Summer and Winter Food Caches of the Heather Vole, *Phenacomys intermedius*, in Quetico Provincial Park, Ontario

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Summer food caches of the Heather Vole (*Phenacomys intermedius*) contained mostly leaf and stem cuttings from Blueberry (*Vaccinium angustifolium*) and Bearberry (*Arctostaphylos uva-ursi*) stored near burrows. Winter caches comprised piles of twigs that were cut from at least 17 species of broad-leaved shrubs and trees. Summer caches provide protection from predators while feeding; winter caches may represent food hoarding.

Key Words: Heather Vole, *Phenacomys intermedius*, food caches, Ontario.

A characteristic of the Heather Vole, *Phenacomys intermedius*, is its habit of making summer and winter food caches (Foster 1961). Most studies of these food caches were made in the boreal forests of eastern Canada (Foster 1961; Nagorsen 1982) or in subalpine and alpine habitats in western North America (Shaw 1924; Racey 1936). In the summers of 1977-79 during a small mammal survey of Quetico Provincial Park, I found a number of winter and summer food piles of *P. intermedius*. They provide data on the food habits of *P. intermedius* in the mixed forests of the Great Lakes – St. Lawrence Forest Region where this vole is at the southern periphery of its geographic range.

Study Area and Methods

Food caches were found in coniferous and mixed forests at Reid Lake (48°18′N, 91°21′W), Emerald Lake (48°07′N, 91°14′W), and Kawa Bay (48°24′N, 91°08′W) while sampling these habitats with transects of small mammal traps. These were mature forests that regenerated from major fires in the late 1800s and early 1900s. The only logging in these sites was selective cutting for Red Pine (*Pinus resinosa*) and White Pine (*Pinus strobus*) 40 to 60 years ago. Dominant trees were Jack Pine (*Pinus banksiana*), Balsam Fir (*Abies balsamea*), Black Spruce (*Picea mariana*), White Spruce (*Picea glauca*), Trembling Aspen (*Populus tremuloides*), and White Birch (*Betula papyrifera*). Mountain Maple (*Acer spicatum*), Red Maple (*Acer rubrum*), Green Alder (*Alnus crispa*), and Beaked Hazel (*Corylus cornuta*) were the most common shrubs. The forest floor was covered with numerous fallen trees (i.e. blowdowns) and decaying stumps. Nagorsen and Peterson (1981) have described the small mammal communities in these forests.

Plant cuttings collected from summer food piles were labelled and stored in a plant press for future identification. Twigs from winter caches (Figure 1) were collected from the forest floor and stored in plastic bags. I recorded species of woody plants in the vicinity of each twig pile and noted any woody plants that were gnawed by small rodents. A reference collection of branches and stems from woody plants in the study areas was prepared to assist in identification. I used the following features to identify twigs: arrangement of branches, colour and texture of bark, arrangement of bud scales, morphology of lenticels, and the colour and texture of pith.

Results and Discussion

Summer Caches

Thirteen summer caches were found that I attributed to *P. intermedius*. They consisted of leaf and stem cuttings from various green plants that had been piled in or near burrows. Four species were identified in the 13 food piles; their frequency of occurrence was Blueberry (*Vaccinium angustifolium*) 69.2%, Bearberry (*Arctostaphylos uva-ursi*) 61.5%, Sweetgale (*Myrica gale*) 7.7%, and hawkweed (*Hieracium* sp.) 7.7%. Although the Rock Vole (*Microtus chrotorrhinus*) and Southern Red-backed Vole (*Clethrionomys gapperi*) also inhabited these forests, there was strong circumstantial evidence that these food piles were made by *P. intermedius*. The only voles taken in traps set near these caches were *P. intermedius*. Moreover, I trapped one Heather Vole during the study with Blueberry cuttings in its mouth. Food piles of the Rock Vole in Quetico Provincial Park contained mostly cuttings of Bunchberry (*Cornus canadensis*), Wild Lily-of-the-Valley (*Maianthemum canadense*), and Large-leaved Aster (*Aster macrophyllus*) [unpublished data].

Cuttings of Bearberry and Blueberry plants were reported in *P. intermedius* caches at Peninsula Harbour, Ontario (Miller 1897) and Authier-Nord, Quebec (Foster 1961). In eastern Canada, berries, leaves and twigs of these plants are an important item

FIGURE 1. Winter cache of cut maple (*Acer rubrum* and *A. spicatum*) twigs. Note that most twigs have been stripped of bark. Lens cap is 50 mm in diameter.

in the summer diet. Evidently there is strong selection for heather plants (Ericaceae) by *P. intermedius* during summer. Although Blueberry and Bearberry were common ground plants in the forests where I found Heather Vole caches, these habitats also supported a rich diversity of forbs that were not exploited by *P. intermedius*. Summer food piles of the Heather Vole that I collected contained small quantities of plant material that would be consumed within a day or two. Because of the abundance of food resources, it is unnecessary for *P. intermedius* to store large food reserves in summer. Caching small amounts of food at burrows is probably a strategy for avoiding predators while feeding.

