

## Six new species of the genus *Eumerus* Meigen, 1822 from Iran (Diptera, Syrphidae)

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**ABSTRACT.** Six new species of the genus *Eumerus* Meigen, 1822 are here described from Iran. The new species and their four related groups are as follows: *E. nadoosheni* Gilasian & van Steenis **sp. nov.** of the *Eumerus barbarus* group; *E. pollinipedes* Gilasian & van Steenis **sp. nov.** of the *Eumerus minotaurus* group; *E. effossus* Gilasian & van Steenis **sp. nov.** and *E. similis* Gilasian & van Steenis **sp. nov.** of the *Eumerus obliquus* group, as well as *E. intermedius* Gilasian & van Steenis **sp. nov.** and *E. khiabani* Gilasian & van Steenis **sp. nov.** of the *Eumerus ornatus* group. In addition, the species *E. argyropus* Loew, 1848 and *E. torsicus* Grković & Vujić, 2015 are newly recorded from Iran. The illustrations of the male genitalia and images of the new species are provided.

**Key words:** Diptera, Hoverflies, new species, Syrphidae, Eristalinae, Merodontini, taxonomy

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### INTRODUCTION

Hoverflies, with more than 6000 described species in the world and about 220 reported species from Iran, make up one of the most dominant families of the order Diptera, which primarily serve both as significant control agents of agricultural pests and important pollinators in natural and agricultural ecosystems (Doyle et al., 2020). The Old World phytophagous genus *Eumerus* Meigen, 1822 (Eristalinae, Merodontini) represents one of the most diverse genera within the family, with more than 300 species occurring frequently in arid and semi-arid regions of the world (Grković et al., 2015; Grković et al., 2019a, 2019b; van Steenis et al., 2017; Mutin, 2019; Barkalov et al., 2020; Aguardu-Aranda et al., 2022; Malidžan et al., 2022). The early stages of the *Eumerus* larvae feed on the roots, bulbs and stems of many plant families such as Liliaceae, Amarillidaceae, Orobanchaceae where some species are found to be seriously damage the commercial and ornamental harvests (Ricarte et al., 2008, 2017; Mutin, 2016, 2019; van Steenis et al., 2017; Souba-Dols et al., 2020). Prior to this study, the Iranian *Eumerus* fauna

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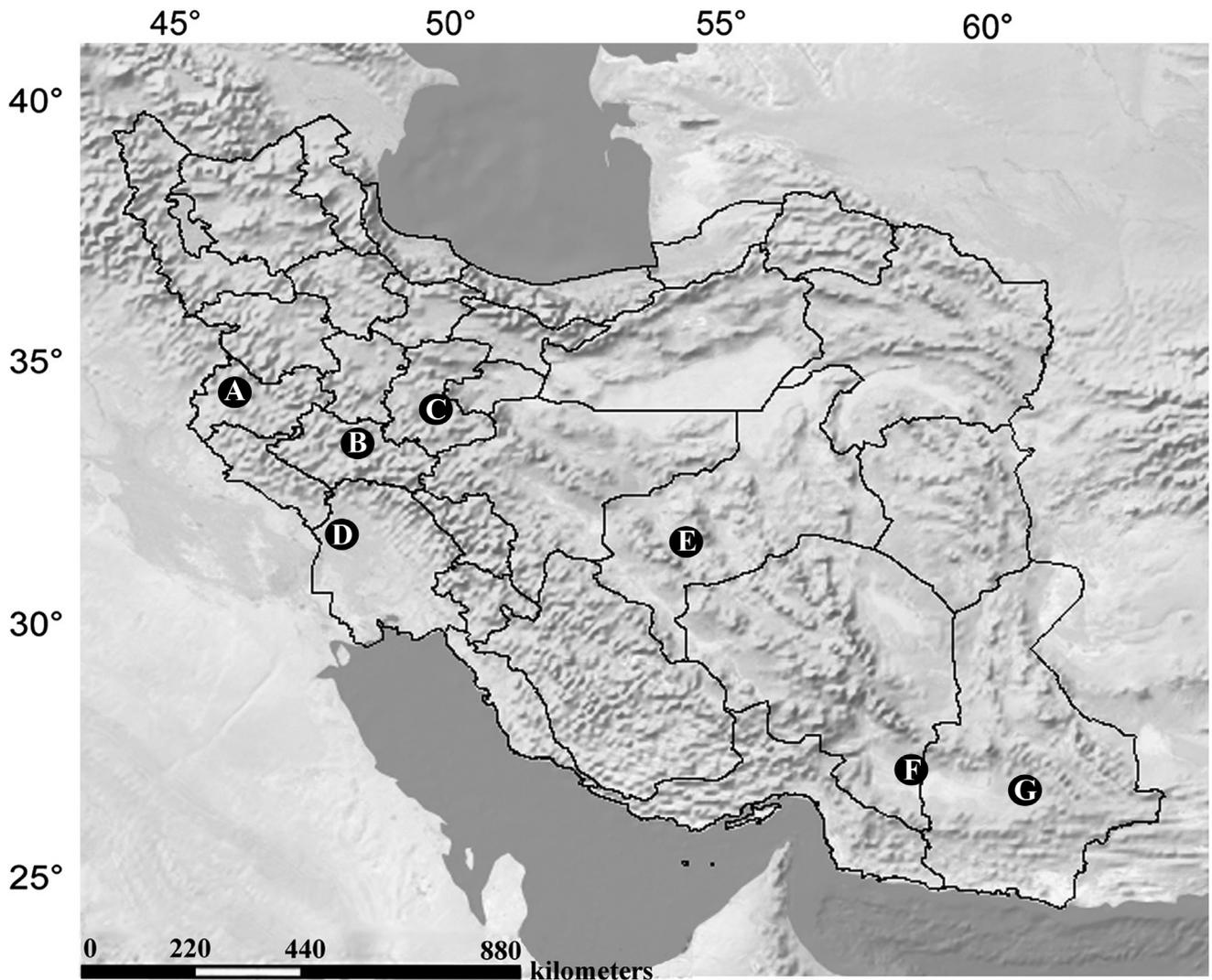
excluding the *E. strigatus* group comprises nine species of the species groups *E. ornatus*, *E. bactrianus* and *E. basalis* (Peck, 1988; Modarres Awal, 1994; Khiaban et al., 1998; Goldasteh et al., 2002; Amirimoghadam & Sirjani, 2004; Barkalov & Gharali, 2004; Kamangar et al., 2004; Khaghaninia et al., 2010; Shojaei Hesari et al., 2013; Hoseini et al., 2014).

This study raises the total number of *Eumerus* species to 34 through adding six newly described and reporting two new records within five groups of which the groups *E. torsicus*, *E. barbarus*, *E. minotaurus*, and *E. obliquus* are new to Iran. In the Palearctic region, different experts have contributed to the taxonomy of the genus, including Doczkal (1996) who described *E. niehuisi* of *E. minotaurus* group from Corsica (France) and morphologically compared it with its closest relatives *E. minotaurus* Claussen & Lucas, 1988 and *E. longicornis* Loew, 1855. Claussen & Standfuss (2017) reported the species *E. lucidus* Loew, 1848 and *E. argyropus* Loew, 1848 of the group *E. ornatus*. The fauna of the hoverflies of Arabian Peninsula was reviewed by Smit et al. (2017) who provided a key to the *Eumerus* species including *E. obliquus* (Fabricius, 1805) and *E. incilis* Smit [in Smit et al., 2017]. Van Steenis et al. (2017) reviewed the species of *E. barbarus* group in the western Mediterranean Basin and described two more species, *E. gibbosus* van Steenis, Hauser & van Zuijen, 2017 and *Eumerus schmideggeri* van Steenis, Hauser & van Zuijen, 2017, and designated a neotype and a lectotype for *E. barbarus* (Coquebert, 1804) and *E. iris* Loew, 1848, respectively. A review of the *E. minotaurus* complex by Chroni et al. (2018), resulted in the description of *E. anatolicus* Grković, Vujić & Radenković, 2018 and discovery of the three cryptic species *E. karyates* Chroni, Grković & Vujić, 2018, *E. minotaurus* Claussen & Lucas, 1988 and *E. phaeacus* Chroni, Grković & Vujić, 1988 within *E. minotaurus* group based on molecular and wing geometric morphometric analyses. With describing a new species from Montenegro, the species group *E. torsicus* was established including two species *E. incisus* Vujić & Malidžan, 2022 and *E. torsicus* Grković & Vujić, 2015 (Malidžan et al., 2022). The present study is part of a research project on the taxonomy of the Iranian species of the genus *Eumerus*, which aims to improve the existing knowledge of this genus in the western Palearctic region.

## MATERIAL AND METHODS

The specimens were collected in western, central and southeastern Iran (Figs 1, 2) using Malaise traps and pan traps with exception of a male and three females of the species *Eumerus nadoosheni* Gilasian & van Steenis **sp. nov.**, which were reared on *Cistanche* sp.. To extract the specimens from ethanol, we followed the AXA method proposed by van Achterberg (2009) to avoid their possible shrinkage, before pinning them. An Olympus BH-2 microscope, equipped with a drawing tube, was used for preparing the illustrations of the male genitalia. Inked drawings were edited using Adobe Photoshop CS2. To study the male genitalia, we gently removed the whole abdomen and heated it at 85°C in a 10% KOH solution for 15–20 minutes. The abdomen was later washed in distilled water and briefly put in glacial acetic acid to neutralize the base. Then, the genitalia were dissected to be examined and later placed in a microvial containing glycerin using as a preservative, and pinned below the source specimen. The photographs were taken with a Canon EOS D6 camera with a Canon MP-E 5× macrozoom and a Yongnuo YN 14 EX Macro Ring Flash. Multiple pictures were taken with the aid of a Stackshot macro-stacking rail and stacked with Zerene Stacker. These images were further edited with the software GIMP ver. 2.8.22 and combined into the color plates.

The specimens are deposited in the Hayk Mirzayans Insect Museum (HMIM), Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection, Tehran, Iran and also in the private collection of Jeroen van Steenis, Amersfoort, the Netherlands (JSA). The specimens studied for comparison with the newly described species are deposited in the Zoological Museum, Russian Academy of Sciences, St. Petersburg, Russia (ZISP). The morphological terminology follows Thompson (1999) for external morphology and Doczkal (1996) for the male genitalia.



**Figure 1.** Distribution of the *Eumerus* species in various regions of Iran. **A.** Kermanshah prov., Paveh (*E. torsicus* Grković & Vujić, 2015, *E. intermedius* Gilasian & van Steenis **sp. nov.**). **B.** Lorestan prov., Robot-e Namaki (*E. torsicus*). **C.** Markazi prov., Haftad-Qolleh Protected Area, Chekab valley (*E. torsicus*, *E. argyropus* Loew, 1848, *E. khiabani* Gilasian & van Steenis **sp. nov.**). **D.** Khuzestan prov., Shoush and Dez National Parks (*E. pollinopedes* Gilasian & van Steenis **sp. nov.**, *E. similis* Gilasian & van Steenis **sp. nov.**). **E.** Yazd prov., Yazd (*E. nadoosheni* Gilasian & van Steenis **sp. nov.**). **F.** Kerman prov., Jazmourian Wetland (*Eumerus effossus* Gilasian & van Steenis **sp. nov.**). **G.** Sistan and Balouchestan prov., Bampur (*E. effossus* Gilasian & van Steenis **sp. nov.**).

The following measurements are done as explained in van Steenis et al. (2017) and repeated here: width of head in frontal and dorsal views is measured at its maximum width; width of face is measured below the antennae; width of ocellar triangle is measured over the posterior ocelli dorsally; length of ocellar triangle is measured from the anterior end of the anterior ocellus to the midline posterior of the posterior ocelli; length of frontal triangle is measured from the anterior corner of the eye contiguity to the posterior corner of the lunule in dorsal view; length of vertical triangle is measured from the posterior corner of the eye contiguity to the anterior ocellus in dorsal view; the eye contiguity is the length in between the previous two measurements; width of vertex in dorsal view is measured between the posterior corner of the eyes (a) and over the posterior ocelli (b).



**Figure 2.** Habitat of the *Eumerus* species in Iran. **A.** Markazi prov., Haftad-Qolleh Protected Area, Chekab valley. **B.** Khuzestan prov., Dez National Park. **C.** Lorestan prov., Khorramabad, Robot-e Namaki.

## RESULTS

### Taxonomic hierarchy

Class Insecta Linnaeus, 1785

Order Diptera Linnaeus, 1758

Superfamily Syrphoidea Latreille, 1802

Family Syrphidae Latreille, 1802

Subfamily Eristalinae Newman, 1834

Tribe Merodontini Edwards, 1915

Genus *Eumerus* Meigen, 1822

### *Eumerus torsicus* species group

**Diagnosis.** Antenna short, metafemur strongly enlarged, abdominal sterna narrow, sternum III about 2.5 times as long as wide in male and female, metatarsomeres II–IV in male very short, posterior surstyle lobe in male genitalia very long.

*Eumerus torsicus* Grković & Vujić, 2015 (Figs 3, 5A, C, E)

**Diagnosis.** This species can be identified by the following characteristics: Eyes almost bare (Figs 3C, D), frons whitish pollinose, ocellar triangle equilateral, pedicel with yellowish-orange margin (Fig. 3E), Basoflagellomere reddish-yellow, scutum short pilose, with 2 lateral and 2 median wide pollinose vittae (Fig. 3A), metatrochanter with triangular extension (Fig. 3F), metatibia slightly curved and pointed apically, metafemur with short pile, abdomen predominantly white pilose, pollinose maculae on tergum II widely V-shaped (Fig. 3G), sternum IV with brownish pile on postero-lateral margin directed medially (Fig. 3H), male genitalia as in Figs 5A, C, E.

**Material examined.** IRAN 2 ♂♂ (glued to a card point), Markazi prov., Arak, Haftad Qolleh Protected Area, Chekab valley, 34°07'05.3"N 50°16'25.3"E, 28 May–16 July 2016, 2219 m, Malaise trap, E. Gilasian & M. Parchami-Araghi (HMIM); 1 ♂ (glued to a card point), same data as previous except for 8 June 2020, pan trap, M. Parchami-Araghi (HMIM); 2 ♂♂, same data as previous (JSA); 1 ♂ (glued to a card point), Kermanshah prov., Paveh, Dodan, 35°02'26.7"N 46°09'22.1"E, 16 June 2016, 1500 m, Malaise trap, M. Zardouei (HMIM); 1 ♀, (glued to a card point), Lorestan prov., Khorramabad, Robat-e Namaki, Rimaleh, 33°36'31.1"N 48°18'16.9"E, 28 July 2017, 2450 m, pan trap, E. Gilasian (HMIM).

