

**FIRST RECORD OF *Eucalyptus* spp. BARK-STRIPPING BY BROWN-CAPUCHIN MONKEYS
(*Sapajus nigritus*, PRIMATES: CEBIDAE)**

PRIMEIRO REGISTRO DE DESCASCAMENTO DE *Eucalyptus* spp. POR MACACOS-PREGO
(*Sapajus nigritus*, PRIMATES: CEBIDAE)

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ABSTRACT

Conflicts involving wild animals and forest plantations are registered all over the world, including the bark-stripping of native and exotic tree species by primates. In Southern Brazil, the Brown-capuchin monkey (*Sapajus nigritus*) is well-known for damaging commercial plantations of *Pinus* spp. and *Araucaria angustifolia*. In this paper, however, we report, for the first time in the literature the bark-stripping of *Eucalyptus* spp. by these monkeys. Considering the growing areas of eucalypt plantations in Brazil and neighboring countries, the information presented here is of great importance to the economy of Forestry. It also enhances the need of scientific studies aimed to minimize the damage for the production without jeopardizing wildlife conservation, as those designed to monitor the availability of food resources (mainly fruits) in native forest remnants and to improve it through the restoration of degraded forests or even those that seek for natural deterrents.

Keywords: damages; eucalypt; feeding behavior; wildlife conservation.

RESUMO

Conflitos envolvendo animais selvagens e plantios comerciais têm sido comumente registrados em todo o mundo, incluindo o descascamento de árvores nativas ou exóticas por primatas. No sul do Brasil, o macaco-prego (*Sapajus nigritus*) é responsável por provocar danos em plantios comerciais de *Pinus* spp e *Araucaria angustifolia*. Nesse artigo, apresentamos de forma inédita na literatura o descascamento de *Eucalyptus* spp. por macacos-prego. Considerando o crescimento das áreas com plantios de eucaliptos no Brasil e países vizinhos, a informação apresentada aqui é de grande importância para a economia florestal. Ele também ressalta a necessidade de estudos científicos que visem minimizar os danos causados à produção sem comprometer a conservação da vida selvagem, como aqueles que visam monitorar a disponibilidade de recursos alimentares (principalmente frutos) em fragmentos de floresta nativa e incrementá-la por meio da recuperação de áreas depauperadas ou ainda aqueles que buscam compostos naturais deterrentes.

Palavras-chave: danos; eucalipto; comportamento alimentar; conservação biodiversidade.

INTRODUCTION

The Brown-capuchin monkey is endemic in the Atlantic Forest, being distributed from Southeastern and Southern Brazil to Northeastern Argentina (VILANOVA et al., 2005). However, other *Sapajus* species are found in other parts of Brazil and abroad (AURICCHIO, 1995; RYLANDS

et al., 2005), three of them endangered in this country (MACHADO et al., 2008). Capuchins are omnivorous primates which diet is composed by fruits, seeds, bulbs, insects, bird eggs and small vertebrates (GALETTI and PEDRONI, 1994; MIKICH, 2001; LUDWIG et al., 2005; SANTOS et al., 2007). Along with behavioral plasticity, omnivore favors the occupation of several forested

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habitats, from large remnants and continuous forests to tiny fragments and largely disturbed areas (IZAWA, 1979; 1980; JOHNS and SKORUPA, 1987; ESCOBAR-PÁRAMO, 1989; FRAGASZY et al., 1990), where they provide important environmental services like seed dispersal and insect predation (BERNARDO and GALETTI, 2004; MIKICH, 2001; VIDOLIN and MIKICH, 2004; MOURA and MCCONKEY, 2007).

