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DISTRIBUTION AND BURROW DENSITY OF FIELD RAT *NESOKIA INDICA* IN NON-CROPPED AREAS OF CENTRAL PUNJAB

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ABSTRACT

Rodents are important pests of agriculture in Pakistan. Short-tailed mole rat, *Nesokia indica*, is one of the most destructive and widely distributed species. The present work attempts to estimate the population density of this rat through its burrow count in non-cropped areas of central Punjab. An area of 378.5 hectares of such land in the districts of Jhang, Faisalabad, Sheikhupura, Gujranwala, Lahore and Kasur was sampled. The overall per hectare density of *N. indica* for all types of sub-habitats was 0.8. The structure of the burrow system was nearly the same in all types of sub-habitats. From the density data it is quite clear that the mole rat attained high density in banks of irrigation ditches (16.2 burrow system per hectare) and banks seepage drains (13.5 burrow system per hectare). On the average, *N. indica* made 0.9 fresh and 2.6 old mounds per burrow system. The maximum number of fresh mounds and open burrow mouths were observed between 08:00 to 10:00 a.m. and between 06:00 to 06:30 p.m.

Keywords: *Nesokia indica*, burrow density, distribution, central Punjab, sub-habitat,

INTRODUCTION

Among field rats, the short-tailed mole rat, *N. indica,* stands out prominent because of its body size, high density and depredatory activities in the croplands of central Punjab. It is a smaller rodent having scaly tail, robust body, deep muzzle and relatively small naked ears. It has relatively shorter tail, which never exceeds 70 percent of the head and body length. The body fur is generally much softer. Generally, it is dark grayish-brown varying to reddish brown with the belly fur grayish white. The head and body length averages 165 mm (range 150-180 mm) and the tail averages 119 mm (range 110-129 mm), the hind foot 32 mm (range 23-36 mm) and the ear averaging 19 mm (range 16-22 mm). Adult specimens vary in weight from 112-177g. The upper pair of incisors is pruodont. This feature shows adaptation towards a fossorial existence (Beg *et al*., 1980; Fulk *et al*., 1981; Khan, 1982). According to Hussain *et al.* (2005) as *N. indica* is a highly fossorial species, surface trapping is believed to have underestimated its prevalence. Prakash and Ghosh (1992) also discussed the nocturnal and fossorial behaviour of this rat. It makes extensive burrows with several chambers. The burrows are about 9-56 cm deep. At each of the openings, there are mounds of excavated soil. The patterns of these burrows vary, but most zigzag and have many openings, although some are simple with one or two openings. The tunnels are roughly circular in diameter (3.5-11.5 cm) and range in length from 17- 3443 cm. They close their exit holes with soil for about 15-60 cm. These rats are inactive during the winter.

Nesokia indica is a pest of primary importance and is widely distributed in Pakistan, India, Iran, Iraq, Egypt, Syria, Northern Arabia, Chinese Turkestan and Southern Russian Turkestan (Pervez *et al*., 1998; Walker, 1975). Not much is known about the reproduction biology of the pest rat. In captivity, breeding occurs throughout the year. However, it has been reported that litters are produced in the winter. Litter size usually varies from two to seven The pest rat feeds on leaves and roots of lawn grass. However, *N. indica* also consumes crops such as barley, wheat, potato, ground nut, sugar cane, mustard, brinjal, and watermelon (Song, 1999; Prakash and Ghosh, 1992). This rat sometimes stores food in its burrow. The tunneling of the rat damages irrigation walls. Also, raiding of fields by *N. indica* does considerable damage to vegetable, fruit and grain crops (Song, 1999; Nowak, 1991).

In Pakistan, it inflicts heavy damage to wheat, rice and sugarcane crops (Beg *et al*., 1981; Fulk *et al*., 1981). It also causes considerable losses to irrigation water through burrowing in the banks of canals and watercourses. Ali (1986) has given variable information on the distribution and density of the burrow system of this rat in wheat, rice and sugarcane fields of the Punjab. Some valuable work in this context has also been contributed by Khan *et al*. (1998) in which they evaluated and developed an underground baiting technique for the control of rats in rice fields.

The significance of the present study was bi-fold:

1- to find out various non-cropped sub-habitats, which serve as reservoir for them
2- to know the species which affect the embankments of irrigation canals and thus may play a role in breaching them.

MATERIALS AND METHODS

A total of 378.5 hectare of non-cropped wasteland in central Punjab was surveyed for the burrows of *N. indica*. During the course of this study, parts of six districts of Punjab (Pakistan), namely, Jhang, Faisalabad, sheikhupura, Gujranwala, Lahore and Kasur were covered.

