

## 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-Azərbayjan, northwestern Iran. Laboratory rearing of seeds infested *E. zinckenella* produced six chalcidoid species. These species are from the family Eulophidae: *Aprostocetus arrabonicus* (Erdős), *Elasmus biroi* Erdős, *Elasmus platydrae* 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. arrabonicus*, *E. biroi*, *E. platydrae*, *A. augasmae* and *A.* near *ghazvini* with *E. zinckenella* are new, and furthermore, *A. arrabonicus* 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 gynecological diseases such as eczema, dermatitis and colpitis, as well as fever, sore throat and inflammation (Küçükboyacı 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 ussuriensis*, *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 Perilampidae, four Pteromalidae, one Torymidae and four Trichogrammatidae (Noyes 2013).

Considering the importance of *E. zinckenella* as a polyphagous pest with wide geographical dis-

tribution, 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 38° 48' 84" & E 45° 77' 24", 1748m), East-Azərbayjan 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 Dzhankmen (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 Eulophinae in Eulophidae. This cosmopolitan genus is most abundant in the Old World tropics. The majority of species are parasitoids or hyperparasitoids of larvae and pupae of Lepidoptera.

Two species of *Elasmus* were identified; *Elasmus biroi* Erdős and *Elasmus platydrae* Ferrière. Five eulophid genera (*Aprostocetus*, *Elasmus*, *Euplectrus*, *Pediobius* and *Tetrastichus*) have been reported as parasitoids of *E. zinckenella* (Noyes 2013). In the genus *Elasmus* two species were previously reared from this pest: *Elasmus flabellatus* (Fonscolombe) (Peiu 1967) and an undetermined species (Herting 1975).

Within the eulophid fauna of Iran only one species, *Elasmus nudus* Nees, has been reported (Talebi et al. 2011). *Aprostocetus* with 758 species worldwide (Noyes 2013), is a very large genus of the family Eulophidae and subfamily Tetrastichinae. Only 14 species of the genus have been reported 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-Azarbaijan, ex *Sophora alopecuroides* pods, 16.Aug.2011, H. Lotfalizadeh leg., 5 ♀♀ & 1 ♂.

**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 pedicellus, second segment quadrate while third one slightly transverse, terminal spine of clava inconspicuous; 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 *Alopecurus pratensis* L. (Poaceae) (Graham 1987). In the present research *A. arrabonicus* was reared from *S. alopecuroides* 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. arrabonicus* from Middle East and Iran.

#### ***Elasmus biroi* Erdős, 1964** (Figs 3A-B)

**Material examined.** Marand and Payam of East-Azarbaijan, ex *Sophora alopecuroides* pods, 30 Aug. 2009, H. Lotfalizadeh leg., 9 ♀♀ & 6 ♂♂. The same collection, 16.Aug.2011, 5 ♀♀ & 7 ♂♂.

**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 funicular segment quadrate (Fig. 3A); apex of metasoma 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-Azarbaijan province (Payam). It has been reported from Hungary (Noyes 2013).

#### ***Elasmus platydrae* Ferrière, 1935** (Figs 2D, 3C-D)

**Material examined.** Marand and Payam, East-Azarbaijan, ex *Sophora alopecuroides* pods, 30 Aug. 2009, H. Lotfalizadeh leg., 72 ♀♀ & 18 ♂♂. The same collection, 16.Aug.2011, 2 ♀♀ & 5 ♂♂.

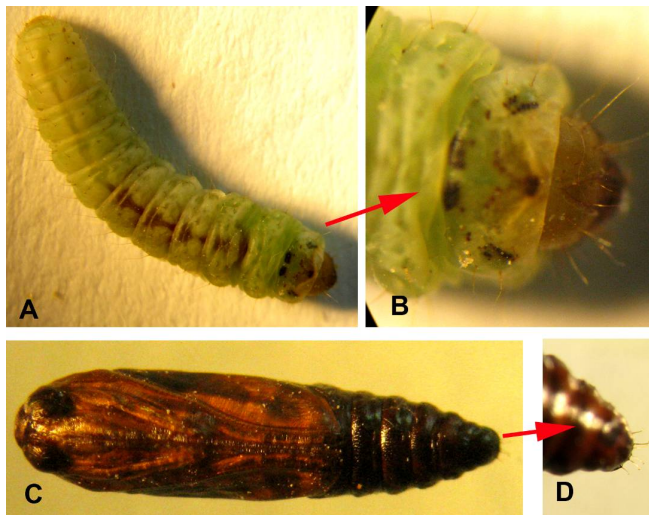
**Diagnosis.** Head and mesosoma black with yellow markings; scape and flagellum brownish-testaceous; legs extensively darkened, mid and hind tibiae fuscous to black; dorsellum broadly black basally; first funicular segment as long as pedicellus, all funicular segments longer than broad (1.8-2.8 times) (Fig. 3C), fore wing as in *E. biroi* with a 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 Gelechiidae, Lymanteridae, Momphidae, and Pyralidae (Noyes 2013). *Etiella zinckenella* is a new host for this parasitoid species.

