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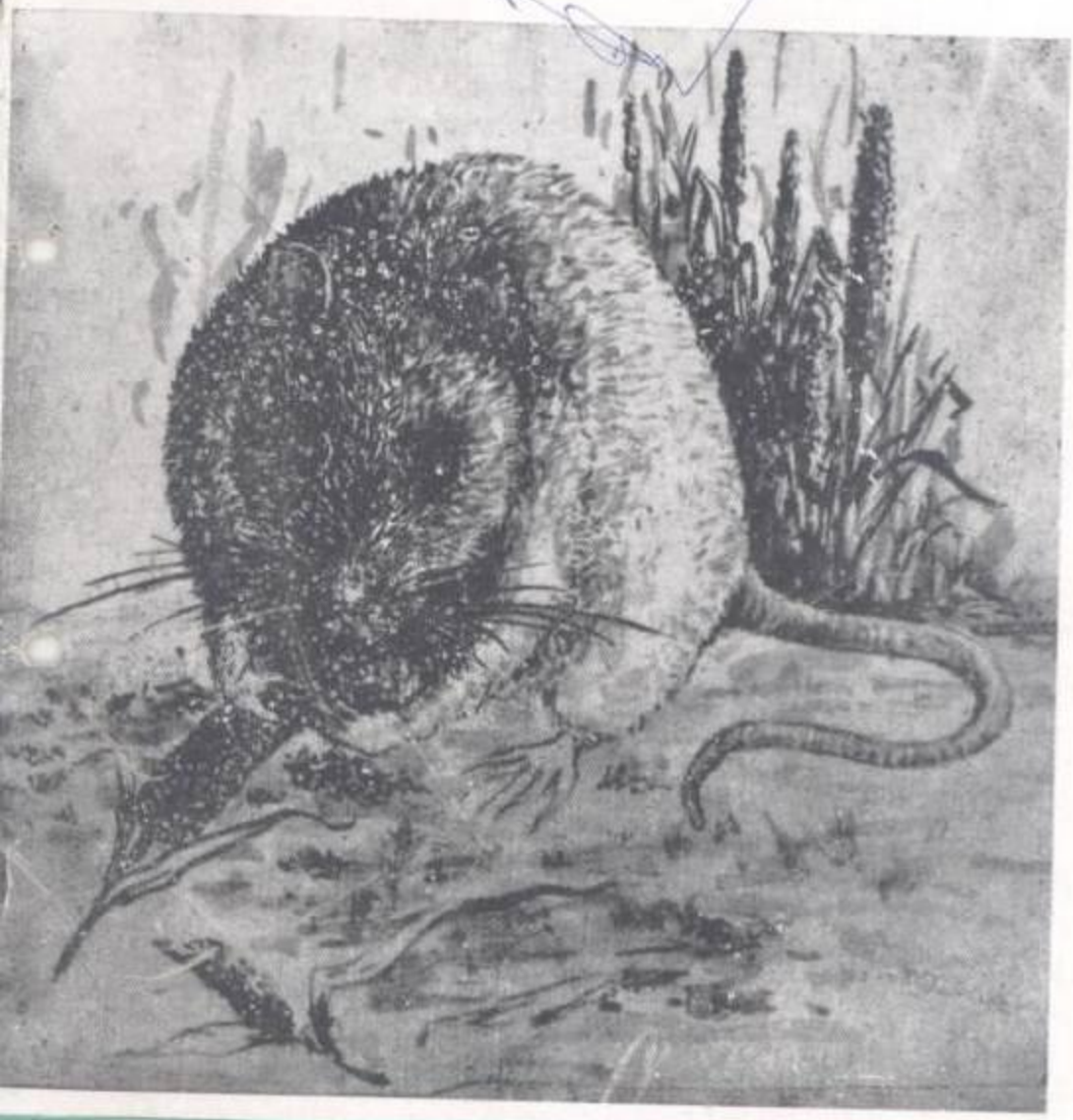

ALL INDIA COORDINATED RESEARCH PROJECT
ON RODENT CONTROL

Central Arid Zone Research Institute, Jodhpur

RODENT NEWSLETTER

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ALL INDIA COORDINATED RESEARCH PROJECT
ON
RODENT CONTROL

CENTRAL ARID ZONE RESEARCH INSTITUTE
JODHPUR-342 003

CONTENTS

Indian mole rat, a problem in tea gardens of Palampur, H.P.

