

## Introduction

Rodents have always been with us, ever since primitive man became an agriculturist and are the most destructive of all the vertebrate pests. They are serious pests of food, fodder and plantation crops and are carriers of a number of diseases. Rodents inflict incalculable losses not only to standing crops but also to stored food grains. No substantial control measures have been devised in our country till very recently. Man has been providing adequate shelter and food to these enemies in crop fields, residential premises and in godowns unknowingly, thereby giving them ideal conditions for survival and multiplication.

## Rodents damage in food grains

The extent of damage done by rodents to various crops will be clear from the following figures. The rodents attack standing crops almost at every stage in the field. In Uttar Pradesh and Tamilnadu, damage to paddy tillers in the fields is estimated to be 7.1 to 21.5 and 5.2 to 65.3 per cent respectively. In Tamilnadu this damage at the growing stage brought about a reduction in the yield of paddy to the tune of 59.5 per cent and yield of straw upto 45.7 per cent.

Damage to groundnut in Andhra Pradesh was assessed to be 6 to 9 per cent at seedling stage, 18.2 to 25.8 per cent at growing stage and 4.1 to 7.6 per cent at maturing stage. Damage by rodents to wheat crop during seedling and earing stages was recorded as 11 per cent in Uttar Pradesh while the damage to barley crop in the same State was 5.4 to 12.4 per cent.

## Rodents damage in Range Management

Rodents are highly destructive pests to range lands. They gnaw the grass and other vegetation near the ground level, fell the entire plant, eat upon nutritional parts and cause high rate of wastage of forage which otherwise could be economically used for livestock production. Trees meant for top feed and shade on range lands are debarked and in some cases completely sliced. Rodents prefer to burrow in contour furrows and bunds meant for soil and water conservation resulting in destruction of the works leading to soil erosion and reduction of range productivity. Apart from this, in the range lands with high intensity of burrowing the grazing animals and graziers are prone to fatal attack by reptiles and also physical injuries.

## Rodents as disease transmitters in human beings

Apart from the fact that rodents destroy food and other things, their role as disease transmitters is also of serious concern to human beings. Rodents can transmit at least 45 diseases to mankind of which plague can be counted as the most serious and dangerous one. The total human deaths due to plague in India were more than one crore and twenty five lakhs for a period of 50 years from 1898 onwards.

Rodent-borne diseases other than plague in Asia include typhus, leptospirosis, salmonellosis, amoebiasis, tuluremia, rabies, infective jaundice and rat bite fever. Cases of rat bites with accompanying ailments, reported from various cities in India, are also on the increase.

