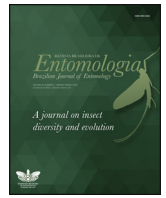




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Effects of changes in the riparian forest on the butterfly community (Insecta: Lepidoptera) in Cerrado areas

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ABSTRACT

Preserved riparian vegetation usually has greater environmental complexity than the riparian vegetation modified by human actions. These systems may have a greater availability and diversity of food resources for the species. Our objective was to evaluate the effect of changes on the structure of the riparian forest on species richness, beta diversity and composition of butterfly species in the Cerrado of Mato Grosso. We tested the hypotheses that: (i) higher species richness and (ii) beta diversity would be recorded in more preserved environments; and (iii) species composition would be more homogeneous in disturbed habitats. For hypothesis testing, the riparian vegetation of eight streams were sampled in four periods of the year in a fixed transect of 100 m along the shores. The richness of butterfly species is lower in disturbed than in preserved areas. However, species richness is not affected by habitat integrity. Beta diversity differed among sites, such that preserved sites have greater beta diversity, showing greater variation in species composition. In addition, beta diversity was positively affected by environmental heterogeneity. A total of 23 of the 84 species sampled occurred only in the changed environment, 42 were exclusive to preserved sites and 19 occurred in both environments. The environmental change caused by riparian forest removal drastically affects the butterfly community. Therefore, riparian vegetation is extremely important for butterfly preservation in the Cerrado and may be a true biodiversity oasis, especially during the dry periods, when the biome undergoes water stress and resource supply is more limited.

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Introduction

Riparian forest is defined as the forest vegetation established along the shores of medium to large rivers. This vegetation has important features and resources for the survival of animal communities (Ribeiro and Walter, 1998, 2001), providing high humidity, temperatures that are cooler and more stable than that of the surrounding landscape, low light incidence and abundant food resources (Brown, 2000). In addition, riparian forests are also ecological corridors for wildlife, connect different habitat fragments and effectively increase percolation in the landscape scale (Metzger, 2010). The density of animal species in the riparian forests in dryer regions and seasons may lead to an intense biotic pressure among the populations present, leading to genetic diversification and evolution, and consequently to a high species richness (Brown, 2000).

Natural habitats have been drastically reduced and/or modified by intense human activities, which have caused only few vegetation remnants to persist. The primary cause of the decline of species diversity in riparian forest is habitat loss. Forest fragmentation increases with the loss of original habitat and has its size reduced, consequently, the isolation of habitat patches increases. Changes in the use of the riparian vegetation, as well as the variation in the intensity of use may cause the loss of some specific environmental conditions or resources that are important for the species. Such loss may thus reduce abundance, cause local extinction of more sensitive species or in some cases favor the input and the establishment of generalist or invasive species (Barrella et al., 2000).

The Cerrado is one of the Brazilian biomes that have most suffered the effects of anthropization. This biome has high levels of endemism (Rodrigues, 2005; Camargo, 2001; Pinheiro, 2008) for several groups, in addition a high species diversity. An example is the butterfly fauna, which consists on a group with high species richness, extremely dependent on specific resources (plants) and highly faithful to microhabitats (Brown and Freitas, 2002; Freitas

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et al., 2003). Butterflies are especially dependent on specific resources associated with environments with high humidity and abundant food resources (Brown, 1992, 2000; Camargo, 2001).

Butterflies respond quickly to environmental and climatic changes are relatively easy to monitor, and its community structure is easily assessed (Brown, 1992; Brown and Freitas, 1999, 2000; Raimundo et al., 2003; Uehara-Prado et al., 2009). These insects are involved in many interactions in the surrounding environment, for example, pollination and predation (Bogiani et al., 2012). Therefore, butterflies are important for the functioning of ecosystem services and are good models for ecological studies. Given this scenario, our objective was to evaluate the effect of the riparian forest changes on species richness, beta diversity and composition of butterfly species in savannah areas of Mato Grosso, Brazil. Therefore, we tested the hypotheses that: (i) higher species richness and (ii) beta diversity would be recorded in more preserved environments, and (iii) species composition would be more homogeneous in disturbed habitats. Preserved sites have wider riparian forest and therefore may provide greater availability and diversity of food resources. We assume that environmental conditions such as temperature and humidity in preserved areas are more favorable

for butterflies, in contrast to the observed when the vegetation is removed (higher sunlight input, high temperatures, drought stress and loss of specific microhabitats). The reduction or elimination of resources and/or specific microhabitats would lead to the local extinction of specialist species, favoring the persistence of generalist species.

