



First discovery of the genus *Miota* Foerster, 1856 (Hymenoptera: Diapriidae) from Iran and the Middle East, with four records of species

Mohammad Izadizadeh¹ , Ali Asghar Talebi¹ , Samira Farahani² , Farzaneh Kazerani² & Ali Ameri³

1- Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran

2- Research Institute of Forests and Rangelands, Agricultural Research Education and Extension Organization, Tehran, Iran

3- Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection, Agricultural Research, Tehran, Iran

✉ mohammad.izadizadeh@modares.ac.ir <https://orcid.org/0000-0002-8724-0132>

✉ talebia@modares.ac.ir <https://orcid.org/0000-0001-5749-6391>

✉ s.farahani@rifr-ac.ir <https://orcid.org/0000-0002-6897-0631>

✉ Farzaneh Kazerani@gmail.com <https://orcid.org/0000-0003-1968-3350>

✉ ameri@iripp.ac.ir <https://orcid.org/0000-0003-2372-8494>

Abstract. The diapriid genus, *Miota* Foerster (Hymenoptera: Diapriidae) is discovered for the first time from the Middle East area, represented by four species in Iran. The specimens were collected using Malaise traps during 2011–2018 in northern Iran. Four newly recorded species were *Miota fungorum* (Kieffer, 1910), *M. monilicornis* (Kieffer, 1910), *M. polita* (Thomson, 1858) and *M. thomsoni* Wall, 1998. Diagnostic characters, illustrations, geographical distributions, and a key to Iranian species are provided.

Keywords: diapriid wasps, Cinetini, distribution, parasitoid, northern Iran

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Introduction

The Diapriidae Haliday, 1833 is a diverse family of small parasitoid wasps with more than 2100 species in the world. They are more abundant in shady habitats such as forests, marshlands, peat bogs and wet meadows (Quadros & Brandao, 2017). Three subfamilies Ambositrinae Masner, 1961, Belytinae Foerster, 1856 and Diapriinae Haliday, 1833 were recognized within Diapriidae (Masner & García, 2002). Species of Diapriidae are primary endoparasitoids of larvae-pupae or pupae of Diptera, but some species are closely associated with ant nests (Nixon, 1957; Huggert, 1979; Loíacono *et al.*, 2013).

The genus *Miota* belongs to the subfamily Belytinae, tribe Cinetini, with 71 species in the world, among which 51 species were recorded from the Palaearctic region (Buhl, 1997; Wall, 1998; Chemyreva, 2019). Most species of this genus were described by Kieffer, who reported 49 species from some parts of the world (Kieffer, 1910, 1916). Nixon (1957) provided an identification key for *Miota* species in British. Later, keys were published for *Miota* species in Finland (Hellen, 1964), Switzerland (Wall, 1967), and the European part of the USSR (Kozlov, 1978). In the course of a taxonomic study on the genus *Miota* in Southwest Germany, Wall (1998) described 13 new species and provided an identification key to European species. No study has been conducted on *Miota* in the world afterward.

The Middle East is a geopolitical region encompassing countries from Central to Western Asian area and the Northern African countries, as well as Turkey (Beaumont *et al.*, 2016; Rahmani *et al.*, 2022). This area comprises rich faunal ecozones from both the Eastern and Western Palaearctic regions, and elements from the Afrotropics and the Oriental regions (Krupp *et al.*, 2009; Rahmani *et al.*, 2022).

Corresponding author: (Ali Asghar Talebi E-mail: talebia@modares.ac.ir)



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Members of the genus *Miota* are easily distinguished from the other Belytinae by a combination of the following characters: mandible short; antenna 15-segmented and filiform in females, 14-segmented in males; notauli converging posteriorly; radial cell closed, stigmal vein straight and perpendicular to the postmarginal vein, marginal vein longer than its distance from basal vein (Nixon, 1957; Kozlov, 1978; Quadros & Brandao, 2017).

So far, seven genera and 14 species of the subfamily Belytinae have been reported from Iran (Izadzadeh *et al.*, 2021, 2023a, 2023b), and no data are available on the genus *Miota* in Iran. In this study, we aimed to collect and present data on the occurrence of *Miota* species in northern Iran.

