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Morphological Study During Annual Reproductive Cycle of Maleleaf-Nosed Bat, *Hipposiderosspeoris* Schneider; Chiroptera

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Abstract: *Hipposiderosspeoris* shows an annual reproductive cycle. The organization of the male reproductive organs shows commencement of spermatogenesis during September-October; Peak spermatogenesis, spermiogenesis and spermiation in December; Regression of testis with storage of sperms in cauda epididymis in February and complete involution of testis and storage of sperms in cauda epididymis in April. The accessory glands in the males remain in an active state for about two months after the regression of the testis. The male accessory glands - the seminal vesicles, prostate and bulbo-urethral glands came to activity in October and remained in an active state until the beginning of April. The active status of the accessory glands and the healthy condition of the epididymal sperms in this bat are physiologically linked together and these appeared to be independent of the factors which maintained spermatogenetic activity of the testis.

Key words: Accessory glands · Anatomy · Epididymis · Testis

INTRODUCTION

The Order Chiroptera comprises of two Suborders, Megachiroptera and Microchiroptera. Family Rhinolophidae of Microchiropteracomprises two subfamilies- Rhinolophinae and Hipposiderinae. The review on the prolonged survival of spermatozoa in bats observed that reproductive tracts of several species of vespertilionid and rhinolophid bats store sperms in the uterus or oviducts of females and in the caudaepididymides and ductus deferens of males [1].

The study of reproductive cycle in the male noctule *Nyctalusnoctula* observed that spermatogenesis occurs during summer accompanied by a thirteen fold increase in the mean weight of the testes. Spermatozoa were stored in the caudaepididymidis for the duration of winter and no spermatozoa were produced in this period. The lowest weight of caput and caudaepididymidis was recorded in June. The maximum weight of the cauda epididymis was recorded in September, coinciding with maximum sperm content. While the weight of the caput epididymis falls progressively throughout winter and few residual spermatozoa were observed during November with the weight of the cauda epididymis being maintained throughout winter [2].

Reproduction in the Canyon bat, *Pipistrellushesperus* observed that the male spermatogenetic cycle is initiated in late June and sperms were available for ejaculation in September [3]. The reproductive biology of male leaf-nosed bat, *Macrotuswaterhousii* has shownthat the spermatogenic cycle is initiated in June, sperm were available in August [4]. The caudaeepididymides of hibernating male *Myotislucifugus* and *M. velifer* were packed with spermatozoa from September-October and April-May despite involuted testes [5].

While studying the reproductive cycle in the male fruit bat, *Cynopterus sphinx* theactive spermatogenesis was observed in October - November and mid-January-April [6]. In *Rhinolophuscapensis,* spermatogenesis occurred between October and May (spring to autumn) and the sperm being released to the cauda epididymis in April and May [7]. While male bat, *Rhinopomahardwickeihardwickei* showed annual

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reproductive cycle andthe testes were permanently abdominal [8] whereas the seasonal chronological events of the reproductive cycle and changes in structure and function of accessory sex organs of *Taphozouslongimanus* at Varanasi [9]. The study is based on the annual variation in the anotomyand histological structure of reproductive system of*Hipposiderosspeoris* as a mammalian example.

MATERIALS AND METHODS

The present work is based on the study of 48 males of *Hipposiderosspeoris*collected with the help of a butterfly net from underground dark places nearby Chandrapur, Maharashtra (India). The collection was made throughout the yearfrom Sept-2008 to Aug-2009. 2bats were collected once in a fort night. The animals were anaesthetized with mild clinicleanaesthesia. The reproductive systems from males dissected out, display andphotographed for anatomical examination.

RESULTS AND DISCUSSION

*Hipposiderosspeoris*shows an annual reproductive cycle. In the adults the pubic capsule is large thick blackish pink in appearance and loose with external wrinkles (Fig. 1), while in the sub-adults, it is thick tightly organized and pinkish with greasy appearance. The penis in sub-adult males is long and thin with its tip directed caudally while in the adult males the penis increases in thickness with the tip directed cranially. On the basis of the appearance of the pubic capsule adults are differentiated from sub-adults.

