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Annual reproductive cycle of the common field rat, *Rattus rattus brunneusculus* (Hodgson) associated with bamboo flowering in Northeastern hilly region (Mizoram) of India

N. S. Chauhan and R.N. Saxena

Department of Zoology, University of Delhi, Delhi - 110 007

This report deals with the annual reproductive cycles of the field rat *Rattus rattus brunneusculus*. These rats commonly occur in the 'jhums' of Mizoram and their population tremendously increases during the period of bamboo flowering in the region. They cause extensive damage to paddy crop, often leading to famine like conditions. The data are based on approximately 2,000 adult rats collected during October 1976 to March 1979, the period of flowering of 'Rawthing' bamboo, *Bambusa tulda*.

The male of this species is a seasonal breeder and shows sexual activity from April to October. During the active breeding period, the weights of the testis and accessory sex organs are high. The testicular histology shows broad seminiferous tubules with bundles of sperms and large interstitial cells with vesicular nuclei and abundant cytoplasm. The histology of various accessory sex organs is typical of breeding condition. The breeding phase is followed and preceded by the short regressive and progressive phase, respectively. The non-breeding phase extends from December to February. During these months, there is significant reduction in the weight of the testis, and the seminiferous tubules have germ cells mainly limited to spermatogonial and primary spermatocyte stages. Interstitial cells are inconspicuous and have small, often pycnotic nuclei and little cytoplasm. Parallel to the reduction in the testis weight, the accessory sex organs also exhibit a decrease in weighet. Their histology is typical of non-breeding condition. The prostate shows an early onset of activity as compared to seminal vesicles.

Like its male partner, the female of this species is also a seasonal breeder. The weight and histology of ovary and uterus show breeding characteristics during the months of March to December, but the peak pregnancies occur only during June and August. The short non-breeding phase is restricted to the months of January and February.

The average number of live fetuses and corpora lutea per pregnant female varies from 5.5 to 6.5 and 6 to 8, respectively. The number

of fetuses per female and the percentage of the pregnant ones in the total population of adult females has also been found to be related with age. On the basis of body weight, maximum number of fetuses is observed in the youngest group whereas the middle-age group shows highest percentage of pregnant females.

Monthly fluctuations in the population of the common field rat *Rattus rattus brunneusculus* (Hodgson) in 'jhums' (fields) of Mizoram during the period of flowering of bamboo *Bambusa tulda* (1976–79)

N.S. Chauhan and R.N. Saxena

Department of Zoology, University of Delhi, Delhi-110 007

Population dynamics of the field rat *Rattus rattus brunneusculus* was studied in the paddy fields ('jhums'), both abandoned and fresh, of Mizoram during the period of flowering of bamboo *Bambusa tulda* (1976-79). The estimation of the relative density of the population was done by using techniques such as removal trapping, counting the number of live burrows and rat captured from them.

The population density showed marked changes during different months in both the abandoned and fresh 'jhums'. In the abandoned 'jhum', the population density was at its peak in the month of January. Thereafter, it declined abruptly in later two months and then gradually reached to lowest in December. In the fresh 'jhums', the popualation was minimum during June/July (growth phase of paddy) and was maximum during November/December (harvesting period). In general, when the density decreased in abandoned 'jhum', it increased in fresh 'jhums'. The fluctuation in the density of the population in both types of 'jhums' depends on factors like paddy crop and its stages, reproductive state, intra-and interspecific competition and presence or absence of predators. The population in new 'jhums' increased during the growth phase of the paddy crop and was at its peak at the harvesting stage. The population was also found to be affected by the breeding activity of this rat. This species breeds from April to October during which the increase in population was significant. Short distance migration, in search of food and shelter, was found to be playing important role in the fluctuation of the population density.

The percentage of sub-adult rats was minimum in February. In later months, it though increased, was still less than adults and was found to be related with the reproductive state of adult rats.

During the entire study, a female dominated sex ratio was observed in adult population. The poor representation of adult males is attributed to their higher rate of mortality, death or escape caused by fighting, greater home-range and greater trap avoidance behaviour. In the sub-adult population, the ratio (1:1) of males and females remained almost the same throughout the year.