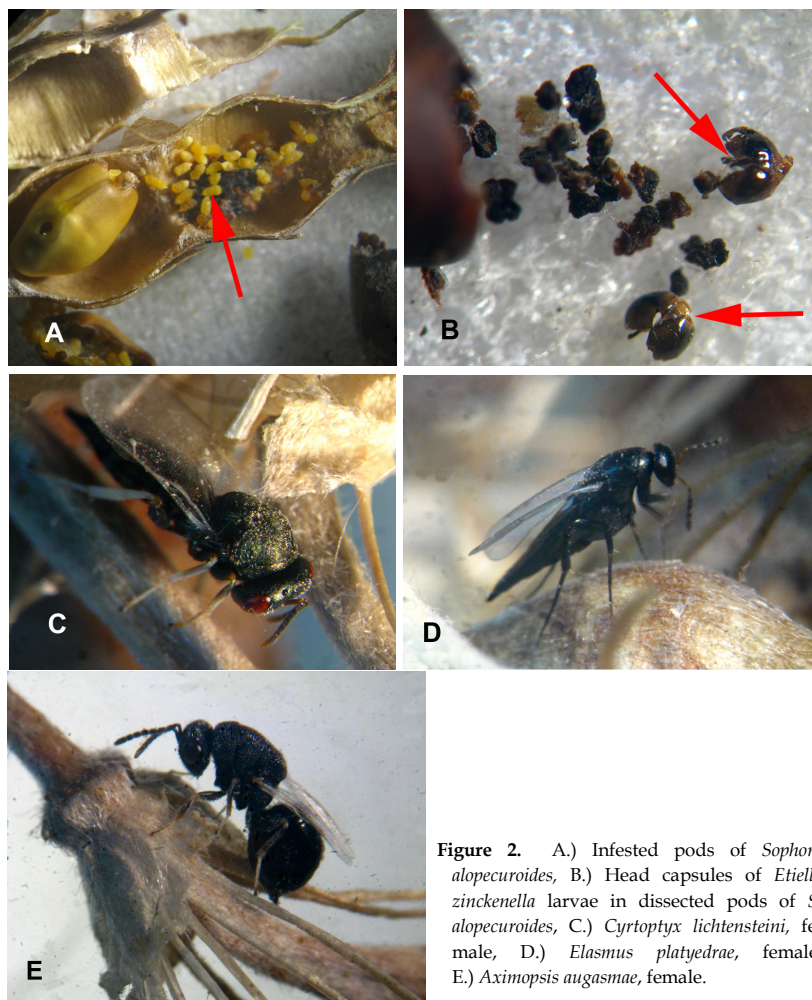
**Distribution.** It was found in Payam and Koshksaray (East-Azarbaijan) and Shirvan-Chardavol (Ilam) as new record, but this species is distributed throughout the Mediterranean region (Ferrière 1947), Europe, North Africa, Middle East, and it is also known from India (Noyes 2013).

In addition to the above materials, we also studied two other specimens. The first was swept on *Euphorbia* in Marand and Koshksaray, East-Azarbaijan, and the second was collected by Malaise trap in a *Cartamus oxycanthus* field in Shirvan-Chardavol, Ilam.