R.M. Bhagat & N.P. Kashyap

Department of Entomology, HPKV, Palampur 176062 (H.P.)

Tea is cultivated in an area of about 3200 ha in Kangra and Mandi districts of Himachal Pradesh. Palampur being situated at about 1300 m above mean sea level is an ideal place, both climatically and geographically, for the cultivation of tea. Kangra local type tea, *Camellia sinensis*, which is a China hybrid variety, is mostly grown in tea gardens of Kangra and Mandi districts of H.P. Palampur tea is liked for its good quality and flavour by a large number of people and is marketed at various places in the country.

Beside various insect pest problems in tea gardens around Palampur, rodents have also posed a serious threat to tea plantations. Their menace in various agricultural crops is well understood. However, no systematic work has been done in relation to tea gardens. An attempt has been made, to establish the role of rodents in dwindling tea plantations in various tea gardens of Palampur area.

An extensive survey was conducted, in different tea gardens of Palampur and adjoining areas during the months of October and November, 1992, when there was no crop in the agricultural fields. Since most of the tea gardens in this area are located adjacent to the crop fields of the farmers, it is quite probable that rodents, especially Indian mole rat, *Bandicota bengalensis*, which causes serious damage to cereals in this area, both in kharif and rabi seasons migrate to tea gardens, when there is no crop in the fields. Tea bushes were found to provide good hiding places to these rodents, as heaps of soil, besides damaged branches of plants could be seen just at the base of tea bushes.

Further, in one of the tea orchards at Palampur, it has been noticed that due to the extensive burrows, ranging from 0-2 burrows/tea bush, the damage caused by rodents affect the growth of tea bushes. About 2000 m^2 area of the orchard was severely infested with Indian mole rats, causing poor growth of tea bushes and scanty bush population as compared to rest of the orchard.

Interestingly, it has been observed that Kangra local *Camellia*

sinensis, tea bushes are heavily infested by rodents, whereas, Assam type *Camellia assamica*, which is also grown on trial basis by some tea planters, though in small number did not show any rodent burrow. The reason may be that *C. assamica* being single stem plant may not provide enough hiding place to rodents as compared to multi-stem bush type, *C. sinensis* which is a very common plant type of Palampur tea orchards.

Effect of gregarious mode of social organisation on scent marking of Mongolian gerbil, *Meriones unguiculatus*

M.IDRIS[1], K.A. ROGOVIN[2], A.V. SUROV & S. PAPOV[3]

As reported earlier the gregarious mode of social organisation affects the frequency of ventral scent marking as well as the development of the ventral scent marking gland in comparison to solitary and sparsely distributed condition. To evaluate the possible influence of laboratory breeding, studies were conducted on the size of the scent marking gland and the behaviour by comparing the frequency of scent marking and size of the mid ventral scent marking gland in Mongolian gerbil, *Meriones unguiculatus* residing in two types of captive conditions.

In the Institute of Evolutionary Morphology and Ecology, *M. unguiculatus* (mostly F_{30}) were lodged in 34 laboratory cages. The density was 1 to 9 gerbils (High density) per cage. However, in Moscow Zoo 2-3 gerbils (Low density) of F_2 generation were lodged using saw dust as bedding material. The measurements (Length and maximum width) of the ventral scent marking gland of 55 male gerbils and 77 females, born to laboratory bred parents and Moscow Zoo gerbils were recorded in relation to their body weights. The gerbils residing in high and low density lodged singly in individual glass cages were observed for their frequency of scent marking, urine marking, urination and defecation for 30 minutes.

A comparison of scent marking with sebum of the mid abdominal gland in the two populations revealed that the frequency of scent marking of low density population was significantly higher ($P<0.001$) than that of the higher population density. Urine marking was observed only in low density population (Table 1).