Identification of rat burrows

The rat burrows were identified by using the characteristics of their burrows and faecal matter found in their vicinity. According to Salam (1978) the faeces of *N. indica* averaged 1.77 ±0.019(SX) cm long and 0.69 ±0.007(SX) cm wide. The faeces of mole rat was slightly curved and rounded at both ends, and generally sandy-yellow in colour mixed in soil excavated from the burrows. The dirt excavated by the short-tailed mole rat almost always contained pieces of underground stems, roots and faeces.

Data collection

Each randomly selected field was carefully examined for the occurrence of rats' burrows. A density sheet was used for data collection. On this sheet, different aspects had been described such as locality, habitat, type of vegetation, soil type, number of active and inactive burrow-systems, number of fresh/open mounds, time of sampling etc. The area sampled was taken in hectares.

RESULTS

Various types of non-cropped sub-habitats, found in close conjunction with the croplands, were surveyed for the burrows of *N. indica*. Table 1 shows the density of burrow system of the mole rat, which appeared to be the most common rat in the non-cropped habitats of central Punjab. This rat attained very high density on the banks of irrigation ditches and seepage drains; the per hectare burrow density being 16.2 and 13.5, respectively. On irrigation canal banks and in canal side plantation and fallow-lands, too, the rat was quite common; the respective densities being 3.3, 1.5 and 2.2. In the remaining sub-habitats, the per hectare density of mole rat burrows ranged between 0.4 - 0.9. The overall average for all the sub-habitats was 0.8 burrow system per hectare.

Table 1. Density (per hectare) of *Nesokia indica* in different sub-habitats in the Central Punjab.

Sub-habitat	**Area surveyed (*Hectares*)**	**Density (per hectare) of burrow system**		
		Active	**Inactive**	**Total**
Water logged land	12.7	0.2	0.3	0.5
Wet wasteland	41.6	0.02	0.1	0.12
Previously water logged	95.3	0.4	0.1	0.5
Banks of seepage drains	4.3	9.1	4.4	13.5
Banks of irrigation ditches	1.6	15.6	0.6	16.2
Canal banks	3.3	3.0	0.3	3.3
Canal side plantation	4.1	0.0	1.5	1.5
Road side plantation	46.6	0.3	0.1	0.4
Alkaline wastes	101.3	0.4	0.1	0.5
Dry fallow land	15.0	1.7	0.5	2.2
Dry waste land	52.7	0.4	0.5	0.9
Total	**378.5**	**0.6**	**0.2**	**0.8**

Table 2. Density (per hectare) of *Nesokia indica* in different sub-habitats in different districts of Central Punjab.

Districts	**Area surveyed (hectares)**	**Density (per hectare) of burrow system**		
		Active	**Inactive**	**Total**
Jhang	34.1	2.1	1.4	3.5
Faisalabad	45.4	0.9	0.5	1.4
Sheikhupura	50.4	0.6	0.1	0.7
Gujranwala	95.1	0.3	0.1	0.4
Lahore	53.0	0.3	0.04	0.3
Kasur	100.5	0.3	0.1	0.4
Total	**378.5**	**0.6**	**0.2**	**0.8**

Table 3. Burrow mounds in the burrow system of short-tailed mole rat (*Nesokia indica*).

Sub-habitat	**No. of burrow systems**	**No. of fresh mounds/burrow system**	**No. of old mounds/burrow system**
Water logged land	7	0.1 (1)	2.6 (18)
Wet wasteland	5	0.6 (3)	1.8 (9)
Previously water logged	43	0.9 (38)	3.5 (152)
Banks of seepage drains	58	0.9 (55)	1.8 (102)
Banks of irrigation ditches	26	1.1 (29)	0.07 (2)
Canal banks	11	1.1 (12)	1.7 (19)
Canal side plantation	6	0.0	1.3 (8)
Road side plantation	21	1.2 (26)	3.7 (77)
Alkaline wastes	56	0.5 (29)	3.6 (201)
Dry fallow land	32	1.5 (49)	4.0 (129)
Dry waste land	51	0.9 (44)	2.3 (119)
Total	**316**	**0.9 (286)**	**2.6 (836)**

Table 4. The average number of mounds per burrow system of *Nesokia indica* in different sub-habitats.