Materials and methods

The material was collected from northern Iran using Malaise traps. The specimens were extracted from the traps, transferred to 70% ethyl-alcohol, and then stored in a freezer for further studies. A total of 41 specimens of the genus *Miota* were collected. For the preparation of samples, the specimen was placed on a piece of absorbing paper for drying. The dried specimens were card-mounted and labeled. Photographs were taken using an Olympus TM SZX9 stereomicroscope equipped with a 650D Canon digital camera. Image stacks were combined with Helicon focus (Helicon Soft Ltd., Kharkiv, Ukraine). The identifications were mainly carried out using reliable keys (Nixon, 1957; Kozlov, 1978; Wall, 1998). Voucher specimens are deposited in the insect collection of the Department of Entomology, Tarbiat Modares University, Tehran (TMUC) and the Research Institute of Forests and Rangelands, Tehran (RIFR). The following abbreviations are used: A1–A15 = antennomeres are numbered from the scape (A1) to the apical segment (A15). T2 = large tergite past petiole or syntergite. Morphological terminology and abbreviations follow Masner & García (2002) and Yoder (2004).

Results

Taxonomy

Family Diapriidae Haliday, 1833

Subfamily Belytinae Foerster, 1856

Genus *Miota* Foerster, 1856

Type species: *Miota glabra* Ashmead, 1890

Diagnosis:

body length 3.0–4.0 mm; mandibles short; female antennae 15-segmented; male antenna 14-segmented, filiform, the first flagellomer with variable proximal emargination; propleuron with or without epomia; notauli distinct, converging posteriorly; mesoscutellar fovea large and subquadrate; fore wings with radial cell closed; marginal vein as long as or longer than its distance from basal vein; stigmal vein straight and perpendicular to the postmarginal vein; hind wing with distinct basal cell; propodeum with median keel simple; petiole elongate, at least two times longer than wide, on dorsal surface with longitudinal keels or sculpture; basal sculpture of macrotergite with long medial furrow and short lateral striation. Body coloration yellowish brown to black.

Biology:

Unknown.

Miota fungorum (Kieffer, 1910) (Figs 1A–F)

Syn.: *Leptorhaptus compressus* Kieffer, 1907.

Material examined:

Golestan Province: Shast Kola forest (36°45'29" N, 54°23'12" E, 424 m a.s.l.), 03.VII.2016, 1♀ (TMUC), 27.IX.2016, 1♀ (TMUC). Leg.: S. Farahani; Shast Kola forest (36°44'10.83" N, 54°24'11.23" E, 754 m a.s.l.),

26.VI.2019, 1♀, 1♂ (TMUC). Guilan Province: Rezvan Shahr (37°31'00" N, 49°27" E, 199 m a.s.l), 13.V.2018, 1♀, 2♂♂ (TMUC); Shafaroud forest (37°28'18" N, 48°49'23" E, 1114 m a.s.l), 25.VI.2018, 1♀ (TMUC), 19.X.2018, 1♀, 3♂♂ (RIFR). Mazandaran Province: Kheyroud Kenar (36°34'36.23" N, 51°34'37.94" E, 722 m a.s.l), 26.VI.2018, 1♀ (TMUC); Neka forest (36°34'49.2" N, 53°27'95.6" E 465 m a.s.l), 27.VI.2018, 1♂ (RIFR), 29.VIII.2018, 3♀♀ (TMUC); Neka forest (36°21'43.03" N, 53°32'56.7" E, 1495 m a.s.l), 25.VII.2018, 2♀♀ (RIFR), 29.VIII.2018, 11♂♂ (TMUC), leg.: F. Kazerani.

Diagnosis:

female (Fig. 1A), Body length 3.1-3.8mm; head in dorsal view transverse, 1.7 times as wide as long (Fig. 1C); A1 as long as or a little longer than A3 (Fig. 1B); epomia present (Fig. 1D); anterior mesoscutellar fovea large and subquadrate (Fig. 1D); fore wing length 2.5-2.8mm, radial cell closed, marginal vein long, 1.5 times as long as its distance from basal vein (Fig. 1E); propodeum smooth and shiny, with sparse setae, median propodeal keel simple; petiole in dorsal view 3.0 times as long as wide, with longitudinal keels (Fig. 1F); metasomal T2 anteriorly with a median groove, each side of median groove with short striation (Fig. 1F). Head black; mesosoma and petiole brown to dark brown, pronotum and abdomen bright brownish; antenna, tegula, wing veins and legs brownish yellow.

