



On the Ophioniformes group (Hymenoptera: Ichneumonidae) from Kerman province with six new records to Iran

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ABSTRACT. The fauna of the Ophioniformes group (Hym.: Ichneumonidae) was studied in the southern part of Kerman province, Iran during 2014–2015. Four localities (Faryab, Jiroft, Maskoon and Sarbijan) have been surveyed using eight Malaise traps. Two traps were operated in each location. A total of 135 specimens of the Ophioniformes group have been collected and identified representing 27 species into seven subfamilies and 17 genera. One genus (i.e. *Meloboris* Holmgren, 1859) and six species are reported from Iran for the first time: *Diadegma kyffhusanae* Horstmann, 1973, *Hyposoter barretti* (Bridgman, 1881), *Hyposoter caudator* Horstmann, 2008, *Meloboris collector* (Thunberg, 1822), *Sinophorus pleuralis* (Thomson, 1887) and *Mesochorus arenarius* (Haliday, 1838). Fifteen species are newly recorded from Kerman province. The biographical and altitudinal range distribution, as well as adult flight period of the identified species, are also discussed.

Key words: parasitoid, taxonomy, distribution, new records, highlands

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INTRODUCTION

The Ophioniformes is a major monophyletic group of the family Ichneumonidae (Insecta: Hymenoptera) based on 28S rDNA sequences and morphological data and currently comprises 16 subfamilies (Quicke et al., 2009). Members of this group are biologically mainly koinobiont parasitoids of Lepidoptera and Hymenoptera and less commonly of Coleoptera and Symphyta (members of the subfamily Tersilochinae) (Quicke, 2015). Study on the Iranian fauna of the Ophioniformes have received more attention recently. Barahoei et al. (2012b) listed 163 species of the Ophioniformes group; Anomaloninae (11), Banchinae (10), Campopleginae (36), Cremastinae (22), Ctenopelmatinae (9),

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Hybrizontinae (1), Mesochorinae (1), Metopiinae (7), Ophioninae (19), Tersilochinae (4) and Tryphoninae (43), respectively from Iran. Later, more species of this group were discovered through ecological or faunistic studies (Kishani-Farahani et al., 2012; Barahoei et al., 2012a, 2013, 2014, 2015; Akbarzadeh-Shoukat, 2012; Abbasipour et al., 2013; Hooshyar & Vafaei-Shoushtari, 2013, 2014; Nikdel & Diller, 2014; Hasanshahi et al., 2015a, 2015b, 2015c; Shamszadeh et al., 2015; Sarafi et al., 2015; Amiri et al., 2015a, 2015b, 2016a, 2016b, 2017; Mohebban et al., 2016; Shaw et al., 2016; Mohammadi-Khoramabadi et al., 2016a, 2016b, 2017, 2018, 2020a, 2020b; Kolarov, 2016; Pourhaji et al., 2016; Mohammadi-Khoramabadi & Ziaaddini, 2017; Hooshyar et al., 2017; Bahremand et al., 2017; Schnee, 2018; Riedel, 2018, 2021; Riedel et al., 2019a, 2019b; Zardouei-Heydari et al., 2019, 2020a, 2020b, 2020c; Falahatpisheh et al., 2021; Johansson, 2021; Johansson et al., 2021).

Jiroft and Faryab counties, locating at the south of Kerman province, are known as two major agricultural producing regions of Iran (Ebadzadeh et al., 2018). The mountain ranges of Jebal Barez with wide gradients of elevation from about 600 (in Jiroft and Faryab) to more than 3000 m a.s.l. (in Sarbijan), fertile plains and topographic heterogeneity provide suitable habitats for a diverse and endemic taxa (Noroozi, 2020). In order to improve the knowledge on the fauna of Ichneumonidae in Iran, this study was conducted to survey the fauna of the Ophioniformes group in various agricultural ecosystems of Jiroft and Faryab counties of Kerman province, Iran.

MATERIAL AND METHODS

Four regions of southern part of Kerman province belonging to Jiroft (Jiroft, Maskoon and Sarbijan) and Faryab counties (Table 1) were selected. Different climatological conditions i.e., cold and moderate mountainous, warm-dry and warm-humid in this area favored a highly prosperous situation for inhabiting a very diverse vegetation as well as developing agricultural activities. The ichneumonid specimens were collected using eight Malaise traps (MT1–MT8) which were installed in different agricultural ecosystems from March 2014 to August 2015 by N. Bahremand (N.B.) and A. Mohammadi-Khoramabadi (A.M.K.).

Table 1. Geographical coordinates of Malaise traps in the studied areas of Kerman province, Iran during 2014–2015.

