

Studies on rodent damage to cocoa in south India: identification of their damage*

S. KESHAVA BHAT

Central Plantation Crops Research Institute,
Regional Station, Vittal - 574 243, India

Studies were conducted both in laboratory and field conditions to distinguish between the squirrel (*Funambulus* spp.) and the rat (*R. rattus*) damaged cocoa pod. Cocoa pods damaged by these rodents were collected separately and observations were made on the position and shape of holes nibbled by them. Squirrels had the tendency to make oval holes either in the central or in the terminal portion of pods, while the rats made oval or round holes near the stalk region for feeding on the cocoa pod. This observation will be of help in assessing the economic importance and the actual pest status of these two rodent pests in a particular garden.

Among rodents, the Western Ghats squirrel, *Funambulus tristriatus* Waterhouse, the South Indian palm Squirrel, *F. pa. narum* L. and the black rat, *Rattus rattus* L. are considered to be pests of cocoa (*Theobroma cacao* L.) in south India (Bhat, 1978). Though the damage inflicted by these rodents to cocoa pods is considerable no attempt has been made so far to control them. Since each rodent species has its own mode of life, a thorough knowledge of the pests natural history is necessary for the control measure to become successful (Barnett & Prakash, 1975). Hence, it is necessary to identify the actual rodent pest responsible for most of the damages before taking up the control measures. The present study was conducted to differentiate between squirrel and rat damage in cocoa.

MATERIALS AND METHODS

The feeding behaviour of squirrels (*Funambulus* spp.) and rat (*Rattus rattus*) on the cocoa pod was studied separately both in captivity and in field. In captivity the cocoa feeding behaviour of rodents was studied using specially designed and fabricated cage (Figure 1).

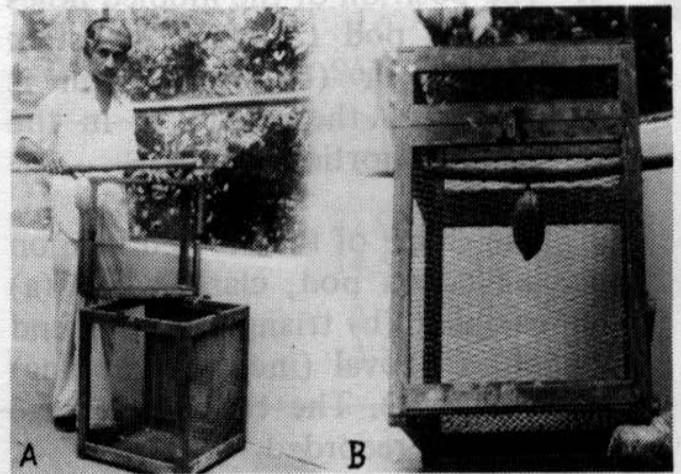


Figure 1. Cage devised to study the cocoa feeding behaviour in squirrel and rat - (a) before assembly and (b) after assembly

The cage was made of wire mesh with two separable halves; an upper smaller and a lower bigger. The size of the cage was 90 x 45 x 45 cm. Semi-circular grooves of 3 cm diameter were made on both the opposable surfaces of the halves and on opposite sides of each cage. A length of branch was kept on this groove and a mature cocoa pod was hung down, by means of a thread, from its centre to simulate approximately the natural condition. The distance between the pod

* Contribution No. 182, Central Plantation Crops Research Institute, Regional Station, Vittal - 574 243, India.

and the sides of the cage was so adjusted that the pod was not easily accessible to the animal except from the branch from which the pod was suspended.

Ten adult squirrels and ten adult rats were collected from the cocoa garden and housed individually inside a cage. Each animal was then provided with a single ripe cocoa pod. The damaged pod was removed for observation after tying a fresh pod in its place. The following observations were made on the damaged pods:

1. The position of the nibbled holes on the pod (a) near the stalk portion or (b) away from it (either in the centre or in the terminal portion) and
2. The shape of the nibbled hole on the cocoa pod, classified as (a) irregular (b) triangular (c) round and (d) oval (including oblong) (Figure 2). The time of damage was also recorded.



Figure 2. Nature of the gnawed hole on the cocoa pods. Position (a) near the stalk and (b) away from the stalk. Shape (1) irregular, (2) triangular, (3) round and (4) oval.

Since the squirrels (*Funambulus* spp.) are diurnal and the rat (*R. rattus*) is nocturnal in habits (Barnett & Prakash, 1975) the cocoa pods damaged by rodents during day time were considered to be damaged by squirrels and those damaged during night time were considered to be damaged by rats. Based on this, rodent damaged cocoa pods were collected from the field both in the evening (6.30–7.00 p.m.) and in the morning (6.30–7.00 a.m.) and the nature of damage studied.

