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Vertical distribution of the Snow vole *Microtus nivalis* (Martins, 1842) in Northwestern Yugoslavia

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Abstract

Studied the vertical distribution of snow vole in Northwestern Yugoslavia. The distribution of localities ranges between 30 and 2450 m above sea level. 43 % out of 37 localities are below 1000 m and 11 % are below 100 m. It is suggested that the snow vole distribution is affected by the presence of deep fissures with stable cavernicolous conditions in the stony habitat and not by altitude.

Introduction

The vertical distribution of the snow vole *Microtus nivalis* (Martins, 1842) is between 100 and 4700 m above sea level in Europe (Krapp 1982) while the best living conditions, at least in the Alps, are above 1000 m (Clouarn and Janeiro 1975). Localities below 1000 m, lying between 100 and 600 m have been reported from Spain, France, Italy, Yugoslavia, Greece and Bulgaria (Krapp 1982). The lowest locality is apparently Latour-de-France, where snow vole remains were found in Barn owl (*Tyto alba*) pellets at about 100 m (Fons and Libois 1977). Four localities from the lowlands of Western Yugoslavia were reported by Jones and Carter (1980). The snow vole inhabits stony places above the tree line and is absent from the forests in the Alps (Kahmann and Halbgewachs 1962; Louarn and Janeiro 1975) in the Carpathians (Kowalski 1957) and in the Tatras (Kratovichil 1981).

Recently, a large number of sites of the snow vole have been found below 1000 m in Northwestern Yugoslavia. The objective of this paper is to describe the vertical distribution of the species in the studied area, to analyse the causes which condition it and, by doing so, to construct a hypothesis to explain its vertical distribution in general.

Material and methods

The original data were collected by snap trapping and analysis of owl pellets (the latter are marked by an asterix in the list of localities). All available data on the snow vole in Northwestern Yugoslavia, north of latitude 45° were used, as well as some data from the Italian border area.

Results

The snow vole has been found in 37 localities: 20 in the Alps, 6 in the Dinarids (Dinaric Alps) and 11 in the Submediterranean region.

List of localities (Fig. 1):
1. Za Lepim vrhom, 1200 m; 2. Planica, 1000 m; 3. Tamar, 1200 m; 4. Mangart, 1900–2050 m; 5. Mangartsko planina, 1300 m; 6. Vršič, 2000 m (Petkov 1968); 7. Kanin, Koča Peter Sklar, 1810 m; Kanin, Prestrelnik, 2050 m (Leg.: S. Brelih); 8. Log Češoški, 470 m (Leg.: J. Gregori and S. Brelih);

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The vertical distribution of the snow vole is between 30 and 2450 m. 4 of the 20 Alpine localities were between 440 and 1000 m and the remaining 16 were above 1000 m. All finds were from open habitats, mainly in the mountain grassland belt and the mountain pine (*Pinus mugo*) belt. In the belt of beech-wood forest (*Anemone-Fagetum*), the snow vole is confined to bare stone cliffs, dry torrential canyons, and on scree slopes. No findings of the snow vole were recorded in dense forest.

Any suitable habitats above 550 m could be inhabited by the snow vole in the Dinarids. The upper limit of its distribution is determined by the height of the highest peaks. The snow vole was most widely distributed in the region of mountain pine forest. It was also
found in the mature forests of *Fagetum subalpinum* and *Abieti-Fagetum illyricum*, where it was limited to large accumulations of stones, sinkholes and fissures connected to caves.

The snow vole was found between 30 and 1000 m in the Submediterranean. With the exception of Učka (1000 m) all localities were below 500 m. The lowest four localities are below 100 m. All the animals were caught to or within fissures in the limestone. The snow vole enters underground caves (point 29 in Fig. 1), and inhabits steep, bare, Karst cliffs (31), quarries (34) and river canyons (30).

**Discussion**

The snow vole is mainly reported to live on open mountain slopes above the tree line (CORBET and OVEN DEN 1980). Its appearance in low altitudes is regarded as an anomaly (MILLER 1912) or at least a rarity. Very few attempts have so far been made to connect actual distribution with other peculiarities of its life (e. g., TVRTKOVIĆ 1976). The snow vole is morphologically adapted to a petricolic way of life (OGNEV 1950; KRA TOCHVIL 1956; KRAPP 1982). It inhabits fissures typical of stony habitats in which cavernicolous conditions can be expected. We assume that the stable, mainly stenothermal conditions in the (micro) cavernicolous habitat are the main factor determining its distribution. The snow vole is thus considered to be a troglophilic animal.

The temperature of a cavernicolous habitat is equal to the average yearly temperature of the region. In the studied area, the average ground temperature is +13.1 °C at the coast (Rovinj, 5 m), +5 °C in the Dinarids (Mašun at Snežnik Mt., 1017 m), and −1.6 °C in the Alps (Kredarica, 2514 m). The ground temperature of the Alpine ice cave near Kredarica (alt. 2450 m), which is inhabited by the snow vole, was found to be between +2.4 and −5.5 °C, measured at 28 sites throughout the year. In many places, the temperature did not fall below 0 °C (NOVAK and KUŠTOR 1983). One would not expect the snow vole to need any special adaptation to extremely low temperatures. BIENKOWSKI and MARszalek (1974) demonstrated that the metabolism of the snow vole does not differ from that of the bank vole (*Clethrionomys glareolus*). They presumed that the snow vole is a high mountain species, so the similarity between the snow vole and the bank vole was explained by the hypothetical mountainous origin of the latter. Some peculiarities of the snow vole metabolism, its heterothermia and almost identical energy budgets for winter and summer (BIENKOWSKI and MARszalek 1974) indicate a species adapted to stable conditions. Its attachment to the stenothermal habitats implies a relict species, which corresponds to its recent distribution area (KRAPP 1982). We attribute the attachment of the snow vole to high mountain habitats in the Alps, Carpathians and Tatras to the lack of suitable cavernicolous habitats at lower altitudes, especially below 1000 m.

The situation is additionally complicated by the presence of another petricolic vole in the Balcan peninsula. Scramble competition between the snow vole and Martino’s vole (*Dinaromys bogdanovi*) has a profound influence on their distribution. Martino’s vole prevails over the snow vole in interspecific encounters (PETROV and TODOROVIĆ 1982). The snow vole retreats to higher altitudes, which is most obvious in the Northern Velebit, where the Martino’s vole inhabits localities from 400 to 900 m and the snow vole localities from 900 to 1700 m (TVRTKOVIĆ 1984). In this and similar cases, the vertical distribution of the snow vole is a result of interspecific competition for habitat.

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Zusammenfassung

Vertikale Verbreitung der Schneemaus Microtus nivalis (Martins, 1842) im nordwestlichen Jugoslawien

Die Höhenverbreitung der Schneemaus in Nordwest-Jugoslawien reicht von 30 bis 2450 m ü. M. Von den 37 Fundorten liegen 43 % unter 1000 m und 11 % unter 100 m. Damit scheint das Vorkommen der Schneemaus weniger durch die Höhe als durch spalten- und höhlenreiche Habitate bestimmt zu sein.

References


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