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Fauna and species richness of chrysidid wasps (Hymenoptera: Chrysididae) in Mountains of Kerman province, south-east Iran

Saeid Iranmanesh*[1], Franco Strumia[2], Seyed Massoud Madjdzadeh[3], Mohammad Purrezaali[1] and Mohammad Reza Lashkari[1]

1 *Department of Biodiversity, Institute of Science and High Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran.*
2 *Physics Department, Pisa University, L. Pontecorvo, 3 – 56127 Pisa, Italy.*
3 *Department of Biology, Faculty of Sciences, Shahid Bahonar University of Kerman, Kerman, Iran.*

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ABSTRACT. We present a list of 25 Chrysididae species mainly captured at high altitudes on mountains of the Kerman province, Iran. The numerous records evidences the rich biodiversity present at high altitudes in Iranian mountains up to an elevation of about 3000 m. The largest richness was observed in the 2100–2300m range. *Elampus kashmirensis* Nurse, 1902, *Holopyga chrysonota appliata* Linsenmaier, 1959, *Chrysis quadrispina* Buysson, 1887 and *Chrysis sacrata* Buysson, 1898 are new records for Iranian fauna.

Key words: Chrysididae, fauna, richness, new record, distribution, Iran

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Introduction

The family Chrysididae is considered as one of the largest families of aculeate Hymenoptera commonly referred to as cuckoo wasps. Around 2509 species in 89 genera are known worldwide (Aguiar et al., 2013; Rosa et al., 2016; Soliman et al., 2013). Many species are characterized by colors with metallic glares, green, blue, copper, gold, or a combination of these colors (Kimsey & Bohart, 1991). Chrysidid wasps are parasitoids or cleptoparasites of other groups of insects especially solitary wasps (Kimsey & Bohart, 1991). Chrysidid fauna of Iran still is not investigated in details and no data is available for some parts of the country especially southeast Iran. Rosa et al. (2013) provided the first checklist of this family mainly based on some published works. Some scattered studies have been carried out recently in some parts of the country (Pourrafei et al., 2011; Rosa & Lotfalizadeh, 2013; Farhad et al., 2015, 2016, 2017; Strumia & Fallahzadeh, 2015; Strumia et al., 2016; Farzaneh et al., 2017). The Kerman province is one of the largest provinces of Iran. The Zagros Mountain range in southern Iran leads to a steppe and semi-arid climate in the interior. High altitude

Corresponding author: Saeid Iranmanesh, E-mail: *saeid_iranmanesh@yahoo.com*

Mountains provide interesting isolated biotopes, possibly hosting an interesting fauna. In the present study we discuss the results observed for Hymenoptera Chrysididae, sampled in sites ranging from an elevation of about 1700m up to above 2900m. Some interesting new records are reported for Iranian fauna.

Material and methods

The specimens were captured using standard Malaise traps from different places in Kerman province, or swept on herbaceous plants, mainly *Medicago sativa* or *Mentha pulegium* (Fig. 1). In this case the standard insect net was employed in the altitudes range between 1711 and 2969 m a.s.l. The insects were captured using an aspirator and dropped directly into 75% ethanol for subsequent studies. Digital images were taken using the special equipment of the Pisa University Entomology laboratory (stereomicroscope Leica Z16 Apo, automate stack shot image capture, software Zerene Stacker), and processed with Adobe Photoshop software. We used the following usual abbreviation: T3, third metasomal tergum. The specimens are deposited in insect collection of Zoological Museum of Shahid Bahonar University of Kerman, Iran (ZMSBUK) and the Franco Strumia Collection, Pisa, Italy (FSC).

Results

List of the captured species:

1. *Chrysellampus tatianae* Semenov, 1967

Material studied: 52♀♀: Kuhbanan-Fidkoiyeh, 22.08.2015, 2114m, 31°27′24.9″N, 56°11′16.8″E, swept on *Medicago sativa,* leg. S. Safahani, 7♀♀ (ZMSBUK); Sirch, 22.06.2014, 1711m, 30°11′95.6″N, 57°33′70.8″E, Swept on *Mentha pulegium*, leg. M. Iranmanesh, 4♀♀ (FSC); Bardsir-Ghanatsir, 14.05.2015, 2121m, 29°44′39.33″N, 56°45′25.3″E, swept on swept on *Medicago sativa,* leg. S. Safahani, 1♀ (ZMSBUK) 4♀♀ (FSC); Qal-eh-Askar, 14.05.2015, 1911m, 29°44′39.2″N 56°45′25.3″E, swept on swept on *Medicago sativa,* leg. S. Safahani, 6♀♀ (FSC); Baft Dam, 25.04.2015, 2301 m, 29°14′32.4″N, 56°37′42.8″E, Malaise trap, leg. S. Safahani, 2♀♀ (ZMSBUK); Bidkhan, 02.07.2014, 2943m, 29°35′39.4″N, 56° 30′ 39.6″E, swept on swept on *Medicago sativa,* leg. F. Abdolalizadeh, 1♀ (ZMSBUK), 1♀ (FSC); Kuhpayeh-Deh Shib, 1834m, 10.08.2015, 30°29′40.5″N, 57°19′28.2″E, swept on swept on *Mentha pulegium–Glycyrrhiza glabra,* leg. S. Safahani, 1♀ (ZMSBUK); Kuhpayeh-Vamegh Abad, 11.08.2015, 2057m, 30°30′47.9″N, 57°16′21.2″E, swept on swept on *Medicago sativa,* leg. S. Safahani, 2♀♀ (FSC); Bidkhan, 18.06.2014, 2770m, 29°36′13″N, 56°30′38.0″E, swept on swept on *Mentha pulegium*, *Glycyrrhiza glabra* leg. F. Abdolalizadeh, 1♀ (FSC); Kuhbanan-Darbhood, 2409m, 21.08.2015, 31°29′23.1″N, 56°14′17.6″E, swept on swept on *Medicago sativa,* leg. S. Safahani, 2♀♀ (ZMSBUK) 3♀♀ (FSC); Lalehzar, 2969m, 01.09.2015, 29°29′42.2″N, 56°49′22.6″E, swept on *Medicago sativa,* leg. S. Safahani, 1♀ (ZMSBUK), 4♀♀ (FSC); Kuhbanan-Zarand Rd., 2412m, 22.08.2015, 31°08′55.7″N, 56°31′13.8″E, swept on *Medicago sativa,* leg. S. Safahani 4♀♀ (ZMSBUK); Bidkhan, 02.07.2014, 2861m, 29°35′27.9″N, 56º30′44.2″E, swept on *Mentha pulegium*, *Glycyrrhiza glabra,* leg. F. Abdolalizadeh, 1♀ (ZMSBUK); Baft-Rabor, 2461m, 25.08.2015, 29°20′4.3″N, 56°55′4.5″E, swept on *Medicago sativa,* leg. S. Safahani, 6♀♀ (FSC).