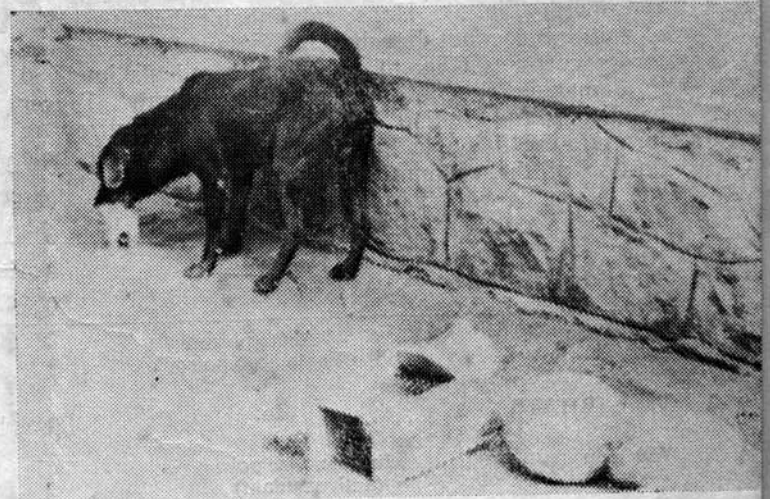
# RODENT CONTROL

P. Natarajan<sup>1</sup>, K. M. Abdulla Koya<sup>2</sup> and Chandu Kurian<sup>3</sup>

## Rodent damage in coconut plantation

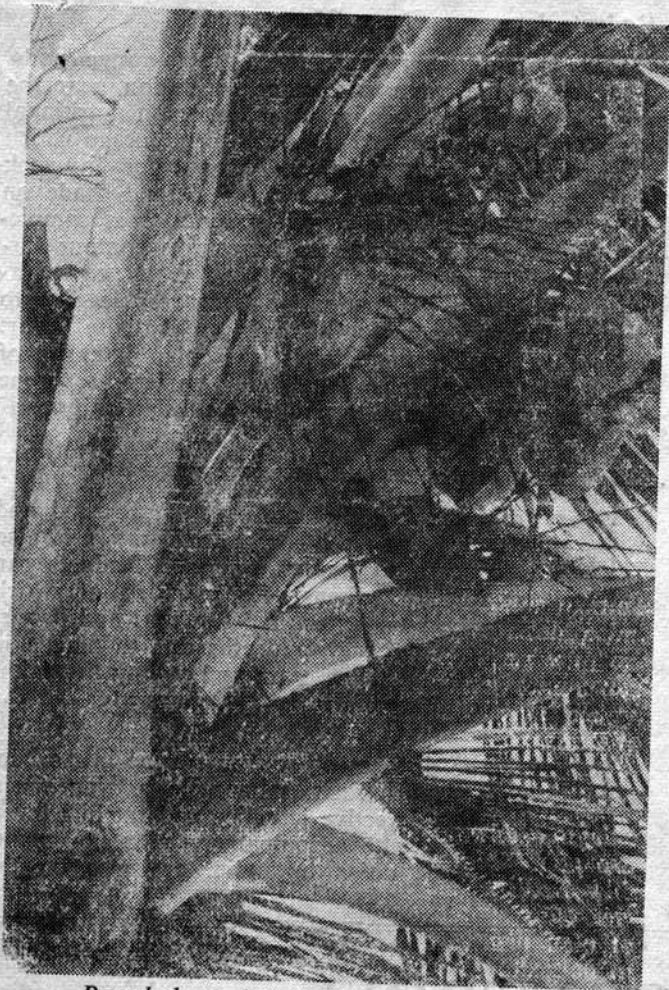
Rat damage to coconuts is more common in most South Pacific territories, Jamaica, Laccadive islands of the Indian Ocean and the southern States of India. More than 11 per cent of coconut palms were reported to have been destroyed by rats during 1967 in Andhra Pradesh and the loss of nuts was 17.1 per cent. A reduction of 50 per cent coconut yield was reported from Laccadive islands due to rodent damage.

Typically rat damage to coconuts consists of a single hole usually found burrowed near the nuts' point of attachment (Fig. 1). Sometimes the damage takes place in the crown of the palm (Fig. 2). Severe damage to the leaf stalks result in the arrest of the vegetative growth of the palm (Fig. 3). In an outbreak of rats in agricultural areas of Kuttanad in Kerala



*Trained dog catching rats*

<sup>1</sup> Assistant Entomologist <sup>2</sup> Research Assistant <sup>3</sup> Entomologist, Central Plantation Crops Research Institute, Regional Station, Kayamkulam, Krishnapuram-690533, Kerala.



*Bore hole made by rat on tender coconut*

State, the problem is so acute that some of the neglected plantations were ruined by these rodents (Fig. 4). It is also very interesting to note that the rats are attacking matured nuts feeding and damaging the endosperm (Fig. 5). House rats inhabit the interspaces of nuts of coconut bunches in Kuttanad and destroy tender coconuts (Fig. 6). The other rodents involved in damaging coconut are Indian mole rat, Bigger bandicoot and Indian Gerbil. They are burrowing forms found living in burrows and eat away the bole portion of the coconut seedling and cause mortality.

