

RODENT

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ALL INDIA COORDINATED
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RODENT CONTROL

CENTRAL ARID ZONE
RESEARCH INSTITUTE,
JODHPUR 342 003

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CONTENTS

Occurrence of the Bay Bamboo Rat, <i>Cannomys badius badius</i> (Hodgson, 1841) (Rodentia : Rhizomyidae) in Mizoram, India —A.K. Mandal, A.K. Poddar & T.P. Bhattacharyya	1
Surveillance of Field Rodents in Central Uttar Pradesh —A.S. Bhadaura & Y.K. Mathur	2
Squirrel Damage to Chrysanthemum —Moni Thomas & S.K. Sengupta	3
Burrow Morphology of Field Rodents of Cauvery Delta —P. Neelanarayanan, R. Nagarajan & R. Kanakasabai	3
Vertebrate pests as Prey and Their Composition in the Diet of Common Barn Owl, <i>Tyto alba</i> . —P. Neelanarayanan, R. Nagarajan & R. Kanakasabai	5
Pit Fall Trap for the Control of Field Rodents in Cotton Fields —P. Neelanarayanan, R. Nagarajan & R. Kanakasabai	7
Response of <i>Meriones hurrianae</i> Towards Rodenticidal Baits Carried in Non Food Bait —Muktha Bai, K & Yashoda L. Urs	8
Field Evaluation of flooumafen Against Rodents Infesting Paddy Crop. —Y.K. Mathur A.S. Bhadauria & V.N. Singh	9
Efficacy of flooumafen against the laboratory rat (<i>Rattus norvegicus</i>) —K. Mukhta Bai	10
Employment of Glue Trap in the Commensal Rodent Control —Y.K. Mathur A.S. Bhadauria & V.N. Singh	12
New Records of Some Rodent Species from the States of North Eastern Hill Region —Y.P. Singh D. Kumar & S.K. Gangwar	12
Rodent Damage to <i>ber</i> (<i>Zizyphus mauritiana</i>) nursery —A.P. Jain, Mohd. Idris & Y.R. Meena	13
Observations on the Behaviour of House Rat, <i>Rattus rattus rufescens</i> Gray, and Five Striped Squirrel, <i>Funambulus pennanti</i> Wroughton, Trapped in a Wonder Trap —Moni Thomas, R.K. Patel & O.P. Dubey	14

Occurrence of the Bay Bamboo Rat, *Cannomys badius badius* (Hodgson, 1841) (Rodentia : Rhizomyidae) in Mizoram, India

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A faunistic survey was conducted in Mizoram, specially for mammals, by the Zoological Survey of India during December, 1993 and January, 1994. The collection contained several species of small mammals. Among the rodents, *Cannomys badius badius* (Hodgson) was found to be unrecorded from that state. Hence, it is recorded in the present communication. External measurements have been taken in the field and the skull measurements in the laboratory. All measurements are in millimetres and have been taken following standard methods.

Material examined : Mizoram : Aizawl district : 1 male and 1 female ; Teirei (C 250 m), Dampa ; coll. Ajoy Kumar Mandal ; 27, 28 Dec., 1993 (rolled skins, skulls extracted).

Measurements : External : 1 female, 1 male : head and body 181.0 & 199.0; tail 64.0 & 75.0 hind foot 30.0 & 32.0; ear 10.0 & 9.0. (ii) Cranial : 1 female, 1 male : occipitonasal 38.3 & 41.5; condylobasal 42.0 & 47.2; nasal 14.5 & 16.4; palate 25.7 & 29.2; molar tooth row 8.8 & 9.9; bulla 8.5 & 10.2; anterior palatal foramina 3.5 & 3.8; zygomatic width 30.0 & 32.8; diastema 15.5 & 17.5; mandible 28.0 & 33.7. Weight (in g) : 1 female, 1 male : 209.0 & 214.0 respectively.

Distribution : *Cannomys badius badius* is known from Nepal, Bhutan, China, Bangladesh, Myanmar, Thailand, Cambodia and India (Sikkim, West Bengal, Assam, Meghalaya, Arunachal Pradesh, Nagaland and Manipur). Hence, the present specimens constitute the first record of the species from Mizoram and extends its distributional range southwards, in India.

Both the specimens were caught alive after excavating the burrows near the roots of the bamboo plantation. The female specimen was comparatively young. Fossorial adaptation in this species is well marked from the flattened shape of the skull with its prodont upper incisor, small size of the eye, short tail and spatula-shaped limbs.

