Nota cientifica

POTENTIAL TRAPS WITH FERMENTED BANANA AS AN ATTRACTANT TO CAPTURE BEETLES (INSECTA: COLEOPTERA)

Rejane Peter[1]
Mayara Ferreira Mendes[2]
Daniel André Carvalho[3]
Luana Amaral dos Santos[4]
Flávio Roberto Mello Garcia[5]

ABSTRACT - Understanding the influence on resource use, reproductive behavior, niche occupation and anthropic changes is also associated with a better definition of collection methods for the Coleoptera fauna. In Brazil, few were officially standardized regarding the use of fruits as an attractant for capturing the group. Thus, we evaluated here the potential of traps with fermented banana attractants to capture beetles in an area of the Pampa Biome in the state of Rio Grande do Sul, RS, Brazil.

Keywords: Biodiversity; Dung beetle; new research methodology; Pampa biome.

ARMADILHAS POTENCIAIS COM BANANA FERMENTADA COMO ATRATIVO PARA CAPTURA DE BESOUROS (INSECTA: COLEOPTERA)

RESUMO - Entender a influência no uso de recursos, comportamento reprodutivo, ocupação de nicho e mudanças antrópicas está também associada a uma melhor definição de métodos de coleta para a fauna de Coleoptera. No Brasil, pouco se padronizou oficialmente quanto ao uso de frutos como atrativo para a captura do grupo. Assim, avaliamos aqui o potencial de armadilhas com atrativos de banana fermentada para capturar besouros em uma área do Bioma Pampa no estado do Rio Grande do Sul, RS, Brasil.

Palavras-chave: Biodiversidade; besouro rola-bosta; nova metodologia; Bioma Pampa.

[1]Doutoranda em Ciências Fisiológicas na Universidade Federal de Rio Grande (FURG), Rio Grande, RS, Brasil. *Corresponding author*: rejanepeter1@gmail.com
[2]Doutora em Biologia Animal, Museu de Zoologia (MZUSP), Universidade de São Paulo (USP), São Paulo, SP, Brasil. E-mail: ferreiramendesmayara@gmail.com
[3]Mestrando em Biologia Animal na Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brasil. E-mail: dandr29@outlook.com
[4]Doutora em Entomologia pela Universidade Federal do Paraná (UFPR), Curitiba, PR, Brasil. E-mail: luanasantos129@hotmail.com
[5]Doutor em Biociências (Zoologia), Professor da Universidade Federal de Pelotas (UFPel), Pelotas, RS, Brasil. E-mail: flaviormg@hotmail.com

INTRODUCTION

Insects represent the most diversified and successful group of terrestrial invertebrates, among which the order Coleoptera stands out, with great taxonomic and functional diversity (BOUCHARD *et al*., 2017). The group plays an important role in the processes of decomposition and incorporation of organic matter and occupation in different ecological niches, being, therefore, considered a good ecological indicator to monitor different environmental disturbances such as habitat fragmentation, for example (FEER & HINGRAT, 2005; NICHOLS *et al*., 2007).

The group's fauna are commonly associated on copro-necrophagous, or used soil trap techniques to capture individuals (SILVA *et al*., 2012a). Pitfall traps, light traps, entomological nets and Malaise traps are also among the most common techniques in studies of Coleoptera diversity in forest vegetation, none of them with any fermented fruit as an attractant (LEKSONO *et al*., 2005; MARQUES *et al*., 2006; CAMPBELL & HANULA, 2007; HODGE *et al*., 2010; FAGUNDES *et al*., 2011).

MATERIAL AND METHODS

Location and climate

The present study was developed in Horto Botânico Irmão Teodoro Luís (HBITL), an area of the Pampa Biome located in the municipality of Capão do Leão, Rio Grande do Sul, Brazil (Figure 1a-c). This area is formed by a Restinga vegetation with 25 hectares (GUERRA *et al*., 2015), and in its surroundings grasses and herbaceous vegetation predominate (Figure 1c) (SILVA *et al*., 2013b). The predominant climate is humid subtropical “Cfa”, according to the Köppen classification (ALVARES *et al*., 2013), without the presence of a distinct dry season. The normal climatological conditions recorded in the sampling period that the average temperature is 17.8°C, and the annual relative temperature is 76.2% (ESTAÇÃO AGROCLIMATOLÓGICA DE PELOTAS, 1988).

