HYPOPYGIA OF THE *HERCYNA* SPECIES GROUP OF *ENTEDON* DALMAN (HYMENOPTERA: EULOPHIDAE), WITH DESCRIPTIONS OF NEW SPECIES

Mikdat Doğanlar* and Oğuzhan Doğanlar**

* Mustafa Kemal Üniversity, Faculty of Agriculture, Department of Plant Protection,TR-31034, Hatay, TURKEY. E-mail: doganlar@mku.edu.tr
** Trakya University, Medical school, Department of Medical Biology, 22030, Edirne, TURKEY. E-mail: doganlaro@yahoo.com.tr

[Doğanlar, M. & Doğanlar, O. 2013. Hypopygia of the *hercyna* species group of *Entedon* Dalman (Hymenoptera: Eulophidae), with descriptions of new species. Munis Entomology & Zoology, 8 (2): 812-824**]**

ABSTRACT: Seven species of the *hercyna* species group of genus *Entedon* Dalman (Hymenoptera: Eulophidae: Entedoninae) were collected in Turkey: *E. ergias* Walker, *E. procioni* Erdös, *E. calcicola* Graham, *E. hercyna* Walker, *E. diotimus* Walker, and the new species, *E. akdagicus* and *E. nevsehiricus***.** Hypopygia of the species, except *E. calcicola* and *E. nevsehiricus*, were studied. Identification key to the Turkish species of the *hercyna* species group of *Entedon* were provided.

KEY WORDS: Hymenoptera (Eulophidae), *hercyna* species group of *Entedon*, Turkey.

The *hercyna* species group of *Entedon* was proposed by Graham (1971) for the association of *Entedon hercyna* Walker, 1839, *Entedon ulicis* (Perris, 1840), *Entedon heyeri* (Ratzeburg, 1848), *E. gracilior* Graham, 1971, *E. calcicola* Graham, 1971, and *Entedon diotimus* Walker, *Entedon ?loti* Erdös and ?*Entedon molybdaenus* Erdös in the *diotimus* species group, as a separate group. Graham (1971) revised the species of the group, and stated that the species sharing the characters as follow: frons without or with short impressed lines; oral fossa relatively small, 1.8-2.4 times malar space; anterior margin of clypeus truncate or slightly curved; fore tibia with two pale longitudinal stripes; forewing immaculate,speculum open below, marginal vein not, or not much thickened; head relatively less transverse in dorsal view, at most 2.35 times as broad as long.

Schauff (1988) revised the Nearctic species of the group, including *E. ashmeadi* Schauff, *E. bigeloviae* Ashmead, *E. columbianus* Ashmead, *E. genei* Schauff, *E. leucopus* (Ashmead), *E. pecki* Schauff, *E. procerus* Schauff, *E. robustus* (Crawford), *E. tachypterelli* Gahan and *E. teedoe* Schauff.

Askew (1992) discussed some characters of *Entedon urticari* Erdös, *E. hercyna, E. molybdaenus, E. procioni* Erdös, *E. gracilior*, and described *Entedon meliloti* Askew.

Gumovsky(1997) revised the species of *hercyna* species group, and gave the diagnostic characters as follow: anterior margin of clypeus truncate, fore tibiae with two white strips or wholly darkened, occipital margin mostly sharp, forming more or less raising crest with pronounced, rounded off peaks, male metasoma sometimes with pale basal spot, stated that this group includes *E. hercyna*, *E. apionis* Erdös, *E. procioni* Erdös, *E. gracilior* Graham, E. *reticulatus* Erdös, *E. calcicola* Graham,1971, *E. ulucis* Perris, *E. heyeri* (Ratzeburg), *E. abdera* Walker,1839, *E. ukranicus* Gumovsky, *E. ergias* Walker, *E. diotimus* Waker, *E. alveolatus* Gumovsky*; E. pini* Yang, *E. broussonetiae* Yang, *E. pumilae* Yang, *E. tumiditempli* Yang, *E. wilsonii* Yang, Nearctic *E. ashmeadi* Schauff, *E. bigeloviae* Ashmead, *E. columbianus* Ashmead, *E. genei* Schauff, *E. leucopus* (Ashmead), *E.*

pecki Schauff, *E. procerus* Schauff, *E. robustus* (Crawford), *E. tachypterelli* Gahan and *E. teedoe* Schauff.

Gumovsky (1999) revised the Ukrainian species of *hercyna* group, discussed the diagnostic characters of the group, and recorded 7 species from Ukraine: *E. procioni, E. gracilior, E. heyeri, E. abdera, E. ukrainicus, E. diotimus* and *E. ergias* and established 5 new synonymies: *Entedon molybdaenus* Erdős, *Entedon urticarii* Erdős, *Entedon meliloti* Askew = *Entedon procioni* Erdős; *E. loti* Erdös = *E. diotimus*; *E. nigritarsis* Erdös = *E. abdera*.

Gumovsky & Boyadzhiev (2003) gave the diagnostic characters of the *hercyna* group by adding the species with fore tibiae darkened completely, the characters are: both sexes. Frontal sulcus absent (or weakly traced as short smooth stripes), clypeus truncate; occipital margin somewhat sharpened, gena evenly curved, propodeal spiracular elevation delimited only laterally (lateral sulcus incomplete), submedian areas not convex, median propodeal carina weakly raised, with more or less expressed furrows along; petiole reduced to narrow band; fore tibia with two pale stripes (most species), or (*E. diotimus*, *E. abdera* and some allied species) completely darkened; trochanters darkened; subcosta of submarginal vein bearing normally 2, but occasionally 3 (*E. apionis* Erdős) setae on its dorsal surface; speculum closed or open and may be a subject for sexual dimorphism. Males**.** Funicle 4- or 3-segmented, often last two flagellar segments fused, but with deep constriction, metasoma occasionally with pale subbasal spot, they recorded 6 species of the *hercyna* group, *E. hercyna*, *E. procioni, E. gracilior, E. heyeri, E. abdera, E. diotimus* and *E. Ergias* in species complex *squamosus* of *perturbatus* group from Bulgaria.

In Turkey, Doğanlar (1985) recorded *E. calcicola*, *E. hercyna*, and *E. molybdeanus* from the *hercyna* species group and some other species of *Entedon* in Erzurum, the Eastern Anatolia.

