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A survey on the fauna of Ichneumonidae (Hymenoptera, Ichneumonoidea) associated with grasslands of Ardabil, and key to species of *Homotropus* Foerster, 1869 from Iran

Mostafa Ghafouri Moghaddam¹, Azizollah Mokhtari¹, Hossein Barahoei², Najmeh Amirinasab¹ and Ehsan Rakhshani*¹

¹ Department of Plant Protection, College of Agriculture, University of Zabol, 98615-538, I.R. Iran.

² Agricultural Research Institute, University of Zabol, Zabol, Iran.

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ABSTRACT. A faunistic survey was conducted in Ardabil province (North-western Iran), during spring 2013 to study the ichneumonids (Hymenoptera: Ichneumonidae) associated with grasslands in this area. Samplings were carried out by the sweeping net in natural grasslands, neighboring fields and orchards. A total of twelve ichneumonid species belonging to nine genera and five subfamilies were collected and identified. The species were identified as follow: *Collyria coxator* (Villers, 1789), *Diadromus collaris* (Gravenhorst, 1829), *Diplazon laetatorius* (Fabricius, 1781), *Diplazon pectoratorius* (Gravenhorst, 1829), *Homotropus crassicornis* (Thomson, 1890), *Homotropus elegans* (Gravenhorst, 1829), *Homotropus signatus* (Gravenhorst, 1829), *Lysibia nana* (Gravenhorst, 1829), *Orthocentrus castellanus* (Ceballos, 1963), *Picrostigeus setiger* (Brischke, 1871), *Promethes sulcator* (Gravenhorst, 1829) and *Syrphophilus bizonarius* (Gravenhorst, 1829). *Homotropus crassicornis* is newly recorded for the fauna of Iran. An identification key to the known species of the genus *Homotropus* Foerster, 1869 from Iran is presented.

Key words: Taxonomy, Identification, Key, New record, Diplazontinae

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Introduction

The family Ichneumonidae is the largest group of the parasitic wasps and the most successful extant lineages of organisms with more than 24,281 described species worldwide, belonging to 39 subfamilies, which is certainly a great underestimate (Townes and Townes, 2016). Ichneumonidae also is one of the insufficiently explored insect families in Iran (Barahoei *et al.* 2012). In terms of biogeography, the Ichneumonidae is a cosmopolitan group that distributed

worldwide except Antarctic region (Bennett 2009). This family representing almost 9,000 described and many undescribed species in the Palaearctic region (Yu *et al.* 2012). In addition, the taxonomy, biology and distribution of many species are still poorly studied (Riedel and Hansen 2012). Almost all ichneumonids are parasitoids of holometabolous insects including Diptera, Hymenoptera, Lepidoptera, Coleoptera and rarely spiders and some other

Corresponding author: Ehsan Rakhshani, E-mail: rakhshani@uoz.ac.ir

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arthropod groups (Gauld 1988), so their larvae develop on or in one host and invariably leads to the death of the host (Waage and Greathead 1985).

Iran is a very peculiar country from the faunistic point of view, which located in the border of Western and Eastern Palaearctic regions with some influences from the Oriental region in the south-east and has a rich fauna of insects (Pujade-Villar *et al.* 2015). The most recent checklist of Iranian Ichneumonidae has been published by Barahoei *et al.* (2012), in which they recorded 502 species belong to 189 genera and 24 subfamilies from 30 provinces. The subsequent studies (Amiri *et al.* 2015a, b; Mohammadi-Khoramabadi *et al.* 2013a, b; Mohammadi-Khoramabadi and Talebi 2013; Barahoei *et al.* 2013, 2014, 2015a, b; Hasanshahi *et al.* 2013, 2014; Firouzi-Jahantighi *et al.* 2013; Gharaei *et al.* 2014; Bakhtiarynasab *et al.* 2014; Hooshyar *et al.* 2014; Mohebban *et al.* 2015; Sarafi *et al.* 2015) in various parts of the country, discretely increased the information about ichneumonids of Iran and number of recorded reached to 608.

Study on Ichneumonidae fauna in Ardabil province has received sporadically and limited attentions, with the report of 33 species from 28 genera and eight subfamilies (Barahoei *et al.* 2012). This paper includes additional evidence and new records of Ichneumonidae in Ardabil province (Table 1).

Material and methods

The present study was carried out in Ardabil province with an average of coordinate, 38°15'N 48°17'E and 1263 m A.S.L., in the northwest of Iran during May 2013. The Alborz mountains provide many unique types of vegetations at various altitudes (Marvie-Mohajer 2006). Sampling was carried out in Fandoghlu National

Park (38°22' N, 48°33'E, 1700m), Abi-Beiglou region (38°16'N, 48°32'E, 1318m) and village Kalle'sar (38°20'N, 48°32'E, 1332m). The sampling areas included grasslands, around the ponds, the margin of filbert shrubs, nettle and chamomile (Fig. 1). Material for the present work was collected using a standard sweeping net. Then picked up using an aspirator and directly dropped into 75% ethyl alcohol as a killing and preservation agent for later steps. They were then pinned or card mounted and labeled. The external morphology of specimens were studied using a Nikon™ SMZ645 stereomicroscope (Japan). Illustrations were taken using a Hund™ Stereomicroscope equipped with the BMZ-04-DZ™ digital imaging system (Behin Pajouhesh Co., Iran). Photographs of *Homotropus longiventris* was taken with a Canon™ EOS 600D Digital Camera. A series of 4–5 captured images were merged into a single in-focus image using Zerene Stacker™ version 1.04 and then mounted Adobe Photoshop™ CS6.

The morphological terms are linked to anatomical concepts in the Hymenoptera Anatomy Ontology [<http://portal.hymao.org>] (Yoder *et al.* 2010; Townes 1969; Gauld 1991). Wing vein nomenclature follows Mason (1986) and Townes (1969). Identifications were made using reliable keys and the original descriptions (Meyer 1933; Mohammadi-Khoramabadi and Talebi, 2013; Klopstein 2014). We excluded species which have not been identified with certain accuracy. Classification, nomenclature and distributional data in Iran and world of Ichneumonidae followed Yu *et al.* (2012). In the present paper, faunistic data on Ichneumonidae species from the Ardabil province are listed alphabetically. Specimens are deposited in the Insect Collection of the Department of plant protection, University of Zabol, Iran (DPPZ).



Figure 1. Sampling locations in Ardabil province. **A.** and **C.** Fandoghlu National Park, **B.** and **D.** Abi-Beiglou.

The following abbreviations are used in the text: DPPZ = Department of plant protection, University of Zabol, Iran; OD = ocellus diameter: maximal diameter of posterior lateral ocellus; OOL = ocular ocellar line: the shortest distance between posterior ocellus and adjacent compound eye margin; POL = posterior ocellar line: the shortest distance between the posterior ocelli.

Results

In the current study, 12 species of ichneumonids in nine genera and five subfamilies were collected from grasslands of Ardabil. For each species, the geographical distribution and valid name are presented here. The newly recorded taxa from Iran and Ardabil province are marked with one (*) and two asterisks (**), respectively.

Subfamily Collyriinae Cushman, 1924** *Collyria coxator* (Villers, 1789)**

Material examined: IRAN, Ardabil province, Abi-Beiglou, 38°16'53.6"N, 48°32'54.7"E, 1318m, 23.V.2013, 1♂ (DPPZ),

swept on Grasslands and *Matricaria chamomilla* (L.); Fandoghlu National Park, 38°22'56.1"N, 48°33'18.5"E, 1700m, 24.V.2013, 4♀ and 5♂♂ (DPPZ), swept on Grasslands, the margin of filbert shrubs, nettle and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Khorasan-e-Razavi province (Barahoei *et al.* 2012, 2014).

