lucid.

As known, it is easily say that these mentioned characters by Pesarini & Sabbadini (2009) can be accepted within the variations of *Cortodera flavimana*. However, this described subspecies is easily distinguished from *Cortodera flavimana flavimana* by red colored legs, not only fore leg.

Such as a form was described by Kraatz (1876) as *Cortodera rufipes* from İzmir province in W Anatolia.

Cortodera rufipes (Kraatz, 1876) was validated by Özdikmen et al. (2014) as a separate species. They mentioned that the species is distributed in many provinces (Aksaray, Ankara, Bursa, Çankırı, İzmir, Kahramanmaraş, Kayseri and Konya), not only İzmir in Turkey.

Already, Danilevsky (2014a) stated that “*Cortodera flavimana corallipes* Pesarini & Sabbadini, 2009 also described on the base of all legs red could be preliminary accepted as another subspecies because of rather distant locality [Askale in Erzurum]”.

Danilevsky (2014b) also mentioned that “ A series (1 male and 3 females) of *C. f. corallipes* Pesarini & Sabbadini, 2009 was collected by J. Hron and S. Murzin very close to the south Georgian border: “9 km E Sausat, 1600 m, 41° 14' 11" N, 42° 25' 48" E, 27-28.V.2012”. It is only 20 km southwards state border, so the population must penetrate to Georgia”.

Therefore, *Cortodera flavimana corallipes* Pesarini & Sabbadini, 2009 should be regarded as a synonym of *Cortodera rufipes* (Kraatz, 1876) necessarily.

Updated distribution patterns of *Cortodera rufipes* is presented in Figure 1.

***Cortodera flavimana* Waltl, 1838: 471 (*Leptura villosa* var.)**

***Cortodera flavimana flavimana* Waltl, 1838: 471 (*Leptura villosa* var.)** (Syntypes ♂ & ♀, ex collection Joseph Waltl, Naturhistorisches Museum Wien) [type locality "İstanbul env." (Turkey)] **E:** AU BU GR HU MC RO SK TR YU **A:** TR

***Cortodera flavimana zoiai* Pesarini & Sabbadini, 2009: 16 (*Cortodera zoiai*)** (Holotype ♂, collection Carlo Pesarini & Andrea Sabbadini, Milano) [type locality "Kozak" (Turkey: İzmir)] **A:** TR

***Cortodera flavimana schurmanni* Sama, 1997: 107** (Holotype ♂, collection Gianfranco Sama, Cesena) [type locality "Kalavryta" (Greece: Peloponnese)] **E:** GR

***Cortodera rufipes* Kraatz, 1876: 344 (*Grammoptera*)** (Holotype, ex collection G. Kraatz, Deutsches Entomologisches Institut, Eberswalde) [type locality "Smyrna" (Turkey: İzmir)] **A:** TR

corallipes* Pesarini & Sabbadini, 2009: 17 (*Cortodera flavimana* ssp.) **syn. nov.* (Holotype ♂, collection Carlo Pesarini & Andrea Sabbadini, Milano) [type locality "Aşkale" (Turkey: Erzurum)] **A:** ?GG TR

Updated distribution patterns of *Cortodera rufipes*: Erzurum prov.: Aşkale as the type locality of *C. flavimana corallipes* (Pesarini & Sabbadini, 2009); Aksaray prov., Ankara prov., Bursa prov., Çankırı prov., İzmir prov., Kahramanmaraş prov., Kayseri prov. and Konya prov. (Özdikmen et al., 2014); Artvin prov.: Şavşat (Danilevsky, 2014) (Fig. 1).

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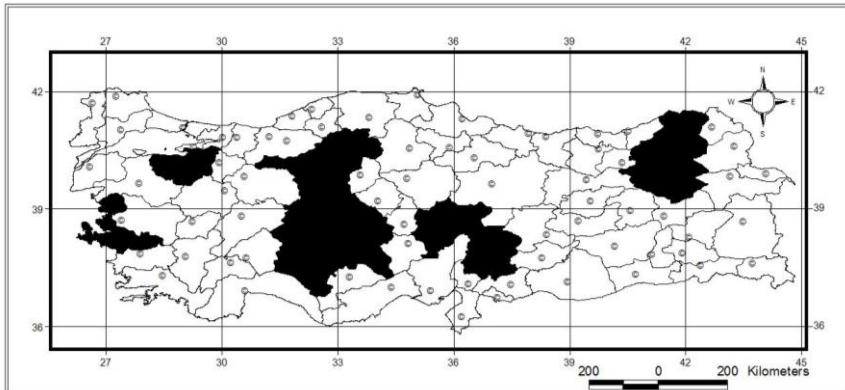


Figure 1. The distribution patterns of *Cortodera rufipes*.

OSTRACODS OF QUATERNARY SEDIMENTS OF THE PROVINCE OF BUENOS AIRES, ARGENTINA

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[Kihn, R. G. & Gómez, E. A. 2015. Ostracods of quaternary sediments of the province of Buenos Aires, Argentina. *Munis Entomology & Zoology*, 10 (1): 283-288]

ABSTRACT: We study the benthic ostracods from the vibro-core KP60Bis (39 ° 08'34 .8689" S, 61 ° 46'10 .0278") of the estuary of Bahía Blanca, province of Buenos Aires. In the upper area of the core (Z2) the ostracofauna this domain is diverse with *Loxocythere variaculpta* Whatley, Moguilevsky, Toy, Chadwick and Ramos *Neocytherideis ruidis* Whatley, Moguilevsky, Chadwick, Toy and *Callistocythere litoralensis* (Rossi de Garcia). Within fitales and parafitales ostracods recovered *Paracytherois* sp. and *Pellucistoma elongata* Whatley, Moguilevsky, Chadwick, Toy and Feijó. Towards the top of the core is recorded species of continental origin as *Limnocythere* sp., *Ilyocypris gibba* Ramdhor, 1808 and *Cypridopsis vidua* O.F. Müller, 1776. In the middle sector (Z1) were abundant specimens of ostracods valves assigned to *Ambostracon* (*Ambostracon*) *tenuireticulata* Kotzians, 1982, *Cornucoquimba lutziana*, Zabert, 1978 and *Caudites ohmertii* Coimbra and Ornellas, 1987. Micropalaeontological analysis shows that the studied sediments were deposited in intertidal estuarine, affected by changes in sea level during the late Holocene.

KEY WORDS: Ostracodes, Holocene, Bahía Blanca, estuary.

The ostracods are microcrustaceans with a wide ecological range that inhabit marine, brackish and freshwater environments. They are very sensitive to the chemical and physical changes in the environment, introducing changes in the species composition of the community and individuals morphological level. Are recorded from the Upper Cambrian and have a shell of CaCO₃ can be preserved in the register (Horne et al., 2002). Ostracods have a high potential as a proxy (proxy-data) in Quaternary paleoecological studies (Carbonel et al., 1983, 1988). While in Argentina, this branch of Micropaleontology has advanced significantly in the last two decades: Ferrero (1996, 2005) and Bertels - Postka Laprida (1998a,b,c); Bertels & Martínez (1990, 1997); Bertels - Postka & Martínez (1999), Martínez (2005), Laprida (2006), the contributions made to records in estuarine environments are still rare. The aim of this study was to determine the diversity of ostracods present in Holocene sediments and provide new data for the reconstruction of paleoenvironment of the study area.

Study area

The Bahía Blanca estuary is a mesotidal system formed by a 3000 km² complex of different sized channels crossing large islands and tidal flats. Above mean sea level (m.s.l.), the intertidal areas are densely vegetated by *Spartina*. The largest freshwater contributions come from the Sauce Chico river and a smaller stream, the Napostá Grande. The temperature and salinity of the water masses are vertically homogeneous along the estuary (Fig. 1).

Lithology and radiocarbon age

The core KP60 bis (39 ° 08'34 " S - 8689 61° 46'10 .0278 "W) is located in the

external sector to Bahía Blanca estuary, at kilometer 60 of the access channel to the port system and where the km 0 corresponds to port Ingeniero White, located in the innermost portion of the estuary. The roof of this core is located 11.4 m below the level of reduction used in the charts, which is defined as the average of syzygy tides subtracted one standard deviation.

The sedimentological study found that the composition is sandy clay loam over all witness with interbedded layers of clayey silt laminated fine sands.

For the lower section (337-340 cm depth) an age of 5980 ± 70 years BP (Gra - 27128) cal age was obtained. 6616-6952 BP, for the middle section (162-165cm): 1950 ± 60 years BP (Gra - 27127) 163-170cm and an age of 1900 ± 40 yr BP (BETA- 216777) and section exceeds 77-80 cm from the ceiling an age of 2220 ± 60 years BP (Gra - 27126) cal age was obtained. 2043-2332 BP.

Methodology

There was sampled the core KP60 Bis every 10cm. The samples were disintegrated in H₂O₂ to 20% and washed by means of a sieve with an opening of Maya of 63 microns. The dried one of the samples carried out in stove to 50 ° C. From every sample the total of copies extracted to itself under magnifying glass binocular Nikon NI-150. The systematic determinations to generic level were based on the offer by Moore and Pitrat (1961), while for the specific determinations there were in use the works of Bertels & Martínez (1997); Bertels-Postka & Martínez (1999). The photographs of electronic microscopy took with microscopio electronic of sweep I read model EVO 40, of the regional center of Basic and Applied investigations of White Bay (CRIBABB). To recognize the autochthonous paleotantocenosis and alóctonas in the different environments involved in this study, versus calculated the proportion of adult valves the total of juvenile valves (Brouwers, 1988). In addition there was calculated the index of diversity of Shannon-Wiener.