The morphology of hypopygia in the taxonomy of Pteromalidae (Hymenoptera: Chalcidoidea) has been studied for separating the species of *Mesopolobus* Westwood, 1833 by Graham (1969), for the species of *Pachyneuron* Walker, 1833 and *Euneura* Walker, 1844 by Doğanlar (1986) and for the species of *Dibrachys* Förster, 1856 by Doğanlar (1987). In the taxonomy of Eulophidae (Hymenoptera: Chalcidoidea) Graham (1987, 1991) used the morphology of hypopygia in the classification of species of some genera in Tetrastichinae, Doğanlar (1991a,b) for some species of Ormyridae, and Tarla et al. (2010) for species of genus *Oopristus* Steffan, 1968 in Monodontomerinae (Torymidae). Doğanlar & Doğanlar (2012) used the morphology of hypopygia in the classification of species of the *cioni* species group, and *crassiscapus* species group of *Entedon* Dalman (Hymenoptera: Eulophidae) in Turkey and some European species.

In this work the morphology of hypopygia and some other morphological characters of the species in the *hercyna* species group of *Entedon* were treated as diagnostic characters for the systematic of the species from Turkey, and the new species were described. Aids of some morphological characters a new identification key was created for the species of the *hercyna* species group of *Entedon* in Turkey.

MATERIAL AND METHOD

This study is based upon examination and identification of the specimens collected from several parts of Turkey. The examined specimens were deposited in Insect Museum of Plant Protection Department, Agriculture Faculty, Mustafa

Kemal University, Antakya, Hatay, Turkey (MKUI). Specimens were collected by sweeping and putting the whole contents of the swept materials directly in 96 % ethanol. After sorting the material, individuals were mounted on cards for further morphological studies. The species were identified by following the keys of Graham (1971), Gumovsky (1999) and Gumovsky & Boyadzhiev (2003). The hypopygia were separated from metasoma by dissecting and slide mounted in Canada balsam, the other parts of the metasoma were replaced on its own card near its mesosoma. Wings and antennae of some paratypes were slide-mounted in Canada balsam. Photographs of diagnostic characters of the genera were taken by using of Leica DM 5500 B microscopes with a digital Leica DFC 295 camera attached to it.

Terminology and abbreviations

Morphological terminology follows Graham (1969) and Doğanlar & Doğanlar (2012) in hypopygia as in Fig. 1, Gibson (1997) and Gumovsky & Boyadzhiev (2003). Abbreviations used in the key and descriptions are: OOL= shorter distance between ocello-ocular line POL= distance between posterior ocelli, F1-4 = funicular segments C1-C2 claval segments. The name of some parts of hypopygium given in Fig. 1.

RESULTS AND DISCISSION

Key to female of the species of the *hercyna* species group of *Entedon*

1- Fore tibia wholly darkened; speculum closed.....2
-- Fore tibia with two distinct longitudinal pale stripes; the other characters variable.....3

2-Antenna (Fig. 5a) with F1 of female as long as pedicel; scape 5.6 times as long as broad; clava 2.6 times as long as broad, C1 2.14 times as long as C2. Hypopygium (Figs. 5d, e) with anterior median incision broadly C-shaped, antero-lateral angle straight; anterior lobe narrow, distally angular, posterior lobe almost circular, hypopygium 5.7 times as broad as median length; median sclerotized line complete, median sclerotized area almost circular; posterior median incision as in Fig. 5e. Flagellum of male (Fig. 5f) with 3-segmented funicle and 2-segmented clava; Smaller species, 1.6-2.2 mm..... ***E. diotimus* Walker**

- Antenna (Fig. 6a) with F1 of female longer than pedicel, scape 4.22 times as long as broad; clava 1.67 times as long as broad; C1 1.2 times as long as C2. Hypopygium (Figs. 6d, e) with anterior median incision straight, antero-lateral angle circular; anterior lobe narrow, distally circular, posterior lobe almost straight apically, hypopygium almost 4 times as broad as median length; median sclerotized line reaching only posterior 2/5 of hypopygium, median sclerotized area almost V-shaped; posterior median incision as in Fig. 6e.....***E. nevsehiricus* n. sp.**

3- At most proximal 1/2 of hind and mid tibiae darkened (Figs. 2c, d).....4
- Hind and mid tibiae broadly darkened, sometimes just their extreme tips pale (Figs. 3b, c).....6

4-Hind (posterior) ocellus equidistant from both, inner eye margin and occipital margin; hypopygium (Figs. 2e, f) with anterior median incision broadly W-shaped, antero-lateral angle broadly circular; anterior lobe broad, distally circular, posterior lobe almost circular, apically narrowing; hypopygium almost 5.6 times as broad as median length; median sclerotized line complete, median sclerotized area almost triangular; posterior median incision as in Fig. 2f. Female antenna with scape 5.5x, pedicel twice, F1 3x, F2 1.5x, F3 1.36x, clava 2.14x as long as broad, C1 twice C2. Flagellum of male antenna with 5 separate segments, scape 3x, pedicel 1.4x, F1 3.36x , F2 2x, F3 1.9, F4 1.84x, clava 3.3x

as long as broad; male metasoma with broad pale subbasal spot, metasoma with petiole conical, about as long as broad .....***E. ergias W*alker**

-- Distance between hind (posterior) ocellus and occipital margin shorter than distance between the ocellus and inner eye margin.....5

5- Metasoma (Fig. 7d) as long as head plus mesosoma, 1.6 times as long as broad; Female antenna (Fig. 7a) with scape 3.9x, pedicel 2.1x, F1 1.6x, F2 1.5x, F3 1.2x, clava 2.1x as long as broad, C1 1.33x C2. Propodeum reticulate, especially near median carina..... ..... ***E. calcicola* Graham**

- Metasoma (Fig. 8d) about 1.3 times as long as head plus mesosoma, 2.67 times as long as broad. Female antenna (Fig. 8a) with scape 5.14x, pedicel 1.9x, F1 1.8x, F2 1.67x, F3 1.67x, clava 2.1x as long as broad, C1 1.22x C2. Propodeum smooth..... .....***E. akdagicus* n. sp.**

