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Research Article

A survey on Ichneumonidae of Isfahan province, central Iran

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Abstract: Fauna of Ichneumonidae of Isfahan province was studied in 2012. Specimens were collected using sweep net and Malaise trap on various plants from different places in Isfahan. Totally, 18 species belong to 16 genera and 7 subfamilies were collected and identified as: *Anomalon cruentatum* (Geoffroy, 1785) (Anomaloninae); *Exetastes syriacus* Schmiedeknecht, 1910 (Banchinae); *Diplazon laetatorius* (Fabricius, 1781), *Enizemum ornatum* (Gravenhorst, 1829), *Homotropus nigritarsus* (Gravenhorst, 1829), *Homotropus signatus* (Gravenhorst, 1829), *Promethes sulcator* (Gravenhorst, 1829) and *Syrphophilus bizonarius* (Gravenhorst, 1829) (Diplazontinae); *Anisobas cingulatellus* Horstmann, 1997, *Diadromus collaris* (Gravenhorst, 1829), *Heterischnus filiformis* (Gravenhorst, 1829) and *Spilothyrateles nuptatorius* (Fabricius, 1793) (Ichneumoninae); *Exochus castaniventris* Brauns, 1896 (Metopiinae); *Itoplectis alternans* (Gravenhorst, 1829), *Itoplectis tunetana* (Schmiedeknecht, 1914), *Pimpla spuria* Gravenhorst, 1829 and *Zaglyptus multicolor* (Gravenhorst, 1829) (Pimplinae) and *Aneuclis incidens* (Thomson, 1889) (Tersilochinae). All species are new record for Isfahan province except for *Exochus castaniventris* and *Heterischnus filiformis* is newly recorded from Iran.

Keywords: *Heterischnus filiformis*, distribution, new record, Isfahan

Introduction

The family Ichneumonidae is an extremely large group of insects with about 60,000 estimated species classified into 48 subfamilies (Yu *et al*., 2012). Species of this family are important biological control agents of insect pests in the orders Coleoptera, Diptera, Hymenoptera and Lepidoptera (Townes, 1971; Wahl, 1993; Gauld *et al*., 2002; Finch, 2005; Gauld and Dubois, 2006; Sugonyaev, 2006). Until now, 36 species of ichneumonids belonging to 11 subfamilies were reported with host from Iran including: Acaenitinae (1 species), Anomaloninae (2 species), Campopleginae (8 species), Cremastinae (2 species), Cryptinae (8 species), Diplazontinae (2 species), Ichneumoninae (7 species), Pimplinae (5 species) and Xoridinae (1 species) (Barahoei *et al*., 2012).

Yet, 540 species belonging to 24 subfamilies have been recorded for the fauna of Iran (Nikdel and Diller, 2011; Abbasipour *et al*., 2012; Barahoei *et al*., 2012, 2014a; Ghahari and Schwarz, 2012; Mohammadi-khoramabadi and Talebi, 2013), of which 27 species have been reported from Isfahan province (Barahoei *et al*., 2012, 2014a). Two subfamilies, Ichneumoninae Latreille and Cryptinae Kirby have 199 and 99 reported species, respectively, comprising the most species-rich groups of the ichneumonids Iran.

In this paper we present new information on occurrence of some species of the subfamilies

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Anomaloninae, Banchinae, Diplazontinae, Ichneumoninae, Metopiinae, Pimplinae and Tersilochinae from Isfahan province.

Materials and Methods

The sampling was carried out during June-November 2012 in several parts (Ahmadreza, Baba peerahmad-ben, Chamtagh, Darafshan, Filour, Flavarjan, Hoyeh, Jafarabad, Morghab, Najafabad, Nazhvan, Neysian, Sadeghabad, Tanbak) of Isfahan province (Fig. 1). Specimens were collected using sweep net and Malaise traps on various plants in different habitats including alfalfa, wheat and weeds. The specimens were extracted from the Malaise traps bi-weekly. The collected specimens were moved into ethanol 75%, then dried, pinned, mounted and labeled.

