

Arboreal activity of *Glirulus japonicus* (Rodentia: Myoxidae) confirmed by use of bryophytes as nest materials

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The structural materials of twenty one nests of the Japanese dormouse *Glirulus japonicus* (Schinz, 1845) collected at Mt Fuji and Mt Akadake in 1988, were analyzed. Fifty seven species of bryophytes were found: 42 species of *Musci* and 15 of *Hepaticae* which constituted the major portion of the materials sampled. Most of these species were epiphytes on tree trunks, and this confirms the supposition that the Japanese dormouse uses arboreal space.

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Introduction

Most of the dormouse species are arboreal, however *Eliomys quercinus* and *Dryomys nitedula* live also on the ground; *Myomimus personatus* is the only dormouse that is exclusively ground dwelling (Baudoin 1986). However, there has still been little research on the habitat of the Japanese dormouse *Glirulus japonicus* (Schinz, 1845).

The place of origin of the nest materials indicates habitats used by an animal, therefore analysis of nest materials is a useful method for investigating habitat use by a species. There have been several studies on the nest materials used by *Gliridae*: *Muscardinus avellanarius* (Ognev 1947, Santini 1983, Hurrell and McIntosh 1984, Morris *et al.* 1990), *Dryomys nitedula* (Ognev 1947, Nevo and Amir 1964), *Eliomys quercinus* (Ognev 1947, Santini 1983), and *Glirulus japonicus* (Mori and Morie 1978, Watanabe 1978). In this paper, we describe the habitat of the Japanese dormouse, based on the bryophytes used in nest-building. This study is part of a general research on the Japanese dormouse, started in 1988.

Methods

In 1988, we obtained 21 nests of the Japanese dormouse from Mt Fuji and Mt Akadake. Table 1 shows the localities, elevations, slopes and forest types where the nests were found. Nest boxes

Table 1. Localities, elevations, slopes, and forest types where nests of Japanese dormice were obtained.

Locality	Elevation (m)	Slope	Forest type (dominant species)
A Mt Fuji, Oyama Shizouka Pref. (35°22' N, 138°49' E)	1400	Eastern	<i>Quercus crispula</i> forest
B Mt Fuji, Narusawa Yamanashi Pref. (35°27' N, 138°45' E)	1150	Northern	<i>Pinus densiflora</i> forest (with <i>Vitis Coignetiae</i> and <i>Akebia quinata</i>)
C Mt Fuji, Narusawa, Yamanashi Pref. (35°25' N, 138°42' E)	1520	North-northwestern	<i>Fagus crenata</i> forest
D Mt Akadake, Ooizumi Yamanashi Pref. (35°56' N, 138°25' E)	1500	Southeastern	<i>Betula platyphylla</i> – <i>Clethra barbinervis</i> forest

(16.6 × 15.0 × 21.0 cm; 12.0 × 14.5 × 18.0 cm) were installed at a height of 1.5 m in all four sites. The following criteria were used for identifying the nests of the Japanese dormouse: (1) There was a dormouse in the nest. (2) If no dormouse was present, either (a) there was a certain type of moss found with bark (according to the method of Mori and Morie 1978) or (b) there was crimped fur found left by a dormouse, which is characteristic of the animal. This last criterion was most valuable to our research.

Results and discussion

Twenty one nests of the Japanese dormouse were examined (Table 2). The major contents of the nest materials of the Japanese dormouse were bryophytes and tree barks. In total, 57 species of bryophytes (42 species of *Musci* and 15 of *Hepaticae*) were identified. Bark, lichen, dead leaves and woods sticks were also used as the nest materials. Bryophytes represented a high average proportion of 53.1% by weight of the total materials. The majority of the bryophyte species were of creeping pleurocarpous mosses, most of them being species that are epiphytic on tree trunks. This indicates that the Japanese dormouse has arboreal habits.

The average dry weight of bryophytes and lichens, which the dormice utilized at 21 nests, was 5.1 g. The weight of 7 nests were heavier than the average weight (Table 2). These 7 nests consisted of single common species of bryophytes, occurring in large quantities in the given locality. In general, 6 species of bryophytes were the most important nest materials for the Japanese dormouse (Table 3).

Different nest materials were often found used in a mixture for construction of the whole nest. In several cases, they built a nest, with different materials used for different parts: large, coarse materials such as bark for the outer part, and bryophytes for inner part. For example, in nest No 20, dead leaves of *Acer mono* and *Acer tenuifolium* were spread over the outside and bryophytes were used

Table 2. Dry weight (g) and number of bryophytes and other plants used by Japanese dormice as nest materials. Localities: A – Mt Fuji, Oyama, B – Mt Fuji, Narusawa (1150 m), C – Mt Fuji, Narusawa (1520 m), D – Mt Akadake, Ooizumi (cf Table 1). “+” – small amount, Av. – average.