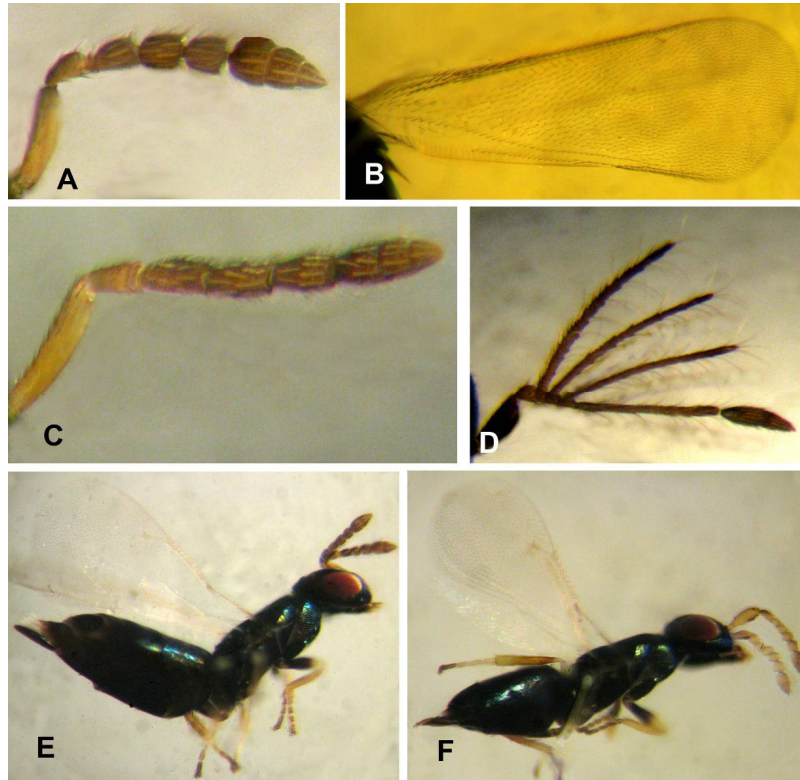
**Remarks.** These two species are widely darkened but *E. biroi* has shorter funicular



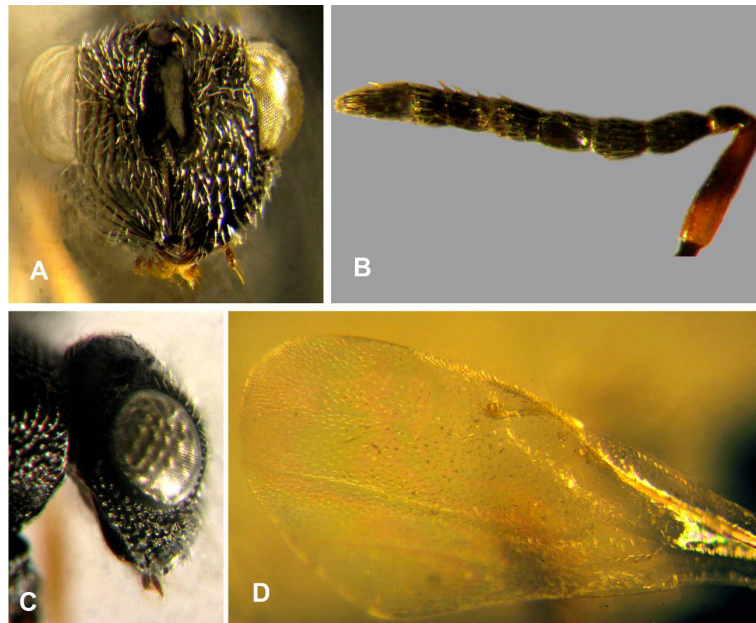
**Figure 1.** *Etiella zinckenella*: A.) Last instar larva, B.) Larval head capsule, C.) Pupa, D.) Terminal segments of pupa.



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



**Figure 3.** *Elasmus biroi*: A.) Female antenna, B.) Fore wing; *Elasmus platydrae*: C.) Female antenna, D.) Male antenna; *Aprostocetus arrabonicus*: E.) Female in lateral view, F.) Male in lateral view.



**Figure 4.** *Aximopsis augasmæ*: A.) Head in frontal view, B.) Female antenna, C.) Head in lateral view, D.) Fore wing.

segments (Fig. 3A) than *E. platydrae*. 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)

**Material examined.** Marand and Payam, East-Azarbaijan, , ex *Sophora alopecuroides* pods, 30 Aug. 2009, H. Lotfalizadeh leg., 3♀ & 3♂.

**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* Kuznetz. (Lep.: Coleophoridae) on *Atraphaxis spinosa* 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)

**Material examined.** Marand and Payam, East-

Azarbaijan, , ex *Sophora alopecuroides* pods, 30 Aug. 2009, H. Lotfalizadeh leg., 5♀ & 3♂.

**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*).

**Hosts.** Reared for the first time from pods of *S. alopecuroides* damaged by *E. zinckenella*. Zerova et al. (2004) reared it from pods of *Glycyrrhiza glabra* L. (Leguminosae).

**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)

**Material examined.** Marand and Payam, East-Azarbaijan, , ex *Sophora alopecuroides* pods, 30 Aug. 2009, H. Lotfalizadeh leg., 1♀ & 2♂. The same collection, 16.Aug.2011, 32 ♀ & 20♂.

