

Insecta, Hymenoptera, Bethylinidae: Range extension and filling gaps in Madagascar

Daniele Ferreira Mugrabi* and Celso Oliveira Azevedo

Universidade Federal do Espírito Santo, Departamento de Biologia, Avenida Marechal Campos, 1468, Maruípe, CEP 29040-090, Vitória, ES, Brazil.
 * Corresponding author. E-mail: danimugrabi@gmail.com

ABSTRACT: Bethylinidae are cosmopolitan wasps, with about 100 valid genera and about 2,400 valid species around the world, with 39 genera recorded from the Afrotropical region. This study aimed to determine the genera of Bethylinidae occurring in Madagascar. The specimens were collected in Madagascar with several traps. A total of 18,915 specimens were obtained and 27 genera recognized. Nine of them are already recorded from Madagascar: *Epyris*, *Glenosema*, *Goniozus Laelius*, *Pilomesitius Pristocera*, *Rhabdepyris*, *Sclerodermus*, *Sulcomesitius*, and 18 genera are recorded for the first time: *Alloplastanoxus*, *Apenesia*, *Bethylus*, *Cephalonomia*, *Diepyris*, *Dissomphalus*, *Formosiepyris*, *Heterocoelia*, *Holepyris*, *Kathepyris*, *Odontepyrus*, *Parascleroderma*, *Plastanoxus*, *Prorops*, *Prosapenesia*, *Pseudisobrachium*, *Trachepyrus* and *Tuberepyris*. The only genus not founded was *Messoria*.

INTRODUCTION

Bethylinidae are widely distributed throughout the world, but the majority of species occur in tropical regions (Azevedo 1999). The family comprises about 100 genera and about 2,400 described species, with 38 genera recorded from the Afrotropical region. This study aimed to determine the genera of Bethylinidae occurring in Madagascar.

MATERIAL AND METHODS

The material studied belongs the California Academy of Science (Robert L. Zuparko, curator). It was collected under the project "Terrestrial Arthropod Inventory of Madagascar" coordinated by Brian Fisher.

The specimens were collected with pitfall trap, beating, light trap, Malaise trap, spider collecting, sweeping, sifting, puffing, digging and hand collecting, monthly from April 1998 to April 2006 in approximately 250 points throughout Madagascar, spread, mostly, in the north, east and south coast.

The identification of the genera was based on the keys by Terayama (2003) and Lanes and Azevedo (2008). Many years will be necessary to cover the identification of all this material at species level. Most of the material corresponds to undescribed species, probably more than 500 ones, what lead our study to have identifications only at genus level.

RESULTS AND DISCUSSION

A total of 18,916 specimens were obtained and 27 genera were recognized distributed in the subfamilies Pristocerinae, Epyrinae, Bethylinae and Mesitiinae (Table 1). Among these 27 genera, *Epyris* Westwood, *Glenosema* Kieffer, *Goniozus* Förster, *Laelius* Ashmead, *Pilomesitius* Móczár, *Pristocera* Klug, *Rhabdepyris* Kieffer, *Sclerodermus* Latreille and *Sulcomesitius* Móczár were previously recorded from Madagascar. *Glenosema* and *Laelius* had their known geographic distribution widened to this island by Lanes and Azevedo (2008) and Barbosa and

Azevedo (2009), who have studied the specimens collected under the same project.

TABLE 1. Number of male (M) and female (F) specimens by genus examined during this study.