Bark-stripping of native and exotic trees by primates have been recorded all over the world (VON DEM BUSSCHE and VAN DER ZEE, 1985; MAGANGA and WRIGHT, 1991; CIANI et al., 2001; KATSVANGA et al., 2006; GWENZI et al., 2007; KATSVANGA et al., 2009). The damage produced by the Brown-capuchin monkey (*Sapajus nigritus*) to *Pinus* spp. trees has been frequently reported in Southern Brazil for at least 20 years (KOEHLER and FIRKOWSKI, 1996; ROCHA, 2000; SANTOS et al., 2007; MIKICH and LIEBSCH, 2009). Besides, there are records of similar damage produced by this monkey to *Araucaria angustifolia* (MIKICH and LIEBSCH, 2009), a native tree of Southern Brazil. The damage is caused when the animal strips the upper part of the bark, what increases the probability of the attack by pathogens or insect pests (MAGANGA and WRIGHT, 1991; ROCHA, 2000), losing its canopy or die (KOEHLER and FIRKOWSKI, 1996). Here, we present the first record of *Eucalyptus* spp. bark-stripping by *Sapajus nigritus* in Southern Brazil.

MATERIAL AND METHODS

Observations were made at Celulose Irani S.A. properties (26° 52' 05" S and 51° 47' 40" E) located in Santa Catarina state, Southern Brazil, where capuchin monkeys and their damage to *Pinus* spp. plantations have been studied since 2006. These properties are covered by Araucaria Forest in different successional stages (34,4% of area), *Pinus* spp. (43,7%) and *Eucalyptus* spp. stands (4,6%), besides other land uses (17,3%). The climate, according to Köppen (1948), is mesothermal humid subtropical (Cfb) with the mean temperature of the hottest month lower than 22 °C and the coolest month lower than 18 °C, no dry season, a mild summer and strong frequent frosts.

Irani plantations, native forests and capuchin groups were monitored since 2006 at least five days per month in order to obtain information on habitat use, damage and food consumption.

To do so, we walked a system of 30 km of trails that cross plantations and native forests in order to find groups of capuchin monkeys and record their feeding behavior and habitat use. We also marked some individuals with radio transmitters so that we could locate some groups using a receiver. It was during such monitoring activities that we observed capuchin monkeys feeding on eucalypt trees, as described below.

RESULTS

The first record of damages in eucalypt was made in 2007, when one monkey was observed bark-stripping a single tree located between a pinus stand and an Araucaria Forest remnant and for this reason used frequently as a path by the capuchins. The damage was a small (40x15 cm) single panel (window).

During the field evaluations conducted in early June 2009 it was found sixty 5-year-old *Eucalyptus badjensis* Beuzev. & Welch trees damaged more than eight months earlier (based on the growth of the bark surrounding the wound) in a 8 ha stand located only 20 m apart from the isolated tree damaged in 2007. The injuries were very similar to those caused by capuchins to pinus trees and were probably caused by the group of that individual observed damaging the tree two years earlier (Figure 1a and 1b).

After that, it was observed two groups (A and B) of *Sapajus nigritus* bark-stripping *Eucalyptus* spp. in 10 different occasions, all between June and July 2009 (Table 1). The first visual record of bark-stripping was made on the morning of June 9, when group A, composed by 13 individuals of different gender and age at that time, was inside (100m from the border) an eucalypt stand and damaged 21 trees.

Damage, in all cases, was similar to those already described by MIKICH AND LIEBSCH (2009) for pine trees, being concentrated in the upper part of the trunk, where the bark is thinner and flexible. The monkeys strip the bark vertically with the teeth first and then with the hands, removing strips with 5-8 x 50-80 cm. After that, they consume the phloem, which is scratched with the teeth or the nails.

The same group was observed the next day in four large *Eucalyptus viminalis* Labill trees situated within a native forest fragment. In this case, however, injuries were made mainly on branches