Table 1. Effect of density on the frequency of scent marking and development of the gland in *M. unguiculatus*

Density level	Body weight (g ± S.E.)	S e x	Gland size (M±S.E.)			Mean No. of behavioural activities			
			Gland length (m)	Gland Width (m)	Area (mm^2)	Scent marking	Urine marking	Defecation	Urination
(High)	70.87	Male	16.82	5.33	99.66[b]	1.50[a]	—	2.62	—
	±4.56		±0.62	±0.13	±4.45	±0.65		±0.37[a]	
	65.75	Female	13.07	4.50	59.32	0.50	—	0.75	
	±3.97		±0.33	±0.11	±2.60	±9.32		±0.36	
(Low)	73.03	Male	20.25	7.37	146.00*[a]	27.00***[b]	1.75[a]	0.62**	0.87
	±2.98		±1.38	±0.42	±6.59	±7.69	±0.95	±0.32	±0.61
	78.62	Female	17.50	6.16	107.16**	19.37***	1.00	0.78	1.25
	±3.93		±0.80	±6.70	±11.18	±2.88	±0.42	±0.42	±0.36

Level of significance between two populations *P<0.05, **P<0.001 *** P < 0.001

Between sex a = P<0.05, b = P<0.01 c = P < 0.001

[1]Central Arid Zone Research Institute, Jodhpur-342003
[2]Institute of Evolutionery, Morphology and Ecology, Moscow
[3]Assistant Director, Moscow Zoo, Moscow.

Wide variation was found in the gland size between two populations (Table I). Those gerbils, residing in low population density, had significantly ($P<0.05$ and $P<0.01$ Table I) longer glands than the higher density population group and gland was also papillated in former population. However, the scent marking gland in males was found to be significantly longer ($P<0.05$, Table I) than those of females in both the populations. Similar dimorphic variation has also been reported in the gland size in both *M. hurrianae* and *Tatera indica*.

On the basis of these observations it is conjectured that probably the gerbils residing in higher population density are living in a very close social organisation for a very long time as compared to the low density animals. The need of olfactory communication declines in the former population since it is replaced by tactile contact. Hence, the frequency of scent marking as well as the size of the ventral scent marking gland of these gerbils decline drastically.

Rodent damage in cardamom *(Elettaria cardamomum* Maton) with special reference to the age of capsules

A.K. Chakravarthy and E. Gangappa

U.A.S., G.K.V.K., Bangalore, - 560 065.

Cardamom is cultivated in evergreen rain forests. The cardamom fruits are depredated upon by rodents causing 10 to 12 per cent losses in yields in Mudigere (13°7', 29", 75°37'35", 982 m amsl), hill region of Karnataka. In order to adopt protection measures against rodents, it is necessary to determine the age of the capsules at which depredations occur.

To determine capsule age most vulnerable for rodent damage, ten cardamom clumps in valley at Regional Research Station, Mudigere, were randomly selected and each flower bud labelled. Capsules were categorized into three groups based on colour and age (days old) as (a) Green (70 days old), (b) Greenish yellow (90 days old) and (c) Yellow (110 days old).

At harvest, the proportion of capsules damaged, to the total number harvested was counted and expressed as per cent. Observations were recorded on thirteen different dates and the data was subjected to t-test.

The squirrel, *Funambulus palmarum* and Lesser bandicool rat, *Bandicota bengalensis* were the rodents implicated in cardamom damage. Squirrels split the locules, while the rat, made holes on the capsules to feed on internal contents. Rodents preferred 110 days old capsules. Statistical analysis showed significant differences in the preference for mature capsules, i.e. yellow over greenish yellow over green. However, rodents damaged 20 per cent of 90 days old capsules (Table I). This is the stage when protection measures need to be adopted. The mature capsules emanate typical cardamom odour (mostly cincole and sesquiterpenes) containing sweetened mucilage and such capsules are easy to split, so rodents preferred such mature capsules. It was found that trapping and baiting, when executed at the time of capsule ripening, together with timely harvests and clean cultivation could alleviate to some extent, rodent problem in cardamom.

