Trichoptera Kirby (Insecta) immature fauna from Rio das Almas Basin and Rio Paranã, Goiás State, Brazil, with new records for some genera

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BARBOSA, F.F., GODOY, B.S. & OLIVEIRA, L.O. **Trichoptera Kirby (Insecta) immature fauna from Rio das Almas Basin and Rio Paranã, Goiás State, Brazil, with new records for some genera.** Biota Neotrop. v11(4): http://www.biotaneotropica.org.br/v11n4/en/abstract?article+bn00311042011.

Abstract: This paper deals with the Trichoptera immature fauna collected in 101 streams in Rio das Almas Basin during August-October 2008 and in Rio Paranã, Iaciara-GO municipality, on August 2003, using kick-nets with 0.025 m^2 of opening and 2 mm mesh. We record four new genera for Goiás State, expanding records of genera from 33 to 37 and contributing to the Trichoptera fauna knowledge in Central Brazil.
Keywords: *aquatic insects, benthic macroinvertebrates, Brazilian Savanna, caddisflies, larvae.*

BARBOSA, F.F., GODOY, B.S. & OLIVEIRA, L.O. **Fauna de imaturos de Trichoptera Kirby (Insecta) na Bacia do Rio das Almas e no Rio Paranã, Estado de Goiás, Brasil, com novos registros de gênero.** Biota Neotrop. v11(4): http://www.biotaneotropica.org.br/v11n4/pt/abstract?article+bn00311042011.

Resumo: Este trabalho apresenta a fauna de imaturos da Ordem Trichoptera coletada em 101 riachos na Bacia do Rio das Almas, entre Agosto e Outubro de 2008, e no Rio Paranã, município de Iaciara-GO, em Agosto de 2003. Foram usadas peneiras de 0,025 m^2 de abertura e malha de 2 mm. Nós registramos quatro novos gêneros para o Estado de Goiás, expandindo, assim, de 33 para 37 os registros de gênero para o Estado de Goiás, contribuindo para o conhecimento da fauna da Ordem Trichoptera no Brasil Central.
Palavras-chave: *insetos aquáticos, macroinvertebrados bentônicos, cerrado brasileiro, tricópteros, larvas.*

Introduction

Insects are well represented in freshwater ecosystems, both in abundance, biomass, productivity and species richness (Merritt & Cummins 1996). The order Trichoptera constitutes the major insect order with exclusively aquatic larvae. The great taxonomic richness makes this order one of the most important among aquatic insects (Wiggins 1996a). According to Morse (2011), it comprises 47 families, 608 genera and approximately 13,574 species. The larvae are found in lentic and lotic ecosystems, including perennial and temporary streams. This order is important in the cycling of organic matter and energy exchange among different trophic levels (Wiggins 1996a). The larvae have peculiar structures related to aquatic life cycle as abdominal gills, and a pair of false legs equipped with claws on the IX abdomen. The larvae produce silk used to build mobile shelters or to anchor their nets, to capture food particles (Angrisano 1995), which awards these organisms a title of great architects (Wiggins 2004).

The knowledge on Brazilian aquatic insects is yet incipient, and only three regions are well studied, Southeast, North and South regions (recorded caddisflies species are 409, 262 and 178, respectively). For the Northeast and Center regions of Brazil few caddisflies species have been recorded (respectively 15 and 34). This situation is even worse in some States (Amapá, Tocantins, Maranhão, Piauí, Rio Grande do Norte, Pernambuco, Alagoas and Sergipe) where no caddisflies record has even been made (Paprocki et al. 2004, Santos et al. 2011). The taxonomic knowledge about the Brazilian caddisflies is concentrated in States that have tradition in this type of research, or more economically developed or those ones that have ecosystems of international interest, like the Amazon and Atlantic forests.

