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The genus *Elasmus* Westwood, 1833 (Hymenoptera: Chalcidoidea: Eulophidae) in Iran with five new records

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Six species of the genus *Elasmus* Westwood (Hymenoptera: Chalcidoidea: Eulophidae) were reported from Southeastern Iran. Five species viz., *Elasmus indicus* Rohwer, 1921, *Elasmus johnstoni* Ferrière, 1929, *Elasmus nephantidis* Rohwer, 1921, *Elasmus phthorimaeae* Ferrière 1947, *Elasmus viridiceps* Thomson, 1878, are recorded for the first time from Iran. *Elasmus nudus* (Nees, 1834) is already recorded from this country. Available biological data, geographical distribution as well as short taxonomic comments are given for each species. A key for identification of Iranian species of the genus *Elasmus* is presented.

Key words: Hymenoptera**,** Eulophidae, *Elasmus,* distribution, new records, Iran

INTRODUCTION

The genus *Elasmus* Westwood is cosmopolitan, with over 259 described species worldwide from which 45 species recorded from the Palaearctic Region (Noyes, 2013). It has long been considered in a separate family Elasmidae (Coote, 1997: 165) or subfamily in the Eulophidae (e.g., Burks, 1979; Yoshimoto, 1984) but is now based on recent molecular evidence considered as the only member of the tribe Elasmini (Eulophidae: Eulophinae) (Gauthier et al. 2000). Larvae of most species of the genus *Elasmus* are solitary or gregarious, primary ectoparasitoids of the larvae or prepupae of leaf-mining, leaf-rolling, web-spinning, and case making Lepidoptera (Coote, 1997). They are ectoparasitoids of a variety of lepidopteran: the families Coleophoridae, Tortricidae, Gracillariidae, Cosmopterigidae and Gelechiidae and one Nearctic species is a primary ectoparasitoid of the pupae of the *Polistes* paper wasps (Hymenoptera, Vespidae) (Burks, 1971). They also are considered as hyperparasitods of the species belonging to the genus *Apanteles* (Hymenoptera: Braconidae) (Graham, 1976, 1995). The genus *Elasmus* is a poorly known taxon in the eulophid fauna of Iran. Until now only one species of the genus is known to occur in Iran, *Elasmus nudus* (Nees) (Yefremova and Strakhova, 2010; Talebi et al. 2011). The objective of the present paper is to report on our investigation of the genus *Elasmus* in Iran, together with new records, world-wide distribution of the species recorded, biological information, taxonomic remarks, and to summarize all the available literature about *Elasmus* of Iran with a key for identification of the species recorded in this study.

MATERIAL AND METHODS

The species of *Elasmus* were collected by sweep net in 2008-2011. They were preserved in 75% Ethanol. Prior to mounting the specimens were treated with hexamethyl disilazane in order to avoid collapsing. The specimens were identified using Graham (1995); Ferrière (1930); Yefremova and Strakhova (2010). Morphological terminology generally follows Graham (1995). The following

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abbreviations were used in the paper: POL, the minimum distance between lateral ocelli; OOL, the minimum distance between the margin of eye and the nearest lateral ocellus; OD, the maximum diameter of one of the simple ocelli; SMV, submarginal vein; MV, marginal vein; SV, stigmal vein; PMV, postmarginal vein; F1–F4, segments of antennal flagellum; T1–T7, metasomal tergites. The identified material is deposited in Zoological Museum of Shahid Bahonar University, Kerman, Iran (ZMSBUK). The identified species are ordered alphabetically and new records are marked by asterisk. General data regarding geographical distribution, biology as well as brief taxonomic comments is given for each species.

RESULTS

Genus *Elasmus* Westwood, 1833

Elasmus Westwood, 1833: 343.

Type species *Eulophus flabellatus* Fonscolombe, 1832: 298, by monotypy.