RESULTS

On the basis of the qualitative and quantitative information of the ostrácodos extracted from the samples and the fauna accompanist could divide the same one in two zones. The low section of the core, from them 390cm, turned out to be sterile. The ostrácodos met a good condition of preservation, the copies were very scanty with complete shells, that is to say with both articulated valves. There have differed, up to the moment, a total of 40 species, though for the present I work only they were considered to be those represented by adult and juvenile copies, in an approximate proportion of 1/8.

In the low sector of the core levels were registered of shells of very fragmented mollusks.

Z1 (380-240cm)

There were situated remains of the mollusks *Tagelus plebeius* (Lightfoot, 1786), *Nucula puelcha* Orbigny, 1846, *Nuculana (Costelloleda) whitensis* Farinati, 1978 and briozoos of smoothed morphology. The valves of copies were abundant of ostrácodos euhalinos assigned to *Ambostracon (Ambostracon) tenuireticulata* Kotzian, 1982, *Cornucoquimba lutziana* Zabert, 1978 (Fig. 2D) and *Caudites ohmertii* Coimbra & Ornellas, 1987 (Fig. 2C). The index of diversity of Shannon-Wiener presented values between 1 and 2,5.

Z2 (240- 235 cm)

In this sector it diminishes very much the diversity and density of ostrácodos and there are very abundant the remains of valves of mollusks with high degree of fragmentation.

Z3 (235-0cm)

Recovered valves of mollusks assigned to *Nuculana (costelloleda) whitensis* Farinati, 1978 and *Paraplicia* sp. and bryozoos of tree-shaped morphology. As for the present ostracofauna two subzone differ: subzone A: he presents a great diversity with domain of species eurihalinas as *Loxocythere variasculpta* Whatley, Moguilevsky, Toy, Chadwick & Branches (Fig. 2E); *Neocytherideis ruidis* Whatley, Moguilevsky, Chadwick, Toy (Fig. 2A) and *Callistocythere litoralensis* (Rossi de García) (Fig. 2F). They turn out to be exemplary adult and juvenile of *Cyprideis salebrosa hartmanni* Ramirez, 1967 (Fig. 2B). Some copies presented the development of nodules of carbonate of calcium in the external face of the valves.

Inside the ostrácodos fitales and parafitales, those that live associated with the vegetation, registered *Paracytherois* sp. and *Pellucistoma elongata* Whatley, Moguilevsky, Chadwick, Toy & Feijó (Fig. 2G). In addition continental species are registered as: *Limnocythere* sp. (Fig. 2J), *Cypridopsis vidua* (Fig. 2I) and *Iliocypris gibba* (Fig. 2H). The index of diversity of Shannon-Wiener presented values between 2 and 3.

Subzone B: the diversity is similar to the descripta for the subfield To but it diminishes the density.

INTERPRETATIONS PALEOENVIRONMENTAL AND DISCUSSION

The information offered to the ostrácodos and fauna accompanist allows to characterize the core KP60Bis. The low sector of the core (240-380 cm) presents a low density of ostrácodos. The low values of the index of diversity Shannon-Wiener indicate an environment with low content of nutrients and a level of energy raised. This is demonstrated, in addition, by the presence of strata by numerous fragments of valves of mollusks and colonies of bryozoos of smoothed morphology. The number of individuals would have been controlled by two factors: the quantity of nutrients in the column of water and the level of energy of the environment (Carbonel, 1988). The form of the colonies of bryozoos is considered to be a warning element of the degree of stability of the environment in which they develop since the development of colonies incrustantes is observed only in environments of high energy and tree-shaped colonies only they can develop in environments of low energy due to his fragility (Moyano, 1979; Hageman et al., 1997). On the other hand, the abundant presence of copies of species euhalinas as *Ambostracon (Ambostracon) tenuireticulata*; *Cornucoquimba lutziana* and *Caudites ohmerti* demonstrate an environment submareal since these species only develop in environments submareales of the estuary in conditions of stable salinity and without air exhibition. The specimens of recovered *Tagelus plebeius* shallow. For the exposed thing it is possible to deduce that the sediments were deposited in an environment submareal by low levels of nutrients and a high level of energy. The increase of the density and high values of the index of Shannon-Wiener in the top part of the core (230-0cm) indicate conditions of minor energy with major quantity of available nutrients. The presence of bryozoos tree-shaped fragile that only can develop in environments of low energy is another indicator of the environmental conditions. As for the present ostracofauna, the dominant species *Loxocythere variasculpta* Whatley, Moguilevsky, Toy, Chadwick and Branches; *Neocytherideis ruidis* Whatley, Moguilevsky, Chadwick, Toy characterize to current sediments submareales of little depth of the internal sector of the estuary of White Bay (Martínez et to. 2005), and *Callistocythere litoralensis* (Rossi de García), this

species was found in current samples of the Channel *Tres Brazas*. The presence of species fiteles and parafitales (*Paracytheroideis* sp. and *Pellucistoma elongata*) and of *Cyprideis salebrosa hartmanni* like that how the record of copies of mollusks *Nuculana (costelloleda) whitensis* and *Paraplicia* sp. permits to indicate that the studied sediments were deposited in shallow environments. The presence of nodules of CaCO₃ in specimens of the genus *Cyprideis* prove to be a character linked to the environment, and develop only under high salinity (Carbonel, 1988).

CONCLUSIONS

On the basis of the results obtained in this study they could have identified the dominant species along the core like that how his preferences to a particular habitat. Consequently, due to the sedimentological characteristics, specific composition of ostrácodos and of molluscos found, the dominancia of *Loxocythere variaculpta*; *Neocytherideis ruidis* and *Callistocythere litoralensis*; and the presence of mollusks *Nuculana (costelloleda) whitensis* and *Paraplicia* sp., in the top part of the core; as well as *Ambostracon (Ambostracon) tenuireticulata*; *Cornucoquimba lutziana* and *Caudites ohmertii*, the valves of *Tagelus plebeius* and the marked decrease of the density of ostrácodos in the average sector; it is possible to infer that the commanding conditions of deposit were corresponding to subenvironments estuarinos of low depth in the area of the Bahía Blanca estuary. The ostracods are an effective tool to enhance and paleoenvironmental ecological studies.

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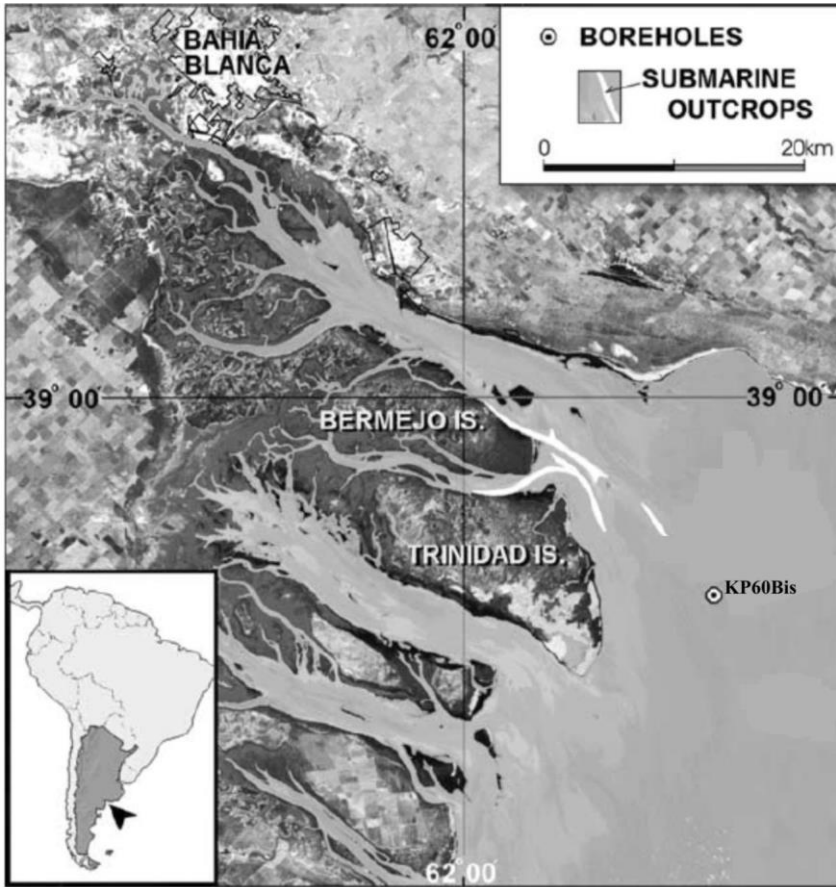


Figure 1. Studied area. Locations of the core KP60Bis in the external area of Bahía Blanca estuary.