The external morphology of specimens was studied using NIKON SMZ645 stereomicroscope. Terminology of morphological characters follows Gauld (1991). Nomenclature and distribution data are mainly taken from Yu *et al*. (2012). The specimens were deposited in the Insect Collection at Zabol University, Zabol, Iran.

	Localities	Coordinates	(m A.S.L)
1	Ahmadreza	32°39'N, 51°41'E	1573
2	Baba peerahmad-ben	32°32'N, 50°44'E	2201
3	Chamtagh	32°30'N, 52°00'E	1521
4	Darafshan	32°59'N, 52°24'E	2363
5	Filour	32°31'N, 51°24'E	1619
6	Flavarjan	32°33'N, 51°30'E	1608
7	Hoyeh	32°38'N, 51°40'E	1578
8	Jafarabad	32°47'N, 51°00'E	2191
9	Morghab	32°07'N, 51°56'E	2018
10	Najafabad	32°38'N, 51°22'E	1648
11	Nazhvan	32°38'N, 51°38'E	1584
12	Neysian	32°58'N, 52°28'E	2201
13	Sadeghabad	32°37'N, 50°50'E	1935
14	Tanbak	32°09'N, 51°21'E	2255

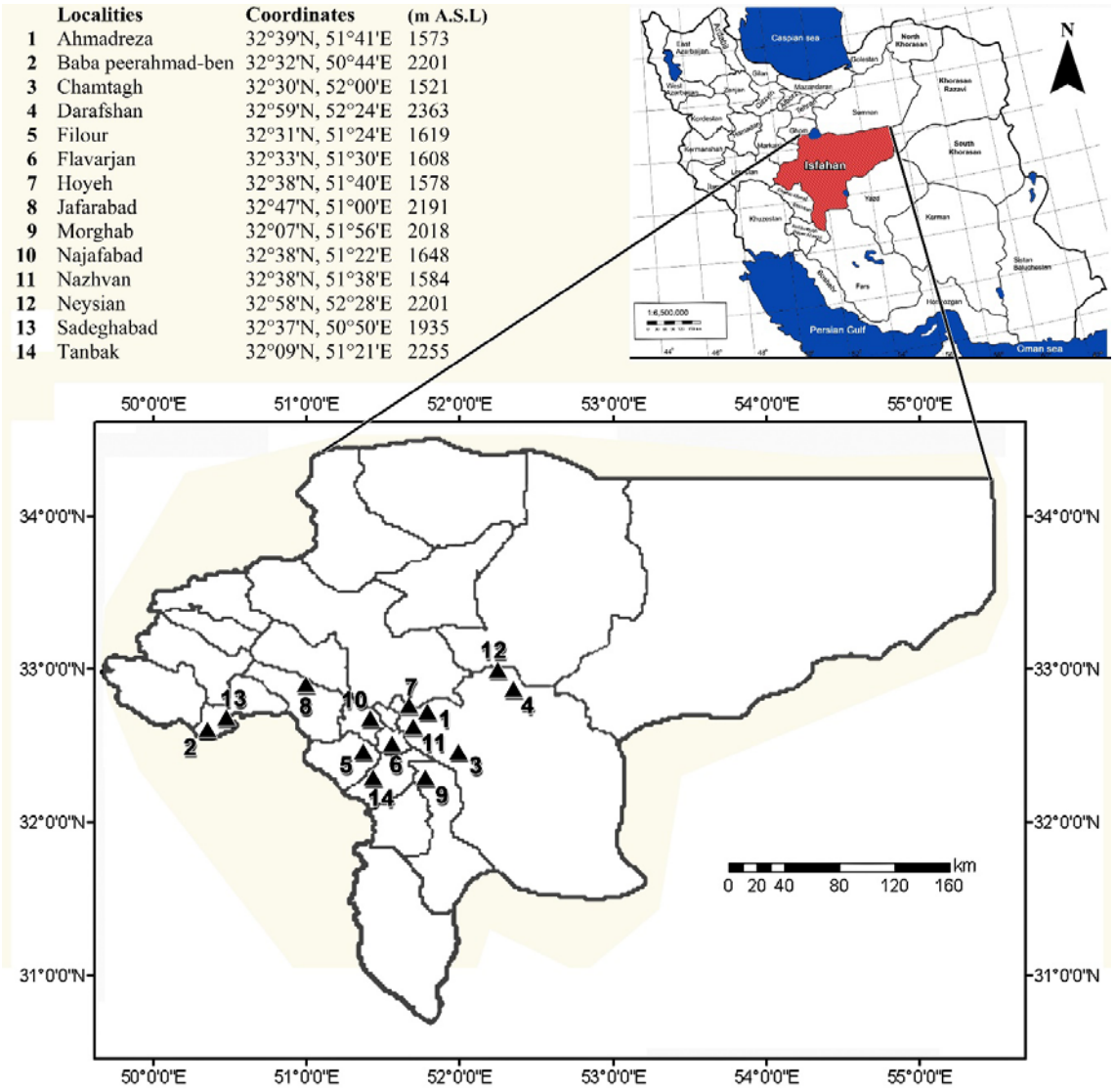

Figure 1 Map of the sampling localities at Isfahan province.

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Results

Totally, 144 specimens of Ichneumonidae belonging to six subfamilies, 16 genera and 18 species were collected and identified, of which *Heterischnus filiformis* (Gravenhorst, 1829) (Ichneumoninae) is newly recorded from Iran. All species are new records for Isfahan province except *Exochus castaniventris* Brauns, 1896. The data are sorted according to the valid name, author and year, material examined, distribution in Iran and general distribution.

Subfamily Anomaloninae Viereck, 1918
Tribe Anomalonini Viereck, 1918
***Anomalon cruentatum* (Geoffroy, 1785)**
Material examined: 3♀♀, swept on *Medicago sativa* L., Nazhvan, 27-X-2012, Leg. E. Nader.
