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Breeding Activity of Indian Gerbil *Tatera indica* Hardwicke in and Around Hisar

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Abstract The present investigations on breeding activity of *Tatera indica* were carried out in and around Hisar. Maximum testicular activity was seen in the months of January and February when the diameter of the seminiferous tubules and the testes was maximum and histology revealed all the stages of spermatogenesis. The size of ovaries was also large in January and February with a less number of developing follicles, whereas ther was an increased number of developed follicles with ova during these months.

Key words Breeding activity, Testicular activity, Ovarian activity, *Tatera indica*

A majority of the mammalian species are seasonal breaders while some are continuous breeders. Among the seasonal breeders, there is a great variation in te time of breeding. Wild rodents invariably breed in the monsoon seson and also in the months of January and February. Rodents are the prolific breeders and the young ones start breeding as soon as they are just three months old. This fast rate of breeding has been mainly attributed to the promiscuous behaviour of the females.

Research has been carried out on different aspects of reprodutive biology in different vertebrates but the information on the rodents is still scanty (Jain 1970, Prakash *et al.* 1973). The knowledge of the reproductive biology of *Tatera indica*, therefore, becomes essential for the effective management in the fields. Present studies were taken up to cover; i) the seasonal changes in gonadal weights, and ii) ovariun and testicular activity as revealed by histology.

Materials and Methods

Wonder traps and the simple wooden traps were used to catch *Tatera indica*, in and around Hisar. The traps with pre- baits were set in a grid fashion at a distance of 10 m. The specimens were identified following Barnett and Prakash (1975). Monthly samples were obtained from the fields in the first week of every month. Before sacrificing, the gerbils were acclimated for four days under laboratory conditions. On the day of autopsy they were weighed on atop loading balance and then sacrificed. Gonads were dissected out and weighed. Care was taken to record the weight of the

Table 1 *Mean monthly changes in testiculr weights (g) in Indian gerbil*

Month	Weight (mean ± SE of five)					
	Body	Left testis	Rioght testis	Testicular	Testis weight $100g^{-1}$ body weight	't'
October	134.0±5.07	2.17±0.09	2.14±0.95	2.16±0.09	1.60±0.02	NS
November	137.8±1.64	2.26±0.03	2.22±0.03	2.24±0.02	1.62±0.02	NS
December	139.8±1.86	2.32±0.04	2.34±0.03	2.33±0.04	1.63±0.03	NS
January	129.0±4.2	2.13±0.03	2.13±0.026	2.13±0.27	1.66±003	P<0.01
February	120.4±5.02	2.20±0.09	2.24±0.09	2.22±0.095	1.85±0.04	NS
March	107.4±9.63	1.91±0.17	1.86±1.6	1.88±0.164	1.76±0.02	P<0.01
April	127.0±4.4	2.06±0.09	2.04±0.08	2.05±0.09	1.61±0.03	P<0.05
May	132.2±6.8	1.83±0.13	1.79±0.12	1,81±0.12	1.48±0.04	P<0.05
June	130.0±2.8	1.80±0.13	1.72±0.11	1.76±0.12	1.35±0.03	

Table 2 *Testicular activity in the Indian gerbil during different months*

Months	Diameter (mm) of six				
	Seminiferous tubules*	't'	Testes*	't'	Testicular response **
October	0.13±0.003	NS	4.28±0.09	P < 0.01	+
November	1.14±0.006	P < 0.02	5.18±0.08	P < 0.01	+
December	0.02±0.003	NS	6.10±0.08	NS	+
January	0.17±0.004	P < 0.001	6.28±0.28	P < 0.001	+ + + +
February	0.19±0.006	NS	7.43±0.47	P < 0.001	+ + + +
March	0.18±0.002	P < 0.01	7.37±0.50	P < 0.001	+ + + +
April	0.15±0.005	P < 0.001	4.28±0.09	P < 0.001	+ + + +
May	0.12±0.005	NS	3.57±0.15	P < 0.001	+ + +
June	0.11±0.002		3.53±0.19		+ +

* Mean ± SE of mean.

