

It is thus concluded from the results obtained with three types of gall tissues that phenolics along with PRO and PPO play an important role in different types of gall growth and their formation. Further studies with auxin protectors and sulphahydral (-SH) group may be of much help to elucidate the mechanism of gall formation.

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PREGNANCY RECORD OF SOME INDIAN BATS

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ABSTRACT

Most of the species of Indian bats studied here are monotocous and exhibit varying degrees of physiological dominance of one side of the female genitalia over the other. In some species there is a functional alternation of the two sides of the female genitalia in successive cycle. Ovulation and gestation occurs on the ipsilateral side in all the species except *Miniopterus schreibersii fuliginosus* in which ovulation as a rule occurs from the left ovary and the embryo migrates to the right uterine cornu where it undergoes implantation and further development.

INTRODUCTION

THE occurrence of physiological dominance of one side of the female genitalia over the other has been noticed in a number of bats¹⁻¹⁰. There is a functional alternation of the two sides of the female genitalia in successive reproductive cycles in some bats^{3,4,11-16}. In polytocous species the two sides of the genitalia are functional synchronously in each breeding cycle¹⁷⁻²⁰.

Investigations on the breeding biology of a number of Indian bats have been carried in this laboratory for the past 30 years and a detailed record of the condition of the genitalia of these bats during all the calendar months of the year is maintained. The present paper embodies observations on pregnancy and ovulation in 17 species of Indian bats.

OBSERVATIONS

Table I, which gives some details regarding pregnancy of 17 species of Indian bats studied in this laboratory, reveals that all the species except some vespertilionids are monotocous and bear the single young in one of the two uterine cornua during each cycle. The female genitalia are, however, morphologically bilaterally symmetrical. Most vespertilionids studied here

normally carry a young in each of the cornua during each cycle, and it is exceptional when a specimen carries a single foetus in one of the cornua. One specimen of *Pipistrellus mimus mimus* carried three foetuses, two in the right cornu and one in the left. Further, among the monotocous species, whereas the two sides of the genitalia are equally functional in the three megachiropteran species (*Rousettus leschenaulti*, *Pteropus giganteus giganteus* and *Cynopterus sphinx gangeticus*) and *Taphozous longimanus*, there is a distinct physiological dominance of one side of the genitalia over the other side in the other species. Barring exceptional specimens, as a rule only the right uterine cornu carries a single conceptus in *Rhinolophus rouxi*, *Taphozous melanopogon* and *Miniopterus schreibersii fuliginosus*, and the left cornu bears the conceptus in *Megaderma lyra lyra*. One specimen of *Rhinolophus rouxi* among 285 pregnant specimens had an embryo in each of the uterine cornua and one specimen of *Taphozous melanopogon* among 57 pregnant females carried the conceptus in the left cornu and none in the right. Among the hipposiderid bats there is a distinct dominance of the left uterine cornu over the right in carrying the pregnancy, the degree of dominance varying among the different species.

TABLE I
 Pregnancy record of some Indian bats

Sl. No.	Name of the species	Pregnancy in			Total
		only right cornu	only left cornu	both cornua	
1.	<i>Rousettus leschenaulti</i>	312	324	..	636
2.	<i>Pteropus giganteus</i>	32	38	..	70
3.	<i>Cynopterus sphinx gangeticus</i>	86	79	..	165
4.	<i>Taphozous longimanus</i>	69	60	..	129
5.	<i>Taphozous melanopogon</i>	56	1	..	57
6.	<i>Megaderma lyra lyra</i>	8*	325	1	334
7.	<i>Rhinolophus rouxi</i>	284	..	1	285
8.	<i>Hipposideros ater ater</i>	64	144	..	208
9.	<i>Hipposideros fulvus fulvus</i>	37	86	..	123
10.	<i>Hipposideros lankadiva</i>	10	56	..	66
11.	<i>Hipposideros speoris</i>	13	267	..	280
12.	<i>Pipistrellus dormeri</i>	83	96	92	271
13.	<i>Pipistrellus mimus mimus</i>	6	1	82	89
14.	<i>Pipistrellus ceylonicus chrysothrix</i>	4	3	238	245
15.	<i>Scotophilus heathi</i>	12	7	246	265
16.	<i>Scotophilus temmincki</i>	76	76
17.	<i>Miniopterus schreibersii fuliginosus</i>	447	447

* 4 of these cases were doubtful.

