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The Genus *Holopyga* (Hymenoptera: Chrysididae) in Iran, with Five New Records

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ABSTRACT

The Iranian species of the genus *Holopyga* (Hymenoptera: Chrysididae) were investigated. Specimens were collected during four years of field research between 2010 and 2013, in northern and southern provinces of Iran. Twenty one species and subspecies were recognized, of which four species and one subspecies were recorded for the first time from Iran: *Holopyga beaumonti* Balthasar, 1953; *H. fascialis* Linsenmaier, 1959; *H. ignicollis* Dahlbom, 1854; *H. inflammata inflammata* (Förster, 1853) and *H. jurinei* Chevrier, 1862. Geographical distribution of all species and morphological diagnostic characteristics of the newly recorded species are given. The number of *Holopyga* species and subspecies in Iran is now raised to 21.

Keywords: Cuckoo wasps, Diagnostic characteristics, Elampini, Taxonomy, Updated list of species.

INTRODUCTION

Holopyga Dahlbom, 1845 (Hymenoptera: Chrysididae), is a large genus belonging to the tribe Elampini and including 110 species. It is distributed in all Zoogeographical regions, with the highest diversity in the Palaearctic Region (Kimsey and Bohart, 1991). Biology of the genus *Holopyga* is poorly known. Apparently, sphecid and crabronid wasps are hosts for this genus (Kimsey and Bohart, 1991; Veenendal, 2012), whereas citations for Megachilidae are doubtful (Paukkunen *et al*., 2015). Veenendal (2012) suggested that *Holopyga* species have the same behavior and parasitism strategies as the American *Pseudolopyga*, which lay an egg directly on the Hemiptera may later transfer into the host nest by the crabronid wasps. Taxonomy of the genus *Holopyga* in the Palaearctic region was studied by various authors (Mocsáry, 1879, 1889, 1911; Linsenmaier, 1959, 1968, 1987, 1994, 1999; Arens, 2004, 2011, 2014). But species belonging to this genus have a confused situation (Rosa and Vårdal, 2015; Rosa and Xu, 2015; Rosa *et al*., 2015), therefore, an extensive review has become necessary to clarify the taxonomic position of the species in this genus. Prior to this study, fourteen species and seven subspecies were recorded for Iran (Mocsáry, 1892; Bischoff, 1910; Linsenmaier, 1959, 1987; Semenov-Tian-Shanskij, 1967; Rosa *et al*., 2013; Torabipour *et al*., 2013a; Farhad *et al*., 2016). The genus *Holopyga* is characterized by the sharply angulate fore wing median vein, setaceous median cell, multidentate tarsal claws, carinate and angulate mesopleuron, angulate postocular region and cross-ridged scapal basin (Kimsey and Bohart, 1991). This genus show sexual dimorphism in color and shape of third abdominal tergum (Kimsey and Bohart, 1991). According to Linsenmaier

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(1999), the genus is divided into four species-groups. The Iranian species belong to two species groups: *H. fervida* species group with a triangular smooth punctuation (in female) and finely punctured area anterobasally on scutellum (in male), and *Holopyga gloriosa* species group without smooth or finely punctured area anterobasally on scutellum. (Rosa *et al*., 2013). The aim of this study was to provide an updated list of the species belonging to the genus *Holopyga* currently found in Iran and provide a brief diagnosis for any newly recorded *Holopyga* species.

MATERIALS AND METHODS

The revised list of *Holopyga* from Iran is based on literature records and specimens recently collected. Sampling was carried out by Malaise traps and sweep net in northern provinces (Guilan, Mazandaran, Alborz, and Qazvin) and southern provinces (Hormozgan, Kerman, and Fars) of Iran during the years 2010-2013. The specimens were prepared and sorted into genus and species level. Fifty-five of the collected specimens belonged to the genus *Holopyga*. Examination and descriptions were done under Olympus SZH10 stereomicroscope and images were taken by Sony CCD digital camera attached to an Olympus AX70 stereomicroscope. Photos were processed by Zerene Stacker 1.04 software. Specimens were deposited in the insect collection of the Department of Entomology, Tarbiat Modares University, Tehran, Iran, and in the private collection of Franco Strumia (Italy). The following data were recorded: valid taxa names, distribution and brief description of the newly recorded species, whiche were marked by an asterisk (*) in the text. The abbreviations used in diagnostic characteristics of the newly recorded species follow Kimsey and Bohart (1991): F1, F2, F3, etc.= Flagellum 1, flagellum 2, flagellum 3, etc.; *MOD*= Middle Ocellus Diameter. The identification of species was done by the first and fifth authors.

RESULTS

List of Species

***Holopyga amoenula oriensa* Linsenmaier, 1959**

Materials Examined: Mazandaran Province, Noor, Chamestan, Gaznasara (36° 16′ 56.82″ N, 52° 10′ 58.50″ E, 2,032 m), 05-vi-2011, 1♂, Noor; Chamestan, Tangehvaz (36° 21′ 55.68″ N, 52° 06′ 10.32″ E, 702 m), 05-ix-2011, 1♀, leg. M. Khayrandish.

Distribution: Greece, Palestine, Syria, Turkey (Linsenmaier, 1968, 1959); Iran (Linsenmaier, 1959; Rosa *et al*., 2013).

