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Article in *Turkish Journal of Zoology* · January 2016

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First record of the family Proctotrupidae (Hymenoptera: Proctotrupeoidea) from Iran, with five new species records

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Received: 20.09.2014

Accepted/Published Online: 23.09.2015

Final Version: 14.12.2015

Abstract: This survey was conducted to investigate the occurrence of the family Proctotrupidae in Iran. The specimens were collected using Malaise traps from northern Iran during 2010 and 2011. The family Proctotrupidae (Hymenoptera: Proctotrupeoidea) is recorded from Iran for the first time. Five species belonging to four genera were identified: *Proctotrupes gravidator* (Linnaeus, 1758); *P. brachypterus* (Schrank, 1780); *Cryptoserphus aculeator* (Haliday, 1839); *Disogmus obsoletus* Brues, 1905; and *Mischoserphus arcuator* (Stelfox, 1950). All genera and species are new records for the fauna of Iran. An identification key for the genera of Proctotrupidae is provided.

Key words: Taxonomy, new record, Proctotrupidae, Iran

1. Introduction

Proctotrupidae Latreille, 1802 is one of the families of the superfamily Proctotrupeoidea (Sharkey, 2007) with worldwide distribution (Townes and Townes, 1981). This family consists of two subfamilies, Proctotrupinae Latreille, 1802 and Austroserphinae Kozlov, 1970, of which the latter is the largest, with 3 tribes, 26 genera, and about 400 species worldwide (Townes and Townes, 1981; Johnson, 1992; Aguiar et al., 2013). The subfamily Austroserphinae includes 4 species in 3 genera in Australian region and southern South America (Townes and Townes, 1981).

Most species are endoparasitoids of beetle larvae, but species of the genus *Cryptoserphus* are known as parasitoids of fungus gnats (Diptera: Mycetophilidae) (Masner, 1968) and members of *Fustiserphus* parasitize the larvae of the genus *Tingena* (Lepidoptera: Oecophoridae) (Early and Dugdale, 1994). Species of the genus *Phanoserphus* attack larvae of rove beetle (Staphylinidae) and centipedes of the family Lithobiidae (Townes and Townes, 1981).

The family Proctotrupidae is quite well studied in the West and East Palearctic Regions (Pschorn-Walcher, 1971; Wall, 1986; Fan and He, 1991; He and Fan, 1991; Wall, 1991; Zettel, 1991; Fan and He, 1993; Wall, 1994; Kolyada, 1996, 1997, 1998, 1999; Fan and He, 2003; He and Fan, 2004; He and Xu, 2004a, 2004b; He et al., 2006; Liu et al., 2006a, 2006b, 2006c; He and Xu, 2007; Hedqvist, 2007; Xu et al., 2007a, 2007b; He and Xu, 2010; Xu and He, 2010; He

and Xu, 2011a, 2011b; Liu et al., 2011; Wall, 2011; Choi et al., 2012; Kolyada, 2012) and about 60 species belonging to 15 genera are reported from the West Palearctic (Townes and Townes, 1981; Wall, 1986, 1991, 1994; Kolyada, 1996; Buhl, 1998; Kolyada, 1998; Hedqvist, 2007; Wall, 2011; Choi et al., 2012). There are no records of Proctotrupidae from Iran.

The aim of this study was to identify the species belonging to the family Proctotrupidae from the northern part of Iran. An identification key for the genera of Proctotrupidae from the north of Iran is provided.

2. Materials and methods

Sampling surveys were conducted using Malaise traps at different locations in northern provinces of Iran (Alborz, Guilan, Mazandaran, Qazvin, and Tehran). Eight Malaise traps were placed in each province in different habitats such as forests, rangelands, and orchards. The specimens were extracted from the traps and sorted weekly, transferred to 70% ethyl alcohol, and then stored in a freezer for further studies. For the preparation of samples, they were transferred to a 96% mixture of 40% xylene and 60% alcohol, moved after 2 days to amyl acetate for 1 day, and finally placed on a piece of absorbing paper for drying (AXA method; van Achterberg, 2009). The dried specimens were card-mounted and labeled. Illustrations were taken using an Olympus AX70 microscope and Olympus SZX9

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stereomicroscope equipped with a BMZ-04-DZ digital imaging system (Behin Pajouhesh Co., Iran). A series of 4 or 5 captured images were merged into a single in-focus image using the image-stacking software Combine ZP1.0. Morphological terminology follows Townes and Townes (1981) and Kolyada (1998). All specimens are deposited in the insect collection of the Department of Entomology, Tarbiat Modares University, Tehran (TMUC).

