



The genus *Paragus* Latreille (Diptera: Syrphidae) in Iran, with the description of a new species

EBRAHIM GILASIAN¹ & VERA S. SOROKINA²

¹Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection, P.O. Box 19395–1454, Tehran, Iran.

E-mail: gilasian@iripp.ir

²Siberian Zoological Museum, Institute of Systematics and Ecology of Animals, Russian Academy of Sciences, Siberian Branch, Frunze Street 11, Novosibirsk 630091 Russia. E-mail: sorokinavs@mail.ru

Abstract

A new species of the genus *Paragus* Latreille is described, *Paragus (Paragus) radjabii* sp. nov. It is similar to *P. compeditus* Wiedemann and *P. hyalopteri* Marcos-García & Rojo. The head, abdomen and male genitalia of the new species are figured. A list of the species of *Paragus* known from Iran is provided, along with a distributional map of the species in Iran.

Key words: *Paragus*, Syrphidae, taxonomy, faunistics, key, hoverflies, *Paragus (Paragus) radjabii*, new species, distributional map, Iran

Introduction

Hoverflies of the genus *Paragus* are widely distributed in the Nearctic Region, but mostly occur in the Old World. The adults of *Paragus* species are small in size (2.5–6.5 mm), with different patterns of coloration and pubescence on the abdomen. The larvae of all species of this genus are known as predators of aphids and can be considered one of the significant factors in the biological control of aphids (Chambers 1986, 1988; Thompson & Ghorpadé 1988; Carver 1989; Marcos-García & Rojo 1994; Gavrilyuk *et al.* 2008).

To date 53 species of the genus *Paragus* have been recorded from the Palaearctic region in the recent literatures (e.g. Peck 1988; Claußen & Weipert 2004; Sorokina 2009; Van de Weyer 2010). Although the Asian species of this genus have not been revised, Mutin & Barkalov (1999), Sorokina & Cheng (2007) and Sorokina (2002, 2009) investigated the fauna of this genus in various parts of the region. These investigations included the descriptions of several new species and the keys to the species of *Paragus* from Russia and adjacent countries (China, Mongolia, Kirghizia, Uzbekistan, Turkmenistan and Iran). The five following species were recorded from Iran by Sorokina (2009): *P. bicolor* (Fabricius), *P. haemorrhous* Meigen, *P. tibialis* (Fallén), *P. quadrifasciatus* Meigen and *P. compeditus* Wiedemann.

Additionally, a list of 11 Iranian species of the genus *Paragus* was presented by Dousti & Hayat (2006). During recent years, further studies on the Iranian fauna of hoverflies improved our knowledge about the distribution of this genus and also led to the discovery of one more species from Iran (Mehrabi & Ssymank 2008; Khaghaninia *et al.* 2010).

The new species which was found in the private collection of Dr. Gholamreza Radjabi is very similar to *P. compeditus* but it can be easily distinguished by the male genitalia. The description of new species and a list of Iranian *Paragus* are given.

Material and methods

Paragus materials used in this study are deposited at the Hayk Mirzayans Insect Museum, Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection, Tehran, Iran (HMIM) and in the Siberian Zoo-

logical Museum of the Institute of Systematics and Ecology of Animals, Russian Academy of Sciences, Siberian Branch, Novosibirsk, Russia (SZNM).

Specimens were examined using an Olympus SZH microscope for external morphological features. For the dissection of the male and female terminalia, the end of abdomen was removed and boiled in 10 % KOH solution for 15–20 seconds. After dissection and study, the abdomen and terminalia were washed and then stored in microvials of glycerine pinned directly underneath the specimens. Illustrations were done in ink and processed using Adobe Photoshop CS2.

Body length was measured in millimeters (mm) from the anterior margin of the head without antenna to the apex of the abdomen.

The morphological terms mainly follows McAlpine (1981), with the exception of the following male genitalic terms: lingula and lateral lobe of aedeagus (aedeagal guide and paramere of McAlpine).

Taxonomy

Paragus (Paragus) radjabii sp. nov.

Figs. 1 A–B, 2 A–B, 4 A–D, 5 A–D, 7 A–F

Diagnosis. The species *P. radjabii* sp. nov. is very similar to *P. compeditus* Wiedemann. The male and the female of the new species can be distinguished as follows: face uniformly rounded medially without a distinct knob, posterior margin of tergite VII of the female with a thickening; the male terminalia are different.

The new species can be incorporated into Sorokina's key to males and female of Asian *Paragus* (Sorokina 2009: 357, 364) by the following couplets:

Key to the males (p. 357)

27. Tergite II 2.5–3.0 times as wide as long 27a
 - Tergite II 1.5–2 times as wide as long (Fig. 3B); male genitalia as in Fig. 3A. *P. hyalopteri* Marcos-García & Rojo
 27a. Face uniformly rounded medially without a distinct knob (Fig. 1A); male genitalia as in Figs. 2A, 2B. *P. radjabii* sp. nov.
 - Face protruded medially with a distinct knob (Fig. 1C); male genitalia as in Figs. 3C, 3D. *P. compeditus* Wiedemann

Key to the females (p. 364)

20. Tergite II 1.5–2 times as wide as long; apical yellow spot of scutellum very small without extending along its margin; abdomen mainly black (Fig. 3B) *P. hyalopteri* Marcos-García & Rojo
 - Tergite II 2.5–3 times as wide as long; apical yellow spot of scutellum extending along its margin; abdomen mainly yellow 21
 21. Abdominal tergite VII large, well visible in dorsal view (Fig. 5C); face entirely yellow; mesonotum weakly lustrous 21a
 - Abdominal tergite VII small, hardly visible in dorsal view; face with or without narrow brownish median stripe; mesonotum with metallic luster 22
 21a. Face uniformly rounded medially without a distinct knob (Fig. 1B); posterior margin of tergite VII with a thickening (Fig. 4D) *P. radjabii* sp. nov.
 - Face protruded medially with a distinct knob (Fig. 1D); posterior margin of tergite VII without a thickening. *P. compeditus* Wiedemann

Etymology. This new species is dedicated to Dr. Gholamreza Radjabi (Iranian Research Institute of Plant Protection), in recognition of his contribution to entomology in Iran, and for collecting the type series.

