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Previous field studies at Virginia Tech have found differences in reproductive output of pine voles in abandoned and maintained orchards. Cengel et al. (1978), trapping in northern Virginia, found higher levels of reproduction in a maintained orchard than in an abandoned orchard. The breeding season of voles extended into winter in the maintained orchard but ceased in late fall and winter in the abandoned orchard. Noffsinger (1976), working in orchards near Roanoke, Virginia, found a higher natality rate in the maintained orchard and a year-round breeding season; however, the percentage of pregnant females declined in winter. Reproduction was lower in the abandoned orchard in late fall and winter with no pregnant females caught in March.

Both of these studies attributed the differences in reproduction to differences in nutrition. Both felt the quality and quantity of forage available to pine voles and the presence of apple drops in the maintained orchard contributed to more reproduction and a longer breeding season. Lochmiller et al. (1980), who worked in the same orchards as Noffsinger, found the maintained orchard had higher levels of both biomass and gross energy in summer, fall, and winter.

The objective of the present study was to test the influence of apples as a food source on the population density, body weights, and reproductive organ weights in pine voles in the fall. To achieve this objective, two experiments were conducted during the autumn of 1980. This paper is a preliminary report of the data collected from these studies.

The first experiment was conducted in a metal frame building near the Virginia Tech campus. One to two inches of soil were placed in the bottom of four concrete troughs inside the building. Each trough was then divided into four equal sections 2.3 sq. m. in area. Sunlight entered the building through skylight panels in the roof.

Pine voles used for this experiment were trapped in late July and immediately placed in the troughs. In early September, two males and five females were grouped at random in 12 of the 16 sections of the troughs. Half of these groups were fed an ad libitum amount of ground rabbit chow, while the other half were fed ad libitum amounts of both rabbit chow and apple. The commercial chow had a fiber content of 15% and a digestibility of 65-68%. In mid-September, florescent lights and black plastic were suspended from the rafters. This further subdivided the groups so that half were maintained on a constant 14L:10D photoperiod and the remaining groups were kept on a natural declining photoperiod. Thus, the four treatment groups in this experiment were

(1) ad libitum chow and declining photoperiod, (2) ad libitum apple and chow and declining photoperiod, (3) ad libitum chow and 14:10 photoperiod, and (4) ad libitum apple and chow and 14:10 photoperiod.

The experiment was run for 12 weeks. Natural photoperiod at the beginning of the experiment was about 12:12 and at the end was approximately 9.5:14.5. Body weight, body length and reproductive condition were recorded every 2 weeks. Dead or missing voles were replaced during the first half of the study but no voles were added during the last 6 weeks.

There was little difference in mean change in body weight for pine voles living through the entire study. Only two groups, females on the apple and chow diet on both constant and declining photoperiods, had a positive mean change in body weight. All other groups showed a slight loss in body weight during the 12 weeks. There was also little difference in mean change in body weight for any group during the last half of the study. Females in the 14:10 constant photoperiod and fed apple and chow were the only group having a positive mean change.

Photoperiod and nutrition had little effect on final mean body weight for adult males. These two factors did influence mean testes weight, however. Mean testes weight was higher in males on the 14:10 photoperiod than in those on the declining photoperiod and in males fed both apples and chow than in those on the chow diet only. Males on a 14:10 photoperiod and apple-chow diet had the highest mean testes weight while those on a declining photoperiod and fed only chow had the lowest mean value.

The second experiment was a field study conducted in an apple orchard near Roanoke, Virginia. During the second week of September, apples were removed from two areas of this orchard. One area was five tree rows wide by three trees long and the second area was four tree rows by 12 trees. Apples were not removed from the remainder of the orchard.

Both areas with apples removed and a third grid (6 rows x 12 trees) in the area with apples present were live-trapped from August to October. All three areas were trapped at the same time for 3 sequential days each month. The voles were weighed, sexed and aged; and reproductive condition, body length and location were recorded. The animals were then marked for later identification and released.

In November, the smaller area with apples removed and an equivalent number of trees from the area with apples were snap-trapped. The larger grid with apples removed and the control grid were live-trapped at this time. In December, the larger area with apples removed and an equal number of trees in the rest of the orchard were snap-trapped.

In November, 5.4 voles per tree were caught from the area where apples were picked and 3.0 voles per tree from the area with apples. Nearly equal numbers were captured from both areas in December. Fifty-two voles were removed from 16 trees in the larger area without apples and 53 voles from 16 trees in the area with apples.

Removing apples appeared to have little influence on monthly mean body weight for either adult females or males. Mean body weight for males was not different from those of females captured in the same month and treatment area.

Presence of apples had little effect on mean body weight or mean adrenal weight for adult males snap-trapped in November. However, there was nearly a two-fold difference in mean seminal vesicle weight and mean testes weight between voles from the two areas. The larger mean weights were from males which had apples available. In December, adult males in the area with apples had a slightly higher mean body weight and mean adrenal weight. The difference between mean seminal vesicle weight and mean testes weight from the two areas was even greater in December than in November. Males from the area with apples present had a mean seminal vesicle weight about six times greater than for males in the area with apples removed. There was a three-fold difference in mean testes weight.

Mean body weight, mean adrenal weight, and mean paried ovarian weight were not different for adult non-pregnant females in the two areas for either November or December. Mean uterine weight was slightly higher for non-pregnant females in November in the area with apples removed. In December, mean uterine weight was higher for females in the area with apples. Mean paired ovarian weight was lower in both areas in December than in November.

No pregnant females were snap-trapped in either area in November. Eight pregnant females were captured in December in the area with apples present but none was caught in the area without apples.

Results from this experiment relate well to those found in other field studies done at Virginia Tech. Cengel et al. (1978) had similar mean testes weights for adult males in the abandoned and maintained orchard. Mean testes weight in their abandoned orchard for November and January are comparable to those found in our area without apples in Nobember and December. Noffsinger (1976) found a higher mean uterine weight in an abandoned orchard in November but in January the maintained orchard had a higher mean weight. Mean uterine weight and mean testes weight reported by Valentine and Kirkpatrick (1970) for a maintained orchard in November are quite close to the values found in November in the area with apples.

In summary, the availability of apples apparently had little influence on population size in the orchard studied. Presence of apples had no effect on mean body weight during the fall in either study. The presence of apples as an additional food source may have increased mean weights of reproductive organs and reproduction. These results and additional data will be further analyzed to gain insight into the influence of apples on reproduction in pine voles.

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