A preliminary survey of Chironomidae adults (Insecta: Diptera) in a heterogeneous landscape of Jaraguá State Park, São Paulo, Brazil

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Resumo

A distribuição dos adultos de Chironomidae foi estudada utilizando armadilhas Malaise em cinco diferentes pontos no Parque Estadual do Jaraguá: A – mata ripária, B – mata na área do sopé do Parque próxima a uma lagoa, C – mata próxima a áreas abertas e distante de um córrego em baixa altitude, D – estreita faixa de mata circundada por campos na área mais alta do parque e E – área aberta circundada por mata. Este estudo aponta para diferenças na riqueza e abundância dos adultos de Chironomidae nos diferentes usos do solo.

Unitermos: Chironomidae, Diptera, Mata Atlântica, Ecologia da Paisagem.

Abstract

The distribution of Chironomidae adults was studied using Malaise traps at five different sites in Jaraguá State Park (São Paulo, Brazil): A – riparian forest, B – forest in low land near a reservoir, C – forest near an open area located far from a stream in the low lands, D – forest patch surrounded by grasslands in the highest area of the park, and E – open area surrounded by forest. This study indicates differences in richness and abundance of Chironomidae adults in relation to the different land uses.

Key words: Chironomidae, Diptera, Atlantic Forest, Landscape Ecology.

Introduction

In the majority of Chironomidae studies, the effects of anthropic impacts have been examined only in the larval stages (Frouz and Paoletti, 2000). There is little data about the influence of different land uses on the ecology of Chironomidae adults (Armitage, 1995; Delettre and Morvan, 2000), especially in Brazil where no published study exist.

Considering the importance and the endangered condition of the Brazilian Atlantic Forest (Morellato and Haddad, 2000; Conservation International do Brasil et al., 2000) and the relevance of obtaining information on the distribution of terrestrial invertebrates for strategy planning in biodiversity conservation (Brown Jr. and Brown, 1992; Kellert, 1992; Kremen, 1992; Brown Jr., 1997), we studied the distribution of Chironomidae adults in relation to different land uses of a watershed in Jaraguá State Park, São Paulo/Brazil, aiming to contribute to the management planning of this area.

Material and Methods

Jaraguá State Park is located in São Paulo city (Brazil), at 23°24. S and 45°44. W, with an area of 491.9 ha., at an average altitude of 900 meters and with a predominance of Atlantic Forest vegetation (Fig. 1). With a "Cfl" climate according to the Koeppen classification, it experiences average annual temperatures of 20°C and annual precipitation of 1500 to 1600 mm. The adjacent region of the park currently suffers from strong human impacts, such as habitat fragmentation, deforestation and water pollution (Projeto Biota-Jaraguá, 1999).