**Distribution.** Greece, Cyprus, Turkey (Grković et al., 2015; Malidžan et al., 2022). Iran (**New Record**).

### *Eumerus barbarus* species group

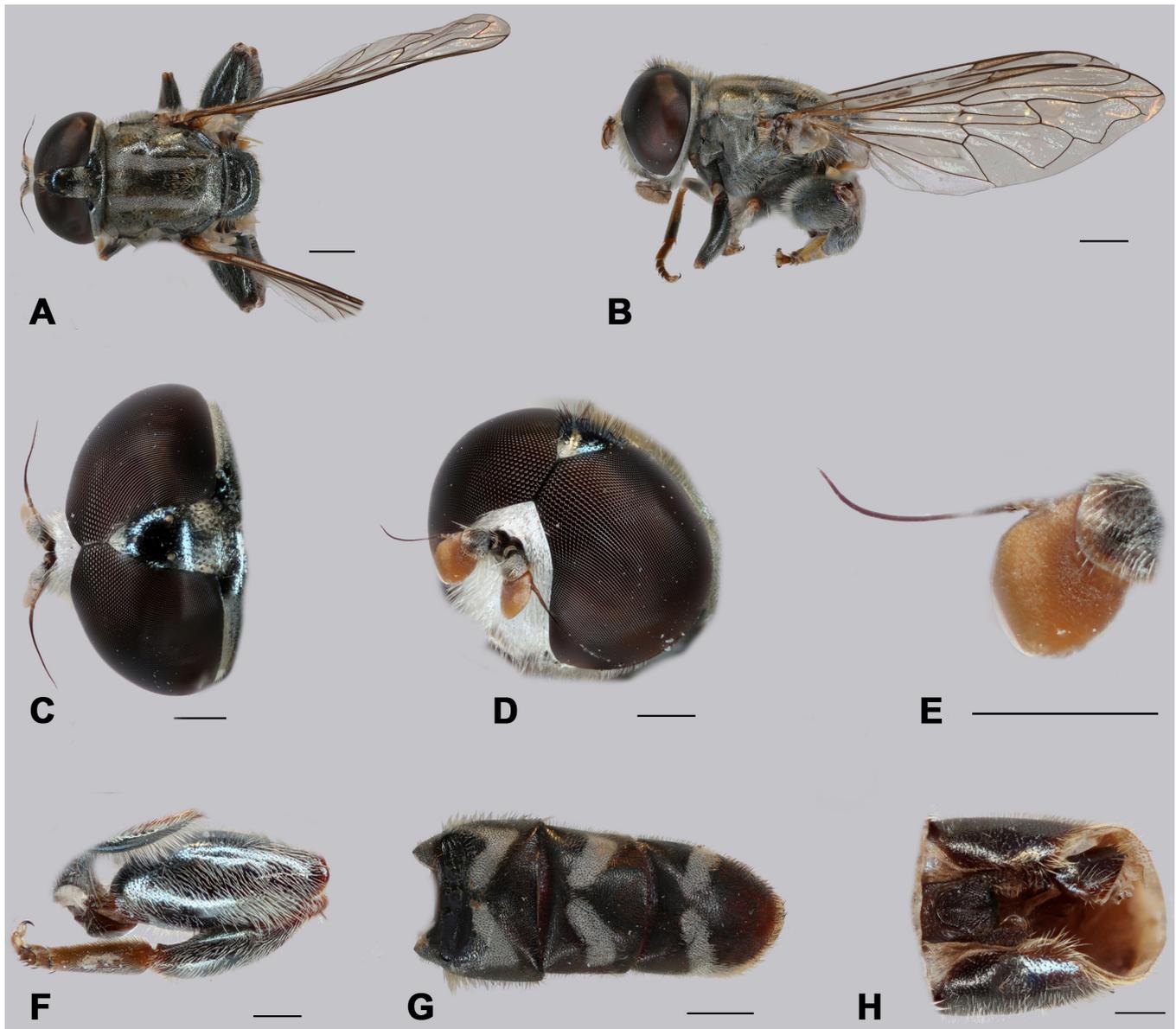
**Diagnosis.** Eyes in male holoptic, with rather long eye contiguity; basoflagellomere reddish-orange; scutum with two median pollinose vittae; notopleural suture absent; metafemur in male strongly enlarged; metatrochanter with small tubercle; posterior lobe of surstylus strongly elongated, hook-shaped apically.

*Eumerus nadoosheni* Gilasian & van Steenis sp. nov. (Figs 4, 5B, D, F)

<https://zoobank.org/urn:lsid:zoobank.org:act:AE685D51-377B-4C56-B001-78885BBB67B2>

**Differential diagnosis.** This species is closely related to *E. acuticornis* Sack, 1933 based on its isosceles ocellar triangle, yellowish-orange coloration of tergum IV in posterior 1/4, almost bare eyes, square basoflagellomere compared to rectangularly shaped in *E. acuticornis*; scutum anteromedially with two wide pollinose vittae (absent in *E. acuticornis*); pollinose maculae on abdominal tergum IV short and almost straight while strongly oblique and long in *E. acuticornis*; sternum IV with median U-shaped incision posteriorly compared to V-shaped in *E. acuticornis*; legs mostly reddish, tibiae with a very narrow median dark ring, metabasitarsus entirely red, comparing distinctly darker legs in *E. acuticornis*; oblique maculae on abdominal tergum IV almost straight comparing skewed oblique maculae in *E. acuticornis*. Furthermore the species *E. acuticornis* seems to be endemic to southern Mongolia.

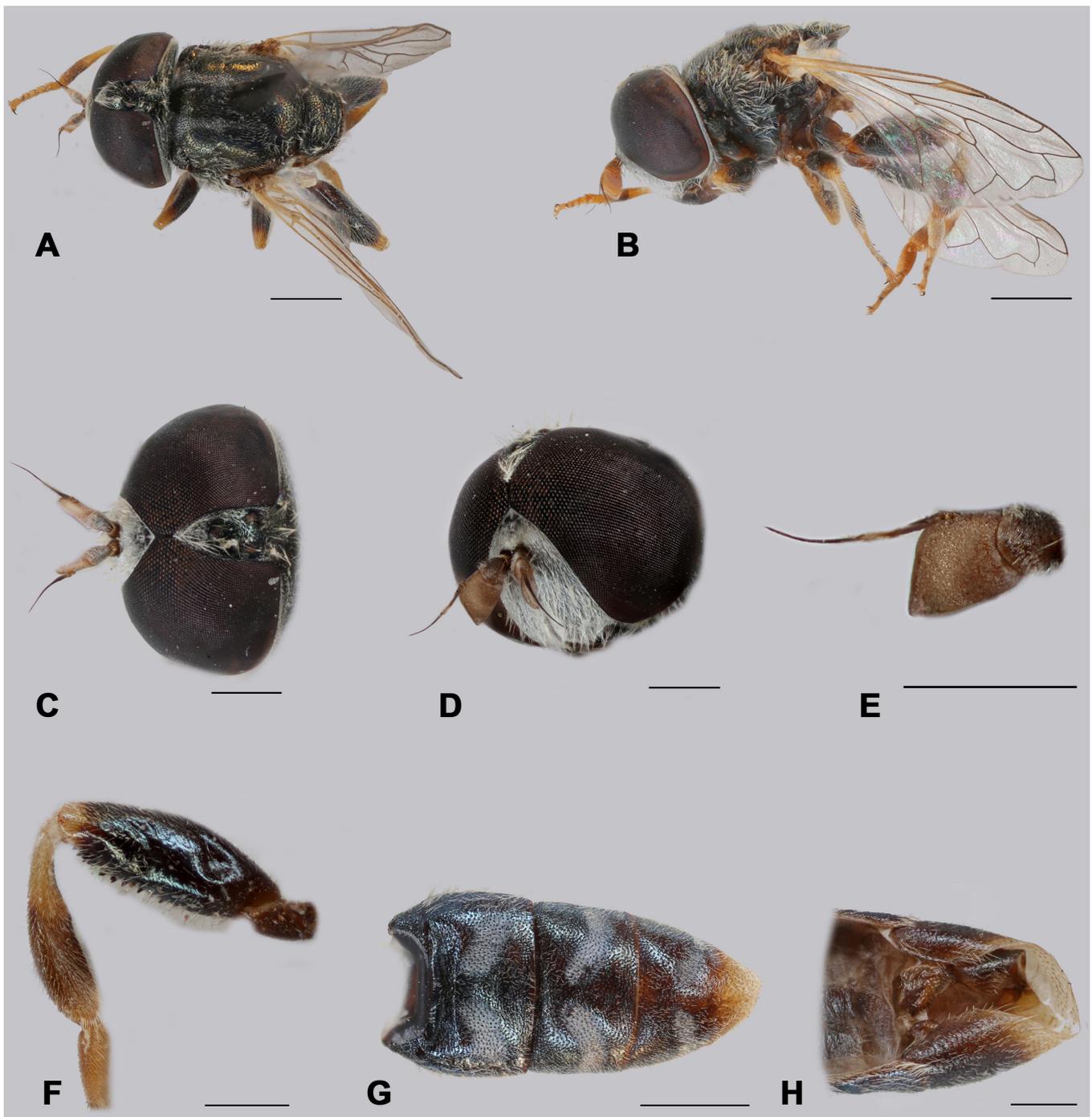
**Material examined. Holotype:** IRAN ♂ (pinned), Yazd prov., Ardakan to Chah Afzal rd., June–2018, reared larva found on *Cistanche* sp., Ali Jafari Nadooshen (HMIM). **Paratypes:** 3 ♀♀: same data as holotype, 2 ♀♀ (HMIM), 1 ♀ (JSA).



**Figure 3.** *Eumerus torsicus* Grković & Vujić, 2015. **A.** Habitus, dorsal view (scale bar: 1 mm). **B.** Habitus, lateral view (scale bar: 1 mm). **C.** Head, dorsal view (scale bar: 0.5 mm). **D.** Head, fronto-dorsal view (scale bar: 0.5 mm). **E.** Antenna, lateral view (scale bar: 0.5 mm). **F.** Metaleg (scale bar: 0.5 mm). **G.** Abdomen, dorsal view (scale bar: 1 mm). **H.** Sternum IV (scale bar: 0.5 mm).

**Etymology.** This species is dedicated to Dr. Ali Jaafari Nadooshen, who collected the material. The specific epithet is a noun in the genitive case.

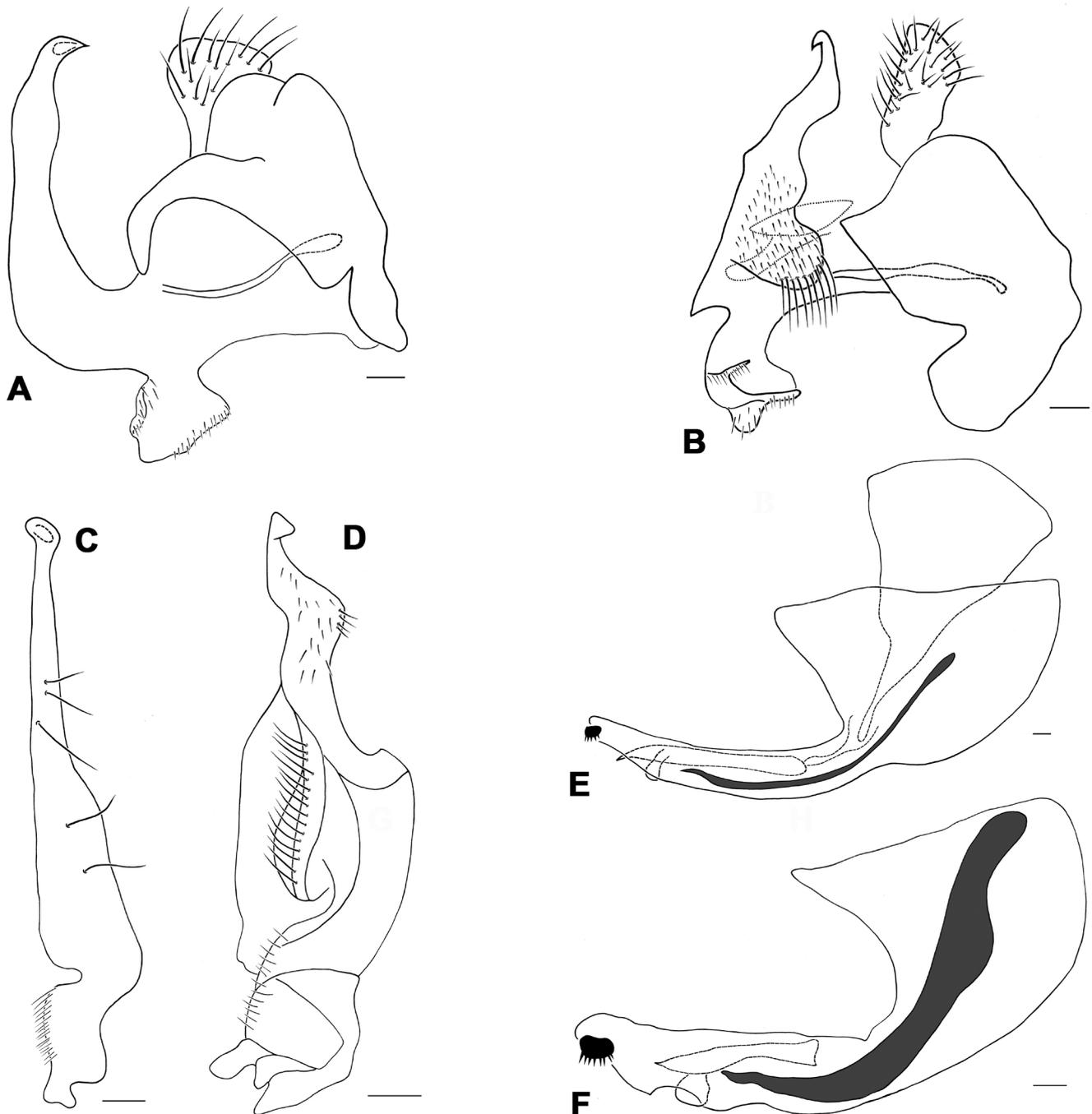
**Description — Male.** Body length: 6.0 mm; wing length: 4.3 mm. **Head** (Figs 4C, D). Eyes almost bare, holoptic; eye contiguity almost 0.75 times as long as frontal triangle; face white pilose, densely covered with white pollinosity; frontal and vertical triangles almost equal in length, white pollinose with white pile; head in frontal view about 2.8 times as wide as face; ocellar triangle isosceles, shiny black, white pilose; distance between posterior ocelli and posterior margin of eye about 0.75 times as long as ocellar triangle; occiput grey pollinose; frontal triangle 1.8 times as wide as ocellar triangle; vertex at posterior corner of eyes about 1.1 times as wide as vertex over posterior ocelli; head in dorsal view 4.4 times as wide as vertex at posterior corner of eyes; scape, pedicel and arista brownish-orange; basoflagellomere orange, square-shaped and pointed apicoventrally; arista 1.9 times as long as basoflagellomere (Fig. 4E).



**Figure 4.** *Eumerus nadoosheni* Gilasian & van Steenis **sp. nov.** (male, holotype). **A.** Habitus, dorsal view (scale bar: 1 mm). **B.** Habitus, lateral view (scale bar: 1 mm). **C.** Head, dorsal view (scale bar: 0.5 mm). **D.** Head, fronto-dorsal view (scale bar: 0.5 mm). **E.** Antenna, lateral view (scale bar: 0.5 mm). **F.** Metaleg (scale bar: 0.5 mm). **G.** Abdomen, dorsal view (scale bar: 1 mm). **H.** Sternum IV (scale bar: 0.5 mm).

