

SHORT COMMUNICATION

BLACK FLY (DIPTERA: SIMULIIDAE) PUPAE MICROHABITAT CHARACTERIZATION IN THE ITATIAIA NATIONAL PARK, BRAZIL

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RESUMO:

O presente estudo foi conduzido no Parque Nacional do Itatiaia localizado no estado do Rio de Janeiro e teve como objetivo determinar os padrões de preferência de habitat e micro-habitat de pupas de Simuliidae. As coletas foram realizadas em quatro sítios no Parque, sendo medidos pH, luminosidade, condutividade e temperatura da água. As pupas foram identificadas e quantificadas em laboratório e seus padrões de preferência de microhabitat foram determinados por meio de análise de correspondência canônica (CCA), enquanto suas comunidades comparadas quanto às similaridades entre si por meio de um escalonamento métrico não dimensional (NMDS). Taquaral, o sítio de mais difícil acesso, e consequentemente menos sujeito à visitação, mostrou maior heterogeneidade, enquanto Campo Belo, localizado fora do Parque, foi o mais homogêneo.

Palavras-chave: Preferência de habitat, borrachudos, pupas.

ABSTRACT:

The present study was conducted in the Itatiaia National Park, located in the state of Rio de Janeiro, and aimed to determine habitat preference patterns of Black fly pupae. The sampling was held in four sites within the Park, where pH, luminosity, conductivity and water temperature were measured. The pupae were then identified and quantified in the laboratory, and microhabitat preference patterns were determined using a Canonical Correspondence Analysis, while their communities were compared in relation to their similarities using NMDS. Taquaral, the site with the hardest access, and consequently that which probably is less prone to visitation, showed more heterogeneity, while Campo Belo, located outside of the Park, was the most homogeneous site.

Keywords: Habitat preferences, black flies, pupae.

Black flies are cosmopolitan insects that belong to family Simuliidae, which is part of the order Diptera, and comprise 2.189 species (Adler & Crosskey 2015). These organisms are distributed world wide, with the exceptions of the arctic and antarctic circles and islands without running waters where their immature forms can breed (Currie & Adler 2008). These are holometabolous insects, which have their development in two distinct environments: while the immature forms are aquatic, adults occupy the terrestrial environment (Crosskey 1990). Black fly immatures usually attach themselves to

substrates such as roots, rocks and riffle litter, with the aid of a silk produced while in larval form (Monteiro & Gorayeb 2014, Figueiró et al. 2006). Black fly pupae are usually protected by a silk cocoon produced by the larvae, and their abdomen show hooks that help them attach to the substrate (Crosskey 1990).

Adult Black flies are haematophagous when adults, what makes these organisms a nuisance that may have economical impacts in ecotourism and rural activities, as well as disease vectors (Coppo & Lopes 2010).

The ecological traits of Black flies are usually approached in their larval forms, while

the studies on adult ecology are more related to their biting activity (Figueiró & Gil-Azevedo 2010, Figueiró et al. 2012, 2014), but the ecological traits of their pupae is widely relegated in the literature. The objective of the present study was to investigate the main abiotic factors related to Black fly pupae distribution within the Itatiaia National Park and its adjacent areas.

The study was conducted in the Itatiaia National Park, which is the first National Park from Brazil, and is located in the southeast of Rio de Janeiro state, in the municipalities of Resende and Itatiaia, and in the southern Minas Gerais state, comprising the municipalities of Alagoa, Bocaina de Minas and Itamonte, between the coordinates 44°34' – 44°42' W and 22°16' – 22°28' S.

Pupae were sampled from four sites at the same day in the summer of 2014, two of these within the Itatiaia National Park: Vêu da Noiva, an important public attraction in the Park, Taquaral, a small stream with difficult access in the Park, and two sites outside the Park which were the urban section of the Campo Belo river and one of its small unnamed tributaries. At each site, three samples of the riffle litter were taken manually.

The sampled material was stored in falcon tubes labelled with the abiotic characteristics of the microhabitat where the sample was taken. Pupae were then identified and quantified in the laboratório de Biotecnologia Ambiental from the Fundação Centro Universitário Estadual da Zona Oeste (UEZO) with the aid of an estereoscopic microscope equipped with an image capturer Moticam 5 and the Gil-Azevedo et al. (2010) identification key.