***Holopyga arabica* Linsenmaier, 1994**

Materials Examined: Hormozgan Province, Minab, Chelo (27° 10′ 30″ N, 57° 01′ 09″ E, 16 m), 18-v-2012, 1♂, leg. A. Ameri.

Distribution: Oman, Saudi Arabia, United Arab (Linsenmaier, 1994; Strumia and Dawah, 2011); Iran (Farhad *et al*., 2016).

***Holopyga beaumonti* Balthasar, 1953**

Material Examined: Hormozgan Province, Hajiabad (27° 17′ 1.8″ N, 55° 45′ 14″ E, 867 m), 10-iv-2011, 1♀; leg. A. Ameri.

Diagnosis: Body length 5.3 mm; height of clypeus 1.4 *MOD*; scapal basin with fine transverse lines (Figure 1-A); temples angular and divergent (Figure 1-B); F1 almost two times as long as its maximum width; punctures on mesonotum, scutellum and metanotum coarse and dense with narrow intervals (Figures 1-C), on pronotum more scattered with smooth intervals covered with small punctures (Figure 1-D); on metasoma fine, deep and close (Figure 1-E), on second metasomal sternum few and sparse (Figure 1-F); coloration: head, pronotum, mesonotum and metasoma golden

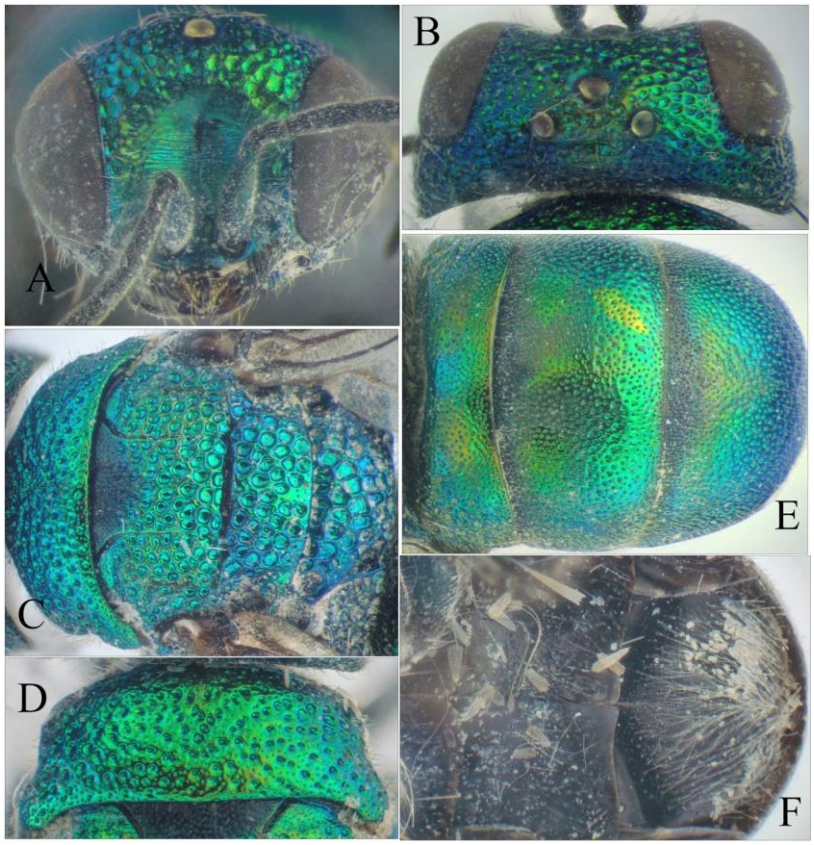

Figure 1. *Holopyga beaumonti* Balthasar, 1953: (A) Head, frontal view; (B) Head, dorsal view; (C) Pronotum, mesonotum and scutellum, dorsal view; (D) Pronotum, dorsal view; (E) Metasoma, dorsal view, (F) Metasoma, ventral view.

green, scutellum and metanotum green, tegula nonmetallic, wings tanned on outer half.

Distribution: Oman (Balthasar, 1953); Egypt, Palestine (Linsenmaier, 1999); Turkey (Strumia and Yildirim, 2011); Saudi Arabia, UAE (Strumia, 2014). New record for Iran.

***Holopyga bifigurata* Linsenmaier, 1968**

Distribution. Iran, Palestine, Syria, Turkey (Linsenmaier, 1968, 1987; Strumia and Yildirim, 2007).

***Holopyga chrysonota* discolor Linsenmaier, 1959**

Distribution: Cyprus, Iran, Lebanon, North Africa, Palestine, Turkey (Linsenmaier, 1959, 1987, 1999; Rosa *et al*., 2013).

***Holopyga crassepuncta* Semenov, 1954**

Distribution: Kazakhstan, Turkmenistan (Semenov and Nikol'skaya, 1954); Turkey (Kimsey and Bohart, 1991); Iran (Rosa *et al*., 2013).

