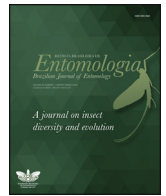




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Biology, Ecology and Diversity

## Diversity of Drosophilidae (Insecta, Diptera) in the Restinga forest of southern Brazil

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### ABSTRACT

Although members of Drosophilidae are frequently the topic of ecological studies in Brazil, few have explored Restinga or, until only recently, Pampa biome environments. This study proposes to describe the diversity and temporal variation of the Drosophilidae assemblage from a Restinga forest of Rio Grande do Sul, Brazil. We performed monthly collections from February 2013 to January 2014 using yeasted banana-baited traps. A total of 25,093 individuals of 46 species were sampled. *Drosophila simulans* and the *D. willistoni* subgroup were the dominant taxa; *D. polymorpha*, *D. immigrans*, *D. paraguayensis* and *Zygothrica orbitalis* were of intermediate abundance, and the other 40 species were rare. Based on sampling effort estimators, our collections were sufficient. Jaccard and Morisita indices evaluated using ANOSIM reveal little similarity in the composition of samples across months. Canonical correspondence analysis shows that the variables of maximum and minimum temperature are the main factors responsible for differentiation of the species composition of the assemblage throughout the year, whereby collections in the coldest periods (July, August and September) are those with a more differentiated composition. In these months, the dominance of *D. simulans* and the *D. willistoni* subgroup decreases while increased abundance of the *D. tripunctata* group (as *D. paraguayensis*) and *Z. orbitalis* occurs. In comparison to other studies carried out in environments in southernmost Brazil, we observed a similar pattern of fluctuation in abundance over the year, with a higher abundance of dominant species in warmer months and population sizes decreasing in colder months.

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### Introduction

Insects play an important role in the diversity of natural habitats and are essential for habitat maintenance (Didham et al., 1996; Samways, 2015). Studies on Drosophilidae, a well-studied Diptera family, have shed light on species coexistence and the relationship between insects and environments (Shorrocks and Rosewell, 1986; Sevenster and Van Alphen, 1993; Yamashita and Hiji, 2003; Mata

et al., 2008), noting that drosophilids are sensitive to changes in habitat conditions, with excellent potential as bioindicators (Mata et al., 2008, 2010). Members of Drosophilidae have been studied throughout Brazil, and their assemblages are characteristic of different ecosystems (Martins, 1987; Val and Marques, 1996; Schmitz et al., 2007; Döge et al., 2008; Mata et al., 2008; Bizzo et al., 2010; Rohde et al., 2010; Poppe et al., 2014).

The Brazilian coast is characterized by Restinga forest, a particular ecosystem formed on sandy and nutrient-poor soils that is characterized by heterogeneous vegetation with a strong marine influence. This ecosystem is mainly associated with the Atlantic forest biome and is distributed along the entire Brazilian coast, occupying 80% of the coastal area. The Restinga forest macroclimate fluctuates according to its latitudinal location, being more stable