The distributional patterns of the pupae were explored using Canonical Correspondence Analysis (CCA) from CANOCO for Windows, and the community similarities were explored using NMDS from the software PAST.

conductivity and water temperature were taken from each site, since these are considered relevant to Simuliidae (Ciborowski & Adler 1990).

A total of 20 pupae were collected in the sampling sites, which were identified as *Simulium rappae* Py-Daniel & Coscarón 1982, *Simulium clavibranchium* Lutz 1910, *Simulium incrustatum* Lutz 1910, *Simulium subpallidum* Lutz 1909, *Simulium petropoliense* Coscarón 1981 and *Simulium serranum* Coscarón 1981 (Tab.1).



Figure 1- Black fly pupae sampled from the Itatiaia National Park.

The Canonical Correspondence Analysis (CCA) showed a trend towards low luminosity and more acid pH faster sites for *S. subpallidum* and *S. incrustatum*, while *S. rappae*, *S. serranum* and *S. clavibranchium* showed a trend towards more basic pH, more luminosity and slower waters (Fig 2).

Table 1- Black fly pupae presence(1)/absence(0) matrix indicating the distribution throughout the sampling sites from the Itatiaia National Park.

	<i>S. rappae</i>	<i>S. clavibranchium</i>	<i>S. incrustatum</i>	<i>S. subpallidum</i>	<i>S. petropoliense</i>	<i>S. serranum</i>
Campo Belo	1	0	1	1	0	0
Taquaral	1	1	0	0	0	1
Vêu da noiva	0	0	1	0	0	0
Unnamed	1	0	0	1	0	0

These patterns are similar to those Pepinelli et al (2005) observed for *S. clavibranchium* larvae, which were related to low and intermediate water velocities and more basic pH. These authors found *S. incrustatum* larvae associated from small creeks to large Rivers with faster flow and

more basic pH, corroborating this study.

The NMDS was performed and showed low stress (Fig. 3A), indicating that the dimension reduction of the NMDS did not result in significant information loss.

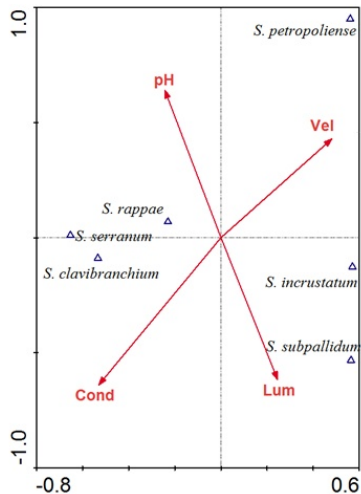


Figure 2- Canonical Correspondence Analysis (CCA) correlating abiotic factors to Black fly pupae distribution. The variables investigated were mean water velocity (Vel), Conductivity (cond), Luminosity (Lum), pH.

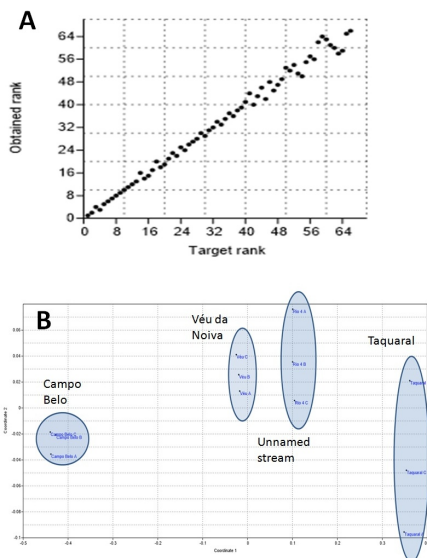


Figure 3: Shepperd plot indicating stress level in the analysis (A) and Non-metric multidimensional scaling indicating that Taquaral was the site that showed more dissimilar communities (B).

The NMDS ordination showed that the communities of the different sites differed significantly in relation to their composition, while the Campo Belo (urban) site showed more homogeneity among the samples, while Taquaral showed more heterogeneity (Fig3B).

Among the sampling sites, Taquaral was the one with hardest Access, and consequently that which probably is less prone to visitation, so its heterogeneity may reflect its conservation status. On the other hand, Campo Belo (urban) is located outside of the Park, and is the site situated in an the most densely human occupied area, so its higher homogeneity may be a consequence of anthropic impact.

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