

Checklist of Acroceridae, Mydidae and Therevidae (Diptera) from Mato Grosso do Sul, Brazil

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ABSTRACT. Here we provide a checklist of the flies of the families Acroceridae, Mydidae and Therevidae on the state of Mato Grosso do Sul, Brazil. Acroceridae are represented in Brazil by 30 species, and only *Philopota tuberculata* Westwood is recorded for the state of Mato Grosso do Sul. The three reported species of Mydidae in the state, *Gauromydas autuorii* (D'Andretta), *Messiasia zikani* D'Andretta, and *Messiasia notospila* (Wiedemann) are among the 27 species now known in Brazil. There are 30 species of Therevidae in Brazil, and only one, *Cyclotelus kroeberi* (Cole) is known to occur in the state.

KEYWORDS. Biodiversity, catalogue, distribution, taxonomy, Biota-MS Program.

RESUMO. Checklist de Acroceridae, Mydidae e Therevidae (Diptera) do Mato Grosso do Sul, Brasil. É apresentada uma checklist de espécies de Acroceridae, Mydidae e Therevidae do estado de Mato Grosso do Sul, Brasil. Acroceridae, família representada no Brasil por 30 espécies, possui registro apenas de *Philopota tuberculata* Westwood para o estado de Mato Grosso do Sul. Três espécies de Mydidae, *Gauromydas autuorii* (D'Andretta), *Messiasia zikani* D'Andretta e *Messiasia notospila* (Wiedemann) das 27 com registro de ocorrência para o Brasil, ocorrem no estado. Há 30 espécies de Therevidae no Brasil, mas somente uma, *Cyclotelus kroeberi* (Cole), é conhecida para o estado.

PALAVRAS-CHAVE. Biodiversidade, catálogo, distribuição, taxonomia, Programa Biota-MS.

This article is one of a series of checklists of Mato Grosso do Sul state (Brazil) and comprises data of the orthorrhaphous Brachycera Acroceridae, Mydidae and Therevidae. Within each topic, information regarding these families was provided separately for better understanding of each group's peculiarities.

Spider flies (Diptera, Acroceridae) are a small yet diverse group of lower brachyceran flies. Acrocerid species present a very conspicuous adult morphology and highly specialized larval biology as parasitoids of spiders. Adults of some species are important pollinators frequently presenting greatly elongate mouthparts for nectar feeding, although some species have reduced or even vestigial mouthparts (SCHLINGER, 1981; BARBOLA *et al.*, 2006; BORKENT & SCHLINGER, 2008; CARVALHO & MACHADO, 2006). Acroceridae comprises approximately 520 species in 53 genera (SCHLINGER *et al.* 2013; GILLUNG & WINTERTON, 2011) occupying most biogeographic regions. Despite this vast distribution, these flies are rarely found in nature, being in consequence a biologically poorly known family, especially in the Neotropical region (PUJOL-LUZ, 2004; GILLUNG & CARVALHO, 2009). Neotropical fauna comprises all three subfamilies and is represented by 19 genera and

approximately 100 species. There are approximately 30 species and nine genera in Brazil, although actual diversity is presumably much greater.

Mydidae is a relatively small group of Asiloidea (Diptera) that comprise the largest flies in the world (BEZZI, 1917). The group is widespread geographically and was probably originated while landmasses were still united forming the Pangea (PAPAVERO & WILCOX, 1974; ARTIGAS & PAPAVERO, 1990; YEATES & IRWIN, 1996). Mydidae is divided into nine subfamilies, three of them occurring in Brazil: Apiophorinae, Rhopaliinae e Mydinae (PAPAVERO & WILCOX, 1974; PAPAVERO *et al.*, 2002) and comprise 65 genera and 473 extant species (DIKOW, 2010). There are 24 extant species occurring in Brazil and one fossil species, *Cretomydas santanensis* Willkommen & Grimaldi, 2007.

Mydid species frequently occur in dry areas (WILCOX, 1981), except for Brazilian species of Midinae, which are found in tropical rainforests (WILCOX & PAPAVERO, 1975; PAPAVERO *et al.*, 2002). Larvae of several species of Mydidae feed on immatures of Coleoptera and can be found in nests of *Atta* spp. (ZIKÁN, 1942) and *Acromyrmex* spp. ants (PAPAVERO *et al.*, 2002). Adults are suggested as being flower visitors (ZIKÁN, 1942; WILCOX, 1981), but biology of most species

is still unknown (PAPAVERO *et al.*, 2002). *Gauromydas heros* males (PERTY, 1833) visit flowers, but adult females were not recorded visiting flowers and might not feed (ZIKÁN, 1942). Mydidae species are rarely sampled and seen in the field. Thus, this fly group is scarcely represented in most entomological collections. Very few records from the state of Mato Grosso do Sul are available, and this fact can be due both to natural low abundance of species in nature and lack of inventory studies in the state.