***Holopyga cypruscula detrita* Linsenmaier, 1959**

Material Examined: Alborz Province, Shahriar (35° 40′ 08.10″ N, 50° 56′ 56.64″ E, 1,168 m), 01-vi-2010, 1♀, 15-vi-2010, 2♀♀, 06-vii-2010, 1♂, 10-vii-2010, 1♂, 12-vii-2010, 1♀, 24-viii-2010, 1♀, 01-ix-2010, 1♂, 07-ix-2010, 1♂, 22-ix-2010, 2♀♀, leg. A. Nadimi; Karaj (35°46′08.88″ N, 50° 56′ 55.20″ E, 1,277 m), 29-v-2010, 2♀♀, 01-vi-

2010, 1♀, leg. A. Nadimi; Hormozgan Province, Bandar Abbas, Zakin (27° 28′ 53″ N, 56° 18′ 27″ E, 680 m), 09-v-2011, 1♀, leg. A. Ameri; Fars Province, Sede (30° 44′ 08.77″ N, 52° 09′ 09.02″ E, 2301 m), 21-vii-2012, 1♀, leg. A. Amiri.

Distribution: Iran, Palestine, Turkey (Linsenmaier, 1959, 1968, 1987; Strumia and Yildirim, 2007; Rosa *et al*., 2013).

Remarks: Strumia and Fallahzadeh (2015) listed *H. cypruscula* from Kordestan, without any subspecies identification. *H. cypruscula cypruscola* Linsenmaier, 1959 is currently considered as an endemic subspecies of Cyprus, and the Iranian specimen could belong to *H. cypruscula detrita* or *H. cypruscula turca*.

Holopyga cypruscula turca Linsenmaier, 1987

Distribution: Turkey (Linsenmaier, 1987; Strumia and Yildirim, 2007); Iran (Rosa *et al*., 2013).

**Holopyga fascialis* Linsenmaier, 1959

Material Examined: Hormozgan Province, Bandar Abbas, Qale Qazi (27° 26′ 53″ N, 56° 32′ 53″ E, 48 m), 17-iv-2011, 1♂; Minab, Agricultural and Natural Resources Research Center of Minab (27° 8′ 39″ N, 57° 04′ 31″ E, 28 m), 20-iii-2012, 1♀, 03-iv-2012, 1♀; Qeshm Island, Ramkan (26° 52′ 25″ N, 56° 01′ 7″ E, 34 m), 16-iv-2012, 1♀, 18-vi-2012, 1♀; Minab, Chelo (27° 10′ 30″ N, 57° 01′ 09″ E, 16 m), 20-iv-2012, 1♀, leg. A. Ameri.

Diagnosis: Body length 6-7.5 mm; height of clypeus 1.5-1.7 *MOD*; scapal basin with transverse lines (Figure 2-A); temples angular and subparallel to slightly divergent (Figure 2-B); punctures on mesonotum, scutellum and metanotum coarse and dense with narrow intervals and clear reticulation in some specimen (Figures 2-C), on pronotum more scattered with smooth intervals covered with small punctures (Figure 2-D), on metasoma fine, deep and close (Figure 2-E), on second metasomal sternite numerous and close (Figure 2-F); coloration: head and mesosoma dark blue with some green reflection, metasoma dark blue, on the second metasomal sternum of some specimen with an antero-basal metallic spot, tegula nonmetallic, wings tanned on outer half.

Distribution: Palestine, North Africa (Linsenmaier, 1959, 1987, 1999). New record for Iran.

Holopyga fastuosa proviridis Linsenmaier, 1959

Material Examined: Alborz Province, Shahriar (35° 40′ 08.10″ N, 50° 56′ 56.64″ E, 1,168 m), 01-vi-2010, 1♀, leg. A. Nadimi.

Distribution: Iran, Palestine, Syria, Turkey (Linsenmaier, 1959); North Africa, south of Europe (Linsenmaier, 1999).

Holopyga fastuosa generosa (Forster, 1853)

Distribution: Europe, west Asia, China (Linsenmaier, 1997); Iran (Torabipour *et al*., 2013a).

Remarks: Torabipour *et al*., (2013a) have recorded *H. generosa* (Lucas, 1849) as a new record species for the fauna of Iran. In this research we follow Fauna Europaea (Rosa and Soon, 2013), where there is only one species *H. fastuosa* (Lucas, 1849) and four subspecies: *H. fastuosa fastuosa* (Lucas, 1849), *H. fastuosa generosa* (Forster, 1853), *H. fastuosa proviridis* (Linsenmaier, 1959), and *H fastuosa virideaurata* (Linsenmaier, 1959). Only *H. fastuosa generosa* (Forster, 1853) and *H. fastuosa proviridis* Linsenmaier, 1959 have been found in Iran. The first one with red or golden abdomen and the other is entirely green (Linsenmaier, 1997).

