J Insect Biodivers Syst 05(3): 159–169

ISSN: 2423-8112

OPEN ACCESS

JOURNAL OF INSECT BIODIVERSITY AND SYSTEMATICS

JIBS

Research Article

http://jibs.modares.ac.ir

http://zoobank.org/References/D262CA64-B31D-4EEC-BFCE-24B610103957

Faunistic study of the genus *Habrobracon* Ashmead (Hymenoptera: Braconidae) from Iran

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Received:
26 May, 2019

Accepted:
25 June, 2019

Published:
01 July, 2019

Subject Editor:
Ali Ameri

ABSTRACT. *Habrobracon kopetdagi* Tobias, 1957 and *H. ponticus* (Tobias, 1986) are collected from Khuzestan province and recorded for the first time from Iran. In addition, three species (viz., *H. crassicornis* (Thomson, 1892), *H. iranicus* Fischer, 1972, *H. stabilis* (Wesmael, 1838)) are new provincial records. A faunistic list of Iranian *Habrobracon* species with distribution, host records and brief diagnoses for new recorded species from Iran are provided.

Key words: Khuzestan, new records, faunistic list, Iran

Citation: Zargar, M., Talebi, A.A. & Farahani, S. (2019) Faunistic study of the genus *Habrobracon* Ashmead (Hymenoptera: Braconidae) from Iran. *Journal of Insect Biodiversity and Systematics*, 5 (3), 159–169.

Introduction

Braconinae (Hymenoptera: Braconidae) is a large subfamily with about 190 genera and over 3000 described species worldwide (Quicke, 2015; Yu et al., 2016). *Habrobracon* Ashmead, 1895 is a moderate genus of the subfamily Braconinae, with 37 valid species worldwide (Yu et al., 2016). The status of *Habrobracon* (as well as most subgenera of the *Bracon* genus group) is not established adequately. In absence of strong morphological criteria in determining the members of this taxon, different authors considered it as either a separate genus (Quicke, 1987; Papp, 2008, 2012) or a subgenus of *Bracon* (Tobias, 1986; van Achterberg & Polaszek, 1996; Yu et al., 2016). In present study we consider *Habrobracon* to be a valid genus. *Habrobracon* differs from *Bracon* in having 1) vein 3-SR less than l.5 times vein r in *Habrobracon vs* more than 1.9 times in *Bracon* and 2) vein 2-SR+M long in *Habrobracon vs* short in *Bracon*.

The species of *Habrobracon* parasitize about 235 species of the order Lepidoptera, mostly Gelechiidae, Noctuidae, Pyralidae and Tortricidae (Yu et al., 2016). *Habrobracon hebetor* Say species complex are the most well-studied species in this genus, as well as in the whole subfamily Braconinae and are extensively used as bio-control agent of the important stored product pests, such as *Ephestia kuehniella* Zeller (Pyralidae), *Plodia interpunctella* Hubner (Pyralidae) and *Angoumois grainmoth* (Gelechiidae).

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To date, ten species of the genus *Habrobracon* have been reported from Iran (Modarres Awal, 1997; Karampour & Fasihi, 2004; Dezianian & Quicke, 2006; Lashkari Bod et al., 2011; Ghahari & Fischer 2011; Ghahari et al., 2011, 2012; Ameri et al., 2014; Farahani et al., 2016; Rajabi Mazhar et al., 2019). Considering the low number of known *Habrobracon* species from Iran (10 out of 23 distributed in Palaearctic), taxonomic and faunistic studies on this subgenus is required. In the present study, two new distributional records and a faunistic list along with distribution and host records are provided.

