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Field observations on *Callithrix jacchus jacchus* L.

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Abstract

Field observations on three groups of *Callithrix jacchus jacchus* L. living in patches of secondary coastal rain forest at Joao Pessoa (Paraiba, Brazil) are reported. The groups comprised 3–7 animals which occupied partly overlapping home ranges of 2–5 ha. In the main study group, a smaller territory around a "home tree" was actively defended. This group was observed on four whole days. On an average about 30 % of the 11.5 hours of daily activity was spent on sap feeding on that "home tree" *(Tapirira guianensis)*. The functional adaptations to and the biological importance of sap feeding are discussed.

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Introduction

The Tufted-ear or Common Marmoset *Callithrix jacchus jacchus* L. of Northeast Brazil has been one of the best known pet-primates for centuries, and it is a common member of zoological gardens and of primate research laboratories. There exist numerous studies on the ethology and physiology of the Common Marmoset under captive conditions (Epple 1967, 1968; Rothe 1975; Stevenson and Poole 1976; Rothe et al. 1978), but there is not too much information available on the biology of wild living marmosets (Coimbra-Filho 1972; Coimbra-Filho and Mittermeier 1977; Stevenson 1978). Therefore, Hershkovitz (1977) had good reason to state that "the home range or territory of wild living marmosets has not been studied. Even the nest or living quarters in the wild has not been described" (p. 545).

This situation did encourage us to publish some data collected on three groups of wild living marmosets at Joao Pessoa, Northeast Brazil. Most observations were made during a visit of 3 weeks in August 1979 by W. M.; alltogether, about 100 hours were spent on field observation, of which about 70 hours were concentrated on group III. C. A. and A. L. continued these observations irregularly during parts of 1979 and 1980. It is planned to extend these studies which can be performed under quite favourable conditions.

According to Hershkovitz (1977), the marmosets at Joao Pessoa belong to the subspecies of *Callithrix j. jacchus* L. Formerly, the marmosets of the eastcoast-region of Brazil were subdivided into a number of good species, but since all of them seem to show an allopatric distribution it is more convincing to consider them as local populations of one superspecies *C. jacchus*. Müller (1973) and Kinzey (ms.) derive the distribution pattern of these and other neotropical primates from a model of Pleistocene forest refugia.

Within recent years, the number of field studies on South American primates, including some Callitrichidae, has increased considerably (s. Kleiman 1977; Coimbra-Filho and Mittermeier 1981, in press). Comparative data from these studies will be referred to subsequently at appropriate places.

Locality and habitat

The study area consisted to two patches of forest situated within the campus of the Federal University of Paraiba at Joao Pessoa, Brazil (Fig. 1). Area A measures about 5 ha and area B about 7 ha. These forests may be classified as a secondary type of the coastal rain forest of East Brazil (Hueck 1966). They have suffered selective lumbering, but a number of older emergent trees are left. A fairly dense and differentiated canopy extends between 5 and 15 m height, roughly corresponding to the layer C of Richards (1976). The shrub layer is not very dense. The marmosets appear to spend most of their time within that middle layer and only rarely were seen climbing into the crowns of the emergent trees or descending to the ground. On some occasions they were seen directly at the edges of the forests. According to Dawson (1977) "callitrichids inhabit 'edge' vegetation" (p. 32), and Rylands (1981) states for *Callithrix humeralifer intermedius* that "the majority of the groups activity time is spent . . . in old and young second growth forest (as well as in) tall forest with a broken canopy and a dense middle layer and abundant lianas" (p. 48).

The forested areas are closely situated by university buildings and are separated by a much frequented road. The patches themselves are crossed by a few trails which are occasionally used by peoples. It is planned to establish these small forests as reserves for study purposes.