By the end of 1980s, five genera were recorded for Goiás State (Paprocki et al. 2004). Recent contributions to the knowledge about the Trichoptera diversity reflected an increase in genera recorded in Goiás from five (Paprocki et al. 2004) to 33 genera (six new records in Oliveira et al. (1999), 11 in Oliveira & Bispo (2001), two in Bispo et al. (2004), two in Shuvartz et al. (2005), six in Martins-Silva et al. (2008) and one in Calor (2008a)). However, as pointed by Oliveira & Froehlich (1997), the ecological and taxonomic knowledge about the Trichoptera in Brazilian Savanna Streams is still incipient. The lack of knowledge of aquatic insects allied to the impact of agriculture in this region makes it urgent the comprehension of the biological components of freshwater ecosystems, especially Trichoptera. In this context, other studies may be affected, such as more detailed studies on the stream ecology or the application of biomonitoring programs. Thus, this paper presents genera records of the caddisflies for Goiás State, Brazil.

Material and Methods

Samples from first and second order streams in Rio das Almas Basin (Sthraler 1957) in the municipalities of Goianésia-GO, Morro Agudo de Goiás-GO, Itapuranga-GO, Jaraguá-GO, São Francisco de Goiás-GO, Itaberaí-GO, Santa Isabel-GO, Pirenópolis-GO, Petrolina de Goiás-GO and Heitoraí-GO (Figure 1) were taken, in the period during August-October 2008. Four types of micro-habitats were sampled: submerged riparian vegetation (e.g. roots and aquatic plants), rocks, litter submerged and sand. Samples in Rio Paranã, municipality of Iaciara-GO (Figure 1), on August 2003 were also taken. Rio Paranã is a fifth order stream (Sthraler 1957) and only rocky micro-habitat was sampled.

Samples were made using kick-nets with 0.025 m^2 area and 2 mm mesh. Although kick-net sampler results in a lower density of organisms compared to other sampling devices as Hess sampler and Surber sampler, no significant difference in the number of families was found among different sampling devices (Chiasson 2009). All samples were fixed with 80% Ethanol and stored in the Laboratório de Meio Ambiente e Recursos Hídricos of Universidade Federal de Goiás-LAMARH-UFG Entomological Collection. The larvae were identified to genus according to: Marshal (1979), Wiggins (1996a,b), Oliveira (2006), Morse & Holzenthal (2006), Calor (2008b) and Calor & Froehlich (2008). This paper also considers data from Oliveira et al. (1999), Oliveira & Bispo (2001) and Bispo et al. (2004) in the total number.

Genus preference for a certain microhabitat was analyzed by calculating the relative proportion of observations on the *taxon* sampling. The proportion is estimated by dividing the number of times the genus was recorded in a given habitat by the total number of occurrence of the genus in all substrates. This basic analysis was chosen because its results are simple and easy to interprete (Hilborn & Mangel 1997).

Results

A total of 3113 Trichoptera larvae distributed in 26 genera and 12 families were sampled in Rio das Almas Basin, three without records to the State, *Anchitrichia* Flint, *Zumatrichia* Mosely and *Cernotina* Ross. In Rio Paranã, a total of 62 Trichoptera larvae distributed in four genera and two families were sampled, one without records to the State, *Synoestropsis* Ulmer. (Tables 1 and 2). Oliveira et al. (1999), Oliveira & Bispo (2001) and Bispo et al. (2004) recorded other six genera in Rio das Almas Basin (*Atopsyche* Banks, *Hydroptila* Dalman, *Atanatolica* Mosely, *Setodes* Rambur, *Polycentropus* Curtis and *Xiphocentron* Brauer), that were not re-sampled during field work, but were considered in the totals for the region. Thus, the actual knowledge about caddisflies is 37 genera (12 families) in Goiás State, Brazil.