Distribution in Iran: Ardabil (Masnadi and Jussila, 2009), Yazd (Zarepour *et al.,* 2009), East Azerbaijan (Ghahari and Jussila, 2011c), Sistan and Baluchestan (Barahoei *et al.,* 2012).
General distribution: Palaearctic and Oriental (Yu *et al*., 2012).

Subfamily Banchinae Wesmael, 1845
Tribe Atrophini Seyrig, 1932
***Exetastessyriacus* Schmiedeknecht, 1910**
Material examined: 1♀, swept on *Medicago sativa* L., Morghab, 19-VI-2012, Leg. E. Nader.
Distribution in Iran: Khorasan-e-Razavi (Barahoei *et al*., 2014b).
General distribution: Nearctic, Palaearctic (Yu *et al*., 2012).

Subfamily Diplazontinae Viereck, 1918
***Diplazon laetatorius* (Fabricius, 1781)**
Material examined: 3♀♀, Malaise trap, Neysian, 06-X-2012; 1♀, Malaise trap, Tanbak, 06-X-2012; 4♀♀, swept on aquatic plants, Hoyeh, 14-VI-2012; 2♀♀, swept on *Cynodon* sp., Jafarabad, 19-VI-2012; 2♀♀, swept on *Cynodon dactylon*, Neysian, 20-VIII-2012; 2♀♀, swept on Poaceae weed, Darafshan, 07-XI-2012; 3♀♀, swept on Poaceae weed, Filour, 28-IX-2012; 1♀, swept on Poaceae weed, Flavarjan, 02-VI-2012; 1♀, swept on Poaceae weed, Najafabad, 29-VI-2012; 4♀♀, swept on Poaceae weed, Nazhvan, 11-VI-2012; 4♀♀, swept on *Medicago sativa* L., Hoyeh, 14-VI-2012, Leg. E. Nader.
Distribution in Iran: West Azerbaijan, Khorasan-e-Shomali (Malkeshi and Kheiabani, 1997), Guilan, Mazandaran, Qazvin, Tehran (Mohammadi-Khoramabadi *et al*., 2013b), Kerman (Kolarov and Ghahari, 2005; Mohammadi-Khoramabadi *et al*., 2014), Chaharmahal-o-Bakhtiari (Nourbakhsh *et al.,* 2008), Mazanderan (Kolarov and Ghahari, 2005; Mohammadi-Khoramabadi *et al.,* 2013b), Sistan and Baluchestan (Barahoei *et al.,* 2013a), Yazd (Zarepour *et al.,* 2008, 2009).
General distribution: Worldwide (Yu *et al*., 2012).

