Additions to the Iranian fauna of Ichneumonidae (Hymenoptera: Ichneumonoidea) with first records of two genera and 13 species

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ABSTRACT. This paper provides new information on the distribution of 32 species of Ichneumonidae (Hymenoptera: Ichneumonoidea) in Iran. Two genera i.e. Isadelphus Forster, 1869 and Linycus Cameron, 1903 as well as 13 species i.e. Casinaria mesozosta (Gravenhorst, 1829), Cymodusa antennator Holmgren, 1880, Gambrus tricolor (Gravenhorst, 1829), Ichneumon inops Holmgren, 1880, Idiolispa grossa (Gravenhorst, 1829), Isadelphus gallicola (Bridgman, 1880), Linycus exhortator (Fabricius, 1787), Lissonota buccator (Thunberg, 1822), L. carbonaria Holmgren, 1860, L. coracina (Gmelin, 1790), L. folii Thomson, 1877, L. saturator (Thunberg, 1822), Theroscopus esenbackii (Gravenhorst, 1829) are newly added to the Iranian wasp fauna.

Key words: Taxonomy, parasitoid, distribution, new record


Introduction

The family Ichneumonidae is an extremely large, diverse and beneficial group of parasitic wasps with 38 subfamilies and 25285 described species worldwide (Quicke, 2015; Yu et al., 2016). Over the last two decades, the ichneumonid wasp fauna in Iran has received increasing attention and as a result many faunistic studies have been published in the country (Barahoei et al., 2012, 2013, 2014, 2015a, 2015b; Barahoei, 2014; Kazemi et al., 2014; Mohebban et al., 2015, 2016; Sarafi et al., 2015; Mahyabadi et al., 2016; Mohammadi-Khoramabadi et al., 2016; Aghadokht et al., 2017; Amiri et al., 2017; Riedel & Aghadokht, 2017; Etemadi et al., 2018; Shirzadegan et al., 2018; Riedel et al., 2019a). Moreover, a number of new species have been recently described from Iran (Riedel & Aghadokht, 2017; Riedel et al., 2018, 2019a, 2019b).

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The aim of the present study is to improve our knowledge on this diverse group of parasitoid wasps and to provide further information on the fauna of ichneumonid wasps in two provinces, Alborz and Fars of Iran.

Material and methods
Surveys were carried out from March to October 2015 using standard Malaise traps in the provinces of Fars (Southwestern Iran) and Alborz (Northern Iran) in the following six localities. The collecting pot of each trap was filled with ethanol 70% as killing and preservation medium. The captured specimens were removed by an interval of two weeks. The ichneumonid specimens were then dried and pinned or card mounted using AXA method (Van Achterberg, 2009). Identification were made using available illustrations and keys provided for Banchinae (Kasparyan, 1981a) and Campopleginae (Kasparyan, 1981b; Dbar, 1984, 1985; Amiri et al., 2017; Riedel, 2018). Identification of Cryptinae, Ichneumoninae and Tryphoninae species and final confirmation of all species were done by R. Jussila (the fourth author) comparing with specimens in Zoological Museum, Section of Biodiversity and Environmental Sciences, Department of Biology, University of Turku, Finland.

loc. 1. IRAN, Alborz, Arangeh, 35°55′ N, 51°04′ E, 1800 m, leg. B. M. Jahromi. Arganeh is a small village in the South Alborz Protected Area (Noroozi et al., 2018). The Malaise trap was located in a pear orchard.

loc. 2. IRAN, Alborz, Kor dan, Deh Varde, 35°55′ N, 50°49′ E, 1400 m, leg. B. M. Jahromi. This area also has a mountainous climate similar to Arangeh, but located at a lower altitude. The Malaise trap was situated in a cherry orchard.

loc. 3. IRAN, Fars, Larestan, 27°13′ N, 54°25′ E, 779 m, leg. A. Falahatpisheh. Larestan is located in the south of Fars province and has a very hot climate, with hot and dry deserts, water shortages and many salt domes. The vegetation includes eucalyptus (Eucalyptus spp.), acacia (Acacia spp.), jujube (Ziziphus spp.) and olive (Olea spp.). The pastures are mostly covered with milkvetch (Astragalus spp.). The Malaise trap was located in an orange orchard.