Therevidae flies are morphologically very similar to asilids, except for the absence of the excavated vertex characteristic of Asilidae. Therevids are characterized by a tapered abdomen and body size ranging from 2.5 to 15 mm. These flies are relatively rare and active during daytime, when they feed mostly on water, plant and insect secretions or even on insect excretions. They usually occur in dry areas (MAJER, 1997), but they can also be found in mountains and tropical humid regions (GAIMARI & WEBB, 2009). Larvae feed on other insects, mainly beetles, butterflies, moths and other flies that live in leaf litter, tree holes or sandy terrains (IRWIN & WEBB, 1992). A few species may even be cannibals and others are phytophagous (MAJER, 1997). Therevids are infrequently collected and sampled, because the predator larvae live inside dry and fragile substrates, and for this reason adults are found in the same areas (GAIMARI & WEBB, 2009). Therevids are better collected and sampled using malaise traps for their behavior could be easily predicted: usually they are flying in arid environments searching for water or displacing themselves along trails. Males of some species tend to set on beams of light in trails, usually waiting for females to mate. Some species may even have a very specific substrate for repose, from sand spots, rocks, herbs, leaves to trunks (GAIMARI & WEBB, 2009). Therevidae is divided into four subfamilies: Agapophytinae, Phycinae, Xestomyzinae e Therevinae (GAIMARI & WEBB, 2009). Worldwide, there are 1,123 described species in 119 genera (THOMPSON, 2008), and this number represents only 56,15% of the estimated fauna of Therevidae (GAIMARI & WEBB, 2009). Neotropical fauna comprises 147 species (AMORIM *et al.*, 2002).

Acroceridae, Mydidae and Therevidae are three ecologically important families of lower brachyceran flies. These three morphologically diverse groups are included in the suborder Muscomorpha.

MATERIAL AND METHODS

Regarding Acroceridae, there is no catalog for neither Neotropical nor Brazilian species. Thus, distribution records were obtained through a search within published literature and references presented on the ZOOLOGICAL RECORD. No record was found within published literature, then the search was expanded and data from Master's dissertations and PhD theses were included. Therefore, no data directly from collections were included in the present check-list.

List of mydid species recorded for the state of Mato Grosso do Sul was performed using data from both available literature (WILCOX & PAPAVERO, 1975; PAPAVERO & ARTIGAS, 1990; PAPAVERO, 2009) and *online* catalog of DIKOW (2010).

Besides, information available from specimens deposited in the Museu de Zoologia da Universidade de São Paulo (MZSP) was included in the checklist of Mydidae. The terms "holotype" and "paratype" were substituted from "HT" and "PT", respectively. The abbreviation "new rec." was used to identify new occurrence records for Mato Grosso do Sul state.

The list of Therevidae species from Mato Grosso do Sul was based mainly on information presented by IRWIN & WEBB (1992). Besides, a search for literature published from 1992 to 2010 on the ZOOLOGICAL RECORD database (Thomson Reuters) using the key-words Brazil, Therevidae and Neotropical was performed. As a complementary source of data, the following works were consulted: GAIMARI & IRWIN (2000), HAUSER & WEBB (2007), WEBB (2005), WEBB & METZ (2006; 2008).

RESULTS

Checklist of species from Mato Grosso do Sul

Acroceridae. Only a single species is recorded to Mato Grosso do Sul, according to the available literature: *Philopota tuberculata* Westwood, 1848 (GILLUNG, 2011). There is a record of a sole male specimen collected in the city of Maracaju in 1937, which is deposited in the National Museum of Natural History, Washington DC (USNM).

Most acrocerid species are rarely found in nature, probably a consequence of both their short adult life and intrinsic low abundance. In addition, they often are not widely distributed and occur locally. *Philopota tuberculata*, however, is an exception, being one of the most common acrocerid species collected in the Neotropical region, even in relatively great numbers. This species occurs in tropical semideciduous seasonal forests in South America and is recorded to Central-West, Southeast and South Brazil. Original vegetation covering the city of Maracaju was mainly the woody dense savannah (also known as "cerradão"), with portions of semideciduous seasonal alluvial forest along river margins. Unfortunately, the original vegetation covering the region is presently replaced by crops and pastures, resulting in an extreme reduction of native vegetation areas.

