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PRIMATES OF THE ITUBERÁ FOREST COMPLEX, BAHIA, BRAZIL

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Introduction

The near complete destruction of the Atlantic forest biome through deforestation and hunting has resulted in the precipitous decline of its endemic primates (Rylands *et al.*, 1997; Myers, 1987; Fonseca, 1985). Santos *et al.* (1987) pointed out the particular importance of preserving the remnant forests of southern Bahia where all six of the Atlantic forest primate genera historically occurred. The forests between the Rio de Contas and the Recôncavo of the Bahia have received only cursory scientific attention, and with the exception of surveys carried out by the WWF Primate Program (Mittermeier *et al.*, 1981, 1982; Santos *et al.*, 1987), by Alonso *et al.* (1987; *Callithrix* hybridization in the Recôncavo da Bahia), and by Oliver and Santos (1991), little information has been collected on the primates of this region. Here I report the results of a primate census from the forests near the town of Ituberá. Fundação BioBrasil (an NGO based in Salvador) initiated this study as part of an effort to determine the conservation value of these forests.

The Area

Ituberá is located on the southern Bahian coast (13°50'S, 39°15'W) in a hilly region dominated by plantation agriculture with rubber, cacao, oil palm, pupunha palm, guaraná, piaçava palm, heliconias, manioc and bananas, as the main crops, along with cattle ranching. The rich biological heritage of the area results from a diversity of distinct habitats including Atlantic

rain forest, *restinga* dune forest, salt marshes, freshwater wetlands, mangroves, estuaries, rivers, beach, and ocean. There is a minimum of 30,000 ha of forest remaining in the region (Fig. 1).

Methods

The study was conducted between May 1997 and July 1998. Primate censuses consisted of walking slowly (1 km/hour) along existing forest trails while scanning the canopy with the aid of binoculars, and yielded a total of 208 survey hours. Primate sightings and calls were also recorded while conducting other work in the forest (171 hours). All sightings and calls were mapped and then transferred onto 1:100,000 topographic maps (Brazil, SUDENE, 1975). The main fazendas (plantations/farms) surveyed and the primates found on these properties are shown in Figure 1. Attempts at estimating densities were abandoned after I realized that the harassed fauna was avoiding encounters with humans. As this violates the assumption that the animals will be detected prior to any movement in response to the observer (Peres, 1999; Southwell, 1996), I use frequency of encounters as a measure of relative abundance instead.

Results

Three species of primates were sighted: *Callicebus personatus*, *Cebus xanthosternos*, and a *Callithrix* species. *Brachyteles arachnoides* and *Alouatta fusca* no longer occur in the area.

Callithrix sp. (nico or mico)

The marmoset of the region resembles *Callithrix penicillata* shown in Plate 8 in Emmons and Feer (1997) with a dark gray body with gray and black stripes on the back, black head, a white "star" on the forehead, and black ear-tufts. Eighteen groups were seen and 13 others heard. Group sizes were difficult to determine because the marmosets fled quickly and traveled spread out in the canopy, but most (59%, $n = 17$) groups had a minimum of five animals and at least two groups had over 15. These marmosets are well adapted to the landscape mosaic of the region and were found inhabiting all forest types including degraded gallery forest, small isolated fragments, and *restinga* forests. They were most frequently seen in the upper canopy, but use all levels of the canopy and readily come to the ground to cross roads. This was the only primate species seen in agricultural lands (mostly in *cabruca* = cocoa groves where forest trees have been left for shade). Several

