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Central Arid Zone Research Institute
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AICRP on Rodent Control
Central Arid Zone Research Institute
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Morphometric studies in rats of cold stores of Ludhiana district

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Rats were trapped from three cold stores of Ludhiana district namely; Gulmarg cold store, Dasmesh cold store and Hemkunt cold store in the month of June and July 2002. Only house rats (*Rattus rattus*) were trapped from the cold stores. Each rat was mildly anaesthetized with ethyl ether and their morphometric study was performed by measuring different morphological parameters along with their body weights and sex. All the rats were trapped from three cold stores showed non-significant variation in different morphological measurements (Table 1).

Table 1 : Measurements (Mean ± S.D.) of different morphological parameters of *Rattus rattus* collected from three cold stores of Ludhiana district.

Parameters	Cold store(s)		
	Gulmarg	Hemkunt	Dashmesh
Trap index*	22.92±13.93	7.28±1.46	7.50±6.12
Sex ratio (M : F)	3:1	2.5:1	1.25:1
Body weight (gm)	150.00±19.13	175.71±12.37	131.25±13.28
Head & Body length (cm)	19.24±1.17	20.51±0.52	18.93±1.82
Tail length (cm)	16.20±0.87	16.08±0.93	17.60±1.93
Ear length (cm)	2.08±0.12	2.13±0.07	2.10±0.10
Fore foot length (cm)	1.42±0.12	1.38±0.09	1.48±0.15
Hind foot length (cm)	3.29±0.24	3.39±0.16	3.33±0.13
Snout length (cm)	1.25±0.17	1.30±0.12	1.30±0.10

* Rats trapped/100 traps/day

Samples of rats trapped from each cold store were got identified from Zoological Survey of India, Kolkata as *Rattus rattus alexandrinus*, revealing the existence of only one sub species of house rat i.e. *R. r. alexandrinus* in cold stores of Ludhiana district of Punjab.

Effect of stubble burning on residents of burrows

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Combine harvested rice and wheat straw is being burnt in large quantities in the Indo-Gangetic plain to clear the fields for timely sowing of crops and it is a convenient method to dispose off the crop refuge. About 12 and 9 million tones of rice and wheat straw constituting 81.4 and 48.2 % of the total straw production, respectively are being burnt in Punjab alone. The straw is a rich source of plant nutrients and its burning may cause loss of nutrients. In term of money, the loss of nitrogen alone may run about 618 million per year. The productivity of rice-wheat cropping system in Punjab is already under severe stress as a sequel of falling organic matter levels in the soil. In addition to financial and nutrient loss, burning of crops residues is a potential health and environmental hazard. On account of emission of CO_2, a green house gas has global implications. Various species of rats and mice are residing in the soil by digging burrow and tunnels. An attempt has been made to know about the effect of stubble burning in the crop fields on the residents of burrows.

In the first week of May, combine harvested ten wheat fields with stubble burnt and ten wheat fields without stubble burning at five different places in district Sangrur (Punjab) were selected. Four burrows from each field were excavated. Observation of the surface opening burrows revealed the predominance of *Bandicota bengalensis* followed by *Tatera indica*, *Mus* spp. and *Rattus meltada*. The number of surface opening of burrows varied form 1 to 12 and 2 to 10 in the fields with stubble burnt and stubble present, respectively. Burnt straw was found about 6" deep in the burrow tunnels through openings. Excavation of burrows has also shown that hard and dry soil was upto 6-8 inches deep and below this was the moist soil. It shows that burning of stubble has affected upto 8" below the ground only. Nesting material was not found in fields with burnt stubble, whereas, nesting material made of dried wheat straw, common weeds in the wheat crops were found in 2% fields only (Table 1). Food material was found in 10% burrow in fields with burnt stubble whereas, food material was not at all found in burrows of other fields (Table 1). This shows that in fields with intact stubble, the rodent might have stayed in their burrows for a longer period than those which were residing in the burrows of fields with burnt straw. Primary residents (*B. bengalensis, T. indica* and *R. meltada*) and their young ones were not retrieved during the excavation of their burrows but in a small number of burrows, toads and *Mus* spp. were present as secondary occupants.

