EFFECTS OF ENVIRONMENTAL VARIABLES ON SOME PHYSIOLOGICAL RESPONSES OF MICROTUS MONTANUS UNDER NATURAL CONDITIONS

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Objectives

Cyclic fluctuations in the population density of microtine rodents have been known since antiquity. However, factors responsible for this phenomenon are not known.

The objectives of this long term study are essentially threefold. First, to characterize those environmental variables that might affect Microtus montanus in different seasons of the year. Second, to record the growth, maturation and reproductive activity of the voles under natural conditions. Third, to determine the maturational, as well as the seasonal pelage changes of these rodents. The data resulting from the execution of the above objectives would be correlated in an attempt to determine the causes underlying the multi-annual fluctuations in the population density of these microtine rodents in Grand Teton National Park.

Methods

Microtus montanus were livetrapped and sacrificed as soon as possible after capture. Age estimation for all animals was based on weight, total length, and pelage characteristics. Reproductive organs, the spleen, and the adrenal glands were collected from the animals and preserved in Lillie's buffered neutral formalin for further histological study. Flat skins were prepared from all animals. All tissues are currently being processed at the Department of Biological Sciences, University of New Orleans.

In 1983 field observations in Grand Teton National Park were carried out over two study periods: spring (22-26 May) and summer (12 July - 10 August).

Results

The spring growing season of 1983 began only about a week earlier than that of 1982. However, meltwater had drained from the study areas by the 3rd week in May, despite a blizzard in the middle of the month. Extensive runways in the matted dead grass indicated the existence of a relatively high winter population of voles. However, despite the presence of the high overwintering population there was still abundant dead herbaceous vegetation in the medows. This was

probably a consequence of extremely luxuriant and abundant vegetation produced during the 1982 growing season. The newly sprouting grasses were being cut extensively by Microtus.

Reproduction had begun on a population wide basis during the 2nd week in May 1983. Litter sizes were unusually high; the mean litter size was among the highest recorded for spring litters since the study began. All females trapped during the spring study period were pregnant with their first litter.

The population density of Microtus in 1983 rose above the 1982 levels. The adult females were the principal reproductive contributors. Approximately 80 percent of all adult females were reproductively active. The mean litter size for this group was 6.1. On the other hand, only approximately 16 percent of the subadult females were reproductively active. The mean litter size for this group was 5.1. Although the latter is by no means a small litter size, the low percentage of breeding subadult females made the reproductive contribution by this group very low. It is possible that the relatively dry summer of 1983 suppressed the maturation rate of animals born in 1983.

The population growth was also favored by an apparently low number of weasels. Both, Mustela frenata and M. erminea, regularly enter the unbaited Sherman traps set for Microtus. Only one weasel was trapped in the summer of 1982 and 1983, each. A similar pattern was observed in 1978-79, followed by a dramatic rise in the population of these predators in 1980. It is anticipated that 1984 will also show a dramatic rise in the numbers of weasels. There probably will be a decline in the numbers of Microtus for a number of reasons. To start with, the overwintering population is high, yet, the food supply will not be as abundant as it was in the winter of 1982-83. Consequently, animals will either starve, or will be undernourished sufficiently to succumb more readily to environmental stresses. Furthermore, the area is currently experiencing an exceptionally heavy snowfall. If this pattern continues through April and May of 1984, meltoff may not be complete until late in May of that year. This was the case in 1975. Onset of reproduction was delayed significantly, the population density of weasels was high, and the Microtus population declined for the 2nd year in a row. On the other hand, however, the early heavy snow provides small mammals with excellent shelter. This decreases the energetic demands for thermogenesis and would lead to decreased caloric intake. As a result, a smaller biomass of vegetation could support a larger number of herbivores. Heavy snow cover also protects voles from aerial predators.

It was reported last year that an unusual white spotted pocket gopher (Thomomys) was captured in one of the traps set of for Microtus. In 1983, three more spotted gophers were trapped. One of these was found only 10 m from the site that yielded the first mutant in 1982. The two other were trapped within 5 m of each other, and 20 m from the site of the 1982 capture. It is highly probable that all the spotted animals are related, since spotting of this type is rarely seen in Thomomys.

Conclusions

Based on results obtained during the course of this study it is proposed that the population density of *Microtus* will decline and that of *Mustela* will rise in 1984.

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