



Contribution to the chalcidoids (Hymenoptera: Chalcidoidea) of Iran: new records of family, genus and species

Mahla Shojaey

Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran.

✉ m.shojaey@modares.ac.ir

<https://orcid.org/0000-0002-5000-6262>

Ali Asghar Talebi

Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran.

✉ talebia@modares.ac.ir

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

Hossein Lotfalizadeh

Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection (IRIPP), AREEO, Tehran, Iran.

✉ h.lotfalizadeh@areeo.ac.ir

<http://orcid.org/0000-0002-7927-819X>

Mohammad Mehrabadi

Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran.

✉ m.mehrabadi@modares.ac.ir

<http://orcid.org/0000-0003-2981-7308>

Mohammad Khayrandish

Department of Plant Protection, Faculty of Agriculture, Shahid Bahonar University of Kerman, Kerman, Iran.

✉ m.khayrandish@uk.ac.ir

<http://orcid.org/0000-0002-2568-2306>

ABSTRACT. The family Macromesidae Graham, 1959, and the genus *Epicopterus* Westwood, 1833, from the family Eunotidae Ashmead, 1904, are recorded for the first time from Iran, by two species *Macromesus amphiretus* Walker, 1848, and *Epicopterus choreiformis* Westwood, 1833, respectively. Specimens were collected using Malaise traps during 2010–2011 from the Guilan and Qazvin provinces in north-central Iran. Detailed morphological characters of the newly recorded species are provided. The number of Macromesidae and Eunotidae species in Iran is newly raised to one and four species, respectively. An updated list of all known species of these taxa from the Middle East is also included.

Keywords: distribution, Eunotidae, Macromesidae, Middle East, parasitoid

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INTRODUCTION

For many years, researchers have sought to elucidate the evolutionary relationships within Chalcidoidea, a superfamily of parasitoid wasps characterized by their extraordinary diversity and ecological importance (Cruaud et al., 2024). Historically, some families, such as Pteromalidae, were considered repositories for species that could not be confidently assigned to well-defined taxonomic groups (Gibson et al., 1997). Advances in molecular phylogeny have since clarified many of these relationships, leading to significant taxonomic revisions (Burks et al., 2022). Some subfamilies and tribes have been elevated to family rank, while others have been reassigned to different families within Chalcidoidea. This is exemplified by the recent reclassifications of Macromesinae Graham, 1959 and Eunotinae Ashmead, 1904, which have been elevated to the family status as Macromesidae and Eunotidae, respectively (Burks et al., 2022). In earlier classification, Macromesinae was treated as a small subfamily of Pteromalidae, comprising a single genus, *Macromesus* Walker, 1848, with approximately 12 described species (Askew & Shaw, 2001; Narendran et al., 2001; UCD Community, 2023). Most species of Macromesinae are parasitoids of bark beetles and snout beetles (Coleoptera: Curculionidae, Scolytinae,

Corresponding author: Ali Asghar Talebi, ✉ talebia@modares.ac.ir

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and Curculioninae), especially those associated with coniferous trees (UCD Community, 2023). Similarly, Eunotinae, which included around 190 species within 23 genera, is known to primarily parasitize the mealybugs (Hemiptera: Pseudococcidae) (Gibson et al., 1997; UCD Community, 2023). According to the re-classification of Chalcidoidea proposed by Burks et al. (2022), Macromesidae is now recognized as a distinct family encompassing a single genus, *Macromesus* Walker, 1848, while Eunotidae includes seven genera: *Butiokeras* Burks & Heraty, 2020; *Cavitas* Xiao and Huang, 2001; *Cephaleta* Motschulsky, 1859; *Epicopterus* Westwood, 1833; *Eunotus* Walker, 1834; *Mesopeltita* Ghesquiere, 1946 and *Scutellista* Motschulsky, 1859. These revisions highlight the importance of both morphological and molecular data in understanding chalcidoid phylogeny and systematics (Burks et al., 2022).