Table1. Effect of stubble burning on the residents of burrows in wheat fields.

Parameters	Wheat fields	
	Stubble burnt	Stubble present
No. of fields	10	10
Species (burrows)	*B. bengalensis, T. indica R. meltada & Mus.* spp.	*B. bengalensis, T. indica, R. meltada & Mus.* spp.
No. of burrow openings	1-12	2-10
Burrows with nest material (%)	Nil	2
Burrows with food material (%)	10	Nil
Any other material	Moist straw pieces	Moist straw pieces
Primary residents	Nil	Nil
Secondary occupants	Toads, *Mus* spp.	*Mus* spp.

A method for studying food composition of barn owl (*Tyto alba stertens*) by pellet analysis

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The common barn owl, *Tyto alba* is cosmopolitan and in fact, it is one of the most widely distributed of all birds. Method for the identification and quantification of prey in raptor diets include pellet analysis, stomach content analysis, examination of uneaten prey in nests, direct and photographic observation of prey delivered to nests and confinement of nesting raptors. Of these, the regurgitated pellet analysis method is considered to be the most reliable and advantageous because (i) A large sample can be collected with relatively little expense of time or disturbance to the raptors and (ii) Seasonal trends in diet can be studied, often from the same birds. The regurgitated pellets contain undigested food materials, viz., bones, furs, feathers and chitin in the form of either round or elliptical pellets, which are formed in the stomach. The present study was conducted to develop a key for the identification of small mammalian prey species in barn owl's diet. In order to collect pellets, nesting /roosting sites of this species in and around Mayiladuthurai, (11° 2' N and 79° 49' E) were searched. The collected pellets were bagged and kept in a oven at 70° C for 24 hrs in order to kill infesting insects, if any. The morphometric data on their length, width and dry weight were recorded. In order to prepare a reference collection of rodent bones, the species viz., *Bandicota bengalensis, Millardia meltada, Mus booduga, Tatera indica* and *Rattus rattus* and an insectivore grey musk shrew *Suncus murinus* were live trapped from within and around the study areas. They were brought to the aviary, weighed and fed to four caged barn owls. Ten animals representing different weight category of each species excepting *M. booduga* were used. The pellets regurgitated by owls on the subsequent day were collected, dried and analyses by using 8% NaOH solution. Of the bones recovered from pellets, lower jaws or mandibles were selected for the preparation of key since most of the pellets collected from barn owls nests/roosts contained mandibles.

The pellets of barn owls were oval and greenish black. Pellet length, width and dry weight ranged from 29 to 56 mm (Mean = 37.9±0.64 mm), 19 to 32 mm (25.91±0.25 mm) and 1.9 to 7.5 g (3.76±1.23 g) (n=50), respectively. The contents of the analyzed pellets were skulls, mandibles, vertebrae, pectoral and pelvic girdles, limb bones, chitinous remains of insects etc. Of these skulls, limb bones, pectoral and pelvic girdles and synsacra (in the case of birds) were useful, especially for identifying and quantifying the avian and amphibian prey.

The lower jaws were selected as key for the identification of prey species as they occurred in most of the pellets and differed morphologically among rodent species. The mandible is roughly triangular and is made up of a single dentary bone. The anterior ends of the mandibles of five species of rodents showed similarities in structure like presence of incisors (detachable), diastema, and three pairs of molars.

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On the other hand, in grey musk shrew, the incisors were fused with mandibles, the diastema was absent and there were four pairs of molar teeth. The morphological difference could be observed only in the posterior end of the dentaries which are listed in the Table 1.