** The average speramtogenic response in the seminiferous tubules was expressed in arbitrary units.

(+ = spermatogonia, + + = monstly spermatocytes), + + + = mostly spermatocytes and spermatids), and + + + + = spermatogenesis active all stages of spermatogenesis. Value of P was calculated by students 't' test.

right and left gonads separately. Then the gonads were fixed in Bouin's fluid for 18 h for histological studies. Transverse sections of the testes (5μ) and ovaries (7μ) were cut and stained in hematoxylin Eosin. Differential counts of the cell types in the seminiferous tubules were made by the methods described by Balinskly (1970) and following stages were identified, i) Spermatogonia, ii) Primary spermatocytes, iii) Spermatids, and iv) Spermatozoa.

Mean diameter of the testes, seminiferous tubules; ovaries and their ducts was taken by using the Sipcon projection microscope. In addition mean number of developing, developed, ruptured follicles and corupus lutea were also identified and recorded from the stained sections during different months of the year.

For comparison of data, all gonadal weights were calculated on a 100 g body weight basis. 'P' value between the different groups were calculated by the students 't' test (Snedecor & Cochran 1971).

Results and Discussion

Testicular cycle : The mean testicular weight was normal from October to December whereas, there was a gradualincrease in the weight in the next two moths and again a decrease from March to June (Table 1). The diameter of the seminiferous tubules and teste was found to be maximum during the months of January and February (Table 2).

Histology revealed the presence of all the four stages of spermatogenesis indicating the maximum reproductive activity of the male animals during these months (Fig. 1 a b & c). Testes and the seminiferous tubules with a smaller diameter were observed from October to December (Fig. 2 a,b & c) and a similar observation was made during the months of March to June (Fig. 3 a,b,c,d,e & f). Active spermatogenesis was not observed and only spermatogonia alongwith spermatocytes were visible during the months of October & November (Fig. 2 a & b). Maximum reproductive activity was observed during the months of January and February (Fig. 1 a,b & c), where all the stages of speramatogenesis were observed. Bundles of spermatozoa filling the centre of the seminiferous tubules were seen. During March and April, although the dimater of seminiferous tubules started decreasing yet all the four stages of active spermatogenesis could be observed (Fig. 3 a & b).

A drastic decrease in the weight of testes during May and June took place. Thereafer the diameter of the testes as well as of seminiferous tubules declined and the spermatogenesis could notbe observed, only the spermatogonia and long spermatocytes were seen (Fig. 3 c,d,e & f).

