J. Entomol. Res. Soc., 17(3): 01-07, 2015 *ISSN:1302-0250*

Pediobius brachycerus (Thomson, 1878) (Hymenoptera: Eulophidae): A Re-discovered Parasitoid in the Polish Fauna with A New Host Record

Agata KOSTRO-AMBROZIAK[1] Wioletta WAWER[2]

[1]Department of Invertebrate Zoology, Institute of Biology, University of Bialystok, Ciołkowskiego 1J, 15-245 Białystok, POLAND, e-mail: ambro@uwb.edu.pl
[2]Museum and Institute of Zoology Polish Academy of Sciences, Wilcza 64, Warszawa 00-679, POLAND, e-mail: wawer@miiz.waw.pl

ABSTRACT

Pediobius brachycerus (Thomson, 1878), a hyperparasitoid of spider egg sacs, is reported from Poland with abundant distribution data. It has been mostly noted from wet and open habitats. *Clubiona stagnatilis* Kulczyński, 1897 and *Argiope bruennichi* (Scopoli, 1772) are recorded as its primary hosts, the former species for the first time. The host associations of *P. brachycerus* are summarized and briefly discussed.

Key words: Secondary parasitoid, spider, host, Chalcidoidea, Ichneumonidae, *Clubiona*, *Argiope*.

INTRODUCTION

The genus *Pediobius* Walker, 1846 belongs to the parasitic wasps of the subfamily Entedoninae (Chalcidoidea: Eulopidae). It is a large taxon with about 200 species known in all zoogeographical regions. In Europe, 47 species of this genus have been recorded (Noyes, 2015); however, only 19 of these have been noted from Poland to date (Skibińska, 2004).

Pediobius species are primary or secondary parasitoids of different insects (Coleoptera, Dermaptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Neuroptera, Orthoptera, Thysanoptera) and very rarely spiders (Noyes, 2015). Only *P. brachycerus* (Thomson, 1878) and *P. grunini* (Nikol'skaya, 1954) are associated with spiders. Both species are gregarious secondary parasitoids (Fitton *et al.*, 1987), but they differ in the host stages and taxon used. *P. grunini* was reared from puparia of *Ogcodes fumatus* (Diptera: Acroceridae) in the abdomen of *Clubiona* sp. (Bouček, 1965), whereas *P. brachycerus* is known as a hyperparasitoid of spider egg sacs, through some species of parasitic wasps in Ichneumonidae (Hymenoptera) (Table 1). *P. grunini* has been recorded from the Czech Republic and Russia, while *P. brachycerus* is widely distributed in both the Nearctic (Canada, United States of America) and the Palearctic (China, Croatia, Czech Republic, Germany, Hungary, Japan, Moldova, Netherlands,

Russia, Slovakia, Sweden, Turkey, Ukraine, United Kingdom, Yugoslavia) (Noyes, 2015). *P. brachycerus* was also recorded on the last check-list of the Polish fauna (Skibińska, 2004), but without references. According to the notes, the mentioned checklist is based on an earlier list (Wiśniowski, 1997), which does not include *P. brachycerus*. Consequently, the occurrence of this species in Poland has been not confirmed so far.

The present paper provides the first distribution data on *P. brachycerus* in Poland along with a new host record. The habitats and the host associations of this parasitoid are presented.

Table 1. Primary and secondary hosts of *Pediobius brachycerus*.

