J. Agr. Sci. Tech. (2019) Vol. 21(3): 647-658

Dolichogenidea fernandeztrianai sp. nov. (Hymenoptera: Braconidae, Microgastrinae) from Iran

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ABSTRACT

The genus *Dolichogenidea* was studied from the northern Iran during 2010–2011. The specimens were collected using a set of Malaise traps. A new species *Dolichogenidea fernandeztrianai* Abdoli and Talebi sp. nov. is hereby described and illustrated. The new species can be distinguished by the following characters: fore wing vein R1 as long as or slightly longer than pterostigma and 4.90× as long as distance of vein R1 to vein 3RSb; T1 more or less parallel- to subparallel sided, smooth, with a distinct protuberance on central area and its length 1.70× posterior width; T2 smooth, transverse and rectangular; T3 longer than T2; ovipositor sheath with uniform width from base to apex and clearly longer than metatibia. An updated checklist for the Iranian species of this genus is provided in addition to their distribution data and references.

Keywords: New species, Species-groups, Taxonomy.

INTRODUCTION

Parasitic Hymenoptera is one of the extremely species-rich group of insects in terrestrial ecosystems (Shaw and Hochberg, 2001). The family Braconidae is the second largest family after Ichneumonidae in the order Hymenoptera (Aguiar *et al*., 2013) include more than 21,220 species under 1,100 genera (Yu *et al*., 2016). The braconid subfamily Microgastrinae is one of the most important groups of parasitoids in terms of both species richness and economic importance (Rodriguez *et al.*, 2013). This subfamily comprises 81 genera and over 2,700 species described worldwide (Yu *et al*., 2016; Fernandez-Triana and Boudreault, 2018). The last estimate of species richness for Microgastrinae is likely 8–20 times that of currently described species. The extraordinary species richness of the group, coupled with the occurrence of many cryptic species produces a significant taxonomic impediment that hinders the advancement of their study (Smith *et al*., 2008, 2013). Rodriguez *et al*. (2013) suggested that number of described species could be about 5–15% of true global diversity of this subfamily.

Viereck (1911) initially described *Dolichogenidea* as a subgenus of *Apanteles* merely because of its elongate genae. Subsequently, it was treated as several species-groups of *Apanteles sensu lato* (Nixon, 1965), which was later raised to genus level by Mason (1981) in which concept of *Dolichogenidea* included three of Nixon's (1965) species-groups: the *ultor*-group, the *laevigata*-group, and the *longipalpis*-group.

Some genera (i.e. *Apanteles*, *Exoryza*, *Iconella* and *Illidops*) are the closest genera

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[DOR: 20.1001.1.16807073.2019.21.3.20.3]

to *Dolichogenidea*, and *Apanteles* is the most controversial and difficult to separate from *Dolichogenidea*. Mason (1981) proposed several characters to distinguish *Dolichogenidea* from *Apanteles sensu stricto*, including punctures of anteromesoscutum typically distinctly separated and not breaking into aciculations posterolaterally; margin of vannal lobe convex and evenly setose; T1 parallel-sided or slightly wider apically; apicolateral areas of propodeum (if distinct) wider than high. The analysis of thousands of specimens by Fernandez-Triana *et al*. (2014) suggests that the only reliable character in *Dolichogenidea* is the presence of a convex to almost straight vannal lobe, which is uniformly fringed with setae, while in *Apanteles sensu stricto* the vannal lobe is strongly concave to almost straight and lacks setae medially. The lack of setae may be partial (there may be some small and sparse setae on the lobe) or complete (absence of setae). These two genera are also generally resolved as separate monophyletic clades using molecular data and thus are distinguishable in DNA barcoding studies (Smith *et al*., 2013; Fagan-Jeffries *et al*., 2018).

The genus *Dolichogenidea* Viereck, 1911 is a large group consisting of over 235 species in the world and 84 species in the west Palearctic (Fernandez-Triana and Ward, 2015; Yu *et al*., 2016; Fagan-Jeffries *et al*., 2018; Fernandez-Triana *et al*., 2018; Liu *et al*., 2018). The Palaearctic species of the genus *Dolichogenidea* have been revised and keyed by Nixon (1972), Papp (1978), Tobias (1986), Chen and Song (2004), and Liu *et al*. (2018).