PLATE 1

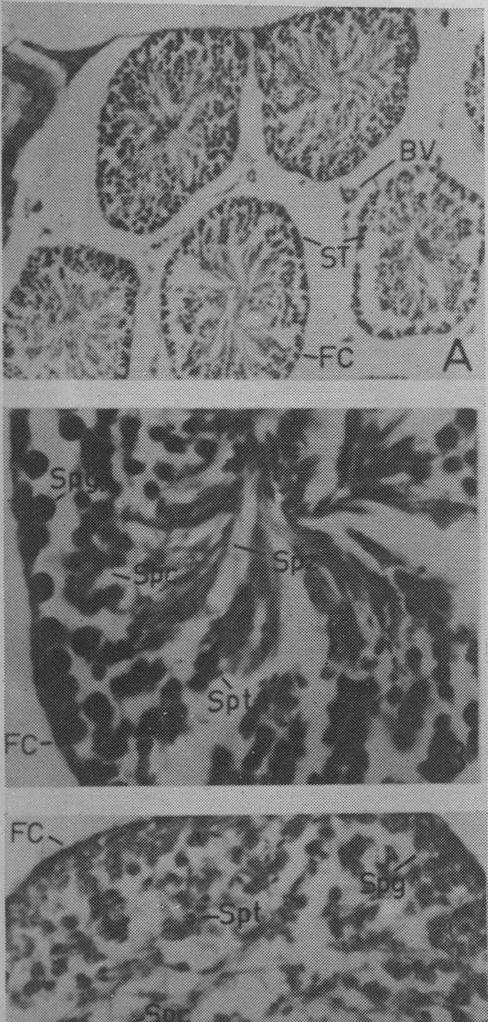


PLATE - II

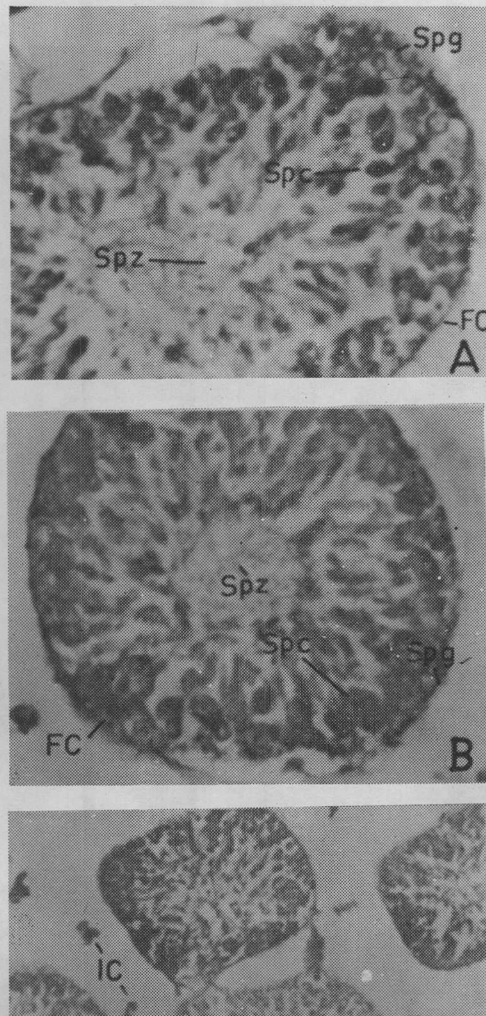


Fig Transverse section of testis and the seminiferous tubules showng the stages of spermatogenesis during different months., **1a)** Seminiferous tubules with all stages of spermatogenesis (January). 1500, **1b)** Seminiferous stubues with spermatogonia, spermatocytes, spermatides and spermatozoa. (January). x 3700, **1c)** Seminiferous tubule with spermatogonia, spermatocytes, spermatids and spermatozoa (February) x 3700, **2a)** Seminiferous tubules with spermatogonia, spermatocytes asnd few residual spermatozoa (October) x 3700, **2b)** Seminiferous tubules with spermatogonia, spermatocytes and few residual spermatozoa (November) x 3700, **2c)** Seminiferous tubule with spermatogonia, spermatocytes and few residual spermatozoa (December) x 1500.