Diagnosis

Fore wing densely setose and wedge-shaped, with elongate marginal vein, short postmarginal, and slightly reduced stigmal vein. Female funicle 3-segmented with two anelli and 3-segmented clava; male funicle 4-segmented, F1-F3 with branches, clava 2-segmented with pronounced apical sensilum. Mesosoma densely setose, metasoma subsessile and gaster triangular in cross. Metanotum projecting as flat, triangular, often translucent plate over propodeum. Dorsal metanotal lamella projecting posterior over propodeum with partial and complete lateroventral keels. Scutellum with 2 pairs of long setae. Metacoxa greatly enlarged and flattened plate-like hind tibia with short bristles forming distinct diamond-shaped or undulating pattern.

Key to Iranian Species of the Genus *Elasmus* (female)

1. Antenna with funicular segments 1.1–1.2 times as long as broad. F3 slightly transverse. Clava as long as funicle. Body black, antenna brownish……....*E. nudus*
- Antenna with funicular segments 2.0–2.8 times as long as broad…….……...….2
2. Body mostly yellow, with dark brown spots on head, thorax and gaster. POL 1.6–2.0 times OOL, PMV 4.0 times as long as SV (Fig. 1.4)……....…….....*E. phthorimaeae*
- Body mostly black with metallic tint……..……..3
3. Antenna with F2 as long as F3……...…….....4
- Antenna with F2 1.1–1.4 times F3. POL 2.1–3.0 times OOL. Body black with metallic bluish tint (Fig. 1.5)..…….……..……...…….....*E. viridiceps*
4. Mesoscutum with two yellow lateral spots near tegula, F1 as long as F2. F1 almost equal to pedicellus, clava 1.6–2.0 times as long as F3, POL 1.8 times OOL. (Fig. 1.3)……..*E. nephantidis*
- Mesoscutum wholly black, F1 1.1–1.4 times as long as F2……..……....….5
5. Scape equal to the first two funicular segments combined. Metasoma dark brownish (Fig.1.2)……...……..……..…….*E. johnstoni*
- Scape shorter about 1.5 times than the first two funicular segments combined. Metasoma has a reddish band on T1–T2 (Fig.1.1)…..…… *E. indicus*

Elasmus indicus Rohwer, 1921*

Elasmus indicus Rohwer, 1921: 124.

Material examined: Iran, Kerman province, Sirch. N: 30º11' E: 57º24'. 26.vii.2009, (F. Abolhasanzadeh), 1♀; Iran, Kerman province, Kouhpayeh, N: 30º30' E: 57º16', 12.viii.2011, (S. Kazemi), 2♂.

Diagnosis: Body dark with greenish metallic tint, gaster with reddish band on T1–T2, whole reddish ventrally. POL 2.5 times OOL. F1 about 1.2–1.5 times as long as F2. F2 as long as F3

(Fig.1.1). Forewing with isolated subcubital line of setae. Male: Body the same color as female. Scape 3.0 times as long as pedicelus, third branch 1.3 times as long as F4, clava as long as F4. *Elasmus indicus* is close to *E. nephantidis* but the former has the pale band on the T1 and T2 on mesosoma and the ratio of antennal segments are different. In *E. indicus* antennal clava is not more than twice as long as broad and 1.9 times as long as F3 but in *E. nephantidis* it is 2.5 times as long as broad, and 2.0 times as long as F3 (see couplet 3, 4). In the latter all three flagellum segments are equal in length while in *E. indicus* only F2 is as long as F3 (Rohwer, 1921, Yefremova and Strakhova, 2010).
Biology: It is recorded as a primary parasitoid of larvae and pupae of the families Noctuidae and Pyralidae (Lepidoptera) (Verma and Hayat, 1986), Asterolecaniidae (Homoptera) (Verma and Hayat, 1986).
Distribution: Russia, India, Vietnam (Verma and Hayat, 1986, Yefremova and Strakhova, 2010).

