# ECOLOGY, STATUS AND POST-NATAL DEVELOPMENT OF THE BLACK RAT INFESTING COCONUT AND CACAO

RANJAN ADVANI
Central Plantation Crops Research Institute, Kasaragod-670 124, Kerala

## ABSTRACT

**The common Black rat, *Rattus rattus wroughtoni* Hinton (Rodentia: Muridae) is a predominant pest (72.5% relative abundance) of cacao and coconut crops, along with seven other species of rodents, three species of bats and one species of shrew. The weights and measurements of head and body were significantly ($P<0.01$) more in males than in females. Of the total free living populations, females (54%) predominated. The highest prevalence of pregnant females, subadult populations and high densities of *R. rattus wroughtoni* coincided with the low rainfall period from September to October. Low levels of reproduction and subadult population were encountered during high rainfall periods from June to August, since rainfall had an adverse effect on reproduction of rats.**

## INTRODUCTION

Rodents inflict heavy losses from sowing to storage, in all agricultural crops. The infestation patterns of rodents and damages caused to different crops prevalent in North India like vegetables (Advani and Mathur, 1982), wheat (Advani, 1982; Advani *et al.* 1982) and millets (Advani *et al.* 1981) are well documented. The cost-benefit ratios of rodent pest management varied from 1:220 (stored grains) to 1:900 (vegetables). Similar studies have been carried out by the author on plantation crops.

The present communication deals with the ecology, biology and economic status of the predominant rodent pest *Rattus rattus wroughtoni* on coconut and cacao crops.

## MATERIAL AND METHODS

Samples of rodents were collected from coconut and cacao plantations continuously for 180 days from June to November,

1982. The habitat included experimental plots of CPCRI, Kasaragod, and some nearby villages like Kudlu, Mogral Puttur, Kuntur, Muliyar village, Muttul Farm, and Madhur. The mean annual rainfall of this biotope is 3700 mm, and mean number of rainy days, 118. The average mean annual minimum and maximum temperatures are 23.1°C and 33.8°C respectively. The sunshine hours of this region vary from 3.3 in June to 9.5 in January and February.

Some farms have coconut as single crop while in others cacao is planted as mixed crop with coconut. Other crops prevalent in this habitat are arecanut, banana, pineapple, paddy, pepper and oil palm.

Rodents were collected in live Sherman wooden traps baited with banana, grape or coconut. After every 6 hours the traps were checked for rodents during which time they were rebaited with fresh baits. Traps were fixed on the top of coconut trees or tied to branches of cacao in a grid manner, and the population levels, species composition and relative abundance of rodents were evaluated following the standard method of Barnett and Prakash (1975). The live trapped rodents were killed with chloroform and after taking their body weights and measurements of head, body, tail, hind foot and ear, they were dissected. The condition of vagina (perforate/imperforate) and of teats for lactation was checked. The number of embryos implanted per pregrant female was counted and measured for crown rump length. The number of corpora-lutea was counted to find out pre-implantation losses. In males, the condition of testes (abdominal/scrotal) was noted. All the rodents were identified (Ellerman, 1961) and later got confirmed by the Zoological Survey of India, Calcutta. After dissection, the rodents were preserved in 6 per cent formalin and registered in the Museum of Rodent Research and Control Centre at CPCRI, for further observations on bionomics. Post-natal development of *R. rattus wroughtoni* was studied in the laboratory for 15 weeks. Assessment of damage to cacao and coconut was made following the methods of Barnett and Prakash (1975), and Flotow (1979).

## RESULTS

Association of *R. rattus wroughtoni* with other small mammals: Among the rodents trapped from the coconut and cacao crops,

**Table 1.** Species composition and relative abundance of various rodent species in plantation crops

| Rodent Species | No. of samples collected | % Occurrence |
|---|---|---|
| Rodentia: Murinae Blackrat, *Rattus rattus wroughtoni* Hinton | 1756 | 72.5 |
| Common house rat, *Rattus rattus rufescens* Gray | 370 | 15.27 |
| Soft furred field rat, *Rattus meltada* Gray | 3 | 0.12 |
| Field mouse, *Mus booduga* Gray | 2 | 0.08 |
| Long tailed tree mouse, *Vandeleuria oleracea* | 4 | 0.16 |
| Lesser bandicoot rat, *Bandicota bengalensis* | 6 | 0.24 |
| Larger bandicoot rat, *Bandicota indica* (Bechstein) | 1 | 0.04 |
| Rodentia: Gerbillinae: Indian gerbil, *Tatera indica* Hardwicke | 4 | 0.16 |
| Rodentia: Sciuridae. Western Ghat squirrel, *Funambulus tristriatus* Waterhouse | 277 | 11.43 |
| Total | 2423 | 100.00 |