***Enizemum ornatum* (Gravenhorst, 1829)**
Material examined: 2♂♂, swept on *Circium* sp., Morghab, 27-VI-2012; 1♂, swept on *Hordeum* sp., Jafarabad, 19-VI-2012, Leg. E. Nader.
Distribution in Iran: Kerman (Mohammadi-Khoramabadi *et al*., 2014), Qazvin (Mohammadi-Khoramabadi *et al.,* 2013b), Sistan and Baluchestan (Barahoei *et al.,* 2013a).
General distribution: Nearctic, Palaearctic, Oriental (Yu *et al*., 2012).

***Homotropus nigritarsus* (Gravenhorst, 1829)**
Material examined: 1♀, swept on aquatic plants, Hoyeh, 14-VI-2012; 1♂, swept on *Circium* sp., Morghab, 19-VI-2012, Leg. E. Nader.
Distribution in Iran: Guilan, Mazanderan, Qazvin, Tehran (Mohammadi-Khoramabadi *et al.,* 2013b).
General distribution: Nearctic, Palaearctic (Yu *et al*., 2012).

***Homotropus signatus* (Gravenhorst, 1829)**
Material examined: 1♂, Malaise trap, Neysian, 06-X-2012; 1♀, swept on *Medicago sativa* L., Hoyeh, 14-VI-2012; 1♀, Malaise trap, Jafarabad, 19-VI-2012, Leg. E. Nader.
Distribution in Iran: Kerman (Sarafi *et al*., 2014).
General distribution: Nearctic, Palaearctic (Yu *et al*., 2012).

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***Promethes sulcator* (Gravenhorst, 1829)**
Material examined: 1♀, Malaise trap, Tanbak, 06-X-2012; 1♀, swept on *Circium* sp., Nazhvan, 11-VI-2012; 1♀, swept on Poaceae weed, Chamtagh, 20-VIII-2012; 2♀♀ 1♂, swept on *Medicago sativa* L., Hoyeh, 16-VI-2012; 1♀ 1♂, Malaise trap, Nazhvan, 11-VI-2012, Leg. E. Nader.
Distribution in Iran: Guilan, Tehran (Mohammadi-Khoramabadi *et al.* 2013b), Sistan and Baluchestan (Barahoei *et al*., 2013a).
General distribution: Nearctic, Palaearctic, Oriental (Yu *et al*., 2012).

***Syrphophilus bizonarius* (Gravenhorst, 1829)**
Material examined: 1♀ 1♂, swept on Poaceae weed, Filour, 28-IX-2012; 1♀ 12♂♂, swept on Poaceae weed, Darafshan, 07-XI-2012; 11♂♂, swept on *Medicago sativa* L., Hoyeh, 14-VI-2012; 1♂, Malaise trap, Flavarjan, 02-VI-2012; 2♂♂, Malaise trap, Jafarabad, 19-VI-2012, Leg. E. Nader.
Distribution in Iran: Guilan, Mazanderan, Qazvin, Tehran (Mohammadi-Khoramabadi *et al.*, 2013b).
General distribution: Nearctic, Palaearctic, Oriental (Yu *et al*., 2012).

Subfamily Ichneumoninae Latreille, 1802
Tribe Ichneumonini Latreille, 1802
***Spilothyrateles nuptatorius* (Fabricius, 1793)**
Material examined: 1♂, Malaise trap, Najafabad, 01-VII-2012, Leg. E. Nader.
Distribution in Iran: Golestan (Kolarov and Ghahari, 2005).
General distribution: Palaearctic (Yu *et al*., 2012).

