Multiple births in Schlieffen's bat, *Nycticeius schlieffenii* (Peters, 1859) (Chiroptera: Vespertilionidae) from the southern African subregion

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Nycticeius schlieffenii is a monestrous species that breeds during the spring months in the northern parts of the Kruger National Park. During spring 1983 the average number of corpora lutea in 11 *Nycticeius schlieffenii* females was 3,1 (range 1–4), with the average number of fetuses recorded 2,8. In the present study this bat has been found to be a polyovular seasonal breeder, giving birth to as many as three young per estrous cycle.

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Nycticeius schlieffenii is 'n monestrus spesie wat gedurende die lente in die noordelike gebied van die Nasionale Kruger Wildtuin teel. Gedurende die lente van 1983 was die gemiddelde aantal corpus luteums wat deur 11 *Nycticeius schlieffenii*-wyfies afgeskei is 3,1 (bestek 1–4), met die gemiddelde aantal fetusse waargeneem 2,8. In die huidige studie is bevind dat hierdie vlermuisspesie 'n poliovulêre seisoenale voortplanter is wat aan so veel as drie kleintjies per estrussiklus geboorte gegee het.

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Nycticeius schlieffenii (Peters, 1859) is one of the smallest bat species occurring in the southern African subregion, the males averaging 4,7 g and the females 5,1 g (Rautenbach 1982). It is widely distributed in south-western Arabia and most of Africa to as far south as Zululand (Hayman & Hill 1971). In southern Africa, Schlieffen's bat is associated with open woodland savanna (Smithers 1983), where it appears to be dependent on open water in the form of marshes, streams or reservoirs (Pienaar 1964; Smithers 1971). It utilizes crevices and hollows in trees as daytime roosts (Verschuren 1957), as well as rock crevices (Pienaar 1964), houses, huts and cellars (Rosevear 1965).

Although widely distributed and common, very little is known about the reproduction of this species. Some peculiar aspects of reproduction in *N. schlieffenii* are reported here, as part of a long-term investigation into the details of male and female reproductive cycles of this species.

Material and Methods

During the spring months (September to November) of 1983, a total of 16 *N. schlieffenii* females were collected from the Pafuri region of the Kruger National Park (20°25'S/31°12'E), Transvaal, South Africa. They were caught with two 30,5 × 6,1 m mistnets. A maximum of six females was collected during the last week of each spring month. At the field laboratory they were killed with chloroform and their reproductive tracts immediately dissected out and preserved. Uteri containing large fetuses were stored in AFA, while the others were preserved in Bouin's fluid. Where fetuses were macroscopically discernible their numbers and distribution between the two uterine horns were recorded. Following routine wax embedding, all the reproductive tracts that had been fixed in Bouin's fluid and AFA, were sectioned at 5 μm and stained with Ehrlich's haematoxylin and eosin.

Results

During the last week of September 1983 five adult females were netted, and all of them were found to be pregnant. Four had morulae in their uterine horns, while one had four implanted embryos at the primitive streak stage, two in each of the uterine horns (Figure 1). Amongst the females with morulae, one had five and one had three morulae, whereas the remaining two had four morulae (i.e. two per uterine horn). The average number of embryos found amongst these five females was therefore 4,0. The average number of corpora lutea found in the ovaries of these females was 3,8, indicating monozygotic twins in the case of the female with

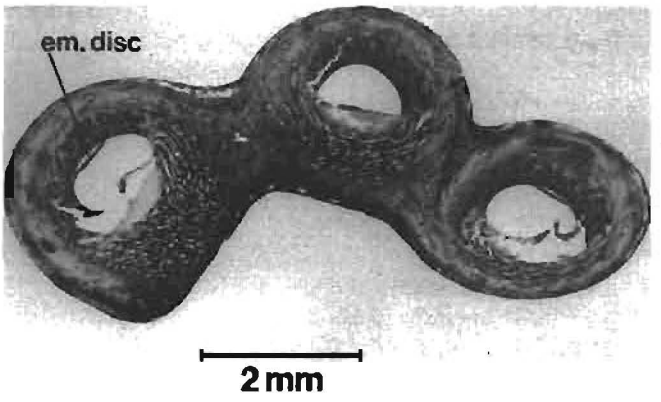

Figure 1 Transverse section through the uterus of *Nycticeius schlieffenii*. In this section only three of the four implantation chambers are visible. In the left and right chamber the embryonic disc (em. disc) of the implanted embryos can be seen.

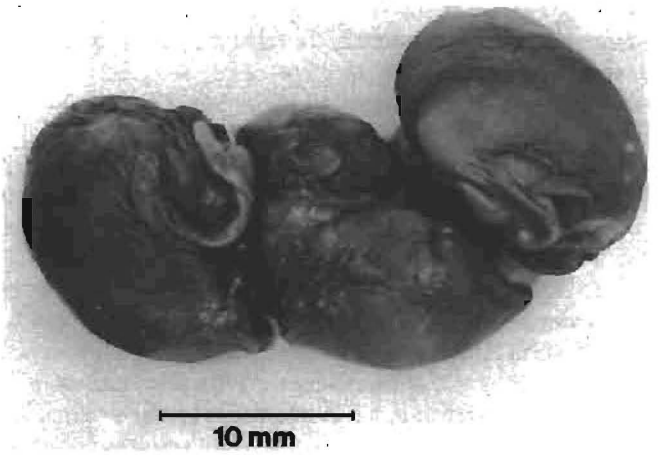

Figure 3 Three full-time *Nycticeius schlieffenii* fetuses arranged exactly as they were positioned within the uterus.

five morulae, as she only had two corpora lutea in each of her ovaries.