Surveillance of Field Rodents in Central Uttar Pradesh

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While carrying out the surveys in different localities of Central Uttar Pradesh during 1986-1988 in five districts (Kanpur Dehat, Kanpur Nagar, Lucknow, Raebareli and Sitapur) to study the rodent fauna, field rodents were collected by digging 100 burrows from each locale. These captured animals were identified on the basis of nucleus collections and later their identification was confirmed by the Zoological Survey of India, Calcutta. The details of survey are presented in Table 1.

Table 1 Surveillance of field rodents in Central Uttar Pradesh

Rodent	Percentage of rodent species in the districts surveyed (locations)				
	Kanpur Dehat (Bilhaur)	Kanpur Nagar (Kalyanpur)	Lucknow (Banthra)	Raebareli (Lalganj)	Sitapur (Khairabad)
<i>B. bengalensis</i>	50.42	24.20	53.03	51.61	29.65
<i>T. indica</i>	25.64	47.65	18.93	29.83	37.93
<i>M. melhada</i>	7.69	4.68	12.87	12.09	9.65
<i>M. booduga</i>	12.82	10.93	6.81	4.83	14.48
<i>N. indica</i>	3.41	3.12	8.33	—	5.51
<i>B. india</i>	—	2.34	—	1.61	2.75
<i>G. ellioti</i>	—	3.12	—	—	—
<i>V. oleracea</i>	—	3.90	—	—	—
Total No of rodents in 100 burrows	117	128	132	124	145

The surveillance studies revealed that bandicoot rat, *Bandicota bengalensis* Gray and Indian gerbil, *Tatera indica indica* Hardwicke are the major field rodent species of this part of the State. The next in order of predominance were field mouse, *Mus booduga* Gray followed by softfurred field rat, *Millardia melhada* Gray and Short tailed mole rat, *Nesokia indica* Gray.

During the course of survey, Bush rat, *Golunda ellioti* Gray and long-tailed tree mouse, *Vandeleuria oleracea* Bennett were also collected. These two species are being reported for the first time from these localities of Uttar Pradesh.

Squirrel Damage to Chrysanthemum

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Five-striped squirrel, *Funambulus pennanti* Wroughton was found seriously damaging potted plants of Chrysanthemum, during last week of October, 1993. Twenty two plants out of the twenty seven (81.48%) were damaged within three days. Squirrels numbering five were found damaging chrysanthemum plants in the morning between 8.00 to 9.00 am. They climbed down from the adjoining mango tree and entered the pots, later cut the plants from its base. One squirrel per pot was observed.

On the second day of damage, prebaiting was carried out with half boiled wheat smeared with groundnut oil. Ten gram of the prebait was kept on a piece of paper in all the twenty seven pots. By evening it was partially consumed at eleven places. Next day zinc phosphide 2% bait was placed in all the twenty seven pots before 8.00 am. Poison bait was found partially consumed at 6 places by all the five squirrels by 8.45 am. Four dead squirrels were collected near the mango tree after 11.00 am. Dead squirrels consisted of a male (adult), and three females (two adults + one young). However, one squirrel could not be traced.

Burrow Morphology of Field Rodents of Cauvery Delta

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The present investigation was carried out in the crop fields of paddy, pulses, sugarcane, soybeans and cotton and in barren lands of approximately 2 ha each in Mannampandal, Kanjanagaram and Natham villages of Nagapattinam Quaid-e-Milleth District, Tamilnadu during February and March 1993. Observations were taken on structure and nature of burrow entrances, the quantity of soil excavated and size of pebbles at the burrow entrances.

For the present study, 166, 70, 79 and 75 burrow entrances of *B. bengalensis*, *M. booduga*, *M. melhada* and *T. indica*, respectively were examined. Each species had a unique pattern of burrow entrance. The burrow entrances of *B. bengalensis* had a large heap of soil with large sized pebbles while the

M. booduga entrances had a smaller heap of soil with small sized pebbles. Both the species were observed to make burrows on the sides of the bunds. Besides, both the rodents plug their burrow entrances after entering into it. The observed behaviour of these rodents might be to avoid the entry of predators. In the present study, the number of burrow openings ranged from 1 to 3 for *B. bengalensis* and one for *M. booduga*.

Of the 166 burrow of *B. bengalensis* observed, 114 burrow entrances were plugged and 52 were unplugged. Both type of burrows were excavated and all the plugged burrows were occupied by rodents and the unplugged burrows were not. Similarly, 70 burrows of *M. booduga* were studied of which 48 were plugged and 22 were open and when they were excavated, only the plugged burrows had the rodents (Table 1).