Type material examined. Holotype ♂, Iran, Tehran, Evin, 35°47'N, 51°24'E, 1580m, 4–21.iv.1987, leg. Gh. Radjabi (HMIM). Paratypes 17 ♂ 14 ♀, same data as holotype. The paratypes 10 ♂ 7 ♀ are deposited at the Hayk Mirzayans Insect Museum (HMIM), 5 ♂ 6 ♀ at the private collection of Gh. Radjabi and 2 ♂ 1 ♀ at the Siberian Zoological Museum, Institute of Systematics and Ecology of Animals, Russian Academy of Sciences, Novosibirsk, Russia (SZMN).

Description. Male: body length 4.6 mm; wing 3.6 mm.

Head: Face without a distinct knob, entirely yellow and covered with yellow hairs. Gena and oral margin yellow (Fig. 1A). Vertex shiny black with dense pollinosity in front of the ocellar triangle, covered with yellow hairs (Fig. 4A). Frontal lunule light brown. Frontal triangle yellow covered with yellow hairs. Ocellar triangle shiny black. Postocellar margin with dense pollinosity, covered with long white hairs. Occiput black with weak pollinos-

ity posteroventrally. Eye brown, two longitudinal rows of thick and white hairs visible; eye touching over a distance as long as 5–7 ommatidia. Antenna light brown, 3rd segment yellowish-orange in internal half, about 2.5 times as long as wide; arista light brown (Fig. 4C).



0.5

A



0.5

B



C



D

FIGURE 1. *P. radjabii* sp. nov. (A, B) and *P. compeditus* (C, D). A, C. Male head, lateral view. B, D. Female head, lateral view.

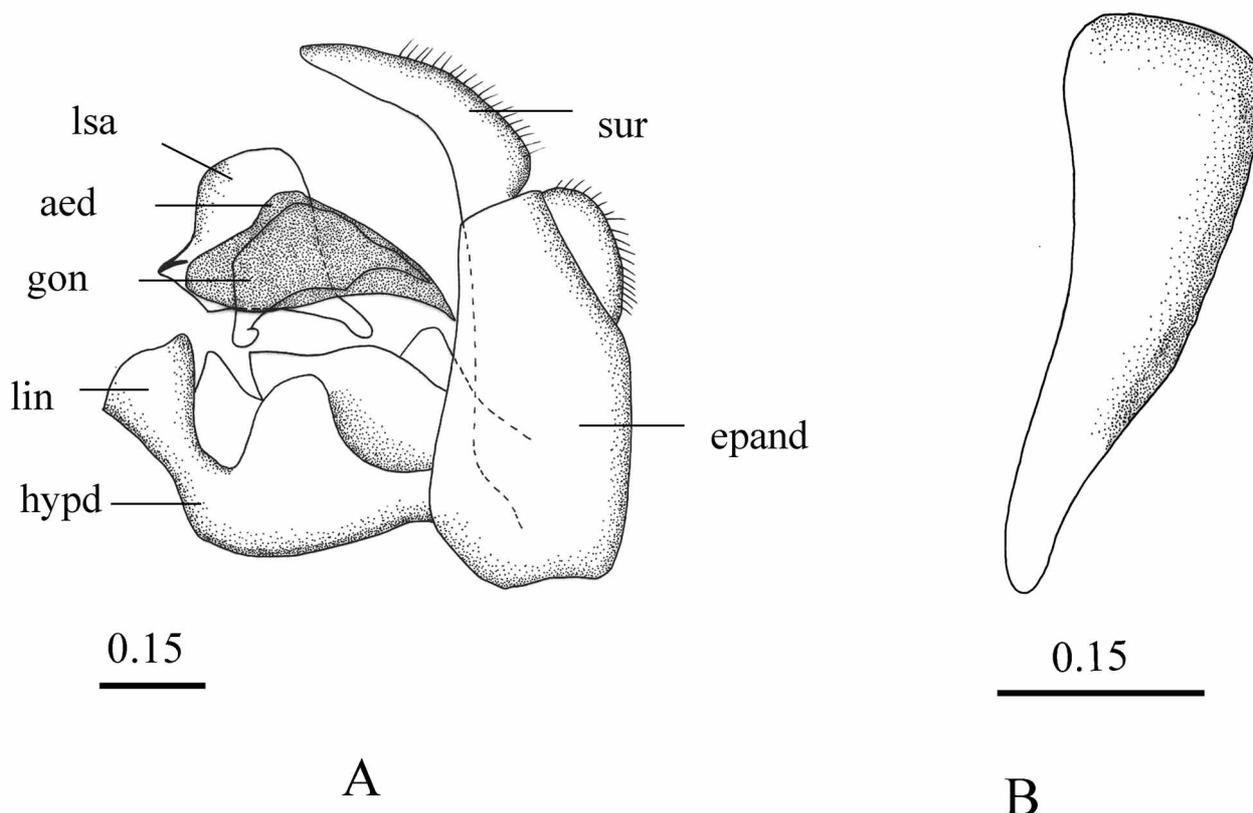


FIGURE 2. *P. radjabii* sp. nov. **A.** Male genitalia, lateral view. **B.** Left surstylus, dorsal view. (Abbreviations: aed=aedeagus, epand=epandrium, gon=gonostylus, hypd=hypandrium, lin=lingula, las=lateral sclerite of aedeagus, sur=surstylus)