Primary hosts /egg sac of/	Secondary hosts	References
**Araneus saevus* (L. Koch, 1872) (=*A. solitarius* Emerton) (Araneae: Araneidae)	----------	Peck, 1963
Argiope aurantia Lucas, 1833 (Araneae: Araneidae)	----------	Lockley & Young, 1993
**Argiope bruennichi* (Scopoli, 1772) (Araneae: Araneidae)	*Polysphincta* sp. (Ichneumonidae: Pimplinae)	Bouček, 1965; Trjapitzin, 1978
	unidentified ichneumonid	*present data*
Argiope trifasciata (Forskål, 1775) (=*A. avara* Thorell) (= *Metargiope bruennichi* Scopoli) (Araneae: Araneidae)	*Tromatobia rufopectus* (Cresson,1870) (Ichneumonidae: Pimplinae)	Swezey, 1946; Peck, 1963;Trjapitzin, 1978; Burks, 1979
**Larinioides cornutus* (Clerck, 1757) (=*Araneus cornutus* Clerck) (Araneae: Araneidae)	unidentified ichneumonid	Fitton *et al*., 1987
Clubiona japonicola Bösenberg & Strand, 1906 (Araneae: Clubionidae)	*Zaglyptus iwatai* (Uchida, 1936) (Ichneumonidae: Pimplinae)	Kamijo, 1986
**Clubiona stagnatilis* Kulczyński, 1897 (Araneae: Clubionidae)	unidentified ichneumonid	*present data*
**Tetragnatha extensa* (Linnaeus, 1758) (Araneae: Tetragnathidae)	*Agasthenes varitarsus* (Gravenhorst, 1829) (=*Arachnoleter stagnalis*) (Ichneumonidae: Cryptinae)	Smith, 1957; Fitton *et al*., 1987
Latrodectus tredecimguttatus (Rossi, 1790) (Araneae: Theridiidae)	----------	Bouček, 1965
----------	*Pimpla* sp. *Pimpla aquilonia* Cresson,1870 (Ichneumonidae: Pimplinae)	Peck, 1963
----------	*Tromatobia* sp. (Ichneumonidae: Pimplinae)	Vidal, 1993
----------	*Gelis* sp. (Ichneumonidae: Cryptinae)	Burks, 1979
----------	*Lissonota oculatoria* (Fabricius,1798) (=*Tromatobia oculatoria*) (Ichneumonidae: Banchinae)	Bouček, 1977

Names of spiders and ichneumonids follow Platnick (2014) and Yu *et. al*. (2012), respectively. Spider species occurring in Poland are marked by *

MATERIAL AND METHODS

During work on the collection of the Museum and Institute of Zoology, Polish Academy of Sciences (Łomna-Las, Poland), we discovered numerous and very valuable material of *P. brachycerus*. Specimens of this species were collected and/or reared by Prof. Łuczak and Dr. Szczepański in the 1950s to 1970s. Additional specimens of *P. brachycerus* were reared from *Argiope bruennichi* cocoons during studies carried out in 2011-2013.

The localities (Fig. 1) of *Pediobius brachycerus* are given as UTM grid codes (Universal Transverse Mercator) and arranged according to zoogeographical regions (Czechowski *et al.*, 2012).

Diagnosis of *Pediobius brachycerus*

By primary host association (hyperparasitoid of spiders), *P. brachycerus* (Fig. 2) is similar to *P. grunini*, from which it can be easily distinguished by the mandibles which have several smaller teeth above the usual two main teeth in the former species and are bidentate in the latter. Additionally, the females differ by having a rather densely hairy flagellum and transverse funicle segments in *P. brachycerus* and not densely hairy flagellum and more or less rounded funicle segments in *P. grunini*. The body of a *P. brachycerus* male is metallic green, whereas in *P. grunini* it is almost black. A description of *P. brachycerus* and a key to the European species of *Pediobius* is given by Bouček (1965).

RESULTS AND DISCUSSION

Material examined of *Pediobius brachycerus*

The Baltic Coast

1 Mierzeja Łebska (UTM: XA57), dune, low grasses and herbs, 26.08.1975, 1♀; *Calluna vulgaris*, 21.07.1975, 2♀♀, leg. and det. H. Szczepański.

2 Nowęcin near Łeba, lake side Sarbsko (UTM: XA67), *Schoenoplectrus lacustris*, 17.08.1975,1♀, leg. and det. H. Szczepański.

The Masurian Lake District

3 Krzywe near Suwałki (UTM: FE39), wasteland, larvae ex Ichneumonidae in spider *Argiope bruennichi* cocoons, 22.04.2013, leg. W. Wawer.

4 Szeroki Bór Forest Inspectorate, Jaśkowo Lake (UTM: EE44), 01.08.1958, 1♀; 04.08.1958, 1♀, leg. and det. H. Szczepański.

5 Mikołajki Lake (UTM: EE36), *Phragmites australis*, larvae ex Ichneumonidae in spider *Clubiona stagnatilis* cocoons, 26.07.1961, 9 specimens, leg. J. Łuczak, det. H. Szczepański.

The Mazovian Lowland

6 Dziekanów (UTM: DD80), *Phragmites australis*, larvae ex Ichneumonidae in spider *C. stagnatilis* cocoons, 10.07.1961, 13♀♀, 4♂♂; 14.07.1961, 34♀♀, 5♂♂, leg. J. Łuczak, det. H. Szczepański.

7 Dziekanów (UTM: DD80), *Phragmites australis*, *Magno caricetum*, larvae ex Ichneumonidae in spider *C. stagnatilis* cocoons,10.07.1961, 4♀♀, 4♂♂; 14.07.1961, 53♀♀, 15♂♂, leg. J. Łuczak, det. H. Szczepański.