3. Results

The family Proctotrupidae is reported here for the first time from Iran. Five species belonging to four genera of Proctotrupidae were collected in different locations from northern Iran. All species are new records for Iran.

Identification key to the genera of Proctotrupidae in northern Iran

- 1- Petiole concealed in dorsal view by the base of T2 (tribe *Cryptoserphini* Kozlov, 1970) 2
- Petiole not concealed in dorsal view by the base of T2. 3
- 2- Longer spur of hind tibia ending between the middle and the apical 0.2 of hind basitarsus (Figure 1a); stigma moderately deep, radial cell moderately wide, the side next to costa (1-R1) about 1.75 times as long as width of stigma. *Cryptoserphus* Kieffer, 1907
- Longer spur of hind tibia ending near the middle of hind basitarsus (Figure 1b); stigma narrow radial cell wide, the side next to costa (1-R1) about 2.2 times as long as width of stigma....*Mischoserphus* Townes, 1981
- 3- Notauli present, often reaching beyond center of mesoscutum (tribe *Disogmini* Kozlov, 1970).
- *Disogmus* Foerster, 1856
- Notauli absent (tribe *Proctotrupini* Latreille, 1802), base of abdomen red or reddish-brown; sides of pronotum with longitudinal wrinkles.
-*Proctotrupes* Latreille, 1796
- Cryptoserphus aculeator* (Haliday, 1839)

Material examined: 43 ♀♀, 3 ♂♂; Iran, Guilan province, Astaneh Ashrafiyeh, Eshman Kamachal (37°22'03.66"N, 49°57'57.84"E, -1 m b.s.l.), 05-IV-2010, 3 ♀♀; 24-X-2010, 1 ♀; Guilan province, Roodsar, Rahimabad, Ziaz (36°52'34.44"N, 50°13'17.40"E, 537 m a.s.l.), 05-IV-2010, 1 ♀; Guilan province, Roodsar, Rahimabad, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m a.s.l.), 19-IV-2010, 1 ♂; Guilan province, Roodsar, Rahimabad, Ghazichak (36°45'57.54"N, 50°19'35.22"E, 1803 m a.s.l.), 17-V-2010, 1 ♀; 31-V-2010, 1 ♀; Guilan province, Astaneh Ashrafiyeh, Eshman Kamachal (37°21'10.50"N, 49°57'56.16"E, 2 m a.s.l.), 22-XI-2010, 3 ♀♀; Mazandaran province, Noor, Chamestan, Tangehvaz (36°21'55.68"N, 52°06'10.32"E, 702 m a.s.l.), 12-IV-2011, 1 ♀; Mazandaran province, Noor, Chamestan, Tangehvaz (36°18'51.42"N, 52°07'48.00"E, 1353 m a.s.l.), 09-VI-2011, 1 ♀; 28-VI-2011, 5 ♀♀; 13-