Holopyga fervida (Fabricius, 1781)

Material Examined: Hormozgan Province, Bandar Abbas, Zakin (27° 28′ 53″ N, 56° 18′

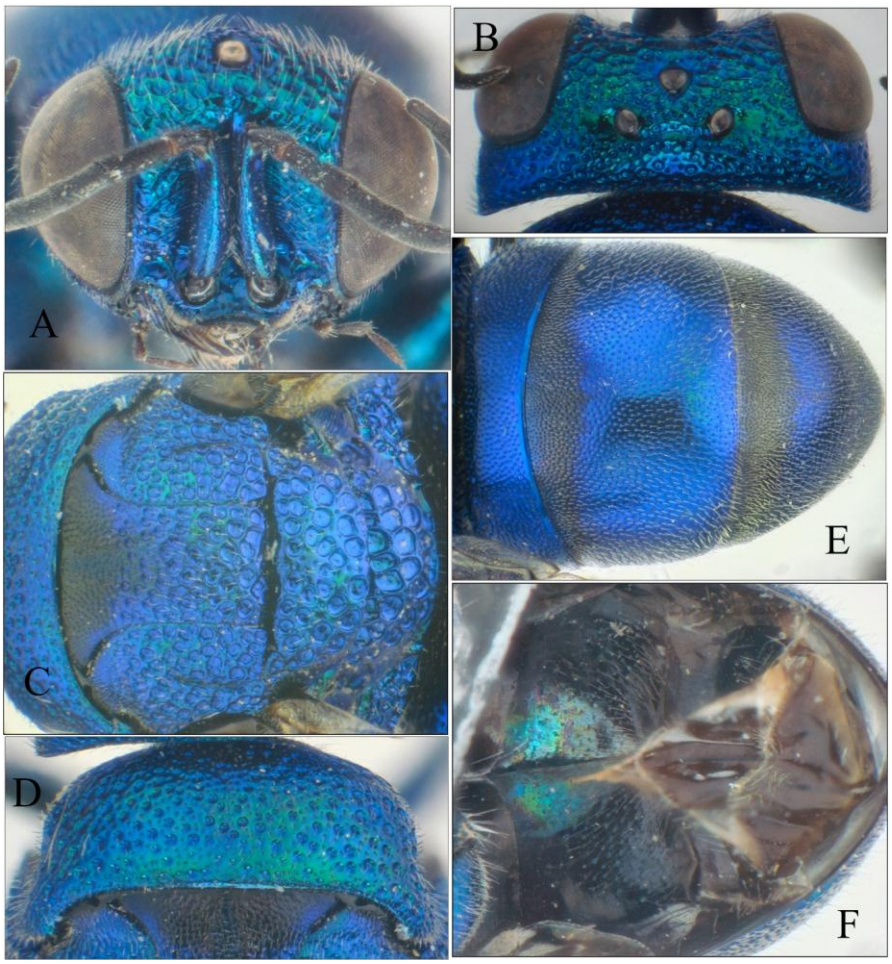

Figure 2. *Holopyga fascialis* Linsenmaier, 1959: (A) Head, frontal view; (B) Head, dorsal view; (C) Pronotum, mesonotum and scutellum, dorsal view; (D) Pronotum, dorsal view; (E) Metasoma, dorsal view, (F) Metasoma, ventral view.

27″ E, 680 m), 25-iv-2011, 1♀, 11-iv-2013, 1♀, 16-v-2011, 1♀; Roodan, Faryab (27° 28′ 58″ N, 57° 04′ 24″ E, 313 m), 11-iv-2013, 1♂, leg. A. Ameri; Fars Province, Eqlid, Shahrmeyan (30º 54′ 39.07″ N, 52º 28′ 16.82″ E, 2,120 m), 19-vii-2012, 1♀, leg. A. Amiri.

Distribution: Europe, Iran, North Africa, Turkey (Bischoff, 1910; Linsenmaier, 1959; Kimsey and Bohart, 1991; Yildirim and Strumia, 2007; Rosa *et al*., 2013).

******Holopyga ignicollis* **Dahlbom, 1854**

Material Examined: Alborz Province, Karaj (35° 46′ 08.88″ N, 50° 56′ 55.20″ E, 1,277 m), 29-v-2010, 3♀♀; Shahriar (35° 40′ 08.10″ N, 50° 56′ 56.64″ E, 1168 m), 01-vi-2010, 3♀♀, 06-vi-2010, 1♂, 15-vi-2010, 1♀, 05-x-2010, 1♀, leg. A. Nadimi; Mazandaran Province, Noor, Faculty of Natural Resources and Marine Sciences (36°34′52.98″ N, 52° 02′ 45.78″ E, -14 m), 09-vi-2011, 1♀; Hormozgan Province, Bandar Abbas, Zakin (site II) (27° 53′ 7″ N, 56°19′58″E, 1,020 m), 25-v-2012, 1♀, leg. A. Ameri; Fars Province, Jahrom (28° 39′ 35.18″ N, 53° 32′ 10.77″ E, 1,017 m), 03-vi-2012, 1♀, 17-vi-2012, 1♀, leg. A. Amiri; Kerman Province, Jiroft, dalfard (28° 58′ 53″ N, 57° 37.06″ E, 5,963 m), 30-vi-2013, 1♀, leg. A. Ameri

Diagnosis: Body length 5-6.2 mm; height of clypeus 2 *MOD*; scapal basin with transverse lines (Figure 3-A); temples subparallel (Figure 3-B); F1 three times longer than its maximum width in female, but shorter in male; punctures on mesonotum, scutellum and metanotum coarse and dense with narrow intervals (Figures 3-C), on pronotum more scattered with smooth intervals covered with small punctures (Figure 3-D); on metasoma very fine, deep and close (Figure 3-E), on second metasomal sternum almost invisible, with few and sparse punctures (Figure 3-F); coloration: female with pronotum, mesonotum and metasoma green-golden to flame red , other parts dark blue, body completely green in male, tegula nonmetallic, wings tanned on outer half.

