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Study of the tribe Heresiarchini (Hymenoptera: Ichneumonidae, Ichneumoninae) in northern Iran, with a new record for the Middle East

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ABSTRACT. In this survey the tribe Heresiarchini (Hymenoptera: Ichneumonidae, Ichneumoninae) of Alborz and Guilan provinces (Iran) was taxonomically studied. The specimens were collected using Malaise traps during March to November 2010. Three species including: *Coelichneumon comitator* (Linnaeus, 1758), *Coelichneumon probator* Horstmann, 2000 and *Syspasis carinator* (Fabricius, 1798) were identified of which *C. probator* is recorded for the first time from the Middle East and Iran. An updated checklist of Heresiarchini in Iran, as well as diagnostic characters of the new recorded species is presented.

Key words: Ichneumonidae, Ichneumoninae, Heresiarchini, *Coelichneumon*, Iran

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Introduction

The Ichneumonidae Latreille, 1802 with 25292 described species is one of the largest families in the insects order (Aguiar et al., 2013). Most ichneumonids are parasitoids of Lepidoptera, Coleoptera, Hymenoptera, Diptera and Arachnida. Thus ichneumonid wasps have important role in decrease of pest population and damages. The Ichneumoninae with 437 genera and about 4355 species is the largest subfamily (after Cryptinae) in the Ichneumonidae family, and has a worldwide distribution (Çoruh & Özbek, 2013; Yu et al., 2016). Almost all known species are parasitoids of Lepidoptera. So far 54 genera and 207 species were reported from Iran (Riedel & Aghadokht, 2017). Tribe Heresiarchini Ashmead, 1900 includes 88 genera and 595 species worldwide and 88 species have been recorded from the Western Palaearctic region (Yu et al., 2016). Members of the tribe Heresiarchini are recognized by sickle-shaped mandibles, upper tooth longer than lower one, third pleural area (area posteroexterna) extremely sharply shortened (the apices of areae dentiparae especially close approach to the hind coxae) (Tereshkin, 2009). So far 6 genera and 33 species of Heresiarchini have been recorded from Iran (Heinrich, 1929;

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Kolarov & Ghahari, 2005; 2008; Masnadi & Sadeghi, 2006; Masnadi & Jussila, 2008; Ghahari & Jussila, 2010; Ghahari et al., 2010 a,2010b; Riedel et al., 2010; Ghahari & Jussila, 2011a, 2011b, 2011c, 2011d; Ghahari & Schwarz, 2011; Ghahari, 2012, 2014; Ghahari & Jussila, 2014; Ghahari & Gadalla, 2015; Ghahari & Jussila, 2016; Riedel & Aghadokht, 2017). Despite recent advances in the taxonomy of Ichneumonidae in Iran (Mohammadi-Khoramabadi et al., 2011; 2013a, 2013b; Amiri et al., 2015a, 2015b, 2016a, 2016b, 2017; Mohebban et al., 2015, 2016; Shirzadegan et al., 2017; 2018), our knowledge on the biology, ecology, and their role in Biological control of insect pests in Iran is low. It is difficult to give a precise estimate of the number of species of Ichneumoninae occurring in Iran, but considering the great diversity in vegetation, monsoon forest, natural ecosystems and farmlands, the number of recorded species, in comparison to the known species of subfamily Ichneumoninae in the Palaearctic region is low (1297 species) (Yu et al., 2016). The results may be useful for future bio control of insect pests and ecological studies.

Material and methods

Malaise traps were used in different places consisting Ghazichak, Eshman Kamachal, Orkom, Ziaz located in Guilan province and Arangeh, Sarziarat, Shahrestanak, Karaj in Alborz province during March to November 2010. For the preparation of samples, they were preserved in a mixture of 40% xylene and 60% alcohol 96% for two days, then transferred into amyl acetate for two days and finally placed on the filter paper for drying (AXA method, van Achterberg, 2009). The dried specimens were then card-mounted and labeled. Photographs were taken using an Olympus™ SZX9 stereomicroscope equipped with BMZ-04-DZTM digital imaging system (Behin Pajouhesh Co., Iran). A series of 10-15 captured images were merged into a single in-focus image using the image-stacking software ZereneStacker version 1.04. Morphological terminology follows Tereshkin (2009). Nomenclature and distribution data are mainly taken from Yu et al. (2016). The specimens are deposited at the Collection of Department of Entomology, Tarbiat Modares University (TMUC).