Sub-habitat	**No. of burrow systems**	**Ave. No. of mounds**	**Range of mounds (fresh+old)**	**S^2**	**S**	**S.E**
Water logged land	7	2.7	1-5	0.81	0.90	0.24
Wet wasteland	5	2.4	1-5	1.00	1.00	0.32
Previously water logged	43	4.7	1-15	3.39	1.84	0.20
Banks of seepage drains	58	2.6	1-7	2.91	1.70	0.17
Banks of irrigation ditches	26	4.4	1-3	0.18	0.43	0.06
Canal banks	11	2.8	1-5	1.89	1.37	0.29
Canal side plantation	6	1.3	1-3	0.24	0.49	0.14
Road side plantation	21	4.7	1-13	7.43	2.73	0.42
Alkaline wastes	56	4.1	1-16	9.68	3.11	0.29
Dry fallow land	32	5.6	1-17	14.88	3.86	0.51
Dry waste land	51	3.2	1-11	5.15	2.27	0.22
Total	316	3.6	1-17	7.54	2.75	0.11

From the data it was quite evident that the mole rat attained high densities in water logged areas, on bank of seepage canals, on banks of irrigation ditches, in canal side plantation and dry fallow and waste lands. The occurrence of rat burrows in good number on banks of ditches is of special significance (Table 1).

Table 2 shows the burrow density of *N. indica* in six districts of the Punjab (Pakistan). This was generally the most common species in all the districts. Its maximum burrow density was recorded in Jhang district, where 3.5 burrow systems occurred in each hectare of non-cropped land. The burrow density of this rat in Faisalabad was 1.4, 0.7 in Sheikhupura, 0.4 in Gujranwala and Kasur each and 0.3 in Lahore district.

Table 3 provides information about the number of mounds per burrow system of the mole rat in different sub-habitats. The number of fresh mounds per burrow system ranged from 0.00 – 1.5, and old mounds from 0.07 – 4.0. The overall average of all the sub-habitats was 0.9 fresh mounds and 2.6 old mounds.

Table 4 documents the average number of mounds per burrow system of the mole rat, which appeared to be 3.6 ± 0.11 (range 1–17) mounds per system. Similarly, Table 5 shows the average number of mounds in the burrow system of the rat in different types of soil. The rat had maximum number mounds in saline sandy loam.

Table 5. The average number of mounds in the burrow system of *N. indica* in different types of soil.

Soil type	No. of burrow systems	Ave. No. of mounds	Range of mounds (fresh+old)	S^2	S	S.E
Sandy	19	2.3	1-5	1.68	1.30	0.21
Saline sandy	-	-	-	-	-	-
Sandy loam	15	1.4	1-5	0.96	0.98	0.18
Saline sandy loam	5	4.8	3-7	-	-	-
Loam	19	3.6	1-17	11.17	3.34	0.54
Saline loam	7	4.1	1-7	0.47	0.69	0.18
Sandy clay	83	3.9	1-16	7.89	2.81	0.22
Clay	81	3.5	1-17	8.67	2.94	0.23
Saline clay	87	3.8	1-13	6.72	2.59	0.20
Total	**316**	**3.6**	**1-17**	**7.54**	**2.75**	**0.11**

Table 6. An assessment of the digging activities on the mole rat (*Nesokia indica*) during light hours.

Time (hrs.)	No. of burrows examined	Fresh mounds per burrow system	Open burrow mouth per burrow system
6-8	1	1.0	-
8-10	3	1.7	0.7
10-12	13	0.8	-
12-14	15	0.2	0.03
14-16	20	1.5	0.1
16-18	23	1.6	0.2
18-1830	6	1.9	0.6

Table 6 provides information on the timing of formation of fresh mounds and opening of the burrow mouths by *N. indica*. The maximum number of fresh mounds was observed between 08:00 to 10:00 a.m. and between 06:00 to 06:30 p.m. The maximum number of open burrow mouths, too, was observed during these two periods.

DISCUSSION

The results of the present study show that the short-tailed mole rat occurred in non-cropped area not so densely as in the cropped area. On the average each hectare of non-cropped areas of the present study had 1.4 burrow systems of rats in it. As compared to this, each hectare of wheat, rice and sugarcane field of roughly the same study area had respectively, 12, 11 and 22 burrows. In the non-cropped areas, the mole rats were with a per hectare burrow density of 0.8. In the croplands, the mole rat was reported by Ali (1986) to be the least common species.

In the non-cropped areas, the mole rat attained very high density on banks of irrigation ditches, seepage drains and irrigation canal banks; the respective per hectare burrow densities being 16.2, 13.5 and 3.3. The occurrence of rat burrows on the embankments of irrigation canals, seepage drains and irrigation ditches is of great importance from water management point of view. Extensive burrow systems of the mole rats on these embankments might result in the loss of irrigation water due to accelerated seepage and breaches.

The non-cropped areas, which occurred in close conjunction with the cropped areas in the present study area, serve as reservoir habitats to these rats. While chalking out a programme for eliminating the rats from the cropland, the non-cropped areas should not be neglected. Removal of rats from the croplands might provide a temporary relief, as rats from non-cropped areas would tend to fill up the vacuum caused by their removal at a very high rate.

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