

Breeding and Post Natal Development of the Short Tailed Mole Rat, *Nesokia indica* in Arid Zone

Mohd. Idris, R S Tripathi and Vipin Chaudhary¹

All India Network Project on Rodent Control, Central Arid Zone Research Institute, Jodhpur - 342 003, Rajasthan, India.

¹Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand - 387 310, Gujarat, India.

E mail: idris1958@yahoo.co.in

Abstract

Studies on breeding aspects including post natal development of short tailed mole rat, Nesokia indica inhabiting irrigated fields of arid region were undertaken in laboratory. The mole rats exhibited an average litter size of 4.33 and 2.85 for field collected pregnant females and laboratory bred females, respectively. Gestation period was estimated to be 22-24 days. Post natal development with respect to different body parts indicated maximum growth rate during first two months after birth. Length of hind foot stabilized by 12-13th week, whereas ear and tail stabilized by 19-20th week after birth. Head body length continued to grow up to 21 to 29 weeks after birth. In general, males grew faster than females. Observations on development of pelage, incisors, parental care, cannibalism and lactation length of short tailed mole rats are reported.

Keywords: Short tailed mole rat, *Nesokia indica*, Breeding, litter size, post natal development

Introduction

The short-tailed mole rat (*Nesokia indica* Gray, 1832) is a palearctic rodent, distributed in India, Bangladesh, Nepal, Pakistan, Iran, Iraq, Egypt, Northern Arabia, Turkistan and Southern Russian Turkistan (Agrawal, 2000). In India, it is mainly distributed in northern parts viz., Delhi, Uttar Pradesh, Punjab, Haryana and Rajasthan (Agrawal and Prakash 1992, Jain *et al.*, 1995). In recent years, it has been reported in irrigated crop lands and orchards in Indira Gandhi Nahar Pariyojna (IGNP) command area at Lunkaransar (27°58'24"N, 073°03' 22"E) district Bikaner and arid forest lands of Tal Chhapar (27°48'03"N, 074°26'16" E) district Churu of Western Rajasthan (Tripathi and Idris 2004). Being a mesic species, it prefers to burrow in soft and moist soil and most of the time found where vegetation cover is good (Ramesh, 1992). It is serious pest of rice, wheat, sugarcane, fruit orchards and forest plantation (Tripathi and Jain, 1990). It also causes considerable damage to canal banks and water channels through extensive burrowing. Except few reports on its incidence and behaviour, concrete information on its breeding and postnatal development is almost lacking from arid ecosystem. As the breeding season of most of the Indian rodent species correlates with the cropping pattern of particular area, the present study would provide useful information on breeding aspects of *N.indica* under arid

conditions enabling to manage newly introduced rodent species in the arid region successfully.

Materials and methods

During regular rodent surveys of irrigated cropping systems, the short-tailed mole rats (*N.indica*) were collected from Lunkaransar, district Bikaner, Rajasthan (India) in the months of October and November. Two methods, one by fixing Sherman traps and another by excavating the burrows were utilized for collection of *N. indica*. Collected rodents were brought to Rodent Control laboratory of Central Arid Zone Research Institute, Jodhpur (Rajasthan) for further studies. After recording the morphometric data on various body parts like, Head & Body (HB), Hind Foot (HF), Ear (E), and Tail (T) length etc. the mole rats were lodged individually in metallic cages (18"x12"x 12") and were maintained on laboratory diet. The pregnant females were lodged individually in metallic breeding cages of similar dimensions having attachment of nest boxes. Dry hay and cotton pads were provided in nest box as nesting materials. Food and water were provided *ad libitum*. Cages of pregnant females were regularly examined specially for parturition. In another set of experiment, males and females were paired for breeding in laboratory cages. The day of birth was designated as day "0" (zero). Newly born young ones were marked with colored dye for identification. After a week,

toe was clipped as mark of identification. Observations on litter size, gestation period, post natal developments, lactation period and parental care were recorded under laboratory.

The morphometric observations like Head and Body (HB), Hind Foot (HF), Ear (E), and Tail (T) length of newborns were recorded every week up to 30 weeks when most of the growth parameters became constant. Body weight was recorded to nearest 0.1g by electronic single pan balance and body measurements were taken to nearest 1.0 mm by plastic ruler. Data on per cent weekly growth of each parameter was worked out using the formula;

% growth within specified period (say 0-4 weeks)

Step 1: Data for 30th week- data for 0 day = A

Step 2: Data for 4th week- data for 0 day = B

Step 3: Percent growth = $BX100/A$

Similarly, per cent growth in all parameters during different weeks was computed.

