

swallowed after excavating the ground with its claws. The entire operation took 15-20 minutes. This is a normal practice employed by villagers whenever a bear visits their village. A close examination of such treated cattle shed showed that the tick population on the body of cattle came down abruptly and ticks did not appear for the next 4-6 months.

This method has been found to be useful

AGRICULTURE COLLEGE,
DHARWAD-580 005,
January 7, 1985.

for the control of ticks in North Karnataka and does not involve risks associated with acaricides but it has got its own limitations since the bear population has come down heavily in recent years and bears will not be available whenever cattle owners require bears for the removal of ticks from the cattle sheds.

SARVAMANGALA HARLAPUR
L. S. HIREGOUDAR

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4. FOOD AND NESTING HABITS OF *FUNAMBULUS TRISTRIATUS* WATERHOUSE IN MALABAR*

This paper deals with the annual diet and nesting habits of the Western Ghats squirrel, *Funambulus tristriatus* Waterhouse. Stomach content analysis revealed their omnivorous nature with termites and male flowers of coconut as the major food items. Nests were globular in shape and built at 2 to 29 m height on trees 4 to 30 m tall.

INTRODUCTION

The Western Ghats squirrel, *Funambulus tristriatus* Waterhouse is an arboreal rodent inhabiting the forest and cultivated fields in the west coast of south India (Moore and Tate 1965). Bhat and Mathew (1984 a and 1984 b) studied the population dynamics and reproductive biology of this species. Our knowledge on the food habits of this squirrel is limited to the bait preferences on captive animals (Bhat 1979). In this communication the

observations made on the annual diet and nesting habits of the Western Ghats squirrel are discussed.

STUDY AREA

The study was conducted in 15 ha of mixed habitat near Vittal (12°30'N, 74°80'E), Karnataka, India from November 1977 to January 1979. The area was evenly divided among 3 habitat types: paddy (*Oryza sativa* L.) fields, arecanut (*Areca catechu* L.) plantations and woodland. The latter habitat had a few evergreen trees and shrubs. The common trees in this area were: *Aporosa lindleyana* Baill., *Careya arborea* Roxb., *Caryota urens* L., *Cin-*

* Part of the thesis submitted to the University of Calicut by the first author for the award of Ph.D. degree 1983.

namomum zeylanicum Bl., *Eugenia jambolana* Lam., *Holarrhena antidysenterica* Wall., *Phyllanthus emblica* L., *Sapium insigne* Benth., *Strychnos nuxvomica* L. and *Terminalia chebula* Retz. Coconut (*Cocos nucifera* L.), arecanut, cashew (*Anacardium occidentale* L.), mango (*Mangifera indica* L.), banana (*Musa paradisiaca* L.) and paddy were cultivated here. The shrub and herb community included *Caesalpinia mimosoides* Lam., *Calycopteris floribunda* Lam., *Ixora coccinea* L., *Lantana camara* L. and *Mimosa pudica* L. *Pandanus leram* Jones, *Agave americana* L. and *Opuntia* sp. also were common but along the edges.

METHODS

Food habits.

Squirrels were collected by snap trapping using roasted coconut kernel as the bait. The animals were then dissected in the laboratory and stomachs removed. The contents of each stomach, after removing the bait, were emptied into a petridish and weighed to the nearest 0.05g using a toppan balance. A gross analysis of the total contents of each stomach was made with a dissecting microscope (40x) to identify the major food materials inside.

The volume of the major food materials was determined by water displacement following Sood and Dilber (1977) and Viljoen (1977). Items such as the exoskeleton of insects, which floated were immersed in water by pressing them with a fine sieve of known volume.

Nesting habits.

As the Western Ghats squirrels are diurnal in habit, their nests were spotted by following individual squirrel to its nest at dusk (after Broadbooks 1974). The inhabitant of each nest was trapped and its sex, weight and reproductive conditions were noted. The height at

which the nest was located was measured and the nest was measured and the nest was removed for further observation. The nesting tree was identified and the site of location of each nest described.

RESULTS AND DISCUSSION

Food habits.

The Western Ghats squirrels examined by us were harmful as well as beneficial in their feeding activities. Among the plant food, male flowers of the coconut palm were most frequent in the stomach contents (Table 1). Only the central rudimentary pistil and the stalk of the stamens were consumed. Cacao, an important commercial crop in south India (Bavappa 1977), is also attacked. Bhat *et al.* (1981) reported the squirrel as one of the important rodent pests of cacao in south India. The grains of paddy, available only from December to February, were consumed mainly during that period. Of the 17 squirrels which took paddy, two (11.1%) had only paddy in their stomachs. In December and January, paddy grains formed more than 40% of the total food contents in their stomachs.

