Contribution to the knowledge of the Chrysididae (Hymenoptera, Aculeata) in the south of Iran, with nine new records

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Abstract: In this study, fourteen species and subspecies in six genera of the family Chrysididae are listed from Hormozgan Province of Iran. Among them, Hedychridium femoratum (Dahlbom, 1854); Hedychridium virescens (du Buysson, 1908); Hedychridium verhoeffii Linsenmaier, 1959; Holopyga arabica Linsenmaier, 1994; Holopyga vicissituda Linsenmaier, 1994; Sphingarina dubai Bohart, 1987; S. integerrima (Klug, 1845); Trichrysis scioensis (Gribodo, 1879); and T. longispina (Mocsáry, 1912) are recorded for the first time from Iran. Geographical distributions of all the species and morphological diagnostic characteristics of the newly recorded species are briefly discussed. The number of chrysidid species in Iran is now raised from 194 to 203.

Key words: Hymenoptera, Chrysididae, fauna, new records, Hormozgan, Iran

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1. Introduction
The family Chrysididae, commonly known as cuckoo wasps, contains 87 genera and 2509 species in the world (Aguiar et al., 2013). This family includes four subfamilies, Chrysidinae, Cleptinae, Amiseginae, and Loboscelidiinae (Kimsey and Bohart, 1991), although some authors consider Parnopinae as a distinct subfamily (Mocsáry, 1889; Linsenmaier, 1959; Mingo, 1994). In the present paper, we list and discuss the members of the tribes Chrysidini and Elampini, the two largest tribes within the subfamily Chrysidinae. These tribes currently includes 126 and 55 species and subspecies known for Iran, respectively (Rosa et al., 2013; Farhad et al., 2015). Several studies were carried out in the Palearctic region by Mocsáry (1889), Balthasar (1953), and Linsenmaier (1959, 1968, 1987, 1994, 1999), all of which are helpful for the study of the chrysidid fauna of Iran. Radoszkowski (1866, 1881, 1889, 191), du Buysson (1887, 1891, 1893, 1900), Mocsáry (1889, 1890, 1892, 1914), Semenov-Tian-Shanski (1892, 1912, 1920, 1932, 1967), Bischoff (1910), Trautmann (1927), Semenov-Tian-Shanski and Nikol’skaya (1954), Linsenmaier (1959, 1968, 1987, 1997), Kimsey and Bohart (1991), and Móczár (1997) recorded some new species from Iran. In recent years some faunistic studies of Chrysididae were carried out in Iran by Pourrafei et al. (2011), Rosa and Lotfalizadeh (2013), Rosa et al. (2013), and Farhad et al. (2015). This study is a part of our ongoing research on the chrysidid fauna of Iran.

2. Materials and methods
Specimens for this study were collected in 2011–2013 by using Malaise traps from different habitats in Hormozgan Province. The province is located in the southern part of Iran, with around 1000 km of coastline along the warm waters of the Sea of Oman and the Persian Gulf. The landscape of Hormozgan Province includes forests, mountain slopes, fruit orchards, and field crops at different altitudes (Figure 1). In total 263 specimens were collected; here, 50 specimens belonging to Chrysidini and Elampini are reported. The specimens were extracted from traps and maintained in 70% ethanol, then prepared and sorted into genus and species levels. Examinations and descriptions were done under an Olympus SZH10 stereomicroscope and images were taken by a Sony CCD digital camera attached to an Olympus AX70 stereomicroscope. Photos were processed by Zerene Stacker 1.04 software. All specimens are deposited in the insect collection of the Department of Entomology, Tarbiat Modares University, Tehran, Iran.

The following data are included: valid taxa names, distribution, and brief description of the newly recorded species. The newly recorded species for the fauna of Iran are indicated by an asterisk in the text. The abbreviations used in diagnostic characteristics of the newly recorded species are given after Kimsey and Bohart (1991): F-I, F-II, F-III, etc. = flagellum I, flagellum II, flagellum III, etc.; MOD = middle ocellus diameter; TFC = transverse frontal carina.

