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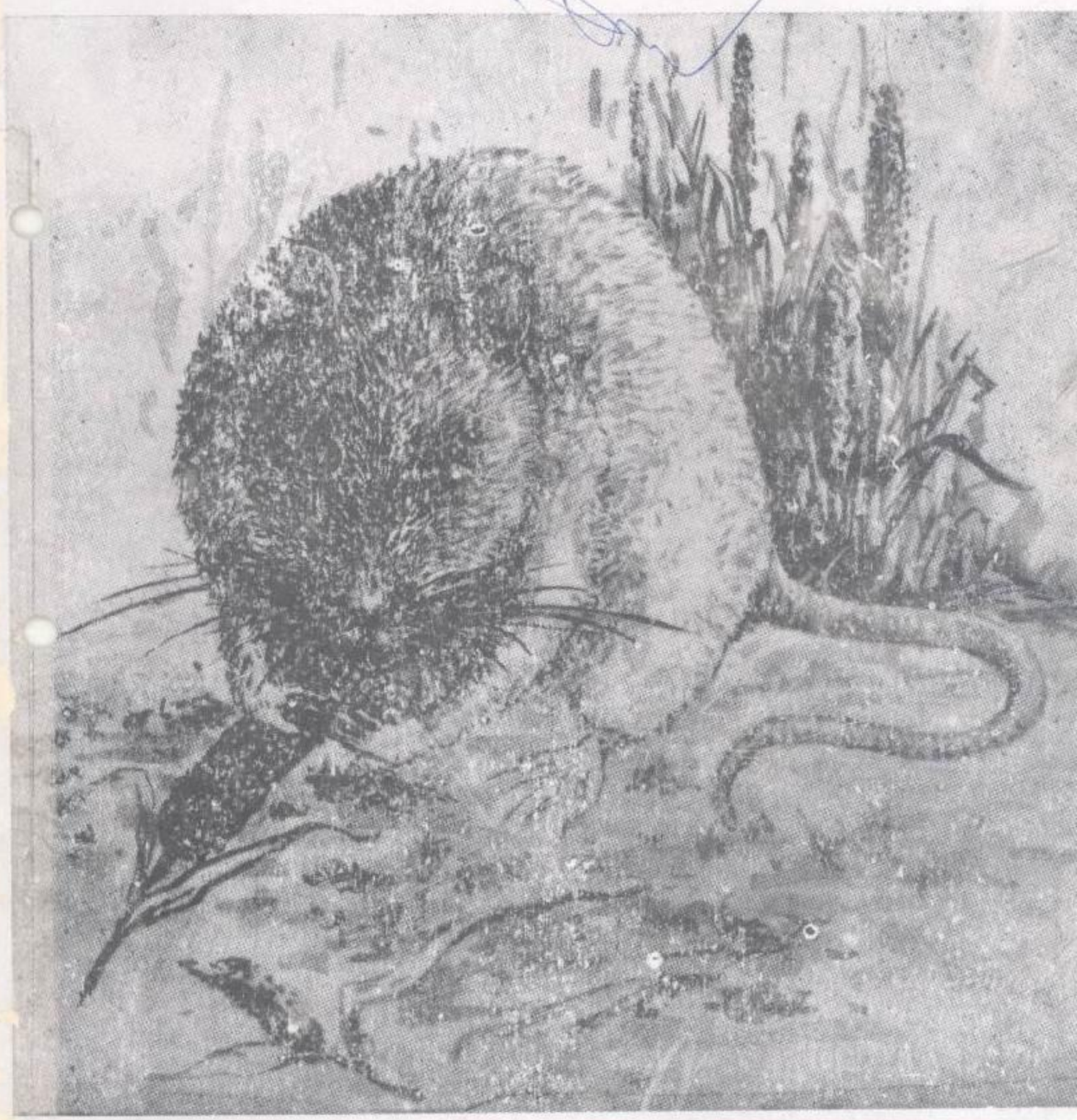

ALL INDIA COORDINATED RESEARCH PROJECT
ON RODENT CONTROL
Central Arid Zone Research Institute, Jodhpur

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ALL INDIA COORDINATED RESEARCH PROJECT
ON
RODENT CONTROL

CENTRAL ARID ZONE RESEARCH INSTITUTE
JODHPUR-342 003

CONTENTS

Rodent from Nasik District, Maharashtra State

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Zoological Survey of India Western Regional Station Pune-411005.