Results

Three species belonging to two genera of the tribe Heresiarchini were collected and identified, of which *Coelichneumon probator* Horstmann, 2000 is newly recorded for the Iranian fauna and the Middle East. The results of this study and review of the previously recorded taxa documented the existence of 34 species of the tribe Heresiarchini in Iran.

***Coelichneumon comitator* (Linnaeus, 1758)**
Material examined: Iran, Alborz province, Karaj, Sarziarat (35°55′12″ N, 51°06′54″ E, 1980 m a.s.l.), 01.VI.2010, 1♀, 06.VII.2010, 1♀, leg.: M. Khayrandish.
Distribution in Iran: Not defined (Heinrich, 1929), Golestan (Kolarov & Ghahari, 2008); Tehran (Masnadi & Jussila, 2008); Khorasan-e razavi (Ghahari & Jussila, 2014).
General distribution: Western and Eastern Palaearctic region (Yu et al., 2016)

***Coelichneumon probator* Horstmann, 2000 (Figs. 1; 2 A–F)**
Material examined: Iran, Guilan province, Rudsar, Ghazichak (36°45′54″ N, 50° 19′ 36″ E, 1803 m a.s.l.), 10.V.2010, 1♂, Leg.: M. Khayrandish.
Description (Male): Body length 11 mm; vertex gradually sloping behind ocelli to occipital carina from lateral view (Fig. 2A); temples short, 0.7 X as wide as transverse diameter of the eye in lateral view, sharply roundly narrowed behind the eyes in dorsal view; occipital carina connected to hypostomal carina far from base of

mandibles; face 3.0 X as wide as its length, its surface densely punctured (Fig. 2B); clypeus almost flat, approximately 2.4 X as wide as its length, its surface coarsely punctated (Fig. 2B); clypeal foveae small; malar space 0.5 X as long as basal width of mandible; flagellum with 31 flagellomeres, flagellomeres 7–16 with tyloides; mesonotum moderately convex and scarcely punctuated; scutellum slightly convex, as long as its wide, its lateral margin carinated up to middle (Fig. 2D); mesopleuron densely punctured, without microsculpture (Fig. 2C); area superomedia hexagonal and merged with area basalis, costulae before middle; apices of area dentiparae slightly prominent (Fig. 2D); propodeal spiracle elongate, its length 3.5 X as long as its width; third pleural area (area postero-externa) extremely sharply shortened (Fig. 2C); hind femur 3.5 X as long as its maximum width; hind tibia 1.8 X longer than hind basitarsus; postpetiole slightly elevated at the middle, 2 X wider than lateral fields, its surface longitudinally striated (Fig. 2E); 2nd and 3rd tergites coarsely and densely punctate, with some longitudinal rugose sculpture at central parts; gastrocoeli developed with several irregular longitudinal ridges; thyridia distinct, oblique, interspace between them longitudinal rugose sculptures (Fig. 2E).

Coloration: Body black; triangular ivory spots on vertex, facial orbits, frontal orbits, genal orbits, spots at lateral corners of clypeus, pronotal rige, tegula and subalarum and lateral carinae of scutellum with ivory; Hind legs black with reddish pattern; coxae and trochanters of all legs black.

Distribution in Iran: New for Iran and the Middle East fauna.

General distribution: west palaearctic, Belgium, Czech Republic, France, France-main, Germany, Poland, Romania, Spain, Spain-main, Ukraine, United Kingdom (Yu et al., 2016).