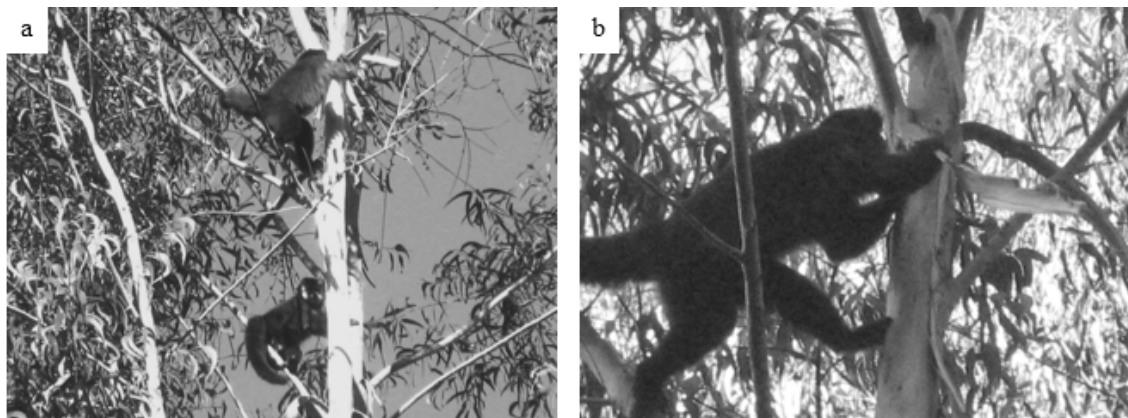


FIGURE 1: *Sapajus nigritus* bark-stripping *Eucalyptus* sp. Trees (a). Detail of a monkey removing the bark of an adult *Eucalyptus* sp tree (b).

FIGURA 1: *Sapajus nigritus* descascando árvore de *Eucalyptus* sp. (a). Detalhe de um macaco removendo a casca de uma árvore adulta de *Eucalyptus* sp.

TABLE 1: Events of *Eucalyptus* spp. bark-stripping by *Sapajus s nigritus*.

TABELA 1: Eventos de descascamento de *Eucalyptus* spp. por *Sapajus nigritus*.

Date	Group	Number of monkeys involved in bark-stripping	Number of eucalypts injured
July 2007	A	1	1
Winter 2008	A	-	60
Winter 2008	B	-	2
June 09, 2009	A	13	21
June 10, 2009	A	14	4
June 11, 2009	B	1	1
July 01, 2009	A	10	+ 30
July 10, 2009	B	1	7
July 28, 2009	A	13	+ 30
July 28, 2009	B	1	4
July 29, 2009	A	13	+ 30
July 30, 2009	A	14	+ 30
July 30, 2009	B	1	7

less than 10 cm thick, but when made on thicker branches or on the tree trunk, the strips were short and wide (30 x 10 cm), probably due to the little flexibility of the bark. Up to five monkeys were seen simultaneously on the same tree. Other records for group A were similar to these.

In June 2009, group B, which was composed at that time of 32 individuals, was recorded in an 8-year-old *Eucalyptus badjensis* stand. They were looking for invertebrates under the loosen bark of the lower part of the tree trunk. However, we found three injured individuals, two of them probably from a year earlier and one from the same day. In July, we

witnessed a single individual of this group stripping trees of their bark in three different occasions.

DISCUSSION

Brown-capuchin monkeys are generalists (GALETTI and PEDRONI, 1994; AURICCHIO, 1995; MIKICH, 2001; SILVA, 2007) and their diet can change strongly along the year and among different years depending on food availability (BROWN and ZUNINO, 1990; PERES, 1994; GALETTI and PEDRONI, 1994; ZHANG, 1995; MIKICH, 2001). Studies conducted in Southern

Brazil indicate that capuchins strip the trees to consume elaborated sap and the phloem itself during periods of fruit scarcity, as a temporary feeding strategy (LIEBSCH and MIKICH, 2009; MIKICH and LIEBSCH, 2009). Damage to forest plantations caused by capuchins in Brazil has been reported exclusively for *Pinus* spp. (LIMA, 1993; KOEHLER and FIRKOWSKI, 1996; ROCHA, 2000; SANTOS et al., 2007; MIKICH and LIEBSCH, 2009) and *A. angustifolia* (MIKICH and LIEBSCH, 2009) so far.

From the productive point of view, bark-stripping of *Eucalyptus* spp. trees by capuchins causes serious concerns, since this genus occupies huge areas of planted forests in Brazil (4.754.000 ha), larger than those occupied by *Pinus* spp. plantations (1.756.000 ha) according to ABRAF (2011). Besides, eucalypts had been suggested by Rocha (2000) as an alternative to reduce the economic loss of pinus bark-stripping by capuchins.

