

BLACK-TUFTED-EAR MARMOSET *CALLITHRIX*
PENICILLATA (PRIMATES: CALLITRICHIDAE)
 FOLLOWING THE ARMY ANT *LABIDUS PRAEDATOR*
 (FORMICIDAE: ECITONINAE) IN THE CERRADO
 AND THE ATLANTIC FOREST, BRAZIL

Tadeu Artur de Melo Júnior
 Fernando José Zara

Introduction

Army ants have different intra- and extranidal symbiotic associations with invertebrates and vertebrates (Gottwald, 1995). Vertebrates that feed on arthropods disturbed by the army ants include the anuran *Bufo marinus*; lizards such as *Ameiva*, *Kentropyx*, *Anolis frenatus*, and *Tupinambis merinanae*; a large number of birds; and callitrichids (Willis and Oniki, 1978, 1992; Rylands *et al.*, 1989; Martins, 2000; Melo Júnior and Zara, pers. observ.). The best studied associations between vertebrates and army ants in the Neotropical region are those between birds and ants. More than 50 species from the families Cuculidae, Cracidae, Dendrocolaptidae, Formicariidae, Thamnophilidae, Rallidae, Tinamidae and Thraupidae have been observed to follow army ants and to pick off arthropods flying or sitting on forest litter that was disturbed by the army ants *Eciton burchelli* and *Labidus praedator* (Willis and Oniki, 1978, 1992). According to Gottwald (1995), swarm-following birds have to compete with marmosets for this food resource stirred up by progressing army ants. However, marmosets only opportunistically exploit the arthropods flushed by swarms of *E. burchelli* and *L. praedator* (Rylands *et al.*, 1989; Martins, 2000). These two army ant species present a similar broad swarm-raiding pattern (Teles da Silva, 1982; Rylands *et al.*, 1989; Gottwald, 1995) that may cause higher prey disturbance in the forest litter than the columnar raiding pattern of *Eciton hamatum* (Teles da Silva, 1982).

In the Neotropics, five species from the genus *Callithrix*—*C. humeralifer*, *C. kuhli*, *C. flaviceps*, *C. geoffroyi*, and *C. aurita*—have been reported to take arthropods over swarms of army ants (Rylands *et al.*, 1989; Martins, 2000). Marmosets seem to associate more frequently with *E. burchelli* than with *L. praedator* (Rylands *et al.*, 1989), and *C. aurita* was only observed in association with *Labidus* sp. during the dry season (Martins, 2000). Association with army ants has not been recorded for *C. penicillata* and *C. jacchus* so far, possibly due to a relative scarcity or absence of army ants in the drier regions of cerrado (Brazilian savanna) and semi-deciduous scrub and woodlands of Brazilian caatinga (Rylands *et al.*, 1989). However, *L. praedator* has a wide geographic distribution and ranges from central Mexico (San Luis Potosi) to northern Argentina (Borgmeier, 1955; Rettenmeier, 1963); it has been collected in some regions of the Cerrado (Kempf, 1972; Watkins, 1976). Here we report the association between *Callithrix penicillata* and the army ant *L. praedator*

on three different occasions at two localities in the Cerrado and the Atlantic Forest of Brazil.

Methods

One observation was made during a field study in the Parque Estadual Fernão Dias (44°04'W, 19°56'S), Minas Gerais, located in a transitional area between the Atlantic Forest and the Cerrado. This protected area has about 2000 ha and varies in altitude between 850 and 950 m a.s.l. (Melo Júnior, 2000). The other two observations were made at the Parque Estadual da Ilha Anchieta (45°01'W, 23°32'S), Ubatuba, São Paulo. This protected 828-ha island is located 600 m from the continent. Both observations on the island were made at different points of the Saco Grande trail, which crosses a fragment of rainforest. In March 1983, five *C. penicillata* were introduced to Ilha Anchieta by the Fundação Parque Zoológico de São Paulo (Guillaumon *et al.*, 1989), and now these marmosets are the most abundant primate on this island (Galetti, pers. comm.). Army ant samples were collected and identified as *L. praedator* according to Borgmeier (1955, p. 84: major worker) and Watkins (1976: worker key 8).