Distribution: Cyprus, Greece, Middle and South Europe, North Africa, Palestine, Turkey, West Palaearctic to Middle Asia (Linsenmaier, 1959, 1968, 1999; Strumia and Yildirim, 2007). New record for Iran.

***Holopyga inflammata caucasica* Mocsáry, 1889**

Distribution: Caucasus, Cyprus, Palestine (Linsenmaier, 1959); Turkey (Strumia and Yildirim, 2007); Iran (Rosa *et al*., 3013).

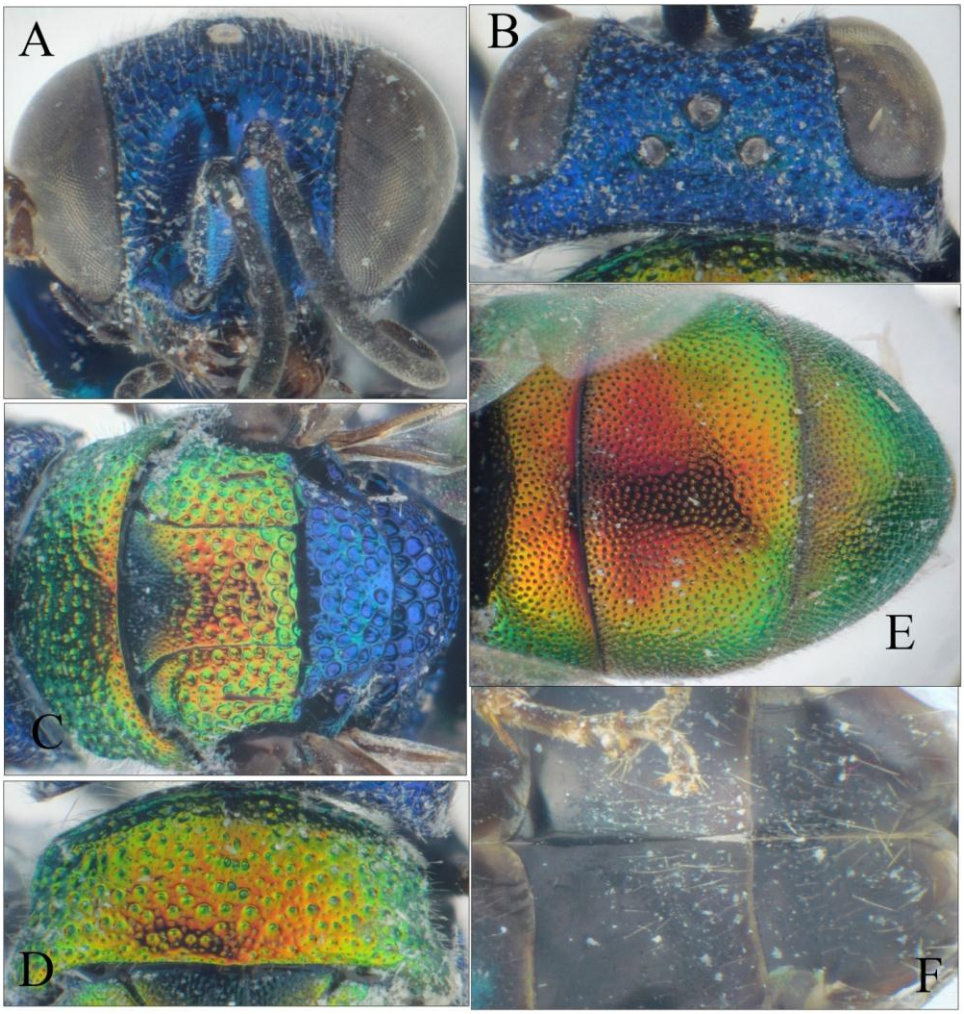

Figure 3. *Holopyga ignicollis* Dahlbom, 1854: (A) Head, frontal view; (B) Head, dorsal view; (C) Pronotum, mesonotum and scutellum, dorsal view; (D) Pronotum, dorsal view; (E) Metasoma, dorsal view, (F) Metasoma, ventral view.

***Holopyga inflammata inflammata (Förster, 1853)**

Material Examined: Alborz Province, Karaj (35° 46′ 08.88″ N, 50° 56′ 55.20″ E, 1,277 m), 06-vii-2010, 1♀, leg. A. Nadimi.