Results and discussion

General observations

The short tailed mole rats collected from arid region were heavily built, slaty to greyish in colour having dark uni coloured tail which is shorter than HB length. The adult mole rats showed a body weight range of 57 to 232g for males and 53to123g for females. The mean lengths of HB, HF, tail and ear of adults were 168.5, 30.7, 94.7, and 11.9 mm in males and 146.4, 28.7, 89.2 and 11.4 in females respectively. The females showed 4 pairs of mammae. These values were similar to other Indian collections by Zoological Survey of India (Agarwal, 2000). In the present collections all the males had scrotal testes and females showed open vagina indicating sexually active stage of mole rats. Typically, the dentition had one pair of wide and yellowish incisors and three molar teeth in each jaw. The pelage was short and soft. They are fussorial in habit and thus make deep and elongated burrows (Jain *et al.*, 1995, Tripathi and Idris, 2004) with characteristic mole hills of loose soil (15-20 kg) at the burrow openings.

Breeding and litter size

The pregnant females were collected from irrigated crop fields in the month October and November only, however, in laboratory breeding was observed in other months also under captivity. Earlier reports from Delhi, indicated peak breeding activities in *N. indica* during January to March and August to October months when the male is sexually

active (Saxena and Gariyali, 1980). Average litter size of field collected pregnant females (N = 9) was 4.33 (range: 2-6), whereas captive bred females (N=14) registered a mean litter size of 2.85 (range: 1-4) with preponderance of 1-2 per litter depending on the age of the females. Haque (1993), Al-Jumaily *et al.* (1975) also observed same range of litter size in field as well as laboratory bred females. The male and female ratio of new borne pups in field collected pregnant females and captive bred females were 45:55 and 37.5:62.5 respectively.

Gestation period

The period of gestation in *N. indica* could be recorded in three cases only. After pairing the adult males and females, the delivery of litters was observed between 24-26 days. Assuming that the males served the females within 24-48 hrs of pairing, the gestation period may be estimated to be of 22-24 days in short tailed mole rats. The gestation period of most of pest rodents have been reported between 19 and 25 days (Aplin *et al.* 2003) however Prakash (1981) reported a gestation period of 28-30 days in desert gerbil, *Meriones hurrianae*.

Newborn young

The newborns of short-tailed mole rats were without hair and their skin was loose transparent and reddish in colour. Small vibrissae were present but eyes were closed and appeared as dark specks. The ears were closed as their pinnae were small and folded. A dot of coagulated blood as black spot was usually visible at the umbilicus. Nails on fused digits but distinct, were feebly developed. Tail was naked, transparent and reddish in colour. The newborn were helpless and uttered faint squeaks and were unable to walk except rolling on the ground. Since, the nipples of inguinal region of mothers were well developed and easily approachable, the young ones mostly preferred to suckle from the nipples of this region only. The newly borne pups weighed 5.95 (males) and 4.20 g (females). Length of head and body (HB) of newborns ranged from 41.0 and 43.5 mm, tail (T) from 14.0-15.0 mm and hind foot (HF) from 7.5-8.0 mm.

Post natal development

The observations on postnatal development were started with 40 young ones, however, 24 young ones died within 4-5 week of study period. Thus the study was completed with 16 young only (seven males and nine females).

General The young ones showed rolling movements in the cage independently even before opening their eyes, however, mother never allowed them to move away from nest box. In the first and second week after birth, a dark line appeared between the two eyelids. The eyes opened 15-19

days after birth. The pinnae were darkly pigmented and sealed in newborns and also folded during 1st week of their life. The places where scrotal sacs were to appear darken within 4-5 weeks after birth. The digits of both hind and fore legs which were fused initially got separated with in 2 weeks. External genitalia of either sex became distinguishable during 4th week after birth. Similar observations have also been reported by Haque and Islam (2002) for *N. indica* and Prakash (1964) for *Meriones hurrianae*.

Pelage. Newborn young were hairless except for few small vibrissae (3-4mm). In the first week, the small pelage appeared and body colour changed to dark reddish and by the second week their body colour changed to grayish black. However, vibrissae measured up to 8 mm in second week. White hairs were also developed on ventrum in second week onwards and covered the under parts. At the end of three weeks, dorsum was covered with gray hairs but ventral part remained white.