Table 1 Burrow occupancy of rodents based on the nature of burrow entrance in different crop fields

Name of the species	Nature of the burrow entrance	No. of burrows excavated	No. of burrows occupied	Percentage of occupation
<i>Bandicota bengalensis</i>	plugged	114	112	98.2
	unplugged	52	0	0
<i>Mus booduga</i>	plugged	48	47	97.9
	unplugged	22	0	0
<i>Millardia melitada</i>	plugged	79	30	37.9
	unplugged			
<i>Tatera indica</i>	plugged	75	18	24.0
	unplugged			

The burrow entrances of *M. melitada* did not have the heap of soil and the burrow goes vertically downwards and remained open. The burrows were seen very often over the bunds and infrequently on the sides and their entrances were round in shape. Besides this, *M. melitada* had two openings one remained open and the other plugged by grasses which cannot be identified easily and it is considered to be an emergency opening.

The burrows of *T. indica* were observed in the barren lands and usually had more than one openings (range : 2 to 3) adjacent to each other and the distance between them was nearly 0.5-1.0 m. Our observations revealed that the burrows go slant-wise (roughly 45°) and the entrances had small amount of heap of soil. Therefore, from the present study it is evident that the burrow entrances of four field rodents of Cauvery delta are highly species specific and their burrow morphology did not differ among the crop fields.

Vertebrate Pests as Prey and Their Composition in the Diet of Common Barn Owl, *Tyto alba*.

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The common barn owl, *Tyto alba* is a bird of prey, nocturnal in habit and can be easily recognized by its heart shaped face. For the present study 335 pellets of common barn owl were collected from five roosting sites, innerside of the temple towers, located in Mayiladuthurai, Tamilnadu, during May '93. The collected intact pellets of barn owl were bagged, labelled and brought to the laboratory and were placed in the oven at 70°C to kill the associated arthropod parasites for 24 hrs.

The pellets were analysed individually in 8% Sodium hydroxide solution and the osteous remains were carefully decanted. The observed osteous remains were mostly of skulls, mandibles, vertebrae, pectoral and pelvic girdles, limb bones, etc.

The mandibles of lower jaws or dentaries were used as the Keys for the identification of prey species as they occurred in most of the pellets. In case of absence of mandibles, either the skull or the pelvic girdle were used as keys for the purpose and this was done upto class level only viz., Mammals, Aves and Amphibians. The mandibles were compared with museum specimens and the respective species were identified and recorded. In the analysed pellets, one set of mandibles (left and right) was counted as one prey species.

The pellets were oval in shape and greenish black in colour. The average length, width and dry weight of the pellets was 37.9 ± 0.099 mm, 25.9 ± 0.03 mm and 3.76 ± 0.17 g, respectively ($n = 50$; $\bar{x} \pm$ S.E.). The results of the study are summarised in Table 1. There were 499 individual prey items representing 6 species of small mammals, birds and amphibians.

The lesser bandicoot rat, *Bandicota bengalensis* was the predominant prey species of barn owl and it constituted 33.66% of the total prey consumption (Table 1). The observed *B. bengalensis* dominance in the barn owl's diet may be due to its high incidence in the agricultural fields. The soft-furred

field rat, (*Millardia meltada*), house rat (*Rattus rattus*) and the Indian field mouse (*Mus booduga*) shared 20.04%, 11.62% and 11.20% of the total prey consumption, respectively. Of the prey items, the rodent pests viz., *B. bengalensis*, *M. meltada*, *R. rattus*, *M. booduga*, *Tatera indica* together with unidentified rodent species were accounted for 85.96% of the total prey intake.

Interestingly, most of the pellets had more than one prey item and they ranged from one to the maximum of six. The mean prey item per pellet was observed as 1.57 (Table 1).

Table 1 Prey Composition of common barn owl (*Tyto alba*) revealed from pellet analysis

Prey species	Total No. of prey from five roosting sites	Percentage of prey composition
<i>Bandicota bengalensis</i>	163	33.66
<i>Millardia meltada</i>	100	20.04
<i>Suncus murinus</i>	061	12.22
<i>Rattus rattus</i>	058	11.62
<i>Mus booduga</i>	055	11.02
<i>Tatera indica</i>	001	00.20
Unidentified rodent species	052	10.42
Frog	006	01.20
Bird	001	00.20
Birds' egg shell	002	00.40
Total number of prey	499	
Mean prey / pellet	1.57	
Range of prey / pellet	1.6	

From the results, it is obvious that the barn owl can be a good predator of the vertebrate pests of this area and this requires further investigations on long term basis for utilizing this predatory bird as a biological control agent against such pests.