Discussion

In Brazil, studies before 1990s declared the existence of 378 Trichoptera species distributed in 61 genera, among which 11 species in 5 genera were collected in Goiás State (Paprocki et al. 2004). Later, new records of genera for the State were added (Oliveira et al. (1999) – 6: *Atopsyche* Banks, *Barypenthus* Burmeister, *Helicopsyche* Siebold, *Macronema* Pictet, *Protoptila* Banks and *Xiphocentron* Brauer; Oliveira &

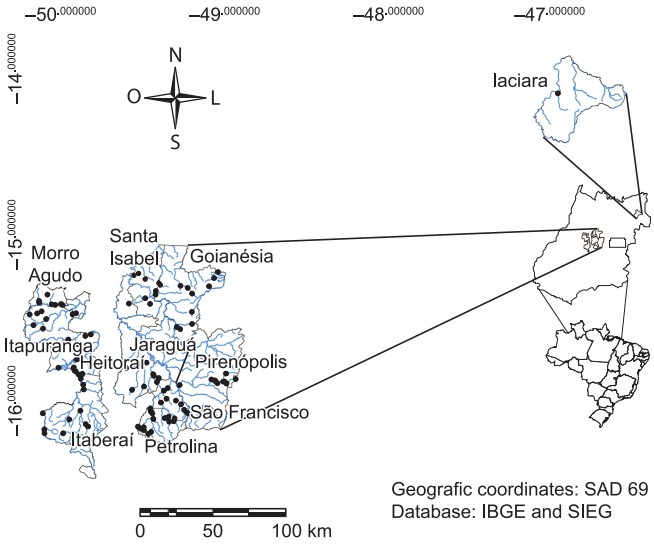

Figure 1. Geographical localization of sampling sites, Rio das Almas Basin, GO and Iaciara-GO (Rio Paranã).

Bispo (2001) – 11: *Alisotrichia* Flint, *Atanatolica* Mosely, *Dicaminus* Müller, *Hydroptila* Dalman, *Nectopsyche* Müller, *Neotrichia* Morton, *Oecetis* McLachlan, *Oxyethira* Eaton, *Polyplectropus* Ulmer, *Setodes* Rambur and *Triplectides* Kolenati; Bispo et al. (2004) – 2: *Grumichella* Müller and *Polycentropus* Curtis; Shuvartz et al. (2005) – 2: *Cyrnellus* Banks and *Ochrotrichia* Mosely; Martins-Silva et al. (2008) – 6: *Austrotinodes* Schmid, *Dolophilodes* Ulmer, *Macrostemum* Kolenati, *Metrichia* Ross, *Mortoniella* Ulmer and *Wormaldia* McLachlan; and Calor (2008a) with one species: *Notalina (Neonotalina) goianensis* Calor (2008).

All four genera, *Synoestropsis* Ulmer, *Anchitrichia* Flint, *Zumatrichia* Mosely and *Cernotina* Ross, were already recorded from the Neotropical region (Marshal 1979, Flint Junior et al. 1999, Holzenthal et al. 2007). *Synoestropsis* Ulmer with 10 described species (Morse 2011), six in Brazil: *Synoestropsis furcata* Flint, 1974 in Pará, Mato Grosso and Minas Gerais States (Paprocki et al. 2004, Calor 2008b, Santos et al. 2011); *Synoestropsis grisoli* Navás, 1924 in Amazonas, Pará, Mato Grosso and Minas Gerais States (Blahnik et al. 2004, Paprocki et al. 2004, Santos et al. 2011); *Synoestropsis obliqua* Ulmer, 1905 in Rio Grande do Sul State (Paprocki et al. 2004); *Synoestropsis pedicillata* Ulmer, 1905 in Pará, Minas Gerais, Santa Catarina and São Paulo States (Blahnik et al. 2004, Paprocki et al. 2004, Calor 2011, Santos et al. 2011); *Synoestropsis punctipennis* Ulmer, 1905 in Amazonas State (Paprocki et al. 2004); and *Synoestropsis stictonata* Navás, 1932 in Santa Catarina State (Paprocki et al. 2004). *Synoestropsis* Ulmer was registered by Marioni & Almeida (2000) in Paraná State, by Bentes et al. (2008) in Roraima State and by Spies & Froehlich (2009) in São Paulo State. In Roraima, Mato Grosso and Goiás it was sampled in the Brazilian Savanna (Bentes et al. 2008, Calor 2008b, and the present study respectivelly).