General Distribution: Eastern Palearctic, Nearctic and Western Palearctic.

Subfamily Cryptinae Kirby, 1837 *Lysibia nana* (Gravenhorst, 1829)**

Material examined: IRAN, Ardabil province, Village Kalle'sar, 38°20'35.4"N, 48°32'51.1"E, 1332m, 23.V.2013, 1♀ and 1♂ (DPPZ), swept on Grasslands and around the ponds, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Isfahan (Barahoei *et al.* 2015a) and Kerman provinces (Mohebban *et al.* 2015).

General Distribution: Eastern Palearctic, Nearctic, Oriental and Western Palearctic.

Subfamily Diplazontinae Viereck, 1918**
Diplazon laetatorius* (Fabricius, 1781)*

Material examined: IRAN, Ardabil province, Abi-Beiglou, 38°16'53.6"N, 48°32'54.7"E, 1318m, 23.V.2013, 1♀ (DPPZ), swept on Grasslands and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Chaharmahal and Bakhtiari, North Khorasan, West Azerbaijan, Yazd (Barahoei *et al.* 2012), Alborz, Guilan, Mazandaran, Qazvin, Tehran (Mohammadi-Khoramabadi *et al.* 2013b), Sistan and Baluchistan (Barahoei *et al.* 2013), Khorasan-e-Razavi (Barahoei *et al.* 2014), Kerman (Bakhtiarynasab *et al.* 2014), Isfahan (Barahoei *et al.* 2015a) and Fars provinces (Sarafi *et al.* 2015).

General Distribution: Afrotropical, Australasian, Eastern Palaearctic, Nearctic, Neotropical, Oceanic, Oriental and Western Palaearctic.

Diplazon pectoratorius* (Gravenhorst, 1829)*

Material examined: IRAN, Ardabil province, Abi-Beiglou, 38°16'53.6"N, 48°32'54.7"E, 1318m, 23.V.2013, 1♀ (DPPZ), swept on Grasslands and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Guilan and Mazandaran provinces (Mohammadi-Khoramabadi *et al.* 2013b).

General Distribution: Western Palaearctic.

Genus *Homotropus* Foerster, 1869

The genus *Homotropus* Foerster, 1869, can be immediately distinguished from the allied genera by the presence of ventrally complete and distinct epicnemial carinae on the mesopleuron, third tergite with spiracle located above the lateral margin and the clypeus with a pre-apical impression (Klopfstain, 2014). Five species of the genus *Homotropus* have already been recorded from Iran. Three species, including, *Homotropus crassicornis* (Thomson, 1890), *Homotropus*

elegans (Gravenhorst, 1829) and *Homotropus signatus* (Gravenhorst, 1829) were found from Ardabil region, of which the first species is new record for Iran fauna. All recorded species of *Homotropus* from Iran has been reviewed below:

Key to the species of the genus *Homotropus* in Iran

- 1- Forewing 3rs-m vein present, but sometime un-pigmented and the areolet closed (Figs. 8B–8E).2
- Forewing 3rs-m vein absent, and the areolet open (Figs. 8A, 8F).5
- 2- Metasoma elongate (Fig. 4C); yellow central face patch broad and confluent with yellow clypeus (Fig. 5A).*H. longiventris* (Thomson)
- Metasoma not elongate (Figs. 3F, 5F, 6F); yellow central face patch small and separated from clypeus (Figs. 3B, 5B, 6B).3
- 3- First metasomal tergite without longitudinal wrinkles (Fig. 5G); lower half of mesopleuron mostly smooth and shining (Fig. 4D); fore wing 3rs-m vein colorless (Fig. 8D).*H. nigritarsus* (Gravenhorst)
- First metasomal tergite with longitudinal wrinkles (Figs. 3G, 6G); lower half of mesopleuron coriaceous (Figs. 3D, 6D); fore wing 3rs-m vein tubular (Figs. 8B, 8E).4
- 4- Outer margin of clypeus strongly excised (Fig. 6B); mid coxae light brown to yellowish (Fig. 6D); hind tibia whitish, darkened at third part; fore wing 2-R1 vein 1.5–1.7x as long as 2rs-m vein (Fig. 8B).*H. pictus* (Gravenhorst)
- Outer margin of clypeus weakly excised (Fig. 3B); mid coxae dark brown to black (Fig. 3D); hind tibia uniformly light brown; fore wing 2-R1 vein 2.2–2.4x as long as 2rs-m vein (Fig. 8E).*H. elegans* (Gravenhorst)

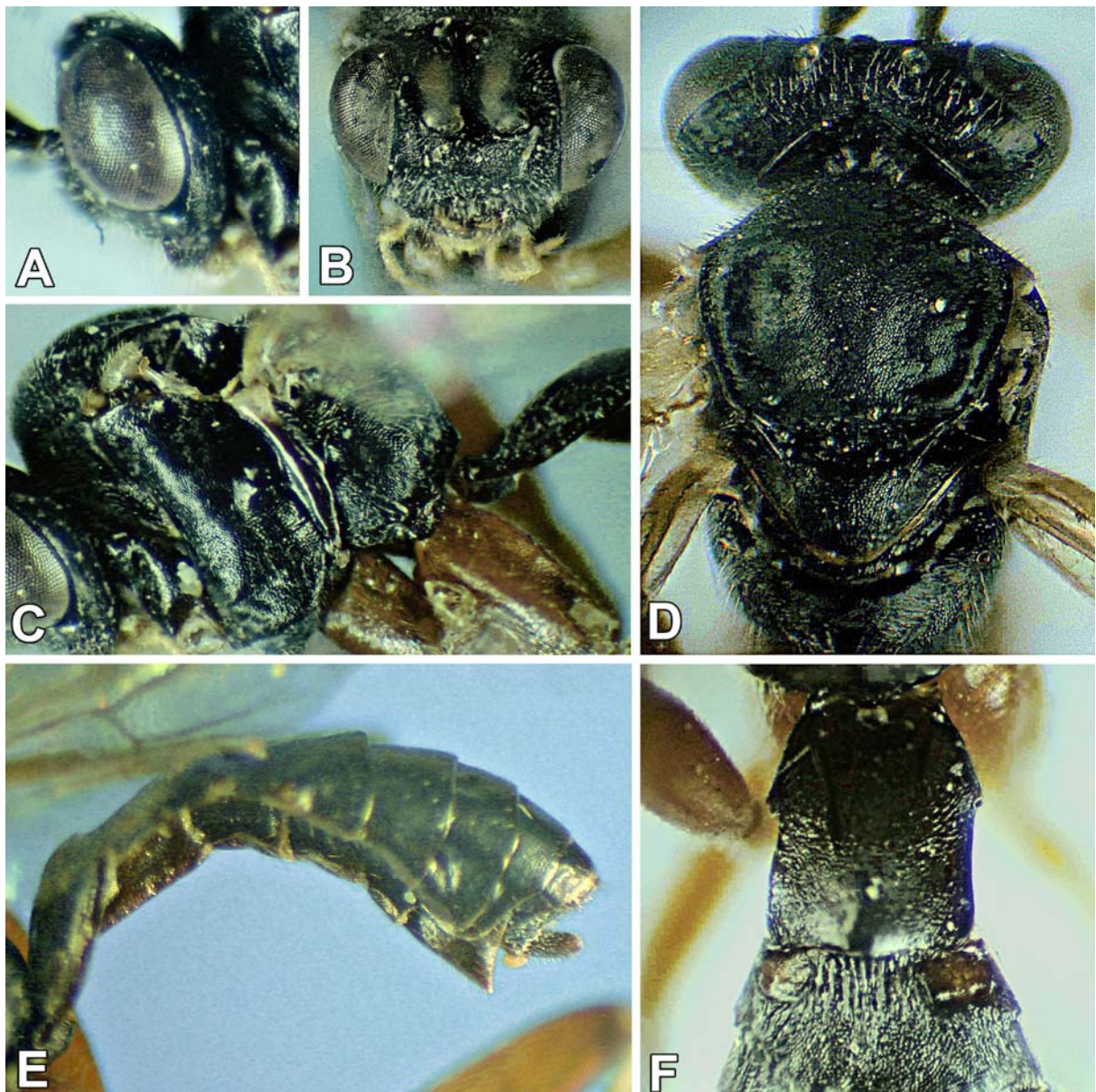


Figure 2. The external morphology of *Homotropus crassicornis* (Thomson, 1890) (Female). **A.** Lateral view of head, **B.** Frontal view of head, **C.** Lateral view of mesosoma, **D.** Dorsal view of head and mesosoma, **E.** Lateral view metasoma and ovipositor sheath, **F.** Dorsal view of first and second tergites.

