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Research Article

FOOD PREFERENCE AND FEEDING HABIT OF BONNET MACAQUE (*MACACA RADIATA*)

Dileep K.[1*] and Boby Jose[2]

[1]St. Michaels Girls H.S.S., West Hill, Calicut-673005, Kerala, India
[2]Department of Zoology, St. Josephs College, Devagiri, Calicut-673008, Kerala, India

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ABSTRACT

Primate demography and behavior are profoundly affected by ecological variables and that even short term changes in environmental conditions affects species population densities and group sizes. Food preference and feeding habit of *Macaca radiata* in a sacred grove was studied. *Macaca radiata* are generalistic feeders, although they exploited a wide variety of food items they concentrated on young leaves, fruits & leaf buds which provide crude proteins, fibers, minerals and sugars. They utilized food sources in a very balanced form that they achieve their nutritional requirement from it. *Macaca radiata* space themselves out as they forage on widely dispersed leaves, flowers and fruits of commonly available plants. Opportunities for monopolization of foods are therefore rare during natural foraging and strong competition may not occur under these circumstances are noted.

Keywords: Food preference, Feeding habit, *Macaca radiata*, Sacred groves.

INTRODUCTION

Primate societies are generally structured organizations with fairly clear social rules that determine patterns of interactions between different classes of individuals comprising these societies. The genus *Macaca*, the Asian representative of cercopithecine monkeys, is the most widely distributed of any non-human primate. The evolutionary diversification of the genus *Macaca* has yielded 19 extand species (Fooden, 1980) occupying ranges in North West Africa and across South and Eastern Asia. The genus *Macaca* is placed within the tribe Papionini, which also includes the genera *Papio (*baboons), *Mandrillus*, *Theropithicus* and *Cercocebus.*

Macaca radiata is occurring in peninsular India in both villages and jungles and the species is highly adaptive. Social behavior varies widely between species sharing the same ecological niche, challenging the view that interspecific differences are closely related to ecological variation (Altmann, 1974; Wilson, 1975; Terborgh and Janson, 1986). Since food selection increases the fitness of an individual primate social structure to an extent depends on this. The ecology of *Macaca radiata* was studied giving preference to its food and feeding habit with variation during different months in a sacred grove in Kerala, India.

MATERIALS AND METHODS

The study was conducted in a sacred grove, near to Calicut, which is an evergreen patch (11^0 30'-45'lat and 75^o 40'- 50' E long) which covers over 9.75 acres. There is a lake in it extending throughout its length, which is connected, to a main river. The study area was covered with tall tree and lianas stratification was clearly seen.

*Corresponding author e-mail: dileepk82@gmail.com

The area is undisturbed, as people are not allowed to enter the site without permission. The method employed was based on direct observations. An 8 x 40 binocular was used for observation with specific sample periods. The study was conducted during 3 seasons, summer (February, March, April) monsoon (June, July) and post monsoon (November, December, January). Four categories of monkeys were identified. Since the dominance hierarchy and lineage of the monkeys were not clearly known, the criteria used in determining an individual's age/sex class are also given.

Adult Male: Any male that was morphologically bigger than an adult female by at least one third.

Adult Female: Any female that was carrying a neonate, pregnant or swollen.

Sub adult: Any male that was morphologically similar to an adult female or any female that was bigger than a juvenile but smaller than an adult female.

Juvenile*:* Any member that was independent of its mother, fed alone and indulged in playing.