Food habit of large Bandicoot rat, *Bandicota indica* (Bechstein) in the fields of West Bengal during rainy season

R. Chakraborty and S. Chakraborty

Zoological Survey of India, Calcutta - 700 087

Large Bandicoot Rat, *Bandicota indica* (Bechstein) is one of the most important rodent species of West Bengal. Except in the city areas, it usually prefers a marshy land particularly along the banks of river, pond or any other water reservoir. During dry or winter season, it subsists mainly on the tubers and to some extent on the paddy, wheat or other crops present in the field. During rainy season, most of the fields are inundated and it is hard to find out any tubers or other crops. This species also try to avoid the granaries or other storehouses due to the activities of the most prevalent species, *Bandicota bengalensis* (Gray). At this period a change in the food habit of *B. indica* has been noticed, when it thrives chiefly on the animal foods. From the analysis of the stomach contents, it is obvious that *B. indica* accepts a wide spectrum of animals, right from insects to amphibians. However, of the different animals, the Apple-snail, *Pila globosa* (Gastropoda) constitutes the major item of its diet. *P. globosa* is amphibious in habit and found in abundance in the fresh water ponds, tanks, marshes and paddy fields particularly during rainy season. Due to its very sluggish nature, it becomes easy prey for *B. indica*. It is interesting to note that, *B. indica* always cracks the hard shell of the snail in the region of dorsal body whorl and in a particular pattern making a large opening, through which it takes the entire flesh of the animal leaving the empty shell. The amount of flesh in each individual snail varies from 10 to 50 g.

Occurrence of *Mus booduga* at an high altitude in India

Ajoy Kumar Mandal

Zoological Survey of India, Calcutta 700 087

While examining a small collection of rodents from Indian Kalidhang (*c* 6435 m) Expedition, 1974 present in the Zoological Survey of India, Calcutta, a small grey-bellied mouse with bi-coloured tail was found. On closer examination it turned out to be an example of the Little Indian Field Mouse, *Mus booduga booduga* (Gray). The specimen was collected from village Nelang (*c* 3695 m), Uttarkashi district, Uttar Pradesh, India.

Previous altitudinal record of this mouse was from Gopalpur (*c* 2770 m), Kangra Valley, Himachal Pradesh. Now the present material from Nelang (*c* 3695 m), Uttarkashi district, Uttar Pradesh constitutes its highest altitudinal record from the Himalayas in India.

Nest of the house rat, *Rattus rattus arboreus* in nature

Ajoy Kumar Mandal

Zoological Survey of India, Calcutta 700 087

The House Rat, *Rattus rattus arboreus* (Horsfield) is arboreal in habit but very little is known about its nesting habits. A nest of this rat was found in a corner on the roof of a *pucca* building by the side of heaps of broken tiles and debris covered by some tins in a slanting position. The nest was made by locally available materials like dried leaves of different plants (mainly black berry leaves, as these were available on the roof itself), grasses, pieces of paper, clothes, etc. The shape of the nest was more or less round with three openings. Five ratlings were found in the nest.

A new dead heart menace of sugarcane pullulates by field rats

R.S. Brar[1] and P.N. Avasthy[2]

Shriram Research Farm, Palhera[1] P.O.-Modipuram[2], and
Indian Institute of Sugarcane Research, Lucknow

Rats being omnivorous cause colossal damage to crop plants in India every year. The damage to sugarcane starts from October onwards and continues upto harvest. The attacked canes are not a complete loss but are gnawed usually from the first internode to the 5th in the lodged crop. However, all the internode may be damaged resulting in greater loss.

The damage in dead heart form in the new sugarcane ratoon shoots was observed in Shamli Mill Area (Western Uttar Pradesh) during the beginning of May 1980. The nature of damage was in accordance with that of early shoot borer *(Chilo infuscatellus)*. The rats gnawed the lower most portion if young shoots (2-4″ from ground level) covered with trash resulting in drying of mother shoot. The intensity of damage varied from 15 to 30 percent in few trash-mulched cane fields near canal bunds used as abode by rodents. In some cases, the remnants of early shoot borer were found lying in the nibbled part of shoots. As a consequence the rats devoured this borer along with the green matter of the plant.

The problem was marked in the trash-mulched ratoon crop where as no such symptoms were located in the trash-burnt ratoon field. Although, the rodents caused morbidity of early shoot borer but magnitude of damage was much more by feeding on young shoots and causing dead hearts. Henceforth, the control measures must be followed by actually visualising the type of pest rather than the nature of damage by a particular pest.