5- Clypeus weakly excised; face completely black (Fig. 2B); propodeum completely and strongly carinated; mesopleuron shining, strongly punctate over most of its surface (Fig. 2C); first tergite sub-quadrate 1.2-1.4 times as long as wide (Fig. 2F).
*H. crassicornis* (Thomson)

- Clypeus strongly excised; face with yellow central patch (Fig. 7B); propodeum with only pleural and lateral longitudinal carinae; mesopleuron coriaceous at least on lower half, weakly punctate on lower half and along anterior margin (Fig. 7D); first tergite elongated, 1.4-1.6 times as long as wide (Fig. 7G). ...*H. signatus* (Gravenhorst)

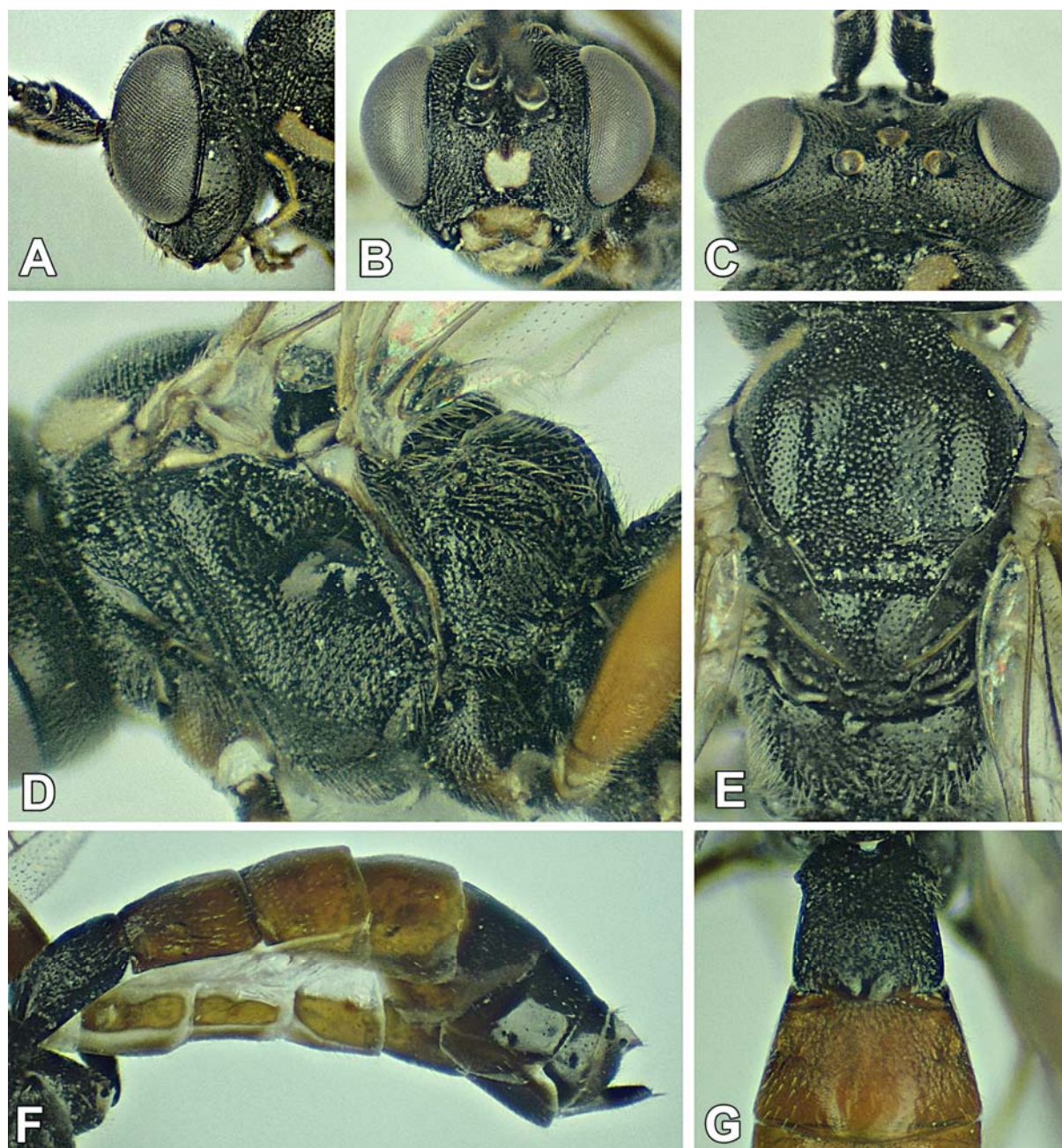


Figure 3. The external morphology of *Homotropus elegans* (Gravenhorst, 1829) (Female). **A.** Lateral view of head, **B.** Frontal view of head, **C.** Dorsal view of head, **D.** Lateral view of mesosoma, **E.** Dorsal view of mesosoma, **F.** Lateral view of metasoma and ovipositor sheath, **G.** Dorsal view of first and second metasomal tergites.

Homotropus crassicornis (Thomson, 1890)*
(Figs. 2, 8A)

Material examined: IRAN, Ardabil province, Village Kalle'sar, 38°20'35.4"N, 48°32'51.1"E, 1332m, 23.V.2013, 1♀ (DPPZ),

swept on Grassland, around the ponds and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Ardabil (New record from Iran).