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3. Results

3.1. Tribe Elampini

*Hedychridium virescens* (du Buysson, 1908)

**Material examined:** Iran: Hormozgan Province, Bandar Abbas, Zakin I, 27°28′53″N, 56°18′27″E, 680 m, 23.IV.2011, 1♀, 25.IV.2011, 1♂, 20.VI.2011, 1♀; Hajiabad, Tezerj, 27°17′1″N, 55°45′14″E, 867 m, 17.V.2011, 1♀; Bandar Abbas, Genou, 27°24′16″N, 56°08′51″E, 1274 m, 30.V.2011, 1♀, leg. A. Ameri.

**Diagnosis:** Body length 5.0–8.0 mm; subantennal space 1.7–2 MOD, clypeus long (2.7–3.2 MOD) (Figure 2A); malar space very narrow (<0.5 MOD) (Figure 2B); temples slightly divergent (Figure 2C); dense punctures on head, mesosoma, and metasoma (Figures 2C–2E); posterior margin of second metasomal tergite swollen and covering the anterior margin of third tergite, posterior margin of third metasomal tergite swollen (Figure 2F); coloration: head green with violet scapal basin; pronotum green with cupreous reflection in some species, mesonotum green, metanotum and propodeum violet with blue reflection in some specimens, tegula green or blue; metasoma green with or without cupreous reflections on second tergite, metasomal sternites metallic.

**Remarks:** We here follow Linsenmaier’s (1999) interpretation of the species. In Kimsey and Bohart (1991) *H. virescens* is listed in the synonymic list of *H. aheneum* (Dahlbom) because the species was described as a variation of *H. aheneum*. Strumia (2004) designated the lectotype at the National Museum of National History in Paris. *H. virescens* is similar to *H. aheneum* (Dahlbom), *H. incrassatum* (Dahlbom), and *H. zimmermanni* (Balthasar); however, it can be separated by the combination of different characteristics: slightly divergent shape of temples, large clypeus, short TFC like on brow, elongated metanotal tooth S-shaped, plastic swelling reduced on the second tergite; uniform punctuation not deeply incised; sternites metallic; green to greenish body color, even if coloration may considerably change, being a variable characteristic.


*Hedychridium verhoeffi* Linsenmaier, 1959

**Material examined:** Iran: Hormozgan Province, Bandarabbas, Zakin I, 27°28′53″N, 56°18′27″E, 680 m, 25.IV.2011, 1♂, leg. A. Ameri.
Diagnosis: Body length 4.7 mm; face triangular, subantennal space 1.1 MOD, clypeus 2.0 MOD (Figure 3A); malar space 0.5 MOD (Figure 3B); temples round and convergent (Figure 3C); first metasomal tergite with depression arcuate anteriorly; punctures on metasoma finer than mesosoma and dense (Figures 3D and 3E); coloration: head green-golden, occiput greenish blue; pronotum and mesonotum green-golden with cupreous reflection, metanotum greenish blue; metasoma green-golden, second and third metasomal tergites with cupreous reflection.

Figure 2. *Hedychridium virescens* (du Buysson, 1908): A) head, frontal view; B) head, lateral view; C) head, dorsal view; D) mesosoma, dorsal view; E) metasoma, dorsal view; F) metasoma, lateral view.
Remarks: The greenish body coloration is quite different from the specimens collected in the Mediterranean countries. The greenish or bronze coloration is commonly observed in most of the species collected in South Iran.


*Hedychridium flavipes rugulosum* Linsenmaier, 1959
Material examined: Iran: Hormozgan Province, Hajiabad, Tezerj, 27°17′1″N, 55°45′14″E, 867 m, 03.IV.2011, 1♂; Bandar Abbas, Zakin I, 27°28′53″N, 56°18′27″E, 680 m, 18.IV.2011, 1♂, 24.IV.2011, 1♂, 25.IV.2011, 1♂, 23.V.2011, 2♂♀ 12.VI.2011, 1♂, 25.V.2012, 2♀♂, 1♂; Bandar Abbas, Zakin II, 27°53′7″N, 56°19′58″E, 1020 m, 02.V.2012, 1♂, 1♀; Bandar Abbas, Zakin III, 27°51′51″N, 56°18′34″E, 1630 m, 25.V.2012, 2♂♂, 04.VI.2012, 1♂, leg. A. Ameri.