Soil effect on growth and breeding of *Bandicota bengalensis*

P.M. Nigam

C.S. Azad University of Agriculture & Technology, Kanpur

A laboratory experiment to note the effect of different type of soils, viz., sandy, clay and loam on the growth maintenance and breeding of the lesser bandicoot, *B. b. bengalensis* was carried out in animal breeding cages (52.5cm x 40cm x 32.5cm) filled with 40 kg of each type of soil with three replications and provided with 800 ml water on alternate days to maintain the necessary soil moisture content. Bandicoots of equal weight, size and age were released in each cage. Data on breeding of the bandicoots, gain in their body weight and burrow pattern inside cages were recorded. The differences in mean weight of the bandicoots bred in sandy and loam soils are not significant, but they are significantly superior to the mean weight of the rats bred on clayey soil. The differences in weight of the male and female bandicoots bred under different soils are not significant. Burrow pattern in sandy and loam soils was regular and smooth inside cages, while they could not make burrows properly in clayey soil as most of the soil due to moisture was converted into clots.

Acceptance of different poison baits by the black rat, *Rattus rattus* L.

R.S. Rai, Panchi Lal and P.K. Srivastava

Indian Grain Storage Institute, P.A.U. Campus, Ludhiana-141 004

The degree of acceptance of different poison baits (acute & chronic poison) alongwith plain bait to house rat, *Rattus rattus* was studied in the laboratory. The poison baits were offered to rats kept in cages individually for 24 hours only.

Poison with concentration (a.i.) tested	Form of bait	Bases used	No. of animals tested	Average bait consumed (g)by 100 g rat in 24 hours	Mortality (%)
Acute poison					
Silmurin 1% dust (a.i. 0.05%)	Wet bait	Wheat, flour, water, oil & sugar.	5	3.888	100
Silmurin 1% dust (a.i. 0.05%)	Dry bait	Wheat, flour, oil and sugar.	6	1.484	50
Silmurin (a.i. 0.05%)	Dry bait	Ready for use bait prepared and supplied by the firm containing 0.05% a.i. and 99.95% wheat grains and adjuvents.	5	0.557	40
Zinc phosphide (a. i. 2%)	Dry bait	Wheat, flour, oil & sugar.	5	3.878	100
Chronic poison					
Racumin (a.i. 0.0375%)	Dry bait	Wheat, flour, oil & sugar.	5	9.413	nil
Rodafarin (a.i. 0.025%)	Dry bait	Wheat, flour, oil & sugar.	5	8.250	nil
Ratafin (a.i. 0.025%)	Dry bait	Wheat, flour, oil & sugar.	5	10.240	nil
Control Plain bait	Dry bait	Wheat, flour, oil & Sugar	5	12.311	nil

It is observed that the degree of acceptance of different baits was in the following descending orders.

Control > Ratafin (0.025% a.i.) >
Racumin (0.0375% a.i. > Rodafarin (0.025% a.i.)>
Silmurin wet bait (0.05% a.i.) > Zinc phosphide 2% a.i.)>
Silmurin dry bait (0.05% a.i.) > Silmurin
ready for use dry bait (0.05% a.i.) prepared and
supplied by the firm.

Efficacy of barium carbonate against *Rattus meltada*

Girish Chopra and M. L. Sood

Department of Zoology, Punjab Agricultural University, Ludhiana

Barium carbonate ($BaCO_3$) was tried in five dosages against *Rattus meltada* (Gray). Hundred per cent mortality was recorded when 20% concentration of poison bait was tried. However, only 50% kill was recorded at 10% and 12.5% concentrations. The average time taken to death was recorded to be between 6 to 12 hours at 10%, 12.5% and 20% concentrations (Table 1). The data in the Table indicate that poison consumed mg/kg of body weight was 1412.84 and 2130.30 at 5% and 20% concentrations, respectively.

The quantity of poison consumed mg/kg body weight was 2520.00 at 7.5% concentration and only 20% kill was observed. On the other hand, the poison consumed mg/kg body weight was 2130.30 when 20% concentration of poison was used resulting into 100% mortality.