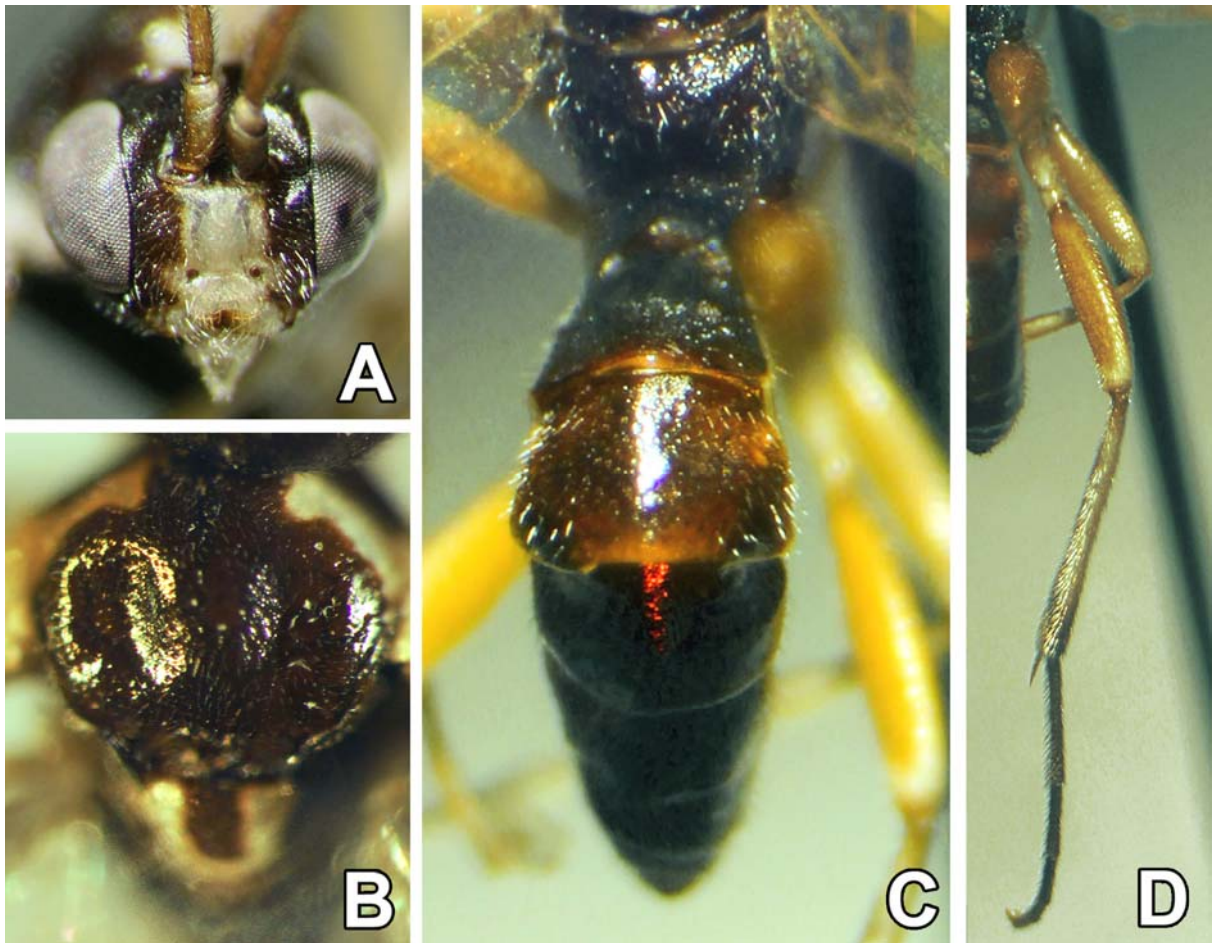


Figure 4. The external morphology of *Homotropus longiventris* (Thomson, 1890) (Female). **A.** Frontal view of head, **B.** Dorsal view of mesoscutum and scutellum, **C.** Dorsal view of propodeum and metasoma, **D.** Hind leg.

Diagnosis: Fore wing length 5.1– 6.5 mm, areolet open (Fig. 8A); Antenna in females with 23 flagellomeres; Face (Fig. 2B) strongly coriaceous and distinctly punctate, with short and sparse setae (Figs. 2A, 2C); Clypeus weakly excised, lobes rounded (Fig. 2B); POL almost 2.0x and 3.0x longer than OOL and OD, respectively (Fig. 2D); Mesopleuron in margins smooth and shining, strongly punctate over most of its surface with very short and sparse setae (Fig. 2C); Mesoscutum strongly punctate and coriaceous (Fig. 2D); Propodeum strongly rugose, especially on the petiolar area; Metasoma dorso-ventrally depressed, first tergite (Fig. 2F) with median dorsal

carinae surpassing middle of the tergite, usually not reaching apex, rugose but without longitudinal wrinkles, 1.2–1.4x as long as wide, second tergite basally irregularly rugose, coriaceous and clearly surpassing middle of the tergite; Hind tibial spurs 0.6–0.7x as long as first tarsomere; Ovipositor sheath (Fig. 2E) very short, but visible, with short and dense setae.

Coloration (female): Body color generally black, palps and tips of mandible yellowish. Legs brown, hind tibia yellowish at base gradually darkening toward tip.

General Distribution: Western Palaearctic.

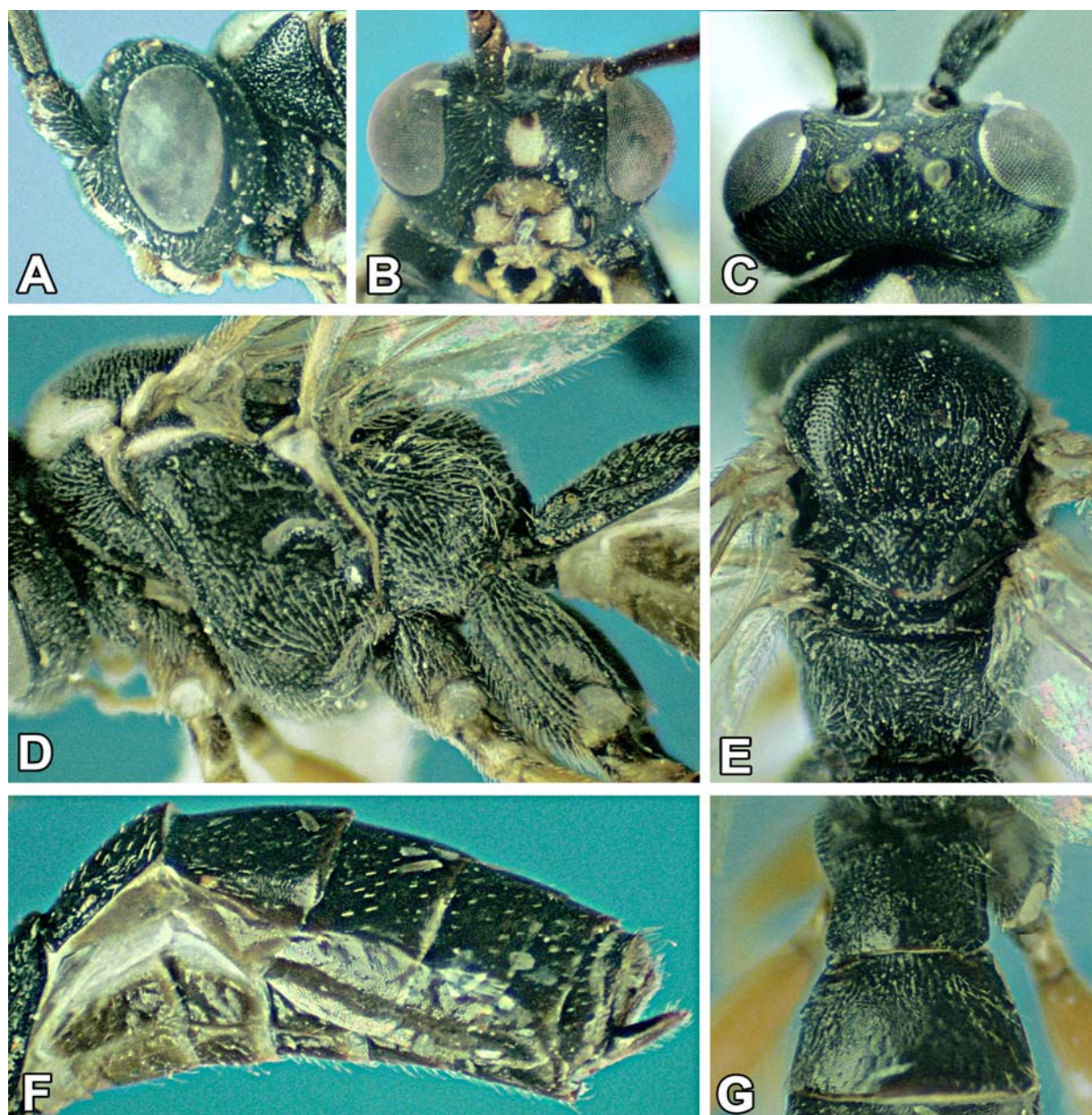


Figure 5. The external morphology of *Homotropus nigritarsus* (Gravenhorst, 1829) (Female). **A.** Lateral view of head, **B.** Frontal view of head, **C.** Dorsal view of head, **D.** Lateral view of mesosoma, **E.** Dorsal view of mesosoma, **F.** Lateral view of metasoma and ovipositor sheath, **G.** Dorsal view of first and second metasomal tergites.