Territoriality and group structure

It is well known from both captive and wild living marmosets that they are socially organized in small family groups with an adult pair as the social nucleus (Epple 1975; Rothe 1975; Hershkovitz 1977). However, in *Callithrix humeralifer intermedius* (Rylands 1981) and in *Saguinus oedipus geoffroyi* (Dawson 1977) two and more pairs of

adult animals appear to be typical. In our study area, we were able to distinguish three group units occupying three different home ranges. It was not possible to clarify all problems of territoriality within such a short study period, but some results did emerge from our observations:

The whole forest area north of the road (Fig. 1) was occupied by a large unit (group I) consisting of 7 animals. There were a pair of adult animals, two infants of about 3–4 months, an older young of perhaps 8–9 months, and two young adults. These two young adults seemed to be only loosely attached to the core group; often they stayed behind during traveling and sat apart during feeding, but all 7 animals were always seen sleeping together at night. Most often, this group was observed in the northern parts of the forest, but on two occasions it was seen in the trees next to the cages of the biotherium, where 9 animals of *Callithrix jacchus* were kept. These encounters, which lasted about one hour were accompanied by exited vocal and visual displays by both groups. The wardens of the cages confirmed that this kind of confrontation takes place once or twice a week quite regularly. Group I was disturbed by man quite often, and it was so shy that it proved unsuitable for regular observation. Although the area of forest A did not seem to be frequented quite evenly, the home range may be given as 4 to 5 ha. A number of "copiuba

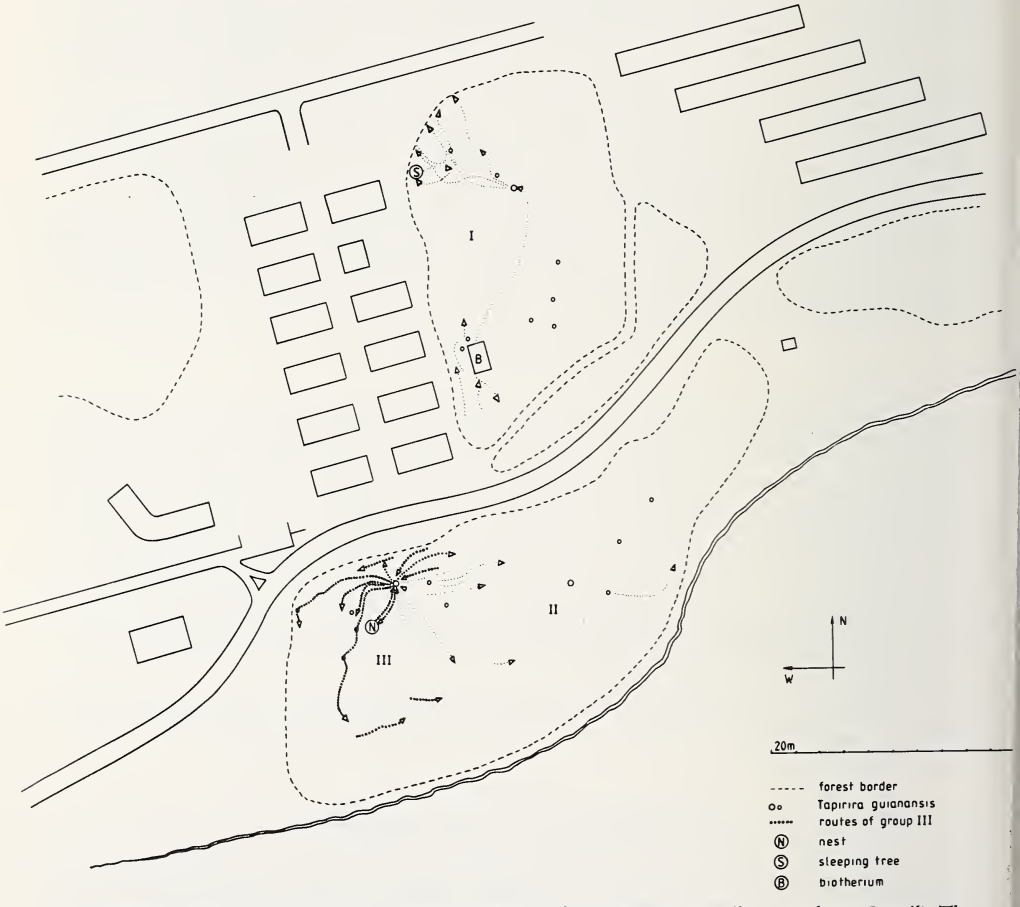

Fig. 1. Map of the study area at the university campus of Joao Pessoa (Paraiba, Northeast Brazil). The forests are marked by broken lines. For explanation of the other symbols see the legend. The roman figures indicate the home ranges of the three groups of *Callithrix j. jacchus*

trees" *(Trapirira guianensis)* with biting marks were noted in that area (small circles), but one tree (bigger circle) obviously played a major role for this group.

