



Ovarian cycle of Indian female vampire bat *Megaderma Lyra Lyra* (GEOFFROY)

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Abstract

The aim of the present study is to observe the histological structure of ovary of *Megaderma lyra lyra* at the different phases of reproductive cycle and to understand the changes in the ovary according to the reproductive cycle. The left ovary shows developed mature Graafian follicle during estrus, while right ovary has only the multilaminar follicles. The development of extrovert corpus luteum during early pregnancy which disappeared during mid pregnancy is unique in this species. While right ovary shows only primordial follicles. This clearly reveals the sinistral dominance of ovary in *Megaderma lyra lyra*.

INTRODUCTION

Many workers have reviewed the reproductive behaviour of chiropterans and observed that bats have no uniformity in reproductive behaviour. Even the closely allied species exhibit different breeding habits (Wimsatt; 1979, Gopalkrishna; 1955, 1975, 1983; and Ramkrishna 1961. Oxberry (1979) and Jerret (1979) reviewed the anatomical and functional asymmetries of the female reproductive organs in bats.

Megaderma lyra lyra shows *Megaderma* pattern of the reproductive asymmetry. Ramkrishna (1951) studied the reproductive biology of *Megaderma lyra lyra* and observed that copulation occurred in November followed by ovulation and pregnancy. Ramaswami (1961) recorded the same observation with the finding of single young ones at delivery. This species is the seasonal breeder and breeds once in a year.

A study of the literature reveals that very little information is available concerning the structure of the ovaries of tropical bats. However it is apparent that the ovaries of these animals present certain characteristic differences from the ovaries of the hibernating bats inhabiting cold climates. It is reasonable to assume that differences in the details of the histology of ovaries of the bats may be in some way correlated with the differences in their breeding habits. Very little is known about the histology of the ovaries of the tropical bats (Gopalkrishna, 1955, 1994; Gopalkrishna and Moghe, 1960, Krishna and Domnik, 1982). Therefore it was felt that the present paper on the structure of the ovaries of *Megaderma lyra lyra* during the ovarian cycle might be of interest and value.

MATERIAL AND METHOD

The specimens were collected throughout the year, representing all the important reproductive periods from Sindewahi district Chandrapur

about 130 km. from Nagpur. Mature females were collected after observing mammary glands and pelvic ducts. These animals were brought alive to the laboratory with minimum stress, and constant supply of food and glucose water. Animals were anesthetized by ether. The specimens were weighed and their body weights were recorded. The ovary of left and right side were dissected out and quickly immersed in aqueous Bouin's fixative for 24 hrs. Tissue were washed in distilled water, followed by washing in running tap water overnight, dehydrated through graded series of ethanol and were stored in 70% alcohol. After taking the weight of ovaries, further dehydrated in ethanol, cleared in xylene and embedded in paraffin wax. Tissues were sectioned at 5-6 μ with the help of Leica 2417 microtome. The sections were stained with Erick's Hematoxylin and eosin. The stained slides were microphotographed at different planes.

OBSERVATION

Morphometry

The sinistral dominance in *Megaderma lyra lyra* is well reflected in the morphometry of ovaries. The weight of the sinistral ovary is always higher than that of dextral ovary during different periods of the reproductive cycle.

During estrus, the weight of the left and right ovary is about 4.22 mg and 2.54 mg, respectively. During early pregnancy the left uterine cornua shows the implantation of embryo. The weight of left ovary increases, to 5.2 mg because of the development of extrovert corpus luteum. While the weight of right ovary is about 3.44 mg. During the month of February, when the animal is in mid pregnancy, the weight of the left and right ovary decreases and it is measured about 1.5 mg. and 2.06 mg, respectively. The weight of right ovary is somewhat more because of the presence of bilaminar, trilaminar and multilaminar follicles. Whereas in left ovary there

is disappearance of corpus luteum and follicles at various stages of atresia are observed. During lactation, again the weight of the left and right

ovary reduces and it is found to be 1.6 mg and 1.58 mg respectively.