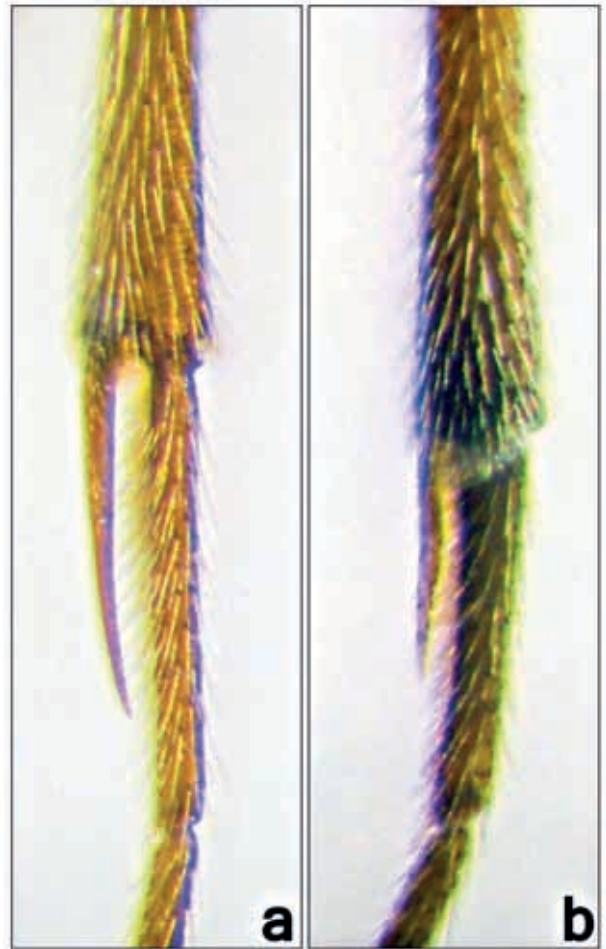


Figure 1. Hind tibial spurs: a) *Cryptoserphus aculeator*; b) *Mischoserphus arcuator*.

VII-2011, 4 ♀♀, 2 ♂♂; 03-VIII-2011, 5 ♀♀; 05-IX-2011, 1 ♀; 31-X-2011, 6 ♀♀; Mazandaran province, Noor, Chamestan, Joorband (36°26'17.28"N, 52°07'16.62"E, 272 m a.s.l.), 17-X-2011, 2 ♀♀; 31-X-2011, 2 ♀♀; Mazandaran province, Noor, Chamestan, Tangehvaz (36°21'55.02"N, 52°06'10.74"E, 692 m a.s.l.), 16-VIII-2011, 1 ♀; 03-X-2011, 1 ♀; Mazandaran province, Noor, Chamestan, Joorband (36°26'15.54"N, 52°07'13.50"E, 275 m a.s.l.), 31-X-2011, 1 ♀; leg. M. Khayrandish. Qazvin province, Zereshk Road (36°21'39.72"N, 50°03'55.56"E, 1541 m a.s.l.), 17-VIII-2011, 3 ♀♀; leg. A. Nadimi.

Diagnosis: Female (Figure 2a): Length of body 2.9–3.8 mm; penultimate antennal segment about 3.0 times as long as wide; hair band on front of mesopleuron continuous (Figure 2b); dorsal smooth areas on propodeum long, each about 1.8 as long as wide, with sparse long hairs (Figure 2c); forewing venation as in Figure 2d; ovipositor sheath about 0.8 times as long as hind tibia, with a few long hairs, its apical part 0.3 curved and tapered to a narrowly rounded apex (Figure 2e).



Figure 2. *Cryptoserphus aculeator* (Haliday, 1839): a) lateral habitus of female; b) mesosoma, lateral view; c) mesosoma, dorsal view; d) fore wing venation; e) ovipositor, dorsal view.

Distribution: Austria, China, Czech Republic, Danish mainland, England, France, Hungary, Iceland, India, Ireland, Italy, Moldova, Nepal, Philippines, Russia, Spain, Sweden, West Germany (Townes and Townes, 1981; He and Fan, 1991; Kolyada, 1998; Johnson, 2013), and Iran (new record).

Biology: This species is a larval endoparasitoid of *Mycetophila ruficollis* Meigen, 1818 and *Exechia contaminata* Winnertz, 1863 (Diptera: Mycetophilidae) (Masner, 1968).

***Disogmus obsoletus* Brues, 1905**

Material examined: 3 ♂♂; Iran, Mazandaran province, Noor, Chamestan, Tangehvaz (36°18'51.42"N, 52°07'48.00"E, 1353 m a.s.l.), 09-VI-2011, 3 ♂♂; leg. M. Khayrandish.

Diagnosis: Male (Figure 3a): Length of body 3.3–3.5 mm; flagellar segments exceptionally short, the third segment about 1.7 times as long as wide, flagellum with tyloids on flagellar segments 3–6, the tyloids in the form of a high ridge that is about 0.8 times as long as the segments (Figure 3b); notauli reaching beyond center of mesoscutum; forewing venation as in Figure 3c, stigma

small, r-rs vein (vertical part of radius) about 3.0 times as long as wide, radial vein runs from apical 0.3 of stigma, radial cell long, the side next to costa (1-R1) about 2.3 times as long as width of stigma.

