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ALL INDIA COORDINATED RESEARCH PROJECT
ON RODENT CONTROL
Central Arid Zone Research Institute, Jodhpur

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Rodents of Himachal Pradesh : A report

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Solan-173 230 (H.P.)

Himachal Pradesh is situated at latitude 30°-24′ 40″N to 33°-12′ 40″N, long. 75°-45′ 55″E to 79°-04′ 20″E and altitude 350 to 6975 m above MSL. Of four agro-climatic zones of Himachal Pradesh, rodent survey was conducted during 1988 in the districts of Solan, Sirmour and Kangra, comprising of subtropical and sub-humid zones (i.e. lower hill and valley and mid hills). The following species have been recorded from the orchards, fields, houses, godowns and forests of the area surveyed :

Bandicota bengalensis : It is widely distributed in orchards, tea plantations, horticultural and agricultural fields and the forests near agro-ecosystem.

Funambulus pennanti : Distributed in orchards, parks, etc., in the foot-hills and valley area.

Golunda ellioti : Inhabits orchards, tea plantations and forest area nearby.

Hystrix indica : Observed so far in Sirmour district only in the potato crop fields.

Mus musculus : Widely distributed, recorded from residential premises as well as fields and orchards.

Mus booduga : Widely distributed, in the fields and orchards.

Mus platythrix : Widely distributed in the fields and orchards.

Rattus rattus : Distributed primarily in residential premises and godowns but also recorded from fields and wastelands near human habitations.

Rattus meltada : Widely distributed in crop fields.

Tatera indica : Collected only from the fields in the foothills of district Solan (Parwanoo).

Studies on burrow openings and their utilization by *Nesokia indica* Gray.

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The short tailed mole rat, *Nesokia indica*, is a predominant pest of northern India causing severe losses to field crops. The present study was made during February to April 1977 at the IARI Farm, New Delhi, corresponding with vegetative growth and maturity stage of wheat crop. The observations revealed that during March and April the same burrow openings were utilized by the mole rat for 3 or more days (upto 13 days) either continuously or with some interval. However during February about 70% of the burrow openings were used for as ingle day only and were deserted latter on. The observations suggest that the activity of *N. indica* started in February, i.e., when the wheat crop was at flowering/milking stage. Since the rats burrow only once at this stage, it appears that they were busy in selecting sites for permanent burrows to be used during March-April, i.e., the period of crop maturity. Thus, it may be concluded that poison baiting operations should be carried out during March, i.e., the period when rats keep on visiting the same burrow openings for even upto 13 days. More frequent visits to a particular burrow opening indicate a better site for bait placement.

Prevalence of greater bandicoot rats, *Bandicota indica* in border areas of Haryana, Punjab and Rajasthan

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South-western part of Haryana and Ganganagar district of Rajasthan have an abundant population of bandicoot rats. Some villages of District Ferozepur (Punjab) have been found to be infested with this species. The villages near Rajasthan Canal passing through Punjab and Haryana contain a varied population including *B. indica* in residential areas. During the year 1990, these bandicoots were trapped from following villages : Abubshahar (Haryana); Kandu Khera (Punjab), Sangaria (Rajasthan). In random sampling studies, these form 6-10 percent of the murids in residential population.

On an average, this rat consumes 36 g of food per day. Openings of burrows of these rats were found both in kutcha walls and floors. The burrows usually have 3-8 openings. Hoarded corns of maize, black gram, rice husk, fodder, etc., were seen in the storage chambers. A large quantity of hoarded food was observed during rainy season. Five to nine young ones of these bandicoots were observed during winter and rainy season.

Prevalence of *Vandeularia oleracea* in Hisar District of Haryana

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Long tailed rat, *Vandeularia oleracea*, was trapped during random sampling studies (year 1990) in dense bushes of water logged area in between Bhakra Canal and Ghaggar river just ahead of village Dher on Jakhal-Kulan link road. These rats occupy deserted nests of weaver birds on different tree species in water-logged areas. These rats are good swimmers, and reach the nearby paddy fields. On one occasion, these rats were observed at H.A.U. Campus, Hisar. From the paddy fields, these rats were found to migrate back to the nests on thick population of bushes by jumping over a height of one metre.

Rodent activities in rabi crops in Bharatpur Region

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Investigations were carried out to assess the rodent activity and rodent population in different rabi crops. Results indicated that the number of live burrows and the damage caused is maximum at maturity stage and minimum at seedling stage. Maximum damage was caused to wheat and barley followed by gram and pea and the least to mustard. The order of preference during different stages of wheat and barley was maturity > vegetative > seedling stage. Minimum infestation was observed in mustard probably due to more row to row distance or less density of plants and also due to its pungent and bitter taste (Table).