Incisor. The incisors appeared as rough eruption in the second week of the birth. Lower incisors appeared one or two days earlier than upper incisor. Initial growth of the lower incisor (2mm) was more than the upper incisor (1mm). However, at end of fourth week when young ones started nibbling grains, the sizes of upper and lower incisors

measured 5 and 3 mm, respectively. Incisor growth was 5 mm in upper and 8 mm in lower jaw recorded at the end of 8th week.

Body measurements and weight. Data on post natal development of *N. indica* as presented in Table 1 and 2 revealed that growth in head body (HB), hind foot (HF), tail (T) and Ear (E) lengths was 34.9, 71.7, 57.1 and 42.3% in case of males as compared to 49.3, 81.4, 57.0 and 56.3% in females indicating that females grew faster than males during first four weeks. Even the gain in body weight was higher in females (28.3%) than males (13.3%) during this period. However, the trend reversed in later weeks.

Age wise interpretation of data on morphometry further revealed that various body parts registered maximum growth rate up to an age of two months (0-8 weeks). The HF which attained maximum lengths of 31 and 29 mm in 12th and 13th week in males and females respectively, registered over 90% increment in size within 8 weeks. Similarly the length of tail showed over 78% gain during this period and finally stabilized at 100g (males) and 92.5g (females) from 20th week onwards. The ears, which were sealed at birth measured 3.0 and 3.5 mm for males and females respectively during second week and registered maximum length of 13 and 12 mm during 19th week for respective sexes (Fig. 1 & 2). The rate of growth of ears was also maximum during first eight

Table 1. Growth (%) of new born *Nesokia indica* (male) in different weeks after birth

Body parameters	Per cent growth at an age group between							
	0-4weeks	5-8 weeks	9-12 weeks	13-16 weeks	17-20 weeks	21-24 weeks	25-28 weeks	29-30 weeks
HB	34.9	30.9	9.7	8.4	5.0	3.4	2.7	5.0
HF	71.7	19.6	8.7	0.0	0.0	0.0	0.0	0.0
T	57.1	21.8	8.8	7.1	5.9	0.0	0.0	0.0
E	42.3	26.9	11.5	11.5	7.7	0.0	0.0	0.0
B Wt	13.3	19.1	9.9	4.3	17.0	14.8	13.7	7.7

Note: HB = Head Body; HF Hind foot; T = Tail; E = Ear; BW = Body weight

Table 2. Growth (%) of new born *Nesokia indica* (female) in different weeks after birth

Body parameters	Per cent growth at an age group between							
	0-4weeks	5-8 weeks	9-12 weeks	13-16 weeks	17-20 weeks	21-24 weeks	25-28 weeks	29-30 weeks
HB	49.3	25.4	12.1	7.0	3.5	2.6	0.0	0.0
HF	81.4	12.8	3.5	2.3	0.0	0.0	0.0	0.0
T	57.0	25.8	8.28	5.7	3.2	0.0	0.0	0.0
E	56.3	16.7	20.8	4.2	2.1	0.0	0.0	0.0
BW	28.3	17.1	8.9	6.7	10.3	15.1	9.9	3.8