Trap #	Location	Position	Elevation (m)	Vegetation
MT1	Faryab	28°05'26" N 57°13'50" E	640	alfalfa, palm
MT2	Faryab	28°04'58" N 57°13'41" E	640	alfalfa, palm, wheat
MT3	Jiroft	28°34'38" N 57°51'41" E	855	Orchard (citrus, olive)
MT4	Jiroft	28°33'14" N 57°51'48" E	855	alfalfa, citrus, palm
MT5	Maskoon	28°51'41" N 57°52'10" E	1665	pomegranate, walnut, fig
MT6	Maskoon	28°51'44" N 57°51'58" E	1665	alfalfa, bean
MT7	Sarbijan	29°06'57" N 57°32'29" E	3043	peach, apple
MT8	Sarbijan	29°06'10" N 57°32'46" E	3043	cherry, apricot

Geographical coordinates and the vegetation around each Malaise trap were presented in Table 1. Collecting bottles were filled by 75% ethanol, and the captured specimens were collected by two weeks intervals. The collected specimens were prepared according to AXA method (van Achterberg, 2009), then pinned or card mounted. Species of Campopleginae (the genera *Campoletis*, *Hyposoter*, *Meloboris* and *Sinophorus*) and Mesochorinae were determined by comparing with the type specimens of this group in Zoologische Staatssammlung Munich, Germany (ZSM) by the fourth author (Dr. M. Riedel) and the others by keys and description provided by Broad & Shaw (2016), Horstmann (2013), Johansson & Cederberg (2019), Schnee (2014), Kasparyan (1981b), Kasparyan & Tolkanitz (1999), Johansson (2018), Tolkanitz (2007), Tolkanitz (2015). The identified specimens were deposited in the Insect Collection of Department of Plant Protection, Shahid Bahonar University of Kerman, Iran, Department of Plant Production, College of Agriculture and Natural Resources of Darab, Shiraz University (DCS), Iran and in Zoologische Staatssammlung, Munich, Germany (ZSM). General distribution map of the newly reported species was generated using ArcGIS 3.1 and Adobe Photoshpe CS5 softwares based on the distribution data available on Yu et al. (2016); Belokobylskij et al. (2019); Klopstein et al. (2019); Pénigot (2021).

RESULTS

In a total, 135 specimens of the Ophioniformes group were collected during 2014–2015 representing 27 species into seven subfamilies. Of which one genus (i. e. *Meloboris* Holmgren, 1859) and six species are stated to be recorded from Iran for the first time, indicated by double asterisks (**). Fifteen species are also newly reported from Kerman province, indicated by single (*) asterisk.

Taxonomic Hierarchy

Family Ichneumonidae Latreille, 1802

Subfamily Anomaloninae Viereck, 1918

Tribe Anomalonini Viereck, 1918

Genus *Anomalon* Panzer, 1854

Anomalon cruentatum (Geoffroy, 1785)

Material Examined: 1♀ (DCS), Iran, Jiroft, MT3, 29.V.2015, Leg.: N.B..

Distribution within Iran: Ardabil (Masnadi-Yazdinejad & Jussila, 2009), Isfahan (Barahoei et al., 2015; Zardouei-Heydari et al., 2020a), Fars and Kerman (Ghahari & Jussila, 2016), Current study, Qazvin (Ghahari & Schwarz, 2012), Khorasan-e-Razavi (Barahoei et al., 2014; Zardouei-Heydari et al., 2020a), Kermanshah (Zardouei-Heydari et al., 2020a), Mazandaran (Hooshyar & Vafaei-Shoushtari, 2014), North Khorasan (Zardouei-Heydari et al., 2020a), Sistan and Baluchistan (Barahoei et al., 2012a), South Khorasan (Zardouei-Heydari et al., 2020a), Yazd (Zarepour-Ashkezari et al., 2009), West Azerbaijan (Mohammadi-Khoramabadi et al., 2020a) provinces.

General distribution: Oriental and Palaearctic (Yu et al., 2016; Klopstein et al., 2019; Belokobylskij et al., 2019; Pénigot, 2021).

Family Ichneumonidae Latreille, 1802

Subfamily Campopleginae Förster, 1869

Genus *Campoletis* Förster, 1869

Campoletis scyticus Riedel, 2017

Material examined: 3♀♀, Iran, Faryab, MT1 and MT2, 14.V.2014; 1♀, Jiroft, MT3, 30.III.2014; 1♀, Sarbijan, MT8, 30. III.2014, leg.: N.B. (DCS).

Distribution within Iran: Kerman province (Mohammadi-Khoramabadi et al., 2018); Current study.

General distribution: Bulgaria, Kazakhstan, Kyrgyzstan, Morocco, Turkey, Turkmenistan (Riedel, 2017), Iran (Mohammadi-Khoramabadi et al., 2018), and Afghanistan (Vas, 2019).

Genus *Casinaria* Holmgren, 1859

Casinaria tenuiventris (Gravenhorst, 1829)*

Material examined: 1♀, Iran, Jiroft, MT4, 30.III.2014; 1♂, Maskoon, MT5, 23.VI.2015, leg.: N.B. (ZSM).

Distribution within Iran: Tehran (Masnadi-Yazdinejad et al., 2010) and Kerman provinces (Current study).