Homotropus elegans (Gravenhorst, 1829)**
(Figs. 3, 8B)

Material examined: IRAN, Ardabil province, Fandoghlu National Park, 38°22'56.1"N, 48°33'18.5"E, 1700m, 24.V.2013, 1♂ (DPPZ), swept on Grasslands, the margin of filbert shrubs, nettle and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam; IRAN, Isfahan

province, Najafabad, 32°38'1.78"N, 51°22'5.86"E, 1600m, 01-06.VI.2013, 2♀ (DPPZ), Malaise trap, Leg.: E. Nader.

Distribution in Iran: Kerman province (Bakhtiarynasab *et al.* 2014).

General Distribution: Eastern Palaearctic, Nearctic and Western Palaearctic.

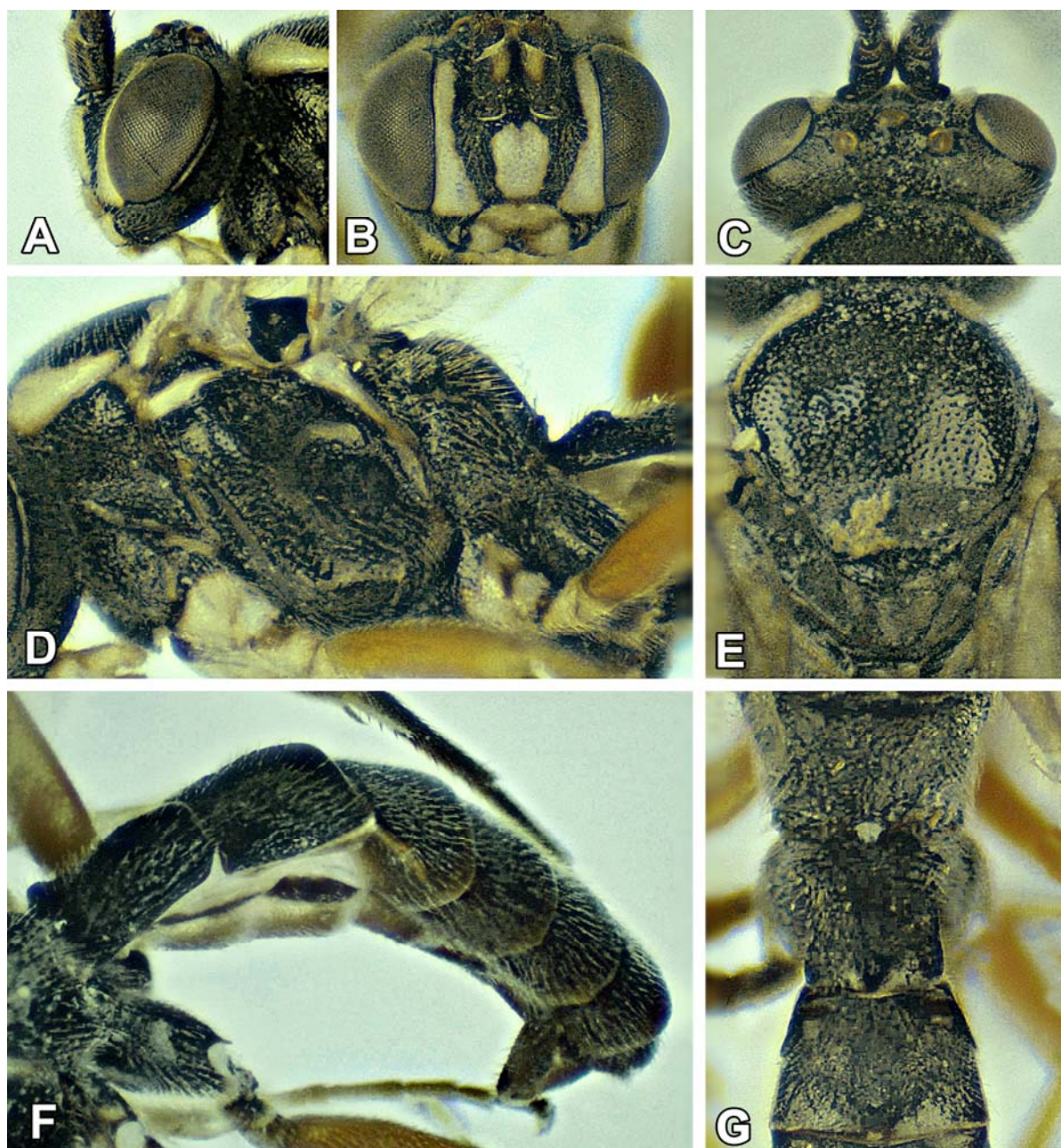


Figure 6. The external morphology of *Homotropus pictus* (Gravenhorst, 1829) (Male). **A.** Lateral view of head, **B.** Frontal view of head, **C.** Dorsal view of head, **D.** Lateral view of mesosoma, **E.** Dorsal view of mesosoma, **F.** Lateral view of metasoma, **G.** Dorsal view of first and second metasomal tergites.

***Homotropus longiventris* Thomson, 1890**
(Figs. 4, 8C)**

Material examined: IRAN, Mazandaran province, Noor, 36°18'N, 52°07'E, 1332m, 11.V.2011, 1♀ (Insect Collection of College of Agriculture and Natural Resources of Darab,

Shiraz University), Leg.: M. Khayrandish.

Distribution in Iran: Mazandaran province (Mohammadi-Khoramabadi and Klopstein, 2015)

General Distribution: Eastern Palaearctic and Western Palaearctic.