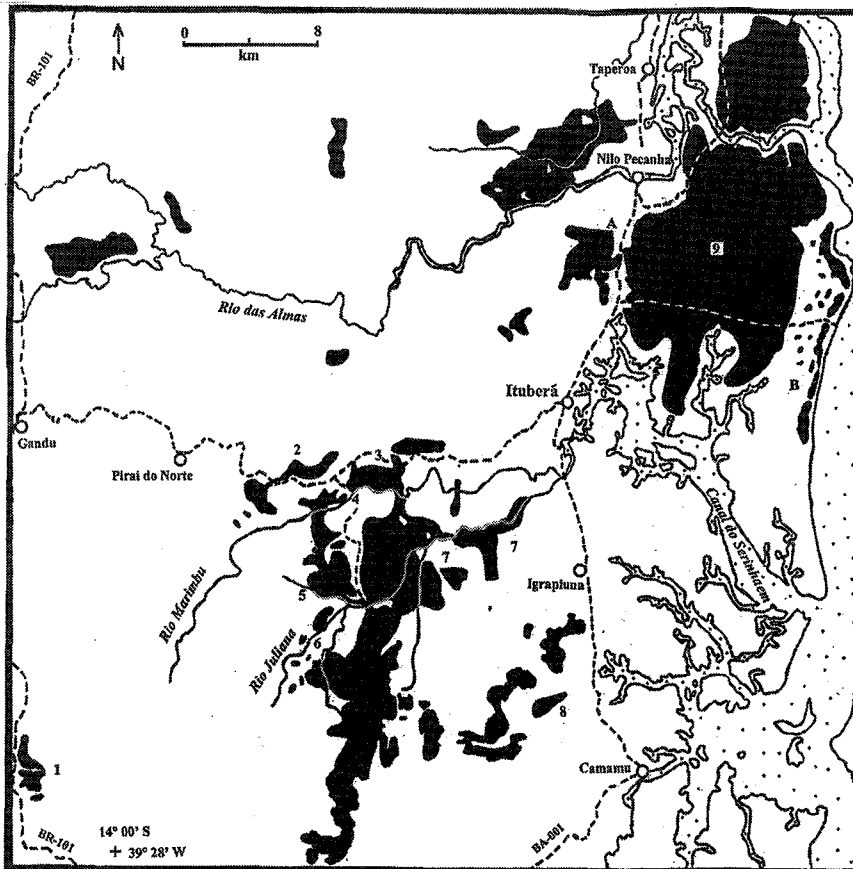


Figure 1. The Ituberá Forest Complex with primate sighting locations. The forest complex has two main fragments: 1) the 8-10,000 ha Pratiği *restinga* forest; 2.) the 7-9,000 ha Juliana/Marimbu basins-Camamu/Igrapiuana watersheds forest. Because most of the forest has been/is being logged, secondary forest dominates and old growth stands are extremely rare. All of the forest is on private property and only the Pratiği forest has protected status (APA = Environmental Protection Area). Numbers indicate the main study sites (fazendas), and C.x. = *Cebus xanthosternos*, C.p. = *Callicebus personatus*, Ca. = *Callithrix* sp.: 1) Paineras (C.x., C.p., Ca.); 2) Piauí (C.p., Ca.); 3) Karin (C.x., C.p., Ca.); 4) Gaudalope/Caipora (C.x., C.p., Ca.); 5) São Jose (C.p., Ca.); 6) Juliana (C.p., Ca.); 7) Plantações Michelin de Bahia (C.p., Ca.) (C.x. last seen in 1995); 8) Jacarandá (C.p., Ca.) (C.x. last seen 1994); 9) *Restingas*, mostly Fazenda Santarém, (Ca.) (C.p.?, C.x.? - this forest awaits a proper survey). Sites for C.x. for which anecdotal information was accepted - A) Three C.x. killed in 1997; B) Two C.x. seen in 'jataipeba' groves behind mangroves, 1998. Map sources - CNES, 1988; Brazil, SOS Mata Atlântica/INPE, 1997; Brazil, SUDENE, 1975. Aerial photographs 1997; and work on the ground 1997/98, Fundação BioBrasil.

people claimed that marmosets are poisonous and only one man was known to hunt them (he used them as fishing bait) and the species is in no immediate danger of extirpation.

