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Analysis of an alternative method for the study of bromeliad-associated fauna in plants with different foliar organization

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ABSTRACT

The efficiency of an alternative method of collection (by suction of water) for the study of Culicidae and Chiron midae (Diptera), Scirtidae (Coleoptera) and Coenagrionidae (Odonata) in bromeliads with different foliar architectu in a restinga at Florianópolis, SC, Brazil, was studied. The alternative method was less efficient to collect Culicid and Chironomidae (Wilcoxon test $p < 0.05$) and was more efficient to Scirtidae and Coenagrionidae (Wilcoxon te $p > 0.05$) from *Aechmea lindenii*. This method was less efficient to collect insects of all groups from *Vriesea friburgensis* (Wilcoxon test $p < 0.05$). The alternative method was efficient to estimate the diversity of these insects both species of bromeliads. The higher mobility of immature forms of beetles and dragonflies, and the availability only one tank in *Aechmea lindenii*, contrasting to several tanks in *Vriesea friburgensis* that help the suction of the immature, probably influenced the results, which indicated that the suction method should not replace the disma tling in the study of Culicidae and Chironomidae. This method can be useful to get immature forms of Scirtidae a Coenagrionidae in one-tank bromeliads.

Key words: Chironomidae, collecting method, Culicidae, Odonata, Phytotelmata, Scirtidae.

INTRODUCTION

Tanks constituted by bromeliads are the most frequent phytotelmata (Frank 1983). The insect fauna on these breeding places is diversified and mostly related to plant size and shape, exposition to light, and quantity of organic material in the tanks (Araújo et al. 2007). Water may be accumulated in a central tank or distributed among several small tanks, formed by leaves (Frank and Lounibos 2008). Müller and Marcondes (2006) noticed differences among the Culicidae faunas in two bromeliad species, which are differentiated by foliar architecture.

Studies on bromeliad-associated fauna have pro- 2006), information on epidemiological role o plants as breeding places for mosquitoes (Varejã 2005), and have led to the description of new (Pinho et al. 2005). Most insects in bromeliad ta long to Culicidae and Chironomidae (Diptera), S (Coleoptera) and Coenagrionidae (Odonata) (C 2001). These insects can be collected by dism the plant, washing and checking all the mater der microscope, by a traditional method (Mestr 2001), or sucking water by an alternative metho out considerable damage to the plant (Müller an condes 2006). The efficiency of the alternative

MATERIALS AND METHODS

Twenty five specimens of *Aechmea lindenii* (E. Morren) Baker var. *lindenii* (with one central tank) and twenty five of *Vriesea friburgensis* (L.B. Smith) (with several small tanks), chosen at random, were collected in a restinga area in the north of Santa Catarina island (Costão do Santinho Particular Reserve of Natural Patrimony). Each plant tank was sucked with a siphon bottle (1,000 ml) and blowed in the tank to mix the material by adding more pure water to the plants and repeating the suction. All the material was poured out in a translucent white plastic tray, in parcels small enough to see the immature forms. The insects were collected with a plastic disposable pipette. This methodology has been referred by Lozovei and Silva (1999) as an "alternative method" for the collection of immature forms of mosquitoes from bromeliads. After the suction, the whole plant was cut, put in a plastic bag, and transported to the Laboratory of Medical Entomology of the Department of Microbiology and Parasitology, Federal University of Santa Catarina, to check if additional animals were caught.

The mean quantity of individuals obtained by the alternative method (by suction) was compared to the mean quantity obtained in the bromeliads (by suction + dismantling the plant) by non-parametric Wilcoxon Test, using BioStat 3.0, (Service 1995) to check the efficiency of this method. Differences among the calculated Shannon-Wiener diversity indices were tested using t test according to Hutcheson ($p < 0.05$) (Zar 1996). Insects from each type of plant were separately analyzed, due to differences among their foliar architectures.

RESULTS AND DISCUSSION

Chironomidae constituted the most abundant group, while Culicidae was the richest one. All insect species occurring in bromeliads, excepting *Wyeomyia pallidoventer*, were sampled by the alternative method (Table I).

For *A. lindenii*, the alternative method was significantly less efficient than the sucking plus dismantling method for the collection of Culicidae and Chironomidae (Wilcoxon test $p < 0.05$), and was equally efficient test $p < 0.05$). The diversity in all insect groups was efficiently estimated by the alternative method ($p > 0.05$) (Table II).

Immature forms of Culicidae and Chironomidae are truly aquatic, while those of Odonata and Scirtidae are semi-aquatic (Greeney 2001). The last two groups are more mobile in the bromeliad, walking among foliar axilles and possibly explaining the ease to collect immature of Scirtidae and Coenagrionidae by suction of *A. lindenii*, which has only one cavity. Since *V. friburgensis* has many water-containing axilles, there are more hiding places for these insects.

