



# MANAGEMENT OF EXOTIC PASTURES AFFECTS ABUNDANCE AND DIVERSITY OF DUNG BEETLES (COLEOPTERA, SCARABAEINAE)

César Murilo Albuquerque Correa

Anderson Puker; Vanesca Korasaki; Gilberto Souza Canuto

César Murilo Albuquerque Correa - Universidade Estadual de Mato Grosso do Sul, Rodovia Aquidauana/CERA km 12, 79200 - 000 Aquidauana - MS, Brasil.

Anderson Puker - Programa de Pós - Graduação em Entomologia, Departamento de Entomologia, Universidade Federal de Viçosa, 36570 - 000 Viçosa - MG, Brasil. Email: pukeragro@gmail.com.

Vanesca Korasaki - Departamento de Biologia, Setor de Ecologia, Universidade Federal de Lavras, 37200 - 000 Lavras - MG, Brasil.

Gilberto Souza Canuto - Universidade Estadual de Mato Grosso do Sul, Rodovia Aquidauana/CERA km 12, 79200 - 000 Aquidauana - MS, Brasil.

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## INTRODUÇÃO

Among tropical forages, *Brachiaria* spp. grass occupies about 80% of the total area of cultivated pastures in Brazil. This grass, native to Africa, was introduced over two centuries ago and by adapting well to the climate and good nutritional value has become widely cultivated. In Brazil, exotic pastures are generally used for the creation of herbivorous mammals such as cattle, horses, goats and sheep, and the feces deposited by these animals have been used by dung beetles (Coleoptera, Scarabaeinae).

By burying and utilizing the dung for nesting and feeding of their offspring, dung beetles increase the rate of nutrient recycling in the soil (Yamada *et al.*, 2007), improve soil fertility and aeration (Bang *et al.*, 2005), contribute to the reduction of helminth and dipteran parasites of animals (Smith & Matthiessen, 1984), assist in the growth and development of pastures (Bang *et al.*, 2005) and also increase the grazing area by incorporating the dung (Mariategui *et al.*, 2000).

The correct use of practices for pasture management, in addition to increasing the productivity of forage and animal consumption, may influence the diversity and abundance of insects to beneficial pastures such as dung beetles. To date no studies have been performed with the intent of investigating the effect of exotic pastures

management on the assembly of dung beetles.

## OBJETIVOS

Here, we investigated the effects of exotic pastures (*Brachiaria* spp.) management on dung beetles, since there are extensive areas of cultivated pastures in Brazil, coupled with the great importance of these insects for this agro - ecosystem.

## MATERIAL E MÉTODOS

The areas selected for conducting the study are located in the transition area between the Cerrado and Pantanal ecosystems in Aquidauana, Mato Grosso do Sul, Brazil. To test the effect of time of the most recent grazing on diversity and abundance of dung beetles, four areas of exotic pastures (*Brachiaria* spp.) were selected that had been grazed at zero (the constant presence of cattle), two, four and six months before trapping of the insects.

In each pasture area four plots at spacing of 50 m were used for allocation of *pitfall* traps (1000 mL). Traps were employed at ground level in previously marked plot points separated from one another by 50 m, with three points per plot. In each point in four traps were

set in the shape of a square with a distance of 10 m between traps. Four bait types were used (cattle dung, human feces, pig feces and stomach bovine), placed in plastic containers (50 mL) in the center of each trap with a wire. Samples were collected in October 2010 with traps remaining active for 48 hours.

A Friedman test followed by a rank test was performed to test the how grazing absence times affected the dung beetle community (BioStat 5.0; Ayres *et al.*, 2007). Nonmetric Multidimensional Scaling (NMDS) was performed to verify the occurrence of different groups for the different periods grazing absence for each type of bait. Data were transformed into square roots and ordination was performed using standardized abundance data. The Bray - Curtis index was used as a measure of similarity between points. An analysis of similarity (ANOSIM) was used to identify significant differences in community composition between the different periods without grazing (Clarke & Warwick, 2001). Analyses were performed with the program Primer v.6 with PERMANOVA+ (Clarke & Gorley, 2006).

## RESULTADOS

A total of 2,934 individuals were captured belonging to 26 species, 14 genera and five tribes of scarab dung beetles: Ateuchini (three genera, three species); Canthonini (two genera, two species); Coprini (three genera, 14 species); Onthophagini (two genera, two species) and Phanaeini (four genera, five species). Abundance of dung beetles was affected by the time without grazing (Friedman = 10.18,  $p < 0.05$ ), increasing after the fourth month of grazing absence. Richness increased after the second month of absence of the animals (Friedman = 8.32,  $p < 0.05$ ) and remained constant until the sixth month.