Table 1 : Age of cardamom capsules in relation to damage by rodent

Sl. No.	Sampling date	sample size (No. of capsules)	Capsules damaged (%) at different ages (days)		
			Yellow (110)	Greenish yellow (90)	Green (70)
1	05.10.1989	62	80.64	16.13	3.23
2	06.10.1989	40	87.50	12.50	0.00
3	16.10.1989	56	69.44	30.36	0.00
4	19.10.1989	143	83.92	13.99	2.09
5	23.10.1989	43	13.95	81.40	4.65
6	24.10.1989	244	68.44	25.00	6.56
7	25.10.1989	410	84.63	12.93	2.44
8	31.10.1989	55	94.55	5.45	0.00
9	31.10.1989	293	81.57	17.41	1.02
10	03.11.1989	422	86.97	9.24	3.79
11	06.11.1989	24	100.00	0.00	0.00
12	07.11.1989	197	76.55	19.80	3.55
13	10.11.1989	495	85.41	12.93	5.66
	Mean		77.68	19.78	2.54

	Table t (5%)	Calculated t (5%)
Yellow vs greenish yellow	2.064	7.184
Greenish yellow vs green	2.064	3.073

Rodent damage to rice germplasm in Mudigere, Karnataka

A.K. Chakravarthy, Y.G. Shadakshri & E. Gangappa.
University of Agricultural Sciences, G.K.V.K., Bangalore-560 065.

Mudigere (13°7'29", 75°37'35", 982 m the AMSL), in hill region of Karnataka is an important rice growing district. Rodents cause considerable yield losses to rice in the region.

Four hundred and sixteen rice varieties were sown in nursery beds (5m x 1m) on 16.6.1989 and seedlings were planted in the mainfield at 20 cm x 10c m on 25.7.1989. There were two replications. Number of clumps damaged by rats was counted on 20.9.1989 in 1.5m x 0.6m plots (=45 clumps) per replication.

Bandicota bengalensis and *Mus booduga* were the main species of rodents found damaging rice. Rodents damaged 36 of the 416 varieties and the damage was noticed two weeks after transplanting. There were significant differences in per cent hills damaged by rodents in 416 varieties. IET 10894 (44.50 per cent), IET 11207 and IET 11223 (40 per cent each) were significantly more damaged then rest. Five varieties viz. IET 10629, IET 7261, IET 11202, IR 46 and IET 10121 received one per cent damage each, which were the least and significantly less damaged than others. Rodent damage on selected 15 varieties is as under -

Variety	Rodent damage (% clumps damaged)*
IET 10894	44.45
IET 11223	40.00
IET 11207	40.00
IET 10615	30.00
IET 9614	24.45
IET 10131	21.11
IET 10618	11.11
IET 10133	10.00
ES 18	5.50
MD 5	2.20
IET 10629	1.11
IET 7261	1.11
IET 11202	1.11
IR 46	1.11
IET 10121	1.11
C.D. at 5%	11.57

* Data transformed to x + 0.5 before analysis by ANOVA

An instance of secondary poisoning with zinc phosphide

V.P. Singh & Ram Singh*
Coordinator, Indo-Dutch Tubewell Project,
Kamla Nehru Memorial Trust,
Sultanpur (U.P.)

Scientific way of disposing of rodents killed during zinc phosphide operation or other stomach poisons, is to bury them in 45 to 60 cm deep pits especially dug for the purpose. Any negligience often comes in the way of ecological balance. Recently, rodent control campaign was undertaken at field level in village Bajapur, under patronage of Indo-Dutch Tubewell Project, Kamla Nehru Memorial Trust, District Sultanpur (U.P.). During the course of prebaiting, rodents were offered mustard oil macerated grains in half open small paper packets. Each packet roughly, had 4-5 gm grains. Two packets so prepared were placed close to each live burrow. The grains were accepted by a large number of rodents. After 6-7 hours, many rodents under the influence of zinc phosphide poisoning were observed to run in bewildered way and a few of them were seen to take shelter in the irrigation channel running along two sides of the treated field. One such rodent was caught by a big cobra snake which later moved to a house close by. Efforts were made to locate the snake, but they proved futile. After 7-8 hours of ingesting the rat, it started producing dreadful sound from hidden place in the house. The efforts to trace and kill the snake were unsuccessful as it had taken shelter in a big crack of the mud wall of the house. On disturbance, the snake paused for 15-20 minutes but again started producing fearful and alarming sound, This activity continued for about 6 hours. Thereafter, pitch of the hissing sound dwindled down and it stopped once for all within 15 minutes. The following morning, this place was revisited to satisfy the curiosity of last night event and it was found that the snake was dead and 1/5 portion of its anterior body was suspended out from the wall and rest hidden in the crack. The snake was removed carefully which had a swollen abdomen. The swollen portion was dissected to retrieve a decaying rodent of about 250 gm in weight belonging to *Bandicota bengalensis*.