6- Female metasoma elongate, 2.7-3.0 times as long as broad, Female antenna (Fig. 3a) with scape 5.7x, pedicel 2.14x, F1 2x, F2 1.9x, F3 1.55x, clava 2.1x as long as broad, C1 1.44x C2. Hypopygium (Figs. 3d, e) with anterior median incision shallow, broadly C-shaped, antero-lateral angle almost straight; anterior lobe broad, distally narrow, posterior lobe almost circular, hypopygium almost 3.4 times as broad as median length; median sclerotized line complete, median sclerotized area distinctly longer than broad; posterior median incision as in Fig. 3e.....***E. hercyna* Walker**

-Female metasoma at most 2.5 times as long as broad; Female antenna (Fig. 4 a) with scape 5x, pedicel 1.87x, F1 2.25x, F2 1.87x, F3 1.4x, clava 1.9x as long as broad, C1 equal to C2. Hypopygium (Figs. 4d, e) with anterior median incision broadly V-shaped, antero-lateral angle straight; anterior lobe narrow, distally circular, posterior lobe circular, hypopygium almost 3 times as broad as median length; median sclerotized line reaching only posterior half of hypopygium, median sclerotized area almost V-shaped; posterior median incision as in Fig. 4 e. antennal flagellum of male (Fig. 4f) with two apical segments fused (3-segmented funicle and 2-segmented clava), antenna with scape 1.94x, pedicel 1.67x, F1 2.4x, F2 1.7x, F3 1.36x, clava 2.5x as long as broad, C1 equal to C2.; larger species. 2.3-3.1 mm.....***E. procioni* Erdös**

*Entedon ergias W*alker, 1839

(Figs. 2a-f)

Entedon ergias Walker, 1839: 99.
Entedon ergias Walker, Graham, 1963: 195.
Entedon ergias Walker, Graham, 1971: 354.
Entedon ergias Walker, Beaver, 1966: 37.
Entedon tenuitarsis Thomson, Giritz, 1959a: 211.
Entedon tenuitarsis Thomson, Giritz, 1959b: 52.
Entedon leucogramma Ratzeburg, 1844: 170.
Entedon leucogrammus Ratzeburg (misspelling of *leucogramma*), Erdős, 1944: 42.
Eulophus albipes Ratzeburg, 1844: 165.
Entedon albipes Ratzeburg, 1848: 166.
Entedon (*Entedon*) *ergias* Walker, Gumovsky, 1999: 31.

Diagnosis: At most proximal 1/2 of hind and mid tibiae darkened (Figs. 2c, d); Hind (posterior) ocellus equidistant from both, inner eye margin and occipital margin; hypopygium (Figs. 2e, f) with anterior median incision broadly W-shaped, antero-lateral angle broadly circular; anterior lobe broad, distally circular, posterior lobe almost circular, apically narrowing; hypopygium almost 5.6 times as broad as median length; median sclerotized line complete, median sclerotized area almost triangular; posterior median incision as in Fig. 2f. Female antenna (Fig. 2a) with scape 5.5x, pedicel twice, F1 3x, F2 1.5x, F3 1.36x, clava 2.14x as long as broad, C1 twice C2. Flagellum of male antenna (Fig. 2b) with 5 separate segments, scape 3x, pedicel 1.4x, F1 3.36x , F2 2x, F3 1.9, F4 1.84x, clava 3.3x as long as broad; male metasoma with broad pale subbasal spot, metasoma

with petiole conical, about as long as broad. Male: Antennae with funicle four-segmented, scape 3.2 times as long as broad, pedicel almost quadrate, 2.75 times as long as F1; the latter 1.9 times as long as broad, F2 and F3 distally petiolate, twice as long as broad, F4 ellipsoidal, 2.14 times as long as broad; clava including spicula thrice as long as broad; basal 1/5 of mid tibiae and basal 1/2 of hind tibiae dark.

Material examined: Turkey: Hatay, Belen., 1♀, 24. iv. 2008, swept from pasture (M. Doğanlar); Erzurum, 1♀, 05.vii. 1984, reared from branch of *Pyrus communis* (M. Doğanlar); Aktaş, 1♀,25.vii. 1982, swept from pasture (M. Doğanlar); Antalya, 2♀♀, 1♂,00.vi. 1984, reared from branch of *Olea europea* (A. Yayla); Germany, Bad Soden, Salmünster, 4♀♀, 27.vii.1983 (R. Schopf). 5♀♀, 5 ♂♂, 14. Vi-26.viii. 1983, reared from branch of *Quercus* sp. (M. Doğanlar); Reinhausen, 2♀♀, 1♂, 12.vi.1983, reared from branch of *Quercus* sp. (M. Doğanlar).

Host: *Mordellistena* spp. (Col. Mordellidae) in stems of *Artemisia* spp. (Asteraceae) (Boucek &Askew 1968; Gumovsky 1998; Gumovsky & Boyadzhiev 2003).

Distribution: Western and Central Europe, Far East Russia, Japan, Korea (Boucek & Askew, 1968; Gumovsky, 1998; Gumovsky & Boyadzhiev, 2003); Turkey (New record).

Hosts. Xylophagous beetles, mainly from Scolytinae (Curculionidae) (Bouček & Askew, 1968; Beaver, 1966).

Entedon hercyna Walker 1839

(Figs. 3a-e)

Entedon hercyna Walker, 1839: 104.
Entedon elongates Thomson, 1878: 246.
Entedon hercyna Walker, Graham, 1971: 345.
Entedon aselli Erdős, 1954: 347 (*nom. nov.* for *elongates* Thomson *nec* Ratzeburg).

Diagnosis: Hind and mid tibiae broadly darkened, sometimes just their extreme tips pale (Figs. 3b, c); Female metasoma elongate, 2.7-3.0 times as long as broad, Female antenna (Fig. 3a) with scape 5.7x, pedicel 2.14x, F1 2x, F2 1.9x, F3 1.55x, clava 2.1x as long as broad, C1 1.44x C2. first funicular segment of female at most 2.5 times as long as broad, hypopygium (Figs. 3d, e) with anterior median incision shallow, broadly C-shaped, antero-lateral angle almost straight; anterior lobe broad, distally narrow, posterior lobe almost circular, hypopygium almost 3.4 times as broad as median length; median sclerotized line complete, median sclerotized area distinctly longer than broad; posterior median incision as in Fig. 3e.