Distribution: Canada, Russia, USA (Townes and Townes, 1981; Kolyada, 1998), and Iran (new record).

Biology: Unknown.

***Mischoserphus arcuator* (Stelfox, 1950)**

Material examined: 1 ♀; Iran, Mazandaran province, Noor, Chamestan, Tangehvaz (36°18'51.42"N, 52°07'48.00"E, 1353 m a.s.l.), 28-VI-2011, 1 ♀; leg. A. Nadimi.

Diagnosis: Female (Figure 4a): Length of body 3.0 mm; penultimate antennal segment about 2.0 times as long as wide; cheek without a groove from eye to mandible; mesopleural suture with a few small foveae on its upper half, smooth part of metapleuron about 0.7 times as long as metapleuron (Figure 4b); length of dorsal smooth areas on propodeum about 1.0 times as long as wide (Figure 4c); forewing venation as in Figure 4d; ovipositor sheath about 1.1 times as long as hind tibia, hairless, weakly curved and gradually tapered to apex (Figure 4e).

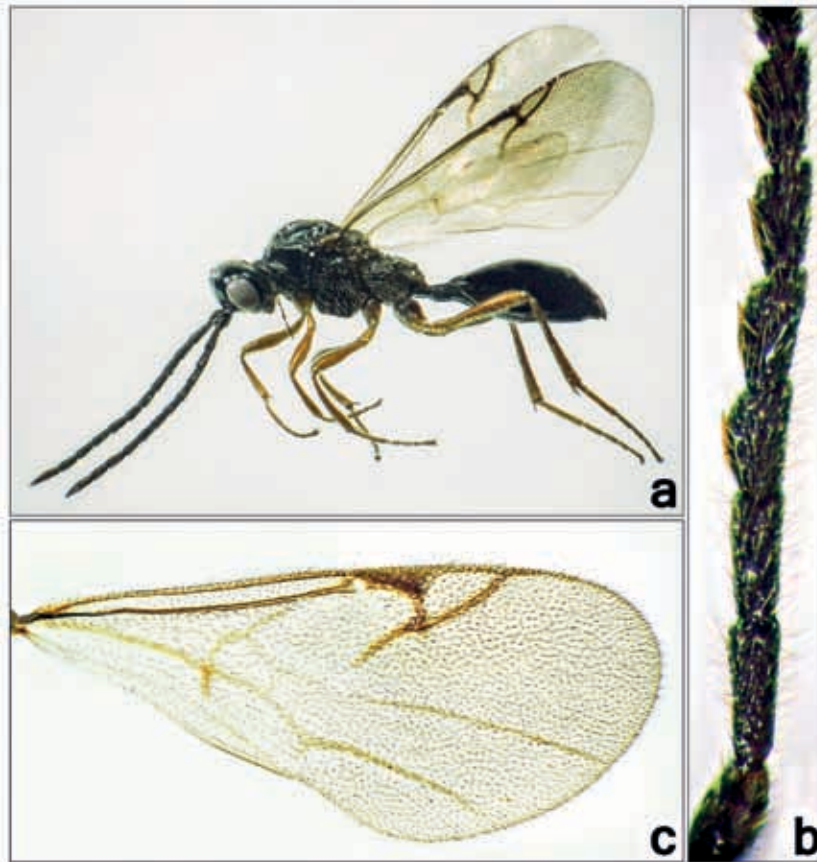


Figure 3. *Disogmus obsoletus* Brues, 1905: a) lateral habitus of male; b) antennae; c) fore wing venation.

Distribution: Canada, Georgia, Ireland, Japan, Russia, Sweden, USA (Townes and Townes, 1981; Kolyada, 1998; Johnson, 2013), and Iran (**new record**).

Biology: Unknown.

