Drosophilids (Insecta, Diptera) of the Paranã Valley: eight new records for the Cerrado biome

Renata Alves da Mata¹²; Francisco Roque¹; Rosana Tidon¹³

¹Departamento de Ciências Biológicas, Universidade de Brasília – UNB,
CP 04457, CEP 70904-970, Brasília, DF, Brazil
²Departamento de Ciências Biológicas, Universidade Federal de Goiás – UFG,
CP 131, CEP 74001-970, Goiânia, GO, Brazil, www.ufg.br
³Corresponding author: Rosana Tidon, e-mail: rotidon@unb.br, www.unb.br

Abstract: The Paranã Valley, located in the Central Brazil Plateau, within the domain of the Cerrado biome, is frequently cited as a center of endemism and diversity. Nonetheless, this region is poorly known, mainly considering its invertebrate fauna. Here, drosophilid flies were used as biological tools to contribute to a broader inventory, whose goals were mapping the Cerrado biodiversity and identifying areas to be conserved. Three previously unsampled areas in the Paranã Valley were sampled. Amongst the 12,297 specimens collected 45 species were identified, which represents 50% of the drosophilid species previously recorded in the Cerrado. Moreover, this sampling presented eight new occurrences for the biome (Drosophila annulosa, D. calloptera, D. papei, D. neomorpha, D. roehrae, Gitona bivisualis, Rhinoleucophenga lopesi, and the genus Diathoneura) and three species that had only one record for the biome, or that were recorded only in a specific area. Therefore, this study confirms the importance of the Paranã Valley as a center of biodiversity in the Cerrado biome, and recommends the establishment of conservation units in this region.

Keywords: biodiversity, Brazilian savanna, Central Brazil Plateau, conservation, Drosophila, inventory.

Resumo: O Vale do Paranã localiza-se no Brasil Central, no domínio do bioma Cerrado, e é frequentemente citado como um centro de diversidade e endemismo. Entretanto, essa região ainda é pouco conhecida, principalmente no que se refere à fauna de invertebrados. Este estudo apresenta a fauna de drosófilos de três áreas nunca avaliadas anteriormente no Vale do Paranã, visando contribuir para um inventário mais amplo, cujos objetivos foram mapear a biodiversidade da região e identificar áreas para serem preservadas. Dentre os 12,297 espécimes coletados foram identificadas 45 espécies, correspondendo a 50% dos drosófilos previamente registrados no Cerrado. Além disso, este trabalho acrescentou oito novas ocorrências para o bioma (Drosophila annulosa, D. calloptera, D. papei, D. neomorpha, D. roehrae, Gitona bivisualis, Rhinoleucophenga lopesi, e o gênero Diathoneura) e três outras espécies com apenas uma única ocorrência para o Cerrado, ou registradas em apenas uma área específica do bioma. Nesse contexto, este estudo confirma a importância do Vale do Paranã como um centro de biodiversidade do Cerrado, e recomenda o estabelecimento de unidades de conservação nesta região.

Palavras-chave: biodiversidade, Planalto Central do Brasil, conservação, Drosophila, inventário, savana brasileira.

http://www.biotaneotropica.org.br/v8n1/pt/abstract?article+bn01208012008
Introduction

The Cerrado biome is one of the 25 hotspots of the world (Myers et al. 2000), because it shows high endemity of plants and is extremely threatened. Moreover, this biome combines a set of ecological and historical context of special interest to those studying the complexities of tropical communities. Therefore, it is subject of great interest for research and conservation. Actually, Cerrado is quite understudied and the lack of information about the arthropod diversity is particularly notorious (Diniz & Kitayama 1998, Pinheiro et al. 2002).

The Paranã Valley, located in the Northeast Cerrado, is considered an area having high value for both scientific studies and conservation (Cavalcanti 1999). It is characterized by the large amount of physiognomies, geomorphologic and vegetation formations that are singular, but still little known (Oliveira & Marquis 2002). Some previous studies suggested that this region corresponds to a center of diversity and endemicity for the Cerrado biome (Silva 1997, Silva & Bates 2002, Werneck & Colli 2006). At the same time, these areas suffer intense exploitation by the implementation of cattle farms. Consequently, the landscape is becoming extremely fragmented and few areas still remain native (Scariot & Sevilla 2005). For all these reasons, inventories that allow a better understanding of biodiversity are very urgent for this region.

Andersen (2004) has emphasized that any program aiming at conserving biodiversity cannot be reliable without including insects. Firstly, insects represent a large proportion of the world biodiversity and, secondly, they play an essential role in maintaining ecosystem functions (Brown 1997, McGeoch 1998, Hilty & Merelender 2000). Moreover, insects are a rich data source for the conservation planning and management, as well as for reserves selection and drawing. They supply delineation of distinct biogeographical zones, areas of endemism, community types, and precise centers of evolutionary radiation, improving the spatial resolution of conservation planning (Kremen et al. 1993, Morrone 2006).

