RODENT NEWSLETTER

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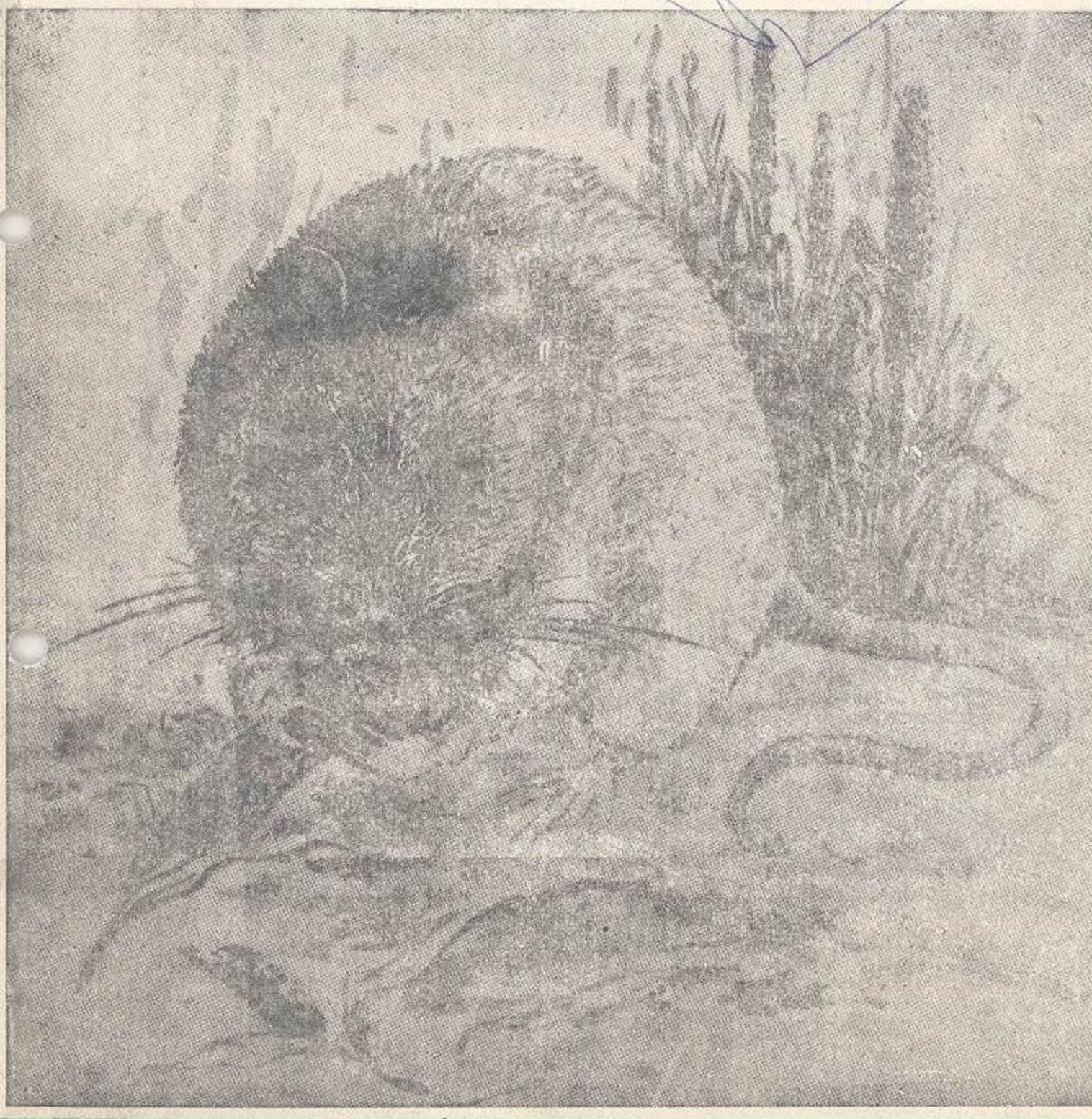

ALL INDIA COORDINATED RESEARCH PROJECT
ON RODENT CONTROL

Central Arid Zone Research Institute, Jodhpur

RODENT NEWSLETTER

Vol. 18 (1) NEH SPECIAL ISSUE 1994

SPECIAL ISSUE
ON
NORTH EASTERN HILL REGION

ALL INDIA COORDINATED RESEARCH PROJECT
ON
RODENT CONTROL

CENTRAL ARID ZONE RESEARCH INSTITUTE
JODHPUR-342 003

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APEX LEVEL TRAINING ON RODENT CONTROL

Under the aegis of Indian Council of Agricultural Research, New Delhi and Directorate of Plant Protection Quarentine and Storage (GOI), Faridabad, a three day Apex Level Training Programme on Rodent Control is being organised for the Senior Extension Functionaries of NEH States/UTs from October 24 to 26, 1994 at ICAR Research Complex for NEH Region, Barapani, Shillong.

PREFACE

Rodent Newsletter has just attained adulthood as it ages 18 years. It was born in 1977 and now its blossom has spread among rodent researchers all over the world. It has become a popular science periodical imbedding and encompassing recent advances in Indian Rodentology. Besides publishing quarterly issues regularly, the RNL has also brought out two special issues on "Social Engineering Activity on Rodent Control (1981)" and "National symposium (1892)". The Editorial board strongly feels that some special issues should be devoted to problematic areas in addition to the regular issues. The first issue of every volume would be a special issue. The first in this series, is on Rodent problem and their management in North-Eastern Hill Regions of India.