Material examined: Turkey: Erzurum, 1♀, 25.vi. 1988, swept from pasture (M. Doğanlar); 2♀♀, 26.vi. 1979, swept from pasture (M. Doğanlar); 1♀, 08. ix. 1989, swept from pasture (H. Özbek).

Host: Unknown.

Distribution. Europe (Graham, 1971; Bouček & Askew, 1968; Trjapitzin, 1978); Turkey, Erzurum, (Doğanlar, 1985).

Entedon procioni Erdös, 1944

(Figs. 4a-f)

Entedon procioni Erdős, 1944: 33.
Entedon molybdaenus Erdős, 1944: 59.
Entedon urticarii Erdős, 1951: 216.
Entedon meliloti Askew, 1992: 123.

Entedon (*Entedon*) *procioni* Erdős, Gumovsky, 1999: 32.

Diagnosis: Hind and mid tibiae broadly darkened, sometimes just their extreme tips pale (Figs. 4b, c); Female metasoma at most 2.5 times as long as broad; Female antenna (Fig. 4a) with scape 5x, pedicel 1.87x, F1 2.25x, F2 1.87x, F3 1.4x, clava 1.9x as long as broad, C1 equal to C2. female metasoma 1.5-2.5 times as long as broad; hypopygium (Figs. 4d, e) with anterior median incision broadly V-shaped, antero-lateral angle straight; anterior lobe narrow, distally circular, posterior lobe circular, hypopygium almost 3 times as broad as median length; median sclerotized line reaching only posterior half of hypopygium, median sclerotized area almost V-shaped; posterior median incision as in Fig. 4e. antennal flagellum of male (Fig. 4f) with two apical segments fused (3-segmented funicle and 2-segmented clava), antenna with scape 1.94x, pedicel 1.67x, F1 2.4x, F2 1.7x, F3 1.36x, clava 2.5x as long as broad, C1 equal to C2.
Material examined: Turkey: Erzurum, 21♀♀, 1♂, 26. vi. 1979, swept from pasture (M. Doğanlar); Horasan, 1♂, 20. v. 1989, swept from pasture (M. Doğanlar); Erzincan, 1♂, 09.v. 1982, swept from pasture (M. Doğanlar).
Hosts. *Apion*-species (Apionidae) inhabiting stems of *Urtica*, *Melilotus* and some other plants (Gumovsky, 1999a).
Distribution. Hungary (Erdős, 1944), France, Great Britain (Askew, 1992), Ukraine (Gumovsky, 1998). Turkey, Erzurum, (as *Entedon molybdaenus* Erdös (Doğanlar, 1985).

Entedon diotimus Walker, 1839

(Figs. 5 a-f)

Entedon diotimus Walker, 1839: 101.
Entedon loti Erdős, 1944: 41-42.
Entedon transversalis Erdős, 1944: 55.
Entedon (*Entedon*) *diotimus* Walker, Gumovsky, 1999: 29.

Diagnosis: Tibiae wholly darkened (Fig. 5b, c); speculum closed; Antennae (Fig. 5a) with F1 as long as pedicel; scape 5.6 times as long as broad; clava 2.6 times as long as broad, C1 2.14 times as long as C2. hypopygium (Figs. 5 d, e) with anterior median incision broadly C-shaped, antero-lateral angle straight; anterior lobe narrow, distally angular, posterior lobe almost circular, hypopygium 5.7 times as broad as median length; median sclerotized line complete, median sclerotized area almost circular; posterior median incision as in Fig. 5e. Flagellum of male (Fig. 5f) with 3-segmented funicle and 2-segmented clava.
Material examined: Turkey: Erzurum, 3♀♀, 26. vi. 1979, swept from *Onobrycis sativa* field (M. Doğanlar); Tortum, 1♀, 2♂♂, 26.v. 1982, swept from pasture (M. Doğanlar); Erzincan, Ekşisu, 1♀, 22.v. 1982, swept from pasture (M. Doğanlar); Niğde, Gümüş, 1♀, 16. vi. 2006, (M. Doğanlar); Çankırı, Ilgaz Mt., Kadın Çayırı, 2♂♂, 13.vi. 2003, swept from pasture (O. Doğanlar); Ardahan, 2♀♀, 02.viii.1987, swept from *Onobrycis sativa* field (M. Doğanlar).
Hosts. Reared from pods of *Trifolium* sp. and *Lotus corniculatus* L. (Graham, 1971). The *Trifolium* spp. and *L. corniculatus* are very common ruderal plants, so that the insects associated with these plants (e. g. *E. diotimus*) are very common in material collected in many areas. This species is likely a parasitoid of various *Apion* species, in particular with *Apion loti* (Kirby) in pods of *Lotus corniculatus* (Graham, 1971; Gumovsky, 1999).
Distribution. Widespread in the Palaearctic (Bouček & Askew, 1968; Gumovsky, 1999).

***Entedon nevsehiricus* n. sp.**
(Figs. 6a-e)

Diagnosis: Tibiae wholly darkened (Figs. 6b, c); speculum closed; antenna (Fig. 6a) with F1 longer than pedicel, scape 4.22 times as long as broad; clava 1.67 times as long as broad; C1 1.2 times as long as C2. Hypopygium (Figs. 6d, e) with anterior median incision straight, antero-lateral angle circular; anterior lobe narrow, distally circular, posterior lobe almost straight apically, hypopygium almost 4 times as broad as median length; median sclerotized line reaching only posterior 2/5 of hypopygium, median sclerotized area almost V-shaped; posterior median incision as in Fig. 6e.

Description: Female. Body length 1.8 mm. Color of body metallic dark greenish-blue. Entire antennae dark. Legs (Figs. 6b, c) dark, except knees, and first tarsomer of fore legs and first two tarsomeres of mid and hind legs, which are pale.