Elasmus johnstoni* Ferrière, 1929
Elasmus johnstoni Ferrière, 1929: 258
Elasmus valparaianus Mani & Saraswat, 1972: 481
Material examined: Iran, Kerman province, Kouhpayeh, N: 30º30' E: 57º16', 12.viii.2011, (S. Kazemi), 1♀
Diagnosis: Body black with greenish tint; antennae brown. Scape equal to the F1 and F2 combined; pedicel a little shorter than F2; F1 2.0 times as long as broad, 1.3 times as long as F2, F2 almost equal to F3 (Fig.1.2). Forewing with isolated subcubital line of setae.
This species can be distinguished from other Iranian species by combination of characters such as dark colour of body and legs; hind tibia with brown ring below middle and the shape of abdomen and antennae.
Biology: It is a larval parasitoid of *Opisini arnosella* Walker (Lepidoptera: Oecophoridae) (Verma et al. 2002) and also as a parasitoid of the families Gelechiidae, Hyblaeidae, Noctuidae, Pyralidae (Lepidoptera) as well as a hyperparasitoid of Braconidae (Hymenoptera) (Verma and Hayat, 1986).
Distribution: Senegal, Sudan, Zimbabwe, Uganda, Pakistan, India, Myanmar (Burma), (Ferrière, 1929; Thompson 1954; Verma et al. 2002; Noyes, 2013).

Elasmus nephantidis* Rohwer, 1921
Elasmus nephantidis Rohwer, 1921 : 125.
Material examined: Iran, Kerman province**,** Lalehzar, N: 29º29' E: 56º49', 6.vii.2009, (F. Abolhasanzadeh), 1♀.
Diagnosis: Body dark brown with green metallic tint, with yellow spot near tegula; legs yellow with a light brown spots. POL 1.8 times OOL. Pedicel 2.0 times as long as broad, shorter than F1; funicular segments subequal in length; clava 2.0 times as long as F3 (Fig. 1.3). Forewing with isolated subcubital line of setae. PMV about 3.5 times as long as SV.
Biology: It is a parasitic species on *Opisina arnosella* Walker (= *Nephantis serinopa* Meyrick) (Lepidoptera: Oecophoridae) (Verma and Hayat, 1986), *Nephantis serinopa* Meyrick (Lepidoptera: Cryptophasidae) (Thompson, 1954).
Distribution: Russia, India, China, Malaysia, Vietnam and South Korea (Verma et al. 2002; Yefremova and Strakhova, 2010).

***Elasmus nudus* (Nees, 1834)**
Aneure nuda Nees, 1834 : 195.
Elasmus albipennis Thomson, 1878 : 206.
Elasmus nudus: Graham, 1995 : 9.
Diagnosis: Body black with weak bluish metallic tint on head, scutellum and propodeum. POL 1.5–2.0 times OOL; OOL 1.5 times OD. Scape 3.0 times as long as broad; antennal funicle subquadrate,

all funicular segments not equal to each other, F3 slightly transverse; the length of clava is equal to all funicular segments combined. Fore wing with isolated subcubital line of setae; PMV 2.5–3.0 times as long as SV.

Biology: Larval-pupal parasitoid of *Etiella* sp. (Phycitidae), *Yponomeuta malinella* (Z.) (Yponomeutidae), *Porthesia chrysorrhoea* L. (Liparidae), *Leucopis* sp. (Leucospidae), *Cydia pomonella* (L.) (Tortricidae) (Yefremova and Strakhova, 2010).

Distribution: Palearctic (Noyes, 2013). It was reported by Hesami (2010) from Iran, central region of Fars Province and Rafsanjan in Kerman Province (Yefremova and Strakhova, 2010).

