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REPRODUCTIVE BEHAVIOUR IN THE NORTHERN FIVE-STRIPED PALM SQUIRREL *FUNAMBULUS PENNANTI* WROUGHTON

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Reproductive activities of the northern palm squirrel, *Funambulus pennati* Wroughton from pre-reproductive phase of courtship, mating to post-reproductive activities of nest building and maternal care have been discussed in the present paper. Courtship is initiated by various displays, most of which are performed by the females; these are emission of sweet mating calls, contact calls, vocalization and allogrooming. Mating continues for a day during which the female mates 4-5 times with the same or different males. Duration of mating act varies from 4 to 30 minutes. Breeding continues throughout the year with peak during March-April and July-August. Nest is constructed and guarded by the female in which it brings her litter, which is globular in shape and consists of cloth bits, jute fibers, small twigs of plants, dry grasses and fibers of plastic rope. The nest is situated on tree branches, holes in tree trunks or inside the crevices in the walls of the old buildings. During maternal care mother feeds her young ones, this increases their survival chances. The litter size varies from 2-4 at a time. The newly born are hairless with their eyes closed. The size of new born ranges from 4-5 cm in body length and 1.5-2 cm in their tail. Eyes open between 10^{th} to 15^{th} day after birth and the suckling period lasts upto 25-30 days.

INTRODUCTION

The northern palm squirrel is one of the most widely distributed rodent, extending its range from south of Sikkim and Nepal tarai to Dharwar district in Karnataka (Ellerman, 1961), and from Baluchistan to Bengal. Besides India, it has been reported to occur in Nepal (Moore, 1960), Pakistan (Robert, 1977) and some parts of Iran (Roonwal, 1987). Chakerborthy (1982) recorded its presence in semi-arid region of Jammu. The species experiences striking ecological contrast and thermal extremes in its vast distributional geographical range.

The species is diurnal and chiefly arboreal in habit. Being polytococus, it is prolific breeder. The work on some aspects of its reproductive biology has been done from various parts of the country by Banerjee (1955 & 1957), Purohit *et al.* (1966), Prakash & Kametkar (1969), Seth & Prashad (1969), Prakash (1971) and Prakash *et al.* (1992). The population inhabiting Jammu, ecologically different from rest of the area of its distribution have not been so far undertaken. Moreover, there is great variation in the litter size and gestation period of the species in its distributional range. The present work embodies observations on various aspects of reproductive behaviour such as courtship, mating, nest building, litter size, gestation period, post natal development and maternal care.

MATERIALS AND METHODS

The study was carried out from April 2001 to June 2002 in and around the campus of Jammu University. Geographically, the area lies at 32^0-67'N longitude and 76^0-50'E latitude at an altitude of 340 m. It experiences subtropical climate with four well defined seasons. The average rainfall is 115 cm. In order to study reproductive behaviour, few adult male and female squirrels were trapped , marked with different colour markers and then released. Binoculars were used to record the observations from a distance to avoid any disturbance to the squirrel. The courtship and mating activities were recorded visually. Data on nesting sites, shape, composition of nests and preferential nesting trees were also recorded. For studying the nest composition, old nests were brought down from the trees and material used was identified. In order to know the preferential nesting heights *viz-a-viz* height of the tree, the measurements were taken with the help of 25 m

measuring tape and for climbing up the trees a long bamboo ladder was used.

RESULTS AND DISCUSSION

Reproductive activities in *F. pennanti* were studied under following heads :

Breeding season

The breeding of five stripped palm squirrel takes place through out the year but the peaks were noticed during March-April and July-August. This aspect was studied by a few workers in different parts of the country reveals variation.

Table I : Breeding period of *F. pennanti* in different areas of India.

Time/Season of Breeding activity	Location	Reference
Thoughout the year	Saharanpur (U.P.)	Banerjee (1955 & '57)
Mostly summer but a single pregnancy was observed in the month of December	Rajasthan	Agarwal (1965)
March to September with peaks in March-April and July-September	Rajasthan	Purohit *et al.* (1966)
January to August with peaks in March and July	Delhi	Seth & Prasad (1969)
Throughout the year but peaks in monsoon	Jodhpur	Prakash & Kametkar (1969)
Throughout the year but peaks in March-April and July-August	Jammu	Present study

Pre-mating activities-courtship

It was initiated by various courtship displays most of which were observed to be performed by females like emission of sweet mating calls, contact calls, vocalization, autogrooming, allogrooming and kissing. Many a times fights were observed between rival males in order to grasp the receptive female.

