

REPRODUCTION AND POPULATION DYNAMICS OF THE INDIAN GERBILLE, *TATERA INDICA* (HARDWICKE)

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Some reproductive and demographic parameters of a cropland population of the Indian gerbille (*Tatera indica*) were studied from 1977 to 1980 in central Punjab. The females ceased to reproduce during December-February. The smallest visibly pregnant female weighed 56.7 g and had a body length of 12.7 cm. The annual rate of pregnancy varied from 22.7% to 47.2%; the average for the three years being 33.16%. Two pregnancy peaks one in April-May and one in October-November were noted. The embryonic litter size was $6.76 \pm .344$ (S.E.) (range=2-10; N=39). The maternal body weight and size of litter were positively correlated ($r = .56321$; d.f.=31; $p < .001$). The litter tended to be larger in April-May and October-November than those of other bimonthly periods. The average annual rate of reproduction was 47.32 young/female/year.

The proportion of sub-adults and juveniles in the yearly samples ranged from 16.7% to 26.5% and from 6.1% to 6.3% respectively and the respective averages for the entire period of study were 22.9% and 12.6%. The ratio of the two sexes approximated the hypothetical 1:1. The relative density of the gerbilles fluctuated widely in different crops. These fluctuations were largely due to movement of the gerbilles between the crops and between the cropped and non-cropped areas.

INTRODUCTION

Formerly, the Indian gerbille (*Tatera indica*) in Punjab was largely confined to the banks of rivers above the flood level. When the tropical thorn plain of the doabs was converted to agricultural land and linked to the riparian habitat by the canal system, the gerbille penetrated the doabs along irrigation canals (Taber *et al.*, 1967) and infested the croplands. Presently, it is considered to be one of the most important rodent pests of agriculture in the Punjab.

The present study documents information on some reproductive and demographic parameters of the gerbille population living in the croplands of the central Punjab.

MATERIALS AND METHODS

Specimens of the Indian gerbille were snap-trapped every month from irrigated farmlands of the central Punjab from December 1977 through November 1980. Fifty to ninety traps were set for two to three successive nights. The traps were set in straight lines in groups of three; the distances between successive groups being 15 meters. All major crops, namely, wheat, sugarcane and fodder and such minor crops of the study area as cotton, rice, pulses and vegetables and some alkaline tracts were also trapped.

The specimens caught were autopsied for reproductive data. Christian's (1950) method was followed to prepare smears of cauda epididymes and testes. The reproductive tracts of the females were examined for visible uterine swellings. The rate of reproduction was computed using Southwick's (1966) procedure. Body weight, body length and condition of the reproductive tracts were used for estimating the age of the gerbille.

RESULTS

Reproduction

Breeding season

Fertile males were recorded in all the months of the year except December. The proportion of such males in the samples of January and November was 11% and 17%, respectively, whereas the average for the remaining nine months of the year was 87%.

The first pregnant females of the season were caught not earlier than March 9 and the last one not later than November 11. Thus, the females apparently did not breed during December - February.

Sexual maturity

The smallest sexually mature male weighed 61.1 g and measured 12.8 cm. The smallest visibly pregnant female weighed 56.7 g and measured 12.7 cm long.

Pregnancy rate

Table 1 documents information about seasonal and annual variations in

Table 1. Rate of pregnancy (sample size) and embryonic litter size in *Tatera indica*

Parameters	Bimonthly periods					
	D-J	F-M	A-M	J-J	A-S	O-N
1977-78						
Pregnancy rate (%)	—(9)	85.71 (7)	69.23 (13)	33.33 (9)	50.00 (4)	50.00 (2)
Litter size	—	6.67 (6)	7.89 (9)	6.33 (3)	7.00 (1)	9.00 (1)
1978-79						
Pregnancy rate (%)	—(4)	25.00 (8)	30.77 (13)	15.38 (13)	33.33 (6)	—
Litter size	—	6.00 (2)	7.50 (4)	5.50 (2)	4.50 (2)	—
1979-80						
Pregnancy rate (%)	—(3)	6.26 (16)	100.00 (1)	62.50 (8)	42.86 (7)	50.00 (2)
Litter size	—	13.00 (1)	7.00 (1)	5.20 (5)	4.00 (1)	6.00 (1)
Combined for three years						
Pregnancy rate (%)	—(16)	29.03 (31)	51.85 (27)	33.33 (30)	41.18 (17)	50.00 (4)
Litter size	—	7.22 (9)	7.72 (14)	5.60 (10)	5.00 (4)	7.50 (2)
						33.60 (125)
						6.76 (39)