Winter Caches

A total of 65 separate winter caches was collected. They consisted of cut twigs piled on the forest floor (Figure 1). Size of tooth marks indicated that twigs were cut by a small cricetid or microtine rodent. Although four species of small rodents (Deer Mouse, *Peromyscus maniculatus*, Southern Red-backed Vole, *Clethrionomys gapperi*, Rock Vole, *Microtus chrotorrhinus*, and *P. intermedius*) were trapped in forests with twig caches, I attribute these caches to *P. intermedius*. There are no reports in the literature that *P. maniculatus, C. gapperi*, or *M. chrotorrhinus* cache twigs in winter. But several studies (Shaw 1924; Foster 1961) demonstrated that *P. intermedius* feeds on bark and caches twigs during winter. Moreover, Foster (1961) observed that this vole made piles of willow twigs in captivity.

Twig piles were found at the base of shrubs and tree saplings, near old burrows, under rocks and logs (Figure 1), and under the branches of fallen trees. Branches and stems of woody plants near twig piles were usually girdled and the tips of many branches were gnawed off. Some of these stems and branches were 1 to 2 m above the ground and, as *P. intermedius* is not arboreal (Johnson 1973), they could only be reached when there was deep snow cover on the ground. The absence of fresh droppings and green twigs in caches was additional evidence that twig piles were made the previous winter.

Number of twigs in caches varied from about 6 to 12 in small caches to more than 1200 in several large caches. Mounds of dried rodent droppings were present in large caches. From incisor marks on the ends of twigs, it was evident that twigs were cut from stems and branches by gnawing. A random sample of 400 twigs from one large cache revealed that twigs

ranged from 8 to 125 mm in length (75% 20 to 60 mm) and from 1 to 6 mm in diameter. *P. intermedius* may be unable to manipulate and carry larger twigs. Most twigs in caches were almost completely stripped of bark (Figure 1). Tooth marks indicated that bark was removed by gnawing with the incisors. The woody xylem was not eaten.

Plant species and their frequency of occurrence in the 65 caches were maple (*Acer rubrum* and *A. spicatum*) 43.1%; blueberry (*Vaccinium* sp.) 35.4%; Trembling Aspen (*Populus tremuloides*) 13.9%; Bearberry (*Arctostaphylos uva-ursi*) 12.3%; White Birch (*Betula papyrifera*) 12.3%; Sweetfern (*Myrica asplenifolia*) 12.3%; cherry (*Prunus* sp.). 9.2%; Northern Bush Honeysuckle (*Diervilla lonicera*) 9.2%; Juneberry (*Amelanchier arborea, A. sanguinea*) 7.7%; Green Alder (*Alnus crispa*) 7.7%; Beaked Hazel (*Corylus cornuta*) 6.2%; Round-leaf Dogwood (*Cornus rugosa*) 3.1%; Sweetgale (*Myrica gale*) 1.5%; Leatherleaf (*Chamaedaphne calyculata*) 1.5%; and honeysuckle (*Lonicera* sp.) 1.5%. No coniferous species were found in twig caches.

My observations suggest that *P. intermedius* is opportunistic in gathering twigs. The relative abundance of various plant species in twig piles generally reflected their availability. The dominant shrubs in Heather Vole habitats in Quetico were Red Maple, Mountain Maple, and species of heather. Although branches of Trembling Aspen and White Birch trees were beyond the reach of Heather Voles even with deep snow on the ground, *P. intermedius* utilized recent blowdowns of these trees. All caches of Trembling Aspen and White Birch that I collected were situated near or under recent blowdowns. The smaller branches and stems of these fallen trees were heavily gnawed and girdled.

The absence of conifers in caches, however, is curious. Jack Pine, Balsam Fir and White Spruce were common in Heather Vole habitats and numerous blowdowns of conifers were present in forests. Inadequate nutrients or the presence of unpalatable resins (Bryant and Kuropat 1980) may make the bark of conifers undesirable to *P. intermedius*. Previous observations of *P. intermedius* suggested that its winter diet was restricted to the bark of willow, birch, and species of Ericaceae (Shaw 1924; Foster 1961; Nagorsen 1982). However, these studies were in alpine or subarctic habitats that supported few species of broad-leaved woody plants. My results demonstrate that the Heather Vole uses a wide range of woody plants for winter food in mixed forests of the Great Lakes – St. Lawrence Forest Region, where there is a diversity of broad-leaved shrub and tree species.

Bark-gnawing during winter has been reported for several vole species (Spencer 1984), but *P. intermedius* and the arboreal Red Tree Vole (*Arborimus longicaudus*) are the only North American voles that cut and store twigs in food caches. Energy costs and risks of predation from this activity are presumably offset by some benefits to *P. intermedius*. If winter caches are located near nests, they would provide an accessible food supply during inclement winter weather. Some of the large twig piles that I found represent substantial food reserves for a single Heather Vole and these caches may have been constructed to hoard food resources. Alternately, large twig piles may have been feeding sites where twigs were deposited repeatedly throughout the winter. The construction of twig caches by *P. intermedius* has not been observed in the wild and nothing is known about the phenology of twig caching or the number of voles that may utilize a cache.

Most species of voles are social during winter, and communal nesting and even food sharing occur in some species (West and Dublin 1984). Because clumped food resources are conducive to voles' forming social groups, *P. intermedius* would be expected to demonstrate some degree of sociality in winter. However, the social biology of the Heather Vole is unknown. Winter caching behaviour and its role in the social biology of *P. intermedius* should be explored in future studies.

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