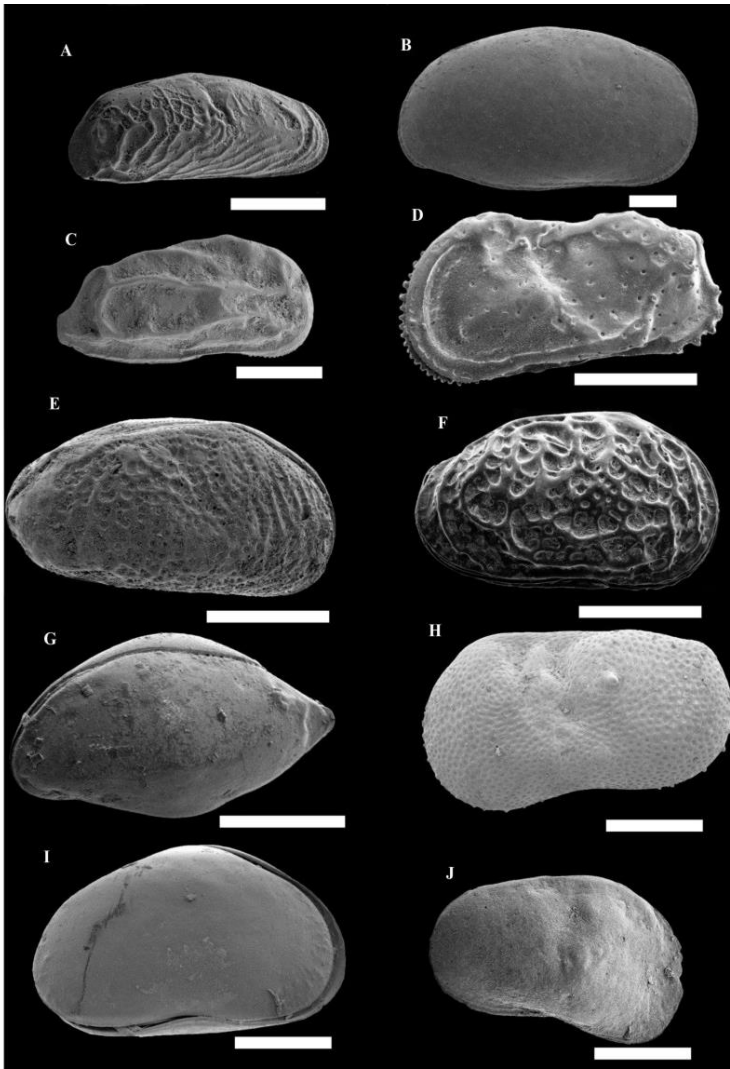


Figure 2. Ostracod species present in the estuary of Bahia Blanca: A. *Neocytherideis ruidis*, B. *Cyprideis salebrosa hartmanni*, C. *Caudites ohmertii*, D. *Cornucoquimba lutziana*, E. *Loxocythere variasculpta*, F. *Callistocythere litoralensis*, G. *Pellucistoma elongata*, H. *Iliocypris gibba*, I. *Cypridopsis vidua*, J. *Limnocythere* sp. (Scale: 100 μ m).

A NEW SYNONYM OF *DORCADION (CRIBRIDORCADION) ANDIRINENSE* BERNHAUER & PEKS, 2011 (CERAMBYCIDAE)

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[**Özdikmen, H.** 2015. A new synonym of *Dorcadion (Cribridorcadion) andirinense* Bernhauer & Peks, 2011 (Cerambycidae). *Munis Entomology & Zoology*, 10 (1): 289-290]

ABSTRACT: With the present work, *Dorcadion (Cribridorcadion) amaliae* Pesarini & Sabbadini, 2012 syn. nov. is discussed and regarded as a synonym of *Dorcadion (Cribridorcadion) andirinense* Bernhauer & Peks, 2011.

KEY WORDS: *Dorcadion andirinense*, *Dorcadion amaliae*, syn. nov., Cerambycidae, Turkey.

***Dorcadion (Cribridorcadion) andirinense* Bernhauer & Peks, 2011**
Dorcadion (Cribridorcadion) amaliae Pesarini & Sabbadini, 2012 **syn. nov.**

Firstly, *Dorcadion (Cribridorcadion) andirinense* was described by Bernhauer & Peks (2011) from Kahramanmaraş province (Andırın: Altınyayla) in S Anatolia.

The same taxon under the name *Dorcadion (Cribridorcadion) amaliae* was secondly described by Pesarini & Sabbadini (2012) from Kahramanmaraş province (Andırın: Altınyayla) in S Anatolia.

According to the original descriptions of both taxa and the photos was originally given by the authors, *Dorcadion (Cribridorcadion) amaliae* should be regarded as a synonym of *Dorcadion (Cribridorcadion) andirinense* due to priority (Fig. 1).

Genus *DORCADION* Dalman, 1817: 397

[type species *Cerambyx glycyrrhizae* Pallas, 1773]

Subgenus *CRIBRIDORCADION* Pic, 1901: 12

[type species *Dorcadion mniszzechi* Kraatz, 1873]

***Dorcadion andirinense* Bernhauer & Peks, 2011: 218** (Holotype ♂, collection Dieter Bernhauer, Bad Schwalbach) [type locality “Andırın: Altınyayla” (Turkey: Kahramanmaraş)] **A: TR**

Dorcadion amaliae Pesarini & Sabbadini, 2012: 55 **syn. nov.** (Holotype ♂, collection Carlo Pesarini & Andrea Sabbadini, Milano) [type locality “Andırın: Altınyayla” (Turkey: Kahramanmaraş)] **A: TR**

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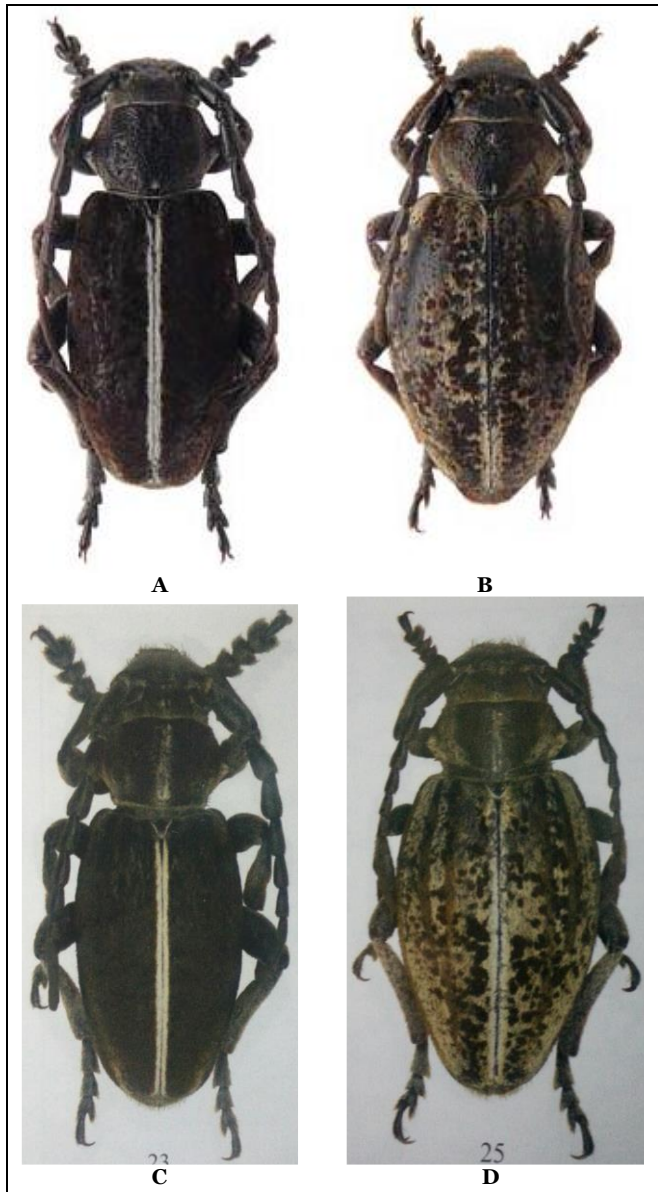


Figure 1. A. Holotype male, B. Paratype female of *Dorcadion amaliae* (From Pesarini & Sabbadini, 2012), C. Holotype male, D. Paratype female of *Dorcadion andirinense* (From Bernhauer & Peks, 2011).

**CONTRIBUTIONS OF THE LONGHORNED BEETLES
KNOWLEDGE OF TURKEY BY THE SUBFAMILIES
ASEMINAE, SAPHANINAE, SPONDYLIDINAE,
CERAMBYCINAE AND STENOPTERINAE
(COLEOPTERA: CERAMBYCIDAE)**

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[Özbek, H., Özdikmen, H. & Aytar, F. 2013. Contributions of the longhorned beetles knowledge of Turkey by the subfamilies Aseminae, Saphaninae, Spondylidinae, Cerambycinae and Stenopterinae (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 10 (1): 291-299]

ABSTRACT: The present work presents new contributions to the knowledge of the subfamilies Aseminae, Saphaninae, Spondylidinae, Stenopterinae and Cerambycinae that is one of the richest subfamilies in terms of diversity among cerambycids, of Turkey. The specimens for this study were collected over various years (2001-2012) from different localities in Adana, Balıkesir, Elazığ, Gaziantep, İçel, Kahramanmaraş, Malatya, Niğde and Osmaniye provinces in Turkey. As a result of the work, a total of 54 species (16 of them into subspecies level) belonging to 31 genera of 5 subfamilies were determined from Turkey. Four of them were described as new species and new subspecies from Turkey in 2012, 2013, 2014. One species of them is recorded for the first time from Turkey. Seven species for Mediterranean Region, three species for Eastern Mediterranean Region, five species for Central Anatolian Region, 1 species for Eastern Anatolian Region and five species for Southern half of Turkey are the first records. Moreover, a total of sixty species are the first record for various provinces (14 for Adana, 1 for Balıkesir, 1 for Elazığ, 2 for Gaziantep, 17 for İçel, 10 for Kahramanmaraş, 1 for Malatya, 11 for Niğde, 3 for Osmaniye) in Turkey. Furthermore, about 15% of the examined taxa in the present work comprise of endemic taxa for Turkey.

