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HISTOLOGICAL CHANGES IN THE OVARY OF THE BAT *Taphozous kachhensis* (Dobon) DURING VARIOUS PHASES OF REPRODUCTIVE CYCLE

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ABSTRACT

The histological structure of ovary of the bat *Taphozous kachhensis* (Dobon) was studied during different phases of reproductive cycle. The female mature bats were collected; dissect-out and respective organ were fixed in bouins fixative for histological observation. During quiescence period no significant histological changes were observed in both ovaries, but during breeding period right ovary showed the development of Grafian follicle while in left ovary only some multilaminar follicles were seen. The study revealed that there was dominance of right ovary over left one; and right ovary seems functional during breeding cycle. The persistence of functional corpus luteum in the ovary of *T. kachhensis* throughout gestation indicated that the ovary may be the major source of progesterone, necessary for the maintenance of pregnancy in the species.

Key words: Bat, corpus luteum, Grafian follicle, histology, ovary, *Taphozous kachhensis*

INTRODUCTION

The endocrine gland plays a vital role in the reproductive physiology of the Chiropteran species. Endocrine control of reproduction in bats has been reviewed by Anthony (2000). The role of gonadal hormones in the reproduction of the bats has been reviewed by Martin and Bernard (2000) and role of peripheral endocrine organ in reproduction of bats has been described by Kwiencinski and Damassa (2000) and that Graffian follicle in some bats by Gopalkrishna *et al.* (1974). *Taphozous kachhensis* (Dobson) is an exclusive Indian Emballonuride bat found in caves, tunnels and temples. Despite considerable information available on the histology of ovary in some bats, literature related to study of ovary during different phases of reproductive cycle is scanty. The detailed histological study of ovary of *Taphozous kachhensis* during different phases of reproductive cycle has been undertaken because no such study has been made on this Microchiropteran species. The bat was selected for present study because of its unique habits and to find the probable role of ovary in the maintenance of pregnancy.

MATERIALS AND METHODS

For the present study 20 mature female bats, representing different phases of reproductive cycle, were collected from August 2006 to June 2007 from the caves of Ambai-Nimbai situated 45 km from Bramhapuri district Chandrapur, Maharashtra, India. Mature females were separated from immature ones after observing mammary glands. The ovaries were dissect out and fixed in alcoholic Bouin's fluid. After fixation for 24 h tissues were washed with 70% ethanol.

For histological observation, the tissues were dehydrated in various grades of alcohol, cleared in xylol and embedded in paraffin wax. The tissues were cut at 5 to 6 µm with the help of Leica 2417 microtome. The sections were stained in haematoxylin and eosin for routine histological examination. Then microphotographs were taken with the help of Lobamade Digi 2 camera attached to microscope.

RESULTS AND DISCUSSION

Histological observation of ovaries of *Taphozous kachhensis* during different phases of reproductive cycle showed a number of changes. The two ovaries were equal in size and joined to mesovarium by a broad hilus. The ovarian bursa completely covered the ovary. During the period of sexual quiescence no significant histological differences were observed in the two ovaries of adult females. As the female approached breeding period the right ovary showed the development of Graffian follicles while left ovary lagged behind as development did not proceed beyond the multilaminar ovarian follicle. Thus in *Taphozous* bat dominance of right ovary over left was noticed. The right ovary was invariably functional during each breeding cycle since it released a single ovum.

Ovary during anestrous period: The specimens collected in August were in anestrous period. A large number of small primordial follicles were observed at the periphery of cortex during this period. As the primary follicles grew they migrated toward deeper part of cortex. The unilaminar follicles were surrounded by a single layer of columnar cells. Some follicles were developed up to bilaminar, trilaminar and multilaminar follicles in both the ovaries of this species during anestrous period (Fig. 1a,b).

Ovary during gestation period: The specimens collected in December were in estrous and ovary exhibited remarkable histological difference during this period. Right ovary showed well developed Graffian follicle (Fig. 1c) along with many primordial follicles, some bilaminar, and trilaminar follicle. The primordial follicle occurred throughout the peripheral part of ovary. All the bilaminar and trilaminar follicles were visible in the cortical region. An interesting feature of Graffian follicle was the presence of one to two layers of cumulus cells covering the surface of oocytes toward the antrum which was filled with liquor folliculi. The membrane granulosa comprised of seven to eight layers of cell having spherical nuclei. The fully formed Graffian follicle lied close to the periphery of ovary. The antral cavity occupied a large part of follicle due to which oocytes was pushed to one side (Fig. 1d).

