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BURROWS OF THE SAGEBRUSH VOLE (LEMMISCUS CURTATUS) IN SOUTHEASTERN IDAHO

Tim R. Mullican¹ and Barry L. Keller¹

ABSTRACT—Burrows of the sagebrush vole (Lemmiscus curtatus) were analyzed by injecting them with expanding polyurethane foam. Average mean depth ± 1 SE of four burrows was 12.5 ± 2.6 cm. Tunnels were wider than high and flat on the bottom. Three of four burrows were nearly linear, with an average of five entrances. Burrows usually contained one nest made of Artemisia tridentata bark. No middens or communal nests were found. The burrow structure in sagebrush habitat suggests that sagebrush voles occur singly or in pairs rather than in colonies.

The sagebrush vole (Lemmiscus curtatus) frequently has been described as a colonial species, and clusters of their burrows have been referred to as colonies (Hall 1928, 1946, Soper 1931, James and Booth 1952, Maser et al. 1974). A few investigators have described the structure of sagebrush vole burrows (Johnson et al. 1948, Dearden 1969, Maser et al. 1974), but a quantitative analysis of this structure has not been published. The taiga vole (Microtus xanthgnathus) frequently has underground structures such as middens and large winter nests which reflect their social organization (Wolff and Lidicker 1981). In general, quantitative analyses of the burrow structure of voles are needed to elucidate the social structure of individual species as well as to determine the effects of voles on soil structure, but few investigators have done such studies.

In August 1984 four sagebrush vole burrows were injected with expanding polyurethane foam that produces an exact cast of the burrow system. The objectives of this paper are to describe the structure of sagebrush vole burrows for an Idaho population in detail and to discuss the social organization that this structure suggests.

METHODS

Our population of sagebrush voles was on the Idaho National Engineering Laboratory (INEL) on a 1-ha live-trapping plot (43°31'39"N, 112°59'26"W, Butte Co., Idaho) used to analyze population trends for this species (Mullican and Keller 1986). Vegetation on the site was dominated by big sagebrush (Artemisia tridentata), green rabbit-brush (Chrysothamnus viscidiflorus), and wheatgrass (Agropyron sp.), which is considered typical habitat for sagebrush voles. Temperatures on the INEL range from 39 C (maximum) in the summer to −41 C (minimum) in the winter (Groves and Keller 1983). The average annual precipitation over a 30-year period prior to our study was 19.2 cm (National Oceanic and Atmospheric Administration 1984), with peak rainfall occurring in the months of May and June.

The exact location of burrows occupied by sagebrush voles was determined by tracking animals tagged with Ta³². Subsequently, individuals were removed by live trapping to recover the Ta³² tags, and the animals were sacrificed to assess their reproductive condition (Mullican and Keller 1986). Only adult animals over 21 g existed in the burrows we examined.

In September four burrows were filled with expanding polyurethane foam with an injection system described by Felthauer and McInroy (1983). When injected, the foam hardened into an exact cast of the burrow system. The soil surrounding the cast was excavated, revealing the details of the burrow. A 1-m² wire grid with 10-cm² squares was positioned over the cast of the burrow while it was still in place, and depth below the surface was measured at 10-cm intervals along the length of the burrow. After the cast was removed from the ground, the height and width of the cast were measured at 10-cm intervals along

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Table 1. Depth from ground surface, height, and width of tunnels from four burrows of *Lemmiscus curtatus*. Number of measurements is in parentheses.

<table>
<thead>
<tr>
<th>Burrow</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth (cm)</td>
<td>10.3 ± 4.8</td>
<td>20.3 ± 9.8</td>
<td>10.6 ± 4.1</td>
<td>8.8 ± 6.4</td>
</tr>
<tr>
<td>± 1 S.D.</td>
<td>(n=42)</td>
<td>(n=6)</td>
<td>(n=8)</td>
<td>(n=15)</td>
</tr>
<tr>
<td>Width (cm)</td>
<td>4.8 ± 0.6</td>
<td>4.5 ± 0.6</td>
<td>5.2 ± 1.1</td>
<td>4.6 ± 0.5</td>
</tr>
<tr>
<td>± 1 S.D.</td>
<td>(n=19)</td>
<td>(n=10)</td>
<td>(n=5)</td>
<td>(n=19)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>3.2 ± 0.9</td>
<td>3.1 ± 0.3</td>
<td>3.2 ± 0.4</td>
<td>3.4 ± 0.6</td>
</tr>
<tr>
<td>± 1 S.D.</td>
<td>(n=19)</td>
<td>(n=9)</td>
<td>(n=5)</td>
<td>(n=19)</td>
</tr>
</tbody>
</table>

Fig. 1. Diagram of a burrow of *Lemmiscus curtatus* as determined from a polyurethane cast. Shaded areas indicate big sagebrush (*Artemisia tridentata*) canopy. Entrances are numbered.

its length. Some of the casts were incomplete because the pressure of our injection system was insufficient to completely fill the tunnels. Because of this, we could not obtain measurements of the height and width of the tunnels along some sections of the burrows. Position and number of entrances, nests, and nest chambers were readily apparent from the cast.