loc. 4. IRAN, Fars, Larestan, 27°38′ N, 54°16′ E, 820 m, leg. A. Falahatpisheh. The Malaise trap was situated in a Eucalyptus plantation.

loc. 5. IRAN, Fars, Larestan, Hormood, 27°32′ N, 54°59′ E, 646 m, leg. A. Falahatpisheh. Hormood is located 100 km to the south of Larestan. Major agricultural crops in this plain are all kinds of vegetable such as tomato, cucumber, eggplant and pumpkin. The Malaise trap was situated in a tomato field.

loc. 6. IRAN, Fars, Larestan, Nime, 27°31′ N, 54°26′ E, 810 m, leg. A. Falahatpisheh. Nime is located at 15 to 20 km to the south-east of Larestan. There are agricultural crops such as wheat, barley, canola, alfalfa, and citrus orchards in this plain. The Malaise trap was located in an alfalfa field.

Voucher specimens are deposited at insect collection of college of Agriculture and Natural Resources of Darab, Shiraz University and private collection of Dr. R. Jussila at University of Turku, Finland. Nomenclature, classification and general distribution were adapted from Yu et al. (2016).
Results

In total, 32 species belonging to five subfamilies: Banchinae (seven species of two genera), Campopleginae (seven species of seven genera), Cryptinae (ten species of nine genera), Ichneumoninae (seven species of five genera) and Tryphoninae (one species of one genus) were collected and identified. Two genera and 13 species are newly recorded for the fauna of Iran, indicated by two (**) and one asterisks (*), respectively. The species are listed alphabetically.

I. Banchinae Wesmael, 1845

*Exetastes adpressorius (Thunberg, 1822)*


Distribution in Iran: Fars and Kerman provinces (Sarafi et al., 2015; Mohebban et al., 2016).

General distribution: Holarctic.

*Lissonota buccator (Thunberg, 1822)*


Distribution in Iran: Alborz and Fars provinces (new record for Iran).

General distribution: Western Palaearctic.

*Lissonota carbonaria Holmgren, 1860*

Material examined: Iran, Fars province, Larestan, 1♀, 12–26.VII.2015.

Distribution in Iran: Fars province (new record for Iran).

General distribution: Palaearctic.

*Lissonota clypeator (Gravenhorst, 1829)*

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.

Distribution in Iran: Fars province (Amiri et al., 2016), Kerman (Mohebban et al., 2016) and Alborz provinces (Current study).

General distribution: Holarctic.

*Lissonota coracina (Gmelin, 1790)*

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.

Distribution in Iran: Alborz province (new record for Iran).

General distribution: Holarctic.

*Lissonota folii Thomson, 1877*

Material examined: Iran, Alborz province, Kordan, Deh Varde, 1♀, 6–20.VIII.2015.

Distribution in Iran: Alborz province (new record for Iran).

General distribution: Holarctic.
**Lissonota saturator** (Thunberg, 1822)*
**Material examined:** Iran, Fars province, Larestan, 1♀, 29.III.2015–9.IV.2015.
**Distribution in Iran:** Fars province (**new record for Iran**).
**General distribution:** Palaearctic.

II. Campopleginae Förster, 1869

**Casinaria mesozosta** (Gravenhorst, 1829)*
**Material examined:** Iran, Fars province, Larestan, 2♀♀, 25.IV.2015–7.V.2015.
**Distribution in Iran:** Fars province (**new record for Iran**).
**General distribution:** Western Palaearctic.

**Campoplex multicinctus** Gravenhorst, 1829
**Material examined:** Iran, Fars province, Larestan, 2♀♀, 23.IX.2015–5.X.2015
**Distribution in Iran:** Tehran (Masnadi-Yazdinejad et al., 2010) and Fars provinces (Current study).
**General distribution:** Palaearctic, Oriental and Nearctic (Introduced into U.S.A.).