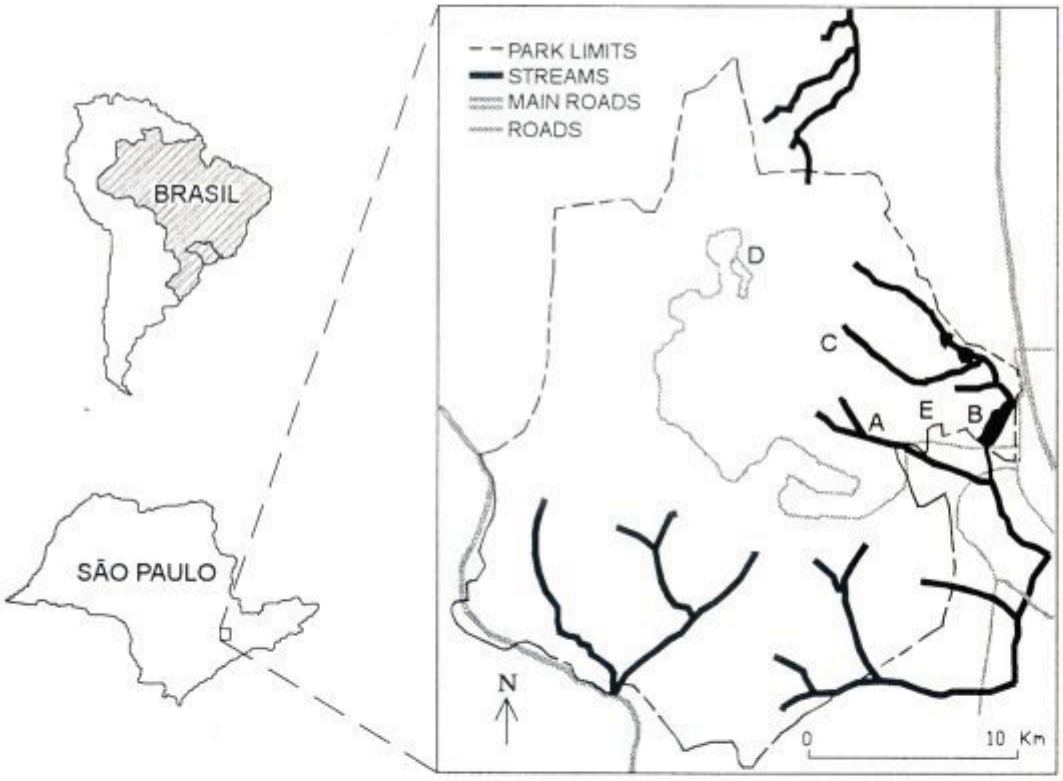

FIGURE 1: Location of sampling sites in Jaraguá State Park, São Paulo, Brazil.

This work was carried out as a part of a rapid assessment of biodiversity in Jaraguá State Park. Hence, the sampling design was drawn up in order to sample many different sites in a short time. Five sites in a watershed were chosen for this study, representing different land uses (Table 1). More information about this area is given by Roque (2000) and Yamada (2001).

The insect samples were obtained daily in a condensed manner during three days of the rainy season (December 2000). One Malaise trap (Malaise, 1937) was employed at each site, except in the case of site A where an elevated Malaise trap (Rafael and Gorayeb, 1982) was placed above a low-order stream.

The shape of the Malaise trap used in this study gave it the capacity of intercepting all types of Chironomidae flight movements described by Armitage (1995): the initial dispersal flight from the water to the resting site, and the swarming or oviposition flight of females. Furthermore, Malaise traps do not have differential sex attractivity to most insects (Mathews and Mathews, 1983). Hence, we did not consider the type of intercepted movement or possible sex attractivity in the discussion of the results.

The males were identified in relation to the genus and morphotype taxonomic levels using appropriate keys (Wiederholm, 1989), and, at times, researchers were consulted. The females were identified only regarding tribe, because there is no identification key for chironomid females of the neotropical region and the females are not described for some taxa (Spies and Reiss, 1996; Trivinho-Strixino and Strixino, 1999). The collected material was fixed in 70% alcohol and deposited in the collection of the Aquatic Entomology Laboratory of the Federal University of São Carlos, São Carlos, SP/Brazil.

To compare total Chironomidae abundance among sampling sites, a Chi-Square Test was carried out, and to compare male and female abundance a T-Test for two proportions (Zar, 1999) was applied.

TABLE 1 – General features of the site studied in Jaraguá State Park, São Paulo, Brazil.

	Sites				
General Features	A	B	C	D	E
Geographical Coordinates	23°27.788.S 46°45.611.W	23°27.684.S 46°45.354.W	23°27.608.S 46°45.584.W	——	23°27.711.S 46°45.405.W
Dominant Land Use	Riparian	Forest	Edge between Forest and glade	Grass	Glade
Altitude (m)	805	800	831	1020	802
Declivity (m)	High	Low	Medium	Low	Low
Nearest aquatic system (distance from trap)	Low order Stream (above)	Reservoir (20 m)	Low order Stream (20 m)	Low order Stream (150 m)	Low order Stream (100 m)
Level of antropic impact, according to Yamada (2001)	Low	Low to medium	Medium	Medium to high	High
Tree and Shrub predominant families	Araceae, Euphorbiaceae and Mimosaceae	Rubiaceae, Lauraceae and Myrtaceae	Arecaceae, Piperaceae and Leguminosae	Myrtaceae, Moraceae and Lauraceae	Lauraceae, Moraceae and Solanaceae

Results

A total of 108 males and 744 females were trapped at the five sites. The total number of Chironomidae was highest at site A (Chi-square $p<0.0001$), with the Tanytarsini as the most abundant tribe (Table 2). Sites B, C, D and E were numerically similar. In all comparisons, female abundance was higher than male abundance, and the male/female proportion was similar among the five sites. The richness of Chironomidae was highest at site A with 22 taxa, and the other sites showed similar richness (Table 3).

TABLE 2 – Total of specimens (mean ± standard deviation) of adult Chironomidae at different sites in Jaraguá State Park, São Paulo, Brazil.