Diagnosis: Body length 7 mm; height of clypeus 1.3 times *MOD*; scapal basin with transverse lines (Figure 4-A); temples parallel with corners toward inside (Figure 4-B); F1 almost two times as long as its maximum width; punctures on head fine and close in the middle of ocellus and posterior part of head (Figure 4-B), on pronotum, mesonotum and scutellum shallow, scattered with smooth intervals covered with very small punctures with medium-sized punctures on scutellum, on metanotum coarse and dense with narrow intervals (Figures 4-C, -D), on metasoma very fine and close (Figure 4-E), on second metasomal sternite almost invisible, with few and dispersed punctures (Figure 4-F); coloration: pronotum, mesonotum, scutellum, matanotum and metasoma green-golden with cupreous reflection, head, sides of scutellum, propodeal angeles, mesopleuron and legs dark blue, tegula

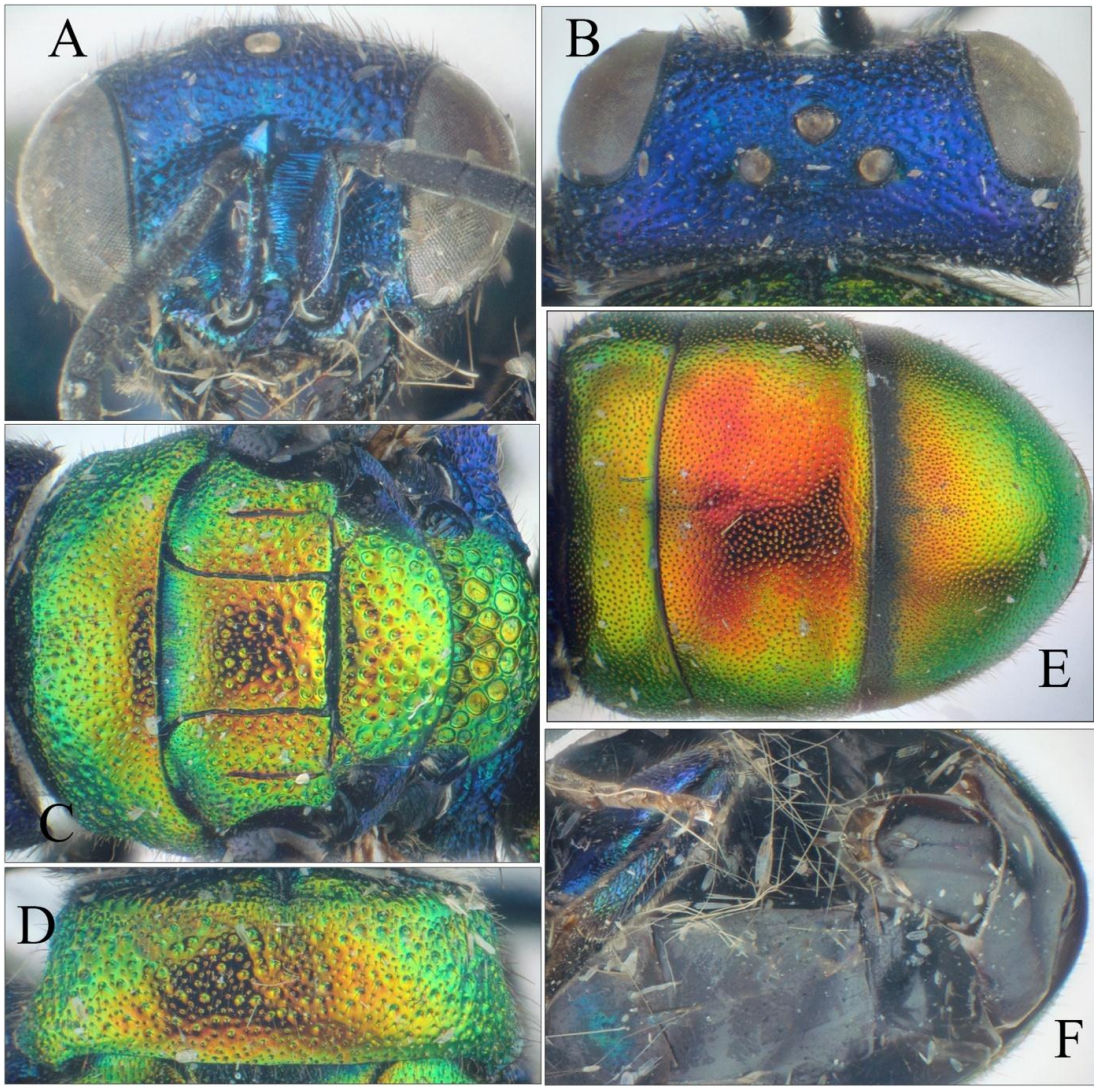

Figure 4. *Holopyga inflammata inflammata* (Förster, 1853): (A) Head, frontal view; (B) Head, dorsal view; (C) Pronotum, mesonotum and scutellum, dorsal view; (D) Pronotum, dorsal view; (E) Metasoma, dorsal view, (F) Metasoma, ventral view.

nonmetallic, wings tanned on outer half.

Distribution: Europe, Turkey (Linsenmaier, 1959; Strumia and Yildirim, 2011). New record for Iran.

Remarks: Strumia and Fallahzadeh (2015) listed *H. inflammata* (Förster, 1853) without any subspecies identification from Khorasan Razavi, but in correspondence with Dr. Franco Strumia, it was found that their specimen belonged to *H. inflammata caucasica* Mocsáry, 1889 subspecies.