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

According to Özdikmen (2012), Cerambycidae is divided into several subfamilies as Parandrinae, Prioninae, Lepturinae, Necydalinae, Aseminae, Saphaninae, Spondylidinae, Apatophyseinae, Cerambycinae, Stenopterinae, Dorcadioninae and Lamiinae. Parandrinae are not represented in Turkey. Also, a total of 6 subfamilies as Necydalinae, Aseminae, Saphaninae, Spondylidinae, Apatophyseinae and Stenopterinae are represented with only some taxa in Turkey. So, only 5 subfamilies as Prioninae, Lepturinae, Cerambycinae, Dorcadioninae and Lamiinae have the richest diversity for Turkey.

In accordance with the status, the aim of present work is contributed to the knowledge of the subfamilies Aseminae, Saphaninae, Spondylidinae, Cerambycinae and Stenopterinae on the base of Özdikmen (2007, 2008a,b, 2010, 2011, 2013).

MATERIAL AND METHOD

The specimens for this study were collected by the third author over various years (2001-2012) from different localities in Eastern Mediterranean Region (Adana, İçel, Kahramanmaraş and Osmaniye provinces), Central Anatolian

Region (Niğde province), Marmara Region (Balıkesir province), South-Eastern Anatolian Region (Gaziantep province) and Eastern Anatolian Region (Elazığ and Malatya provinces) in Turkey and deposited in Entomology Department of Eastern Mediterranean Forestry Research Institute (İçel province, Turkey). All of the specimens were determined by the authors. In this paper classification and nomenclature of the longhorn beetles suggested by Özdikmen (2012) are followed. Within the subfamilies all genera are listed in the same order as in Özdikmen (2012). Within the genera the species are listed alphabetically. Each name of a species or subspecies is accompanied by the author's name and description date.

RESULTS AND DISCUSSION

SUPERFAMILY CERAMBYCOIDEA Latreille, 1802

FAMILY CERAMBYCIDAE Latreille, 1802: 211

SUBFAMILY ASEMINEAE Thomson, 1861: 139

GENUS *ARHOPALUS* Audinet-Serville, 1834: 77

SPECIES *A. ferus* (Mulsant, 1839: 64)

Material examined: Adana: Feke, Süphandere, 07.VII.2009, 1 specimen; Feke, süphandere, 14.VII.2009, from wood of *Pinus brutia*, 1 specimen; İçel: Anamur, Abanos, 23.VI.2005, from wood of *Pinus brutia*, 1 specimen; Central, Toroslar, Kızılkaya village (Çamlyayla part), 16.VI.2009, from wood of *Pinus nigra*, 1 specimen; Central, Toroslar, Kızılkaya village, 16.VI.2009, *Pinus nigra*, 1 specimen; Niğde: Alihoca, 15.V.2004, 1 specimen; Osmaniye: Karatepe, 16.IX.2011, *Pinus halepensis*, 1 specimens.

Remarks: The species is the first record for İçel, Niğde and Osmaniye provinces.

SPECIES *A. rusticus* (Linnaeus, 1758: 395)

Material examined: Adana: Feke, Süphandere, 02.VII.2009 and 09.VII.2009, on *Pinus nigra*, 2 specimens; İçel: Çamlyayla, İledin top, 27.VI.2006, from wood of *Pinus nigra*, 1 specimen; Erdemli, Hacıalanı, pheromone traps, 30.VI.2011, 5 specimens, 14.VII.2011, 3 specimens, 11.VIII.2011, 1 specimen, 25.VIII.2011, 9 specimens, 28.VIII.2011, 16 specimens, 08.IX.2011, 5 specimens, 22.IX.2011, 45 specimens, 20.X.2011, 1 specimen; Osmaniye: Karatepe, Taurus, 27.VI.2006, pheromone trap, 1 specimen.

Remarks: The species is the first record for Adana and İçel provinces.

SPECIES *A. syriacus* (Reitter, 1895: 86)

Material examined: Adana: Feke, Süphandere, 14.VII.2009, from wood of *Pinus nigra*, 2 specimens; İçel: Gülnar, Büyükeceli, 28.VI.2003, from wood of *Pinus brutia*, 1 specimen; Anamur, Kızılçakaya village, 02.VI.2004, from wood of *Pinus brutia*, 1 specimen; Anamur, Abanoz road, 23.VI.2005, from wood of *Pinus brutia*, 1 specimen; Anamur, Sarıyayla, 26.VI.2005, from wood of *Pinus brutia*, 2 specimens; Mut, Alahan, 19.VI.2008, forest store (pheromone trap), 2 specimens; Central, Toroslar, Kızılkaya village, 16.VI.2009, from wood of *Pinus nigra*, 3 specimens; Tarsus, Ayvalı, 22.VI.2008, *Pinus nigra*, 1 specimen; Central, Toroslar, Kızılkaya village (Çamlyayla part), 16.VI.2009, from wood of *Pinus nigra*, 1 specimen; Çamlyayla, Buludan, 22.VII.2009, from wood of *Pinus nigra*, 1 specimen; Erdemli, Hacıalanı, 29.VII.2011, pheromone trap, 1 specimen; Central, Toroslar, Coçakdere, 04.VIII.2011, pheromone trap, 1 specimen; Erdemli, Hacıalanı, pheromone traps, 25.VIII.2011, 16 specimens, 08.IX.2001, 2 specimens, 22.IX.2011, 5 specimens.

GENUS *ASEMUM* Eschscholtz, 1830: 66

SPECIES *A. striatum* (Linnaeus, 1758: 396)

Material examined: İçel: 2002, 1 specimen; Çamlyayla, Pamukluk, 11.VI.2006, on *Pinus nigra*, 1 specimen; Erdemli, Hacıalanı, 27.V.2011, on *Pinus nigra*, 1 specimen.

Remarks: The species is the first record for İçel province and Mediterranean Region of Turkey and thereby also for South Turkey.

SPECIES *A. tenuicorne* Kraatz, 1879: 97

SUBSPECIES *A. t. claricostulatum* Özdikmen & Aytar, 2012: 1253

Material examined: İçel: Çamlyayla, Dikenlioluk, 17.VI.2009, on *Pinus nigra*, 1 specimen.

Remarks: The species is the first record for İçel province. The subspecies was described on the base of the specimen in the present text.

SUBFAMILY SAPHANINAE Gistel, 1848: [1]

GENUS *OXYPLEURUS* Mulsant, 1839: 57

SPECIES *O. nodieri* Mulsant, 1839: 57

Material examined: İçel: Çamlyayla, top of İledin, 18.V.2005, with net, 1 specimen.

Remarks: The species is the first record for İçel province and Eastern Mediterranean Region of Turkey.

SUBFAMILY SPONDYLIDINAE Audinet-Serville, 1832: 123

GENUS *SPONDYLIS* Fabricius, 1775: 159

SPECIES *S. buprestoides* (Linnaeus, 1758: 388)

Material examined: İçel: Central, Toroslar, Coçakdere, 27.VI.2006, on *Abies cilicica*, 1 specimen; Çamlyayla, İledin top, 10.VII.2006, on *Abies cilicica*, 1 specimen; Çamlyayla, Sadiye village, Gündoğan, 24.VI.2010, on *Abies cilicica*, 1 specimen; Erdemli, Hacıalanı, pheromone traps, 30.VI.2011, 49 specimens, 14.VII.2011, 35 specimens, 26.VII.2011, 6 specimens, 28.VII.2011, 85 specimens, 11.VIII.2011, 16 specimens, 25.VIII.2011, 19 specimens, 22.IX.2011, 1 specimen.

Remarks: The species is the first record for İçel province and Mediterranean Region and thereby South half of Turkey.

SUBFAMILY CERAMBYCINAE Latreille, 1802: 211

GENUS *ICOSIUM* Lucas, 1854: VIII

SPECIES *I. tomentosum* Lucas, 1854: IX

SUBSPECIES *I. t. atticum* Ganglbauer, 1882: 743

Material examined: İçel: Çamlyayla, Pamukluk, 11.VI.2006, on *Pinus brutia*, 1 specimen; Central, Toroslar, Aslanköy, 10.VI.2010, on *Pinus nigra*, 2 specimens.

Remarks: The species is the first record for İçel province and Eastern Mediterranean Region of Turkey.