RESULTS

Macaca radiata exploits a wide variety of plant species as food sources. In addition to plant it was observed that *Macaca radiata* also fed upon insects and moist soil in very small amounts. It was found that *Macaca radiata* fed upon eighteen species of plants (Table-1) and consumed thirteen food items (Table 2). Of the thirteen food items three items constituted nearly 43% of total food item. *Macaca radiata* moves early in the morning from the roost to their daily routine of feeding. Before feeding it was seen that some kind of caper was done which have seasonal variations. The caper was observed during November, December and January but during summer it was never observed. During the former period *Macaca radiata* moved from roost by 6.45 in the morning. It was seen that during monsoon also they were following somewhat the same pattern. But during summer they moved out by 6.00. Though *Macaca radiata* fed throughout the day two peaks was able to be observed during all the season. It was found to be from 7 to 8.30 am in morning and 15.30 to 17.00 hours in the evening. During summer it was found that most of the time *Macaca radiata* were resting under shades. Eventhough not much seasonal variation was seen in feeding time the adult females was having high feeding rate and time during December to March.

Macaca radiata fed throughout the study time on *Madhuca nerifolia*. It fed on its leaves and leafbuds. No seasonal preference was seen for feeding on *Madhuca nerifolia.* All the four groups fed on it with equal status. When looking on monthly average also except during three months during all the other months *Macaca radiata* preferred young leaves followed by fruits. Dry leaves were found to be used by adults only during March and April. It was found that *Macaca radiata* used pith of the *Hitchenia caulina*. No competition for food was observed during the study time.

Macaca radiata also utilized animals as their food which consists of only 2.79% of the total food consumed. The animal food mainly consisted of invertebrates like termites, larva, caterpillar and some other forms, which could not be identified. Juveniles were not seen to use animal food. It was seen that during June and July *Macaca radiata* feds on moist soil. It was also observed that *Macaca radiata* also went to nearby areas where they fed upon *Cocos nucifera* and *Areca catechu*.

Table 1. Plants used by *Macaca radiata* during different months.

Sl. No.	Plants species	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1	*Caryota urens*	√	√	-	-	√	√	√	√	-
2	*Syzygium cumini*	√	√	-	-	√	√	√	√	-
3	*Adenathera pavonina*	√	√	-	-	√	√	√	√	√
4	*Ficus religiosa*	√	√	√	√	-	√	√	√	-
5	*Mimosa pudica*	√	√	√	-	-	√	√	-	-
6	*Bambusa aurdinaceae*	√	√	√	√	√	√	√	-	√
7	*Ficus hispida*	√	√	-	-	-	√	√	-	-
8	*Strychnosnux-vomica*	-	√	-	√	√	√	-	-	-
9	*Eugenia microphylla*	-	-	-	-	√	√	√	-	-
10	*Terminalia arjuna*	-	-	-	-	√	√	√	-	-
11	*Hitchenia caulina*	√	√	√	√	√	√	√	√	-
12	*Cocos nucifera*	√	√	√	√	√	√	√	-	-
13	*Artocarpos heterophyllus*	-	-	-	-	√	√	√	√	-
14	*Areca catechu*	√	√	√	-	√	√	√	-	-
15	*Diostyros foliosa*	-	-	-	-	√	√	√	√	-
16	*Anthocephalus chinensis*	-	-	-	-	√	√	√	√	-
17	*Grass sp.*	√	√	-	-	√	√	-	√	√
18	*Madhuca nerifolia*	√	√	√	√	√	√	√	√	√

Table 2. Food preference by *Macaca radiata* during different months.

Food items	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total	%
Leaf bud	10	7	6	3	2	3	6	8	9	54	12.58
Mature leaves	5	4	3	2	3	2	4	4	3	30	6.99
Fruits	4	6	5	4	6	7	10	9	8	59	13.75
Flower	-	-	1	-	-	5	7	8	9	30	6.99
Flower bud	6	8	4	2	-	-	7	5	4	36	6.99
Petioles	6	6	3	3	2	2	3	3	3	31	7.22
Young leaves	13	12	6	2	3	7	8	9	12	72	16.78
Small grass	6	5	3	2	2	1	3	4	3	29	6.75
Seeds	2	3	2	1	4	4	4	5	4	29	6.75
Pith of stem	2	3	3	3	5	5	7	2	1	31	7.22
Dry leaves	-	-	-	-	1	3	4	-	-	8	1.86
Invertebrates	2	2	-	1	1	2	2	2	-	12	2.79
Moist soil	-	-	-	-	-	-	1	4	3	8	1.86
Total	56	56	36	23	29	41	66	63	59	429	100