Table 1. Genera of Trichoptera, showing the new records from Goiás State (*) and the genera sampled in Rio das Almas Basin and Rio Paranã (†). *Synoestropsis* Ulmer was sampled only in Rio Paranã.

Families	Genera
Calamoceratidae	*Phylloicus* Müller, 1880
Ecnomidae	*Austrotinodes* Schmid, 1955
Glossosomatidae	*Protoptila* Banks, 1904
Helicopsychidae	*Helicopsyche* Siebold, 1856
Hydrobiosidae	*Atopsyche* Banks, 1905
Hydropsychidae	*Leptonema* Guérin-Meneville, 1843
	Macronema Pictet, 1836†
	Macrostemum Kolenati, 1859
	Smicridea McLachlan, 1871†
	Synoestropsis Ulmer, 1905*†
Hydroptilidae	*Alisotrichia* Flint, 1964
	Anchitrichia Flint, 1970*
	Dicaminus Müller, 1879
	Hydroptila Dalman, 1819
	Neotrichia Morton, 1905
	Ochrotrichia Mosely, 1934
	Oxyethira Eaton, 1873
	Zumatrichia Mosely, 1937*
Leptoceridae	*Atanatolica* Mosely, 1936
	Grumichella Müller, 1879
	Nectopsyche Müller, 1879
	Oecetis McLachlan, 1877
	Setodes Rambur, 1842
	Triplectides Kolenati, 1859
Odontoceridae	*Barypenthus* Burmeister, 1839
	Marilia Müller, 1880
Philopotamidae	*Chimarra* Stephens, 1829†
	Dolophilodes Ulmer, 1909
Polycentropodidae	*Cernotina* Ross, 1938*
	Cyrnellus Banks, 1913
	Polycentropus Curtis, 1835
	Polyplectropus Ulmer, 1905
Xiphocentronidae	*Xiphocentron* Brauer, 1870

The genus *Anchitrichia* Flint, with four described species (Morse 2011), *Anchitrichia duplifurcata* Flint, 1983 is the only record from Brazil, more precisely from Minas Gerais and Rio de Janeiro States (Blahnik et al. 2004, Paprocki et al. 2004). In generic level, Pes et al. (2005) sampled this genus in Amazonas State. *Zumatrichia* Mosely has no specific records from Brazil (Paprocki et al. 2004), despite the 22 described species (Morse 2011). However, this genus was registered by Kikuchi & Uieda (2005) in São Paulo State and by Pes et al. (2005) in Amazonas State.

Cernotina Ross, with 65 described species (Morse 2011), 32 in Brazil: 20 in Amazonas State (Paprocki et al. 2004, Santos & Nessimian 2008); three in Pará State (Paprocki et al. 2004); two in Roraima State (Paprocki et al. 2004); one in Paraná State (Holzenthal & Almeida 2003, Paprocki et al. 2004); one in Santa Catarina State (Flint Junior 1983, Paprocki et al. 2004); one in Rio de Janeiro State (Dumas & Nessimian 2011); one in Paraná and Minas Gerais states (Holzenthal & Almeida 2003; Paprocki et al. 2004); one in Amazonas and Minas Gerais states (Blahnik et al. 2004, Paprocki et al. 2004); one in Roraima and Pará states (Paprocki et al. 2004); and one in Amazonas, Pará and Minas Gerais states (Blahnik et al. 2004, Paprocki et al. 2004). In generic level, Cortezzi et al. (2009) sampled this genus in São Paulo State. *Cernotina antonina* Holzenthal & Almeida, 2003 was sampled in Morro do Pilar, Minas Gerais State, in a transition of Central Brazilian Savanna and Atlantic Forest (Holzenthal & Almeida 2003), and in the present study, *Cernotina* Ross was sampled in Goiás Savanna.