In recent years, Nasik district, situated in the northern part of Western Ghats, was surveyed. This district exhibits dense dry deciduous forest cover in the ghat section on western side to rich agricultural zone comprising multicrop system on the eastern side. The agricultural produce crops like wheat, jowar, bajara and nachani to fruits like grapes and banana, not forgetting cash crops like sugarcane and onion. Onion is a seasonal crop which is harvested on a very large scale in the eastern part of the district.

Nasik district was surveyed in 1984, '85 & '87. During these surveys rodent collections were made from fifteen different localities in the district. Ten species were collected from varied habitats, whereas three species were actually sighted at different places. Table I gives an account of species collected and/or sighted, their methods of collection and the habitats from where the specimens were obtainted. Interestingly, *Golunda ellioti gujerati* Thomas, which was known to occur earlier from Mt. Abu, only, has, now, established itself in the northern part of Maharashtra State also.

Tab'e 1 : Rodents of Nasik District, Maharastra

Sl. No.	Scientific Name	Remarks
1.	*Rattus rattus rufescens* (Gray)	Trapped in wonder traps set in residential areas.
2.	*Bandicota bengalensis kok (lordi)* (Gray)	Dug out from the live burrows made in the harvested field near a river bank.
3.	*Bandicota indica indica malabarica* (Shaw)	Escaped after being trapped in the burrow made in jowar field.
4.	*Mus musculus castaneus* Water house	Trapped on locally made glue trap set in the tribal's hut.
5.	*Mus booduga booduga* (Gray)	Dug out from the live burrow made in the harvested field near a river bank.
6.	*Mus dunni* Wroughton	Caught alive from a nest built under a boulder.
7.	*Mus (Pyromys) saxicola* Elliot	Caught alive from a burrow made in the bund built along the border of a jowar crop.

8.	*Millardia meltada meltada* (Gray)	Caught alive from a burrow in an open field.
9.	*Golunda ellioti gujerati* Thomas	Trapped in sherman traps set in a tribal's hut in the forested areas.
10.	*Vandeleuria o. oleracea* (Bennett)	Caught from a nest built in a tree in a forest.
11.	*Funambulus pennanti* Wroughton	Actual sighting at a number of places in open areas.
12.	*Funambulus tristriatus* (Waterhouse)	Actual sighting of number of specimens in Western Ghats.
13.	*Hystrix indica* Kerr	Actual sighting in Harsul forest.

Information on Rodent infestion in some vegetable crops.

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A preliminary survey of the losses to eight vegetable crops by the rodents was conducted. Three fields of each crop were selected randomly and in each experimental field six plots (4x4 m^2) were marked out in a diagonal manner following the line transect method. The population structure, the species composition and live burrow density were recorded at various developmental stages. Trap index was determined following Barnett & Prakash (1975).

Six rodent species viz. *Bandicota bengalensis, Tatera indica, Rattus meltada, Mus booduga, Rattus rattus* and *Mus musculus* were identified as principle forms infesting the various vegetable crops. All these species were trapped from the bottle gourd (*Lagenaria siceraria*); musk melon (*Cucumis melo*); sponge gourd (*Lufa cylindrica*) and tomato (*Lycopersicum esculentum*) but two of the species viz. *R. rattus* and *M. musculus* could not be trapped in the fields of cucumber (*Cucumis sativa*); cabbage (*Brassica oleiracea Var. capitata*); Onion (*Allium cepa*) and squash crop (*Cucurbita moschata*).

The relative percentage occurrence of *B. bengalensis* was found to be maximum (between 35.89 and 50.00) in all the eight vegetable crops and it was followed by *T. indica, R. meltada, M. booduga, R. rattus* and *M. musculus* respectively. The percentage damage was found to be maximum in bottle gourd (13.5-19.9) followed by musk melon (13.3-19.9), tomato (13.5-16.5), cucumber (13.9 to 15.8), sponge gourd (10.15-11.50), cabbage (3.1-4.0), onion (3.1-4.0) and the squash crop (1.4-1.6).

Rodent species composition in spinach crop.

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Spinach is a crop mostly grown for leafy vegetable. In rural areas of Kanpur, the farmers use to cultivate this crop for seed purposes in addition of taking 2-3 cuttings of leaves for vegetables. Being high price of the seeds, cultivators get this way good return from the field.

While conducting operational research work at village Naubasta of Kalyanpur block, Kanpur located in the vicinity of Chandra Shekhar Azad University of Agric. & Tech. Campus, the farmers reported about the damage caused by rats to the spinach crop. With a view to note the rodent pest complex attacking this crop, a survey was carried out during May, 1993 when the crop was at maturity stage in a compact area of five hectares.