Material and methods

The specimens were collected from Khuzestan province during 2016–2017 using Malaise traps. Khuzestan province includes mountainous areas located in the north with plains and sea level areas in the south. The specimens were fortnightly removed from the collecting bottle and preserved in 70% alcohol. Later, the specimens were prepared according to the AXA method (van Achterberg, 2009) and mounted on triangular cards and eventually labeled. The key by Tobias (1986) and comparison with the type material of all the listed species were used for identification of the specimens. Photographs of the specimens were taken under a microscope (Olympus™ AX70) or stereomicroscope (Olympus™ SZX9) equipped with digital camera (Sony, Japan). The terminology of morphological characters follows van Achterberg (1988, 1993). Abbreviations used in this paper are as follows: POL = postocellar line, OOL = ocularocellar line, MOD = median ocellar diameter.

Results

A total of 12 species of the genus *Habrobracon* (Braconidae: Braconinae) are listed from the Iranian fauna, of which *Habrobracon kopetdagi* Tobias, 1957 and *H. ponticus* (Tobias, 1986) are recorded for first time from Iran. The list of species is given below.

Family Braconidae Nees, 1811

Subfamily Braconinae Nees, 1811

Genus *Habrobracon* Ashmead, 1895

***Habrobracon brevicornis* (Wesmael, 1838)**

Original name. *Braco brevicornis* Wesmael, 1838

Distribution in Iran. Bushehr (Karampour & Fasihi, 2004), Ilam (Gharali, 2004), Semnan (Dezianian & Jalali, 2004).

General distribution. Worldwide (introduced into Nearctic) (Yu et al., 2016).

Host records. Lepidoptera: Crambidae, Depressariidae, Erebidae, Gelechiidea, Lymantriidae, Noctuidae, Nolidae, Plutellidae, Pyralidae, Tineidae, Tortricidae, Xyloryctidae, Yponomeutidae (Yu et al., 2016).

Remark. *Habrobracon brevicornis*, the former synonym of *H. hebetor*, has been re-validated based on molecular data (Kittel & Maeto, 2018).

***Habrobracon concolorans* (Marshall, 1900)**

Original name. *Bracon concolorans* Marshall, 1900

Synonyms. *Bracon* (*Bracon*) *concolor* Thomson, 1892, *Habrobracon nigricans* Szepligeti, 1901, *H. mongolicus* Telenga, 1936.

Distribution in Iran. Fars (Lashkari Bod et al., 2011, as *H. nigricans*), Hormozgan (Ameri et al., 2014, as *Bracon* (*Habrobracon*) *nigricans*), Kerman (Iranmanesh et al., 2018)

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

Host records: Coleoptera: Anobiidae, Lepidoptera: Gelechiidae, Tortricidae, Pyralidae (Yu et al., 2016).

***Habrobracon crassicornis* (Thomson, 1894)**

Original name. *Bracon* (*Bracon*) *crassicornis* Thomson, 1892

Synonym. *Habrobracon* (*Habrobracon*) *flavosignatus* Tobias, 1957.

Material examined. Southwestern Iran, Khuzestan province: Baghmalek, Ghaletol [31°37′49″ N, 49°52′53″ E], 880 m a.s.l., 5–19.II.2017, 1♀, Malaise trap in citrus orchards, leg.: M. Zargar.

Distribution in Iran. Ilam (Ghahari et al., 2011), Khuzestan (current study).

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

Host records. Lepidoptera: Gelechiidae, Pyralidae, Tortricidae, Yponomeutidae (Yu et al., 2016).

***Habrobracon didemie* (Beyarslan, 2002)**

Original name. *Bracon* (*Habrobracon*) *didemie* Beyarslan, 2002

Distribution in Iran. Hormozgan (Ameri et al., 2015)

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

Host record. Unknown.

***Habrobracon excisus* Tobias, 1957**

Original name. *Habrobracon* (*Habrobracon*) *excisus* Tobias, 1957

Distribution in Iran. Iran (exact location is not known) (Haeselbarth, 1983; Fallahzadeh & Saghaei, 2010).

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

Host records. Lepidoptera: Depressariidae (Yu et al., 2016).