Head in dorsal view 2.32 times as broad as long; POL 2.6 OOL. Occipital margin moderately sharp. Eye with short sparse setae, eye height 3.4 times as long as malar space. Head in front view 1.33 times as broad as long. Interocular distance 2.66 times as long as eye breadth. Malar sulcus indicated by a line. Breadth of mouth opening twice as long as malar space. Clypeus reticulate, its anterior margin truncate. Antennae inserted slightly above the level of ventral eye margin. antenna (Fig. 6a) with F1 longer than pedicel, scape 4.22 times as long as broad; clava 1.67 times as long as broad; C1 1.2 times as long as C2.

Mesosoma 1.25 times as long as broad. Pronotal collar hardly traceable, postero-lateral corners of pronotum evenly rounded. Mesoscutum 2.3 times as broad as long, notauli traceable anteriorly as very fine sutures, posteriorly as shallow depressions; scutellum as long as broad and 1.2 times as long as mesoscutum. Propodeal surface finely reticulate, median carina complete, lateral sulcus incomplete; supracoxal flange moderate; spiracular elevation with blunt projection below, propodeal callus with 3 long setae. Hind coxa reticulate dorsally. Fore femur about 5.4 times as long as broad, fore tibia 8.25 times as long as broad, and almost as long as its femur; mid femur 4.4 times as long as broad; mid tibia 7.0 times as long as broad, spur of mid tibia 1.5 times as long as breadth of tibia, 0.8 as long as dorsal margin of mid basitarsus; hind femur about 3.1 times as long as broad, hind tibia about 7.5 times as long as broad, spur of hind tibia about as long as breadth of its tibia, 0.75 times as long as dorsal margin of hind basitarsus. Hind tarsus 0.74 times as long as its tibia, mid tarsus 0.8 times as long as its tibia.

Fore wing 1.95 times as long as broad; costal cell bare, comparatively wide, 6.6 times as long as broad, 0.82 times as long as marginal vein; subcosta of submarginal vein with 2 dorsal setae, postmarginal vein slightly shorter than stigmal; speculum closed below; apical margin with very short fringe, setae of which half as long as width of marginal vein at its narrowest part. Hind wing 2.8 times as long as broad.

Petiole reduced, strongly transverse. Metasoma as long as almost mesosoma, about 1.4 times as long as broad; penultimate tergite 0.33 times as long as basal broad, about one-sixth of length of the metasoma, last tergite about as long as broad. Hypopygium (Figs. 6d, e) with anterior median incision straight, antero-lateral angle circular; anterior lobe narrow, distally circular, posterior lobe almost straight apically, hypopygium almost 4 times as broad as median length; median sclerotized line reaching only posterior 2/5 of hypopygium, median sclerotized area almost V-shaped; posterior median incision as in Fig. 6e.

Male: unknown.
Type material. Holotype, ♀, Turkey: Nevşehir, 19. v. 2005, swept from pasture (M.& O. Doğanlar). (MKUI).
Host: unknown.
Discussion: *Entedon nevsehiricus* n. sp. is similar to *E. diotimus* in having fore tibiae wholly black, but it differs in having F1 of female longer than pedicel, scape 4.22 times as long as broad; clava 1.67 times as long as broad; C1 1.2 times as long as C2 (in *E. diothimus* F1 of female as long as pedicel; scape 5.6 times as long as broad; clava 2.6 times as long as broad, C1 2.14 times as long as C2); hypopygium (Figs. 2b, c) with anterior median incision straight, antero-lateral angle circular; anterior lobe narrow, distally circular, posterior lobe almost straight apically, hypopygium almost 4 times as broad as median length; median sclerotized line reaching only posterior 2/5 of hypopygium, median sclerotized area almost V-shaped; posterior median incision as in Fig. 6e (in *E. diotimus* hypopygium (Figs. 2b, c) with anterior median incision broadly C-shaped, antero-lateral angle straight; anterior lobe narrow, distally angular, posterior lobe almost circular, hypopygium 5.7 times as broad as median length; median sclerotized line complete, median sclerotized area almost circular; posterior median incision as in Fig. 2c).

Entedon calcicola Graham, 1971

(Figs. 7a-d)

Entedon calcicola Graham, 1971: 347.
Entedon calcicola Graham; Askew, 1992: 126; Doğanlar, 1985: 97.

Diagnosis: Metasoma (Fig. 7d) as long as head plus mesosoma, 1.6 times as long as broad; antenna (Fig. 7a) with scape 3.9x, pedicel 2.1x, F1 1.6x, F2 1.5x, F3 1.2x, clava 2.1x as long as broad, C1 1.33x C2. Propodeum reticulate, especially near median carina; Distance between hind (posterior) ocellus and occipital margin shorter than distance between the ocellus and inner eye margin; Fore tibia with two distinct longitudinal pale stripes; at most proximal 1/2 of hind and mid tibiae darkened (Figs. 7b, c).
Material examined: Turkey: Adıyaman, from Pazarcık to Gölbaşı highway, connection to Araban Road, 1♀, 02. v. 2008, swept from pasture (M. Doğanlar).
Hosts. Unknown.
Distribution. England, Yugoslavia (Former) (Graham, 1971); Turkey (misidentification of *E. biroi* Erdös) (Doğanlar, 1985).

Entedon akdagicus n. sp.

(Figs. 8a-d)

Diagnosis: Fore tibia with two distinct longitudinal pale stripes; at most proximal 1/2 of mid tibiae darkened (Fig. 8c); distance between hind (posterior) ocellus and occipital margin shorter than distance between the ocellus and inner eye margin; Metasoma (Fig. 8d) about 1.3 times as long as head plus mesosoma, 2.67 times as long as broad. Female antenna (Fig. 8a) with scape 5.14x, pedicel 1.9x, F1 1.8x, F2 1.67x, F3 1.67x, clava 2.1x as long as broad, C1 1.22x C2. Propodeum smooth.
Description: Female. Body (Fig. 8b) length1.9 mm. Color of body metallic dark blue, Entire antennae dark. Legs (Fig. 8c) dark, except knees, apical 1/3 of tibiae of mid and hind legs, and first three tarsomeres of tarsi which are pale; pretarsi

pale brown. Dorsal and ventral pale longitudinal stripes on fore tibia discernible along entire tibia.

