JOURNAL OF INSECT BIODIVERSITY
ISSN: 2147-7612

RESEARCH ARTICLE

New records and three new species of Chrysididae (Hymenoptera, Chrysidoidea) from Iran

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Abstract: Data on the distribution of 52 cuckoo wasp species (Hymenoptera, Chrysididae) from Iran are given. One genus and 27 species (including 3 new species: 52% of the captured material) are new records for the country. In addition, three new species, *Chrysis gianassoi* **sp. nov.**, *Chrysis majidi* **sp. nov.** and *Chrysis unirubra* **sp. nov.** are described and illustrated, and diagnostic characters are provided to identify them. *Chrysis turcica* du Buyson, 1908 is removed from synonymy with *Chrysis peninsularis* du Buysson, 1887. *Chrysis bilobata* Balthasar, 1953 is confirmed as valid species and illustrated. The composition of the Iranian Chrysididae fauna is compared with that of South Palaearctic countries. The large proportion of new record and new species (≈52%) indicates that the fauna of Iranian Chrysididae is rich and diverse but has not yet been thoroughly studied. The majority of new record were obtained from mountainous sites above 1000 m above sea level, indicating the rich biodiversity of this biotope.

Key words: Chrysididae, malaise trap, pan trap, Palaearctic Region, taxonomy, fauna, Iran.

Introduction

Iran is a large country with diverse biotopes, bordered on the East by Pakistan and Afghanistan, to the North by Turkmenistan and Caucasus, to the West by Turkey and Iraq, and to the South by the Persian Gulf and Indian Ocean. As a consequence its fauna is

expected to be mainly South Palaearctic, but with the possible presence of Oriental, Caucasus and Central Asian elements. The Persian Gulf was a dry land during most of the last glacial period, this was not a barrier for exchange between Arabian and Persian species.

Data on Iranian Chrysididae are sparsely present in several papers. Recently, Rosa *et al*. (2013) provided a checklist of Iranian Chrysididae, mainly based on published data. This review paper provided also an almost complete list of all papers referencing to the Iranian Chrysidid fauna. Field researches will therefore contribute towards establishing a reliable checklist of this family in Iran. No review studies on taxonomy of Iranian Chrysididae are available, thus the study of this fauna is not easy. For the South Palaearctic Region the revisions of Linsenmaier (1957, 1959, 1968, 1969, 1987, 1994, 1997, 1999) and Kimsey & Bohart (1991) are particularly useful. On the contrary the taxonomy of species entering in Iran from central Asia is more complex. Russian authors described these species. After some preliminary contributions by Radoskowski and Semenov in the XIX century, all the successive discovers were not properly illustrated. After the death of Semenov, the preliminary Semenov annotations were simply published, without any critical comparison or discussion in three papers (Semenov 1954, 1967; Semenov & Nikol'skaya 1954). This resulted in a confused lists of short descriptions, useless without comparison with types or paratypes. Unfortunately the present policy of the Zoological Museum of St. Petersburg is do not allow study on loan of the original Semenov material. Fortunately Kimsey & Bohart (1991) sdudied this material and provided a number of synonymies and confirmed validity of others species. It is hopeful that an illustration of the Semenov material with critical comments will be published and made available, as recently done for other important collections (Rosa *et al.* 2015).

Material and methods

A portion of the specimens studied were captured by Malaise-trap in the provinces of Fars (South Iran) and Alborz (North Iran) during 2012. Additionally, some interesting specimens were collected mainly in the mountains of South, North and West Iran by Mr. Domenico Gianasso (Castelnuovo don Bosco, Asti, Italy) while using pan traps to study Buprestidae (Coleoptera). He kindly donated all the Hymenopteran material to the first author.

Because many species of Chrysidid wasps, mostly of the tribe Elampini, rarely feed on flowers and fly close to ground, they are rarely collected by netting despite their relative abundance; so, not surprisingly, little is known about their geographical distribution. In fact the use of traps (e.g. pan or Malaise traps) gives better results, offering the opportunity to discover uncommon or new species. In addition, the material captured by traps is less influenced by the collector's skill or preferences, thus offering unbiased data for a more accurate statistical analysis.

The trapped specimens were preserved in an ethanol-water mixture, but identification was based on properly pinned and labeled specimens. The format of description, terminology and taxonomic arrangement used in this work was adapted from Bohart & Kimsey (1982) and Kimsey & Bohart (1991).

Digital images were taken using a Nikon 990 camera mounted on a Nikon SMZ-2T stereoscopic microscope, and were processed with Adobe Photoshop or Apple Preview software. For the multivariate analysis, "Statistica" software by Statsoft, Inc. was used. Voucher specimens of all the species are deposited in the Franco Strumia Collection, Pisa,

Italy (FSC) and the Insect Collection of Jahrom Branch, Islamic Azad University, Iran (JIAU).

We use in text the following abbreviations (after Kimsey & Bohart 1991): L/w: length/width ratio; F: flagellomere; MOD: midocellus diameter; P: pedicel; PD: puncture diameter; PS: punctures separation; S: metasomal sternum; T: metasomal tergum; TFC: trasverse frontal carina; roman numerals (I, II, III, etc.) are used for antennal and metasomal segments.

Results

A total of 52 Chrysidid species representing 14 genera were collected from different regions of Iran. Three new species, *Chrysis gianassoi* **sp. nov.**, *Ch. majidi* **sp. nov.** and *Ch. unirubra* **sp. nov.**, mainly from the southern part of Iran, United Arab Emirates and Southern Saudi Arabia, are described. The descriptions and remarks on the new species are given. The genera are ordered according to Kimsey & Bohart (1991), and within a genus, species are listed alphabetically.

Descriptions of the new species

The *Chrysis millenaris* species group

The *Chrysis millenaris* group is a rich one, including a set of several small species, defined by Kimsey & Bohart (1991: 354) as: "F-I l/w 2-3; face microridged medially; TFC practically absent, sometimes indicated medially; malar space 2.6 MOD; subantennal space 1.5-1.7 MOD; T-III pit row distinct, prepit bulge low or absent; apex of T-III without teeth or lateral corners, lateral edge of T-III simple; S-II spots large, almost fused" (see also Linsenmaier 1959: 98). All known species in this group are relatively small: average body length 4.73 mm (Standard Deviation 0.89 mm). A few male genitalia of the *Ch. millenaris* group were illustrated by Linsenmaier 1959 (Figs 272-276) and appear to be of taxonomic value ("male S-VIII triangular or long triangular; gonocoxa stout or narrow posteriorly, setae at apex", Kimey & Bohart, 1991: 354). A few individuals in the material studied belong to the *Ch. millenaris* group and represent two new undescribed species (*Chrysis majidi* **sp. nov.** and *Chrysis unirubra* **sp. nov.** described below).

In their worldwide review of family Chrysididae, Kimsey & Bohart (1991) listed 16 species in the *Ch. millenaris* group (15 species + 1 doubtful) (Table 1).

One species, *Chrysis vachali* du Buysson 1898, was only tentatively included in the *Ch. millenaris* group by Kimsey & Bohart (1991), because the authors could not study the holotype or any material. Recently, the study of additional new material from Saudi Arabia (Strumia & Dawah 2008) showed that *Ch. vachali* du Buysson, 1900: 140 may be a synonym of *Ch. rodochalcea* du Buysson 1900: 137 (this can be checked only by the study of type material), in wich case it should be included in the *Ch. incisa* group, on the basis of the male genitalia and the shape of T-III distal border (Strumia & Dawah 2010).

Linsenmaier (1968, 1999) described additional, new species of the *Ch. millenaris* group and transferred some from other groups after revision (Table 1).

In conclusion, the *Ch. millenaris* group is composed of 27 species at present, all distributed in the Western Palaearctic Region. In this paper we describe two additional, new species (*Ch. majidi* **sp. nov**. from Iran and the Arabian Peninsula, and *Ch. unirubra* **sp. nov.**

from Iran), thus increasing the group size to 29 species. It is possible that some other known species will be transferred into this group after revision.

Table 1. Updated checklist of the 29 species belonging to the *Chrysis millenaris* group.

No	***Chrysis* species of the *millenaris* group (in the Kimsey & Bohart (1991) checklist)**
1	*Ch. atriventris* Linsenmaier, 1968: 57 and Linsenmaier, 1968:74
2	*Ch. basalis* Dahlbom, 1854: 106
3	*Ch. basiliana* Semenov-Tian-Shanskij, 1967: 152
4	*Ch. batyamensis* Linsenmaier, 1969: 376
5	*Ch. bilobata* Balthasar, 1953: 178
6	*Ch. birecikensis* Linsenmaier, 1968: 132
7	*Ch. chakouri* du Buysson 1900: 43; see Linsenmaier, 1999: 131
8	*Ch. coriacea* du Buysson, 1900: 137
9	*Ch. curta* du Buysson, 1896: 724
10	*Ch. fugax* Abeille de Perrin, 1878: 5
11	*Ch. hebes* du Buysson, 1896: 719
12	*Ch. illudens* du Buysson, 1894: 334
13	*Ch. krueperi* Mocsáry, 1889: 216
14	*Ch. millenaris* Mocsáry, 1897: 645
15	*Ch. perexigua* Linsenmaier, 1959: 99
16	*Ch. profugax* Linsenmaier, 1968: 55
17	*Ch. serva* du Buysson, 1898:132 and Linsenmaier, 1999: 136
18	*Ch. tantilla* Linsenmaier, 1968: 74 = *cupriminuta* Linsenmaier, 1994: 176
19	*Ch. tenella* Mocsáry, 1880: 197
	Species inserted in the group after 1991
20	*Ch. cavifacies* Linsenmaier, 1999: 134
21	*Ch. curtina* Linsenmaier, 1999: 135
22	*Ch. curtula* Linsenmaier, 1999: 133
23	*Ch. divaridens* Linsenmaier, 1999: 134
24	*Ch. omyanensis* Linsenmaier, 1994: 174
25	*Ch. peculiaris* Linsenmaier, 1999: 130
26	*Ch. simyplicita* Linsenmaier,1994: 174
27	*Ch. spinifugax* Linsenmaier, 1999: 132
	New species in the present paper
28	*Ch. majidi* Strumia **sp. nov.**
29	*Ch. unirubra* Strumia **sp. nov.**

Since it was not possible to study reliable material of so many species, we had to rely on the published original descriptions for identifications. We selected 19 characters in addition to those that define the group. Most of these characters are represented by categorical data (incised or bilobate T-III distal border, microridged facial cavity, presence of a more or less weak TFC, presence of a sulcus or a depression in middle of the pronotum anterior border, prevalent metasomal colour (blue-green, bronze-red, or a red and blue-green mixture), puncture size on T-II disc: fine, large, double (a combination of large with fine between)). Others data are numerical (body length, ratio between F-I and P lengths, and ratio between F-I length and malar space).

The characters defining the 29 species were summarized in a 29 x 19 matrix, where each row represents a species and each column a single morphological character. Multivariate statistical analysis of the data indicated the presence of two major sub-clusters composed of

16 and 13 species respectively, thus simplifying the taxonomy and species identification (Fig. 1).

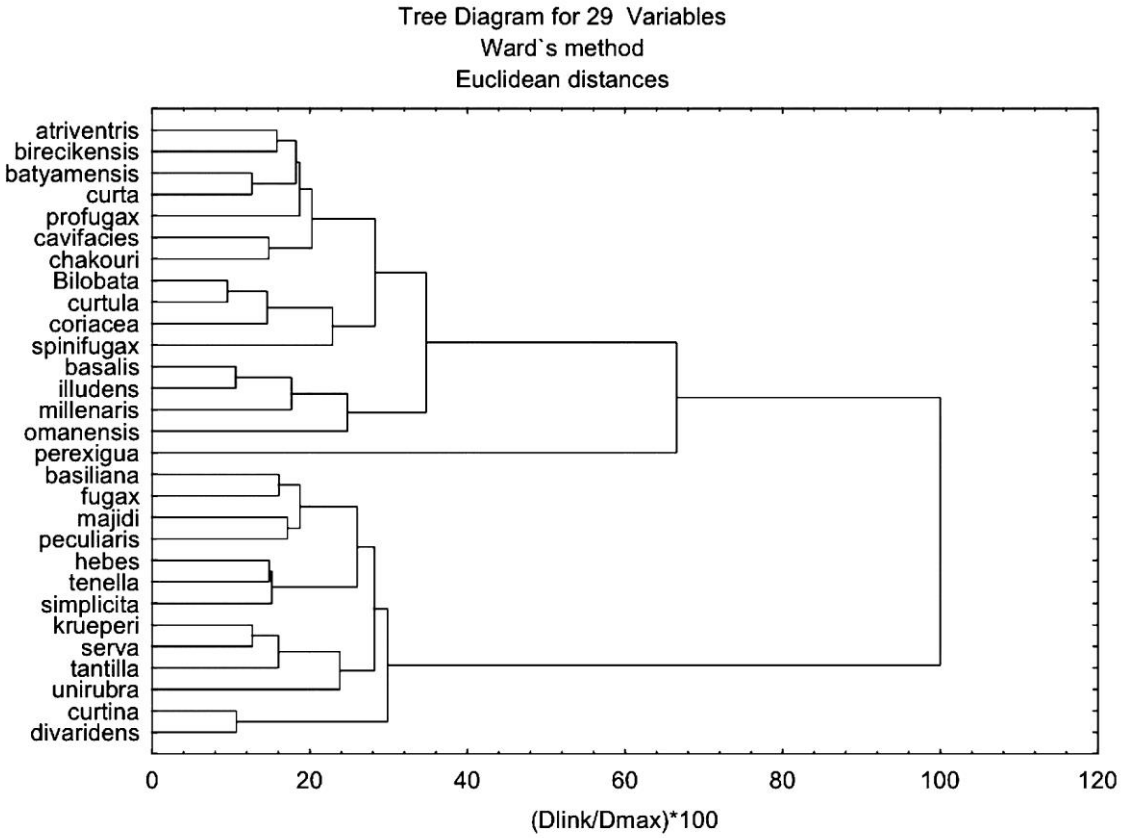

Figure 1. Cluster of affinity between the 29 species of the *millenaris* group. Two major subgroups of 16 and 13 species respectively are evidenced.