General distribution: Austria, Bulgaria, Czechia (Bohemia, Moravia), France, Italy, Norway, Russia (Caucasus), United Kingdom (Riedel, 2018).

Genus *Cymodusopsis* Viereck, 1912

Cymodusopsis persicus Riedel, 2019

Material examined: 1♀ (ZSM), Iran, Sarbijan, MT7, 20. IV. 2014, leg.: A.M.K..

Distribution within Iran: Kerman province (Riedel et al., 2019b); Current study.

General distribution: Iran (Riedel et al., 2019b).

Genus *Diadegma* Förster, 1869

Diadegma anurum (Thomson, 1887)*

Material examined: 1♀, Iran, Jiroft, MT3, 30.III.2014, 1♀ 1♂, 21. IV.2014, leg.: N.B. (DCS).

Distribution within Iran: Fars (Falihatpisheh et al., 2021), Golestan (Masnadi-Yazdinejad et al., 2010), Tehran (Hasanshahi et al., 2014), and Kerman provinces (Current study).

Remarks: Reporting of this species from Alborz province (Golizadeh et al., 2008) was based on a misidentification (Karimzadeh & Broad, 2013).

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

Diadegma armillatum (Gravenhorst, 1829)

Material examined: 2♀♀, Iran, Faryab, MT1, 21.IV.2014; 4♀♀ same locality, MT2, 14.V.2014; 1♀, Jiroft, MT4, 30.III.2014; 2♀♀, same locality, 14.V.2014, leg.: N.B. (DCS).

Distribution within Iran: East Azerbaijan (Masnadi-Yazdinejad et al., 2010) and Kerman provinces (Mohammadi-Khoramabadi et al., 2016a); Current study.

General distribution: Australasian and Palaearctic (Yu et al., 2016).

Diadegma fenestrale (Holmgren, 1860)*

Material examined: 2♀♀, Iran, Faryab, MT2, 14.V.2014; Jiroft, MT3 and MT4, 1♀, 9.IV.2015, 4♀♀, 2♂♂, 13.III.2015, 1♀, 30.III.2014; Maskoon, MT5 and MT6, 1♀1♂, 24.V.2015, 1♀, 23.VI.2015; Sarbijan, MT7, 1♀, 30.III.2014, 1♀, 21.IV.2014, leg.: N.B. (DCS).

Distribution within Iran: Fars (Falihatpisheh et al., 2021), Isfahan (Ghahari et al., 2012) and Kerman provinces (Current study).

General distribution: Oriental, Oceanic and Palaearctic (Yu et al., 2016).

Diadegma kyffhusanae Horstmann, 1973**

Material examined: 1♀, Iran, Faryab, MT1, 14.V.2014, leg.: N.B. (DCS).

Distribution within Iran: Kerman province (Current study).

General distribution: Western Palaearctic (Yu et al., 2016), new record from Iran.

Diadegma maculatum* (Gravenhorst, 1829)

Material examined: 1♀, Iran, Maskoon, MT5, 1.V.2015; Sarbijan, MT8, 1♀, 30.III.2014, leg.: N.B. (DCS).

Distribution within Iran: East Azerbaijan (Mohammadi-Khoramabadi et al., 2020a), West Azerbaijan (Pourhaji et al., 2016) and Kerman provinces (Current study).

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

***Diadegma majale* (Gravenhorst, 1829)**

Material examined: 1♂, Iran, Faryab, MT1, 14.V.2014; 1♀, Jiroft, MT3, 13.III.2015, 1♀, 30.III.2014; 1♀1♂, Maskoon, MT6, 1.V.2015, leg.: N.B. (DCS)

Distribution within Iran: Fars (Masnadi-Yazdinejad et al., 2010), Ardabil (Fathi et al., 2012); Kerman (Mohammadi-Khoramabadi et al., 2016a; current study); Markazi and Khuzestan provinces (Riedel et al., 2019a).

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

***Diadegma semiclausum* (Hellén, 1949)**

Material examined: 1♀, Iran, Sarbijan, MT7, 21.IV.2014, leg.: N.B. (DCS).

Distribution within Iran: Isfahan (Ghahari et al., 2012), Qazvin (Ghahari & Schwarz, 2012), Kerman (Mohammadi-Khoramabadi et al., 2016a), Khorasan-e Razavi (Barahoei et al., 2014); Sistan and Baluchestan (Barahoei et al., 2013) and Fars provinces (Sarafi et al., 2015).

General distribution: Afrotropical, Australasian, Oceanic, Oriental, Palaearctic (Yu et al., 2016).

Genus *Enytus* Cameron, 1905***Enytus apostatus* (Gravenhorst, 1829)***

Material examined: 1♀, Iran, Faryab, MT1, 21.IV.2014; 2♀♀, Jiroft, MT3 and MT4, 2.V.2015, 4♀♀1♂, 9.IV.2015, 1♀, 21.IV.2014, leg.: N.B. (DCS).

