Chalcidoid parasitoids (Hymenoptera) of *Etiella zinckenella* (Treitschke) (Lep.: Pyralidae) on *Sophora alopecuroides* L. in Iran

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Abstract. The seeds of *Sophora alopecuroides* L. (Leguminosae) are damaged by *Etiella zinckenella* (Treitschke) (Lep.: Pyralidae) in East-Azarbaijan, northwestern Iran. Laboratory rearing of seeds infested *E. zinckenella* produced six chalcidoid species. These species are from the family Eulophidae: *Aprostocetus ararabonicus* (Erdős), *Elasmus biroi* Erdős, *Elasmus platyedrae* Ferrière; Eurytomidae: *Aximopsis augasmae* (Zerova) **Comb. n.**, *Aximopsis near ghazvini* (Zerova) **Comb. n.**; and Pteromalidae: *Cyrtoptyx lichtensteini* (Masi). All of these species are new records for Iran. Associations of *A. ararabonicus*, *E. biroi*, *E. platyedrae*, *A. augasmae* and *A. near ghazvini* with *E. zinckenella* are new, and furthermore, *A. ararabonicus* may be a hyperparasitoid of *E. zinckenella*.

Key words: *Sophora alopecuroides*, *Etiella zinckenella*, chalcidoid parasitoids, new records, Iran.

Introduction

Some *Sophora* species (Leguminosae=Fabaceae) are commonly used in traditional Chinese medicine. They are known to contain quinolizidine alkaloids as their principal bioactive constituents, which have been shown to exhibit sedative, analgesic, antipyretic, anti-inflammatory, anti-tumor and notable antiviral activities (Rahman et al. 2000). The seeds of *Sophora alopecuroides* L. are widely used for the treatment of some skin and gynaecological diseases such as eczema, dermatitis and colpitis, as well as fever, sore throat and inflammation (Kütükboyaci et al. 2010, 2011).

*Sophora alopecuroides* grows in some area of south Europe and some countries of Asia and in most areas of Iran (Barimani Varandi et al. 2012). This medical plant is attacked by some insect pests that consume its seeds or green tissues. *Etiella zinckenella* (Treitschke, 1832) (Lep.: Pyralidae) is one of the important pests of *S. alopecuroides* which recently recorded from the Caspian Sea coast, northern Iran (Barimani Varandi et al. 2012). It is a cosmopolitan species and attacks different host plants such as soybean, pea, string bean, lima bean, *Caragana*, *Glycine uralensis*, *Vicia* spp., *Lathyrus* spp., etc. (Kobayashi 1972). On the other hand, *Etiella zinckenella* is the host of 27 Chalcidoidea species including one Chalcididae, seven Eulophidae, six Eupelmidae, three Eurytomidae, one Pteromalidae, four Pteromalidae, one Torymidae and four Trichogrammatidae (Noyes 2013).

Considering the importance of *E. zinckenella* as a polyphagous pest with wide geographical distribution, a study of its parasitoids in Iran is desirable. Therefore, this study of the chalcidoid parasitoids of *E. zinckenella* in Iran was undertaken.

Materials and Methods

Examination of *Sophora alopecuroides* pods in Payam (10 Km of Marand) (N 38º 48' 84'' & E 45º 77' 24'', 1748m), East-Azarbaijan province, northwestern Iran, showed some infestations (Fig. 2A). Collected pods were transferred to Entomology Lab. of Plant Protection Dept. in Islamic Azad University, Tabriz Branch. Collections were made in 2009 and 2011. During pods dissection, we found lepidopterous larvae (Figs 1A, B) and pupae (Figs 1C, D). We also observed the exuviae of the parasitized larvae (Fig. 2B). Rearing was then conducted in laboratory condition of 25±2°C and 70±10% RH. Reared parasitoids were identified following the descriptions of Dzhankomken (1976), Bouček & Rasplus (1991), Ferrière (1947), Graham (1969, 1987, 1995), Zerova (1995) and Zerova et al. (2006).

Results and Discussion

*Etiella zinckenella* was parasitized by six chalcidoid species of the family Eulophidae, Eurytomidae, and Pteromalidae with three, two, and one species respectively.

Fam. Eulophidae

The eulophid species obtained from *E. zinckenella* belong to the genera *Elasmus* Westwood and *Aprostocetus* Westwood. *Elasmus* is a unique genus formerly considered to represent a valid family Elasmidae but after a molecular study of Gauthier...
et al. (2000) it was transferred to the subfamily Eu-
lophiinae in Eulophidae. This cosmopolitan genus is
most abundant in the Old World tropics. The major-
ity of species are parasitoids or hyperparasiti-
oids of larvae and pupae of Lepidoptera.