8 Dziekanów (UTM: DD80), wet meadow, *Phragmites australis*, larvae ex Ichneumonidae in spider *C. stagnatilis* cocoons, 10.07.1961, 4♀♀, 2♂♂; 17.07.1961, 14♀♀, 12♂♂; 10.07.1962, 2♀♀, 1♂, leg. J. Łuczak, det. H. Szczepański.

9 Dziekanów (UTM: DD80), wet meadow, larvae ex Ichneumonidae in spider *C. stagnatilis* cocoons, 19.07.1961, 6♀♀, 2♂♂, leg. J. Łuczak, det. H. Szczepański.

10 Dziekanów Leśny (UTM: DD89), wet meadow, *Phragmites australis*, *Magno caricetum*, larvae ex Ichneumonidae in spider *C. stagnatilis* cocoons,19.07.1961, 17♀♀, 2♂♂, leg. and det. H. Szczepański.

11 Łuże (UTM: DC99), marsh, *Phragmites australis*, larvae ex Ichneumonidae in spider cocoons, 01.05.1974; imago 10-15.05.1974, 5♀♀, 7♂♂, leg. and det. H. Szczepański.

Roztocze Upland

12 Zamość Forest Inspectorate, Łabunie forest distinct (UTM: FB61), glade, 26.07.1970, 1♀, leg. and det. H. Szczepański.

The Western Beskidy Mountains

13 Lipnica Mała, Nowy Targ Forest Inspectorate (UTM: DV08), wet meadow, *Equisetum* sp., *Juncus* sp., 17.08.1963, 1♀, leg. and det. H. Szczepański.

The Sandomierz Lowland

14 Kamionka near Ostrów (UTM: EA45), meadow with *Juncus* sp., larvae ex Ichneumonidae in spider *Argiope bruennichi* cocoons, collection 18.04.2013, larvae April 2013, leg. and det. W. Wawer.

15 Huta Przedborska near Kolbuszowa (UTM: EA55), meadow with *Juncus* sp., larvae ex Ichneumonidae in spider *Argiope bruennichi* cocoons, collection 11.11.2012, imagines April 2013, 2♂♂, leg. W. Wawer, det. G. Grabenweger.

Hosts of *Pediobius brachycerus*

P. brachycerus is an obligatory secondary parasitoid of spider egg sacs (Fitton *et al.*, 1987). Its primary hosts belong to the following four families: Araneidae, Clubionidae, Tetragnathidae and Theridiidae (Table 1). Our data shows that in Poland this wasp utilizes cocoons of *Argiope bruennichi* (Scopoli, 1772) and, very often, *Clubiona stagnatilis* Kulczyński, 1897. The latter spider is for the first time indicated as a host of *P. brachycerus*. Like other members of the clubionids, *C. stagnatilis* is an active

(not using webs to capture prey) nocturnal spider. It spends the day inside a retreat constructed from rolled leaf fastened with silk. In this shelter, the female also guards and defends its egg-sac (Kupryjanowicz, 2008). On the other hand, *A. bruennichi* is a diurnal species of orb-web spider which builds a spiral orb web with a zigzag stabilimentum (Foelix, 2011). The females of this spider make egg sacs which are affixed to plants. They usually guard these egg sacs by staying on them for a few days (Leborgne and Pasquet, 2005). Hosts of *P. brachycerus* from Tetragnathidae and Theridiidae, exhibit slightly different patterns of maternal care, e.g. *L. tredecimguttatus* hide their egg sacs in a web (Bouček, 1977), whereas *Tetragnatha extensa* attract coccons to plant stem and camouflage them with grey tufted silk resembling a bird dropping (Kupryjanowicz, 2008).

Known secondary hosts of *P. brachycerus* are ichneumonid species of the subfamilies Pimplinae (mainly), Cryptinae and Banchinae (Table 1). Most of these species are specialized in ovipositing in spider egg sacs (Yu *et al.*, 2012). They develop by feeding on successive eggs, while *P. brachycerus* attacks the primary parasitoid probably after it has finished feeding (Fitton *et al.*, 1987).