Among the 19 characters used for the statistical analysis, the only one present in all species and capable of distinguishing between the 13- and 16-species sub-clusters was the body length, as given in the original descriptions (a character not requiring the study of types).

The 16 species of the first sub-cluster have an average body length of 5.172 mm (Standard Deviation 0.642 mm), and the 13 species of the second sub-cluster have an average body length of 4.173 mm (S.D. 0.656): this difference is statistically significant. The body length distribution is shown in Figure 2. The two new species here described clearly belong to the 13-species sub-cluster with the smaller body length.

Chrysis majidi Strumia sp. nov. (Figs. 3-7)

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Material studied: *Holotype*: 1♂, Iran, Kerman, 2300 m, 29˚03'39"N, 57˚53'24"E, 23.05.2011, body length 4.0 mm, leg. Domenico Gianasso; reared from a nest in *Rubus* sp., 02.06.2012, in FSC. In addition 19 *Paratypes* from Iran, UAE, and Saudi Arabia, as follow: 1♂: U.A.E., Dubai, al-Wathba, 24˚26'N, 54˚61'E, 06.11.2009, body length 4.5 mm, leg. Anitha Saji, in the collection of the Biodiversity Assessment & Monitoring Division of the Environment Agency, Abu Dhabi (EAD). 1♂: U.A.E., Dubai, al-Dubbayya, 24˚17'N,

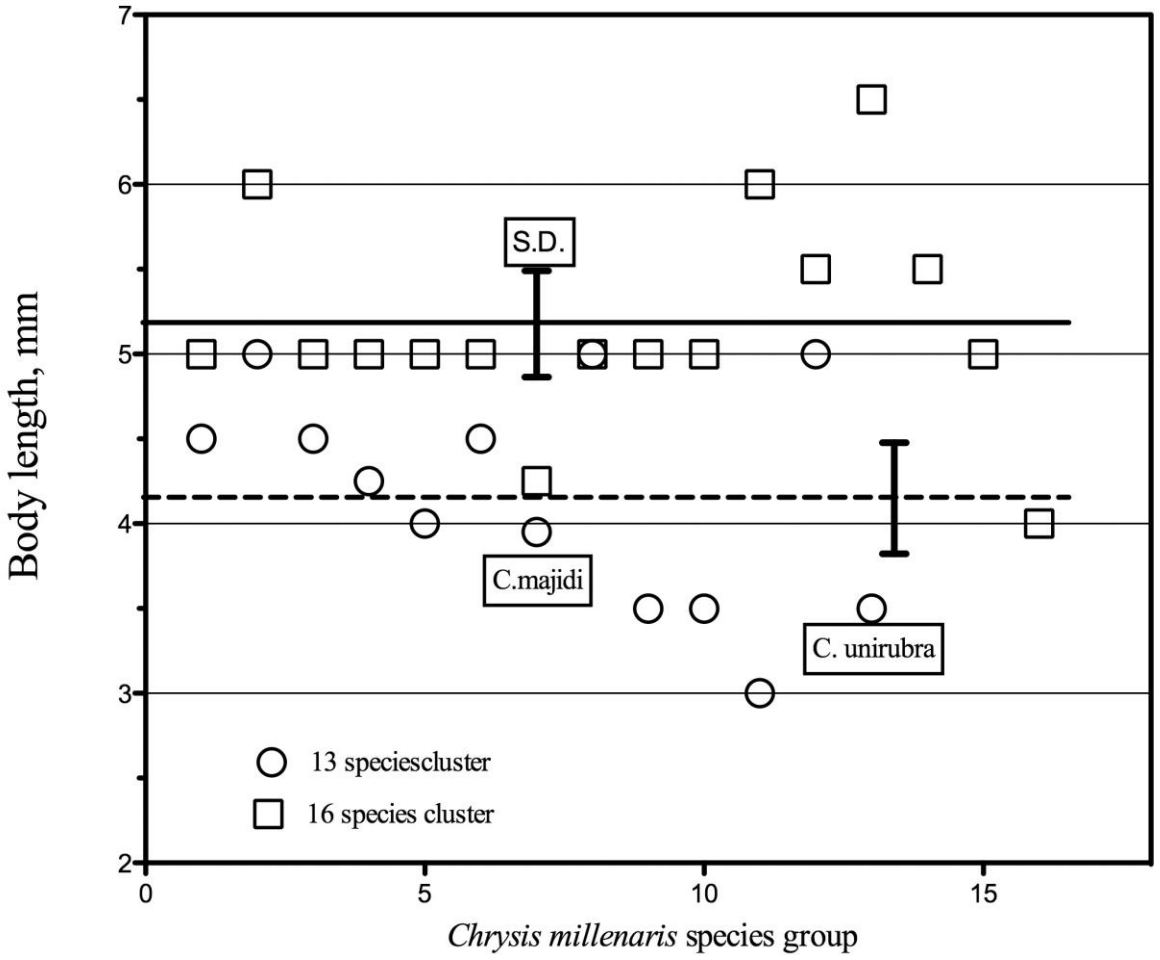


Figure 2. Distribution of body length values in the 13- and 16-species sub-clusters in the *Chrysis millenaris* species group. The horizontal lines show the average value respectively for the 16- (continuous line) and 13-species (broken line) sub-clusters; the vertical bars show the corresponding standard deviations, respectively.

54˚14'E, 13.02.2008, body length 3.5 mm, leg. Dr. Anitha Saji, in FSC. 1♂: W Iran, Lorestan, 10 km South-West of Dorud, 30.04.2007, 1400 m, body length 3.8 mm, Leg. D. Gianasso., in FSC. 1♀: Saudi Arabia, Asir region, Sabya, Basahy farm, 15 km, E of Abha, 17˚07'N, 42˚37'E, 23 m, 06.11.2013, body length 3.5 mm, leg. Dr. Hassan Dawah, in FSC. 1♀: Saudi Arabia, Asir region, Sabya, 09.06.2014, body length 4.2 mm, leg. Hassan Dawah, in FSC. 1♀: Saudi Arabia, Jazan, Sabya, Basahy Farm, 17˚07'N, 42˚37'E, Malaise trap, 09.05.2014, leg. Hassan Dawah. 1♂: Saudi Arabia, Abu, Aresh Almahdage, Village, 1-6.06.2013, Malaise trap, leg. Hassan Dawah. 1♀: Saudi Arabia, Maraba, 17˚51'N, 42˚23'E, 286 m, 27.05.2014, leg. Hassan Dawah. 1♂: Iran, Kaftarak, Fars Province, 29˚57'N, 52˚69'E, 26.07.2014, leg. Sh. Rezaei, in Department of Entomology, Jahrom branch, Islamic Azad University collection (JIAU). 1♂: Iran, Kaftarak, Fars Province, 26.07.2014, 29˚57'N, 52˚69'E, leg. Sh. Rezaei, in Department of Entomology, Jahrom branch, Islamic Azad University collection (JIAU). 4♀ and 2♂: Saudi Arabia, Jazan, Abu Aresh, Mohana, 66 m, 16˚58'N, 42˚5'.48 E, Malaise trap, 21.09.2014, leg. Hassan Dawah. 1♀: Saudi Arabia, Jazan, Abu Aresh, Mohana, 66 m, 16˚58'N, 42˚5'.48E, Malaise trap, 20.10.2014, leg. Hassan Dawah. 1♂: Saudi Arabia, Jazan, Abu Aresh, Mohana, 66 m, 16˚58'N-42˚5'.48E, Malaise

trap, 21.09.2014, leg. Hassan Dawah. 1♂: Saudi Arabia, Asir, Abha, Maraba, Alhudity Farm, 226 m, 17˚51'N-42˚23'E, Malaise trap, 15.09.2014, leg. Hassan Dawah.

Average body length of 11 males and 9 females:

Males l = 4.07 mm (Standard Deviation SD = 0.41 mm); females l = 4.12 mm (Standard Deviation SD = 0.41 mm); for males and females the body length range (within the confidence limit of 95%) between 3.9 mm and 4.3 mm. The size difference between males and females is null within the statistical errors.

Type and paratypes in authors collections and in collections of the Museum of Natural History of Pisa University, of Jazan University (Saudi Arabia), Department of Entomology, Jahrom branch, of Islamic Azad University collection (JIAU) and of Biodiversity Assessment & Monitoring Division of the Environment Agency, Abu Dhabi (EAD).

With the average length of 4.10 mm, *Ch. majidi* **sp. nov.** is among the smaller species of the *Ch. millenaris* group, and body size is of taxonomic value.

Distribution: Iran, United Arab Emirates and Saudi Arabia.

Remarks: This new species belong to the *Ch. millenaris* group, confirmed by study of the male genitalia of the holotype and of the paratype from U.A.E. and Saudi Arabia (Fig. 3).

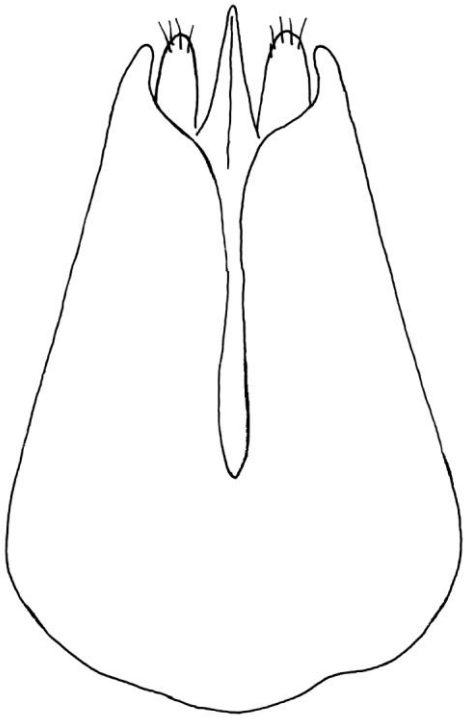


Figure 3. Outline of the male genitalia of *Chrysis majidi* **sp. nov.** holotype in dorsal view, length 0.055 mm.

Etymology: The species is named after Dr. Majid Fallahzadeh, Islamic Azad University, Jahrom Branch, Fars, Iran.

Diagnosis: *Chrysis majidi* **sp. nov**. is one of the few species of the *Ch. millenaris* group with a uniform light blue body colour (including S-II and S-III), without the traces of red or

bronze-red color present in most species of the group. Unique features of *Ch. majidi* are the scutellum longer than propodeum and the shape of T-III distal border: round and weakly incised medially with a large obtuse angle (Fig. 7); however, in the female paratypes this angle is weak and observable only when viewed from the posterior end.

Description

***Body length*.** The average for all ten specimens is 4.0 mm. The average body length in the second sub-group is 4.7 mm, and *Chrysis majidi* **sp. nov**. is the smallest in the group.