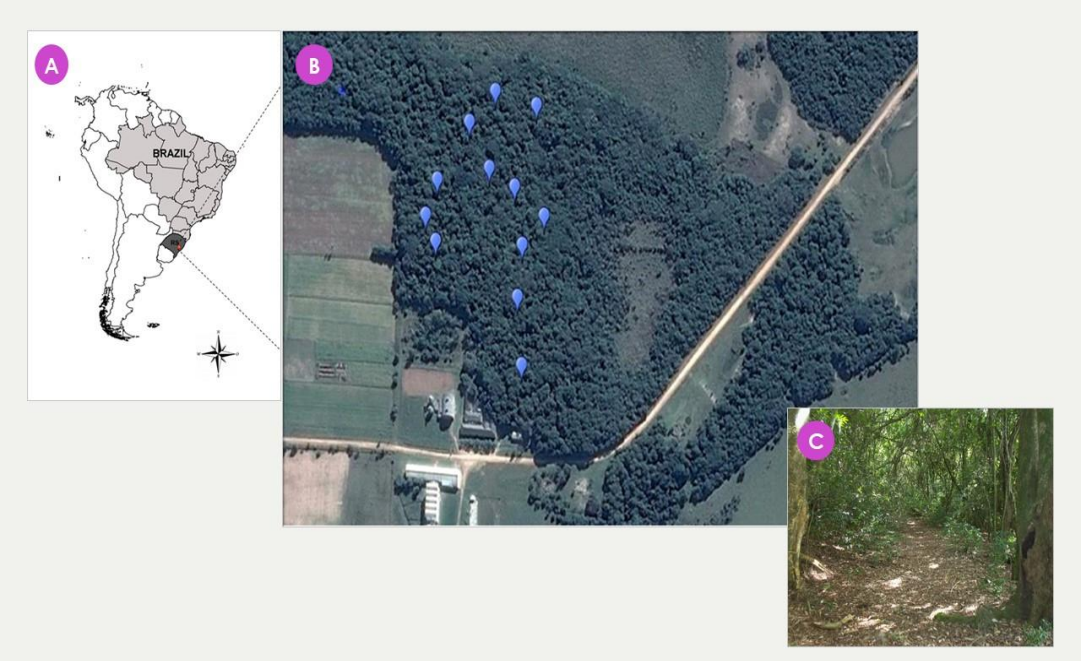

Figure 1. (A) Map of South America highlighting Brazil (in gray) and Satellite location of the Horto Botânico Irmão Teodoro Luís in Restinga Forest (HBITL - red dot; 31°47'48''S, 52°15'45''W) in the state of Rio Grande do Sul (in dark gray). (B) Blue dots - indicate the location of each trap in the HBITL. According Google Earth, accessed in http://www.google.com.br/earth/. (C) Phytophysionomy of vegetation around the traps.

Coleoptera collection

Monthly, samplings were collected, from February 2013 to January 2014. Using 12 plastic traps with 150 grams of smashed banana mixed with 25g of dry biological yeast in 12 points of Restinga vegetation (Figure 1b). The traps were kept in the field for 3 days.

The trap consists of two 2L PET bottles cut in middle (Figure 2a). In one of the bottles entirely painted in black, the compartment where the fermented banana bait is stored is the lower middle, where a lateral opening (5cm diameter) is also made through which the attracted individuals enter, while the upper middle is the coupled compartment above. For the transparent PET bottle, we used only the upper middle, which is attached just above the black PET bottle, where the idea is that this compartment retains the captured individuals (Figure 2b).

All points were georeferenced and spaced 60m from one another, starting from the border to the interior of the forest, suspended approximately 1.5m from the ground at each point, where they remained in the field for three days. For identification, individuals were maintain in 70% alcohol and determined by analyzing the external morphology, with the help of a stereomicroscope, following keys and appropriate bibliography (GALILEO & MARTINS, 2006; VAZ-DE-MELLO *et al*., 2011) up to the category of family.