GENUS *TRICHOFERUS* Wollaston, 1854: 427

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

Material examined: Adana: Balcalı, 18.III.2010, 28.IV.2010 and 30.IV.2010, from wood of *Ficus carica*, 3 specimens; Karaisalı, 12.IV.2011, from wood of *Ficus carica*, 1 specimen; İçel: Tarsus, Gülek, 31.III.2005, on *Pinus brutia*, 1 specimen; Central, Akdeniz, Kızılbaş, 18.V.2005, on *Pinus brutia*, 1 specimen; Çamlyayla, İledin top, 18.V.2005, with net, 1 specimen; Aydınçık, 23.VI.2005, 1 specimen; Anamur, Sarıyayla, 23.VI.2005, 1 specimen; Silifke, 23.IX.2005, forest store, 1 specimen; Tarsus, Dörtler, 07.IV.2006, from wood of *Ficus carica* 1 specimen; Central, Akdeniz, Kızılbaş, 01.VIII.2006, 2 specimens; Silifke, Değirmendere, 25.IV.2009, 1 specimen; Central, Toroslar, Çelebili, 21.V.2009, with net, 1 specimen; Central, Toroslar, Kızılkaya, 16.VI.2009, 1 specimen; **Osmaniye:** Karatepe, 18.III.2012, from wood of *Ficus carica*, 1 specimen.

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

Material examined: İçel: Central, Akdeniz, Kızılbaş, 16.VI.2009 and 01.VIII.2006, 2 specimens; Çamlyayla, Pınarlıbük (part of sebil), 15.VII.2008, on *Cerris siliquastrum*, 1 specimen; Erdemli, Hacıalanı, 30.VI.2009, on *Pinus brutia*, 1 specimen.

Remarks: The species is the first record for İçel province.

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

Material examined: Adana: Balcalı, 18.III.2010, from wood of *Ficus carica*, 2 specimens; İçel: Silifke, Forest store, 23.IX.2005, from root of *Ficus carica*, 1 specimen; Silifke, Efkaçfıtlığı village, 08.VII.2009, *Capparis sipinosa*, 1 specimen; Değirmençay, 18.VIII.2009, from wood of *Morus alba*, 2 specimens; Mut, Alahan, 01.VII.2010, from root of *Capparis sipinosa*, 1 specimen; Erdemli, Hacıalanı, 30.VI.2011, pheromone trap, 2 specimens; **Osmaniye:** Karatepe, 18.III.2012, from wood of *Ficus carica*, 1 specimen.

Remarks: The species is the first record for Osmaniye province.

GENUS *STROMATIUM* Audinet-Serville, 1834: 80

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

Material examined: İçel: Tarsus, 06.IV.2002, from wood of furniture, 1 specimen; Tarsus, Karabucak, 20, 26 and 30.VI.2004, from wood of *Citrus aurantium*, 6 specimens; Tarsus, Yalamık, 09.VII.2007, from wood of *Flueggea anatolica*, 1 specimen.

GENUS *PHORACANTHA* Newman, 1840: 19

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

Material examined: Adana: Akvatağan, 27.IV.2002, on *Eucalyptus camadulensis*, 1 specimen; İçel: Tarsus, Karabucak, 22.IV.2002, on *Eucalyptus camadulensis*, 3 specimens; İstasyon, 23.IV.2002, on *Eucalyptus camadulensis*, 1 specimen; Tarsus, Karabucak, 25.IV.2002, on *Eucalyptus grandis*, 1 specimen; Tarsus, Karabucak, 27.IV.2002, on *Eucalyptus camadulensis*, 1 specimen; Silifke, 05.V.2002, on *Eucalyptus camadulensis*, 1 specimen.

GENUS *CERAMBYX* Linnaeus, 1758: 388

SUBGENUS *CERAMBYX* Linnaeus, 1758: 388

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

Material examined: İçel: Gülnar, Kaynak, 28.VI.2006, from wood of *Quercu ithaburensis*, 1 specimen.

Remarks: The species is the first record for İçel province and Mediterranean Region of Turkey.

SPECIES *C. cerdo* Linnaeus, 1758: 392

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

Material examined: **İçel:** Gülnar, Daşdüştü, 20.VI.2006, from wood of *Quercu ithaburensis*, 2 specimens; **Niğde:** Alihoca, 07.VIII.2011, from wood of *Quercu ithaburensis*, 1 specimen.

SPECIES *C. nodulosus* Germar, 1817: 220

Material examined: **İçel:** Ayvalı-Tarsus, 22.VI.2008, 1 specimen; Mut, 24.IV.2006, from wood of *Prunus armeniaca*, 1 specimen.

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

Material examined: **Adana:** Feke, Buğlayan, 29.VII.2008, with net, 1 specimen; **İçel:** Gülnar, Büyükeceli, 28.VI.2003, with net, 1 specimen; Güzne road, 29.V.2005, from wood of *Prunus dulcis*, 1 specimen; Central, Toroslar, 14.VI.2006, 1 specimen; Mut, 24.VI.2006, from wood of *Prunus armeniaca*, 3 specimens; Yenişehir, Eğriçam, 10.VI.2007, from wood of *Puronus persico*, 1 specimen; Tarsus, Ayvalı, 22.VI.2008, 2 specimens; Çamliayla, 10.VII.2008, *Quercus sp.*, 2 specimens; **Kahramanmaraş:** Göksun, Çardak, 29.IV.2009, from wood of *Quercus cerris*, 1 specimen; **Niğde:** Alihoca, 07.VIII.2011, on *Quercu ithaburensis*, 2 specimens.

Remarks: The species is the first record for Adana and Niğde provinces.

SUBGENUS *MICROCERAMBYX* Mikšić & Georgijević, 1973: 22

SPECIES *C. scopoli* Fuessly, 1775: 12

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

Material examined: **Kahramanmaraş:** Andırın, Fındıklidere, 08.IV.2011, on *Fagus orientalis*, 2 specimens.

Remarks: The species is the first record for Kahramanmaraş province.

GENUS *PURPURICENUS* Dejean, 1821: 105

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

Material examined: **Adana:** Pozanti, 09.VI.2008, on *Pistacia terebinthus*, 1 specimen; **İçel:** Anamur, Kızılçakaya village, 02.VI.2004, on *Quercus sp.*, 1 specimen; Boz Yazı, 03.VI.2004, on *Pistacia terebinthus*, 2 specimens; Yeşilovaçık, 03.VI.2004, on *Carduus sp.*, 1 specimen; Aydıncık, 03.VI.2004, on *Carduus sp.*, 1 specimen; Tarsus, Eskişehir, 05.VI.2006, on *Carduus sp.*, 1 specimen; Tarsus, Eskişehir, 22.VI.2007, on *Quercus coccifera*, 1 specimen; Erdemli, 27.III.2008, on *Pistacia terebinthus*, 1 specimen; Erdemli, Coast, 27.III.2008, on *Pistacia lestiscus*, 1 specimen; Tarsus, Ayvalı, 22.VI.2009, on *Carduus sp.*, 2 specimens; Mezitli, Davultepe, 28.IV.2010, on *Carduus sp.*, 1 specimen; Mezitli, Pelitkoyacı village, 28.IV.2010, on *Carduus sp.*, 1 specimen; **Kahramanmaraş:** Göksun, Çardak, 20.VI.2009, on *Quercus cerris var. cerris*, 1 specimen; **Niğde:** Alihoca, 09.VI.2008, on *Salvia aucheri*, 1 specimen; Alihoca, 09.VI.2008, *Paliurus spina-christi*, 1 specimen; Çiftelhan, 09.VI.2008, on *Pistacia terebinthus*, 1 specimen.

SPECIES *P. dalmatinus* Sturm, 1843: 353

Material examined: **Gaziantep:** Nurdağı, 30.VI.2009, *Quercus sp.*, 1 specimen; **İçel:** Anamur, Kızılçakaya, 02.VI.2004, *Quercus sp.*, 1 specimen; Mut, Erosion area, 29.IV.2009, *Quercus coccifera*, 1 specimen; **Kahramanmaraş:** Göksun, Çardak, 29.VI.2003, *Quercus cerris*, 3 specimens; Andırın, Akifiye, 05.IV.2011, *Quercus cerris*, 1 specimen.

Remarks: The species is the first record for Gaziantep province.

SPECIES *P. interscapillatus* Plavilstshikov, 1937: 247

SUBSPECIES *P. i. interscapillatus* Plavilstshikov, 1937: 247

Material examined: **Hatay:** İskenderun, 13.V.2010, on *Carduus sp.*, 2 specimens; Kırkhan, 13.V.2010, on *Carduus sp.*, 2 specimens; **İçel:** Anamur, Kızılçakaya, 02.VI.2004, on *Carduus sp.*, 1 specimen; Esenli, 03.VI.2004, on *Carduus sp.*, 1 specimen; Aydıncık, 03.VI.2004, on *Carduus sp.*, 1 specimen; Yeşilovaçık, 03.VI.2004, on *Carduus sp.*, 1 specimen; Tarsus, Eskişehir, 05.VI.2006, on *Carduus sp.*, 1 specimen; Erdemli, Limonlu, 26.VI.2006, on *Carduus sp.*, 1 specimen; Silifke, Susanoğlu, 26.VI.2006, on *Pistacia terebinthus*, 1 specimen; Erdemli, Coast, 27.III.2008, on *Pistacia lestiscus*, 1 specimen; Erdemli, Karahıdırlı, 16.IV.2008, on *Pistacia terebinthus*, 2 specimens; Tarsus, Ayvalı, 22.VI.2009, on *Carduus sp.*, 1 specimen; Güzne, 28.IV.2010, on *Carduus sp.*, 1 specimen; **Kahramanmaraş:** Göksun, Çardak, 20.VI.2009, on *Quercus cerris var. cerris*, 1 specimen.

Remarks: The species is the first record for Kahramanmaraş province.