All the burrows of survey site were counted and closed in an evening. Next day morning, the burrows re-opened and those covered with freshly excavated soil, were considered alive.

Field area as well as live burrows of each species were counted. The identification of burrows was also confirmed by digging sample burrows of each species. On the basis of the species wise live burrow count, the rodent pest complex of the spinach crop was determined Table 1.

Table 1 : Rodent pest complex of spinach crop based on live burrow count of each species.

Field wise average of Survey site (ha)	No. of burrows closed	No. of live burrows	Species wise live burrow count			
			B. bengalensis	*T. indica*	*M. meltada*	*M. booduga*
(1) 0.80	23	20	2	10	2	6
(2) 1.15	54	30	2	11	1	15
(3) 1.05	62	36	5	16	4	11
(4) 1.30	55	30	4	14	3	9
(5) 0.70	42	21	3	9	3	6
Total--5	236	137	17	60	13	47

The burrow count of each species indicates that *Tatera indica* was found in dominating status followed by *Mus booduga*, *Bandicota bengalensis* and *Millardia meltada* Overall, the spinach crop was found infested with these four species of field rats causing damage by cutting stalks and seed portion of the plants. Seed was found stored in the burrow of *B. bengalensis* only, while leaves stalks and roots in burrows of other species.

A specimen of *Bandicota Bengalensis* with abnormal development of upper incisiors.

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A specimen of *Bandicota bengalensis* came across our examination in 1989. This rat was collected from Bishnupur area of Shillong by bandicoot trap. It was observed that this rat had the upper incisors abnormally developed and found to be embedded in the lower jaw. This rat was unable to eat food and died after 3 days of capture. Except the abnormal growth of incisors no other deformity or abnormality could be recorded. The brief description of rat is presented below: Locality-Bishnupur, Shillong. Sex - Female, Weight - 312 g, Size - Head and body length-20.2 cm, Tail length - 17.4 cm, Ear length - 2.1 cm, Hind foot length - 5.6 cm, Upper incisors - 4.3 cm, Lower incisors - 1.2 cm (broken) Mammary glands - 8 pairs.

This rat was the only specimen having abnormal growth of incisors teeth from about 7000 collected specimens.

Rat, *Bandicota bengalensis* (Gray) damage to maize in potato based intercropping system

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Although the rodents cause heavy damage to various crops but their exact extent of damage which varies from crop to crop, season to season

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and place to place needs indepth studies. Sometimes their populations remain localised or found in patches as such there may be a heavy damage in a particular patch or areas whereas neighbouring fields could be rodent free.

Rodent damage was assessed in maize (cv. pioneer hybrid 3438) intercropped with potato cv. Kufri Jyoti and french bean variety Contender (American) sown in the first fortnight of April at the farm of Central Potato Research Institute at Shimla. Harvest time observations were recorded during July-September, 1993. Besides, sowing maize in intercropping layout, its seeds were also scattered in fallow plots.

Interestingly, it was observed that the bandicota rats climbed over the stems and ate grains from maize cobs intact on plants. The first damage was noticed on 22nd July, 1993 and subsequently the damage continued till harvest. Maximum damage (9.8%) was seen in the second fortnight of August. Out of total 153 cobs, seven were completely damaged, three were half damaged while five were partially (one forth) damaged. The damage symptoms were peculiar in the context that feeding of grains from cobs started from top to lower side and scaly leaves covering the cobs were also consumed simultaneously. Further, large and full grained cobs were preferred over small cobs containing scanty grains.

An assessment of rodent damage to pulse crops in Cauvery Delta

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In the Cauvery delta, Tamil Nadu, the black gram and green gram are sown after harvesting the Samba season paddy. A survey was initiated in Tranquebar taluk, Nagapattinam Quaid-e-Milleth district to assess the magnitude of rodent damage to 55 day old black gram and green gram crops each sown in 2 ha area. In the diagonal line of each plot, one sq. ft. quadrat was put at every 10 m intervals and the cut (pods and plants) and uncut plants were enumerated/counted to work out the percentage of damage to each pulse crop.

The rodent damage to the black gram and green gram were to the tune of 64.8 and 60.99 per cent, respectively. The extent of damage to

these crops might be due to the gnawing behaviour of rodents as it had consumed very less seeds (approximately 5%) out of the total pods cut. The remaining cut pods could be seen around the standing plants on the rodent runways and at their burrow openings, especially of *Bandicota bengalensis*.