Mydidae. According to available literature (PAPAVERO & WILCOX, 1968; WILCOX & PAPAVERO, 1975; WILCOX *et al.*, 1989; PAPAVERO & ARTIGAS, 1990; PAPAVERO, 2009), two mydid species are recorded for the state of Mato do Grosso do Sul (MS): *Gauromydas autuorii* (D'Andretta, 1951) and *Messiasia zikani* D'Andretta, 1951. Besides, recently collected material from Porto Murtinho, MS was consulted and *Messiasia notospila* (Wiedemann, 1828) was also recorded for the state.

The material examined was:

Messiasia notospila (Wiedemann). BRAZIL: Mato Grosso do Sul (Porto Murtinho, arredores do Hotel Camalotes, 21°42'28"S, 57°35'00"O), 21-30.I.2008, 1 male, S. Nihei, R. Figueiredo & J. Almeida cols. (MZSP), new rec.

Messiasia zikani D'Andretta. BRAZIL: Mato Grosso do Sul (Corumbá, Serra do Urucum), 28.XI.1960, 1 male,

K. Lenko col. *Messiasia zikani* D'Andretta, N. Papavero det. 1967 (MZSP).

Besides, type material was examined:

Gauromydas autuorii (D'Andretta). Maracajú/Mato Grosso/Brasil; Junho/1937; Serviço Febre/Amarela/M. E. S. Bras.; 20.126; *Gauromydas/autuorii* (D'And.)/N. Papavero det. PT female (MZSP).

Therevidae. Regarding therevid species from Mato Grosso do Sul, only one record was obtained within the literature published up to 2010: *Cyclotelus kroeberi* (Cole, 1960), a species included in the subfamily Therevinae.

Comparative species richness

Acroceridae. Despite the apparent low richness of acrocerid fauna in Mato Grosso do Sul specifically, the actual diversity of species in the state, as well as in Brazil is probably much greater. We estimate that nearly 20 species are likely to occur in the state. This shows the lack of information available for the group in Brazil, especially in some states where collecting and sampling efforts were little up to now. Regardless of their ecological importance as endoparasitoids and their potential relevance for pollination, studies and sampling in Acroceridae are still scarce. This evidences the necessity of sampling in Brazil, as in Mato Grosso do Sul area, for instance.

Mydidae. There are 27 species occurring in Brazil, and even though this number is relatively low compared to other taxa, a greater number of species occurring in Mato Grosso do Sul is expected. Species widely distributed, such as *Dolichogaster brevicornis* (Wiedemann, 1821), *Gauromydas heros* (Perty, 1833), *G. apicalis* (Wiedemann, 1831) and *Protomydas coerulescens* (Olivier, 1811), are likely to also occur in the state since they are recorded from the states of São Paulo and Mato Grosso, which are adjacent to Mato Grosso do Sul (PAPAVERO & ARTIGAS, 1990). If collecting effort is increased in this region, it is very likely that new records and even new species would be found.

Therevidae. From Brazil, 30 species and 11 genera of Therevidae are recorded. The state of Amazonas (AM) presents the greater species richness (eight species), followed by Paraná (PR), Santa Catarina (SC) and Rio de Janeiro (RJ), each state with six recorded species. The estimated fauna of therevids for Mato Grosso do Sul is at least eight species, since many other species are recorded for the surrounding states: *Henicomomyia flava* Lyneborg, *Brachylinga ornata* (Krober), *Cyclotelus beckeri* (Krober), *C. silacrusus* Irwin & Webb and *Anolinga melanothrix* Gaimari & Irwin for São Paulo; *H. flava* Lyneborg for Mato Grosso and *H. flava* Lyneborg for Goiás. All of these species are likely to also occur in Mato Grosso do Sul.

Main research groups and collections

Acroceridae. The two main research groups in Brazil conducting research in taxonomy and systematics of Acroceridae are the laboratories of Dr. José Roberto Pujol-Luz (Departamento de Zoologia, Instituto de Ciências Biológicas, Universidade de Brasília, Brasília, DF) and the laboratory

