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Canine Teeth of the Monkey, *Callicebus moloch*: Lack of Sexual Dimorphism

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ABSTRACT. Unlike other primates, the South American titi monkey, *Callicebus moloch*, does not exhibit sex-differences in the size or shape of the canine teeth, or in the extent of loss or fracture from excessive use. Males and females have similar canines as well in each of six subspecies of *C. moloch*. The lack of dimorphism is related to the low level of aggression in this species.

INTRODUCTION

Most members of the Order Primates exhibit strong sexual dimorphism in the size of canine teeth (GARN et al., 1967; SCHULTZ, 1969). Dimorphism is well developed in terrestrial Old World baboons (SWINDLER et al., 1967) as well as in the arboreal New World howler monkey, *Alouatta* (ZINGESER, 1967). Even in man and gibbon in which sexual dimorphism in canine size is small, there is a significant difference of 3 to 10% in man (MOORREES, 1957) and 6 to 12% in gibbon (FRISCH, 1963) between male and female in length and breadth of both the maxillary and mandibular canine teeth.

Lack of sex-differences in canine size or shape has not previously been reported in a primate.

MATERIALS AND METHODS

A total of 214 specimens of titi monkeys (*Callicebus*) from the Amazonas and Orinoco River basins of South America were used in this study. This represents the combined collections of skulls of known sex (excluding specimens obtained from zoological gardens) from the Field Museum of Natural History, Chicago, and the American Museum of Natural History, New York. Mesiodistal length, labiolingual breadth, and crown height on the labial side of canine teeth were recorded to the nearest 0.05 mm using dial calipers with needle points. The left side was measured except where a tooth was missing or damaged. Crown height was measured only for those teeth on which wear was not visible, or at least had not yet exposed the dentine. Crown area is the product of length and breadth; the shape index is length times 100 divided by breadth. Three species of *Callicebus* are recognized (HERSHKOVITZ, 1963); data for two of these, *C. moloch* and *C. torquatus*: are presented here. Sufficient data were not available for analysis of *C. personatus*.

RESULTS

Measurements of the canine teeth are presented in Table 1. In *C. moloch* there is no significant difference between male and female in any of the given parameters of size or shape of the upper or lower canine teeth. The canine tooth is small and, even when unworn, projects only slightly above the level of adjacent teeth. See Figure 1. The data were also compared by subspecies. For *C. moloch* data are available for both males and females of six of the seven subspecies (*C.m.moloch, C.m.hoffmannsi, C.m.cupreus, C.m.brunneus, C.m.discolor,* and *C.m.ornatus,* but not *C.m.donacophilus*). In no subspecies of *C. moloch* is there a significant difference between male and female in any of the given parameters of size or shape of maxillary or mandibular canine teeth ($p>0.05$ for all male-female comparisons in one-tailed T-tests).

I counted the number of missing, damaged, and fractured teeth. These effects of excessive use are found in 21 % of males and 22 % of females. Thus, *Callicebus moloch* lacks sexual dimorphism not only in canine size and shape but also in extent of damage resulting from extreme utilization.

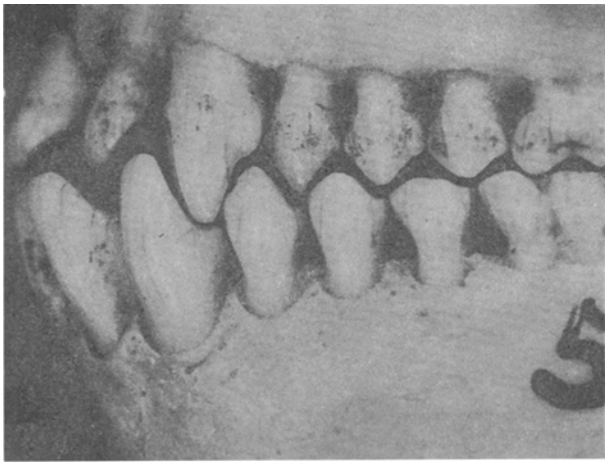

Fig. 1. *Callicebus moloch hoffmannsi.* Lateral view of dentition showing relatively small canine teeth in the male (FMNH 50860). × 5.4

DISCUSSION

The lack of any sex-difference in the canines of *Callicebus moloch* is significant, for dimorphism exists in all other genera of the family Cebidae (KINZEY, in prep.), and probably in most, if not all, other higher primates. Even in the closely related *Aotus* the maxillary canine of the male is at least 5 % broader than that of the female and at least 10 % higher. The large canine in males of other nonhuman primates apparently serves as an organ of defense, display, and/or intragroup aggression. *Callicebus moloch* is exceptional, however, in its extremely low level of intraspecific aggression (MASON, 1966, 1968; MOYNIHAN, 1966). Fighting is infrequent. MASON, who ob-

served *C. moloch ornatus* in its natural habitat in Columbia, reported he never saw evidence of wounds or torn ears as is so frequently seen in other male primates.