RESULTS

Studies in cages

Out of the total number of 124 pods damaged by squirrels in captivity, significantly more ($P < 0.01$) number of pods had the damage away from the stalk region, whereas in those pods damaged by rats, significantly more ($P < 0.01$) number of pods had the damage near the stalk region (Table 1). While gnawing the cocoa pods squirrels made oval holes more frequently ($P < 0.01$) than other types but rats preferred to make both oval as well as round types. Squirrels damaged the pods during day time and rats during night time.

Field studies

Among the rodent damaged pods collected from the field during day time significantly more ($P < 0.01$) number of pods had the damage away from the stalk portion. Further, in these pods oval type of damage was more frequently ($P < 0.01$) observed than other types. The results obtained from the pods damaged by rodents during day time were on par with that of the

Pods damaged by squirrels in captivity. Among the pods damaged by rodents during night time significantly more ($P < 0.01$) number of pods had the damage near the stalk portion and in most of the pods the shape of the hole was round (Table 2).

DISCUSSION

The observations made in laboratory and field conditions indicated that squirrels (*Funambulus* spp.) appeared to feed on the cocoa pods by making oval holes whereas the rat (*R. rattus*) made both

TABLE 1. POSITION AND SHAPE OF THE NIBBLED HOLE ON THE COCOA PODS DAMAGED BY SQUIRRELS AND RATS (IN CAPTIVITY)

Characteristics of the nibbled hole on the pods	No. of damaged pods		Percentage of total	
	Squirrel	Rat	Squirrel	Rat
Position				
Near the stalk	5	74*	4.0	85.1
Away from the stalk	119*	13	96.0	14.9
Shape				
Oval	88*	22*	71.0	25.3
Round	18	39*	14.5	44.8
Triangular	3	13	2.4	14.9
Irregular	15	13	12.1	14.9

*Significant at $P = 0.01$.

TABLE 2. POSITION AND SHAPE OF THE NIBBLED HOLE ON COCOA PODS DAMAGED BY RODENTS DURING DIFFERENT TIMES OF THE DAY (IN FIELD)

Characteristics of the nibbled hole on the pods	No. of damaged pods during		Percentage of total	
	Day	Night	Day	Night
Position				
Near the stalk	4	119*	3.4	90.8
Away from the stalk	115*	12	96.6	9.2
Shape				
Oval	95*	18	79.8	13.7
Round	17	73*	14.3	55.7
Triangular	2	14	1.7	10.7
Irregular	5	26	4.2	19.8

*Significant at $P = 0.01$

round and oval holes for feeding. Other types of damages were also observed in both cases, but significantly in low frequency (Table 1 and 2). It was also observed that squirrels preferred to make holes away from the stalk or basal region either in the central or in the terminal portion of the pod. On the contrary, rats had the tendency to make holes near the stalk portion of the cocoa pods.

To distinguish between the damage caused to cocoa pods by these two rodents, certain other methods are also in practice. The markings of their incisors on the objects they gnaw enable one to have a rough idea of the rodent involved by comparing the size of their incisor with the marks left on the object (Taylor, 1972). Williams (1974) considered this aspect as a criterion for distinguishing the damages between *R. rattus* and *R. exulans* Peale in coconuts. Since the size of the incisors of *R. rattus* and *Funambulus* spp. is more or less similar, comparison of the incisor marks is unlikely to lead to any definite conclusion. Further, unlike in coconuts, the cocoa pods damaged by rodents will dry up and continue to remain on the tree for several months. Precise identification of incisor marks of rodents in such dried pods is not feasible, especially for the cultivators who have to carry out control operations. On the other hand, it is not difficult to examine the

shape and position of nibbled holes even on such dried pods. Hence, the results of the present study will be of help in assessing the economic importance of these two rodent pests, i.e., *Funambulus* spp. and *R. rattus*, separately in a particular garden.

ACKNOWLEDGEMENT

The author is indebted to Dr N.M. Nayar, Director, Central Plantation Crops Research Institute, Kasaragod and Mr K. Shama Bhat, Agronomist-in-charge, CPCRI, Regional Station, Vittal for providing the facilities for the study. Thanks are also due to Mr B.P. Nair, statistician for assistance in statistical analysis. The award of a research fellowship by the CSIR, New Delhi is gratefully acknowledged.

REFERENCES

- BARNETT, S.A. & PRAKASH, I. (1975) *Rodents of economic importance in India*, Arnold-Heinemann, India, pp. 175.
- BHAT, S.K. (1978) Rodent damage to cacao in south India, *Rodent Newsletter* 2(3), 1.
- TAYLOR, K.D. (1972) Rodent problems in tropical agriculture, *PANS*, 18(1), 81-88.
- WILLIAMS, J.M. (1974) Rat damage to coconut in Fiji, Part I - Assessment of damage, *PANS*, 20(4), 379-391.