The fauna of some subfamilies of Iranian Braconidae is already studied (Rakhshani *et al*., 2007; Farahani *et al*., 2012, 2014a,b, 2015, 2016; Ameri *et al*., 2015; Ghahari and Beyarslan, 2017; Rajabi Mazhar *et al*., 2018), but the Microgastrinae has been poorly studied (Farahani *et al*., 2014c, 2016; Gadallah *et al*., 2015; Ghafouri Moghaddam

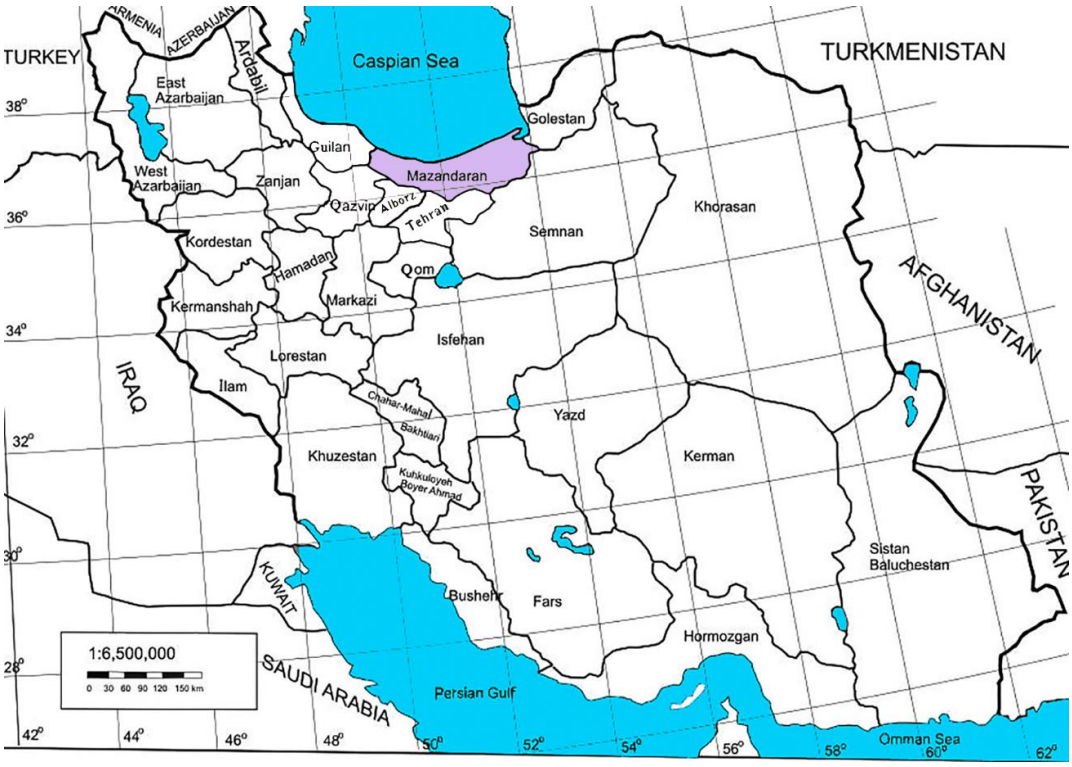

Figure 1. Map of Iran: Mazandaran Province, where *Dolichogenidea fernandeztrianai* **sp. nov.** Specimens have been collected.

[DOR: 20.1001.1.16807073.2019.21.3.20.3]

et al., 2018; Abdoli *et al*., 2019). This group has a relatively wide range of hosts, including many lepidopteran families such as Aegeriidae, Choreutidae, Cochylidae, Coleophoridae, Crambidae, Elachistidae, Gelechiidae, Momphidae, Oecophoridae, Plutellidae, Pterophoridae, Pyralidae, Tortricidae, and Yponomeutidae (Liu *et al*., 2018).

The objective of this study was to improve our knowledge about the genus *Dolichogenidea* from Iran. We here describe a new species as a part of the ongoing research on the systematics of Microgastrinae from Iran.