SPECIES *P. nigronotatus* Pic, 1907: 169

Material examined: **İçel:** Çamliayla, Pamukluk, 29.IV.2008, on *Quercus cerris*, 1 specimen; **Kahramanmaraş:** Göksun, Çardak, 29.VI.2009, on *Quercus cerris*, 1 specimen.

Remarks: The species is the first record for Kahramanmaraş province.

SPECIES *P. nudicollis* Demelt, 1968: 65

Material examined: **Adana:** Karaisalı, 10.VIII.2010, *Carduus sp.*, 1 specimen; **Gaziantep:** Nurdağı, 30.VI.2009, *Quercus sp.*, 1 specimen; **İçel:** Erdemli, Limonlu, 26.VI.2006, on *Carduus sp.*, 1 specimen; Silifke, Susanoğlu, 26.VI.2006, on *Pistacia terebinthus*, 1 specimen; Tarsus, Naçarlı, 29.IV.2010, on *Carduus sp.*, 1 specimen; **Kahramanmaraş:** Göksun, Çardak, 29.VI.2009, on *Quercus cerris*, 1 specimen.

Remarks: The species is the first record for Adana, Gaziantep, İçel and Kahramanmaraş provinces.

GENUS *CALCHAENESTHES* Kraatz, 1863: 97

SPECIES *C. primis* Özdikmen, 2013: 150

Material examined: **İçel:** Mut, Erosion area, 05.IV.2006, *Quercus coccifera*, 2 specimens.

Remarks: The species was described on the base of the specimen in the present text.

GENUS AROMIA Audinet-Serville, 1834: 559

SPECIES A. ambrosiaca (Steven, 1809: 40)

Material examined: **İçel:** Tarsus, Karabucak, 25-27.IV.2002 and 22.VI.2002, on *Salix* sp., 3 specimens; Erdemli, Karahıdırlı, 28.VII.2002, on *Salix* sp., 1 specimen; Central, Toroslar, Aslanköy, 21.IV.2010 and 26.VI.2011, from wood of *Populus* sp., 2 specimens; **Niğde:** Alihoca, 07.VIII.2011, on *Salix* sp., 2 specimens.

Remarks: The species is the first record for Niğde province.

GENUS ANATOLOBRIUM Adlbauer, 2004: 419

SPECIES A. eggeri Adlbauer, 2004: 421

Material examined: **İçel:** Erdemli, Sorgun road, 30.V.2006, *Quercus* sp., 2 specimens.

GENUS CERTALLUM Dejean, 1821: 111

SPECIES C. ebulinum (Linnaeus, 1767: 637)

Material examined: **Adana:** Karaisalı, 10.VIII.2010, with net, 1 specimen; **İçel:** Erdemli- Sorgun road, 30.IV.2003, with net, 1 specimen; Central, Toroslar, Ayvagediği, 05.V.2005, with net, 1 specimen.

GENUS DELAGRANGEUS Pic, 1892: XCIII

SUBGENUS DELAGRANGEUS Pic, 1892: XCIII

SPECIES D. angustissimus Pic, 1892: XCIII

SUBSPECIES D. a. angustissimus Pic, 1892: XCIII

Material examined: **İçel:** Erdemli, Sorgun road, 30.VI.2006, on *Quercus* sp., 1 specimen.

GENUS DELIUS Audinet-Serville, 1834: 73

SPECIES D. rugosicollis Rapuzzi & Sama, 2012: 668

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

Material examined: **Adana:** Karaisalı, 10.VIII.2010, *Spartium junceum*, 1 specimen; **İçel:** Central, Toroslar, Çelebili, 21.V.2009, *Spartium junceum*, 1 specimen; Tarsus, Çamalan, 25.V.2009, wood of *Spartium junceum*, 1 specimen.

Remarks: The species is the first record for Adana and İçel provinces.

GENUS STENHOMALUS White, 1855: 243

SUBGENUS OBRIOPSIS Müller, 1948: 65

SPECIES S. bicolor (Kraatz, 1862: 126)

Material examined: **İçel:** Çamlyayla, 31.X.2007, *Euonymus europaeus*, 12 specimens; Çamlyayla, 20.IV.2008, *Juglans regia*, 3 specimens.

GENUS HYLOTRUPES Audinet-Serville, 1834: 77

SPECIES H. bajulus (Linnaeus, 1758: 396)

Material examined: **Adana:** Feke, 11.VII.2003, *Pinus nigra*, 2 specimens; Central, 19.VI.2009, *Populus* sp., 1 specimen; Karaisalı, 10.VIII.2010, from wood of *Pinus brutia*, 1 specimen; **İçel:** Çamlyayla, İledin top, 11.III.2006, *Pinus nigra*, 1 specimen; Mut, Alahan, 2009, pheromone trap, 1 specimen; Mezitli, Fındıkpınarı, 19.VI.2009, *Pinus nigra*, 1 specimen; Central, Toroslar, Coçakdere, 23.VII.2011, *Pinus nigra*, 1 specimen; **Osmaniye:** Karatepe, Taurus, 04.VIII.2008, *Pinus nigra*, 1 specimen.

GENUS ROPALOPUS Mulsant, 1839: 40

SUBGENUS ROPALOPUS Mulsant, 1839: 40

SPECIES R. clavipes (Fabricius, 1775: 188)

Material examined: **İçel:** Bozyazı, Kozağacı, 08.XI.2007-16.VI.2008, from wood of *Cedrus libani*, 12 specimens; Anamur, Abanos, 10.VI.2008, from wood of *Cedrus libani*, 1 specimen; Anamur, Abanos, 16.VI.2008, from wood of *Cedrus libani*, 2 specimens; Bozyazı, Kozağacı, 23.VI.2008, from wood of *Cedrus libani*, 2 specimens.

Remarks: The species is the first record for İçel province.

GENUS SEMANOTUS Mulsant, 1839: 54

SPECIES S. russicus (Fabricius, 1777: 232)

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

Material examined: **Adana:** Feke, Süphandere, 25.VI.2009, from wood of *Juniperus excelsa*, 1 specimen; **İçel:** Central, 27.V.2005, from wood of *Cupressus sempervirens*, 1 specimen; Central, 30.V.2005, from wood of *Cupressus arizonica*, 1 specimen; Tarsus, Karboğazi, 09.IV.2007, from wood of *Juniperus excelsa*, 2 specimens; Akdeniz, Karailyas, 24.IV.2007, from wood of *Cupressus sempervirens*, 2 specimens; **Niğde:** Çiftelhan, 09.VI.2008, with net, 1 specimen.

Remarks: The species is the first record for Adana, İçel and Niğde provinces and Eastern Mediterranean Region and Central Anatolian Region of Turkey.

GENUS CALLIDIUM Fabricius, 1775: 187

SUBGENUS CALLIDIUM Fabricius, 1775: 187

SPECIES C. syriacum Pic, 1892: CXI

Material examined: **İçel:** Çamlyayla, Cehennemdere, collected in 20.X.2008 and emerged in 04-09.IV.2009, from wood of *Cedrus libani*, 62 specimens; Erdemli, Taurus, collected in 15.XI.2004 and

emerged in 10 and 21.IV.2005, from wood of *Cerodus libani*, 6 specimens.

SUBGENUS CALLIDOSTOLA Reitter, 1913: 37

SPECIES *C. aeneum* (DeGeer, 1775: 89)

SUBSPECIES *C. a. pilosicollis* Özdikmen & Aytar, 2014: 599

Material examined: **İçel:** Central. 2003, 2 specimens.

Remarks: The species is the first record for İçel province and Mediterranean Region of Turkey and thereby also for south Turkey. The subspecies was described on the base of the specimens in the present text.

GENUS PHYMATODES Mulsant, 1839: 47

SUBGENUS PHYMATODES Mulsant, 1839: 47

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

Material examined: **İçel:** Central. 2003, 1 specimen; Erdemli, Sorgun road, 30.V.2006, on *Quercus* sp., 1 specimen; Gülnar, Köseçobanlı, 20.VI.2006, from wood of *Quercus ithaburensis*, 2 specimens; Çamlıyayla, Pamukluk, 25.IV.2007-14.V.2007, from wood of *Quercus cerris* and *Quercus infectoria*, 4 specimens; Çamlıyayla, Pamukluk, 14.IV.2008, from wood of *Quercus cerris*, 3 specimens; Mezitli, Sarılar, 14.IV.2009, from wood of *Quercus cerris*, 8 specimens; **Kahramanmaraş:** Andırın, 08.IV.2011, from wood of *Quercus cerris*, 3 specimens; **Niğde:** Alihoca, 12.VI.2010, with net, 1 specimen.

Remarks: The species is the first record for Kahramanmaraş province.

SUBGENUS PHYMATODERUS Reitter, 1913: 39 nec Dejean, 1837

SPECIES *P. lividus* (Rossi, 1794: 98)

Material examined: **Adana:** Central, 07.VII.2005, wood of furniture, 2 specimens; **İçel:** Gülnar, Büyükeceli, 28.VI.2003, with net, 1 specimen.

Remarks: The species is the first record for Adana province.