pregnancy rate. In the 1977-78 sample, the proportion of pregnant females was 47.72%; December - January being the period of reproductive quiescence. Pregnancy peaked in February - March and ebbed in June - July and then improved during the subsequent two bimonthly periods. In 1978-79 the annual rate was 22.72%; there being little variations during the bimonthly periods. The annual rate of pregnancy in 1979-80 was 29.72%. During this year, pregnancy rate was very low in February - March past which it greatly improved and peaked in April - July.

The yearly data pooled on bimonthly basis indicated two pregnancy peaks one in April - May and one in October - November. The average rate of pregnancy for the three years was 33.60%.

Litter size

The annual embryonic litter size in the gerbille did not vary significantly (Table 1). However, bimonthly litters (computed from pooled data of three years) were statistically different ($F = 2.6530$; d.f. = 4,34; $P < .05$) and the litters tended to be larger in February - March, April - May and October - November as compared to those of the remaining bimonthly periods. The average litter size was $6.76 \pm .344$ (S. E.) (range = 2 - 10; $N = 39$).

The maternal body weight and the number of embryos were found to be positively correlated ($r = .56321$; d.f. = 31; $P < .001$), whereas the maternal body length was not correlated with the litter size.

Rate of reproduction

The rate of reproduction during the three years of the present study was variable. High rate in 1977-78 was largely due to higher pregnancy rate and somewhat larger litter size than during the following two years. The average annual rate of reproduction was 47.32 young/female/year (Table 2).

Table 2. Annual variations in the rate of reproduction in *Tatera indica*.

Year	Rate of pregnancy (%)	Litter size (l)	Incidence of pregnancy (f)*	Young/female (l x f)
1977-78	47.72 (44)	7.30 (20)	9.95	72.64
1978-79	22.72 (44)	6.20 (10)	4.73	29.33
1979-80	29.72 (37)	6.22 (9)	6.19	38.50
Weighted Average	33.60 (125)	6.76 (39)	7.00	47.32

* Incidence of pregnancy 'f' was calculated according to Southwick, (1966).

The bimonthly rate of reproduction (computed from the data of three years) varied considerably with two peaks, one in April - May and the other in October - November (Table 3 and Fig. 1 a).

Table 3. *Bimonthly variations in the rate of reproduction of Tatera indica. (These estimates are based on combined bimonthly data of three years).*

Bimonthly period	Rate of pregnancy(%)	Litter size (l)	Incidence of pregnancy (f)	Young/female/yr (l x f)
D - J	—	—	—	—
F - M	29.03 (31)	7.22 (9)	0.97	7.06
A - M	51.85 (27)	7.72 (14)	1.80	13.95
J - J	33.33 (30)	5.60 (10)	1.16	6.50
A - S	41.18 (17)	5.00 (4)	1.43	7.17
O - N	50.00 (4)	7.50 (2)	1.73	13.07
Weighted Average	33.60 (125)	6.76 (39)	7.00	47.32

Population structure

Age composition

The proportion of adult gerbilles in the annual samples ranged from 58.99% to 69.05% and the average for the three years was 64.45 %. The proportion of sub-adults and juveniles in the yearly samples ranged from 16.67 % to 26.52 %, and from 6.06 % to 16.29 %, respectively and the averages for the entire period of the study were 22.94% and 12.61%, respectively.

In the pooled bimonthly samples the proportion of adults peaked in February - March and then continually declined till upward trend was reset in October - November. The sub-adults were rare in the February - March and entirely absent from the April - May samples. During the remaining bimonthly periods, the proportion of sub-adults ranged between 27.95 % to 36.84 %. The juveniles were most abundant in April - May and the least in February - March.

