



Additional distributional data of the genera *Brachymeria* Westwood and *Monodontomerus* Westwood (Hymenoptera, Chalcidoidea), with two new records from Greece

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ABSTRACT. Chalcidoidea is a hyperdiverse superfamily of mostly small, parasitoid wasps of which 14 families and at least 422 species have been recorded from Greece. In the present study, additional distributional data from Greece is provided for *Brachymeria rugulosa* (Forster, 1859) and *Brachymeria tibialis* (Walker, 1834). Furthermore, *Brachymeria podagrica* (Fabricius, 1787) and *Monodontomerus obscurus* Westwood, 1833 are recorded for the first time from Greece. As well, a new host gall species for *B. rugulosa* is noted and the presence of *Brachymeria inermis* (Fonscolombe, 1840) is briefly discussed. Finally, a checklist for the genera *Brachymeria* (Hymenoptera, Chalcididae) and *Monodontomerus* (Hymenoptera, Torymidae) is compiled.

Key words: Distribution, host association, inquiline, oak, parasitoid, new records

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INTRODUCTION

The chalcidoid wasps (Hymenoptera, Chalcidoidea), are a hyperdiverse superfamily of Hymenoptera containing at least 22,500 described species, divided into 50 families (Heraty et al., 2013; Haas et al., 2021; Burks et al., 2022). Chalcidoid wasps are cosmopolitan in distribution and show extreme heterogeneity in general morphology and size, ranging from the 0.13 mm long male mymarid *Dicopomorpha echmepterygis* Mockford, 1997 to the 41.7 mm long female peleciniellid *Doddifoenus wallacei* Krogmann & Burks, 2009 (Mockford, 1997; Krogmann & Burks, 2009; Heraty et al., 2013). They also exploit a wide range of ecological niches, with most of them being either endo- or ectoparasitoids during various developmental stages (eggs to adults) of many invertebrates (Noyes, 2019). In addition, several families, such as Agaonidae, are considered partly or totally phytophagous, while other species in the families Encyrtidae and Eurytomidae have carnivorous larvae (Henneicke et al., 1992; Chin et al., 2009; Heraty et al., 2013; Janšta et al., 2017). Currently, at least 20 families and 5658 chalcidoid species occur on the European continent, of which 14 families and only 422 species have been recorded from Greece (Mitroiu, 2013; Noyes, 2019; Koutsoukos & Demetriou, 2021).

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Brachymeria Westwood, 1829 is a genus of parasitoid wasps in the family Chalcididae. This genus is the sole representative of its tribe, Brachymeriini, in the Palaearctic region and can be separated from the other two related genera *Caenobrachymeria* Steffan, 1974 and *Ceyxia* Girault, 1911 by the combined presence of their well-defined foveas on the metapleura and the lack of a scrobal-malar carina in the lower area of the face (De Andrade & Tavares, 2009). *Brachymeria* is a very large genus, containing at least 350 species worldwide, with 17 of them present in Europe (Noyes, 2019). However, until now, only six species were recorded from Greece, namely *B. femorata* (Panzer, 1801), *B. inermis*, *B. obtusata* (Foerster, 1859), *B. rugulosa*, *B. tibialis* and *B. vitripennis* Foerster, 1859 (Fusu, 2013; Noyes, 2019). In this study, a seventh species of *Brachymeria* has been added to this list.

Monodontomerus Westwood, 1833 is a genus of medium-sized parasitoid wasps in the family Torymidae. It can be differentiated from the rest of the genera in its tribe, Monodontomerini, by combining the presence of a prominent tooth on the ventral side of the metafemora and a distinct frenal line on the mesoscutellum (Zerova & Seryogina, 2002; Xiao et al., 2012). At least 12 species of this genus occur in Europe, with only one of them, *Monodontomerus aereus* Walker, 1834, recorded from Greece (Janšta, 2013; Noyes, 2019). In this paper, a second species of *Monodontomerus* has been added to this list.

Herein, as part of an ongoing study of the insect biodiversity of Greece, we present an updated catalogue of the currently known Greek species of *Brachymeria* and *Monodontomerus*. In addition, the ecology of *B. rugulosa* and the distributional status of *B. inermis* in Greece are briefly discussed.