Table -1:- Weight of right and left ovary in mg during different phases of reproductive cycle

Reproductive period	Mean weight of right ovary n= 5	±SEM	Mean weight of left ovary n= 5	±SEM
Estrus	2.54	0.327109	4.2	0.5561
Early pregnancy	3.44	0.361594	5.2	0.242528
Mid pregnancy	2.06	0.253969	1.6	0.258844
Lactation	1.58	0.171026	1.6	0.244949

Graph-1 :-

The above morphometry study of left and right ovary clearly shows that there is a gradual increase in the weight of ovaries from quiescence to early pregnancy. With the disappearance of the corpus luteum in mid pregnancy the weight of the ovary is reduced. There is a further reduction in weight of ovary during lactation.

Light microscopic study of ovary

The ovarian asymmetry is the most unique feature in *Megaderma lyra lyra*. Though the two ovaries are morphologically symmetrical but the sinistral ovary appears to be physiologically dominant. The sinistral ovary develops the ovulatory follicle and undergoes ovulation. While in the dextral ovary the follicular development starts but does not reach to the ovulatory follicle. In early pregnancy the corpus luteum is well developed. While in right ovary the atresia of follicles are more prominent.

Ovary during the Estrous period

Bats collected in the month of November are in estrus. The sinistral ovary shows the well developed single Graafian follicle along with many primordial follicles, some bilaminar, trilaminar and vesicular follicles are also seen. The primordial follicles occur throughout the peripheral part of the ovary. The bilaminar and trilaminar follicles mostly situated in the cortical region. The vesicular follicle is 4-5 layers thick with centrally situated oocyte. Oocyte is covered by zona pellucida and granulosa cells. Theca cells are multilayered and differentiated into outer theca externa and inner theca interna. Theca externa is made of fusiform or spindle shaped cells while theca interna have larger cells. The ovarian stroma consist of the dense connective tissue and fusiform cells.

Out of many vesicular follicles only one follicle usually in the left ovary reaches to the Graafian follicle, to release the ovum. Graafian follicle is surrounded by 4-6 layers of large granulosa cells with centrally placed nucleus. The antrum is large crescent shape and is filled with the

eosinophilic liquid, the liquor folliculli. The cumulus layer surrounding the oocyte is one layer thick. Because of the well developed antrum, the oocyte is shifted to one side of the follicle. The zona pellucida covering the oocyte is clearly visible. The cytoplasm in oocyte is reticular and the nucleus is peripheral. The theca folliculli are distinguished into two distinct regions, the outer theca externa and inner theca interna. The theca externa is composed of 2-3 layers of closely packed spindle shaped fibrous cells. The theca interna are composed of two to four layers of cells (figs. 1-4).

The ovary of right side also shows the development of follicles upto vesicular stage. The primordial follicles are numerous, while some bilaminar and trilaminar follicles are situated in the stromal region of the ovary. Some of the follicles are showing atresia. Follicular atresia is more in the right ovary. The atretic changes involved nuclear degeneration manifested by chromatolysis, rupture and dissolution of nuclear membrane. Granulosa cells show nuclear dissolution. Vacuolation are prominent.

Ovary during Early pregnancy

Ovulation occurs in the second half of November which is then followed by fertilization. The implantation of blastocyst takes place in the uterus in the month of November. The bats collected in this month are in early pregnancy. Ovary in the early pregnancy shows different histological pictures as compared to the ovary of the estrous period. The ovary shows the presence of well developed extrovert corpus luteum. The hypertrophy of granulosa cells after ovulation forms a hemispherical body on the upper part of the ovary. The histological changes so occur in the cells, changes them to lutein cells resultant in the formation of corpus luteum (fig.5). The size of corpus luteum is near about 1/3 of the ovary. The cells of the corpus luteum are polyhedral compactly arranged with round nucleus and darkly stained nucleoli. The vacuolations are observed in luteal cells during early pregnancy

(fig.6).The follicles present in the left ovary are in different states of follicular atresia. While right ovary shows the number of primordial, bilaminar and trilaminar follicles as well the vesicular follicle. As the dextral side is physiologically inert it does not show any further changes like the left ovary. Most of the follicles show atresia. The degeneration of oocyte is observed.