Sex ratio

In none of the three age categories the ratio of the two sexes deviated significantly from 1 : 1. The ratio of the two sexes in the combined sample of all the age categories was 1 : 0.89 (N=436).

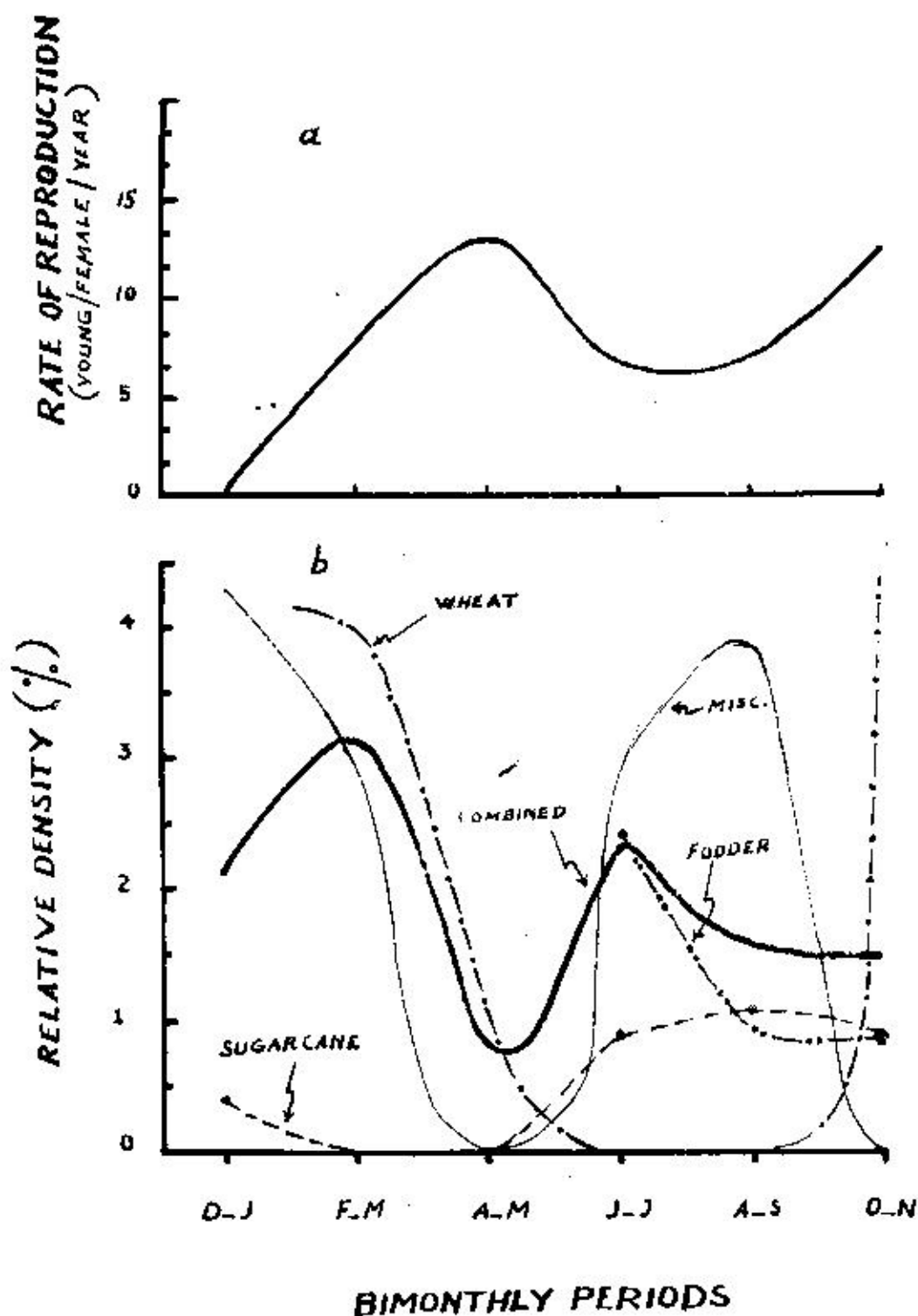


Fig. 1. Bimonthly changes in the rate of reproduction (a) and relative density (b) in the Indian gerbille (*Tatera indica*).