The forest south of the main road which in its southern and eastern parts lies at a steep slope, seemed to be more diversified ecologically. It was inhabited by two distinct social units. The eastern part of the forest most probably housed a group of 5 or 6 animals (group II), two of which were infants of about 1 month. This group was extremely shy and was only seen on a few occasions.

The western part of this forest area was occupied by a small group of 3 animals, which became used to the observers quite quickly even though an adult female had been shot there two months ago. This group III consisted of an adult pair and a juvenile animal of about 6–7 months of age. Most of our observations were concentrated on this small unit, mainly for reasons of convenience. The sex of the adult individuals could not be established for sure before the end of the study; therefore, we are presently unable to tell much about the roles of the different sexes.

It became clear after a short time that one tree of *Tapirira guianensis* formed the center of the daily activities of group III. This "home tree" (Castro and Soini 1977) apparently was the core area (territory) of the home range as well. We observed this group within an area of about 140 × 120 m (Fig. 1) and a home range size of about 2 ha should be a fairly accurate estimate. On two separate occasions it was observed that the central "home tree" was aggressively defended against intruders from group II. During a longer phase of absence of the residental group one or two members of group II entered the tree to feed on the sap. The strangers were easily recognized by their pronounced uneasiness, and at one time they were chased away without difficulties by a returning animal of group III. On another occasion, a vocal and visual confrontation (reminding the the encounters at the biotherium) lasting some minutes only occurred between both groups about 30–40 m east of the central tree before group II retreated.

The road separating the two forests seems to act as a natural barrier between the highly arboreal marmosets, but on several occasions animals were observed crossing this road in both directions. The territorial dynamics could only become clarified by long-term observations. At irregular intervals, the groups were observed since 1979, but a number of significant changes are not understood properly. The table provides some comparative data on group size and home range of other Callitrichidae.

Table

Compiled data on group size and home range size in some callitrichid taxa

It becomes evident that the sapivorous taxa *Callithrix jacchus* and *Cebuella pygmaea* are able to subsist on only small areas due to their special feeding habits

Species	group size	home range	authors
Callithrix j. jacchus	3– 7	2–5 ha	present study
Callithrix j. jacchus	5–13	ca. 1 ha	Stevenson 1978
Callithrix j. penicillata	4– 5		Fonseca et al. 1981
C. humeralifer intermedius	4–13	ca. 13 ha	Rylands 1981
Cebuella pygmaea	5–10	0.8–1.3 ha	Castro and Soini 1977
Cebuella pygmaea	7	0.3 ha	Ramirez et al. 1977
Saguinus midas	2– 6	ca. 12 ha	Thorington 1968
Saguinus mystax	2– 6	(ca. 35 ha)	Castro and Soini 1977
Saguinus fuscicollis	2–10	ca. 20 ha	Castro and Soini 1977
Saguinus nigricollis	4– 8	30–40 ha	Izawa 1978
S. oedipus geoffroyi	1–14	26–32 ha	Dawson 1977
S. oedipus oedipus	3–12	8–10 ha	Neyman 1977
Callimico goeldii	3– 8	33–60 ha	Heltne et al. 1981
	8– 9	40–60 ha	Pook and Pook 1981