**Cymodusa antennator** Holmgren, 1860 *
**Material examined:** Iran, Fars province, Larestan, 1♀, 25.IV.2015–7.V.2015; Alborz province, Kordan, Deh Varde, 1♂, 6–20.VIII.2015.
**Distribution in Iran:** Fars and Alborz provinces (**new record for Iran**).
**General distribution:** Palaearctic, Oriental and Afrotropical (Introduced into South Africa).

**Diadegma anurum** (Thomson, 1887)
**Material examined:** Iran, Fars province, Larestan, 2♀♀, 25.IV.2015–7.V.2015.
**Distribution in Iran:** [Reported through a misidentification from Alborz province by Golizadeh et al. (2008) but corrected by Karimzadeh & Broad (2013)]; Golestan (Masnadi-YazdiNejad et al., 2010) and Fars provinces (Current Study).
**General distribution:** Palaearctic.

**Diadegma fenestrale** (Holmgren, 1860)
**Material examined:** Iran, Fars province, Larestan, 2♀♀, 25.IV.2015–7.V.2015.
**Distribution in Iran:** Fars province (Masnadi-YazdiNejad, 2006).
**General distribution:** Palaearctic, Oriental, Oceanic.

**Hyposoter leucomerus** (Thomson, 1887)
**Distribution in Iran:** Tehran (Hasanshahi et al., 2015c) and Fars provinces (Current Study).
**General distribution:** Western Palaearctic.
*Venturia canescens* (Gravenhorst, 1829)
Material examined: Iran, Fars province, Larestan, 2♀, 5–12.X.2015.
Distribution in Iran: Guilan, Kerman, Khorasan-e-Razavi and Fars provinces (Barahoei et al., 2012).

III. Cryptinae Kirby, 1837

*Cryptus armator* (Fabricius, 1804)
Material examined: Iran, Alborz province, Kordan, Deh Varde, 3♀, 6–20.VIII.2015
Distribution in Iran: Kerman (Mohebban et al., 2016) and Alborz province (Current study).
General distribution: Palaearctic.

*Dichrogaster perlae* (Doumenc, 1855)
Distribution in Iran: Fars (Etemadi et al., 2018) and Alborz provinces (Current study).
General distribution: Western Palaearctic.

*Gambrus tricolor* (Gravenhorst, 1829)*
Distribution in Iran: Alborz and Fars provinces (new record for Iran).
General distribution: Western Palaearctic.

*Idiolispa grossa* (Gravenhorst, 1829)*
Distribution in Iran: Alborz and Fars provinces (new record for Iran).
General distribution: Western Palaearctic.

*Isadelphus gallicola* (Bridgman, 1880)**
Distribution in Iran: Fars province (new record for Iran). The genus is newly recorded from Iran.
General distribution: Western Palaearctic.

*Meringopus pseudonymus* (Tschek, 1878)
Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀, 6–20.VIII.2015.
Distribution in Iran: West Azarbaijan, Lorestan (Barahoei et al., 2012) and Alborz provinces (Current study).
General distribution: Palaearctic.
Mesostenus graminicus Gravenhorst, 1829


Distribution in Iran: Fars, Kerman (Mahyabadi et al., 2016) and Alborz provinces (current study).

General distribution: Palaearctic.

Theroscopus esenbeckii (Gravenhorst, 1829)*


Distribution in Iran: Fars province (new record for Iran).

General distribution: Western Palaearctic.

Trychosis legator (Thunberg, 1824)


Distribution in Iran: Fars, Kerman, Sistan and Baluchestan, West Azarbaijan, Khorasan-e Razavi, Qazvin (Mahyabadi et al., 2016) and Alborz provinces (Current study).

General distribution: Western Palaearctic.

Trychosis tristator (Thomson, 1871)


Distribution in Iran: West Azarbaijan (Mahyabadi et al., 2016) and Fars provinces (Current study).

General distribution: Palaearctic.

IV. Ichneumoninae Latreille, 1802

Barichneumon derogator (Wesmael, 1845)


Distribution in Iran: Kerman (Mohebban et al., 2015) and Fars provinces (Current study).

General distribution: Palaearctic.

Ctenichneumon devylderi (Holmgren, 1871)

Material examined: Iran, Alborz province, Kordan, Deh Varde, 3♀♀, 6–20.VIII.2015.