The north eastern hilly tract covering seven sister states viz. Assam, Meghalaya, Arunachal Pradesh, Nagaland, Mizoram and Tripura is an abode of several strange phenomenon. Being a tribal area with green earth, it naturally abounds in lots of diverse flora and fauna (except few avifauna), vast streches of tea gardens, pineapple orchards, arecanuts and magnificent bamboo forests. In some states of the region *Jhum* (Shifting) cultivation is a common practice, wherein farmers clear the forests for agriculture and shift to other areas after 2-3 years. Periodic flowering of certain varieties of bamboo is a strange phenomenon which is belived to bring famine due to sudden population explosion of rodents. Such famines have occurred during 1880-84, 1910-12, 1928-29, 1958-59 and 1976-77 the years of flowering of certain bamboo varieties. During 1991 bamboo shrubs were seen in all their glorious hues in West Kameng district of Arunachal Pradesh. Such reports from Meghalaya, Upper Assam, Mizoram, and Nagaland have also started pouring in. The years 2005-07 AD are expected to be again the periods of believed curse for NEH people.

The ICAR Research complex for NEH Region, Barapani had initiated insensive rodent research since 1982 under the ageis of AICRP on Rodent Control. The findings of this centre and of North Eastern Hill University, Shillong do not indicate any scientific basis for bamboo flowering *vis* a *vis* rodents outbreaks. The Central and State Governments have initiated plannings and programmes to fight against the army of the tiny mammal, the rodents. It is in this context, the first

special issue of Rodent Newsletter is a NEH SPECIAL. We hope this issue of RNL would be of great significance in its new shape. We intend to publish the next special issue on "Plantation crops" during 1995. The The countributors are requested to send articles on various aspects of rodents of plantation crops and their management for the next special issue. Valuable comments/suggestions for this endeavour are welcome from the esteemed members of RNL family.

Editors

Status paper on Rodents of North Eastern Hill Region and their management

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Introduction

The North Eastern Hill States of Idia are full of green vegetation and bamboo forests which have become aintegral part of the tribal life and its customs. These forests have various groecological systems of which *jhum* type cultivation is important. In the states several rodent species occur. Of them, some are associated wh the bamboo flowering which reportedly lead to the famine like conditios in the States of Mizoram and Arunachal Pradesh. The population of rodnts was reported to enormously increase at the time of bamboo flowering which occurs at an interval of 18 and 30 years. The next flowering is xpected in about 2007 A.D. in Mizoram.

Ecological Surveys

The survey of rodents was undertakn in the states of Meghalaya, Mizoram, Arunachal Pradesh, Sikkim, Nagaland, Manipur and Tripura at periodic intervals to record the prevalece of the rodent pests through counting of active burrows. It was observe that the maximum number of active burrows were recorded in Meghalaya followed by Tripura state.

Infestation patterns in different agroecosystes

Survey of rodents was conducted inall the States of NEH Region in different agroecosystems. Cumulative observations revealed that the rodent activity was highest in the areas where animal and poultry farms exist (73.37%). The reason may be due tohe presence of nutritious feeds available to them round the year. In croped areas, pineapple fields had the highest number of active burrows (44.25%) followed by upland cropped area and *jhum* fields. In Non-cultivated area, the pine forests had the highest number of active burrows while th wasteland area also harboured 29.4% of active burrows. The runways ofodents were also noticed in the wasteland under the grasses which led to cpped fields or field godowns.

Seasonal activity

The seasonal activity of rodents ws observed at ICAR Research Complex farm, Barapani in Meghalaya. Itvas found that highest per cent

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of active burrows were recorded in the month of August (50.2%). It was further noticed that the rodent activity was of low order from December to February and exhibited an increasing trend from March onward. The activity was maintained at higher level from March to November (41 to 49%). The rise in rodent activity from March coincides with availability of crops and vegetation and rise in atmospheric temperatures. Rodent population revealed peak activity from July to October (46-50%) when the crops were at maturity stage in this area.

Rodent species composition and distribution

A total of fifteen rodent species were collected and identified from this region. These belonged to various genera like *Rattus*, *Bandicota*, *Cannomys*, *Mus*, *Vandeleuria* and *Callosciurus* etc. The altitudinal distribution of rodent species in different NEH states is provided in Table 1.

Table 1. Distribution of rodent species at different altitudes.

Rodent species	Altitude (M. amsl)		
	Lower 0-500	Middle 500-100	High 1000-1500
1. *Rattus nitidus*	R	R	R
2. *Rattus rattus*	R	R	R
3. *Rattus khyensis*	NR	R	R
4. *Rattus tristae*	NR	R	NR
5. *Rattus norvegicus*	NR	R	R
6. *Rattus niviventor*	NR	R	R
7. *Rattus bowersi*	NR	R	R
8. *Bandicota bengalensis*	R	R	R
9. *Bandicota indica nemorivaga*	NR	R	NR
10. *Cannomys badius*	R	NR	NR
11. *Mus musculus*	R	R	R
12. *Mus booduga*	NR	R	R
13. *Mus cervicolor*	NR	R	NR
14. *Vandeleuria oleracea dumaticola*	NR	R	R
15. *Callosciurus pygrithrus*	R	R	NR

R = Recorded NR = Not Recorded

In Meghalaya (Barapani Area), *Rattus nitidus* was recorded as predominent species as it constituted 24.5% of the total collection but during recent years this species seems to be replaced by *Bandicota bengalensis*. The *Bandicota bengalensis* is dominating in Meghalaya, Manipur, Nagaland and Tripura States. However, *Rattus rattus* constituted 14.3% whereas *Mus musculus* dominated among commensal rodents by registering 16.9% population in houses of Shillong town.

The sex ratio (male to female) was 1 : 0.99 in *Rattus nitidus nitidus*, 1 : 1.33 in *Mus booduga* and 1 : 1.5 in *Cannomys badius badius*.