Key to species of the genus *Proctotrupes* in northern Iran

- Sides of pronotum without a median hairless area; radial vein moderately curved
 *Proctotrupes brachypterus* (Schrank, 1780)
 - Sides of pronotum with a median hairless area, which is 0.5–0.7 as large as tegula; radial vein straight.
 *Proctotrupes gravidator* (Linnaeus, 1758)
- Proctotrupes brachypterus* (Schrank, 1780)

Material examined: 2 ♂♂; Iran, Alborz province, Chalous Road, Sarziar (35°55'10.38"N, 51°06'51.24"E, 1980 m a.s.l.), 06-VII-2010, 1 ♂, 25-X-2010, 1 ♂; leg. A. Nadimi.

Diagnosis: Male (Figure 5a): Length of body 6.5–7.3 mm; clypeus about 2.9 as wide as long; sides of pronotum without a median hairless area; surface of propodeum with reticulation and laterally with longitudinal carina (Figure 5b); forewing venation as in Figure 5c, radial vein moderately curved.

Distribution: Austria, Belgium, China, Czech Republic, Denmark, England, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Romania, Russia, Spain, Sweden, Switzerland (Townes and Townes, 1981; He and Fan, 2004; Johnson, 2013), and Iran (**new record**).

Biology: This species is a larval endoparasitoid of *Zabrus tenebrioides* (Goeze, 1777) and *Harpalus rufipes* (De Geer, 1774) (Coleoptera: Carabidae) (He and Fan, 2004).

***Proctotrupes gravidator* (Linnaeus, 1758)**

Material examined: 8 ♀♀ 14 ♂♂; Iran, Tehran province, Peykanshahr, National Botanical Garden (35°44'19.91"N, 51°10'52.49"E, 1265 m a.s.l.), 20-IV-2010, 2♂♂; 04-V-2010, 5 ♂♂; 18-V-2010, 3 ♂♂ 6 ♀♀; Alborz province, Chalous Road, Shahrestanak (35°58'16.26"N, 51°21'25.80"E, 2225 m a.s.l.), 06-VII-2010, 2 ♂♂ 2 ♀♀; leg. A. Nadimi. Guilan province, Roodsar, Rahimabad, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m a.s.l.), 09-VII-2010, 2 ♂♂; leg. M. Khayrandish.

Diagnosis: Female (Figure 6a): Length of body 4.6–7.0 mm; clypeus about 3.0 as wide as long; sides of pronotum with a median hairless area, which is 0.5–0.7 as large as tegula; forewing venation as in Figure 6b, radial vein