***Syspasis carinator* (Fabricius, 1798)**

Material examined: Iran, Alborz province: Karaj, Shahrestanak (35°57′36″ N, 51°22′18″ E, 2301 m a.s.l.), 03.VIII.2010, 1♀, leg.: M. Khayrandish.

Distribution in Iran: Tehran province (Ghahari, 2014)

General distribution: Western Palaearctic region (Yu et al., 2016).

Figure 1. *Coelichneumon probator*, male lateral habitus.

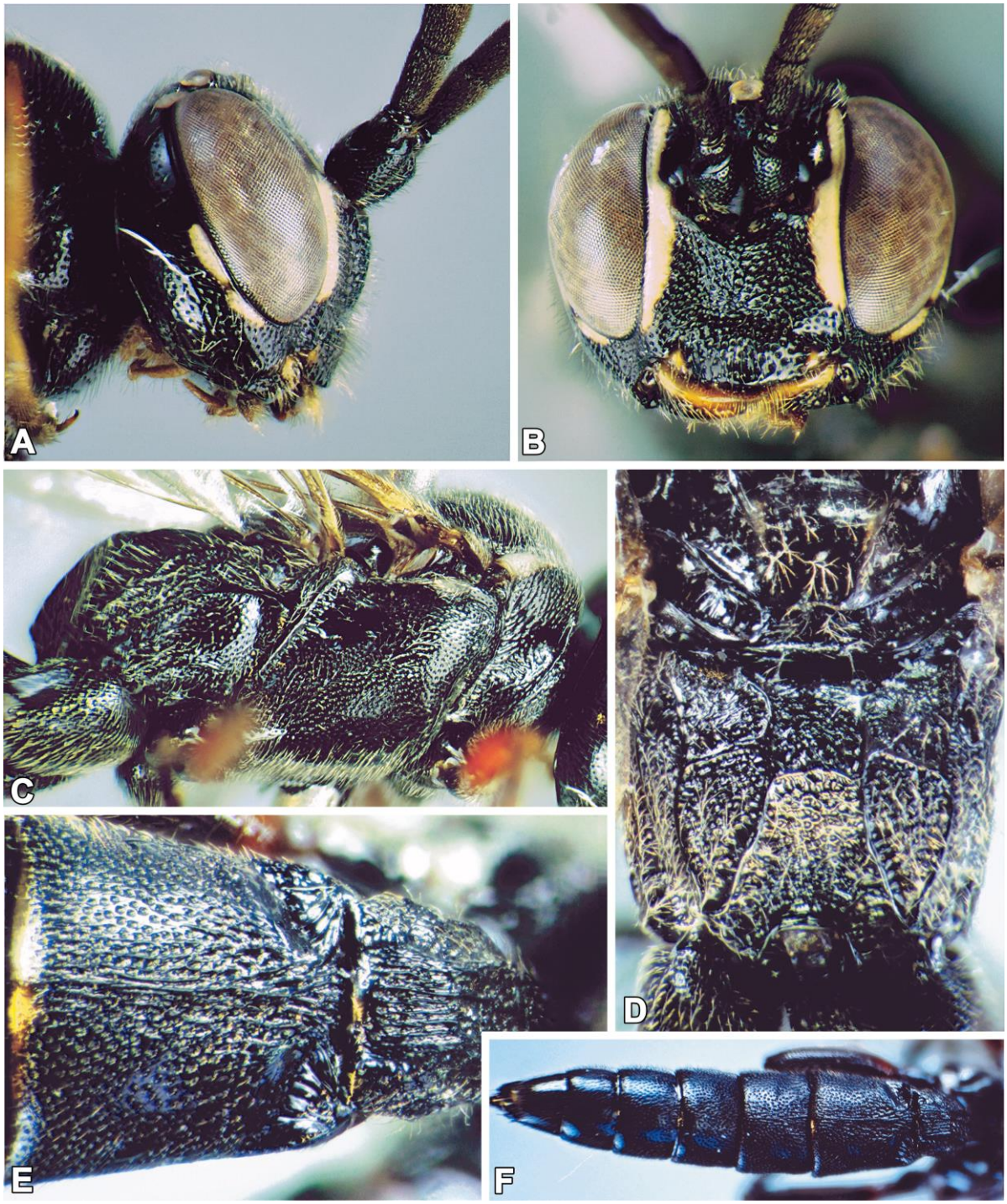

Figure 2. *Coelichneumon probator*, male: **A.** Head, lateral view, **B.** Head, frontal view, **C.** Mesosoma, lateral view, **D.** Scutellum and propodeum, dorsal view, **E.** First and second tergites, dorsal view, **F.** Metasoma, dorsal view.

Discussion

As a crossroad between the Eastern Mediterranean area and the Oriental region, Iran is home to representatives of the Middle East and Central Asian parasitoid faunas (Rakhshani et al., 2008). According to previous studies, 33 species belong to tribe Heresiarchini has been reported from Iran (Table 1). Most species are attributed to the genus *Coelichneumon*. The members of this tribe attacking lepidopterous larvae (19 families) (Yu et al., 2016), sometimes coleoptera (Curculionidae) and Hymenoptera (Cimbicidae, Pamphilidae) are reported as their hosts (Dalla Torre, 1902; Rudow, 1917). In this study, the biology of recorded species is unknown because the specimens were collected by Malaise trap; The number of Heresiarchini species were reported in neighboring countries including: former USSR 209 species, Turkey 35 species, Tajikistan four species, Turkmenistan one species, Armenia one species, Afghanistan nine species, Azerbaijan 20 species and Pakistan three species (Yu et al., 2016). We expected that the tribe Heresiarchini fauna of Iran be substantially increased in next studies.