SUBGENUS PARAPHYMATODES (Plavilstshikov, 1934: 215)

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

Material examined: **Adana:** Pozanti, 03.VI.2008, with net, 1 specimen; **İçel:** Tarsus, Melemez, 15.V.2007, *Vitis vinifera*, 1 specimen; Silifke, Değirmendere, 30.IV.2009, *Vitis vinifera*, 2 specimens; **Niğde:** Alihoca, 27.IV.2007, from wood of *Vitis vinifera*, 1 specimen; Alihoca, 01 and 21.V.2007, from wood of *Vitis vinifera*, 1 specimen; Çiftehane, 09.VI.2008, with net, 1 specimen.

Remarks: The species is the first record for Adana, İçel and Niğde provinces and Mediterranean Region and Central Anatolian Region of Turkey, and thereby also for Turkey with exact localities. The present specimens were published by Özdikmen et al. (2014) as a new record for Turkey.

GENUS PLAGIONOTUS Mulsant, 1842: 1

SUBGENUS ECHINOCERUS Mulsant, 1862: 143

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

Material examined: **Adana:** Karaisalı, 10.VIII.2010, on flower, 1 specimen; **İçel:** Aydınçık, 23.VI.2005, on flower, 1 specimen; Çamlıyayla, Pamukluk, 29.IV.2008, on flower, 1 specimen; Çamlıyayla, Fakılar, 18.VIII.2009, on flower, 1 specimen; Gülnar, Gezende, 13.VII.2011, on flower, 1 specimen; Erdemli, Karahıdırlı, 28.VII.2011, on flower, 1 specimen; **Kahramanmaraş:** Andırın, Akifiye, 27.VII.2010, with net, 1 specimen; **Niğde:** Alihoca, 24.VI.2009, on flower, 1 specimen; Alihoca, 07.VIII.2011, on flower, 1 specimen; **Osmaniye:** Karatepe, 27.VII.2011, on flower, 1 specimen.

GENUS ISOTOMUS Mulsant, 1862: 143

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

SUBSPECIES *I. c. meridionalis* Özdikmen & Aytar, 2012: 691

Material examined: **Osmaniye:** Karatepe, Gündoğan, 08.VII.2010, pheromone trap, 1 male specimen; Karatepe, Taurus, 22.VII.2010, on *Abies cilicica*, 1 female specimen.

Remarks: The species is the first record for Osmaniye province and Mediterranean Region of Turkey and thereby also for south Turkey. The subspecies was described on the base of the specimens in the present text.

GENUS CHLOROPHORUS Chevrolat, 186: 290

SUBGENUS CHLOROPHORUS Chevrolat, 1863: 290

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

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

Material examined: **Adana:** Karaisalı, 10.VIII.2010, on flower, 1 specimen; **İçel:** Çamlıyayla, Fakılar, 18.VIII.2003, on *Rubus caesius*, 1 specimen; Çamlıyayla, 19.VIII.2003, on *Rubus* sp., 2 specimens; Tarsus, Karabucak, 02.VI.2004, with net, 1 specimen; Tarsus, Çamalan, 09.VIII.2005, with net, 1 specimen; Silifke, forest store, 20.VI.2006, on *Ficus carica*, 1 specimen; Mut, Central, 20.VI.2006, with net, 1 specimen; Tarsus, Dörtler, 14.V.2007, from wood of *Ficus carica*, 1 specimen; Gülnar, Gezende, 13.VII.2011, on flower, 1 specimen; **Kahramanmaraş:** Andırın, 27.VII.2010, with net, 1 specimen; **Niğde:** Alihoca, 06.VI.2003, on flower, 1 specimen; Alihoca, 07.VIII.2011, on flower, 1 specimen; **Osmaniye:** Karatepe, 27.VII.2011, with net, 1 specimen.

SUBGENUS PERDEROMACULATUS Özdikmen, 2011: 537

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

Material examined: Adana: Pozanti, 09.VI.2008, with net, 1 specimen; Karaisalı, 10.VIII.2010, on flower, 1 specimen; İçel: Bozyazı, Kozçağacı, 23.VI.2005, with net, 1 specimen; Aydınçık, 23.VI.2005, on flower, 2 specimens; Çamlyayla, Pamukluk, 05.VI.2006, on flower, 2 specimens; Çamlyayla, Pamukluk, 06.VI.2006, on flower, 1 specimen; Erdemli, Karahıdırlı, 26.VI.2006, on flower, 1 specimen; Erdemli, Karahıdırlı, 18.VI.2009, on flower, 1 specimen; Silifke, Değirmendere, 25.IV.2009, from wood of *Morus alba*, 2 specimens; Kahramanmaraş: Andırın, Akifiye, 27.VII.2010, with net, 3 specimens; Niğde: Alihoca, 09.VI.2008, with net, 1 specimen.

Remarks: The species is the first record for Adana and Niğde provinces.

SUBGENUS HUMEROMACULATUS Özdikmen, 2011: 537

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

Material examined: İçel: Çamlyayla, Pamukluk, 05.VI.2006, on flower, 1 specimen; Erdemli, Karahıdırlı, 26.VI.2006, on flower, 4 specimens; Aydınçık, 27.VI.2006, on flower, 1 specimen; Anamur, Abanoz road, 27.VI.2006, *Quercus cerris*, 1 specimen; Kahramanmaraş: Andırın, Akifiye, 27.VII.2010, with net, 1 specimen; Niğde: Alihoca, 09.VI.2008, with net, 1 specimen.

Remarks: The species is the first record for Kahramanmaraş province.

GENUS XYLOTRECHUS Chevrolat, 1860: 456

SUBGENUS XYLOTRECHUS (Chevrolat, 1860: 456)

SPECIES *X. antilope* (Schoenherr, 1817: 465)

SUBSPECIES *X. a. antilope* (Schoenherr, 1817: 465)

Material examined: Adana: Feke, Buğlayan, 25.VII.2008, with net, 1 specimen; İçel: Erdemli, Hacıalanı, 30.VI.2011, pheromone trap, 1 specimen.

Remarks: The species is the first record for Adana and İçel provinces and Mediterranean Region of Turkey and thereby also for south Turkey.

SUBGENUS TURANOCLYTUS Sama, 1994: hevrolat, 1860: 456

SPECIES *T. sieversi* (Ganglbauer, 1890)

Material examined: Adana: Saimbeyli, 19.VI.2009, from wood of *Astragalus* sp., 1 specimen; Elazığ: Central, Sakabaşı (Picirik) village, 29.III.2012, from wood of *Astragalus* sp., 1 specimen; İçel: Erdemli, Sorgun, 05-08.V.2005, from wood of *Astragalus* sp., 4 specimens; Silifke, 20.VII.2011, from wood of *Astragalus* sp., 1 specimen; Kahramanmaraş: Göksun, Çardak, 12.V.2010, from wood of *Astragalus* sp., 1 specimen; Niğde: Alihoca, 20 and 29.V.2008, from wood of *Astragalus* sp., 1 specimen; Ulukışla, Çiftköy, 08.VI.2008, from wood of *Astragalus* sp., 1 specimen; Malatya: Pötürge, Kubbe pass, 13.IV.2011, from wood of *Astragalus* sp., 1 specimen.

Remarks: The species is the first record for Adana, Elazığ, İçel, Kahramanmaraş, Niğde and Malatya provinces, and thereby also Central Anatolian Region and Eastern Anatolian Region of Turkey.

GENUS CLYTUS Laicharting, 1784: 88

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

Material examined: İçel: Mezitli, Davultepe, V.2006, with net, 1 specimen; Çamlyayla, Central, 10.VI.2006, on flower, 1 specimen.

SPECIES *C. rhamnii* Germar, 1817: 223

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

Material examined: Adana: Pozanti, 09.VI.2008, with net, 1 specimen; Karaisalı, 10.VIII.2010, on flower, 1 specimen; Balıkesir: Kazdağı, 09.VI.2011, on *Cistus creticus*, 1 specimen; İçel: Erdemli, Karahıdırlı, 26.VI.2006, on flower, 1 specimen; Mut, Alahan, 19.VI.2008, on flower, 1 specimen; Çamlyayla, Fakılar, 18.VIII.2009, on flower, 1 specimen; Erdemli, Hacıalan road, 18.VI.2009, on flower, 1 specimen; Kahramanmaraş: Andırın, Akifiye, 27.VII.2010, with net, 2 specimens; Niğde: Alihoca, 29.VI.2009, with net, 1 specimen; Osmaniye: Karatepe, Taurus, 27.VII.2011, on flower, 1 specimen.

Remarks: The species is the first record for Balıkesir and Niğde provinces.

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

Material examined: İçel: Çamlyayla, Central, 05.VI.2006, 1 specimen; Silifke, Değirmendere, 25.IV.2009, from wood of *Morus alba*, 2 specimens; Silifke, Değirmendere, 30.IV.2009, from wood of *Morus alba*, 1 specimen; Silifke, Değirmendere, 05.V.2009, from wood of *Morus alba*, 1 specimen; Gülnar, Gezende, 13.VII.2011, on flower, 1 specimen; Kahramanmaraş: Göksun, Değirmendere, 25.IV.2009, *Vitis vinifera*, 1 specimen.

Remarks: The species is the first record for Kahramanmaraş province.

