

New data on braconid wasps (Hymenoptera: Braconidae: Cheloninae, Opiinae, Rogadinae) of South-Eastern Iran

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The fauna of Braconidae (Hymenoptera: Ichneumonoidea: Cheloninae, Opiinae, Rogadinae) was studied in different habitats of Kerman province, southeastern Iran. The specimens were collected using sweep net, Malaise traps and light trap during 2013 to 2018. Three subfamilies: Cheloninae, Opiinae and Rogadinae were identified in the present study. A total of 11 species belonging to six genera were identified. Among identified sample, a single species, *Opius (Cryptonastes) ficedus* Papp, 1979 (Opiinae) is reported for the first time from Iran.

Key words: Iran, Hymenoptera, Braconidae, distribution, faunistics, new record.

La faune des Braconidae ((Hymenoptera: Ichneumonoidea: Cheloninae, Opiinae, Rogadinae) a été étudiée dans différents habitats de la province de Kerman, Iran. Les spécimens ont été collectés par filet, piège Malaise et piège lumineux entre 2013 et 2018. Trois sous familles, Cheloninae, Opiinae and Rogadinae, ont été identifiées dans la présente étude. Un total de 11 espèces appartenant à six genres ont été identifiées. Parmi les échantillons identifiés, une seule espèce, *Opius (Cryptonastes) ficedus* Papp, 1979 (Opiinae) est rapportée pour la première fois en Iran.

Mots clés : Iran, Hymenoptera, Braconidae, distribution faunistique, nouvelle espèce.

1. INTRODUCTION

Braconidae (Hymenoptera: Ichneumonoidea) is the second largest family of Hymenoptera, with more than 20.000 described species, in more than 1000 genera and 46 subfamilies, worldwide (Yu *et al.*, 2016). They play major ecological roles in the regulation of other insect groups. They have been used in the biological control of agricultural and forest pests (Coronado *et al.*, 2004).

The subfamily Cheloninae Foerster is a large subfamily with about 1300 described species worldwide (Yu *et al.*, 2016). Members of this subfamily are solitary egg-larval koinobiont endoparasitoids on various Lepidoptera, especially Pyraloidea and Tortricoidea (Shaw & Huddleston, 1991). The subfamily Opiinae is considered as one of the largest groups of Braconidae with more than 2063 valid species in 39 genera (Li *et al.*, 2013; Yu *et al.*, 2016). The species of this subfamily are solitary koinobiont endoparasitoids of larvae of cyclorrhaphous Diptera (Wharton, 1997). The hosts are known for only around 300 species, mostly within Agromyzidae, Anthomyiidae, Drosophilidae, Ephydriidae, Psilidae, Scatophagidae and Tephritidae (Fischer 1971a,b, 1972, 1977, 1987; Shaw & Huddleston, 1991). Rogadinae is a widespread subfamily of koinobiont endoparasitoids of Lepidoptera (Shaw, 1997). All Rogadinae induce the hardening of the host larva before

pupation, producing a “mummy” which conceals the parasitoid pupa (Shaw *et al.* 1997). More than 1159 species of Rogadinae have been described in 58 genera, which most of them are distributed to northern Europe, Asia, and North America (Yu *et al.*, 2016).

Recently some contributions were made on the Iranian fauna of Cheloninae (Fallahzadeh & Saghaei, 2010; Lashkari-Bod *et al.*, 2011; Ameri *et al.*, 2012; Farahani *et al.*, 2012, 2013, 2014; Derafshan *et al.*, 2017), Opiinae (Lashkari-Bod *et al.*, 2011; Ameri *et al.*, 2014; Khajeh *et al.*, 2014, Ranjbar *et al.*, 2016; Peris-Felipo *et al.*, 2018; Safahani *et al.*, 2018, Dolati *et al.*, 2018, 2019) and Rogadinae (Telenga, 1941; Hedwig, 1957; Shenefelt, 1975; Lashkari-Bod *et al.*, 2011; Farahani *et al.*, 2015). The objective of this study (being part of our ongoing research on the braconid fauna of Iran) is to improve our knowledge of the family Braconidae in Iran.