MATERIALS AND METHODS

The specimens for the present study were collected using Malaise traps during March to November 2010−2011 in northern Iran (e.g., Alborz, Guilan, Mazandaran, Qazvin and Tehran Provinces) (Figure 1). Malaise traps were placed in different habitats such as forests, rangelands, and orchards.

The specimens were identified by the keys of Nixon (1972), Papp (1978), Tobias (1986), Chen and Song (2004) and Liu *et al*. (2018). Morphological terminology follows Wharton *et al*. (1997) for wing venation, and Karlsson and Ronquist (2012) for the other various body parts used in description of the new species. The abbreviations T1, T2, and T3 refer to the metasomal tergites 1, 2, and 3, respectively, and F 2, 3, 14, 15 refer to flagellomeres 2, 3, 14 and 15, respectively; OOL means Ocello-Ocular Line (minimum distance between posterior ocellus and eye), OD means Ocellus Diameter (transverse diameter of anterior ocellus) and POL means Posterior Ocellar Line (minimum distance between posterior ocelli). USNM means National Museum of Natural History, Washington, DC, USA.

Measuring ovipositor sheath length is usually difficult due to its curvature. Thus, the comparison of ovipositor sheaths is based on approximate (not exact) values of its length with considering curvature (Abdoli *et al*., 2019). We measured the ovipositor sheath length from the beginning of the setal area to the distal end of the sheath.

The specimens were photographed with a Keyence VHX-1000 Digital microscope, using a lens with a range of 13–130×. Multiple images through the focal plane later were combined to produce a single in-focus image. The software associated with the Keyence system produced the focused images taken with that camera. The measurements were done using an Olympus™ SZX9 stereomicroscope equipped with a graticule. The specimens of new species are deposited in the Insect Collection of the Department of Entomology, Tarbiat Modares University, Tehran, Iran (TMUC).

RESULTS

Present study describes one new *Dolichogenidea*. An updated checklist for the Iranian species of this genus in addition to their distribution data and references are provided (Table 1).

Dolichogenidea Viereck, 1911

Dolichogenidea Viereck, 1911: 173. Type species: *Apanteles* (*Dolichogenidea*) *banksi* Viereck, 1911, by original designation, (USNM).

Viereck (1911) initially described *Dolichogenidea* as a subgenus of *Apanteles*. Subsequently, it was treated as some species-groups of *Apanteles sensu lato* (Nixon, 1965), but was later raised to genus level by Mason (1981). Fagan-Jeffries *et al*. (2018), Fernandez-Triana *et al*. (2018), and Liu *et al*. (2018) considered *Dolichogenidea* as a valid genus. However, Yu *et al*. (2016) treated *Dolichogenidea* as a synonym of *Apanteles* Foerster (1863).

[DOR: 20.1001.1.16807073.2019.21.3.20.3]

Table 1. Distribution and references for all species of the genus *Dolichogenidea* from Iran.

Number	Species	Distribution: Provinces (sampled regions)	References
1	*D. aethiopica* (Wilkinson, 1931)	Guilan (Fooman and Rasht)	(Ghahari *et al*., 2010)
2	*D. agilla* (Nixon, 1972)	East Azarbayjan (Arasbaran)	(Ghahari *et al*., 2011d)
3	*D. appellator* (Telenga, 1949)	Isfahan	(Kazemzadeh *et al*., 2014)
4	*D. candidat*a (Haliday, 1834)	Ilam (Ilam)	(Ghahari *et al*., 2011c)
		Lorestan (Noor Abad)	(Ghahari *et al*., 2012)
		Semnan (Damghan)	(Samin and Fischer, 2015)
5	*D. cytherea* (Nixon, 1972)	Golestan (Kalaleh)	(Ghahari and Fischer, 2011)
6	*D. decora* (Haliday,1834)	Qazvin (Danesfahan)	(Ghahari *et al*., 2011a)
7	*D. fernandeztrianai* Abdoli & Talebi **sp. nov.**	Mazandaran (Tangehvaz)	This study
8	*D. emarginata* (Nees, 1834)	Ardabil (Ardabil)	(Ghahari *et al*., 2009)
9	*D. halidayi* (Marshall, 1872)	Isfahan (Golpayegan)	(Ghahari *et al*., 2011b)
10	*D. iranica* (Telenga, 1955)	Kerman (Shurab - Zarudnyi), Sistan and Baluchistan (Degak, Megas - Zarudnyi).	(Telenga, 1955)
11	*D. lacteicolor* (Viereck, 1911)	Guilan (Bandar-e Anzali)	(Herard *et al*., 1979)
12	*D. longipalpis* (Reinhard, 1880)	Lorestan	(Pirhadi *et al*., 2008)
13	*D. seriphia* (Nixon, 1972)	Golestan (Galikesh)	(Ghahari and Fischer, 2011)
14	*D. sicaria* (Marshall, 1885)	Ilam (Darrehshahr)	(Ghahari *et al*., 2011a)