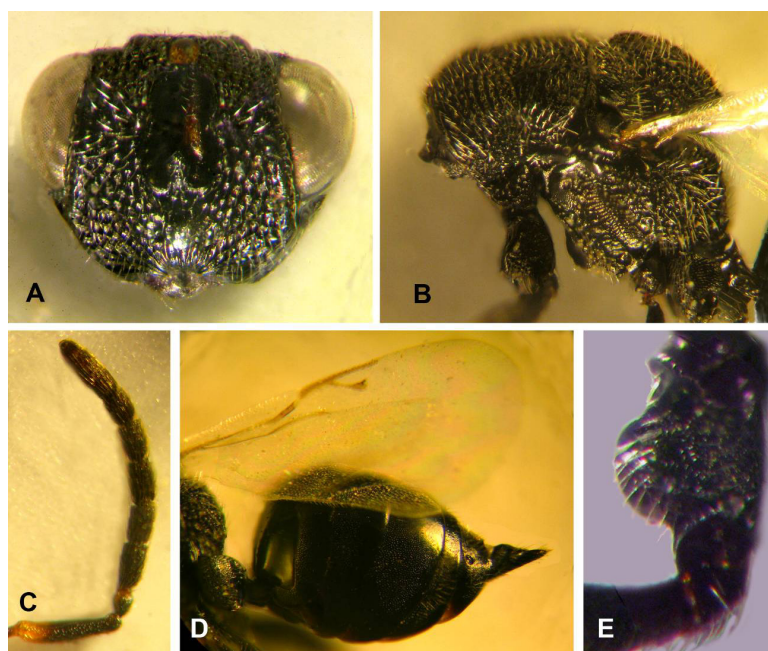
Only two species of the genus *Cyrtoptyx* have been reported from Iran: *Cyrtoptyx pistaciae* (Nikol'skaya) (Lotfalizadeh & Gharali 2008) and *Cyrtoptyx* cf. *latipes* (Rondani) (Mitroiu et al. 2011).

**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).

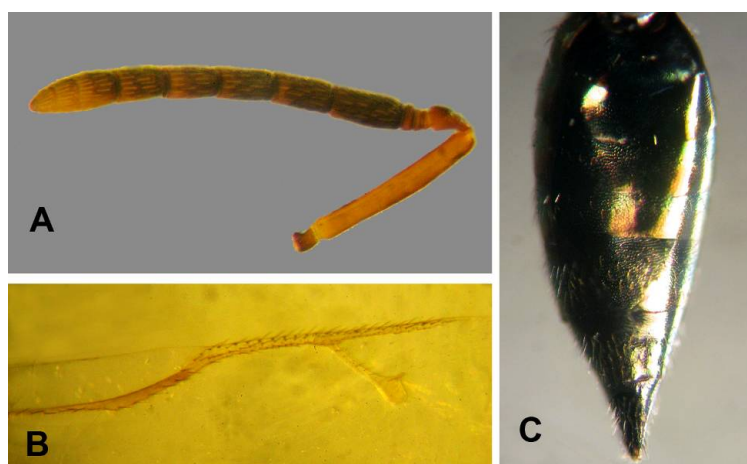
**Hosts.** This species has been reported on *E. zinckenella* and two Curculionidae genera (*Lixus* and *Mononychus*) (Noyes 2013).

**Distribution.** This species is distributed in the Palaearctic (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 biroi*, *E. platydrae*, *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.



**Figure 6.** *Cyrtoptyx lichtensteini*: A.) Female antenna, B.) Fore wing venation, C.) Female metasoma in dorsal view.

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

Family	Parasitoids species	Number of individuals			
		2009		2011	
		♀♀	♂♂	♀♀	♂♂
Eulophidae	<i>Aprostocetus arrabonicus</i> (Erdős)	-	-	5	1
	<i>Elasmus biroi</i> Erdős	9	6	5	7
	<i>E. platydrae</i> Ferrière	72	18	2	5
Eurytomidae	<i>Aximopsis augasmae</i> (Zerova) <b>Comb. n.</b>	3	3	-	-
	<i>A. near ghazvini</i> (Zerova) <b>Comb. n.</b>	5	3	-	-
Pteromalidae	<i>Cyrtoptyx lichtensteini</i> (Masi)	1	2	32	20
Total		122		77	