Distribution within Iran: West Azerbaijan (Masnadi-Yazdinejad et al., 2010; Akbarzadeh-Shoukat, 2012), East Azerbaijan (Lotfalizadeh et al., 2012), Tehran, Qazvin (Sooudi et al., 2007) and Kerman provinces (Current study).

General distribution: Afrotropical, Nearctic, Oriental, Western Palearctic (Yu et al., 2016).

Genus *Hyposoter* Förster, 1869***Hyposoter barretti* (Bridgman, 1881)** (Fig. 1A)**

Material examined: 3♀♀ (DCS), Iran, Faryab, MT1 and MT2, 14.V.2014; 2♀♀ (ZSM), Jiroft, MT3 and MT4, 21.IV.2014, 1♀ (DCS), 30.III.2014, 1♀ (DSC), 2.V.2015; 1♂ (DCS), Maskoon, MT5 and MT6, 1.V.2015, 2♀♀ (DCS), 18.VI.2015; 1♀ (DCS), Sarbijan, MT7 and MT8, 30.III.2014, 2♀♀ (DCS), 21.IV.2014, leg.: N.B..

Distribution within Iran: Kerman province (Current study).

General distribution: Western Palaearctic (Europe) (Yu et al., 2016), new record from Iran.

***Hyposoter caudator* Horstmann, 2008** (Fig. 1B)**

Material examined: 1♀ (DCS), Iran, Faryab, MT1 and MT2, 21.IV.2014, 1♀ (DCS), 14.V.2014; 1♀ (DCS), Jiroft, MT3 and MT4, 9.IV.2015, 1♀ (DCS), 2.V.2015, 1♀ (DCS), 29.V.2015; 4♀♀2♂ (DCS), Maskoon, MT5 and MT6, 1.V.2015, 1♀1♂ (DCS), 24.V.2015, 3♀♀ (ZSM) 1♂ (DCS), 18.VI.2015; MT8, 1♀ (DCS), Sarbijan, 21.IV.2014, 1♀ (DCS), 14.V.2014, Leg.: N.B..

Distribution within Iran: Kerman province (Current study).

General distribution: Spain and Switzerland (Horstmann, 2008), new record from Iran.

Genus *Meloboris* Holmgren, 1859***Meloboris collector* (Thunberg, 1822)****

Material examined: 1♀, Iran, Jiroft, MT3, 8.IV.2015; 1♀, Sarbijan, MT7, 29.III.2014, Leg.: N.B. (ZSM).

Distribution within Iran: Kerman province (Current study).

General distribution: Afrotropical, Oceanic, Palaearctic (Yu et al., 2016), new record from Iran.

Remark: The genus *Meloboris* is newly recorded from Iran.

Genus *Sinophorus* Förster, 1869***Sinophorus pleuralis* (Thomson, 1887)****

Material examined: 1♂ (ZSM), Iran, Jiroft, MT3, 13.III.2015, leg.: N.B..

Distribution within Iran: Kerman province (Current study).

General distribution: Oriental, Palaearctic (Yu et al., 2016), new record from Iran.

Subfamily Cremastinae Förster, 1869**Genus *Temelucha* Förster, 1869*****Temelucha lucida* (Szépligeti, 1899)***

Material examined: 2♀♀ 1♂, Iran, Jiroft, MT3 and MT4, 14.IV.2015; 1♂, Maskoon, MT6, 18.VI.2015, leg.: N.B. (DCS).

Distribution within Iran: Fars (Ghahari & Jussila, 2010), Kurdistan (Mohammadi-Khoramabadi et al., 2016b; Kamangar et al., 2017), West Azerbaijan (Ghahari & Jussila, 2011) and Kerman provinces (Current study).

General distribution: Western Palaearctic (Yu et al., 2016; Belokobylskij et al., 2019).

Temelucha schoenobia* (Thomson, 1890)

Material examined: 2♀♀ 1♂ (DCS), Iran, Maskoon, MT5 and MT6, 23.VI.2015, leg.: N.B..

Distribution within Iran: Golestan (Masnadi-Yazdinejad & Jussila, 2009) and Kerman provinces (Current study).

General distribution: Western Palaearctic (Yu et al., 2016; Belokobylskij et al., 2019).

Genus *Trathala* Cameron, 1899***Trathala hierochontica* (Schmiedeknecht, 1910)***

Material examined: 1♀ (DCS), Iran, Jiroft, MT3, 9.IV.2015; leg.: N.B..

Distribution within Iran: Mazandaran (Masnadi-Yazdinejad & Jussila, 2009) and Kerman provinces (Current study).

General distribution: North Africa, Western Palaearctic (Yu et al., 2016; Belokobylskij et al., 2019).

Subfamily: Mesochorinae Förster, 1869**Genus *Mesochorus* Gravenhorst, 1829*****Mesochorus arenarius* (Haliday, 1838)** (Fig. 1C)**

Material examined: 1♀ (ZSM), Iran, Maskoon, MT5, 24.V.2015; leg.: N.B..