MATERIAL AND METHODS

The specimens were collected from the localities of Athens, Corinth, Lesvos Island and Salamis Island between May 2017 and July 2023. All specimens were collected by hand except the specimens of *B. podagrica*, which were collected by using fish-baited pitfall traps, as described by Newton & Peck (1975). The specimens were stored in 70% ethyl alcohol or dried and pinned. They are stored in the Zoological Collection of the Laboratory of Agricultural Zoology and Entomology of the Agricultural University of Athens (A.U.A.), Greece. Identification was made using the keys of Bouček (1951), Masi (1951), Zerova & Seryogina (2002) and Kaplan & Yildirim (2022).

RESULTS

Taxonomic hierarchy

Class Insecta Linnaeus, 1758

Order Hymenoptera Linnaeus, 1758

Superfamily Chalcidoidea Latreille, 1817

Family Chalcididae Latreille, 1817

Genus *Brachymeria* Westwood, 1829

***Brachymeria podagrica* (Fabricius, 1787) (Fig. 1)**

Material examined. 4 ♀, Greece, Athens, Kerameikos, Agricultural University of Athens, 37°58'53.1" N, 23°42'22.4" E, 80 m a.s.l., collected from the experimental orchard of A.U.A., 18.x.2021, coll. G.D. Rakopoulou; 1 ♀, Greece, Salamis Island, Selinia, 37°55'44.7" N, 23°30'48.0" E, 140 m a.s.l., found on a bush in maquis shrublands, 27.v.2017, obs. E. Koutsoukos.

Distribution. Australia, Bangladesh, Borneo, Brazil, Bulgaria, Canada, Colombia, Croatia, Cyprus, Democratic Republic of Congo (Zaire), Egypt, France, Germany, Greece (**New record**), Haiti, Hungary, India, Indonesia, Iran, Iraq, Israel, Italy, Sicily, Jamaica, Japan, Madagascar, Malaysia, Mauritius, Mexico, Mongolia, Netherlands, Hong Kong, Philippines, Romania, Saudi Arabia, Seychelles, Slovakia, Slovenia, Somalia, South Africa, Spain, Sweden, Thailand, Tunisia, Ukraine, United States of America, Vietnam, Zambia (Noyes, 2019; Rajabi et al., 2011; Ramirez-Mora & Durango-Manrique, 2021; Abd Al Galil et al., 2022; Kareem et al., 2022).

***Brachymeria rugulosa* (Forster, 1859) (Fig. 2)**

Material examined. 6 ♀, Greece, Lesvos Island, Agiasos, Sanatorio, 39°03'47.2"N, 26°23'28.4" E, 680 m a.s.l., collected from an old gall of *Andricus insanus* (Westwood, 1837) (Hymenoptera, Cynipidae, Cynipini) on *Quercus infectoria* Olivier inside a chestnut forest, 04.i.2022, coll. S. Zafeiriou.

Distribution. Austria, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Iran, Italy, North Macedonia, Moldova, Romania, Serbia, Slovakia, Slovenia, Spain, Turkey, Turkmenistan (Noyes, 2019).