Distribution:

Sweden, Switzerland, Ireland, Germany, England, France, Italy, Russia (Nixon, 1957; Wall, 1998; Chemyreva, 2019) and Iran (new record).

Biology:

Unknown.

Miota monilicornis (Kieffer, 1910) (Figs 2A–F)

Syn.: *Leptorhaptus brevicornis* Kieffer, 1910.

Material examined:

Mazandaran Province, Kheyroud Kenar (36°34'36.23" N, 51°34'37.94" E, 722 m a.s.l), 24.VII.2018, 1♀ (TMUC), leg.: F. Kazerani.

Diagnosis:

female (Fig. 2A), Body length 3.4mm; head in dorsal view transverse, 1.3 times as wide as long; A1 2.0 times longer than A3 (Fig. 2B), A14 slightly transverse (Fig. 2B); epomia present (Fig. 2D); anterior mesoscutellar fovea large and subquadrate (Fig. 2C); fore wing length 2.5mm, radial cell closed, marginal vein long, 1.3 times as long as its distance from basal vein (Fig. 2E); propodeum smooth and shiny, with sparse setae, median propodeal keel simple; petiole elongate, swollen and humped in the middle (Fig. 2F), in dorsal view 4.0 times as long as wide, without longitudinal keels and usually with sculpture (Fig. 2F); metasomal T2 anteriorly with a median groove, each side of median groove with short striation (Fig. 2F). Head black; mesosoma and petiole brown, pronotum light brown; abdomen yellowish brown; antenna at base yellowish brown and distal half dark brown; tegula, wing veins and legs brownish yellow.

Distribution:

England, Scotland, Ireland, Germany, Italy, Hungary, Switzerland and Russia (Nixon, 1957; Wall, 1998; Chemyreva, 2019) and Iran (new record).

Biology:

Unknown.