***Habrobracon hebetor* Say, 1836**

Original name. *Bracon hebetor* Say, 1836

Synonyms. *Bracon dorsator* Say, 1836, *Bracon juglandis* Ashmead, 1889, *Habrobracon brunneus* Szépligeti, 1901, *Habrobracon vernalis* Szépligeti, 1901, *Habrobracon beneficientior* Viereck, 1911, *Habrobracon plotnicovi* Bogoljubov, 1914, *Bracon breviantennatus* de Stefani, 1919, *Habrobracon serinopae* Cherian, 1929, *Habrobracon tortricidarum* Goidanich, 1934, *Habrobracon pectinophorae* Watanabe, 1935, *Bracon* (*Habrobracon*) *hebetor asiaticus* Telenga, 1936, *Habrobracon flavus* Telenga, 1936, *Habrobracon turkestanicus* Telenga, 1936, *Habrobracon lozinskii* Bogacev, 1939.

Material examined. Southwestern Iran, Khuzestan province: Khoramshahr, Sheneh [30°25′32″ N, 48°11′20″ E], 2 m a.s.l., 8–22.VI.2016, 2♀♀; 7–21.III.2017, 4♀♀; 8–22.VII.2017, 3♀♀; Malaise trap in palm orchards, leg.: M. Zargar.

Distribution in Iran. East Azarbaijan (Modarres Awal, 1997), Fars (Lashkari Bod et al., 2011), Hormozgan (Ameri et al., 2014), Isfahan (Bagheri & Nematollahi, 2006), Kerman, Tehran (Modarres Awal, 1997), Khuzestan (current study), Kermanshah (Noori, 1994), Qom (Norouzi et al., 2009), West Azarbaijan (Modarres Awal, 1997).

General distribution. Worldwide (Yu et al., 2016).

Host records. Coleoptera: Chrysomelidae, Curculioniade, Tenebrionidae. Hemiptera: Anthocoridae. Hymenoptera: Braconidae, Ichneumonidae, Ceraphronidae, Chalcididae, Cynipidae, Encyrtidae, Eulophidae, Eurytomidae, Pteromalidae. Lepidoptera: Arctiidae, Depressariidae, Gelechiidae, Lymantriidae, Noctuidae, Nolidae, Papilionidae, Pieridae, Plutellidae, Pyralidae, Saturniidae, Tortricidae, Yponomeutidae (Yu et al., 2016).

***Habrobracon iranicus* Fischer, 1972**

Original name. *Habrobracon iranicus* Fischer, 1972

Material examined. Southwestern Iran, Khuzestan province: Behbahan, Dodangeh [30°42′08″ N, 50°10′41″ E], 300 m a.s.l., 8-

22.VII.2017, 1♀; Malaise trap in citrus orchards, leg.: M. Zargar.

Distribution in Iran. Tehran (Modarres Awal, 1997), Khuzestan (current study), Iran (exact location is not known) (Fischer, 1972; Shenefelt, 1978).

General Distribution. Western Palaearctic (Yu et al., 2016).

Host records. Lepidoptera: Noctuidae, Tortricidae, Yponomeutidae (Modarres Awal, 1997).

Habrobracon kopetdagi Tobias, 1957

(Fig. 1)

Original name. *Habrobracon* (*Habrobracon*) *kopetdagi* Tobias, 1957

Material examined. Southwestern Iran, Khuzestan province: Ramhormoz, Gharabad [30°59′37″ N, 49°46′50″ E], 126 m a.s.l., 22.V-5.VI.2017, 2♂♂; Malaise trap in olive orchards, leg.: M. Zargar.

Distribution in Iran. Khuzestan (current study). New record for Iran.

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

Host records. Coleoptera: Buprestidae. Lepidoptera: Gelechiidae (Yu et al., 2016).