**Table 2.** Revised list of *Etiella zinckenella* chalcidoid associated parasitoids.

Family	Parasitoid species	Biological association	Geographical distribution	References
Chalcididae	<i>Hockeria singularis</i> Bouček	P <sup>a</sup>	PAL <sup>b</sup>	Herting (1975)
Eulophidae	<i>Aprostocetus arrabonicus</i> (Erdős)	H	PAL	<b>Present paper</b>
	<i>Aprostocetus</i> sp.	P	PAL	Herting (1975)
	<i>Elasmus biroi</i> Erdős	P	PAL	<b>Present paper</b>
	<i>Elasmus flabellatus</i> (Fonscolombe)	P	PAL	Peiu (1967)
	<i>Elasmus platyedrae</i> Ferrière	P	PAL, ORL	<b>Present paper</b>
	<i>Elasmus</i> sp.	P	PAL	Herting (1975)
	<i>Euplectrus bicolor</i> Swederus	P	PAL	Bouček & Askew (1968), Thompson (1955)
	<i>Pediobius pyrigo</i> Walker	H	PAL, ORL, NEA	Herting (1975)
	<i>Pediobius</i> sp.	H	PAL	Herting (1977)
<i>Tetrastichus</i> sp.		PAL	Herting (1975)	
Eupelmidae	<i>Eupelmus annulatus</i> Nees	H	PAL, NEA	Herting (1975, 1977)
	<i>Eupelmus cushmani</i> Crawford	P	NEA, NET	De Santis (1967, 1980), Herting (1975)
	<i>Eupelmus microzonus</i> Förster	P	PAL, NEA	Herting (1975)
	<i>Eupelmus muellneri</i> Ruschka	H	PAL	Herting (1975, 1977)
	<i>Eupelmus urozonus</i> Dalman	H	AUS, PAL, NEA, ORL	Herting (1975, 1977), Thompson (1955)
<i>Eupelmus vesicularis</i> Retzius	P	PAL, NEA	Herting (1975)	
Eurytomidae	<i>Aximopsis augasmae</i> (Zerova) <b>Comb. n.</b>	P	PAL	<b>Present paper</b>
	<i>A. near ghazvini</i> (Zerova) <b>Comb. n.</b>	P	PAL	<b>Present paper</b>
	<i>Eurytoma insularis</i> Ashmead	P	NET	De Santis (1989)
	<i>Eurytoma verticillata</i> Fabricius	H	PAL, NEA	Herting (1975, 1977)
	<i>Eurytoma</i> sp.	P	NET	Segarra-Carmona & Barbosa (1990), Thompson (1955)
Perilampidae	<i>Perilampus tristis</i> Mayr	H	PAL, NEA, NET	Herting (1975)
Pteromalidae	<i>Cyrtoptyx lichtensteini</i> (Masi)	P	PAL, NEA	Peck (1963), Herting (1975), De Santis (1983), <b>Present paper</b>
	<i>Dibrachys microgastri</i> Bouché	P	PAL, NEA, NET, ORL	Herting (1975)
	<i>Lyracus tortricidis</i> Crawford	P	NEA	Thompson (1958), Peck (1963), Oatman (1967), Burks (1979)
	<i>Pteromalus</i> sp.	P	PAL	Herting (1975)
Torymidae	<i>Exopristus trigonomerus</i> Masi	H	PAL	Herting (1975, 1977)
Trichogrammatidae	<i>Trichogramma evanescens</i> Westwood	P	PAL, NEA, NET, ORL	Herting (1975)
	<i>Trichogramma minutum</i> Riley	P	AFT, AUS, PAL, NEA, NET, ORL	Thompson (1958), De Santis (1979)
	<i>Trichogramma</i> sp.	P	PAL, NET	Herting (1975), Segarra-Carmona & Barbosa (1988),
	<i>Trichogrammatoidea armigera</i> Manjunath	P	NET, ORL	Nagaraja (1979), Hayat & Viggiani (1984)

<sup>a</sup> P: Parasitoid, H: Hyperparasitoid. <sup>b</sup> The abbreviations of zoogeographic regions: AFT, Afrotropical; AUS, Australian; NEA, Nearctic; NET, Neotropical; ORL, Oriental; PAL, Palaearctic.

sented species are new to the Iranian fauna. With the inclusion of five species listed above, 32 chalcidoid species from eight families are now known as parasitoids or hyperparasitoids of *E. zinckenella*: 1 Chalcididae, 10 Eulophidae, 6 Eupelmidae, 5 Eurytomidae, 1 Perilampidae, 4 Pteromalidae, 1 Torymidae and 4 Trichogrammatidae (Table 2).

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