Taxa	A	B	C	D	E
Tanypodinae ♂	1 (0.3 ± 0.5)	0	0	0	0
Tanypodinae ♀	10 (3.3 ± 1.1)	0	0	0	0
Chironomini ♂	24 (8 ± 7.8)	1 (0.3 ± 0.5)	0	0	0
Chironomini ♀	125 (41.6 ± 8.3)	8 (2.6 ± 0.5)	0	0	0
Tanytarsini ♂	63 (21 ± 6.2)	0	0	0	0
Tanytarsini ♀	347 (115.6 ± 29.1)	0	0	0	0
Orthocladiinae ♂	12 (4 ± 1)	1 (0.3 ± 0.5)	4 (1.3 ± 2.3)	3 (1 ± 1.7)	2 (0.6 ± 1.1)
Orthocladiinae ♀	63 (21 ± 9.1)	8 (2.6 ± 0.5)	18 (6 ± 1.7)	16 (5.3 ± 3.5)	7 (2.3 ± 1.1)
Chironomidae ♂	100 (33.3 ± 14.0)	2 (0.6 ± 1.1)	4 (1.3 ± 2.3)	3 (1 ± 1.7)	2 (0.6 ± 1.1)
Chironomidae ♀	545 (181.6 ± 28.9)	16 (5.3 ± 0.5)	18 (6 ± 1.7)	16 (5.3 ± 3.5)	7 (2.3 ± 1.1)

TABLE 3 – Occurrence of male adults of Chironomidae at different sites in Jaraguá State Park, São Paulo, Brazil.

	SITES				
Taxa	A	B	C	D	E
Tanypodinae					
Larsia	X				
Chironominae					
Caladomyia 1	X				
Caladomyia 2	X				
Chironomus		X			
Endotribelos	X				
Nandeva	X				
Polypedilum 1	X		X		
Polypedilum 2	X				
Rheotanytarsus 1	X				
Rheotanytarsus 2	X				
Stenochironomus 1	X				
Stenochironomus 2	X				
Stenochironomus 3	X				
Tanytarsus 1	X				
Tanytarsus 2	X				
Tanytarsus 3	X				
Tanytarsus 4	X				
Xestochironomus	X				
Orthocladiinae					
Aff. *Compterosmittia*	X				
Antillocladius			X	X	X
Cf. *Boreosmittia*				X	
Cf. *Mesosmittia*					X
Cricotopus	X				
Curitibacladius	X				
Orthomesosmittia				X	
Parametriocnemus	X				
Pseudorthocladius 1	X				
Pseudorthocladius 2			X		X

Discussion

The majority of the Chironomidae taxa identified in this study had already been reported in the streams of Jaraguá State Park by Roque (2000), except *Curitibacladius, Pseudorthocladius,* cf. *Mesosmittia, Antillocladius,* cf. *Boreosmitiia,* and *Orthomesosmittia*.

At site A, most of the Chironomidae we collected have aquatic larvae strongly associated with allochthonous (terrestrial) organic matter, such as *Stenochironomus* and *Xestochironomus* that live in decaying woods and *Endotribelos* that lives in fallen fruits. At sites D and E, the male Orthocladiinae we intercepted probably have semi-aquatic and terrestrial larvae (Wiederholm, 1989), indicating that the adults can be autoctone. At site B, only *Chironomus* was collected, and this is probably associated with the high abundance of larval stages of this genus in a polluted reservoir near the site (Projeto Biota-Jaraguá, 1999).

The predominance of females, corroborating other studies revised by Armitage (1995), can be interpreted as a result of an unbalanced sex abundance of Chironomidae; however, the identification of females at higher taxonomic levels might blur the differences among the taxa.

The landscape structure may influence the dispersal of Chironomidae adults in different ways. According to Frouz and Olejnicek (1999), the land uses, particularly the vegetation, can affect the distribution of flying insects in passive airflow transport by the effect of wind intensity. Regarding the conditions for active flight by means of microclimatic conditions and shelter formation, prominent vegetation can be used as a significant orientation marker. Furthermore, vegetation plays an important role in the structure and function of streams, influencing directly and indirectly chironomid larvae ecology (habitat, food, refuge, and others), and, according to Frouz and Paoletti (2000), the behavior of the adults

is strongly influenced by the requirements of the larvae. Thus the species composition of Chironomidae adults found at the different sites may be a result of multiple factors influencing the different chironomid life stages.

The highest abundance and richness was found at site A, corroborating Delletre and Morvan´s (2000) studies, who demonstrated that in densely-vegetated landscapes the chironomid species are normally confined, at least partly, to the stream from which they emerged.

In open landscapes, where edges are absent, a homogeneous species community can still be found at great distance from water bodies (Delettre and Morvan, 2000). In Jaraguá State Park, the impacted areas of the watershed studied are located a certain distance from water bodies and/or on upper lands. Therefore a low Chironomidae abundance and richness trapped in these sites could be induced by the distance effect on aquatic taxa (Delettre and Morvan, 2000), by the riparian vegetation effect discussed above, or by the influence of impacted areas on temperature, luminosity and wind, and consequently on Chironomidae flight movement.

Finally, although this study represents a preliminary survey, it allows us to point out the importance of riparian vegetation conservation for the maintenance of Chironomidae diversity, and we would like to reinforce the need for further studies involving the ecology of Chironomidae adults in the neotropical region to support strategies for biodiversity management and conservation.

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