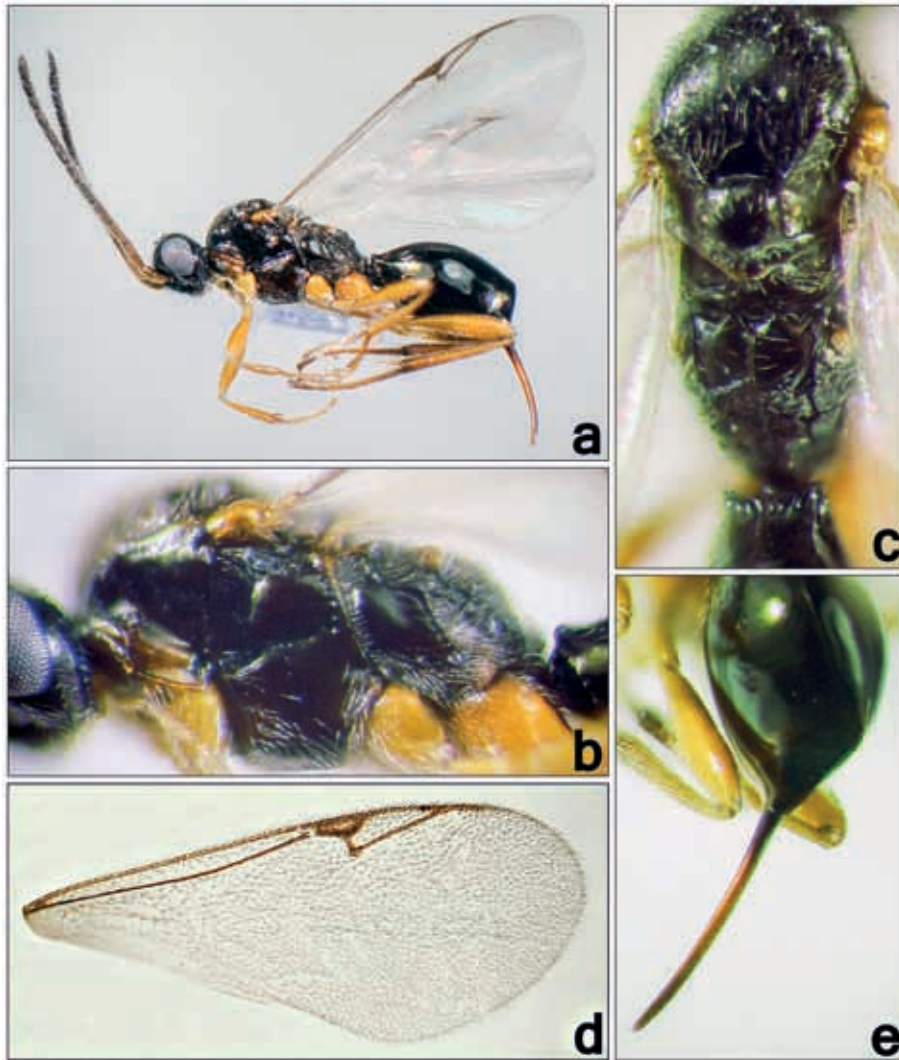


Figure 4. *Mischoserphus arcuator* (Stelfox, 1950): a) lateral habitus of female; b) mesosoma, lateral view; c) mesosoma, dorsal view; d) fore wing venation; e) metasoma and ovipositor, dorsal view.

moderately straight; surface of propodeum with coarse reticulation and with a median carina; ovipositor sheath without longitudinal grooves and about 1.0 as long as hind tibia (Figure 6c).

Distribution: Austria, Belgium, Canada, China, Czech Republic, Croatia, Danish mainland, Denmark, England, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Jordan, Mongolia, Norway, Poland, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, USA (Townes and Townes, 1981; Kolyada, 1998; Johnson, 2013), and Iran (**new record**).

Biology: This species is a larval endoparasitoid of *Amara apricaria* (Paykull, 1790), *Amara bifrons* (Gyllenhal, 1810), and *Harpalus* sp. (Coleoptera: Carabidae) (Kolyada, 1998; He and Fan, 2004).

4. Discussion

In this paper five species including *Cryptoserphus aculeator*, *Disogmus obsoletus*, *Mischoserphus arcuator*, *Proctotrupes brachypterus*, and *P. gravidator* are reported from Iran for the first time. *Cryptoserphus aculeator*, *Proctotrupes brachypterus*, and *P. gravidator* are common species in the Palearctic Region. Among the neighboring countries *C. aculeator*, *D. obsoletus*, and *P. brachypterus* are recorded from Russia and *P. gravidator* from Russia and Turkey (Townes and Townes, 1981; Kolyada, 1998). Another species, *M. arcuator*, is distributed in Georgia and Russia (Kolyada, 1998). *Cryptoserphus aculeator* was the most abundant species, followed by *Proctotrupes gravidator*. The species of the genus *Disogmus* are rare (Townes and Townes, 1981), and we collected only 3 specimens of *D. obsoletus* from Mazandaran province.