Other associated vertebrate fauna

a. *Insectivores*: Shrews, *Suncus murinus*, *Annourosorex squamipes* and *Crocedura attenuata* belonging to family soricidae were also collected. These nocturnal and placental mammals are commensal in habit, generally feed on insects but recorded to cause immense damage by making burrows in living premises of human beings and also cause nuisance due to their repugnant secretions. These species were found to be active throughout the year in Shillong town except the *Crocedura attenuata*.

b. *Carnivores* : *Mustella kathiah* and *Malogale personata* which belong to order carnivora were also collected. They are flesh eating placental mammals with long piercing canine teeth and toes with sharp claws. *M. kathiah* was collected from bushes at Shillong, Meghalaya, and in Mizoram while *M. personata* was collected from forest thickets of Mizoram. It is reported that they are predators of small mammals.

c. *Primates : Tupaia glis* was collected from Arunachal Pradesh and Mizoram. It is arboreal in habit and damages the fruit crops.

Morphological Variations

The sexual dimorphism of two species of rodents for external body measurements and internal organs were studied in the populations collected from Shillong, Meghalaya. These rodent species were *Bandicota bengalensis* and *Rattus norvegicus*. In both the species, the males were heavier than females in body weight and bigger in total length. It was also noticed that *Rattus norvegicus* was heavier and bigger than *Bandicota bengalensis* in both the sexes.

Parasites of Rodents

The live collection of rodents were observed for the ectoparasites while dead collection was observed for both etco. and endoparasites during the experimental period.

(i). *Ectoparasites :* The ticks and mites belonging to order Acarina were found to infect mostly the *Rattus* group. The infection of ticks was noticed in 46-47% of rodents while mites infected 17 to 84% of rodents. Fleas belonging to order Siphnoptera were recorded from 12 to 22% of

rats. Some rats had very high number of ectoparasites, specially the ticks and the mites (Table 2).

(ii) *Endoparasites :* Rodents were found to be infected with endoparasites to the extent of 16.67% to 36.00. Three species of endoparasites were recorded i.e. *Hydetigera teaniformis, Cystocercus facionaris* and *Hymenolopis dimunata.* These parasites were found in the form of cysts in liver as white patches and 1-10 number of parasites in the intestines (Table 2).

Table 2. Showing per cent occurrence of different ecto and endoparasites in rodents

Rodent species	Ectoparasites			Endoparasites
	Ticks (%)	Mites (%)	Fleas (%)	% occurrence
R. rattus	47.67	17.51	33.00	34.16
R. nitidus	46.24	17.14	19.95	16.67
R. norvegicus	NP	84.00	12.99	36.00
B. bengalensis	NP	58.00	22.00	34.00
Mus musculus	NP	NP	NP	NR

*Average of three years NP=Not present; NR=Not Recorded

Burrow structure of *Bandicota bengalensis* : The burrowing pattern of *B. bengalensis* was studied at Shillong. The burrows of *Bandicota bengalensis* were complex with several openings (Range 4-7). The tunnels were smooth, round and almost clean with 1-2 storage chambers and 1-2 brood chambers. It was further noted that diameter of burrow openings was 8.7 to 8.9 cm with the average circumference of 19.1 to 19.2 cm. On the mouth of each opening fresh excavated soil, feacal pellets and eaten stuff were also found. The average soil dug overnight was 5.04 kg (range 1.1 to 9.3 kg). The burrows were found mostly open. The inside burrows were 7-12 m long with several branchings. Most of the branchings of tunnel started from 30-60 cm from the mouth of the burrow.

Bait preference studies

Maize, gram, rice, paddy and *ragi* were fed to different species of rodents. It was noted that maize was preferred food of all rodent species followed by gram/paddy. Although *Rattus* spp. and *Bandicota bengalensis* consumed more food (per 100 g body weight basis) but surprisingly, *Mus musculus* left them far behind.

In another sequence of experiments, baits used were : cereals, pulses, oil seeds and vegetables. It was found that in *Bajra* cereals, gram in pulses, coconut in oilseeds and potatoes vegetables in were most prefered ones. For *Rattus nitidus nitidus,* gram was highly preferred feed

over the others. Thus gram may be used as poison carrier to control the *Rattus nitidus nitidus.*

Bandicota bengalensis, however, showed preference for wheat kneaded balls and rice alongwith groundnut oil and sugar. Therefore, wheat flour in the from of kneaded balls or rice could be used as a bait for poisoning *B. bengalensis.*

Damage assessment in various crops

Extensive studies on rodent damage to various crops were carried out in Meghalaya and Mizoram, whereas, in other states the damage was assessed only at the time of survey. The lowland paddy recorded 12.5% damage in Meghalaya. The early maturing varieties suffered upto 100% damage in plant breeding trials at Barapani and Upper Shillong in Meghalaya. In upland paddy, the rodent damage was found to be 9.98% in Meghalaya and 4.34% in Mizoram. The damage was recorded at grain formation stage till harvest of paddy. Rodents responsible for the damage were *Rattus nitidus* and *Bandicota bengalensis.* The maize cobs were also found damaged by rodents to the extent of 9.14% in Meghalaya and 7.95% in Mizoram.

Pineapple fruit crop witnessed much damage due to rodents. The ripening fruits and ripe fruits had the maximum damage. The damage was more in Maghalaya (8.53%) in comparison to Mizoram (4.71%.) A negligible damage was noticed in groundnut crop. Some vegetable crops and mushrooms were also damaged by rodents.

The stored maize, paddy and groundnut suffered much damage due to rodent depradations in field godowns but this could not be properly estimated (Table 3).

Table 3. Magnitude of damage in various crops (Average of five years)

States	Per cent damage				
	Upland paddy (Tiller damage)	Lowland paddy (Tiller damage)	Pineapple Fruit	Groundnut pods	Maize cobs
Meghalaya	0.88	12.48	8.53	Negligible	9.14
Mizoram	4.34	not recorded	4.71	-do-	7.95

Rodent Management

a. Non chemical

(i) *Trapping* : Trapping of rodents was done with sherman, Bandi-

coot, wonder, snap, mice and glue traps and it was found that glue traps were most successful to capture the the rodents inside the house followed by bandicoot and sherman traps. Further, it was observed that when the regular (Galvanised sheet) traps were painted black the trappability increased to the extent of 45% (Table 4).