******Holopyga jurinei* **Chevrier, 1862**

Material Examined: Alborz Province, Karaj (35° 46′ 08.88″ N, 50° 56′ 55.20″ E, 1,277 m), 14-vii-2010, 1♀; Shahriar (35° 40′ 08.10″ N, 50° 56′ 56.64″ E, 1,168 m), 01-ix-2010, 1♀; Qazvin province, Zereshk Road (36° 25′ 23.88″ N, 50° 06′ 37.68″ E, 1,926 m), 27-vii-2011, 1♀, leg. M. Khayrandish.

Diagnosis: Body length 6-7 mm; height of clypeus 1.8 *MOD*; scapal basin with transverse lines (Figure 5-A); temples angular and subparallel (Figure 5-B);

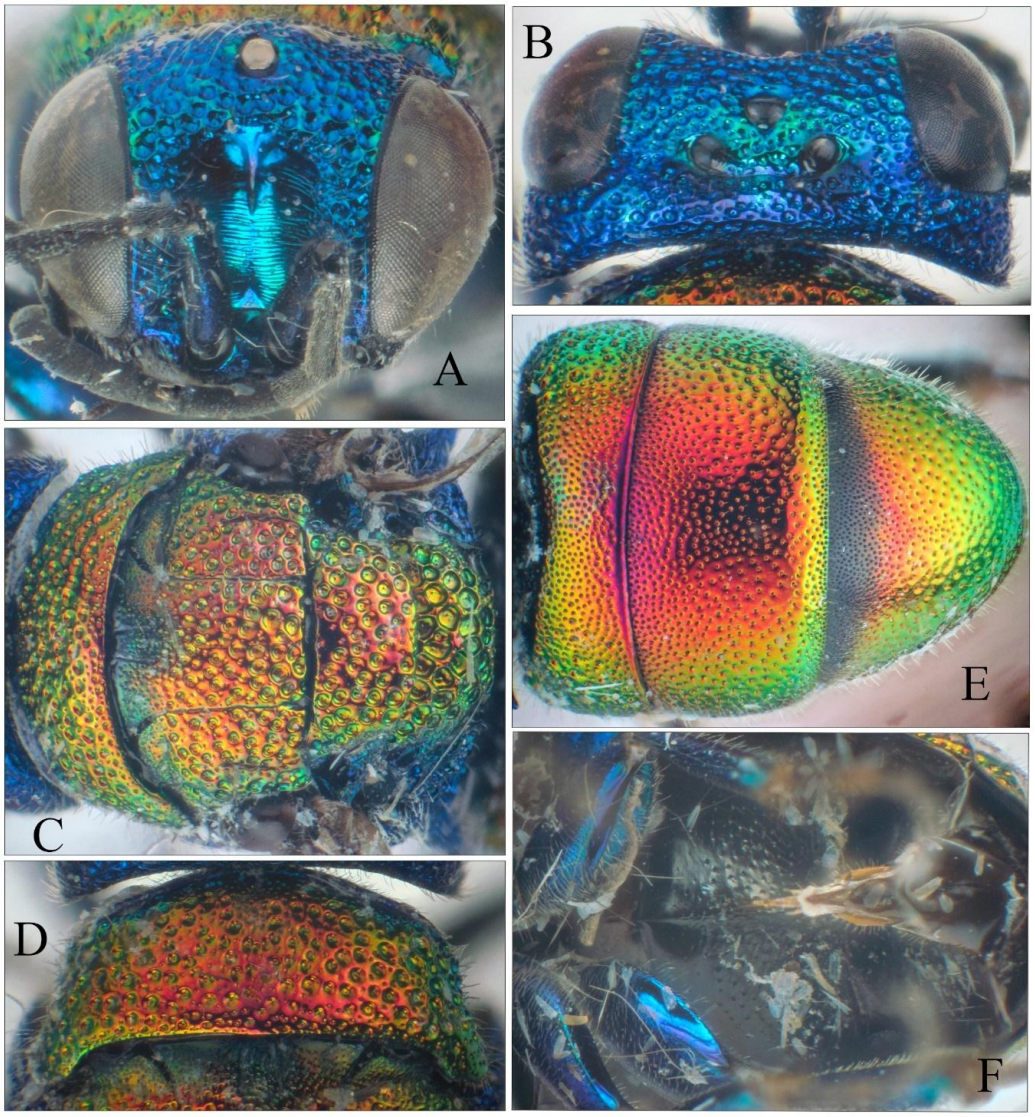

Figure 5. *Holopyga jurinei* Chevrier, 1862: (A) Head, frontal view; (B) Head, dorsal view; (C) Pronotum, mesonotum and scutellum, dorsal view; (D) Pronotum, dorsal view; (E) Metasoma, dorsal view, (F) Metasoma, ventral view.

punctures on pronotum, mesonotum and scutellum irregularly scattered with smooth intervals covered with small punctures on pronotum and mesonotum, on metanotum coarse and dense with narrow intervals (Figures 5-C, -D), on metasoma fine, deep and close (Figure 5-E), on second metasomal sternite numerous and dense (Figure 5-F); coloration: head mesopleuron, propodeum and mesosoma ventrally blue, pronotum, mesonotum, scutellum, metanotum and metasoma flame red to cupreous, sternites and tegula nonmetallic, wings tanned on outer half.

Distribution: Middle and south of Europe, North India, Palestine, Turkey (Linsenmaier, 1968, 1959, 1987; Strumia and Yildirim, 2007). New record for Iran.