Table Number of live burrows/hectare

Crop	Seedling stage			Growth stage			Maturity tage		
	1986-87	1987-88	Average	1986-87	1987-88	Average	1986-87	1987-88	Average
Wheat	31.4 ±1.6	38.0 ±1.92	34.7	43.5	43.5 ±1.53	43 5	62.5 ±0.68	61.2 ±1.93	61.8
Barley	30.0 ±1.17	36.6 ±1.50	33.3	43.8 ±1.59	44.2 ±1.42	44.0	52.5 ±1.63	56.6 ±1.20	54.5
Pea	9.2 ±0.52	11.2 ±1.02	10.2	12.2 ±0.28	14.6 ±0.81	13.4	16.0 ±0.79	21.6 ±1.07	18.8
Gram	24.2 ±1.14	23.6 ±1.20	23.9	31.5 ±0.97	28.0 ±1.0	29.7	39.7 ±0.91	36.8 ±1.15	38.2
Mustard	9.8 ±0.76	11.2 ±0.66	10.5	11.4 ±0.99	14.6 ±0.50	13.0	14.0 ±1.13	17.4 ±0.74	15.7

Food habit and feeding behaviour of the large bandicoot rat, *Bandicota indica* (Bechstein)

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The study was conducted in the Sagar Island, 24-Parganas district (South), West Bengal for a period of two years, as well as in the laborarory.

The large bandicoot Rat comes out of the burrow for feeding only after dusk and returns at dawn. During monsoon and premonsoon, it feeds mainly on molluscan and crab species. In search of food, it often goes into the water, as it can swim easily, going deep to capture fishes, prawns, crabs and molluscs. After capture of the prey, it takes the latter to a particular feeding place or near the burrow for consumption. Thus, large deposits of shells of molluscs, crabs and sometimes scales of fishes are found near the feeding place or burrow. During harvesting of paddy (November-December), it regularly visits the neighbouring paddy fields and often settles there. It drags the ears of paddy or entire tiller into the burrow for immediate consumption or for hoarding. Extent of damage due to consumption does not appear to be severe. However, during August-September, when there is knee deep water in the fields it invades the paddy fields in search of animal food. At that time, it bends and twists the paddy tillers of small areas to make feeding platforms above the level of water thereby causing considerable damage. During dry period, vegetable gardens, particularly those of potato, are favourite foraging grounds of *B. indica*. However, never more than 10 to 30 percent of a potato is consumed. Similar damage is done to the musk-melon. It also regularly visits the bushes around its habitat to consume other plant material.

Analysis of contents of 42 stomachs, revealed a great diversity of food material as well as some seasonality. By weight (species-wise) consumption of the gastropod, *Pila globosa* was highest (38%). Among the plant materials, intake of seeds and fruits was highest (68%).

In captivity, *P. globosa* was highly preferred when *P. globosa*, rice, Bengal gram and wheat were given in a multiple-choice test (mean consump-

ption of food per rat per day was 91.36 g). When *P. globosa* was replaced by green gram, the intake dropped down to 42.3 g.

B. indica plays an important role in the biological control of several pestiferous species of molluscs and crabs.

Rodent epidemic during 1989 in Gujarat State and report of secondary and non-target poisoning due to baiting with zinc phosphide

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During 1989, the rodent population was observed in epidemic form in several districts of Gujarat state. This might have been due to the comparatively severe drought conditions during the preceding 2-3 years. There was also heavy damage by rodents in cereal crops, vegetables, coconut, groundnut and sugarcane. The damage to cereal crops, groundnut and sugarcane was particularly severe.

For the control of rodent damage in the field, some farmers of Baroda district carried out rodent control operations using poison bait prepared from popcorn (Maize or Sorghum) and zinc phosphide. While they got very good results with this bait, some cases of non-target poisoning of our national bird, the common peafowl *(Pavo cristatus)* was also reported. However, some of the more knowledgeable farmers could avoid this poisoning of peafowls by using the poison bait only at night and by covering the poisoned popcorns in the morning with soil when the birds' activity usually starts. In Mehsana district, some cases of non-target poisoning of donkeys and of secondary poisoning of dogs were also reported. The present information on poisoning of non-target animals due to zinc phosphide was provided to us by extension workers.

Rodent damage to desert afforestation plantations

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A peculiar type of damage due to rodents has been observed in the afforestation plantations in the desert. Even from the 'bets' in the greater Rann of Kachch, the 5-8 year old trees were suddenly found to dry up. Digging revealed that the main stem under the soil surface, had been totally gnawed by rodents. Usually no burrow openings were found near the base of the 'killed' trees. We had a chance to quantify this type of damage in a 25 ha plantation in Panwari range, near Kuchaman city (Nagaur) in Central Rajasthan.

