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Succession and diversity of Chironomidae in detritus of *Typha domingensis* in a coastal lagoon (Parque Nacional da Restinga de Jurubatiba, State of Rio de Janeiro, Brazil)

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Introduction

Aquatic macrophytes are often the most important primary producers in coastal lagoons. They are subjected to little grazing due to high levels of tannins and a high cell-wall fraction. The organic matter processed in the detritus chain represents an important source of energy in aquatic ecosystems.

Macroinvertebrates are important in the acceleration of the decomposition of detritus from aquatic macrophytes (BERGEY et al. 1992). The larvae of Chironomidae are often the most abundant macroinvetebrate associated with detritus from litter and aquatic macrophytes (GRUBBS et al. 1995). There are very few studies in the Neotropical region which investigate the role of the macroinvertebrates in the decomposition of aquatic macrophytes, especially studies which identify the specimens to the generic taxonomic level (ZOZAYA & NEIFF 1991, CALLISTO et al. 1996, NESSIMIAN & DE LIMA 1997).

The goal of this research was to evaluate the ecological succession and the diversity of larvae of Chironomidae during the decomposition of leaves of *Typha domingensis* in a coastal lagoon.

Study area

Cabiúnas Lagoon is located in the Parque Nacional da Restinga de Jurubatiba in the State of Rio de Janeiro, Brazil (22° 15' S and 41° 40' W). This lagoon shows low antropogenic influence and the watershed is composed of a coastal sand dune community of "restinga".

The climate of the region is the AW type, according to the Köppen classification system, with warm characteristics (maximum average temperature of 29.9 °C in February and minimum average of 25.4 °C in July) and humid (maximum pluviometric average of 194.4 mm in January and minimum of 43.8 mm in June).

The lagoon is characterized as a brown-water ecosystem, with warm water (average temperature of 23.6 °C) and slightly acidic waters (pH approximately 6.3), with an electrical conductivity average of 0.45 mS/cm, salinity of 0.22 ppt and total alkalinity of 480.8 µEq/L CO_2.

Material and methods

Senescent leaves, 30 cm in length, of *Typha domingensis* (about 20 g dry weight) were incubated in an in situ experiment with litter bags (30 × 30 cm with 5 mm mesh) for 180 days. Samples were collected in triplicates at intervals of 1, 2, 3, 9, 16, 23, 30, 60, 90, 120, 150, 180 days, with the detritus washed over a sieve of 120-µm mesh. The remaining material was fixed with 10% formaldehyde and organisms were sorted under a stereomicroscope. For taxonomic identification, the chironomid larvae were prepared using 10% lactophenol slides and their mouthparts examined under a 400× microscope. The specimens are registered in the Collection of Benthic Macroinvertebrates of the Institute of Biological Sciences, Federal University of Minas Gerais, Brazil.

Results and discussion

Twenty-one genera belonging to the subfamilies Tanypodinae (*Ablabesmyia, Djalmabatista, Labrundinia, Tanypus*), Orthocladiinae (*Corynoneura, Cricotopus, Orthocladius, Nanocladius, Thienemanniella*) and Chironominae (*Asheum, Beardius, Chironomus, Dicrotendipes, Endochironomus, Endotribelos, Goeldichironomus, Harnischia, Parachironomus, Polypedilum, Stenochironomus, Nimbocera*) were observed (Table 1). In addition, 10 genera that were difficult to identify were grouped together in Tanytarsini genera varia.

The results obtained in this experiment char-

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Table 1. Taxonomic composition of the larvae of Chironomidae (average total number of organisms) found colonizing the litter bags.

Taxa	Incubation time (days)											
	1	2	3	9	16	23	30	60	90	120	150	180
Tanypodinae												
Ablabesmyia		1	1	3	5	3	6	16	42	27	24	21
Djalmabatista						1						
Labrundinia				1				1	14	9	2	
Tanypus				1					7	2		
Orthocladiinae												
Corynoneura				1	1	1		2	3	3		
Cricotopus							1					
Orthocladius									1	1		
Nanocladius										4		
Thienemanniella							1	1	1			
Chironominae												
Asheum	2	4	4	11	13	20	28	32	47	113	70	61
Beardius							2	2		8	16	
Chironomus					1		2	2	2	1	2	2
Dicrotendipes												2
Endochironomus							1					
Endotribelos							1					
Goeldichironomus				2		1	3	6	15	13	7	
Harnischia									3	10	6	
Parachironomus				3			1	1	1	3		3
Polypedilum	1	1		9	2	6	18	22	29	6	16	15
Stenochironomus										1		
Nimbocera	1			1			5	21	11	15	10	2
Tanytarsini genera varia	2	4	3	26	13	20	55	28	22	42	15	7
Total	6	10	8	58	35	52	124	134	198	258	168	113
Richness	4	4	3	10	6	7	13	12	14	16	10	8
Evenness	0.96	0.86	0.89	0.72	0.77	0.71	0.65	0.78	0.80	0.69	0.80	0.67
H′Shannon-Wiener	1.92	1.72	1.41	2.40	1.99	1.99	2.41	2.81	3.04	2.77	2.64	2.01