Diagnosis

Members of this genus are diagnosed by having moderate to large hypopygium, usually with a series of median longitudinal striae but at least sharply folded medially; ovipositor sheath usually long, setose throughout, sometimes with short ovipositor straight to gently down-curved; T1 length usually much longer than width, usually parallel-sided or barrel-shaped, but occasionally slightly wider or narrower apically and almost always bearing a median apical longitudinal depression; T2 always wider than its length and usually a little or much shorter than T3; propodeum coarsely sculptured to smooth and never with a median longitudinal carina, often with a more or less well-defined areola and costulae, this carination often reduced to a U-shaped area or median depression extending forward from the abdominal fovea or carination completely suppressed, leaving a uniformly sculptured or smooth surface; margin of vannal lobe of hind wing uniformly convex and setose, rarely slightly flattened (Mason, 1981).

Dolichogenidea fernandeztrianai Abdoli and Talebi sp. nov. (Figures 2 and 3)

Type of Material

Holotype: Female, Mazandaran Province, Noor, Chamestan, Tangehvaz (36° 21′ 55.68″ N, 52° 06′ 10.32″ E, 702 m a.s.l.), 05.ix.2011 (TMUC). Paratypes: 2 females, same data as Holotype (TMUC).

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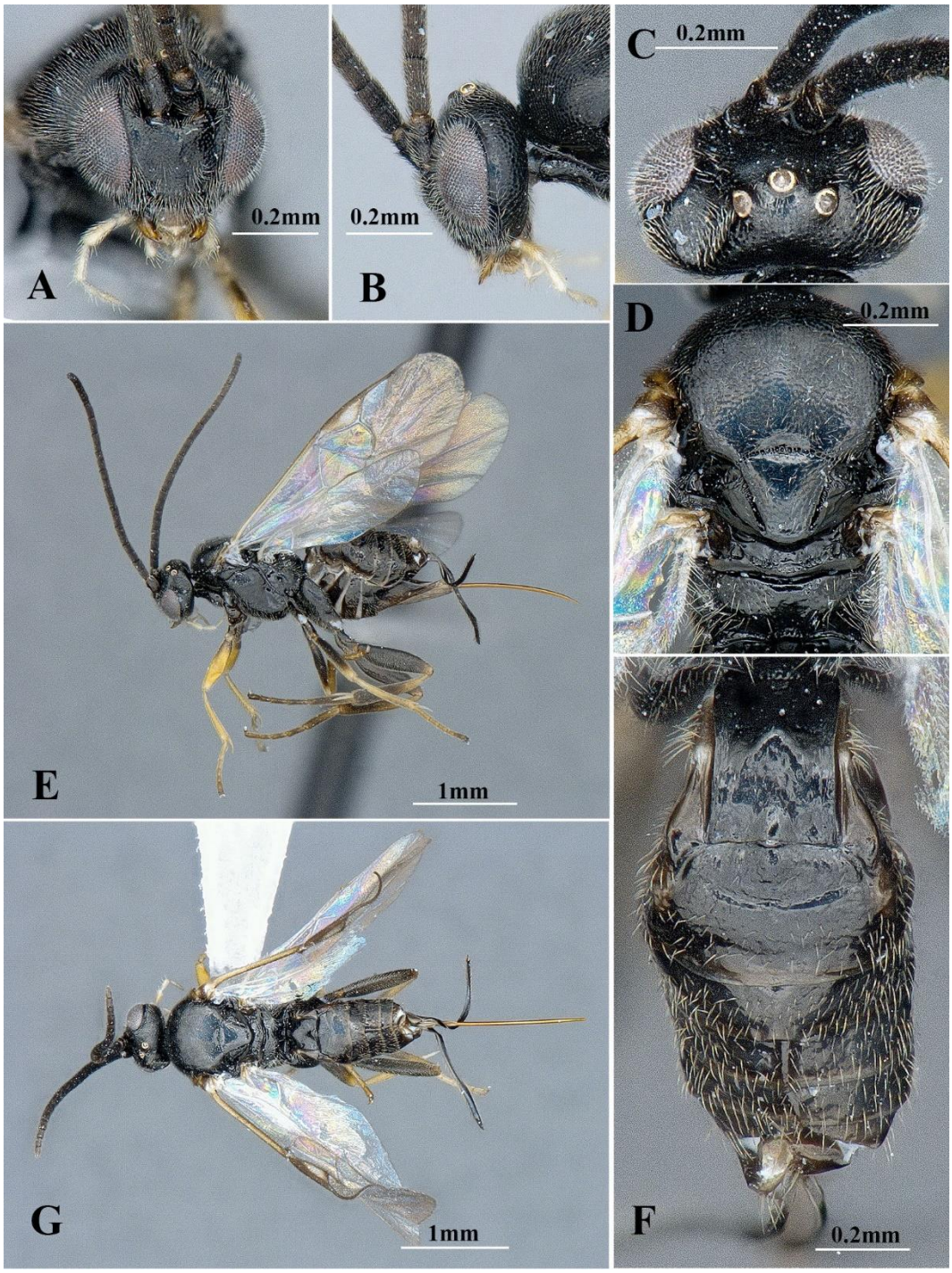

