

Research Article

Review of the genus *Mesopolobus* Westwood (Hymenoptera: Pteromalidae) in Iran with a new record

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Abstract: Prior to this study eight species of *Mesopolobus* Westwood were recognized from Iran. In this study, one species namely *M. aspilus* (Walker) is newly recorded. An illustration of the external features of this species is provided. All known species from Iran were reviewed, the key to species and their geographical distribution in Iran is provided.

Keywords: Pteromalidae, soil and litter, Chalcidoidea, parasitoid, Iran

Introduction

The genus *Mesopolobus* Westwood, 1833 is a specious worldwide genus of the family Pteromalidae (Hymenoptera: Chalcidoidea), including about 133 species (Noyes, 2021). About 70% of nominated species have been recorded from the Palaearctic region.

They are generally less than 4 mm with metallic and usually green or golden-green coloring. The following features characterize the representatives of the genus *Mesopolobus*: antennae situated in the lower part of the head, antennal formula 11353 or 11263; unsymmetrical mandibles: right mandible 4-toothed and left mandible 3-toothed; the pronotum with a very narrow and shiny strip along the rear edge; the front edge of the pronotum with a distinct edge that can be a little lifted in, with a sharp edge but not carinate; the notauli incomplete; the scutellum without a separated frenum; the propodeum usually with a complete middle cross-vein and with at least

partly developed plicae; the upper part of the mesepisternum is smooth and shiny; the speculum of fore wings elongated. Males of some species have heavily modified tibia of mid legs flattened and widened, often with different outgrowths and colorful spots or strips.

Species of the genus biologically are associated with five orders of insects as larval or pupal parasitoids (Graham, 1969). Most species of the genus play an important role in the biological control of gall maker Diptera, Hymenoptera, and Coleoptera (Bouček, 1988). *Mesopolobus aequus* (Walker) and *M. arcanus* Askew are hyperparasitoids of other *Mesopolobus* species (Raatikainen, 1961, 1970; Herting, 1977; Askew and Blasco-Zumeta, 1997).

According to valid reports, eight species of the genus were hitherto recorded from Iran (Haeselbarth, 1983; Askew *et al.*, 2006; Lotfalizadeh and Gharali, 2008; Alemansour *et al.*, 2010; Tavakoli *et al.*, 2010; Hasani *et al.*, 2011; Hasani and Madjdzadeh, 2012; Mahdavi and Madjdzadeh, 2013; Dehdar and Madjdzadeh,

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2013; Abolhassanzadeh *et al.*, 2017) (Table 1). This research aims to report another species and review the previously reported species from Iran.

Materials and Methods

Samples were collected from the soil litter (20 cm of upper soil layer) and were transferred to the laboratory, where the litter was placed in a Berlese funnel. Sampling was done from Arasbaran forest, in East-Azarbaijan province, northwest Iran, during 2020.

The collected material, initially preserved in 70% alcohol, was later sorted and dry-mounted

on cards using water-soluble glue or on slides in Canada balsam according to the method outlined in Noyes (1982). The preserved wasps were identified to species using Graham (1969) and Xiao *et al.* (2016).

Illustrations were made using an Olympus™ SZH, equipped with a Canon™ A720 digital camera. The specimens were deposited in the insect collection of the Plant Protection Research Department, East-Azarbaijan Agricultural and Natural Resources Research and Education Center.

Table 1 Known species of the genus *Mesopolobus* from Iran and their biological data and distribution in the different provinces.