### Some basic knowledge needed for rodent control

Some of the rodents are diurnal and some are nocturnal while some others are active at dusk. So the study of behaviour helps the operator to fix the correct timing of placing prebait and poison baits in the burrow openings in order to avoid the lifting of poison baits by other useful vertebrates/domestic animals. A knowledge on the burrow distribution of certainly helps in fumigation operation. It is needless to emphasise that a knowledge of feeding habits is an essential prerequisite to the selection of bait for poisoning the rodents. Censusing of rodent populations helps the operator to estimate the loss of food grains and in turn it helps in planning and assessing the economics of rodent control. It also helps in calculating the required quantity of baits and poisons. The population cycles indicate to some extent the suitability of the time for control operation during the year. It is always easy to control a smaller population with a low cost and by spending less baiting and poisoning material.

For preparation of baits, knowing the carrier of the poison is also equally important. This carrier of the poison should invariably be highly palatable to the individuals of the population to be controlled. Usually rice flour, coconut meal, fish powder, bajra grain with some additives like sugar, salt or oil are the best carrier baits. Sugar is often added with anticoagulant water baits as attractants. The addition of mould inhibitors like wax, particularly in humid areas where baits are to be placed for a longer period in the field, is important. But they should not act as repellents. Chemicals are also added for catalytic effect. For instance to break the clumps of strychnine, sodium bicarbonate is added to disperse it. Thus a basic knowledge of all these aspects of rodent control is quite essential and the proverb "knowing the enemy is winning half the war" is quite apt to the occasion.

### Rodenticides

A rodenticide is a type of lethal chemical agent used to kill rodents, whether applied as poison bait or as gas. Almost all rodenticides are toxic to man and his domestic animals. Some of the common rodenticides available in the market are listed in Table-1.

TABLE-1

Name of rodenticide	Nature	Bait dose	Antidote
Zinc phosphide	Acute poison (Single dose poison)	2.5%	Induce vomiting using mustard emetic. Administer potassium permanganate solution in hot water followed by copper sulphate solution.
Vacor [RH 787]	do.	2.0%	Induce vomiting Administer high levels of nicotinamide as soon after ingestion as possible,
Warfarin	Multiple dose poison (anticoagulant)	5.0%	Injection of Vitamin-K and blood transfusion.
Fumarin	do.	5.0%	do.
Aluminium phosphide tablets	Fumigant	1.5g tablet per live burrow	—
Calcium cyanide dust	do.	10-20 g per live burrow	—

### Rodent control to save stored food grains

The problems of storage of food grains in rural areas and in large scale storage are enormous. The losses and wastage of stored food grains caused by rodents is recognised in the country and efforts are being made by the Government to prevent this. Control of rodents in large scale storage of food grains can be carried out both by rodent proofing method and by use of chemicals. The maintenance of rodent proof characteristics in a godown is very essential. Allowing trees and shrubs to grow near godowns will give access to this noxious pest. The high rodent proof plinth will not serve the purpose if the steps used by workers are left touching verandhas of godown in which case rodents would climb the steps and enter the godowns. In case the godowns do not have any provision of rodent proofing, control of rodents by using chemicals like zinc phosphide and anticoagulants of both solid and liquid baits becomes inevitable. In case of burrowing rodents Aluminium phosphide tablets can be used. The godown fumigation adopted periodically using Ethylene dibromide and Aluminium phosphide eliminates rodent infestation. Dimethyl dichloro vinyl phosphate can be used for mill fumigation. Necessary precautions should be taken to make them reasonably airtight.

The Government of India has taken some legal measures also to induce wholesale traders, roller flour millers and rice millers to undertake rodent control measures in their premises. The prevention of Food Adulteration Act prescribes limits for contamination of rodent hair and excreta in the food material. Rodent hair and excreta should not exceed 5 pieces per kg. of the sample.