Distribution: Cyprus, Iran (Linsenmaier, 1959), Palestine (Linsenmaier, 1968).

*Hedychridium femoratum* (Dahlbom, 1854)
Material examined: Iran: Hormozgan Province, Bandar Abbas, Zakin I, 27°28′53″N, 56°18′27″E, 680 m,
25.IV.2011, 1♂; 09.V.2011, 2♂; Bandar Abbas, Zakin III, 27°51′51″N, 56°18′34″E, 1630 m, 23.V.2011, 1♀; Minab, Agricultural and Natural Resources Research Center of Minab, 27°8′39″N, 57°04′31″E, 28 m, 17.IV.2012, 1♀, leg. A. Ameri.

**Diagnosis:** Body length 4.0–5.0 mm; subantennal space 0.8 MOD (Figure 4A), gena visible (Figure 4B), temples round and slightly convergent (Figure 4C); last flagellomere elongate (Figure 4C), longer than F-X; punctures on metasoma fine and dense (Figure 4D); coloration: pronotum and mesonotum green-golden, metanotum and propodeum blue to violet; metasoma metallic green-golden, basally on all tergites and medially on second metasomal tergite nonmetallic rosy-ferruginous (Figure 4E).

**Remarks:** The specimens examined match the description of *H. miricolor* Morice, which turns out to be the greenish metallic form of *H. femoratum*. This species is characterized by the elongate last flagellomere compared with other similar species (e.g., *H. gratiosum*) (Schmid-Egger, 1995). *H. elegans* (Mocsáry) and *H. femoratum* var. *miricolor* Morice have been registered in the Middle East, but they are currently synonyms of *H. femoratum* (Linsenmaier, 1968; Kimsey and Bohart, 1991).

**Distribution:** Anatolia, Europe, North Africa, Turkey (Linsenmaier, 1959; Kimsey and Bohart, 1991; Yildirim and Strumia, 2006a; Rosa and Soon, 2013). New for the Iranian fauna.

*Hedychridium miramae* Semenov, 1967

**Material examined:** Iran: Hormozgan Province, Bandar Abbas, Zakin I, 27°28′53″N, 56°18′27″E, 680 m, 25.IV.2011, 1♂, leg. A. Ameri.

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

*Holopyga arabica* Linsenmaier, 1994

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**Figure 4.** *Hedychridium femoratum* (Dahlbom, 1854): A) head, frontal view; B) head, lateral view; C) head, dorsal view; D) mesosoma, dorsal view; E) metasoma, dorsal view.
Material examined: Iran: Hormozgan Province, Minab, Agricultural and Natural Resources Research Center of Minab, 27°8′39″N, 57°04′31″E, 28 m, 20.III.2012, 1♀; Minab, Chelo, 27°10′30″N, 57°01′09″E, 16 m, 18.V.2012, 1♀, leg. A. Ameri.

Diagnosis: Body length 6.4 mm, clypeus 2.5 MOD, scapal basin with fine horizontal lines (Figure 5A), temples angular and parallel or slightly convergent (Figure 5B), punctures on mesonotum scutellum and metanotum coarse, shallow and dense without smooth intervals (Figures 5C), on pronotum more scattered with smooth intervals covered with small punctures (Figure 5D); on metasoma moderately fine, deep and close (Figure 5E); coloration: body blue and green (Figure 5F), wings tanned on outer half.

Distribution: Oman, United Arab Emirates, Saudi Arabia (Linsenmaier, 1994; Strumia and Dawah, 2011). New for the Iranian fauna.

Holopyga fervida (Fabricius, 1781)

Material examined: Iran: Hormozgan Province, Bandar Abbas, Zakin I, 27°28′53″N, 56°18′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.