Pit Fall Trap for the Control of Field Rodents in Cotton Fields

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During a survey for estimation of rodents population and their damage to cotton crops near Andoor village, Nagapattinam Quaid-e- Milleth district Tamilnadu it was observed that the pit fall traps were used for rodent control. The details of these traps are as follows. Mud pots of 20 litres capacity were used as pit fall traps. For 1.5 acre of cotton field, eight mud pots were buried in the ground when the crops were of approximately 70-75 days. Two thirds of the pot was buried into the earth and the exposed portion of the pot was covered with mud so as to camouflage it. (Fig. 1) Semisolid cowdung was prepared and poured into one third of the implanted pot which served as effective marshy trap. The semisolid condition of cowdung was maintained by stirring it with the help of a stick each evening. To attract the field rodents, parched paddy mixed with coconut oil (bait) was spread around the pot in a few places. The prepared bait was also kept over a layer of husk which was spread on the semisolid cowdung. After consuming the bait spread around the pot, the rats entered into the pot for consuming the bait inside, where they got trapped. The pots were checked for the trapped next morning. In all 30 rodents were trapped in three days of which 16 were *Bandicota bengalensis*, 10 *Millardia meltada* and 4 *Mus booduga*. The mean number of animals trapped per day was 10.



Fig 1 Pit fall trap for control of rodent pests in cotton fields

Response of *Meriones hurrianae* Towards Rodenticidal Baits Carried in Non Food Bait

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Various rodenticides viz., zinc phosphide, warfarin, diphacinone, flocoumafen and brodifacoum carried in non-food (Polystyrene) bait, (a new process has been developed at CFTRI Mysore) were evaluated against desert gerbils, *M. hurrianae* under captivity. For each rodenticide tested six adult females weighing between 90-120 gms were used. After weighing, these were released individually in polypropalene cages and were provided with stock diet pellets and water *ad libitum* throughout the experimental period, inclusive of posion baiting period. Non food baits containing different rodenticides were provided to them for one or three days (Table 1). The gerbils were observed daily for their gnawing behaviour, symptoms and mortality while

Table 1 Response of *M. hurrianae* towards poison baits carried in non-food baits

Rodenticides & their conc. in nonfood bait	Avg. body wt. of gerbils (gms)	Posion bait exposure** (days)	No. of gerbils Tested/Dead	Death period	Avg. Food Consumption (gms) 100g. bodywt/day
Zinc Phosphide (300 mg)	98	1	6/6	within 16 hrs	7.75
Warfarin (10 mg)	110	3	6/5	5-6 days	5.72
Diphacinone (10mg)	102	3	6/5	4-8 days	6.56
Flocoumafen (5 mg)	112	1	6/6	7-8 days	7.05
Brodifacoum (5 mg)	107	1	6/6	6-7 days	7.10

* Polystyrene block of 50 mmx50mmx20mm

** Stockdiet pellets as alternate food was always available

the survivors were further observed for three weeks. The response of desert gerbils to different rodenticides when carried in polystyrene bait blocks were of interest to observe. Initially (for 5-10 minutes) they were hesitant to approach the treated baits, however they overcame the new object reaction, and started at tackling and gnawing them vigourously. The results obtained also indicated

that among the five rodenticides tested zinc phosphide, flocoumafen an brodifacoum were effective in killing all the test rodents resulting in 100% mortality. However, zinc phosphide killed the rats within 16 hours and was 6-8 days with second generation anticoagulants viz. Flocoumafen an Brodifacoum in one day exposure. Warfarin and Diphacinone killed onl 83.3% of the test gerbils although the exposure period was 3 days. Th above results clearly point out the usefulness of non food bait as carrier of different rodenticides against desert gerbils.

Field Evaluation of Flocoumafen Against Rodents Infesting Paddy Crop

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Field trials for bio-efficacy of flocoumafen, bromadiolone and zinc phosphid against rodent pests were laid down continuously in two kharif seasons i paddy at oil seed Research Farm and New Dairy Farm located at Kalyanpur Kanpur. Mixed population of field rodent species were found infesting padd crop. At oilseed Farm the predominant species were, *Millardia meltdada* Gra and *Mus booduga* Gray while at New Dairy Farm *Bandicota bengalensi* Gray and *Tatera indica indica* Hardwicke were predominant. All the fou species were found at both the experimental sites. Ready to use poison bait of flocoumafen and bromadiolone 0.005% conc and 2% loose poison bait of zinc phosphide were applied in the live burrows. The per cent contro success was calculated on the basis of live burrow count.