Reproductive activities-mating

After brief courtship display, the male finally succeeded in overpowering female and then mounted her, the clasp being affected by the forelegs. The female has been noticed presenting her genital region, a mating invitation to male. The female accepted the male and remained in still position keeping her eyes closed. The mating act lasted for 4-30 minutes. The pair was usually disturbed by other willing males which finally ended the mounting. The estrous female which has participated in mating activities with the resident male, at times forcibly mounted by intruder males the same very day after which this female was not noticed to under go another act of copulation on subsequent days. The duration of mating decreased as the number of matings increased. It may be due to exhaustion and fatigue of female so as to continue with the act and unwillingness on her part to participate with the stranger males. An interesting thing which has been observed was that mating period lasted only for a day. The same female was not seen mating again, rather she secluded herself and started collecting nesting material for her forthcoming ones.

Post mating activities

Nesting : The nest building instinct, in the future mothers sprang up nearly a week after

mating is in accordance with the observation of Banerjee (1957). Of the 21 nests of *F. pennanti* located in the study area, 12 were made on the peripheral branches of trees, 6 in the holes of tree trunks, 2 in crevices of the walls and 1 nest was located in the wooden letter box. Out of 18 nests made on either branches of the tree or trunk holes, 1 was constructed on *Acaccia modesta*, 3 each on *Eucalyptus* sp. and *Morus alba*; and 1 each on *Melia azedarachtia*, *Ficus bengalensis* and *Zizyphus mouritiana*. Hole nesting height was nearly half of that made on branches of the trees, it ranged between 2 to 3 m. Correlation test revealed that height of the nest and the height of the corresponding tree was positively correlated (r = +0.814).

Most of the trees used for nesting had light coloured bark which made the squirrel to appear cryptic while resting on trees. Very few nests were recorded on fruiting trees. It may be to avoid detection and disturbances due to visitor birds.

Purohit *et al.* (1966) recorded that squirrel nest is an assemblage of bits of cloth, thread pieces and fibres from jute bags, dry and fresh grass, feather of birds and animal hairs. Similar observations have been made during the present work as well.

Gestation period and litter size : Gestation is the period of pregnancy, the time from the fertilization to birth of the young ones. In the present study, the gestation period ranged between 35-37 days and litter size was 2-4 but lot of variations in the gestation period and litter size has been reported by earlier workers (Table II).

Table II : Gestation period and litter size in *F. pennanti* from different places.

Gestation period	Litter size	Place	Reference
40-42 days	3	Saharanpur (U.P.)	Banerjee (1955 & '57)
35-39 days	2-5	Rajasthan	Agarwal (1965)
37-40 days	1-4	Rajasthan	Purohit *et al.* (1966)
30-32 days	1-5	Delhi	Seth & Prasad (1969)
35-37 days	2-4	Jammu	Present work

Post-natal development : The new born youngs of squirrel are without any hair on their body and their skin is pink in color. Light markings on the dorsum are visible. Eyes are closed and pinna is folded. The tail is naked. Claws on the toes are feebly developed and colourless. The youngs could crawl for a while but are unable to support their body on their limbs for longer period. The body length varies from 4-5 cm and tail length was 1.5-2 cm.

In the 2nd week after birth, a dark line appeared between the two eyelids. The eyes opened 10-14 days after birth. The youngones were observed suckling for about 3-4 weeks after birth. By 8th to 9th week, the young accomplishes the mature colouration of the adult but the hairs remained shorter than the adult.

Maternal care : It involves an association between the mother and her offsprings. Mother feeds and protects them, thus increasing their chances of survival. In case of squirrels, youngones are fed and taken care by their mothers upto the juvenile stage, whereafter they start independent feeding. When juveniles are feeding, the mothers usually keep an eye around surroundings. The mother remains with the juveniles all the time and they also maintain contact with the mother, especially during resting when they lie on and hold mother tail which they even bit gently at times. During travel and escaping from a predator, the mobility of the adult female decreased. If the juvenile was with her, she would slow down and wait until the juvenile approaches the same tree. However, she is extremely quick and fast when escaping alone.

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