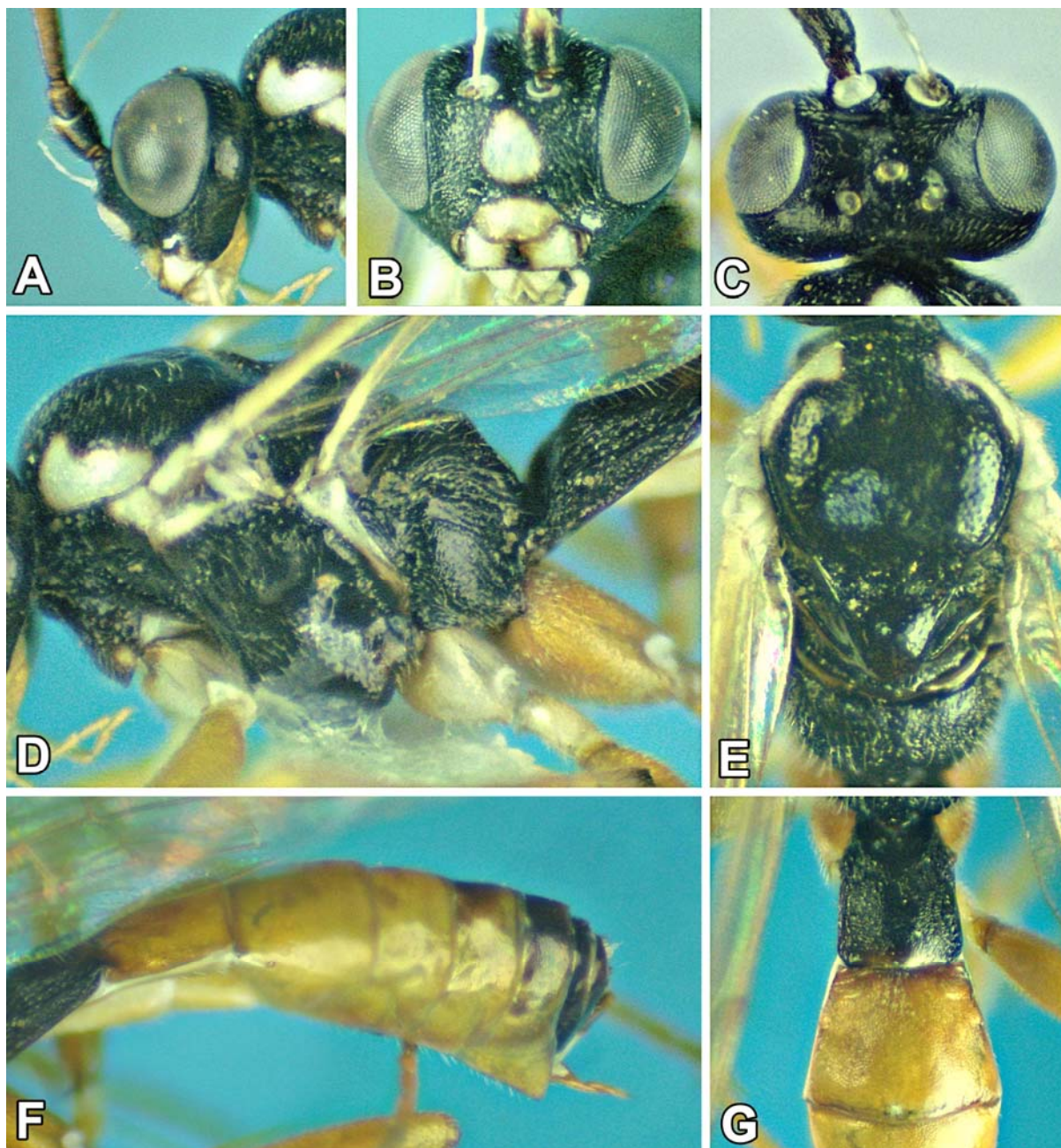


Figure 7. The external morphology of *Homotropus signatus* (Gravenhorst, 1829) (Female). **A.** Lateral view of head, **B.** Frontal view of head, **C.** Dorsal view of head, **D.** Lateral view of mesosoma, **E.** Dorsal view of mesosoma, **F.** Lateral view of metasoma and ovipositor sheath, **G.** Dorsal view of first and second tergites.

***Homotropus nigratarsus* (Gravenhorst, 1829)**
(Figs. 5, 8D)**

Material examined: IRAN, Guilan province, Ziaz, 36°52'45"N 50°13'16"E, 140m, 5-12.IV.2010, 1♀ (DPPZ), Malaise trap, Leg.: M. Khayrandish; IRAN, Isfahan

province, Hoye, 32°39'16"N, 51° 40'4.79"E, 1300m, 14.VI.2012, 1♀ (DPPZ), swept on Aquatic plants; IRAN, Isfahan province, Morghab, 32°38'1.78"N, 51°22'5.86"E, 1600m, 19.VI.2013, 1♂ (DPPZ), swept on mixed field, Leg.: E. Nader.

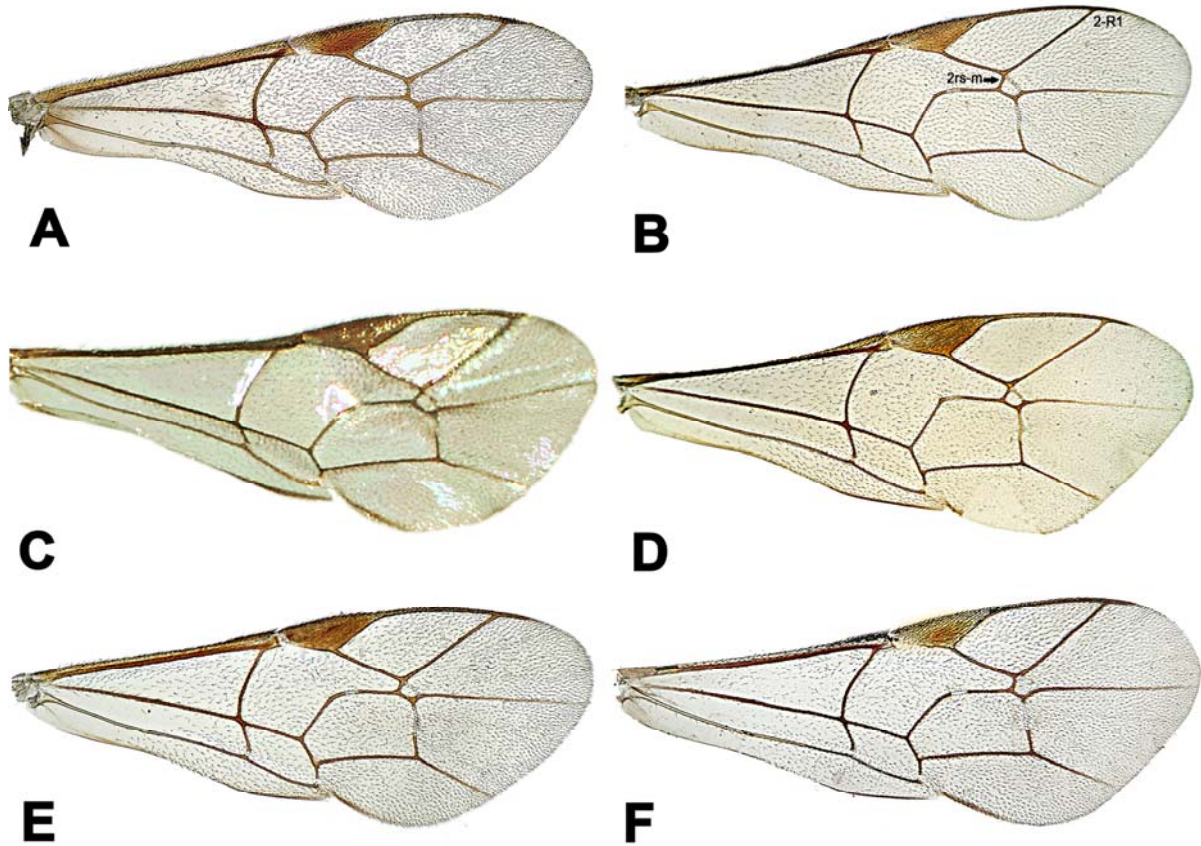


Figure 8. Fore wing of *Homotropus* species. **A.** *Homotropus crassicornis*. **B.** *Homotropus elegans*. **C.** *Homotropus longiventris*. **D.** *Homotropus nigratarsus*. **E.** *Homotropus pictus*. **F.** *Homotropus signatus*.

Distribution in Iran: Fars (Sarafi *et al.* 2015), Isfahan (Barahoei *et al.* 2015a), Alborz, Guilan, Mazandaran, Qazvin, Tehran (Mohammadi-khoramabadi *et al.* 2013b).

General Distribution: Eastern Palaearctic, Nearctic, Neotropical, Western Palaearctic.

***Homotropus pictus* (Gravenhorst, 1829)** (Figs. 6, 8E)

Material examined: IRAN, Isfahan province, Najafabad, 32°38'1.78"N, 51°22'5.86"E, 1600m, 4-10.V.2013, 1♂ (DPPZ), Malaise trap, Leg.: E. Nader.

Distribution in Iran: Mazandaran (Mohammadi-Khoramabadi *et al.* 2013b).

General Distribution: Eastern Palaearctic and Western Palaearctic.