The organization of the male reproductive organs shows commencement of spermatogenesis during September-October (Fig. 2); Peak spermatogenesis, spermiogenesis and spermiation in December (Fig. 3); Regression of testis with storage of sperms in cauda epididymis in February (Fig. 4) and complete involution of testis and storage of sperms in cauda epididymis in April (Fig. 5). The accessory glands in the males remain in an active state for about two months after the regression of the testis. There is an unbalanced sex-ratio with the females outnumbering the males.

In the present bat, spermatogenesis commenced in September and continued until the second week of January, after which the testes underwent regression and there is complete cessation of spermatogenetic activity. However,the cauda epididymis is full of healthy spermatozoa until about the first week of April [2 and 5] after which there is a sudden fall in their population and most underwent degenerative changes.

The male accessory glands - the seminal vesicles, prostate and bulbo-urethral glands came to activity in October and remained in an active state until the beginning of April. The active status of the accessory glands and the healthy condition of the epididymal sperms in this bat are physiologically linked togetherand these appeared to be independent of the factors which maintained spermatogenetic activity of the testis. Alternately the factors which triggered the onset of sexual activity in the males of *H. speoris*, continue to operate on the accessory glands even after the cessation of spermatogenetic activity in the testes (Figs. 1-5). *H. speoris* developed the mechanism to overcome the disadvantages of low fecundity in the females, to ensure that all adult females do conceive during the breeding season. Similar observations were reported in *H. speoris* [10].

The testes are ellipsoidal in shape and post-abdominal in position. Both in the adult as well sub-adult males, the testis are enclosed in a thick muscular sac - the pubic capsule [11, 12]. The epididymis closely abuts the testis on its dorso-medial aspect and is recognized into distinct caput and cauda regions and a thin inconspicuous corpus epididymis. The ductus deferens which emerges from the cauda epididymis is short in length and it enters the abdominal cavity along with the components of the spermatic cord. In the abdominal cavity, the ductus deferens leaves the other components of the spermatic cord (internal spermatic nerve, spermatic artery and spermatic vein), passes mesially and loops dorsal to the ureter and joins the ampullae of Henle of the respective side. The male accessory reproductive organs comprise of a paired ampullae of Henle, a prostate, paired Cowper's glands and urethral glands. The accessory reproductive organs are all distinctly cyclic varying in gross size, weight, histology and secretory activity [12, 13].

Abbreviations:

T: Testis; e: Epididymis; Pb.c.: Pubic Capsule; U: Urinary bladder; am.H: Ampulla of Henle; Cg: Cowper's gland; P: Penis; Vd: Vas deferens; Cpe: Caput epididymis; Cde: Cauda epididymis; Pr: Prostate; Sperm storage in epididymides (arrow).

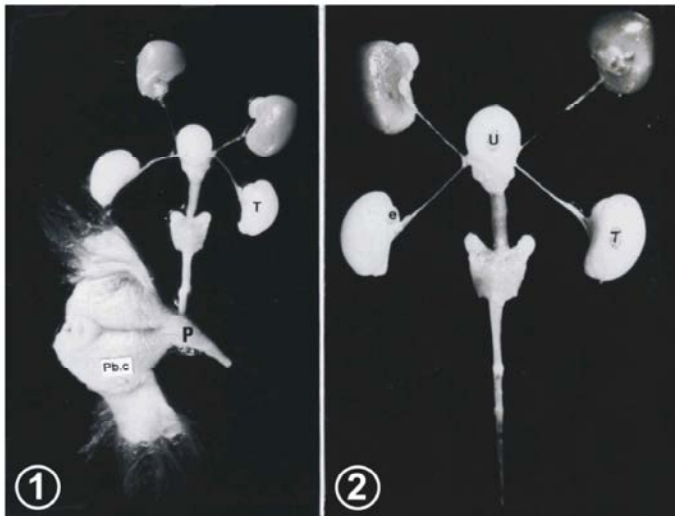

Fig. 1: Photograph of the ventral view of male reproductive system of *H. speoris* during commencement of breeding season with the intact public capsule