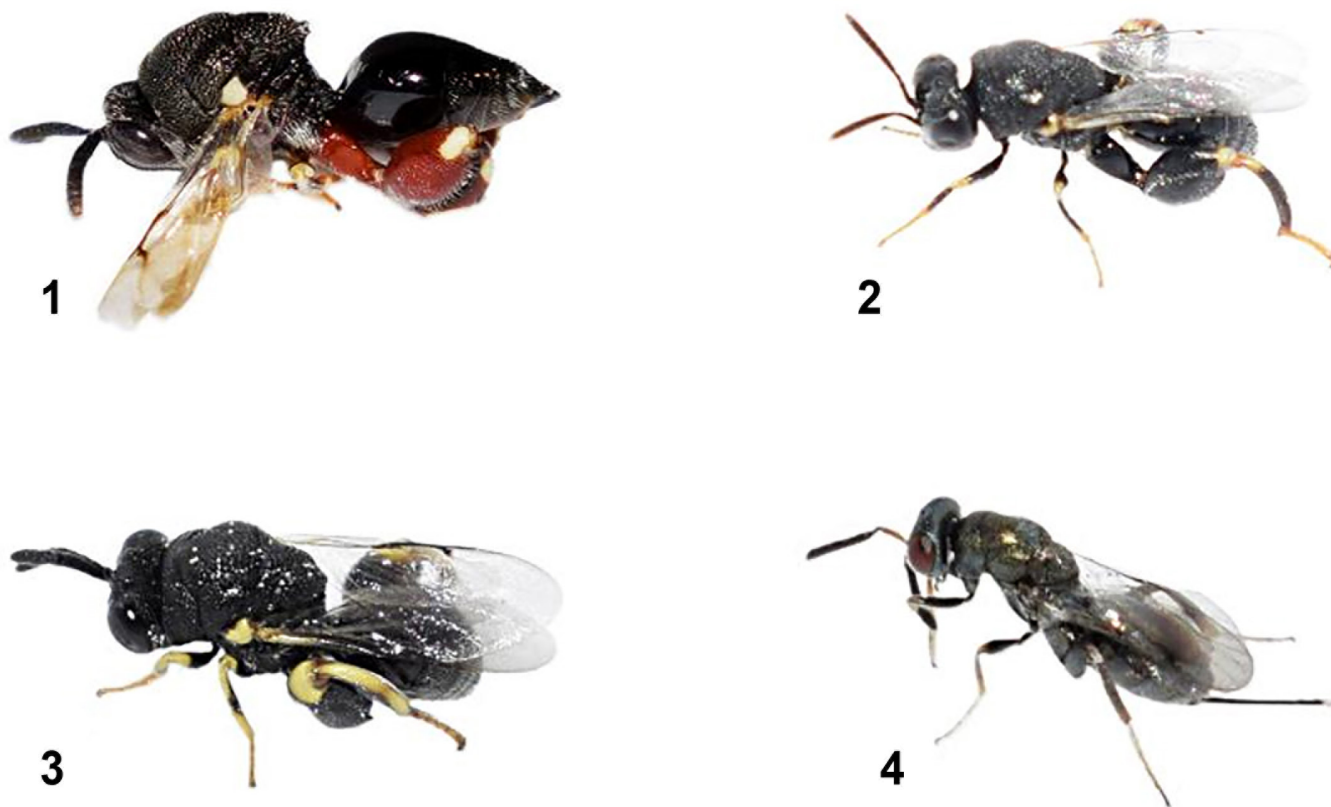
Remarks. New record for Lesvos Island, Greece. In addition, *B. rugulosa* is known to live in old galls of *Andricus kollari* (Hartig, 1843) (Hymenoptera, Cynipidae, Cynipini), as a parasitoid of tiny inquiline lepidopteran species (Bouček, 1951; Lotfalizadeh et al., 2012). As such, *A. insanus* is considered a new host gall for *B. rugulosa*.

***Brachymeria tibialis* (Walker, 1834) (Fig. 3)**

Material examined. 1 ♀, Greece, Lesvos Island, Agiasos, Agios Fanourios, 39°03'08.0"N, 26°22'56.1" E, 860 m a.s.l., collected from a mixed *Quercus-Rubus-Crataegus* forest, 24.iv.2023, coll. S. Zafeiriou.

Distribution. Albania, Algeria, Armenia, Austria, Azerbaijan, Bosnia Herzegovina, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, France, Germany, Greece, Hungary, India, Iran, Iraq, Israel, Italy, Kazakhstan, Lebanon, North Macedonia, Moldova, Morocco, Netherlands, Pakistan, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Tunisia, Turkey, Ukraine, United Kingdom, United States of America, Uzbekistan (Noyes, 2019).

Remarks. New record for Lesvos Island, Greece.



Figures 1–4. Female specimens. **1.** *Brachymeria podagrica* (Fabricius, 1787); **2.** *Brachymeria rugulosa* (Forster, 1859); **3.** *Brachymeria tibialis* (Walker, 1834) and **4.** *Monodontomerus obscurus* Westwood, 1833.



Figures 5–6. Sampling information. **5.** The habitat of *Monodontomerus obscurus* in Pirgi Thermis, Lesvos Isl., Greece. **6.** An old gall of *Andricus insanus* (Westwood, 1837), where *Brachymeria rugulosa* was found.

