Foraging behavior and microhabitats used by black lion tamarins, *Leontopithecus chrysopygus* (Mikan) (Primates, Callitrichidae) [1]

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ABSTRACT. Foraging in the Black Lion Tamarin (*L. chrysopygus* Mikan, 1823) was observed in the Caetetus Ecological Station, São Paulo, southeastern Brazil, during 83 days between November 1988 to October 1990. These tamarins use manipulative, specific-site foraging behavior. When searching for animal prey items, they examine a variety of microhabitats (dry palm leaves, twigs, under loose bark, in tree cavities). These microhabitats were spatially dispersed among different forest macrohabitats such as swamp forests and dry forested areas. These data indicated that the prey foraging behavior of *L. chrysopygus* was quite variable, and they used a wide variety of microhabitats, different of the other lion tamarin species.
KEY WORDS. Callitrichidae, *Leontopithecus chrysopygus*, black lion tamarin, animal prey, foraging behavior, diet, microhabitats

Lion tamarins, *Leontopithecus* Lesson, 1840, are considered primarily insectivores and frugivores (COIMBRA-FILHO & MITTERMEIER 1973), or omnivores (KLEIMAN *et al.* 1988) because of the diversity of their diet. In the wild, they consume mostly fruits, exudates, nectar, and animal prey. In comparison to fruits, animal prey make up a relatively small proportion of the diet and are costly to obtain, but its nutritional value make it an essential component of their diet. The prey of black lion tamarins (*L. chrysopygus*) may include a variety of invertebrates (insects, spiders, and other arthropods) and small vertebrates, such as anuran frogs (CARVALHO *et al.* 1989; PASSOS 1999). In this note, we present our observations on prey foraging. We then compare them with studies of other lion tamarin species and discuss some of the unique aspects of black lion tamarin foraging in relation to the microhabitats they use.

MATERIAL AND METHODS

The foraging behavior of a group of radio-collared black lion tamarins at the 2,179 ha Caetetus Ecological Station in south-central São Paulo state, south-east Brazil (22°23'S, 49°49'W) was studied. The group was observed for 11-12 hours during 30 days in November to December 1988. The same group was followed from

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January to June 1989 and April to October 1990, for a total over 53 days of observations. The studies included observations from both the wet and dry seasons. The number of individuals in the group ranged from 5-7. Activities were recorded by daily scan sampling at 15 minute intervals.

RESULTS AND DISCUSSION

The behavior used by black lion tamarin to locate and capture animal prey was manipulative, specific-site foraging. As described by RYLANDS (1993), this type of foraging is characterized by searching for concealed, often immobile prey in specific microhabitats. We noted that before an animal prey was located, the group members foraged alone or in pairs in the mid to lower canopy (PASSOS 1994). They searched among dry palm leaves, twigs, under loose bark, in tree cavities of all sizes, and in moss patches and epiphytes. While foraging, sometimes the black lion tamarins would stop and stare with evident concentration at one spot. Non-mobile insect prey were often seized after this intense, focused behavior.

If the tamarins were aware of a prey item in a concealed location, *e.g.* a tree crevice, they were persistent in their efforts to capture it. If the location was very constricted, the tamarins sometimes acted aggressively toward each other, shoving and pushing. This unusual behavior indicated the intensity of their efforts and the dietary importance of animal prey. In addition, adults were frequently observed sharing captured animals with the infants, especially when the prey were large, such as anurans, cerambycid coleopterans (long-horned beetles), or tettigoniid orthopterans (katydids). When a tamarin found and captured an insect, it emitted a soft "prrr", whereupon other members of the group congregated to search that area.

Specific-site foraging was used by the other lion tamarin species and associated with the capture of non-mobile prey (RYLANDS 1993). PERES (1989) observed that non-mobile prey accounted for 98% of the captures for *Leontopithecus rosalia* (Linnaeus, 1766), the golden lion tamarin. VALLADARES-PADUA (unpublished data), who studied four groups of black lion tamarins at the 34,441 ha Morro do Diabo State Park in western São Paulo state, documented that 72% of the animal prey were non-mobile.

In a previous study at the Morro do Diabo State Park, CARVALHO & CARVALHO (1989) noted that the black lion tamarins allocated most of their time to searching the middle to lower canopy while foraging for animal prey. In addition, we and CARVALHO & CARVALHO (1989) observed that they captured prey and even collected fruits from the ground.