Tribe Listrodromini Förster, 1869
***Anisobas cingulatellus* Horstmann, 1997**
Material examined: 2♀♀ 2♂♂, Malaise trap, Tanbak, 06-X-2012, Leg. E. Nader.
Distribution in Iran: Semnan (Kolarov and Ghahari, 2008), Tehran (Masnadiand Jussila, 2008).
General distribution: Palaearctic (Yu *et al*., 2012).
Tribe Phaeogenini Förster, 1869

***Diadromus collaris* (Gravenhorst, 1829)**
Material examined: 1♂, swept on *Medicago sativa* L., Nazhvan, 27-X-2012; 1♂, swept on *Taraxacum* sp., Neysian, 20-VIII-2012; 3♀♀ 3♂♂, swept on aquatic plants, Hoyeh, 14-VI-2012; 2♀♀, Malaise trap, Nazhvan, 11-VI-2012; 2♂♂, Malaise trap, Hoyeh, 14-VI-2012; 1♀, Malaise trap, Baba peerahmad-ben, 22-VI-2012; 2♀♀, Malaise trap, Nazhvan, 20-VIII-2012, Leg. E. Nader.
Distribution in Iran: Golestan (Kolarov and Ghahari, 2008; Ghahari and Jussila, 2011a), Semnan (Ghahari, 2012), Sistan and Baluchestan (Firuzi Jahantighi *et al*., 2012; Barahoei *et al*., 2013a).
General distribution: Neotropical, Ethiopian, Palaearctic, Australasian (Yu *et al*., 2012).

***Heterischnus filiformis* (Gravenhorst, 1829) (Figs. 2, 3)**
Material examined: 2♀♀ 1♂, Malaise trap, Darafshan, 07-XI-2012; 2♀♀, swept on *Medicago sativa* L., Filour, 28-IX-2012; 1♀, Malaise trap, Ahmadreza, 19-VI-2012; 1♀, Malaise trap, Najafabad, 03-VII-2012, Leg. E. Nader.
Distribution in Iran: new record from Iran.
General distribution: Europe (Yu *et al*., 2012).
Diagnostic characters: The three basal and the four apical flagellomeres black, others brown, white in the middle (Fig. 3A), flagellar segments with tyloid in male specimen, head black, without yellow drawing, gena weakly punctured, frons with dense and rough punctation, temple deep, occiput weakly punctured (Figs. 2A, B), notauli broad and shallow depressed (Figs. 2C, D), forewings with irregular pentagonal areola, 2m-cu with 2 bullae (Fig. 2E), trochanter brown (Fig. 3A), propodeum carinated, with central areola (Fig. 2F), second abdominal tergite long and wide (Figs. 3A, B), the last two metasomal tergites black with white posterior margins (Fig. 2G), ovipositor sheet short, white in basal 1/4 and black in remaining ¾ (Fig. 2G), body length: 8-9 mm in female and 6-7 mm in male (Fig. 3).

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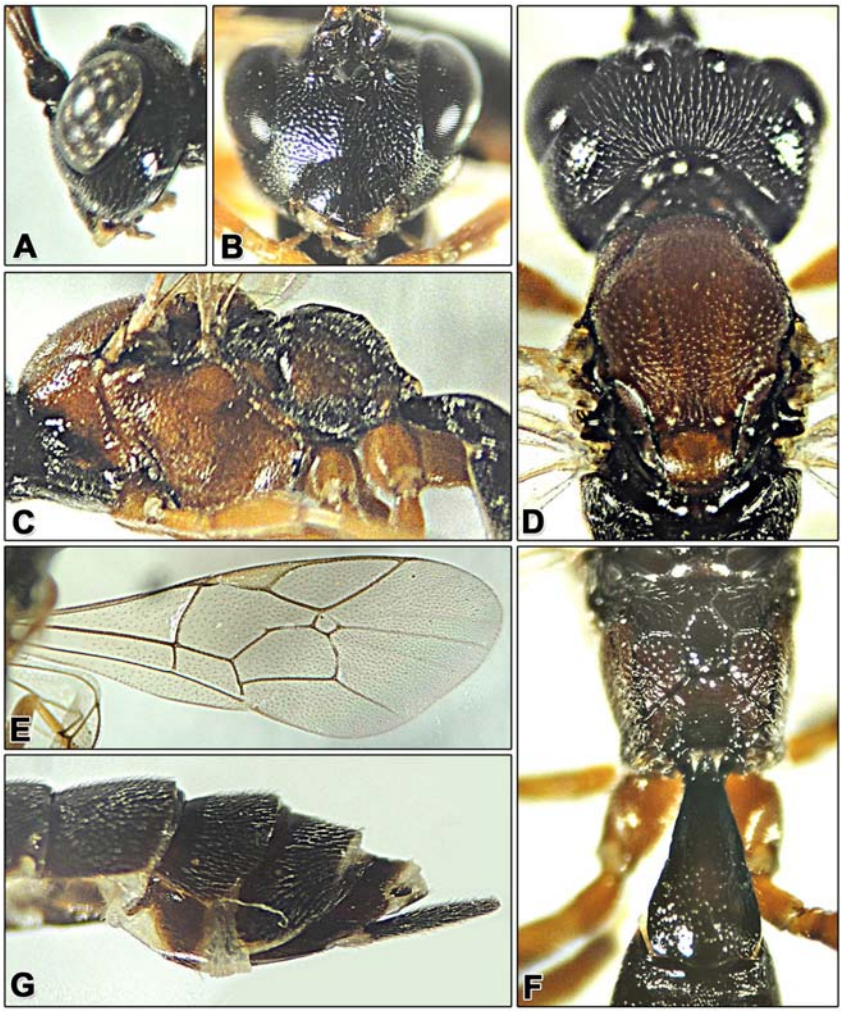