### Rodent control in residential areas

Rodents, being very adaptive, have world wide distribution and are also much older than human beings in the evolutionary history. The domestic rodents are Roof rat, Norway rat, Mole rat and house mouse. Damages by these domestic rodents could be categorised into food losses, damages to articles of daily use and public health hazards. Besides these, they also transmit diseases to livestock, poultry and are a source of constant annoyance in the night for man.

The residential rodents can be controlled in three ways viz. mechanical, chemical and environmental manipulation. The long term method of rodent control in residential buildings will centre around prevention of rodent infestation rather than rodent control. This include house management in such a way that rats do not get either shelter or food. Mechanical methods like killing with the help of sticks may be useful in case of solitary infestation or so. Trapping live rodents by wonder traps and box traps will be useful in case of light infestation.



*Damaged crown*

Chemical methods can be used in the case of heavy infestation. Human beings, particularly small children, pets and domestic animals must be protected against accidental poisoning. Utmost care must be taken in handling the materials and necessary precautions taken to avoid contamination of food-stuffs. The efficiency of any rodenticide largely depends upon toxicity, dosage, degree of acceptance, bait shyness, odour and taste.

As an acute poison, Zinc phosphide is a very commonly used rodenticide and it can be served at 2.5 per cent strength. But to avoid the hazards and secondary poisoning it can be used at 1 per cent in the residential areas. Death usually occurs within 3-12 hours.



*Damaged leaf stalks*

**Precautions**

1. For mixing the poison, the carrier material should be a locally available one.
2. Prebaiting for a period of 2 days using unpoisoned carrier material should precede baiting operation.
3. Bait should be prepared fresh every day and served in protected bait containers.
4. Unconsumed bait should be promptly collected and disposed of by deep burial.
5. Baiting operation should be done 1-2 days and not long after, since they develop bait shyness.

6. Dead rats should be promptly located and if necessary searched out and disposed of by deep burial.
7. The poisonous rodenticide should always be kept under lock and used by trained personnel or under their direct supervision.

The safest method of rodent control in the residential premises is the use of anticoagulant (warfarin). Their main advantage over the acute poisons are the absence of the development of bait shyness and relatively less toxicity to birds. In order to prepare the bait material, the cereals or whatever may be the carrier material will be crushed and mixed with the anticoagulant in the proportion of 19:1 and it will be served in suitable containers like coconut shells, bamboo, broken vessels, mud pot piece etc. The baiting should continue for 3 weeks with about 300 g bait per house. This operation should be repeated once in six months.



*Plantation ruined by rodents*



*Matured nut attacked by rodents*

Placement of baits involves several basic principles. The number of baiting centres and the quantity of baits should be adequately assessed by the control operator based on the knowledge of the habits and the behaviour of the test rodent. Baits should be placed at places most frequented by the rodents.

#### **Rodent control in crop fields and threshing floors.**

In crop fields and threshing floors, there is a mixed population of rodent species. Therefore, control programmes have to be of a broad spectrum to cover all known rodent species. For a mixed population of rodents, the medium selected for poisoning should be acceptable to all rodent species.