CONCLUSIONS

Studies on the interactions among *Sapajus nigritus* and commercial tree species, including *Eucalyptus* spp., whose objective are to develop management protocols to conciliate productiveness and conservation should be improved. These studies must include at least the evaluation of damage and economic losses as well as the monitoring of natural food resources available to capuchin monkeys inside the native forest remnants. Wherever necessary, forest restoration programs must take place in order to improve habitat quality for the capuchins and other wild species and, consequently, to reduce the pressure upon forest plantation resources. The search for natural deterrents must also be considered.

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REFERENCES

- ABRAF – Associação Brasileira de Produtores de Florestas Plantadas. **Anuário estatístico da ABRAF** – ano base 2010. Brasília: ABRAF, 2011. 130 p.
- AURICCHIO, P. Primatas do Brasil. São Paulo: Terra Brasilis, 1995. 168 p.
- BERNARDO, C. S. S.; GALETTI, M. Densidade e tamanho populacional de primatas em um fragmento florestal no sudeste do Brasil. **Revista Brasileira de Zoologia**, v. 21, p. 827-832. 2004.
- BROWN A. D.; ZUNINO, G.E. Dietary variability in *Cebus nigritus* in extreme habitats: evidence for adaptability. **Folia Primatologica**, v. 54, p. 187-195. 1990.
- CIANI, A. C. et al. Effects of water availability and habitat quality on bark-stripping behavior in barbary macaques. **Conservation Biology**, v. 15, p. 259-265. 2001.
- ESCOBAR-PÁRAMO, P. Social relations between infants and other group members in the wild black-capped capuchin (*Cebus apella*). **Field Studies of New World Monkeys**, v. 2, p. 57-63. 1989.
- FRAGASZY, D. M.; VISALBERGHI, E.; ROBINSON, J. G. Variability and adaptability in the genus *Cebus*. **Folia Primatologica**, v. 54, p. 114-118. 1990.
- GALETTI, M.; PEDRONI, F. Seasonal diet of capuchin monkeys (*Cebus apella*) in a Semideciduous Forest in south-east Brazil. **Journal of Tropical Ecology**, v. 10, p. 27-39. 1994.
- GWENZI, D. et al. Baboon *Paio ursinus* ranging patterns and troop size relative to bark stripping in the Chimanimani Pine Plantations of Zimbabwe. **Acta Zoologica Sinica**, v. 55, p. 777-782. 2007.
- IZAWA, K. Foods and feeding behavior of wild black-capped capuchin (*Cebus apella*). **Primates**, v. 20, p. 57-76. 1979.
- IZAWA, K. Social behavior of the wild black-capped capuchin (*Cebus apella*). **Primates**, v. 21, p. 443-467. 1980.
- JOHNS, A. D.; SKORUPA, J. P. Responses of rain-forest primates to habitat disturbance: a review. **International Journal of Primatology**, v. 8, p. 157-191. 1987.
- KATSVANGA, C. A. T.; MUDYIWA, S. M.; GWENZI, D. Bark stripping and population dynamics of baboon troops after chemical control in pine plantations of Zimbabwe. **African Journal of Ecology**, v. 44, p. 413-416. 2006.
- KATSVANGA, C. A. T. et al. Susceptibility of pine stands to bark stripping by chacma baboons *Papio ursinus* in the Eastern Highlands of Zimbabwe. **Current Zoology**, v. 55, p. 389-395. 2009.