Distribution within Iran: Kerman province (Current study).

General distribution: Holarctic (Riedel, 2020), new record from Iran.

Mesochorus pictilis Holmgren, 1860 (Fig. 1D)

Material examined: 1♀ (ZSM), Iran, Jiroft, MT4, 14.IV.2015, Leg.: N.B..

Distribution within Iran: Kerman province (Mohammadi-Khoramabadi et al., 2016a); Current study.

General distribution: Holarctic (Riedel, 2020).

Subfamily Metopiinae Förster, 1869

Genus *Exochus* Gravenhorst, 1829

Exochus gravipes (Gravenhorst, 1820)*

Material examined: 1♀ (DCS), Iran, Jiroft, MT3, 21.IV.2014; leg.: N.B..

Distribution within Iran: East Azerbaijan (Mohammadi-Khoramabadi et al., 2020a) and Kerman provinces (Current study).

General distribution: Holarctic (Yu et al., 2016; Belokobylskij et al., 2019).

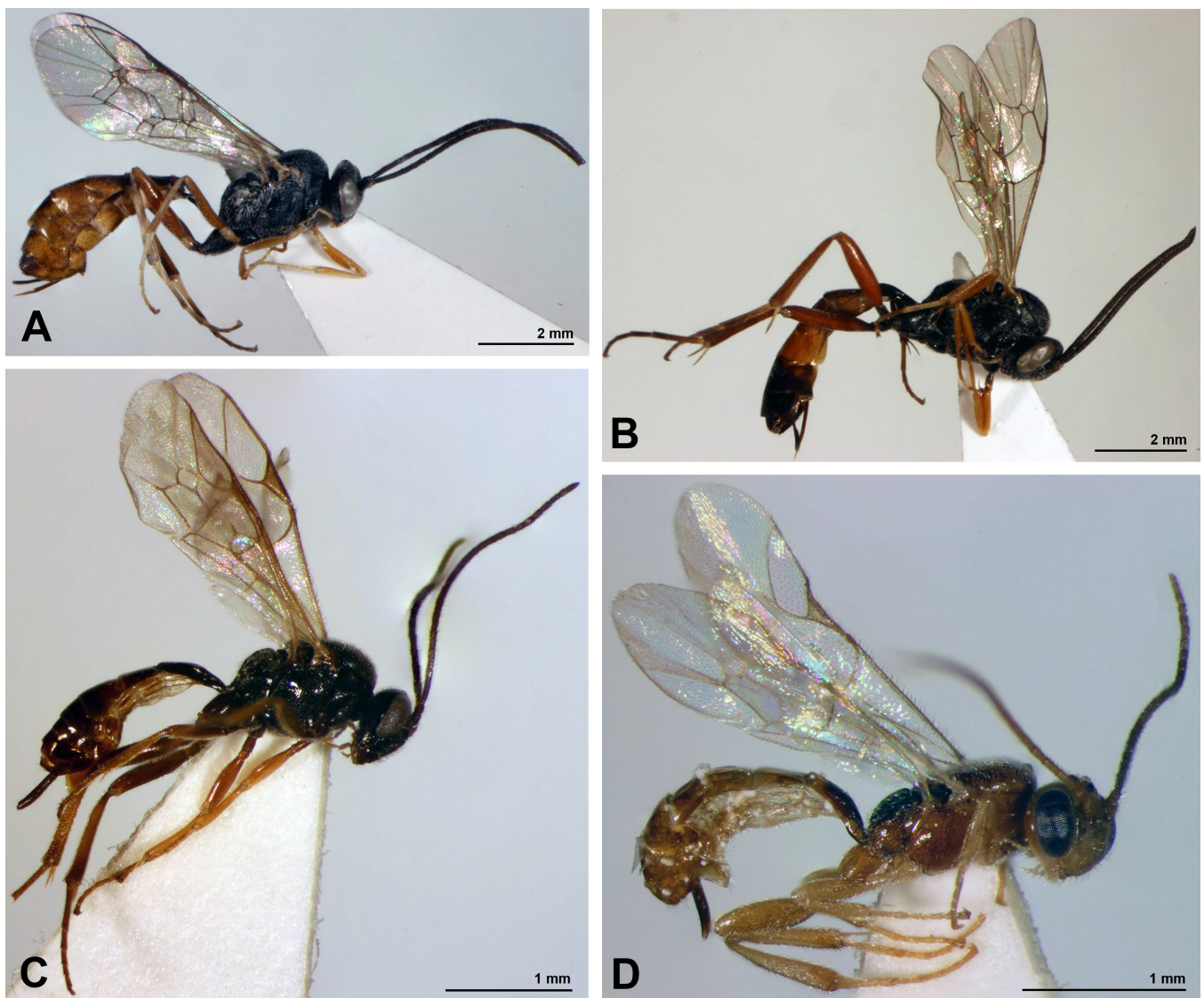


Figure 1. The female habitus of **A.** *Hyposoter Barretti* (Bridgman, 1881), **B.** *Hyposoter caudator* Horstmann, 2008, **C.** *Mesochorus arenarius* (Haliday, 1838) and **D.** *Mesochorus pictilis* Holmgren, 1860.