Distribution: Iran (East-Azarbaijan) (Rosa et al., 2013) South USSR (Kimsey & Bohart, 1991).

The Fig. 2 and the following key can help for the identification of the West-Palaearctic *Chrysellampus* species.

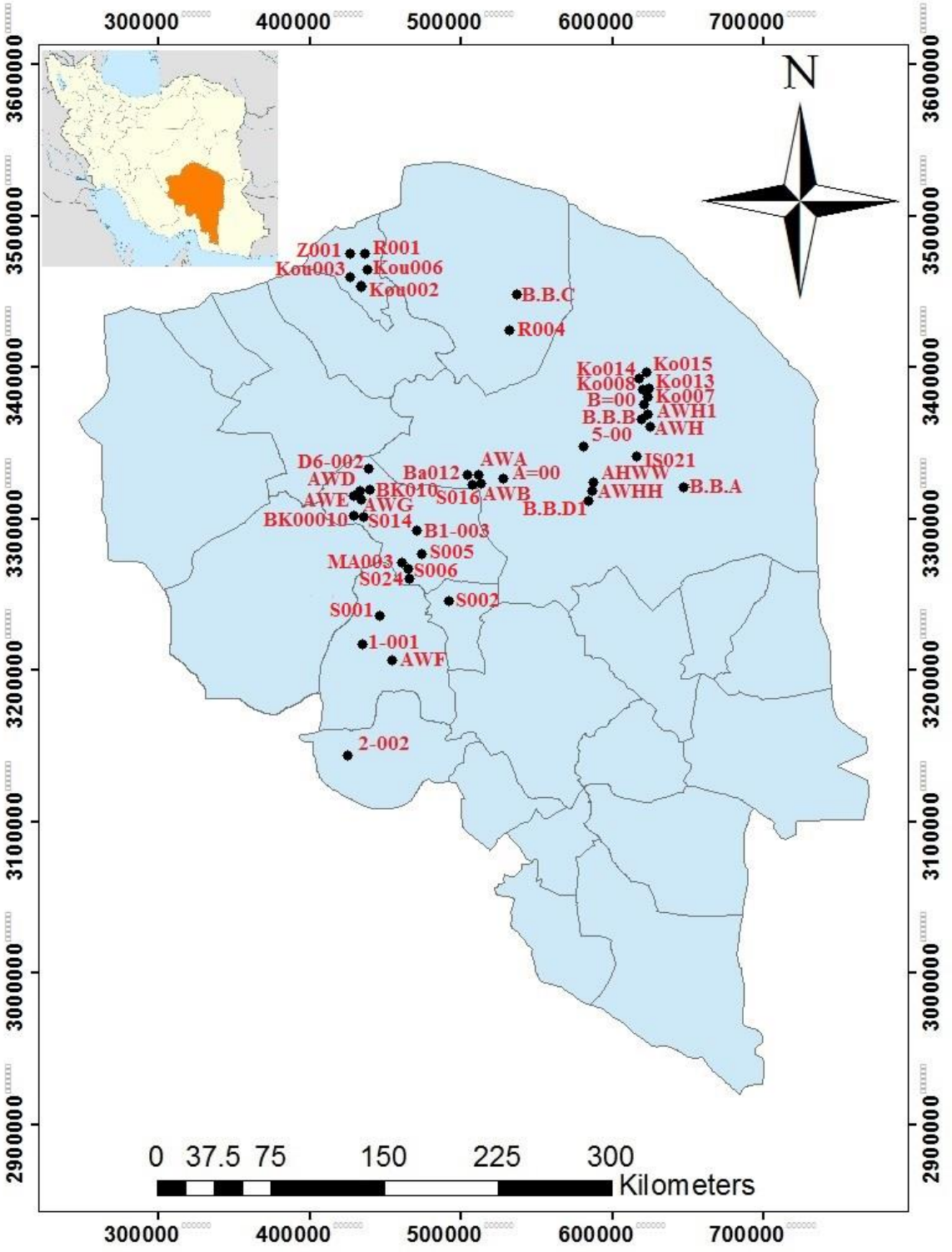

Figure 1. Map of the sampling localities in Kerman province, south-east Iran.

Figure 2. Female of *Crysellampus tatianae* Semenov, 1967 from Kerman province,: Qal-eh-Askar, 1911m, 14.05.2015, 29°44´39.2˝N56°45.25´3˝E, swept on *Medicago sativa,* leg. S. Safahani. From left: dorsal view, lateral view and magnification of mesonotum dorsum.