Homotropus signatus* (Gravenhorst, 1829)* (Figs. 7, 8F)

Material examined: IRAN, Ardabil province, Abi-Beiglou, 38°16'53.6"N, 48°32'54.7"E, 1318m, 23.V.2013, 1♀ and 1♂ (DPPZ), swept on Grasslands and *M. chamomilla*; Fandoghlu National Park, 38°22'56.1"N, 48°33'18.5"E, 1700m, 24.V.2013, 1♂ (DPPZ), swept on Grasslands, the margin of filbert shrubs, nettle and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Khorasan-e-Razavi (Barahoei *et al.* 2014), Kerman (Bakhtiarynasab *et al.* 2014), Isfahan (Barahoei and Nader, 2014; Barahoei *et al.* 2015b) and Fars provinces (Sarafi *et al.* 2015).

General Distribution: Eastern Palaearctic, Nearctic and Western Palaearctic.

Promethes sulcator* (Gravenhorst, 1829)*

Material examined: IRAN, Ardabil province, Village Kalle'sar, 38°20'35.4"N, 48°32'51.1"E, 1332m, 23.V.2013, 2♀♀ (DPPZ), swept on Grasslands and around the ponds; Fandoghlu National Park, 38°22'56.1"N, 48°33'18.5"E, 1700m, 24.V.2013, 2♀♀ and 1♂ (DPPZ), swept on Grasslands, the margin of filbert shrubs, nettle and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Alborz, Guilan, Tehran (Mohammadi-Khoramabadi *et al.* 2013b), Sistan and Baluchistan (Barahoei *et al.* 2013) Khorasan-e-Razavi (Barahoei *et al.* 2014), Isfahan (Barahoei *et al.* 2015b).

General Distribution: Eastern Palaearctic, Nearctic, Oriental and Western Palaearctic.

Syrphophilus bizonarius* (Gravenhorst, 1829)*

Material examined: IRAN, Ardabil province, Abi-Beiglou, 38°16'53.6"N, 48°32'54.7"E, 1318m, 23.V.2013, 2♀♀ and 2♂♂ (DPPZ), swept on Grasslands and *M. chamomilla*; Village Kalle'sar, 38°20'35.4"N, 48°32'51.1"E, 1332m, 23.V.2013, 1♀♀ and 1♂ (DPPZ), swept on Grasslands and around the ponds; Fandoghlu National Park, 38°22'56.1"N, 48°33'18.5"E, 1700m, 24.V.2013, 6♀♀ and 2♂♂ (DPPZ), swept on Grasslands, the margin of filbert shrubs, nettle and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Alborz, Guilan, Mazandaran, Qazvin (Mohammadi-Khoramabadi *et al.* 2013b), Tehran (Hasanshahi *et al.* 2013; Mohammadi-Khoramabadi *et al.* 2013b) and Isfahan provinces (Barahoei *et al.* 2015b).

General Distribution: Eastern Palaearctic, Nearctic, Oriental and Western Palaearctic.

Subfamily Ichneumoninae Latreille, 1802
Diadromus collaris* (Gravenhorst, 1829)*

Material examined: IRAN, Ardabil province, Abi-Beiglou, 38°16'53.6"N, 48°32'54.7"E, 1318m, 23.V.2013, 1♀ (DPPZ), swept on Grasslands and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Sistan and Baluchistan, Khorasan-e-Razavi (Barahoei *et al.* 2012, 2014), Isfahan (Afiunizadeh and Karimzadeh 2010; Barahoei *et al.* 2015b), Fars (Sarafi *et al.* 2015) and Kerman provinces (Mohebban *et al.* 2015).

General Distribution: Afrotropical, Australasian, Eastern Palaearctic, Neotropical, Oceanic, Oriental and Western Palaearctic.

Subfamily Orthocentrinae Foerster, 1869**
Orthocentrus castellanus* (Ceballos, 1963)*

Material examined: IRAN, Ardabil province, Abi-Beiglou, 38°16'53.6"N, 48°32'54.7"E, 1318m, 23.V.2013, 1♂ (DPPZ), swept on Grasslands and *M. chamomilla*; Fandoghlu National Park, 38°22'56.1"N, 48°33'18.5"E, 1700m, 24.V.2013, 3♂♂ (DPPZ), swept on Grasslands, the margin of filbert shrubs, nettle and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Tehran province (Mohammadi-Khoramabadi and Talebi 2013).

General Distribution: Western Palaearctic.

Picrostigeus setiger* (Brischke, 1871)*

Material examined: IRAN, Ardabil province, Village Kalle'sar, 38°20'35.4"N, 48°32'51.1"E, 1332m, 23.V.2013, 1♂ (DPPZ), swept on Grasslands and around the ponds; Fandoghlu National Park, 38°22'56.1"N, 48°33'18.5"E, 1700m, 24.V.2013, 1♀ and 1♂ (DPPZ), swept on Grasslands, the margin of filbert shrubs, nettle and *M. chamomilla*, Leg.: M. Ghafouri Moghaddam.

Distribution in Iran: Fars province (Sarafi *et al.* 2015).

General Distribution: Western Palaearctic.

Table 1. Updated list of subfamilies and species which recorded from Ardabil province.

Subfamilies	Previously recorded species (Barahoei <i>et al.</i> 2012)	Newly recorded species (current study)
Anomaloninae	<i>Anomalon cruentatum</i> (Geofroy, 1785)	
Banchinae	<i>Lissonota magdaleneae</i> (Pfankuch, 1921) <i>Lissonota mediterranea</i> (Seyrig, 1927) <i>Exetastes crassus</i> (Gravenhorst, 1829)	
Collyriinae**		<i>Collyria coxator</i> (Villers, 1789)**
Cre mastinae	<i>Eucremastus collaris</i> (Narolsky, 1990)	
Cryptinae	<i>Buathra laborator</i> (Thunberg, 1824) <i>Meringopus turanus</i> (Habermehl, 1918) <i>Dichrogaster saharator</i> (Aubert, 1964) <i>Gelis proximus</i> (Foerster, 1850) <i>Glyphicnemis vagabunda</i> (Gravenhorst, 1829) <i>Pleolophus larvatus</i> (Gravenhorst, 1829)	<i>Lysibia nana</i> (Gravenhorst, 1829)**
Diplazontinae**		<i>Diplazon laetatorius</i> (Fabricius, 1781)** <i>Diplazon pectoratorius</i> (Gravenhorst, 1829)** <i>Homotropus crassicornis</i> (Thomson, 1890)* <i>Homotropus elegans</i> (Gravenhorst, 1829)** <i>Homotropus signatus</i> (Gravenhorst, 1829)** <i>Promethes sulcator</i> (Gravenhorst, 1829)** <i>Syrphophilus bizonarius</i> (Gravenhorst, 1829)**
Ichneumoninae	<i>Coelichneumon biannulatus</i> (Gravenhorst, 1820) <i>Coelichneumon erythromerus</i> (Rudow, 1888) <i>Barichneumon quadriguttatus</i> (Gravenhorst, 1829) <i>Diphyus mercatorius</i> (Fabricius, 1793) <i>Diphyus ochromelas</i> (Gmelin, 1790) <i>Obtusodonta equitatoria</i> (Panzer, 1786) <i>Stenobarichneumon citator</i> (Thunberg, 1822) <i>Triptognathus bolivari</i> (Berthoumieu, 1894) <i>Virgichneumon callicerus</i> (Gravenhorst, 1820) <i>Vulgichneumon suavis</i> (Gravenhorst, 1820) <i>Centeterus confector</i> (Gravenhorst, 1829) <i>Heterischnus truncator</i> (Fabricius, 1798) <i>Phaeogenes melanogonos</i> (Gmelin, 1790) <i>Cyclolabus nigricollis</i> (Wesmael, 1845)	<i>Diadromus collaris</i> (Gravenhorst, 1829)**
Metopiinae	<i>Colpotrochia triclitor</i> (Aubert, 1979)	
Orthocentrinae**		<i>Orthocentrus castellanus</i> (Ceballos, 1963)** <i>Picrostigeus setiger</i> (Brischke, 1871)**
Pimplinae	<i>Endromopoda detrita</i> (Holmgren, 1860) <i>Scambus nigricans</i> (Thomson, 1877) <i>Strongylopsis belua</i> (Kuzin, 1950) <i>Pimpla rufipes</i> (Miller, 1759)	
Tryphoninae	<i>Netelia armeniaca</i> (Tolkanitz, 1971) <i>Netelia (Bessobates) cristata</i> (Thomson, 1888) <i>Neleges proditor</i> (Gravenhorst, 1829)	

The newly recorded taxa from Iran and Ardabil province are marked with one (*) and two asterisks (**), respectively.

