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Studies in South-Occidental Amazon: contribution to the knowledge of Brazilian Chironomidae (Insecta: Diptera)

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ABSTRACT. Chironomidae (Diptera) are a diverse and large group of small flies, whose larvae inhabit nearly every possible niche in most freshwater aquatic ecosystems. The Acre river is an important affluent of the Purus river. Our objective was to contribute to the knowledge of Chironomidae in this region by making the first survey of Chironomidae composition in the Acre river (Amazon Basin), and relate its distribution to physical and chemical variables. Samples were collected at three sites using a modified Petersen grab. A grain size analysis showed heterogeneity between sampling sites. Eighteen morphospecies of Chironomidae larvae were recorded. In site 2, there was higher density of Chironomidae. Higher richness was observed in site 1, and the composition of this site was similar to site 3. The present study showed that the Chironomidae community was influenced by urban area. Chironomidae can be considered an important component of the fauna of this river and a potential instrument in future studies of ecology in the region.

Keywords: Amazon, composition, abundance, distribution.

Estudos na Amazônia Sul-ocidental: contribuição para os conhecimentos sobre Chironomidae (Insecta: Diptera) no Brasil

RESUMO. Chironomidae é uma família de Diptera com muitas espécies, cujas larvas ocupam praticamente todos os nichos possíveis na maioria dos ecossistemas aquáticos de água doce. O rio Acre é um importante afluente do rio Purus. O objetivo deste trabalho foi realizar o levantamento da composição da comunidade de larvas de Chironomidae do rio Acre (Bacia Amazônica) e relacionar a distribuição da comunidade com as variáveis físicas e químicas. As amostras foram coletadas em três estações utilizando-se um pegador do tipo Petersen modificado. Foram encontradas larvas de 18 morfoespécies de Chironomidae. Na estação 2, foram registradas as maiores densidades. A maior riqueza foi observada na estação 1 e a composição desta estação foi mais similar a da estação 3. O presente estudo revelou que a comunidade de Chironomidae respondeu a influência do trecho urbano. Chironomidae pode ser considerado um importante componente da fauna deste rio e um potencial instrumento de futuros estudos de ecologia na região.

Palavras-chave: Amazônia, composição, abundância, distribuição.

Introduction

Chironomidae are a fantastically diverse and large group of small flies, whose larvae inhabit nearly every possible niche in most freshwater aquatic ecosystems (EPLER, 2001). They are the most broadly distributed, species-rich, and often the most abundant family of benthic macroinvertebrates in freshwater systems (PINDER, 1986). Chironomidae larvae represent the most important food source for many species of fish (FUGI et al., 2007) and have great ecological importance.

Chironomidae have been widely studied in the world (ARMITAGE et al., 1995) and the Neotropical region is exemplary for discussing chironomid species richness because it probably represents one of most species-rich areas in the world (ROQUE et al., 2007).

However, little is known about real Chironomidae species richness in this region. Reiss (1982) speculated that the Central American region has 1,500 - 2,000 species, and according to Fittkau (2001), we can expect a total far exceeding 1,000 chironomid species in the Amazon alone, but only 618 species belonging to 168 genera have been reported in the Neotropics (FERRINGTON, 2008).

In Brazil, Chironomidae (Insecta, Diptera) began to receive attention in the 1970s, with the first studies in the Central Amazon by Fittkau (1971) and

Reiss (1977a and b). Currently, there are about 40 Chironomidae researchers in Brazil, mainly in the Southeast. Few studies of Chironomidae are still being developed in the Amazon (COUCEIRO et al., 2010; FIDELIS et al., 2008; FUSARI et al., 2009), all in the Central Amazon.

In the South-Occidental Amazon, more precisely in Acre State, there are few records of Chironomidae; few studies have been carried out in this region. There are only two species of Chironomidae recorded for this region, *Nilothauma calori* (MENDES; ANDERSEN, 2009) and *N. fittkaui* (SOPONIS, 1987).

However, high richness of Chironomidae larvae is expected in this region; therefore, our objective was to contribute to the knowledge of Chironomidae in this region by making the first survey of Chironomidae composition in the Acre river (Amazon Basin), and relate its distribution to physical and chemical variables.