2. MATERIAL and METHODS

The braconid specimens were collected using a standard sweep net, Malaise traps and light traps at different habitats (farms and orchards) located in Kerman province, southeastern Iran during 2013–2018 (**Figure 1**). The specimens were collected from the traps and sorted weekly. Among collected material, 94 specimens belonging to three subfamilies: Cheloninae, Opiinae and Rogadinae were identified. The collected specimens were subsequently dried and mounted on cards using AXA method (van Achterberg, 2009). The external morphology of specimens was studied using NIKON SMZ800 stereomicroscope. Nomenclature and distributional data are mainly from Yu *et al.* (2016). The voucher specimens were deposited in the Insect Collection of the Zoological Museum of Shahid Bahonar University of Kerman, Kerman, Iran (ZMSBUK).



Figure 1: Geographic map of Kerman province

3. RESULTS

A total of 11 species belonging to six genera of the 3 subfamilies studied were identified. Among the collected material the species *Opius (Cryptonastes) ficedus* Papp, 1979 (Opiinae) is a new record for the fauna of Iran. m. a. s. l. refers to 'meters above sea level'.

Subfamily Cheloninae Förster 1862

Tribe Chelonini Förster 1862

1. *Chelonus (Chelonus) annulipes* Wesmael 1835

Material examined: (4♀); Kerman province: 1♀, sweep net, Bidkhan (29°34' N 56°30' E, 2943 m a. s. l.), 01.viii.2014; 1♀, sweep net, Negar, (29°53' N 56°46' E, 2096 m a. s. l.), 21. viii.2014; leg: F. Abdolalizadeh; 1♀, sweep net, Dashtkar (29°55' N 56°37' E, 2073 m a. s. l.), 21.viii.2014; leg: F. Abdolalizadeh; 1♀, Malaise trap, Sirch (30°11' N 57°34' E), 25.v.2013, leg.: Sh. Mohebban.

Distribution in Iran: Alborz, Tehran, Guilan, Qazvin, Semnan provinces (Farahani *et al.*, 2016).

General distribution: Nearctic, Oriental and Palearctic.

2. *Chelonus (Chelonus) oculator* (Fabricius 1775)

Material examined: (2♀); Kerman province: Anbar Abad, Bardeh (28°28'4.1" N, 58°12'39.3" E, 1501m), 05-23.v.2017, 1♀, and 21.iv-05.v.2017, 1♀, Malaise trap, Leg.: M. Purrezaali
 Distribution in Iran: Lorestan, Alborz, Tehran and Qazvin provinces (Farahani *et al.*, 2016).
 General distribution: Palaearctic.

Tribe Phanerotomini Baker, 1926

3. *Phanerotoma (Phanerotoma) leucobasis* Kriechbaumer 1894

Material examined: (2♀); Kerman province: Jiroft, Dalfard (29°00'36"N, 57°36'39.1"E, 2232m), 17.vii-27.viii.2017, 1♀, Malaise trap, Leg.: M. Purrezaali; Qaleh Ganj, Rostam Abad (27°29'57.3" N, 57°54'14.4" E, 387m), 14.iv.2018, 1♀, light trap, Leg.: M. Ehsani.
 Distribution in Iran: Sistan and Baluchestan and Isfahan provinces (Farahani *et al.*, 2016).
 General distribution: Afrotropical, Nearctic and Palaearctic.

4. *Phanerotoma (Bracotritoma) permixtella* Fischer 1968

Material examined: (1♀); Kerman province: Dehbakri, Marghak, Bidkhun (29°07'22.6" N, 57°52'56.8" E, 2220m), 04-16.vii.2017, 1♀, Malaise trap, Leg.: M. Purrezaali.
 Distribution in Iran: West Azarbaijan, Hormozgan and Golestan provinces (Farahani *et al.*, 2016).
 General distribution: Greece, Iran and Syria.

Subfamily Opiinae

5. *Opius (Cryptonastes) ficedus* Papp 1979

Material examined: (2♀); Kerman province: Bam, Hemat Abad (29°08'19.6" N, 57°58'05.1" E, 1673m), 13-31.v.2017, 1♀, and 31.v-04.vii. 2017, 1♀, Malaise trap, Leg.: M. Purrezaali.
 Distribution in Iran: Kerman province (current study). New record from Iran.
 General distribution: Poland, Slovakia.