Figure 2. *Dolichogenidea fernandeztrianai* Abdoli & Talebi **sp. nov.** (Holotype). Female: (A) Head; frontal view, (B) Head; lateral view, (C) Head; dorsal view, (D) Mesosoma, dorsal view; (E) Habitus; lateral view, (F) Metasoma; dorsal view, (G) Habitus; dorsal view.

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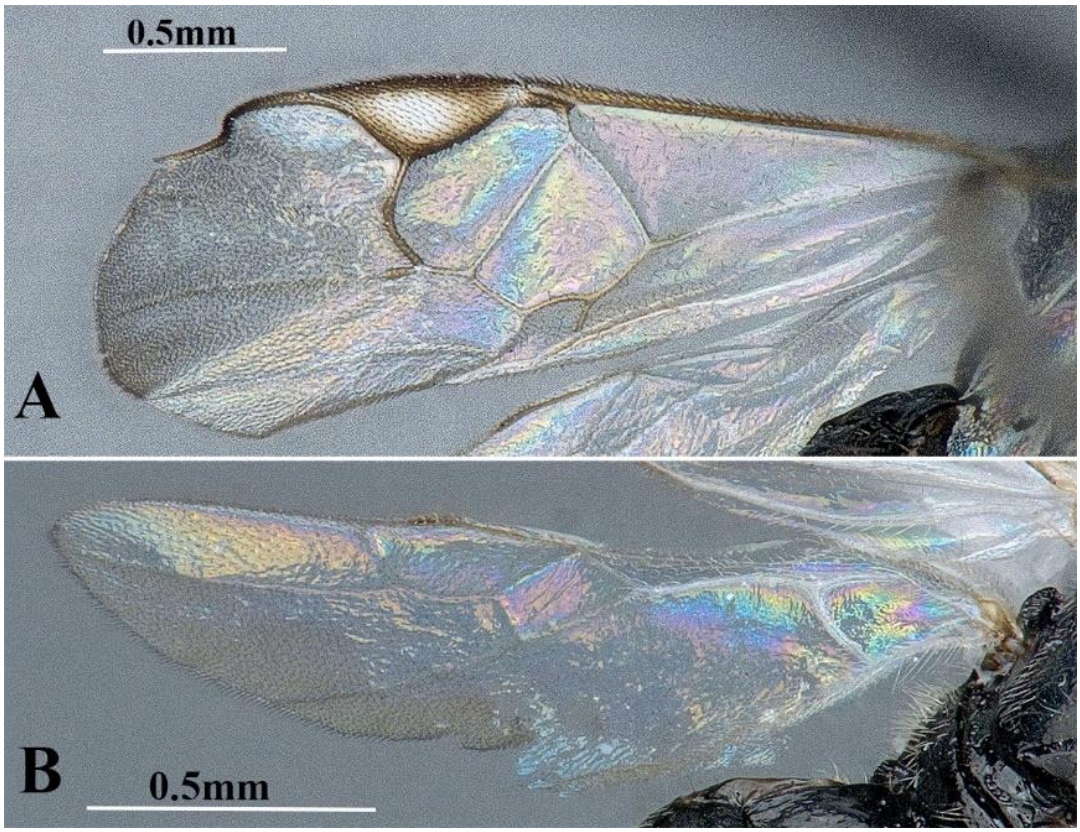