Table 1. Updated checklist of the tribe Heresiarchini species known in Iran.

Species	Distribution in Iran (provinces)	References
Amblyjoppa fuscipennis (Wesmael, 1845)	East Azarbaijan	Ghahari & Jussila (2010)
Callajoppa caspica (Heinrich, 1929)	Fars	Kolarov & Ghahari (2005)
Coelichneumon afghanicus (Heinrich, 1957)	Mazandaran	Kolarov & Ghahari (2008)
Coelichneumon biannulatus (Gravenhorst, 1820)	Ardabil; Mazandaran; Zanjan	Kolarov & Ghahari (2008); Ghahari & Jussila (2010, 2016)
Coelichneumon biguttulatus (Kriechbaumer, 1875)	Guilan, Mazandaran	Kolarov & Ghahari (2008)
Coelichneumon bohemani (Holmgren, 1864)	Lorestan	Ghahari & Gadalla (2015)
Coelichneumon comitator (Linnaeus, 1758)	Not defined; Golestan; Tehran; Khorasan-e Razavi, Alborz	Heinrich (1929); Kolarov & Ghahari (2008); Masnadi & Jussila (2008); Ghahari & Jussila (2014); current study
Coelichneumon desinatorius (Thunberg, 1822)	Qazvin; Golestan; Guilan	Kolarov & Ghahari (2008)
Coelichneumon deliratorius (Linnaeus, 1758)	Guilan; Golestan; Qazvin	Kolarov & Ghahari (2005, 2008); Masnadi & Jussila (2008)
Coelichneumon dorsosignatus (Berthoumieu & Eversmann, 1894)	Mazandaran	Kolarov & Ghahari (2008)
Coelichneumon erythromerus (Rudow, 1888)	Ardabil	Ghahari et al. (2010b)
Coelichneumon falsificus (Wesmael, 1845)	Khuzestan	Kolarov & Ghahari (2008)
Coelichneumon fasciatus (Gmelin, 1790)	Mazandaran	Ghahari & Jussila (2010)