Head in dorsal view 2.25 times as broad as long; POL 2.5 OOL; occipital margin moderately sharp; distance between hind (posterior) ocellus and occipital margin shorter than distance between the ocellus and inner eye margin;. Eye with short sparse setae, eye height 2.6 times as long as malar space. Head in front view 1.35 times as broad as long. Interocular distance 3.1 times as long as eye breadth. Malar sulcus indicated by a line. Breadth of mouth opening 1.7 times as long as malar space. Clypeus reticulate, its anterior margin truncate. Antennae inserted slightly above the level of ventral eye margin. Antenna (Fig. 8 a) with scape 5.14x, pedicel 1.9x, F1 1.8x, F2 1.67x, F3 1.67x, clava 2.1x as long as broad, C1 1.22x C2.

Mesosoma 1.6 times as long as broad. Pronotal collar hardly traceable, postero-lateral corners of pronotum evenly rounded. Mesoscutum 2.1 times as broad as long, notauli traceable anteriorly as very fine sutures, posteriorly as shallow depressions; scutellum slightly longer than broad and 1.5 times longer than mesoscutum. Propodeal surface almost smooth, median carina complete, lateral sulcus incomplete; supracoxal flange moderate; spiracular elevation with distinct projection below, propodeal callus with 2 long setae. Hind coxa reticulate dorsally. Fore femur about 4.3 times as long as broad, fore tibia 6 times as long as broad, and as long as its femur; mid femur 7 times as long as broad; mid tibia about 8 times as long as broad, spur of mid tibia about 1.4 times as long as breadth of its tibia, 0.7 times as long as dorsal margin of hind basitarsus; mind tarsus 0.83 times as long as its tibia. Fore wing 2.1 times as long as broad; costal cell bare, wide, 8 times as long as broad, 0.8 times marginal vein; subcosta of submarginal vein with 2 dorsal setae, postmarginal vein slightly sorter than stigmal; speculum open below; apical margin with very short fringe, setae of which half as long as width of marginal vein at its narrowest part. Hind wing 4.8 times as long as broad.

Petiole reduced, strongly transverse. Metasoma (Fig. 8d) 1.3 times as long as head plus mesosoma, about 2.67 times as long as broad; penultimate tergite 0.66 times as long as basal broad, about one-fifth of length of the metasoma, last tergite about 1.5 times as long as broad.

Male: unknown.

Type material. Holotype, ♀, Turkey: Erzurum, Akdağ, 25. vi. 1980, swept from pasture (M.& O. Doğanlar). (MKUI).

Host: unknown.

Discussion: *Entedon akdagicus* n. sp. is similar to *E. calcicola* and *E. ergias* in having fore tibia with two distinct longitudinal pale stripes and at most proximal 1/2 of mid tibiae darkened, but it differs from *E. ergias* in having distance between hind (posterior) ocellus and occipital margin shorter than distance between the ocellus and inner eye margin (in *E. ergias* distance between hind (posterior) ocellus and occipital margin as long as distance between the ocellus and inner eye margin); It differs from *E. calcicola* in having metasoma (Fig. 8d) about 1.3 times as long as head plus mesosoma, 2.67 times as long as broad (in *E. calcicola* metasoma as long as head plus mesosoma, 1.6 times as long as broad); female antenna (Fig. 8a) with scape 5.14x, F1 1.8x, F2 1.67x, F3 1.67x (in *E. calcicola* female antenna with scape 3.9x, F1 1.6x, F2 1.5x, F3 1.2x).

LITERATURE CITED

Askew, R. R. 1992. Additions to the British list of *Entedon* Dalman (Hymenoptera: Eulophidae) with description of three new species. Entomologist's Monthly Magazine, 128: 119-128.

Beaver, R. A. 1966. The biology and immature stages of *Entedon leucogramma* (Ratzeburg) (Hymenoptera: Eulophidae), a parasite of bark beetle. . Trans. R. Entomol. Soc. London, 41: 37-41.

Boucek, Z. & Askew, R. R. 1968. Palearctic Eulophidae (excl. Tetrastichinae).Index of entomophagous insects, Paris, vol. 3. 260 pp.

Doğanlar, M. 1985. Notes on Chalcidoidea of Turkey, III.Encyrtidae, Tetrastichinae, Aphelinidae, Eulophidae and Elasmidae. Türkiye bitki koruma Dergisi, 9: 91-103.

Doğanlar, M. 1986. Morphological studies on the hypopygium and its importance to the taxonomy of the genera *Pachymeuron* and *Euneura* (Hymenoptera, Pteromalidae), with description of a new species of *Pachyneuron* from Turkey. C.Ü. Fen-Edebiyat Fakültesi, Fen Bilimleri Dergisi, 4: 23-32.

Doğanlar, M. 1987. Hypopygia of most Nearctic and Palaearctic species of *Dibrachys* Förster, key to most species of the genus and descriptions of three new species (Hymenoptera, Pteromalidae). Spixiana, München 10: 191-206.

Doğanlar, M. 1991a. Systematic positions of a new species in *Ormyrus* from Turkey and a new genus in the family Ormyridae (Hym., Chalcidoidea). Türkiye Entomoloji Dergisi, 15: 1-13.

Doğanlar, M. 1991b. Systematic studies on the species of *Cyrtosoma* Perris. from Turkey, and descriptions of some new species (Hymenoptera: Ormyridae). Türkiye Entomoloji Dergisi, 15: 71-87.

Doğanlar, M. & Doğanlar, O. 2012. Hypopygia of species in the *cioni* species group, and *crassiscapus* species group of *Entedon* Dalman (Hymenoptera: Eulophidae) in Turkey and some European species. J. Nov. Appl. Sci., 1 (3): 74-81.

Erdös, J. 1944. Species hungaricae generis *Entedon* Dalm. Kalocsa. 64 pp.

Erdös, J. 1951. Eulophidae novae. Acta Biologica Academiae Scientiarum Hungaricae, 2 (1-3): 169-237.

Erdős, J. 1954. Eulophidae hungaricae undescriptae. Ann. Hist. Natur. Mus. Natn. Hung. (natural sciences), 5: 323-366.