***Holopyga minuma* Linsenmaier, 1959**

Distribution: Bulgaria, Greece, Hungary, Iran, Middle East, Syria, Turkey (Linsenmaier, 1968, 1959, 1987; Kimsey and Bohart, 1991; Strumia and Yildirim, 2007).

***Holopyga punctatissima* Dahlbom, 1854**

Material Examined: Alborz Province, Karaj (35° 46′ 08.88″ N, 50° 56′ 55.20″ E, 1,277 m), 29-v-2010, 1♀, leg. A. Nadimi; Hormozgan Province, Minab, Chelo (27° 10′ 30″ N, 57° 01′ 09″ E, 16 m), 10-iv-2012, 1♀, leg. A. Ameri.

Distribution: Iran (Mocsáry 1892); Caucasus, Cyprus, Palestine, Turkey (Linsenmaier, 1959); Egypt, southern Russia (Linsenmaier, 1968).

***Holopyga vigora* Linsenmaier, 1959**

Distribution: Turkey (Linsenmaier, 1959); Bulgaria, Greece, Iran (Linsenmaier, 1968).

***Holopyga vissicituda* Linsenmaier, 1994**

Material Examined: Hormozgan Province, Minab, Agricultural and Natural Resources Research Center of Minab (27° 8′ 39″ N, 57° 04′ 31″ E, 28 m), 17-iv-2013, 1♀, leg. A. Ameri.

Distribution: Oman, Saudi Arabia (Linsenmaier, 1994); UAE (Strumia, 2014); Iran (Farhad *et al*., 2016).

***Holopyga zarudniana* Semenov-Tian-Shanskij, 1967**

Material Examined: Fars Province, Jahrom (28° 39′ 31″ N, 53° 32′ 17″ E, 1,018 m), 03-vi-2012, 1♀, leg. A. Amiri.

Distribution: Iran (Semenov-Tian-Shanskij, 1967).

DISCUSSION

So far, 244 species of chrysidid wasps have been recorded from Iran (Kimsey and Bohart, 1991; Rosa *et al*., 2013; Torabipour *et al*., 2013a, b; Samin *et al*., 2014; Farhad *et al*., 2015; Strumia and Fallahzadeh, 2015; Tavasoli and Fallahzadeh, 2015; Farhad *et al*., 2016; Strumia *et al*., 2016). The number of cuckoo wasps reported from Iran is considered high if compared to that of some neighboring countries such as Iraq, Pakistan, and Afghanistan (Kimsey and Bohart, 1991); but still far to be enough well-known if compared with the Turkish fauna, which includes about 400 species (Strumia and Yildirim, 2007).

Four species (*Holopyga beaumonti* Balthasar, 1953; *H. fascialis* Linsenmaier, 1959; *H. ignicollis* Dahlbom, 1854; *H. jurinei* Chevrier, 1862) and one subspecies (*H. inflammata inflammata* (Förster, 1853)) are newly recorded for the Iranian fauna. According to previous studies (Mocsáry, 1892; Bischoff, 1910; Linsenmaier, 1959, 1987; Semenov-Tian-Shanskij, 1967; Rosa *et al*., 2013; Farhad *et al*., 2016) along with the current four new records, 21 species and subspecies of *Holopyga*, have been recorded in Iran. According to our data, *H. cypruscula*

detrita and *H. ignicollis* are the most abundant species with a wide distribution in Iran.

Iran is located in southwest Asia and considered as a bridge connecting the Palaearctic, Oriental, and Afrotropical Regions (Abivardi, 2001) between Caspian Sea in the north and Persian Gulf and Gulf of Oman in the south. The fauna from the south part of Iran seems to be partially different from that of the northern part. We collected certain species (*H. arabica*; *H. beaumonti*; *H. fascialis* and *H. vissicituda*) distributed also in North Africa or in the Arabian Peninsula (Linsenmaier, 1959, 1994, 1999; Strumia, 2014). Since Iran is a territory of vast arid and semiarid areas, mountains, and forests, a larger variety of cuckoo wasps is expected and the Chrysididae fauna will be very likely substantially increased with further studies.

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جنس *Holopyga* (Hymenoptera: Chrysididae) درایران، همراه با پنج گزارش جدید

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چکیده

گونه های متعلق به جنس *Holopyga* در ایران مورد بررسی قرار گرفتند. نمونه ها طی چهار سال تحقیقات از ۹۲-۸۹ 13در استان های شمالی و جنوبی ایران جمع آوری شدند. بیست و یک گونه و زیرگونه شناسایی شدند، که چهار گونه و یک زیرگونه برای اولین بار از ایران گزارش شدند: *Holopyga beaumonti* Baltasar, 1953، *H. fascialis* Linsenmaier, 1959، *H. ignicollis* Dahlbom, 1854، *H. inflammata inflammata* (Förster, 1853) و *H. jurinei* Chevrier, 1862. پراکنش جغرافیایی همه گونه ها و صفات مورفولوژیک گونه هایی که برای اولین بار گزارش شدند، به اختصار مورد بحث قرار گرفت. تعداد گونه های *Holopyga* در ایران به ۲۱ گونه افزایش یافت.