*Professor & Head, Fisheries/Professor Entomology,
Narendra Deva University of Agriculture & Technology,
Narendra Deva Nagar (Kumarganj), Faizabad 224 229 (U.P.)

This observation reveals that a sizeable population of various species of snakes and other animals like cats, dogs, mongoose, eagles, kites and crows etc. which are responsible for regulating the rodent population to a certain extent, often succumb to feeding on poisoned rats. It is, therefore, imperative to educate the rodent control operators regarding careful disposal of poisoned and dead rats to avoid secondary poisoning of non-target species of animals.

Cholecalciferol, an effective rodenticide for rodent management

B.D. RANA

AICRP on Rodent Control, CAZRI, Jodhpur

Recent development in the field of rodenticides have not been limited to anticoagulants only. Previously, we used to refer to anticoagulants as chronic and all others as acute rodenticides. But this categorisation does not hold valid today because several second generation anticoagulants are effective as single dose poisons and several new non anticoagulants are multidose poisons. Cholecalciferol is one of several such non-anticoagulants which is required to be fed for prolonged periods for effective kill of target species. This poison has entirely different mode of action than those of conventional acute and chronic poisons. It releases stores of calcium from bones to plasma and the pest dies of hyper calcimia. It has also been reported to be effective against anticoagulant resistant strains of rodents.

Cholecalciferol is Vitamin D_3 based compound. The closely related vitamin D_2 based chemical, calciferol has been marketed as a rodenticide in Europe and Canada during last two decades. Studies have shown that cholecalciferol is both-single and multiple feeding toxicant, effective against a wide range of rodents. Its effective dosage in baits is 0.075% (750 ppm). The death of target species is initiated after 4th day following ingestion of lethal dose. Due to delayed death, it provides least chances of development of bait/poison shyness. Secondly, it has not been reported so far, to cause any secondary hazards too. Its acceptance by target species in baits is also fairly good.

Zinc phosphide and aluminium phosphide being true acute poisons produce desired results within few hours of treatment, whereas, cholecalciferol results in delayed mortality. However, zinc phospide usage has other problems like bait/poison shyness and secondary hazards which have not been encountered so far with cholecalciferol. Cholecalciferol is a superior rodenticide to warfarin, fumarin, etc., the first generation anticoagulants, in its bioefficacy. However, bioefficacy of second generation anticoagulant, bromadiolone has an edge over cholecalciferol. Among various bait formulations of cholecalciferol, freshly prepared loose bait (based on locally available foodgrain) is found to be more acceptable to test rodents than the readymade baits in the form of pellets or wax cakes.

In India, there is a great paucity of rodenticides, as only 5-6 rodenticides are registered for common use. Of them only three, viz., zinc phosphide, aluminium phosphide and bromadiolone are in demand. But during last decade the common use of aluminium phosphide has also been restricted. Hence the end users are left with only two effective rodenticides. Single use of zinc phosphide kills 60-70% of rodent population. The residual population (30-40%) become bait shy and are the real problem for pest control operators and the end users, because Zn_3P_2 becomes ineffective for them. Secondly, use of Zn_3P_2 for commensal rodent control is not advocated at all due to its very high toxicity to non-target species. In such a situation, use of cholecalciferol can very well be integrated in the management scheme against field as well as commensal rodents.

Control of rodent pests in a sugarcane field

MUKTHA BAI, K. and KRISHNAKUMARI, M.K.

Infestation, Control and Protectants Discipline, CFTRI, MYSORE-570 013

A plot of 6 acres sugarcane crop was found to be infested by rodent pests near Mysore City. Main rodent species responsible for damage were *Bandicota bengalensis* and *Rattus meltada*. The damages was by gnawing of the stem portions (30-45 cm from ground level) and thereby resulting in the death of plants. However, mostly plants in the outskirts or borders were attacked and damaged. Therefore control

operations were undertaken in only 4 acres keeping 2 acres as control plot.