Some immature forms of Culicidae and Chironomidae, which are smaller and less mobile, can be hidden in the bottom of the axils, causing a low efficiency in the collection by suction of water and immature forms. Present results on the collection of Culicidae contrast with those of Lozovei and Silva (1999), which, not specifying the studied bromeliads, concluded that the alternative method could replace the traditional one.

The traditional method of collection of fauna in bromeliads, in which it is totally dismantled, may be considered as a census, because all insects are surveyed. The alternative method intends to get a sample as representative as possible of the fauna, without destroying the plant.

Although the alternative method was efficient to estimate the diversity of the four studied families, it was efficient to estimate just the abundance of Scirtidae and Coenagrionidae from bromeliads with only one cavity (*Aechmea lindenii*). So, the choice of the method for the study of the insect fauna in bromeliad tanks should consider insect group, foliar architecture, aim of the study, and amount of plants in the study area. Thus, the alternative method of collection represents a viable option in situations where the flora cannot be removed from the study area.

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TABLE I
Species/Morphospecies of Culicidae, Chironomidae, Coenagrionidae and Scirtidae collected from *Aechmea lindenii* and *Vriesea friburgensis* by the alternative and traditional method in a restinga area at Florianópolis, SC, Brazil.

Bromeliad	Families	Species/ Morphospecies	Alternative method (suction)	Traditional method
Aechmea lindenii				
	Culicidae	*Anopheles cruzii*	5	6
		Culex (Microculex) sp.1	8	12
		C. (Mcx) sp.2	3	8
		C. (Mcx) sp.3	5	11
		Toxorhynchites sp.	1	1
		Wyeomyia davisi	2	2
		W. edwardsi	1	4
		W. incaudata	5	6
		W. pallidoventer	0	1
		W. pilicauda	2	5
	Chironomidae	Chironominae 1	31	87
		Chironominae 2	70	106
		Chironominae 3	28	101
	Coenagrionidae	*Leptagrion* sp. 1	14	23
	Scirtidae	Scirtinae 1	4	17
Vriesea friburgensis				
	Culicidae	*A. cruzii*	5	8
		C. (Mcx) sp.1	9	19
		C. (Mcx) sp.3	19	29
		W. incaudata	1	4
		W. pallidoventer	1	3
	Chironomidae	Chironominae 2	39	78
		Chironominae 3	69	94
		Chironominae 4	2	12
	Coenagrionidae	*Leptagrion* sp. 1	27	37
		Leptagrion sp. 2	1	2
	Scirtidae	Scirtinae 1	8	37

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RESUMO

A eficiência do método alternativo de coleta (por sucção da água) para o estudo de Culicidae e Chironomidae (Diptera), Scirtidae (Coleoptera) e Coenagrionidae (Odonata) em bromélias com diferentes estruturas foliares de restinga em Florianópolis, SC, Brasil, foi estudada. O método alternativo foi menos eficiente para coletar Culicidae e Chironomidae (teste de Wilcoxon $p < 0,05$) e foi mais eficiente para Scirtidae de Wilcoxon $p < 0,05$). O método alternativo se m eficiente em estimar a diversidade desses insetos nas e pécies de bromélias. A alta mobilidade das formas i dos coleópteros e libélulas e a disponibilidade de ape tanque em *Aechmea lindenii*, em contraste com as vá las em *Vriesea friburgensis*, facilitando a sucção des mas imaturas provavelmente influenciaram os resulta resultados indicam que o método de sucção não deve tuir o desmanche no estudo de Culicidae e Chironomi pode ser útil para a obtenção de formas imaturas de S e Coenagrionidae em bromélias de um só tanque.

TABLE II
Mean ± S.D. and Shannon-Wiener index (H) of immature forms of insects collected from *Aechmea lindenii* and *Vriesea friburgensis* in a restinga area at Florianópolis, SC, Brazil.

Aechmea lindenii				
Taxa	Alternative method (suction)		Traditional method	
	Mean±S.D.	H	Mean±S.D.	H
Culicidae	1.28 ± 1.57*	0.869	2.24 ± 2.60*	0.900
Chironomidae	5.16 ± 7.77*	0.437	11.76 ± 16.38*	0.476
Scirtidae	0.16 ± 0.47	0	0.68 ± 1.38	0
Coenagrionidae	0.56 ± 1.00	0	0.92 ± 1.29	0
Vriesea friburgensis				
Taxa	Alternative method (suction)		Traditional method	
	Mean±S.D.	H	Mean±S.D.	H
Culicidae	1.40 ± 1.87*	0.505	2.52 ± 3.04*	0.565
Chironomidae	4.40 ± 7.48*	0.318	7.36 ± 8.09*	0.384
Scirtidae	0.32 ± 1.04*	0	0.32 ± 2.12*	0
Coenagrionidae	1.08 ± 1.00*	0.067	1.56 ± 2.12*	0.088

*Significantly different.

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