***Exochus mitratus* (Gravenhorst, 1829)**

Material examined: 4♀♀ (DCS), Iran, Jiroft, MT3 and MT4, 21.IV.2014, leg.: N.B..

Distribution within Iran: Tehran ([Masnadi-Yazdinejad & Jussila, 2009](#)), Fars, Hormozgan ([Amiri et al., 2015b](#)) and Kerman provinces ([Mohebban et al., 2016](#)).

General distribution: Holarctic ([Yu et al., 2016](#); [Belokobylskij et al., 2019](#)).

Genus *Metopius* Panzer, 1806***Metopius (Cultrarius) turcestanicus* Clément, 1930***

Material examined: 4♀♀, 1♂ (DCS), Iran, Jiroft, MT3 and MT4, 9.IV.2015, leg.: N.B..

Distribution within Iran: Hormozgan ([Amiri et al., 2015b](#)), and Kerman provinces (Current study).

General distribution: Palaearctic ([Tolkanitz, 2015](#); [Yu et al., 2016](#)).

Subfamily Ophioninae Shuckard, 1840**Tribe Enicospilini Townes, 1971****Genus *Enicospilus* Stephens, 1835*****Enicospilus ramidulus* (Linnaeus, 1758)***

Material examined: 1♀ (DCS), Iran, Maskoon, MT5, 18.VI.2015, leg.: N.B..

Distribution within Iran: Fars ([Amiri et al., 2016a](#)), Zanjan, Ardebil, West Azerbaijan, East Azerbaijan, Mazandaran ([Johansson et al., 2021](#)) and Kerman provinces (Current study).

General distribution: Afrotropical, Oriental, Palaearctic ([Yu et al., 2016](#); [Shimizu et al., 2020](#)).

Tribe Ophionini Shuckard, 1840**Genus *Ophion* Fabricius, 1798*****Ophion obscuratus* Fabricius, 1798**

Material examined: 5♀♀ 4♂♂ (DCS), Iran, Jiroft, MT3 and MT4, 13.III.2015, leg.: N.B..

Distribution within Iran: Yazd ([Zarepour-Ashkezari et al., 2010](#)), Tehran, Golestan, Hormozgan, Kerman, Fars ([Masnadi-Yazdinejad et al., 2010](#)) and Mazandaran ([Johansson et al., 2021](#)) provinces.

General distribution: Neotropical, Oriental and Palaearctic ([Yu et al., 2016](#)).

Subfamily Tryphoninae Shuckard, 1840**Tribe Phytodietini Hellén, 1915****Genus *Netelia* Gray, 1860*****Netelia (Netelia) dilatata* (Thomson, 1888)**

Material examined: 1♀ (DCS), Iran, Maskoon, MT5, 1.V.2015, leg.: N.B..

Distribution within Iran: Not exactly defined ([Kasparyan, 1981a](#)), Kerman province ([Mohammadi-Khoramabadi et al., 2020b](#)).

DISCUSSION

According to the result of this survey 27 species of the Ophioniformes parasitoid wasps were identified in various agricultural ecosystems of Jiroft and Faryab counties, of which six species are first records for Iran. With this publication and other recently published studies ([Schnee, 2018](#); [Riedel, 2018, 2021](#);

Riedel et al., 2019a, 2019b; Zardouei-Heydari et al., 2019, 2020a, 2020b, 2020c; Belokobylskij et al., 2019; Mohammadi-Khoramabadi et al., 2020a, 2020b; Falahatpisheh et al., 2021), the number of Iranian Ophioniformes group increased to 319 species as follows: Anomaloninae (17), Banchinae (38), Campopleginae (68); Cremastinae (35), Ctenopelmatinae (11); Hybrizontinae (1); Mesochorinae (5); Metopiinae (13); Ophioninae (63); Tersilochinae (14); Tryphoninae (54). The recorded Ophioniformes species in the current study includes nearly 8.5% of the known species of this group in Iran. Considering the number of singletons (collected species with one individual) (Chao et al., 2009) in this study, additional samplings or sampling areas require to detect more Ophioniformes species in the agricultural ecosystems of this region.