Control procedure : Two days prebaiting (using standard bait) followed by 2% zinc phosphide baiting for one night (hole baiting using torpedoes) resulted in the death of 23 *B. bengalensis* and of 3 *R. meltada* within 72 hours of baiting. After 15 days, Warfarin (0.005%) + Vitamin A acetate (0.02%) baiting was carried out for 7 days continuously. However, only one *B. bengalensis* corpse was found on 4th day of poison baiting. Post-operational survillance carried after 2 week of baiting suggested a great relief (nearly 70-80%) from rodent menace and the damage was reduced to a great extent (>50%) as compared to control plot.

Evaluation of Difethialone (LM-2219), a new anticoagulant rodenticide against house rat, *Rattus rattus*

K.K. Arora, Juggi Lal, Virendra Kumar, Babu Ram And Sone Lal.
Indian Grain Storages Institute Hapur - 245101

Difethialone (LM-2219) is the first representative of a new chemical, family called hydroxy-4 benzothiopyranones. The chemical modification involving the replacement of one oxygen atom by a sulphur atom in the Hydroxy-5 Coumarin has generated interest in toxicology of anilcoagulant posions.

Difethialone (liquid 1.25 gm/litre) mixed in bait was tested at different concentrations, viz., 0.00125, 0.0025 and 0.00375 per cent against house rat, *Rattus rattus* in the laboratory. Prepared bait of each concentrations was offered to the test animals for 24, 48 and 72 hours both in no choice and choice feeding tests.

Results revealed that Difethialone all the tested concentrations yielded 100% mortality in black rat, *Rattus rattus* both in no choice and choice tests under laboratory conditions. Out of three concentrations tested, it was found that 0.00125 per cent Difethialone resulted in earlier

mortality with shortest feeding period (24 hours) and proved more effective as the acceptablility of the poison bait of this concentration was more than the control during choice test. It was further observed that Difethialone is of high potency and palatable poison bait at lowest concentration i.e. 0.00125 per cent.

Study of rodents in the north eastern fringes of Indian desert

B.D. Rana, A.P. Jain and B.K. Soni
Central Arid Zone Research Institute, Jodhpur 342 003

We have been investigating ecological relationships between rodent populations, habitat, soil and vegetation composition under arid zone environment. Quantified data is so far not available on the species composition of small rodents, inhabiting north-eastern boundary of the desert, particularly, Bharatpur, Mahendragarh and Agra regions, where it is alleged that the desert is creeping in. In view of this, the present study was undertaken to evaluate whether rodents can be considered as one of the factors responsible for the process of desertification.

The study was undertaken at five work spots during summer. Four traplines, having 30 snap traps, each arranged at 10 m apart, were fixed in crop fields. The traps, were prebaited with peanut butter. These trap lines were checked early in the morning, the bait replenished and refixed as necessary each day. Thereafter, these were checked at four hourly intervals, till dusk. Trapping was continued for 50 nights, 2 nights each in Ajmer, Jaipur, Bharatpur (Rajasthan), Agra (Uttar Pradesh) and Mahendragarh (Haryana) regions of north-eastern Thar desert.

Trapping Areas : Ajmer (26°31'N-74°32'), Jaipur (75°58'N-26°54'E, Bharatpur (77°28 'N-27°13'E). Agra (27°10'N-78°02'E) and Mahendragarh (76°09'N-28°16'E) are located in the north eastern parts of the Thar desert. The mean annual rainfall is 557.4, 648.1, 673.5, 765.4 and 430.5 mm at Ajmer, Jaipur, Bharatpur, Agra and Mahendragarh

respectively. The soil texture varies from sandy to loamy in these regions. The mean maximum and minimum temperatures in Ajmer, Jaipur and Agra are 31.2-18.3, 31.7-18.4, 32.3-19.0. Relative humidity varies from 35 to 60 per cent in these areas.

Species composition: The sandy soil of Puskhar (Ajmer) ravine feeder catchment area were represented exclusively by typical desert rodent, *Meriones hurrianae*. Similarly, in duny sands of Durgapura Research Farm (Jaipur), *Meriones hurrianae* were collected. At Bharatpur *T. Indica* were found predominantly (93.1 per cent) followed by *M.b. booduga* (6.9 per cent). The Indian crested porcupine, *Hystix indica* were also present, causing severe damage to the roots of 10-15 years old *Azadirachta indica* plantation in the whole area.