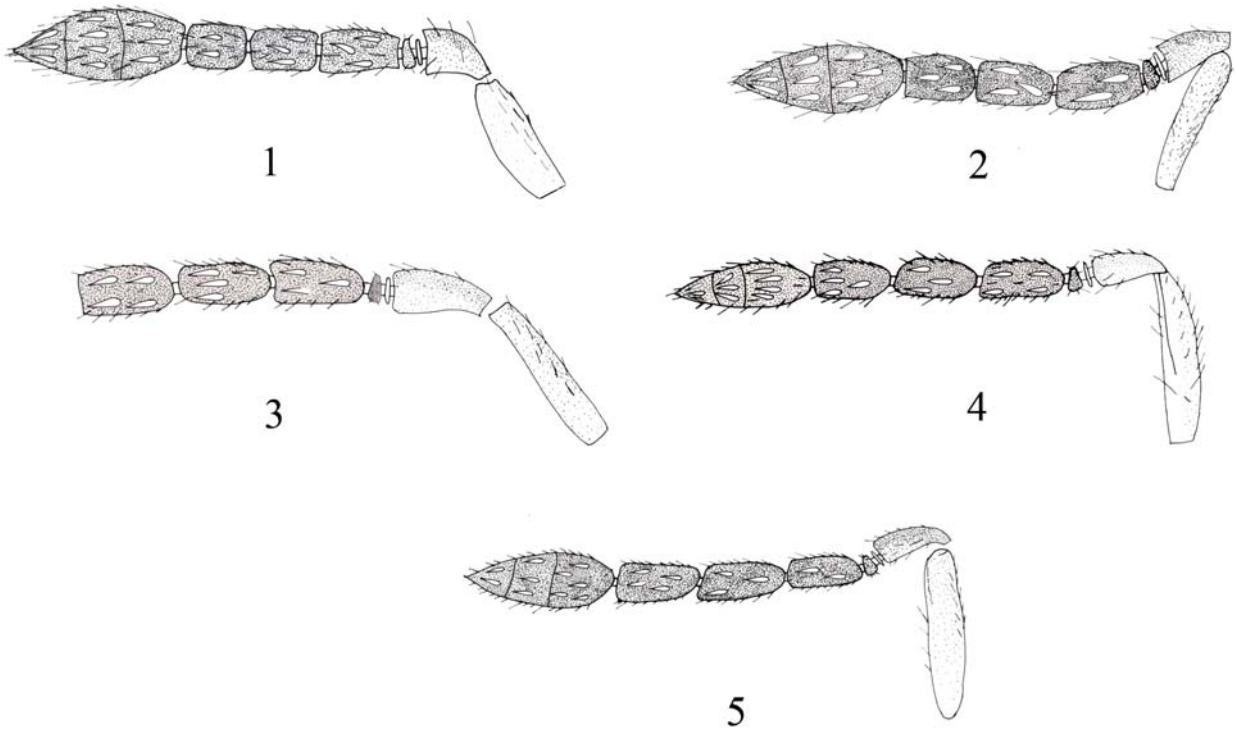

FIGURE 1.- Right antenna: 1- *E. indicus*, 2- *E. johnstoni*, 3- *E. nephantidis*, 4- *E. phthorimaeae*, 5- *E. viridiceps* (original).

Elasmus phthorimaeae* Ferrière 1947

Elasmus phthorimaeae Ferrière, 1947: 572.

Material examined: Iran, Kerman province, Shahdad, N: 30º25' E: 57º42', 11.xi.2011, (F. Abolhasanzadeh), 1♀, 2♂.

Diagnosis: Body yellow with dark brown spots on vertex, pronotum, scutellum, propodeum and gaster. The species was redescribed by Strakhova and Yefremova (2010). POL 1.6–2.0 times OOL. Male: Colour of body more extensively darker than in female. POL 1.5–2.0 times OOL. OOL 1.9 times OD. F4 1.2 times longer than clava (Fig. 1.4).

Biology: The hosts of this species are unknown but its primary host is *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae) (Ferrière, 1947).

Distribution: Europe, Turkey, Yemen, Saudi Arabia, United Arab Emirates (Strakhova and Yefremova, 2010).

Elasmus viridiceps* Thomson, 1878

Elasmus viridiceps Thomson, 1878: 205-206.