Thorax: Mesonotum shiny black with two short submedian vittae (Fig. 5D), covered with long erect white hairs. Scutellum mostly yellow, dark brown at basal third without hind marginal teeth. Notopleuron, dorsal half of katepisternum, posterior 2/3 of anepisternum with dense grey pollinosity plus white hairs. Proepisternum with grey pollinosity. Halter yellow. Posterior spiracle yellow with yellow hairs. Postalar callus dark brown with yellow erect hairs. Subscutellum and anatergite shiny black.

Legs: Mostly yellow, covered with yellow hairs. Coxa dark brown. Trochanter light brown. Hind femora with a black submedian ring occupying about 1/3 the length of femora. Hind tibia with a dark submedian dorsal spot.

Wing: Hyaline, covered with microtrichia. Cells 1st costal, 2nd costal, anterior half of r_1 , 1st basal, 2nd basal and basal portion of anal cell bare or with appressed microtrichia.

Abdomen: Mostly yellowish-orange. Anterolateral portions of tergite 1 black; tergite 2 with a black submarginal transverse stripe in apical 1/3 and anterolaterally with a pair of dark brown spots. Basal 2/3 of tergite 2 and anterior half of tergite 3 pale yellow. Apical half of tergite 3 and tergites 4–5 orange (Fig. 5A). Tergites 4–5 each with a pair of transverse fasciae of white pollinosity. Tergites covered with short yellow to dark brown hairs. Lateral margin of tergites (especially tergites 1–2) with long and yellow hairs. Sternite 3 about 1.1 times as long as sternite 4. Posterior margin of sternite 4 nearly straight (Fig. 5B).

Terminalia: Lingula funnel-shaped; surstylus shorter than epandrium, slightly tapered apically in dorsal view (Fig. 2B). Gonostylus (superior lobe of hypandrium) semitriangular. Lateral sclerite of aedeagus almost trapezoidal. Aedeagus semirectangular. Hypandrium relatively short and wide (Fig. 2A).

Female: body length 4.4–5.1 mm, wing 3.4–3.8 mm.

Similar to male except for the normal sexual dimorphism and the following characters: frons dark brown, posterior half and lateral margin with dense grey pollinosity (Figs 1B, 4B). Vertex dark brown, uniformly protruded in lateral view. Frontal lunule brown. Tergites 2–4 with a transverse submarginal black stripe extending to anterior margin of tergite 4 (Fig. 7D). Transverse submarginal black stripes on tergites 2–4 are rarely narrow and disconnected in the middle and the one on tergite 4 is pale (Figs 7E, 7F). Tergite 5 concave. Tergite 6 visible in dorsal

view. Tergites 7–8 dark brown. Tergite 7 about 0.4 times as long as tergite 5 with a ring-shaped thickening posteriorly (Fig. 4D). Tergite 8 with a posteromedial notch (Fig. 5C).

Distribution. Iran.

Remarks. Relatively small range of variations are visible on the male abdomen, such as weakly presence of anterolateral spots of tergite 2 or their entirely absence; submarginal transverse stripe on tergite 2 sometimes pale and interrupted medially, the white pollinosity on tergites 4–5 nearly connected medially in a few specimens (Figs 7A, 7B, 7C). Also, the body length of the males varies 3.4 – 5.2 mm.