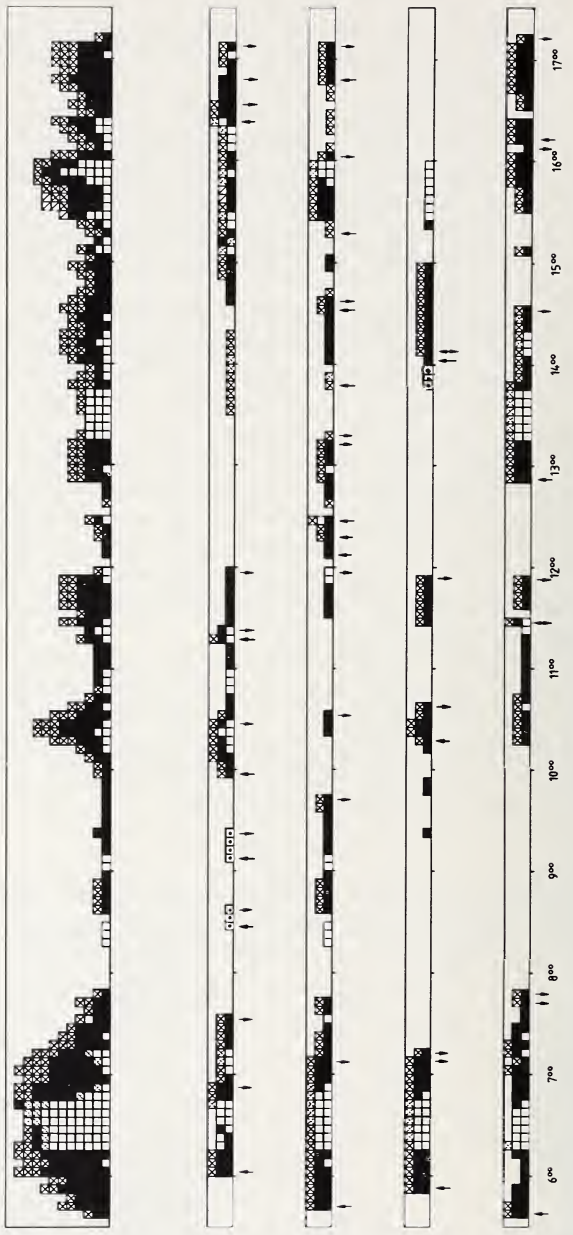

Fig. 2. Diagram of the activity pattern of group III at four days (lower columns with dates). The upper column presents the total sum of the data of these four days, giving an impression of the importance of the main feeding tree (*Tapirira guianensis*). The symbols are explained in the legend of the figure, and the data are discussed in the text

Daily activity pattern

Since usually only one observer was working at a time, it proved impossible to follow the study group throughout the day. Allthough a considerable part of the daily activity was spent feeding on one tree, the animals dispersed during the rest of the day throughout the home range. Therefore it was decided that at the beginning mainly the activity of the animals of group III at the most important feeding tree *(Tapirira guianensis)* should be recorded. Whenever possible, the activities at this tree were protocolled every five minutes during four whole days (Fig. 2). When the whole group left the tree together, it was followed in the forest as long as possible.

The animals of group III normally stayed over night in a distinct sleeping place which seemed to consist of tangle of vines and dry leaves (Fig. 3). Since this tangle has not been removed, it is not clear whether it should be considered as a true nest. The large group I was many times observed to rest over night in a fork of big branches of a *Byrsonima sericea* some 12–15 m above the ground. Very diverse sleeping habits are reported for *Saguinus o. oedipus* (Neyman 1977) and for *S. o. geoffroyi* (Dawson 1979); for the latter, sleeping in constructed nests is confirmed.

Fig. 3. Nest-like tangle, where group III stayed over night during the study period. This 'nest' was only about 5 m above the ground; it was entered and left from above. Members of group I used to sleep in a fork of branches of an emergent tree however

Whereas sunrise was around 05.20 to 05.25 h, the animals did appear from their "nest" between 05.35 and 06.00 h. Without any delay the animals ran directly the 40–50 m toward the "copiuba -tree" and started sap-feeding with great intensity. This first feeding period on an average lasted about 40 minutes. Then, the animals used to climb to the top branches of the feeding tree which are about 15 m high. Here they started both auto- and allogrooming, and they exposed themselves to the sun for about half an hour. Subsequently, sap-feeding was resumed for another half an hour or so, before one or all animals moved away for a longer excursion within the forest. Several times they were

observed visiting a number of different fruit trees (not yet determined), but only taking relatively few fruits from each. After this fruit eating phase which lasted from a few minutes up to about half an hour, they rapidly dispersed whithin the canopy and were difficult to follow. Most probably they started hunting for animal food separately from one another. *Saguinus nigricollis* shows very different activities in the morning, for example (Izawa 1978).