Studies indicated that desert gerbils, *Meriones hurrianae*, were the most predominant species in the range (60%) followed by Indian gerbil, *Tatera indica* (30%), short tailed mole rat, *Nesokia indica* (7%) and soft furred field rat, *Millardia meltada* (3%). The fields were full of burrows varying from 300-1000 per ha.

Two distinct types of damaging activities were noticed. First, the slicing activity from under ground, resulting in complete drying of the trees and secondly, the debarking activity above the ground. Former type of damage was done by *N. indica*. whereas the debarking was done by other rodents. *Nesokia indica* damaged 2-4 year old plantations of *Acacia tortilis*, *Prosopis juliflora* and *Acacia nilotica* trees to the tune of 4.4, 10.0 and 10.0 percent respectively, resulting in complete death of trees (Table).

Table. Rodent damage to desert afforestation plantations.

Tree species	Slicing activity*			Debarking activity**	
	Total No of trees in area	No. of damaged trees	Damage (%)	Mean length of debarked portion	Shoots (main + branches debarked (%)
Acacia tortilis	22,500	1000	4.4	13.6	33.2
Prosopis juliflora	5,000	500	10.0	NR	NR
Acacia nilotica	500	50	10.0	NR	NR
Parkinsonia aculeata	500	No slicing	—	11.6	24.0

* Based on total count.

** Based on observations on 75 trees (5 sets of 15 trees).

NR : Not recorded.

Other rodent species viz., *M. hurrianae*, *T. indica* and *M. meltada* caused debarking of the main shoot as well as the the side branches above the ground level. The mean debarking length was 13.6 cm in *A. tortilis* (maximum 21.2 cm) and 11.6 cm in *Parkinsonia aculeata*.

Encapsulation of Zinc phosphide kneaded balls by animal membrane-A new method of rodent control in NEH Region

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A new method of Zinc phosphide bait formulation was developed and tried by us in North Eastern Hill Region. The bait was prepared by using 2% zinc phosphide in the kneaded balls which were then encapsulated by animal membrane (mesenteron of goats). The acceptance of this bait was studied in comparison to those of other baits viz., uncoated kneaded flour balls, wax coated balls, gur coated balls and bread pieces (1" x 1"). The test was carried out on four rodent species viz., *Rattus norvegicus*, *R. nitidus nitidus*, *R. rattus* and *Bandicota bengalensis*. The study revealed that membrane coated balls were most acceptable (67%) while other types were consumed to the extents varying from 40.7-56.5% (Table). It was further seen that membrane encapsulation increases the keeping quality of the baits because the membrane does not allow the phosphene gas to permeate. Moreover, the membrane being a fatty layer, it also lures the rodents to a great extent. Further studies on its field efficacy are in progress.

Table. Comparison of various Zinc phosphide baiting techniques.

Location	No. of balls kept.	Uncoated flour balls eaten (%)	Wax coated flour balls eaten (%)	Gur coated flour balls eaten (%)	Bread pieces (1" x 1") eaten (%)	Membrane coated flour balls eaten (%)
Site I (Entomology lab)	500	200 (40.0)	195 (39.0)	131 (26.2)	167 (33.4)	350 (70.0)
Site II (Soil Sci. lab)	450	175 (38.9)	193 (42.9)	129 (28.7)	206 (45.8)	349 (77.6)
Site III (Houses)	1050	439 (41.8)	485 (46.2)	403 (38.4)	756 (72.0)	641 (61.1)
Total and Mean, %	2000	814 (40.7)	873 (43.7)	663 (33.2)	1129 (56.50)	1340 (67.0)

Trials of a herbal powder, Indiara-M, as a rodent repellent

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Indiara-M, a herbal non-toxic powder, constituting of the active ingredients of *Ipomoea muricata*, *Acorus salamus*, *Allium sativum*, *Brassica* sps., *Allium cepa* and Rametha was tested for its repellency to rodent species, the Indian desert gerbil, *Meriones hurrianae*, Northern palm squirrel, *Funambulus pennanti* and house rat, *Rattus rattus*. The powder was tested under laboratory conditions in cages and plus mazes.

In the cages, the consumption of preferred food dropped sharply when Indiara-M was mixed with it, simultaneously the consumption of alternate food increased. With the addition of 5% Indiara-M, the consumption dropped by 60% and 68% in *Meriones hurrianae* and *Funambulus pennanti*, respectively. Similarly; with 6% Indiara - M it was reduced by 80% and 93%, respectively.

In the plus maze no significant difference was observed between the consumption of food by house rats in the arms sprayed with the test powder and those without it.

The efficiency of the Indiara-M powder as a repellent decreased with its diminishing freshness, i.e. with increased period of exposure.

