

# Fruit exploitation by Golden Lion Tamarins (*Leontopithecus rosalia*) in the União Biological Reserve, Rio das Ostras, RJ - Brazil

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## SUMMARY.

The golden lion tamarin (*Leontopithecus rosalia*), like other Callitrichidae, feeds on insects, small vertebrates, bird eggs and fruits. Preferred fruits are pulpy, sweet and soft. Two groups of golden lion tamarins were studied during 24 months from December 1998 to December 2000, on a total of 871.9 h. The aims of this paper are to list the fruits species consumed by the golden lion tamarin, and to describe the morphological characteristics of the exploited fruits. The tamarins started their activities at sunrise and finished at the end of sunset with a mean activity pattern of 10.45 h. The fruits and branches from species eaten were collected and identified. During the study the two tamarin groups consumed 57 fruits species, and swallowed and defecated seeds from 39 species. The data show the importance of fruits in golden lion tamarin diet. This species is one of the most threatened in the world, and studies on its ecology and behaviour will contribute to preserve the species, its habitat and one of the last areas of lowland Atlantic Forest in Rio de Janeiro state.

## KEY WORDS

*Leontopithecus rosalia*,  
golden lion tamarin,  
frugivory, Atlantic Forest,  
União Biological Reserve.

## RÉSUMÉ

Le tamarin lion doré (*Leontopithecus rosalia*) s'alimente comme d'autres Callitrichidae, d'insectes, de petits vertébrés, d'oeufs d'oiseaux et de fruits. Ses fruits préférés sont charnus, doux et tendres. Deux groupes de tamarsins lion dorés ont été étudiés pendant 24 mois (décembre 1998 - décembre 2000), sur un total de 871,9 h. Les objectifs de cet article sont de détailler les espèces de fruits mangés par le tamarin lion doré, et de décrire les caractéristiques morphologiques des fruits exploités. Les tamarsins commencent leurs activités du lever jusqu'au coucher du soleil, avec un taux d'activité journalière moyen de 10,45 h. Les fruits et branches des arbres des espèces utilisées ont été recueillis et identifiés. Pendant l'étude, les deux groupes de tamarsins ont mangé 57 espèces de fruits, et ont avalé et déféqué les semences de 39 espèces. Les données montrent l'importance des fruits dans le régime du tamarin lion doré. Cette espèce est une des plus menacées au monde, et les études sur son écologie et son comportement contribueront à la conservation de l'espèce, de son habitat et d'un des derniers domaines de la Forêt Atlantique de l'État de Rio de Janeiro.

## INTRODUCTION

Studies on interaction between plants and animals indicate that frugivorous primates play an important role in forest regeneration and plant reproduction (Garber and Kitron 1997), since this group represents a major component of frugivore biomass in many tropical communities (Terborgh 1986).

The golden lion tamarins (*Leontopithecus rosalia*) like other primates from family Callitrichidae, feeds on a variety of insects, small vertebrates, bird eggs and fruits. Preferred fruits are pulpy, sweet and soft (Coimbra-Filho and Mittermeier 1973). Plant exudates, unripe fruit and flowers are less frequently consumed (Peres 1986). In the forest, the tamarins prefer the middle layer of the canopy, between three and ten metres, where they find the majority of insects. Occasionally, they may ascend to the highest layer to feed on fruits (Coimbra-Filho and Mittermeier 1973).

Of 23 species of primates in the Atlantic Forest of Brazil, 17 are endemic and 18 are at risk of extinction, among them, the four species of lion tamarins (Rylands et al. 1995). The golden lion tamarin has been used as flagship species to pro-

tect the Atlantic Forest of the state of Rio de Janeiro (Dietz et al. 1994). The majority of the 43 mammalian species at risk of extinction in that state is located in lowland forest (Bergallo et al. 2000), where the tamarins occur. The researches carried out in the União Biological Reserve will help to protect one of the last and largest remnants of lowland Atlantic Forest in Rio de Janeiro State. This forest represents 23 % of the forest area currently inhabited by golden lion tamarins (Kierulff and Oliveira 1996).