A safe method to anesthesize wild rodents for laboratory studies

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Wild rodents i.e. *Rattus nitidus nitidus* and *Bandicota bengalensis* are predominant species in fields at Barapani while *Bandicota bengalensis*, *Rattus norvegicus*, *Rattus rattus* and *Mus musculus* are found in shops/godowns/houses of Shillong, Meghalaya. These rodents especially *B. bengalensis* and *Rattus norvegicus* become furious and often bite or run away while handling in laboratory for morphological examinations. So, it is necessary to anesthize them for proper observations. Chloroform and Diethylether were tried but these chemicals often left dead rats if they were over exposed or overdosed, specially in case of chloroform. There fore, it was thought essential to find out the optimum quantity of diethylether to ensure no death.

The collected rats by live trap were first transfered to thick polythene bag and weighed on top pan balance and put in the glass jar with cover plate (size 200 x 125 x 125 mm). To ensure air tightness of glass jar, little vacum grease was applied on fringe of the plate. Then measured quantity of diethyllaether was poured to the little cotton by pipette and transferred to the glass jar. The animals were uniformly exposed for 5 minutes. It was found that no animal died when we gave the quantity of Di-ethyl-ether (Table) according to their body weight.

Body weiget of rodents in gm (Range)	Amount of Di-ethyl ether in ml.
5-10	0.07
11-20	0.10
21-40	0.25
41-75	0.50
76-100	0.75
101-150	1-00
150-200	1.50
201-250	2.00
251-300	2.50
301-350	3.00
350-above	3.50

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Mechanical control of Rodents in soybean fields

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In the cauvery delta, Tamil Nadu the popuar Tanjore bow trap, a mechanical device, is used to control rodent populations usually in the paddy fields. However, an attempt was made to use these traps for the control of rodents in soybean fields near Pillur village of Nagapattinam Quaid-e-Milleth district. A sum of 250 traps were set for 3 and 2 consecutive days after third and fourth irrigation respectively, in one ha soybean feld. The total number of rats trapped was 170 and the trapping success was 68%. The mean number of animals trapped per day was 34 and all of them were *Bandicota bengalensis*.

Effect of 'isolation stress' on the toxicity (acute oral) of zinc phosphide in albino rat (*Rattus norvegicus*)

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The role or influence of housing conditions of test animals viz, grouping or keeping them as individuals in isolation on the toxicity of zinc phosphide (an acute rodenticide) has been reported for the first time. Albino rats (*R. norvegicus*) bred in cages as well as in rat pens were further divided into various groups wherein they were housed singly, or in groups of six and ten animals separately and were intubated with different doses of zinc phosphide (0, 21, 28, 38, 51, 68 and 91 mg/kg b.w.). After intubation, the rats were closely monitored for their behaviour and mortality while water and stock diet pellets were provided to them *ad libitum*.

The results obtained have shown that the acute oral LD_{50} values were always of lower values (21.2 and 24.2 mg/kg b.w.), when kept as individuals for cage and rattery bred rats respectively as compared to increased value of 113.0 and 150 mg/kg b.w. when they were housed in 'groups'. The results have clearly indicated the toxicity of chemical rodenti cidal compounds could be altered to a great extent due to 'isolation stress'.

Efficacy of rice bran as a carrier of different rodenticides

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Various rodenticides like zinc phosphide, warfarin, diphacinone, brodifacoum, bromodiolone and flocoumafen were evaluated for their efficacy when carried in rice bran against adult albino rats (*R. norvegicus*).

The poison baits thus prepared were left in cages for one night only except for warfarin, wherein it was left for five days continuously. Water was provided *ad libitum* throughout the experimental period. The concentration of the rodenticides tested, number of animals tested and dead and the poison bait ingestion etc. are in Table 1.