Key for West-Palaearctic *Chrysellampus* species

1. Body color all green or blue or with some black spot. ……..…***Chrysellampus pici*** Buysson, 1900 [= *Chrysellampus nigromaculatus* Linsenmaier, 1997 and few East Asia species of the Oriental Region (Rosa, 2015)]

- Body clearly bicolor with red metasoma and blue-green mesosoma. ……....**2**

2. Mesonotum punctures clumped along notaulus, colliculate sculpture strong and visible, head and mesosoma color more blue. .....……...**3**

- Mesonotum with large punctures not clumped along notaulus, colliculate sculpture fine and visible at higher magnification, T3 distal notch v shaped with an angle of nearly 90 degrees. ….. ...***Chrysellampus tatianae*** Semenov 1967

3. Distal notch of T3 v shaped with an acute angle less than 90 degrees. ……. ……***Chrysellampus sculpticollis*** Abeille de Perrin, 1878

- Distal notch of T3 elliptical without an acute angle. …..***Chrysellampus medanae*** Buysson, 1890

2. ***Elampus kashmirensis*** **Nurse, 1902**

(Fig. 3: E, F)

Material studied: 14♂♂ 4♀♀: Kuhpayeh-Darb Anarestan, 2256m, 10.08.2015, 30°29´23.1˝N57°11´47.6˝E, swept on *Medicago sativa*, leg. S. Safahani, 2♂♂ (ZMSBUK) 2♂♂, 1♀ (FSC); Kuhbanan-Fidkoiyeh, 2114m, 22.08.2015, 31°27´24.9˝N, 56°11´16.8˝E, swept on *Medicago sativa,* leg. S. Safahani, 3♂♂, 1♀ (ZMSBUK) 1♀ (FSC); Kuhpaye-Darb Anarestan, 2256m, 10.08.2015, 30°29´23.1˝N, 57°11´47.6˝E, sweeping *Medicago sativa,* leg. S.

Safahani, 1♂ (ZMSBUK); 2♂♂, 1♀; Bardsir-Ghanatsir, 2121m, 14.05.2015, 29°44′39.33″N, 56°45′25.3″E, swept on *Medicago sativa,* leg. S. Safahani, 1♂1♀ (ZMSBUK) 1♀ (FSC); Bardsir-Dashtkar, 2084m, 30.08.2013, 33°07′36.0″N, 04°88′8.6″E, swept on *Mentha pulegium,* leg. Sh. Ghotbi, 1♂ (FSC); Kuhpayeh-Biduiyeh, 2550m, 12.07.2015, 30°30′42.8″N, 57°11′07.6″E, swept on *Mentha pulegium,* leg. S. Safahani, 1♂ (FSC); Bardsir-Negar, 2120m, 01.06.2016, 29°52′03.3″N, 56°47.14′2″E, swept on *Medicago sativa,* leg., M. Purrezaali, 1♀ (ZMSBUK); 1♂, Negar-Goomane, 28.08.2014, 29°51′58.3″N, 56°48′41.2″E, swept on *Medicago sativa,* leg. S. Safahani, 1♂ (FSC).

Distribution: Pakistan, Kashmir (Bingham, 1903). New record for Iran.

3. *Omalus margianus* (Semenov, 1932)

Material studied: Bardsir, 16.05.2013, 1968m, 33°16′80.3″ N, 049°85′8.4″ E, swept on *Medicago sativa,* leg. Sh. Ghotbi, 1♀ (ZMSBUK) 1♀ (FSC); 1♂; Urzuiyeh-Vakilabad, 1014m, 27.04.2016, 28°26′88.9″N, 56°20.67′6″E, swept on *Triticum monococcum,* leg., M. Purrezaali, 1♂ (FSC).

Distribution: Iran (Sistan and Baluchestan), Turkmenistan, Uzbekistan (Rosa et al., 2013).

4. *Hedychridium incrassatum* Dahlbom, 1854

Material studied: Kuhbanan-Darbhood, 2409m, 21.08.2015, 31°29′23.1″N, 56°14′17.6″E, swept on *Medicago sativa,* leg. S. Safahani, 1♀ (ZMSBUK).

Distribution: Iran (Strumia et al., 2016), SW Europe, North Africa, Greece, Turkey, Italy (Sicily), Morocco Cyprus (Kimsey & Bohart, 1991).

5. *Hedychridium maculisternum* Arens, 2011

Replacement name for *Hedychridium maculiventre* Linsenmaier, 1959.

Material studied: Kuhpaye-Darb Anarestan, 2256m, 10.08.2015, 30°29′23.1″N, 57°11′47.6″E, swept on *Medicago sativa,* leg. S. Safahani, 1♀ (ZMSBUK).

Distribution: Iran**:** Fars province (Strumia & Fallahzadeh, 2015), Turkey, Asia Minor, Syria, Palestine (Arens, 2010).

6. *Hedychridium monochroum farsensis* Strumia & Fallahzadeh, 2016

Material studied: Ravar-Hojedk, 2109m, 08.07.2016, 30°44′23.62″N, 57°02′13″E, swept on *Medicago sativa,* leg., M. Purrezaali, 1♀ (ZMSBUK) 1♀ (FSC); Kerman-Mahan, 1874m, 21.06. 2016, 30°50′55.8″N, 57°16′83.3″E, Malaise trap, leg., M. Purrezaali, 1♀ (ZMSBUK).

Distribution: Iran (Strumia & Fallahzadeh, 2016).

7. *Pseudomalus turkestanicus* Mocsáry, 1889

Material studied: 17♂♂ 38♀♀, Kerman-Negar, 2133m, 01.06.2016, 29°51′85.7″N, 56°48′66.8″E, swept on *Triticum monococcum,* leg., M. Purrezaali, 2♀♀ (ZMSBUK) 2♀♀, 1♂ (FSC); Kuhbanan-Zarand Rd., 2412m, 22.08.2016, 31°08′55.7″N, 56°31′13.8″E, swept on *Medicago sativa,* leg. S. Safahani, 2♀ (ZMSBUK) 1♂ 1♀ (FSC); Kuhbanan-Afzad, 2092m, 21.08.2015, 31°26′36.9″N, 56°15′12.6″E, swept on *Medicago sativa,* leg. S. Safahani, 4♀♀ (ZMSBUK) 1♀ (FSC); Negar-Goomane, 2106m, 28.08.2014, 29°51′58.3″N, 56°48′41.2E″, swept on *Medicago sativa* leg. S. Safahani, 1♀, 1♂ (ZMSBUK); Kuhpayeh-Biduiyeh, 2550m, 12.07.2015, 30°30′42.8″N, 57°11′07.6″E, swept on *Mentha pulegium,* leg. S. Safahani, 1♂ (FSC); Kuhpayeh, 1998m, 16.06.2016, 30°29′58.6″N, 57°16.23′3″E, swept on *Medicago sativa,* leg., M. Purrezaali, 1♀ 1♂ (FSC); Bardsir-Ghanatsir, 2121m, 14.05.2015, 29°44′39.33″N, 56°45′25.3″E, swept on *Medicago sativa*, leg. S. Safahani, 2♂♂ 1♀ (FSC); Kerman-Bahramjerd, 2092m, 17.05.2013, 33°05′63.8″N, 049°63′2.0″E, swept on *Medicago sativa*, leg. Sh. Ghotbi, 3♀♀, 1♂ (ZMSBUK); Lalehzar, 2969m, 01.09.2015, 29°29′42.2″N, 56°49′22.6″E, swept on *Medicago sativa* leg. S. Safahani, 4♀♀, 1♂ (FSC);