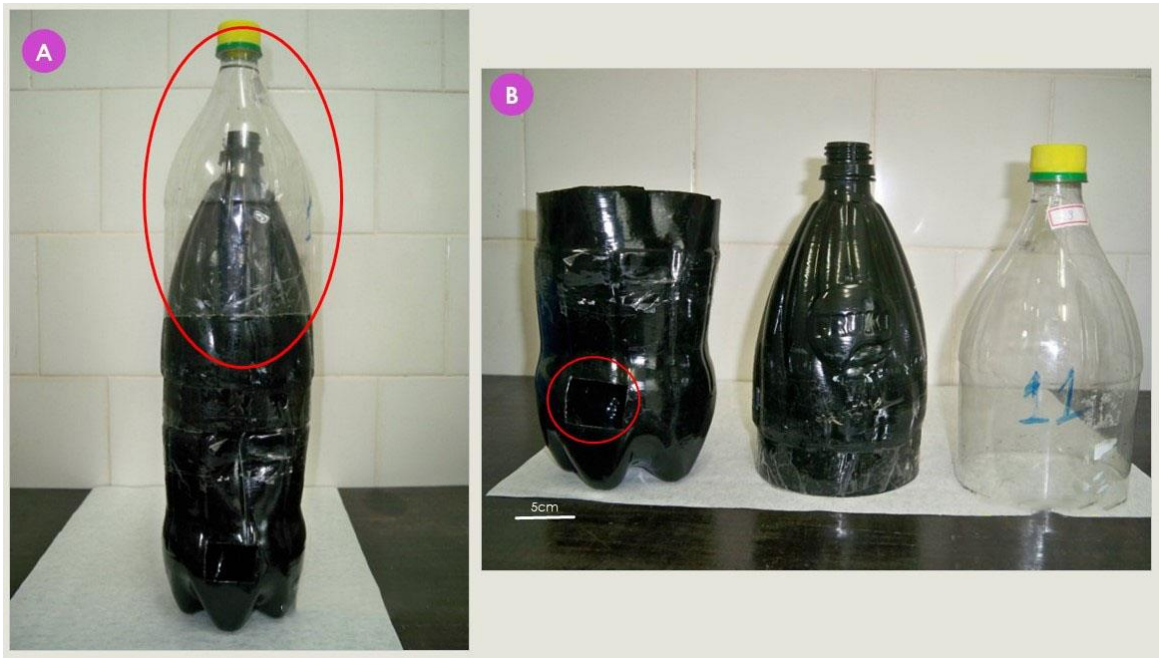

Figure 2. (A) Retention trap of Coleoptera with red circle in capture compartment of individuals. (B) Retention trap dismantled, with red circle in bait storage compartiment and individuals entrance.

RESULTS AND DISCUSSION

In total, 1003 Coleoptera were collected, distributed in six families (Table 1). The most abundant family, collected throughout the year in the Restinga vegetation, was Nitidulidae (n=974), representing 97.1% of the total individuals sampled. Similar results were found by Fagundes et al. (2011) in the Pampa area, where they obtained the highest number of individuals of Nitidulidae (n=1,113) representing 61.4% and Staphylinidae (n=452) representing 24.9% of the total number of individuals sampled.

In the literature, the abundance of Nitidulidae is referred to different eating habits, which predominate in areas with tree and shrub cover, and because they are important recycling organisms of organic matter within ecosystems. While the abundance and wide distribution of Staphylinidae would be associated with natural and semi-natural environments or managed forest ecosystems, being considered as an environmental indicator, especially where there is anthropic action (AUDINO *et al*., 2007; BÜCHS, 2003).

Table 1 - Frequency of specimens from Coleoptera families captured in traps with banana attractive in Restinga vegetation of Bioma Pampa, Rio Grande do Sul, Brazil.