*R. rattus wroughtoni* was a predominant species (relative occurrence—72.5% Table–1). It was followed by *R. rattus rufescens* Gray, and the Western Ghat squirrel, *Funambulus* tristriatus Waterhouse (Rodentia: Sciuridae). Other species competing with *R. ratus wroughtoni* for food and space in these crops were, the soft furred field rat, *Rattus meltada* Gray (Rodentia: Muridae), long tailed tree mouse, *Vandeleuria oleracea* Bennett (Rodentia: Muridae), field mouse, *Mus booduga* Gray (Rodentia: Muridae) and the larger bandicoot rat, *Bandicota indica* Bechstein (Rodentia: Muridae). Groupwise, murids predominated the rodent fauna (88.41%) over other groups such as sciurids (11.43%) and gerbils (0.16%). Along with rodents, three species of bats, the Indian flying fox, *Pteropus giganteus* (Brunnich) (Chiroptera: Pteropidae); Short-nosed fruit bat, *Cynopterus sphinx* Vahl (Chiroptera: Pteropidae), and the Indian false vampire bat, *Megaderma lyra* Geoffroy (Chitroptera: Megadermatidae), which frequently visit cacao and coconut plantations after dusk, were also captured in rodent traps.

An insectivore, the Mouse shrew, *Suncus murinus* Anderson (Insectivora: Soricidae) was also collected in the rat traps kept in cacao crop.

**Variations in body weight and parts:** The body weight of male was significantly ($P < 0.01$) higher than that of the female. Regarding measurements of various taxonomically important external features except the length of head and body ($P < 0.01$), there was no significant variation between tail, hind foot and ear of male and female.

**Sex ratio and population structure:** In the free-living population of rats, the males predominated from June to September, whereas females outnumbered males in the post-monsoon months of October and November. However, the females predominated (54%) in the total collection.

Recruitment of sub-adults in the *R. rattus* population was parallel to the prevalence of pregnancy among females. The highest percentage of sub-adults was encountered in November (about 25%) followed by October. The highest body weight class (171–200g) was captured only during July, September and October. The major segment of rodent population in all months belonged to the age group of 81–110g.

**Population and reproduction as related to rainfall pattern:** During high rainfall periods, the pregnant females as well as the number of pests collected was in least frequency. On the other hand, with gradual decrease in rainfall and number of rainy days from August to November, the per cent pregnancy as well as density of rodents per hectare increased, the highest being in October and November.

**Damage assessment and cost benefit analysis of rodent trapping:** The rodent damage to coconut (mainly by *R. rattus*) and to cacao (by the mixed population of *R. rattus* and *F. tristriatus*) varied from 70.4 to 79.4 per cent. There was a relationship between population level and damage magnitude in the respective months. When coconut plantations had cacao as a mixed crop, the rodent damage was significantly higher (average of 6 months—28.53%),

than when the coconut was cultivated as a single crop (average damage—21.03%). In case of cacao, in several farmers' fields, 95–100% damage had occurred, according to their records of harvest, and after successful trapping, the production had increased five-fold. Overall, with trapping for 180 days, the rodent damage to coconut and cacao could be reduced by 92.21 and 76.20 per cent respectively.

While evaluating economics of rodent trapping (2423 rodents trapped) in relation to reduction in losses to cacao and coconut, keeping in view the feeding and damage habits (daily food intake of rodents), the cost benefit ratio for one year, after trapping, was estimated to be about 1:490 (in rupees).

**Post-natal development:** Newly born young ones were naked but had vibrissae measuring about 1.5 mm. Internal viscera was visible under the translucent pink skin. Eyes were closed. The body length and breadth varied from 35 to 40 mm, 7 mm and 5.1 mm. The mother transported the young ones to the cotton nest made in a corner. However, the infants were able to make wriggling movements. The planter pads and nails were poorly developed.