Table 4. Eff.ct of black paint on the trappability

Name of Traps	Rat captured in regular trap (%)	Rat captured after black paint (%)	Increased Trappability (%)
Bandicoot	35.00	81.67	+ 46.67
Sherman	30.00	73.33	+ 43.33
Average	32.50	77.50	+ 45.00

ii) *Effect of cement mixed food on rodent :* A non-chemical method to control the rodents was tried with cement mixing in wheat flour from 5 to 50%. No effect was noticed on the *Bondicota bangalensis* except the feacal pellets were very hard. No experimental rat was found dead.

iii) *Effect of Rodent Repeller* : The rodent repeller was kept in the rodent room to observe the effect on the caged animals. It was found that for only 1-3 days the rats ate less quantity of food and remained scared but after that period they became acclimated and fed the same quantity of food as earlier.

b. Chemical Control

i) *Determination of Kneaded ball size* : It was tried to find out the suitable size of the wheat flour kneaded balls for exposing the poison. The balls from 0.5 g to 5 g were tested against the rodent complex population which revealed that 2 g size ball was most preferred (68.8%) followed by 0.5 g size ball (45.0%).

ii) *Concentration of Zinc phosphide* : It was found that for *B. bengalensis* 2% and 3% zinc phosphide provided 100% mortality of both the sexes, however, other concentrations (0.5, 1.0, 1.5, 2.5, 3.5, 4.0, 4.5 and 5.0%) resulted into low mortality and the baits having higher concentration were consumed very less. Therefore 2% zinc phosphide bait in wheat flour was found to be the most suitable concentration to control *B. bengalensis*.

iii) *Different baiting techniques of zinc phosphide* : When zinc phosphide (2%) kneaded balls of wheat flour were covered with wax coating, it was found that coated balls had an edge over the plain ball. The wax

coated balls were consumed more (21.2%) in comparison to plain balls (16.4%).

To supress the bait shyness of zinc phosphide in rodents, various techniques i.e. wax coating, gur coating, bread pieces and animal membrane coating were tested against *B. bengalensis*. It was found that the kneaded balls with animal membrane coating were consumed more and preferred over other types of coatings tested.

(iv) *Comparative efficacy of rodenticides against B. bengalensis* : Five rodenticides viz , Zinc phosphide, barium carbonate, bromadiolone, broadifacoum and warfarin were fed to *B. bengalensis*. Zinc phosphide was found to be much superior in recording cent per cent mortality within 24 hrs. of ingestion, followed by barium carbonate (70% mortality). Other rodenticides (Anticoagulants) could provide 50-80% mortality 7-15 days after one day feeding (Table 5).

Table 5. Comparative toxicity of rodenticides to *B bengalensis* in laboratory under no choice tests

Rodenticides	Response period (days/hours)	Mortality (%)
1. Zinc phosphide (2%)	24 hrs	100
2. Barium carbonate (10%)	24 hrs	70
3. Bromadiolone (0.005%)	7 days	50
4. Brodifacoum (0.005%)	15 days	80
5. Warfarin (0.025%)	13 days	70

v) *Comparative performance of anticoagulants* : Bromadiolone 0.005%, cholecalciferol 0.075% and flocoumafen 0.005%, were tested against *B. bengalensis* under choice and no choice tests. Under no choice feedings, cent per cent mortality was achieved in 2 day feeding of bromadiolone while the same mortality was recorded in 3 days feeding of cholecalciferol. Floucoumafen gave 98% mortality in 2 days feeding. Under choice test when poison baits were given with plain bait (maize), it was found that the mortality ranged from 70-95% in all anticougulants tested.

When wax blocks of cholecalciferol, bromadiolone and flouocomafen were offered together, rodents preferred flocoumafen followed by bromadiolone wax blocks.

vi) *Performance of rodenticides in various habitats* : Zinc phosphide, barium carbonate, bromadiolone, flocoumafen, brodifacoum and aluminium phosphide (tablets) were tested at different places for their efficacy.

The membrane coated zinc phosphide (2%) in kneaded balls was found to have an edge over other rodenticides in managing the rodents in field as well as in other habitats. However, 2 tablets of aluminium phosphide per burrow, were found to kill cent per cent rats in burrows in the fields at Barapani. Among anticoagulants, bromadiolone was found safe and effective to control the rats in houses, shops and in poultry farms.

vii) *Rodent management in poultry farms* : The studies were conducted at Barapani, Meghalaya and NERDA poultry farm. Pre and post population censuses of rodents were conducted through bandicoot traps and sherman traps for one week. Bromadiolone (0.005%) wax blocks were used to control this population which resulted into reduction of 81.64% pest population as per trap index method.

By active burrow count method, bromadiolone (0.005%) wax blocks yielded 67.24 and 87.9% control success after 10 and 15 days of treatment, respectively, while zinc phosphide (2% in kneaded balls) produced 75% control. In the area where zinc phosphide was exposed, the remnant rodent population was treated with bromadiolone and this resulted into 92.0% success.

Zinc phosphide treatment followed by 2 tab/burrow of aluminium phosphide yielded 100% control of rodents. Zinc phosphide followed by aluminium phosphide was undertaken only in areas adjoining to poultry farm. The major species associated in the pouetry farm was *B. bengalensis.*

Social engineering activity on rodent control

The rodent management technology was carried over to end users. By this process, rodents were controlled in fields, houses, godowns, shops, poultry farms and in scientific laboratories as well, thus providing hygienic conditions of living and working. The rodent control technology was also transferred to local farmers to control the rodents in their fields which helped them to harvest a good crop.

A total of 780 hectare of fields were managed for rodent infestation, besides controlling the rats in houses, godowns, poultry farm etc. The activity index of rodents before starting the control operation and after the control, showed a marked decline in rodent population. The active burrows did not show any sign of opening, revealing success in control operation.