Material examined: Iran, Kerman province, Kouhpayeh, N: 30º30' E: 57º10', 12.viii.2011, (S. Kazemi), 1♀; Iran, Kerman province, N: 30º22' E: 55º30', 15.vi.2011, (F. Abolhasanzadeh), 1♀.
Diagnosis: Body black with greenish or bluish metallic tint. POL 2.0–2.9 times OOL. Scape 2.0 times as long as F1; F2 1.1–1.4 times as long as F3 (Fig. 1.4). PMV 2.8–3.0 times as long as SV; forewing with isolated subcubital line of setae; forewings in some specimens has a fuscous clouds behind SV.
Biology: Barbuceanu & Andriescu (2009) reported this species as a larval solitary primary ectoparasitoid of *Sparaganothis pilleriana* (Den. et Schiff.) (Lepidoptera: Tortricidae) in Romania. It is a primary larval or pupal ectoparasitoid of the families Coccidae (Hemiptera), Bethylidae, Coleophoridae, Gelechiidae, Gracillariidae, Noctuidae, Tortricidae (Lepidoptera) and Bethylidae, Chrysididae (Hymenoptera) and a hyperparasitoid of Pteromalidae (Hymenoptera) (Graham, 1995).
Distributions: France, Sweden, Poland, Greece, Russia, Romania, Bulgaria, Ukraine, Moldova, Azerbaijan Kazakhstan, Turkmenistan, Afghanistan, Tajikistan, China, Mongolia, South Korea (Yefremova and Strakhova, 2010).

DISCUSSION

In the present study, six species of the genus *Elasmus* are recorded for the fauna of Iran: *E. indicus*, *E. johnstoni*, *E. nephantidis*, *E. nudus*, *E. phthorimaeae*, *E. viridiceps*. All mentioned species except *E. nudus* are recorded for the first time from Iran. However there are some records of the species belonging to this genus in adjacent countries: *E. viridiceps* for Afghanistan; *E. flabellatus* (Fonscolombe, 1832) and *E. schmitti* Ruschka, 1920 for Armenia; *E. bicolor* (Fonscolombe, 1840), *E. ceylonicus* Ferrière, 1929, *E. flabellatus*, *E. nudus* and *E. platyedrae* Ferrière, 1935 for Azerbaijan; *E. bistrigatus* Graham, 1995, *E. flabellatus*, *E. nikolskayae* Myartseva et Dzhanokmen, 1989, *E. unicolor* (Rondani, 1877), *E. platyedrae*, *E. steffani* Viggiani, 1967, *E. turkmenicus* Yefremova & Strakhova, 2010 and *E. viridiceps* for Turkmenistan (Yefremova and Strakhova, 2010); *E. flaviceps* Ferrière, 1941, *E. phthorimaeae*, *E. pulchellus* Verma & Hayat, 2002, *E. nudus*, *E. platyedrae*, *E. steffani* and *E. viridiceps* for UAE (Yefremova, 2008). Kerman province is situated on South-eastern Iran and is the largest province of Iran (11.15% of whole country). This region is the place that Zagros Mountains, central mountains and lowland deserts, meet in. Kerman is located next to the Loot desert which is one of the hottest zones of Iran and the world. However, presence of mountains including Kouhbanan (3775m), Jaftan (3975m) and Pelvar (4233m) at the margin of the desert moderates its destroying effects on fauna and flora of the region. Extension of Zagros and central mountains has divided this place into two distinct sections, dry deserts and temperate valleys which meet together form three zones: desert and marginal desert, tropical zones and temperate mountain zones (Geographic studies of Kerman province, 2007); therefore, it is among the rare regions where possesses the variety of climates and different aspects of environmental forms. As a result of this geographic isolation, diversity of animal species and habitats is unique. Unfortunately, from the viewpoint of animal species, this region has been paid less attention and examination. As mentioned above larvae of most species of the genus *Elsmus* are ectoparasitoids of some species of Lepidoptera, so they play a vital role in biological control programmes. However, some habitats in north, northwestern and parts of southern province especially Jazmurian basin district and also other diverse regions of Iran have not been studied in details till now. Probably with more extensive investigations, the number of species in the future checklists will be increased and even new species and/or new records for Kerman province and Iran may be added.

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