Diagnosis (male): Head width 1.9 times its length in dorsal view; POL:MOD:OOL = 3:2:6 (Fig. 1A); malar space subequal to basal width of mandible; width of face 1.7 times its height (Fig. 1B); antenna 27-segmented, longer than body, length of penultimate segment 1.7 times its width; length of mesosoma 1.2 times its maximum height; mesoscutum granulose (Fig. 1C), with two smooth longitudinal stripes in middle part; propodeum granulose, without median carina; fore wing vein 1-R1 as long as pterostigma, vein 3-SR 1.3 times as long as vein r, 0.9 times as long as vein 2-SR; pterostigma 2.8 times longer than wide (Fig. 1D); first metasomal tergite as long as its apical width, coriaceous, second metasomal tergite more sculptured compared to next tergites (Fig. 1E). Coloration: Body mostly black, inner side of eyes with reddish pattern, mandibles yellowish (Fig. 1F).

Habrobracon ponticus (Tobias, 1986)

Original name. *Bracon* (*Habrobracon*) *ponticus* Tobias, 1986

Material examined. Southwestern Iran, Khuzestan province: Lali, Taraz [32°20′ 49″ N, 49°05′11″ E], 390 m a.s.l., 21.III–4.IV.2017, 1♀; Malaise trap in citrus orchards, leg.: M. Zargar.

Distribution in Iran. Khuzestan (current study). New record for Iran.

General Distribution. Palaearctic (Yu et al., 2016).

Host record. Unknown.

Diagnosis: Head width 2.0 times its length in dorsal view; POL: MOD:OOL = 3:2:6 (Fig. 2A); malar space 1.2 times basal width of mandible; width of face 1.8 times its height (Fig. 2B); antenna 22-segmented, shorter than body, length of penultimate segment 1.5 times its width; length of mesosoma 1.7 times its maximum height; mesoscutum granulose (Fig. 2C); propodeum granulose, without median carina; marginal cell in fore wing ending clearly before tip of wing, vein 1-R1 as long as pterostigma, vein 3-SR 1.3 as long as vein r, 0.75 times as long as vein 2-SR; pterostigma 3 times as longer than width (Fig. 2D); length of first metasomal tergite 0.75 times as long as its apical width, granoluse (Fig. 2E). Coloration: Body mostly black, lower side of abdomen with reddish or dark brownish yellow pattern, mandibles yellowish red, anterior margin of clypeus and hind tibiae in basal half reddish dark brown, wings darkened (Fig. 2F).