Callicebus personatus (melanochir) (guigo)

These titis have long dull yellow/gray brown fur with orange/red on the lower back, sometimes going up the spine. The topside of the tail is orange/red while the underside is yellow/light brown. They have gray to black faces circled with a ring of darker fur and black/brown hands and feet. Masked titis were seen seven times and heard calling on 50 occasions. Of the groups seen, two consisted of three monkeys, three of two monkeys, and twice monkeys were seen alone. The titis appear to be well adapted to the mosaic of secondary forests (Pinto *et al.* 1993; Santos *et al.* 1987) and were encountered in all forest types except the old growth groves. They continue to survive in small (100-300 ha) isolated forest fragments, use forest edges, narrow (200 m wide) forest patches, and forest "peninsulas" jutting into agricultural lands. They were never seen in, heard calling from, or reported using agricultural lands, including *cabruca*. Anecdotal information suggests that they are absent from the *restinga* forests of Pratigi, and we neither heard nor saw titis there, but our surveys in this forest type were too brief (eight hours) to provide conclusive evidence one way or the other.

Titi monkeys are fairly abundant and widely distributed in the forests of the basins of the Rios Juliana and Marimbu and do not appear to be in immediate danger of extirpation. No one reported killing this monkey nor did people mention the species when asked to list the animals that were hunted, although when asked directly, hunters considered them edible. The titi's cryptic coloration and behavior, and small group sizes make this species difficult to find (Rylands *et al.*, 1997). Although their loud calls can make them vulnerable to hunters (Santos *et al.*, 1987), calling bouts in these forests typically consisted of a single burst (49%, n=22) or a series of short bursts with each burst lasting a few seconds to two minutes. These brief calling bouts allow a hunter little time to locate and approach the monkeys. Also, the titi's small size gives the hunter a low return for the effort required to kill it (Emmons, pers. comm.). The relative abundance of *C. personatus* in the Juliana and Marimbu basins makes these forests a high priority for the conservation of this threatened species.

Cebus xanthosternos (macaco-de-bando or macaco-prego-de-peito-amarelo)

Coloration was highly variable among the few individuals seen. The chest and back were dark brown to bright yellow, the shoulders and upper legs yellow, lower arms and legs brown, tail dark brown with yellow over-hairs, face dark to pink, bright yellow cap and a yellow ring around the face. Troops were only seen on three occasions, heard on another and reliably reported several times. Two of the sightings, the calling recorded, and all but one of the anecdotal accounts was of one group, and only three groups were known to exist there. Capuchins were seen in groups of two, three, and five animals. They use all forest types including the *restingas*. Anecdotal information suggests that capuchins used to be widespread and many people were familiar with the animal.

Various people reported knowing someone who had owned a pet capuchin, but none were located during the study.

Despite frequent reports that there were capuchins in particular forest patches, intensive searches almost always failed to locate them, and the extremely low encounter rate (1 encounter per 68 census hours) clearly indicates that this species is on the brink of extirpation. Three monkeys from one group were reportedly killed during our study. Its conspicuous group living, bright coloration, and relatively large size make it an optimal game species, and over-hunting as much as forestation is the main cause of species' decline (Coimbra-Filho *et al.*, 1992; Mittermeier *et al.*, 1989; Santos *et al.*, 1987). As this species is highly endangered, immediate efforts should be made to protect these remaining groups. If this cannot be achieved *in situ*, perhaps they should be removed to establish a captive-breeding colony.

Brachyteles arachnoides and *Alouatta fusca*

Neither of these species was seen, reported present, or familiar to any one in the area. Middle-aged hunters, whose fathers had hunted these forests before them, did not recall having heard their fathers mention them, so if they were present in the past, it must have been a long time ago.

Threats to the primate community

Agricultural expansion, logging, and hunting are the main threats to the primate community in the Ituberá forest. Habitat destruction threatens all three species, while hunting impacts especially *C. xanthosternos*. Agricultural expansion on the large plantations to increase pupunha palm production resulted in the loss of over one hundred hectares of forest. In addition to these clearings, the owner of Fazenda Contendas practically eliminated his forest by clearing over 50 ha to plant bananas and plantains. The owner of Itapema II has plans to clear several hundred hectares to plant pasture grasses.