Family Torymidae Walker, 1833.

Genus *Monodontomerus* Westwood, 1833

Monodontomerus obscurus Westwood, 1833 (Fig. 4)

Material examined. 1 ♀, Greece, Lesvos Island, Pirgi Thermis, 39°10'31.9" N, 26°30'15.4" E, 10 m a.s.l., collected from a house window, coll. S. Zafeiriou, 21.vii.2021 (Fig. 5); 1 ♀, Greece, Lesvos Island, Pirgi Thermis, 39°10'33.2" N, 26°30'17.9" E, 10 m a.s.l., collected from *Arundo donax* leaves, 30.viii.2021, coll. S. Zafeiriou; 1 ♀, Greece, Lesvos Island, Pirgi Thermis, Agia Thekla, 39°10'12.5" N, 26°29'48.2" E, 60 m a.s.l., collected from *Quercus pubescens* leaves, 14.x.2022, coll. S. Zafeiriou; 1 ♀, Greece, Athens, Agia Varvara, 37°59'19.7" N, 23°39'48.1" E, 60 m a.s.l., collected from a *Citrus* garden, 04.vi.2023, coll. G. Agapakis; 1 ♀, Greece, Corinth, Lechaio, 37°56'06.5" N, 22°51'35.8" E, 20 m a.s.l., collected from the rocky wall of a house in a *Citrus* garden, 21.vii.2023, coll. G. Agapakis; 1 ♀, Greece, Lesvos Island, Pirgi Thermis, 39°10'31.9" N, 26°30'15.4" E, 10 m a.s.l., collected from a house window, 24.vii.2023, coll. S. Zafeiriou.

Distribution. Azores Isl., Canada, Chile, Croatia, Czech Republic, Denmark, Egypt, France, Germany, Greece (**New record**) Hungary, India, Iran, Israel, Italy, Kazakhstan, Lebanon, North Macedonia, Moldova, Netherlands, Pakistan, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Turkey, Turkmenistan, Ukraine, United Kingdom, United States of America (Fallahzadeh et al., 2015; Noyes, 2019).

DISCUSSION

Until recently, six *Brachymeria* and one *Monodontomerus* species were reported from Greece (Noyes, 2019). In the current study, one species is added to each one of the genera (Table 1). Since both these newly recorded species (*B. podagrica* and *M. obscurus*) are widely distributed throughout Europe and possess a vast variety of hosts, they would be expected to be present in Greece. However, the lack of knowledge about their presence in Greece mirrors the scarcity of collecting studies, highlighting the need for more targeted research concerning the Greek chalcidoid fauna. *Monodontomerus obscurus* belongs to a group of Old-World species characterized by an uninterrupted borderline of punctures on the scutellum apex. Within this group, it can be separated by the infumated pterostigma and the presence of fine striations on a smooth and shiny frenum (Zerova & Seryogina, 2002). *Monodontomerus obscurus* is considered one of the most widely distributed species of the genus, as it is found in both the Holarctic and Oriental regions. It has also been recorded once in the Neotropics (De Santis & Fidalgo, 1994; Abdul-Rassoul & Mahmoud, 2017; Noyes, 2019). In parallel with its large geographic distribution, it is a parasitoid with a large range of hosts in the genus. The host list contains at least 10 families of 4 insect orders, namely Coleoptera (Curculionidae), Diptera (Stratiomyidae), Hymenoptera (Apidae, Chrysididae, Diprionidae, Sphecidae and Vespidae) and Lepidoptera (Gelechiidae, Erebidae and Tortricidae), and a single record from a Trichoptera larva (Zerova & Seryogina, 2002; Noyes, 2019).

