THE USE OF A PRECIPITIN TEST TO DETERMINE HOST PREFERENCES OF THE VAMPIRE BATS, *DESMODUS ROTUNDUS* AND *DIAEMUS YOUNGI*

by

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INTRODUCTION

Vampire bat rabies is one of the greatest deterrants to the raising of livestock in Latin America. To know more of the epizootiology of the disease as well as to understand the ecology of the vampire bat family, Desmodontidae, detailed information about their feeding habits and host preferences is essential. Vampire bats feed exclusively on blood. Examination of probable host animals for bat bites has been the primary method used to determine their victims. More reliable precise data are achieved by serological analyses of the digestive tract contents of vampires killed after attacking their hosts. Precipitin test techniques were used similar to those devised for the identification of blood meals of bloodsucking arthropods (Weitz, 1952, 1956, 1960; Tempelis & Lofy, 1963).

If the exact domestic as well as wild animal host preferences of vampire bats were known, this knowledge could assist in their control and might indicate other hitherto unsuspected hosts.

Since the digestive physiology of the Desmodontidae is not well understood, it was necessary to determine whether the method used for the identification of blood meals of bloodsucking arthropods would be satisfactory for vampire bat studies and how long blood meals would be identifiable in the bat's digestive tract. To answer these questions, an experiment was conducted on January 9, 1961, in the Trinidad Regional Virus Laboratory using *Desmodus rotundus*, the vampire bat most involved with the transmission of rabies.

MATERIALS AND METHODS

Twenty four vampire bats were collected alive by the bat collecting crews of the Government of Trinidad and Tobago (which has been conducting a vampire bat destruction programme since 1934) and brought to the laboratory on December 13, 1960. They were housed in six cages, four bats to a cage, and fed daily on the usual maintenance diet of defibrinated cattle blood.

To clear their digestive tracts before the beginning of the experiment, the bats were starved for three days, which according to personal experience and the literature is the longest period that *Desmodus* can remain alive without feeding. Some of the starved bats would not drink the test bloods when offered. Five refused to feed for as long as 88½ hours — a record. The test therefore, had to be recycled.

The protocols of the experiment required that 24 vampire bats, *Desmodus rotundus*, be fed for 15 minutes on two serologically different defibrinated bloods, ox and sheep, 12 bats to be fed on each kind of blood. The blood meals were offered in sterilized dishes. No drinking water was provided. On January 9, 1961 all 24 bats fed for the required 15 minutes as planned.

After 15 minutes the dishes containing the two blood meal types were removed from the cages. Next, one bat from each group (ox blood and sheep blood; was sacrificed at intervals of: 15 minutes, 30 minutes, 1, 2, 4, 8, 12, 18, 24, 36, 48, and 72 hours. Blood meals were then dissected from the stomach and intestines, using sterilized instruments, one smear each from stomach and

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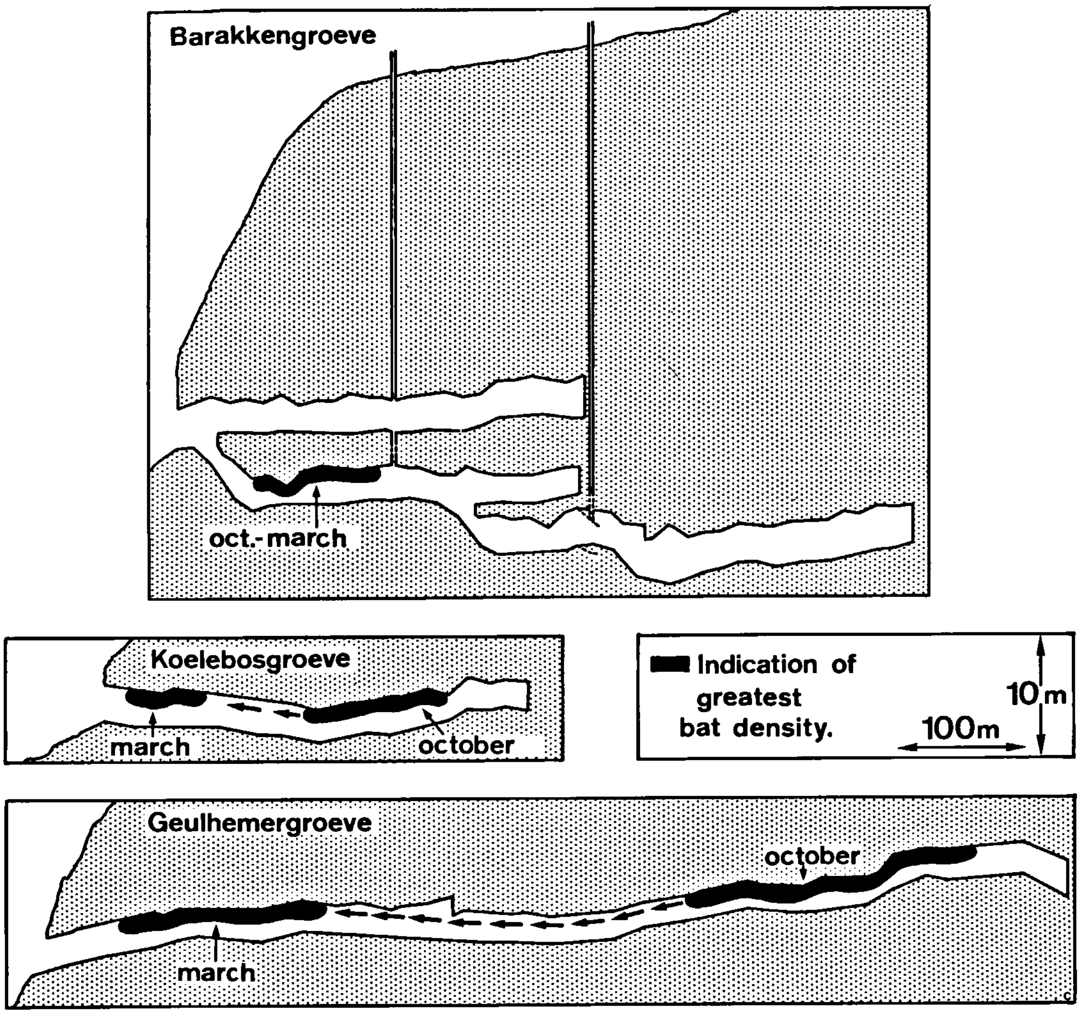