Family	Total	Frequency %
Nitidulidae	974	97%
Staphylinidae	14	1,4%
Scarabaeidae	8	0,8%
Cerambycidae	4	0,4%
Elateridae	2	0,2%
Ptilidae	1	0,1%
Total	**1003**	

In the literature, Coleoptera families are commonly associated the different attractants (SILVA *et al*., 2008c; SILVA *et al*., 2012a). However, the data collected here with banana

attractive for the Pampa area do not corroborate those found in the Atlantic Forest Biome area (PETRONI, 2008). In the transition biome to the south, Scarabaeidae was the most abundant family, followed by Nitidulidae and Staphylinidae.

In conclusion, we demonstrate that the abundance and richness of families collected for traps with fermented banana bait do not differ significantly from other works for the Coleoptera fauna also carried out in areas of the Pampa Biome. (PINTO *et al*., 2009; SILVA *et al*., 2012). Moreover, the sampling instrument proved to be efficient not only to monitor, but also to capture Coleoptera diversity with different feeding habits, a group under sampled in traditional soil traps.

ACKNOWLEDGMENTS

This work was supported by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

AUTHOR'S CONTRIBUTIONS

Conceptualization: RP, MFM, LAS, FRMG; Data collection: MFM, LAS; Identification: RP, LAS; Writing and editing: RP, MFM, LAS, DAC; Final manuscript correction: RP, LAS, FRMG.

REFERENCES

ALVARES, C. A.; STAPE, J. L.; SENTELHAS, P. C.; DE MORAES GONÇALVES J. L.; SPAROVEK, G. Köppen's climate classification map for Brazil. **Meteorologische Zeitschrift,** v. 22, n. 6, p. 711-728, 2013. doi: 10.1127/0941-2948/2013/0507

AUDINO, L. D.; NOGUEIRA, J. M.; SILVA, P. G. DA; NESKE, M. Z.; RAMOS, A. H. B.; MORAES. L.P.DE.M.; BORBA, M.F.S. **Identificação dos coleópteros (Insecta: Coleoptera) das regiões de Palmas (município de Bagé) e Santa Barbinha (município de Caçapava do Sul), RS**. Bagé: Embrapa Pecuária Sul, 92p, 2007.

BOUCHARD, P.; SMITH, A. B. T.; DOUGLAS, H.; BRUNKE, A. J.; KANDA, K. **Biodiversity of Coleoptera**. In book: Insect Biodiversity, Science and Society (pp. 337-417), 2017.

CAMPBELL, J. W.; HANULA, J. L. Efficiency of Malaise traps and colored pan traps for collecting flower visiting insects from three forested ecosystems. **Journal of Insect Conservation**, v. 11, P. 399–408, 2007. doi: 10.1007/s10841-006-90554

IBGE. **Instituto Brasileiro de Geografia e Estatística, Unidades Climáticas**. Pelotas. 1997. Disponível em: http://www.ibge.gov.br. Acesso em: 03 set. 2022.

BÜCHS, W. Biodiversity and agri-environmental indicators-general scopes and skills with special reference to the habitat level. **Agriculture, Ecosystems and Environment**, v. 98, n. (1-3), p. 35-78, 2003. doi: 10.1016/S0167-8809(03)00070-7

ESTAÇÃO AGROCLIMATOLÓGICA DE PELOTAS (Capão do Leão) (1988) http://agromet.cpact.embrapa.br/estacao/index.html. Acesso em: 13 fev. 2015.

FAGUNDES, C. K.; DI MARE, R. A.; WINK, C.; MANFIO, D. Diversity of the families of Coleoptera captured with pitfall traps in five different environments in Santa Maria, RS, Brazil. **Brazilian Journal of Biology**, v. 71, p. 381–390, 2011. doi: 10.1590/S1519-69842011000300007

FEER, F.; HINGRAT, Y. Effects of forest fragmentation on a dung beetle community in French Guiana. **Conservation Biology**, v. 19, p. 1103–1112, 2005. doi: 10.1111/j1523-1739.2005.00087.x

GALILEO, M. H. M.; MARTINS, E. U. R. **Cerambycidae (Coleoptera) Parque Copesul de Proteção Ambiental, Triunfo, Rio Grande do Sul**. (Org.) Fundação de Zoobotânica do Rio Grande do Sul, RS, Brasil, 2006.