Figure 3. *Dolichogenidea fernandeztrianai* Abdoli & Talebi **sp. nov.** (Holotype). Wings, female: (A) Fore wing, (B) Hind wing.

Diagnosis

The newly described species can be distinguished from all previously described species of the genus *Dolichogenidea* from the Palaearctic region by the following combination of characters: Antennal flagellomeres, all coxae and metafemur dark brown to black; tegula reddish yellow or yellow; pterostigma whitish yellow with brownish margin; propodeum with areola weakly defined by an impression; fore wing vein R1 as long as or slightly longer than pterostigma; vein R1 4.90× as long as distance of vein R1 to vein 3RSb (Figure 3-A); T1 more or less parallel- to subparallel-sided i.e., slightly narrower medially; T1 smooth, with a distinct protuberance on central area; T1 length 1.70× posterior width; T2 smooth, transverse and rectangular; T3 longer than T2 (Figure 2-F); hypopygium pointed apically and slightly protruding beyond apical tergites; ovipositor sheath with uniform width from base to apex and clearly longer than metatibia (Figure 2-E).

Description (Female-Holotype)

Body Length without Ovipositor: 2.50 mm, antennae length 2.60 mm and forewing length 2.60 mm

Head: Antenna about as long as body; F 2, 3, 14, 15 length/width: 2.40, 2.40, 1.30 and 1.30, respectively; mouthparts not elongated (Figures 2-A and -B); head rounded or weakly constricted behind eyes (Figure 2-C); upper face (frons) smooth to rather finely punctate; gena, vertex and lower face (face) distinctly punctate; basal width of mandible 3.20–4.00× malar space length (Figure 2-A); OOL, OD, POL length: 0.13,

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0.06 and 0.13 mm, respectively (Figure 2-C).

Mesosoma: Anteromesoscutum densely punctate and setose, notauli indistinct; scutoscutellar suture narrow, distinctly crenulate; mesoscutellar disc finely and sparsely punctate to smooth and shiny; metanotum with uniform coarse wrinkles; anterior half of propodeum with few punctures and shiny, rest mostly smooth to slightly uneven; propodeum without distinct areola, weakly defined by an impression; pronotum weakly punctate; propleuron punctate; prepectal carina absent; mesopleuron medially smooth with some punctures on antero- and ventro-lateral parts; metapleuron weakly wrinkle to smooth, anteriodorsal corner rugulose, and with deep medial pit on anterior half (Figure 2-D).

Wings: Forewing length 2.60 mm; Forewing length/width: 2.90; vein R1 as long as or slightly longer than pterostigma; Pterostigma length/width: 2.50; vein R1 4.90× as long as distance of vein R1 to vein 3RSb; vein r as long as or slightly longer than vein 2RS; vein 1-CUb slightly shorter than vein 1-CUa (Figure 3-A).

Legs: Metafemur length/width: 3.60; length of metafemur, metatibial, metabasitarsus and sum of other metatarsal segments i.e., sum of segments 2, 3, 4 and 5: 0.75, 0.85, 0.40 and 0.60 mm, respectively; length of metatibial inner and outer spur 0.20 and 0.17 mm, respectively; metatibia inner spur length/metabasitarsus length: 0.50.