*Holopyga vicissituda Linsenmaier, 1994

Material examined: Iran: Hormozgan Province, Minab, Agricultural and Natural Resources Research

Figure 5. Holopyga arabica Linsenmaier, 1994: A) head, frontal view; B) head, dorsal view; C) pronotum, mesonotum and scutellum, dorsal view; D) pronotum, dorsal view; E) metasoma, dorsal view; F) habitus, dorsal view.
Center of Minab, 27°8′39″N, 57°04′31″E, 28 m, 17.IV.2013, 1♀, leg. A. Ameri.

Diagnosis: Body length 6.1 mm, body robust, evidently convergent anteriorly and posteriorly (Figure 6A); clypeus 2.1 MOD, scapal basin with obvious horizontal lines curved toward the compound eye (Figure 6B), temples angular and parallel to slightly divergent (Figure 6C), punctures on head and pronotum not deep and with large smooth intervals, on the other parts bigger and deeper except in anterior part of mesonotum (Figures 6C–6E), on first metasomal tergite fine, on second and third metasomal tergites very fine and very scattered except laterally; metasoma triangular (Figure 6F); coloration: body color greenish with golden to cupreous reflections, especially on metasoma.

Figure 6. *Holopyga vicissituda* Linsenmaier, 1994: A) habitus, dorsal view; B) head, frontal view; C) head, dorsal view; D) mesonotum, scutellum and metanotum, dorsal view; E) pronotum, dorsal view; F) metasoma, dorsal view.
3.2. Tribe Chrysidini

*Chrysidea pumila* (Klug, 1845)

Material examined: Iran: Hormozgan Province, Bandar Abbas, Zakin I, 27°28′53″N, 56°18′27″E, 680 m, 20.VI.2011, 1 ♀; Minab, Chelo, 27°10′30″N, 57°01′09″E, 16 m, 01.VI.2012, 1 ♂, leg. A. Ameri.

Distribution: Afrotropical, Paleartic (Kimsey and Bohart, 1991), Turkey (Yıldırım and Strumia, 2006b; Strumia and Yıldırım, 2007), Iran (Rosa et al., 2013).

*Spintharina dubai* Bohart, 1987

Material examined: Iran: Hormozgan Province, Minab, Agricultural and Natural Resources Research Center of Minab, 27°8′39″ N, 57°04′31″ E, 28 m, 17.IV.2012, 1 ♂, 1 ♀; Qeshm Island, Ramkan, 26°52′25″N, 56°01′7″E, 34 m, 17.VII.2012, 1 ♀, leg. A. Ameri.

Diagnosis: Body length 5.3–5.8 mm; malar space 1 MOD in female and 1.5 MOD in male (Figure 7A); mesopleuron tridentate with polished omalus (Figure 7B); propodeal angle emarginated at base, swollen at side, and keen at apex (Figure 7C); preapical margin of third metasomal tergite with a round swollen lobe (Figure 7D); coloration: body nearly all purple with green reflections in male (Figure 7E).


Figure 7. *Spintharina dubai* Bohart, 1987: A) head, frontal view; B) mesopleuron and metapleuron, lateral view; C) propodeal angles, dorsal view; D) metasoma, lateral view; E) habitus, dorsal view.
*Spintharina integerrima* Klug, 1845

Material examined: Iran: Hormozgan Province, Bandar Abbas, Zakin I, 27°28′53″N, 56°18′ 27″E, 680 m, 23.V.2011, 2♀♀, leg. A. Ameri.

Diagnosis: Body length 5.5–6.6; malar space 1.5 MOD and slightly convergent (Figure 8A); mesopleuron tridentate with two unequal teeth located at apex of omalus, omalus moderately polished in the middle (Figure 8B); propodeal angle not keen at apex; second metasomal tergite with large and fine punctures spread densely in the middle (Figure 8C); preapical margin of third metasomal tergite with an angled swollen lobe (Figure 8D); coloration: body golden green, middle part of mesonotum dark violet, third metasomal tergite with a weak cupreous reflection in some species (Figure 8E).