Drosophilids, in particular, have played an important role in the progress of genetics, evolution, and developmental biology (Brookes 2001). According to Powell (1997), no other biological model has been so thoroughly studied as the flies of the genus Drosophila. However, the geographic distribution and ecology of drosophilids is still poorly known, especially in tropical areas (Val et al. 1981, Brnic et al. 1985, Saavedra et al. 1995).

In tropical South America, systematic samplings of drosophilids have been taken only after the 1940-decade (Dobzhansky & Pavan 1943; Pavan & Cunha 1947, Pavan 1950, 1959; Mourão et al. 1965). Subsequently, based on the previous studies and on an extensive sampling program, Sene et al. (1980) and Vilela et al. (1983) discussed the drosophilid fauna of the Brazilian morphoclimatic domains, aiming at investigating the geographical distribution of the most common species. The fauna of Central Brazil Plateau, however, was little sampled by those surveys. In the Cerrado biome, where drosophilid have been collected regularly only after 1998, 90 species were recorded, 80 of them endemic to the Neotropical Region (Chaves & Tidon 2005, Roque et al. 2006). The drosophilid fauna of the Cerrado, however, is well known only for the neighborhoods of Brasília city, the capital of Brazil. Even areas widely recognized as important for biodiversity maintenance have not been sampled yet, which indicates that drosophilid diversity in the biome is still an underestimate.

It was suggested that studies investigating insect diversity, mainly in poorly known neotropical areas showing high conservation value, are likely to help formulating effective management strategies for the Cerrado biome (Brown & Gifford 2002), and for improving biodiversity knowledge. This project was a part of a broader inven-
in Table 1. The drosophilid were identified by identification keys, species description and, in some cases, by the male *terminalia* (Dobzhansky & Pavan 1943, Pavan & Cunha 1947, Freire-Maia & Pavan 1949, Frota-Pessoa 1954, Val 1982, Vilela 1983, Vilela & Bachli 1990, Vilela 1992). Females of cryptic species (*D. cardini* and *D. cardinoides*, *D. prosaltans* and *D. austrosaltans*, *D. simulans* and *D. melanogaster*) were not identified due to the lack of reliable diagnostic characters, and they were classified according to the relative abundance of the males captured. Voucher specimens of the flies have been deposited in the Laboratório de Biologia Evolutiva of the Universidade de Brasília.

### Results and Discussion

In this study 12,297 specimens belonging to 45 drosophilid species were collected, 40 of which are endemic of the Neotropical Region and five are exotic (*Drosophila busckii*, *D. malerkotliana*, *D. simulans*, *Scaptodrosophila latifasciaeformis*, and *Zaprionus indiana*) (Table 2). This number of species represents 50% of all drosophilid species known for the Cerrado biome until this moment (Chaves & Tidon 2005, Roque et al. 2006). Since this is the first inventory of drosophilids in Paranã Valley, all species correspond to new records to this region, representing new important information on Neotropical and exotic drosophilid species’ geographic ranges. Moreover, considering the entire Cerrado biome, this study presented eight new drosophilid occurrences: *Drosophila annulosa* (770 specimens), *D. calliptera* (2), *D. papei* (1), *D. neomorpha* (1), *D. roehrae* (1), *Gitona bivisualis* (164), *Rhinoleucophenga lopesii* (5), and one undetermined species of the genus *Diaetherea* (2). Except for *Rhinoleucophenga personata* (3, Malogolowkin 1946), recorded in the biome in Miranda (MS) in 1946, the other three morphospecies of this genus, as well as the six undetermined species of *Drosophila*, are being evaluated and can represent new records for the Cerrado, or even new species (Table 2).

Although *D. canalinea* did not represent a new occurrence for the Cerrado, its first and unique record in the biome was made by Dobzhansky and Pavan in 1950, in Anápolis (GO), in a locality described by the authors as constituted mainly of savannas, but that shows, however, some forests in the valleys around the mountains that exist there (Pavan 1959). *Drosophila caponei* and *D. trapeza* were previously recorded only in the Serra do Cipó (Tidon-Sklorz et al. 1994, Vilela & Mori 1999), a part of Espinhaço Plateau that is considered a center of biodiversity and endemism for the Cerrado biome (Silva & Bates 2002). The *Drosophila* studies conducted in the Serra do Cipó confirm this proposition, since they record a relatively high number of species of *Drosophila* (about 60) there, when compared to other Cerrado areas (Tidon-Sklorz et al. 1994, Vilela & Mori 1999).

Likewise the Serra do Cipó, the Paranã Valley was pointed as a region presenting high conservation value because of its elevated species richness, singularity in species composition and threat level (Cavalcanti 1999). Silva (1997) and Silva & Bates (2002) have also proposed that this region corresponds to an important center of avifauna endemism for the Cerrado biome, and these propositions have been supported by studies considering other taxa. Moojen et al. (1997) described a new rodent species, belonging to the genus *Kerodon*, and Werneck & Colli (2006) found a new reptile species of the genus *Mabuya*, both of them endemic to the seasonally dry tropical forests of the Paranã Valley. The great diversity and singularity of the regional biota are largely due to these seasonally dry tropical forests.