The aims of this paper are to list the fruits species consumed by the golden lion tamarins in União Biological Reserve, and to describe the morphological characteristics of these fruits.

## MATERIAL AND METHODS

### *Study area*

This study was conducted in the União Biological Reserve (22°27'36"S, 42°02'15"W), municipality of Rio das Ostras and Casimiro de Abreu, Rio de Janeiro, Brazil. The Reserve under the

control of IBAMA (Brazilian Environmental Institute) consists of an area of 3,121.2ha with approximately 2,400 ha of forest, divided into two sections by a Federal Eghway BR 101 (500 ha on the south and 1,900ha on the north).

The climate in this region is hot and humid according to Köppen climate classification (Kleiman *et al.* 1988), with a defined seasonality. The annual rainfall was 1549.3 mm during study period, with temperatures averaging 24.2 °C. The dry season occurs from April to September (494.8 mm), and the wet season from October to March (1054.5 mm).

### Data collection

The groups were located by radiotelemetry. Data were collected on two golden lion tamarin groups : LB (group size varied from three to six individuals during study period), in the south forest section, and SJ II (six to 12 individuals during study period), in the north forest section. The data were collected continuously and every time the group was feeding and defecating was noted. The groups were studied during 24 months from December 1998 to December 2000, on a total of 395.25 h and 476.67 h respectively.

### Fruit feeding

The fruits eaten by golden lion tamarins were collected. The fruits and seeds were weighed and measured (width and length) (for seeds > 3 mm). Branches from these fruiting trees were collected and identified at Universidade Federal de Minas Gerais Herbarium, (data from Golden Lion Tamarin Translocation Project). The fate of the seeds was considered as swallowed, dropped or damage, and the fruit development as ripe or unripe.

## RESULTS

The lion tamarins started their activities at sunrise, and the study groups were observed leaving the sleeping trees on average at 5 : 53 h ( $n = 37$  days), ranging from 04 : 55h (spring/

summer) to 06 : 55 h (autumn/winter). The golden lion tamarins ended their activities in the late afternoon, in the end of sunset. The study groups were observed entering their sleeping site on average at 16 : 34 h ( $n = 45$  days), ranging from 14 : 08 h to 17 : 40h (spring/summer). The golden lion tamarins had a mean length off daily activity of 10.45 h ( $n = 16$  days), ranging from 11.35 + 0.72 h (spring/summer) to 9.52 + 0.77 h (autumn/winter). Kierulff (2000), studying the same groups in 1997, found an activity pattern of 9-12 h, with the earliest time of leaving their sleeping tree at 4 : 54 h and latest time entering the sleeping site at 17 : 54 h.

### Morphological characteristics of seeds and fruits

During the study, the two tamarin groups consumed 57 fruit species, from at least 17 families (Appendix) and the majority of fruits were yellow (40.3 %). Black and purple fruits accounted for 28 1 % of consumed fruits species, and red fruits, 14 %. Different seed fates were noted for these fruits. Seeds of 68.4 % fruit species were swallowed, and 3.5 % of them were consumed ripe and unripe. Seeds of 36.8 % species were dropped under parent trees and seeds of 3.5 % species were damaged during handling (Figure 1).

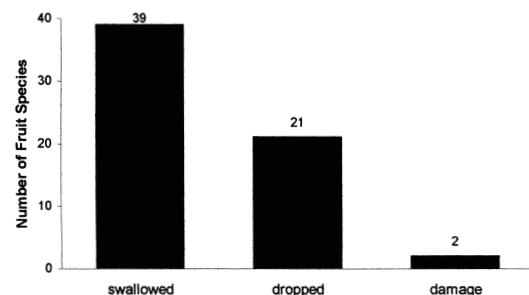


Fig. 1. – Number of seeds species swallowed, dropped and damaged.