Species	Biological association in Iran	Geographical distribution	References
<i>Mesopolobus albitarsus</i>	<i>Andricus grossulariae</i> Giraud, 1859 and <i>A. moreae</i> Graeffe, 1905 (Hym.: Cynipidae) on <i>Quercus</i> spp.	Kordestan, West-Azarbaijan, Kermanshah, Lorestan, Qazvin	Sadeghi <i>et al.</i> (2009), Tavakoli <i>et al.</i> (2010)
<i>Mesopolobus amaenus</i>	<i>Leucoma wiltshirei</i> (Lep.: Lymantriidae)	Fars	Haeselbarth (1983)
	<i>Diplolepis mayri</i> (Hym.: Cynipidae)	Lorestan	Askew <i>et al.</i> (2006)
	<i>Andricus cecconii</i> Kieffer, 1901; <i>A. grossulariae</i> Giraud, 1859; <i>A. curator</i> Hartig, 1840 and <i>Doryocosmus israeli</i> (Geoffroy in Fourcroy, 1785) (Hym.: Cynipidae) on <i>Quercus</i> spp.	Lorsetan, West and East-Azarbaijan, Ardabil, Gilan, Kordestan, Kermanshah, Kohkiluyeh-Boyerahmad, Khuzestan	Sadeghi <i>et al.</i> (2009), Tavakoli <i>et al.</i> (2010)
<i>Mesopolobus arcanus</i>	<i>Eurytoma</i> sp. (Hym.: Eurytomidae) on <i>Ephedra procera</i> (Ephedraceae)	Fars	Alemansour <i>et al.</i> (2010)
<i>Mesopolobus aspilus</i>	-	East-Azarbaijan	Present study
<i>Mesopolobus deserti</i>	-	Khorasan Razavi	Hasani <i>et al.</i> (2011)
<i>Mesopolobus fasciventris</i>	Leaf galls on <i>Salix pycnostachya</i>	Kerman	Mahdavi and Madjdzadeh (2013)
	<i>Andricus pseudoaries</i> Melika <i>et al.</i> , 2008; <i>A. sternlichti</i> Bellido <i>et al.</i> , 2003; <i>Cynips quercus</i> Fourcroy, 1785 and <i>Neuroterus quercusbaccarum</i> L., 1758 (Hym.: Cynipidae) on <i>Quercus</i> spp.	Lorsetan, West and East-Azarbaijan, Ardabil, Gilan, Kordestan, Kermanshah, Mazandaran, Qazvin, Zanjan, Mazandaran, Hamadan	Sadeghi <i>et al.</i> (2009), Tavakoli <i>et al.</i> (2010)
<i>Mesopolobus sericeus</i>	<i>Tamarix</i> sp.	Khorasan Razavi	Hasani and Madjdzadeh, (2012)
	Galls of <i>Diplolepis fructuum</i> on <i>Rosa beggeriana</i>	Kerman province	Mahdavi <i>et al.</i> (2015)
	<i>Andricus megalucidus</i> Melika <i>et al.</i> , 2003 (Hym.: Cynipidae)	Lorsetan, East-Azarbaijan, Ardabil, Gilan	Tavakoli <i>et al.</i> (2010)
<i>Mesopolobus tibialis</i>	<i>Cynips quercus</i> Fourcroy, 1785 and <i>Neuroterus quercusbaccarum</i> L., 1758 (Hym.: Cynipidae) on <i>Quercus</i> spp.	West and East -Azarbaijan, Qazvin, Zanjan, Mazandaran	Sadeghi <i>et al.</i> (2009), Tavakoli <i>et al.</i> (2010)
<i>Mesopolobus xanthocerus</i>	on Gramineae	Kordestan	Dehdar and Madjdzadeh (2016)

Results

A *Mesopolobus* species was identified from collected specimens under *Mesopolobus aspilus* (Walker, 1835). It is found in Iranian fauna for the first time. The list of Iranian species of *Mesopolobus* is as follows:

1- *Mesopolobus albitarsus* (Walker, 1834)

Remarks. This species is a parasitoid of *Andricus* spp. (Hym.: Cynipidae) on *Quercus* spp. In the western provinces of Iran (Sadeghi et al., 2009; Tavakoli et al., 2010). It was reported from *Andricus* and *Neuroterus* in Europe (Noyes, 2021).

2- *Mesopolobus amaenus* (Walker, 1834)

Remarks. This species was reported from *Leucoma wiltshirei* Collenette, 1938 (Lepidoptera: Erebididae) in Fars province (Haeselbarth, 1983) and rose gall wasp, *Diplolepis mayri* Schlechtendal, 1877 (Hymenoptera: Cynipidae) in Lorestan province (Askew et al., 2006). However, it is a parasitoid of gall maker Cynipidae (Hymenoptera) of the genera *Andricus* and *Doryocosmus* on *Quercus* spp. (Fagaceae) in the west and northwestern forests of Iran (Sadeghi et al., 2009; Tavakoli et al., 2010).

3- *Mesopolobus arcanus* Askew, 1997

Remarks. *Mesopolobus arcanus* is known as a parasitoid of *Eurytoma* sp. (Hymenoptera: Eurytomidae) on *Ephedra procera* Fisch and Mey (Ephedraceae) in Fars province (Alemansour et al., 2010). It was described based on collected materials from *Ephedra nebrodensis* Tineo as a parasitoid of *Blascoa ephedrae* Askew, 1997 (Hymenoptera: Pteromalidae) (Askew and Blasco-Zumeta, 1997).