Bidkhan, 2861m, 02.07.2014, 29°35´27.9˝N, 56°30´44.2˝E, swept on *Medicago sativa*, F. Abdolalizadeh, 3♀♀ 1♂ (FSC); Kerman-Negar, 2133m, 01.06. 2016, 29°51´85.7˝N, 56°48´66.8˝E, 29°51´85.7˝N, 56°48´66.8˝E, swept on *Triticum monococcum*, leg., M. Purrezaali, 1♀ (ZMSBUK) 1♂ (FSC); Kerman-Mahan, 1874m, 21.06,2016, 30°50´55.8˝N, 57°16´83.3˝E, Malaise trap, leg., M. Purrezaali, 2♀♀ (FSC); Kerman-Sohrang, 1831m, 03.07, 2015, 30°48´48.5˝N, 57°02´07.3˝E, swept on *Medicago sativa*, leg. S. Safahani, 1♀ 1♂ (ZMSBUK) 1♀ (FSC); Kuhpayeh-Vamegh Abad, 2057m, 11.08.2015, 30°30´47.9˝N, 57°16´21.2˝E, swept on *Medicago sativa*, leg. S. Safahani, 2♀♀ (ZMSBUK); Kerman-Kahnuj-e-Modim, 1723m, 13.05.2016, 30°28´23.57˝N, 56°54.43´75˝E, Malaise trap, leg., M. Purrezaali, 3♀♀ (ZMSBUK); Baft-Rabor, 2461m, 15.08.2015, 29°20´4.3˝N, 56°55´4.5˝E, swept on *Medicago sativa*, leg. S. Safahani, 2♀♀ (ZMSBUK); Baft-Anjerk, 2148m, 21.05.2016, 29°09´34.9˝N, 56°47´00.2˝E, swept on herbaceous plants, leg., M. Purrezaali, 1♀ (ZMSBUK); Kuhbanan-Fidkoiyeh, 2144m, 22.08.2015, 31°27´24.9˝N, 56°11´16.8˝E, swept on *Medicago sativa*, leg. S. Safahani, 1♂ (ZMSBUK); Kuhbanan- Ravar Rd., 2057m, 03.07.2015, 31°21´6.8˝N, 56°30´1.4˝E, swept on *Medicago sativa*, leg. S. Safahani, 1♀ (FSC); Bardsir-Dashtkar, 2084m, 30.08.2013, 33°07´36.0˝N, 046°88´8.6˝E, swept on *Medicago sativa*, leg. Sh. Ghotbi, 1♀ (FSC); Ravar-Hojedk, 2109m, 08.07.2016, 30°44´23.6˝N,57°02´13 ˝ E, Malaise trap, leg., M.Purrezaali, 1♂ (FSC); Bidkhan, 2460m, 01.06.2016, 29°41´34.7˝N, 56°31´75.7˝E, swept on *Medicago sativa*, leg., M. Purrezaali, 1♀ (FSC); Bardsir-Dashtkar, 2208m, 27.04.2016, 28°56´060.8˝N, 56°27.84´3˝E, swept on herbaceous plants, 1♀ (FSC); Kerman-Kuhpayeh, Vamegh Abad, 2187m, 04.07.2016, 30°31´08.5˝N, 57°15´08.5˝E, Malaise trap, M.Purrezaali, 1♂ (ZMSBUK); Bidkhan, 2460m, 01.06.2016, 29°41´34.7˝N, 56°31´75.7˝E, swept on *Medicago sativa*, leg., M. Purrezaali, 1♀ (FSC); Kerman-Tikdar, 1928m, 19.05.2016, 30°40´28.45˝N, 56°52´50.22˝E, swept on *Medicago sativa*, leg., M. Purrezaali, 1♀ (FSC).

Distribution: *Pseudomalus turkestanicus* is a frequent and wide spread species, ranging from Turkey to central Iran (Strumia & Yildirim, 2011; Strumia & Fallahzadeh, 2015).

Remark: *Pseudomalus turkestanicus* holotype is badly damaged (Rosa et al., 2015), making comparison uncertain. Fortunately the original descriptions of Buysson and Mocsáry are accurate enough to confirm the identification.

8. *Holopyga chrysonota appliata* Linsenmaier, 1959

(Fig. 3: G)

Material studied: Baft-Anjerk, 2148m, 21.05.2016, 29°09´34.9˝N, 56°47´00.2˝E, swept on herbaceous plants, leg., M. Purrezaali, 1♂ (FSC).

Distribution: Greece, Turkey, Palestine, Caucasus (Linsenmaier, 1959), new record for Iran.

9. *Holopyga cypruscula detrita* Linsenmaier, 1959

Material studied: Kerman-Bahramjerd, 2110m, 29°53´20.8˝N, 56°57.8´9˝E, swept on *Triticum monococcum*, leg., M. Purrezaali, 1♀ (FSC); Ravar-Hojedk, 2109m, 08.07.2016, 30°44´23.6˝N, 57°02´13˝E, Malaise trap, leg., M. Purrezaali, 1♀ (ZMSBUK) 1♂ (FSC); Qal-eh-Askar, 1911m, 14.05.2015, 29°44´39.2˝N, 56°45.25´3˝E, swept on *Medicago sativa*, leg. S. Safahani, 1♂ (FSC).

Distribution: Iran, Turkey (Kimsey & Bohart, 1991).