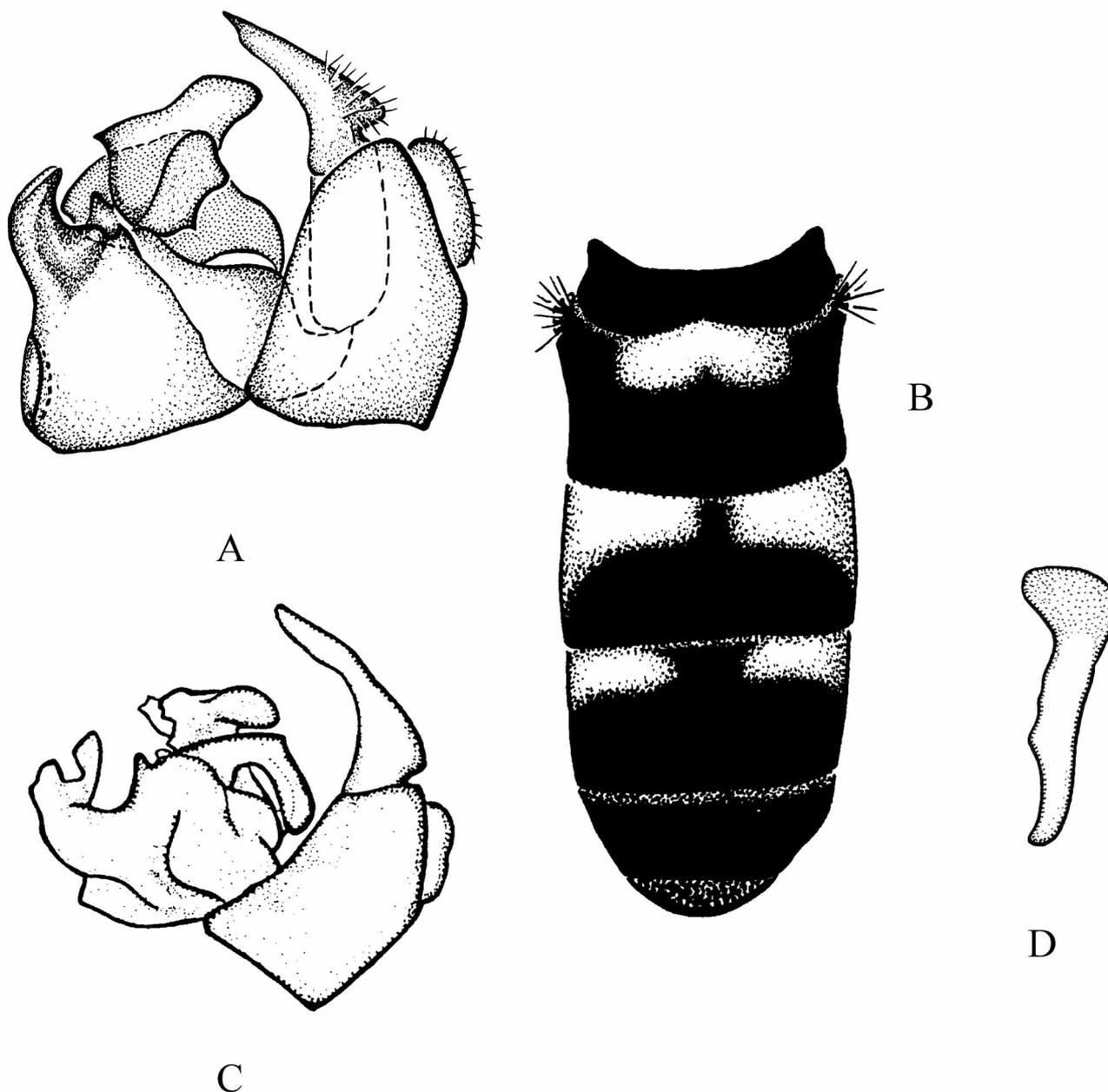


FIGURE 3. *Paragus hyalopteri* (A, B) and *Paragus compeditus* (C, D). A, C. Male genitalia, lateral view. B. Female abdomen, dorsal view. D. Left surstylus, dorsal view (after Sorokina, 2009).

List of *Paragus* species known from Iran

This list summarizes earlier reports of *Paragus* species and gives distribution of all known Iranian species (Fig. 6). The list includes three species of subgenus *Pandasyophtalmus* Stukenberg and nine species of subgenus *Paragus* Latreille.