Bamboo flowering *vis a vis* upsurge in rodent population

The north eastern states are abundant with bamboo forests. There are several species of bamboo but *Bambusa tulda, Dendrocalamus longi-*

spathus and *Malocanna bambusoides* are dominant species. The interval of flowering between these two species is 18 and 30 years. The flowering of bamboo in Mizoram and Arunachal Pradesh is considered as a bad sign and supposed to be year of famine due to rodent depradations. The flowering of *Bambusa tulda* and *Dendrocalamus longispathus* is called "Thingtam" "Mautam" while flowering of *Melocanna bambusoides* is called "Thingtam" in Mizoram. A detailed account of bamboo flowering in Mizoram is given in Table 6.

Table 6. Showing bamboo species and their flowering period

Bamboos in flower	Period	Year
B. tulda, D. longispathus	Thingtam	1880-1884
Melocanna bambusoides	Mautam	1910-1912
B. tulda, D. longispathus	Thingtam	1928-1929
Melocanna bambusoides	Mautam	1958-1959
B. tulda, D. longispathus	Thingtam	1976-1977
M. bambasoides	Mautam	2007*

*Expected year of flowering.

Other species of bamboos also flower but in sporadic manners. It is seen through the records that famine occurred four times in Mizoram during the years 1880-1960 due to gregarious bamboo flowering which synchronized with the sudden increase in rodent population thereby causing famine like conditions. The upsurge of rodent population during bamboo flowering is still a myth. This may be due to interplay of ecological factors which influence the rodent population at the time of gregarious flowering.

Effect of feeding of bamboo seeds on rodents in laboratory

i) *Rattus nitidus* : Two species of Bamboo *Bambusa arundinacea* and *Dendrocalamus strictus* and paddy as check were fed to 15 rats of each sex of *Rattus nitidus* in laboratory under no choice condition for 60 days. It was observed that bamboo seeds had no obvious effect on breeding, though there was reduction in body weight, except a little gain by males fed with *B. arundinacea*.

ii) *Rattus norvegicus* (Albino) Both the varieties of bamboo seeds were fed along with paddy as check. The reduction in body weight was also recorded in this species after 60 days of feeding in no choice condition but loss in weight was greater (13-16%) when fed on seeds of *D. strictus*.

Strategies for rodent management in NEH region with special reference to bamboo flowering areas

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The north eastern hill region is characterised by thick forests and unapproachable terrain with heavy rainfall throughout the year. Local population practice *Jhum* (Shifting) cultivation by clearing the jungles in almost all NEH states except Assam and a portion of Meghalaya, Manipur and Tripura, where settled cultivation is done. Rodents are universally distributed even in these areas and form part of pest population and take a heavy toll of almost all the crops. These mammalian pests have been found to create famine like situations at periodic intervals of 15-25 years. This period coincides with the flowering of certain bamboo species. In the hilly terrains of Mizoram and Arunachal Pradesh there are sixteen major varieties of bamboo of which only few flower at different times. These are locally named as Mautak, Rawthing, Rawangal, Ranomi and Rawthela. Flowering of two varieties viz. Rawthing and Mautak had coincided with the outbreak of rodent population. In Mizoram, the word "Tam" means death. That is why when Mautak and Rawthing varieties flower, they are named as Mautam and Thingtam, respectively. Mautak flowers at an interval of 48-50 years. Thingtam on the other hand flowers at an interval of 45-50 years. The gap between two cycles is fouud to be almost regular, which is about 30 years from a Thingtam to Mautam and 18 years from a Mautam to thingtam.

Whatever may be the cycle, their flowering is believed to enhance the breeding of rodents immensly and then their populations migrate to the *jhums* and destroy the standing crops at night. It is also said that bamboo seeds are relished by the rodents greatly which increase their fertility, to such an extent that their litter size is doubled. However, this belief has not yet been proved scientifically. The crop losses due to these rodents during bamboo flowering years had been 90% (in 1911), 70% (in 1929), and 75% (in 1958). During 1977, the losses could not be assessed properly as the government took several steps for containing the rodent menace.

Flowering in bamboo shrubs were noticed in 1991 in Arunachal Pradesh and is being reported from Mizoram, Upper Assam and Nagaland. As per the reports of Mizoram Government, this year Mautak

bamboo has shown sporadic flowering in certain areas of the state. The full bloom of Mautak, i.e., Mautam is expected in the year 2007 AD. Thus, it is right time to work out the strategies for management of rodent pests. Since our experience in the past has forewarned us about the problem we must be forearmed also to save the humanity from rodent famine during early next centuary. The central as well as state governments have initiated some actions in this direction. Following longterm and short terms measures are necessary. Besides the governmental agencies, cooperation from non government and voluntary organisations and of local people are very important.

A LONG TERM MEASURES :

(i) Research work at ICAR Research complex for NEH Region may be strengthened. One cooperating centre of AICRP on Rodent Control stationed at Barapani (Shillong) is undertaking extensive research on this aspect. However research projects based on *Jhum* situation may be planned on a long term basis. For this the ICAR complex at Kolasib (Mizoram) may be strengthened to help in combating the large scale rodent menace expected in early next century.

(ii) Department of Agriculture of all the NEH states should workout a schedule for regular monitoring of rodent pest incidence in various crops in general and bamboo flowering areas in particular. For this, assistance from Directorate of PFQ & S, GOI the ICAR Research complex and AICRP on Rodent Control may also be sought.

(iii) Rodent management requires a large number of trained personnel. Unfortunately, we do not have sufficient trained personnel in this field. For creating a nucleus of trained personnel, regular Apex level Training Programme on rodent control should be organised at ICAR complex for NEH region. Experts from other AICRP centres and Central Plant Protection Training Institute, Hyderabad may also be invited to impart training. Such a training needs greater involvement of State government by deputing senior level officers of the department. The officials trained by this training are further expected to train their junior officers, extension workers by organising middle and field level trainings.