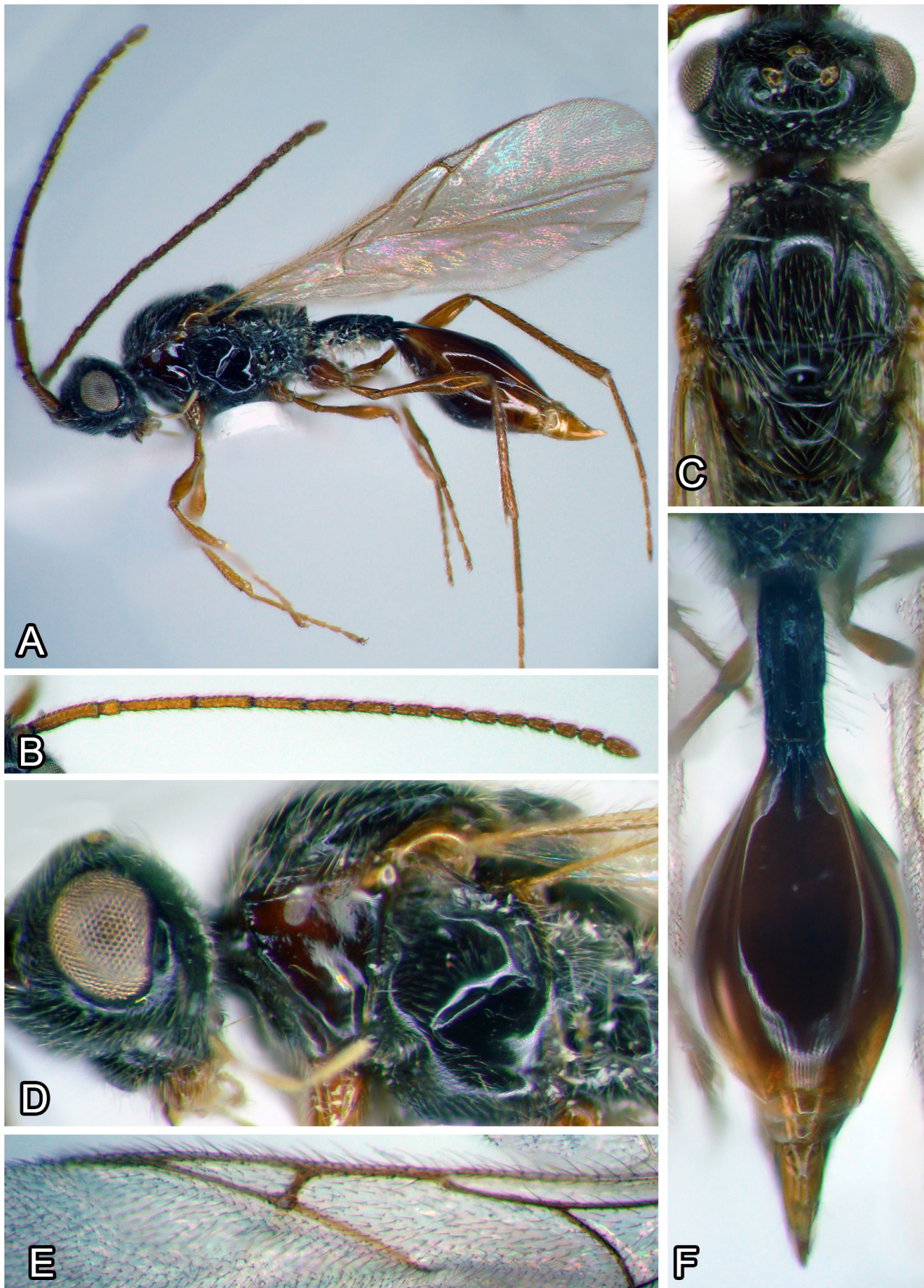


Fig. 1. *Miota fungorum*: female, **A.** general habitus, in lateral view; **B.** antenna; **C.** head and thorax in dorsal view; **D.** head and thorax in lateral view; **E.** fore wing venation; **F.** metasoma in dorsal view.



Fig. 2. *Miota monilicornis*: female, A. general habitus, in lateral view; B. antenna; C. thorax in dorsal view; D. thorax in lateral view; E. fore wing venation; F. metasoma in dorsal view.

Miota polita (Thomson, 1858) (Figs 3A–E)

Syn.: *Leptorhaptus heterocerus* Kieffer, 1907; *Miota fulviventris* Kieffer, 1907; *Leptorhaptus niger* Kieffer, 1910; *L. scutellaris* Kieffer, 1910.

Material examined:

Mazandaran Province, Neka forest (36°34'49.2" N, 53°27'95.6" E, 465 m a.s.l), 24.VII.2018, 2♀♀ (RIRF); Neka forest (36°21'43.03" N, 53°32'56.7" E, 1495 m a.s.l), 25.VII.2018, 4♀♀ (TMUC); Guilan Province, Shafaroud forest (37°28'18" N, 48°49'23" E, 1114 m a.s.l), 26.VII.2018, 3♀♀ (TMUC), leg.: F. Kazerani.

Diagnosis:

female (Fig. 3A), Body length 2.9-3.3mm; head in dorsal view transverse, 1.4 times as wide as long; A1 1.8 times as long as A3 (Fig. 3B), A14 as long as wide (Fig. 3B); epomia present (Fig. 3C); anterior mesoscutellar fovea large and subquadrate; fore wing length 2.4-2.6mm, radial cell closed, marginal vein long, 1.5 times as long as its distance from basal vein (Fig. 3D); propodeum smooth and shiny, with sparse setae, median propodeal keel simple; petiole elongate, in dorsal view 3.0 times as long as wide, with longitudinal keels (Fig. 3E); metasomal T2 anteriorly with a median groove, each side of median groove with short striation (Fig. 3E). Head black; mesosoma and petiole brown to dark brown; abdomen brown; antenna at base yellowish brown and distal segments dark brown; tegula, wing veins and legs brownish yellow.



Fig. 3. *Miota polita*: female, **A.** general habitus, in lateral view; **B.** antenna; **C.** head and thorax in lateral view; **D.** fore wing venation; **E.** metasoma in dorsal view.