Discussion

In this study, 12 species of ichneumonids belonging to nine genera were collected and identified, in association with grasslands of Ardabil province at the northwestern part of Iran. Three subfamilies including Collyriinae, Diplazontinae, and Orthocentrinae are newly recorded from Ardabil province and the number of recorded species increased from 33 to 45. Concerning to the high diversity of the plant species, not surprising that all 12 species are newly recorded from the studied area (Table 1).

The subfamily Diplazontinae with seven species was the most abundant subfamily in this area during the sampling period. They are koinobiont endoparasitoids of aphidophagous hoverflies (Diptera, Syrphidae) (Sugonyaev 2006). Sixteen species of the subfamily Diplazontinae are reported from Iran (Mohammadi-Khoramabadi *et al.* 2013b). *Homotropus crassicornis* (Thomson, 1890) is a new species record for Iran that is distributed in western Palearctic region (Klopfstein 2014). Some species of Diplazontinae were very frequently encountered in many researches. *Diplazon laetatorius* is reported from different places of Iran (Barahoei *et al.* 2012, 2014, 2015a; Mohammadi-Khoramabadi *et al.* 2013b; Sarafi *et al.* 2015). This species has a worldwide distribution (Yu *et al.* 2012), which is probably reached at least partly through human-mediated dispersal. It was reared from puparia of *Scaeva albomaculata* (Macquart, 1842) (Diptera, Syrphidae) (Nourbakhsh *et al.* 2008). The genus *Promethes* Foerster, 1869 is a moderately large genus, but has only a single species in Iran. In general, species of the subfamily Diplazontinae (*Diplazon laetatorius*, *Enizemum ornatum*, *Homotropus elegans*, *Promethes sulcator* and *Syrphophilus bizonarius*) have a wide distribution, which can be justified after their host range

pattern on their syrphid hosts (Thirion 1994). Firouzi-Jahantighi *et al.* (2013) reported *Diadromus collaris* from Sistan and Baluchistan province. Also, this species documented by Aliyev (1999) from Azerbaijan (Yu *et al.* 2012) and was reared from the diamondback moth, *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera, Plutellidae), one of the most important pest of cabbage, *Brassica oleracea* (Linnaeus, 1758) in Isfahan province (Afiunizadeh and Karimzadeh 2010).

Except for a few species (*Collyria coxator*, *Homotropus elegans*, *Homotropus signatus*, *Lysibia nana*, *Promethes sulcator* and *Syrphophilus bizonarius*) which have been recorded also from the Oriental region, the rest have common in the Holarctic (Palearctic and Nearctic) region. In addition, *Lysibia nana* has been recorded from Oceanic region (Yu *et al.* 2012).

Four species (*Diplazon pectoratorius*, *Homotropus crassicornis*, *Orthocentrus castellanus* and *Picrostigeus setiger*) are largely restricted to Western Palearctic regions (Yu *et al.* 2012). Some other species (*Diplazon laetatorius* and *Diadromus collaris*) are mainly distributed in overall of the world (Cosmopolitan). Generally the Iran fauna including Ardabil province resembles that of neighboring countries, and predominantly contains common Western Palearctic species. Notwithstanding the supposed high biodiversity of Iranian ichneumonid wasps, the distribution, identification and biology of the majority of this family species is poorly known.

Iran possesses an extremely diverse fauna and flora, partly because of its great range of habitats from permanent snows to deep deserts and from lush deciduous forests in the north to palm groves and mangroves in the south and partly because of its position at a crossroads between three major faunal regions (Firouz 1974). The greater part of the country is situated in the

Palaearctic region, with typically Western Palaearctic species predominating throughout the northwest, west and central parts of the country and some typically Eastern Palaearctic species extending into northeastern Iran. However, the territory of Iran, as a cross-road of Eastern and Western Palaearctic (and Oriental region) (Pujade-Villar *et al.* 2015).

In conclusion, there is still a great deal of work on Ichneumonids of Iran, to be done, but we believe that more investigation with biological data and host associations are needed to reveal the faunal complex of this large group of insects even at this territory as well as other part of the country with extremely different climatic and biogeographic situations. The findings of this paper will encourage additional work on ichneumonids in Ardabil province and also encourage similar studies on other groups that will lead to more information about Iran biodiversity and increased levels of conservation within this remarkable country. An overall comparison of Iranian fauna of Ichneumonids especially with the central Asian countries (Thirion 1994; Bordera *et al.* 2000), clearly indicating necessity of comprehensive researches. With regards to the vast number of the recorded species in the Palaearctic region, further investigations are necessary to have a better understanding from the occurrence of other Ichneumonid taxa in Iran and even in the neighboring countries.

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بررسی فونستیک خانواده Ichneumonidae (Hymenoptera, Ichneumonoidea) مرتبط با مراتع اردبیل، به همراه کلید گونه‌های جنس *Homotropus* Foerster, 1869 از ایران

مصطفی غفوری مقدم^۱، عزیزاله مختاری^۱، حسین براهویی^۲، نجمه امیری نسب^۱ و احسان رخشانی^{۳*}

۱ گروه گیاه پزشکی، دانشکده کشاورزی، دانشگاه زابل، ایران

۲ پژوهشکده کشاورزی، دانشگاه زابل، زابل، ایران

* پست الکترونیکی نویسنده مسئول مکاتبه: rakhshani@uoz.ac.ir

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چکیده: در بهار سال ۱۳۹۲، فون زنبورهای خانواده Ichneumonidae (Hymenoptera, Ichneumonoidea) مرتبط با مراتع در استان اردبیل (شمال غرب ایران) بررسی گردید. نمونه برداری بوسیله تور حشره گیری در مراتع طبیعی، کنار مزارع و باغات انجام شد. در مجموع ۱۲ گونه از این خانواده که متعلق به ۹ جنس و ۵ زیر خانواده بودند، جمع آوری و شناسایی شدند. گونه های شناسایی شده شامل موارد ذیل بودند: *Diadromus collaris* (Gravenhorst, 1829)، *Collyria coxator* (Villers, 1789)، *Diplazon pectoratorius* (Gravenhorst, 1829)، *Diplazon laetatorius* (Fabricius, 1781)، *Homotropus elegans* (Thomson, 1890)، *Homotropus crassicornis* (Thomson, 1890)، *Homotropus signatus* (Gravenhorst, 1829)، *Orthocentrus castellanus* (Ceballos, 1963)، *Lysibia nana* (Gravenhorst, 1829)، *Promethes sulcator* (Gravenhorst, 1829)، *Picrostigeus setiger* (Brischke, 1871) و *Syrphophilus bizonarius* (Gravenhorst, 1829). گونه *Homotropus crassicornis* گزارش جدیدی برای فون ایران می باشد. یک کلید شناسایی برای گونه های شناخته شده جنس *Homotropus* Foerster, 1869 از ایران ارائه شد.

واژگان کلیدی: تاکسونومی، شناسایی، کلید، گزارش جدید، Diplazontinae