Crops pests such as termites, caterpillars, beetles and scales were also eaten consistently. Termites occurred more frequently (96.8% of stomachs) and in greater quantity (36.5% of volume) than any other food material in the stomachs of squirrels (Table 1). Of the 60 squirrels which took termites three (5.0%) had consumed termites only. The northern palm squirrel, *F. pennanti* also preyed upon large quantities of termites and caterpillars (Krishnaswami and Chowhan 1957). Insects (unspecified) were reported to be the most common food of the northern palm squirrel by Sood and Dilber (1977). The latter authors considered the northern palm squirrel to be

MISCELLANEOUS NOTES

TABLE 1

SUMMARY OF FOODS EATEN BY *F. tristriatus*, DECEMBER 1977 TO JANUARY 1979 (THE FIGURES IN LEFT DENOTE PERCENTAGES BY OCCURRENCE AND THOSE WITHIN PARANTHESIS PERCENTAGES BY VOLUME) TR. TRACE

Food	Season		
	Winter (Nov.-Jan.)	Summer (Feb.-May)	Rainy (June-Aug.)
Paddy grains	56.0(22.8)	7.1(1.6)	—
Male flowers of Coconut	52.0(6.6)	39.3(11.9)	44.4(11.1)
Mucilage of cacao beans	12.0(3.0)	28.6(14.8)	22.2(8.5)
Cashew apple	—	28.6(13.9)	—
Fruits of Kokra Laurel	—	—	11.1(8.0)
Flowers of silk cotton	20.0(9.3)	—	—
Dried wood	28.0(tr)	46.4(8.5)	11.1(1.1)
Termites	100.0(30.3)	92.9(35.2)	88.9(18.2)
Black ants	20.0(1.4)	50.0(4.7)	33.3(tr)
Beetles	16.0(tr)	21.4(tr)	33.3(tr)
Caterpillars/grubs	44.0(1.5)	60.7(3.3)	66.7(12.7)
Scales	12.0(tr)	14.3(2.0)	11.1(1.0)
Other insects	32.0(2.1)	25.0(2.5)	22.2(tr)
Soil/sand	16.0(2.2)	7.1(tr)	22.2(tr)
Sample size	25	28	9

economically beneficial to crops as predators of insect pests.

The economic effects of this squirrel feeding on male flowers of coconut palm is not clear. Yelf (In Williams 1974) noted a significant premature nut fall in the coconut palm due to the feeding activity of rats and flying foxes on the male flowers. But Williams (1974) opined that such feeding activity was unlikely to have any adverse effect on production as there were considerable excess of pollen in each spadix.

Nesting habits.

In all 20 active and one incomplete nest were studied. The nests were round with mean diameter of 22.27 ± 0.66 cm and thickness of 11.85 ± 0.54 cm (Table 2). The nests weighed 35.0-207.0 g (mean 71.23 ± 6.42 g). Only three of the 30 nests weighed more than 100 g.

These three nests had 8-10 unhusked dried arecanuts, which by themselves weighed more than 100 g. The intact nuts probably were collected for their fibrous husks, one of the common nesting materials in the nests of these squirrels.

Male and female squirrels inhabited separate nests. Male nests were used for resting and female nests for sleeping and rearing their young. Of the 29 active nests observed, 11 were of males and 18 females. The mean weights of the nests of male and female squirrels were 58.64 ± 6.28 g and 80.17 ± 9.36 g respectively. The difference in their weights was not significant ($P > 0.05$).

All nests were constructed of fibrous materials unlike several other sciurids (Middleton 1931, Layne 1954, Everard 1968, Brown and McGuire 1975, Raspopov and Isakov 1980) which mostly used dried leaves and twigs for

nest construction. The Western Ghats squirrels collected nesting materials from 15 species of trees (Table 3). The fibres of dried leaves of *Agave*, *Pandanus*, *Musa*, the crown matrix of the coconut palm, dried fronds and nuts of the arecanut palm and of the bark of *Careya* were commonly used in constructing the nests.

The northern palm squirrel, *F. pennanti* is also known to use fibrous plant parts as the common nesting material (Purohit *et al.* 1960).