The habitats and distribution of *Pediobius brachycerus* in Poland

In Poland, *P. brachycerus* has been recorded mainly from wet meadows, especially with *Phragmites australis* and *Juncus* sp. This reflects the habitats of its primary hosts: *C. stagnatilis* is associated with wetlands, particularly peat bogs and wet meadows, while *A. bruennichi* are found in grasslands and wasteland (both dry and wet), commonly with long grass (Kupryjanowicz, 2008). Additionally, the habitats of other spider hosts which occur in Poland (Table 1) suggest that *P. brachycerus* can inhabit open areas rather than forests. *L. cornutus* and *T. extensa* live in meadows and scrub (mainly in waterside and wetland habitats) and only the rare *Araneus saevus* has an affinity for forest habitats (Kupryjanowicz, 2008). A couple of adult *P. brachycerus* examined by us were collected in dunes, low grasses and herbs as well as in a habitat with *Calluna vulgaris*.

P. brachycerus seems to be widespread in Poland (Fig. 1). Our study shows that it occurs in six zoogeographical regions but the distributional data on its spider hosts (Kupryjanowicz, 2008) indicates that this parasitoid can also occur in other parts of Poland.

ACKNOWLEDGEMENTS

We want to convey our special thanks to Dr. Giselher Grabenweger (Agroscope, Switzerland), who confirmed our determination of *P. brachycerus.* We are very grateful to Mr. Tomasz Huflejt (curator at the Museum and Institute of Zoology, Polish Academy of Science, Poland) for providing materials and helpful suggestions.

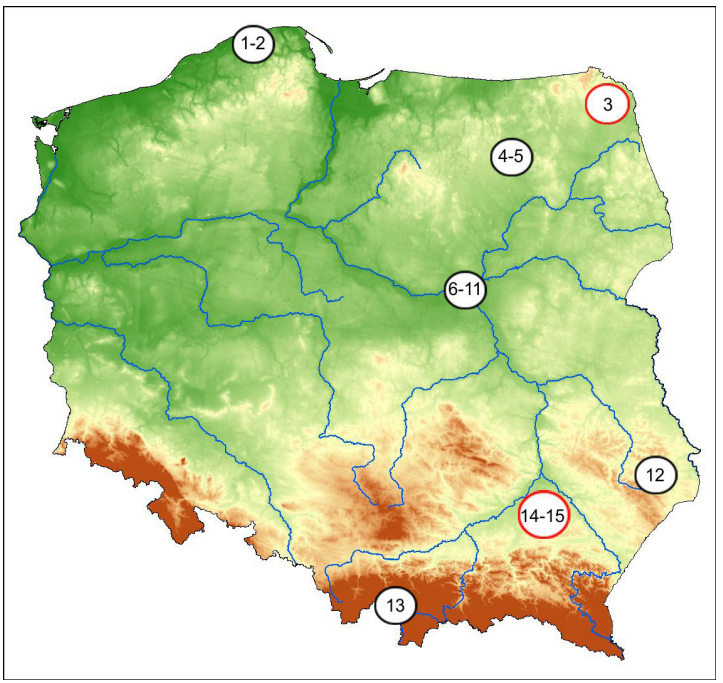

Fig. 1. Distribution of *P. brachycerus* in Poland; black circles - data from 1960-1970, red circles - data from 2011-2013. For detailed information about localities (numbers 1-15) see text “Material examined of *Pediobius brachycerus*”.

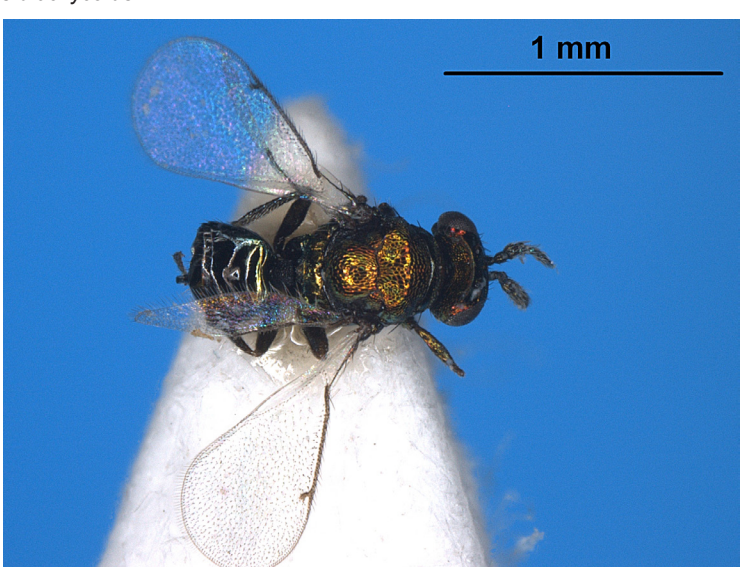

Fig. 2. Habitus of *Pediobius brachycerus* (Thomson, 1878), female.