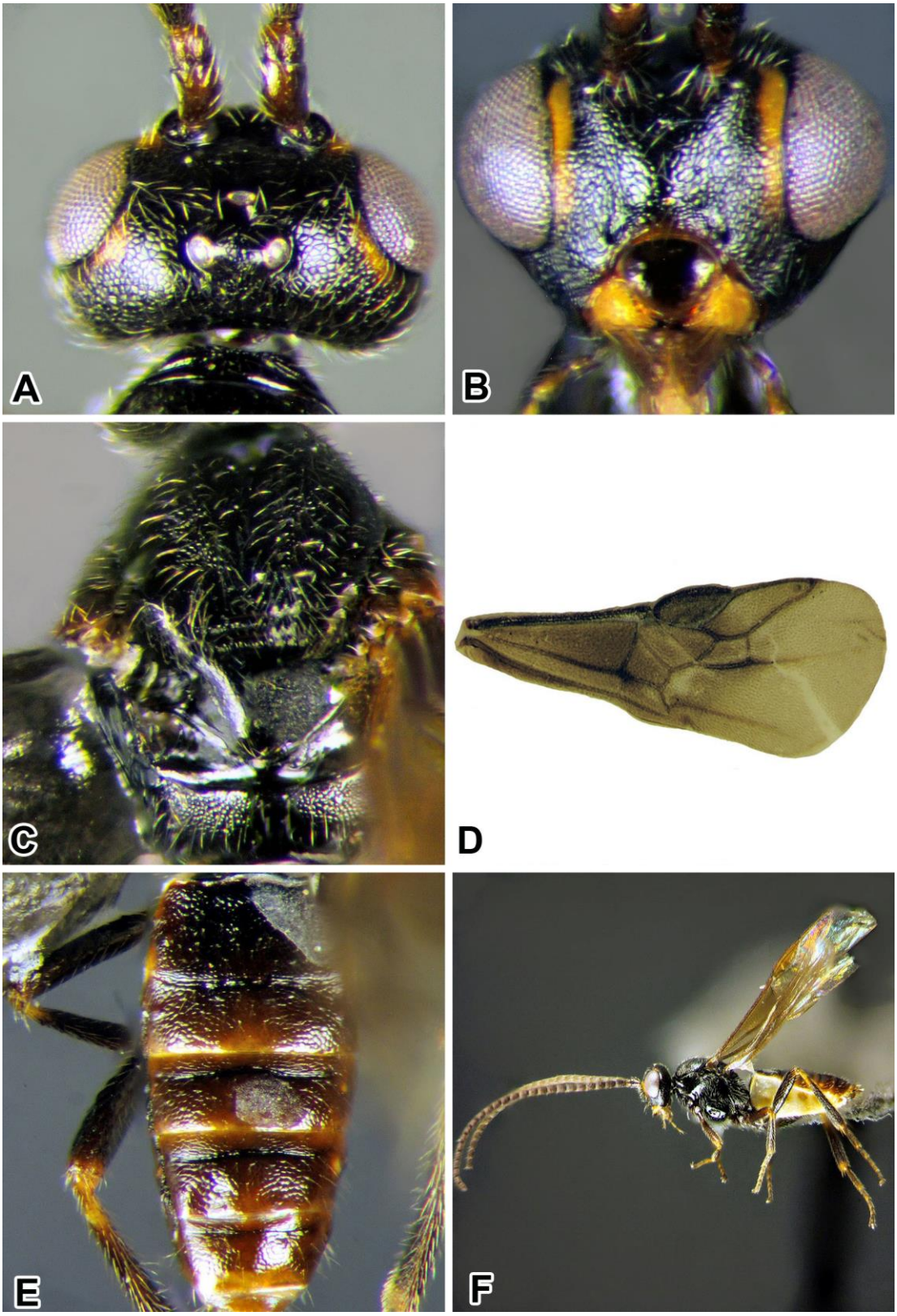

Figure 1. *Habrobracon kopetdagi* (Tobias, 1957), **A.** Head, dorsal view; **B.** Head, frontal view; **C.** Mesosoma, dorsal view; **D.** Fore wing; **E.** Metasoma, dorsal view; **F.** Habitus, lateral view.