Evaluation of Ratobar cakes (Fumarin) against house rats

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Ready to use cakes containing 0.025% Fumarin, as active ingredient, were tested against house rats, *Rattus rattus*, under laboratory and field conditions. In no choice tests only Ratobar cakes were offered, whereas in choice test the plain food (wheat flour) was also provided along with the test formulation to individually caged rats. Both the experiments were run for 15 days. Observations on symptoms of illness, consumption of plain food and Ratobar cakes and days to death were recorded.

Table 1. Average consumption of Ratobar cakes, period required to cause death and mortality % of *Rattus rattus* (Linn)

Rodenticide	Period of poison bait feeding (in days)	Average body weight of rats (g)	Mortality percentage	Period required to cause death (days)		Consumption of Ratobar in mg/kg body weight	
				Range	Average	Range	Average
Ratobar cake (no-choice)	15	92.8	90.0	6-14	10	140-302	185.0
Ratobar cake and wheat flour (choice)	60	111.0	50.0	11-19	15	03-47	23.0

Table 2. Efficacy of Ratobar cake against house rats in rural dwellings.

No. of houses treated	Estimated population per house	Estimated total population	No. of dead rats collected during experiment	Percent mortality recorded	Estimated rat population per house (after use of Ratobar)
40	3.97	158.8	41	25.8%	3.0

Under no choice test, Ratobar caused 90% mortality, with an average consumption of 185 mg/kg. Contrarily, the mortality was quite low under choice test, showing poor acceptability of Ratobar cakes. The average consumption of poison during first 20 days was 23.3 mg per kg resulting in 50% mortality. At the end of 60 days it was evident that plain food (wheat flour) was highly preferred to Ratobar cakes.

Poor acceptability of Ratobar cakes was further manifested when these were placed in 40 houses of a village having an estimated rodent population of 3.97 rats/house. This treatment resulted in only 25.8% control success leaving about 3 rats/house uncontroiled. Thus it may be concluded that Ratobar cake is not an effective formulation for containing the rodent menace under field situation.

Studies on the control of rodents in Soybean crop

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A non-replicated field trial to test different rodenticidal treatments was conducted in Soybean crop, in Kharif season, at livestock farm of JNKVV, Jabalpur. Three different treatments namely, zinc phosphide 2%, Bromadiolone 0.005% wax blocks and snap traps were tested for their efficacy in managing rodents. The species mainly responsible for causing damage to soybean crop were *Rattus rattus*, *Bandicota bengalensis* and *Millardia meltada*. A 10 hectare area of soybean crop was selected for this trial. The area was divided into 3 parts and each part was treated differently. Burrow counts were taken before and after the treatments.

In the first part, zinc phosphide, 2% bait was given which was prepared in whole grains of wheat smeared with 2% groundnut oil. 15 gm of poison bait was kept at the entrance of each burrow. In the second part of the field, 15 g of bromadiolone wax cakes was put at the entrance of all burrows. In the third part, snap traps were laid at the rate of 55/ha. The efficacy of each treatment was calculated on the basis of percent reduction in number of live burrows.

Bromadiolone and zinc phosphide treatments resulted in control success of above 80% after 2 and 12 days treatment, respectively, whereas snap traps gave a poor performance (27.27%) after 7 days of placemant (Table).

Table Effect of different treatments for the control of rats in soybean crop

Treatment	Live burrow (No.)				Burrow reduction (%)			
	Pre treatment	Post treatment after days			Post treatment after days			
		2	7	12	2	7	12	
Zinc phosphide (2%)	37	7	–	–	81.08	–	–	
Bromadiolone (0.005)	80	–	30	14	–	62.50	82.50	
Snap trap	55	–	40	–	–	27.27	–	
Control (untreated)	20	–	32	–	–	60.00*	–	

*Increase

Efficacy of bromadiolone wax blocks against *Funambulus pennanti* under no choice condition

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Laboratory trials were conducted using 0.005% bromadiolone wax blocks against five striped squirrel which is supposed to be a difficult species from management point of view. The squirrels were trapped from orchards and kept individually in the laboratory cages for acclimatization.

Our findings indicated 83.33 and 100% mortality when the bait was exposed for 2 and 3 days, respectively. In both feeding trials mortality started from 12th day. It was observed that days to death varied from 12-14 days when feeding period was 2 days and 12-18 days when bait was exposed for 3 days. The results thus indicate that wax block formulation of bromadiolone at a concentration of 0.005%, is very effective against squirrels.

Table. Efficacy of bromadiolone wax blocks at 0.005% concentration under no choice condition

Exposure period (days)	Cumulative consumption of wax blocks (g)	Cumulative a.i. ingested (mg/kg)	Mortality (%)	Days to death	
				Mean	Range
2	23.62±1.32	12.00±0.68	83.33	12.8+0.37	12-14
3	40.14±3.06	21.1±2.01	100.00	13.4+1.16	12-18

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

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