Seasonally dry tropical forests are considered the most threatened ecosystem. They occur in fertile soils highly favorable for agriculture, contain plant species of commercial interest, and little attention is given for the conservation of these habitats (Sánchez-Azofeifa et al. 2005, Prance 2006, Vieira & Scariot 2006). Currently, these seasonally dry tropical forests are strongly fragmented, isolated from each other, and the less known fragments in the Cerrado biome (Oliveira & Marquis 2002).

This drosophilid inventory in the Paranã Valley supports the importance of this region as a diversity center. The numbers of species, as well as the new occurrences found during this study, were extremely high when compared to other Cerrado areas at the same sampling period (data not shown). However, the Paranã Valley has not a single reserve area protecting its biological resources, and the creation of such reserves still remains as a high priority for the conservation of this unique biological region of the Cerrado biome (Silva 1997). Thus, to value the spent public investment, the efforts of several research groups, and mainly the knowledge produced by these studies, the creation of ecological reserves that preserve the richness and singularity of the region is urgent.

It is widely recognized that knowledge of biodiversity, mainly in tropical regions, is severely restricted. Although there have been an increasing effort to improve sampling data sets, and to provide available information on biodiversity, there are still immense gaps to be covered. In fact, the lack of knowledge creates challenges that were recently discussed under the names of “Wallacean” and “Linnean” shortfalls (Lomolino 2004, Whittaker et al. 2005). Most of the species were not yet described and named (the Linnean shortfall), and the geographic ranges and biogeographic patterns of the majority of the known species are poorly known (the Wallacean shortfall) (Lomolino 2004, Whittaker et al. 2005, Bini et al. 2006). Part of the problem is that across most tropical regions predominately developing tropical forests are strongly fragmented, isolated from each other, and the less known fragments in the Cerrado biome (Oliveira & Marquis 2002).

### Table 1. Characterization of the sampling areas of Paranã Valley region.

<table>
<thead>
<tr>
<th>Area</th>
<th>Habitat</th>
<th>Sites location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alvorada do Norte - Goiás State</td>
<td>cerrado sensu strictu</td>
<td>14° 31’ S and 46° 47’ W</td>
</tr>
<tr>
<td></td>
<td>cerradão</td>
<td>14° 30’ S and 46° 46’ W</td>
</tr>
<tr>
<td></td>
<td>seasonally dry tropical forest</td>
<td>14° 30’ S and 46° 43’ W</td>
</tr>
<tr>
<td>São Domingos - Goiás State</td>
<td>seasonally dry tropical forest</td>
<td>13° 39’ S and 46° 45’ W</td>
</tr>
<tr>
<td></td>
<td>seasonally dry tropical forest</td>
<td>13° 39’ S and 46° 46’ W</td>
</tr>
<tr>
<td></td>
<td>seasonally dry tropical forest</td>
<td>13° 36’ S and 46° 46’ W</td>
</tr>
<tr>
<td>Paranã - Tocantins State</td>
<td>cerrado sensu strictu</td>
<td>12° 52’ S and 47° 37’ W</td>
</tr>
<tr>
<td></td>
<td>cerradão sensu strictu</td>
<td>12° 54’ S and 47° 34’ W</td>
</tr>
<tr>
<td></td>
<td>gallery forest</td>
<td>12° 52’ S and 47° 35’ W</td>
</tr>
</tbody>
</table>

countries, with few research tradition and relatively small amount of resources for biodiversity research. This problem certainly constrains the development of deeper biodiversity studies in the tropics, especially those involving large-scale surveys, covering an extensive area, which has serious implications for biodiversity conservation of those regions.

Important and new information about Neotropical and exotic species ranges has been presented here, as this is the first inventory of drosophilids species in the Paranã Valley, located at northeast part of Cerrado biome. The present survey has also contributed to increase the drosophilid checklist of Cerrado biome in eight species. However, because some of those flies are extremely seasonal, only appearing...
in some times of the year (Tidon 2006), this sample can still be an underestimate of the real drosophilid diversity in this region. Despite this, such fact does not invalidate the results obtained here. Surely, as discussed by Balmford & Gaston (1999), the best way to circumvent both Wallaecean and Linnean shortfalls is to invest in biodiversity inventories. Such surveys, whose objective is to produce knowledge on diversity of still unknown areas, will provide a solid baseline that will improve the biodiversity knowledge in tropical regions and help the development of conservation and management policies. Therefore, the inventories in other areas that are considered centers of diversity or endemism in Brazil (e.g. as those suggested by Silva & Bates 2002, to the Cerrado), that are poorly known for the great majority of the taxa, are still extremely necessary.

Acknowledgments

We are grateful to A. Brito for helping in the field work, to J. A. F. Diniz-Filho and three anonymous reviewers for the critical reading of the manuscript, and to S. Noronha and Laboratório de Ecologia of the Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA)/Recursos Genéticos e Biotecnologia (Cenargen) for providing the GSI base to the figure production. We are also grateful to the Universidade de Brasília for the logistic support. This research was granted by MMA/PROBIO, Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

References