Table 1 : Efficacy of rice bran as carriers of rodenticides

Rodenticide concentration (%)	Average body weight	Number Tested/ Dead	Average poison bait ingestion (g/rat/day) (g)	Death time
Zinc phosphide* (2%)	184	8/8	5.0	Within 16 hrs
Warfarin (0.025%)	197	8/8	9.0	5 - 8 days
Brodifacoum (0.005%)	178	8/8	9.4	5 - 8 days
Bromadiolone (0.005%)	172	8/8	10.0	5 - 10 days
Diphacinone (0.005%)	195	8/4	9.4	5 - 11 days
Flocoumafen (0.005%)	199	8/8	10.0	5 - 10 days
Control (rice bran)	195	8/0	10.6	-

a - Five days exposure
* - Prebaiting using rice bran for 2 days

The results obtained indicated that zinc phosphide killed all the rats within 16 hrs of ingesting the bait and the average consumption was 5 gm/rat. Among the two first generation anticoagulants tested viz., warfarin and diphacinone, 100% and 50% mortality were observed respectively. The lesser mortality observed with diphacinone might be attributed to insufficient period of baiting, (one day). However, single day baiting was sufficient to kill all the test rats in second generation anticoagulants viz., brodifacoum, bromadiolone and flocumafen. In general it was observed that when rice bran was used as a carrier of six different rodenticides, it did not alter the palatability or toxicity of different rodenticides and they were found effective against albino rats (*R. norvegicus*) under laboratory conditions. However, bioefficacy studies against different rodent species and field trials are necessary before it could be recommended for large scale rodent control programmes.

Laboratory evaluation of cholecalciferol (0.075%) ready to use baits against *Bandicota bengalensis* and *Tatera indica*

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Cholecalciferol (0.075%) a new rodenticide in ready to use formulation both pellet and cake forms quintox supplied by the new Chemi Industries Limited; Bombay, were evaluated in the laboratory against *B. bengalensis* and *T. indica*. For choice, no choice and feeding trials, after 24 hrs of starvation, a group of 10 *B. bengalensis* and 10 *T. indica* were utilized for each trial. In choice tests, cholecalciferol pellets (20 gm), cake (28 gm), cereal mixture consisting of broken rice (30%), Jowar (30%) and Ragi (30%) in 5% groundnut oil combination were provided to each rodent till their death with *ad libitum* quantity of water. In no choice tests only Cholecalciferol pellets and only cakes were provided to experimental rodents separately till their death. The effect of starvation for 24 hrs, was also evaluated to see if it had any effect on more consumption, subsequent effect on duration of mortality if any in single exposure. In all three tests, the daily intake of poison baits pellet or cake and the cereal mixtures were recorded together with the duration of death as a result of cholecalciferol (0.075%) toxicity.

The results are shown in the table 1. In choice tests the order of bait preference by *B. bengalensis* was cereal>cake>pellet and *T. indica* prefers cereal>pellet>cake. Further *B. bengalensis* registered only 60% mortality over 10 days mean for mortality whereas *T. indica* registered only 40% with 8.5 days mean for mortality.

In no choice feeding tests *B. bengalensis* registered 100% mortality for Quintox cake baits over 10.2 days mean for mortality compared to 80% mortality registered by *T. indica* over 9.2 days mean, for death whereas both *B. bengalensis* and *T. indica* showed 100% mortality over 4.4 days and 6.6 days for death to Quintox pellet baits.

After 24 hrs of starvation *B. bengalensis*, registered 100% mortality over 7.3 days mean for death whereas *T. indica* registered only 20% mortality over 8 days of duration for death to Quintox cake baits. The mortality of *B. bengalensis* remained the same towards Quintox pellet as seen in the case of cake formulation except that *T. indica* showed 40% mortality.

Further *T. indica* did not show 100% mortality in all the tests conducted except for pellets in no choice tests. In general these rodents exhibit variations of less mortality towards Quintox baits both (pellet and cake) in the presence of alternate food source.

Table 1. Laboratory evaluation of Quintox, ready to use bait containing cholecalciferol 0.075% on rodents.

Sl. No.	Rodent Species mean body wt. (g) & (Sex ratio)	Consumption of Baits/day Mean & Range g/100 gm. Cake	Pellets	Cereal	Intake of active ingredient mg/kg body wt/day Cake	Pellet (mean range)	Mortality	Duration* of death Mean-range (days)
					a) *Choice Test/Trials cake vs pellets vs cereal mixture*			
1.	*B. bengalensis*	5.89	4.80	24.65	0.39	0.311	60%	10
	343 (5:5)	(1.78-32.14)	(2.5-56.0)	(5.0-60.5)	(0.26-0.57)	(0.14-0.311)		(6-15)
2.	*T. indica*	2.10	6.15	18.75	0.26	0.56	40%	8.5
	184 (5:5)	(1.42-12.50)	(1.50-50.0)	(2.5-100.0)	(0.22-0.31)	(0.15-0.98)		(7-10)
					b) *No choice test/trials-Cake formulation*			
1.	*B. bengalensis*	13.75			3.99		100%	10.2
	263 (5:5)	(4.75-25.0)			(1.82-6.48)			(5-21)
2.	*T. indica*	6.0			3.23		80%	9.2
	145 (5:5)	(3.42-9.05)			(1.9-6.16)			(7-12)
					c) *No choice test/trials-Pellet formulation*			
1.	*B. bengalensis*	21.15			1.18		100%	4.4
	230 (5:5)	(5.90-35-75)			(0.46-2.0)			(3-6)
2.	*T. indica*	5.10			0.49		100%	6.6
	153 (5:5)	(2.55-8.30)			(0.25-0.77)			(7-11)