Metasoma: T1 more or less parallel- to subparallel-sided i.e. slightly narrower medially; T1 smooth, with a distinct central protuberance; T1 length 1.70× posterior width; T2 smooth, transverse and rectangular (T2 posterior width 2.75× its medial length); T3 longer than T2 (T3/T2 length: 1.25) (Figure 2-F); hypopygium pointed apically, slightly extending beyond the apex of metasoma; ovipositor sheath with uniform width and slightly curved downwards; ovipositor sheath clearly longer than metatibia (ovipositor sheath 1.20× as long as metatibia), ovipositor sheath length 1.15 mm (Figure 2-E).

Colouration: Body black; except yellow or reddish yellow mouthparts, tegula, fore legs, apex of mesofemur, mesotibia, mesotarsus, basal one-third of metatibia and ovipositor; metatarsus brown; palpi whitish yellow; pterostigma whitish yellow, with brownish margin; wing venation with combination of whitish yellow and brown (Figures 2 and 3).

Male: Unknown.

Note: Although there is no available key that covers all Palaearctic species of *Dolichogenidea*, we provide comparisons of *Dolichogenidea fernandeztrianai* **sp. nov.** with all previous keys of Palaearctic *Dolichogenidea*. *Dolichogenidea fernandeztrianai* **sp. nov.** runs close to *D. britannica* (Wilkinson, 1941), in the keys by Nixon (1972) but it differs from the latter as follows: in *D. fernandeztrianai* **sp. nov.** T1 more or less parallel- to subparallel-sided not narrowed apically and ovipositor sheath 1.20× as long as metatibia (whereas in *D. britannicus* T1 markedly narrowed towards apex and ovipositor sheath twice as long as metatibia). This species runs into *D. jilinensis* Chen and Song (2004) [this species is synonymized with *D. purda* (Papp, 1977) by Liu *et al*. (2018)] as per the key by Chen and Song (2004), nevertheless, it differs from *D. fernandeztrianai* **sp. nov.** as follows: in *D. fernandeztrianai* **sp. nov.** T1 length 1.70× posterior width; pterostigma whitish yellow, with brownish margin; anterior half of propodeum with some punctures, shiny, other areas mostly smooth to slightly uneven, propodeum without distinct areola, weakly defined by an impression; notauli not defined (whereas in *D. purda*, T1 1.50× its posterior width, pterostigma evenly brown; propodeum mostly smooth, with only a small trace of posterior areola carinae near nucha, notauli distinct by crowded punctation). This species runs in the key by Liu *et al*. (2018) to *D. poliobrevis* Liu & Chen, 2018, however, it differs from *D. fernandeztrianai* **sp. nov.** as follows: in *D. fernandeztrianai*

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sp. nov. T1 more or less parallel- to subparallel-sided i.e., slightly narrowermedially, T1 length 1.70× posterior width; pterostigma whitish yellow, with brownish margin; ovipositor sheath 1.20× as long as metatibia (whereas in *D. poliobrevis* T1 parallel-sided and as long as posterior width, pterostigma brown, ovipositor sheath nearly as long as metatibia).

Dolichogenidea fernandeztrianai **sp. nov.** is similar to *Dolichogenidea eleagnellae* Tobias, 1976, but it differs from *D. eleagnellae* as follows: in *D. fernandeztrianai* **sp. nov.** scutoscutellar suture narrowed with 20 crenulate; ovipositor sheath clearly longer than metatibia, 1.20× as long as metatibia; pterostigma whitish yellow, with brownish margin (whereas in *eleagnellae* scutoscutellar suture wide and deep with 10 crenulate; ovipositor sheath slightly longer than metatibia; pterostigma entirely dark i.e. opaque brown to blackish brown, without pale basal spot).

Paratypes: F 2, 3, 14, 15 length/width: 2.40–2.70, 2.40–2.70, 1.16–1.30 and 1.20–1.25, respectively; OOL,OD,POL length: 0.12, 0.05–0.06 and 0.13–0.15 mm, respectively; Forewing length: 2.70–2.75 mm; Forewing length/width: 2.90–3.00; Pterostigma length/width: 2.60–2.70; length of metafemur, metatibial, metabasitarsus and sum of other metatarsal segments: 071–0.75, 0.83–0.92, 0.41–0.42 and 0.60 mm, respectively.