Results and Discussion

The first association was observed on 11 October 1999, in the late dry season. A group of seven black-tufted marmosets, *C. penicillata*, was seen following the army ant *L. praedator*. Total observation time lasted 42 minutes, but the total time that this group followed the army ants was longer, because the marmosets were already near the ground when observations began. On eight different opportunities, individual marmosets were seen to take insects on the ground, an uncommon behavior for marmosets. Two other observations of *C. penicillata* following the army ant *L. praedator* were made on 23 January 2000 and 7 February 2003, both during the rainy season on Ilha Anchieta. The first observation lasted for 12 min and occurred at 08:45. Two individuals from a group of six individuals were seen close to the swarm front, at about 0.5 m from the ground. The other members sat on branches at around 3–5 m above ground and emitted alarm calls towards the observers. To avoid interference, we retreated to a distance of 5 m and made further observations using binoculars. Marmosets were observed taking arthropods from the ground. The army ants showed a small swarm front (0.5 m wide) near the marmosets. Other swarm fronts (not exploited by marmosets) were observed, but most of the ants remained in columns. The raiding pattern seemed more columnar, similar to the description by Fowler (1979). The marmosets stopped foraging over the army ants due to disturbance from arriving tourists. The second record started at 09:15 when a group of seven marmosets was observed capturing flushed arthropods over the swarm front during 38 min. This time the army ants were foraging in a swarm raiding pattern, similar to descriptions by Borgmeier (1955) and Rettenmeier

(1963). This swarm raid was more vigorous than the first and more than 2 m wide. The marmosets were positioned at the front of the swarm and over the fan area on branches at 0.3–1 m above ground. Three different individuals were observed going down to the ground and capturing arthropods ahead of the swarm on seven different occasions.

Our observations indicate that *C. penicillata* may follow the army ant *L. praedator* and use disturbed arthropods as a food source, similar to what has been described for *C. humeralifer*, *C. kubli*, *C. flaviceps*, *C. geoffroyi* (Rylands *et al.*, 1989), and *C. aurita* (Martins, 2000). Flushed arthropods captured by the marmosets included crickets, grasshoppers, cockroaches, and spiders, in line with what has been described for other *Callithrix* species (Rylands *et al.*, 1989; Martins, 2000). Moths, true bugs (Hemiptera), and beetles that are usually preyed upon by *L. praedator* (Borgmeier, 1955; Rettenmeier, 1963; Gottwald, 1995) were also preyed upon by the marmosets during our observations. We did not observe the marmosets taking prey that had been captured by the army ants, as reported for *C. humeralifer* by Rylands *et al.* (1989).

The *C. penicillata* individuals that captured insects were located on branches below 1 m, similar to other *Callithrix* species during ant following (Rylands *et al.*, 1989). They were always in the center of the swarm front or fan area. This positioning resembles that described for dominant birds during ant following. According to Willis and Oniki (1978, 1992), large dominant birds occupy the central and probably best zone of high prey disturbance in the swarm front, while medium-sized birds were chased off to more peripheral zones with fewer flushed arthropods. According to Martins (2000), for *C. aurita* following army ants is more attractive during the dry months, when availability of arthropods and other resources is low. Paradoxically, during the dry and cold months, *L. praedator* performs fewer and less intense raids (Fowler, 1979). For *C. penicillata*, following behavior seems to be more opportunistic and related to the presence or absence of the army ants in swarm raid pattern rather than to season. Rylands *et al.* (1989) suggested that this association has not been observed for *C. penicillata* and *C. jacchus* possibly due to the relative scarcity or absence of this ant species in their ranges. This is probably true for *C. jacchus* in the Caatinga, where there are no records for *L. praedator*. In the Cerrado, however, *L. praedator* is one of the most common army ants collected (Zara, unpubl. data), and original records of these army ants in the Cerrado were presented in Kempf (1972) and Watkins (1976).

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Tadeu Artur de Melo Júnior, UNIFRAN, Universidade de Franca, Avenida Armando Salles de Oliveira s/n, Franca, SP, Brazil, CEP 14404-600, e-mail: <tadeu@unifran.br>, and **Fernando José Zara**, UNESP – Campus do Litoral Paulista, Unidade de São Vicente, Praça Infante Don Henrique s/n São Vicente, SP, Brazil, CEP 11330-900, e-mail: <fjzara@csv.unesp.br>.

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