Despite their ecological significance, the fauna of Macromesidae and Eunotidae remains poorly studied in Iran. Previous works on Iranian Chalcidoidea have provided limited insights into their diversity, with most research focusing on economically important families (Haeselbarth, 1983; Hesami et al., 2008; Mahdavi et al., 2015; Karimpour et al., 2023; Ehteshami et al., 2024; Jafarlu et al., 2024). This study as part of an ongoing project on the taxonomy and biodiversity of Iranian Chalcidoidea, aims to document the first record of the family Macromesidae and the genus *Epicopterus* (family Eunotidae) in Iran, providing new insights into their diversity, and distribution, thereby contributing to a more comprehensive understanding of Chalcidoidea biodiversity in Iran and the Middle East.

MATERIAL AND METHODS

Specimens were collected during 2010–2011 from the Guilan and Qazvin provinces of Iran using the Malaise traps. The collected specimens were preserved in 75% ethanol for subsequent preparation and identification. Mounting of the specimens followed the protocol outlined by Noyes (1982). The morphological terminology and classification follow Bouček (1988) and Gibson et al. (1997). Identifications were done using taxonomic keys provided by Bouček and Rasplus (1991), Graham (1969), Medvedev (1987), and Askew and Shaw (2001). External morphology was studied using an Olympus SZX9 stereomicroscope equipped with a BMZ-04-DZ digital imaging system. A series of four or five captured images were merged into a single in-focus image using the image-stacking software Combine ZP1.0 (Hadley, 2023) and Adobe® Photoshop CS6 programs. All voucher specimens were deposited in the insect collection of the Department of Entomology at Tarbiat Modares University, Tehran (TMUC). The following abbreviations were used according to Bouček (1988): Antennal formula: including scape, pedicel, anelli, funiculars and clavomeres, respectively; POL: the shortest distance between the posterior ocelli; OOL: the shortest distance between the posterior ocellus and the eye.

RESULTS

Taxonomic hierarchy

Class Insecta Linnaeus, 1785

Order Hymenoptera Linnaeus, 1758

Superfamily Chalcidoidea Linnaeus, 1758

Family Macromesidae Graham, 1959

Genus *Macromesus* Walker, 1848

Macromesus Walker, 1848:161. Type species: *Macromesus amphiretus* Walker, 1848, by monotypy.

Diagnosis. Antenna formula in female 1, 1, 1, 7, 3 and in male 1, 1, 1, 7, 2; lower face with vertical groove parallel to genal groove; pronotum very short, prepectus not detectable; mid tarsus in female with four tarsomeres, first tarsomere longer than other tarsomeres; mid tarsus in male with five tarsomeres; stigmal vein shorter than marginal vein (Bouček & Rasplus, 1991).

***Macromesus amphiretus* Walker, 1848 (Fig. 1)**

Material examined. 1♀ (TMUC), Qazvin province, Zereshek Road (36°25'39.36"N, 50°06'36.90"E, 1997 m, a. s. l.), 22.VI.2011, Malaise trap, Leg.: A. Nadimi.

Short description. Body length 2.8 mm (Fig. 1A); POL much longer than OOL (Fig. 1C); all funiculars longer than board (Fig. 1B); mesosoma 0.62× as long as metasoma (Fig. 1A); notauli complete (Fig. 1D); anterior tibia with a row of 9 small teeth; basal cell with a row of setae, marginal vein longer than postmarginal vein, stigma large (Fig. 1E); female gaster sublanceolate and 2.5× as long as broad.

Distribution in Iran. Qazvin (Current study).

General distribution. Croatia, Czech Republic, Denmark, England, Finland, France, Iran (New record), Italy, Poland, Serbia, Slovakia, Sweden, United Kingdom (UCD Community, 2023).

Family Eunotidae Ashmead, 1904

Epicopterus Westwood, 1833

Epicopterus Westwood, 1833:418. Type species: *Epicopterus choreiformis* Westwood, by monotypy.

Diagnosis. Head and thorax reticulate, in female 2 first funiculars small and anelliform; marginal vein widened and covered with setae, end of costal cell with wide incision, marginal vein shorter than stigmal vein; first tergite of gaster very long and convex (Graham, 1969; Bouček & Rasplus, 1991).

Epicopterus choreiformis Westwood, 1833 (Fig. 2)

Material examined. 1♀ (TMUC), Guilan province, Roodsar, Rahim Abad, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m, a. s. l.), 10–17.V.2010, Malaise trap, Leg.: M. Khayrandish.