Two species of Elasmus were identified; Elas-
mus biroi Erdős and Elasmus platyedrae Ferrière.
Five eulophid genera (Aprostocetus, Elasmus, Eu-
plectus, Pediobius and Tetrastichus) have been re-
ported as parasitoids of E. zinckenella (Noyes 2013).
In the genus Elasmus two species were previously
reared from this pest: Elasmus flabellatus (Fonsco-
lombe) (Peiu 1967) and an undetermined species
(Herting 1975).

Within the eulophid fauna of Iran only one spe-
cies, Elasmus nadius Nees, has been reported
(Talebi et al. 2011). Aprostocetus with 785 species
worldwide (Noyes 2013), is a very large genus of
the family Eulophidae and subfamily Tetrastichi-
nae. Only 14 species of the genus have been re-
ported from Iran (Talebi et al. 2011). Graham
(1987) classified A. arrabonicus in subgenus
Aprostocetus Westwood and compared it with
Aprostocetus pausiris (Walker).

Aprostocetus arrabonicus (Erdős, 1954)
(Figs 3F-D)
Material examined. Marand and Payam of East-
Azerbaijan, ex Sophora alopecuroides pods,
Diagnosis. Body black with metallic tinge
(Figs 3F-D); male with antennal segments mostly
testaceous (Fig. 3D); scape about 3 times as
long as broad, first funicular segment of female slightly
longer than broad and slightly shorter than pedi-
cellus, second segment quadrate while third one
slightly transverse, terminal spine of clava incon-
spicuous; ovipositor sheath relatively exerted (Fig.
3E); stigmal vein at 45°-50°, marginal vein 3.6-4
times longer than stigmal vein (Fig. 3F).

Host. No biological data about A. arrabonicus
are available so far; it was collected on Aloe-
pecurus pratensis L. (Poaceae) (Graham 1987). In the
present research A. arrabonicus was reared from S.
aloepecuroide pods infested by E. zinckenella and it
seemed to be a hyperparasitoid of other associated
parasitoids.

Distribution. This species has been reported
from Europe (Czech Republic, Hungary,
Netherlands, Russia, Slovakia, Sweden and UK)
(Noyes 2013). This is the first record of A. arraboni-
cus from Middle East and Iran.

Elasmus biroi Erdős, 1964 (Figs 3A-B)
Material examined. Marand and Payam of East-
Azerbaijan, ex Sophora alopecuroides pods, 30 Aug.
2009, H. Lotfalizadeh leg., 9♀♀& 6♀♀. The same

Diagnosis. This species is extensively black
with yellow marks on mesosoma and metasoma,
antennae, tibiae and tarsi; scape about 3 times as
long as broad, funicular segments short, third fu-
nicular segment quadrate (Fig. 3A); apex of me-
fasoma obtuse, last tergite broader than long; fore
wing with long triangular bare strip at base, with
isolated subcubital setal line (Fig. 3B).

Host. This species has not been reared on
lepidopterous species and its association with E.
zinckenella is new.

Distribution. This is the first record of E. biroi
from Iran, East-Azerbaijan province (Payam). It
has been reported from Hungary (Noyes 2013).

Elasmus platyedrae Ferrière, 1935 (Figs 2D, 3C-D)
Material examined. Marand and Payam, East-
Azerbaijan, ex Sophora alopecuroides pods, 30 Aug.
2009, H. Lotfalizadeh leg., 72♀♀& 18♀♀. The same

Diagnosis. Head and mesosoma black with
yellow markings; scape and flagellum brownish-
testaceous; legs extensively darkened, mid and
hind tibiaefuscous to black; dorsellum broadly
black basally; first funicular segment as long as
pedicellus, all funicular segments longer than
broad (1.8-2.8 times) (Fig. 3A); apex of me-
tasoma obtuse, last tergite broader than long; fore
wing with long triangular bare strip at its base
and with an isolated subcubital setal line.

Hosts. It has been reported as a parasitoid of
several lepidopterous pests of the family Gelechii-
dae, Lymanteridae, Momphidae, and Pyralidae
(Noyes 2013). Etiella zinckenella is a new host for
this parasitoid species.