Table 1. continued

Coelichneumon iranicus (Riedel, 2017)	East Azarbaijan, West Azarbaijan	Riedel & Aghadokht (2017)
Coelichneumon leucocerus (Gravenhorst, 1820)	Hamedan; East Azarbaijan; West Azarbaijan	Kolarov & Ghahari (2008); Ghahari & Jussila (2011b)
Coelichneumon melanocastaneus (Riedel, 2017)	Golestan	Riedel & Aghadokht (2017)
Coelichneumon nigerrimus (Stephens, 1835)	West Azarbaijan; Tehran	Kolarov & Ghahari (2005, 2008); Ghahari (2014)
Coelichneumon nigrifrons (Riedel, 2017)	Golestan	Riedel & Aghadokht (2017)
Coelichneumon nigratus (Berthoumieu, 1894)	Guilan	Kolarov & Ghahari (2005)
Coelichneumon nobilis (Wesmael, 1857)	Golestan	Riedel & Aghadokht (2017)
Coelichneumon nudicoxator (Aubert, 1966)	Semnan	Ghahari (2012)
Coelichneumon orbitator (Thunberg, 1822)	Chaharmahal-o-Bakhtiari; Esfahan; Markazi; Fars; Mazandaran	Kolarov & Ghahari (2008); Masnadi & Sadeghi (2006); Masnadi & Jussila (2008)
Coelichneumon probator Horstmann, 2000*	Guilan	Current study
Coelichneumon problematicus (Riedel, Coruh & Ozbek, 2010)	Tehran	Riedel et al. (2010)
Coelichneumon singularis (Berthoumieu, 1892)	Sistan and Baluchestan; Fars; East Azarbaijan	Kolarov & Ghahari (2008); Masnadi & Jussila (2008); Masnadi & Sadeghi (2006); Ghahari & Jussila (2011b)
Coelichneumon validus (Berthoumieu, 1894)	Tehran	Masnadi & Jussila (2008)
Lymantrichneumon disparis (Poda, 1761)	Mazandaran	Kolarov & Ghahari (2005, 2008)
Protichneumon fusorius (Linnaeus, 1761)	Mazandaran	Ghahari et al. (2010a)
Protichneumon persicus Morley, 1915	Golestan	Kolarov & Ghahari (2005)
Protichneumon pisorius (Linnaeus, 1758)	Khorasan-e Razavi; Mazandaran	Ghahari & Jussila (2011a, c); Ghahari & Schwarz (2011)
Protichneumon similatorius (Fabricius, 1798)	Not defined	Kolarov & Ghahari (2005)
Syspasis carinator (Fabricius, 1798)	Tehran, Alborz	Ghahari (2014), current study
Syspasis rufina (Gravenhorst, 1820)	Guilan; East Azarbaijan	Kolarov & Ghahari (2005); Ghahari & Jussila (2011d)
Syspasis scutellator (Gravenhorst, 1829)	Mazandaran; West Azarbaijan; Tehran	Kolarov & Ghahari (2008); Masnadi & Jussila (2008)

* New records for the Iranian insect fauna.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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مطالعه قبیله Heresiarchini (Hym., Ichneumonidae, Ichneumoninae) در شمال ایران، به همراه یک گزارش جدید برای خاورمیانه

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چکیده: در این تحقیق قبیله Heresiarchini (Hymenoptera: Ichneumonidae, Ichneumoninae) در استان‌های البرز و گیلان مورد مطالعه رده‌بندی قرار گرفت. نمونه‌ها با استفاده از تله مالیز طی ماه‌های اسفند تا آذر ۱۳۸۸ و ۱۳۸۹ جمع‌آوری شدند. سه گونه شامل *Coelichneumon comitator* (Linnaeus, 1758)، *Coelichneumon probator* Horstmann, 2000 و *Syspasis carinator* (Fabricius, 1798) شناسایی شد که از میان آنها گونه *Coelichneumon probator* برای اولین بار از ایران و خاورمیانه گزارش می‌شود. چک‌لیست به روز شده قبیله Heresiarchini به همراه خصوصیات افتراقی گزارش جدید ارایه شده است.

واژگان کلیدی: Ichneumonidae، Ichneumoninae، Heresiarchini، *Coelichneumon*، ایران