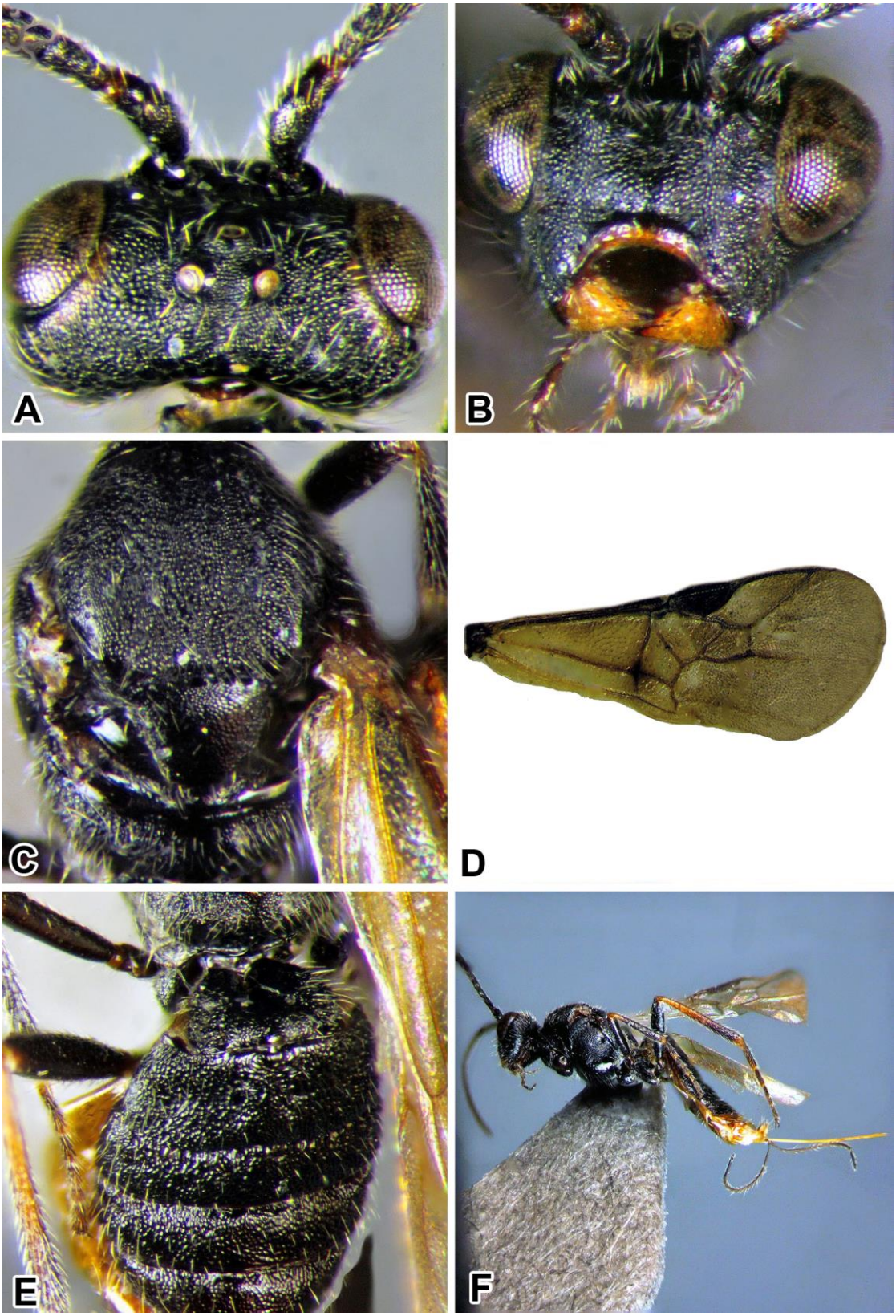

Figure 2. *Habrobracon ponticus* Tobias, 1986, **A.** Head, dorsal view; **B.** Head, frontal view; **C.** Mesosoma, dorsal view; **D.** Fore wing; **E.** Metasoma, dorsal view; **F.** Habitus, lateral view.

***Habrobracon radialis* Telenga, 1936**

Original name. *Habrobracon radialis* Telenga, 1936

Distribution in Iran. Golestan (Sakenin et al., 2012), Guilan (Ghahari et al., 2012), Semnan (Dezianian & Quicke, 2006).

General Distribution. Palaearctic (Yu et al. 2016).

Host records. Lepidoptera: Gelchiidae, Plutellidae (Yu et al., 2016).

***Habrobracon stabilis* (Wesmael, 1838)**

Original name. *Braco stabilis* Wesmael, 1838

Synonym. *Bracon opacus* Stelfox, 1953

Material examined. Southwestern Iran, Khuzestan province: Ramhormoz, Gharabad [30°59′37″ N, 49°46′50″ E], 126 m a.s.l., 5–19.II.2017, 1♀; 7–21.III.2017, 1♀; Malaise trap in olive orchards, leg.: M. Zargar.

Distribution in Iran. Hamadan (Rajabi Mazhar et al., 2019), Khuzestan (current study), Qazvin province (Ghahari & Fisher., 2011).