SUBFAMILY	GENUS	M	F	TOTAL	
Pristocerinae	<i>Apenesia</i> Westwood, 1874	1347	69	1416	
	<i>Diepyris</i> Benoit, 1957	221	0	221	
	<i>Dissomphalus</i> Ashmead, 1893	7193	216	7409	
	<i>Kathepyris</i> Kieffer, 1907	1580	0	1580	
	<i>Parascleroderma</i> Kieffer, 1904	363	19	382	
	<i>Pristocera</i> Klug, 1808	879	50	929	
	<i>Prosapenesia</i> Kieffer, 1910	0	42	42	
	<i>Pseudisobrachium</i> Kieffer, 1904	145	0	145	
	Epyrinae	<i>Alloplastanoxus</i> Terayama, 2006	0	1	1
		<i>Cephalonomia</i> Westwood, 1833	4	28	32
<i>Epyris</i> Westwood, 1832		1605	497	2102	
<i>Formosiepyris</i> Terayama, 2004		57	18	75	
<i>Glenosema</i> Kieffer, 1905		42	71	113	
<i>Holepyris</i> Kieffer, 1905		2399	894	3293	
<i>Laelius</i> Ashmead, 1893		106	50	156	
<i>Plastanoxus</i> Kieffer, 1905		1	15	16	
<i>Prorops</i> Waterston, 1923		6	8	14	
<i>Rhabdepyris</i> Kieffer, 1904		389	143	532	
Bethylinae	<i>Sclerodermus</i> Latreille, 1809	0	19	19	
	<i>Trachepyrus</i> Kieffer, 1905	0	43	43	
	<i>Goniozus</i> Förster, 1856	15	295	310	
	<i>Tuberepyris</i> Lanes and Azevedo, 2008	1	2	3	
	<i>Bethylus</i> Latreille, 1802	1	7	8	
	<i>Odontepyrus</i> Kieffer, 1904	5	41	46	
	Mesitiinae	<i>Heterocoelia</i> Dahldom, 1854	20	1	21
		<i>Pilomesitius</i> Móczár, 1970	2	2	4
		<i>Sulcomesitius</i> Móczár, 1970	4	0	4
	Total	16384	2548	18916	

Other 18 genera are first recorded from Madagascar, named *Alloplastanoxus* Terayama, *Apenesia* Westwood, *Bethylus* Latreille, *Cephalonomia* Westwood, *Diepyris* Benoit, *Dissomphalus* Ashmead, *Formosiepyris* Terayama, *Heterocoelia* Dahldom, *Holepyris* Kieffer, *Kathepyris* Kieffer, *Odontepyrus* Kieffer, *Parascleroderma* Kieffer, *Plastanoxus* Kieffer, *Prorops* Waterston, *Prosapenesia* Kieffer, *Pseudisobranchium* Kieffer, *Rhabdepyris* Kieffer, *Sclerodermus* Latreille, *Trachepyris* Kieffer and *Tuberepyris* Lanes and Azevedo.

It is important to point out that we did not consider *Pristepyrus* Kieffer here, because it was recently synonymized with *Epyris* (Azevedo and Alencar, 2009). Thus the Madagascan species *P. levicollis* Kieffer is now *E. levicollis*.

The only genus that we were not able to find is *Messoria* Meunier. This happened because it is known only from one single fossil species and it would be necessary special sampling method to collect it.

Diepyris, *Kathepyris*, *Prosapenesia* and *Tuberepyris* were known only from the continental Africa. The report of these genera from Madagascar emphasizes their Afrotropical distribution.

Alloplastanoxus and *Formosiepyris* are genera found in Madagascar and recorded for the first time from the Afrotropical region. The former is Palaearctic (Japan) and the latter is Oriental (China, Thailand and India). These data demonstrate that these genera can be found in other zoogeographic regions since there is a large gap between their previous known distribution and Madagascar.

Bethylus was recorded for the first time from the Afrotropical region by Azevedo and Guimarães (2006) in their recent study on Yemenian Bethyliidae. It is previously known from northern hemisphere. This constitutes the first record from the southern hemisphere.

Apenesia, *Cephalonomia*, *Dissomphalus*, *Epyris*, *Glenosema*, *Goniozus*, *Holepyris*, *Parascleroderma*, *Prorops*, *Pseudisobranchium*, *Rhabdepyris* and *Sclerodermus* are cosmopolitan. The occurrence of these genera in Madagascar emphasizes their wide distribution.

Dissomphalus, *Holepyris*, *Epyris*, *Kathepyris* and *Apenesia* were found in large series of specimens, representing more than 88 % of all the material reported in this work. Out of this total, 39 % is *Dissomphalus*, which is the most abundant genus in Madagascar. That is explained by the fact that Madagascar is considerably covered by moistened areas (rainforest and moist montane forest) and, as proposed by Azevedo and Helmer (1999) and Mugrabi *et al.* (2008), this genus has great representation in humid environments.