The consumed fruits had distinct morphological characteristics, considering the length, width, number and size of seeds. The mean fruit length and width were 18.6 + 11.1 mm and 15.6 + 8.4 mm, respectively. The size of seeds

varied considerably. Fruits like *Miconia* spp. and others had seeds smaller than 3 mm and the largest seeds defecated by tamarins were from *Abuta* sp1 (27.5 mm in length). This species was infrequent in the diet. The mean seed length swallowed by the tamarins was  $11.3 \pm 5.0$  mm, and the mean seed width was  $7.4 \pm 2.8$  mm. In general, seeds swallowed by tamarins were elongate (72.4 %), and round seeds were usually dropped under or near parent crown (26.3 %) like *Eugenia* spp. The mean length and width of dropped seeds were  $13.9 \pm 6.0$  mm and  $8.1 \pm 3.4$  mm, respectively.

## DISCUSSION

Other primates of Callitrichidae family (*Leontopithecus*, *Saguinus*, *Callithrix* and *Cebuella*) have an activity pattern about 8 to 12 hours (Kleiman et al. 1988 ; Snowdon and Soini 1988 ; Soini 1988 ; Stevenson and Rylands 1988). The shortest activity period in winter and the largest activity period in summer may be associated with photoperiod and temperature during the seasons.

Fruits from many tropical trees show morphological characteristics, which favour seed dispersal by animal agents (Janson 1983 ; Van der Pijl 1972). Fruit characters that attract particular groups of animal dispersers include colour, degree of protection, nutritional quality of the flesh, and size (Tutin et al. 1991). The characteristics of fruits eaten may be associated with their primary dispersal agents. Succulent fruits with small seeds like *Miconia* spp and *Cecropia* spp., can be dispersed by birds, ants and primates (McKey 1975 ; Howe 1980 ; Howe and Smallwood 1982). Studies on Old and New World Primates (Lambert and Garber 1998) show a preference by yellow fruits and the second most eaten fruit category was red. In this study, it was confirmed the preference by yellow fruits but the red fruits represent only 14.3 % of the consume. The small size of tamarins (averaging 525 g for adult individuals, according to Kierulff 2000) probably restricts the size of eaten fruits. It is likely that fruit choice is determined by availability plus other correlated factors such colour, fruit size, pulp weight, seed size, and nutritional content rather than by any single trait. (Lambert and Garber 1998). In União Biological Reserve and in Poco das Antas

field site, the main item in the lion tamarin diet was ripe fruits, followed by nectar (Kierulff 2000 ; Procopio de Oliveira 2002). The preference for ripe fruits may be important for the role lion tamarins may play in seed dispersal (Lapenta 2002). Many species of primates are known to disperse viable seeds and contribute to forest regeneration (Estrada and Coates-Estrada 1984, McCoukey 2000 ; Lapenta 2002 ; Lapenta et al., in prep.).

Fruits usually eaten by tamarin monkeys (Genus *Saguinus*) are characterised by fibrous or gelatinous pulp or arils mechanically difficult to remove from the seed, which is swallowed (Garber and Kitron 1997). The species with seeds always dropped under parent trees does not contain adhesive pulp, like the fruits of *Myrcia fallax* and *Faramea bracteata*, among others. Similar results were found in primate seed dispersal studies in Indonesia and Singapore (Corlett and Lucas 1990 ; McConkey 2000). Dietz et al. (1997) found that seeds up to 1.5 cm in length have been swallowed intact and defecated by the golden lion tamarins. However, beside the size, the seed shape and adherence of the pulp influences whether it is swallowed or not by the frugivores, and it appears that seed width was a stronger determinant than seed length. This results agreed with Chapman (1995), when stat that the most suitable seed shape for endozoochory is elongate, since it has sufficient volume to encourage the seedling growth, and it is still easier to be swallowed by the frugivores.