Ovary during Mid pregnancy

As the pregnancy proceeds further the left ovary shows small follicles and many primordial follicles aggregated towards the peripheral part of cortex part of the ovary. The bilaminar and trilaminar follicles are not observed. The atresia of follicles is high. The corpus luteum disappears during this stage (fig. 7).

Ovary during Lactation

After the parturition, the female is in lactating stage in the month of May-June. The young ones are attached to the body of mother. The ovary during this period is totally different from that of the previous period. In both the left and right ovaries the atretic follicles are observed. Most of the follicles are degenerated leaving only the empty follicles. Primordial follicles are still persisted in peripheral part of ovary. The connective tissue stroma is poorly developed and vascularization is also poor (figs. 8).

DISCUSSION

The unilateral sinistral dominance of female genital tract in *Megaderma lyra lyra* is the remarkable feature. Such unilateral dominance also observed in *Tadarida australis*, where the right ovary and uterine horn is functional (Kitchener and Hudson, 1978). In *Taphozous melanopogon melanopogon* the dextral dominance of female genital tract is observed. The folliculogenesis occurs in both the ovaries but only right ovary shows the mature Graafian follicle (Jarolli and Lall, 1987), *Rhinopoma kinneari* (Anandkumar, 1965), *Eptesicus regulus* (Kitchener and Halse, 1978) and *Taphozous kachhensis* (Chauhan and Dhamani, 2011). In *Carollia* both the ovaries are functional but they show the alternation of successive ovulation (Bonilla and Rasweiler, 1982).

During estrus the single Graafian follicle and many bilaminar, trilaminar, vesicular follicles were observed in *Megaderma lyra lyra*. Similar observations were noticed in *Taphozous kachhensis* (Chauhan and Dhamani, 2011), *Megaderma lyra lyra* (Trivedi and Lall, 1987, Meshram and Janbandhu, 2016) supporting the present observations.

During early pregnancy ovary shows different histoarchitectural picture with extensively developed extrovert corpus luteum. The

occurrence of extrovert corpus luteum in *Megaderma lyra lyra* during early pregnancy is to maintain the pregnancy. Such extroversion of granulosa cells may be related with providing more surface area to synthesis of steroid hormones. In the present study extrovert corpus luteum which disappears from the left ovary during mid pregnancy in *Megaderma lyra lyra*, similarly extrovert corpus luteum and its disappearance observed in *Hipposideros speoris* (Gopalkrishna and Bhatia, 1983), *Hipposideros lankadiva* (Sapkal and Bhandarkar, 1984), *Rhinopoma kinneari* (Anadkumar, 1965), *Taphozous melanopogon melanopogon* (Jarolli and Lall, 1987), *Hipposiderous fulvus* (Gopalkrishna and Moghe, 1960).