6. *Phaedrotoma exigua* (Wesmael 1835)

Material examined: (4♀); Kerman province: Bam (29°06'01.7"N, 58°19'44"E, 1111m), 4.vii-26.viii.2017, 1♀, 05-31.v.2017, 1♀, 31.v-04.vii.2017, 2♀, Malaise trap, Leg.: M. Purrezaali.
 Distribution in Iran: Tehran, Lorestan and Sistan and Baluchestan provinces (Farahani *et al.*, 2016).
 General distribution: Afrotropical, Oriental and Palaearctic.

7. *Phaedrotoma pulchriceps* (Szépligeti 1898)

Material examined: (4♀); Kerman province: Bam (29°06'01.7"N, 58°19'44"E, 1111m), 4.vii-26.viii.2017, 1♀ and 31.v-04.vii.2017, 1♀, Malaise trap, Leg.: M. Purrezaali; Bam, Hemat Abad (29°08'19.6" N, 57°58'05.1"E, 1673m), 31.v-04.vii. 2017, 2♀, Malaise trap, Leg.: M. Purrezaali.
 Distribution in Iran: Guilan and East Azarbaijan provinces (Farahani *et al.*, 2016).
 General distribution: Nearctic, Oriental and Palaearctic.

8. *Xynobius rudis* (Wesmael 1835)

Material examined: (3♀); Kerman province: Manujan (27°29'53.1" N, 57°33'43.4" E, 358m), 07.iv-05.v.2017, 1♀, Malaise trap, Leg.: M. Purrezaali; Manujan, Chah Nasri (27°31'14.6"N, 57°33'51.5" E, 384m), 20.iv-05.v.2017, 1♀, Malaise trap, Leg.: M. Purrezaali; Qaleh Ganj, Rostam Abad (27°29'57.3" N, 57°54'14.4" E, 387m), 14.iv.2018, 1♀, light trap, Leg.: M. Ehsani.
 Distribution in Iran: Kermanshah and Sistan and Baluchestan provinces (Farahani *et al.*, 2016).
 General distribution: Nearctic and Palaearctic.

Subfamily Rogadinae Förster 1862

Tribe Aleiodini Muesebeck 1928

9. *Aleiodes (Aleiodes) bicolor* (Spinola 1808)

Material examined: (50♀, 17♂); Kerman province: Jiroft, Baqer Abad (28°36'13.7"N, 57°49'42"E, 652m), 20.iv-13.v.2017, 1♀ and 13-23.v.2017, 2♀, Malaise trap, Leg.: M. Purrezaali; Manujan, Chah Nasri (27°31'14.6"N, 57°33'51.5"E, 384m), 10.iv-05.v.2017, 3♀ and 05-22.v.2017, 1♀, Malaise trap, Leg.: M. Purrezaali; Manujan, Chermil (27°31'14.6"N, 57°33'51.5"E, 445m), 05-22.v.2017, 2♀, Malaise trap, Leg.: M. Purrezaali; Jiroft, Mijan, Sar Asiab (28°41'6.6"N, 57°55'17.7"E, 1288m), 20.iv-05.v.2017, 1♀, 2♂, 05-23.v.2017, 1♀, 23.v-5.vii.2017, 3♂, Malaise trap, Leg.: M. Purrezaali; Jiroft, Mijan, Koldan (28°41'27.8"N, 57°55'17.8"E, 1349m), 20.iv-05.v.2017, 2♀, 05-23.v.2017, 3♀, 23.v-5.vii.2017, 2♀, 5♂, Malaise trap, Leg.: M. Purrezaali; Anbar Abad, Bardeh (28°28'4.1"N, 58°12'39.3" E, 1501m), 21.iv-23.v.2017, 1♀, 05-23.v.2017, 3♀, 1♂, 23.v-5.vii.2017, 5♀, 05.vi-05.vii.2017, 2♀, 3♂, 05-21.ix.2017, 1♂, Malaise trap, Leg.: M. Purrezaali; Anbar Abad, Roodfarq (28°29'4" N, 58°9'56.2"E, 1429 m), 05-23.v.2017, 1♀, 1♂ and