Short description. Body length 1.1 mm (Fig. 2A); antenna clavate (Fig. 2B), all funiculars wider than long (Fig. 2B), POL 2.3× as long as OOL (Fig. 2C); clypeus reticulate and convex (Fig. 2B); notauli complete; median area of prepectus reticulate (Fig. 2D); one-third base of wing infuscate (Fig. 2F); dorsal surface of metasoma (except base of metasoma) finely reticulate (Fig. 2E).

Distribution in Iran. Guilan (Current study).

General distribution. Denmark, England, Germany, Iran (New record), Italy, Netherlands, Northern Ireland, Sweden, United Kingdom (UCD Community, 2023).

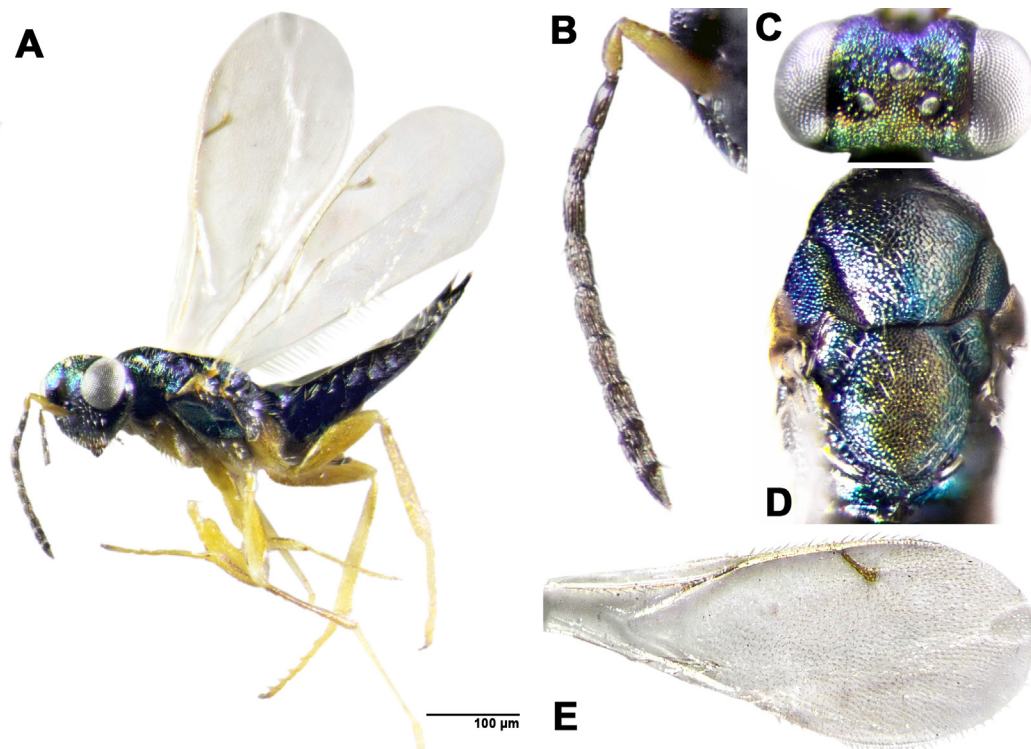


Figure 1. *Macromesus amphiretus* Walker, 1848, female. **A.** General habitus, lateral view; **B.** Antenna; **C.** Head, dorsal view; **D.** Mesosoma, dorsal view; **E.** Fore wing.