Material and methods

Our study was carried out in two streams that drain from the Left Bank of the Pindaíba River. This river is a tributary in the right bank of the Middle Mortes River, located at the Southwest region of the state of Mato Grosso, and runs through the municipalities of Barra do Garças, Araguaiana, Cocalinho and Nova Xavantina. The regional climate is Aw according to Köppen, with two well-defined seasons – dry from May to October and rainy from November to April (Peel et al., 2007). The average annual rainfall ranges from 1500 to 1800 mm and the temperature from 18.9 and 33.7 °C (INMET, 2009). The main soil use changes are derived from beef cattle breeding activities and extensive agriculture.

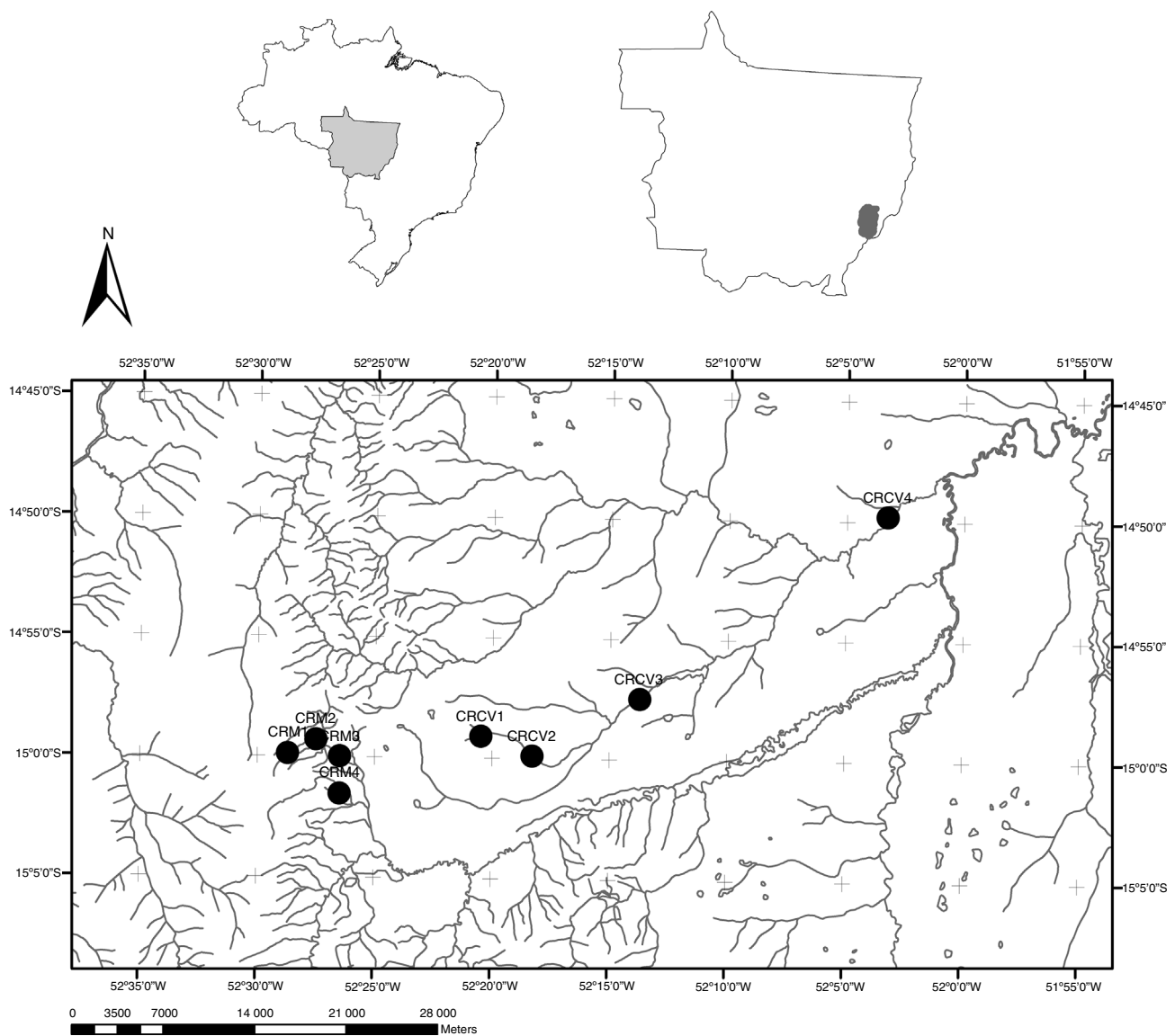


Fig. 1. Butterfly sampling sites at the Pindaíba River Basin, MT – Brazil; (CVS.1, CVS.2, CVS.3, CVS.4 = Caveira stream (1st to 4th order); MS.1, MS.2, MS.3 and MS.4 = Mata Stream (1st to 4th order).

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