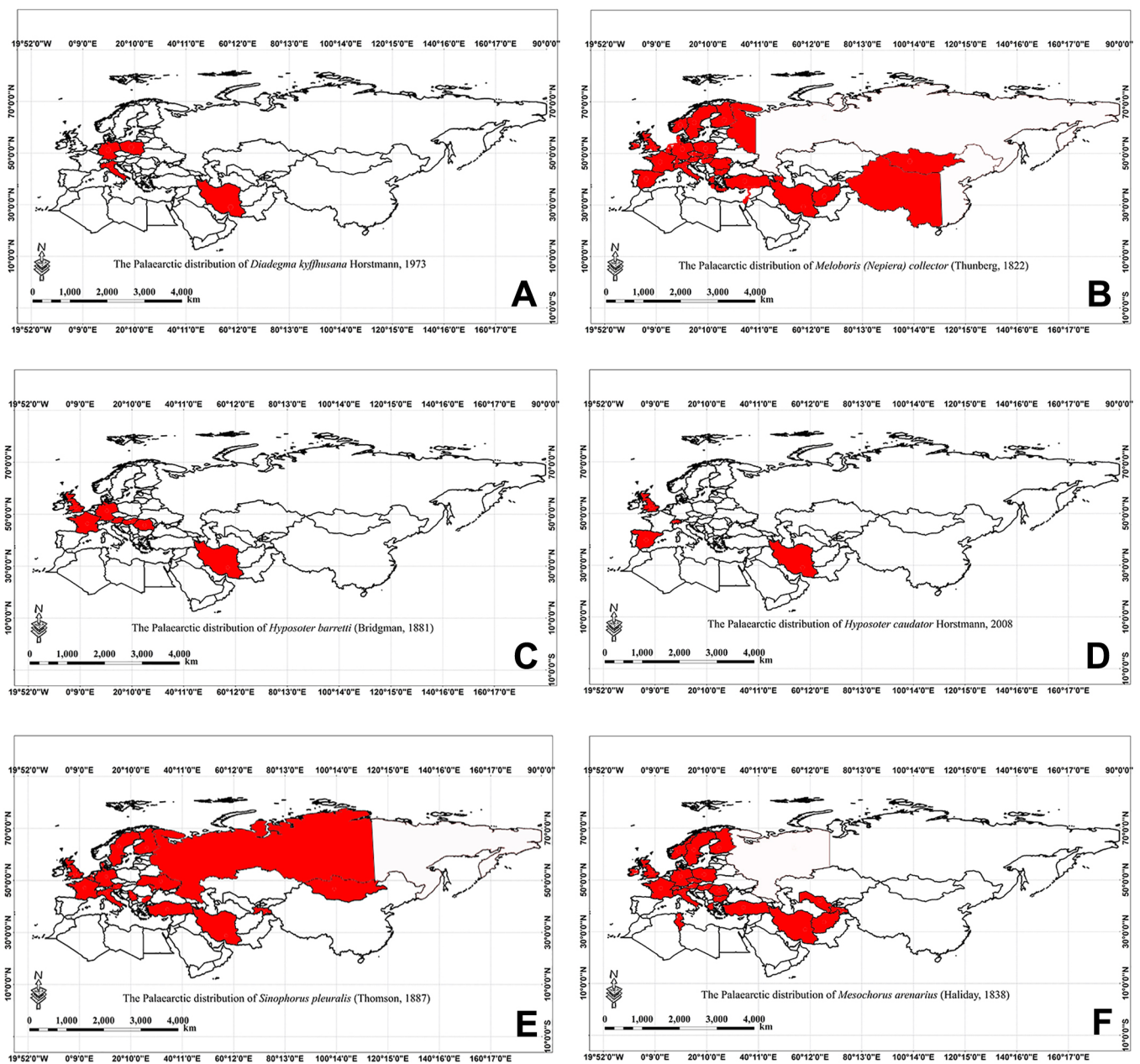


Figure 2. The Palaearctic distribution of **A.** *Diadegma kyffhusana*, **B.** *Meloboris collector*, **C.** *Hyposoter Barretti*, **D.** *Hyposoter caudator*, **E.** *Sinophorus pleuralis* and **F.** *Mesochorus arenarius*.

Members of the subfamily Campopleginae with 15 species showed a very minor fraction of its real diversity in the studied agricultural ecosystems. Yet, despite being the prominent position of this subfamily from a biocontrol point of view, the number of reported host-association of campoplegines with major Iranian agricultural pests are still 15 relations (Mohammadi-Khoramabadi & Ziaaddini, 2017). Future sampling and rearing programs will get a more complete picture of the ecological association of the Campopleginae in agricultural ecosystems. Geographical distribution of the newly reported Ophioniformes species have been extended in the Palaearctic region. Distribution map of *M. collector*, *S. pleuralis* and *M. arenarius* reached to the southern border of the Palaearctic (Fig. 2B, 2E, 2F). By reporting of *D. kyffhusana*, *H. barretti* and *H. caudator* from Iran, their Palaearctic distribution extended far away from their reported countries in Europe (Fig. 2A, 2C, 2D).