Figure 8. *Spintharina integerrima* Klug, 1845: A) head, frontal view; B) mesopleuron and metapleuron, lateral view; C) metasoma, dorsal view; D) metasoma, lateral view; E) habitus, dorsal view.
**Remarks:** The coloration of the species in the *Spintharina* genus is very variable after death, excluding *S. dubai*, which is always more or less dark green to bluish. In all the other species the body color is usually red flame to coppery in living specimens, but later it turns to bronze or greenish, according to the different killing substances and preserving methods.

**Distribution:** Palestine, Sudan, United Arab Emirates, Saudi Arabia (Linsenmaier, 1994; Strumia and Dawah, 2011). New for the Iranian fauna.

*Stilbum cyanurum* (Forster, 1771)

**Material examined:** Iran: Hormozgan Province, Qeshm Island, Ramkan, 26°52′25″N, 56°17′E, 34 m, 13.VII.2012, 1 ♀, leg. A. Ameri.

**Distribution:** Eastern Hemisphere, Iran (Mocsáry, 1889; Kimsey and Bohart, 1991).

*Trichrysis scioensis* (Gribodo, 1879)

**Material examined:** Iran: Hormozgan Province, Bandar Abbas, Zakin I, 27°28′53″N, 56°18′27″E, 680 m, 20.VI.2011, 1 ♂; 26.VI.2011, 1 ♂, leg. A. Ameri.

**Diagnosis:** Body length 4.0 mm; the upper line of scapal basin covered with elongate punctures (Figure 9A); punctures on forehead very large and impressed (Figure 9B); punctures on the second metasomal tergite a little finer than the first tergum and notum (Figures 9C and 9D); teeth intervals of third abdominal tergite straight or slightly concave, the middle tooth slightly prominent compared with the lateral teeth (Figure 9D); spots of

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**Figure 9.** *Trichrysis scioensis* (Gribodo, 1879): A) head, frontal view; B) head, dorsal view; C) mesosoma, dorsal view; D) metasoma, dorsal view.
metasomal sternites fused; coloration: head and mesosoma green to gold green; metasoma green-blue, base of second metasomal tergite in the middle dark blue to purple.

Remarks: After type examination of the known species from the South Palearctic area, we could assign this specimen only to *T. scioensis* (Gribodo, 1879), even if some differences can be observed in the body sculpture. We also observe that the pictures of *T. scioensis* and *T. lacerta* (Semenov-Tian-Shanski and Nikolskaya), replacement names for *T. cypria* (Mocsáry, 1902) in Strumia (2009), are inverted.


*Trichrysis longispina* Mocsáry, 1912


Diagnosis: Body length 5.2 mm; TFC with weak carina, angular in the middle and ends, on both ends with a weak carina toward the middle ocelli (Figure 10A); punctures on most parts of body similar in size, third metasomal tergite with more scattered and less deep punctures (Figures 10B and 10C); teeth on the anal margin triangular and elongate, completely prominent (Figure 10C); black spots on the second sternite not fused with a narrow space (Figure 10D); coloration: head green, ocelli area green-blue, darker blue in its center; mesosoma green, mesonotum and scutellum medially darker blue; metasoma green with darker bluish stripes latero-apically on second and third metasomal tergum (Figure 10E).

4. Discussion
Nine species of Chrysididae belonging to four genera are newly added to the Iranian fauna. All 14 species listed here are also new records for Hormozgan Province. Previously, 194 species of Chrysididae had been reported from Iran (Rosa and Lotfalizadeh, 2013; Rosa et al., 2013; Farhad et al., 2015). The results of this study increase the recorded taxa for Iran to 203 species. In comparison to about 400 species known from Turkey (Strumia and Yildirim, 2007), it seems most likely that the diversity of species of the family Chrysididae in Iran is still far greater than currently known.

Iran is commonly known as the crossroads between the Palearctic and Oriental regions. The fauna of Chrysididae has recently been investigated in the northwestern part of Iran (Rosa et al., 2013), but there are still areas insufficiently studied, such as the southern part of Iran including Hormozgan Province. More studies of Iranian Chrysididae are required to better understand the real diversity of this large family.

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