Gibson, G. A. P. 1997. Morphology and terminology. pp. 16–44. in Gibson, G. A. P., Huber, J. T. & Woolley, J. B. (Eds). Annotated keys to the genera of Nearctic Chalcidoidea (Hymenoptera). Ottawa, Ontario, National Research Council Research Press.

Giritz, A. A. 1959a. Some parasites of *Scolytus rugulosus* Ratz. in orchards of Transcarpathia. Nauch. Zap. Uzhgorod. Gos. Univ., 40: 211-219 (in Russian).

Giritz, A. A. 1959b. Data for a studyof the parasites of *Scolytus rugulosus* Ratz. in Transcarpathia. Dokl. Soob. Uzhgorod. Gos. Univ. (s. biol.), 3: 51-52 (in Russian).

Graham, M. W. R. de V. 1963. Additions and corrections to the British list of Eulophidae (Hym., Chalcidoidea).Transactions of the Society for British Entomology, 15 (9): 167-275.

Graham, M. W. R. de V. 1969. The Pteromalidae of north-western Europe (Hymenoptera: Chalcidoidea). Bulletin of the British Museum (Natural History) (Entomology) Supplement, 16 pp. 908 pp.

Graham, M. W. R. de V. 1971. Revision of British *Entedon* (Hymenoptera: Chalcidoidea) with descriptions of four new species. Transactions of the Royal Entomological Society of London, 123: 313-358.

Graham, M. W. R. de V. 1987. A reclassification of the European Tetrastichinae (Hymenoptera: Eulophidae), with a revision of certain genera. Bulletin of the British Museum (Natural History) (Entomology), 55: 1-392.

Graham, M. W. R. de V. 1991. A reclassification of the European Tetrastichinae (Hymenoptera: Eulophidae); Revision of the remaining genera. Memoirs of the American Entomological Institute, 49: 1-322.

Gumovsky, A. V. 1997. Review of the genus *Entedon* Dalman, 1820 (Hymenoptera, Eulophidae, Entedoninae). 1. Infrageneric division of the genus *Entedon* with description of a new subgenus from Africa. Vestnik Zoologii, 31 (5-6): 24-36.

Gumovsky, A. V. 1998. Review of the genus *Entedon* Dalman, 1820 (Hymenoptera, Eulophidae, Entedoninae). 3. Review of *kerteszi* species group. Vestn. zool., 32 (5-6): 33-38.

Gumovsky, A. V. 1999. Review of the genus *Entedon* Dalman, 1820 (Hymenoptera, Eulophidae, Entedoninae). 4. Revision of Ukrainian species of *hercyna* group. Vestn. zool., 33 (6): 27-37.

Gumovsky, A. V. & Boyadzhiev, P. 2003. Review of the Bulgarian *Entedon* Dalman, 1820 (Hymenoptera: Eulophidae, Entedoninae). Acta Entomologica Bulgarica, 55 (3): 3-32.

Ratzeburg, J. T. C. 1844. Die Forst-Insecten, order Abbildung und Beschreibung der in den Wäldern Preussens und der Nachbarstaaten als schädlich oder nützlich bekannt gewordenen Insecten. III. Die Ader-, Zwei-, Halb-, Netz- und Geradflügler. Berlin, 314 pp.

Ratzeburg, J. T. C. 1848. Die Ichneumonen der Forstinsecten in forstlicher und entomologisher Beziehung; ein Anhang zur Abbildung und Beschreibung der Forstinsecten. Berlin, 2, 238 pp.

Schauff, M. E. 1988,The species of *Entedon* in America north of Mexico (Hymenoptera: Eulophidae). Journal of the New York Entomological Society, 96 (1): 53.

Tarla, Ş., Doğanlar, M. & Gözüaçık, C. 2010. The species of *Oopristus* Steffan, 1968 (Hymenoptera: Torymidae: Toryminae: Monodontomerini) of Turkey, with descriptions of two new species. Turkish Journal of Zoology, 34: 487-495.

Thomson, C. G. 1878. Hymenoptera Scandinaviae 5. *Pteromalus* (Svederus) continuation. 245 pp. Lund.

Trjapitzin, V. 1978. Eulophidae. . In: Medvedev, G. (ed.). Identification of insects of the European part of U.S.S.R. Hymenoptera 3 (2). Nauka, Leningrad, 381-430 (In Russian).

Walker, F. 1839. Monographia Chalciditum, 1: 105, London.

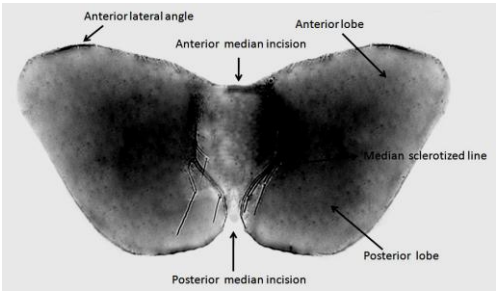

Figure 1. Hypopygium of *Entedon hercyna* Walker.

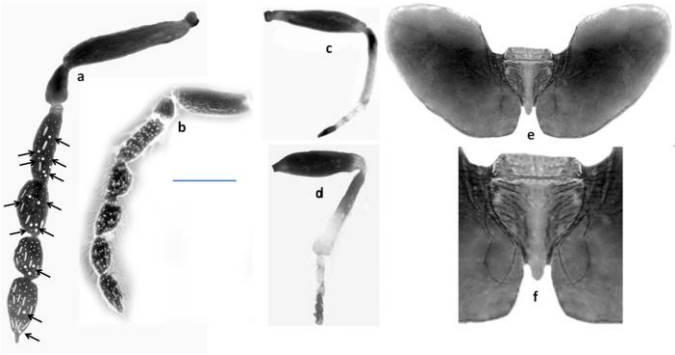

Figure 2. *Entedon ergias* Walker. a-b. antenna; a. female; b. male; c. mid leg; d. hind leg; e. hypopygium; f. median part of hypopygium.