Distribution. It was found in Payam and
Koshksaray (East-Azerbaijan) and Shirvan-
Chardavol (Ilam) as new record, but this species is
distributed throughout the Mediterranean region
(Ferrière 1947). Europe, North Africa, Middle East,
and it is also known from India (Noyes 2013).
In addition to the above materials, we also
studied two other specimens. The first was swept
on Euphorbia in Marand and Koshksaray, East-
Azerbaijan, and the second was collected by Mal-
aise trap in a Cartamus oxyanthus field in Shirvan-
Chardavol, Ilam.

Remarks. These two species are widely
darkened but E. biroi has shorter funicular
Chalcidoid parasitoids of Etiella zinckenella in Iran

Figure 1. Etiella zinckenella: A.) Last instar larva, B.) Larval head capsule, C.) Pupa, D.) Terminal segments of pupa.

Figure 2. A.) Infested pods of Sophora alopecuroides, B.) Head capsules of Etiella zinckenella larvae in dissected pods of S. alopecuroides, C.) Cyrtopitys lichtensteini, female, D.) Elasmus platyedrae, female, E.) Aximopsis augasmae, female.
Figure 3. 


Figure 4. 

segments (Fig. 3A) than E. platypedrae. The latest possesses a longer first funicular segment compare to its pedicellus (Fig. 3C), apex of metasoma obtuse, penultimate metasomal segment twice times longer than its basal width.

Fam. Eurytomidae

Two eurytomid species were reared on E. zinckenella. These species belong to the nodularis species group of Eurytoma (Lotfalizadeh et al. 2007) which exhibits a conspicuous mesopleuron ventral shelf (Fig. 5B), carinate fore coxae (Fig. 5E), distinctly petiolate female metasoma (Fig. 5D), male funicular segments with two convex apices and covered with long pubescence. According to Lotfalizadeh et al. (2007), the species belonging to the nodularis species group should be transferred to the genus Aximopsis Ashmead.

Aximopsis augasmae (Zerova) Comb. n. and Aximopsis near ghazvini (Zerova) Comb. n. were reared in this research while two other species of the genus Eurytoma (E. insularis and E. verticillata) have been reported on E. zinckenella (Noyes 2013).

Aximopsis augasmae (Zerova, 1977) Comb. n. (Figs 2E, 4A-D)


Diagnosis. Face at margins and above clypeus with dense, distinct fan-like striation diverging upwards and nearly reaching level of antennal toruli (Fig. 4A); all funicular segments of female longer than wide (Fig. 4B), male funicular segments not convex dorsally; metasoma of female longer than mesosoma, metasomal tergites smooth or with vague punctuation; mesosternal carina in form of low triangular prominence; marginal vein about as long as stigmal vein (Fig. 4D).

Hosts. Aximopsis augasmae was reared for first time on E. zinckenella on S. alopecuroides. It had been reported as a parasitoid of the gall moth larvae Augasma atraphaxidellum Kuzn. (Lep.: Coleophoridae) on Atraphaxis spinoso L. (Polygonaceae) and some other moth species on Zygophyllum (Zerova and Seryogina 2006).

Distribution. Aximopsis augasmae is distributed in Caucasus and Central Asia (Zerova and Seryogina 2006), and Bulgaria (Stojanova 2004), while for Iran this is a new record.

Aximopsis near ghazvini (Zerova, 2004) Comb. n. (Figs 5A-E)


Diagnosis. All features of the specimen we collected in Iran match well with those reported by Zerova et al. (2004) for A. ghazvini, except as follows: funicular segments are black (Fig. 5C) (brownish in A. ghazvini) and much longer in the female, femur and tibiae basally and distally brownish orange (yellow in A. ghazvini).


Distribution. This species is originally described from Ghazvin, Iran (Zerova et al. 2004) and is a new record for East-Azarbaijan.

Fam. Pteromalidae

Only one pteromalid species was reared on E. zinckenella, although four pteromalid genera, Cyrtoptyx, Dibrachys, Lyrcus and Pteromalus, have been reported on E. zinckenella (Noyes 2013).

Cyrtoptyx lichtensteini (Masi, 1921) (Figs. 2C, 6A-C)


Only two species of the genus Cyrtoptyx have been reported from Iran: Cyrtoptyx pistaciae (Nikol’skaya) (Lotfalizadeh & Gharali 2008) and Cyrtoptyx cf. latipes (Rondani) (Mitroui et al. 2011).

Diagnosis. Tibiae and tarsi whitish (Fig. 2C), middle and fore tibiae brown on the inner side, eyes relatively narrow, metasoma in the female tapered posteriorly, longer than head and mesosoma altogether, more than two times as long as wide, metasomal tergites bright green posteriorly and green anteriorly (Fig. 6C), F1 in female more than 1.5 times longer than F5 (Fig. 6A).