Table 1 : Morphological dissimilarities of six species of small mammalian mandibles (Posterior end)

Species	Coronoid process	Condyle	Notch	Angular process
Bandicota bengalensis	Slightly curved and broad with a blunt end	Broad and short	Shallow	As that of condyle
Millardia meltada	Slightly curved with a tapering end	Comparatively narrow & longer than *B. bengalensis*	Deep, curved than *B. bengalensis*	As that of condyle
Rattus rattus	Slightly curved with a tapering end	Longer than *B. bengalensis*	[-Shaped notch.	As that of condyle
Mus booduga	Slightly curved with a tapering end	Comparatively narrow & longer than *B. bengalensis*	Deep, curved than *B. bengalensis*	As that of condyle
Tatera indica	Slightly curved comparatively shorter than *B. bengalensis* with a tapering end	Comparatively narrow & longer than *B. bengalensis*	Comparatively deep, curved than other four species	As that of condyle
Suncus murinus	Vertical, broad with a blunt end	Short and stumpy in appearance	"V" shaped appearance	Slender projection

Based on the above morphological differences in mandibles of small mammals, the prey species could be identified. Moreover, no difference in the morphology of the mandibles representing different weight categories, excepting the size was observed. Hence, above key could be useful for the identification of prey species in the barn owl diet samples

Impact of changes in land use pattern on rodent communities in arid zone

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Silvi-pastoral system provides safe shelter and continuous nourishment to free living rodents in arid areas, but over the period, changes in land-use pattern and urbanization have posed a great impact on species composition of rodent communities. In some areas native desertic species are being replaced by other sub-mesic and commensal species. The present study is mainly aimed to visualize the impact of such changes on the species composition of rodent community in an arid ecosystem.

Study area, the Central Research Farm of the Institute which was a sandy, scrub-grass land, interspersed with sandy hummocks about three decades ago, has been transformed into well-established silvi-pasture, horticultural orchards and crop fields. Besides, several residential and office buildings have also come up at many places. Such changes in land use pattern and urbanization has led to drastic changes in rodent species composition of the area during last three decades. During the year long study (2002) the whole area was divided into two major blocks viz. silvipastoral block and pastoral block. In each block trapping was done at four places in a line pattern for three consecutive nights on monthly basis. In all five species were trapped viz. *Tatera indica, Funambulus pennanti, Rattus rattus, Mus musculus and Golunda ellioti*. Typical burrows of *Mus booduga* and *Rattus meltada* were also observed in the area, but these rodents could not be trapped during this year. *T. indica* was the most predominant species accounting for 58.25% followed by *F. pennanti* (20.0%), *R. rattus* (9.55%), *M. musculus* (7.85%) and *G. ellioti* (4.35%). In the present study true xeric rodent species, viz., *Gerbillus gleadowi*, *G. nanus* (= *dasyurus*), *Meriones hurrianae* and *Mus cervicolor* were not reported from the study area throughout the study period, which were 0.82, 24.0, 28.9 and 0.82%, respectively during early seventies. The average annual trap index was 5.33 rodents/100 traps/24 hours. The monthly trap index indicated higher rodent infestation during the winter months (5.56-13.34), probably due to availability of ample food to newly recruited population (bred during September-October). Severe drought during the year had its shadow on rodents also which was evident from lower trap index of 2.23-3.34 from May-October. Mean data on trap index for the last three years revealed higher rodent population from November-February, medium from March-July and lowest from August-October. Preference of native rodents to silvi-pastoral and pastoral habitat was almost equal, 48.75 and 51.25%, respectively.

On the basis of these observations it may be inferred that changes in land-use pattern and urbanization might have influenced the replacement of desertic rodents by submesic (*G. ellioti*) and commensal rodents (*R. rattus* and *M. musculus*).

Report on rodent pests of Manipur and Assam in view of bamboo flowering

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A survey was conducted during March - April, 2003 to monitor the rodent menace in Manipur in view of the bamboo flowering which is likely to occur on mass scale during 2004-2007 AD. Four districts of Manipur have been identified by the State Department where different species of bamboos are abundantly growing. The bamboo growing areas of Manipur where rodents are likely to cause damage to crops due to commencement of bamboo flowering are in the district of: Churachandpur (5,402 ha); Tamenglong (20,526 ha); Chandel (947 ha) and Imphal East (Jiribam Sub-Division) (400 ha).