of Dr. Silvio Shigueo Nihei (Departamento de Zoologia, Instituto de Biociências - USP, Cidade Universitária, São Paulo, SP). As a former member of the second, Jéssica Paula Gillung has recently finished a revision of *Philopota* Wiedemann, 1830 the most diverse acrocerid genus in the Neotropical region, and intends to carry out phylogenetic studies of the group. No other researcher in South America is actively working on this group, according to the DIRECTORY OF SOUTH AMERICAN DIPTERISTS <<http://zoo.bio.ufpr.br/diptera/south/index.html>>. The major Brazilian institutions and collections holding acrocerid specimens are Museu de Zoologia da Universidade de São Paulo, São Paulo, SP (MZSP), Coleção Entomológica Pe. Jesus Santiago Moure, Curitiba, PR (DZUP) and Instituto de Pesquisas da Amazônia, Manaus, AM (INPA). These three museums hold less than two hundred specimens, most of them unidentified until recently (CARVALHO *et al.*, 2002). Efforts in bringing the family up to date have been made in the past five years by Jéssica Gillung, resulting in the identification of pinned specimens in collections and description of several new genera and species.

Mydidae. The two major Brazilian specialists in Mydidae are Dr. Nelson Papavero and MSc. Julia Calhau Almeida, who is finishing a phylogenetic study on the subfamily Mydinae as her PhD thesis at Universidade de São Paulo, São Paulo, Brazil, under supervision of Drs Silvio Nihei and Carlos Lamas. Currently, the most important specialist in mydids from other biogeographical regions is Dr. Torsten Dikow (Smithsonian Institution, EUA). The most important collection for Mydidae in Brazil is the Museu de Zoologia da Universidade de São Paulo, São Paulo, SP (MZSP). This collection holds the greater number of mydid specimens. Other important collections are: Coleção Entomológica do Instituto Osvaldo Cruz, Rio de Janeiro, RJ (CEIOC), Museu Nacional do Rio de Janeiro, Rio de Janeiro, RJ (MNRJ), Coleção Entomológica Padre Jesus Santiago Moure, Curitiba/PR (DZUP), Instituto Nacional de Pesquisas da Amazônia, Manaus, AM (INPA) and Museu Paraense Emílio Goeldi, Belém, PA (MPEG).

Therevidae. There are no research groups on Therevidae in Brazil. Description of new genera and species, and discovery of new occurrence records are being conducted mainly by foreign dipterists. The main researchers in Therevidae worldwide are Mark A. Metz, Michael E. Irwin, Martin Hauser, Stephen D. Gaimari and Shaun Winterton. CARVALHO *et al.* (2002) provide information about six of the main Diptera collections in Brazil. Five Brazilian collections hold specimens of Therevidae: Coleção Entomológica Padre Jesus Santiago Moure, Curitiba, PR (DZUP); Instituto Nacional de Pesquisas da Amazônia, Manaus, AM (INPA); Museu Nacional do Rio de Janeiro, Rio de Janeiro, RJ (MNRJ); Museu Paraense Emílio Goeldi, Belém, PA (MPEG); and Museu de Zoologia da Universidade de São Paulo, São Paulo, SP (MZSP). The authors estimate that there are 516 specimens deposited in these collections, and approximately 48% of specimens are identified at least at genus level. The collection of Museu Paraense Emílio Goeldi,

Belém, PA (MPEG) is the only Brazilian Institution that does not hold any identified specimens, although therevids are represented by 149 pinned specimens in the collection.

Main neglected issues and research perspectives

Acroceridae. Taxonomic and systematics studies as well as collecting and sampling of acrocerids in Brazil are still incipient. Many efforts are being directed to these aspects nowadays, but there is still much to be accomplished. There are still many new species and genera to be described and several taxonomic issues regarding Neotropical groups to be solved.

Mydidae. Despite many taxonomic and systematic works are being conducted on Mydidae, several important aspects are still neglected, such as the scarcity of taxonomic knowledge in some groups, especially species and genera from undersampled areas, such as Mato Grosso do Sul state. Biogeographical studies could only be performed accurately if more data on distributions of species are provided. Finally, studies on biology and behavior of species of Mydidae are still lacking. However, these studies are likely to be a challenge for specialists, because species are difficult to be found and observed in the field.

Therevidae. Generally, therevids are poorly studied and insufficiently known in Brazil. This fact is due mostly to the absence of specialists actively working on therevids in the country. New perspectives of research will be available with the results provided by the project “SISBIOTA Brazil: A network for studies on diversity, systematics and distribution of Diptera in the states of Mato Grosso, Mato Grosso do Sul and Rondônia”. The general coordinator of this project is Professor Carlos José Einicker Lamas, from MZSP and up to now there are 22 researchers and 16 institutions from seven different Brazilian states engaged in the project. Many specimens are being collected and from now on, people should be trained to mount, identify and study all of this material.

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