Effects of Environmental Variables on Some Physiological Responses of Microtus montanus under Natural Conditions

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The aims of the study were essentially the same as those described in the report on this project for the summer of 1969. In brief, between May and October, 1970, several physiological parameters were examined in the montane vole (Microtus montanus) under natural conditions. The physiological responses of these rodents are being correlated with seasonal changes in several environmental variables. The collection of data was essentially the same as outlined in the 1969 report.

Field observations

Field observations at the Research Station were carried out over three study periods: spring (May-June); summer (July-August); and fall (October).

A. Spring study period (May-June).

Microtus populations had undergone a precipitous decline ("crash") during the winter of 1969-70. In all study areas fresh sign (droppings, grass cuttings) was limited to isolated and widely spaced spots. Voles could be found only in small scattered groups.

Large areas of the meadows were virtually denuded of vegetation. Frequently even the roots of grasses as well as of the willows had been gnawed. However, some areas with heavy mats of dead grass still remained. Microtus occurred both in areas of sparse vegetation as well as in spots that still retained the dead grass cover.

Breeding in Microtus on a population-wide scale started between the second and third week in May, shortly following the meltoff of all snow in the meadows. Approximately 75% of the females were pregnant by the end of May. Embryo counts ranged from 3 to 7, with an average of 5.3. All of these were first pregnancies of the year, since no lactating females were found and no recent placental scars were observed.

The remaining 25% of the females were beginning to show signs of reproductive activity at the end of May. The only evidence for gonadal recrudescence was a perforate vagina and an increase in uterine turgidity over the infantile proportions seen in sexually quiescent individuals. However, none of these animals had ovulated by the end of May.

Judging from the growth stages of various plants spring in 1970 was later than that in 1969 by approximately two weeks. The reproductive status of Microtus in 1970 also lagged behind the conditions observed in 1969 by approximately two weeks.

B. Summer study period (July-August).

Although Microtus had been breeding since the middle of May, the populations were understandably still at very low levels. Very few well defined runways, characteristic of a Microtus habitat in years of higher population density, could be located. Voles occurred only in small isolated groups, indicating a minimal degree of dispersal by the new recruits into the summer population.

Both subadult and adult Microtus were reproductively active. Embryo counts for subadult females ranged from 4 to 5 (average 4.5); for adult females from 5 to 7 (average 6.3). For the subadults these were first litter pregnancies. All adult females were multiparous. The difference in the average values between females in the two age groups is in agreement with earlier observations (Negus and Pinter, 1966) that litter size in Microtus montanus is related to the age and the parity of the female.

Long-tailed and short-tailed weasels (Mustela frenata and M. erminea, respectively) frequently entered unbaited Sherman livetraps set for Microtus. The abundance of weasels trapped undoubtedly reflects the relative food shortage experienced by the small carnivores as a result of the Microtus crash.

C. Fall study period (October).

Microtus populations were still at a very low level since production during the summer had probably been countered by heavy predation pressure. Once again, voles could be found in small groups only.

Microtus were still reproductively active at this time. Both pregnant and lactating females were trapped. In pregnant females estimated parturition dates fell between October 17-26. However, reproductive activity was confined only to adult animals. Even in this age class reproduction was decreasing: several adult females showed no sign of lactation or ovulation, although placental scars could still be detected. Circumstantial evidence also points to a decreasing reproductive activity in males: the androgen-dependent hip glands which had exhibited heavy sebaceous activity in the summer months were virtually undetectable in males of all age classes trapped during the fall period.

No explanation can be offered at the present for the crash in the Microtus population; a multitude of factors is doubtless involved. However, the crash does not appear to be a density-related phenomenon. Some areas had been trapped considerably more heavily than others over the past years. Consequently, the various populations entered the winter of 1969-70 at

different levels of density. Nevertheless, Microtus disappeared from all study areas. It is also impossible to say at what time between October 1969 and May 1970 the voles had died. The Research Station was visited at the end of January 1970. Although recent sign was located repeatedly, Microtus apparently ventured only infrequently out of their subnivean runways, and were reluctant to enter the traps.

The materials collected during the 1970 study period are currently being processed. This phase of the work is incomplete and the results will not be included in the present report.

The study will continue. The physiological characteristics of voles will be followed and scrutinized throughout the next multiannual cycle of population buildup. Simultaneously information will be collected regarding changes in several environmental variables on a seasonal and a multiannual basis.

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