Hosts. This species has been reported on E. zinckenella and two Curculionidae genera (Lixus and Mononychus) (Noyes 2013).

Distribution. This species is distributed in the Palearctic (from Europe and North Africa to China) and Nearctic regions (Noyes 2013), but it is newly recorded from Iran.

Five out of six species of E. zinckenella chalcid parasitoids found in the present study: Aprostocetus arrabonicus, Elasmus biret, E. platypedrae, Aximopsis augasmae and A. near ghazvini, are newly associated with E. zinckenella, while all six pre-
Figure 5. *Aximopsis near ghazvini*: A.) Head in frontal view, B.) Mesosoma in lateral view, C.) Female antenna, D.) Metasoma and fore wing in lateral view, E.) Fore coxa in lateral view.

Table 1. Species and number of individual of *Etiella zinckenella* associated parasitoids reared from *Sophora alopecuroides* pods collected in Iran.

<table>
<thead>
<tr>
<th>Family</th>
<th>Parasitoids species</th>
<th>♂♂</th>
<th>♂♂</th>
<th>≥♀</th>
<th>≥♀</th>
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<td>Eulophidae</td>
<td>Aprostocetus arabonicus (Erdős)</td>
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<td>Elasmus birei Erdős</td>
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<td>6</td>
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<td>7</td>
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<tr>
<td></td>
<td>E. platyedrae Ferrière</td>
<td>72</td>
<td>18</td>
<td>2</td>
<td>5</td>
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<tr>
<td>Eurytomidae</td>
<td><em>Aximopsis augasiomae</em> (Zeronova)</td>
<td>3</td>
<td>3</td>
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<td>-</td>
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<tr>
<td></td>
<td><em>A. near ghazvini</em> (Zeronova) Comb. n.</td>
<td>5</td>
<td>3</td>
<td>-</td>
<td>-</td>
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<td>Pteromalidae</td>
<td>Cyrtoptyx lichtensteini (Mani)</td>
<td>1</td>
<td>2</td>
<td>32</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>122</td>
<td>77</td>
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Table 2. Revised list of *Etiella zinckenella* chalcidoid associated parasitoids.

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<th>Parasitoid species</th>
<th>Biological association/distribution</th>
<th>References</th>
</tr>
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<tr>
<td>Chalcididae</td>
<td>Hockeria singularis Bouček</td>
<td>P⁺, PAL⁺</td>
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<td>Eulophidae</td>
<td>Aprostocetus araharicus (Erdős)</td>
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<td>Herting (1975)</td>
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<td>Present paper</td>
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<tr>
<td></td>
<td>Elasmus flabelatus (Forsocolombe)</td>
<td>P</td>
<td>Petu (1967)</td>
</tr>
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<td></td>
<td>Elasmus platyrhachis Ferrière</td>
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<td>Present paper</td>
</tr>
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<td>Elasmus sp.</td>
<td>P</td>
<td>Herting (1975)</td>
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<td>Eaplectrus bicolor Sweederus</td>
<td>P, PAL</td>
<td>Bouček &amp; Askew (1968), Thompson (1955)</td>
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<td></td>
<td>Pedioius pyrgo Walker</td>
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<td>Herting (1975)</td>
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<td>Pedioius sp.</td>
<td>H</td>
<td>Herting (1977)</td>
</tr>
<tr>
<td></td>
<td>Tetrastichus sp.</td>
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<td>Eupelmidae</td>
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<td>Herting (1975, 1977)</td>
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<td>Eupelmus vesicularis Retzius</td>
<td>P, PAL, NEA</td>
<td>Herting (1975)</td>
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<td>A. near ghazvini (Zerova) Comb. n.</td>
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<td>Present paper</td>
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<td></td>
<td>Eurytoma insularis Ashmead</td>
<td>P</td>
<td>De Santis (1989)</td>
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<td>Eurytoma verticillata Fabricius</td>
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<td>Pteromalidae</td>
<td>Cyrtopys lichensteinis (Masji)</td>
<td>P</td>
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<td>Lyrus tortricidis Crawford</td>
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<td>Trichogramma minutum Riley</td>
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<td>Trichogramma sp.</td>
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<td>AUS, PAL, Thompson (1958), De Santis (1979)</td>
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</table>

*P*: Parasitoid, H: Hyperparasitoid. *The abbreviations of zoogeographic regions: AFT, Afrotropical; AUS, Australian; NEA, Nearctic; NET, Neotropical; ORL, Oriental; PAL, Palaearctic.*

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References