The black lion tamarins foraged for animal prey in a wide variety of microhabitats. They frequently foraged on the palm species, *Syagrus romanzoffiana* Glass., *Syagrus oleracea* (Mart.) Becc. and *Euterpe edulis* Mart., which have a diversity of microhabitats for arthropods. The tamarins searched on the palm fronds, in the sheaths of fronds and flowers, and among clusters of fruits. Many insects, especially cockroaches (Blattaria), inhabit these microhabitats. PERES (1989) and DAWSON (1979) observed similar behavior for *L. rosalia* and *Saguinus oedipus geoffroyi* Pucheran 1845, respectively.

The black lion tamarins foraging was observed for prey in fallen, dried out seed pods of the "jequitibá" tree (*Cariniana estrellensis* (Raddi) Kuntze, Lecythidaceae). Tamarins captured insects and spiders, and collected old seeds from the pods. Other prey foraging microhabitats included vine entanglements, where there were large accumulations of dried leaves and leaf-litter arthropods. Bamboo thickets were also searched. The tamarins inserted their hands in the cracks of dry bamboo and often found arthropod adults and larvae. They foraged among materials in decomposition, such as rotting logs, and captured the larvae of cerambycid beetles (Coleoptera). The black lion tamarins used their long fingers and claws to yank off pieces of bark and search for insect larvae. The golden lion tamarins also foraged among vine tangles, dead bamboo, and litter (PERES 1989).

The microhabitats used by *L. chrysopygus* were spatially dispersed among different forest habitats. In humid sections of the forest, such as palmetto (*Euterpe edulis*) swamps and stream riparian zones, the foraging sites available to the black lion tamarins were principally palmetto microhabitats and tree cavities. In drier areas, the microhabitats of the other palms (*Syagrus romanzoffiana* e *S. oleracea*), bamboo and vine thickets, "jequitibá" pods, and tree cavities were available to the tamarins.

In comparison to the golden lion tamarin, *L. rosalia* (COIMBRA-FILHO & MITTERMEIER 1973; PERES 1989), the golden-faced lion tamarin, *Leontopithecus chrysomelas* (Kuhl, 1820) (RYLANDS 1989), and the black-faced lion tamarin, *Leontopithecus caissara* (Lorini & Person, 1990) (M.L. Lorini, personal communication) that spend considerable time foraging in epiphytes, especially bromeliads (Bromeliaceae), the black lion tamarins foraged only occasionally in this type of microhabitat. This difference may be associated to the epiphytic richness that occurs on the coast of the Atlantic Forest where the other lion tamarins reside. At the Morro do Diabo State Park, bromeliads are absent , and at the Caetetus Ecological Station, they occur in low densities. Other epiphytes, such as cacti (Cactaceae) and orchids (Orchidaceae), provided foraging sites for the black lion tamarins when available.

Quantifying insects that tamarins consume is a difficult task, because only large species or dropped fragments can be identified. However, was collected pieces of 26 insects that were eaten by the tamarins. Thirteen of these (50%) were coleopterans, mostly Cerambycidae, subfamily Prioninae, 12 (46%) were katydids of the superfamily Tettigonoidea and Blattaria (cockroaches), and one (4%) was a planthopper (Homoptera, Acanaloniidae). Tettigoniid orthopterans, an important source of proteins and lipids, were the most common insect prey for the Panamanian tamarin (*Saguinus oedipus geoffroyi*) (GARBER 1984). Stick insects (Phasmatodea) and caterpillars of Lepidoptera are also prey, and more unusual prey included snails, lizards, snakes, young birds, inactive bee hives, and spider webs (VALLADARES-PADUA, unpublished data).

In comparison to other callitrichids, the species of *Leontopithecus*, in general, may be less flexible ecologically due to their specialized use of epiphytes microhabitats for foraging and other factors (FERRARI 1993). However, the study of VALLADARES-PADUA (unpublished data) and this study indicated that the prey foraging of at least *L. chrysopygus* was quite variable. Black lion tamarins used a wide variety of microhabitats and forest types, and their foraging habits appeared to be adjusted to the daily, monthly, and seasonal cycles of prey availability

(KEUROGHLIAN & PASSOS, unpublished data), *i.e.* foraging effort was higher during periods when animal prey made up a larger portion of the diet.

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