Assembly of dung beetles attracted to human feces (ANOSIM,  $R = 0.50$ ,  $p < 0.05$ ) differed with the increased in time without grazing. For cattle dung, with the exception of the second and fourth months without grazing that were similar (ANOSIM,  $R = 0.02$ ,  $p > 0.05$ ), the other periods of grazing absence altered the structure of the assembly (ANOSIM,  $R = 0.54$ ,  $p < 0.05$ ). The assembly attracted by pig feces changed between the times zero and two (ANOSIM,  $R = 0.25$ ,  $p < 0.05$ ), zero and four (ANOSIM,  $R = 0.47$ ,  $p < 0.05$ ) and four and six months (ANOSIM,  $R = 0.16$ ,  $p < 0.05$ ) without grazing. Structure of the assembly attracted to bovine stomach was similar for different time periods without grazing, except for time zero and sixth months (ANOSIM,  $R = 0.51$ ,  $p < 0.05$ ).

The presence of cattle in the area apparently favors some species. However, the presence of manure left by the animals is not the main factor to ensure a large number of species and individuals in the area (*e.g.*, Es-

cobar *et al.*, 2007). With increasing time of abandonment there is an increase of plant biomass, mainly due to the growth of native herbs in the mid of exotic grass. These plants change the local microclimate conditions, which may facilitate the assembly of dung beetles, being that the increased amount of cattle feces is an important factor but not decisive for increasing richness and abundance of the local assembly (*e.g.*, Halffter, 1991). Assembly structure of beetles attracted to different food sources was also differentiated with respect to time of abandonment. This demonstrates that with increases in time of the absence of animals, the structure of the assembly which is active in the area and used the different food sources varies. This may be due to several factors, such as resource availability and soil and microclimate changes.

## CONCLUSÃO

The assemblage of dung beetles was affected by exotic pastures management, where the richness and abundance increase with time in which animals are not present. The assembly of dung beetles attracted to human feces was more sensitive for detecting change in time of abandonment of grazing. The results of this study provide substance and point to the need to investigate the optimal time for cattle rotation in exotic pastures, taking into consideration the needs of cattle and detritivorous beetles. Thus, a plan for managing these areas will be developed in order to conserve the diversity and abundance of beetles in these areas, given their enormous importance to livestock and forage.

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## REFERÊNCIAS

AYRES, M.; AYRES JUNIOR, M.; AYRES, D. L.; SANTOS, A. S. *Bio Estat 5.0: aplicações nas áreas das ciências bio - médicas*. Belém: Instituto Mamirauá, 2007.

- BANG, H. S.; LEE, J. - H.; KWON, O. S.; NA, Y. E.; JANG, Y. S.; KIM, W. H. Effects of paracoprid dung beetles (Coleoptera: Scarabaeidae) on the growth of pasture herbage and on the underlying soil. *Applied Soil Ecology*, Netherlands, v. 29, n. 2, p. 165 - 171, 2005.
- CLARKE, K. R.; GORLEY, R. N. *Primer v6 Permannova+*. Primer - E Ltd., Plymouth, UK, 2006.
- CLARKE, K. R.; WARWICK, R. M. *Change in Marine communities: an approach to statistical analysis and interpretation*. Plymouth: Primer - E, 2001.
- ESCOBAR, F.; HALFFTER, G.; ARELLANO, L. From forest to pasture: an evaluation of the influence of environment and biogeography on the structure of dung beetle (Scarabaeinae) assemblages along three altitudinal gradients in the Neotropical region. *Ecography*, Denmark, v. 30, n. 2, p. 193 - 208, 2007.
- HALFFTER, G. Historical and ecological factors determining the geographical distribution of beetles (Coleoptera: Scarabaeidae: Scarabaeinae). *Folia Entomologica Mexicana*, Mexico, n. 82, p. 195 - 238, 1991.
- MARIATEGUI, P.; SPEICYS, C.; URRETABIZKAIA, N.; FERNÁNDEZ, E. Efecto de *Ontherus sulcator* F. (Coleoptera: Scarabaeidae) en la incorporación de estiércol al suelo. *Zootecnia Tropical*, Venezuela, v. 19, n. 2, p. 131 - 138, 2001.
- SMITH, T. J. R.; MATTHIESSEN, J. N. Field assessments of the impact of night - flying dung beetles (Coleoptera: Scarabaeidae) on the bush fly, *Musca vetustissima* Walker (Diptera: Muscidae), in south - western Australia. *Bulletin of Entomological Research*, England, v. 74, n. 2, p. 191 - 195, 1984.
- YAMADA, D.; IMURA, O.; SHI, K.; SHIBUYA, T. Effect of tunneler dung beetles on cattle dung decomposition, soil nutrients and herbage growth. *Grassland Science*, Japan, v. 53, n. 2, p. 121 - 129, 2007.