In the ravine habitat of Agra (3 to 9 metres deep), the species were represented by *R.m. pallidior* (38.4 per cent) and *Golunda elliott* (61.5 per cent). *Tatera indica* were collected only from top of ravines. The hutments situated on the top of the ravines were inhabited by *Rattus rattus rufescens*, 52.6 per cent, *Mus musculus*, 36.8 per cent and *Suncus murinus*, 10.5 per cent. *Meriones hurrianae* were collected exclusively from the base of *Calligonum polygonoides* in the Mahendragarh region.

Trap Index: In summer season trap index of rodents per 100 trap per 24 hrs indicates that it is significantly ($P<0.05$) higher in sandy habitat as compared to rocky and crop fields (Table 1). It ranged from 3.3 to 13.6 at Ajmer and Mahendragarh respectively. Trap index was found to be maximum (13.3) at Ajmer and minimum (0.84) at Bharatpur in the rocky habitat. Almost similar trend of trap indices were recorded in the crop fields at all the localities (Table 1).

Table 1. Trap index in various habitats at 5 localities in the Indian desert.

Locality	Trap index, Habitats		
	Sandy	Rocky	Crop fields
		Summer season	
Ajmer	3.3	13.3	3.8
Jaipur	4.2	5.0	2.5
Bharatpur	12.9	0.84	4.0
	Ravine	Residential buildings	
Agra	5.5	4.2	3.8
Mahendragarh	13.6	5.2	6.0

Sex Rats: The sex rats of rodent species revealed that, the males of all the species of rodents outnumbered females. The difference from the hypothetical 50 : 50 ratio was significant only in *Tatera indica*. (Table 2).

Table 2. Sex rats of various species of rodents

Species	Males	Females	% Males
G. elliott	17	12	58.6
R. meltada	16	10	53.8
R. rattus	10	17	37.0
R. cutchicus	8	10	32.1
B. bengalensis	6	4	60.2
M. musculus	11	7	62.2
M. cervicafor	4	4	50.0
M. booduga	5	4	55.5
M. hurrianae	11	8	57.9
T. indica	47	33	58.7
Total	135	105	56.2

*$P<0.05$, ** $P<0.001$

Conclusion: The total number of rodents irrespective to various habitats and localities revealed that *Tatra indica*, *Golunda elliott*, *Rattus rufescens* and *Rattus meltada pallidior* are most common rodent species in the north eastern part of the Indian desert. However, other

small rodents such as *Funnambulus pennanti*, *Bandicota bengalensis*. *Mus cervicolor*, *M. booduga*, *Gerbillus gleadowi* and *G. namus* were collected significantly in low numbers. *Suncus murinus* were also collected in small numbers.

The results of infestation pattern of rodents tend to indicate that *Meriones hurrianae* and *Gerbillus gleadowi*, two typical desert rodents were found to inhabit the sandy dunes, whereas, these two desert rodents were not captured from Bharatpur and Agra region, where it is alleged that sand is encroaching. This investigation suggests that the condition of soil has not deteriorated in these regions. It further pin points that submesic species like *Bandicota bengalensis*, *Rattus meltada*, *Golunda ellioti*, *Mus booduga* and *Mus musculus* have started to invade the new environment. Out of these species of rodents, *Bandicota bengalensis* and *Mus musculus* which are found to infest crops of wheat, mustard and gram in wet land agriculture, pose alarming situation, as these will prove more destructive to agriculture in coming years than the existing rodent species.

News from Nisha Patel, CAZRI, Jodhpur

Soursce : The Statesman, Feb. 8, 1993

Ottawa City in South Canada is currently facing a peculiar problem. The environmentalists suggested making compost pits in the backyards of house so that organic material could be reused as manure for gardening etc. But these pits created an ideal habitat for commensal rodents, causing a sudden spurt in their numbers. With the advent of cold season these rodents have now moved inside houses to protect themselves from the cold. According to PTI reports, there has been a dramatic rise in the number of calls to the pest control companies around Toronto This experience warns people against unwittingly creating suitable habitats for rodents.

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,
JODHPUR-342 003

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