4- *Mesopolobus aspilus* (Walker, 1835) (Fig. 1)

Eutelus (*Eutelus*) *elongatus* Thomson, 1878

Mesopdoby aspilus (Walker, 1835)

Mesopolobus aspilus (Walker, 1835)

Mesopolobus elongatus (Thomson, 1878)

Platymesopus aspilus (Walker, 1835)

Platymesopus elongatus (Thomson, 1878)

Pteromalus aspilus Walker, 1835

Material examined: Iran, East Azarbaijan, Arasbaran forest (38S46758568-855925) 19.x.2018, H. Taher leg., 1♀.

Remarks. *Mesopolobus aspilus* is characterized by the following features (Fig. 1): Body more than 1.5mm. Anterior margin of clypeus shallowly emarginated medially, without tooth, lower face slightly reticulate; antennae with 3 anelli and 5 funiculars; antennal funiculars yellow; antennae near to ocular line, antennal toruli to clypeal margin distinctly shorter than it to middle ocellus; combined length of pedicellus and flagellum nearly equal to breadth of head; Fu1 distinct longer than the third anellus; scape slightly longer than eye height; pronotum with collar margined; propodeum smooth on median part, with distinctly medial carina without costula; frenum not distinctly marked off by an impressed line, except just at the sides; forewing with basal cell bare or with several hairs, marginal vein 1.68 times as long as stigmal vein; female with gaster long oval, at least slightly longer than head plus thorax, at most 2.7 times as long as broad, ovipositor sheaths hardly exerted.

Biological association. The species was mainly reared from gall-maker insects such as Cecidomyiidae (Diptera) and also Tenthredinidae (Hymenoptera), lepidopterous families Lasiocampidae and Tortricidae (Graham, 1969; Doganlar, 2011; Noyes, 2021).

Distribution. Europe (Bulgaria, Czech Republic, Denmark, Hungary, Moldova, Norway, Spain, Sweden, UK) and Asia (China, Kazakhstan, Turkey), and Iran (**new record**).

5- *Mesopolobus deserti* Dzhanokmen, 1994

Remarks. This species was recorded from the northeast of Iran but without any biological association (Hasani et al., 2011). It is a parasitoid of several gall midges (Diptera: Cecidomyiidae) on *Haloxylon* spp. and *Salsola* spp. (Chenopodiaceae) (Noyes, 2021). These host plants are widely distributed in northwest Iran.

6- *Mesopolobus fasciiventris* Westwood, 1833

Remarks. It was reared from leaf galls on *Salix pycnostachya* Andersson in Kerman province

without any host report (Mahdavi and Madjdzadeh, 2013). While it was reported mainly on Cynipidae (Hymenoptera) of the genera *Andricus*, *Cynips*, and *Neuroterus* on

Quercus spp. in Iran (Sadeghi *et al.*, 2009; Tavakoli *et al.*, 2010) and rarely on Curculionidae (Coleoptera) and Syrphidae (Diptera) (Noyes, 2021).