10. *Holopyga fervid* (Fabricius, 1781)

Material studied: Kerman-Rayen, 2123m, 16.06.2016, 29°37´75.85˝N, 57°27.30´164˝E, swept on *Medicago sativa*, leg., M. Purrezaali, 1♀ (ZMSBUK); Bidkhan, 2615m, 01.06.2016, 29°38´74.9˝N, 56°30´77.8˝E, swept on herbaceous plants, leg., M. Purrezaali, 1♂ (FSC).

Distribution: Europe, North Africa, Turkey (Linsenmaier, 1959, 1999; Kimsey & Bohart, 1991) Iran (Bischoff, 1910; Rosa et al., 2013).

11. *Holopyga fastuosa proviridis* Linsenmaier, 1959

Material studied: Kerman-Kahnuj-e-Modim, 1723m, 13.05.2016, 30°28´23.57˝N, 56°54.43´75˝E, Malaise trap, leg., M. Purrezaali, 1♂ (FSC) 1♂ (ZMSBUK); Kerman-Bahramjerd, 2110m, 12.05.2016, 29°53´20.8˝N, 56°57.83´9˝E, swept on *Triticum monococcum*, leg., M. Purrezaali, 1♂ (FSC).

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

12. *Chrysidea pumila* (Klug, 1845)

Material studied: Kerman-Mahan, 1874m, 21.06.2016, 30°50´55.8˝N, 57°16´83.3˝E, Malaise trap, leg., M. Purrezaali, 1♀ (ZMSBUK); Ravar-Hojedk, 2109m, 08.07.2016, 30°44´23.6˝N, 57°02´13˝E, Malaise trap, leg., M. Purrezaali, 1♀ (FSC); Qal-eh-Askar, 2567m, 26.06.2016, 29°32´55.5˝N, 56°36´8.9˝E, swept on *Medicago sativa*, leg., M. Purrezaali, 1♀ (ZMSBUK).

Distribution: Iran, widespread in Palaearctic Region (Kimsey & Bohart, 1991).

13. *Chrysis albanica alia* Linsenmaier, 1959

Material studied: Baft-Anjerk, 2148m, 21.05.2016, 29°09´34.9˝N, 56°47´00.2˝E, swept on herbaceous plants, leg., M. Purrezaali, 1♀ (FSC).

Distribution: Iran (Rosa et al., 2013), Turkey (Linsenmaier, 1959).

14. *Chrysis frivaldszkyi sparsepunctata* Buysson, 1895

Material studied: Kerman-Mahan, 1874m, 21.06.2016, 30°50´55.8˝N, 57°16´83.3˝E, Malaise trap, leg., M. Purrezaali, 1♀ (FSC).

Distribution: Iran, Turkmenistan, Palestine, Syria, Turkey (Rosa et al., 2013).

15. *Chrysis inaequalis* Dahlbom, 1845

Material studied: Kuhbanan-Fidkoiyeh, 2144m. 22.08.2015, 31°27´24.9˝N, 56°11´16.8˝E, swept on *Medicago sativa*, leg. S. Safahani, 1♀ (FSC); Kerman, Bidkhan, 2770m, 18.06.2014, 29°36´13˝N, 56°30´38˝E, swept on *Mentha pulegium*, leg. F. Abdolalizadeh, 1♀ (ZMSBUK).

Distribution: Iran (Farzaneh et al., 2017), Palaearctic, Europe, Middle East, North Africa (Linsenmaier, 1959).

16. *Chrysis komarowi* Radoszkowski, 1891

Material studied: Kerman-Mahan, 1874m, 21.06.2916, 30°50´55.8˝N, 57°16´83.3˝E, Malaise trap, leg., M. Purrezaali, 1♀ (FSC); Ravar-Hojedk, 2109m, 08.07.2016, 30°44´23.6˝N,57°02´13˝E, Malaise trap, leg., M. Purrezaali, 1♀ (ZMSBUK).

Distribution: Iran, Pakistan, Turkmenistan (Kimsey & Bohart, 1991).

17. *Chrysis maculicornis* Klug, 1845

Material studied: Kerman-Mahan, 1874m, 21.06. 2016, 30°50´55.8˝N, 57°16´83.3˝E, Malaise trap, leg., M. Purrezaali, 1♂ (FSC) 1♂ (ZMSBUK).

Distribution: Iran (Rosa et al., 2013), Palestine, Saudi Arabia, North Africa (Linsenmaier, 1959, 1994), Middle East, southern USSR (Kimsey & Bohart 1991), Turkey (Strumia & Yildirim, 2009).

18. *Chrysis majidi* Strumia & Fallahzadeh, 2015

Material studied: Kerman-Kuhpayeh, 2187m, 04.07.2016, 30°31´08.5˝N, 57°15´08.5˝E, Malaise trap, leg., M. Purrezaali, 1♂ (FSC) 1♂ (ZMSBUK).

Distribution: Iran, Saudi Arabia, UAE, Dubai (Strumia & Fallahzadeh, 2015).

19. *Chrysis marginata* Mocsáry, 1889

Material studied: Kerman-Mahan, 1874m, 21.06.2016, 30°50´55.8˝N, 57°16´83.3˝E, Malaise trap, leg., M. Purrezaali, 1♀ (FSC) 1♀ (ZMSBUK).

Distribution: Iran (Rosa et al., 2013), South Europe, Turkey, Palestine Linsenmaier, 1959), Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan (Rosa et al., 2013).

20. *Chrysis quadrispina* Buysson, 1887

(Fig. 3: C, D)

Material studied: Kerman-Bidkhan, 2510m, 09.06.2016, 29°39′87.3″N, 56°30′09.3″E, Malaise trap, leg., M. Purrezaali, 1♀ (FSC) 1♀ (ZMSBUK).

Distribution: Arabia, Egypt, Palestine (Linsenmaier, 1999), Yemen (Aden) (Mocsáry, 1912), new record for Iran.

The taxonomic status of *Chrysis quadrispina* Buysson, 1887 has been recently discussed by Rosa et al. (2017).