(iv) Besides this, participation of local masses is the most important factor for success of such a mission. For this, local inhabitants,

must be made aware of the problem and its outbreak and their possible solutions. Thus Govt. should initiate actions on mass education through All India Radio, Doordarshan, Press etc. In addition, audio visual aids, posters, pamphlets etc. may be distributed in the problematic areas. Expert guidance on this aspect may be taken from Rodent scientists at ICAR Research complex, Shillong Project Coordinor (Rodent Control), CAZRI, Jodhpur and Dte. of Plant Protection, Quarentine and Storage (GOI) Faridabad.

(v) The Agricultural Extention Officers should keep a close watch on the problem and remain in touch with the farmers for monitoring of the rodents in endemic areas. Besides this, field demonstrations on rodent management should also be organised regularly.

B SHORT TERM MEASURES :

(i) The farmers should be convinced to continue normal agricultural operations in the bamboo flowering areas. They should be made aware of the rodent problem through various extension media. An audiovisual documentary on rodent control in *Jhum* fields should be made by State Department of Agriculture, involving scientists of ICAR complex, Barapani, Shillong.

(ii) Since the bamboo flowering is in pockets and all tribals perfer to eat rodents, trapping may prove an effective method for rodent management. Trapping is also a tool for survey and monitoring of rodent population. Thus regular trapping in *Jhums*/crop fields/forests/endemic areas may be done with the help of local traps.

(iii) The rodent control operation in the crop fields may be taken up during April and all the infested areas may be treated with zinc phosphide bait (2.5%) before the onset of monsoon.

(iv) Looking to the preference of rodents and availability of bait materials, it is recommanded to prepare the zinc phosphide poison bait in boiled rice/cracked rice or maize, bamboo seeds etc. Locally available edible oil (3%) should be used as an additive for making the poison bait in cereal grains. The ICAR Research complex at barapani (Shillong) has evolved a new method of zinc phosphide bait formulation. It is prepared by using 2% zinc phosphide in kneaded flour balls which are then encapsulated with mesenteron of goats. It has been found very effective against a variety of rodents.

(v) These baits may be either applied in the rodent burrows or placed in bait containers. The bait containers may be made by bamboo stem or banana leaves which are locally available.

(vi) Zinc phosphide baiting must be done only once in a season. Thus, it is to be done on a large scale by forming rodent control squads on a whole village approach basis.

(vii) Single application of zinc phosphide bait yields about 60-70% control success. The residual rodent population (30-40%) may be managed by 0.005% bromadiolone loose bait/wax cakes. The wax cakes of bromadiolone would be more effective in humid areas of NEH region and may be used for sustained baiting also. Both the baiting programmes should be extensively done in and around crop fields, *Jhum* fields and surrounding bamboo forests.

(viii) In the cropfields fumigant poison, aluminium phosphide may be used in the burrows under strict supervision of trained Govt. personnel. The rate of application would be 1.5 g tablet per burrow.

(ix) It must be assured that the rodents killed by the use of poisons are safely disposed off and *in no circumstances such rodents be consumed by local people.*

(x) Broadcasting of poison baits should be discouraged to avoid any secondary hazard. It is advisable to use bait stations in *Jhum* areas for bait placement. Secondly, there must be proper control over the quality of rodenticides used in control programmes. The availability of adequate quantity of quality rodenticides at all vulnerable points may also be ensured.

Rodents-Cheap source of proteins for tribals of NEH region

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Of 5,000 rodent species world-over, a few have been used as human food. Among them, the capybara *(Hydrochoreus hydrochaeris)* of South America, the musk rat *(Thryonomys swinderianus)* of West Africa and musk rat *(Ondatra zibethica)* and dormouse *(Glis glis)* of Europe have established their dietary delicacy in the countries of their occurrence. The body weight of these large rodents vary from 2 kg to 65 kg. Even today, in the restaurants of these countries flesh of these rodents is on the menu. In the context of India, most of the tribals do consume this cheap animal protein source, especially in the NEH region. The nutritive value of Indian field rodents as determined at National Institute of Nutrition. Hyderbad is as under :-

Components	Percent occurrence (per 100 g)
Protein	23 6 g
Fat	1.0 g
Minerals	1.4 g
Carbohydrates	0.1 g
Moisture	73.9 g
Energy	104 K cal
Phosphorus	242 mg
Calcium	30 mg

The markets of South America and Europe do not prefer the flesh of these large rodents when these rodents undergo hibernation. Since they deposit/store large amount of fat, the taste/quality of flesh changes. Contrarily, in the days of Roman Empire the flesh of dormouse *(Glis glis)* was especially preferred during autumn when these rodents stored fats and were in plump condition. Since dormouse is small rodent as compared to capybaras and cane-rats, the fat content of flesh would be very less. However, the Indian field rodents do not reveal hibernation behaviour, hence the store of fats would naturally be quite less. Therefore, the flesh of Indian rodents is equally relishable althrough the year.

In NEH region, when the flesh of rodents is not easily procurable, especially during heavy rains, albino rats are reared as an alternate to it in some parts of Mizoram. Since albino rats are docile, breed profusely have good litter size with least cannibal activity, prove best for the

commercial exploitation. It is not only in NEH region that rodents are consumed as food but several other tribal communities largely depend on field rodents for food, and livelihood. These communities are enlisted below :

Tribal community	*States*
All tribals	NEH region
Nat	Bihar and U.P.
Yenadis	Andhra Pradesh
Irulas and Kuruvas	Tamil Nadu
Kuravans	Kerala

(Indian field rodents include bandicoots, gerbils, metads and field mice.)

In NEH region, rodents are trapped or physically caught for self consumption, whereas, in southern India, the surplus field rodents are sold out. Tribals are expert and are well aware of rodent ethology and ecology. Out of 8-10 burrows, they can easily locate a burrow where bandicoot is available. They catch-hold of bandicoots bare-handedly. They just catch them from the middle of body, give a twist of tail around the neck (back is slightly stretched) and a small stroke using index finger and thumb at head kills these rats. These are stored in a dug. Certain tribals take help of smoke to drive out the rats from hidden emergency exits. These escaping rats are either trapped in nets or beaten with flexible sticks. In paddy and wheat growing areas, during preharvest period, these people charge rupees 1 to 2.50 per rat for catching a rat (which is ultimately used at dinner). Interestingy, certain people release the pregnant females back into the burrows (probably for future generation of rats) for regular bread and butter.