It was usually at about 10.00 h when one or more of the animals returned to the "home tree" to feed on the sap and to rest occasionally. There seems to exist a small peak of feeding activity on the "copiuba-tree" between 10.00 and 12.00 h. The following two hours show a reduced activity at the feeding tree, but it could not be ascertained whether they rested somewhere during this time. This sap-eating activity gradually increased in the course of the afternoon. Quite regularly, between 16.00 and 17.00 h two or three animals were actively feeding at the "home tree" or went hunting in the vicinity. One day (27. 8.), heavy rainfall stopped all feeding activities after 15.00 h. Shortly after 17.00 h the animals left the feeding tree and moved slowly to their "nest" nearby. Thus their daily activity stopped shortly before sunset. Once they were disturbed by the observers and slipped out of the "nest" well after sunset to find another sleeping place.

Of course, four full days of observation cannot supply a representative picture of the typical activity pattern which appears to vary considerably from day to day and may even vary more during the course of the year. But at least a preliminary picture becomes visible: During this part of the year the length of the daily activity of *Callithrix j. jacchus* amounted to about 11.30 hours, whereas Rylands (1981) records 10 hours only for *C. humeralifer intermedius*. The most remarkable feature appears to be the great importance of sap-feeding on one tree of *Tapirira guianensis*. If we calculate from the upper column, where all feeding activities of four days are summed up, the relation of the sap-feeding with the total amount of daily activity time, we receive about 29 %. This figure certainly underrates the real importance of sap-eating, since only positive sight records were noted, and since some less important "copiuba-trees" existed within the home range. Our data compare well with those of Ramirez et al. (1977), who noticed that troops of *Cebuella pygmaea* "spent 32 percent of observed daily activity eating exudate and excavating exudate holes" (p. 95). However, we were unable to make as clear a distinction between sap-feeding and hole digging as these authors did. Assuming that the Pygmy Marmosets spend most of the late afternoon for only excavating holes includes a connotation of purposeful action which would seem to be problematical to us.

It will be gathered from Fig. 2 that during considerable parts of the day only one or two animals were present at the central "home-tree", wheras the others were striving through the forest. In a number of times it was noted that the animal staying in the tree moved away as soon as another came in; normally the animal slipped away just at the opposite side from where the newcomer entered the tree. We suspect that some behavioural mechanism for protecting the core area of the territory may be responsible for this phenomenon; as mentioned above, two times members of the neighbouring group II had entered the "home tree" during a longer absence of the residential group III. Since much work is invested to open up and to maintain the sap-providing grooves, it would seem to be a selective advantage for a group to protect such an important source of food. In order to minimize the locomotory efforts, it would also seem advantageous to concentrate sap-feeding on one or few trees for a certain period of time.

Feeding biology

As shown in the last chapter, a highly differentiated system of sap-feeding is a very conspicuous feature of the feeding biology of *Callithrix jacchus*. By far the most important

tree species with respect to this habit is *Tapirira guianensis,* of which about 40 specimens were located in the study area. Occasional feeding on *Thrysodium schomburgkianum* (caboatao de leite) was recorded as well. Meanwhile, a considerable number of South American tree species are reported as providing exudates for most observed taxa of callitrichids to various degrees (Coimbra-Filho 1972; Kinzey et al. 1975; Castro and Soini 1977; Ramirez et al. 1977; Coimbra-Filho and Mittermeier 1977; Izawa 1981). Subsequent observations made on the study groups at Joao Pessoa seem to indicate that feeding on the sap of "copiuba-trees" may be less intensiv during other times of the year.

All of the specimens of *Tapirira guianensis* within the two forests showed at least some scars from biting by *Callithrix jacchus.* However, in most trees the scars were dry or healed. Some of the trees were partly destroyed by the extensive gnawing of the bark layer. Both in group I and III, we were able to identify one tree that was most intensively worked

Fig. 4A (left). Trunk and lower branches of the central 'copiuba-tree' *(Tapirira guianensis)* of group III. Note the numerous transversal grooves which were gouged into the bark by the marmosets for sap feeding. – *Fig. 4B. (right).* This picture shows a close-up view of some grooves with exudate oozing out in some places. The scoop-like lower dentition of *Callithrix jacchus* exactly fits into these grooves, whereas the upper jaws with their divergent canines are too broad

upon at the time of observation (large circles in Fig. 1). The stem and the larger branches of the main "copiuba" of group III are covered with grooves of about 10–15 mm width and 9–12 mm depth. They are always orientated perpendicular to the long axis of the stem and the branches (Fig. 4). An area of 0.25 m^2 about 1 m above the ground was covered by 33 grooves varying in length from 2–20 cm. 18 of these grooves showed signs of fresh biting after the first feeding period in the morning. The animals tend to feed at the fresh end of the scars, where the exudates of the phloem flow more rapidly, and thus the grooves are gradually elongated.