GUERRA E.; STREHER N.S.; LUDTKE, R. Plantas trepadeiras do Horto Botânico Irmão Teodoro Luís, sul do Rio Grande do Sul, Brasil. **Revista Brasileira de Biociências**, v. 13, p. 201-209, 2015. http://www.ufrgs.br/seerbio/ojs/index.php/rbb/article/view/3181

HODGE, S.; MARSHALL, S. A.; OLIVER, H.; BERRY, J.; MARRIS, J.; ANDREW, I. A preliminary survey of the insects collected using mushroom baits in native and exotic New Zealand woodlands. **New Zealand Entomologist**, v. 33, p. 43–54, 2010.

LEKSONO, A. S.; TAKADA, K.; KOJI, S.; NAKAGOSHI, N.; ANGGAENI, T.; NAKAMURA, K. Vertical and seasonal distribution of flying beetles in a suburban temperate deciduous forest collected by water pan trap. **Insect Science**, v. 12, p. 199–206, 2005. doi: 10.1111/j.1005-295x.2005.0005.x

MARQUES, M. I.; ADIS, J.; BRIZZOLA DOS SANTOS, G.; BATTIROLA, L. D. Terrestrial arthropods from tree canopies in the Pantanal of Mato Grosso, Brazil. **Revista Brasileira de Entomologia**, v. 50, p. 257–267, 2006. doi: 10.1590/S0085-56262006000200007

NICHOLS, E., LARSEN T., SPECTOR, S., DAVIS, A. L., ESCOBAR, F., FAVILA M.; VULINEC K. Global dung beetle response to tropical forest modification and fragmentation: a quantitative literature review and meta-analysis. **Biology Conservation**, v.137, p.1–19, 2007. doi: 10.1016/j.biocon.2007.01.023

SILVA, P. G. da; AUDINO, L. D.; NOGUEIRA, J. M.; MORAES, L. P. de; VAZ-DE MELLO, F. Z. Escarabeíneos (Coleoptera: Scarabaeidae: Scarabaeinae) de uma área de campo nativo no bioma Pampa, Rio Grande do Sul, Brasil. *Biota Neotropica*, v. 12, n. 3, p. 1-8, 2012a. doi: 10.1590/S1676-06032012000300024

SILVA, J. M.; CUNHA, S. K. da; SILVA, E. J. E.; GARCIA, F. R. M. Borboletas frugívoras (Lepidoptera: Nymphalidae) no Horto Botânico Irmão Teodoro Luis, Capão do Leão, Rio Grande do Sul, Brasil. **Revista Biotemas**, v. 26, n 1, p. 87-95, 2013b. doi: 10.5007/2175-7925.2013v26n1p87

SILVA, P. G.; GARCIA, M. A. R.; VIDAL, M. B. Besouros copro-necrófagos (Coleoptera: Scarabaeidae stricto sensu) coletados em ecótono natural de campo e mata em Bagé, RS. **Ciência e Natura**, v. 30, n.2, p. 71-91, 2008c.

PETRONI, D. M. **Diversidade de famílias de Coleoptera em diferentes fragmentos florestais no município de Londrina, PR – Brasil**. 61f. (2008) Dissertação (Pós-Graduação em Ciências Biológicas), Universidade Estadual de Londrina, Londrina, 2008.

PINTO, M. P.; DUARTE, J. L. P.; RIBEIRO, P. B.; JÚNIOR, P. S. Collection of Coleoptera from a poultry farm in Pelotas, Rio Grande do Sul, Brazil. **Ciência Rural**, v. 39, n. 2, p. 319-324, 2009. doi: 10.1590/S0103-84782008005000060

VAZ-DE-MELLO, F. Z.; EDMONDS, W. D.; OCAMPO, F. C.; SCHOOLMEESTERS, P. A multilingual key to the genera and subgenera of the subfamily Scarabaeinae of the New World (Coleoptera: Scarabaeidae). **Zootaxa**, v. 2854, p. 1-73, 2011. doi: 10.11646/zootaxa.2854.1.1