Porcupine, largest rodent of India, is hunted peculiarly. Bananas are thrown towards a porcupine which will raise its quills. These bananas get into the quills making the body of porcupine very heavy. Thus, movement of porcupine becomes very slow on one hand and quills, the attacking weapons also become useless. Now it is easily caught and consumed.

The bandicoots not only generate employment, money and food to the tribals but also provide stored food grains in their burrows, So, catching of bandicoots along with its cache is a full and complete food to the rat-catcher.

As far as rearing of larger rodents is concerned in America, Europe aud West African countries, the situation is better in India. The litter size of capybaras and cane-rats is 4, whereas, Indian field rodents bring forth 5 to 18 youngones at a time. Moreover, the gestation period is hardly over a month among Indian rodents, whereas, it is 2 to 8 months in other species mentioned above. Thus, the cheap animal protein source can be exploited/procured through Indian rodents too.

Keeping in view, the rodent consuming habits of tribals in NEH region, suitable traps should be developed and local traps be modified scientifically to increase their efficacy. As far as possible, rodent management through chemicals should be avoided, and more emphasis be given on live trapping of rodents in NEH region. However in case of emergency situations, if rodent control in undertaken through chemical toxicants, adequate education and warning must be given to the inhabitants not to consume any live or dead rodents from treated areas.

Selected Bibiliography of Rodent Researches of North Eastern Hill Region of India

Agarwal, V.C. 1980. Murids of North-Eastern India. *In* Studies on rodents and their control. (Ed. A.K. Ghosh). *Proc. of Seminar on Problem of rodents and their control with special reference to North Eastern Region* (1977) 1-22. Shillong.

Agarwal, V.C. and Bhattacharya, T.P. 1975. Highlights of a collection of mammals from Tripura. *Newsl. Zool. Surv. India.* Calcutta, 1 (3): 41-42.

Agarwal, V.C. and Chakarborty, S. 1970. Occurrence of wooly flying squirrel, *Eupetaurus cinereus* Thomas (mammalia : Rodents) in North Sikkim. *J. Bombay nat. Hist. Soc.* 61 (3) (1969) 615-616.

Borthakur, D.N. and Sachan, J.N. 1980. Developing Strategy for rodent control in north eastern hill region : Role of ICAR Research complex. *In* Studies on rodents and their control (Ed. A.K. Ghosh). *Proc. Seminar on problems of rodents and their control with special reference to North-Eastern Region* (1977) 112-118. Shillong.

Chouhan, N.S. 1984. Studies on population dynamics and biology of reproduction of the field rat, *Rattus rattus brunneusculus* (Hodgson) associated with bamboo flowering in North-Eastern Hilly Region (Mizoram) of India. Ph.D. Thesis, Delhi University, Delhi. 178 pp.

Chouhan, N.S. and Saxena, R.N. 1982. Annual reproductive cycle of common field rat, *Rattus rattus brunneusculus* (Hodgson) associated with bamboo flowering in North-Eastern Hilly Region (Mizoram) of India. *Rodent Newsl.* 6 : 25-26.

Chouhan, N.S. and Saxena, R.N. 1982. Studies on composition and ecology of important rodent species of Mizoram. *Rodent Newsl.* 6 : 9-10.

Chouhan, N.S. and Saxena, R.N. 1982. Monthly fluctuations in the population of common field rat, *Rattus rattus brunneusculus* (Hodgson) in 'Jhum' (fields) of Mizoram during the period of flowering of bamboo, *Bambusa tulda.* (1976-79). *Rodent Newsl.* 6 : 26-27.

Chauhan, N.S. and Saxena, R.N. 1983. Food preference of the rat, *Rattus rattus brunneusculus*, a common field rat in jhums of Mizoram *Rodent Newsl.* 7 : 5-6.

Chauhan, N.S. and Saxena, R.N. 1983. Reproductive cycle of female *R. rattus brunneuculus* (Hodgson), a common field rat of Mizoram. *Proc. Indian Nat. Sci. Acad.* 51 : 560-565.

Chouhan, N.S. and Saxena, R.N. 1985. The phenomenon of bamboo flowering and associated increase in rodent population in Mizoram. *J. Bombay nat. Hist. Soc.* 82 : 644-647.

Chouhan, N.S. and Saxena, R.N. 1987. Annual reproductive cycle of the male fields rat, *R. rattus brunneusculus* (Hodgson) in hilly terrains of Mizoram. *J. Bombay nat. Hist. Soc.* 84 : 138-144.

Chouhan, N.S. and Saxena, R.N. 1989. Population dynamics, sex ratio and age structure of the field rat, *Rattus rattus brunneusculus* (Hodgson) (Mammalia : Muridae) in cultivated areas of Mizoram. *Ind. J. Pure Appl. Zool.* 1 : 99-110.

Das, B.B. and Sachan, J.N. 1980. Rodent problem in Mizoram and its control strategy. *In* Studies on rodents and their control (Ed. A.K. Ghosh). *Proc. Seminar on problem of rodents and their control with special reference to North-Eastern Region* (1977) 80-87. Shillong.

Gangwar, S.K. and Singh Y.P. 1985. Rodent pests and their control. *Indian Farming* 35 (8) : 32-33.

Gangwar, S.K., Singh, Y.P. and Kumar, D. 1990. Encapsulation of zinc phosphide kneaded balls by animal membrane : a new method of rodent control in NEH Region. *Rodent Newsl.* 14 : 8-9.

Ghosh, A.K 1977. Of rodents, flowering of bamboos and famines. *Science Reporter*, April 1977 : 246-247.