Note: HB = Head body; HF = Hind foot; T = Tail; E = Ear; BW = Body weight

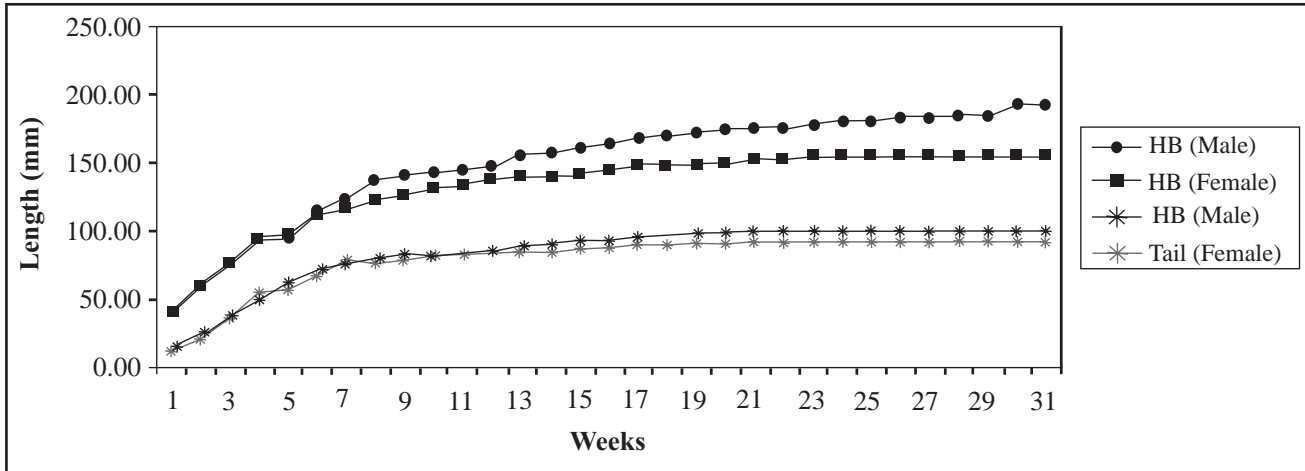


Figure 1. Growth curve for head body (HB) and tail length in *Nasokia indica* from birth to 30 weeks of age

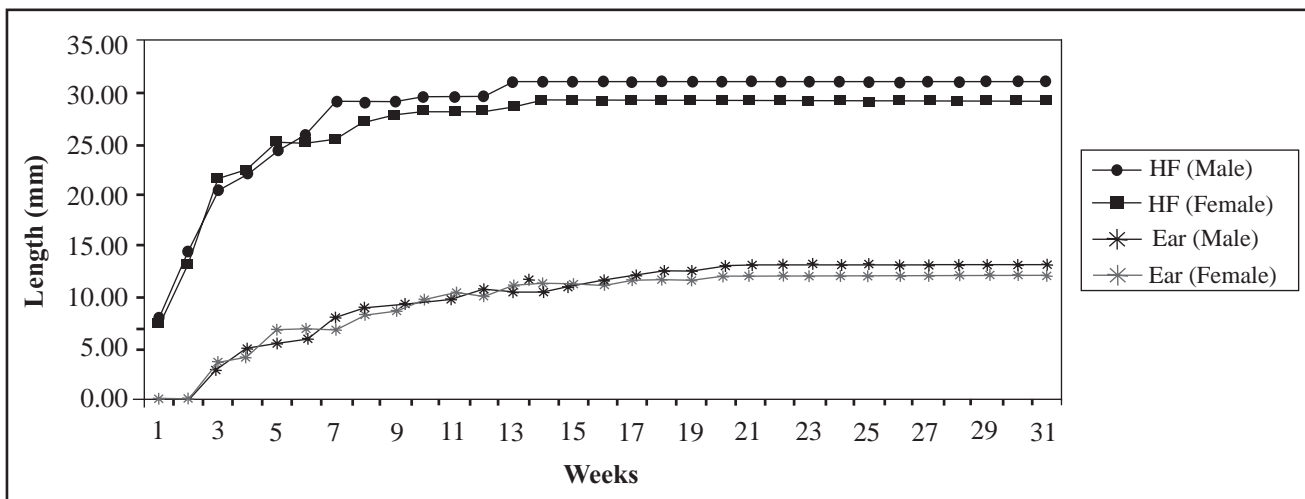


Figure 2. Growth curve for hind foot (HF) and ear length in *Nasokia indica* from birth to 30 weeks of age

weeks i.e., 69.2 and 72.9% for males and females, respectively. Though the development in HF, tail and ear completed with in 12-19th week, length of HB took longer time to stabilize as males and females showed a mean HB of 192.5 and 155 mm in 29th week. (Figures 1 & 2). Here also maximum growth rate of 65.77% in males and 74.78% in females was achieved during first eight weeks only (Table 1&2). Haque and Islam (2002) have also reported higher values of HB, HF, Tail and Ear for males during 100 days observation on post natal development of *N. indica*. Reports of Prakash (1981) on Indian desert gerbil, *Meriones hurrianae*, which is relatively a smaller rodent, indicated complete growth of HB, HF, tail and ear by 17, 13, 17 and 6 weeks, respectively after birth.