Distribution in Iran: Qom (Masnadi-Yazdinejad & Jussila, 2008), Kerman (Mohebban et al., 2015) and Alborz provinces (Current study).

General distribution: Palaearctic.
**Ichneumon inops** Holmgren, 1880*
**Material examined:** Iran, Alborz province, Kordan, Deh Varde, 1♀, 6–20.VIII.2015.
**Distribution in Iran:** Alborz province (new record for Iran).
**General distribution:** Palaearctic.

**Ichneumon melanosomus** Wesmael, 1855
**Material examined:** Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.
**Distribution in Iran:** West Azerbaijan (Barahoei et al., 2012) and Alborz provinces (Current study).
**General distribution:** Western Palaearctic.

**Ichneumon sarcitorius caucasicus** Meyer, 1926
**Material examined:** Iran, Alborz province, Arangeh, 2♀♀, 13–27.IX.2015.
**Distribution in Iran:** Northern Khorasan, Kerman (Mohebban et al., 2017) and Alborz provinces (Current study).
**General distribution:** Western Palaearctic, Oceanic.

**Linycus exhortator** (Fabricius, 1787)**
**Material examined:** Iran, Fars province, Larestan, 1♀, 29.III.2015–9.IV.2015; Alborz province, Arangeh, 1♀, 13–27.IX.2015.
**Distribution in Iran:** Fars and Alborz provinces (new record for Iran). The genus is newly recorded from Iran.
**General distribution:** Holarctic.

**Probolus concinnus** Wesmael, 1853
**Material examined:** Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.
**Distribution in Iran:** East Azerbaijan (Barahoei et al., 2012) and Alborz provinces (Current study).
**General distribution:** Palaearctic.

**V. Tryphoninae** Shuckard, 1840
**Netelia semenowi** (Kokujev, 1899)
**Material examined:** Iran, Alborz province, Kordan, Deh Varde, 3♀♀, 6–20.VIII.2015.
**Distribution in Iran:** Not exactly defined (Barahoei et al., 2012); Alborz province (Current study).
**General distribution:** Palaearctic.

**Discussion**
Here, we present new distributional data for 32 Ichneumonid species collected during the year 2015 in two provinces Alborz and Fars. Two genera and 13 species are newly added to the Iranian wasp fauna. With this publication and other recently published data in 2019
(Mohammadi-Khoramabadi et al., 2020; Riedel et al., 2019a), the number of some Iranian Ichneumonid subfamilies (e.g. 216 Ichneumoninae species) corresponds to some rather well-studied neighboring countries, e.g. Turkey with 218 ichneumoninae species (Yu et al., 2016). Now, the number of Iranian Banchinae, Ichneumoninae and Cryptinae increased to 27, 216 and 138 species, respectively (Barahoei et al., 2012; Amiri et al., 2016; Mahyabadi et al., 2016; Mohammadi-Khoramabadi et al., 2016; Riedel & Aghadokht, 2017; Shirzadegan et al., 2018; Riedel et al., 2019a). But, the presence of a large new records in this study and the recent publication of (Riedel et al. (2019a)) may indicate that the Iranian Ichneumonidae not thoroughly explored yet.

Table 1. The adult flight period of the current known ichneumonids during 2015 in Iran.

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<td>Idiolispa grossa</td>
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<td>Ctenichneumon devylderi</td>
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</table>
Most of the species collected in the current study restricted to the Palaearctic region (26 species, 81.26%), whereas only a single species (3.12%) distributed in all biogeographic areas and is a cosmopolitan species. Moreover, four species (12.5%) are distributed in the Holarctic region, while a slight overlap with the fauna of the Oriental region (a single species, 3.12%).