**Thorax.** Scutum and scutellum shiny black with green lustre, short whitish pilose; scutum with two median wide grey pollinose vittae (Fig. 4A); scutellum with marginal rim; pleurae shiny black, covered with whitish pile except for bare meron and katepimeron; metasternum pilose. **Legs.** Short yellowish-white pilose; femora mostly brownish-black, orange apically; tibiae black in apical half; tarsi orange; metafemur strongly enlarged, about 2.5 times as long as wide (Fig. 4F), ventral pile short and about 1/3 of the width of metafemur; anteroventral and posteroventral margins of metafemur with an apical row

of six and nine black setae respectively. **Wing.** Hyaline; entirely microtrichose; calypters yellowish-white; halter yellowish-orange. **Abdomen** (Fig. 4G). Predominantly brownish-black with short whitish pile; posterior margin of tergum IV yellowish-orange; terga II-IV with a pair of slightly oblique white pollinose maculae; maculae on tergum IV short and almost straight; sternum IV trapezoidal, with median U-shaped incision posteriorly (Fig. 4H). **Male genitalia.** Hypandrium simple; aedeagal apodeme in lateral view as in Fig. 5F; epandrium, cercus, posterior and anterior lobes of surstylus as in Figs 5B, D.



**Figure 5.** Male genitalia. **A, C, E.** *Eumerus torsicus* Grković & Vujić, 2015. **A.** Lateral view. **C.** Dorsal view. **E.** Hypandrium. **B, D, F.** *E. nadoosheni* Gilasian & van Steenis **sp. nov.** **B.** Lateral view. **D.** Dorsal view. **F.** Hypandrium. Scale bar: 0.1 mm.

**Female.** Body length: 4.5–6.1 mm; wing length: 3.5–4.5 mm. Similar to the male except for sexual dimorphism and for the following characters: Distance between posterior ocelli and posterior margin of eye about as long as ocellar triangle; vertex at posterior corner of eyes about 0.9 times as wide as vertex over posterior ocelli; head in dorsal view about 5.1 times as wide as vertex at posterior corner of eyes; basoflagellomere slightly longer than male; arista 1.4 times as long as basoflagellomere; tergum IV almost entirely black.

**Distribution.** Iran.

**Remarks.** The type material of *Eumerus acuticornis* was not available for this study. The original description (Sack, 1933) and the description in Stackelberg (1961) were used to identify this species.

### *Eumerus minotaurus* species group

**Diagnosis.** The species of this group are easily distinguished from other *Eumerus* species by their long pedicels, at least 1.5 times as long as wide.

### *Eumerus pollinipedes* Gilasian & van Steenis sp. nov. (Figs 6, 7, 8)

<https://zoobank.org/urn:lsid:zoobank.org:act:7967C5D1-53FE-43D2-ADBB-E8290ED83EFC>

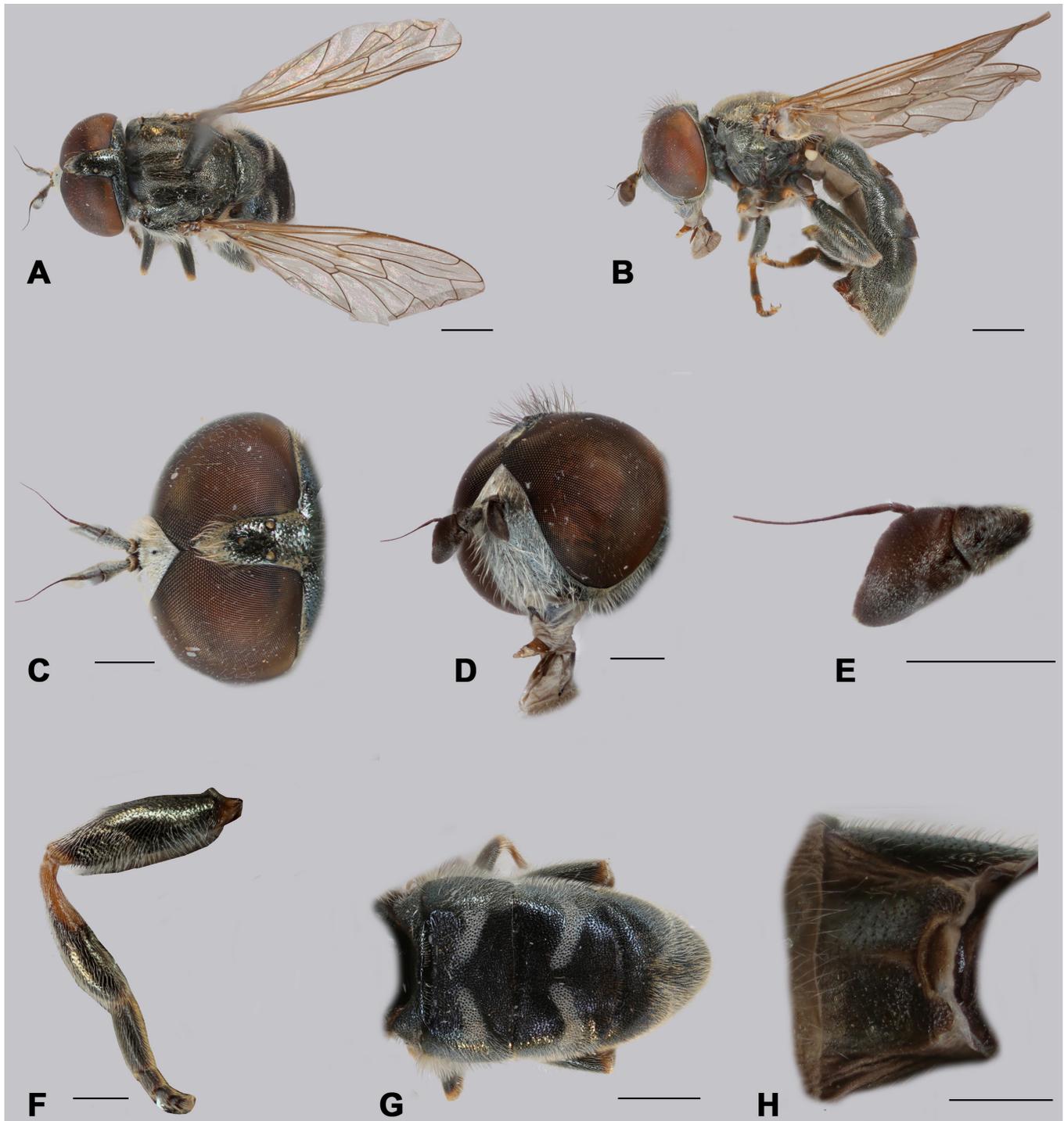
**Differential diagnosis:** This species is closely related to *E. niehuisi* Doczkal, 1996 and *E. crassus* Grković, Vujić & Radenković [in Grković et al., 2015]. The later species, in the original description, was compared to *E. sogdianus* Stackelberg, 1952 from the *E. strigatus* species group (Grković et al., 2015), it belongs however to the *E. minotaurus* group.

Body length about 6.5 mm (in *E. niehuisi* 9–10 mm); ocellar triangle equilateral (isosceles in *E. niehuisi*); pedicel with long pile ventrally, much longer than dorsal pile (in *E. crassus* and *E. niehuisi* with shorter pile, ventral pile only slightly longer than dorsal pile); face and frontal triangle with entirely white pollinosity (in *E. crassus* and *E. niehuisi* white pollinose in ventral part and yellow pollinose in dorsal part); scutum with 3 distinct pollinose vittae extending to posterior portion of transverse suture (in *E. crassus* lateral vittae extending almost to scutellum, in *E. niehuisi* median vitta very narrow or absent); supra-alar callus with yellow pile posteriorly as in *E. crassus*, at most one black pilus present (in *E. niehuisi* mixed of yellow and black pile); pre-genital segment yellowish pilose (in *E. niehuisi* with brownish-black pile); lunulate pollinose maculae on tergum IV clearly developed (in *E. crassus* absent and in *E. niehuisi* either weakly developed or absent); sternum IV wide, squarish, posterior margin with two small rounded lobes and a very wide weakly curved incision medially, this incision wide, two times wider than width of one lobe (in *E. crassus* less squarish, with more rounded postero-lateral corners, and incision less wide, only slightly wider than width of one lobe, in *E. niehuisi* lobes very wide, incision as wide as one lobe), cercus with small lobe ventrally (in *E. crassus* this lobe more clearly defined and more dorsally situated, in *E. niehuisi* with rather large lobes divided by a medial incision, dividing the apex into two equally sized lobes), surstylus broadly triangular shaped as in *E. niehuisi*, although the basal part clearly narrower in *E. niehuisi* (in *E. crassus* more rectangular shaped and with relatively narrow basal part).

Furthermore *E. pollinipedes* Gilasian & van Steenis sp. nov. differs from *E. crassus* by much less dense pile on eyes; vertical triangle with pollinosity at eye contiguity and poster-laterally from the posterior ocelli, along eye margin (in *E. crassus* seemingly without pollinosity), pile on tergum IV as long as pile on terga II and III (in *E. crassus* longer than pile on terga II and III).

**Material examined. Holotype:** IRAN ♂ (pinned), Khuzestan prov., Dez National Park, Mianrood, sanctuary for Persian Fallow Deer, 32°06'11.2"N 48°26'43"E, 11 March–10 May 2015, 50 m, Malaise trap, E. Gilasian (HMIM). **Paratypes, 9** ♂♂, **16** ♀♀: 1 ♂, 4 ♀♀, same data as holotype (HMIM); 2 ♂♂, same data as holotype except for 32°06'24.5"N 48°26'16.8"E, 53 m (HMIM); 2 ♂♂, 1♀, same as previous (JSA); 2 ♂♂,

4 ♀♀ (pinned), Khuzestan prov., Shoush, Karkheh National Park, Persian Fallow Deer sanctuary, 32°04'36.5"N 48°14'15.6"E, 11 March–10 May 2015, 45 m, Malaise trap, E. Gilasian (HMIM); 2 ♂♂, 4 ♀♀, same as previous except for 32°04'42.7"N 48°14'33.2"E, 45 m (HMIM); 3 ♀♀, same as previous (JSA).



**Figure 6.** *Eumerus pollinipedes* Gilasian & van Steenis **sp. nov.** (male). **A.** Habitus, dorsal view, holotype (scale bar: 1 mm). **B.** Habitus, lateral view, holotype (scale bar: 1 mm). **C.** Head, dorsal view, paratype (scale bar: 0.5 mm). **D.** Head, fronto-lateral view, holotype (scale bar: 0.5 mm). **E.** Antenna, lateral view, holotype (scale bar: 0.5 mm). **F.** Metaleg, paratype (scale bar: 0.5 mm). **G.** Abdomen, dorsal view, holotype (scale bar: 1 mm). **H.** Sternum IV, paratype (scale bar: 0.5 mm).

**Etymology.** The specific epithet “pollinipedes” consists of the words pollinis, Latin for pollen and pedes, Latin for legs, referring to the extensively pollinose legs, which occur in both *E. niehuisi* and *E. crassus*. The epithet is a noun in apposition.

**Description — Male.** Body length: 5.8–6.4 mm; wing length: 4.8–5.4 mm. **Head** (Figs 6C, D). Eyes short pilose, holoptic; eye contiguity 0.37–0.50 times as long as frontal triangle; face and frontal triangle white pilose, densely covered with white pollinosity; vertical triangle white pollinose on anterior 1/2–2/3, with yellow to yellowish-brown pile; frontal and vertical triangles almost equal in length; head in frontal view about 3 times as wide as face; ocellar triangle equilateral, shiny black, with brown to brownish-black pile; distance between posterior ocelli and posterior margin of eye about 0.8 times as long as ocellar triangle; occiput grey pollinose; frontal triangle 1.5 times as wide as ocellar triangle; vertex at posterior corner of eyes about 1.3 times as wide as vertex over posterior ocelli; head in dorsal view 4.2 times as wide as vertex at posterior corner of eyes; antenna dark brown; pedicel about 0.55 times as long as basoflagellomere and with long pile ventrally, at least 1/2 times as long as width of pedicel; arista 1.5 times as long as basoflagellomere (Fig. 6E). **Thorax.** Blackish, with green lustre, scutum predominantly short yellowish pilose, a few black pile present in postsutural portion; scutum with 3 distinct grey pollinose vittae extending to posterior portion of transverse suture (Fig. 6A); scutellum with a marginal rim and slightly serrated posteriorly, white pilose; pleurae covered with whitish pile except for bare meron and katepimeron; metasternum pilose. **Legs.** Predominantly white pollinose, with yellowish-white pile; femora black with exception for narrow apical orange margin; tibiae orange in basal 1/3 and black in apical 2/3; tarsi orange ventrally and black dorsally; metafemur incrassate, about 3.6 times as long as wide (Fig. 6F), ventral pile about 1/3 as wide as metafemur; anteroventral and posteroventral margins of metafemur with an apical row of 9 and 12 black setae respectively. **Wing.** Hyaline; entirely microtrichose; calypters yellowish-white; halter yellowish-orange. **Abdomen** (Fig. 6G). Brownish-black, with green lustre, short whitish pilose; terga II–III each with a pair of oblique pollinose maculae; tergum IV with a pair of narrow lunulate white pollinose maculae; sternum IV square, with a shallow median U-shaped incision posteriorly (Fig. 6H). **Male genitalia.** Hypandrium simple; aedeagal apodeme in lateral view as in Fig. 8C; epandrium, cercus, posterior and anterior lobes of surstylus as in Figs 8A, B.

**Female** (Fig. 7). Body length: 6.3–9.0 mm; wing length: 5.1–7.2 mm. Similar to the male except for the sexual dimorphism and for the following characters: Frons mostly shiny black, narrowly pollinose along eye margin (Fig. 7C); head in dorsal view about 3.9 times as wide as vertex at posterior corner of eyes.

**Distribution.** Iran.

**Remarks.** The type material of *Eumerus crassus* or *E. niehuisi* was not available for this study. The original descriptions (Doczkal, 1996; Grković et al., 2015) were used to identify these species.