Figure 2 The external morphology of female specimen of *Heterischnus filiformis* (Gravenhorst): A- lateral view of head; B- anterior view of head; C- lateral view of thorax, propodeum and first segment of gaster; D- dorsal view of head and mesoscutum; E- forewing; F- dorsal view of propodeum and first segment of gaster; G- hind segments of gaster and ovipositor sheets.

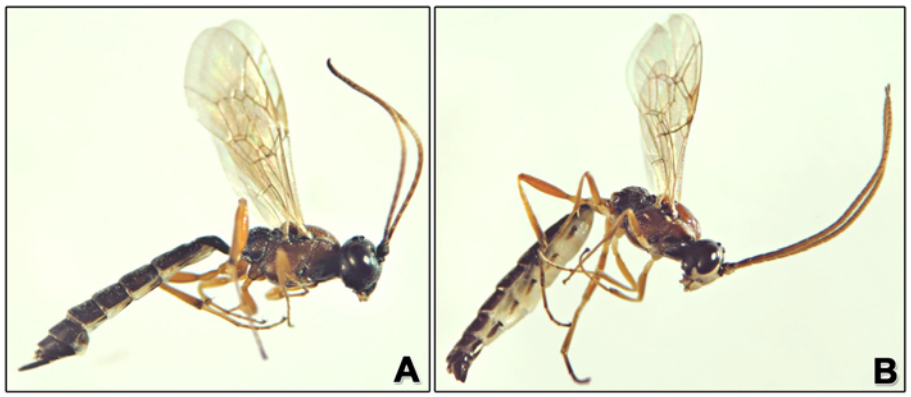

Figure 3 Lateral view of *Heterischnus filiformis* (Gravenhorst): A) female specimen, B) male specimen.

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Subfamily Metopiinae Förster, 1869
***Exochus castaniventris* Brauns, 1896**
Material examined: 1♂, Malaise trap, Baba peerahmad-ben, 22-VI-2012; 7♀♀ 3♂♂, swept on Poaceae weed, Darafshan, 07-XI-2012; 1♂, swept on *Medicago sativa* L., Filour, 28-IX-2012; 1♂, Malaise trap, Hoyeh, 14-VI-2012; 1♂, swept on *Medicago sativa* L., Morghab, 19-VI-2012; 9♀♀ 7♂♂, Malaise trap, Najafabad, 02-VII-2012; 1♀ 3♂♂, Malaise trap, Nazhvan, 20-VIII-2012; 1♂, swept on *Cirsium* sp., Sadeghabad, 06-VI-2012, Leg. E. Nader.
Distribution in Iran: Isfahan, Tehran (Masnadi and Jussila, 2009), Qazvin (Ghahari and Schwarz, 2012), Semnan (Ghahari, 2012).
General distribution: Palaearctic (Yu *et al*., 2012).