On a second visit to the study area during the last week of October 1983, five females were caught. Of these, four had three fetuses, i.e. two in the right uterine horn and one in the left uterine horn (Figure 2) while the fifth one had twins, one in each uterine horn. The average number of fetuses per female was 2,8. The average number of corporea lutea found amongst these females was 2,4, indicating the presence of monozygotic twins in two of the females. One of the females with triplets had one corpus luteum in each ovary while the female with twins had only one corpus luteum in the right ovary with none in the left one.

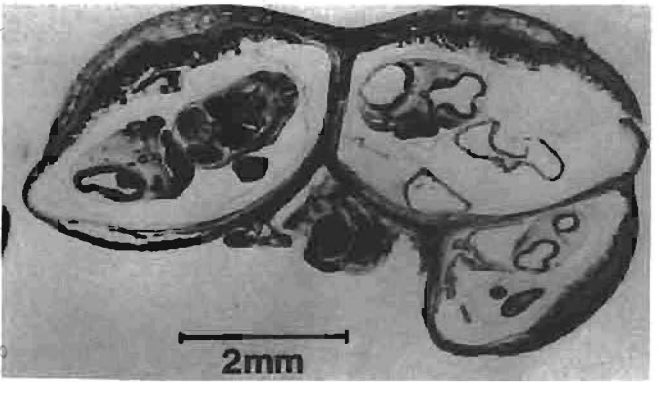

Figure 2 Transverse section through the uterus of *Nycticeius schlieffenii* showing three developing fetuses.

The third visit during the last week of November produced six females, of which five were lactating and one had three full-term fetuses, two in the right uterine horn and one in the left horn (Figure 3). Judging by the six females displaying advanced pregnancy during October and November, it is apparent that the average litter size for the 1983 breeding season was 2,8, with triplets recorded in five instances and twins in one. None of the five lactating females caught during November carried their offspring with them while foraging.

Discussion

The majority of bats are monovular, giving birth to a single offspring per estrous cycle (Wimsatt 1975; Hill and Smith 1984). From Rautenbach (1982) and Smithers (1971 and 1983) it is clear that the majority of southern African bats for which information is available have one offspring per breeding cycle. Although twins are common in some species, triplets in the southern African subregion have only been recorded as exceptional cases in one female of *Eptesicus capensis* (A. Smith, 1829) and one of *Scotophilus dinganii* (A. Smith, 1833) (Rautenbach 1982). The highest number of young per female recorded for any bat is the occasional four recorded for the red bat, *Lasiurus borealis* (Muller, 1776) (Lyon 1903), or in rare instances five young (Mumford 1973).

Although our data on the details of reproduction in *N. schlieffenii* are as yet insubstantial, it is apparent that for the 1983 spring season, the average number of corpora lutea per female was 3,1 (range 1–4) and that at least in some females four embryos had implanted and developed for some time. This statement is based on the fact that three out of five females collected during the last week of September 1983 had four or more morulae while another had four healthy implanted embryos at the primitive streak stage. Whether all four embryos would eventually have reached full term and been born is dubious as we have not yet found any female in advanced pregnancy with more than three fetuses. Since five out of the six females recorded with large fetuses during the 1983 spring season had triplets, it is suggested that triplets may, however, be common in this species.

In some bat species more ova are shed than the number of young that are eventually born and according to Wimsatt (1945) the majority of these apparently succeed in implanting, but with continued enlargement of the embryos those less advantageously situated in the uterine horns become resorbed. The same may apply for *N. schlieffenii*, especially in the case where five morulae were found. Probably they all would have implanted and developed for some time before some would have been resorbed. Until now four or more full-term fetuses have not yet been found in this species although the possibility is not overruled.

Reproductive asymmetry is expressed as unilateral dominance of the ovary, the uterus or both, and shows a higher incidence amongst the Chiroptera than in any other mammalian order (Wimsatt 1975). In *N. schlieffenii* there is a strong tendency towards reproductive asymmetry with the right ovary and uterine horn being dominant. This state-

ment is based on the fact that in all cases where triplets were found, two were implanted in the right uterine horn and one in the left. In all but one of these cases, two corpora lutea were in the right ovary and one in the left. The exceptional female had all three corpora lutea in the right ovary and none in the left. *N. schlieffenii* has a bicornuate uterus with horns differing in size in parous females. In non-pregnant parous females it was found that although both horns are similar in diameter, the right horn can be as much as 1/3 longer than the left. Unfortunately no nulliparous females were examined to see if the same applies for them. However, two full-term female fetuses examined showed no difference in the size of the two uterine horns. At this stage therefore, it appears as if this difference in size between the two uterine horns in parous females may be the result of dextral dominance in the reproductive tract. Although we have found transmigration of embryos in this species, the specific distribution of triplets between the two uterine horns thus far observed, suggests dextral dominance in uterine function. Nevertheless, it is believed that this dextral dominance of the uterus is mainly the result of the superior functioning of the right ovary.

In three of the females one more embryo was found than the number of corpora lutea counted. It is expected that in all three these cases the extra embryo must have been a member of monozygotic twins. Other alternatives would be complete fusion of two corpora lutea or the shedding of two ova from the same follicle (biovular follicle). Although some of the corpora lutea were bigger than others, no evidence could as yet be found of fusion between two corpora lutea. Polyovular follicles are rare in bats (Guthrie & Jeffers 1938) and although biovular follicles are more frequently found amongst the polyovular follicles (Brambell 1956) it is unlikely that all three females under discussion would have had biovular follicles.

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