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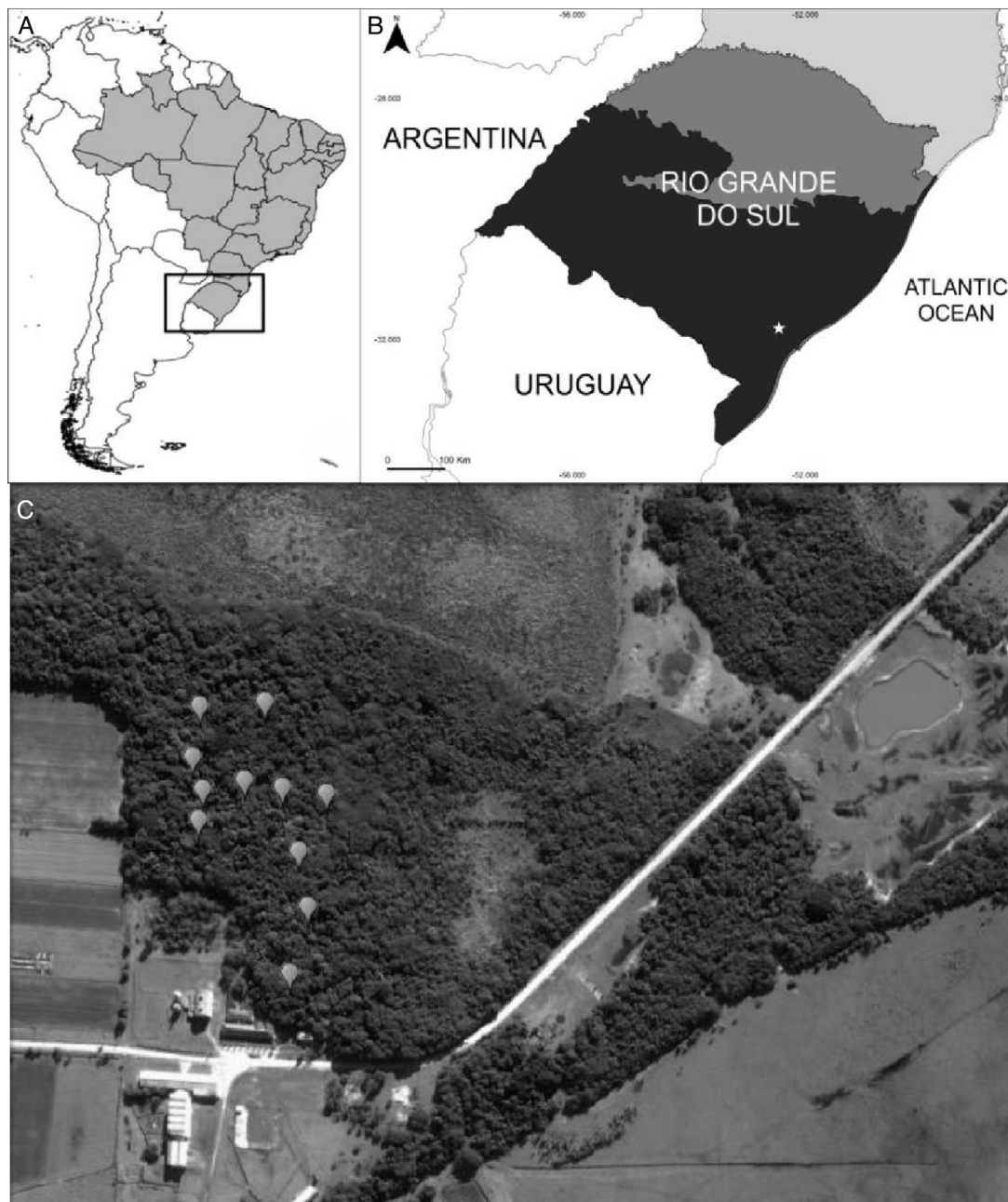
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than in field areas but varying more widely than forests with richer soils. The structure and distribution of Restinga forests are a result of depositional features determined by successive changes in sea level during the Quaternary period (Lacerda et al., 1982; Coutinho, 2006; Behling et al., 2009; Magnago et al., 2010).

In the state of Rio Grande do Sul, Brazil, the Restinga forest has a particular physiognomy and flora related to the Pampa biome. This ecosystem is conditioned by a temperate climate, which contrasts with the tropical influence that predominates on the northern coast of the state (Waechter, 1985; Bencke, 2009). Recently, areas of Restinga have been used for the development of commercial forests, mainly eucalyptus and pine, which is changing this environment and giving rise to a new structural configuration (Fonseca and Diehl, 2004). Overall, in addition to other negative effects, the loss of any natural habitat can cause a severe decrease in

biodiversity, affecting the rate of population growth, reducing the length and diversity of the food chain and changing interactions among species (Forero-Medina and Vieira, 2007).

Different environments of southern Brazil have been characterized in terms of their Drosophilidae fauna. However, most research to date has been conducted in the Atlantic forest, forests and agricultural areas of the Pampa biome and urbanized areas (Valente and Araújo, 1991; Silva et al., 2005; Hochmüller et al., 2010; Garcia et al., 2012; Poppe et al., 2012, 2013). Furthermore, studies of Restinga were performed in Santa Catarina and São Paulo States (Bizzo and Sene, 1982; Bizzo et al., 2010) where the environmental conditions are different due to the Atlantic forest influence. Therefore, the present study sought to report the diversity and temporal variation in Drosophilidae species of Restinga forest in southernmost Brazil, with a goal of joining efforts in characterization of the



**Fig. 1.** Studied area. (A) Map of South America, with Brazil in gray and the state of Rio Grande do Sul highlighted. (B) Map of the state of Rio Grande do Sul, highlighting the Horto Botânico Irmão Teodoro Luís (HBITL) with a circle. (C) Satellite image of the Restinga forest of HBITL, with the positions of the traps shown (Google Earth).

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