***Head*.** Of metallic blue color without evidence of TFC (Figs 4-7); malar space 1.5 MOD long**;** subantennal space short, only 1.0 MOD long; clypeus with sparse punctures and humped in middle, mandible brown in middle, distally darker and with an additional apical tooth, metallic blue at basis on external side; facial cavity deep, nearly polished in middle and only weakly microridged horizontally in middle (microridging stronger in female), with close punctures laterally, each a little smaller in diameter than those on frons (the U.A.E. paratypes have a more clear central area and more horizontal striation in the facial cavity); flagellum dark brown and non-metallic, pedicel weakly metallic blue and even more weakly at basis of F-I (Fig. 6); relative lengths of P:F-I:F-II = 8:11:9; F-I L/W = 2.0. Head transverse in top view about 1.7 times wider than long, larger than pronotum; on occiput the ocellar triangle is obtuse (but in the paratype from al-Wathba (U.A.E.) this angle is about 90˚); the ocellocular distance larger than MOD.

Mesosoma. Dorsum closely punctate (Fig. 4), punctures double, small and large, sparser at basis of scutellum and on the central part of mesonotum, PS = 0.2 PD. metanotum with a small depression at middle of anterior border; propodeal angle pointed and directed backward; tegula metallic blue-green, mesopleuron with large, sparse punctures, each with a flat bottom (Fig. 5); scrobal sulcus well impressed; episternal sulcus weak, or indicated only by alignment of a few of the larger punctures (stronger in female); scutellum longer than propodeum; legs metallic blue-green, tarsus light brown becoming darker distally; wing clear, venation brown, radial cell closed (Fig. 4).

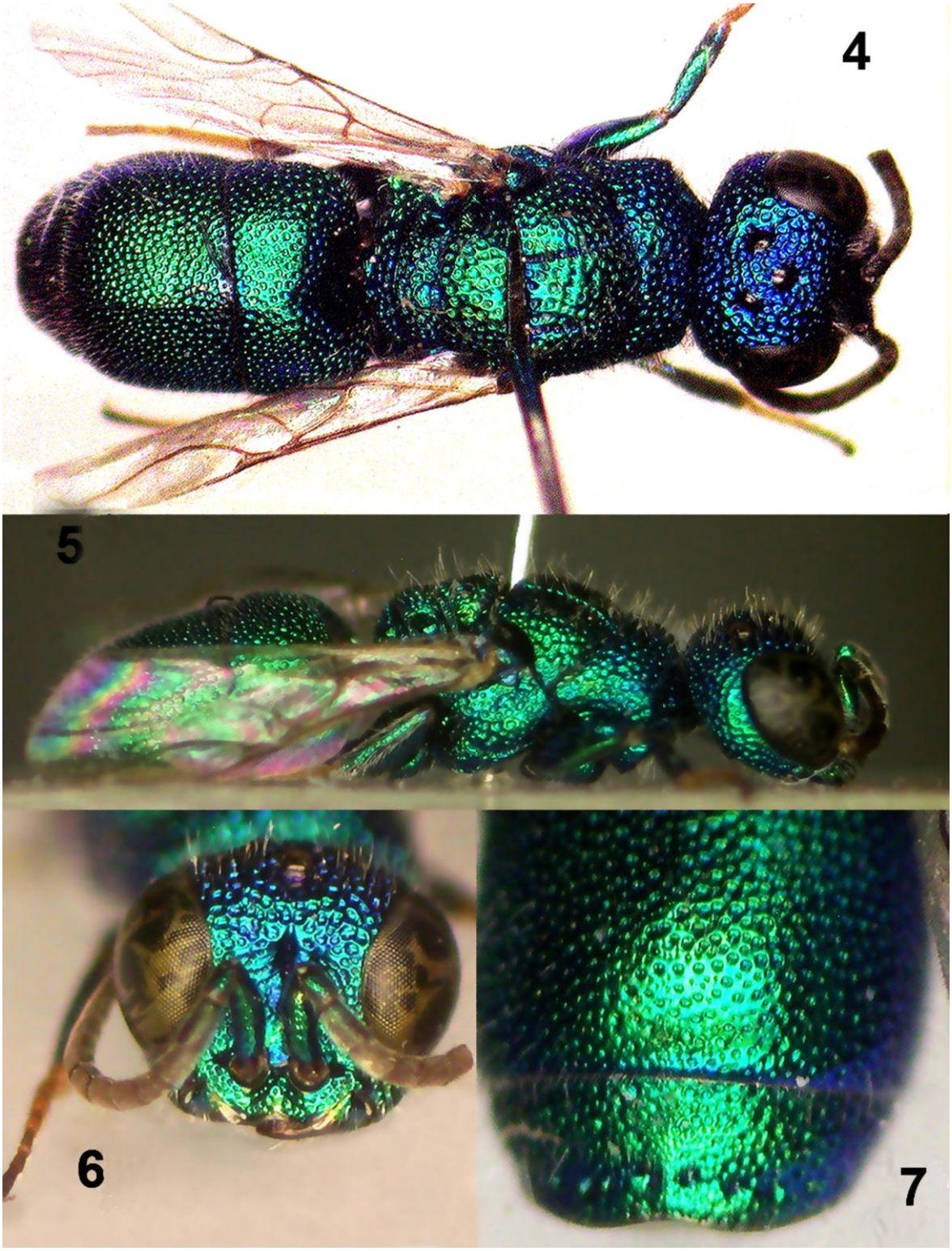
Metasoma. Uniform blue in colour; punctures on disc of T-I with a flat bottom, PS about =PD, the interspaces with finer punctures. Punctures double also on T-II and T-III ; on T-II punctures larger basally (PD = 0.3 MOD, PS = 0.3 PD) becoming smaller and sparser distally, PS = 1.5 PD; T-III with smaller, denser punctures and a thin transparent rim at distal border; subapical pit row with round, deep, dark pits; swelling above the pit row weak, the central pre-pit bulge weak in female, almost unobservable in male. T-III distal border incised in middle, with a large V-shaped obtuse angle (Fig. 7): this peculiar shape is clear in type and male paratypes, but is weaker in females. The abdominal underside is metallic blue; the black spots of ST-II are large, rectangular and nearly touching.

***Male*.** The genital capsule has been studied and is outlined in Figure 3, in top view; the shape resembles that of *Ch. fugax* Abeille de Perrin, 1878, confirming the inclusion of these species in the same group.

Female, sexual dimorphism and intraspecific variation

The female individuals of *Ch. majidi* recently captured in the Asir and Jazan Provinces of Saudi Arabia have the same uniform males blue body color, a similar body shape and body length.

Head. As in the male type, the facial cavity of the female paratypes has only a weak transverse striation (barely visible); the genae are convergent and 2.0 MOD long ; clypeus short and humped in middle; mandible light brown, metallic blue externally at basis. Antenna dark, P weakly metallic blue.



Figures 4–7. Male holotype of *Chrysis majidi* **sp. nov. 4,** dorsal view; **5,** lateral view; **6,** face in frontal view; **7,** tergit III in postero-dorsal view.

Mesosoma. Pronotum weakly concave, in top view, on the external side, with a weak sulcus at middle of anterior border; punctures on pronotum, mesonotum and scutellum deep and double, with finer punctures in the space between; mesopleuron with a visible

verticaulus; scutellum longer then metanotum; notauly diverging anteriorly. Wing veins brown with the radial cell almost closed: legs blue with brown tarsi; tegulae metallic blue; propodeal tooth pointed and directed backwards.

Metasoma. T-I long; punctures double on all tergites; T-III with a thin, transparent rim at distal border: distal border shape approximately rounded with a weak, obtuse central incision; T-III of female weakly saddled in lateral view, distal border has 10, deep punctures. All sternites metallic blue; black spots on S-II weak and divergent posteriorly.

The females from Southern Saudi Arabia have the same uniform body blue color and body shape as in males. Only the horizontal microstriation of facial cavity can be stronger; the obtuse incision of T-III distal border is weaker or not visible in top view, but is bended in V shape in back view.

Geographic distribution: *Chrysis majidi* is widely distributed in Near East: from South Saudi Arabia (Asir and Jazan Provinces) to U.A.E. and Iran (Kerman, Lorestan and Fars Provinces).

Chrysis unirubra Strumia sp. nov. (Figs. 8-11)

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Type Material: *Holotype* 1♀, Fars (Iran), 7 km West of Dasht-e-Arzhan, 2050 m, 29˚38'N – 51˚54'E, 04-06.05.2008, leg. D. Gianasso. In FSC.

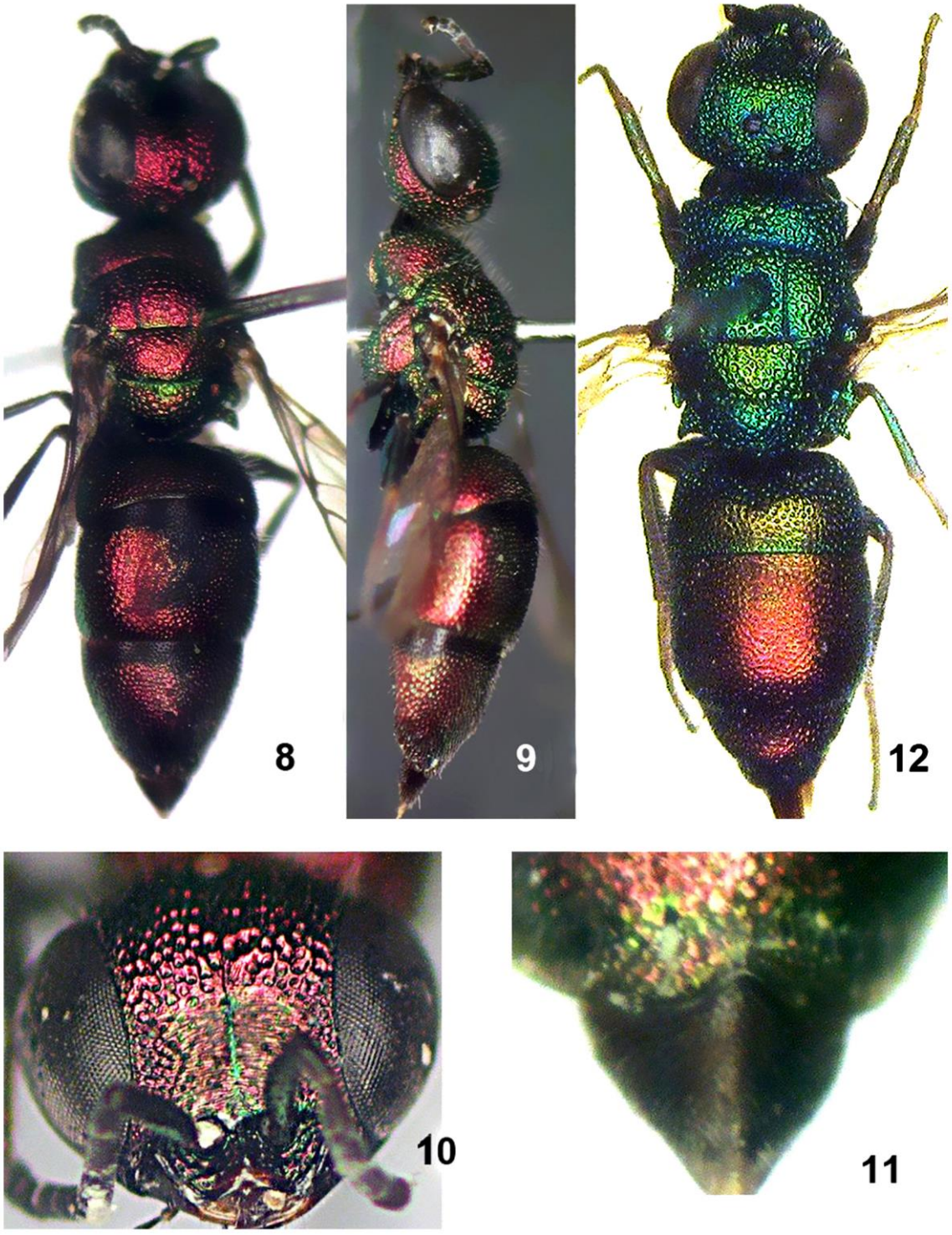
Material studied: Males and females of *Ch. bilobata* Balthasar, 1953 from Giordan (Damascus, Syria); males and females of *Ch. millenaris* Mocsáry, 1897 from Spain, Italy and Greece; males and females of *Ch. tantilla* Linsenmaier 1968: 74 = *Ch. cupriminuta* Linsenmaier, 1994: 176, from U.A.E.; ♂ and ♀ of *Ch. krueperi* Mocsáry, 1889 from Greece; ♂ and ♀ of *Ch. fugax* from Italy and Spain.