*Poison exposure : The rodents were exposed to poison baits (cake & pellets in choice & no choice tests in multiple does till their death)

	d) After 24 Hrs starvation-cake formulation in single dose				
1.	*B. bengalensis*	80.71	29.2	100%	7.3
	233 (2:3)	(42.85-100.0)	(11-44)		(5-10)
2.	*T. indica*	27.85	14.67	20%	8
	141 (2:3)	(5.35-50.0)	(2.97-26.78)		
	e) After 24 Hrs. starvation-pellet formulation				
1.	*B. bengalensis*	37.5	2.67	100%	5.3
	210 (2:3)	(30.0-50.0)	(2.32-3.57)		(4-7)
2.	*T. indica*	17.5	1.67	40%	5
	148 (2:3)	(10.0-25.0)	(1.0-2.34)		(4-5)

Farmers' perception about vertebrate pest's damage to arid crops

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Vertebrate pests, viz., rodents, birds and ungulates are serious pests of various field crops, vegetable, fruit and fodder crops of the arid region. The present study was aimed to understand the perception of arid land farmers about these pests. Accordingly, an opinion survey was conducted in four villages, viz., Luni, Sar, Satlana and Madhopura belonging to Luni Panchayat Samiti, District Jodhpur. In each village 20 farmers were interviewed through structured schedules.

The samples consisted of farmers belonging to age groups upto 25 years (5%); between 26-50 years (72.5%) and more than 50 years (22.5%). The subjects were mostly illiterate (61.25%) and 31.25% were educated upto higher secondary level. Among the respondants, 58.75% farmers belonged to small and marginal groups and rest had large land holdings.

The results of the study revealed that all the respondants were in agreement that vertebrate pests cause severe damage to various crops. Among different pests, rodents were considered most serious followed by ungulates (blue bull) and birds (Table 1). On an average 75% farmers opined that rodents and ungulates are most serious pests of field crops followed by birds (62%). Of these more than 95% subjects thought that wheat crop is highly damaged by these pests, whereas, sesame crop is least damaged (27.5-52.5%). In the vegetable crops, 41.0% farmers complained of rodent pests followed by 25.5% (birds) and 19.25% (ungulates). According to these farmers, tomato and onion are most and least damaged by these pests, respectively. The survey, further revealed that the fodder crops, such as lucerne and *Cenchrus* are most preferred by ungulates (91.87%) followed by rodents (51.87%) and birds (35.0%). However, these farmers thought that fruit crops are damaged more by birds (53.34%) than rodents (50.83%) and ungulates (41.25%).

Table 1. Showing farmers' perception about vertebrate pest damage.

Pests	Farmers' opinion (%) about damage			
	Field crops	Vegetables	Forage	Fruit crops
Rodents	1 = 96 (Wheat) 2 = 33 (*Til*) 3 = 75	1 = 70 (Tomato) 2 = 25 (Onion) 3 = 41	1 = 63 (Lucerne) 2 = 40 Grass 3 = 51	1 = 52 (*Anar*) 2 = 46 (*Ber*) 3 = 50
Birds	1 = 97 (Wheat) 2 = 97 (*Til*) 3 = 62	1 = 65 (Tomato) 2 = 4 (Onion) 3 = 34	1 = 47 (Lucerne) 2 = 2 (Grass) 3 = 35	1 = 60 (*Anar*) 2 = 35 (Papaya) 3 = 53
Ungulates	1 = 98 (Wheat) 2 = 52 (*Til*) 3 = 75	1 = 43 (Tomato) 2 = 16 (Brinjal) 3 = 19	1 = 97 (Lucerne) 2 = 86 (Grass) 3 = 91	1 = 93 (*Ber*) 2 = 13 (Papaya) 3 = 41

1 = Maximum; 2 = Minimum; 3 = Average.

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

Project Coordinator,
AICRP on Rodent Control,
Central Arid Zone Research Institute,
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