PLATE III

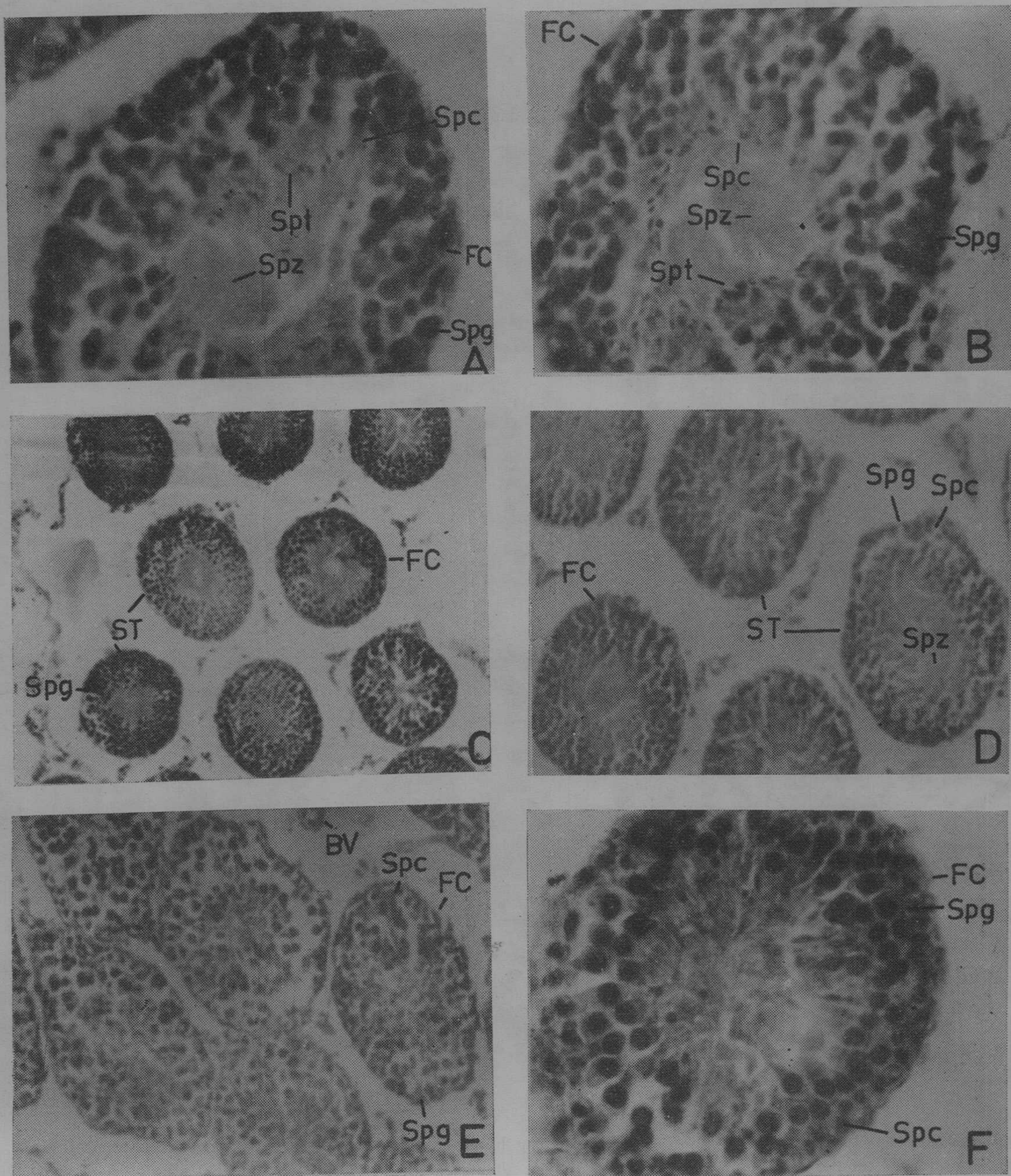


Fig 3a) Seminiferous tubuels with all the stages of spermatogenesis (March) x 3700, **3b)** Seminiferous tubule with all the stages of spermatogenesis (April) x 3700, **3c) & d)** Decreased dimeter of testis and the seminiferous tubules with only spermatogonia, spermatocytes and few residual spermatozoa (May) x 1500, **3e)** Testis with only spermatogonia and spermatocytes (June) x 1500, **3f)** Seminiferous tubule with only spermatogonia and spermatocytes (June) x 3700

Table 3 *Mean monthly changes in ovarian weights (mg) in Indian gerbil*

Month	Weight (mean±SE of five)					
	Body	Left ovary	Right ovary	Ovarian	Ovary weight 100 g body weight	't'
October	123.2±3.4	92.0±4.3	90.2±2.5	91.2±4.25	73.9±0.87	NS
November	128.2±4.08	94.4±7.8	99.6±6.05	97.7±7.4	75.6±3.33	NS
December	122.6±4.77	103.8±7.5	101.4±8.2	102.6±7.8	83.7±4.54	NS
January	103.0±5.70	97.0±5.15	94.8±3.9	95.9±4.5	93.0±2.01	NS
February	106.0±5.2	98.0±5.12	94.8±3.9	96.4±4.5	09.0±2.04	$P < 0.01$
March	100.0±3.54	90.4±2.7	69.2±2.17	97.3±2.4	79.3±1.22	$P < 0.01$
April	108.8±3.21	88.4±2.28	85.6±2.7	87.0±2.69	71.0±0.76	$P < 0.01$
May	103.0±2.97	64..4±3.36	61.4±3.36	62.9±3.31	61.0±1.27	$P < 0.01$
June	100.0±3.2	48.0±5.12	44.8±3.6	46.4±4.5	46.4±1.26	

Ovarian cycle : The weight of the ovaries was normal from October to December with the gradual in crease during the months of January and February followed by a gradual decrease from March to June (Table 3).

Size of the ovaries was large, number of the developing follicles was less while the number of developed follicles with ova increased during the months of January and February (Fig. 4 a & b). Moreover, a significant increase in the diameter of ovaries was also observed. On the other hand ovaries were exremely small with small diameter from October to December (Fig. 5 a, b & c). Histological studies had revealed the presence of only developing follicles with no developed or ruptured follicles (Fig 5 a) during October. During November developing follicles with few developed and ruptured follicles (Fig. 5b) were obtained. Corpus lutea were observed during December (Fig. 5 c).