Material and methods

Study area and sampling stations

The study area is located near the city of Rio Branco along the middle stretch of the Acre river. This river is an important affluent of the Purus river, which is a tributary of the Solimões river (Amazon Basin). The Acre river begins in Peru near the Brazilian border, in altitudes of about 300 m, has an extension of approximately 1,200 km and drains into the Purus river in the city of Boca do Acre (State of Amazonas) (Figure 1).

To characterize the Chironomidae larval community of the Acre river, three sites were sampled along a stretch of 13.5 km: site 1 (10°00'48.5"S and 67°50'41.2"W) is located near ETA II (water treatment station) upriver of the city of Rio Branco; site 2 (09°58'50.1"S and 67°48'57.3"W) is located in the Gameleira recreational area, which is an urban environment that receives organic pollution from the city; and site 3 (09°57'42.1"S and 67°46'53.8"W) is located downriver from the urban stretch, where organic pollution is considered to be lower. In each site, samples were collected at three points: left bank (LB), right bank (RB) and in the center (CE) of the Acre river.

The grain size analysis showed predominance of medium, fine and very fine sand in site 1, mud and very fine sand in site 2, very fine and fine sand in site 3, which demonstrates heterogeneity among sampling sites (Figure 2); however, significant differences were not observed (Manova: $W_{6.12}$= 0.79; p= 0.69).

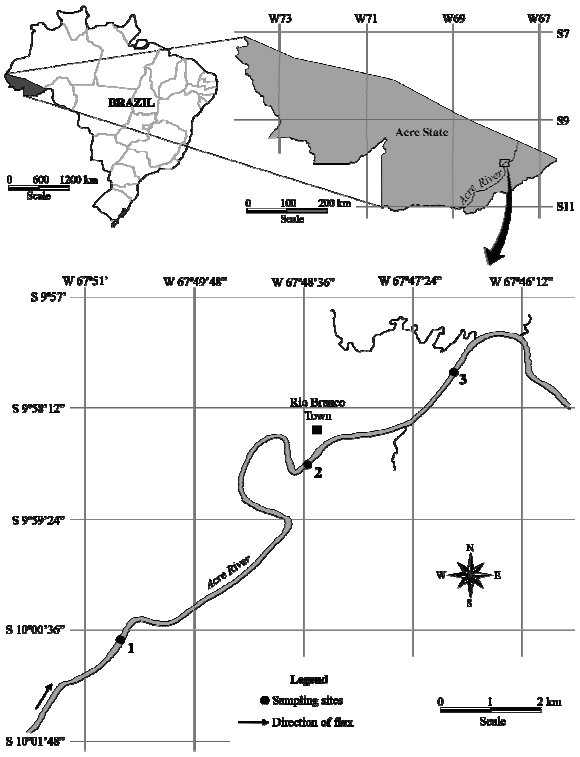

Figure 1. Location of sampling sites along the Acre river (Rio Branco, Acre State, Brazil).

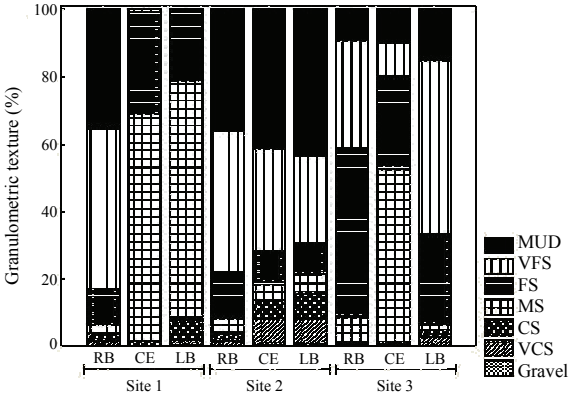

Figure 2. Granulometric textures of three sites along the Acre river. VCS= very coarse sand; CS= coarse sand; MS= medium sand; FS= fine sand; VFS= very fine sand. LB= left bank; RB= right bank; CE= center region.

Data collection

Samples were collected on September 11, 2009 using a modified Petersen grab (0.0189 m^2). Four benthic samples were taken at each left bank (LB), right bank (RB) and in the center (CE), which included three for biological analysis and one for grain size analysis. Granulometric textures were determined using methodology of Wentworth (1922). To verify the existence of significant differences in the texture of particle in the sites, we applied a multiple analysis of variance (MANOVA).