REFERENCES

Bouček, Z., 1965, Studies of European Eulophidae, IV: *Pediobius* Walk. and two allied genera (Hymenoptera). *Acta Entomologica Musei Nationalis Pragae*, 36: 5-90.

Bouček, Z., 1977, A faunistic review of the Yugoslavian Chalcidoidea (Parasitic Hymenoptera). *Acta Entomologica Jugoslavica*, 13 (Supplement): 110.

Burks, B. D., 1979, *Torymidae (Agaoninae) and All Other Families of Chalcidoidea (excluding Encyrtidae)*. *In:* Krombein, K. V., Hurd, P. D. Jr., Smith, D. R., Burks, B. D. (Eds.). Catalog of Hymenoptera in America North of Mexico. Smithsonian Institute Press, Washington, 1: 1019.

Czechowski, W., Radchenko, A., Czechowska, W., Vepsäläinen, K., 2012, *The ants of Poland with reference to the myrmecofauna of Europe*. Fauna Poloniae, 4: 496.

Fitton, M. G., Shaw, M. R., Austin, A. D., 1987, The Hymenoptera associated with spiders in Europe. *Zoological Journal of the Linnean Society*, 90: 65-93.

Foelix, R. F., 2011, *Biology of spiders*. Third Edition. Oxford University Press, 432.

Kamijo, K., 1986, Notes on *Pediobius* Walker (Hymenoptera, Eulophidae) from Japan, with description of a new species. *Kontyû*, 54(1): 70-78.

Kupryjanowicz, K., 2008, *Pająki Araneae*. *In:* Bogdanowicz, W., Chudzicka, E., Pilipuk, I., Skibińska, E. (Eds.). Fauna Polski. Charakterystyka i wykaz gatunków. Muzeum i Instytut Zoologii PAN, Warszawa, 1: 223-255.

Leborgne, R., Pasquet, A., 2005, Time of oviposition and reproductive success in *Argriope bruennichi* (Araneae: Araneidae). *European Journal of Entomology*, 102: 169-174.

Lockley, T. C., Young, O. P., 1993, Survivability of overwintering *Argiope aurantia* (Araneidae) egg cases, with an annotated list of associated arthropods. *Journal of Arachnology,* 21:50-54.

Noyes, J. S., 2015, Universal Chalcidoidea Database. World Wide Web electronic publication. http://www.nhm.ac.uk/chalcidoids

Platnick, N. I., 2014, *The world spider catalog,* version 15. American Museum of Natural History, http://research.amnh.org/entomology/spiders/catalog/index.html, DOI: 10.5531/db.iz.0001.

Peck, O., 1963, A catalogue of the Nearctic Chalcidoidea (Insecta; Hymenoptera). *Canadian Entomologist*, (Supplement) 30: 234.

Skibińska, E., 2004, *Stylikowce Apocrita*. *In:* Bogdanowicz, W., Chudzicka, E., Pilipuk, I., Skibińska, E. (Eds.). Fauna Polski. Charakterystyka i wykaz gatunków. Muzeum i Instytut Zoologii PAN, Warszawa, 1: 285-336.

Smith, K. G. V., 1957, Some ichneumonid parasites and a eulophid hyperparasite (Hym.) bred from egg-sacs of spiders. *Entomologist's Monthly Magazine*, 93: 102.

Swezey, O. H., 1946, *Tromatobia rufopectus* (Cresson). *Proceedings of Hawaiian Entomological Society*, 12: 474.

Trjapitzin, V. A., 1978, Hymenoptera II. Chalcidoidea 13. Eulophidae (excl. Tetrastichinae). *Opredeliteli Nasekomykh Evropeyskoy Chasti SSR* 3: 413.

Vidal, S., 1993, Determination list of entomophagous insects. No 12. *Bulletin. Section Regionale Ouest Palaearctique*, Organisation Internationale de Lutte Biologique. 16: 19.

Wiśniowski, B., 1997, *Chalcidoidea* (*bez Mymaridae*). *In:* Razowski, J. (Eds.). Wykaz zwierząt Polski. Wydawnictwa Instytutu Systematyki i Ewolucji Zwierząt PAN, Kraków, 132-158.

Yu, D. S, Achtenberg, K. van, Horstmann, K., 2012, *World Ichneumonoidea 2011*. Taxapad 2012. Flash drive version, Vancouver, Canada.

Received: August 25, 2014 *Accepted: August 20, 2015*