Distribution:

Sweden, Finland, England, Scotland, Ireland, Germany, Austria, Hungary, Russia (Nixon, 1957; Wall, 1998; Chemyreva, 2019) and Iran (new record).

Biology:

Unknown.

Miota thomsoni Wall, 1998 (Figs 4A–G)

Syn.: *Belyta petiolaris* Nees, 1834.

Material examined:

Mazandaran province, Noor, Chamestan, Tangehvaz, (36°18'51.42" N, 52°07'48.00" E, 1359 m a.s.l.), 16.VIII.2011, 1♂ (TMUC), leg.: M. Khayrandish.

Diagnosis:

male (Fig. 4A), Body length 2.8mm; head in dorsal view transverse, 1.5 times as wide as long (Fig. 4B); head between antennal socket with transverse carina (Fig. 4B); A1 a little shorter than A3 (Fig. 4C); epomia present (Fig. 4E); anterior scutellar fovea large and subquadrate (Fig. 4D); fore wing length 2.6mm, radial cell closed, marginal vein long, 1.3 times as long as its distance from basal vein (Fig. 4F); propodeum smooth and shiny, with sparse setae, median propodeal keel simple; petiole elongate, in dorsal view 2.9 times as long as wide, with longitudinal keels; metasomal T2 anteriorly with a median groove, each side of median groove with short striation (Fig. 4G). Head black; mesosoma and petiole brown; pronotum light brown; abdomen brownish yellow; scape and pedicel yellowish brown and flagellum brown; tegula, wing veins and legs brownish yellow.

Distribution:

Sweden, Norway, Finland, Scotland, Ireland, Denmark, Switzerland, England, Russia (Nixon, 1957; Hellen, 1964; Kozlov, 1978; Wall, 1998) and Iran (new record).

Biology:

Unknown.

Key to the known species of the genus *Miota* (Female and Male) in Iran and the Middle East (modified from Nixon, 1957 and Wall, 1998)

- | | |
|--|---|
| 1- Female, Antenna 15-segmented | 2 |
| - Male, Antenna 14-segmented | 5 |
| 2- A1 as long as or a little longer than A3 (Fig. 1B) | 3 |
| - A1 at least 1.5 times as long as A3 (Figs 2B, 3B) | 4 |
| 3- Antennal socket without keel | <i>Miota fungorum</i> (Kieffer, 1910) |
| - Antennal socket with keel (Fig. 4B) | <i>Miota thomsoni</i> Wall, 1998 |
| 4- Petiole thickened in the middle and without keels in dorsal view, with sculpture consisting of flat points and small wrinkles (Fig. 2F) | <i>Miota monilicornis</i> (Kieffer, 1910) |
| - Petiole not thickened in the middle and with longitudinal keels in dorsal view (Fig. 3E) | <i>Miota polita</i> (Thomson, 1858) |
| 5- Sides of T2 gaping apart from the gaster; antennal sockets with a sharp keel (Fig. 4B) | <i>Miota thomsoni</i> Wall, 1998 |
| - Sides of T2 closely wrapped around the gaster; antennal sockets without keel | 6 |
| 6- F1 1.3 times longer than the scape | <i>Miota fungorum</i> (Kieffer, 1910) |
| - F1 at most as long as scape | 7 |

7- Petiole swollen in anterior half, smooth or with fine reticulation *Miota monilicornis* (Kieffer, 1910)

- Petiole not swollen on anterior half and without reticulation *Miota polita* (Thomson, 1858)