Ghosh, R.K. 1966. Notes on some rats (mammalia : Rodentia) from Mizo district, Assam, India. *J. Bengal nat. Hist. Soc.* 31 : 382-403.

Ghosh R.K. and Chakraborty, T.K. 1983. A note on the status of the flying squirrels of Darjeeling and Sikkim. *J. Bombay nat. Hist. Soc.* 80 : 411.

Gobardhan Roy, L., Thambalsana Singh, R.K. and Singh, D. 1987. Rodent control in poultry farms near Imphal, Manipur, using bromadiolone. *Rodent Newsl.* 11 : 6-8.

Gobardhan Roy, L., Thambalsana Singh, R.K. and Singh, D. 1988. Field evaulation of bromadiolone against rodent pests of paddy in Manipur. *Rodent Newsl.* 12 : 5 6.

Gobardhan Roy L., Thambalsana Singh, R.K. and Singh, D. 1989. Rodent control in the homesteads of Imphal, Manipur using bromadiolone. *Rodent Newsl.* 13 : 10-11.

Gupta, S N. 1980. Problems of rodents and their control in Arunachal Pradesh. *In* Studies on rodents and their control (Ed. A.K. Ghosh) *Proc. Seminar on Problems of rodents and their control with special reference to North-Eastern Region* (1977) 91-83. Shillong.

Hinton, M.A.C. and Lindsay, H.M. 1926. Bombay Natural History Society's survey of India, Burma, Cylon. Report No. 41. Assam and Mishimi Hills. *J. Bombay nat. Hist. Soc.* 31 : 382-403.

Jain, A.P., Tripathi, R.S. and Rana, B.D. 1993. Rodent problem in North Eastern Hill Region. *In* Rodent management - The state of Art. AICRP on Rodent Control, Jodhpur. pp. 17-19.

Kurup, G.U. 1966. Mammals of Assam and adjoining areas. I. An analytical study. *Proc. Zool. Soc.*, Calcutta. 17 : 1-21, and II, Distributional list. *Proc. Zool. Soc.*, Calcutta. 21 : 79-99.

Majumdar, R.B. 1980. Bamboos in North - Eastern India and their flowering periods. *In* Studies on rodents and their control (Ed. A.K. Ghosh). *Proc. Seminar on problem of rodents and their control with special reference to North-Eastern Region* (1977) 88-90. Shillng.

Mandal, A.K. 1981. Reports on the occurrence of the little field Mouse, *Mus booduga* (Gray) in Arunachal Pradesh, India *Bull. Zool. Surv. India.* 3 : 271-272.

Mandal, A.K. 1982. Rodents of Sikkim. *Rodent Newsl.* 6 : 10-11.

Mandal, A.K. 1983. Occurrence of *Mus booduga booduga* (Gray) at high altitudes in India. *Rodent Newsl.* 6 : 28.

Mishra, A.C. 1980. Sucking lice as definitive index in the rodent systematics. *In* Studies on rodents and their control (Ed. A.K. Ghosh). *Proc. Seminar on Problem of rodents and their control with special reference to North-Eastern Region* (1977) 125-130. Shillong.

Prakash I. 1978. 'Bell the rat' in Mizoram. *Rodent Newsl.* 2 : 10.

Roonwal, M.L. 1950. Contribution to the fauna of Manipur, state Assam Part III. Mammals with special reference to the family Muridae (Order : Rodentia. *Rec. Indian Mus.* 47 : 1-64.

Roonwal, M.L. and Seal, S.C. 1968. Variability in size of body parts and skull in the Manipur rat, *Rattus ratius bullocki J. Zool. Soc. India* Calcutta. 18 (1966) 46-48.

Seal, S.C., Ghoshal, S.C. and Bose, P.N. 1951. Notes on the bamboo flowering migration of rats, and their unusual mortality in certain districts of North Assam. *Calcutta Med. J.*, 48 : 149-155. and 195-199.

Singh, Y.P. and Gangwar, S.K. 1986. Arunachal Pradesh aur Mizoram mein bans ke phulon par chuhon ka hamla (Hindi). *Krishi Chayanika* rch. pp. 9-14.

Singh, Y.P. and Kumar D. 1994. Bharat ke Uttar-Purvi Parvatiya Kshetron ki krantak prajatiyan (Hindi). *ICAR Res. Complex Newsl.* 16(4) 10-11.

Singh, Y.P., Kumar, D. and Gangwar, S.K. 1993. A safe method to anesthesize wild rodents for laboratory studies. *Rodent Newsl.* 17 (3-4) : 6-7.

Singh, Y.P., Kumar, D. and Gangwar, S.K. 1993. A specimen of *Bandicota bengalensis* with abnormal upper incisors. *Rodent Newsl.* 17 (3-4) : 4.

Srinath, D. 1977. Present situation of rodent menace in Mizoram. *Rodent Newsl.* 1 : 9-10.

Subish, K.S. 1977. Rat menace in Arunachal Pradesh, *Rodent Newsl.* 1 : 10-11.

Subiah, K.S. 1984. Strategy for rodent pest management in the state of Manipur - An approach. 16 pp, (Mimeo).

Subiah, K.S. and Singh D. 1894. Record of *Bandicota bengalensis* from Imphal, Manipur. *Rodent Newsl.* 8 : 13-14.

Thomas, O. 1916. A new mouse from Sikkim, *J. Bombay nat. Hist. Soc.* 24 : 203-205.

Tiwari, C.P. 1984. Arunachal Pradesh-State report. *Workshop on Rodent Pest Management in urban and agric. situation.* CPPTI, Hyderabad. *Pest Management* 4(4) : 6.

Trivedi, S. and Tripathi, R.S. 1980. Bamboo flowering and increase in rodent population in Mizoram : A Preliminary report. *In* Studies on rodents and their control (Ed. A.K. Ghosh). *Proc. Seminar on Problem of rodents and their control, with special reference to North Eastern Region.* (1977) 66-72. Shillong.

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