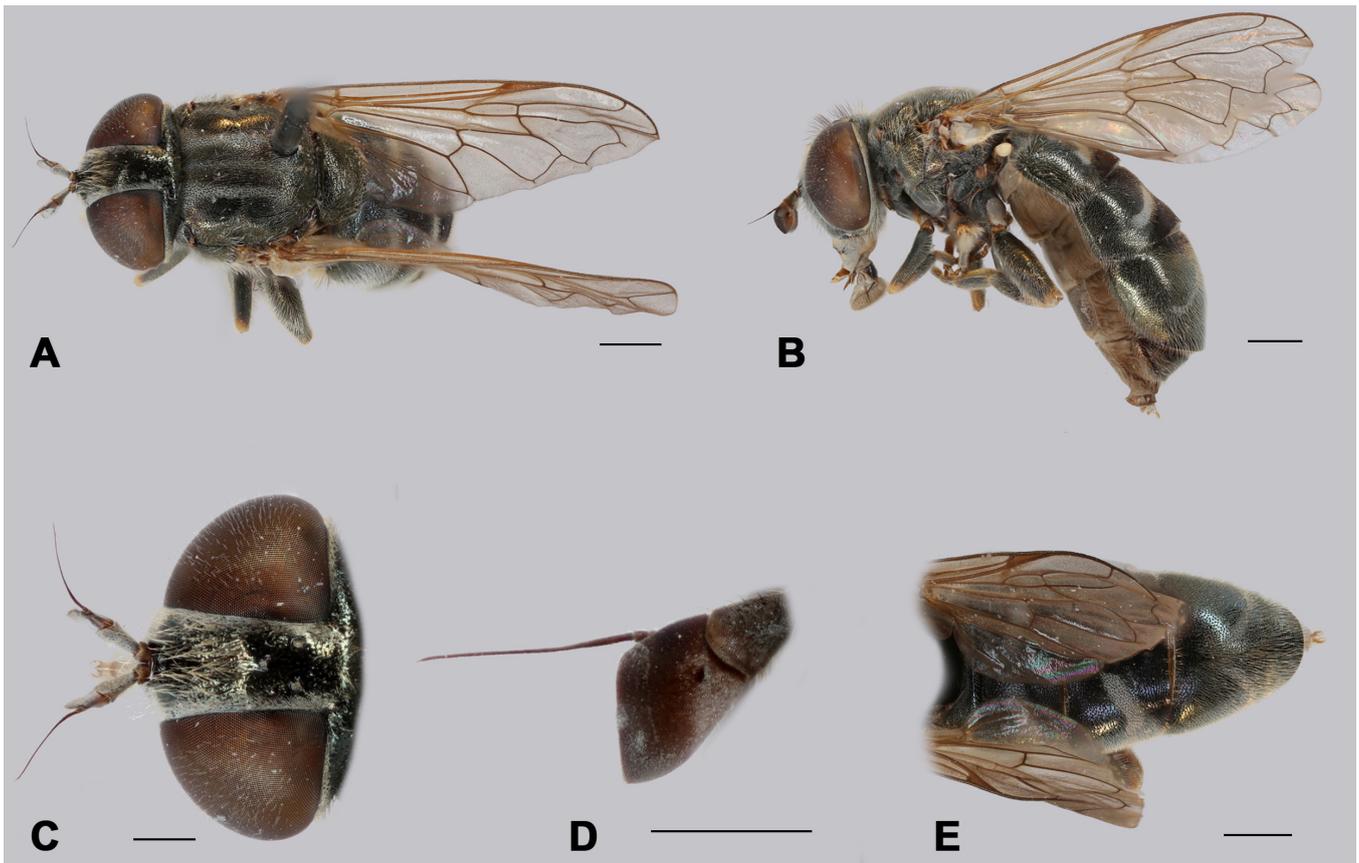
### *Eumerus obliquus* species group

**Diagnosis.** Robust flies; male holoptic, eyes contiguity long; frons in female extensively and densely pollinose; scutum densely grey pollinose laterally; scutellum with whitish pollinosity posteriorly; metabasitarsus in male with dense black pile dorsally; body punctuation always very deep.

*Eumerus effossus* Gilasian & van Steenis sp. nov. (Figs 9, 12A, C, E)

<https://zoobank.org/urn:lsid:zoobank.org:act:49ED024D-FA90-4FC8-89A6-E336531AD59E>

**Differential diagnosis.** This species is closely related to *E. incilis* for its deep excavation on metabasitarsus and two apicoventral black spina on metatibia. It is separated from *E. incilis* by the following characteristics:

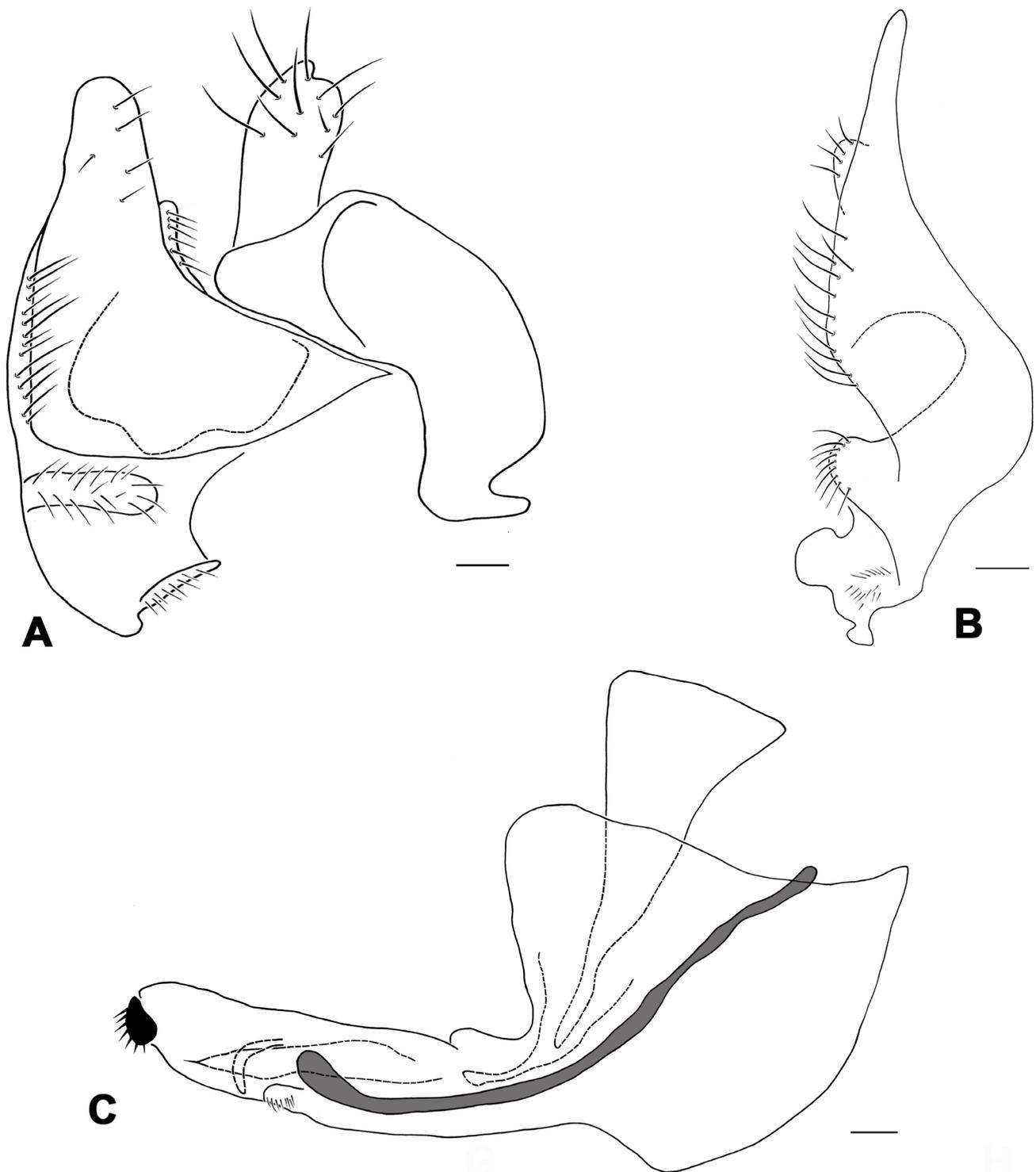


**Figure 7.** *Eumerus pollinipedes* Gilasian & van Steenis **sp. nov.** (female, paratype). **A.** Habitus, dorsal view (scale bar: 1 mm). **B.** Habitus, lateral view (scale bar: 1 mm). **C.** Head, dorsal view (scale bar: 0.5 mm). **D.** Antenna, lateral view (scale bar: 0.5 mm). **E.** Abdomen, dorsal view (scale bar: 1 mm).

The dorsal pilosity of metabasitarsus very short, with longer dense black subappressed setae-like pile apically (in *E. incilis* the entire dorsal surface of metabasitarsus with medium long pile); legs and basoflagellomere in male extensively brownish compared to predominantly black in *E. incilis*; abdominal tergum II white pollinose anterolaterally with a pair of oblique pollinose maculae (in *E. incilis* only with oblique pollinose maculae); sternite IV in male rounded at posterior corners with a shallow median U-shaped incision (compare with Fig. 25 in Smit et al., 2017, page 583 for sternite IV of *E. incilis*).

The species *E. effossus* Gilasian & van Steenis **sp. nov.** is incorporated into the identification key to the species of the *E. obliquus* species group provided by Ricarte et al. (2020) as follows:

- 4 Eye with short sparse pile; metabasitarsus, in male, with a small basal tooth in the sulcus [see figure 30 in Smit et al. (2017)]..... *E. vestitus*
- Eye bare; metabasitarsus, in male, without teeth in the sulcus [see figure 30 in Smit et al. (2017)]. ..... 4 (a)
- 4 (a) Dorsal pilosity of metabasitarsus very short, with longer dense black subappressed setae-like pile apically; metabasitarsus in male yellowish-orange; abdominal tergum II white pollinose anterolaterally with a pair of oblique pollinose maculae. .... *E. effossus* **sp. nov.**
- Dorsal pilosity of metabasitarsus with medium long pile; metabasitarsus in male predominantly black; abdominal tergum II only with oblique pollinose maculae. .... *E. incilis*



**Figure 8.** Male genitalia. *Eumerus pollinipedes* Gilasian & van Steenis **sp. nov.** **A.** Lateral view. **B.** Dorsal view. **C.** Hyandrium. Scale bar: 0.1 mm.

**Etymology.** The specific epithet “effossus”, Latin for excavated, refers to the deeply excavated metabasitarsus, which is only shared with *E. incilis*. It is to be treated as a noun in apposition.

**Material examined. Holotype:** IRAN ♂ (glued to a card point), Sistan & Balouchestan prov., Bampour, Agricultural Research Center, 27°11'56"N 60°29'52"E, 4 March–21 May 2016, 525 m, Malaise trap, F.

Basavand (HMIM). **Paratypes**, 4 ♀♀: 1 ♀, (glued to a card point), Sistan & Balouchestan prov., Sarbaz, Sefid Sang village, 28°38'21.4"N 61°16'19.9"E, 10 March–15 May 2017, 903 m, Malaise trap, F. Basavand (HMIM); 2 ♀♀, (glued to a card point), Kerman prov., Zeh-Kaloot, Jazmourian Wetland, Chah-Alam village, palm grove, 27°44'43.2"N 58°34'37"E, 30 May–10 September 2017, 387 m, Malaise trap, Mehrdad Parchami-Araghi (HMIM); 1 ♀, same as previous (JSA).

**Description — Male.** Body length: 3.8 mm; wing length: 3.7 mm. **Head** (Figs 9C, D). Eyes bare, holoptic; eye contiguity 0.65 times as long as frontal triangle; face white pilose, densely covered with white pollinosity; frontal and vertical triangles almost equal in length, with white pollinose and white pile; head in frontal view about 3 times as wide as face; ocellar triangle isosceles, white pollinose on about anterior half with white pile; distance between posterior ocelli and posterior margin of eye about 0.5 times as long as ocellar triangle; occiput grey pollinose; frontal triangle twice as wide as ocellar triangle; vertex at posterior corner of eyes about 1.1 times as wide as vertex over posterior ocelli; head in dorsal view 5.7 times as wide as vertex at posterior corner of eyes; antenna brownish-orange, arista 1.5 times as long as basoflagellomere (Fig. 9E). **Thorax.** Scutum with long white pile, predominantly white pollinose except for two median brownish vittae and four semi-square brownish spots (two anteriorly and two posteriorly located to the transverse suture) (Fig. 9A); scutellum brownish, with long white pile, densely white pollinose at posterior margin; pleurae brownish, covered with whitish pile except for bare meron and katapimeron; metasternum pilose. **Legs.** Yellowish-orange with yellowish-white pile; metafemur enlarged, about 2.7 times as long as wide (Fig. 9F), ventral pile about 1/3 times as wide as metafemur; anteroventral and posteroventral margins of metafemur with an apical row of 8 and 4 black setae respectively; metatibia with two apicoventral black spina; metabasitarsus with an excavation, dorsal pile very short, with long dense black subappressed setae-like pile apically (Fig. 9G). **Wing.** Hyaline; entirely microtrichose; calypters yellowish-white; halter yellowish-orange. **Abdomen** (Fig. 9H). Brownish-orange with short whitish pile; terga II–III each with a pair of oblique pollinose fasciae, narrowly connected medially; tergum II anterolaterally and tergum III laterally white pollinose; tergum IV predominantly white pollinose except for a narrow anterior shiny brownish margin, sternum IV rounded at posterior corners, with a shallow median U-shaped incision posteriorly. **Male genitalia.** Hypandrium simple; aedeagal apodeme in lateral view as in Fig. 12E; epandrium, cercus, posterior and anterior lobes of surstylus as in Figs 12A, C.

**Female.** Body length about 5.5–7.1 mm; wing length: 4.4–6.0 mm. Similar to the male except for the sexual dimorphism and for the following characters: Darker than male; head in dorsal view about 5 times as wide as vertex at posterior corner of eyes; metabasitarsus unmodified, without excavation.

**Comment.** Considering the presence of a single male specimen, we interpret the existing different coloration between the sexes more likely as a result of discoloration of the male due to preservation in ethanol than a morphological sexual dimorphism.