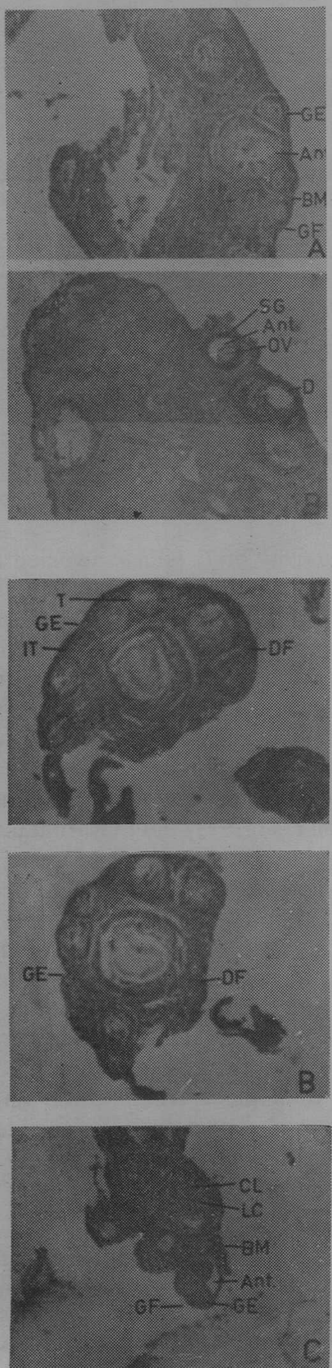
After a maximum activity during January and February ovaries once again started regressing and were hardly distinguishable from the surrounding tissue (Fig. 6 a,b,c,d,e,& f). However, during March developed follicles and some corpus lutea were obtained (Fig. 6 a & b). During April their weight started declining, number of ruptured folicles were higher (Table 4) as compared to developed or developing follicles (Fig. 6 c & d). The weight of the ovaries further reduced during May and June, however the number of ruptured follicles and corpus lutea increased (Fig. 6 e & f).

The breeding activity of *T. indica* revealed a maximum activity from December through March and a regression thereafter till June. Whereas itbreeds from September to March in the environments of Delhi (Prasad 1954), November in Madhya Pradesh (Khajuria 1955), and during Mach in West Bengal (Parrack 1966). In Rajasthan, the breeding in this gerbil occurs throughout the year with pregnancy reaching a peak during monsoon season (Prakash et al. 1971) but in Karnataka bimodal pattern was oberved one during January, Febrary and March and the other durng October-November (Prasad 1961). Chandrahas (1975) showed a complete cessation of the female sexual activity during May to July. It was further concluded that the GSI (Gonado Somatic Index) started increasing significantly during December, January and February and thereafter a sudden nd significant derease took place from March onwards. It was further observed that the female shows some peaks in breeding while the male *T. indica* remains almost active throughout the year.

Reproductive activity of *T. indica* shows an inverse relationship with the seasonal changes in day length and temperature (Fig. 7). This clearly shows that the reproductive activity is not in fluenced by these two extrinsic factors and some other factors like rainfall, food or te cropping pattern and atmospheric humidity may be providing stimulation for the successful reproduction.

Significance of the day length in the regulation of reproductive activity in rodents in the desert of