Fig. 2: Photograph of the ventral view of male reproductive system of *H. speoris* during commencement of breeding season after the removal of the pubic capsule Note the large size of the testis as compared to the epididymis and the large penis

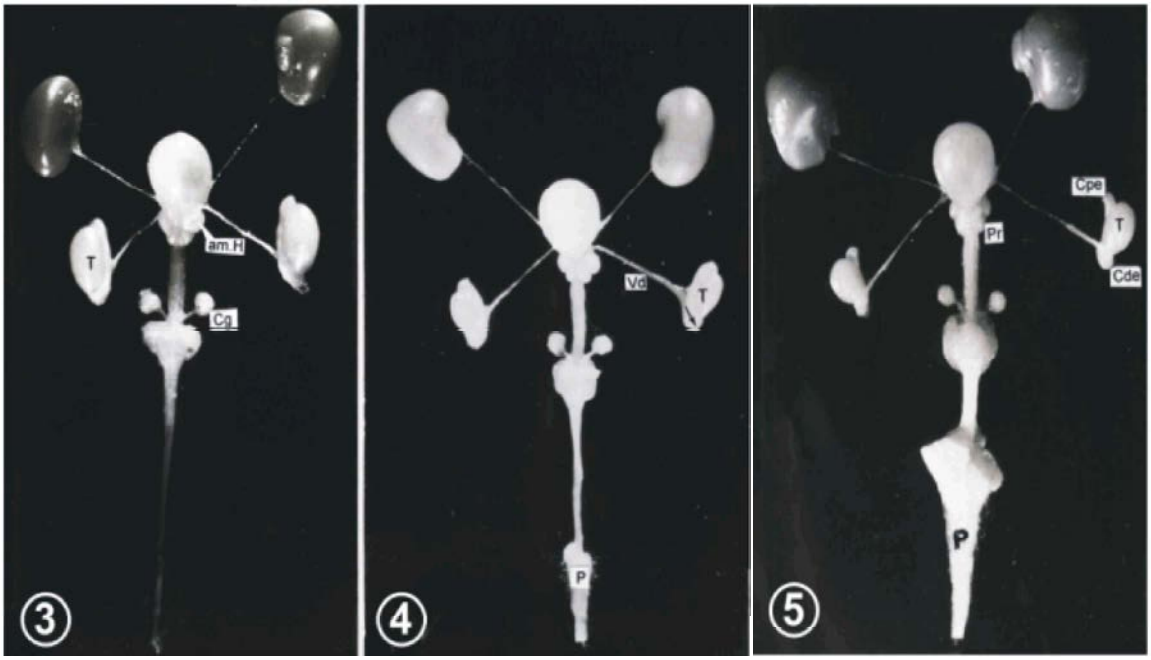

Fig. 3: Photograph of the dorsal view of the male genitalia of *H. speoris*shows peak activity of the testes. Note, the vas deferens joins the ampulla of Henle of the respective side. The duct of the Cowper's gland joins the urethra dorsally

Fig. 4: Photograph of the dorsal view of the testes and accessory reproductive organs of *H.speoris*shows regression of the testes with storage of sperm in the caudaepididymides. Note, the size of the testis is reduced. Epididymides get swollen due to sperm storage

Fig. 5: Photograph of the male genitalia of *H. speoris*shows involuted testes - with storage of spermatozoa in the caudaepididymides.Note, the testis size is further reduced as compared to February and the cauda epididymis is extended beyond the margin of testis as it is packed with sperms

CONCLUSION

In *H. speoris* spermatogenesis continues from September to second week of January, followed by regression and complete cessation of spermatogenetic activity. The cauda epididymis contain healthy spermatozoa until the first week of April [2 and 5] after which there is a sudden decrease in number and most of the spermatozoa underwent degenerative changes.

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