Ch. bilobata Balthasar, 1953 was wrongly considered as a ssp. of *Ch. millenaris* Mocsáry, 1897 by Linsenmaier (1959: 99). On the contrary we consider *Ch. bilobata* a different species on the basis of its unique shape of T-III distal border (Figs. 13-16). As noted by Balthasar 1953 " Cette nouvelle espèce est reconaissable par la forme de la marge apicale du 3^{e} segment abdominal. Ce caractère donne a cette especе une apparence très particulière…" (Balthasar 1953: 178 and figs. 13-14), Kimsey & Bohart (1991: 429) considered *millenaris* as a ssp. of *Ch. kruperi* (Mocsáry 1889: 216). This interpretation is also wrong. We studied specimens of *Ch. millenaris* Mocsáry, 1897 that were captured in Portugal, Spain, France, Greece Egypt and Turkey. On the contrary the studied specimens of *Ch. bilobata* were captured in Jordan, Libanon, Syria and Palestinae, thus evidencing a different distribution.

The presence of a more or less bilobate T-III distal border is present in all Near East Species (*Ch. tantilla*, *Ch.bilobata*, *Ch. unirubra*) and appears to be a regional feature (Figs. 13-16).

Etymology: The name of the new species refers to the uniform bronze red body colour of the holotype.

Diagnosis: This new species is close to *Ch. bilobata* Balthasar, 1953 for the unique shape of T-III distal margin **(**see Fig. 13 and 14 in Balthasar 1953: 186, and Fig. 13-16 of peresent paper) but differs by the uniform bronze-red body colour. In contrast, *Ch. bilobata* has short



Figures 8–12. Holoype female of *Chrysis unirubra* **sp. nov. 8,** dorsal, view; **9,** lateral views ; **10,** face frontal view; **11,** tergit III distal margin of *Chrysis bilobata* Balthasar, 1953; **12,** dorsal view of a female of *Ch. athalia* Balthasar 1953 from Lebanon (Bekaa, 14.06.1953).

genae, not longer than the antennal flagellum diameter; the facial cavity, head and mesosoma are green with some weak yellow effulgence on the scutellum**.** In both these species the

mesopleuron is simple with a very weak episternal sulcus, this differentiating them from the close species *Ch. millenaris* Mocsáry, 1897.

In conclusion *Ch. bilobata* is not a subspecies of *Ch. millenaris* (Spain, Italy, Greece); *Ch. bilobata* and *Ch. unirubra* **sp. nov** are valid species, with different shapes of T-III distal margin, as shown in Figures 13-16.

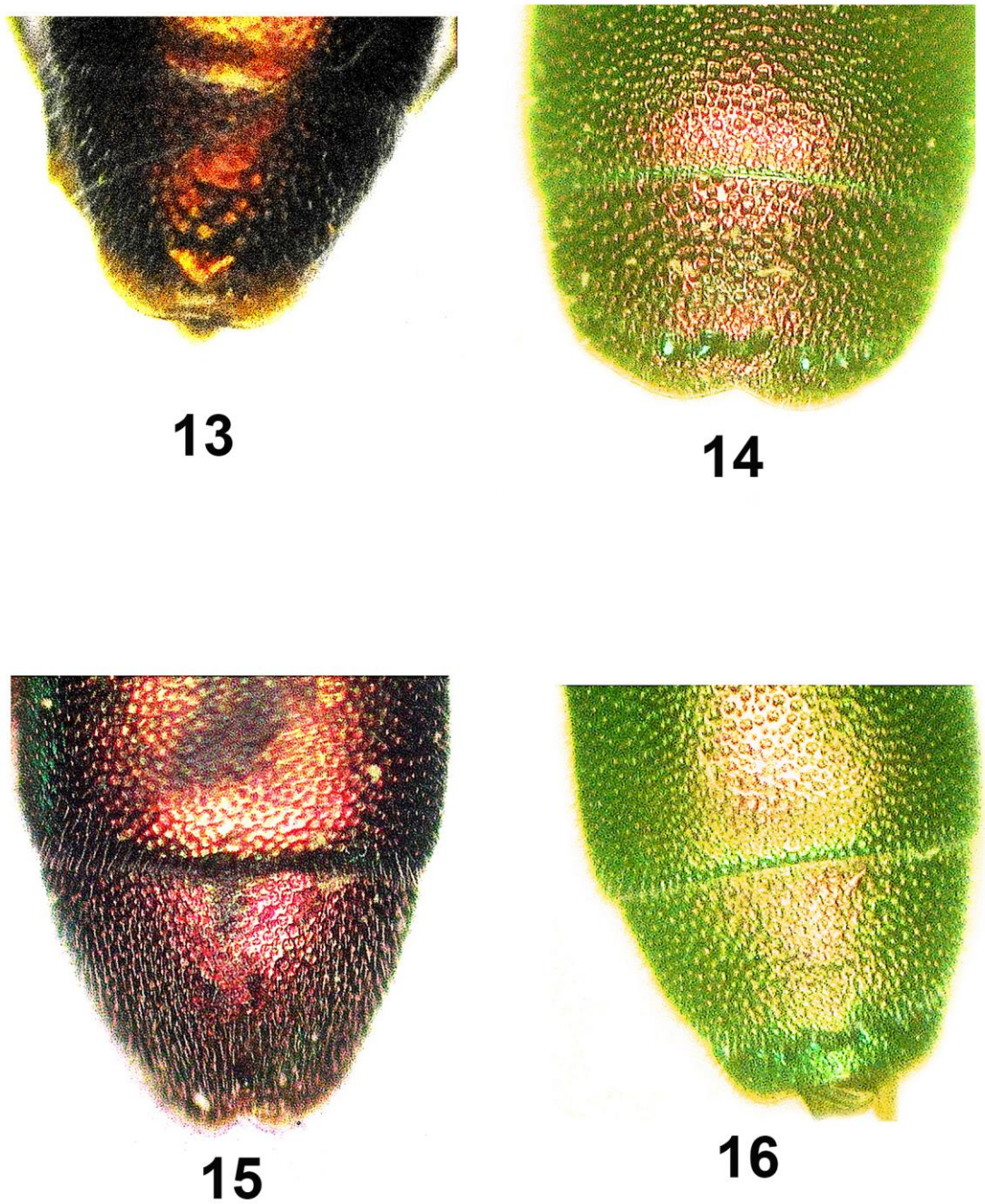


Figure 13–16. Outline of the tergit III distal border in some species of millenaris group. **13,** female of *Chrysis tantilla* Linsenmaier, 1968 = *Ch. cupriminuta* Linsenmaier, 1994 (14.04.2005, Wadi Wurayah, United Arab Emirates); **14,** *Chrysis bilobata* Balthasar, 1953, female (Ain Hadra, Damascus, Syria, 13.08.1954); **15,** *Chrysis unirubra* **sp. nov.** holotype female (04-06.05.2008, 7 km West of Dasht-e-Arzhan, 2050 m, Fars, Iran); **16,** *Ch. millenaris*, female (Noci (BA), Italy, 9-21.07.2005).

Description of female holotype

Body length. 3.5 mm.

Head. Head and clypeus bronze-red; facial cavity nearly flat; puncture size on the brow extending below along the composite eye internal margin; central part of facial cavity finely horizontally micro-ridged (Fig. 10); clypeus short, elevated in middle, with a concave distal margin; mandible light brown distally; genae convergent and shorter than antennal diameter; scape weakly metallic bronze-red, pedicel and flagellum non-metallic dark brown; length of FI = 1.5 FII, FII L/W = 1.5, all other flagellomeres L/W = 1.

Mesonotum. Dorsum bronze-red and closely punctate, a weak green line between scutellum distal margin and metanotum basis; punctures not deep, each with flat bottom; propodeal angle pointed and directed backward (Fig. 8); tegula weakly metallic green, mesopleuron rounded and a little directed backward; wing hyaline, radial cell closed, medial vein straight. Body setae erect and white; foreleg metallic bronze-red, hind- and mid-tibia with a dull green effulgence, tarsus brown.

Metasoma. Dorsum bronze-red; punctures nearly touching, each with flat bottom; disc of T-II with a diffuse dark spot; T-III with a weak hump on disc; distal margin bronze-red, rounded and deeply incised in middle (Fig. 11), lateral margin weakly concave; pit row small and deep, numbering about 12; S-II metallic green-gold with two large quadrangular black spots nearly touching, half long as S-II and diverging distally; S-III black with fine, dense punctures.

Male. Unknown.

The *Chrysis facialis* group

According to Kimsey & Bohart (1991: 346) the species of the *Chrysis facialis* group are identified by: "F-I l/w = 2.4 (male), 2.8 (female); face (female) microridged or polished medially; genae (female) nearly parallel, TFC absent or weak and inverted broad U; malar space 2.4 MOD (male) and 3.0 MOD (female); sub antennal space 1.6 MOD; T-III apex with four teeth; T-III lateral edge straight; S-II spots large nearly touching".

This is a small group of 10 described species (Table 2). All the species are known from South-West Asia (except for *Ch. nox*, described from Mongolia

Linsenmaier's 1959: 105 description of the group is in agreement with Kimsey & Bohart, with the addition of the body punctures double (large punctures with smaller ones in the spaces between).

Table 2. List of the presently known species of the *Chrysis facialis* species group.

	***Chrysis* species**
1	*Ch. athalia* Balthasar, 1953= *filiafacialis* Linsenmaier, 1959
2	*Ch. convexianalis* Linsenmaier, 1994
3	*Ch. facialis* Abeille de Perrin & du Buysson, 1887
4	*Ch. lermontovi* Semenov, 1967
5	*Ch. myirabilis* Radoszkowski, 1867
6	*Ch. nox* Semenov, 1954
7	*Ch. propinquata* Linsenmaier, 1968
8	*Ch. regalis* Mocsáry, 1912
9	*Ch. sefrensis* du Buysson, 1900
10	*Ch. verae* Semenov, 1967

***Chrysis gianassoi* Strumia sp. nov. (Figs. 17-20)**

urn:lsid:zoobank.org:act: 8BAC6D44-EE92-42F6-961F-854B4ABA87D8

Remarks: *Chrysis gianassoi* belongs to the *Ch. facialis* group and is easily identified by the small body length of 4.5 mm, while the group has an average body length of 7.05 mm, (standard deviation SD= 1.7 mm) and an unique metasomal colour patterns.

Type material: *Holotype* 1♀, Fars (Iran), 7 km West of Dasht-e-Arzhan, 2050 m, 29˚38'N – 51˚54'E, 04 - 06.v.2008. In FSC.

Material studied: ♂ and ♀ of: *Chrysis facialis* Linsenmaier, 1959 from Lebanon and Syria; ♂ and ♀ of *Chrysis myirabilis* Radoszkovski, 1876a from Greece, Syria and Palestine; ♀ of *Chrysis athalia* Balthasar 1953, from Lebanon and Syria; ♂ and ♀ of *Chrysis sefrensis* du Buysson, 1900 from Syria, Jordan and Iran.

Etymology: The new species is dedicated to the collector, the italian entomologist Domenico Gianasso (Castelnuovo Don Bosco, Asti, Piedmont).

Diagnosis: The new species is easily separated from other species of the *Ch. facialis* species group based on the body colour pattern and body size. The body length of only 4.5 mm is the smallest of the group, together with *Ch. athalia* (the average length of the *Ch. facialis* group is 7.05 mm, standard deviation SD= 1.7 mm). Head and mesosoma green with only weak yellow effulgence on scutellum and legs. All tergites red with a striking green distal margin (Figs. 17-19).