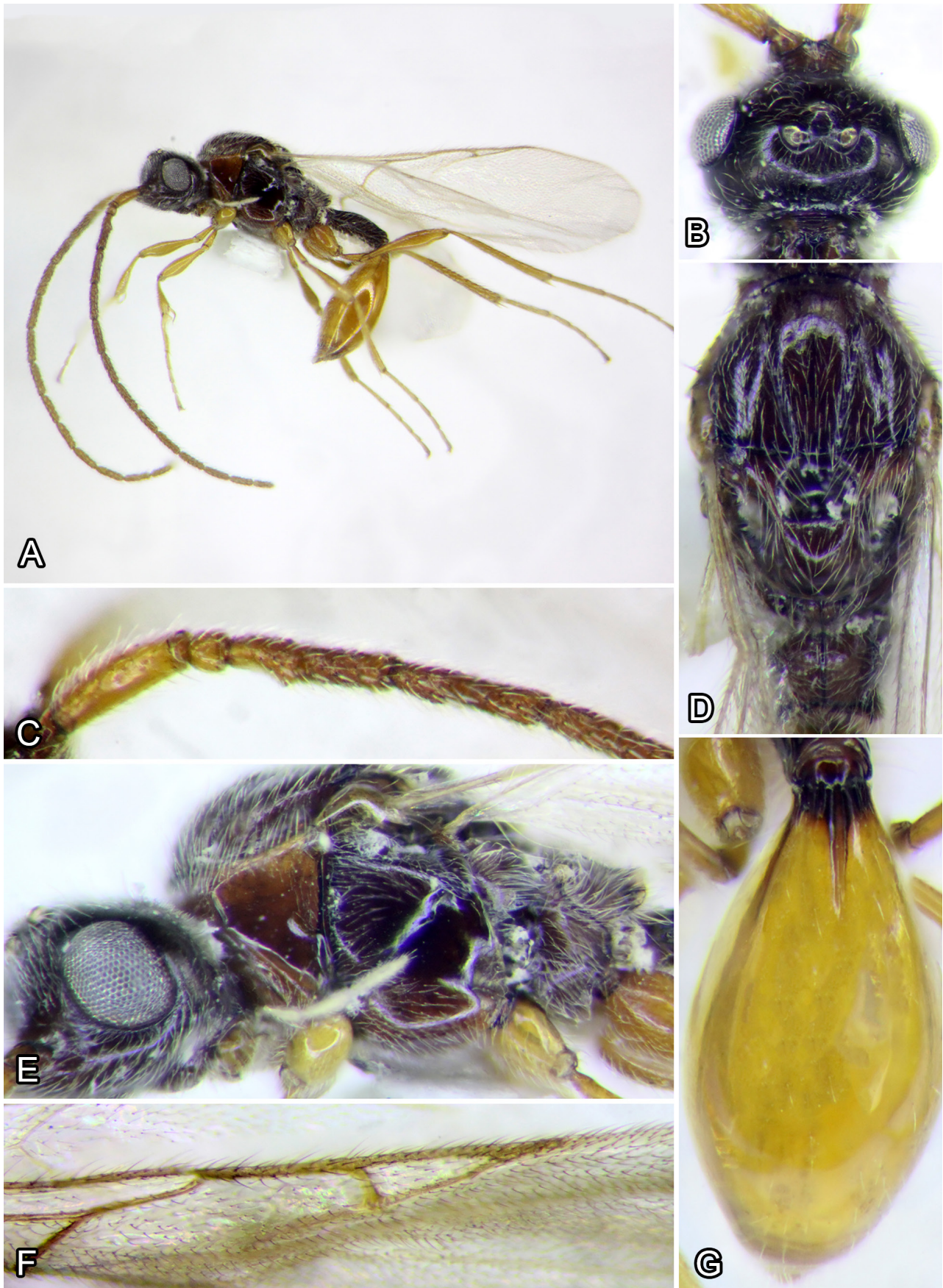


Fig. 4. *Miota thomsoni*: male, A. general habitus, in lateral view; B. head in dorsal view; C. base of antenna; D. thorax in dorsal view; E. head and thorax in lateral view; F. fore wing venation; G. metasoma in dorsal view.

Discussion

The known assemblage of the Diparidae from Iran is represented by 26 species (Izadzadeh *et al.*, 2020, 2021, 2023a, 2023b), belonging to 14 genera.

The genus *Miota* is well-studied in the west Palaearctic region (Kieffer, 1916; Nixon, 1957; Hellen, 1964; Stelfox, 1966; Chambers, 1975; Kozlov, 1978; Wall, 1967, 1998), but no data are available on this genus in the Middle East. In this study, four species of the genus *Miota* are known from Iran and the Middle East while nine species are known from Russia (Chemyreva, 2019). *Miota* is a genus of the subfamily Belytinae with 70 extant described species worldwide (Johnson, 1992; Chemyreva, 2019). The highest number of species (51 species) are known from the Palaearctic region (Johnson, 1992; Buhl, 1997; Wall, 1998; Chemyreva, 2019); 17 species from the Nearctic region (Johnson, 1992); one species from the Oriental (Johnson, 1992) and one species from the Neotropical region (Johnson, 1992; Quadros & Brandao, 2017).