21. *Chrysis sacrata* Buysson, 1898

(Fig. 3: A, B) [=*svetlana* Semenov, 1954]

Material studied: Ravar-Hojedk, 08.07.2016, 2109m, 30°44′23.6″N, 57°02′13″E, swept on *Medicago sativa*, leg., M. Purrezaali, 1♀ (ZMSBUK); Kerman-Kuhpayeh, 2187m, 30°31′08.5″N, 57°15′08.5″E, Malaise trap, leg., M. Purrezaali, 1♀ (FSC); Qal-eh-Askar, 1911m, 14.05.2015, 29°44′39.2″N, 56°45.25′3″E, swept on *Medicago sativa*, leg. S. Safahani, 1♂ (FSC).

Distribution: Palaearctic, North Africa, Palestine (Kimsey & Bohart, 1991), new record for Iran. The distribution and synonymies of *Chrysis sacrata* has been recently discussed by Rosa et al. (2017).

22. *Chrysis soror gracilia* Linsenmaier, 1959

Material studied: Kerman-Mahan, 1874m, 21.06.2016, 30°50′55.8″N, 57°16′83.3″E, Malaise trap, leg., M. Purrezaali, 7♂ 2♀ (ZMSBUK) 3♂, 1♀ (FSC); Ravar-Hojedk, 2109m, 08.07.2016, 30°44′23.6″N, 57°02′13″E, Malaise trap, leg., M. Purrezaali, 2♂ 1♀(ZMSBUK) 2♂ 1♀(FSC); Kerman-Kuhpayeh, 04.07.2016, 2187m, 30°31′08.5″N, 57°15′08.5″E, Malaise trap, leg., M. Purrezaali, 2♂ (ZMSBUK) 1♂ (FSC).

Distribution: Iran, Palestine (Linsenmaier, 1959), Turkey (Strumia & Yildirim, 2007).

23. *Chrysis zobeida* Buysson, 1896

Material studied: Kerman-Mahan, 1874m, 21.06.2016, 30°50′55.8″N, 57°16′83.3″E, Malaise trap, leg., M. Purrezaali, 1♀ (ZMSBUK) 1♀ (FSC); Kerman-Kuhpayeh, 04.07.2016, 2187m, 30°31′08.5″N, 57°15′08.5″E, Malaise trap, leg., M. Purrezaali, 2♀ (ZMSBUK); Ravar-Hojedk, 2109m, 08.07.2016, 30°44′23.6″N, 57°02′13″E, Malaise trap, leg., M. Purrezaali, 1♀ (FSC).

Distribution: Iran, Palestine, Saudi Arabia (Linsenmaier, 1999), Turkey (Strumia & Yildirim 2007).

24. *Spintharina vagans* Radoszkowski, 1887

Material studied: Ravar-Hojedk, 2109m, 08.07.2016, 30°44′23.62″N, 57°02′13 ″E, Malaise trap, leg., M. Purrezaali, 1♀ (ZMSBUK) 1♀ (FSC).

Distribution: Iran, South-eastern Europe, Cyprus, Palestine, Turkey, Rhodes (Linsenmaier, 1959).

25. *Stilbun cyanurum* (Förster, 1771)

Material studied: Kuhpayeh-Vamegh Abad, 2057m, 11.08.2015, 30°30′47.9″N, 57°16′21.2″E, swept on *Medicago sativa*, leg. S. Safahani, 1♀ (ZMSBUK).

Distribution: Iran, Palaearctic Region, wide spread (Linsenmaier, 1959).

Discussion

Recently the rich Chrysididae biodiversity of the high altitude Iranian biotopes was evidenced and new species were discovered (Strumia & Fallahzadeh, 2015). Four new species were described, namely: *Haba persica* (captured between 2050 and 2370 m. a. s. l.), *Chrysis majidi* (captured at 2300 m. a. s. l.), *Chrysis unirubra* (captured at 2050 m. a. s. l.), *Chrysis gianassoi* (captured at 2050 m. a. s. l.).