Description of female holotype

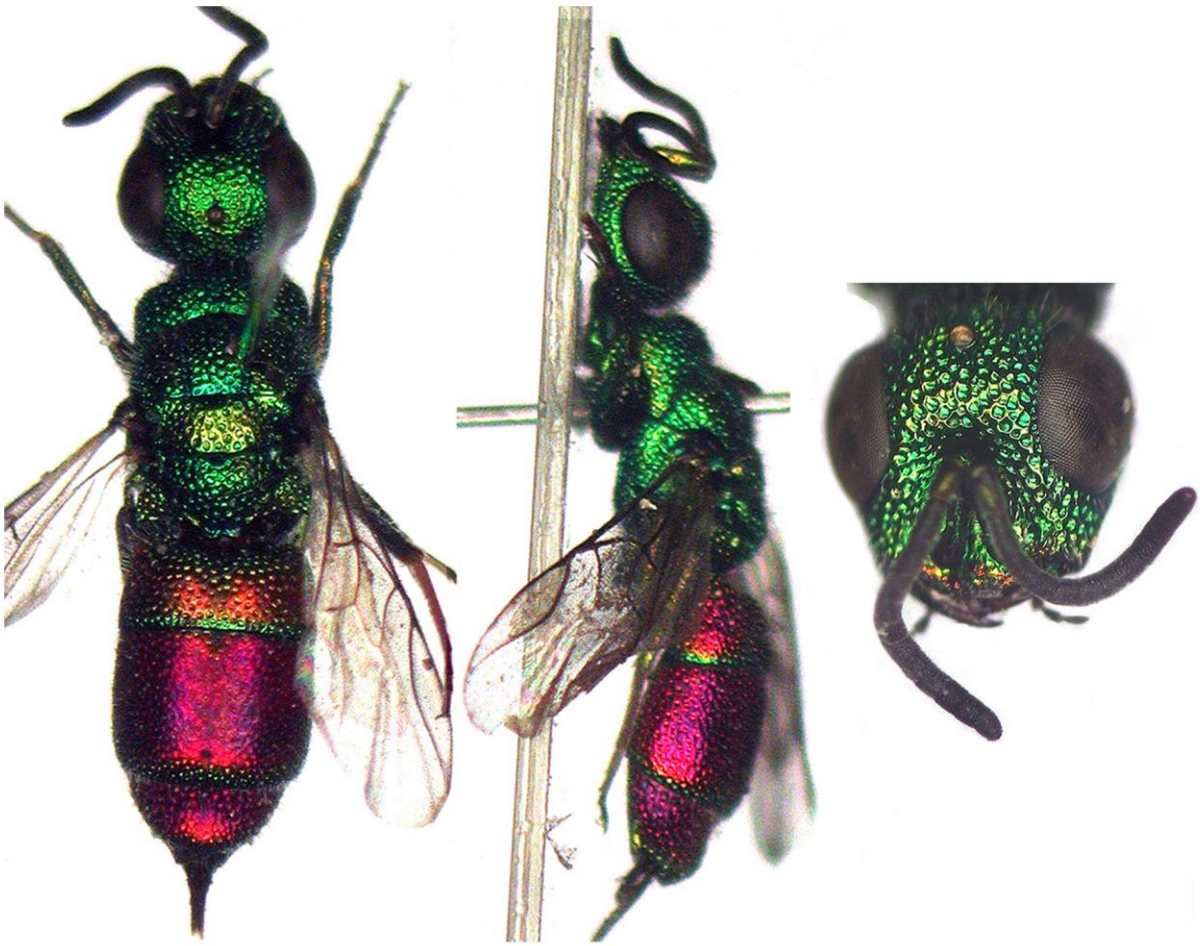
Body length. 4.5 mm.

Head. Head green without TFC; malar space as long as F-I+F-II (Fig. 20); subantennal space short, less than the antennal socket diameter; mandible brown, distally bidentate, metallic yellow red at basis externally. Facial cavity deep along middle, laterally with punctures of the same size as on frons and occiput; flagellum black, non-metallic, pedicel weakly yellow-green.

Mesosoma. Dorsum closely punctate, with finer punctures between, punctuations sparser on scutellum and central part of mesonotum; propodeal angle pointed and directed backward. Tegulae metallic green, mesopleuron rounded (Figs 17-18), episternal sulcus with large punctures; legs yellow-green, tarsus brown; wing hyaline, radial cell closed**.**

Metasoma. TI, T-II and T-III red with a striking green distal margin (Figs 17-19); T-I with two humps on anterior margin, and a double punctuation; T-III stellate and with a central patent hump above the pit row distal margin; (Fig. 19) pits deep, 8 in number. Distal margin green with four pointed teeth; long white setae on over entire body. ST-II metallic green with two large quadrangular black spots nearly touching, half long as S-II. ST-III entirely metallic pale gold-red, becoming green distally, with fine and dense punctures.

***Male*.** Unknown



Figures 17–20. Female holotype of *Chrysis gianassoi* **sp. nov. 17,** dorsal view; **18,** lateral view; **19,** lateral view of metasoma tergit II and tergit III; **20,** frontal view of the face.

Species of Hymenoptera, Chrysididae captured in Iran

Cleptinae

Cleptes Latreille, 1802

***Cleptes semiauratus* (Linnaeus, 1761)**

Material studied: 2♀, Alborz, Karj, Kordan, 35°93'N, 50°83'E, 11.vi.2012, leg. B. M.. Jahromi.

Distribution: Europe, Algeria, Turkey (Strumia and Yildirim 2009), Caucasus and Siberia (Linsenmaier 1959). **New record for Iran**.

Chrysidinae

Elampini

Haba Semenov, 1954. **New record for Iran** (Rosa *et al*. 2013).

***Haba biroi* (Mocsáry, 1911)** (**Fig. 21**)

Material studied: 1♀, Iran, Buyer Ahmad, Sisakht, 2370 m, 30˚52'N, 51˚25'E, 07.v.2008, leg. D. Gianasso; 1♂, Iran, Fars, 7 km West of Dasht-e-Arzhan, 2050 m, 29˚38'N, 51˚54'E, 04 - 06.vi.2008, leg. D. Gianasso; 1♂, U.A.E, Wadi Bih Dam, 22 - 26.iii.2009, leg. A. van Harten, water trap.

Distribution: Palaearctic (Tunisia and U.A.E.) (Strumia 2014). **New record for Iran**.

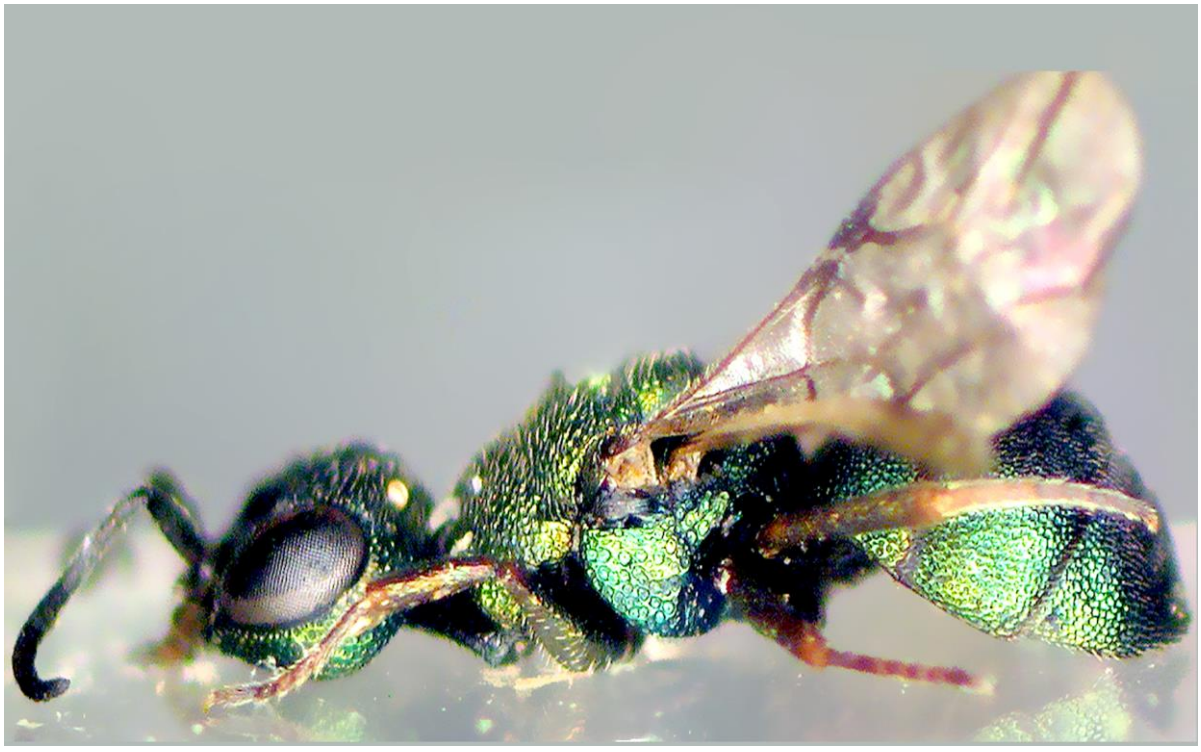


Figure 21. Lateral view of a male *Haba biroi* (Mocsáry, 1911).

Remarks: *Haba* Semenov, 1954 is a small genus of the tribe Elampini, including only 3 species, presently known from North Africa (Tunisia) and Central Asia (Kimsey & Bohart 1991). The genus is in need of revision. In Iran, *H. biroi* was found at an elevation above 2000 m, while in U.A.E. it was captured at a lower altitude (100 m, 25˚48'N – 56˚04'E) (Strumia 2014).

Hedychridium Abeille de Perrin, 1879

***Hedychridium maculisternum* Arens, 2011**

= *scutellare palestinense* Balthasar, 1951 = *Hedychridium maculiventre raucum* Linsenmaier, 1997

Material studied: 1♂, Fars, Larestan, 27°98'N, 54°29'E, 15.viii.2012, leg. A. Falahatpishe.

Distribution: Turkey (Linsenmaier 1997: 258). **New record for Iran**.

Remarks: The above synonymies were recently proposed (Arens 2010, 2011). Our specimen fits with Linsenmaier's original description quite well, while Balthasar's original description does not fit the head shape of our specimen and fig. 5b in Arens (2010).

Hedychrum Latreille, 1802

***Hedychrum longicolle* Abeille de Perrin, 1877**

Material studied: 1♀, Fars, Neyriz, 29°12'N, 54°20'E, 29.vii.2012, leg. M. Khosroabadi; 1♀, Fars, Neyriz, 29°12'N, 54°20'E, 15.ix.2012, leg. M. Khosroabadi; 1♀, Fars, Neyriz, 29°12'N, 54°20'E, 07.ix.2012, leg. M. Khosroabadi.

Distribution: South Europe, Turkey, North Africa, West Asia, China (Kimsey & Bohart 1991). **New record for Iran**.

***Hedychrum niemelai* Linsenmaier, 1959**

Material studied: 1♂, Khorasan Razavi, 40 km North-West of Cheshmeh, 1100 m, 26.iv.2008, leg. D. Gianasso; 1♂, Golestan, Azad Shar-Shahrud road, near Til Abad, 1380 m, 36˚51'51"N, 55˚24'21"E, 19 - 23.v.2010, leg. D. Gianasso.

Distribution: Widespread species in Palaearctic Region (Linsenmaier 1959). **New record for Iran**.

Holophris Mocsáry, 1890

Remarks: This genus is present in West Africa, Yemen, Arabia (Strumia 1995, 2008, 2014) and probably also in Iran, but so far there have been no Iranian records.

Holopyga Dahlbom, 1845

***Holopyga amoenula* ssp. *oriensa* Linsenmaier, 1959**

Material studied: 1, Fars, Neyriz, 29°12'N, 54°20'E, 14.ix.2012, leg. M. Khosroabadi; 1♀, Fars, Neyriz, 29°12'N, 54°20'E, 14.ix.2012, leg. M. Khosroabadi.

Distribution: Greece, Turkey, Syria, Palestine and Iran (Rosa *et al.* 2013).

Remarks: *H. amoenula* ssp. *oriensa* is the oriental form of *H. amyoenula* ssp. *occidenta* Linsenaier, 1959: the western form is known from Spain, France, Greece and Siberia (Linsenaier 1959; 1968).

***Holopyga cypruscula* Linsenmaier, 1959**

Material studied: 1♀, Kordestan, 25 km South of Saqqez, 2260 m, 33˚13'48"N, 49˚19'21"E, 11.v.2008, leg. D. Gianasso.

Distribution: Turkey, Syria, Lebanon, Palestine and Iran (Linsenmaier 1959).

***Holopyga inflammata* (Forster, 1853)**

Material studied: 1♀, Khorasan Razavi, 40 km North-West of Cheshmeh, 1100 m, 26.iv.2008, leg. D. Gianasso.

Distribution: Caucasus, Palestine, Cyprus (Linsenmaier 1959), Iran (Rosa *et al*. 2013) and Turkey (Strumia & Yildirim 2009).

***Holopyga fastuosa proviridis* Linsenmaier, 1997**

= *Holopyga ovata proviridis* Linsenmaier, 1959

Material studied: 1♀, Fars, Neyriz, 29°12'N, 54°20'E, 20.ix.2012, leg. M. Khosroabadi; 1♀, Fars, Neyriz, 29°12'N, 54°20'E, 18.viii.2012, leg. M. Khosroabadi; 1♀, Alborz, Karaj, Kordan, 35°93'N, 50°83'E, 11.vi.2012, leg. B. Majnon Jahromi.

Distribution: Italy, Greece, Turkey, Syria, Iran, Saudi Arabia and North Africa (Linsenmaier 1959, 1999).

Remarks: This taxon was originally described as a sub-species of *Holopyga ovata* Dahlbom, 1854 (Linsenmaier 1959), from Turkey, with the abdomen completely emerald green, instead of cuprous red as in the nominal form. The form *proviridis* appears less frequent in the *fastuosa* populations and only in females. *Proviridis* has been found in the Mediterrranean Region (Italian myainland, Spain, Sicily, Corsica, Sardinia, Rhodes, Greece, Algeria, Morocco, Turkey), and in Saudi Arabia, Iran and Siberia (Rosa *et al.* 2013), where all the studied individuals show a stable body colour and shape.