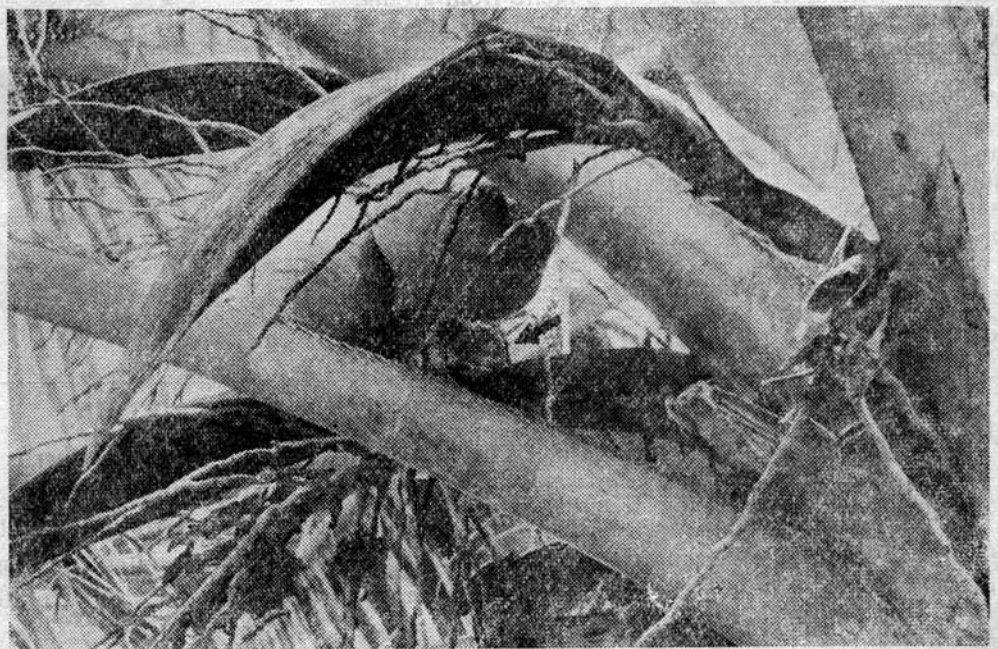
Rodent control operation should be taken up before sowing of the crops. Summer is the most appropriate season for massive rodent control operation since the acceptability of bait is maximum during this period due to paucity of natural food.

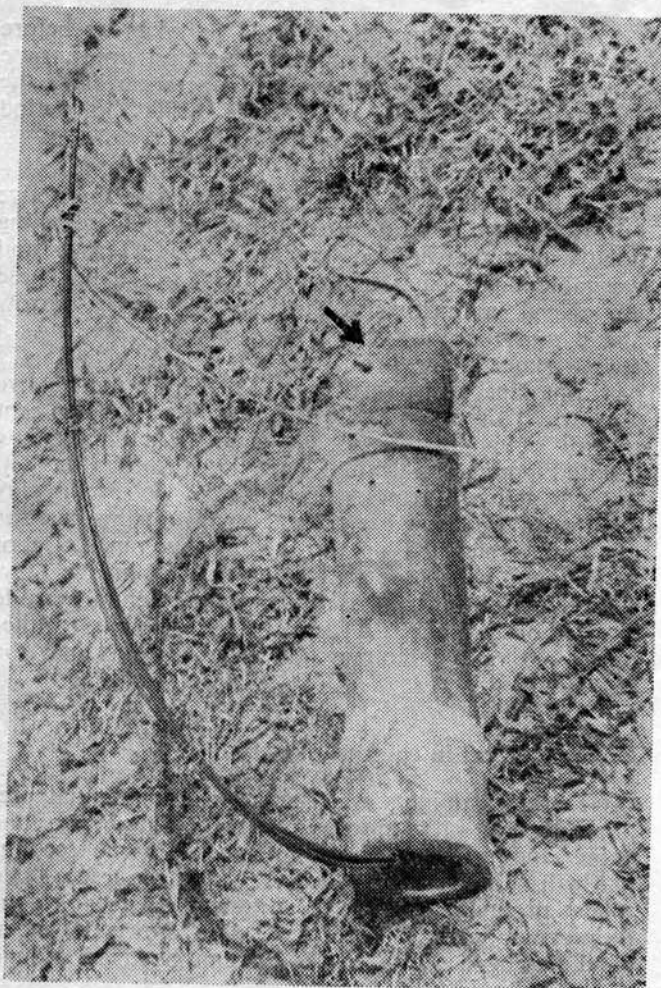
For the control of rodents in fields first the active burrows in the field are to be surveyed and prebaiting done with cereal flour or cracked grains 97 parts and vegetable oil 3 parts in the form of 1 g ball. These are placed in burrows at the rate of 6 g per burrow and it must be done on the first and third day. As a second stage in the field, treat bait materials with 2.5 per cent zinc phosphide on the fifth day in the live burrows. This operation will yield 70 to 80 per cent control of population in the field. The remaining residual population should be controlled by fumigating still active burrows. On the sixth or seventh day all burrow openings are closed. If any of the burrows are found reopened on the eighth day, put 1.5 g of Aluminium phosphide tablet per active burrow. Cyanogassing of burrows is done using calcium cyanide powder or granules. These can be introduced either by spoons or by pumping the chemical dust into the burrows.