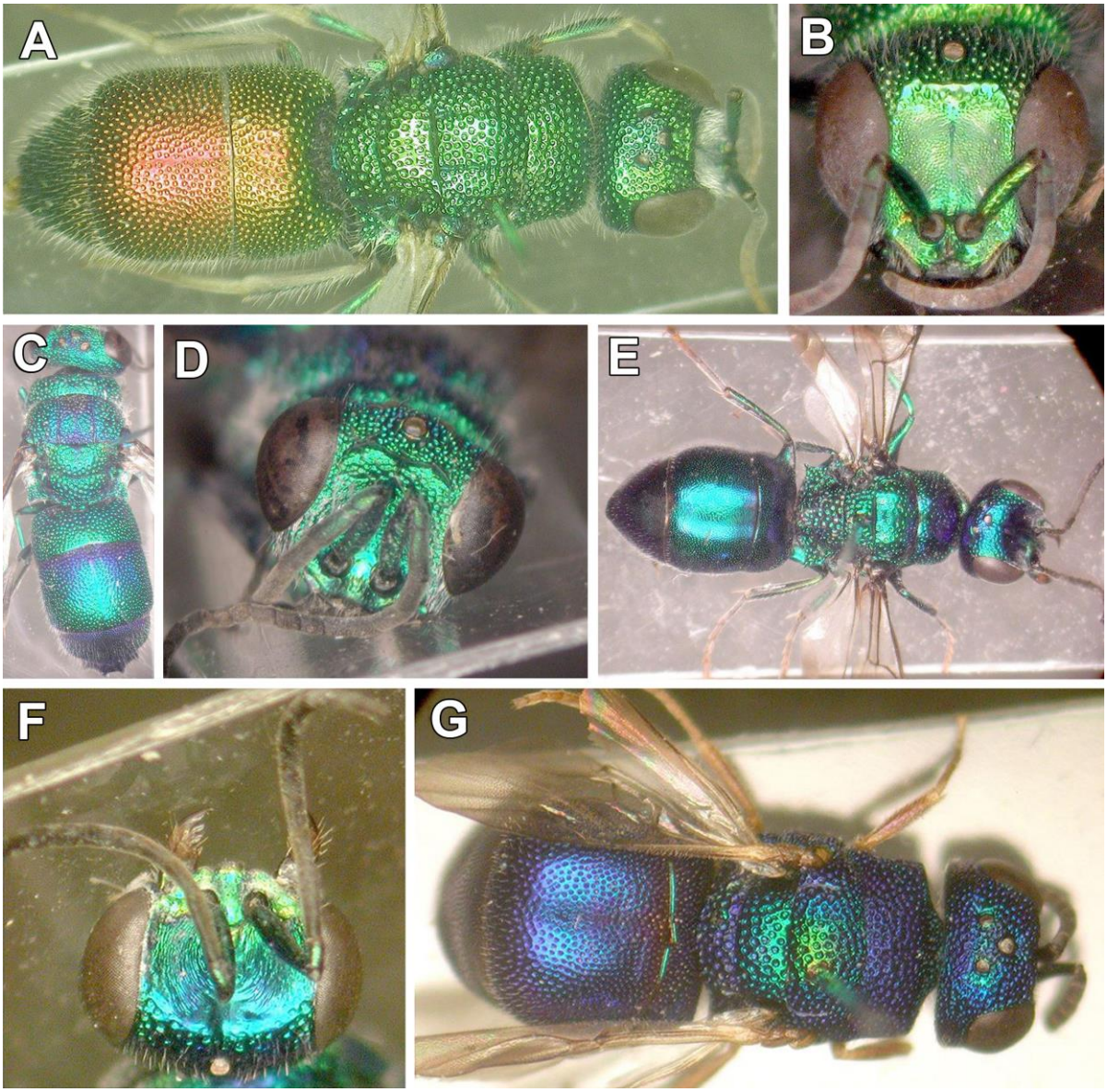

Figure 3. *Chrysis sacrata* Buysson, 1898: **A.** body, dorsal view; **B.** head, frontal view; *Chrysis quadrispina* Buysson, 1887; **C.** body, dorsal view; **D.** head, frontal view; *Elampus kashmirensis* Nurse, 1902; **E.** body, dorsal view; **F.** head, frontal view; **G.** *Holopyga chrysonota appliata* Linsenmaier, 1959. Male from Kerman, Baft-Anjerk, 21.05.2016, 2148m, 29º9′35″N-56º46′00″E, M. Purrezaali.

Of these species only *Chrysis majidi* resulted widely distributed in Southern Arabian Peninsula and Iran, from sea level to high altitude mountains. In the present research several high altitude biotopes were investigated in the Kerman province. As a result a large fraction of the species was captured on Mountains at high altitudes, and in some cases only above a given elevation. In table 1 the altitude distribution of our captures is summarized in altitude interval of 100m. The largest species richness is observed between 2100 and 2200 m with the presence of 17 species. Three species were captured in several biotopes and the altitudinal distribution is illustrated in Fig. 4. *Chrysellampus tatianae* and *Pseudomalus*

turkestanicus were observed in the widest range reaching the elevation of about 3000 m, but with a preference around 2200m. On the contrary the distribution of *Elampus kashmirensis* is restricted to a small range between 2000 and 2300 m: no individuals were captured outside this interval. For *Chrysellampus tatianae* we have also investigated a possible correlation of body size with altitude, the result is shown in Fig. 5, where the absence of any correlation can be observed. In Fig. 6 we show the linear regression of the altitude distribution data of Table 1.

Table 1. Distribution, as a function of altitude in 100m intervals, of the Chrysididae observed in the Kerman province (Iran). The maximum richness belongs to the 2100-2200m range.

Chrysididae species captured between 1700–3000 m	1750	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950
Chrysellampus tatianae Semenov, 1967		*	*	*	*		*	*			*	*	*
Elampus kashmirensis Nurse, 1902				*	*	*			*				
Omalus margianus (Semenov, 1932)			*										
Hedychridium incrassatum Dahlbom, 1854								*					
Hedychridium maculisternum Arens, 2010						*							
Hedychridium monochroum farsensis Strumia, 2017		*			*								
Pseudomalus turkestanicus Mocsáry, 1889	*	*	*	*	*	*		*	*			*	*
Holopyga chrysonota appliata Linsenmaier, 1959					*								
Holopyga cypruscula detrita Linsenmaier, 1959			*		*								
Holopyga fervida (Fabricius, 1781)					*					*			
Holopyg aproviridis Linsenmaier, 1959	*				*								
Chrysidea pumila (Klug, 1845)		*			*				*				
Chrysis albanica alia Linsenmaier, 1959					*								
Chrysis frivaldskyi sparsepunctata Buysson, 1895		*											
Chrysis inaequalis Dahlbom, 1845					*								
Chrysis komarowi Radoszkowski, 1891		*			*								
Chrysis maculicornis Klug, 1845		*											
Chrysis majidi Strumia, 2015					*								
Chrysis quadrispina Buysson, 1887									*				
Chrysis sacrata Buysson, 1898			*		*								
Chrysis sororappliat Linsenmaier, 1959		*			*								
Chrysis zobeida Buysson, 1896		*			*								
Spintharina vagans Radoszkowski, 1887					*								
Stilbun cyanurum Förster, 1771				*									
Number of observed species in 100m interval	2	9	5	4	17	3	1	3	4	1	1	2	2

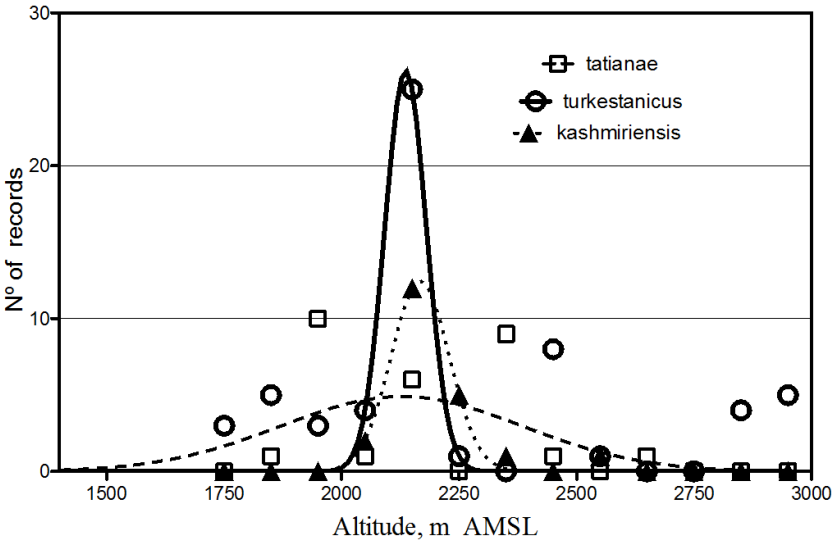

Figure 4. Altitude distribution of three Chrysididae species from Kerman Mountains: *Chrysellampus tatianae* Semenov, 1967 (broken line), *Pseudomalustur kestanicus* Mocsáry, 1889 (continuous line), and *Elampus kashmirensis* Nurse, 1902 (pointed line).