General Distribution. Nearctic, Orienal, Palaearctic (Yu et al., 2016).

Host records. Coleoptera: Dermestidae, Anobiidae, Curculionidae. Diptera: Tephritidae. Lepidoptera: Coleophoridae, Depressariidae, Gelechiidae, Tortricidae, Yponomeutidae (Yu et al., 2016).

***Habrobracon telengai* Muljarskaya, 1955**

Original name. *Habrobracon telengai* Mulyarskaya, 1955

Distribution in Iran. Hormozgan (Ameri et al., 2014), Kerman (Mehrnejad, 2010).

General Distribution. Palaearctic (Yu et al., 2016).

Host records. Coleoptera: Buprestidae, Curculionidae. Lepidoptera: Gelechiidae, Tortricidae (Yu et al., 2016).

Discussion

This survey, for the first time, was carried out in Khuzestan province in the southwestern part of Iran. Geographically, this province is covered by mountainous areas in the north and the plains and sea level regions in the south. The sampling sites, for this study, include both zones. Because of the specific geographic conditions, the flora of Khuzestan is varying from mountainous trees in highlands to marshlands in low elevation areas (Hoberlandt, 1983).

The result of this study led to identifying six species of genus *Habrobracon* Ashmead, 1895, which increased the total number of Iranian *Habrobracon* to twelve. Moreover, three species are recorded, for the first time, from Khuzestan province.

According to the previous literature on the genus *Habrobracon* in the different parts of Iran, the *H. hebetor* Say, 1836 species complex has the most dispersal in Iran with seven provincial records (Fig. 3) (Modarres Awal, 1997; Karampour & Fasihi, 2004; Dezianian & Quicke, 2006; Lashkari Bod et al., 2011; Ameri et al., 2014; Farahani et al., 2016). It should be noted that the provinces located in south (Hormozgan with four recorded species) (Ameri et al., 2014) and southwest (Khuzestan with 6 recorded species) (Modarres Awal, 1997; current study) are more species rich than other provinces of Iran (Fig. 3).

Considerable studies have been performed on the genus *Habrobracon* in the Palaearctic region including about 23 species known from the countries adjacent to Iran (Yu et al., 2016). Considering the number of *Habrobracon* species revealed in Khuzestan province and the potential role of its species in biological control, further integrated taxonomic and faunistic research along with revealing the host associations are essentially required.