PLATE IV



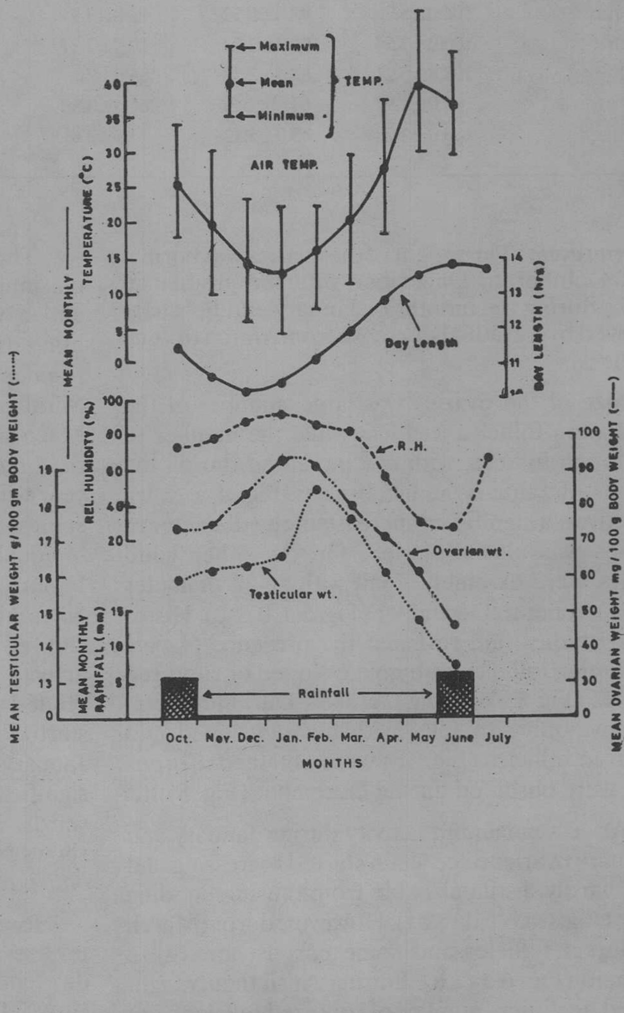


Fig Transverse section of the ovary in different months., **4a)** Ovary with growing follicles and Antrum (January) x450, **4b)** Ovary with developed follicles, ovum of and Antrum (Februar) x 450, **5a)** Ovary with a large number of developing follicles x 450, **5b)** Ovary showing the presence of developing follicles (November) x 450, **5c)** Ovary with growing follicles and Antrum x 450 **7)** Influente of environmental factors on reproductive activity.