The three samples collected for biological analysis were washed through a series of sieves (mesh size from 2.0 to 0.2 mm). All organisms retained on 2.0 and 1.0 mm sieves were immediately picked out. The material retained on the 0.2 mm sieve was fixed in 80% alcohol and sorted under a stereoscopic microscope.

Chironomidae larvae were dissected and mounted in slides with Hoyer, according to methodology proposed by Trivinho-Strixino and Strixino (1995); next, the organisms were identified to the lowest possible taxonomic level using the identification keys of Trivinho-Strixino and Strixino (1995) and Epler (2001). The slides are stored in the Zoobentos laboratory (NUPELIA/UEM), Maringá, Paraná State, Brazil.

Along with biological samples, we measured conductivity (μS cm^{-1}), pH, temperature (ºC) and dissolved oxygen (mg L^{-1}) with a HI 9828 multi-parameter water quality monitor (Hanna Instruments) (Table 1).

Table 1. Abiotic variables values in Acre river. T = water temperature (ºC); Cond = conductivity (mS cm^{-1}); D.O. = dissolved oxygen (mg L^{-1}); LB = left bank; RB = right bank; CE = center region.

Sites	Points	pH	T	Cond	O.D.
Site 1	LB	7.5	27.1	58.0	4.3
Site 1	CE	7.8	27.0	57.7	4.5
Site 1	RB	7.9	27.0	56.7	4.4
Site 2	LB	7.9	27.2	59.0	4.4
Site 2	CE	8.0	27.2	56.7	4.4
Site 2	RB	8.0	27.2	57.7	4.5
Site 3	LB	7.9	27.3	63.0	4.5
Site 3	CE	8.0	27.3	58.0	4.5
Site 3	RB	8.0	27.5	58.0	4.6

Chironomidae abundance data were transformed to density (number of individuals/0.0189 m^2) and the proportionate share of each taxon were represented graphically.

We calculated the mean density and richness of each point. Means were represented graphically using the Statistica software (version 7.1).

Results and discussion

Eighteen morphospecies of Chironomidae larvae were recorded, which belonged to three subfamilies – Tanypodinae, Chironominae and Orthocladiinae. Chironominae was the most representative subfamily with 13 taxa. Chironomini sp. refers to a taxon that is not identified (Table 2).

A higher density of larvae was recorded at site 2 (Figure 3), and higher richness recorded at site 1 (Figure 4).

The composition of Chironomidae differed among sites. Genera *Djalmbatista*, *Pentaneura, Axarus* and Chironomini sp. were recorded at site 1, while *Parachironomus*, *Cryptochironomus* and *Coelotanypus* occurred only at site 2.

Table 2. Subfamily, tribe and Chironomidae morphospecies recorded in the Acre river.

Tanypodinae	
	Coelotanypodini
	Clinotanypus sp. 1
	Coelotanypus sp. 1
	Pentaneurini
	Pentaneura sp. 1
	Procladiini
	Djalmabatista cf pulcher (Johannsen, 1908)
Chironominae	
	Chironomini
	Axarus sp. 1
	Cryptochironomus sp. 1
	Cryptochironomus sp. 2
	Endotribelos sp. 1
	Fissimentum sp. 1
	Fissimentum sp. 2
	Parachironomus sp. 1
	Polypedilum sp. 1
	Polypedilum (Tripodura) sp. 1
	Robackia sp. 1
	Chironomini genus 1
	Tanytarsini
	Caladomyia/Tanytarsus sp. 1
	Caladomyia /Tanytarsus sp. 2
Orthocladiinae	
	Lopescladius sp. 1

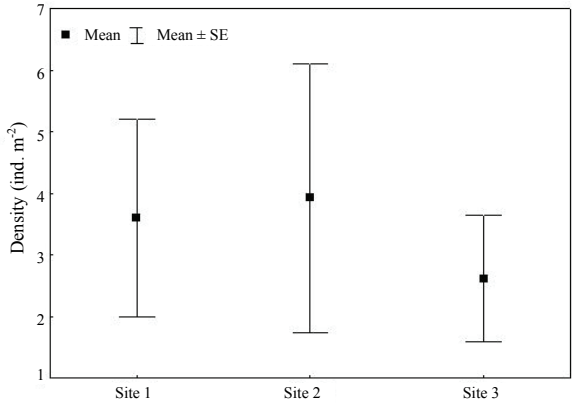

Figure 3. Mean density ± SE of Chironomidae larvae in three sites along the Acre river.