Main species	Nest number and locality																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
	A	A	C	C	D	A	D	A	B	B	A	A	A	D	A	B	D	A	D	A	A	
<i>Musci</i>																						
<i>Anomodon rugelii</i>	-	-	-	4.7	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Boulaya mittenii</i>	0.7	+	+	-	-	-	-	-	-	-	-	+	+	-	-	-	-	+	-	-	-	
<i>Brachythecium</i>																						
<i>helminthocladum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	+	
<i>Brotherella yokohamae</i>	-	-	-	-	1.5	+	-	-	-	-	-	-	+	-	+	+	-	-	+	-	+	
<i>Dozya japonica</i>	-	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Entodon scabridens</i>	+	-	+	-	-	-	-	+	4.0	-	-	-	-	+	-	-	+	-	+	+	+	
<i>Eurhynchium hians</i>	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	+	-	-	-	
<i>Haplohymenium longinerve</i>	-	-	-	-	-	-	-	-	-	-	-	+	3.4	-	+	-	-	-	-	-	-	
<i>Hypnum tristo-viride</i>	+	+	+	-	-	-	-	-	-	-	-	5.1	-	-	-	-	5.0	-	+	+	-	
<i>Hypnum reptile</i>	-	-	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	
<i>Hypnum plumaeforme</i>	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	1.7	-	-	-	-	-	
<i>Isothecium subdiversiforme</i>	1.3	+	+	+	-	2.3	-	+	-	-	2.4	+	+	-	-	-	-	-	-	+	-	
<i>Leucodon sapporensis</i>	+	+	0.9	+	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	
<i>Okamuraea hakoniensis</i>	0.8	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	+	1.6	
<i>Thuidium glaucinum</i>	-	-	-	-	-	-	2.3	-	-	-	+	-	-	-	-	-	-	-	-	-	-	
<i>Hepaticae</i>																						
<i>Frullania tamarisci</i>	3.1	3.3	8.9	+	-	-	-	-	-	-	-	-	-	-	+	-	-	3.8	+	-	-	
subsp. <i>obscura</i>																						
Totals																					Av.	
Bryophytes and lichenes	14.0	6.5	16.4	5.9	2.0	3.7	2.3	2.1	4.0	0.8	3.2	6.2	4.8	1.6	1.0	2.0	5.5	3.9	3.0	4.4	13.2	5.1
Others (leaves, branches, barks, etc)	3.6	9.7	2.1	1.1	4.1	0.3	3.5	3.5	0.4	0.4	3.7	0.5	1.6	8.7	6.9	9.5	0.1	13.7	21.1	36.8	9.7	6.7
Nest	17.6	16.2	18.5	7.0	6.1	4.0	5.8	5.6	4.4	1.2	6.9	6.7	6.4	10.3	7.9	11.5	5.6	17.6	24.1	41.2	22.9	11.8
Number of bryophyte species	16	12	22	10	3	6	1	5	1	3	4	4	5	6	6	2	3	9	6	7	7	6.6

Table 3. Bryophytes used by Japanese dormice as main materials in 21 nests.

Species	Total weight (g)	Localities
<i>Hepaticae</i>		
<i>Frullania tamarisci</i> subsp. <i>obscura</i>	19.1	A, C, D
<i>Musci</i>		
<i>Hypnum tristo-viride</i>	10.1	A, C, D
<i>Isothecium subdiversiforme</i>	6.0	A, C
<i>Anomodon rugelii</i>	4.7	A, C
<i>Entodon scabridens</i>	4.0	A, B, C, D
<i>Haplohymenium loginerve</i>	3.4	A

inside. But it was rare that the Japanese dormouse used dead leaves. Nest No 2, utilized for parturition and rearing the young, contained more bark than the other nests.

Watanabe (1978) identified 25 species of bryophytes (24 species of *Musci* and 1 of *Hepaticae*) by studying 8 dormouse nests obtained at 800–1760 m altitude on Mt Mitsutoge, located 20 km north of Mt Fuji. Watanabe (l.c.) found an average of 4 bryophyte species per nest. Compared with 6.8 in the present study: possibly the later, higher figure reflects adventitious use of bryophytes growing close to the nest. Although Watanabe (l.c.) reported that there were great numbers of *Musci* species used as nest materials, more than *Hepaticae*, we found in the present study that the hepatic *Frullania tamarisci* subsp. *obscura* was the most commonly-used material for many nests. This species spreads over the surface of tree trunks to form large mats and it was probably easier for the dormouse to harvest at our study sites.

During the breeding period, a mother dormouse constructs several nests within her home range in the wild (Minato 1993). In captivity as well as in the wild, a mother sometimes built new breeding nests and transferred her pups when their normal activities were disturbed (S. Minato, unpubl.). The mother built a new nest in 3 hours 13 minutes in captivity and within 1 night in the wild (Mt Fuji). At Mt Akadake, we observed traces of them having picked up nest materials at point 40–60 cm distant from their nests or at trees nearby. This indicates that the dormouse selects a nesting site on a tree where nest materials are closely available. This would be efficient in terms of defense against an enemy.

Apodemus argenteus also built a nest in our nest boxes, using dead leaves as nesting materials. This indicates that *A. argenteus* is also active on the ground. *A. argenteus* uses several habitats: it drills tunnels under the ground, searches for food on the ground and climbs trees. In contrast, the Japanese dormouse feeds on the tree (Minato 1989, 1993), and is more restricted to trees.

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