Table 1. Efficacy of barium carbonate against *Rattus meltada*

Dose	Wt. of rat (Mean ± S.E.)	Bait consumed (g)	Actual quantity of poison consumed (g)	Poison consumed mg/kg body weight	Time taken to death (Hours)	Mortality %
5.0%	54.5 ± 6.45	1.54	0.0770	1412.84	—	—
7.5%	50.0 ± 4.52	1.68	0.1260	2520.00	18-24*	20
10.0%	58.5 ± 6.28	1.02	0.1020	1743.59	6-12*	50
12.5%	59.0 ± 5.78	0.98	0.1230	2084.75	6-12*	50
20.0%	60.0 ± 6.02	0.75	0.1500	2130.30	6-12*	100

* Observations recorded at 6 hour intervals

Glass powder mortar can provide protection from rats

P.K. Srivastava and N. K. Garg

IGSI, (PAU campus), Ludhiana

Pieces of glass put in rat burrows and sealed do provide protection from rats making them incapable of burrowing into burrows. An experiment was therefore planned to see if glass powder mortar can provide any protection from rats. Two experiments were performed,

A. A Bharoli (earthen storage structure)was plastered with mud-mortar containing hand made glass-powder @ 1.0 kg per 5.0 kg of mud on dry-weight basis and the another one used as control. Both the bharolis were placed in the demonstration shed and were encased in a single covering structure of perforated mild steel sheet. The casing was having wooden frame at top and bottom and was covered with removable M.S. sheet cover which was needed to check any cat going inside and also the rats from going outside the casing. Two rats were released inside the casing but outside the earthen structures and were allowed to feed wheat grains for 7 days. Drinking water was also provided. Daily watch was kept to note any kind of damage, if so, caused to the mud mortar structures by the released rats.

B. Another experiment was done with modifications. Here the idea was to pin-point the specific particle size/grade of the glass powders used achieving the goal. For this purpose glass powder was prepared manually by hammering and separated as per the particle size into five different grades through seiving with the following range of particle size(diameter):-

(1) 1 mm and below
(2) 1.1. to 1.5 mm
(3) 1.6. to 2.0 mm
(4) 2.1 to 2.5 mm
(5) 2.6 to 4.0 mm

By using a particular grade of glass powder, the mud-mortar was prepared by mixing the clay (powder) in the ratio of 1:5 on dry weight basis. A little amount of wheat straw was also added to check the cracking. This mud mortar was used to prepare 2 plates per grade with 7 cm thickness and 30 cm diameter each. In addition 2 plates with mud alone (without using any glass powder) were prepared to serve as control. A set of six plates, one from each of the grades including control was placed outside the demonstration shed in *kacha* floor and the second similar set on *pucca* floor inside the shed.

The plates from different grades were used as bottom bases which were separately mounted by a circular metal sheet casing of 30 cm inner diameter with 40 cm height fitted with wire net cover on the top of each of them. Regular supply of wheat grains and water was continued for seven days.

None of the two bharolis, the plastered with mud mortar containing hand made ungraded glass powder as well as control, were damaged by rats.

In case of the other experiment both the sets placed outside as well as inside the demonstration sheds the mud mortar plates containing the glass powder grades with the particle size (I) 1 mm and below (II) 1.1. to 1.5 mm diameter and control were damaged by the rats. On the other hand the structures (Plates) containing the glass powder of the particle sizes of 1.6 to 2.0 mm, 2.1 to 2.5 mm and 2.6 to 4.0 mm, respectively could not be burrowed/damaged by rats. In case of outside trial on *kacha* floor rats after burrowing came out of the casings and escaped within three days after setting the experiment.

However, in due course the structures placed in the trial outside the demonstration shed got moistened due to rains and consequently from among them the structures containing the glass powder with the particle size of 1.6 to 2.0 mm and 2.6 to 4.0 mm were also slightly damaged/cut by the rats where as the structure with the glass powder with the particle sizes of 2.1 to 2.5 mm could not be damaged and thus proved to be most successful for the purpose.

It can be concluded that the structures plastered from outside with clay and glass powder (with the particle size ranging from 1.6 to 4.0 mm) in the ratio of 5:1 on dry weight basis can be used conveniently as the device against damage caused by rats with negligible or no extra cost.

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Coordinator
National Programme for Rodent Pest Management,
Central Arid Zone Research Institute,
JODHPUR - 342 003.

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