Ovary during early pregnancy: The specimen collected in January showed early pregnancy. The two ovaries at this stage showed different histological pictures. The right ovary showed the presence of well developed introverted corpus luteum which appeared a solid ball-like structure occupying about1/3 part of ovary. The luteal cells were compactly arranged and showed moderate hypertrophy. Nuclei were very distinct and darkly stained. Chromatin clump was present. Cytoplasm was granular. In some cells vacuolization were observed in some cells. (Fig. 1e,f). The left ovary showed the follicle in all stages of development up-to multilaminar stage. Thus left ovary did not seem to remain quiescent.

Ovary during mid pregnancy: The specimen collected in March showed mid-pregnancy. During mid-pregnancy the corpus luteum is fully developed and it occupied the entire ovary except small peripheral region. Corpus luteum during this stage attained its maximum size. In peripheral region some follicles continued to develop upto unilaminar or bilaminar follicles. The corpus luteum consisted of hypertrophied highly vacuolated luteal cells. The nuclei were very distinct; cytoplasm is deeply stained and appeared granular (Fig. 1g).

Ovary during lactation: After the parturition, the females were in lactating stage in June. The young ones were attached to the body of female. The ovary of parturated horn contained degenerating corpus luteum in the form of scar-like body or corpus albicans; most of the follicles were degenerating leaving

only empty follicles. Many unilaminar and some bilaminar were also seen. Primordial follicles still persisted in the peripheral part of ovary. The connective tissue stroma was poorly developed (Fig.1h).