Microscopic examination of the reproductive organs revealed the following facts : In all the species (barring exceptional specimens to be mentioned later), except *Miniopterus schreibersii fuliginosus*, the conceptus was carried in the uterine cornu of the same side on which the ovary had released the ovum. There was one specimen of *Scotophilus temmincki* in which the right ovary had two corpora lutea, and the left none, but there was an embryo in the limb-bud stage of development in each of the uterine cornua. Evidently one of the embryos had migrated to the contralateral uterine cornu. There was one specimen of *Megaderma lyra lyra* carrying a full term embryo in each of the uterine cornua. Unfortunately, it was not possible to determine the side of ovulation since the corpus luteum in this species regressed very early in pregnancy. Of the 8 specimens of *Megaderma* listed as carrying the embryo in the right cornu, 4 cases were doubtful since the specimens were in very advanced pregnancy and the uteri were found to be badly damaged. They have been listed as carrying the foetus on the right side only on the basis of the fact that the damaged uterus was noticed to be lying slightly to the right of the middle line when the specimens were dissected. However, there is no other evidence to substantiate this conclusion and hence these specimens are included as doubtful cases.

Miniopterus schreibersii fuliginosus is unique in certain respects. All 447 pregnant specimens carried the conceptus in the right uterine cornu. The ovaries of 263 out of 447 specimens were subjected to histological examination, and in all but 4 specimens there was a corpus luteum in the left ovary and none in the right. The latest embryonic stage noticed in the left uterine cornu and the earliest stage noticed in the right was a 38-celled morula. In the four exceptional specimens the right ovary carried a corpus luteum while the left ovary had not undergone ovulation. Evidently, in *Miniopterus schreibersii fuliginosus* as a rule the left ovary releases the ovum during each cycle and the ovum develops into a morula during its transit through the left oviduct before entering the right cornu where it undergoes further development leading to nidation. Thus, transuterine migration of the embryo is the rule in this species—with rare exceptional cases where the ovary on the right side releases the ovum and the embryo implants in the ipsilateral uterine cornu.

DISCUSSION

The occurrence of physiological dominance of one side of the genitalia over the other has been known to occur in several bats¹⁻⁵. In a recent detailed review on the reproductive asymmetry and unilateral pregnancy in Chiroptera, Wimsatt²¹ recognized 6 basic patterns of reproductive asymmetry—pteroid pattern, phyllostomid pattern, *Myotis* pattern, molossid

pattern, megadermatid pattern and *Miniopterus* pattern. In the pteropid and rhylostomid patterns there is an alternation of the two ovaries in releasing the ovum in successive pregnancies and the embryo implants in the ipsilateral uterine cornu or in the "intraendometrial segment of the oviduct on the ovulation side". In the *Myotis* pattern "ovulation may occur from either ovary with nearly equal frequency", but there is no evidence of a regular alternation of the two ovaries in successive cycles. However, pregnancy as a rule is carried in the right uterine cornu. The molossid pattern exhibits the most profound dominance of the right side over the left with the left ovary showing signs of atrophy. Pregnancy is also carried in the right uterine cornu. *Megaderma* pattern is characterised by the dominance of the left side over the right. In the *Miniopterus* pattern, while ovulation takes place from the left ovary, the embryo migrates to the right cornu where it undergoes implantation and further development. The present investigations reveal that the various patterns of physiology of the female genitalia recognized by Wimsatt²¹ are illustrated by Indian bats, which can be arranged in a series from species exhibiting perfectly bilaterally symmetrical genitalia to those showing extreme conditions of genital asymmetry, where only one side of the genitalia is functional always and the contralateral side exhibits atrophic changes. Thus, the genitalia of polytocous vespertilionids are bilaterally symmetrical and both sides are synchronously functional during each cycle. The monotocous bats have either complete dominance of one side (the right side in *Rhinolophus rouxi* and *Taphozous melanopogon* and the left side in *Megaderma lyra lyra*) or partial dominance of the left side (as in hipposiderid bats). *Miniopterus schreibersii fuliginosus* is unique among the Indian bats because while the left ovary releases the ovum pregnancy invariably occurs in the right cornu since transuterine migration of the embryo is the rule in this species. This phenomenon was also noticed in *Miniopterus dasythrix*⁴ and *Miniopterus australis* and *Miniopterus*

schreibersii in Australia²². Physiological alternation of the two sides of the genitalia in successive cycles occurs in *Rousettus leschenaulti*^{14,15,23} and *Taphozous longimanus*^{12,13}.

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