Subfamily Pimplinae Wesmael, 1845
Tribe Ephialtini Hellén, 1915
***Zaglyptus multicolor* (Gravenhorst, 1829)**
Material examined: 1♀ 1♂, Malaise trap, Ahmadreza, 19-VI-2012; 1♀, Malaise trap, Baba peerahmad-ben, 22-VI-2012, Leg. E. Nader.
Distribution in Iran: Kerman, Khorasan-e-Razavi, Mazandaran, Golestan (Kolarov and Ghahari, 2006), Guilan, Tehran (Mohammadi-Khoramabadi *et al*., 2013a).
General distribution: Palaearctic, Oriental (Yu *et al*., 2012).

Tribe Pimplini Wesmael, 1845
***Itoplectis alternans* (Gravenhorst, 1829)**
Material examined: 1♀, Malaise trap, Tanbak, 06-X-2012, Leg. E. Nader.
Distribution in Iran: Fars (Lotfalizadeh *et al*., 2012), Guilan (Mohammadi-Khoramabadi *et al*., 2013a).
General distribution: Palaearctic, Oriental (Yu *et al*., 2012).

***Itoplectis tunetana* (Schmiedeknecht, 1914)**
Material examined: 2♀♀ 1♂, swept on *Taraxacum* sp., Neysian, 20-VIII-2012, Leg. E. Nader.
Distribution in Iran: West Azerbaijan (Akbarzadeh, 2011), Guilan, Tehran (Mohammadi-Khoramabadi *et al*., 2013a), Qazvin (Ghahari and Schwarz, 2012), Sistan and Baluchestan (Barahoei *et al*., 2013a).
General distribution: Palaearctic (Yu *et al*., 2012).

***Pimpla spuria* Gravenhorst, 1829**
Material examined: 2♀♀, Malaise trap, Nazhvan, 20-VIII-2012, Leg. E. Nader.
Distribution in Iran: Khuzestan, Mazandaran (Kolarov and Ghahari, 2006), Guilan, Tehran (Mohammadi-Khoramabadi *et al*., 2013a).
General distribution: Palaearctic, Oriental (Yu *et al*., 2012).

Subfamily Tersilochinae Schmiedeknecht, 1910
***Aneuclis incidens* (Thomson, 1889)**
Material examined: 1♀, swept on Poaceae weed, Filour, 28-IX-2012; 1♂, Malaise trap, Tanbak, 06-X-2012, Leg. E. Nader.
Distribution in Iran: Mazandaran (Ghahari and Jussila, 2011a), Kerman, Khorasan-e-Razavi, Sistan and Baluchestan (Barahoei *et al*., 2013b).
General distribution: Palaearctic (Yu *et al*., 2012).

Discussion

During this survey eighteen species of six subfamilies of the family Ichneumonidae were collected and identified in association with general field crops of Isfahan province. The subfamily Diplazontinae with seven species (73 Individuals) was the most abundant subfamily in this area during the sampling period. They are koinobiont endoparasitoids of Syrphidae (Diptera) (Sugonyaev, 2006), and this is why they were more common at the middle to end of growing season, when many syrphid species are associating with aphids on field crops. Up to now, 19 species of the subfamily Diplazontinae are reported from Iran (Barahoei *et al*., 2012; Mohammadi-Khoramabadi *et al*., 2013b).

Three subfamilies Anomaloninae, Banchinae and Metopiinae were only represented by only a single species in alfalfa fields. They were recorded as parasitoids of Lepidoptera larvae (Townes, 1971; Wahl, 1993). *Anomalon cruentatum* has been recorded as parasitoid of

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noctuid moth pests like *Agrotis ipsilon* (Hufnagel), which is common in alfalfa and other field crops (Okyar and Yurtcan, 2007). Until now, 13 species from the subfamily Anomaloninae (Nikdel and Diller, 2011; Barahoei *et al*., 2012; Ghahari and Schwarz, 2012) and 10 species of Banchinae and seven species of Metopiinae are reported from Iran (Barahoei *et al*., 2012).