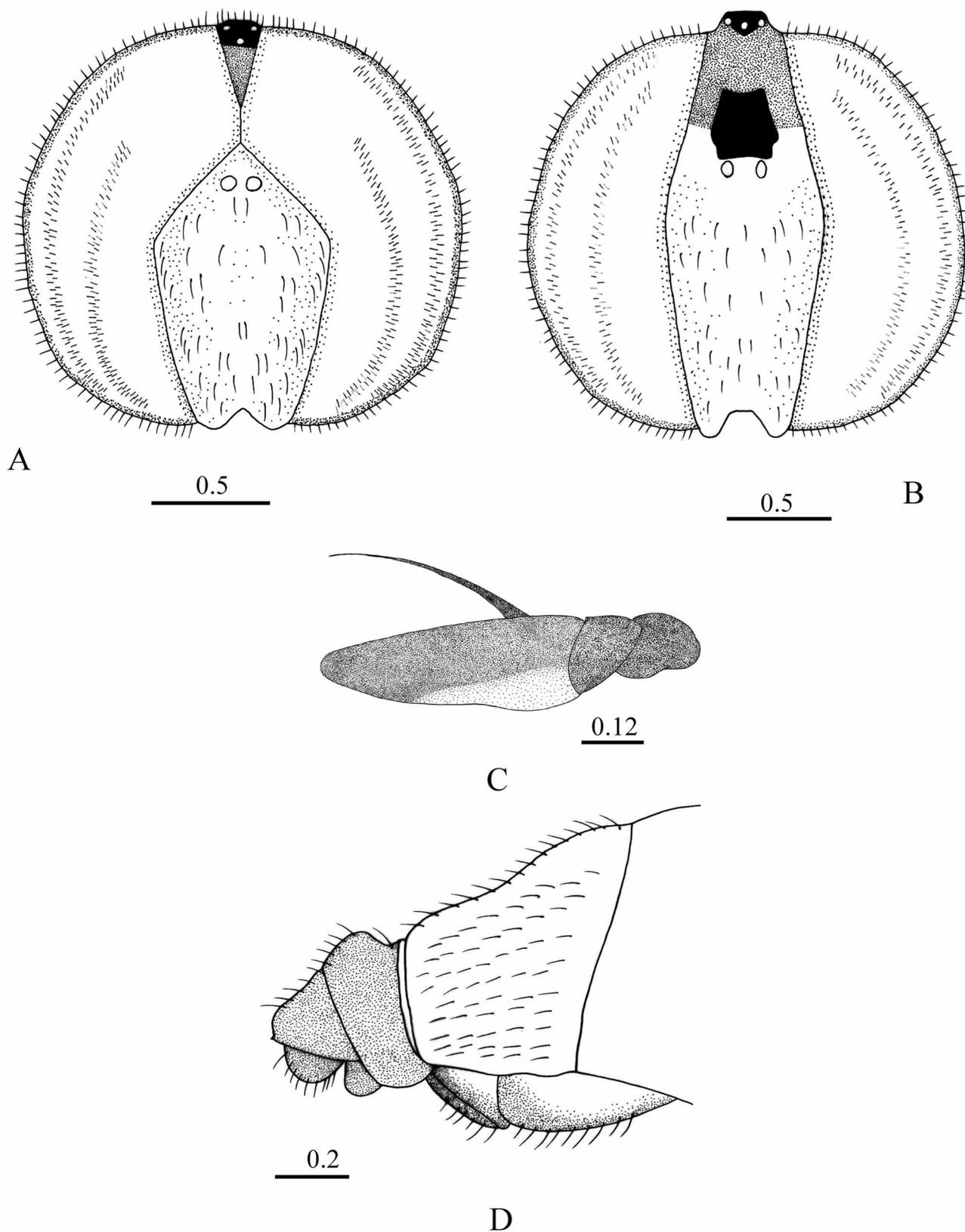


FIGURE 4. *Paragus radjabii* sp. nov. **A.** Male head, frontal view. **B.** Female head, frontal view. **C.** Male antenna, lateral view. **D.** Female postabdomen, lateral view.

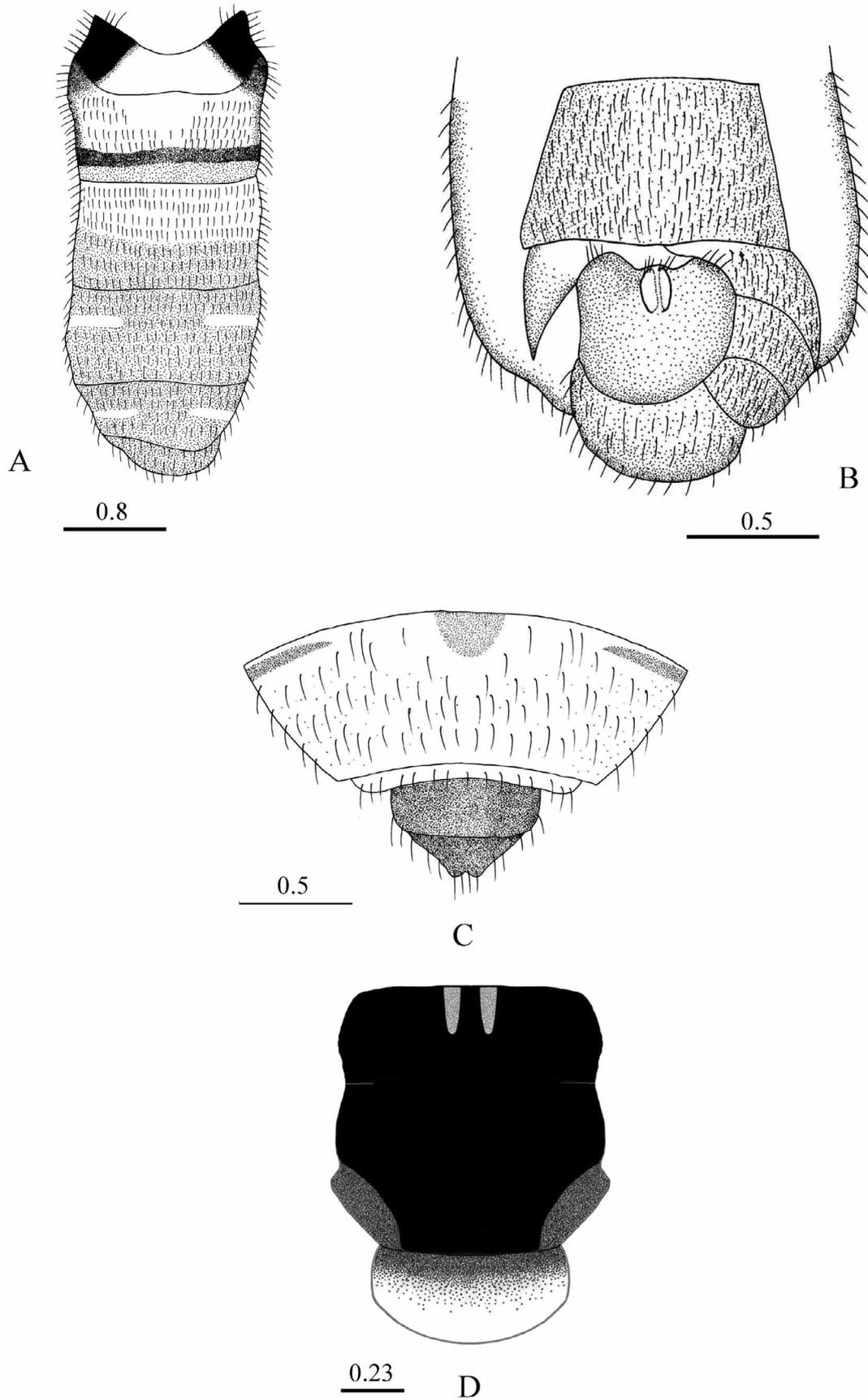


FIGURE 5. *Paragus radjabii* sp. nov. **A.** Male abdomen, dorsal view. **B.** Male postabdomen, ventral view. **C.** Female postabdomen, dorsal view. **D.** Male mesonotum, dorsal view.