***Holopyga punctatissima* Dahlbom, 1845**

Material studied: 1♂, Fars, Neyriz, 29°12'N, 54°20'E, 18.viii.2012, leg. M. Khosroabadi.

Distribution: South-East Europe, Turkey, Palestine, Caucasus, Eygyp (Linsenmaier 1959) and Iran (Mocsáry 1892).

Omalus Panzer, 1801

***Omalus biaccinctus* (du Buysson, 1892)**

Material studied: 1♀, Alborz, Karaj, Kordan, 35°93'N, 50°83'E, 11.vi.2012, leg. B. Majnon Jahromi; 3♂, Fars, 7 km West of Dasht-e-Arzhan, 2050 m, 29˚38'N, 51˚54'E, 01 - 06.v.2008, leg. D. Gianasso; 1♀, Lorestan, 10 km South-West of Dorud, 1400 m, 30.iv.2007, leg. D. Gianasso.

Distribution: Europe, Turkey, Western Asia and Iran (Rosa *et al.* 2013).

Philoctetes Abeille de Perrin, 1879

***Philoctetes bidentulus* (Lepeletier, 1806)**

Material studied: 2♂, Lorestan, 25 km South-East of Aligurdaz, 08.v.2008, leg. D. Gianasso. No data available for the elevation of this site.

Distribution: Morocco, Southern Europe to West Asia (Linsenmaier 1999). **New record for Iran**.

Pseudomalus Ashmead, 1902

***Pseudomalus auratus* (Linnaeus, 1758)**

Material studied: 1♂, Tehran, 10 km North of Ziaran, 36˚07'00"N – 50˚39'25"E, 17.v.2010 leg. D. Gianasso.

Distribution: Widespread in the Palaearctic; North America (introduced) and Iran (Rosa *et al*. 2013).

***Pseudomalus turkestanicus* (Mocsáry, 1889)**

Material studied: 1♂, 7♀, Alborz, Karaj, 35˚93'N, 54˚83'E, 11.vi.2012, leg. B. Majnon Jahromi; 1♂, 7♀, Alborz, Karaj, 11.vi.2012, leg. B. Majnon Jahromi; 3♀, Alborz, Karaj, 11.vi.2012, leg. B. Majnon Jahromi.

Distribution: Uzbekistan and Turkey (Strumia & Yildirim 2011). **New record for Iran**.

Remarks: These specimens are identified as *P. turkestanicus* because they agree very well with Mocsáry's original description. The study of Mocsáry's material (in the Hungarian Natural History Museum) confirms our identification. The body shape and punctures are simlar to *P. auratus*, but with a different body colour, entirely emerald green. More recent material shows that *P. turkestanicus* is a frequent and widespread species in Iran, probably the most frequently captured species of the genus.

***Pseudoyalus violaceus* (Scopoli, 1763)**

Material studied: 1♀, North-West Iran, Kordestan, 15 km North of Kamyaran, 1700 m, 12.v.2002, leg. D. Gianasso.

Distribution: Palaearctic widespread but not common (Kimsey & Bohart 1991). **New record for Iran**.

Chrysidini

Chrysidea Bischoff, 1913

***Chrysidea pumila* (Klug, 1845)**

= *persica* Radoszkowski, 1881

Material studied: 1♀, Fars, 40 km North-West of Mian Jangal, 1750 m, 29˚09'33"N, 52˚24'16"E, 07.v.2010, leg. D. Gianasso.

Distribution: Widespread in the Western Palaearctic and Afrotropical Regions (Kimsey & Bohart 1991).

Chrysis Linnaeus, 1761

***Chrysis ambigua* Radoszkowski, 1891**

Material studied: 1♂, Fars, 7 km West of Dasht-e-Arzhan, 29˚36'00"N, 51˚54'51"E, 12.v.2010.

Distribution: A species with mostly a Near East distribution: Palestine, Turkey, Turkmenistan, Transcaspia, Rhodes (Linsenmaier 1959) and Iran (Rosa *et al.* 2013).

***Chrysis coa* Invrea, 1939**

Material studied: 1♀, Kordestan, 1500 m, 22 km North of Kamyaran, 34˚55'N, 46˚57'E, 15.v.2010, leg. D. Gianasso.

Distribution: North Greece (Kerkini in FSC), Rhodes and Coo Islands, South-West former SSSR (Kimsey & Bohart 1991). **New record for Iran**.

***Chrysis consanguinea* Mocsáry, 1889**

Material studied: 2♂, Khorasan Razavi, 40 km North-West of Cheshmeh, 1100 m, 26.iv.2008. leg. D. Gianasso.

Distribution: South Europe, North Africa and Turkey (Strumia & Yildirim 2008). **New record for Iran**.

***Chrysis daphnis* ssp. *syriensis* Linsenmaier, 1959**

Material studied: 6♀, Fars, 40 km North of Fasa, Mian Jangal, 1750 m, 29˚10'N – 53˚23'E, 05.v.2008; 1♀, Khorasan Razavi, 40 km North-West of Cheshmeh, 1100 m, 26.iv.2008, leg. D. Gianasso.

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

Remarks: Kimsey & Bohart (1991) erroneously considered *Chrysis daphnis* as a synonym of *Ch. cylindrica* Eversmann, 1857. On the contrary, *Ch. daphnis* is an accepted and valid species. *Chrysis daphnis syriensis* is the Middle Eastern form, with: "[the punctures on abdomen are larger and sparser]" (Linsenmaier 1959: 133). This is a feature common to several Chrysididae species distributed from East Europe to Middle East.

***Chrysis distincta* ssp. *exigua* Mocsáry, 1889**

Material studied: 1♀, Alborz, Karaj, Kordan, 35°93'N, 50°83'E, 11.vi.2012, leg. B. Majnon Jahromi.

Distribution: South Russia, Cyprus, Caucasus, Turkestan (Linsenmaier 1959, 1968). **New record for Iran**.

Remarks: *Chrysis distincta* is a widespread and variable species in the southern Palaearctic Region. Several colour form have been described (synonymized by Kimsey & Bohart 1991: 404). *Chrysis distincta* ssp. *exigua* was described as a valid species from Turkestan by Mocsáry (1889) and the present female agrees very well with Mocsáry'soriginal description.

***Chrysis elegans* ssp. *smaragdula* Trautmann, 1926**

= *Chrysis elegans* ssp. *interrogata* Linsenmaier, 1959 = *Chrysis smaragdula* Trautmann, 1926

Material studied: 1♂, Iran, Kordestan, 25km Southeast Sayyez, 11.v.2008, leg. D. Gianasso.

Distribution: Rodes (Linsenmaier 1959), Turkey (Linsenmaier 1968) and Iran (Rosa *et al*. 2013).

Remarks: The above synonymies were recently established by Rosa and Vardal (2014) and is a replacement name of *Chrysis smaragdula* Trautmann, 1926 because the name is not available (*Chrysis smaragdula* Fabricus, 1775 is a Nearctic species).

***Chrysis gianassoi* Strumia sp. nov.**

Material studied: *Holotype* ♀, Fars (Iran), 7 km West of Dasht-e-Arzhan, 2050 m, 29˚38'N, 51˚54'E, 04 - 06.v.2008. Holotype deposited in FSC.

Distribution: Iran. The description of holotype is given above.

***Chrysis maculicornis* Klug, 1845**

Material studied: 1♂, Fars, Neyriz, 29°12'N, 54°20'E, 18.viii.2012, leg. M. Khosroabadi.

Distribution: North Africa, Palestine, Arabia, Iran (Rosa *et al.* 2013).

***Chrysis majidi* Strumia sp. nov.**

Material studied: 1♂, Iran, Kerman, 2300 m, 29˚03'39''N, 57˚53'24''E, 23.v.2011, leg. Domenico Gianasso; reared from a nest in *Rubus* sp., 02.vi.2012; 1♂: Iran, Lorestan, 10 km South-West of Dorud, 1400 m, 30.iv.2007, leg. D. Gianasso; 1♂: U.A.E., Dubai, al-Wathba, 24˚26'N, 54˚61'E, 06.xi.2009, leg. Anitha Saji; 1♂: U.A.E., Dubai, al Dubbayya, 24˚ 17'N, 54˚14'E, 13.ii.2008, leg. Anitha Saji; 1♀: Saudi Arabia, Asir region, Sabya, Basahy farm 15 km East of Abha, 17˚ 07'N, 42˚37'E, 23 m, 06.xi.2013, leg. Hassan Dawah; 1♀: Saudi Arabia, Asir region, Jazan, Sabya, 09.vi.2014, body length 4.2 mm, leg. Hassan Dawah.

Distribution: Iran, U.A.E. and Saudi Arabia. The description of the holotype is given above.

***Chrysis mandibularis* du Buysson 1901**

Material studied: 1♀, Iran, Lorestan, 54˚29'E, 27˚98'N, 04.viii.2012, leg. D. Gianasso, (body length 7.1 mm); 1♀, Saudi Arabia, Farasan Islands (Red Sea), 15.iii.2014, leg. Hassan Dawah (body length 5.5 mm).

Distribution: Afrotropical: Kenia, Tanzania (Kimsey & Bohart 1991), Saudi Arabia (FSC). **New record for Iran**.

Remarks: *Chrysis myandibularis* belong to the Afrotropical *Ch. delicatula* group of species. This is the first record outside Africa for this group: a second female individual was recently found in Saudi Arabia (Farasan Islands, Red Sea, 15.03.2014, leg. H. Dawah).

***Chrysis minutissima* Radoszkowski, 1876**

Material studied: 2♂, Fars, Larestan, 27°98'N, 54°29'E, 15.viii.2012, leg. A. Falahatpishe.

Distribution: Morocco, Egypt, Palestine and Jordan (Linsenmaier 1999). **New record for Iran**.

***Chrysis mysta* du Buysson, 1900**

Material studied: 1♀, Fars, 40 km North-West of Fasa, 1750 m, 15.v.2005, leg. D. Gianasso.

Distribution: Middle East, Libya, Turkey, Kazakhstan, Palestine, Syria, Jordan, Iran (Farhad *et al.* 2015).

***Chrysis palliditarsis* Spinola, 1838**

Material studied: 3♂, Fars, Larestan, 27°98'N, 54°29'E, 04.viii.2012, leg. A. Falahatpishe; ♂, Fars, Larestan, 27°98'N, 54°29'E, 15.viii.2012, leg. A. Falahatpishe; 1♂, Fars, Darab, 28°51'N, 54°18'E, 19.vi.2012, leg. M. Fallahzadeh; 2♂, Fars, Neyriz, 29°12'N, 54°20'E, 14.ix.2012, leg. M. Khosroabadi.

Distribution: Afrotropical Region, Egypt, Ethiopia, Eritrea, South Africa, Palestine, Saudi Arabia, Oman, Yemen and U.A.E. (Linsenmaier 1994; Strumia 2008) (*Ch. palliditarsis* is a wide spread species in the South Palaearctic Region).

***Chrysis pulchella* Spinola, 1808**

Material studied: 1♂, Fars, 7 km West of Dasht-e-Arzhan, 2050 m, 29˚38'00"N – 51˚54'51"E, 12.v.2010, leg. D. Gianasso.

Distribution: South Europe, Turke**y**, southern former SSSR, Iraq, Kazakhstan, and Iran (Pourrafei *et al.* 2011).

***Chrysis schousboei* Dahlbom, 1854**

Material studied: 1♀, Khorasan, 40 km North-West of Cheshmeh, 1100 m, 26.iv.2008, leg. D. Gianasso; 1♀, Khorasan, 40 km North-West of Cheshmeh, 1050 m, 27.vi.2003, leg. D. Gianasso.

Distribution North Africa (Kimsey & Bohart 1991), Morocco, Algeria (Linsenmaier 1999), South Europe, Turkey (Strumia & Yildirim 2009). **New record for Iran**.

Remarks: According to Linsenmaier (1999) and Kimsey & Bohart (1991), *Ch. schousboei* is a North African species known from Morocco to Egypt. Balthasar (1953: 217) described a similar species (*Ch. marani* Balthasar, 1953: 217) from Palestine. Later, Linsenmaier (1959, 1987) described *Ch. schousboei* ssp. *naefi* Linsenmaier 1959: 112, also from North Africa and *Ch. marani cupricolor* Linsenmaier 1987: 148, from Morocco. Our specimen agrees well with *Ch. schousboei* specimens (in FSC) from Morocco and clearly differs from *Ch. marani* and the *Ch.* ssp. *cupricolor* by the metasomal punctuation, the shape of the T-III distal margin, and the body size and color patterns. It is interesting to note that Balthasar (1953) considered *Ch. schousboei* to be a synonym of *Ch. elegans* Lepeletier, a quite different species. This suggests that he was not able to study specimens of *Ch. schousboei*.