Etymology: The new species is named in the honor of Dr. Jose L. Fernandez-Triana, specialist on the systematics of Braconidae at the Canadian National Collection of Insects, for his significant contributions to the Microgastrinae knowledge of the world.

DISCUSSION

The new species was collected from deciduous forest of Mazandaran Province. The genus *Dolichogenidea* is newly recorded from Mazandaran Province. The sampled regions in this study belong to the Irano-Anatolian hotspot that forms a natural barrier between the Mediterranean basin and the dry plateaus of western Asia (Paknia and Rajaei, 2015; Kiani *et al*., 2017). The mountains and basins that make up the Irano-Anatolian region contain many centers of local endemism. Most of north and west parts of Iran belong to this Irano-Anatolian region (Kiani *et al*., 2017; Mohammadi-Khoramabadi and Talebi, 2018), which is expected to have the highest biodiversity in Iran. Previously, the species of this genus were recorded from 11 provinces (Table 1), which shows that *Dolichogenidea* species are well adapted to a wide range of habitats in north, central, and south Iran. This study has added one new species of *Dolichogenidea*, thus increasing the total number to 85 in the west Palaearctic region. The number of Iranian *Dolichogenidea* species has risen from 13 to 14. However, the majority of the species records from Iran are not confirmed, since they are sourced from the solely faunistic works, with no depository. Therefore, only an updated checklist is written based on previous literatures (Table 1). The number of Iranian *Dolichogenidea* species compares to neighboring countries as follows: 41 species in Russia (Telenga, 1955), 27 species in Turkey (Inanc and Beyarslan, 2001), 20 species in Azerbaijan (Tobias, 1976; 1986), eight species in Tajikistan (Telenga, 1955; Kotenko, 2007), four species in Afghanistan (Tobias, 1998) and one species in Pakistan (Watanabe, 1967). Further investigations are needed to obtain better knowledge on the genus and unveil distribution range of Iranian *Dolichogenidea* because many areas of the country are still unexplored.

ACKNOWLEDGEMENTS

Thanks are due to the Department of Entomology, Tarbiat Modares University for providing financial support for this study and to the Canadian National Collection of Insects (CNC) of Agriculture and Agri-Food

[DOR: 20.1001.1.16807073.2019.21.3.20.3]

Canada for providing facilities. We cordially thank four anonymous reviewers for their critical review and constructive comments, which significantly helped the improvement of the manuscript. We are thankful to Drs. Khayrandish, Nadimi and Mohammadi for helping with the collection of the specimens. The senior author especially thanks Dr. Jose L. Fernandez-Triana (CNC) for his guidance in improving her knowledge on Microgastrinae.

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توصیف گونه جدید *Dolichogenidea fernandeztrianai* sp. nov. (Hymenoptera: Braconidae: Microgastrinae) از ایران

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چکیده

جنس *Dolichogenidea* در طی سالهای ۱۳۹۰-۱۳۸۹ در شمال ایران مورد مطالعه قرار گرفت. نمونه ها با استفاده از یک سری از تله های مالایز جمع آوری شد. گونه جدید *Dolichogenidea fernandeztrianai* Abdoli and Talebi sp. nov. توصیف و شکل های مربوط به ویژگی های تاکسونومیک آن ارائه گردید. گونه جدید با استفاده از خصوصیات زیر تشخیص داده می شود: در بال جلو طول رگبال R1برابر یا اندکی بلندتر از پترواستیگما و ۴.۹ برابر فاصله رگبال R1تا رگبال RSb۳؛ حاشیه های جانبی ترژیت اول شکم کم و بیش موازی، صاف و طول آن ۱.۷ برابر عرض ناحیه عقبی آن؛ ترژیت دوم شکم صاف، عریض و مستطیلی شکل؛ ترژیت سوم شکم بلندتر از ترژیت دوم؛ غلاف تخمریز از قاعده تا انتها تقریبا یک شکل و طول آن بیشتر از طول ساق پای عقب است. چک لیست به روز شده برای گونه های ایرانی این جنس همراه با اطلاعات پراکنش جغرافیایی و مراجع مرتبط ارائه شده است.

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