Properties owned by small holders support little more than degraded hill top forest remnants, some of which were being cleared during the study, making it likely that all forest on these properties will be eliminated in the coming years. In the older established small holder areas such as the Colonia (established in the 1950s), the forest had already disappeared. The recent invasions of the Fazendas Karin and Cascata by more than 70 families of *sem terras* (landless peasants) poses a threat to the forests on these properties as the peasants consider them to be unproductive. They had cleared 15-20 ha by the end of the study.

Intensive logging began in the 1950s and most of the large trees were felled by the early 1980s. Logging continues with a minimum of 15 timber mills operating in the vicinity of the Ituberá forests. Fazendas Jubiaba, Cascata, and Itapema I and II and the forests of the Igrapiuna and Camamu watersheds were the main sites being logged in 1997/98.

Hunting, although illegal, is practiced openly. Most of the hunters are peasants who hunt for pleasure/subsistence, but there was at least one gang of commercial poachers operating in the Juliana/Marimbu forests. Gunshots were heard both

during the day and night, and traps and hides were abundant. Hunting has devastated the local fauna, with the largest mammals mostly extirpated and many of the medium-sized mammal populations severely reduced (Flesher 1997).

The Instituto do Desenvolvimento Sustentavel da Bacia do Rio Juliana (IDES) is an institute established in 1998 which includes many of the larger landowners and leading businessmen in the Ituberá area, and has proposed the construction of four small hydroelectric dams on the Juliana River and an access road along the north bank. If these plans are carried out, the resulting deforestation will eliminate wildlife habitat and split the 7-9,000 ha Juliana/Marimbu forest in half.

Conservation initiatives

Local conservation initiatives have been limited and insufficient to guarantee the protection of the flora and fauna. The Centro de Recursos Ambientais (CRA) has been the government agency most involved in conservation work and has taken several measures to try to stop deforestation. They have included shutting down several timber mills, requiring bakeries to switch from using wood to electric ovens, and creating an APA (Area de Proteção Ambiental) for the Pratigi *restinga* forest (8-10,000 ha). Another APA has been proposed for the Cachoeira Pancada Grande that would protect the 50 ha surrounding the waterfall. Fundação BioBrasil's approach has been to collect and disseminate data on the flora and fauna, to promote agroforestry, and to work with landowners in establishing private reserves. Some plantation owners have posted "No hunting" signs on their properties and they have been ineffective.

All of the land is in private ownership, and the establishment of private reserves (Reserva Particular de Patrimônio Nacional - RPPN) and APAs may be the best approach to protecting the remaining flora and fauna. The owners of fazendas Juliana, Piauí, California, Caipora, Paineras, Guadalupe, São José, Plantações Michelin de Bahia, Jacarandá, and several others have recently declared their forests protected, but little has been done beyond this, and few of the reserves have been officially registered. For the RPPN/APA approach to be effective, reserves will have to be officially registered and organized into a regional network, so that the forest can be managed as a single entity instead of as isolated units (Fonseca, 1985).

Conclusion

The Ituberá forest complex is one of the largest remaining fragments in Bahia and its importance as a potential site for the long-term preservation of the region's biodiversity should be acknowledged. This forest is large enough to support viable populations of the three primate species as well as populations of rare endemics such as the bristle-spine porcupine (*Chaetomys subspinosus*), the hairy dwarf porcupine (*Coendou insidiosus*), the maned sloth (*Bradypus torquatus*), and the gray slender mouse opossum (*Marmosops incanus*). Laws exist that protect both the flora and the fauna, but few are enforced, and logging, hunting, and agricultural expansion continue to erode the region's biodiversity. This critical

situation warrants the involvement of the larger NGOs that have the expertise and the financial resources to take on the multi-faceted challenge that effective conservation of Ituberá's fauna entails.