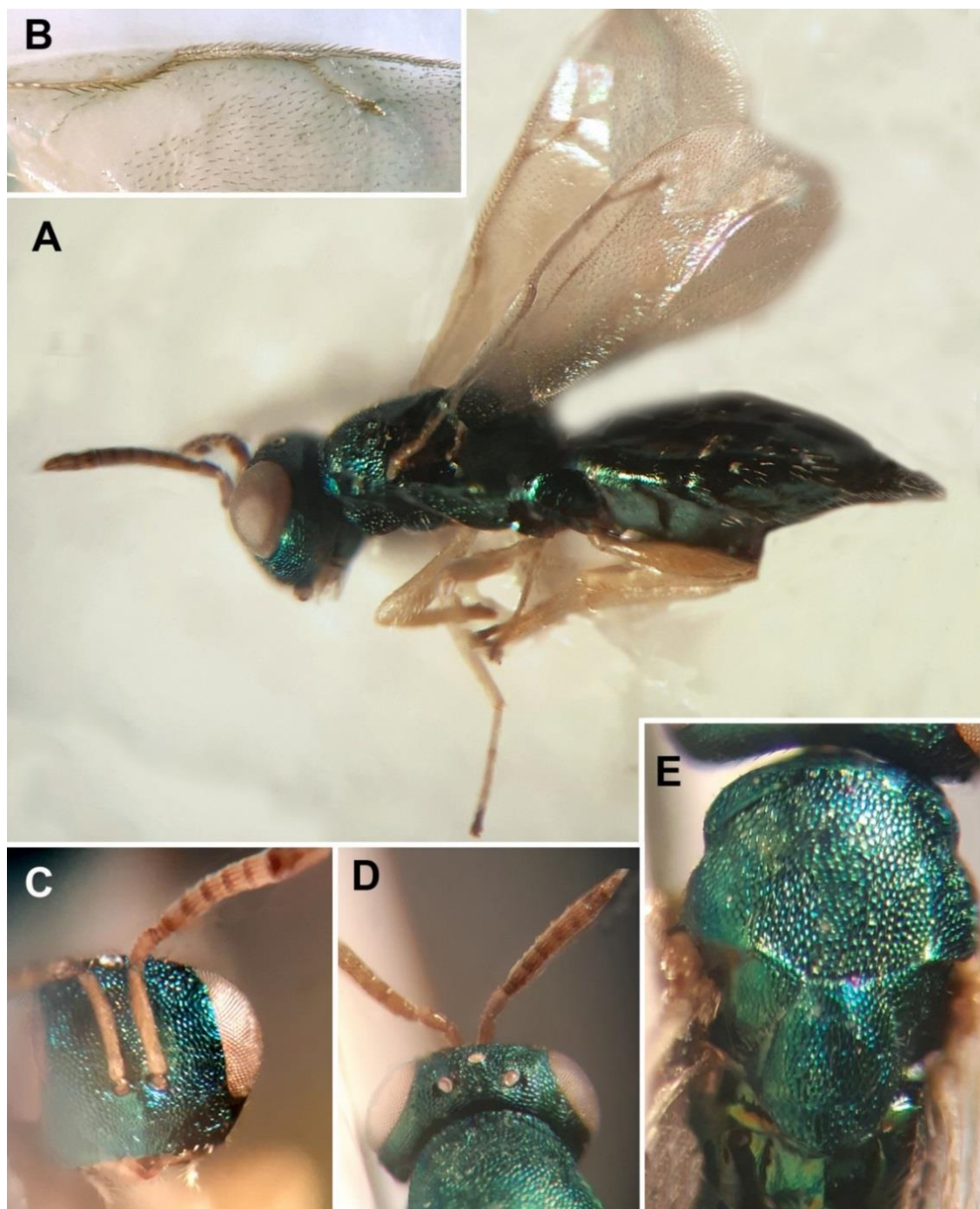


Figure 1 *Mesopolobus aspilus*, female: **A**- Female in lateral view, **B**- Fore wing venation, **C**- Head and antenna in frontal view, **D**- Head, antennae, and pronotum in dorsal view, **E**- Mesosoma in dorsal view.

7- *Mesopolobus sericeus* (Förster, 1770)

Remarks. It has been reported on *Andricus megalucidus* Melika et al., 2004 (Hym.: Cynipidae) in Ardabil, East-Azarbaijan, Gilan, and Lorsetan provinces (Tavakoli et al. 2010). Subsequently, it was collected on *Tamarix* sp. in Khorasan Razavi province (Hasani and Madjdzadeh, 2012). Mahdavi et al. (2015) reared it from *Diplolepis fructuum* (Hym.: Cynipidae) galls on *Rosa beggeriana*.

8- *Mesopolobus tibialis* (Westwood, 1833)

Remarks. This species was reared from *Cynips quercus* Fourcroy, 1785 and *Neuroterus quercusbaccarum* L., 1758 (Hym.: Cynipidae) galls on *Quercus* spp. in the north and northwestern forest in Iran (Sadeghi et al., 2009; Tavakoli et al., 2010). In Europe, it was reported from galls of different cynipid wasps on *Quercus* (Noyes, 2021).

9- *Mesopolobus xanthocerus* (Thomson, 1878)

Remarks. *Mesopolobus xanthocerus* has been collected on Gramineae in Kordestan province (Dehdar and Madjdzadeh, 2016). This report needs to be confirmed because all previous reports corroborated its association with Cynipidae (Hymenoptera) of *Quercus* sp. (Noyes, 2021).