The host range of the current ichneumonid wasps is highly variable, some attacking a wide variety (i.e. E. adpressorius, L. buccator, L. carbonaria, L. clypeator, L. coracina, L. folii, L. saturator, C. multicinctus, D. fenestrale, V. canescens, G. tricolor, I. gallicola, M. grammicus, T. esenbeckii, I. sarcitorius) and others being specialized to one (i.e. M. pseudonymus) or a few host species (i.e. C. mesozosta, C. Antennator, D. anurum, H. leucomerus, C. armator, D. perlae, T. legator, T. tristator, B. derogator, L. exhortatory). They attack hosts in the orders Lepidoptera (i.e. E. adpressorius, L. buccator, L. carbonaria, L. clypeator, L. coracina, L. folii, L. saturator, C. mesozosta, C. multicinctus, C. antennator, D. anurum, D. fenestrale, H. leucomerus, V. canescens, C. armator, G. tricolor, I. gallicola, M. pseudonymus, M. grammicus, T. esenbeckii, T. legator, B. derogator, I. sarcitorius, L. exhortatory), Hymenoptera (i.e. G. tricolor, I. gallicola, T. esenbeckii), Diptera (i.e. L. buccator, D. fenestrale) Coleoptera (i.e. L. buccator, D. anurum, D. fenestrale, I. gallicola), Neuroptera (i.e. D. perlae), as well as spiders and spider egg sacs (T. legator, T. tristator) (Quicke, 2015; Yu et al., 2016). In biological control perspective of important agricultural pests and because of high reproductive capacity and ease of mass rearing, the performance of V. canescens has been recently determined on five resistant cultivars of pomegranate as a promising biological control agent of the carob moth, Apomyelois ceratoniae Zeller, 1839 (Lep.: Pyralidae) in Iran (Kishani-Farahani et al., 2012; Abedi et al., 2020). Some species, i.e. H. leucomerus may affect their host pest populations to some lower degree in a parasitoids complex (Razmi et al., 2011; Hasanshahi et al., 2015a, 2015b, 2015c). On the other hand, species of the genera Dichrogaster (i.e. D. perlae) and Trychosis (i.e. T. legator and T. tristator) negatively affect the predator populations of Neuroptera and spiders (Yu et al., 2016). As Malaise traps were used for collecting in the current study, no conclusions on biological traits such as host specificity can be made. Therefore, an intensive collection and further studies on the distribution, systematics, behavior and biology should be supported.

The adult flight period of the known ichneumonids in this study show some differences (Table 1). Seven species, i.e. L. buccator, C. antennator, D. perlae, G. tricolor, I. grossa, M. grammicus and T. legator which were found both in the southwest (Larestan, Fars province) and in the north (Alborz province) of Iran, and H. leucomerus, T. esenbeckii and L. exhortatory which were captured only in Larestan (southwest of Iran) showed two periods of appearance. The rest appeared in one period (Table 1) but cannot completely reflect their annual flight period in their habitat.

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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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References


اطلاعات جدید از فون زنبورهای خانواده Ichneumonidae

ایران با گزارش دو جنس و سیزده گونه جدید

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چکیده: این مقاله، اطلاعات جدیدی از پراکنش ۲۲ گونه از زنبورهای خانواده Ichneumonidae (Hymenoptera: Ichneumonoidea) در ایران فراهم نموده است. دو جنس ۱۸۶۹ Lycus Cameron، ۱۹۰۳ و Isadelphus Forster، ۱۸۶۹ Cymodusa Casinaria mesozosta (Gravenhorst، ۱۸۲۹) و Cambrus tricolor (Gravenhorst، ۱۸۲۹) antennator Holmgren، ۱۸۶۰ Idiolispa grossa (Gravenhorst، ۱۸۲۹) Ichneumon inops Holmgren، ۱۸۸۰ Lycus exhortator (Fabricius، ۱۷۸۷) Isadelphus gallicola (Bridgman، ۱۸۸۰) L. carbonaria Holmgren، Lissonota buccator (Thunberg، ۱۸۲۲) و L. saturator L. folii Thomson، ۱۸۷۷ L. coracina (Gmelin، ۱۷۹۰) ۱۸۸۰ L. folii Thomson، ۱۸۷۷ L. coracina (Gmelin، ۱۷۹۰) ۱۸۸۰ L. saturator (Thunberg، ۱۸۲۲) و Theroscopus essenbackii (Gravenhorst، ۱۸۲۹) به فون زنبورهای ایران اضافه شدند.

واژگان کلیدی: طبقه‌بندی، پارازیتیوید، پراکش، گزارش جدید