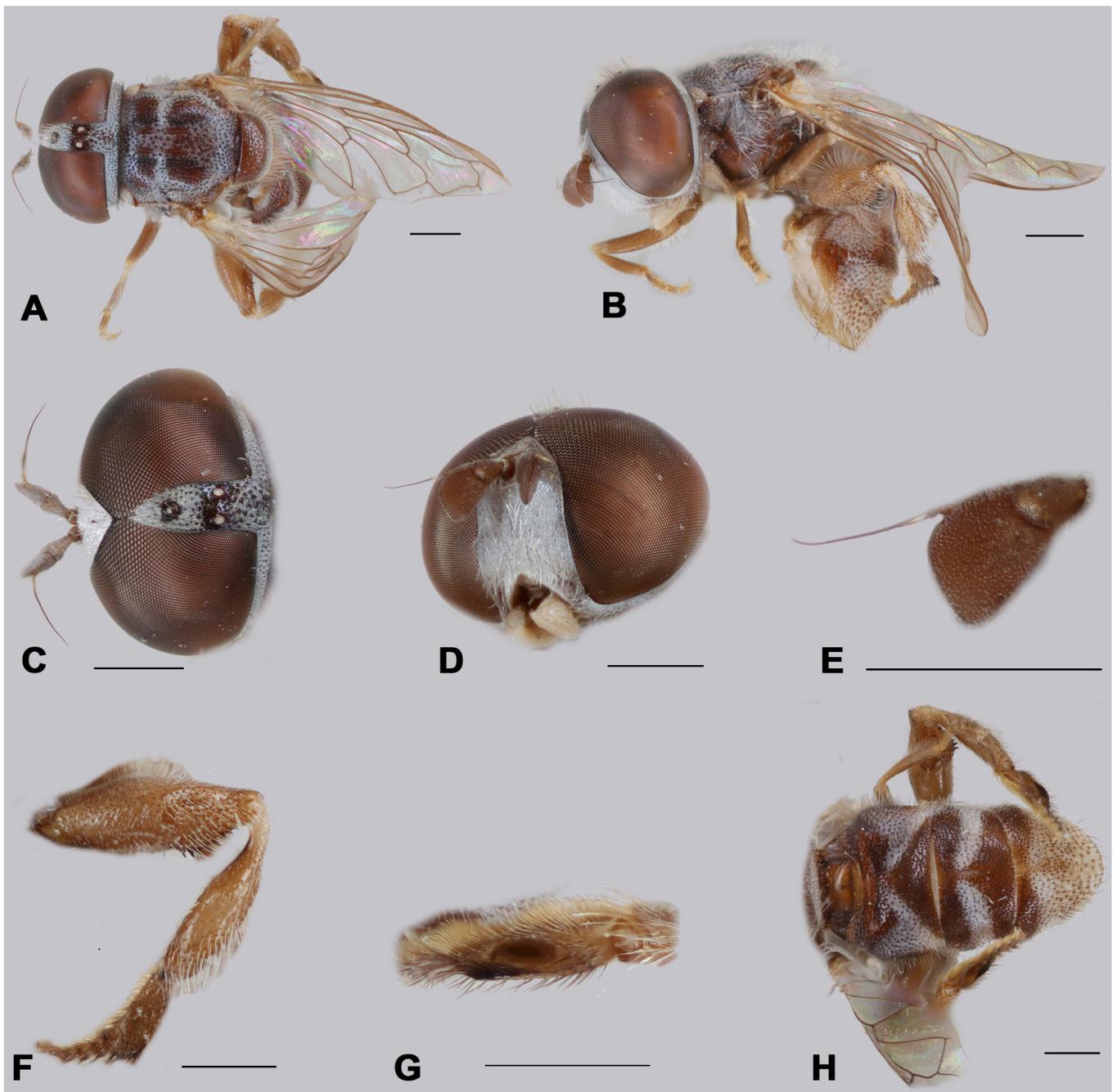
**Distribution.** Iran.

**Remarks.** The type material of *Eumerus incilis* was not available for this study. The original description (Smit et al., 2017) and the paper on the *E. obliquus* group (Ricarte et al., 2020) were used to identify this species.

*Eumerus similis* Gilasian & van Steenis sp. nov. (Figs 10, 11, 12B, D)

<https://zoobank.org/urn:lsid:zoobank.org:act:08CC26BD-6EDD-4FA2-AA3A-47125A0D0690>

**Differential diagnosis.** Although it has morphological similarities to *E. obliquus* (Fabricius, 1805), strikingly differs from this species in male genitalia for its hook-shaped and apically rounded posterior lobe of surstylus (Fig. 12B) compared to that rectangularly shaped in *E. obliquus* (See Fig. 127A in Grković, 2018, page 172 for the male genitalia of *E. obliquus*).



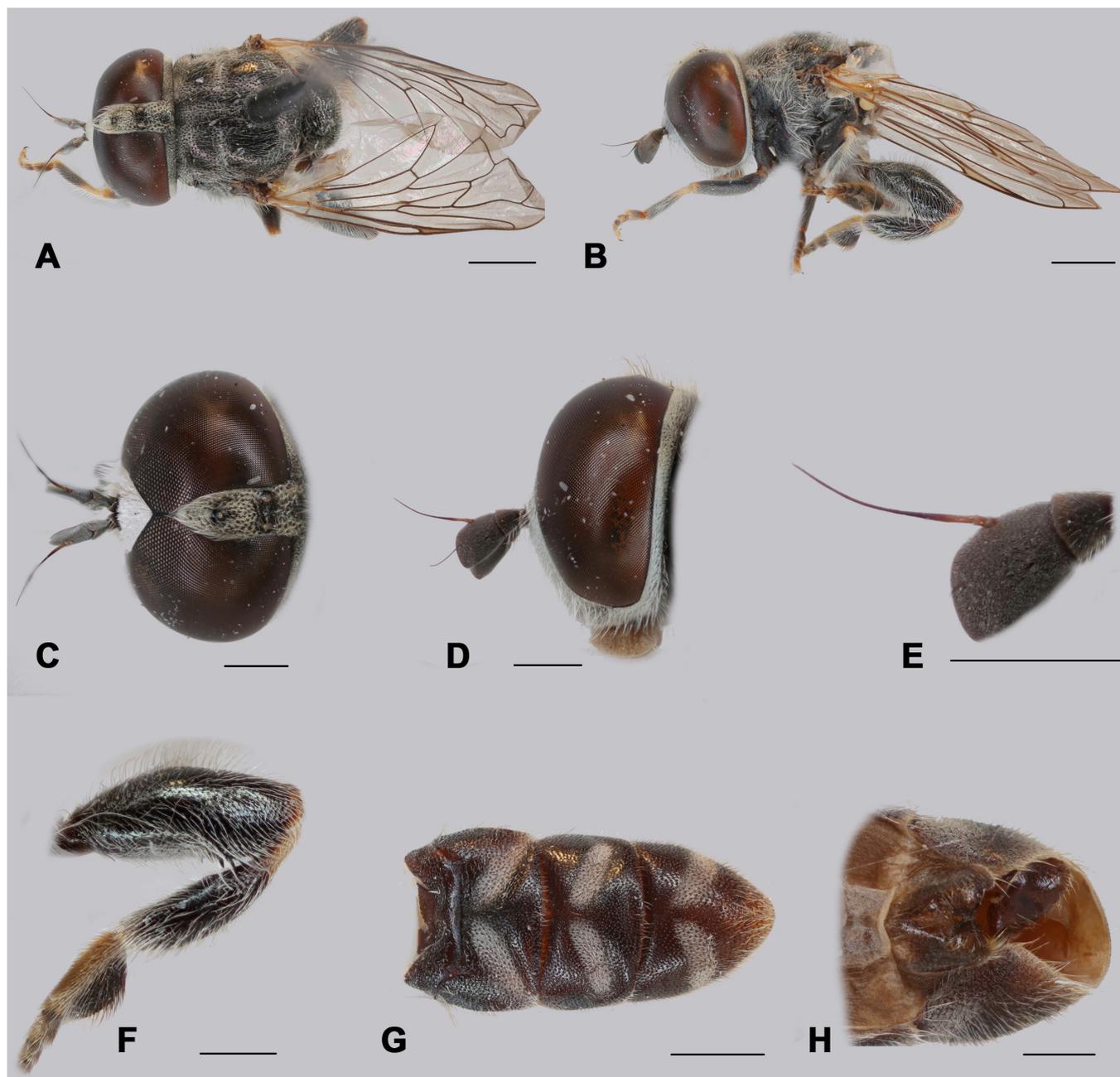
**Figure 9.** *Eumerus effossus* Gilasian & van Steenis **sp. nov.** (male, holotype). **A.** Habitus, dorsal view. **B.** Habitus, lateral view. **C.** Head, dorsal view. **D.** Head, fronto-lateral view. **E.** Antenna, lateral view. **F.** Metaleg. **G.** Metabasitarsus, dorsal view. **H.** Abdomen, dorsal view. Scale bar: 0.5 mm.

This species is incorporated into the identification key to the species of the *E. obliquus* species group provided by Ricarte et al. (2020) as follows:

- 5. Metabasitarsus in male laterally compressed, with a dorsal ridge. .... 5 (a)
- Metabasitarsus without a dorsal ridge. .... *E. punctifrons*
- 5 (a) Vertex with black pile and extensive areas free of pollinosity or sparsely pollinose; posterior lobe of surstylus recangularly shaped apically. .... *E. obliquus*
- Vertex without black pile, covered in dense pollinosity except for a narrow area surrounding each ocellus; posterior lobe of surstylus hook-shaped and apically rounded. .... *E. similis* **sp. nov.**

**Etymology.** The specific epithet “*similis*” is Latin for ‘resembling’ based on the similarity in non-genital characters of this species with *E. obliquus*. It is to be treated as a noun in apposition.

**Material examined.** **Holotype:** IRAN ♂ (pinned), Khuzestan prov., Shoush, Karkheh National Park, Persian Fallow Deer Sanctuary, 32°06'25.5"N 48°26'14.8"E, 11 March–10 May 2015, 53 m, Malaise trap, E. Gilasian (HMIM). **Paratypes,** 2 ♀♀: 2 ♀♀, (one pinned, one glued to a card point), same data as holotype (HMIM, JSA).



**Figure 10.** *Eumerus similis* Gilasian & van Steenis **sp. nov.** (male, holotype). **A.** Habitus, dorsal view (scale bar: 1 mm). **B.** Habitus, lateral view (scale bar: 1 mm). **C.** Head, dorsal view (scale bar: 0.5 mm). **D.** Head, lateral view (scale bar: 0.5 mm). **E.** Antenna, lateral view (scale bar: 0.5 mm). **F.** Metaleg (scale bar: 0.5 mm). **G.** Abdomen, dorsal view (scale bar: 1 mm). **H.** Sternum IV (scale bar: 0.5 mm).

**Description — Male.** Body length: 6.3 mm; wing length: 5.2 mm. **Head** (Figs 10C, D). Eyes short pilose, holoptic; eye contiguity 0.65 times as long as frontal triangle; face white pilose, densely covered with white pollinosity; frontal and vertical triangles almost equal in length, with white pollinose and white pile; head in frontal view about 3 times as wide as face; ocellar triangle isosceles, white pollinose except for circle shiny area around ocelli; distance between posterior ocelli and posterior margin of eye about 0.6 times as long as ocellar triangle; occiput grey pollinose; frontal triangle about twice as wide as ocellar triangle; vertex at posterior corner of eyes about 1.1 times as wide as vertex over posterior ocelli; head in dorsal view 5.6 times as wide as vertex at posterior corner of eyes; antenna brownish-black, arista 1.65 times as long as basoflagellomere (Fig. 10E). **Thorax.** Scutum with long white pile, predominantly white pollinose except for two median blackish vittae and four semi-square blackish maculae (two anteriorly and two posteriorly located to transverse suture) (Fig. 10A); scutellum blackish, with long white pile, densely white pollinose at posterior margin; pleurae blackish, covered with whitish pile except for bare meron and katepimeron; metasternum pilose. **Legs.** Yellowish-white pilose; femora predominantly brownish-black except for apical narrow orange margin; protibia and mesotibia orange in basal 1/3 and blackish in apical 2/3; metatibia orange in basal 1/4 and blackish in apical 3/4; tarsi orange ventrally and brownish dorsally, metabasitarsus blackish dorsally; metafemur strongly incrassate, about 2.6 times as long as wide (Fig. 10F), ventral pile relatively long, about 1/2 times as wide as metafemur; anteroventral and posteroventral margins of metafemur with an apical row of 8 and 6 black setae respectively; metabasitarsus widened, laterally compressed in dorsal portion, with a longitudinal row of black pile dorsally. **Wing.** Hyaline; entirely microtrichose; calypters yellowish-white; halter yellowish-orange. **Abdomen** (Fig. 10G). Brownish-black with short whitish pile; terga II–IV each with a pair of oblique pollinose fascia; lateral and posterior margins of tergum IV white pollinose; sternum IV rectangular, with a narrow median V-shaped incision posteriorly (Fig. 10H). **Male genitalia.** Hypandrium simple; epandrium, cercus, posterior and anterior lobes of surstylus as in Figs 12B, D.

**Female** (Fig. 11). Body length: 6.5 mm; wing length: 5.5 mm. Similar to the male except for the sexual dimorphism and for the following characters: Head in dorsal view 4.4 times as wide as vertex at posterior corner of eyes (Fig. 11C); metabasitarsus normal, laterally uncompressed.

**Distribution.** IRAN.

**Remarks.** The type material of *Eumerus obliquus* was not available for this study. The original description (Smit et al., 2017) and the papers on *Eumerus* (Grković, 2018) and the *E. obliquus* group (Ricarte et al., 2020) were used to identify this species.

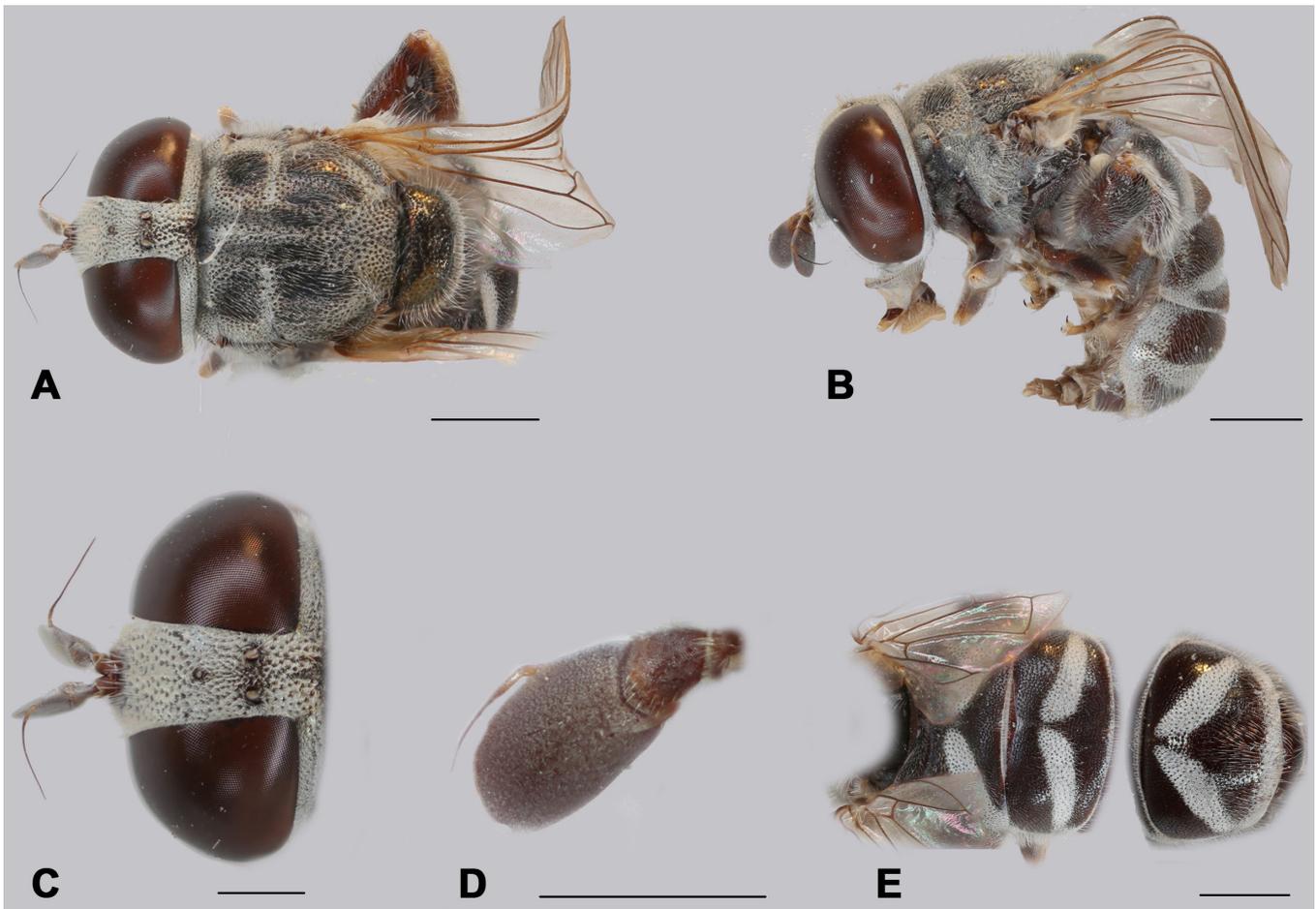
### *Eumerus ornatus* species group

**Diagnosis.** Eye contiguity in male long; frons narrow; ocellar triangle isosceles; basoflagellomere partially or entirely reddish-orange; cercus in male genitalia enlarged.