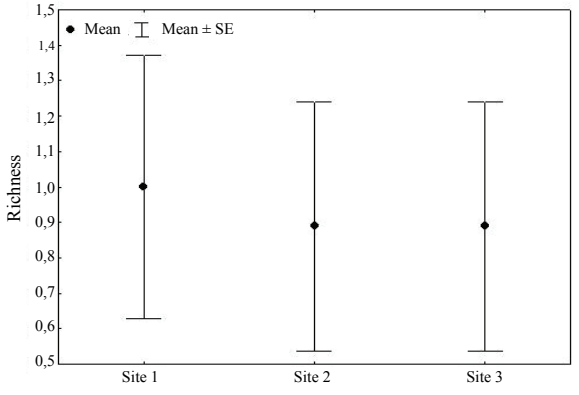

Figure 4. Mean richness ± SE of Chironomidae larvae at three sites along the Acre river.

Some taxa, such as *Endotribelos* sp. 1, *Robackia* and *Polypedilum*, were recorded at sites 1 and 3 (Figure 5).

Globally, 11 subfamilies of Chironomidae are known (FERRINGTON, 2008). In Brazil, five subfamilies of Chironomidae may be observed: Telmatogetoninae, Podonominae, Tanypodinae, Orthocladiinae and Chironominae. In our study in the Acre river, we recorded Chironominae, Tanypodinae and Orthocladiinae subfamilies that are the most commonly recorded in aquatic habitats in Brazil. Chironominae were the most specious subfamily, which confirms the observations of Fittkau (1971), Spies and Reiss (1996), Roque et al. (2000) and Rosin and Takeda (2007) and Rosin et al. (2009).

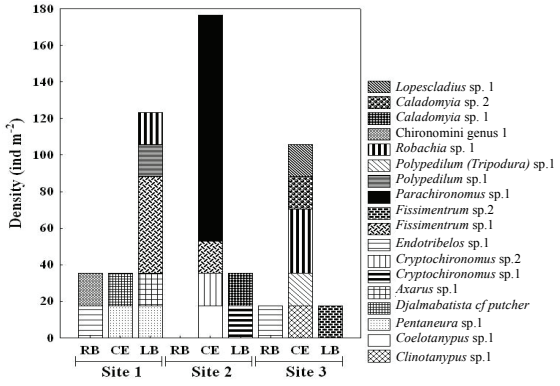

Figure 5. Total density of Chironomidae larvae at three sites along the Acre river. LB= left bank; RB= right bank; CE= center region.

We found 14 genera in the Acre river; however, it is difficult to compare these numbers with other studies in the Amazon, because most previous research on Chironomidae has been conducted in lentic environments or impacted habitats (CALLISTO, 1997; CALLISTO; ESTEVES, 1996; REISS, 1977a and b), or refer to Chironomidae in family taxonomic level (COUCEIRO et al., 2010; FIDELIS et al., 2008). Among the taxa recorded, it was not possible to identify a genus, Chironomini genus 1, using the identification keys mentioned above. Considering the scarcity of studies in this region, it is possible that this is a taxon still unknown to science.

The highest density of organisms was recorded in site 2, but with the predominance of only one taxon, *Parachironomus* sp. 1. This genus is frequently found in fine sediment, and can support a wide range of environmental conditions (EPLER, 2001). The genera *Cryptochironomus* and *Coelotanypus*, such as *Parachironomus,* were recorded only in site 2. This site is heavily influenced by the urban area and has worst water conditions. The presence of these taxa, only at this site, probably reflects the adaptive abilities of these taxa to under conditions. Silva et al. (2008) recorded high densities of *Cryptochironomus* below a fish tank and associated this taxon with high levels of organic matter. The taxonomic composition in sites 1 and 3 were more similar, because of the lower influence of the urban area.

Conclusion

This was the first research on Chironomidae in the Acre river, and even with few samples, it was possible to characterize the community of Chironomidae of the river and show that the distribution of larvae responds to the influences of urban area. Thus, Chironomidae can be considered an important component of the fauna of this river and a potential instrument in future ecology studies in the region.

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