Table 1 Bioefficacy of rodenticides against field rodents infesting paddy crop in two kharif seasons

Treatments	Mean No. of burrows treated	Mean per cent control success on days			
		3rd	5th	7th	9th
Flocoumafen (0.005%)	49.5	39.3	57.1	66.5	79.2
Bromadiolone (0.005%)	35.5	34.8	42.6	58.4	72.4
Zinc phosphide (2%)	23.5	36.0	53.4	53.4	53.4

The performance of rodenticides in non-replicated field trial revealed that 3rd day after treatment, the mean per cent control success were 39.3, 34.8 and 36.0 in case of flocoumafen, bromadiolone and zinc phosphide, respectively. On fifth day, successive increase in mean per cent control success was observed in all the treatments. The maximum control success was recorded on ninth day in flocoumafen (79.2%) and bromadiolone (72.4%). No increase in control success could be observed in zinc phosphide treated areas after fifth day after treatment (53.4%). It may be due to the fact that animals later showed non-acceptance of zinc phosphide poison bait after its initial uptake.

Efficacy of Flocoumafen Against the Laboratory Rat (*Rattus norvegicus*)

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Adult albino rats (CFT-Wistar strain) comprising of both sexes and weighing between 160-190 gms (females) and 250-270 gms (males), were tested against the ready to use flocoumafen wax blocks (each block weighing 17 gms containing 0.005% flocoumafen as active ingredient) supplied by NOCIL, Bombay. After acclimatization period of one week the rats were weighed, sexed and released into individual cages. A total of 36 rats were divided into three groups of 12 rats each (1:1 sex ratio) and were offered flocoumafen wax blocks (1 block/rat) for one, two and three days respectively in no choice conditions (Table 1). The test rats were closely monitored for symptoms, mortality, etc., further for a period of four weeks. The results obtained were as follows:

Male rat response : When the exposure period of flocoumafen wax blocks was for one day, none of the rats succumbed to the toxicant. The average ingestion of wax blocks/ rat was found to be 1.0 gm only. (Table 1). However, with the increase in exposure period to two and three days, the average intake per animal also increased to 8.0 and 10.0 gms, and the percent mortality being 33.3 and 100 respectively. The symptoms of poisoning viz., bleeding in the eyes, nose, snout, paws and anal regions although were observed from 3rd day of feeding, they generally succumbed to the toxicant between 5-7 days.

Female rats response : Unlike male rats, 66.6% of the female rats succumb between 5-6 days to one day exposure of the wax blocks containing flocoumafen. The average ingestion per rat was also 3.0 gms (Table 1). However, the test rats succumbed within 7 days when the exposure period was 1 and three days. The average consumption of the bait per rat was 7.6 g and 10.7 gms, respectively.

Table 1 Response of the laboratory rat (*R. norvegicus*) to wax blocks containing Flocoumafen (0.005%)

Average body weight (gms)	Exposure period of wax blocks (Days)	Number		Average bait consumption per rat (gms)	Active ingredient (mg/kg b.w.)	Death period (Days)
		Tested	Dead			
MALE						
260	1	6	0	1.0	Negligible	—
258	2	6	2	7.0-9.0 (8.0)	1.47	5-7
258	3	6	6	9.0-15.0 (14.0)	2.70	5-6
FEMALE						
173	1	6	4	3.0-3.0 (3.0)	0.86	5-6
169	2	6	6	5.0-10.0 (7.6)	2.3	5-7
190	3	6	6	11.0-13.0 (10.72)	2.82	3-7

The above results point out that although both sexes of *R. norvegicus* are susceptible to the flocoumafen wax blocks, the females appear to be more susceptible than males.

Employment of Glue Traps in the Commensal Rodent Control

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With a view to avoid the use of rodenticides for the commensal rodent pest management a new type of rodent trap commonly known as sticky or glue trap supplied by m/s. Eco Safe Traps (India) Ltd. was tested in the houses where 2-3 glue traps were set in each house in the area of maximum rodent activity.