#### *Eumerus argyropus* Loew, 1848 (Fig. 13)

= *E. bernhardi* Lindner, 1969:342.

**Diagnosis.** Eyes short pilose, male holoptic (Fig. 13C), eye contiguity almost as long as frontal triangle; face white pilose, densely covered with white pollinosity; vertical triangle shiny black; ocellar triangle isosceles, shiny black; basoflagellomere elongated, orange ventrally and black dorsally (Fig. 13D); scutum with two median pollinose vittae (Fig. 13A); abdominal terga III and IV, and in female also tergum II, with a pair of rectangular white pollinose maculae (Fig. 13A), posteriorly whitish pollinose; metatibia and metatarsus in male covered with dense silvery pile (Fig. 13B); male cercus enlarged (Fig. 13E); for the details of the male genitalia see figs 4–6 in Claussen and Standfus (2017).



**Figure 11.** *Eumerus similis* Gilasian & van Steenis **sp. nov.** (female, paratype). **A.** Habitus, dorsal view (scale bar: 1 mm). **B.** Habitus, lateral view (scale bar: 1 mm). **C.** Head, dorsal view (scale bar: 0.5 mm). **D.** Antenna, lateral view (scale bar: 0.5 mm). **E.** Abdomen, dorsal view (scale bar: 1 mm).

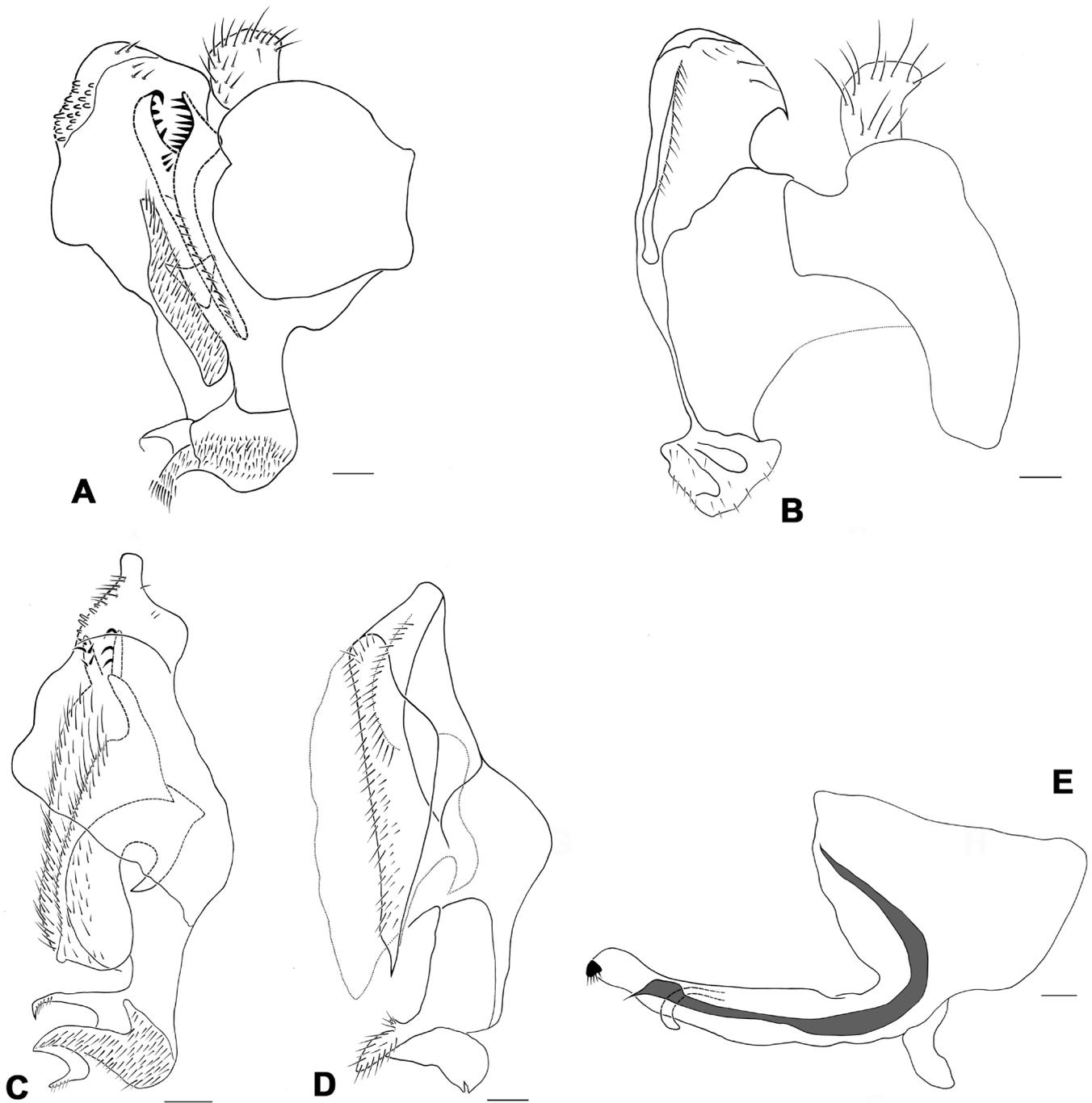
**Material examined.** IRAN 1 ♂ (glued to a card point), Markazi prov., Haftad-Qolleh Protected Area, Chekab valley, 34°07'05.3"N 50°16'25.3"E, 28 May–16 July 2016, 2219 m, Malaise trap, E. Gilasian & M. Parchami-Araghi (HMIM); 2 ♂♂ same as previous except for 8.June.2020, pan trap, Mehrdad Parchami-Araghi (HMIM).

**Distribution.** Mediterranean parts of Europe; Transcaucasia; Turkey (Peck, 1988; Claussen & Standfuss, 2017), Iran (New record).

*Eumerus intermedius* Gilasian & van Steenis **sp. nov.** (Figs 14, 17A, C, E)

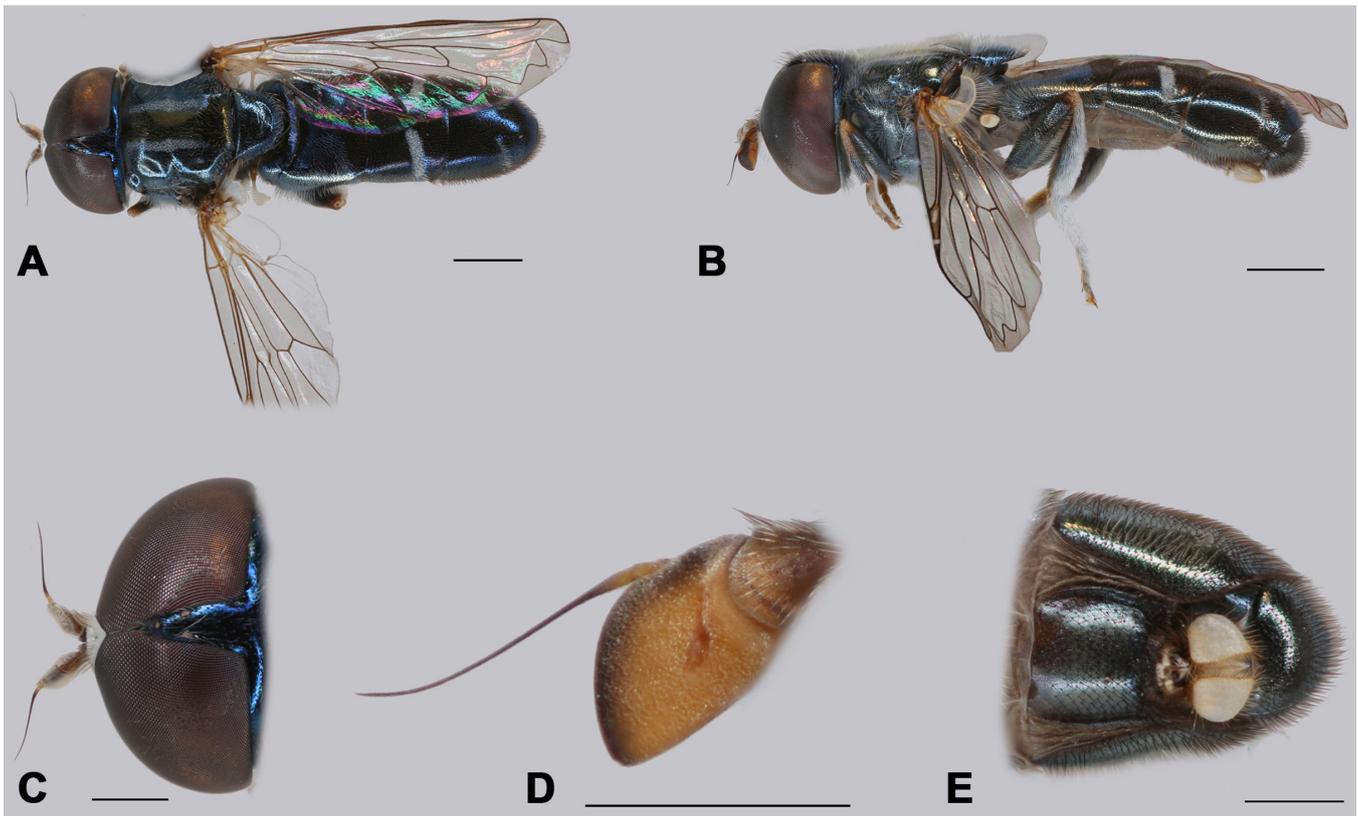
<https://zoobank.org/urn:lsid:zoobank.org:act:0C1280FD-E2E3-4262-BFEB-C65339FA1ED3>

**Differential diagnosis:** This species differs from the members of *Eumerus ornatus* group by the following characters: Eyes short pilose as in *E. lucidus* Loew, 1848 and *E. subornatus* Claussen, 1989; eye contiguity about two times as long as frontal triangle (in *E. subornatus* as long as frontal triangle); basoflagellomere rectangular, yellowish-orange with a narrow brown margin dorsally and anteriorly (in *E. lucidus* oval and entirely yellowish-orange, in *E. ornatus* Meigen, 1822 nearly square with extended ventral margin and brownish-black and in *E. subornatus* rectangular with extended ventral margin); ocellar triangle isosceles (in *E. lucidus* almost equilateral); eye contiguity slightly shorter than in *E. ornatus*; thorax white pilose (in *E. ornatus* extensively black pilose); metafemur rather narrow, entirely yellowish-white pilose (in *E. ornatus* extensively black pilose on apical 1/4 anteriorly);



**Figure 12.** Male genitalia. **A, C, E.** *Eumerus effossus* Gilasian & van Steenis **sp. nov.** **A.** Lateral view. **C.** Dorsal view. **E.** Hypandrium. **B, D.** *E. similis* Gilasian & van Steenis **sp. nov.** **B.** Lateral view. **D.** Dorsal view. Scale bar: 0.1 mm.

metatibia pilose, without dense whitish pile (in *E. argyropus* Loew, 1848 and *E. flavitarsis* Zetterstedt, 1843 densely white pilose); metatibia white pilose dorsally and apically (in *E. subornatus* mostly black pilose, with only iridescent white pile apically); yellowish-orange triangular maculae on tergum II whitish pollinose posteriorly (*E. subornatus* only with a narrow long white pollinose maculae); pre-genital segment black pilose; cerci enlarged, spherical as in *E. subornatus* (almost unmodified in *E. argyropus* and *E. flavitarsis* while slightly enlarged in *E. lucidus* and in *E. ornatus* extremely enlarged).



**Figure 13.** *Eumerus argyropus*. (male). **A.** Habitus, dorsal view (scale bar: 1 mm). **B.** Habitus, lateral view (scale bar: 1 mm). **C.** Head, dorsal view (scale bar: 0.5 mm). **D.** Antenna, lateral view (scale bar: 0.5 mm). **E.** Sternum IV (scale bar: 1 mm).

**Material examined. Holotype:** IRAN ♂ (glued to a card point), Kermanshah prov., Paveh, Dodan, 35°02'26.7"N 46°09'22.1"E, 16 June 2016, 1500 m, Malaise trap, M. Zardouei (HMIM). **Paratypes**, 7 ♂♂ 4 ♀♀: Same data as holotype, 5 ♂♂ 2 ♀♀ (HMIM), 2 ♂♂ 2 ♀♀ (JSA).

**Etymology:** The genitalia characters of *E. intermedius* are almost identical to those of *E. subornatus* while otherwise it is found to be superficially similar to *E. lucidus*. The specific epithet “intermedius”, which is intended to underscore the relation of the newly described species to both species, is a Latin equivalent word of “intermediate” and a noun in apposition.

**Description — Male.** Body length: 6.0–7.8 mm; wing length: 4.2–5.5 mm. **Head** (Figs 14C, D). Eyes short pilose, holoptic; eye contiguity almost twice as long as frontal triangle; face white pilose, densely covered with white pollinosity; frontal and vertical triangles white pollinose with white and brown pile respectively; frontal triangle 1.3 times as long as vertical triangle; head in frontal view about 4 times as wide as face; ocellar triangle isosceles, shiny black and brownish pilose; distance between posterior ocelli and posterior margin of eye about 1.4 times as long as ocellar triangle; occiput grey pollinose; frontal triangle 1.4 times as wide as ocellar triangle; vertex at posterior corner of eyes about 1.3 times as wide as vertex over posterior ocelli; head in dorsal view 5.3 times as wide as vertex at posterior corner of eyes; antenna orange, arista brown; basoflagellomere rectangular, yellowish-orange with a narrow brown margin dorsally and anteriorly; arista 1.5 times as long as basoflagellomere (Fig. 14E). **Thorax.** Scutum and scutellum shiny black; scutum with two median wide pollinose vittae, white pilose (Fig. 14A); scutellum with marginal rim; pleurae shiny black, covered with whitish pile except for bare meron and katepimeron; metasternum pilose. **Legs.** Short yellowish-white pilose; femora mostly brownish-black, orange apically; protibia and mesotibia black in apical half, metatibia black in apical 2/3; protarsus and mesotarsus orange, metatarsus brown dorsally and orange ventrally; metafemur

rather narrow, about 3.5 times as long as wide (Fig. 14F), ventral pile short and about  $\frac{1}{4}$  times as wide as metafemur; anteroventral and posteroventral margins of metafemur with an apical row of 5 and 6 black setae respectively; metatibia without dense whitish pile. **Wing.** Hyaline; entirely microtrichose; calypters yellowish-white; halter yellowish-orange. **Abdomen** (Fig. 14G). Predominantly brownish-black with short whitish pile; yellowish-orange triangular maculae on tergum II with whitish pollinosity posteriorly; tergum III with a pair of orange oblique maculae with white pollinosity; tergum IV with a pair of narrow oblique grey maculae; sternum IV squarish, with a median V-shaped incision posteriorly (Fig. 14H). **Male genitalia.** Hypandrium simple; aedeagal apodeme in lateral view as in Fig. 17E; epandrium, cercus, posterior and anterior lobes of surstylus as in Figs 17A, C.