Brachymeria podagrica has a cosmopolitan distribution and is currently considered a member of the newly defined *minuta* species group (Delvare & Huchet, 2017; Noyes, 2019). Within this group, *B. podagrica* is very similar to *B. parvula* (Walker, 1834), a species long considered synonymous under the name *Chalcis dalmanni* Thompson, 1876 (Delvare & Huchet, 2017). However, the two species can easily be separated on ecological grounds, where *B. podagrica* parasitizes the larvae of carrion-feeding flies in the families Calliphoridae, Muscidae and Sarcophagidae, while *B. parvula* is a secondary parasitoid, targeting the larvae of Orthoptera feeding flies from the families Anthomyiidae and Sarcophagidae (Masi, 1951; Delvare & Huchet, 2017). *Brachymeria podagrica* is considered a forensically important species, as it is known to parasitize the larvae of numerous necrophagous Diptera (Masi, 1951; Delvare & Huchet, 2017). The collected specimens were captured in traps baited with fish placed primarily to attract necrophagous Diptera, which suggests its specific parasitic lifestyle.

Table 1. Greek records of the genera *Brachymeria* and *Monodontomerus* (the newly added species are noted with asterisk).

Family	Species	Localities	Literature
Chalcididae	<i>B. femorata</i>	Amphissa	Bouček (1951)
	<i>B. inermis</i> (as <i>B. punctulata</i> Erdos, 1946)	Sarina [?]	Bouček (1951)
	<i>B. obtusata</i> (as <i>B. vicina</i> Walker, 1834)	Crete	Bouček (1951)
	<i>B. podagrica</i> *	Attiki, Salamis Isl.	present paper
	<i>B. rugulosa</i>	Peloponnese, Mt. Parnassos, Lesvos Isl.	Lykouressis & Eastop (1997); Koutsoukos & Demetriou (2021); present paper
	<i>B. tibialis</i>	Peloponnese, Lesvos Isl.	Lykouressis & Eastop (1997); present paper
	<i>B. vitripennis</i>	Corfu Isl., Mt. Parnassos	Bouček (1951)
Torymidae	<i>M. aereus</i>	Peloponnese	Lykouressis & Eastop, (1997)
	<i>M. obscurus</i> *	Attiki, Lesvos Isl., Peloponnese	present paper

Brachymeria rugulosa is known to live in old galls of *A. kollari* as a parasitoid of small lepidopteran species (Bouček, 1951; Lotfalizadeh et al., 2012). In the present study, *A. insanus* (Fig. 6) is reported as a new host gall, suggesting that the galls of other similar species, like *A. quercustozae* (Bosc, 1792) or *A. hungaricus* (Hartig, 1843), could also be potential shelters for *B. rugulosa*. Finally, *Brachymeria inermis* was supposedly recorded in Greece from an unspecified place called “Sarina” as *B. punctulata* (Bouček, 1951). However, according to the authors, no such place exists in Greece, pointing to either a mispronunciation of a known region or an erroneous record for the country.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: G.D.R., S.Z. and G.A. Collecting, separating and counting Chalcidoidea specimens, designing research plans and organizing the manuscript. 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 Zoological Collection of the Laboratory of Agricultural Zoology and Entomology of the Agricultural University of Athens, Greece and are available from the curator upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

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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یافته‌های بیشتر از انتشار جنس‌های *Monodontomerus* Westwood و *Brachymeria* Westwood (Hymenoptera, Chalcidoidea) به همراه دو گزارش جدید از کشور یونان

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چکیده: بالاخانواده Chalcidoidea گروهی فوق‌العاده متنوع از پارازیتوئیدهای اغلب ریزجثه هستند که انتشار ۱۴ خانواده و حداقل ۴۲۲ گونه از آنها در یونان ثبت شده است. در این تحقیق، اطلاعات بیشتری از انتشار دو گونه *Brachymeria rugulosa* (Forster, 1859) و *Brachymeria tibialis* (Walker, 1834) در یونان ارائه شد. به علاوه دو گونه *Brachymeria podagrica* (Fabricius, 1787) و *Monodontomerus obscurus* Westwood, 1833 برای اولین بار از یونان گزارش می‌شوند. همچنین، یک گونه گال‌زا به عنوان میزبان جدیدی برای *B. rugulosa* ثبت و وقوع گونه *Brachymeria inermis* (Fonscolombe, 1840) به طور مختصر شرح داده شد. در نهایت، چک‌لیست گونه‌های دو جنس *Brachymeria* (Hymenoptera, Chalcididae) و *Monodontomerus* (Hymenoptera, Torymidae) گردآوری شد.

واژگان کلیدی: انتشار، روابط میزبانی، مهمان، بلوط، پارازیتوئید، گزارش جدید