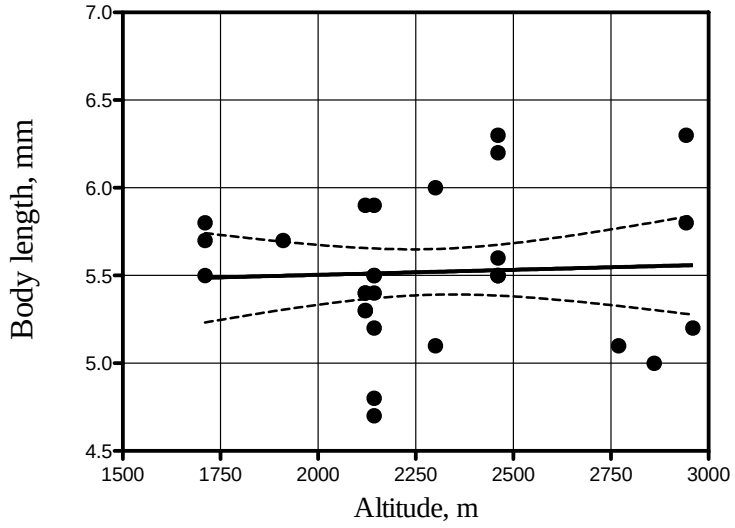

Figure 5. Linear regression of body length distribution of *Chrysellampus tatianae* Semenov, 1967 as a function of altitude. The continuous line show the linear fit of data and the broken lines the confidence interval of 95%.

We considered all captured species and the peak at 2350 m reflects the narrow distribution of *Elampus kashmirensis*. From this extrapolation we suggest probable to find some Chrysididae species up to an elevation above 3000 m. a. s. l. With the new records here reported the Iranian Chrysididae fauna reach the score of about 257 species or subspecies: the largest number after Turkey (Strumia & Yildirim, 2007). This result is most likely correlated to the biotopes richness in Iran. The isolation of high altitude biotopes may favor the presence of new endemic species, and suggest increasing research efforts.

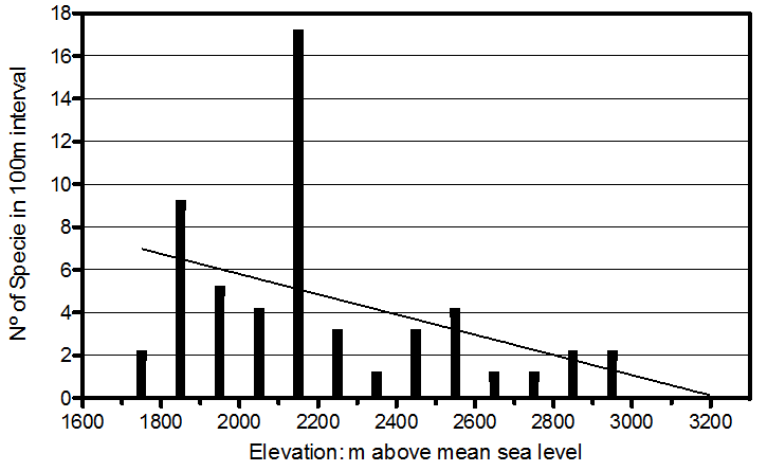

Figure 6. Linear regression of Chrysididae altitudinal distribution in Kerman Mountains (Iran).

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Conflict of Interests

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

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فون و تنوع گونه‌ای زنبورهای فاخته‌ای (Hymenoptera: Chrysididae) در مناطق کوهستانی استان کرمان، جنوب شرق ایران

سعید ایرانمنش[1]*، فرانکو استرومیا[2] ، سید مسعود مجدزاده[3]، محمد پوررضا علی[1]، محمد رضا لشکری[1]

۱ گروه تنوع زیستی، پژوهشکده علوم محیطی، دانشگاه تحصیلات تکمیلی صنعتی و فناوری پیشرفته، کرمان، ایران.
۲ گروه فیزیک، دانشگاه پیزا، ال. پونتیکوروا، ۳ – ۵۶۱۲۷ پیزا، ایتالیا
۳ گروه زیست شناسی، دانشکده علوم، دانشگاه شهیدباهنر کرمان، کرمان، ایران.
* پست الکترونیکی نویسنده مسئول مکاتبه: *saeid_iranmanesh@yahoo.com*
تاریخ دریافت: ۲۲ مرداد ۱۳۹۶، تاریخ پذیرش: ۲۲ مهر ۱۳۹۶، تاریخ انتشار: ۵ آبان ۱۳۹۶

چکیده: فهرست ۲۵ گونه از زنبورهای خانواده Chrysididae که از مناطق مرتفع کوهستانی استان کرمان جمع‌آوری شدند ارایه شد. گزارش‌های متعدد، تنوع زیستی غنی این خانواده را در مناطق مرتفع کوهستانی ایران تا ارتفاع حدود ۳۰۰۰ متری نشان می‌دهد. بیشترین غنای گونه‌ای در محدوده ۲۱۰۰ تا ۲۳۰۰ متری مشاهده شد. گونه‌های *Elampus kashmirensis* Nurse, 1902، *Holopyga chrysonota appliata* Linsenmaier, 1959، *Chrysis quadrispina* Buysson, 1887 و *Chrysis sacrata* Buysson, 1898 برای اولین بار از ایران گزارش می‌شوند.

واژگان کلیدی: Chrysididae، فون، غنای گونه‌ای، گزارش جدید، پراکنش، ایران.