The micro-distribution for the genera did not show differences from previous studies. The genus *Cernotina* Ross was found in streams larger than 1.5 m. It occurred in submerged riparian vegetation micro-habitats (66%), in submerged litter (25%) and in rocks (8%) (Table 2). Previous adult collection suggests that larvae are most likely found in slow flowing rivers, streams and backwaters (Flint Junior 1983). *Cernotina* Ross larvae are predators (engulfers) and build silk tube retreats (Wiggins 1996b).

The genera *Synoestropsis* Ulmer, *Anchitrichia* Flint and *Zumatrichia* Mosely were collected only in rocky micro-habitats (Table 2). *Anchitrichia* Flint and *Zumatrichia* Mosely are found in regions with fast water flow, where they produce silk shelters that attached to rocks (Flint Junior 1983, Wiggins 1996a,b). *Zumatrichia* Mosely larvae are periphyton scrapers (Wiggins 1996a,b) and probably so are *Anchitrichia* Flint larvae (Flint Junior 1983). *Synoestropsis* Ulmer is a predatory hydropsychid (Bentes et al. 2008) and was collected in a gravel riffle of a large stream (Flint Junior et al. 1999), the same micro-habitat where this genus was sampled in this study.

The present study extends the Trichoptera genera records for the Goiás State from 33 to 37, contributing to a more effective knowledge about the Trichoptera. It also contributes to the expansion and application of ecological studies, bioassessment and conservation of this group.

Table 2. New Trichoptera genera collected in Rio das Almas Basin-GO and Iaciara-GO (Rio Paranã), showing the municipalities, micro-habitats and geographic coordinates (degrees).

Municipality	Micro-habitat	Latitude	Longitude	*Synoestropsis* Ulmer	*Anchitrichia* Flint	*Zumatrichia* Mosely	*Cernotina* Ross
SI-4	RV	15.298	49.344	0	0	0	1
SI-7	RV	15.226	49.329	0	0	0	1
SF-4	R	15.971	49.311	0	0	1	0
SF-7	R	15.982	49.187	0	0	1	1
J-2	R	15.805	49.355	0	0	1	0
IP-9	RV	15.417	50.082	0	0	0	2
IP-9	LS	15.417	50.082	0	0	0	1
MA-2	LS	15.359	49.934	0	0	0	1
MA-5	RV	15.404	50.054	0	0	0	1
MA-8	R	15.359	49.991	0	0	1	0
MA-8	RV	15.359	49.991	0	0	0	3
MA-9	R	15.341	50.069	0	65	0	0
G-1	LS	15.501	49.211	0	0	0	1
G-8	R	15.160	48.957	0	0	3	0
P-3	R	16.125	49.419	0	0	26	0
IC-1	R	14.047	46.840	16	0	0	0
				16	65	33	12

Municipalities: SI – Santa Isabel-GO, SF – São Francisco de Goiás-GO, J – Jaraguá-GO, IP – Itapuranga-GO, MA – Morro Agudo de Goiás-GO, G – Goianésia-GO, P – Petrolina de Goiás-GO and IC – Iaciara (Rio Paranã); Micro-habitats: R – Rocks, RV – Submerged riparian vegetation and LS – Litter submerged.

Acknowledgements

We thank the support from LAMARH-UFG friends especially Luciano Lopes Queiroz for helping in identification, and Sara Lodi de Carvalho for the reading and suggestions in the manuscript. We also thank CNPq for the Grant project Nº. 475355/2007-5, Nº. 502067/2008-0, Nº. 303835/2009-5 and logistics provided by the Instituto de Ciências Biológicas (ICB-UFG).

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Received 13/12/2010
Revised 03/10/2011
Accepted 04/10/2011