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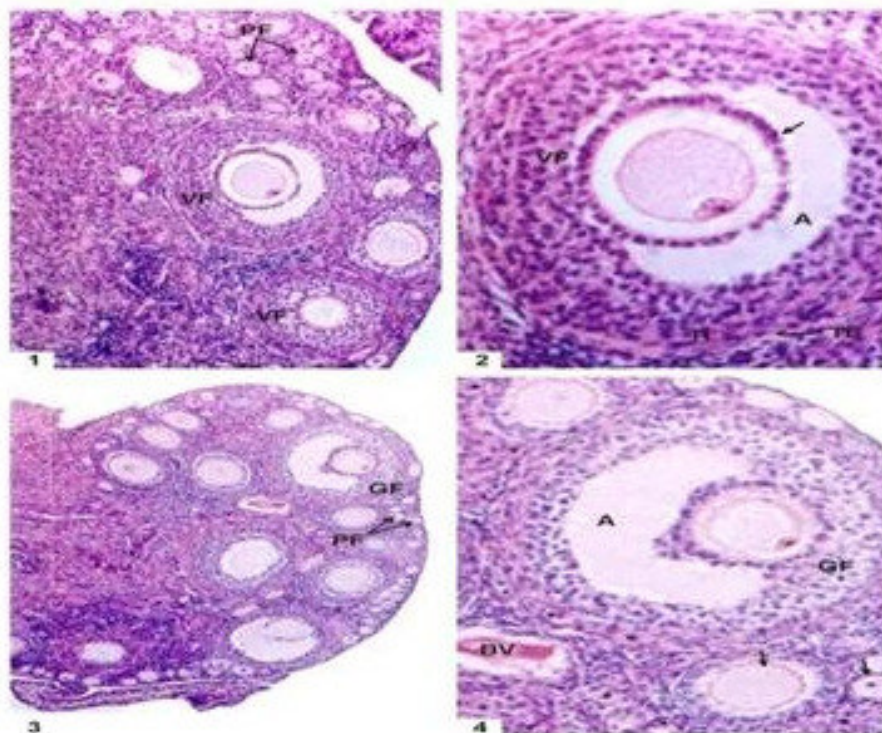


Fig.1- Transverse section of left ovary during estrous period, showing the presence of primordial [PF], multilaminar and vesicular follicle [VF] at different stages development. Note developing antrum [A] filled with liquor folliculi (X 100).

Fig.2-High power of vesicular follicle [VF] showing developing ovum [O]. Note the presence of single layer around the ovum. Also note the presence of theca interna [TI] layer and theca externa [TE] layer. (X 400).

Fig. 3- - Transverse section of left ovary during estrus, showing the presence of primordial [PF], multilaminar follicles and Graafian follicle [GF]. Note the antrum [A] filled with liquor folliculi. (X 100).

Fig. 4 - Graafian follicle [GF] showing ovum. Note the presence of single layer cumulus cells around the ovum. Also note the presence of theca interna [TI] layer and theca externa [TE] layer. Note the large antrum [A] filled with liquor folliculi.(X 400).

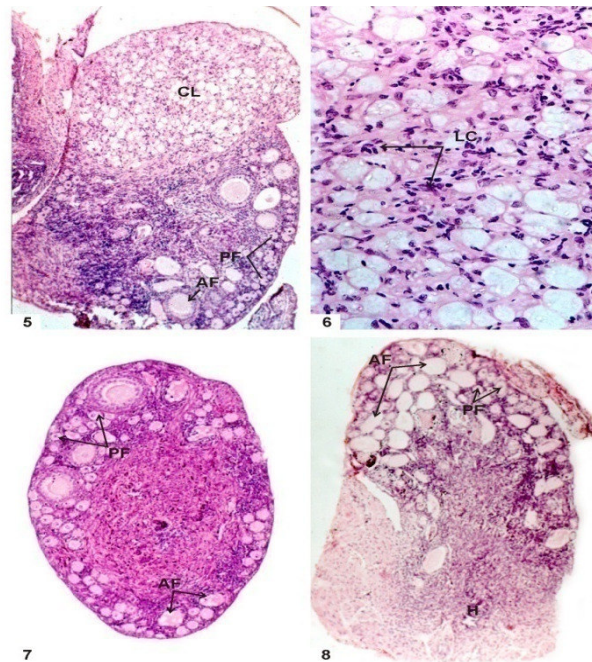


Fig. 5 Transverse section of left ovary during early pregnancy showing the well developed extrovert corpus luteum [CL] . (X 100).

Fig. 6 Magnified view of corpus luteum [CL] showing the luteal cells [LC]. (X 400).

Fig. 7 Transverse section of left ovary during mid pregnancy showing the many primordial [PF], few multilayered and atretic follicles [AF]. (X 100).

Fig. 8 Transverse section of left ovary during lactation showing many primordial [PF] and atretic follicles [AF] (X 100).