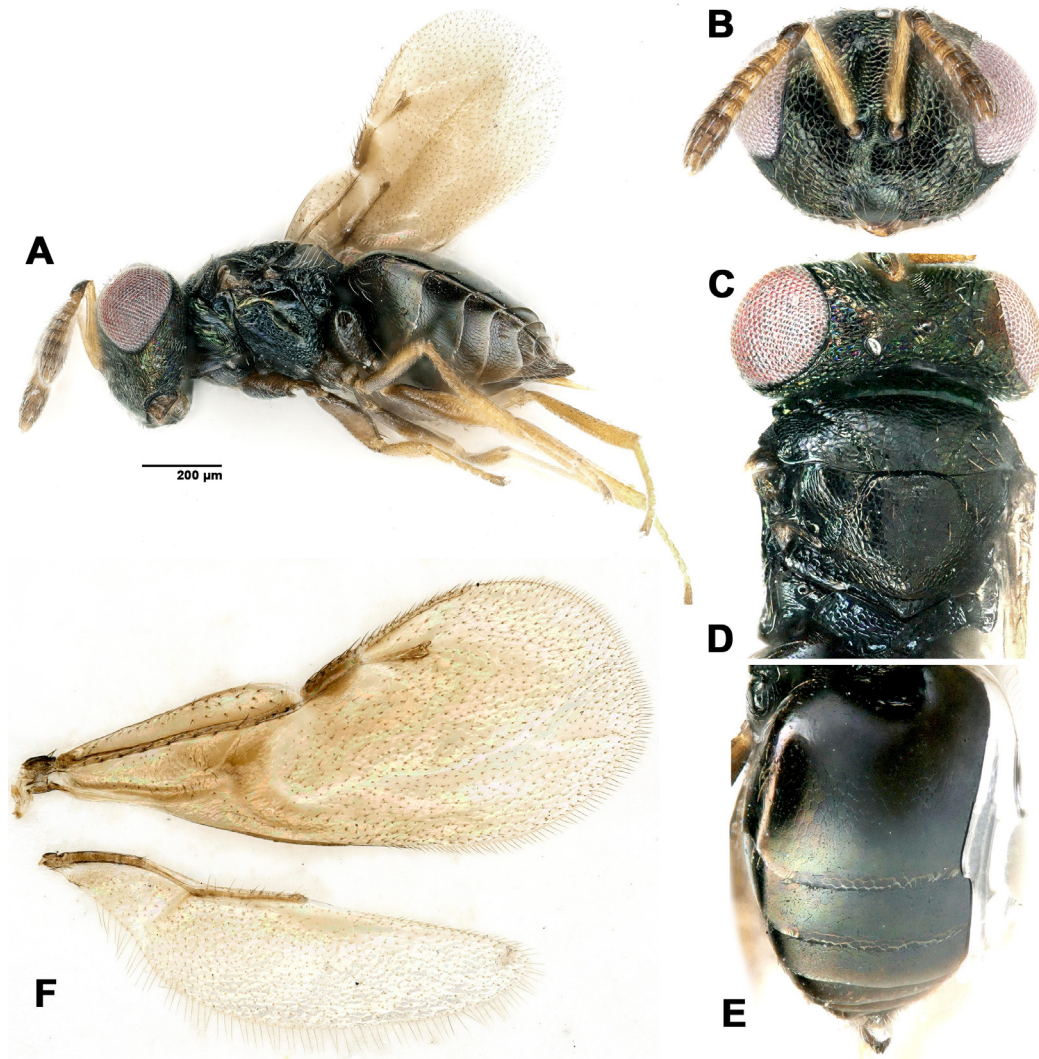


Figure 2. *Epicopterus choreiformis* Westwood, 1833, female. **A.** General habitus, lateral view; **B.** head, frontal view; **C.** Head, dorsal view; **D.** Mesosoma, dorsal view; **E.** Metasoma, dorsal view; **F.** Fore and hind wings.

DISCUSSION

Based on previous credible published reports (Rahmani et al., 2022), this study reports that the family Macromesidae and the genus *Epicopterus* (family Eunotidae) are documented for the first time from Iran, significantly contributing to the knowledge of Chalcidoidea biodiversity in the region. Previously, three species from three genera of Eunotidae had been reported in Iran, while eight species from four genera were documented in the broader Middle East (Rahmani et al., 2022). An updated list of all recorded species from Macromesidae and Eunotidae in the Middle East is provided in Table 1, highlighting the diversity and distribution of these families across the region. The data reveal that a total of 20 species are currently documented, with significant variation in species richness among countries. The highest number of recorded species comes from Iran (7 species), followed by Morocco (6 species), Türkiye (5 species), and Egypt (4 species). Other countries, such as Iraq, Syria, and Algeria, have relatively fewer records, indicating potential underreporting in these areas (e.g., Abd-Rabou & Evans, 2017; Diab et al., 2014). Some species such as *Scutellista caerulea* and *Scutellista nigra* exhibit wide distributions, extending from North Africa to the eastern Mediterranean, reflecting their adaptability to diverse ecological conditions (Faragalla et al., 1985; Kumral & Kovanci, 2004). Despite these records, the checklist (Table 1) underscores significant gaps in knowledge. Countries such as Afghanistan, and the Arabian Peninsula lack documented records for these families. This may reflect limited taxonomic surveys or insufficient sampling efforts in these regions (Askew et al., 2013).