**Female.** Body length: 6.3–8.2 mm; wing length: 5.0–6 mm. Similar to the male except for the sexual dimorphism and for the following characteristics: Distance between posterior ocelli and posterior margin of eye about 1.1 times as long as ocellar triangle; vertex with 2 lateral whitish pollinosity behind the posterior ocelli; head in dorsal view 4.5 times as wide as vertex at posterior corner of eyes.

**Distribution.** Iran.

**Remarks.** The type material of the similar species as given in the diagnosis was not available for this study. The papers on *Eumerus* (Stackelberg, 1961; Claussen, 1989; Claussen & Standfus, 2017; Grković, 2018; van Steenis et al., 2019) and specimens from the collection JSA were used to identify this species.

*Eumerus khiabani* Gilasian & van Steenis sp. nov. (Figs 15, 16, 17B, D, F)

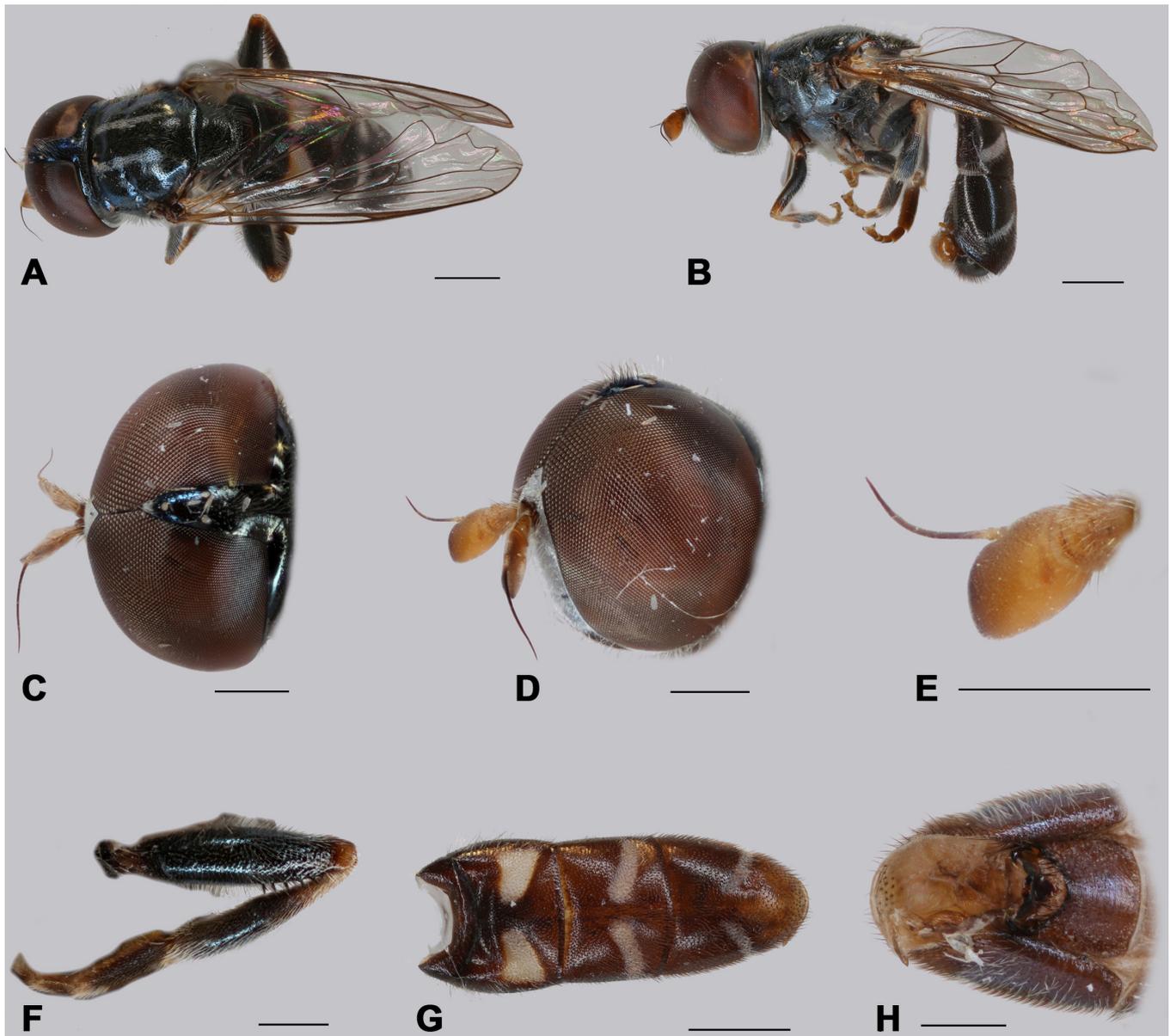
<https://zoobank.org/urn:lsid:zoobank.org:act:E13713FD-4168-42E3-966F-0F7D07D95394>

**Differential diagnosis:** This species is closely related to *E. lucidus* Loew, 1844. The eye contiguity in male about 1.3 times (in *E. lucidus* twice) as long as frontal triangle; basoflagellomere more squarish than in *E. lucidus*; frons in female almost entirely white pollinose with exception of a narrow anterior shiny black margin along lunule (in *E. lucidus* almost without pollinosity medially); vertex in female with large posterolateral pollinose maculae almost 3 times as wide as posterior ocellus (in *E. lucidus* at most twice as wide as posterior ocellus); scutum in female with a weakly seen medial pollinose vitta and two medio-lateral wider vittae (in *E. lucidus* with only two medio-lateral pollinose vittae); metabasitarsus along anterior margin with a single row of black and yellowish-orange setae (in *E. lucidus* with only yellowish-orange setae); tergum II with large triangular yellow maculae posteriorly with white pollinosity (triangular maculae in *E. lucidus* white pollinose, sometimes narrowly yellow along anterior margin); sternum II and anterior half of sternum III white pilose, sternum IV and posterior half of sternum III black pilose (in *E. lucidus* sternum II and III entirely white pilose and sternum IV predominantly white pilose with black pile on posterior 1/3); male genitalia as in Figs 17B, D, F and differ from *E. lucidus* (See Fig. 115B in Grković, 2018).

**Material examined. Holotype:** IRAN ♂ (glued to a card point), Markazi prov., Haftad-Qolleh Protected Area, Chekab valley, 34°07'05.3"N 50°16'25.3"E, 30 May–3 June 2017, 2219 m, Malaise trap, E. Gilasian & M. Parchami-Araghi (HMIM). **Paratypes,** 1 ♂ 4 ♀♀: Same data as holotype, 3 ♀♀ (HMIM), 1 ♂ 1 ♀ (JSA).

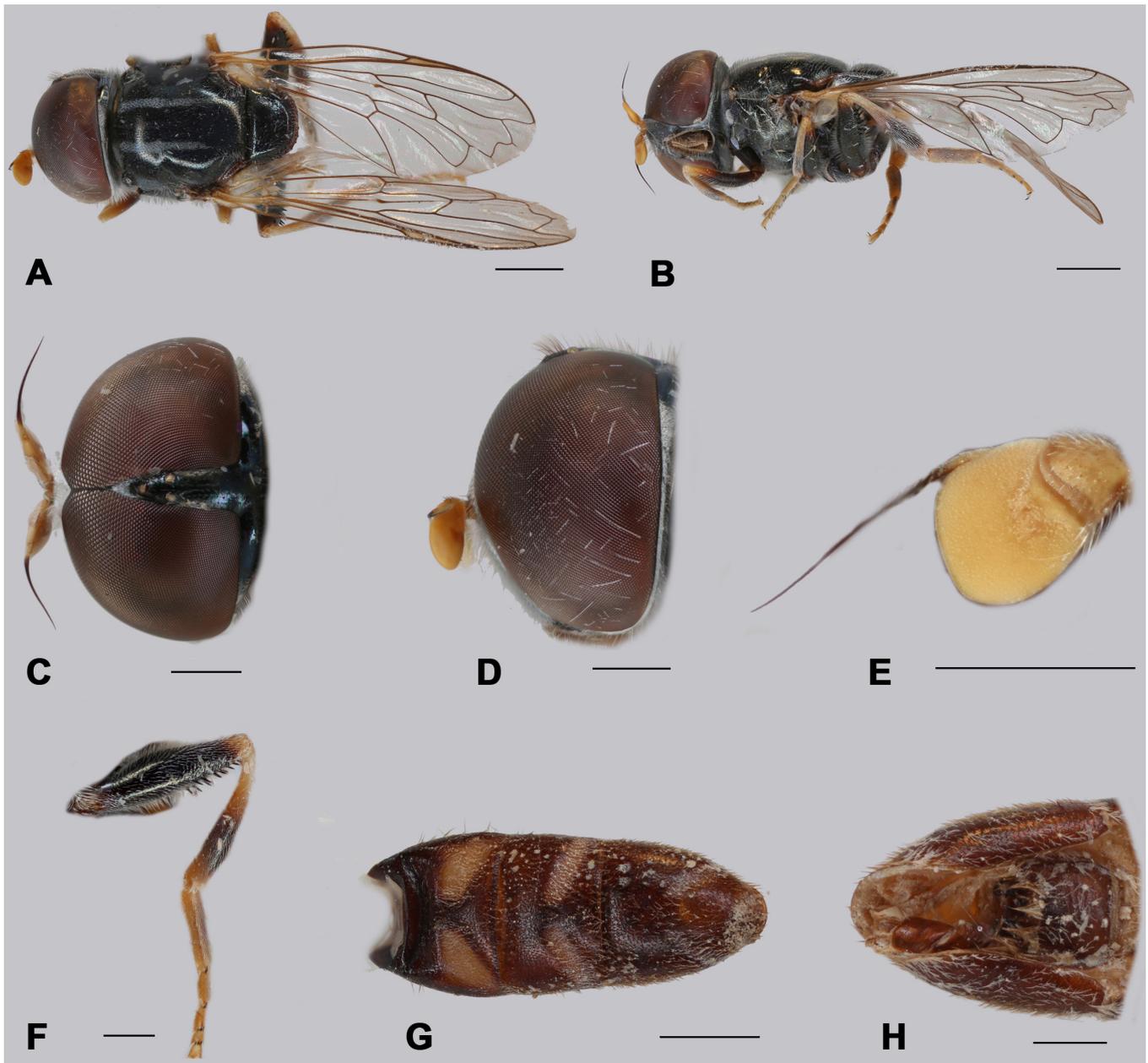
**Etymology.** This species is dedicated to our deceased Iranian colleague Dr. Nader Golmohammad Zadeh Khiaban for his contribution to the study of the Iranian fauna of the family Syrphidae. The specific epithet is a noun in the genitive case.

**Description — Male.** Body length: 7.2–7.5 mm; wing length: 4.9–6.3 mm. **Head** (Figs 15C, D). Eyes bare, holoptic; eye contiguity almost 1.3 times as long as frontal triangle; face white pilose, densely covered with white pollinosity; frontal and vertical triangles white pollinose with white and yellowish-orange pile respectively; frontal triangle almost 1.2 times as long as vertical triangle; head in frontal view about 3.6 times as wide as face; ocellar triangle isosceles, shiny black and brownish pilose; distance between posterior ocelli and posterior margin of eye about 1.7 times as long as ocellar triangle;



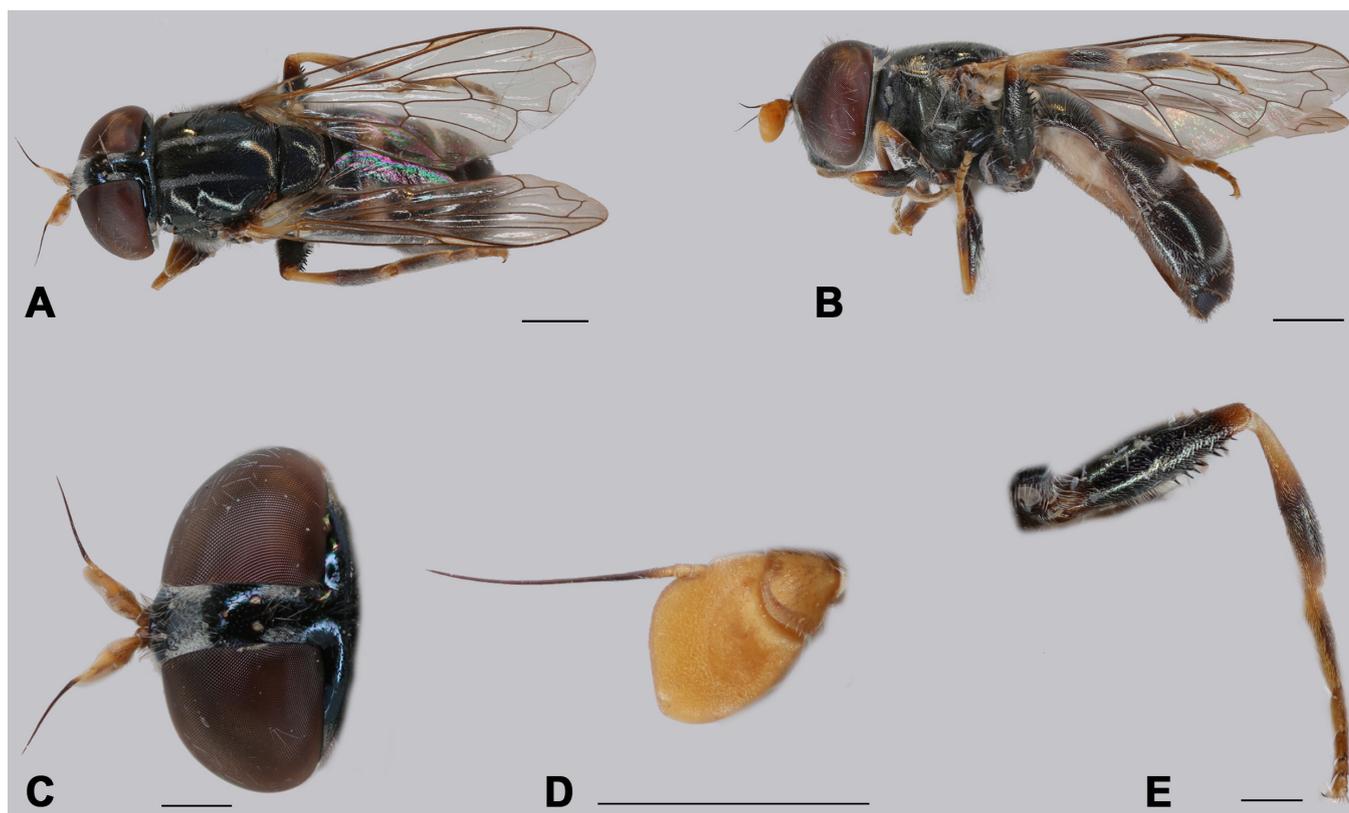
**Figure 14.** *Eumerus intermedius* Gilasian & van Steenis **sp. nov.** (male). **A.** Habitus, dorsal view, paratype. **B.** Habitus, lateral view, paratype. **C.** Head, dorsal view, holotype. **D.** Head, dorsal-lateral view, holotype. **E.** Antenna, lateral view, holotype. **F.** Metaleg, paratype. **G.** Abdomen, dorsal view, holotype. **H.** Sternum IV, holotype. Scale bar: 0.5 mm.