Although the feeding activity could be observed from as near as about 5 m, the exact technique of gouging was not clearly recognized. But experiments with a cleaned skull

indicated that the lower jaw of *Callithrix jacchus* fits exactly into the grooves, whereas the upper jaw is too broad, mainly due to the prominent and divergent canines. Thus it appears most likely that the upper canines are fixing the skull, and that the scoop-like front teeth of the mandible are scraping off the bark layers and the exudates – much as described by Coimbra-Filho and Mittermeier (1977). It is likely that the tongue is helping to ingest the soft exudates as well.

In the early morning, at three intervals of half an hour the positions of the body during feeding was recorded whenever visible. In group III, from at total of 117 observations, the body was directed upward in 57 %, transversal in 28 %, and downward in 15 %. We have also good evidence that during sap-feeding a spacing mechanism keeps apart the group members; for this we divided the "home tree" arbitrarily into 6 sectors and checked the positions of the animals every 5 minutes. In only 5 out of 32 records two animals were observed feeding within one sector. Quite often aggressive chasing was occuring, and we have preliminary evidence that the adult female was dominating the male, and this again was superior to the juvenile. The most favourite and productive feeding place seemed to be the lower trunc region; this observation is in accordance with the results of Ramirez et al. (1977). In most cases the animals worked upward slowly and were feeding or jumping downward more rapidly.

The exudate of *Tapirira guianensis* at first is colourless and transparent, but becomes opaque, brownish and jelly-like after some hours. To man it is tasteless and odourless, but evidently it is highly attractive to the marmosets. Scraped-off exudate caused great excitement when offered to the captive animals which always were very keen on getting this substance. Branches of *Tapirira* placed in the cage were gnawed immediately by the marmosets. Machado and Leite (1957) analyzed the exudate of a related tree species, *Anacardium occidentale* (Anacardiaceae) and found a high content of polymerous sugars (arabin, cerasin etc.) as well as mineral salts. Coimbra-Filho and Mittermeier (1977) thus conclude that this sap and resin "may serve as a source of energy and of trace elements. In addition, gums and other exudates are probably a more dependable food source than seasonal fruits" (p. 109). In any case, tree-gouging and sap-feeding appears to be an important and deeply-rooted biological adaptation of the marmosets. However, the sapivorous habits vary within the genus *Callithrix,* and even more so within the other Callitrichidae. With reference to *Callithrix humeralifer intermedius* Rylands (1981) for instance states that "a large part of each day is spent foraging for insects" (p. 51) and that only "infrequently *C. h. intermedius* was observed eating tree exudates" (p. 52).

Callithrix jacchus is characterized dentally by the peculiar lower front teeth that form a kind of scraper. This feature has been noted for a long time but was mainly used for diagnostic purposes only. Since the sap-feeding habits of these primates have become better known, these dental structures are understood as to their biological role. The lower front teeth look slightly different in the *Callithrix argentata*-group and even more so in the tamarins (cf. Hershkovitz 1977), whereas *Cebuella pygmaea* presents typical scoop-like front teeth.

The biological importance of sapivory has been documented in recent years for a number of prosimian and simian primates (Charles-Dominique 1977; Seligsohn 1977; Coimbra-Filho and Mittermeier 1977; Maier 1980). Gouging the bark of suitable trees certainly is an energy-consuming activity, but it provides the animals with a stable food source and renders them more independent of the fruiting seasons. Apart from the adaptive modifications of the front teeth, it proved necessary to develop claw-like nails to find hold at the thick and often smooth trunks and branches of the food trees (Cartmill 1974). The claw-like nails of the Callitrichidae most probably are to be considered as secondary adaptations to this feeding habit (Bluntschli 1929), but some authors tend to interpret them as primitive retentions (Clark 1962; Hershkovitz 1977). However, it is certainly premature to speculate whether Callitrichidae in general are primitive simian morphotypes.