acterized a process of degradative ecological succession (BEGON et al. 1996). The detritus of leaves of *T. domingensis* were exploited by the larvae of Chironomidae as a food source and shelter. During the process of decomposition the occurrence and disappearance of different taxa were observed, with an increase in the taxonomic richness and diversity. The maximum diversity (Shannon-Wiener index) was observed between 60 and 120 days, with a gradual increase before and a gradual decrease after this period. The dominant taxa for the duration of the experiment were *Asheum* (35.8%), Tanytarsini genera varia (21.4%), *Ablabesmyia*

(12.8%), *Polypedilum* (11.7%) and *Goeldichironomus* (4.0%) (Fig. 1).

Evaluating the biodiversity of the larvae of Chironomidae, some taxa that are typically miners were found. These larvae were usually present in the mesophylum of the leaves of the *Typha* (*Asheum, Beardius, Endochironomus, Goeldichironomus, Polypedilum* and *Stenochironomus*). The larvae of *Chironomus* and *Parachironomus* usually inhabit the sediment (CALLISTO et al. 1996), but they also colonized the detritus of plants in this environment (littoral zone) facilitated by its reduced depth and a large supply of detritus with high nutritional quality.

The abundance of predatory organisms throughout the experiment was remarkable. The specimens found were the genera of Tanypodinae (*Ablabesmyia, Djalmabatista, Labrundinia, Tanypus*). The presence of carnivorous larvae of the same genus and different body sizes was detected from laboratory observations. This may suggest that these organisms are playing the role of "controllers" of the abundance of the other taxa. In advanced stages of the decomposition process an increase of the abundance of *Ablabesmyia* was observed (Fig. 1). This increase was directly related to the increase of the complexity in the community of benthic macroinvertebrates associated with the detritus of *T. domingensis* (from diversity measurements).

Members of the Tanytarsini tribe that were collected in this in situ experiment could not be identified even to the generic level suggesting that they may belong to the many, still undescribed, endemic species in the Neotropical region (FITTKAU & REISS 1973).