**RESULTS**

The average mean depth ± 1 SE of the four burrows was 12.5 ± 2.6 cm. Mean depths ± 1 SD of individual burrows ranged from 8.8 ± 6.4 cm to 20.3 ± 9.8 cm (Table 1). The burrow entrances were usually under or near big sagebrush (*Artemisia tridentata*), and often tunnels were found between adjacent sagebrush (Fig. 1). The mean number of entrances per burrow system was 5 and ranged from 2 to 7. The burrow tunnels were wider than high (Table 1) and were usually flat on the bottom.

Three of the burrows were nearly linear, but one was complicated in structure with tunnels radiating outward from a central nest chamber. Maximum straight-line length of burrows ranged from 0.7 to 4.6 m with a mean of 1.9 m.

Three of the four burrows contained nests that averaged 12.4 cm in diameter. Two of the nests were composed entirely of shredded sagebrush bark, whereas one occupied by a male was composed mostly of the bedding
material used in the live traps and a small amount of sagebrush bark. No young were found trapped in any of the nests.

**DISCUSSION**

The burrows that we examined were much less extensive than those reported by Maser et al. (1974), who described a burrow system that covered an 11 x 26 m area. However, the burrow systems described by Maser et al. (1974) proved to be abandoned burrows of the northern pocket gopher (*Thomomys talpoides*) taken over and modified by sagebrush voles. Although there is no way to know if the burrows that we described were constructed exclusively by sagebrush voles, the size of the tunnel precludes previous development by pocket gophers on our study plot.

We found that the average depth of burrows was 12.5 cm. Johnson et al. (1948) found that burrows ranged from 10 to 30 cm below the surface. Dearden (1969) found that sagebrush vole burrows were shallow, extending to an average depth of 36 cm. Maser et al. (1974) stated that pocket gopher burrows invaded by sagebrush voles were usually 5 to 8 cm below the surface.

Burrows of the taiga vole, *Microtus canadensis*, are limited to the upper 15 to 25 cm of the soil due to mineral soil or permafrost (Wolff and Lidicker 1980). Apparently taiga voles must resort to group nesting to conserve energy during the long winter period (Wolff and Lidicker 1981). At least six other rodent species are known to nest in groups (West and Dublin 1984). We found no evidence of coloniality in the sagebrush vole, but sagebrush voles may employ communal nesting during winter, especially if snow cover is limited. However, the density of vegetation in sagebrush-grassland areas in Idaho may not be adequate to support large concentrations of these voles. Because we did not inject burrows during winter, our burrow structures would not reflect potential seasonal changes in the social organization of sagebrush voles in winter. Studies are needed to understand how this species can conserve enough energy to survive and produce offspring during winter, as we initially experienced difficulty keeping individual animals alive if they were held in live traps for more than four hours.

Sagebrush vole burrows have been reported to have up to 30 entrances (Hall 1946, James and Booth 1952). The four burrows that we excavated contained an average of 5 entrances (range 2–7). The higher number of burrow entrances reported in other studies could be due to other species that previously occupied the burrow, the fossorial work of other species which share the burrows of *Lemnisce* (Miller 1930), or incorrect assumptions about the below-ground structure of burrows that were not excavated by investigators.

Soper (1931) found that sagebrush voles in southern Alberta and Saskatchewan constructed extensive runways between burrows. He located sagebrush vole burrows by capturing individuals in traps placed in runways near burrow entrances. We could not find evidence of runways utilized by sagebrush voles on our study plots, as most of the ground surface on this area was composed of bare soil where any trail would be quickly obliterated by frequent winds.

In areas where sagebrush (*Artemisia* sp.) is present, nests are usually made of sagebrush bark (Moore 1943, Johnson et al. 1948, James and Booth 1952). However, Maser et al. (1974) found that sagebrush vole nests were made of leaves, stems, and seed heads of grass in central Oregon.

Based on the structure of burrows, we found nothing to suggest that sagebrush voles are colonial during summer. This is consistent with the results of our dispersion analysis reported elsewhere (Mullican and Keller 1986). Further research is needed, however, during winter and at densities that exceed those we observed in Idaho to elucidate the social organization of this species.

**ACKNOWLEDGMENTS**

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**LITERATURE CITED**


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