The four rodent species identified as predominant in the bamboo growing areas of the state are: White bellied rat (*Rattus rattus bullocki*), Manipur rat (*Rattus manipulus*), Indian mole rat (*Bandicota bengalensis*) and Large bandicoot rat (*Bandicota indica*). Other rodent species of minor importance reported from the region are : *Rattus rattus brunneusculus, Rattus rattus tistae, Rattus bowersi, Vandeleuria oleracea, Hadromys humei, Mus cervicolor, Mus famulus cookie, Diomys crumpi, Cannomys badius badius* and *Rhizomys pruinosus*.

Similarly, in Assam rice cultivated as jhoom crop experienced heavy rodent infestation in 568 ha area in Khonbamon and Singhason area under Lambajong block of Karbi Anglong district. According to State Department of Agriculture, Government of Assam, a total of 32 villages and 641 farm families of the district were affected by rodent menace during 2002-03. After harvest of rice crop by the month of July, substantial damage was also observed in ginger crop.

Community trap barrier system for integrated management of rodent pests in low land irrigated rice crops in south-east Asia

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The barrier system in which traps are set across gaps or doorways is referred as 'Trap Barrier System or TBS'. Lam Yuet Ming of Malaysian Agricultural Research and Development Institute developed this technique for lowland irrigated rice. This concept has been refined and tested in many experimental sites in Indonesia and Vietnam. In order to attract the rats towards TBS 'trap or lure' crop is incorporated i.e., an early transplanted rice crop acts as lure crop which is 2-3 weeks older at the time of TBS construction than the surrounding crop. This technology if used at the community level for rodent pest management is termed as Community Trap Barrier System (CTBS).

The lure crop actively attracts the rats from the surrounding fields into the TBS and this provides a halo of protection around the crop fields. At least 8 multiple capture live traps are set all along the barrier and the invading rodents are trapped and killed. Already available results indicate that the 'halo effect' can extend as far as 200 m in each directioin depending on the location of other CTBS and other factors such as major

canals and villages. In other words, a single CTBS can protect a surrounding crop area of 10-15 ha. More than one CTBS may be constructed if the total cropped area exceeds 10 ha.

Construction of CTBS

- 25x25 m square plot is selected within the rice field; or on one side one feet off from the bunds.
- Bamboo or wooden or casuarinas poles of 75-85 cm high are to be implanted at 1 m interval on all four sides. All the poles must be connected with a string or wire in order to keep erect and secure the fence around 25x25 m selected plot.
- 75 cm high plastic/PVC barrier is to be unrolled all along the implanted poles. It must be ensured that atleast 10-15 cm of barrier is dug into the ground i.e., in the mud and the remaining 60-65 cm should stand above the ground. The free ends of the fence can be stapled along with the string or wire (if the barrier is thick enough then the same can be nailed on the implanted poles). In the four corners fence must be securely fixed and the entire fence must act as a rodent proof system for 'lure or trap' crop.
- In the plastic barrier at least 8 holes of 3-4 inch diameter can be cut open (two holes in each side and 2 inch above water level). A mud platform should be made in front of the holes on both sides and onto that 8 multiple live capture rodent traps are to be placed. The mouth of the trap must be fixed on the 3-4 inch diameter hole on the barrier.
- Kill or snap traps are to be placed along the inner side of the fence to catch any rodents that have penetrated the barrier.
- As the 'lure' crop is 2-3 weeks older than the surrounding crop, it attracts the rodents from nearby fields and when they make an entry through the holes made in the fence (inside a multiple live capture trap is set) they are trapped.

Monitoring

- All the multiple live capture rodent traps are to be checked every day morning and trapped rodents must be removed.
- The barrier must also be carefully checked on all sides every morning. If there are any holes they must be plugged.
- Suitable bait materials can also placed inside the trap in order to enhance the trapping efficacy.
- The traps may be covered at the top with straw.

Scientists of Community Ecology Group of CSIRO Sustainable Ecosystems, Canberra, Australia currently recommend this CTBS for use in lowland irrigated rice crops in South-East Asian countries. Success stories of this method are available from Indonesia and Vietnam. Rice production has increased 0.3-1 tonne/hectare within the 200 m 'halo' area.

(Source: Non-chemical Control of Rodents in Lowland Irrigated Rice Crops, ACIAR Research Notes, GPO Box 1571, Canberra ACT 2601, Australia.)

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

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