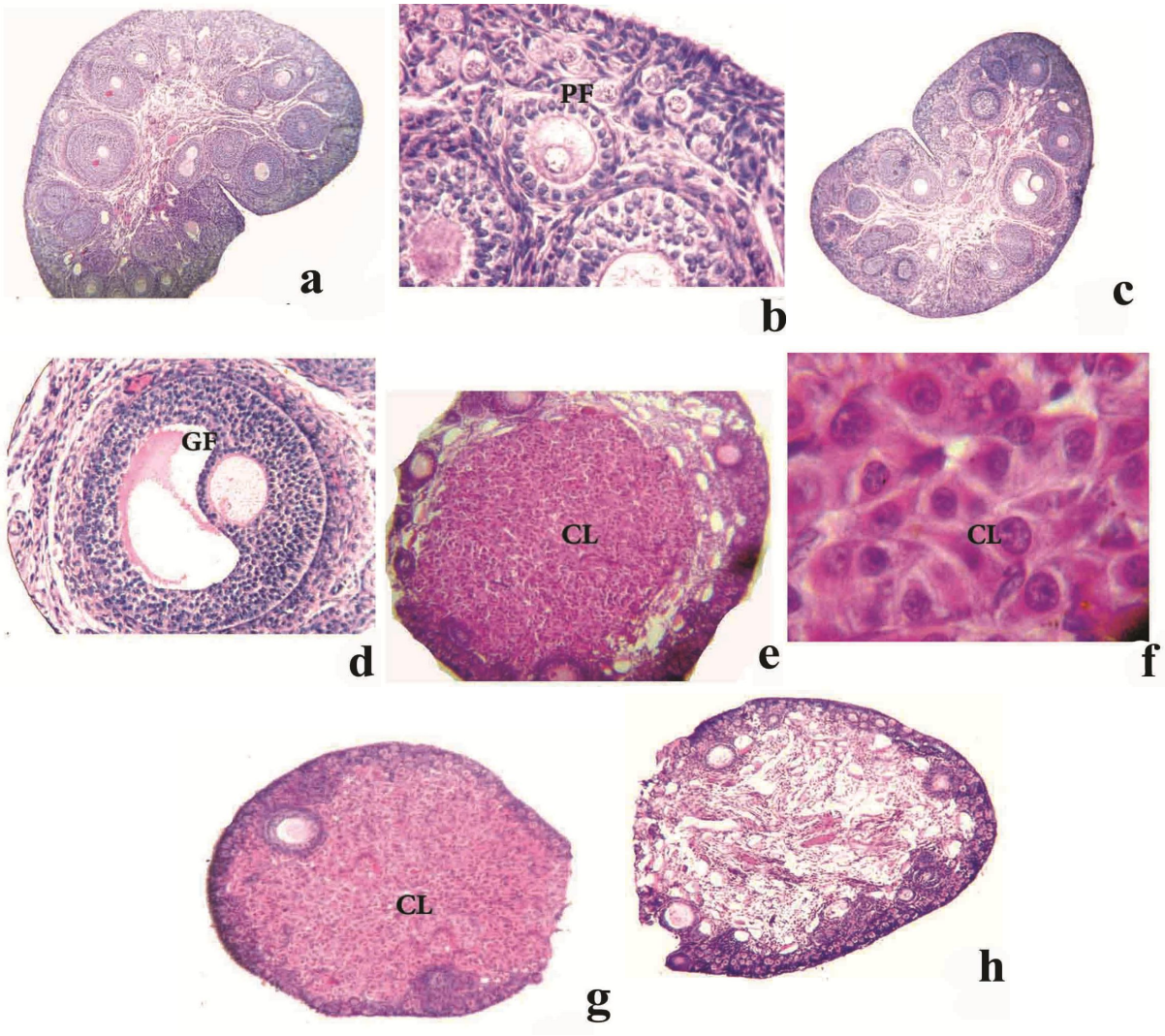

Fig. 1: Histological observation of ovaries during various reproductive stages; **a)** Transverse section of ovary during anestrus showing primordial follicle at peripheral part of ovary while deeper part of ovary shows the presence of multilaminar follicle (100 X); **b)** A part of ovary enlarged to show primordial follicle at the peripheral part of ovary. The cortex shows the presence of multilaminar and unilaminar follicle (400 X); **c)** Transverse section of right ovary during estrus showing the presence of primordial follicle (PF), multilaminar follicle and Graffian follicle (GF). Note the antrum (A) filled with liquor folliculi (100 X); **d)** A part of ovary during estrus showing a large graffian follicle at peripheral part of ovary. The antral cavity occupies large part of follicle due to which oocytes pushed to one side (400 X); **e)** Transverse section of ovary during early pregnancy showing the presence of introvert corpus luteum (100 X); **f)** Magnified view of corpus luteum showing the presence of luteal cell with granular cytoplasm. Note the stages of mitotic division in the luteal cells. In some cell cytoplasm is vacuolated (1000 X); **g)** Transverse section of ovary during mid-pregnancy showing the presence of well developed corpus luteum, few primordial follicles, and one double layered follicle (100 X); and **h)** Transverse section of ovary during lactation showing many primordial follicles and atretic follicle. Most of the follicles are degenerating leaving the empty spaces (100 X)

The corpus luteum occupied the entire ovary although the formation of extrovert corpus luteum is reported in *Megaderma lyra lyar* (Sonwane, 2010) and *Hipposideros speoris* (Gopalkrishna and Bhatiya, 1983).The presence of introvert corpus luteum has been observed in *Taphozous longimanus* (Nerkar, 2007). Penduculate corpus luteum is reported only in *Rhinolopus rouxi* (Ramakrishna *et al*., 1981) and *Hipposideros lankadiva* (Sapkal and Bhandarkar, 1984; Seraphim, 2002). The rapid enlargement of corpus luteum as noticed in *Taphozous kachhensis* is also reported in other species of Chiropterans such as *Cynopterus sphinx* (Krishna and Dominic, 1983) and *Taphozous longimanus* (Nerkar, 2007). The corpus luteum is a transient endocrine gland required for successful maintenance of pregnancy and one of the ovarian hormone progesterone is secreted from the corpus luteum. Corpus luteum is reported to persist for several months after parturition in *Rousettus leschenaulti* (Gopalkrishna *et al*., 1986) and *Cynopterus sphinx* (Krishna and Dominic, 1983). The corpus luteum is short-lived and disappears very early in pregnancy in some bats such as *R. rouxi* (Ramakrishna, 1978), *Pipistrellus mimus* (Krishna, 1985), *Megaderma lyra lyra* (Sonwane, 2010) and *Hipposideros lankadiva* (Seraphim, 2002). In contrast, corpus luteum persist till parturition in *Taphozous longimanus* and *Taphozous longimanus* (Nerkar, 2007) and in *Scotophilus heathi* (Krishna and Dominic, 1988).

In most of the mammals corpus luteum is composed of two distinguishable cell types – small-sized luteal cells and large-sized luteal cells (Koering, 1974; Paovola, 1977) and is derived from both granulosa and theca layer of ovarian follicle. In Chiroptera, the study of corpus luteum has been reported in *Taphozous longimanus* (Nerkar, 2007), *Hipposideros speoris* (Ramakrishna *et al.*, 1981), in *Miniopterus schreibersii* (Bernard *et al.,* 1991), *Megaderma lyra lyra* (Sonwane, 2010).

Anatomical and functional asymmetry of reproductive organ is another interesting feature of Chiropteran reproductive organs. Apart from the size differences, the Grafian follicle in *Pteropus* and *Cynopterus* show circlet of cumulus cells round the ovum consist of 2 to 3 layers of small cells and this is attached to the granulosa layer at one pole of follicle. A very interesting feature of Grafian follicle of *Taphozous kachhensis* was the presence of double layer of cumulus cells surrounding oocytes. The ovary showed a typical quiescent condition from middle of September to first week of March. During this period the peripheral part of ovary contained clusters of primordial cells with large darkly stained nuclei. Below these clusters were observed unilaminar and multilaminar follicles. The medulla was extensive and contained few atretic follicles.

Conclusion: The study revealed that luteal cells in corpus luteum of *Taphozous kachhensis* are steroidogenieally active and involved in biosynthesis of progesterone which is necessary for the maintenance of successful pregnancy in the species.

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