This research was conducted in the northern slope of Alborz Mountains which is usually characterized by semi-humid to humid climate having an average annual precipitation between 500 and 1800 mm, and covers the southeastern part of the Caucasus biodiversity hotspot (Williams *et al.* 2006). This hotspot contains one of the greatest biological diversity of temperate forest regions across the world (Japoshvili and Ljubomirov, 2023). It is expected that the species identified in this research will also be found in the countries of the Caucasus region (Armenia, Azerbaijan, Georgia, and parts of Southern Russia). All the species of the genus *Miota*, which are reported for the first time from Iran, were previously identified in European countries (the Western Palaearctic region) (Nixon, 1957; Wall, 1998; Chemyreva, 2019).

Iran is a large country comprising various ecosystems and many parts of the country are still unexplored, and we expect that the species number of the genus *Miota* in Iran will be significantly increased in the future. Accordingly, previous comprehensive investigations on other groups of Hymenoptera, including Chrysidoidea (Barahoei *et al.*, 2022), Platygasteridae and Scelionidae (Minab *et al.*, 2023), Pteromalidae (Rahmani *et al.*, 2022), Braconidae (Rakhshani *et al.*, 2019), and Proctotrupidae (Izadzadeh *et al.*, 2022) have clearly shown that Iranian fauna comprises elements from the Palaearctic, the Afrotropical, and the Oriental regions.

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کشف جنس *Miota* Foerster, 1856 (Hymenoptera: Diapriidae) از ایران و خاورمیانه، به همراه چهار

گزارش جدید

محمد ایزدی زاده^۱ , علی اصغر طالبی^۱ , سمیرا فراهانی^۲ , فرزانه کازرانی^۲  و علی عامری^۳ 

- ۱- گروه حشره‌شناسی، دانشکده کشاورزی، دانشگاه تربیت مدرس، تهران، ایران
- ۲- مؤسسه تحقیقات جنگل‌ها و مراتع کشور، سازمان تحقیقات، آموزش و ترویج کشاورزی، تهران، ایران
- ۳- بخش تحقیقات رده‌بندی حشرات، مؤسسه تحقیقات گیاهپزشکی ایران، سازمان تحقیقات، آموزش و ترویج کشاورزی، تهران، ایران

✉ mohammad.izadizadeh@modares.ac.ir

✉ talebia@modares.ac.ir

✉ s.farahani@rifr-ac.ir

✉ Farzaneh Kazerani@gmail.com

✉ ameri@iripp.ac.ir

 <https://orcid.org/0000-0002-8724-0132>

 <https://orcid.org/0000-0001-5749-6391>

 <https://orcid.org/0000-0002-6897-0631>

 <https://orcid.org/0000-0003-1968-3350>

 <https://orcid.org/0000-0003-2372-8494>

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چکیده

زنبورهای جنس *Miota* (Hymenoptera: Diapriidae) برای اولین بار از منطقه خاورمیانه با معرفی چهار گونه به عنوان گزارش جدید از ایران مورد شناسایی قرار گرفت. نمونه‌ها با استفاده از تله مالیز طی سال‌های ۱۳۸۹ تا ۱۳۹۷ از شمال ایران جمع‌آوری شدند. چهار گزارش جدید گونه عبارتند از: *M. Miota fungorum* (Kieffer, 1910)، *M. thomsoni* Wall, 1998 و *M. polita* (Thomson, 1858) *amonilicornis* (Kieffer, 1910) و ویژگی‌های افتراقی، تصاویر، پراکنش جغرافیایی و کلید شناسایی گونه‌های ایران ارائه شده است.

کلمات کلیدی: زنبورهای Cinetini diapriid، پراکنش، پارازیتوئید، شمال ایران

نویسنده مسئول: علی اصغر طالبی (پست الکترونیک: talebia@modares.ac.ir)

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