Like various body parts the weight gain by *N. indica* was also higher in females (45.4%) than males (32.5%) during first two months (0-8 weeks). Later on during 9-12 and 13-16th week it was reduced to 4-9 %. However, the trend reversed on subsequent weeks when the growth rate increased to 17.0 and 14.8 % (males) and 10.3 and 15.1% (females) during 17-21 and 21-24 week, respectively. Initially (up to 5 weeks) the body weight of males and females was closely comparable but after wards there was steep increase in body weight gain by males. Though males were heavier than females since birth the difference peaked to 232.5 (males) and 123.5g (females) during 29-30 week after birth (Figure 3). Similar trend in body weight in *N. indica* was also reported by Haque and Islam (2002) from

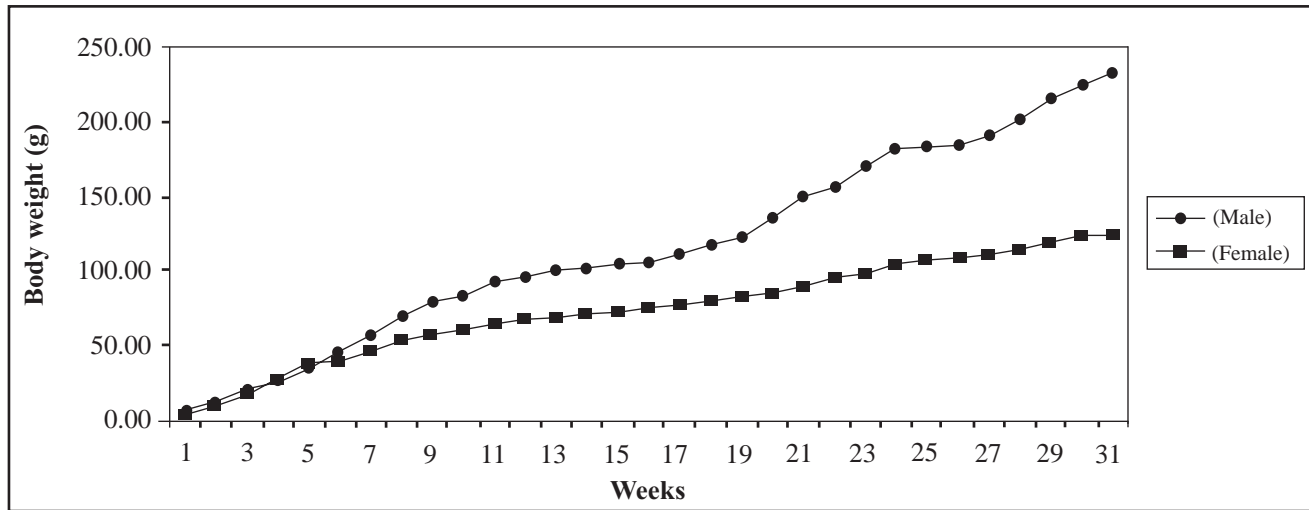


Figure 3. Growth curve for body weight of *Nesokia indica* from birth to 30 weeks of age

Bangladesh. Prakash (1981) also reported that *M. hurrianae*, continued to register gain in body weight even up to 25 weeks after birth.

Parental care and cannibalism

Parturient mothers, just after delivery took 6-7 minutes for taking care of their young ones. Mother licked and picked the pups holding their neck safely between their jaws and putting them inside the nest chamber. When young ones were removed from its mother for recording observations, the pups produced faint squeaks and mother protested against intruding hand by moving fast in the cage. It was observed that *N. indica* takes greater care of their young ones as compared to desert dwelling rodents. Mother did not allow even 7-8 weeks old young ones to go near water bowl or away from the nest chamber. Cannibalism, which is very common in many rodents (Prakash 1964; Prakash *et al.*, 1971) was not observed in this species during the present study. However, Haque and Islam (2002) from Bangladesh have reported cannibalism in this species within first three days of the birth.

Lactation period

Suckling was noticed 4-5 hrs after delivery. Initially the mothers helped the pups reaching the nipples. During suckling, mother used to hide them in such a way that the young ones could not be seen from outside. Under captive conditions the lactation length extended up to 30 days.