Relative density

Trap success has been used here to assess the relative density of the Indian gerbille in different types of sub-habitats found in the cultivations of the study area. Fig. 1b elucidates bimonthly variations in relative abundance of the Indian gerbille in various sub-habitat types.

Sugarcane

Sugarcane crop is the most stable subhabitat in the croplands as it remains in the field almost throughout the year. The cane crop is generally planted in February. By July the plants attain a height of about 5 ft and canes get mature by early October. Harvesting of the cane generally begins in October and continues through April. As a result of a protracted harvesting period, the acreage of the cane crop decreases progressively.

Excepting February-March and April-May, the gerbilles were captured from sugarcane fields during all the bimonthly periods. It was noted that they rarely burrowed in the cane fields. Perhaps they visited the cane fields from adjacent subhabitats for foraging.

Wheat

Wheat is the most important crop of the study area. Normally it is sown in October-November, heading takes place in February-March ripening in April and by the end of April the crop is harvested. The gerbille affected the wheat fields in fairly good numbers from sowing through the heading and maturation period of the crop. During ripening and preharvesting phases, however, fewer gerbilles were left in the fields.

Leguminous fodder crops

Leguminous fodder crops, namely, berseem (*Trifolium alexandrinum*), shaf-tal (*T. repens*) and lucern (*Medicago sativa*) are generally sown in October and remain in the field till June. The crops were trapped during all bimonthly periods but no specimens of *T. indica* could be captured from them.

Fodder crops of the grass family

This group of fodder crops included maize, millet and sorghum which remain in the field from May to November. The gerbilles were caught in these crops from June to November but maximum abundance was recorded in June-July when vegetation cover is generally scanty in the croplands.

Miscellaneous sub-habitat

The miscellaneous sub-habitat was comprised of such minor crops as cotton, rice pulses, vegetables, and some small and scattered tracts of alkaline wastes. The gerbilles inhabited the miscellaneous sub-habitats in relatively good numbers in all the bimonthly periods excepting April - May and October - November.

DISCUSSION

Reproduction and Population Structure

From the studies of Prasad (1953, 1961), Prakash (1962) and Beg and Ajmal (1977) it appears that the reproduction peaks and the length of the breeding season in the Indian gerbille is adjusted to the local climatic conditions. The result of the present study indicates that the gerbille breed round the year except during the two coldest months (December - January) of the year. The breeding peaks occurred during April - May and October - November which are periods of moderate temperatures and abundant food supply. During these periods the rate of pregnancy was high and larger litters were produced.

The present Indian gerbille population did not breed as rapidly as do *Mus musculus*, *Bandicota bengalensis*, *Rattus meliada*, and *Rattus rattus* populations in the croplands of the central Punjab (Khan, 1982; Beg *et al.*, 1983a). Nevertheless its rate of reproduction is high enough to enable it built its population rapidly provided the same is not cancelled by high mortality. The present data on age structure of the gerbille suggest considerably high post-natal mortality, especially among the young animals.

Relative density

The observed seasonal fluctuation in the rate of reproduction and density changes in the present gerbille population are not harmonious. Sudden build-ups and retractions in its population seem to be largely related to inter-crop movements and movements between the cropped and non-cropped areas. Immediately after the April-May reproduction peak, for example, the gerbille density reached its lowest ebb in all sub-habitats. This precipitous decline particularly in the wheatlands cannot be attributed to mortality alone. As the gerbilles are known to leave the wheat fields well before the harvesting of the crop (Beg *et al.*, 1983b), the possibility of mortality due to harvesting operations can be easily ruled out. As the gerbilles are least abundant during late spring and early summer all over

the cropland, it seems that they temporarily leave the croplands and do not return till vegetational cover improves by mid-summer. Thus, unlike other species of rats and mice which find enough forage and shelter in the croplands and stay there throughout the year, the Indian gerbille must also utilize the resources of non-cropped areas for its sustenance.

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