As far as the functional morphology of the dentition of *Callithrix* (Fig. 5) is concerned, it would be more plausible to derive it from anything like *Saimiri* rather than reverse (Maier 1977).

Besides a number of anatomical adaptations to sap-feeding, there exist behavioural adaptations to this mode of feeding as well. First of all, the territorial behaviour of the family groups appears to be organized around one or a few sap-producing trees. This would seem favourable for the animals, because preparation of a feeding tree and

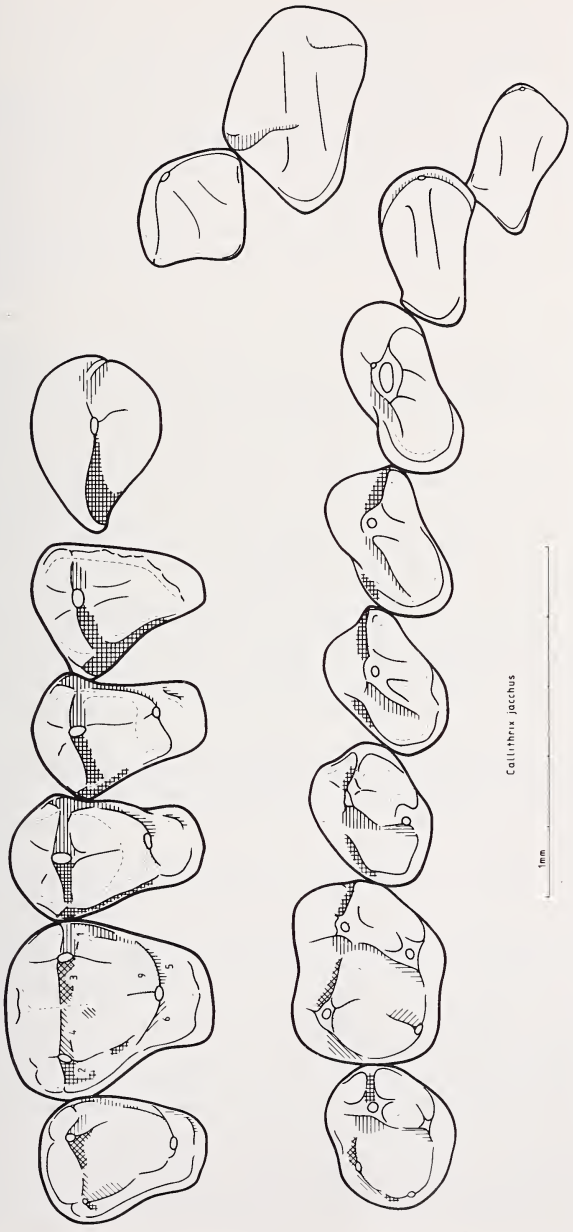

Fig. 5. Functional morphology of the dentition of *Callithrix jacchus*. The different hatchings indicate the opposing shearing facets in upper and lower teeth (For more details see Maier, 1977). It is concluded that the molar morphology is simplified secondarily, whereas the front dentition is specialized for sapivory

maintaining this "plantation" means a great energy investment which justifies aggressive defense. As documented by a number of heavily damaged trees, this treatment of the food source must be limited, and the centers of activity will have to be shifted. We have evidence that some shifting did occur since 1979, but the consequences for the structure of the home ranges have yet to be established.

Apparently, there exists some competition for the exudates elicited by the marmosets. Quite regularly ants are seen feeding on the sap. One day at 15.30 h a marsupial, *Caluromys philander,* was observed entering the "home tree" while all three members of group III were sap-feeding. The Woolly Opossum was seen investigating the grooves and licking some of the exudates. After some minutes the juvenile marmoset did attack the marsupial, which did not appear to be intimidated at all but threatened back. Only after the following attacks of an adult marmoset it slowly retreated. Alltogether, this interspecific confrontation lasted about 5 or 6 minutes. Two hours later (17.40 h) when it was nearly dark, probably the same marsupial was seen again running and jumping in the trees near the "home tree", finally disappearing in direction of the sleeping nest of the marmosets which had settled there half an hour before.