The subfamily Ichneumoninae is one of the largest groups of the ichneumonids (Yu *et al*., 2012), with only 169 recorded species from Iran, of which seven species had already been reported from Isfahan province (Kolarov and Ghahari, 2005, 2008; Masnadiand Jussila, 2008; Ghahari and Jussila, 2011b; Barahoei *et al*., 2012; Ghahari and Schwarz, 2012). In the present survey, we found two species of Ichneumoninae, of which *Heterischnus filiformis* is newly recorded for the fauna of Iran. This is also the first record of this species outside Europe. It has also been recorded in association with the noctuid moths (Rudow, 1917).

The recorded species of the subfamily Pimplinae are all considered to have a complicated biology ranging from parasitoid to hyperparasitoid of various insect groups (Aubert, 1969; Pisicaand Diaconu, 2000). *Zaglyptus multicolor* is a parasitoid of the spiders (Aubert, 1969). Among 62 recorded species of Pimplinae, none has been yet reported from Isfahan province (Barahoei *et al*., 2012; Ghahari and Schwarz, 2012; Mohammadi-Khoramabadi *et al*., 2013a). The relatively small subfamily Tersilochinae with worldwide distribution comprises 234 species in 13 genera, represented with only four recorded species from Iran (Barahoei *et al*., 2012). They are parasitoids of Coleoptera (Curculionidae), Lepidoptera (Eriocraniidae) (Jordan, 1998) and sawflies (Tenthredinidae and Xyelidae) (Al-Saffar and Aldrich, 1997; Khalaim and Blank, 2011). *Aneuclis incidens*has has been recorded as a parasitoid of Anobiidae and Nitidulidae (Starke, 1956; Sedivy, 1983) which can be commonly encountered on flowering weeds within the field crops.

The results of this survey indicates existence of diverse range of the ichneumonids in Isfahan province, many of them are waiting for subsequent explorations. Furthermore, it is necessary to complement these finding with the biological data, especially on host association and seasonal occurrence.

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بررسی زنبورهای خانواده Ichneumonidae در استان اصفهان، مرکز ایران

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چکیده: فون زنبورهای خانواده Ichneumonidae در استان اصفهان در سال ۱۳۹۱ مورد بررسی قرار گرفت. نمونه‌ها به‌وسیله تور حشره‌گیری و تله مالیز روی گیاهان مختلف از مناطق متفاوت در استان اصفهان جمع‌آوری گردید. در مجموع ۱۸ گونه متعلق به ۱۶ جنس و ۷ زیرخانواده جمع‌آوری و شناسایی شد که عبارتند از: *Anomalon cruentatum* (Geoffroy, 1785) (از زیرخانواده Anomaloninae)، *Exetastes syriacus* Schmiedeknecht, 1910 (از زیرخانوادهBanchinae)، *Diplazon laetatorius* (Fabricius, 1781)، *Enizemum ornatum* (Gravenhorst, 1829)، *Homotropus nigritarsus* (Gravenhorst, 1829)، *Homotropus signatus* (Gravenhorst, 1829)، *Promethes sulcator* (Gravenhorst, 1829)، *Syrphophilus bizonarius* (Gravenhorst, 1829) (از زیرخانواده Diplazontinae)، *Anisobas cingulatellus* Horstmann, 1997، *Diadromus collaris* (Gravenhorst, 1829)، *Heterischnus filiformis* (Gravenhorst, 1829)، *Spilothyrateles nuptatorius* (Fabricius, 1793) (از زیرخانواده Ichneumoninae)، *Exochus castaniventris* Brauns, 1896 (از زیرخانواده Metopiinae)، *Itoplectis alternans* (Gravenhorst, 1829)، *Itoplectis tunetana* (Schmiedeknecht, 1914)، *Pimpla spuria* Gravenhorst, 1829، *Zaglyptus multicolor* (Gravenhorst, 1829) (از زیرخانواده Pimplinae) و *Aneuclis incidens* (Thomson, 1889) (از زیرخانواده Tersilochinae). همه گونه‌ها به‌غیر از *Exochus castaniventris* گزارش جدید برای استان اصفهان می‌باشند. گونه *Heterischnus filiformis* برای اولین بار از ایران گزارش می‌شود.

واژگان کلیدی: *Heterischnus filiformis*، انتشار، گزارش جدید، اصفهان

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