occiput grey pollinose; frontal triangle about twice as wide as ocellar triangle; vertex with whitish pollinosity laterally extending to about 3/4 distance between posterior ocelli and posterior eye margin; vertex at posterior corner of eyes about 1.25 times as wide as vertex over posterior ocelli; head in dorsal view about 7 times as wide as vertex at posterior corner of eyes; antenna orange, arista brown; basoflagellomere squarish, arista 1.7 times as long as basoflagellomere (Fig. 15E). **Thorax.** Scutum and scutellum shiny black; scutum with two narrow median pollinose vittae, short white pilose (Fig. 15A); scutellum with marginal rim; pleurae shiny black, covered with whitish pile except for bare meron and katepimeron; metasternum pilose. **Legs.** Short yellowish-white pilose; femora mostly black, profemur and mesofemur orange in apical 1/5–1/4; metafemur orange apically; tibiae predominantly orange, apical half brownish-black dorsally; tarsi orange, metabasitarsus brownish dorsally; metafemur rather narrow, about 4.5 times as long as wide (Fig. 15F), ventral pile short and about 1/4 times as wide as metafemur;



**Figure 15.** *Eumerus khiabani* Gilasian & van Steenis **sp. nov.** (male, holotype). **A.** Habitus, dorsal view (scale bar: 1 mm). **B.** Habitus, lateral view (scale bar: 1 mm). **C.** Head, dorsal view (scale bar: 0.5 mm). **D.** Head, lateral view (scale bar: 0.5 mm). **E.** Antenna, lateral view (scale bar: 0.5 mm). **F.** Metaleg (scale bar: 0.5 mm). **G.** Abdomen, dorsal view (scale bar: 1 mm). **H.** Sternum IV (scale bar: 0.5 mm).

anteroventral and posteroventral margins of metafemur with an apical row of 8 and 6 black setae respectively; metatibia without dense whitish pile. **Wing.** Hyaline; entirely microtrichose; calypters yellowish-white; halter yellowish-orange. **Abdomen** (Fig. 15G). Predominantly brownish-black with short yellowish-white pile; yellowish-orange triangular maculae on tergum II with whitish pollinose posteriorly; tergum III with a pair of orange oblique maculae with white pollinosity; tergum IV with a pair of narrow oblique grey maculae; sterna yellowish-white pilose; sternum IV squarish, with a median wide V-shaped incision posteriorly (Fig. 15H). **Male genitalia.** Hypandrium simple; aedeagal apodeme in lateral view as in Fig. 17F; epandrium, cercus, posterior and anterior lobes of surstylus as in Figs 17B, D.



**Figure 16.** *Eumerus khiabani* Gilasian & van Steenis **sp. nov.** (female, paratype). **A.** Habitus, dorsal view (scale bar: 1 mm). **B.** Habitus, lateral view (scale bar: 1 mm). **C.** Head, dorsal view (scale bar: 0.5 mm). **D.** Antenna, lateral view (scale bar: 0.5 mm). **E.** Metaleg (scale bar: 0.5 mm).

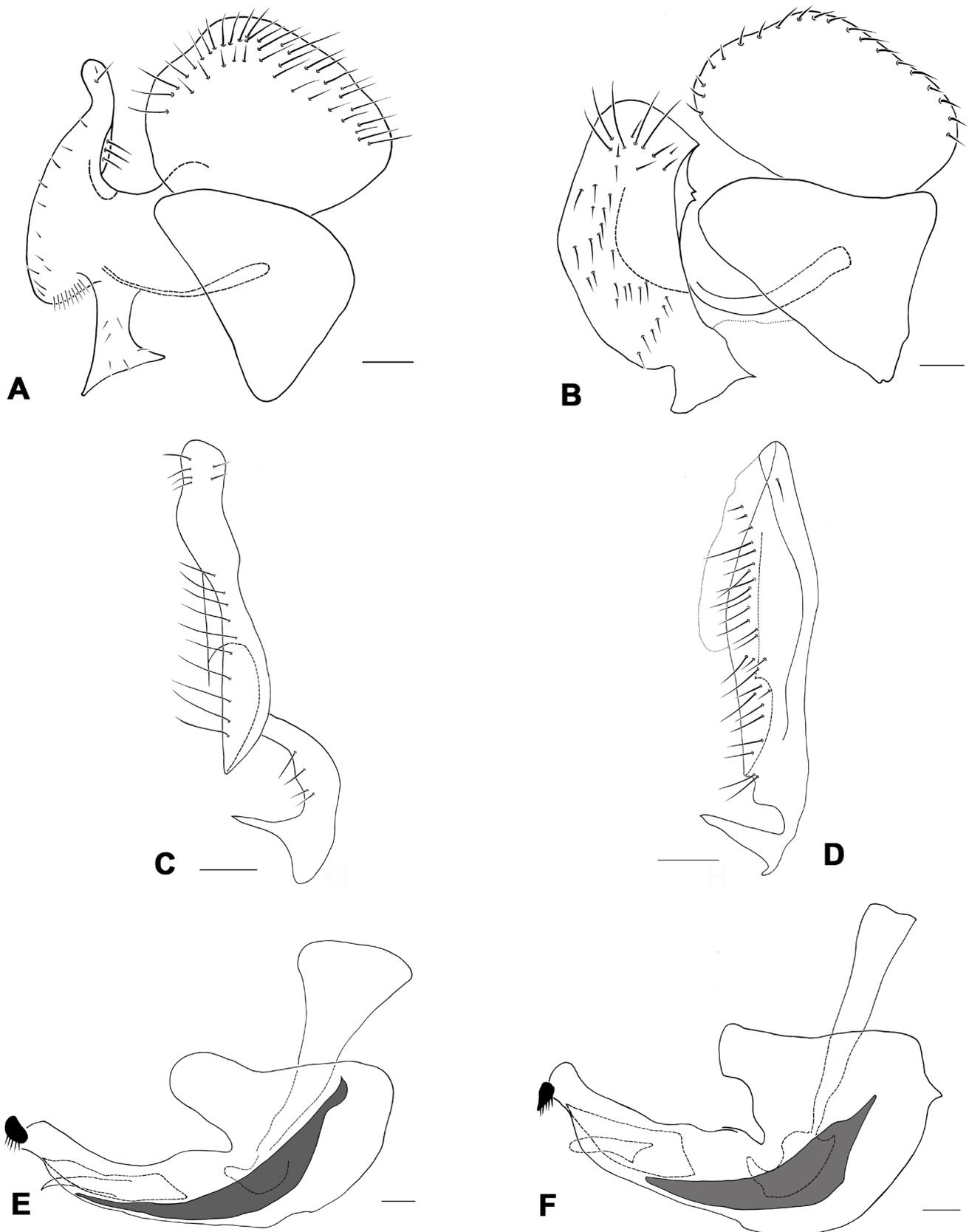
**Female** (Fig. 16). Body length: 7.6–7.8 mm; wing length: 5.5–6.4 mm. Similar to the male except for the sexual dimorphism and for the following characters: Frons almost entirely white pollinose with exception of a narrow anterior shiny black margin along lunule (Fig. 16C); distance between posterior ocelli and posterior margin of eye about 1.5 times as long as ocellar triangle; posterolateral pollinosity on vertex wider than that in male; vertex at posterior corner of eyes about as wide as vertex over posterior ocelli; head in dorsal view 5.9 times as wide as vertex at posterior corner of eyes; scutum with a weakly seen medial pollinose vitta and two medio-lateral wider vittae.

**Distribution.** Iran.

**Remarks.** The type material of the similar species as given in the diagnosis was not available for this study. The papers on *Eumerus* (Stackelberg, 1961; Claussen & Standfus, 2017; Grković, 2018; van Steenis et al., 2019) and specimens from the collection JSA were used to identify this species.

## DISCUSSION

Through this study, four new species groups within the genus *Eumerus* are discovered in Iran. The species *E. nadoosheni* Gilasian & van Steenis **sp. nov.** of *E. barbarus* group is recognized here to infest the stem of *Cistanche* sp. whereof its larvae were successfully reared to adult stage. This parasitic plant is known to serve as a favorite host for other *Eumerus* species such as *E. ammophilus* Paramonov, 1926, *E. turcmenorum* Paramonov, 1926, *E. cistanchei* Eflatoun, 1926, *E. mucidus* Bezzi, 1921 and *E. arnoldii* Stackelberg, 1952 (Souba-Dols et al., 2020). The species *E. nadoosheni* Gilasian & van Steenis **sp. nov.** can be separated from these species by the following characters:



**Figure 17.** Male genitalia. **A, C, E.** *Eumerus intermedius* Gilasian & van Steenis **sp. nov.** **A.** Lateral view. **C.** Dorsal view. **E.** Hypandrium. **B, D, F.** *E. khiabani* Gilasian & van Steenis **sp. nov.** **B.** Lateral view. **D.** Dorsal view. **F.** Hypandrium. Scale bar: 0.1 mm.

Ocellar triangle isosceles (equilateral in *E. arnoldii*), scutum in male and female with two pollinose vittae (with three pollinose vittae in female of *E. arnoldii*), metatarsomere III about 1.5 times as long as wide (in *E. arnoldii* much short, about two times as wide as long); sternum IV with U-shaped posterior incision (V-shaped in *E. arnoldii*). The species *E. naddosheni* Gilasian & van Steenis **sp. nov.** can be easily separated from *E. cistanchei* (*E. strigatus* group) by the structure of the posterior lobe of the male surstylus and can be identified from *E. mucidus*, and *E. turcmenorum* and *E. ammophilus* (*E. tricolor* group) by developed anterior lobe of surstylus. The specimens of *E. arnoldii*, *E. turcmenorum* and *E. ammophilus* are deposited in ZISP. The *E. minotaurus* group is also newly recorded from Iran through the discovery of *E. pollinipedes* Gilasian & van Steenis **sp. nov.** Its European members include *E. crassus* Grković, Vujić & Radenković, 2015, *E. longicornis* Loew, 1855, *E. niehuisi* Doczkal, 1996 and the *E. minotaurus* cryptic species complex, which itself includes *E. karyates* Chroni, Grković & Vujić, 2018, *E. minotaurus* Claussen & Lucas, 1988, and *E. phaeacus* Chroni, Grković & Vujić, 2018. The dorsal lobes of the surstyli of males differ among the members of the group as they occur narrowly elongated in *E. pollinipedes*, *E. crassus* and *E. niehuisi* (Chroni et al., 2018). The Old World *E. obliquus* group is a new record for Iran due to the description of *E. effossus* Gilasian & van Steenis **sp. nov.** and *E. similis* Gilasian & van Steenis **sp. nov.** Although the species of this group has been originally collected from Guinea, its distribution extends far beyond the Afrotropical region. It is recorded from the following Mediterranean countries Spain (including Canary Islands), southern France, Italy, Algeria and Balkans as well as Australasian and Neotropical (Brazil, Paraguay) regions. But in contrast, the remaining species such as *E. efflatouni* (Curran, 1938) and *E. incilis* have been modestly spread as are exclusively known from Egypt and the United Arab Emirates respectively (Dawah et al., 2020; Ricarte et al., 2020). Both the Iranian species of this group frequent the southern subtropical parts of the country whose climate is characterized by relatively higher temperatures and humidity.

Prior to this research, the *E. ornatus* group was reportedly known through *E. lucidus* and *E. ornatus* from East-Azerbaijan and Tehran provinces (Shojaei Hesari et al., 2013; Khaghaninia et al., 2011). Now, the number of Iranian members of this group rises to five by adding the three species *E. intermedius* Gilasian & van Steenis **sp. nov.**, *E. khiabani* Gilasian & van Steenis **sp. nov.** and the newly recorded *E. argyropus*. Most of the examined material for this study was collected from Haftad-Qolleh Protected Area whose relatively high diversity of this genus underlines the need for further explorations to its habitats (Gilasian et al., 2020).

#### AUTHOR'S CONTRIBUTION

The authors confirm their contribution in the paper as follows: E. Gilasian: Collecting and identifying the material, describing the new species; preparing the manuscript and providing the drawings. J. van Steenis: Confirming and describing the recorded taxa and new species; preparing the manuscript and providing the photographs. M. Parchami-Araghi: Collecting the material; checking the English grammar and writing style of the manuscript. All authors read and approved the final version of the manuscript.

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#### AVAILABILITY OF DATA AND MATERIAL

The reference specimens of the new species are deposited in Hayk Mirzayans Insect Museum (HMIM), Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection, Tehran, Iran and also in the private collection of Jeroen van Steenis, Amersfoort, the Netherlands (JSA).

#### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

## CONSENT FOR PUBLICATION

Not applicable.

## CONFLICT OF INTERESTS

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

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## شش گونه جدید از جنس *Eumerus* Meigen, 1822 از ایران (Diptera, Syrphidae)

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**چکیده:** شش گونه جدید از مگس‌های جنس *Eumerus* Meigen, 1822 از کشور ایران توصیف شدند. گونه‌های جدید و گروه‌های گونه‌ای وابسته به آنها به شرح زیر می‌باشند: گونه *E. naddosheni* Gilasian & van Steenis **sp. nov.** از گروه گونه‌ای *E. barbarus* Gilasian & van Steenis **sp. nov.**؛ گونه *E. minotaurus* Gilasian & van Steenis **sp. nov.**؛ گونه‌های *E. effossus* Gilasian & van Steenis **sp. nov.** و *E. obliquus* Gilasian & van Steenis **sp. nov.** از گروه گونه‌ای *E. khiabani* Gilasian & van Steenis **sp. nov.** و *E. intermedius* Gilasian & van Steenis **sp. nov.** از گروه گونه‌ای *E. ornatus* Gilasian & van Steenis **sp. nov.** هم‌چنین دو گونه *E. argyropus* Loew, 1848 و *E. torsicus* Grković & Vujić, 2015 برای اولین بار از ایران گزارش شدند. ترسیم‌های اندام جنسی نر و تصویرهای رنگی گونه‌ها تهیه و ارائه شدند.

**واژگان کلیدی:** دوبالان، مگس‌های گل، گونه جدید، *Eristalinae*, *Syrphidae*, *Merodontini*، تاکسونومی