In the first week, ears unfolded with darkening of dorsum and growth of hairs. A narrow cleavage appeared in between two eyelids. Incisors developed as a rough area in gums. Sucking continued and the young ones could crawl over cage surface. In the second week, pelage of short hairs developed on dorsum and tail. Planter pads also appeared. Teats appeared in the form of spots while vibrissae increased to 6.5 mm in length, and suckling continued. In the third week (19th day) eyes opened and looked prominent and round. In the fourth week, tail length equalled the combined length of head and body (each 70 mm). Ears became prominent (12 mm) with an average of 8 g body weight. Suckling continued and during the 5th week grooming and digging started. In the 6th week, in addition to suckling, young ones (36 days old) started self-feeding attaining 15.2g average body weight. Incisors became 3.95 mm long (average) in the seventh week. Tail (11.5 mm) and body length (90.3 mm) also increased further. After two months, young ones attained 42.55g body weight. The head + body, tail, hind-foot and ears measured on an average 98mm,

24 mm and 19 mm respectively. During the subsequent period, the growth rate was very slow as compared to the first seven weeks. However, development of tail (about 165 mm) was completed only after the 14th week, the body weight being about 85.5g. This period also coincided with the development of testes which showed the presence of sperms.

## Discussion

Occurrence of a varied (nine species) and dense rodent fauna in the plantation area is regulated by the presence of diversified habitat (various crops and grasslands) and regular availability of food in the form of coconut and cacao. Therefore, in comparison to north India (Rajasthan) the trap indices obtained in plantation crops of Kerala (28.21) was about twice that in Rajasthan (14.5, Advani *et al.*, 1982). The predominance of *Rattus rattus* depends upon the high rainfall of this area, which provides enough water needed for its survival, reproduction and multiplication (Collins and Bradshaw, 1973). The predominance of females in the population of *R. rattus* is an additional favourable factor for infesting plantation crops in higher number.

On the basis of 6 monthly observations, June to August is considered to be suitable for control operations with rodenticide, as during this period, the prevalence of pregnancy as well as proportion of sub-adults are very low compared to that during September and November. However, as June, July and August months receive high rainfall, a suitable technology should be developed and evaluated for rodenticide formulations, least affected by rains and having short term action. Relatively more damage recorded in coconut mixed with cacao, than in coconut cultivated as single crop, is due to the availability of cacao as additional food source which results in higher densities of *R. rattus* populations damaging coconuts. The cost benefit ratio achieved during trapping (1:490) can be increased, if the traps used (180 in number) are maintained and used for 5 to 7 years continuously.

## Acknowledgement

The author is gratefui to Dr. K. V. Ahamed Bavappa, Director, Central Plantation Crops Research Institute, Kasaragod for encouragement and

facilities. Thanks are due to my field staff Messrs Basavaraj, Shankar, Rama and Haridas, and to farmers of Kudlu, Madhur, Kunthur and Muliyar villages, who had extended full co-operation during the study. Help rendered by Dr. V. C. Agrawal, Superintending Zoologist, Z.S.I., Calcutta, in the identification of rodent species is gratefully acknowledged.

## REFERENCES

ADVANI, R. 1982. Rodent infestation patterns in the cereal crops in the Indian desert. *Zeit. Saugetierk. Mitteil.*, **30**: 302-306.

ADVANI, R. and MATHUR, R. P. 1982. Experimental reduction of rodent damage to vegetable crops in Indian villages. *Agroecosystems*, **8**: 39-45.

ADVANI, R., PRAKASH, I. and MATHUR, R. P. 1981. Rodent control in Jodhpur. *Indian Fmg.*, **32**: 9-11.

ADVANI, R., PRAKASH, I. and MATHUR, R. P. 1982. Assessment of damage by rodents to standing wheat crop in a desert village complex. *Zeit. Angewandte Zool.* **69**: 10-18.

BARNETT, S. A. and PRAKASH, I. 1975. *Rodents of economic importance in India.* Arnold–Heinemann, New Delhi, and Heinemann, London, 715p.

COLLINS, B. G. and BRADSHAW, S. D. 1973. Studies on metabolism, thermoregulation and evaporative water loss of two species of Australian rats, *Rattus villosissimus* and *Rattus rattus. Physiol. Zool.*, **46**: 1-21.

ELLERMAN, J. R. 1961. *The fauna of India including Pakistan, Burma and Ceylon.* (IInd Edition), Vol. 3. *Rodentia.* Roonwal, M. L. (ed.) Z.S.I., New Delhi.

FLOTOW, A. 1979. Rat damage appraisal in different crops. *Knowhow. No.* **10–11**: 45-51.