The nests were found on 14 species of trees (Table 2). Mango, arecanut and Strychnine together supported nearly 50% of the nests. This suggested that these squirrels had some

TABLE 2
OBSERVATIONS ON THE NESTS OF THE WESTERN GHATS SQUIRREL

Nesting tree	Height of nesting tree (m)	Height of nest (m)	Weight of nest (g)	Mean diameter of nest (cm)	Thickness of nest (cm)
<i>Strychnos nuxvomica</i> Linn.	8.0	5.0	84.0	22.0	12.0
	8.0	5.0	100.0	18.0	15.0
	9.0	5.0	58.0	18.5	14.0
	9.0	7.0	49.0	21.5	10.0
	9.0	7.0	49.0	22.5	8.0
<i>Areca catechu</i> Linn.	6.0	4.0	73.0	28.5++	12.0
	7.0	6.0	65.0	25.0	14.0
	10.0	9.0	128.0	●	●
	15.0	14.0	87.0	22.5	16.0++
<i>Mangifera indica</i> Linn.	20.0	19.0	53.0	19.5	7.0+
	30.0	4.5	207.0++	24.0	15.0
	10.0	7.0	59.0	20.5	11.0
	7.0	5.0	70.0	22.5	16.0
	10.0	5.0	37.0	19.5	10.0
<i>Cocos nucifera</i> Linn.	8.0	4.0	35.0+	●	●
	4.0	3.0	67.0	24.5	8.0
	10.0	9.0	126.0	27.5	15.0
<i>Holigarna</i> sp.	30.0	29.0	81.0	22.5	14.0
	10.0	7.0	72.0	21.5	11.0
	8.0	4.0	37.0	21.0	14.0
<i>Borassus flabellifer</i> Linn.	20.0	2.0*	77.0	19.0	14.0
<i>Theobroma cacao</i> Linn.	4.0	2.0	98.0	●	●
<i>Cinnamomum zeylanicum</i> Blume	7.0	5.0	81.0	14.5+	12.0
<i>Pandanus tectorius</i> Soland.	5.0	4.0	38.0	26.5	9.0
<i>Hopea wightiana</i> W. & A.	8.5	7.0	56.0	28.5	12.0
<i>Terminalia</i> sp.	8.0	4.0	51.0	25.0	11.0
<i>Tamarindus indica</i> Linn.	12.0	5.0	44.0	●	●
<i>Sapindus emarginatus</i> Linn.	16.0	12.0	50.0	22.0	8.0
Unidentified tree	4.0	2.5	52.0	23.0	12.0
Building roof	4.0	4.0	53.0	19.0	8.0

+ Minimum ++ Maximum * Built on some epiphytes at 2 m above the ground. ● Measurements could not be taken as the shape of the nest was changed while removing.

MISCELLANEOUS NOTES

TABLE 3
 ABUNDANCE (EXPRESSED AS PERCENTAGE IN EACH NEST) AND FREQUENCY (EXPRESSED AS PERCENTAGE OF TOTAL NESTS) OF OCCURRENCE OF NESTING MATERIALS IN THE NESTS OF THE WESTERN GHATS SQUIRREL (N = 30)

Plant species	Nesting material	Percentage in each nest					Complete this nesting material	Percentage of nests with this nesting material
		5	5-24	25-49	50-74	75-99		
<i>Agave</i> sp.	Fibre from dried leaves	1	1	1	0	0	3	20.0
<i>Borassus flabellifer</i> Linn.	Fibre of crown matrix	0	0	0	0	0	1	3.3
<i>Bombax malabaricum</i> DC.	Fibre of the bark	0	3	1	0	0	0	13.3
<i>Musa paradisiaca</i> Linn.	Fibre of the leaf sheath	1	2	4	1	4	2	46.7
	Dried leaves	1	0	0	0	0	0	3.3
<i>Pandanus tectorius</i> Soland.	Fibre of dried leaves	1	1	0	0	1	2	16.7
<i>Theobroma cacao</i> Linn.	Fibre of the bark	0	0	0	0	1	0	3.3
	Beans	0	1	0	0	0	0	3.3
	Fibre of crown matrix	2	2	1	2	0	0	23.3
<i>Cocos nucifera</i> * Linn.	Fibre of husk	1	2	0	0	0	0	10.0
	Leaflets	2	0	0	0	0	0	6.7
<i>Areca catechu</i> Linn.	Parts of inflorescence	2	2	2	0	0	0	20.0
	Dried arecanuts	0	2	0	0	0	0	6.7
	Fibre of areca husk	0	3	0	0	0	0	10.0
	Fibre of dried frond	0	2	1	1	2	0	20.0
	Leaflets	1	4	1	0	0	0	20.0
<i>Terminalia</i> sp.	Fibre of the bark	0	0	1	0	0	0	3.3
<i>Careya arborea</i> Roxb.	Fibre of the bark	0	0	2	2	1	1	20.0
Unidentified grass	Complete	0	1	0	0	0	0	3.3
<i>Monstera</i> sp. (root-climber)	Fibre of the vine	0	0	0	1	0	0	3.3
Unidentified climber	Complete	0	1	0	0	0	0	3.3
Unidentified tree	Fibre of the bark	0	1	0	0	0	0	3.3
Jute thread	Complete	0	0	1	0	0	0	3.3