Key to the Iranian species of *Mesopolobus* (female)

- 1- Marginal vein slightly longer than stigmal vein, lateral plicae of the propodeum incomplete ***M. arcanus***
 - Marginal vein longer than stigmal vein, lateral plicae of the propodeum complete 2
2. Antenna with 2 anelli and 6 funicle segments and head and thorax green, legs predominantly yellow; gaster long ovate, slightly more than twice as long as broad; mesosoma relatively elongated, about 1.6 times as long as broad 3
 - Either antenna with 3 anelli and 5 funicle segments, or with 2 anelli and 6 funicle segments and head and thorax extensively bronze to coppery, legs with femora and tibiae yellow-brown and more or less darkened; gaster usually

- less than twice as long as broad; mesosoma usually more compact, about 1.5 times as long as broad 4
- 3. Anterior margin of clypeus with median incision; venation uniformly pale ***M. sericeus***
 - Anterior margin of clypeus shallowly emarginate; parastigma and stigmal vein darker than rest ***M. fasciiventris***
- 4- Marginal vein 1.1-1.25 times as long as stigmal vein; head and mesosoma mainly dark green-blue to violet; femora and tibiae strongly darkened; strigose sculpture extending from clypeus on to gena; propodeum with lateral plicae indicated only posteriorly, median area with regular reticulate sculpture ***M. albitarsus***
 - Marginal vein more than 1.5 times as long as stigmal vein; head and mesosoma green, bright blue-green, bronze to violet; femora and tibiae sometimes not darkened; strigose sculpture restricted to part of clypeus; propodeum with lateral plicae complete or almost so, its median area mostly smooth or relatively weakly strigose-reticulate 5
- 5- Antenna with 2 anelli and 6 funicle segments, the third flagellar segment with at least one placoid sensillum (although in small individuals intermediate in size between flagellar segments 2 and 4), and all femora strongly darkened and the pronotal collar medially only one-seventh the length of the mesoscutum. ***M. tibialis***
 - Antenna either with 3 anelli and 5 funicle segments **or**, if the third flagellar segment bears placoid sensilla, the femora are usually at most weakly infuscate and the pronotal collar is longer 6
- 6- Marginal vein 1.1-1.25 times as long as stigmal vein; head and mesosoma mainly dark green-blue to violet; femora and tibiae strongly darkened; strigose sculpture extending from clypeus on to gena; propodeum with lateral plicae indicated only posteriorly, median area with regular reticulate sculpture ***M. deserti***
 - Marginal vein more than 1.5 times as long as stigmal vein; head and mesosoma green, bright blue-green, bronze to violet; femora and tibiae

sometimes undarkened; strigose sculpture restricted to part of clypeus; propodeum with lateral plicae complete or almost so, its median area mostly smooth or relatively weakly strigose-reticulate 7
 7- Pronotal collar at least 0.2 times as long as mesoscutum; mesosoma mainly greenish; legs except for coxae yellowish, usually at most only slightly darkened ***M. amaenus***
 - Pronotal collar shorter; mesosoma often strongly bronzed or coppery; legs with femora and tibiae sometimes strongly darkened 8
 8- Mesoscutum with several shallow but distinct piliferous punctures visible amongst the reticulation, 1.6-1.8 times as broad as long ***M. xanthocerus***
 - Mesoscutum without piliferous punctures, distinctly less than 1.6 times as broad as long ***M. aspilus***

Discussion

Mesopolobus aspilus was obtained from soil and litter in the Arasbaran biosphere reserve. Arasbaran is the ninth Biosphere Reserved in Iran which covers an area of 78560 hectares and is a part of the Caucasus mountains with an elevation ranging from 256 m to 2896 m. Due to the area's importance in having rich flora (about 1000 taxa) and fauna, it has been listed by UNESCO as a wildlife refuge since 1976. The reserve encompasses diverse natural landscapes, including highlands, steep valleys, high and steep mountainsides, forest lands, and agricultural, mountainous, and river rangelands. Finding a new record species associated with phytophagous insects in Arasbaran biosphere reserve with a wide range of diversity seems ordinary. Although one of the richest genera of Pteromalidae, *Mesopolobus* remains incompletely known, as shown by the discovery of *M. aspilus* presented here. Regardless of its origin, it is whether indigenous or alien. This study demonstrates the importance of including poorly documented taxonomic groups in regional or national faunistic biodiversity surveys.

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مروری بر جنس *Mesopolobus* Westwood (Hymenoptera: Pteromalidae) در ایران، با یک گزارش جدید

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چکیده: هشت گونه از جنس *Mesopolobus* Westwood قبلاً از ایران گزارش شده است. در این پژوهش یک گونه تحت عنوان *M. aspilus* (Walker) به عنوان گزارش جدید به این تعداد افزوده شد. تصاویری از مشخصات مورفولوژیکی این گونه فراهم گردید. کلیه گونه‌های شناخته شده از ایران مرور شده و کلید شناسایی و پراکنش جغرافیایی آنها در ایران فراهم گردید.

واژگان کلیدی: Pteromalidae، خاک، Chalcidoidea، پارازیتوئید، ایران