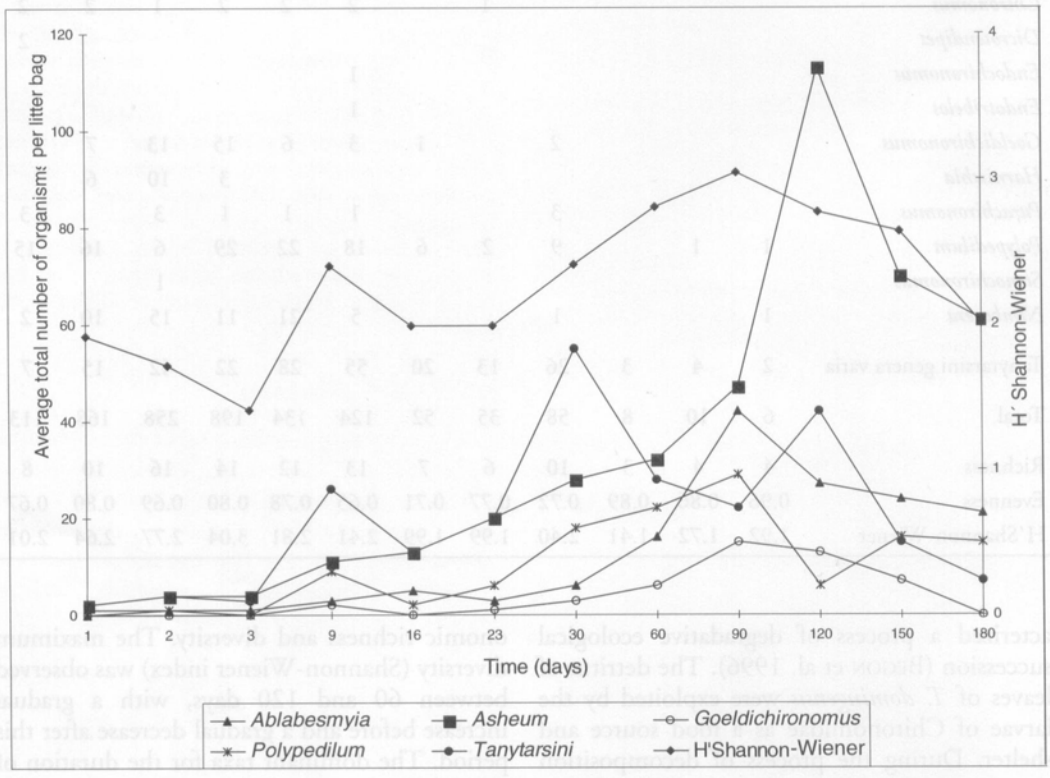

Fig. 1. Ecological succession and numerical distribution in the most abundant genera of Chironomidae throughout the process of decomposition of the leaves of *T. domingensis*.

Therefore, the results obtained in this experiment showed the predominance of taxa with a typically miner life style (*Asheum, Goeldichironomous*), as well as taxa that are detritivores (*Polypedilum* and Tanytarsini), that live associated with periphyton and/or detritus of *T. domingensis*. The high abundance of larvae that are predators (*Ablabesmyia*) throughout the process of succession should be noted, accompanying the increase in the biodiversity of the larvae of Chironomidae.

After 180 days of the experiment, the detritus of the leaves of *T. domingensis* was still scarcely metabolized and mineralized. Estimates performed in this experiment, through the organic carbon data (unpublished data), projected that it would take approximately 1 year and 5 months to decompose the detritus of *T. domingensis*.

Due to their role as primary producers in these environments, it is important to study the decomposition rates of aquatic macrophtyes in Brazilian coastal lagoons. This approach represents an important contribution to the knowledge of the biodiversity of macroinvertebrates and the quantification of Chironomidae in functional groups (e.g. shredders, gatherers, collectors, detritivores, and predators). Also, a better understanding of the decomposition of organic detritus and its relevance to the energy flows of these ecosystems is necessary in order to construct a food web of the fishery in the lagoons (Bowen et al. 1998).

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References

Begon, M., Harper, J. L. & Townsend, C. R. (eds), 1996: *Ecology: individuals, populations and communities.* 3rd ed. – Blackwell Science, 1068 pp.

Bergey, E. A., Balling, S. F., Collins, J. N., Lamberti, G. A. & Resh, V. H., 1992. Bionomics of invertebrates within an extensive *Potamogeton pectinatus* bed of a California marsh. – *Hydrobiologia* **234**: 15–24.

Bowen, K. L., Kaushik, N. K. & Gordon A. M., 1998. Macroinvertebrates communities and biofilm chlorophyll on woody debris in two canadian oligotrophic lakes. – *Arch. Hydrobiol.* **141(3)**: 257–281.

Callisto, M., Serpa-Filho, A., De Oliveira, S. J. & Esteves, F. A., 1996: Chironomids on leaves of *Typha domingensis* in a lagoon of Rio de Janeiro State (Brazil). – *Stud. Neotrop. Fauna Environ.* **31(1)**: 51–53.

Fittkau, E. J. & Reiss, F., 1973: Amazonische Tanytarsini (Chironomidae, Diptera) I. Die *riopreto*-Gruppe der Gattung *Tanytarsus*. – *Stud. Neotrop. Fauna Environ.* **8**: 1–16.

Grubbs, S. A., Jacobsen, R. E. & Cummins, K. W., 1995: Colonization by Chironomidae (Insecta, Diptera) on three distinct leaf substrates in an Appalachian mountain stream. – *Ann. Limnol.* **31(2)**: 105–118.

Nessimian, J. L. & De Lima, I. H. A. G., 1997: Colonização de três espécies de macrófitas por macroinvertebrados aquáticos em um brejo no litoral do Estado do Rio de Janeiro. – *Acta Limnol. Brasil.* **9**: 149–163.

Zozaya, I. Y. B. & Neiff, J. J., 1991: Decomposition and colonization by invertebrates of *Typha latifolia* L litter in Chaco cattail swamp (Argentina). – *Aquat. Bot.* **40**: 185–193.

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