DISCUSSION

Macaca radiata are omnivorous (Ali, 1986; Krishnamani, 1994). They exploited a wide variety of food items but concentrated on a rather small number of selected species. The consumption of leaves probably satisfied certain nutrient requirements of *Macaca radiata*. Young leaves contain a high percentage of crude protein and mature leaves have fairly high concentration of Calcium (Struhsaker, 1975). Studies conducted by Agoramoorthy and Hsu (2005) on Proboscis monkey also show that young leaves contain high amount of crude proteins, fibres and minerals like Sodium, Potassium and Magnesium. Leaves, fruits and flowers are most important food items. Fruits normally contain relatively large amount of simple sugars and are readily usable sources of energy.

It was seen that even though it was available in plenty during June and July, the rate of feeding it was high during March, April and May. This may be due to the less availability of water during these months that the fleshy pith of *Hitchenia caulina* was used mostly during this time.

The folivorous aspect of the *Macaca radiata* diet was perhaps adaptive in the context of the life style of this species and the periodic fluctuations in the abundance of various food resources (Ellefson, 1968). Freeland and Jensen (1974) hypothesize that herbivores must continuously sample a variety of the foods available to them in order to maintain enzymatic pathways for detoxifying secondary compounds. This allows them to ingest large quantities of relatively toxic food if necessary (when preferred food is not available) without suffering any ill effects. It is possible that *Macaca radiata* consumes several foods, especially leafy foods, in order to keep periodically, important metabolic pathways open. The use of wide variety of foods may also be necessary to maximize food intake to increase total food consumption.

In general fruits, leaf bud, flower bud etc are commonly eaten than the mature leaves. This is easily explicable in terms of higher protein content and lower cellulose level found in these plant parts compared to mature leaves (Hladik, 1977). Differences among plant species covering the plant parts most often consumed are also probably related to such nutritional differences. In many cases food choice may be the product of simple differences in energetic value or digestibility. The leaves and to a lesser extent the fruits of different species vary in the specific nutrients they contain in order to achieve a balanced diet, it may be necessary for both folivores and frugivores to select particular food series for their chemical content (Westboy, 1974).

The seeds and leaves of many tropical tree species contain a variety of secondary compounds including tannins, alkaloids & terpenes (Duke, 2002).

Macaca radiata are generalist feeders and usually space themselves out as they forage on widely dispersed leaves, flowers and fruits of several commonly available plants. Opportunities for monopolization of foods are therefore rare during natural foraging and strong competition may not occur under these circumstances (Goodal, 1963). *Macaca radiata* most likely eat invertebrates for their protein, where as mature leaves contain cellulose and secondary compounds and are thus rather difficult to digest.

Macaca radiata was observed to eat moist soil which is reported by many workers (Hladick and Gueguen1974). The behavior was observed by Goodal (1963) and and later by Hladik (1974) and named as *Earth eating* which satisfied deficiency of certain minerals. They observed and studied it in chimpanzees, patas monkeys and lemurs. In the present study, all the 4 classes were engaged in Earth eating.

CONCLUSIONS

Macaca radiata, endemic to peninsular India, are omnivorous with a myriad of food preferences

and feeding habits. Food preference and feeding habit of *Macaca radiata* in a sacred grove was studied. For attaining a balanced diet *Macaca radiata* concentrated on young leaves, fruits & leaf buds which provide crude proteins, fibers, minerals and sugars. These observations clearly demonstrate the significant behavioural attributes with respect to feeding pattern in an undisturbed tropical evergreen fragment (sacred grove).

CONFLICTS OF INTEREST

There are no conflicts of interest associated with this article.

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