#### **Rodent control in coconut plantation**

General cleanliness and sanitation are essential prerequisites for rat control. Cleaning of crown of the palms and prompt removal of weeds in the seedling pits will substantially reduce the rat harbourage. As a rodent proofing, banding or sheathing of trees is done to prevent access of rodents to the crown. A metal band having a width of 30 cm can be fixed around

*Rats take shelter in the interspaces of nuts*





*Bamboo snap back-cum-noose tray, with trapped mole rat*

the palm's trunk at the height of 2 metre from ground level to prevent rat attack on nuts. In the rodent pest management programme trapping plays an important role. Bamboo snap back-cum-noose trap can be effectively used for catching mole rats (Fig. 7). Plank trap/death fall trap is mainly intended for trapping highly migratory forms particularly bigger bandicoot, Indian Gerbil and house rat (Fig. 8). Trained dogs and cats are used for hunting rodents in Kuttanad and elsewhere (Fig. 9).

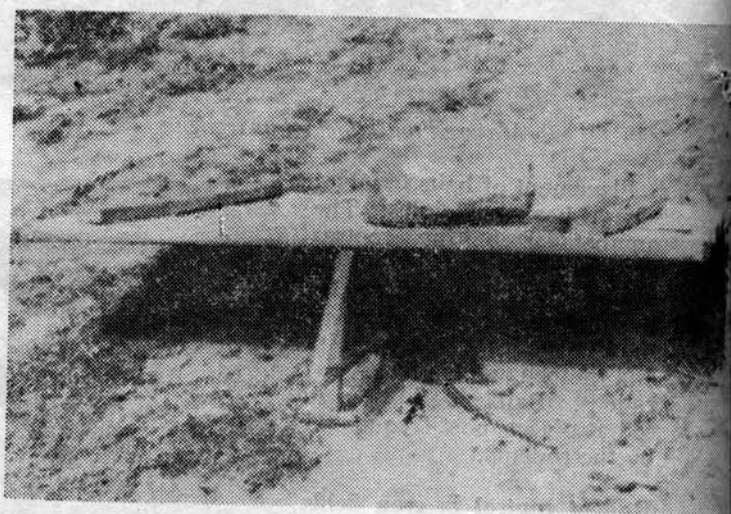
Control using rodenticide is the most efficient method of destruction of rodents in plantations. Zinc phosphide is to be used at 2.5 per cent strength in

the different bait carriers. Anticoagulants like warfarin blocks are placed in the crown of the palms. The warfarin blocks being coated with wax can withstand the climatic changes and are not subjected to attack of moulds. After baiting, the remaining residual population may be controlled by fumigation. Aluminium phosphide tablets of 1.5 g can be used to fumigate the live rat burrows. Calcium cyanide dust at 10-20 g per burrow can be utilised to fumigate active burrows using a cyanogas pump.

### Conclusion

The basic strategy of rodent control is not only to involve the progressive groups in the programme but the entire population of the village. For organising programmes like rodent control, early assurances of co-operation and active participation of villages over a wide area must be sought and achieved. For successful implementation of such programmes, the adoption of a cluster of 4 or 5 villages would rather be advocated instead of taking up a single village. Proper communication and equal response to the message and methodology of rodent control are of prime significance. The success of the whole programme mainly depends upon the spread of knowledge, methods and technology of rodent control and proper use of poisons. Unless the community is wholeheartedly involved in the programme, any amount of government effort alone will not lead to effective rodent control.

*Plank trap/deathfall trap with bigger bandicoot trapped*



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—Editor