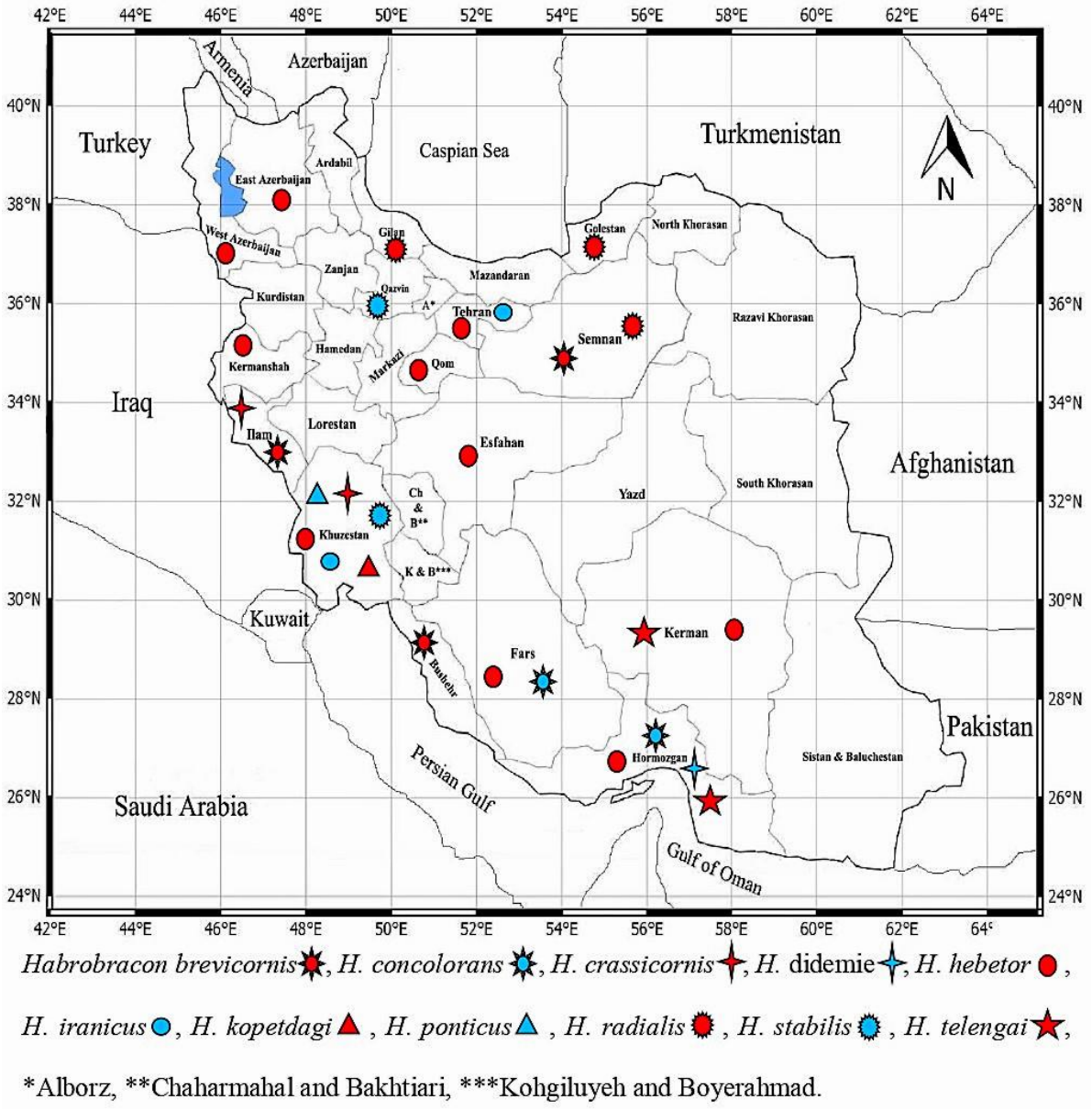

Figure 3. Provincial distribution species of subgenus *Habrobracon* Ashmead, 1895.

Acknowledgments

Thanks are due to the Department of Entomology, Tarbiat Modares University for providing financial support for this study. We are most grateful to Dr. Konstantin Samartsev (Zoological Institute of the Russian Academy of Sciences) for valuable help in identification of the species and very helpful comments on the earlier version of the manuscript.

Conflict of Interests

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

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مطالعهٔ فونستیک جنس *Habrobracon* Ashmead (Hymenoptera: Braconidae) در ایران

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تاریخ دریـافت: ۰۵ خرداد ۱۳۹۸ ، تاریخ پذیرش: ۰۴ تیر ۱۳۹۸ ، تاریخ انتشار: ۱۰ تیر ۱۳۹۸

چکیــده: دو گونه *Habrobracon kopetdagi* (Tobias, 1957) و *H. ponticus* Tobias, 1986 از استان خوزستان جمع آوری گردید و برای اولین بار از ایران گزارش می‌شوند. علاوه بر این سه گونه *H. crassicornis* Thomson, 1892 ، *H. iranicus* (Fisher, 1972)، *H. stabilis* (Wesmael, 1838) برای اولین بار از استان خوزستان گزارش می‌شوند. لیست گونه‌های جنس *Habrobracon* به همراه پراکنش، میزبان‌ها و خصوصیات تفکیکی برای گزارش‌های جدید از ایران ارایه شد.

واژگــان کلیدی: خوزستان، گزارش، لیست گونه‌ها، میزبان