Apart from sap- and fruit-eating, the omnivorous marmosets showed interesting hunting activities. On several occasions it was observed that one animal detached from the group at the "copiuba-tree" and went for a hunting excursion. Then, the animals appeared to display a special hunting behaviour, looking very concentrated in their search for animal prey. They sit crouched and check the near surrounding carefully; then they either rush ahead or take a new watching position. Sometimes they enter thick tangles and climb around quite noisily, probably to hunt up and chase small animals. They may even descend to the ground on such hunting expeditions. Once, an animal was seen catching a locust at the forest floor and then eating it on a bush of 1.5 m height. On another occasion, an animal was observed catching a big, some 20 cm long Phasmid-locust sitting on a trunk; the insect first fell down to the ground some 6 or 7 m, but was quickly followed and caught again. Subsequently it was ingested and chewed for about 15 minutes on a higher branch. Several times the juvenile was observed accompanying an adult animal at hunting; however, it kept away some 5 to 10 meters, only intensively watching the hunter.

There existed an opportunity to examine the stomach content of an adult female collected some months before this study in the area of group III. Most of the contents consisted of bulks of dirty-whitish jelly, most likely corresponding with the exudates of the "copiuba-trees"; of other plant material we noted unidentifyable remains of various fruits. In addition, the stomach contained th remains of a small lizard, a big buprestid beetle, parts of spiders and grasshoppers. Some feeding experiments have been made with the captive marmosets at the "biotherium", by offering them insect catches. Most insects and spiders are quickly seized with one or two hands and then ingested by mastication (Kay and Hiiemae 1974). Bigger grasshoppers are pressed to the substrate with both hands before being bitten and chewed from the head. A fairly big lizard was easily overwhelmed by an adult female which seemed to be dominant within the caged group, and which was usually the first animal to obtain preferred food items. The lizard was ingested from the head and no remains were left for the other animals which were intensively trying to catch some parts. Some small beetles, some ants and some black juveniles of an unidentified species of locust were not accepted by the animals. Other species of ants were easily taken, and in summer, when cicadas become abundant in the late afternoon, animals of the biotherium used to retire for rest later in order to catch them at the grid.

It may thus be summarized that *Callithrix jacchus* is organized in family groups which occupy a home range of a few hectars, but only defend actively a core area. At least during certain parts of the year, a "home tree" providing considerable amounts of nutritive exudates seems to be an important part of the central territory. Much time and effort is spent by each group to feed on these exudates and to keep the wounds of these trees

opened. Numerous structural and behavioural characteristics of the marmosets have to be interpreted as adaptations to this special feeding habit. It is likely that the relatively small home ranges of *Callithrix jacchus* and *Cebuella pygmaea* are a result of the availability of exudates as a stable food source. In addition, fruits, flowers, and small animals form an important portion of the wide dietary spectrum. It is to be expected that a better knowledge of the feeding habits of the Common Marmoset under natural conditions will further improve their maintenance in captivity as well.

Zusammenfassung

Feldbeobachtungen an Callithrix jacchus jacchus L.

Feldbeobachtungen an drei Gruppen von *Callithrix jacchus jacchus* L. werden mitgeteilt. Die Tiere lebten in kleinen Stücken von sekundärem Küstenregenwald in unmittelbarer Nähe des Universitäts-Campus von Joao Pessoa (Paraiba, Brasilien). Die Familiengruppen umfaßten 3–7 Tiere, die teilweise sich überlappende Reviere von etwa 2–5 ha Größe einnahmen. Für die hauptsächlich studierte Gruppe wurde ein aktiv verteidigtes Territorium festgestellt, in dessen Zentrum der wichtigste Nahrungsbaum lag. Diese Gruppe wurde an vier ganzen Tagen beobachtet; durchschnittlich wurden dabei von den 11,5 Stunden Tagesaktivität etwa 30 % mit der Aufnahme von Exsudaten der Baumspecies *Tapirira guianensis* verbracht. Anpassungen an diese sapivore Ernährungsweise und weitere biologische Daten werden diskutiert.

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