Table 1. Updated list of known species of Eunotidae and Macromesidae (Hymenoptera: Chalcidoidea) in the Middle East.

Family	Species	Middle East distribution	References
Eunotidae	<i>Epicopterus choreiformis</i> Westwood, 1833	Iran	Current study
	<i>Eunotus acutus</i> Kurdjumov, 1912	Türkiye	Kaydan et al. (2006)
	<i>Eunotus areolatus</i> (Ratzeburg, 1852)	Türkiye	Ülgentürk & Toros (1999)
	<i>Eunotus nigriclavus</i> (Förster, 1856)	Iran	Haeselbarth (1983)
	<i>Mesopeltita truncatipennis</i> (Waterston, 1917)	Egypt	Abd-Rabou & Evans (2017)
	<i>Moranila californica</i> (Howard, 1881)	Iran	Davoodi et al. (2004); Ebrahimi (2014); Jalilvand et al. (2013)
		Israel	Mendel et al. (1984)
		Morocco	Smirnoff (1956)
	<i>Scutellista caerulea</i> (Fonscolombe, 1832)	Algeria	Thompson (1958)
		Egypt	Saad et al. (1977); El-Minshawy et al. (1978); Abd-Rabou (2011)
		Iran	Hesami et al. (2008)
		Iraq	Alrubeai (2017)
		Israel	Rosen (1962); Rosen et al. (1971); Mendel et al. (1984)
		Jordan	Awamelah et al. (2008, 2009)
		Lebanon	Khazawinah & Talhouk (1964)
		Libya	Lal & Naji (1979)
		Morocco	Thompson (1958); Vago (2002)
		Oman	Xiao & Huang (2001)
		Palestine	Rivnay (1944)
		Syria	Diab et al. (2014)
		Saudi Arabia	Faragalla et al. (1985)
		Tunisia	Jarraya (1974); Mansour et al. (2011)
	Türkiye	Öncüer (1991); Yayla et al. (1995); Xiao & Huang (2001); Kumral & Kovanci (2004)	
	<i>Scutellista nigra</i> Mercet, 1910	Algeria	Graham (1969)
		Egypt	Priesner & Hosny (1940); Herting (1972)
		Morocco	El-Hormiti & Laraichi (1979)
		Syria	Diab et al. (2014)
<i>Scutellista obscura</i> (Förster, 1878)	Morocco	Jourdan & Rungs (1934)	
Macromesidae	<i>Macromesus africanus</i> Ghesquière, 1963	Morocco	Ghesquière (1963)
	<i>Macromesus amphiretus</i> Walker, 1848	Türkiye	Ünal (2010)
		Iran	Current study

The redescription of *Macromesus* and its type species *M. amphiretus* has been thoroughly documented by Graham (1959) and Szczepariski (1959), establishing a solid foundation for understanding the taxonomy of this family. Prior to this study, *M. amphiretus* was only known from Eastern Türkiye (Ünal, 2010) and other parts of the western Palaearctic region (UCD Community, 2023). This species is primarily associated with Scolytinae beetles (Coleoptera: Curculionidae), with at least 13 species of scolytin beetles recognized as its hosts (UCD Community, 2023). The coniferous trees, such as *Picea abies* (L.) H. Karst. (formerly known as *Picea excelsa*), have been reported as the primary host plants (Graham, 1969). The occurrence of *M. amphiretus* in northern Iran suggests a biogeographical link between Türkiye and the Caspian forest ecosystem, highlighting the importance of studying the distributional patterns and ecological connections of Macromesidae in this area.