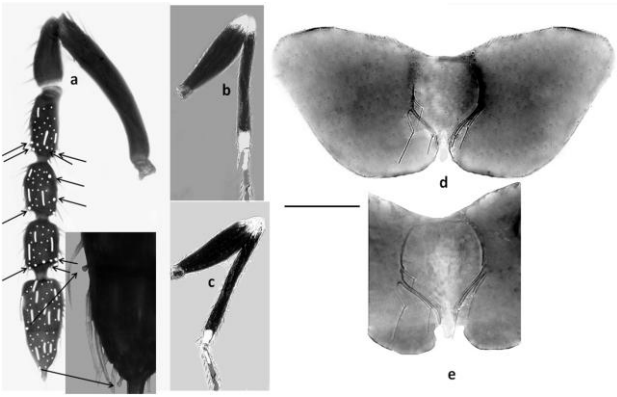

Figure 3. *Entedon hercyna* Walker. Female a. antenna; b. mid leg; c. hind leg; d. hypopygium; e. median part of hypopygium.

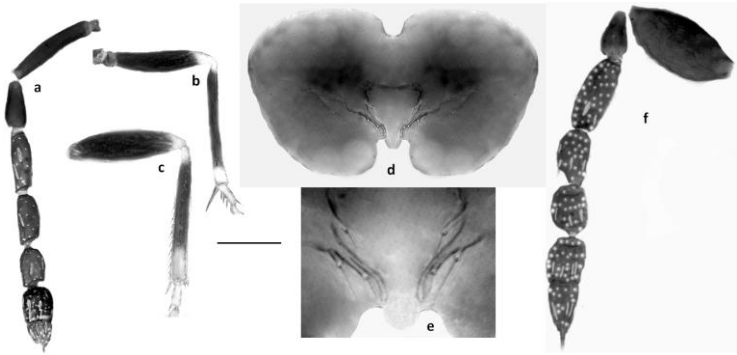

Figure 4. *Entedon procioni* Erdös. a-e. Female a. antenna; b. mid leg; c. hind leg; d. hypopygium; e. median part of hypopygium; f. male antenna.

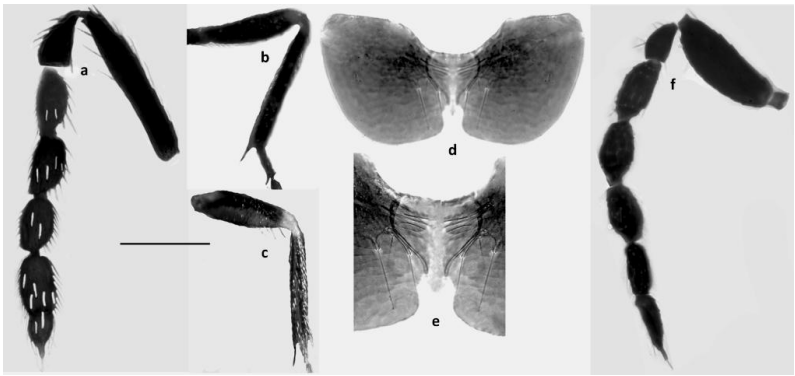

Figure 5. *Entedon diotimus* Walker. a-e. Female a. antenna; b. mid leg; c. hind leg; d. hypopygium; e. median part of hypopygium; f. male antenna.

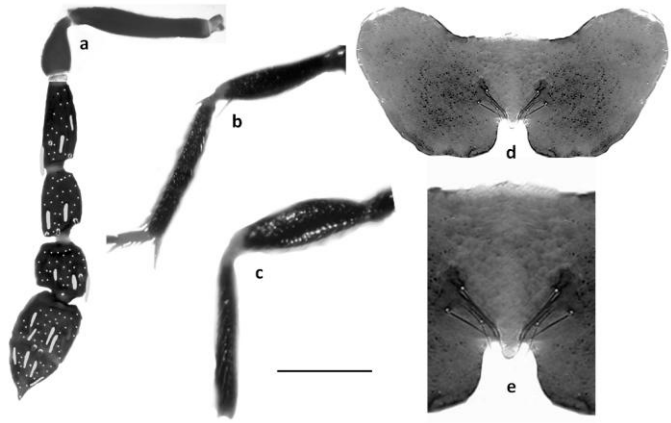

Figure 6. *Entedon nevsehiricus* n. sp.. a-e. Female a. antenna; b. mid leg; c. hind leg; d. hypopygium; e. median part of hypopygium.

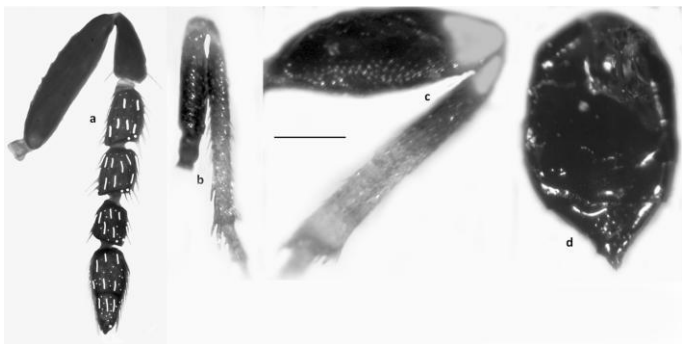

Figure 7. *Entedon calcicola* Graham. a-d. Female a. antenna; b. mid leg; c. hind leg; d metasoma.

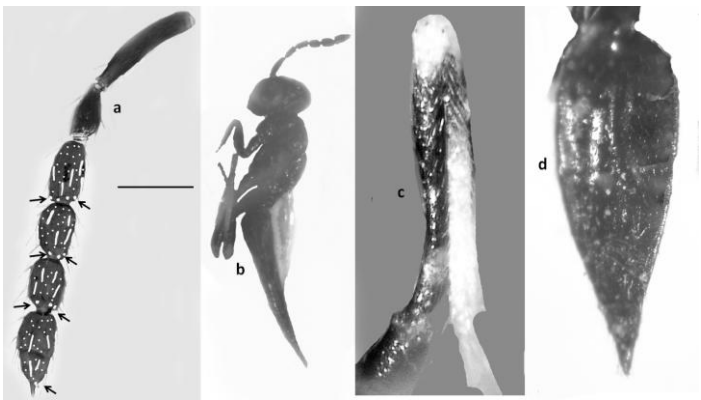

Figure 8. *Entedon akdagicus* n. sp. a-d. Female a. antenna; b. body, in lateral view; c. mid leg; d. metasoma.