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APPENDIX. – Fruits consumed by golden lion tamarins (*Leontopithecus rosalia*) in União Biological Reserve, from December 1998 to December 2000.

Family	Species	Fruit colour	Seed fate
Anacardiaceae	<i>Tapirira guianensis</i>	yellowish	SS
Annonaceae	<i>Rollinia dolabripetala</i>	yellow	SS
Arecaceae	<i>Bactris setosa</i>	purple	DS
Cecropiaccae	<i>Cecropia hololeuca</i>	black	SS
	<i>Cecropia pachystachya</i>	brown-green	SS
	<i>Cecropia glaziovii</i>	yellow	SS
	<i>Pourouma guianensis</i>	dark-violet	SS, UF
Clusiaceae	<i>Rheedia brasiliensis</i>	yellowish	DS
Euphorbiaceae	<i>Euphorbioceae sp. 1</i>	yellow	SS
Fabaceae	<i>Inga thibaudiana</i>	green	SS, Dc, DmS
	<i>Inga edulis</i>	brown	SS, DS, DmS
	<i>Inga subnada</i>	yellow	SS, DS
	<i>Inga praegnans</i>	green	SS, DS
Flacourtiaceae	<i>Casearia decandra</i>	yellow	SS
Melastomataceae	<i>Miconia hypoleuca</i>	orange	SS
	<i>Miconia latecrenata</i>	black	SS
	<i>Miconia cinnamomifolia</i>	black	SS
	<i>Miconia sp. 1</i>	black	SS
	<i>Henrietea saldanhei</i>	purplish	SS
Menispermaceae	<i>Abuta sp. 1</i>	yellow	SS, DS
Moraceae	<i>Sorocea hilarii</i>	black	SS, DS
	<i>Helicostylis tomentosa</i>	green	SS, DS
Myrtaceae	<i>Calyptranthes lucida</i>	yellow	SS
	<i>Myrcia fallax</i>	black	DS
	<i>Myrcia sp. 1</i>	red	SS
	<i>Marlierea subacuminata</i>	yellowish	SS, DS
	<i>Marlierea parviflora</i>	violet	SS, DS
	<i>Marlierea sp. 1</i>	violet	SS
	<i>Marlierea sp. 2</i>	black	
	<i>Eugenia sp. 1</i>	purple	DS
	<i>Eugenia robustovenosa</i>	yellowish	DS
	<i>Eugenia involucrata</i>	red	DS
	<i>Eugenia excelsa</i>	red	DS
	<i>Myrtaceae sp. 1</i>	green	SS
	<i>Myrtaceae sp. 2</i>	black	
	<i>Campomanesia cf. espiritosantensis</i>	yellow	SS
Passifloraceae	<i>Passiflora sp. 1</i>	yellow	SS
Rhamnaceae	<i>Rhamnidium cf elaeocarpus</i>	purple	SS
Rubiaceae	<i>Randia cf. sp. 1</i>	yellow	SS
	<i>Rubiaceae sp. 1</i>	yellow	SS
	<i>Posoqueria cf. acutifolia</i>	yellow	SS
	<i>Faramea bracteata</i>	purple	DS
Sapotaceae	<i>Sarcalus brasiliensis</i>	yellow	SS, UF
	<i>Micropholis guyanensis</i>	scarlet red	SS
	<i>Pouteria bangii</i>	yellow	SS
	<i>Ecclinusa ramiflora</i>	yellow	DS
	<i>Pradosia sp. 1</i>	yellow	SS, DS
Simaroubaceae	<i>Simarouba amara</i>	yellow	DS
Other families	Sp. 1	black	SS
	Sp. 2	yellow	DS
	Sp. 3	red	SS
	Sp. 4	green	
	Sp. 5	red	
	Sp. 6	scarlet red	
	Sp. 7	yellow	SS
	Sp. 8	red	SS
	Sp. 9	black	SS

SS = swallowed seeds ; DS = dropped seeds, DmS = damaged seeds; UF = unripe fruit.