***Chrysis sefrensis* du Buysson, 1900**

Material studied: 1♂, Khorasan, 40 km North-West of Cheshmeh, 1100 m, 26.iv.2008, leg. D. Gianasso; 1♂, Fars, Qader Abad, 2000 m, 03.v.2008, leg. D. Gianasso.

Distribution: South Palaearctic: Morocco, Algeria, Tunisia, Libya and Jordan (Linsenmaier 1999). **New record for Iran**.

Remarks: The study of male genitalia confirm the identification.

***Chrysis subincisa* Linsenmaier, 1959**

Material studied: 1♀, Khorasan Shomali, Chaman Bid, 1450 m, 29.vi.2003, leg. D. Gianasso.

Distribution: North Africa, Turkey, Palestine, Iran (Rosa *et al.* 2013) and the Middle East (Kimsey & Bohart 1991).

***Chrysis succincta* Linnaeus, 1767**

Material studied: 2♀, Fars, Neyriz, 29°12'N, 54°20'E, 23.viii.2012, leg. M. Khosroabadi; 2♀, Fars, Neyriz, 29°12'N, 54°20'E, 29.vii.2012, leg. M. Khosroabadi.

Distribution: Europe, North Africa, Turkey and the Near East (Linsenmaier 1997). **New record for Iran**.

This species was mentioned as a doubtful record for the Iranian fauna by Rosa *et al.* (2013), on the basis of a specimen with a label "Persia", without any precise locality: possibly might have been collected in Turkmenistan or another adjacent country; thus we confirm the occurrence of *Ch. succincta* in Iran.

Remarks: We identify these four females as belonging to *Ch. succincta*. Linsenmaier (1968) described a new species, *Chrysis prosuccincta* Linsenmaier, 1968: 70 from Anatolia. Unfortunately the concise original description refers only to male individuals and we cannot exclude the possibility that the present females may belong to *Ch. prosuccincta*.

***Chrysis turcica* du Buysson, 1908**

Material studied: 1♀, Golestan, Azad Shar-Shahrud road, near Til Abad, 1350 m, 36˚51'51"N, 55˚24'21"E, 19 - 23.v.2010, leg. D. Gianasso.

Distribution: Turkey (Mocsáry 1914). **New record for Iran**.

Remarks: Kimsey & Bohart (1991) considered *Ch. turcica* a synonym of *Ch. peninsularis* du Buysson, 1887. This synonymy is erroneous because *Ch. peninsularis* (a species endemic to Spain) differs in body colour and shape. We follow the Linsenmaier interpretation of *Ch. turcica* (Linsenmaier 1968: 69). In body colour, *Ch. turcica* is close to *Ch. merceti* Trautmann, 1926 (from Spain and Portugal). In fact, Linsenmaier (1959) considered *Ch. merceti* as a synonym of *Ch. turcica*, but modified his position in 1968 (Linsenmaier 1968: 69), when he considered *Ch. merceti* a species distinct from *Ch. turcica*.

***Chrysis unirubra* Strumia sp. nov.**

Material studied: *Holotype* 1♀, Fars (Iran), 7 km West of Dasht-e-Arzhan, 2050 m, 29˚38'N – 51˚54'E, 04 - 06.v.2008, leg. D. Gianasso, in FSC.

Distribution: Iran.

***Chrysis vachali* du Buysson, 1900**

Material studied: 1♀, Fars, 40 km North of Fasa, Mian Jangal, 1750 m, 29˚10'N 53˚54'E, 05.v.2008, leg. D. Gianasso.

Distribution: North Africa (Kimsey & Bohart 1991). **New record for Iran**.

Remarks: The differences between *Ch. vachali* and *Ch. rhodochalcea* du Buysson, 1900 from Arabia and Algeria has been discussed recently by Strumia & Dawah (2008). *Chrysis vachali* belongs to the *incisa* group because of the shape of the male genitalia.

***Chrysis viridissima* Klug, 1845**

Material studied: 1♀, Fars, Neyriz, 29°12'N, 54°20'E, 29.vii.2012, leg. M. Khosroabadi; 2♀, Fars, Larestan, 27°98'N, 54°29'E, 04.viii.2012, leg. A. Falahatpishe.

Distribution: An Afrotropical species known from Libya, Egypt, Mauritania, Sudan, Nigeria, Tanzania, Middle East, Jordan, U.A.E. (Strumia 2008; Madl & Rosa 2012), Saudi Arabia (Strumia & Dawah 2008), Oman, Yemen, Azerbaijan, North India and Iran (Pourrafei *et al.* 2011).

***Chrysis zobeida* du Buysson, 1896**

Material studied: 1♂, Fars, Neyriz, 29°12'N, 54°20'E, 29.vii.2012, leg. M. Khosroabadi.

Distribution: Egypt, Palestine, Saudi Arabia, U.A.E. (Strumia 2014), Turkey (Strumia & Yildirim 2008) and Iran (Linsenmaier 1968: 109).

Chrysura Dahlbom, 1845

***Chrysura cyrenaica* (Gribodo, 1924)**

Material studied: 1♂, 40 km North Fars, Mian Jangal, 1750 m, 29˚10'N, 53˚23'E, 02.v.2009, leg. D. Gianasso.

Distribution: Libya (Kimsey & Bohart 1991). **New record for Iran**.

Remarks: *Chrysura cyrenaica* was considered as a possible subspecies of *Ch. simplex* Dahlbom, 1845. Here we follow the interpretation of Kimsey & Bohart (1991: 488) and consider *Ch. cyrenaica* a valid species of the *Chrysura austriaca* species group.

***Chrysura darii* (Mocsáry, 1914)**

Material studied: 1♂, Iran Fars, 40 km North of Fasa, Mian Jangal, 1750 m, 29˚09'33.7"N, 53˚24'16.7"E, 07.v.2010, leg. D. Gianasso.

Distribution: At present, *Ch. darii* is known only from Iran (Mocsáry 1914).

***Chrysura desertorum* (du Buysson, 1887)**

Material studied: 1♂, Iran, Khorasan, Iran, 40 km North-West of Cheshmeh, 1100 m, 26.iv.2008, leg. D. Gianasso.

Distribution: Turkey, Middle East, South-West of former USSR (Kimsey & Bohart 1991). **New record for Iran**.

***Chrysura erigone* (Mocsáry, 1889)**

Material studied: 2♀, Iran, Fars, 40 km North of Fasa, Mian Jangal, 1750 m, 29˚09'33"N - 3˚24'16.7"E, 07.v.2010, leg. D. Gianasso.

Distribution: Near East species: North Greece, Cyprus, Turkey, Palestine, Libanus, Syria and Caucasus (Rosa *et al.* 2013).

***Chrysura rhodia* (Mocsáry, 1889)**

= *Ch. judith* Balthasar, 1953 = *Ch. orgopia* Linsenmaier, 1968

Material studied: 1♂, Iran, Kerman, 45 km North-East of Sirjan, 2410 m, 25.iv.2006, leg. D. Gianasso.

Distribution: Greece, Turkey and Midle East (Kimsey & Bohart 1991).

Remarks: The above synonymies were established by Kimsey & Bohart (1991: 495).

***Chrysura genalis* (Mocsáry, 1887)**

= *Ch. foveata* Radoszkowski, 1877: 13, pl. 1, Fig. 7 = *Ch. smaragdolus* Semenov, 1967: 148.

Material studied: 1♂, Iran, Fars, 40 km North of Fasa, Mian Jangal, 1750 m, 29˚09'33.7"N - 53˚24'16.7"E, 07.v.2010, leg. D. Gianasso; 1♂, 40 km North of Fasa, Mian Jangal, 1750 m, 29˚ 10' N, 53˚23'E, 05.v.2009, leg. D. Gianasso.

Distribution: Turkmenistan (Kimsey & Bohart 1991). **New record for Iran**.

Remarks: The taxonomic history of this species is complex: in 1877, Radoszkowski (1889, Fig. 35 *a* and *b*) described as *Ch. foveata* a species from Turkestan and published the description of the male genitalia. Mocsáry (1887) noted that the female of *Ch. foveata* Dahlbom, 1845 (a species from Egypt described in Dahlbom, 1845: 171, pl.VIII, N˚ 87) was a different species. Since the name *foveata* was preoccupied, he renamed the Radoszkowski species as *Ch. genalis* Mocsáry 1887: 14, giving a full description in Mocsáry (1889: 197). Later, Semenov (Semenov-Tian-Shanskij 1967) described two additional new species close to *Ch. genalis* from Turkmenistan: namely *Ch. foetiana*, on the basis of a male from near Ashkhabad, and *Ch. smaragdolus* Semenov, 1967 from Imam-Baba.

We have studied the genitalia of our male specimen, finding that it corresponds with that illustrated by Radoszkowski's (1889) Fig. 35 *a* and *b*, and recently by Rosa and Lotfalizadeh (2013). Consequently our specimens are identified as *Ch. genalis* Mocsáry, 1887.

Semenov's descriptions are too short and incomplete to clarify relationships with *Ch. genalis.* Fortunately Kimsey & Bohart (1991) were able to study Semenov's original material. Their conclusions were: *Ch. genalis* Mocsáry, 1887 is a valid species of the *Chrysura radians* group; *Ch. smaragdolus* Semenov, 1967 is a junior synonymy of *Ch. genalis*; *Ch. foetiana* Semenov, 1967 is a valid species from Turkmenistan; and *Ch. foveata* Dahlbom, 1845 is a junior synonym of *Ch. trimaculata* Förster, 1853: 307.

***Chrysura pruna* (Gribodo, 1879)**

Material studied: 1♀, Iran, Kerman, 45 km North-East of Sirjan, 2410 m, 25.iv.2006, leg. D. Gianasso.

Remarks: *Chrysura pruna* was described by material from Algeria. The species is also known from Egypt and Palestine (Linsenmaier 1999: 110) and is easy to identify within the *Ch. cuprea* species group.

Distribution: Algeria, Libya, Palestine and Middle East: a South Palaearctic species (Kimsey & Bohart 1991; Linsenmaier 1999). **New record for Iran**.

***Chrysura pseudodichroa* (Linsenmaier, 1959)**

Material studied: 1♀, Iran, Fars, 40 km North-West of Fasa, Mian Jangal, 1730 m, 29˚09'23"N -53˚24'16"E, 07.v.2010, leg. D. Gianasso.

Distribution: South Europe, North Africa, Turkey, Palestine, the Near East and Iran (Rosa *et al.* 2013).

***Chrysura pseudohybrida* (Linsenmaier, 1999)**

Material studied: 1♀, Fars, Qaderabad, 2500 m, 30˚23'N, 53˚13'E, 11.v.2005, leg. D. Gianasso.

Distribution: Libya, Tunisia (Linsenmaier 1999). **New record for Iran**.

***Chrysura varicornis* (Spinola, 1838)**

Material studied: 1♀, Iran, Khorasan, 40 km North-West of Cheshmeh, 1100 m, 26.iv.2008, leg. D. Gianasso; 1♀, Fars, Iran, Fars Province, 28˚54'N-53˚39'E, 24.05.2013; 1♂, Kherameh, Fars Province, 19.04.2013; 1♂, Kherameh, Fars Province, 09.04.2013.

Distribution: A Palaearctic species: South Europe, North Africa, Middle East and Turkey (Kimsey & Bohart 1991; Linsenmaier 1999). **New record for Iran**.

Pseudospinolia Linsenmaier, 1951

***Pseudospinolia uniformis* (Dahlbom, 1845)**

Material studied: 2♂, Khorasan Razavi, 40 km North-West of Cheshmeh, 1100 m, 26.iv.2008, leg. D. Gianasso.

Distribution: Europe, West Asia (Linsenmaier 1959), Turkey (Strumia & Yildirim 2009).

Stilbum Spinola, 1806

***Stilbumy cyanurum* (Forster, 1771)**

Material studied: 1♀, Fars, Jahrom, 28°31'N, 53°34'E, 15.v.2010, leg. M. Fallahzadeh.

Distribution: Eastern Hemisphere, widespread in tropics and temperate areas, previously cited for Persia without precise localities (Rosa *et al.* 2013).

Trichrysis Lichtenstein, 1876

***Trichrysis cyanea* (Linnaeus, 1758)**

Material studied: 2♀, Alborz, Karaj, Kordan, 35°93'N, 50°83'E, 11.vi.2012, leg. B. Majnon Jahrom; 2♀, Fars, Larestan, 27°98'N, 54°29'E, 4.viii.2012, leg. A. Falahatpishe; 1♀, Fars, Larestan, 15.viii.2012, leg. A. Falahatpishe; 1♀, Fars, Jahrom, 28°19'N, 52°45'E, 21.x.2011, leg. M. Fallahzadeh.