Fig. 3. Schematic representation of internal migration inthree quarries.

be an argument supporting to the concept of internal migration as a response to changes in the microclimate of the quarries.

INDIVIDUAL MIGRATION?

As shown in figures 2b and 2c (solid lines), the concentrations of bats in the entrance area keep increasing throughout the winter (as does the temperature difference between entrance and rear part of the quarry). In order to find out whether this shift in distribution is due either to individual migration from back to front, or to a tendency in bats arriving later to select the front area more frequently, we have traced individual habitat selection in the Barakkengroeve. The animals were marked with plastic head stickers, utilising a two-letter code (Daan, in press). This method allows the identification of each individual from some distance without disturbance. The data have been divided in two groups: one of "early arrivers" (marked before November 29, 1967) and one of "late arrivers" (marked after this date). The change in distribution of both groups with respect to the border line of the entrance area is included in figures 2b and 2c for the two most abundant species (*Myotis mystacinus* and *M. daubentonii*).

From these data, the conclusions can be drawn that, firstly, the "early" bats kept moving individually into the entrance area, even after November 29; secondly, that no consistent difference is found between early and late arrivers in their distribution in the quarry.

This proves that the second assumption — of internal migration as a change in individual habitat selection — is indeed justified.

DISCUSSION

Comparison of the behaviour of bats hibernating in different types of limestone quarries gives the following overall picture: in those quarries where relatively warm air can flow in in the entrance area, this part of the cave is avoided by bats at the beginning of the hibernating season. In the "Barakkengroeve" the entrance area of the middle system remains the coldest part all summer and bats concentrate here immediately on arrival in October. In both types of quarries individual migration from rear to entrance takes place as the entrance areas cool down. High relative humidity and low temperature often go hand in hand in the quarries. In the entrance area of the Barakkengroeve, relative humidity reaches almost 100 % throughout the year. Therefore, only decreasing temperature can be related with migration towards this area.

The ecological meaning of the selection of lower temperatures in the hibernacula can be sought in the resulting decrease in the frequency of spontaneous arousal from hibernation. Most of the stored body reserves available for the whole hibernation period is used during interruptions in the hypothermic state. In the European ground squirrel *(Citellus citellus)* 90 % of the total weight loss has been found to occur during such spontaneous arousals, which together make up only 7 % of the complete hibernation season (Kayser, 1952). This figure, obtained in constant laboratory conditions may well be even more extreme in nature, where external stimuli add to the total number of arousals.

Lower ambient temperatures in the quarries in winter are usually found in the entrance areas and it is in these areas also that thermocirculation and temperature fluctuations are most pronounced. Consequently, external stimuli leading to arousal are much stronger than in the rear: this is especially so in the autumn in horizontal caves. The balance between ambient temperature and the amount of arousing stimuli present can indeed be conceived of as favouring a gradual shift of the bats towards the entrances. It is even tempting to speculate that such species as *Myotis emarginatus,* which probably have very long uninterrupted hibernation periods (Daan & Wichers, 1968) can therefore tolerate staying in the warmer rear of the quarries all winter.

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