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PROSTHENORCHIS ELEGANS (OLIGACANTHORHYNCHIDA, OLIGACANTHORHYNCHIDAE) AND DIPETALONEMA SP. (SPIRURIDA, ONCHOCERCIDAE) IN SAIMIRI SCIUREUS (PRIMATES, CEBIDAE) IN BRAZIL

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Introduction

The use of nonhuman primates as models in biomedical research has contributed significantly to the development of Medical Primatology, and the growing interest in the biology of these mammals has demonstrated the need for a better understanding of their diseases, especially with regard to zoonoses (Cooper, 1968; Melo and Pereira, 1986; Cubas, 1996). New World primates are hosts to a large number of internal and external parasites, the study of which, in both wild and captive populations is most important in order to (1) determine the consequences of host-parasite interactions, (2) to identify adequate anti-parasitic agents, and (3) to identify infection sources to develop efficient control and prevention programs (Wolff, 1993). Cebids have been identified as hosts to a number of helminths, including *Oesophagostomum* sp., *Strongyloides cebus*, *Trypanoxyuris* sp., *Molineus* sp., *Filariopsis godius*, *Trichuris* sp., *Dipetalonema* sp. and *Prosthenorchis* sp. (Kuntz and Myers, 1972; Rego and Schaeffer, 1988; Wolff, 1993; Cubas, 1996; Diniz, 1997). Despite this, there is little published information on the occurrence and clinical aspects of helminth infections in, for example, the

widely-used model for biomedical research, the squirrel monkey, *Saimiri sciureus*. Here we report on two parasite species found during the autopsy of a wild caught *S. sciureus*. The study is part of a larger project identifying parasites in captive and wild primates in the state of Pernambuco, North-east Brazil.

Material and Methods

A young male *Saimiri sciureus* (Primates, Cebidae), approximately one year old, captured in the state of Amazonas was sent to a private collection in Recife, state of Pernambuco, Brazil. A few days after its arrival, the monkey showed clinical alterations, including anorexia, acute caquexia, prostration and dermatitis and died after a week. The monkey was sent to the Parasitology Laboratory of the Department of Biology, Federal Rural University of Pernambuco (UFRPE) where an autopsy was carried out. Large numbers of filariiform parasites were found in the mesentery and beside the liver. The parasites were collected, fixed in hot alcohol-acetic formol (AAF), and cleared in Amman's lactophenol following the procedure prescribed by Amato *et al.* (1991). They were identified through the descriptions of Webber (1955) and Anderson and Bain (1974). When opening the intestine, helminths were found in the ileo-cecal ostium which was apparently totally obstructed by the parasites, and there was also a severe reaction noted in the intestinal tissues. The cecum and descending colon were partially obstructed. Thirty-two parasites were collected and placed in a recipient in distilled water and cooled until the probosci were extroverted (Amato *et al.*, 1991). They were subsequently fixed and mounted following Machado Filho (1950) and Amato *et al.* (1991), and identified according to the descriptions of Machado Filho (1950), Yamaguti (1963) and Amin (1987).

Results and Discussion

The parasites found in the abdominal cavity were identified as filaria of the genus *Dipetalonema* Diesing, 1861 (Spirurida, Onchocercidae), transmitted by hematophagous mosquitoes. According to Dunn (1968) *Dipetalonema* spp. are one of the most prevalent parasites of squirrel monkeys in Brazil, Peru, Colombia and Panama. Adults are frequently found in the peritoneum and mesentery and associated with the presence of fibrous and adherent exudates. As microfilaria they occur in the peripheral bloodstream, without any associated pathologies or clinical symptoms (Dunn, 1968; Potkay, 1992).

The helminths, found deep in the intestinal mucosa, were identified as acanthocephalans of the species *Prosthenorchis elegans* Diesing, 1851 (Oligacanthorhynchida, Oligacanthorhynchidae). *P. elegans* is a heteroxene acanthocephalan. Cockroaches and beetles are intermediate hosts (Stunkard, 1965; Cubas, 1996), and it has been diagnosed for a number of cebids and callitrichids (Machado Filho, 1950; Kuntz and Myers, 1972; Potkay, 1992; Wolff, 1993; Ferraz *et al.*, 1995; Cubas, 1996). Large numbers can be found without the hosts showing any clinical symptoms, although Ferraz *et al.* (1995) recorded diarrhea and loss of appetite and energy in wild and captive callitrichids as a result of parasitism by *P. elegans*. Dunn (1963) argued that infestations of