Distribution: Widespread in the Palaearctic, Iran (Rosa *et al.* 2013).

Discussion

In this small collection of 52 species, three new species are described and one genus and 27 species are reported as new records for Iran. Such a large proportion of new record (52%) indicates that the Iranian Chrysididae fauna is still largely unknown and needs more extensive investigation, possibly by using non-attractive traps.

In the material studied, we observed a prevalence of mediterranean and North African species (Fig. 22). In order to investigate the affinities of the Iranian Chrysididae fauna, we have assembled a matrix of species presence-absence of those South Palaearctic countries for which we could find enough data in the literature.

Unfortunately the available data are arranged by political countries and political borders, not by biotopes or biogeographical regions (mountains, irrigated plains, desert, etc.). In particular, the territory North of Iran had to be considered to include Turkmenistan and Uzbekistan (together Western Turkestan) to the North -East and the Caucasus Region to the West. In addition, entomologists of the former USSR (Semenov-Tian-Shanskij 1954, 1967; Semenov-Tian-Shanskij & Nikol'skaya 1954) were more interested in describing new species rather than in reporting on the composition of local populations; in fact, only Radoszkowski (1877) documented a local population. Consequently, any statistical investigation to find the similarities between the Iranian Chrysididae fauna and those of the bordering regions suffers from a possible distortion due to the strong weighting given by species from Central Asia. Nevertheless, we assembled a list of 997 species cited in the literature as present in the South Palaearctic Region. The result is summarized in Table 3.

This list is not to be considered complete (a few doubtful subspecies were skipped, but this influenced the results very little as a consequence of the large numbers involved, Table 3); the sample size is large enough to allow a sound multivariate clustering analysis. For the calculus of distances we used several algorithms: i.e. the Euclidean geometrical distance, the Percent disagreement and the Pearson correlation coefficient. For the clustering aggregation we used the Ward method, because it is purely statistic and less prone to be influenced by the aggregation starting point (Pielou 1984; Legendre & Legendre 2012). Two results are shown in Figure 22.

The clusters are all in agreement and consistent. We observe a first aggregation between the rich fauna of the countries on the North side of the Mediterranean Sea (Greece, Italy, Spain, Turkey, Sicily and Sardo-Corsican complex: an important refugia during last Ice age with recent cladogenesis (Strumia 2014)). Countries in Western North Africa (Morocco, Algeria, Tunisia) show a close similarity, as may be expected. The same affinity is observed for countries of the Arabian Peninsula (Saudi Arabia, Yemen, Oman, U.A.E.). From Egypt to Iran we observe the affinity of the Near East, as conventionally considered. Unfortunately there are few data available for Syria, Jordan and Iraq. The surprising affinity between Libya and Turkmenistan is explained as a possible mathematical artifact due to the insufficient and incomplete knowledge of these fauna (Table 3), as noted above. Iran shows affinity with the Egypt, Palestine an Arabian complex.

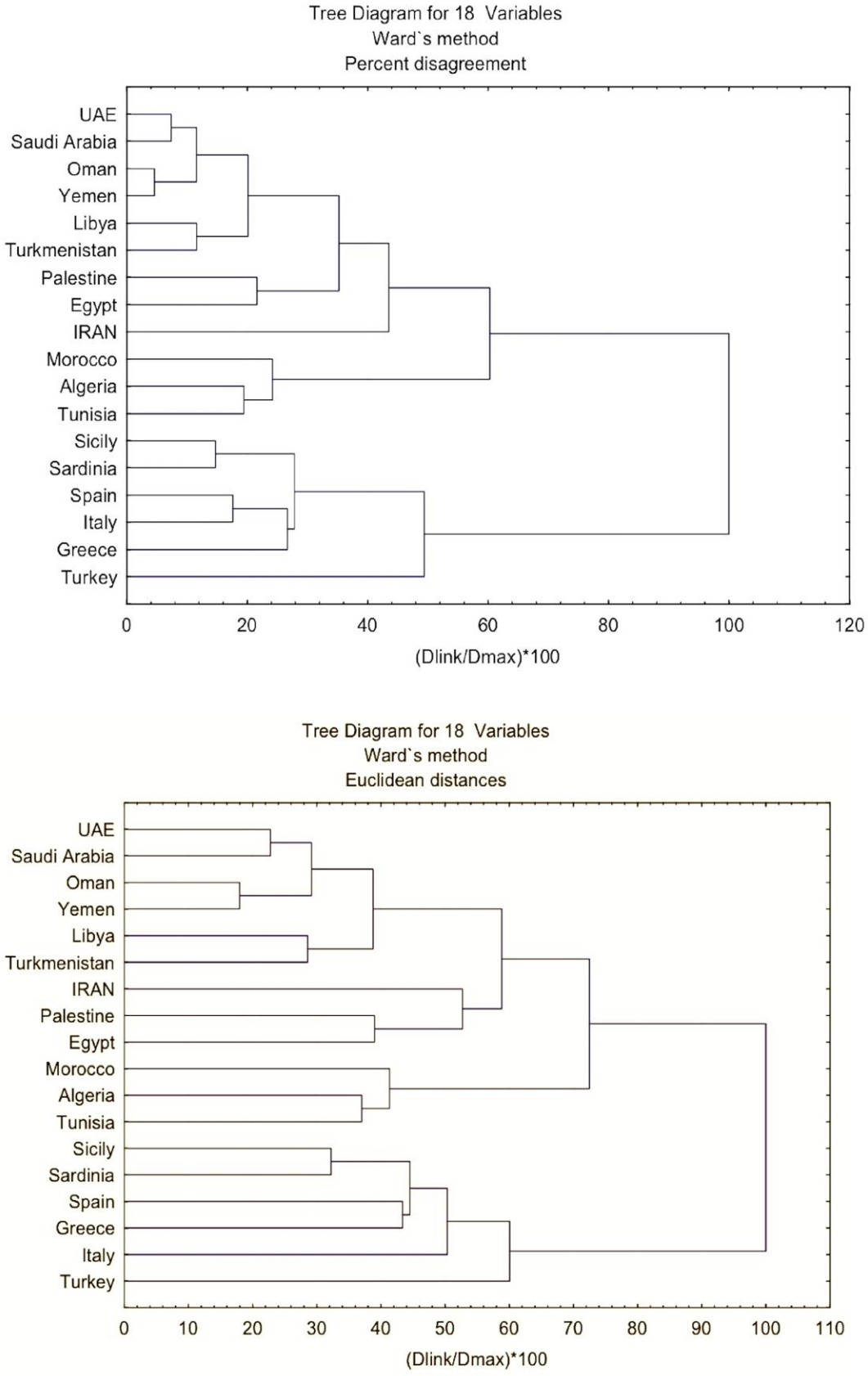


Figure 22. Affinity clusters between the chrysididae populations of 18 South Palaearctic and Mediterranean countries: distances measured with the percent disagreement and euclidean distance respectively.

Table 3. The number of presently known Chrysididae species present in 18 countries in the South Palaearctic Region.

Country	No. species
Turkey	389
Italy	251
Spain	248
Morocco	236
Greece	226
Iran	222
Palestine	184
Algeria	169
Tunisia	150
Egypt	138
Saudi Arabia	110
Sardinia	106
Sicily	101
UAE	79
Libya	53
Turkmenistan	46
Sultanate of Oman	43
Yemen	32

It should be more correct to compare the fauna from similar biotopes, but unfortunately the available data refers only to political countries. Nevertheless, the result shows statistical evidence of the affinity of the Iranian fauna with those of the South Palaearctic and North Africa. The affinity between Egypt and Arabian Peninsula was already illustrated on the basis of study of a rich material (Strumia 2014). It is worth to remind that the Persian Gulf was a dry land during most of Wurm Ice Age, thus facilitating the intermixing of Arabian and Persian fauna.

An interesting result of our investigation is the large number (about 52%) of new records obtained from mountain sites, as illustrated in Table 4. The mountain tops in an arid country were found to be biodiversity hotspots similar to islands. This is more evident for the genus *Chrysura*; in fact, *Chrysura* species are widespread and numerous in South and Central Europe, but much less frequent in the drier biotope of North Africa (Linsenmaier 1999), even when interesting new species are taken into account.

Table 4. List of the 28 Chrysididae species captured at high altitude in Iran. Seventeen species (about 59%) are new record. In column III the elevation above the sea level of the collecting site is given; in column IV, the elevation of a second site; N.R. = new record for Iran.

No	High altitude Chrysididae in Iran	m a.s.l.	m a.s.l.	Status
1	*Chrysura pseudohybrida* (Linsenmaier, 1999)	2500		**N.R.**
2	*Chrysura pruna* (Gribodo, 1879)	2410		**N.R.**
3	*Chrysura rhodia* (Mocsáry, 1889)	2410		
4	*Haba biroi* Mocsáry, 1911	2370		**N.R.**
5	*Chrysis majidi* Strumia **sp. nov.**	2300		**N.R.**
6	*Holopyga cypruscula* Linsenmaier, 1959	2260	1400	
7	*Chrysis gianassoi* Strumia **sp. nov.**	2050		**N.R.**
8	*Chrysis pulchella* Spinola, 1808	2050		

9	*Chrysis unirubra* Strumia **sp. nov.**	2050	1050	**N.R.**
10	*Omalus biaccinctus* (du Buysson, 1892)	2050	1100	
11	*Chrysis sefrensis* du Buysson, 1900	2000		
12	*Chrysidea pumila* (Klug, 1845)	1750		
13	*Chrysis mysta* du Buysson, 1900	1750		**N.R.**
14	*Chrysis vachali* du Buysson, 1900	1750		**N.R.**
15	*Chrysura cyrenaica* (Gribodo, 1924)	1750		**N.R.**
16	*Chrysura darii* (Mocsáry, 1914)	1750		
17	*Chrysura erigone* (Mocsáry, 1889)	1750		
18	*Chrysura genalis* (Mocsáry, 1887)	1750		**N.R.**
19	*Chrysura pseudodichroa* (Linsenmaier, 1959)	1730		
20	*Pseudomalus violaceus* (Scopoli, 1763)	1700		**N.R.**
21	*Chrysis coa* Invrea, 1939	1500		**N.R.**
22	*Chrysis subincisa* Linsenmaier, 1959	1450		
23	*Chrysis turcica* du Buysson, 1908	1350		**N.R.**
24	*Chrysis consanguinea* Mocsáry, 1889	1100		**N.R.**
25	*Chrysis daphnis* Mocsáry, 1889	1100	2050	
26	*Chrysis schousboei* Dahlbom, 1854	1100		**N.R.**
27	*Chrysura desertorum* (du Buysson, 1887)	1100	1400	**N.R.**
28	*Chrysura varicornis* (Spinola, 1838)	1100		**N.R.**
29	*Pseudospinolia uniformis* (Dahlbom, 1854)	1100		

In conclusion we wish to stress two points:

1 – The Chrysidid fauna of Iran is rich, and it is expected that further study will result in several more new records and new species.

2 – The mountains of the arid South Palaearctic Region and Arabia are biodiversity hotspots for Hymenoptera Chrysididae, and are especially rich in species of the genus *Chrysura*.

Acknowledgements

The authors are grateful to Mr. Domenico Gianasso (Castelnuovo don Bosco, Asti, Italy) for the donation of Chrysididae specimens collected recently in Iran using pan traps. We are glad to express our gratitude to Dr. Hassan Dawah (Jazan University, Saudi Arabia), to Dr. Anitha Saji (Environment Agency Abu Dhabi, U.A.E.) for the loan of their material. We are most grateful to Dr. Antonius van Harten for making available the rich Chrysidid material captured in the frame of the Project of the survey of the Arthopod fauna of the United Arab Emirates. We are most grateful to Dr. P. Rosa for a color photograph of *Chrysis mandibularis* holotype and to Zoltan Vas (Hungarian Natural History Museum) for the loan of *Haba biroi* holotype and *Pseudomalus turkestanicus* material. The authors also thank Dr. Gillian W. Watson (California Department of Food and Agriculture, Sacramento, California, USA) for helpful critique of the text. This research was supported by the Physics Department, Pisa University, Italy and the Department of Entomology, Jahrom Branch, Islamic Azad University, Jahrom, Iran.

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Received: 30.04.2015 *Accepted*: 03.09.2015 *Published*: 05.10.2015
Cite paper: Strumia F. & Fallahzadeh M. 2015. New records and three new species of Chrysididae (Hymenoptera, Chrysidoidea) from Iran. *Journal of Insect Biodiversity* 3(15): 1–32.
http://dx.doi.org/10.12976/jib/2015.3.15 http://www.insectbiodiversity.org