Since, the short tailed mole rat has been reported recently in irrigated crop fields and orchards of arid region particularly from Bikaner and Churu districts, less

information is available on its breeding and role in arid agriculture. Tripathi and Idris (2004) observed 1.2 per cent damage in cotton field and 5-7 per cent damage in perennial trees *viz.*, lemon (in orchards) and *Prosopis juliflora* (in forest). Jain *et al.*, (1995) have also reported 4.4-10.0 per cent damage to 2-10 years old forestry plantations of *P. juliflora*, *Parkinsonia aculeata*, *Acacia tortilis* etc. It also caused considerable damage to sugar cane (Parshad, 1987), cereals and vegetable crops (Ramesh, 1989) in adjoining states of Rajasthan. As the breeding season of most of the rodents correlate with cropping pattern, the findings of this study on breeding and post natal development would help to formulate effective management strategy to manage newly introduced rodent species, *N. indica* in arid cropping systems and forestry.

The present study reveals that *N. indica* breeds during October and November in arid conditions. The control practices applied during this period will not provide better result. Since, the young ones would not eat poison bait as they start nibbling grains at the end of fourth week of their birth. During this period only adult population will be suppressed. Keeping in view, the management practices should applied either prior to breeding season (October and November) or after one month to achieve significant control success.

References

- Agrawal V C 2000. Records of the zoological survey of India: Taxonomic studies on Indian Muridae and Histicidae (Mammalia: Rodentia). Occasional paper No 180, Zoological Survey of India, Calcutta. Pp 1-177.

- Agrawal V C and Prakash I 1992.** Ecology distribution of Indian rodents. In: Rodents in Indian Agriculture.(eds. Prakash I and Ghosh P K) Scientific Publishers, Jodhpur. Pp 1-10.
- Al-Jumaily M M, Nader I A and Bunni M K 1975.** Natural history study of the Bandicoot rat, *Nesokia indica* (Gray and Hardwicke). *Bulletin Natural History Research Centre. University of Baghdad* **6** : 55-59.
- Aplin K P, Brown P R, Jacob J, Krebs C J and Singleton G R 2003.** Reproduction and growth in rodents. (In Field Methods for Rodent Studies in Asia and the Endo-Pacific). Australian Center for International Agricultural Research, Canberra. Pp 61-70.
- Haque M E 1993.** Biology, ecology and control of short tailed mole rat, *Nesokia indica* (Gray) in Bangladesh. Ph.D. thesis, University of Dhaka. Pp 1-161.
- Haque M E and Islam S M N 2002.** Early post natal growth and behavioural development in the short tailed mole rat. *Bangladesh Journal of Agricultural Research* **27** : 143-150.
- Jain A P, Tripathi R S and Patel N 1995.** Influence of aridity on burrowing and other behavioural traits of *Nesokia indica* Gray. *Annals of Arid Zone* **34** : 67-69.
- Parshad V R 1987.** Rodent damage and control in sugarcane. *Indian Sugar* **37** : 341-345.
- Prakash I 1964.** Eco-toxicology and control of the Indian desert gerbil *Meriones hurrinae* (Jerdon)-II Breeding Season, litter size and postnatal development. *Journal of Bombay Natural History Society* **61** : 142-148.
- Prakash I 1981.** Ecology of Indian Desert gerbil, *Meriones hurrianae*. Monograph No 10, Central Arid Zone Research Institute, Jodhpur. Pp 1-87.
- Prakash I, Jain A P and Purohit K G 1971.** A note on the breeding and post natal development of the Indian gerbil, *Tatera indica* (Hardwicke, 1807) in Rajasthan desert. *Saugetier Mttel* **19** : 375-380.
- Ramesh P 1989.** Habitat selection in short tailed bandicoot rat. *Annals of Arid Zone* **28** : 323-324.
- Ramesh P 1992.** The short tailed mole rat, *Nesokia indica* Gray. In: Rodents in Indian Agriculture (eds. Prakash I and Ghosh P K) Scientific Publishers, Jodhpur. Pp 165-171.
- Saxena R N and Gariyali V 1980.** Physiology and Neuroendocrine control of reproduction in female short-tailed rat, *Nesokia indica*. In: Studies on Rodent and their control. (ed. P.K. Ghosh) The Meghalaya Science Society, Shillong. Pp 110-111.
- Tripathi R S and Idris M 2004.** Burrowing pattern of short tailed mole rat, *Nesokia indica* Gray in irrigated crop fields and orchards in arid zone. *Indian Journal of Plant Protection* **32** : 145-146.
- Tripathi R S and Jain A P 1990.** Rodent damage to desert afforestation plantations. *Rodent Newsletter (ICAR)*, Jodhpur, India. **14** : 7-8.

Received : 09-03-2012

Accepted : 10-06-2012