- KOEHLER, A.; FIRKOWSKI, C. Descascamento de pinus por *Cebus apella*. **Floresta**, Curitiba, v. 24, p. 61-75. 1996.
- KÖPPEN, W. **Climatologia**. México: Fondo de Cultura Económica. 1948.
- LIEBSCH, D.; MIKICH, S. B. Fenologia reprodutiva de espécies vegetais da Floresta Ombrófila Mista do Paraná, Brasil. **Revista Brasileira de Botânica**, v. 32, p. 275-391. 2009.
- LIMA, G. S. Manejo e conservação de fauna silvestre em áreas de reflorestamento. **Estudos de Biologia**, v. 34, p. 5-15. 1993.
- LUDWIG, G.; AGUIAR, L. M.; ROCHA, V. J. Uma Avaliação da Dieta, da Área de Vida e das Estimativas Populacionais de *Cebus nigritus* (Goldfuss, 1809) em um Fragmento Florestal no Norte do Estado do Paraná. **Neotropical Primates**, v. 3, p. 12-18. 2005.
- MACHADO, A. B. M.; DRUMMOND, G. M.; PAGLIA, A. P. Livro vermelho da fauna brasileira ameaçada de extinção, v. 2. Brasília; Belo Horizonte: MMA/Fundação Biodiversitas. 2008. 1420 p.
- MAGANGA, S. L. S.; WRIGHT, R. G. Bark-stripping by blue monkeys in a Tanzanian forest plantation. **Tropical Pest Management**, v. 37, p. 169-174. 1991.
- MIKICH, S. B. Frugivoria e dispersão de sementes em uma pequena reserva isolada do Estado do Paraná, Brasil. 2001. 145 f. Tese (Doutorado em Zoologia) - Universidade Federal do Paraná, Curitiba, 2001.
- MIKICH, S. B.; LIEBSCH, D. O macaco-prego e os plantios de *Pinus* spp. **Comunicado Técnico Embrapa Florestas**, v. 234, p. 1-5. 2009.
- MOURA, A. C. A.; MCCONKEY, K. R. The Capuchin, the Howler, and the Caatinga: Seed Dispersal by Monkeys in a Threatened Brazilian Forest. **American Journal of Primatology**, v. 69, p. 220-226. 2007.
- PERES, C. A. Primate responses to phenological changes in amazonian terra firme forest. **Biotropica**, v. 26, p. 8-112. 1994.
- ROCHA, V. J. Macaco-prego: como controlar esta nova praga florestal? **Floresta**, v. 30, p. 95-99. 2000.
- RYLANDS, A. B.; KIERULFF, M. C. M.; MITTERMEIER, R. A. Notes on the taxonomy and distributions of the tufted capuchin monkeys (*Cebus*, Cebidae) of South America. **Lundiana**, v. 6, p. 97-110. 2005.
- SANTOS, C. V. et al. Ecologia, comportamento e manejo de primatas invasores e populações-problema. In: A PRIMATOLOGIA NO BRASIL, 10., 2007, Porto Alegre. **Anais...** Porto Alegre: Sociedade Brasileira de Primatologia, 2007, p. 101-118.
- SILVA, C. R. Registro de alimentação noturna em macaco-prego (*Cebus apella*). **Neotropical Primates**, v. 14, p. 72-74. 2007.
- VIDOLIN, G. P.; MIKICH, S. B. *Cebus nigritus* (Primates: Cebidae) no P. E. Vila Rica do Espírito Santo, Fênix – PR: estimativa populacional e área de vida, composição e dinâmica dos grupos. In: CONGRESSO BRASILEIRO DE UNIDADES DE CONSERVAÇÃO, 4., 2004. Curitiba. **Anais...** Curitiba: FBPN, 2004. p. 196-205.
- VILANOVA, R. et al. Limites climáticos e vegetacionais das distribuições de *Cebus nigritus* e *Cebus robustus* (Cebinae, Platyrrhini). **Neotropical Primates**, v. 13, p. 14-19. 2005.
- VON DEM BUSSCHE, G. H.; VAN DER ZEE, D. Damage by samango monkeys to pine trees in the northern Transvaal. **South African Forestry Journal**, v. 133, p. 43-48. 1985.
- ZHANG, S. Activity and ranging patterns in relation to fruit utilization by brown capuchins (*Cebus apella*) in French Guiana. **International Journal of Primatology**, v. 16, p. 489-507. 1995.