Among other nonhuman primates reduced secondary sexual morphological differentiation is well known in the gibbons. FRISCH found, however, that male gibbons (*H. lar*) had broken or damaged canines more than twice as frequently as females (41.5% compared with 19.6%) (FRISCH, 1963). He suggested this resulted from a higher incidence of aggressive behavior in the male gibbon, although the female gibbon also has large canine teeth.

CROOK and GARTLAN (1966) proposed a series of five adaptive ecological grades in which patterns of social organization in primates were related to species ecology. They correlated *inter alia* group size, sexual dimorphism, and social role differentiation, and suggested that sexual dimorphism increased from Grade I (solitary nocturnal animals such as *Aotus* and *Microcebus*) to Grade V (animals such as the gelada with marked social role differentiation and large group size). *Callicebus moloch* was allocated to Grade II on the basis of 'slight' sexual dimorphism and a family unit social organization. The existence of slight dimorphism in Grade I may be related to "population dispersal based on aggressive contact" among frequently solitary animals such as *Aotus* which has been shown to be very aggressive (MOYNIHAN, 1963); whereas, the development of marked sexual dimorphism in Grades IV and V is probably related to social role differentiation which requires large social groups. I suggest that the least sexual dimorphism is to be expected in Grade II, among diurnal primates in which the development of aggressive behavior is inhibited within small cohesive family groups. With the exception of *Callicebus* and the gibbon, all other primates which CROOK and GARTLAN assign to Grade II are lemuroids among which sexual dimorphism in the canines has not been reported (REMANE, 1960).

There is a relationship in *Callicebus moloch* between small canines lacking sexual dimorphism in size, shape, and wear, and the low level of aggression. The positive selective value of small canines is not clearly understood. It may serve to permit a more efficient grinding mechanism through a greater range of side-to-side jaw movements (MILLS, 1963), and to provide a functionally efficient horizontally sharp shearing device (EVERY, 1970), since the tip of the canine wears flat in *Callicebus,* not to a point as in the canine-honing mechanism of other non-human primates (ZINGESER, 1969). Similar reasoning has been put forth in the parallel development of small canines in human evolution (KINZEY, 1971).

In contrast to *C. moloch,* there is a slight degree of sexual dimorphism in the maxillary canine teeth of the larger species, *Callicebus torquatus.* See Table 1. It is more evident in the subspecies *C.t. lugens* from Venezuela in which the male tooth averages 4.3% longer and 3.0% broader than that of the female. (Differences in mesiodistal length and in crown area are significant at the 1% level). The incidence of damaged canines in *C. torquatus* is slightly (but not significantly) higher than in *C. moloch*: 28% of males and 24% of females. The values may be even higher in *C. torquatus* since the teeth are much more heavily worn in this species, possibly obscuring previously damaged teeth.

Since *C. torquatus* is larger than *C. moloch,* the slight canine dimorphism may be related allometrically to an increase in body size. The degree of sexual dimorphism

Table 1. Measurements of canine teeth in *Callicebus*.

Species			N	Length (mm)	Breadth (mm)	Crown area (mm^2)	Shape index (L/B×100)	N	Labial height (mm)
C. moloch	C′	♂	86	2.89±0.02	2.97±0.02	8.60±0.11	95.42±1.59	53	4.10±0.05
		♀	71	2.85±0.02	2.98±0.03	8.54±0.12	94.69±1.44	36	3.99±0.05
	C,	♂	86	1.98±0.02	3.00±0.01	5.94±0.08	66.02±0.51	64	4.19±0.04
		♀	71	1.97±0.02	2.98±0.02	5.91±0.10	66.29±0.73	49	4.10±0.04
C. torquatus	C′	♂	30	3.35±0.03	3.61±0.04	12.13±0.22	92.92±1.07	8	4.98±0.16
		♀	27	3.26±0.03	3.54±0.03	11.57±0.18	92.34±1.19	5	4.62±0.20
	C,	♂	30	2.35±0.03	3.44±0.04	8.09±0.17	68.47±0.77	11	4.91±0.13
		♀	27	2.28±0.04	3.41±0.03	7.84±0.16	67.26±0.86	7	4.69±0.20

C′=maxillary canine; C,=mandibular canine; Mean±S.E.

in *C. torquatus* appears to represent a position intermediate between *C. moloch* on the one hand with none and *Aotus* on the other hand with small, but slightly greater dimorphism in the canines. Comparative field studies of both species of *Callicebus* could indicate whether corresponding behavioral differences exist and, if present, would aid in understanding the interrelationship between aggression and canine tooth size in the primates, including man.

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