04.vi-5.vii.2017, 8♀, 1♂, Malaise trap, Leg.: M.Purrezaali; Dehbakri, Marghak, Bidkhun (29°07'22.6" N, 57°52'56.8" E, 2220m), 22.v-04.vii.2017, 2♀, Malaise trap, Leg.: M. Purrezaali; Bam (29°06'01.7" N, 58°19'44" E, 1111m), 31.v-04.vii.2017, 6♀, 4.vii-26.viii.2017, 2♀ and 26.viii-21.iv.2017, 1♀, Malaise trap, Leg.: M. Purrezaali; Bam, Hemat Abad (29°08'19.6" N, 57°58'05.1" E, 1673m), 31.v-04.vii. 2017, 1♀, Malaise trap, Leg.: M. Purrezaali.

Distribution in Iran: Sistan and Baluchestan, Mazandran, Isfahan, Fars, Alborz, Guilan and Tehran provinces (Farahani *et al.*, 2016).

General distribution: Palaearctic

10. *Aleiodes (Aleiodes) nocturnus* Telenga 1941

Material examined: (2♀, 2♂); Kerman province: Qaleh Ganj, Rostam Abad (27°29'59.2" N, 57°54'13.9" E, 387m), 10.iv-04.v.2017, 1♂, Malaise trap, Leg.: M. Ehsani; Manujan, Chah Nasri (27°31'14.6" N, 57°33'51.5" E, 384m), 10.iv-05.v.2017, 1♀ and 05-22.v.2017, 1♀, Malaise trap, Leg.: M. Purrezaali; Manujan, Chermil (27°31'14.6" N, 57°33'51.5" E, 445m), 05-22.v.2017, 1♂, Malaise trap, Leg.: M. Purrezaali.

Distribution in Iran: Tehran and Guilan provinces (Farahani *et al.*, 2016).

General distribution: Palaearctic

11. *Aleiodes (Chelonorhogas) apicalis* (Brullé 1832)

Material examined: (1♀); Kerman province: Anbar Abad, Bardeh (28°28'4.1" N, 58°12'39.3" E, 1501m), 05.vi-05.vii.2017, 1♀, Malaise trap, Leg.: M.Purrezaali

Distribution in Iran: Sistan and Baluchestan, Isfahan, West Azarbaijan, Guilan and Mazandaran provinces (Farahani *et al.*, 2016).

General distribution: Palaearctic

4. DISCUSSION

In the present research, we focused on the fauna of Braconidae of Kerman province, which has not been sufficiently explored until now. Totally 11 species in six genera belonging to three braconid subfamilies were identified and recorded from Kerman province, southeastern Iran. A single species, *Opius (Cryptonastes) ficedus* Papp, 1979 (Opiinae) was recorded for the first time for the fauna of Iran. Almost all the species identified in the current study were collected using Malaise traps, a single species, *Chelonus annulipes*, was collected using both sweep net (three specimens) and Malaise trap (a single specimen). This species was collected from alfalfa fields (*Medicago sativa*) in Bidkhan, Negar and Dashtkar. Two species, *Phanerotoma leucobasis* and *Xynobius rudis* were collected using both Malaise trap (three specimens) and light trap (two specimens). Other species (85 specimens) were collected by Malaise traps. The geographical distribution of some species (*Chelonus oculator*, *Phanerotoma permixtella*, *Aleiodes bicolor*, *A. nocturnus* and *A. apicalis*) is limited to the Palaearctic region, while other species are also distributed in other zoogeographical regions.

Prior to this study, the number of the recorded species of the three mentioned subfamilies in Kerman province were: 2 (Cheloninae), 19 (Opiinae) and 7 (Rogadinae) (Farahani *et al.* 2016; Ranjbar *et al.*, 2016; Abdolalizadeh *et al.*, 2017; Safahani *et al.*, 2018). However, as a result of this study the number of known species of the first two subfamilies in Kerman province increased to 6 and 20 species respectively. There was no new record for Rogadinae.

In general, the wasps of the mentioned braconids are considered as the most important group of insects which have significant role in biological control of agricultural pests.

In conclusion, although the present study increases the number of species of Braconidae known from the province, but some habitats in north, northwestern and central parts of the province, have not yet been studied in detail and the real number is expected to be much higher. So more samplings are necessary to increase the knowledge of diversity and applicability of this important group of parasitoids in Kerman province.

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