sort of discrimination in selecting trees for nest construction. Selection for nest trees was earlier noticed in certain other squirrels also (Brown and McGuire 1975, Fancy 1980). The branches of the wild trees of the study area were cut and mutilated every year for firewood and leaves for composting. The regrowth on such branches is dense and the squirrels found convenient nesting spots in such branches where the nests are concealed and protected by the leaves.

The nests were built at heights of 2-29 m on trees 4-30 m tall. However, on palms like arecanut and coconut the nests were situated on the crown irrespective of their height. This squirrel, unlike several other species (Allen 1943, Layne 1954), was not observed to build

its nests in natural cavities of trees. The northern palm squirrel (Agrawal 1965-'66, Purohit *et al.* 1966) and the European red squirrel, *Sciurus vulgaris* (Raspopov and Isakov 1980) were some of the other squirrels which built their nests on the branches of trees.

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S. KESHAVA BHAT¹
D. N. MATHEW

DEPARTMENT OF ZOOLOGY,
UNIVERSITY OF CALICUT,
KERALA 673 635,
January 21, 1985.

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¹ Present address: Central Plantation Crops Research Institute, Kasaragod 670 124, Kerala, India.

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5. REPORT ON THE OCCURRENCE OF THE BROWN SPINY MOUSE, *MUS PLATYTHRIX* BENNETT, 1832 (RODENTIA: MURIDAE) IN WEST BENGAL, INDIA

During a recent mammal survey tour in September 1984, a large-sized white-bellied mouse with bicoloured tail and spiny hair was trapped at Mandalpushkarini near Garhbeta in Midnapore district, West Bengal. It turned out to be an example of the Brown Spiny Mouse, *Mus platythrux* Bennett.

This species occurs within the Indian limits in southern India, Maharashtra, Gujarat, Rajasthan, Madhya Pradesh, east to Pareshnath Hill in Bihar and patches in Kangra (Punjab) to Kumaon (Uttar Pradesh). Out side Indian limits, it occurs in Pakistan, Burma, Sri Lanka and Nepal (Blanford 1891, Ellerman 1961, Ellerman and Morrison-Scott 1966, Biswas and Tiwari 1969, Agrawal and Chakraborty 1971 and Marshall 1977). However, the extant literature does not mention its distribution in Orissa, West Bengal, Sikkim and the north-eastern part of India (Assam, Meghalaya, Arunachal Pradesh, Nagaland, Manipur, Tripura and Mizoram). Hence the present material constitutes the first authentic record of its occurrence in West Bengal.

The details of the specimen are given below. The external measurements were taken in the field. All measurements are according to Ellerman (1961) and given in millimetres.

Material: 1 adult ♂; Z.S.I. Registration Number 21265; in alcohol; Mandalpushkarini, c 5 km North of Garhbeta, Midnapore district, West Bengal; 21 September 1984; P. K. Das collector; deposited in the National Zoological Collection of India, housed at the Zoological Survey of India, Calcutta.

Measurements: External — Head and body 110; tail 75; hindfoot 18; ear 16.5. Cranial — Occipitonasal 25.8; condylobasal 24.9; nasal 10.2; palate 14.2; bulla 4.5; molar tooth row 4.4; anterior palatal foramen 5.9; diastema 7.2.

The specimen was trapped outside the kitchen of the Forest Rest House which is surrounded by secondary sal forests. The colour of the soil is red.

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