Elevation range distribution of the identified Ophioniformes was varied in the studied region. Twenty-one species have been collected in Jiroft site with the elevation of 855 m a.s.l. followed by Maskoon (1665 m): 12 species, Faryab (640 m): 11 species and Sarbijan (3043 m): 10 species (Table 2). Four species i.e., *C. scyticus*, *D. fenestrata*, *H. barretti* and *H. caudator* distributed in a wide altitudinal zone from 640 m in Faryab to 3043 m in Sarbijan. *Diadegma majale* has been found in Faryab (640 m) to Maskoon (1665 m). *Casinaria tenuiventris* and *T. lucida* have been collected in the elevations 855 (Jiroft) – 1665 (Maskoon). The elevation distribution from 1665 to 3043 belonged to *D. maculatum* and *M. collector*. Some species were captured in one site (elevation band) as follow: *D. kyffhusana* in Faryab; *A. cruentatum*, *D. anurum*, *S. pleuralis*, *T. hierochontica*, *M. pictilis*, *E. gravipes*, *E. mitratus*, *M. turcestanicus* and *O. obscuratus* in Jiroft; *M. arenarius*, *T. schoenobia* and *E. ramidulus* in Maskoon; *C. persicus* and *D. semiclausum* in Sarbijan.

Table 2. Elevation range distribution of the Ophioniformes species in the south of Kerman province, Iran.

Species	Faryab (640 m)	Jiroft (855 m)	Maskoon (1665 m)	Sarbijan (3043 m)
<i>A. cruentatum</i>		*		
<i>C. scyticus</i>	*	*		*
<i>C. tenuiventris</i>		*	*	
<i>C. persicus</i>				*
<i>D. anurum</i>		*		
<i>D. armillatum</i>	*	*		
<i>D. fenestrata</i>	*	*	*	*
<i>D. kyffhusanae</i>	*			
<i>D. maculatum</i>			*	*
<i>D. majale</i>	*	*	*	
<i>D. semiclausum</i>				*
<i>E. apostatus</i>	*	*		
<i>H. barretti</i>	*	*	*	*
<i>H. caudator</i>	*	*	*	*
<i>M. collector</i>		*		*
<i>S. pleuralis</i>		*		
<i>T. lucida</i>		*	*	
<i>T. schoenobia</i>			*	
<i>T. hierochontica</i>		*		
<i>M. arenarius</i>			*	
<i>M. pictilis</i>		*		
<i>E. gravipes</i>		*		
<i>E. mitratus</i>		*		
<i>M. turcestanicus</i>		*		
<i>E. ramidulus</i>			*	
<i>O. obscuratus</i>		*		
<i>N. dilatata</i>			*	

Table 3. Flight period of the Ophioniformes adults in Kerman province, Iran during 2015.

Species	March			April			May			June			July			August		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
<i>A. cruentatum</i>									■	■								
<i>C. scyticus</i>			■		■	■												
<i>C. tenuiventris</i>			■									■	■					
<i>C. persicus</i>					■	■												
<i>D. anurum</i>			■			■												
<i>D. armillatum</i>			■			■			■	■								
<i>D. fenestrata</i>		■	■	■	■	■			■	■	■		■	■				
<i>D. kyffhusanae</i>									■	■								
<i>D. maculatum</i>			■						■	■								
<i>D. majale</i>		■	■						■	■								
<i>D. semiclausum</i>						■												
<i>E. apostatus</i>					■	■			■	■								
<i>H. barretti</i>			■			■			■	■								
<i>H. caudator</i>			■		■	■			■	■	■		■	■				
<i>M. collector</i>			■		■	■												
<i>S. pleuralis</i>		■	■															
<i>T. lucida</i>						■	■					■	■					
<i>T. schoenobia</i>												■	■					
<i>T. hierochontica</i>					■	■												
<i>M. arenarius</i>										■	■							
<i>M. pictilis</i>						■	■											
<i>E. gravipes</i>						■	■											
<i>E. mitratus</i>						■	■											
<i>M. turcestanicus</i>					■	■												
<i>E. ramidulus</i>												■	■					
<i>O. obscuratus</i>		■	■															
<i>N. dilatata</i>								■	■									

With describing *C. persicus* from Kerman province, the genus *Cymodusopsis* has currently two species in Iran as well as in the Palaearctic region. Its congener, *Cymodusopsis rufator* Riedel, 2019 has been reported from Khuzestan and Markazi provinces at altitude 45–53 m a.s.l. and 2090 m. a.s.l., respectively (Riedel et al., 2019a). By the available data on this genus, it can be noted that these two species is distributed at different altitudes in Iran. But future studies will reveal the true elevational distribution of these species in Iran.

The flight period of the Ophioniformes in the studied agricultural ecosystems was prolonged in the spring season, lasting about three months, from mid-March to late June (Table 3). The highest number of species were collected during April (16 species), followed by May (12 species). Based on the phenological data on this group (Shaw et al., 2016), the identified species may pass one generation on their host in the agricultural ecosystems of the studied region.

AUTHOR'S CONTRIBUTION

The authors confirm contribution to the paper as follows: M.K., A.M.K.: conceptualization, supervision and project administration, and writing the manuscript; N.B.: collecting; M.R., A.M.K.: identification of specimens; M.K.: Funding acquisition. All authors have read and agreed to the published version of the Manuscript.

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AVAILABILITY OF DATA AND MATERIAL

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

CONSENT FOR PUBLICATION

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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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