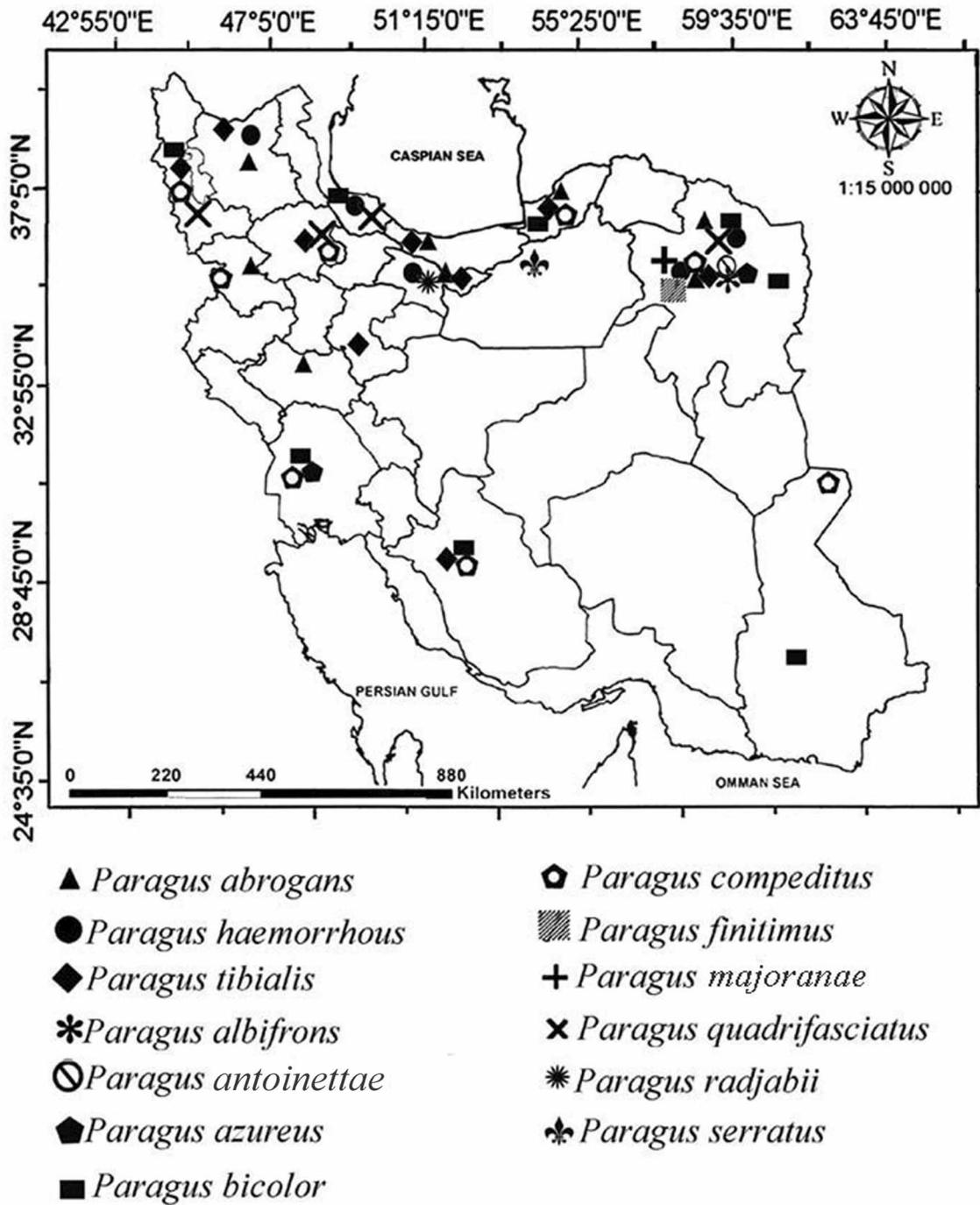


FIGURE 6. Distribution of the *Paragus* species in Iran.