The results indicated the effectiveness of glue traps as *Rattus rattus* and *Mu. musculus* were easily trapped. However, mice were trapped more frequently than rats due to their fast movement and less realization for traps laid. In one trap a maximum of ten mice were caught within 24 hours. Besides, two lizards and several household insect pest such as house flies, cockroaches etc were also trapped. On first day, maximum rodents were trapped in all houses and within five days, the population level reached to zero. Thus, glue traps were found most effective especially for the control of house mouse and proved a safer approach of commensal rodent management.

However, the detaching of trapped animals from sticky surface of traps was felt combessom to some extent. This may be a constraint in the wider adoption of glue traps by the public. Trap needs to be improved in this respect to enhance its extensive use.

New Records of Some Rodent Species from the States of North Eastern Hill Region

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Since the inception of All India Co-ordinated Research Project on Rodent Control, all the states of North Eastern Hill Region viz., Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland, Sikkim and Tripura were surveyed

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for the rodent species composition. The collection of rodents were made from fields, forests, houses, shops, godowns and poultry/animal farms as well as from jhum fields. A total of 15 rodent species has been identified, out of them 6 species seems to be the new records from different states. These species has not been recorded from these states and are probably the new records (Table 1).

Table 1 New Records of rodent species from NEH Region

S.N o.	Rodent species	Place and State of new Record
1.	<i>Rattus nitidus nitidus</i> (Hodgson)	Medziphima, Nagaland.
2.	<i>Rattus rattus khyensis</i> (Hinton)	Barapani, Meghalaya.
3.	<i>Rattus rattus tistae</i> (Hinton)	Kolasib, Mizoram.
4.	<i>Mus musculus</i> (Linn.)	Basar, Arunachal Pradesh.
5.	<i>Mus booduga</i> (Gray)	Barapani, Meghalaya, Kolasib, Mizoram, Todang, Sikkim.
6.	<i>Callosciurus</i>	Kolasib, Mizoram, Lembucherra, Tripura.

Rodent Damage to *ber* (*Zizyphus mauritiana*) nursery

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A six bed *ber* nursery raised at Krishi Vigyan Kandra, CAZRI, Jodhpur campus was regularly observed for rodent damage. In each bed 1200 seeds were sown. The beds 1 and 2 were covered with wire mesh nets and interestingly these beds escaped rodent damage. Uncovered beds (Nos. 3 to 6), however, registered severe attack of rodents in as much as that 80 per cent damage occurred in bed No.4 (Table 1). Among rodents, *Tatera indica* ate away sown seeds from dusk to dawn, whereas, *Funambulus pennanti* ravaged the germinating seeds during early morning and late evening hours. Nocturnal *Tatera* gerbils attributed to 15 percent damage. The maximum damage incurred on day 3rd of sowing when the seeds had embedded sufficient moisture,

got softened and stored nutrients were converted into easily assimilable forms, i.e., amino acids, sugars etc., so that rodents need not spend large water budgets, a scarce commodity, for digestion.

Table 1 Rodent damage to sprouting *ber* (*Z. mauritiana*)

Bed Nos.	Nos. of damaged seeds			% damage
	Day I	Day II	Day III	
1 & 2	Covered with wire mesh nets		NIL	NIL
3	—	—	200	16.6
4	—	—	100	8.3
5	—	—	180	15.0
6	—	—	960	80.0

Observations on the Behaviour of House Rat, *Rattus rattus rufescens* Gray, and Five Striped Squirrel, *Funambulus pennanti* Wroughton, Trapped in a Wonder Trap

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The University poultry complex is known to harbour house rat, *Rattus rattus rufescens* Gray and five-striped squirrel, *Funambulus pennanti* Wroughton as a regular visitor. The squirrels enter into sheds through the hanging branches of Kapok trees (*Cibea pentandra*) over its roof. On 4th June 1994, two 'wonder' rat traps with baits were placed in a shed, as a part of regular Project work. In one of the traps, three *R. r. rufescens* and one *F. pennanti* were captured. There were two males (101 g and 82 g. body wt.) and one female (79 g.) of *R. r. rufescens* while *F. pennanti* was found freely moving and mixing with rats. This is the first instance when *R. r. rufescens* and *F. pennanti* were trapped together. Frequent visits and regular encounter among both the species may have made them familiar to each other, while sharing of food and water in the same area may have helped to develop an amicable behaviour among them. Earlier, when *Bandicota bengalensis* and *R. r. rufescens* were trapped in the same trap, fight occurred resulting in death of *R. r. rufescens*.

Contributions for inclusion in the Newsletter may please be forwarded along with 1-2 good black and white photographs to :

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