

Synanthropy and diversity of Phlebotominae in an area of intense transmission of visceral leishmaniasis in the South Pantanal floodplain, Midwest Brazil

Suellem Petilim Gomes Barrios, Luciana Escalante Pereira, Neiva Zandonaide Nazário Monaco, Gustavo Gracioli, Aline Etelvina Casaril, Jucelei de Oliveira Moura Infran, Everton Falcão de Oliveira, Wagner de Souza Fernandes, Antônio Conceição Paranhos Filho, Alessandra Gutierrez de Oliveira

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Abstract

Phlebotomines have been recorded from a wide variety of habitats, and some of these vector species have shown preference for human environments, with high levels of adaptation. This study evaluated the degree of preference of these vectors for urban, rural, and forested environments (synanthropic behavior), as well as the diversity of these species, in three areas (forested, rural, and urban, exhibiting different degrees of anthropogenic changes) in a region of intense transmission of visceral leishmaniasis in Corumbá county, Mato Grosso do Sul, Brazil. Using light traps, sand fly specimens were collected from the three environments simultaneously, from May 2015 to April 2017, totaling 7 213 sand flies of 14 species in eight genera. Nuorteva's synanthropy index was determined for the species *Lutzomyia cruzi*, *Brumptomyia brumpti*, *Micropygomyia peresi*, *Lu. forattinii*, *Martinsmyia oliveirai* and *Evandromyia corumbaensis*. *Lutzomyia cruzi*, the vector of *Leishmania infantum* in Corumbá, was the most abundant vector species, recorded from all three areas and sampling plots, on all 24 months investigated. This species exhibited the highest synanthropic index (+75.09), indicating a strong preference for urban environments. *Brumptomyia brumpti*, *Micropygomyia peresi*, *Lu. forattinii*, and *Martinsmyia oliveirai* showed preference, albeit not strong, for urban environments. Overall, males were more abundant than females ($W = 490$; $p < 0.0001$). High density, high synanthropic index, and sustained indoor presence were found for *Mi. peresi* in the rural area. Monitoring changes in the ecological behavior of sand flies is of vital importance, as these changes may indicate an increased likelihood of leishmaniasis emergence or reemergence.

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Introduction

Leishmaniasis, a disease whose etiological agents involve roughly 20 species of the genus *Leishmania* (Kinetoplastida: Trypanosomatidae), is transmitted to animals and humans through the bites of female insects of the order Diptera, family Psychodidae, subfamily Phlebotominae. Six countries alone account for 90% of all cases of visceral and tegumentary leishmaniasis in the world. In the Americas, Brazil is the only country on this list [1, 2].

In the 1930s, incidence in Brazil was sporadic, with no epidemic cycles, but affected all age ranges. Early findings by Chagas [3] and Deane and Deane [4] led to a false belief that sand flies were restricted to wild and rural environments in the vicinity of forests. In the 1950s, however, the urbanization of leishmaniasis became evident, with cases detected in northeastern Brazil and later across the country [5–8]. Since then, epidemiological studies have revealed changes in the epidemiological profile of leishmaniasis in Brazil, formerly affecting only animals in the wild and occasionally humans who ventured into wild environments [5, 9]. The disease has now been reported from both rural and urban environments in all Brazilian regions, characterizing the entire country as an endemic area [1].

In early studies on the phlebotomine fauna of Mato Grosso do Sul state, conducted in the 1930s, sand flies were only found in the wild [3, 10, 11, 12, 13]. Unplanned urbanization, deforestation, slash-and-burn, poor sanitary conditions, and climate change have all contributed to destroying the natural habitats of sand flies, forcing these insects to seek food and shelter in human dwellings, as well as where domestic animals are housed [14].

Subsequent adaptation to these new environments has been revealed by synanthropy studies that evaluated the level of adaptation of these insects to human environments [15, 16]. Some specimens can become highly adapted to new environments, to the point of fully depending on the ecological relationships operating in the anthropogenically altered environment [16]. Varying degrees of domesticity have been observed among insect species [16].