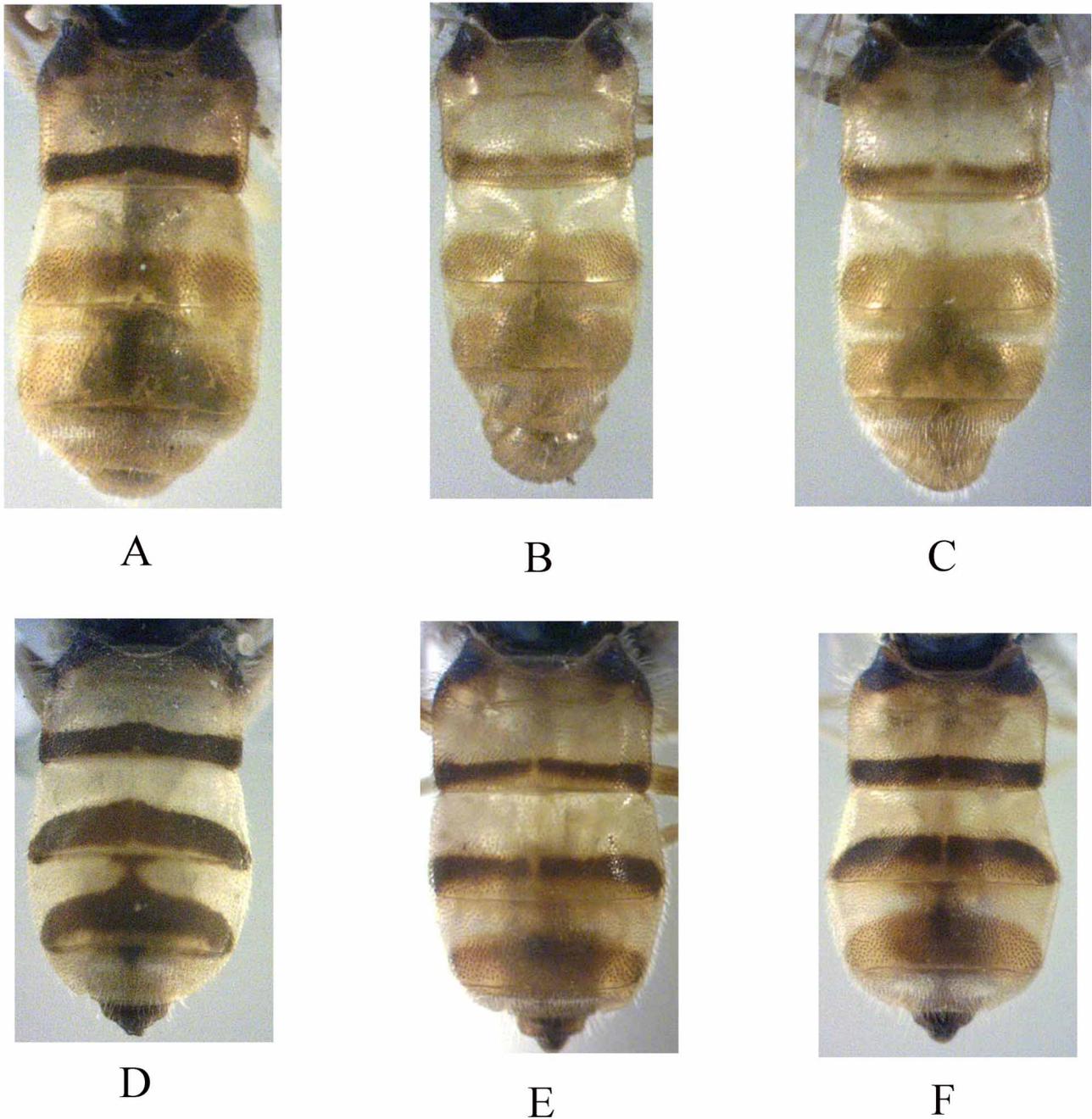


FIGURE 7. *Paragus radjabii* sp. nov. A–C. Male abdomen, dorsal view. D–F. Female abdomen, dorsal view.

***Paragus (Pandasyoptalmus) abrogans* Goeldlin de Tiefenau, 1971**

Paragus albipes Gimmerthal, 1842 of Dousti & Hayat, 2006: 19.

Material examined. IRAN: *East Azarbaijan Province*: Lighvan, Sahand Mt. 2440m, 3.viii.1992, leg. Parchami; *Golestan Province*: Golestan National park, Koylar, 1250m, 23.vii.1996, leg. Ebrahimi; *Khorasan-e Razavi Province*: Ghoochan, Emamgholi, Chovinli, 1746m, 30.v.2006, leg. Gilasian; *Kordestan Province*: Bidjar, 2300m, 6.vii.1968; *Lorestan Province*: Alashtar, Kahman, 1900m, 25.vi.2004, leg. Gilasian; *Mazandaran Province*: Tonkabon, Dohezar, 650m, 29.v.2003, leg. Gilasian; *Tehran Province*: Damavand, Nava, 12.vii.1976, leg. Lavallee.

***Paragus (Pandasyophtalmus) haemorrhous* Meigen, 1822**

Dousti & Hayat, 2006: 19; Sorokina, 2009: 358, 363, 365.

Material examined. IRAN: *East Azarbaijan Province*: Kaleybar, Youzband, 1500m, 4.vii.1997, leg. Mofidi; *Khorasan-e Razavi Province*: Mashhad, Shandiz, Zoshk, 27.v.2006, leg. Gilasian; *Tehran Province*: Evin, 1550m, 12.iv.2003, leg. Gilasian.

***Paragus (Pandasyophtalmus) tibialis* (Fallén, 1817)**

Dousti & Hayat, 2006: 19; Sorokina, 2009: 359, 365; Khaghaninia *et al.*, 2010: 273.

Material examined. IRAN: *East Azarbaijan Province*: Khodaafarin, Jananlou, 360m, 20.v.2004, leg. Gilasian; *Golestan Province*: Golestan National Park, Koylar, 1250m, 23.vii.1996, leg. Ebrahimi; *Mazandaran Province*: Amol, 1125m, 3.ix.2003, leg. Moghadam; *Tehran Province*: Damavand, 20.vii.1970, leg. Safavi.

***Paragus (Paragus) albifrons* (Fallén, 1817)**

Dousti & Hayat, 2006: 19; Khaghaninia *et al.*, 2010: 273.

***Paragus (Paragus) azureus* Hull, 1949**

Dousti & Hayat, 2006: 20.

***Paragus (Paragus) bicolor* (Fabricius, 1794)**

Dousti & Hayat, 2006: 20; Sorokina, 2009: 354, 355, 357, 358, 360, 361; Khaghaninia *et al.*, 2010: 273.

Material examined. IRAN: *Khorasan-e Razavi Province*: Ghoochan, Emamgholi, Chovinli, 1746m, 30.v.2006, leg. Gilasian, Torbate jam, 2.vi.1973, leg. Ayatollahi.

***Paragus (Paragus) antoinettae* Goeldlin de Tiefenau & Lucas, 1981**

Dousti & Hayat, 2006: 19.

Material examined. IRAN: *Golestan province*: Golestan National Park, Sulgerd, 1100m, 5.ix.2000, leg. Gilasian.

***Paragus (Paragus) compeditus* Wiedemann, 1830**

Dousti & Hayat, 2006: 20; Sorokina, 2009: 356, 360, 364, 365; Khaghaninia *et al.*, 2010: 273.

Material examined. IRAN: *Kordestan Province*: Marivan, 1320m, 9.viii.2004, leg. Ghayourfar; *Sistan & Balouchestan Province*: Zabol, 503m, 27.x.2004, leg. Moghadam; *Zanjan Province*: Khorramdarreh, Hidaj, 1750m, 29.vii.1992, leg. Parchami.