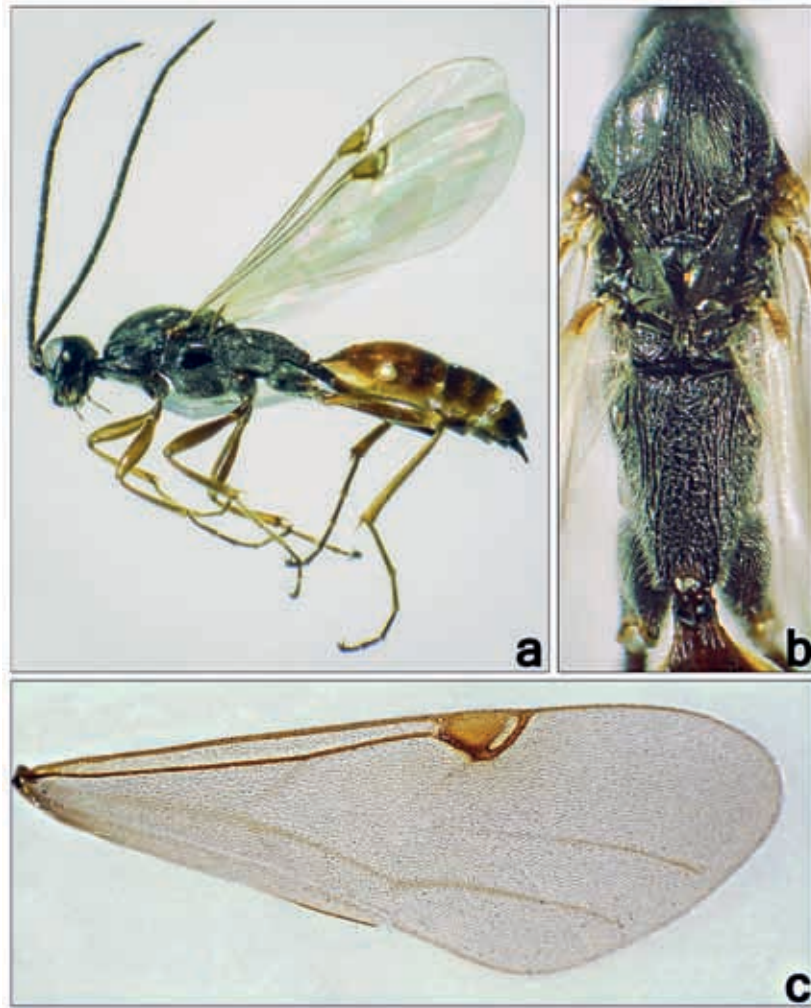


Figure 5. *Proctotrupes brachypterus* (Schrank, 1780): a) lateral habitus of male; b) mesosoma, dorsal view; c) fore wing venation.

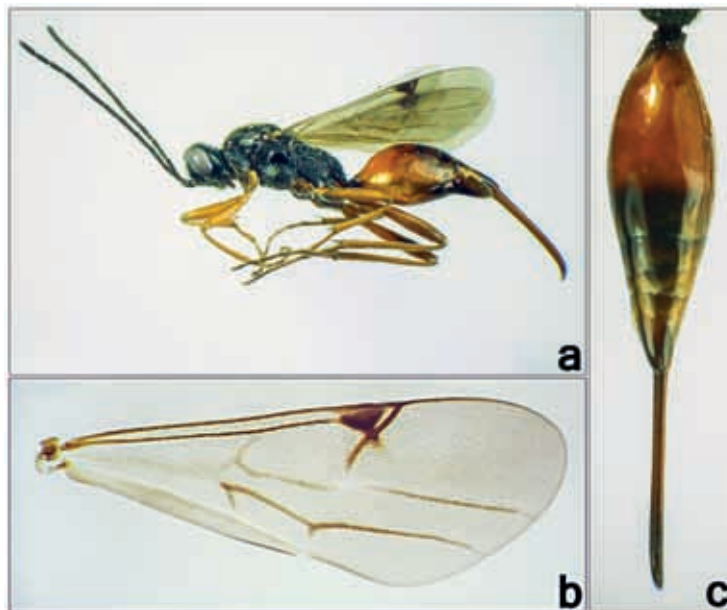


Figure 6. *Proctotrupes gravidator* (Linnaeus, 1758): a) lateral habitus of female; b) fore wing venation; c) metasoma and ovipositor, dorsal view.

Due to the rich biological diversity in Iran, we think that many more species of Proctotrupidae occur in Iran. Therefore, further studies are needed to clarify the distribution of the family Proctotrupidae in other parts of Iran.

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Acknowledgments

We would like to thank the Department of Entomology, Tarbiat Modares University for providing financial support. The authors thank two anonymous referees for their valuable comments and suggestions on the earlier version of this paper. Our cordial thanks are expressed to Dr M Khayrandish and Dr A Nadimi for helping us in collecting the specimens.

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