SUBFAMILY STENOPTERINAE Gistel, 1848: [9] (unnumbered section)

GENUS STENOPTERUS Illiger, 1804: 120

SPECIES *S. rufus* (Linnaeus, 1767: 642)

SUBSPECIES *S. r. syriacus* Pic, 1892: 22

Material examined: Adana: Feke, Buğlayan, 25.VI.2009, on flower, 1 specimen; Feke, Süphandere, 02.VII.2009, on flower, 1 specimen; İçel: Mut, Dandi, 07.VI.2003, with net, 1 specimen; Anamur, Sarryayla, 26.VI.2005, 1 specimen; Erdemli, Karahıdırlı, 16.VI.2008, 1 specimen; Kızılkaya (Çamlyayla part), 16.VI.2009, 1 specimen; Central, Toroslar, Kızılbağ, 16.VI.2009, on flower, 1 specimen; Niğde: Alihoca, 07.VI.2009, on flower, 1 specimen.

Remarks: The species is the first record for Adana province.

GENUS MOLORCHUS Fabricius, 1792: 356**SUBGENUS CAENOPTERA Thomson, 1859: 150****SPECIES *M. juglandis* Sama, 1982: 219**

Material examined: Adana: Karaisalı, 17.III.2011-23.IV.2011, *Juglans regia*, 4 specimens; İçel: Mut, Kozlar, 07.V.2006, *Juglans regia*, 3 specimens; Çamliya, 20.IV.2008, *Juglans regia*, 1 specimen; Çamliya, 30.X.2008, *Cornus sanguinea*, 1 specimen; Kahramanmaraş: Andırın, 25.III.2011-07.V.2011, *Juglans regia*, 4 specimens; Niğde: Çiftehane, 15-29.IV.2009, *Juglans regia*, 3 specimens.

Remarks: The species is the first record for Adana and Kahramanmaraş provinces.

SUBGENUS MOLORCHUS Fabricius, 1792: 356**SPECIES *M. kiesewetteri* Mulsant & Rey, 1861: 189****SUBSPECIES *M. k. hircus* Abeille de Perrin, 1881: 133**

Material examined: İçel: Tarsus, Eskişehir, 22.VI.2007, 3 specimens; Çamliya, Pınarlıbük, Erguvan, 30.X.2007-10.IV.2008, 4 specimens; Niğde: Alihoca, 05.VIII.2007, from wood of *Juglans regia*, 10 specimens.

Remarks: The species is the first record for Niğde province.

GENUS NATHRIUS Brèthes, 1916:**SPECIES *N. brevipennis* (Mulsant, 1839: 105)**

Material examined: Adana: Karaisalı, 17.III.2011, *Juglans regia*, 4 specimens; İçel: Mut, Kozlar, 07.V.2006, *Juglans regia*, 1 specimen; Tarsus, Meşelik district, 17.IV.2008, *Ceratomia* sp., 1 specimen; Çamliya, 04.V.2008, *Juglans regia*, 2 specimens; Kahramanmaraş: Andırın, 25.III.2011 and 07.V.2011, 2 specimens; Niğde: Çiftehane, 15-29.IV.2009, *Juglans regia*, 3 specimens; Alihoca, 25.V.2008 and 01.V.2009, *Juglans regia*, 18 specimens.

Remarks: The species is the first record for Adana, Kahramanmaraş and Niğde provinces and thereby Central Anatolian Region of Turkey.

GENUS CALLIMUS Mulsant, 1846: [5]**SUBGENUS CALLIMUS Mulsant, 1846: [5]****SPECIES *C. angulatus* (Schränk, 1789 77)****SUBSPECIES *C. a. angulatus* (Schränk, 1789 77)**

Material examined: Adana: Feke, Buğlayan, 25.VI.2009, on flower, 2 specimens; İçel: Mut, Dandi, 07.VI.2003, with net, 1 specimen; Gülnar, Daşdüştü, 24.V.2006, on *Quercus* sp., 2 specimens; Erdemli, Sargunlu, 30.V.2006, on *Quercus* sp., 1 specimen; Erdemli, Karahıdırlı, 16.VI.2008, on flower, 2 specimens; Çamliya, Karakoyak, 16.VI.2009, on flower, 1 specimen; Çamliya, Kızılkaya, 16.VI.2009, on flower, 1 specimen; Niğde: Alihoca, 07.VI.2009, 1 specimen.

Remarks: The species is the first record for Adana and Niğde provinces and thereby Central Anatolian Region of Turkey.

SUBGENUS LAMPROPTERUS Mulsant, 1862: 214**SPECIES *C. femoratus* (Germar, 1824: 519)**

Material examined: Adana: Feke, Buğlayan, 25.VI.2009 and 02.VII.2009, on flower, 4 specimens; Feke, Süphandere, 02.VII.2009, on flower, 3 specimens; Karaisalı, 10.VIII.2010, with net, 1 specimen; İçel: Mut, Dandi, 07.VI.2003, with net, 1 specimen; Anamur, Saryaya, 26.VI.2005, on flower, 2 specimens; Çamliya, Pamukluk, 14.V.2007 and 10.IV.2008-09.V.2008, from wood of *Quercus cerris* and *Quercus infectoria*, 45 specimens; Central, Akdeniz, Kızılbağ, 16.VI.2009, on flower, 2 specimens; Kahramanmaraş: Andırın, Akifiye, 24.IV.2011, *Quercus cerris*, 5 specimens; Niğde: Alihoca, 07.VI.2009, on flower, 1 specimen.

Consequently, a total of eight taxa among the examined fifty-eight taxa are endemic to Turkey as *Aseum tenuicorne claricostulatum*, *Trichoferus preissi*, *Cerambyx scopolii nitidus*, *Purpuricenus nigronotatus*, *Anatolobrium eggeri*, *Delagrangus angustissimus angustissimus*, *Callidium aeneum pilosicollis* and *Isotomus comptus meridionalis*. Namely, about 15% of the examined taxa in the present work comprise of endemic taxa.

A total of sixty species are the first records for different provinces in Turkey to the present work.

Also only one species is the first record for Turkey as *Phymatodes fasciatus* (Villers, 1789).

Finally, a total of four species group taxa, the species *Calchaenesthes primis* and the subspecies *Aseum tenuicorne claricostulatum*, *Callidium aeneum pilosicollis* and *Isotomus comptus meridionalis* were described on the base of the specimens in the present work.

Note: This work is based on the Master Thesis of the first author.

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SCIENTIFIC NOTES

**HOLOTYPE AND PARATYPES DESIGNATIONS OF
PHYTOECIA (HELLADIA) HUMERALIS CANERI ÖZDİKMEN &
TURGUT, 2010 (CERAMBYCIDAE: LAMIINAE)**

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[Özdikmen, H. 2015. Holotype and paratypes designations of *Phytoecia (Helladia) humeralis caneri* Ozdikmen & Turgut, 2010 (Cerambycidae: Lamiinae). Munis Entomology & Zoology, 10 (1): 300-300]

Phytoecia (Helladia) humeralis caneri was described by Ozdikmen & Turgut (2010) from S Turkey (Osmaniye, Hatay, Gaziantep provinces). Unfortunately, type material was not designated in their work. Therefore, I designate type material for *Phytoecia (Helladia) humeralis caneri*:

Holotype ♂: Hatay prov.: Kırıkhan–Belen road, Kıcı, N 36 28 E 36 16, 481 m, 31.03.2007. Paratypes: Osmaniye prov.: Yaylalık–Türkoğlu road, N 36 17 E 36 37, 701 m, 18.05.2006, 1 specimen; Zorkun road, Çiftmazı, N 37 01 E 36 17, 223 m, 20.05.2006, 1 specimen; Entry of Yarpuz, N 37 03 E 36 25, 930 m, 18.05.2006, 5 specimens; Hasanbeyli, N 37 07 E 36 32, 711 m, 21.04.2007, 3 specimens; Toprakkale, N 37 03 E 36 08, 107 m, 23.04.2007, 3 specimens; Bahçe, Kızlaç village, Aslanlı, N 37 10 E 36 38, 768 m, 21.04.2007, 1 specimen; Hatay prov.: Kırıkhan–Belen road, Kıcı, N 36 28 E 36 16, 481 m, 31.03.2007, 7 specimens; Hassa–Kırıkhan road, 10 km to Kırıkhan, N 36 33 E 36 23, 31.03.2007, 5 specimens; Hassa–Kırıkhan road 20th km, N 36 35 E 36 24, 145 m, 31.03.2007, 1 specimen; Serinyol, N 36 21 E 36 13, 115 m, 30.03.2007, 2 specimens; Alahan castle, N 36 19 E 36 11, 147 m, 30.03.2007, 7 specimens; Akbez, N 36 50 E 36 32, 464 m, 22.04.2007, 9 specimens; Akbez, Gülpınarı plateau, N 36 51 E 36 30, 617 m, 19.05.2006, 1 specimen; Samandağı, Hüseyinli village, N 36 09 E 36 04, 149 m, 20.04.2007, 1 specimen; Samandağı, Üzengili village, N 36 09 E 36 04, 141 m, 20.04.2007, 1 specimen; Gaziantep prov.: Fevzipaşa–İslahiye road, N 37 05 E 36 38, 542 m, 31.03.2007, 26 specimens (Fig. 1).

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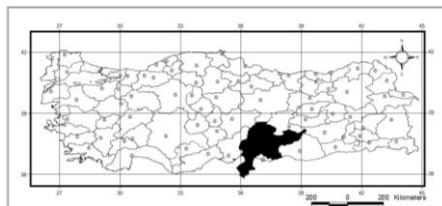


Figure 1. The distribution of *Phytoecia (Helladia) humeralis caneri*.