***Paragus (Paragus) finitimus* Goeldlin de Tiefenau, 1971**

Dousti & Hayat, 2006: 20.

***Paragus (Paragus) majoranae* Rondani, 1857**

Dousti & Hayat, 2006: 21.

Comment. Probably *Paragus pecchiolii* Rondani has been found in Iran, because many authors earlier used the name *majoranae* for this species. Unfortunately we could not check the indicated species by Dousti & Hayat (2006), so *P. majoranae* is given here.

***Paragus (Paragus) quadrifasciatus* Meigen, 1822**

Dousti & Hayat, 2006: 21; Sorokina, 2009: 357, 359, 363, 365; Khaghaninia *et al.*, 2010: 274.

Material examined. IRAN: *Gilan Province*: Lowshan, Bivarzin, 900m, 27.v.1997, leg. Sarafrazi; *West Azarbaijan Province*: Orumieh, Ghasemlou, 1350m, 17.viii.1994, leg. Ebrahimi; *Zanjan Province*: Khorramdarreh, Hidaj, 1750m, 29.vii.1992, leg. Parchami.

***Paragus (Paragus) serratus* (Fabricius, 1805)**

Mehrabi & Ssymank, 2008: 73.

Discussion

Being represented by only 13 species, the Iranian fauna of the genus *Paragus* is poorly known. We believe that with respect to the geographical diversity of Iran, we would expect more *Paragus* species to occur in this part of the world.

Acknowledgments

We would like to thank Dr. Mehrdad Parchami-Araghi (Iranian Research Institute of Plant Protection, Tehran, Iran) for his useful suggestions on the manuscript.

References

- Carver, M. (1989) Biological control of aphids. In: Minks, A.K. & Harrewijn, P. (Eds), *Aphids their biology, natural enemies and control*. Elsevier, Amsterdam, 141–165.
- Chambers, R.J. (1986) Preliminary experiments on the potential of hoverflies (Dipt., Syrphidae) for the control of aphids under grass. *Entomophaga*, 31, 197–204.
- Chambers, R.J. (1988) Syrphidae. In: Minks, A.K. & Harrewijn, P. (Eds), *Aphids their biology, natural enemies and control*. Elsevier, Amsterdam, 259–270.
- Claußen, C.J. & Weipert, J. (2004) Notes on the subgenus *Paragus (Pandasyopthalmus)* (Diptera, Syrphidae) from Nepal, with the description of a new species. *Volucella*, 7, 75–88.
- Dousti, A. & Hayat, R. (2006) A Catalogue of the Syrphidae (Insecta: Diptera) of Iran. *Journal of the Entomological Research Society*, 8(3), 1–68.
- Gavrilyuk, A.V., Sorokina, V.S. & Novgorodova, T.A. (2008) On the trophic interactions of aphids (Homoptera, Aphididae) and aphidophagous hoverflies (Diptera, Syrphidae) of the forest-steppe zone of Western Siberia. *Euroasian Entomological*

- Journal*, 7 (3), 236–242. [In Russian with English abstract.]
- Khaghaninia, S., Jafarlu, M., Khiaban, N. G. & Askari, O. (2010) Introduction to Hover flies (Diptera: Syrphidae) of sunflower and Pumpkin fields in west Azerbaijan province- Iran. *Munis entomology & Zoology*, 5(1), 270–277.
- Marcos-García, M.A. & Rojo, S. (1994) *Paragus hyalopteri* n. sp. an aphidophagous hoverfly (Diptera: Syrphidae) attacking the mealy plum aphid (Homoptera: Aphididae). *Entomophaga*, 39 (1), 99–106.
- McAlpine, J.F. (1981) Morphology and terminology – adults. In: McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. & Wood, D.M. (Eds.), *Manual of Nearctic Diptera*. Vol. 1. *Agriculture Canada Monograph*, 27, 9–63.
- Mehrabi, R. & Ssymank, A. (2008) Species composition and Flower visiting by Syrphidae (Diptera) in north-eastern Iran. *Zoology in the Middle East*, 45, 73–78.
- Mutin, V.A., Barkalov A.V. (1999) 62. Family Syrphidae. In: Ler, P.A. (Ed), *A Key to the Insects of Russian Far East*. Vladivostok, Dal'nauka, 6(1), 342–500.
- Peck, L.V. (1988) Family Syrphidae. In: Soos, A. (Ed), *Catalogue of Palaearctic Diptera*. Syrphidae-Conopidae, 8, Budapest, 11–230.
- Sorokina, V.S. (2002) Beschreibung von drei neuen Arten der Gattung *Paragus* Latreille, 1804 (Diptera, Syrphidae) aus Asien, mit einem Bestimmungsschlüssel der bisher bekannten russischen *Paragus*- Arten. *Volucella*, 6, 1–22.
- Sorokina, V.S. & Cheng, X. (2007) New species and new distributional records of the genus *Paragus* Latr. (Diptera, Syrphidae) from China. *Volucella*, 8, 1–33.
- Sorokina, V.S. (2009) Hover Flies of the Genus *Paragus* Latr. (Diptera, Syrphidae) of Russia and Adjacent Countries. *Entomological Review*, 89(3), 351–366. [Original Russian text in *Entomologicheskoe Obozrenie*, 88(2), 466–487.]
- Thompson, F.C. & Ghorpadé, K. (1988) A new coffee aphid predator, with notes on other Oriental species of *Paragus* (Diptera: Syrphidae). *Colemania*, 5, 1–24.
- Van de Weyer, G. (2010) A new species of *Paragus* Latreille, 1804 from Turkey (Diptera: Syrphidae). *Phegea*, 38(1), 16–20.