PLATE VI

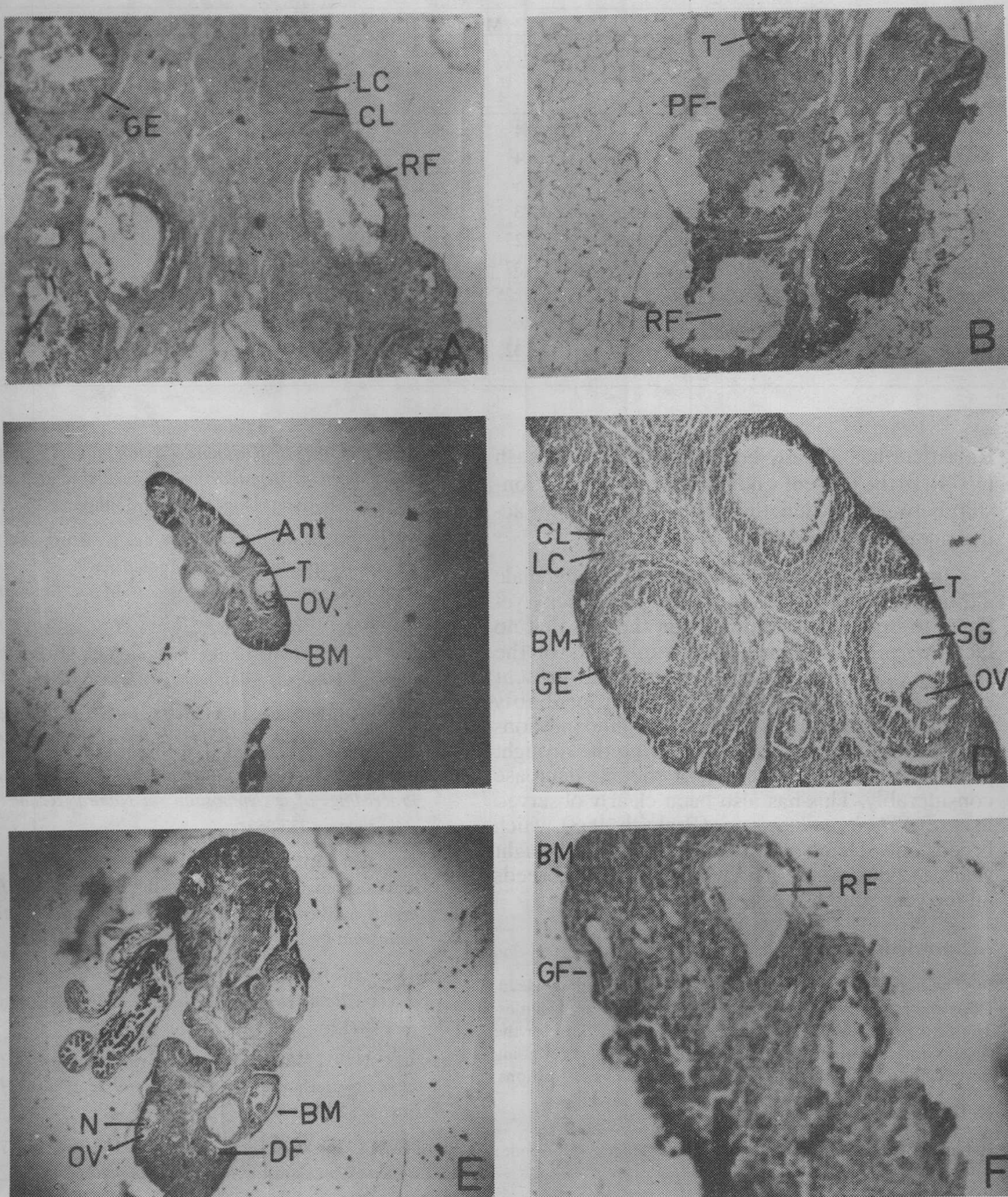


Fig 6 Transverse section of ovry in different months. **a)** Ovary showing the presence of ruptured follicle (March) x 450, **b)** Ovary with ruptured follicle (March) x 450, **c)** Ovary with ovum in the developed follicle (April) x 120, . **d)** Ovary with the developed follicle (April), x 450, **e)** Ovary with developing follicles (May), x 450 and **f)** Ovary with ruptured follicle (June) x 450

Table 4 *Ovarian activity in Indian gerbil (Tatera indica) during different months*

Months	Mean + SE of five								
	Developing follicles	Developed follicles	Ruptured follicles	C.L.	Total number of follicles	Ovarian diameter (mm)	't'	Diameter of duct	't'
October	7.4±0.4	1.0±0.02	0±0	0.8±0.4	8.2±0.4	0.54±0.026	NS	0.36±0.013	NS
November	9.6±0.8	1.2±0.03	3.6±0.93	1.2±0.4	15.6±0.4	0.58±0.026	NS	0.38±0.012	NS
December	86.±0.6	1.2±0.06	3.9±0.60	1.2±0.6	14.9±1.7	0.60±0.03	P < 0.001	0.38±0.01	NS
January	5.3±0.99	1.4±0.22	4.5±0.67	1.3±0.3	12.5±1.5	0.86±0.10	P < 0.001	0.39±0.015	P < 0.01
February	3.0±1.04	1.4±0.25	6.0±0.25	1.7±0.25	12.1±0.25	0.80±0.80	NS	0.52±0.14	NS
March	3.0±0.32	1.6±0.26	5.8±0.4	2.2±0.37	12.6±1.16	0.80±0.03	P < 0.001	0.50±0.021	NS
April	2.0±0.18	2.5±0.29	8.8±1.03	2.25±0.25	15.5±1.23	0.78±0.08	P < 0.001	0.38±0.02	NS
May	0.5±0.29	= +0	2.8±0.37	2.0±0.0	5.3±0.45	0.50±0.08	NS	0.35±0.002	NS
June	0±0	0±0	3.8±0.27	1.7±0.32	5.5±0.29	0.46±0.06		0.29±0.03	

Rajasthan has already been provided by Prakash (1974). In the present studies, however, no relationship between day length and the reproductive activity could be established.

Interestingly enough, the male and the female although exhibited seasonal gonadal cyclicity yet failed to breed as is evident from the fact that no lactating/pregnant females or sub-adults of the species were ever observed during the present course of ivestigations. This most probably reflected the prevailing servere drought conditions in this area. This indicate that during the drought years, the breeding potential of rodents decrease considerably. This has also been clearly observed in case of *Meriones hurrianae* (Prakash 1968), which breeds only during monsoon season in the drought years and during years of normal rainfall it breeds all the year round.

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