Epicopterus choreiformis, the only species of the genus *Epicopterus* identified in Iran, represents a new addition to the Middle Eastern fauna. Historically, this species has been known from the western Palaearctic region (UCD Community, 2023). According to Graham (1969), *Simopterus solaris* Masi, 1928, which was described in Italy, is considered synonymous with *Epicopterus choreiformis*. This species is a parasitoid of coccids (Hemiptera: Coccoidea) associated with fire trees (Myrtaceae) (UCD Community, 2023). Kryger (1934) reported that adults of *E. choreiformis* typically emerge in July and August (Graham, 1969). However, recent collections indicate an earlier emergence in May. This phenological variation may be influenced by local climatic conditions, host phenology, or other regional environmental factors. Further ecological investigations are necessary to elucidate these patterns. The limited historical records and the apparent disjunct distribution of *Epicopterus* in the Middle East highlight the need for more extensive sampling across diverse habitats in the region. This is especially important in underexplored areas where new species may be discovered. Furthermore, studies focusing on host-parasitoid relationships and phenological trends will offer deeper insights into the ecological significance of Macromesidae and Eunotidae.

In conclusion, this study not only expands the known geographical range of Macromesidae and *Epicopterus* in the Middle East but also emphasizes the importance of integrating morphological, ecological, and molecular approaches to comprehensively understand the diversity and biogeography of Chalcidoidea in the region. The use of these integrative methods is critical for resolving taxonomic ambiguities and uncovering evolutionary relationships within Chalcidoidea, as demonstrated in recent comprehensive studies on the classification and phylogenetics of Chalcidoidea (Burks et al., 2022; Cruaud et al., 2024).

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: M. Kayrandish & A.A. Talebi: Fieldwork and collecting the specimens; M. Shojaey, A.A. Talebi & H. Loftalizadeh: Identification of specimens, photography and writing the manuscript; M. Mehrabadi: Writing, and reviewing. All authors approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the insect collection of the Department of Entomology at Tarbiat Modares University, Tehran (TMUC), Iran, and are available upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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اطلاعات جدید از زنبورهای کالسیدوئید (Hymenoptera: Chalcidoidea) در ایران: گزارش جدید خانواده، جنس و گونه

مهلا شجاعی^۱، علی اصغر طالبی^{۱*}، حسین لطفعلی زاده^۲، محمد مهرآبادی^۱، محمد خیراندیش^۳

۱ گروه حشره شناسی، دانشکده کشاورزی، دانشگاه تربیت مدرس، تهران، ایران

۲ بخش تحقیقات رده‌بندی حشرات، مؤسسه تحقیقات گیاهپزشکی کشور، سازمان تحقیقات، آموزش و ترویج کشاورزی، تهران، ایران

۳ گروه گیاهپزشکی، دانشکده کشاورزی، دانشگاه شهید باهنر کرمان، کرمان، ایران

* پست الکترونیک نویسنده مسئول مکاتبه: talebta@modares.ac.ir

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چکیده: خانواده *Macromesidae* Graham, 1959 و یک جنس از خانواده *Eunotidae* Ashmead, 1904 برای اولین بار از ایران گزارش می‌شوند. این خانواده‌ها به ترتیب با گونه‌های *Macromesus amphiretus* Walker, 1848 و *Epicopterus choreiformis* Westwood, 1833 در ایران معرفی شدند. نمونه‌ها در سال‌های ۱۳۸۸ و ۱۳۸۹ با استفاده از تله مالیز از استان‌های گیلان و قزوین در شمال مرکزی ایران جمع‌آوری شده‌اند. مهمترین ویژگی‌های مورفولوژیک برای گونه‌های تازه گزارش شده ارائه شد. تعداد گونه‌های خانواده‌های *Eunotidae* و *Macromesidae* در ایران در حال حاضر به ترتیب به یک و چهار گونه افزایش یافت. فهرست به روز شده‌ای از تمام گونه‌های شناخته‌شده این واحدهای رده‌بندی از خاورمیانه نیز ارائه شد.

واژگان کلیدی: *Eunotidae*, *Macromesidae*، پارازیتوئید، انتشار، خاورمیانه