Tuberepyris is a monotypic genus from Tanzania recently described by Lanes and Azevedo (2008). Its specimens here recognized probably represent a new species and emphasize the connection between Madagascar and East Africa.

The large number of new generic records as presented

here is due to the fact that the fauna from Madagascar has been poorly sampled, therefore there is few works that makes reports on bethylids for this region.

The large number of new generic records as presented here is due to the fact that the fauna from Madagascar has been poorly sampled, therefore there is few works that makes reports on bethylids for this region.

The fact that 27 genera of Bethyliidae were found in one project, and 18 of them were first records from Madagascar demonstrates the large gap of knowledge of this family of parasitic wasps in this country and the necessity of more samplings. As pointed out by Azevedo (2006) for the Australian fauna, this conclusion can certainly be extended to other areas of the planet.

Finally, Madagascar fauna of Bethyliidae is rich in terms of number of genera. For example, there are 19 genera recorded from Australia (Azevedo 2006), an island much larger than Madagascar with more diverse kinds of ecosystems. So our data emphasize Madagascar as a megadiverse country.

ACKNOWLEDGMENTS: We are most grateful to Robert Zuparko and Brian Fisher for the loan of material examined; to Diego Barbosa, Elizandra Redighieri, Isabel Alencar and Lidiana Zamprogno for their helping in mounting and labeling the specimens; to CNPq - Brazil (grant #306331/2007-7) by providing a fellowship and financial support; and to National Science Foundation (grant BSI #0072713) by financial support was granted to Brian Fisher.

LITERATURE CITED

- Azevedo, C.O. 1999. Família Bethyliidae; p. 169-181 In C.R. Brandão and E.M. Cancelo (ed.). *Biodiversidade do estado de São Paulo, Brasil: síntese do conhecimento ao final do século XX*. Vol. 5: Invertebrados Terrestres. São Paulo: FAPESP.
- Azevedo, C.O. 2006. Insecta, Hymenoptera, Bethyliidae: range extension and filling gaps in Australia. *Check List* 2(1): 42-44.
- Azevedo C.O. and I.D.C.C. Alencar. 2009. Rediscovery of *Pristepyrus* Kieffer (Hymenoptera, Bethyliidae), a new synonym of *Acrepyris* Kieffer. *Zootaxa* 2287: 45-54.
- Azevedo, C.O. and B.H. Guimarães. 2006. Insecta, Hymenoptera, Bethyliidae: range extension and filling gaps in Yemen. *Check List* 2(3): 26-29.
- Azevedo, C.O. and J.L. Helmer. 1999. Ecologia de comunidade de Bethyliidae (Hymenoptera, Chrysidoidea) da Reserva Biológica do Roncador, Brasília, DF, Brasil. *Revista Brasileira de Zoologia* 16: 1115-1126.
- Barbosa, D.N. and C.O. Azevedo. 2009. *Laelius* Ashmead (Hymenoptera, Bethyliidae) from Madagascar, with description of two new species. *Zootaxa* 2170: 1-14.
- Lanes, G.O. and C.O. Azevedo. 2008. Phylogeny and taxonomy of Sclerodermini (Hymenoptera, Bethyliidae, Epyrinae). *Insect Systematics & Evolution* 39: 55-86.
- Mugrabi, D.F., I.D.C.C. Alencar, F.C.C. Barreto and C.O. Azevedo. 2008. Os gêneros de Bethyliidae (Hymenoptera: Chrysidoidea) de quatro áreas de Mata Atlântica do Espírito Santo. *Neotropical Entomology* 37:152-158.
- Terayama, M. 2003. Phylogenetic Systematics of the Family Bethyliidae (Insecta: Hymenoptera) Part II. Keys to subfamilies, tribes and genera in the world. *The Academic Reports of the Faculty of Engineering of Tokyo Polytechnic University* 26: 16-29.

RECEIVED: November 2008

REVISED: October 2009

ACCEPTED: November 2009

PUBLISHED ONLINE: March 2010

EDITORIAL RESPONSIBILITY: Cristiano Lopes-Andrade