Novitates Theriologicae, Pars 3, 2003: 48–50
Bats of the Carpathian Region (Rakhiv)
Кажани Карпатського регіону (Рахів)

Spatial structure of winter bat colonies of the Ukrainian Carpathians

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Pokynchereda V. Spatial structure of winter bat colonies of the Ukrainian Carpathians. — Bats start wintering in warmer parts of the cave, but then move to cooler parts, where they spend most of the winter. In spring, the bats leave the shelters directly from the cold zone without forming intermediate colonies in warmer parts of the caves. The author found that the temperature optimum for bats during wintering is very diverse and specific. *Myotis myotis / M. blythii* hibernate in winter in the coldest parts of the caves, where the temperature ranges from 0 to 5°C. *Rhinolophus hipposideros* chooses to winter in the area of the cave with temperature 5–8°C. *Rhinolophus ferrumequinum* is the most thermophilic among the species noted: temperatures of 8°C and above are optimal for its wintering. Other species found are cold-loving and they winter in cold areas. Changes in the spatial structure of winter bat colonies are illustrated by the dynamics of the grouping index during winter. The grouping index gradually increases over the winter, peaking in February, after which its value begins to decrease.

Introduction

Spatial structure of winter bat colonies and its dynamics practically has remained beyond attention of researchers in the Ukrainian Carpathians. Partially this topic is discussed only by Krochko (1992).

The spatial structure of winter bat colonies was studied every month during September–May 1998/1999 in 3 caves in the territory of the Carpathian Biosphere Reserve, which are located in the Maramoroski Alps and in Svydovets. These caves are characterised by different inner architecture, dimensions and microclimate.

Results and discussion

The specifics of spatial structure are investigated for the winter colonies of 4 bat species: *Rhinolophus hipposideros*, *R. ferrumequinum, Myotis myotis* and *M. blythii.* It was determined that spatial structure is very dynamic and depends on many factors. The biggest influence on the change of spatial structure have the microclimate of the refuge and specifics of biology of the Chiroptera.

The general regularity consists in the fact that Chiroptera begin hibernation in the warmer parts of a cave and later move to the cooler zones (except for *R. ferrumequinum*, which remains to hibernate in the warm zone), where they spend the main part of hibernation.

In spring, bats leave the refuge directly from the cold zone, and do not form intermediate colonies in the warmer parts of caves, which is noted by some authors (Krochko 1992).

Among the model shelters, the most evident influence of microclimate is observed in the adit "Dovharunia", where, in the stable zone, a considerable gradient of temperature is marked — from $+1^0$C to $+10^0$C. The biggest changes of spatial structure are common for *Myotis myotis / M. blythii*, which is related to the specifics of biology of this species (Fig. 1).

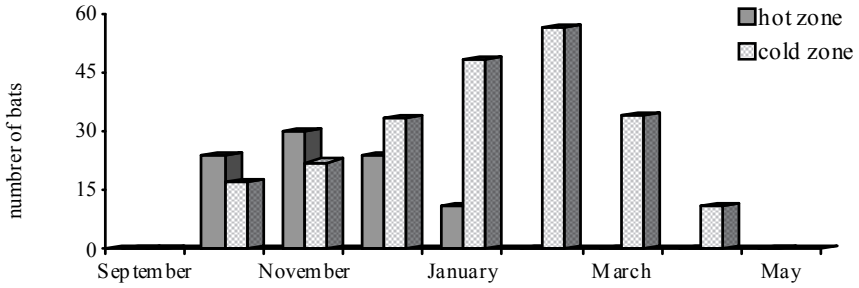

Fig. 1. Dynamics of *Myotis myotis* and *blythii* during hibernation in "Dovharunia".

The changes of spatial structure of winter colonies of those bat species, which form the dense groups, illustrates the dynamics of grouping index during hibernation (Fig. 2). The grouping index constantly increases reaching the maximum in February, afterwards its meaning decreases.

The grouping index depends on the type of refuge, its dimensions and microclimate. In the model objects, it did not exceed 2.0, while the biggest meanings of grouping indices of the winter Chiroptera colonies in separate karst caves of the Uholskyi massif of the Carpathian Biosphere Reserve was 4.4 (cave "Hrebin") and even 6.5 (entrance hall of the cave "Druzhba").

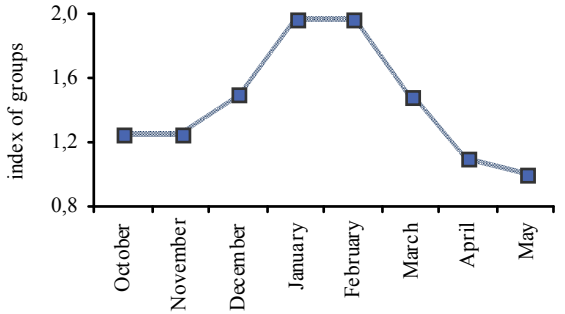

Fig. 2. Dynamics of the grouping index of *Myotis myotis / M. blythi* during hibernation in the adit "Dovharunia" .

Conclusion

Bats begin the hibernation in warmer parts of a cave and later move to the cooler zones, where they spend the main part of hibernation. In spring, bats leave the shelters directly from the cold zone, and do not form intermediate colonies in the warmer parts of caves.

The changes of spatial structure of winter colonies of those bat species, which form the dense groups, illustrate the dynamics of grouping index during the hibernation. The grouping index constantly increases, reaching the maximum in February, afterwards its meaning decreases.

References

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Резюме

Покиньчереда В. Просторова структура зимових колоній кажанів в Українських Карпатах. — Рукокрилі починають зимівлю в тепліших частинах печери і згодом переміщуються у більш прохолодні зони, де і проводять основну частину зимівлі. Навесні кажани покидають сховища безпосередньо з холодної зони, не утворюючи проміжних колоній у більш теплих частинах печер. Встановлено, що для рукокрилих температурний оптимум під час зимівлі є дуже різноманітним і видоспецифічним. *Myotis myotis / M. blythii* зимують у найбільш холодних частинах печер, де температура складає від 0 до 5°С. *Rhinolophus hipposideros* обирає для зимівлі ділянки печери з температурою 5–8°С. *Rhinolophus ferrumequinum* є найбільш теплолюбним серед відмічених видів — оптимальною для зимівлі виду температурами є 8^0С та більше. Інші відмічені види є холодолюбними і зимують у холодних зонах. Зміни просторової структури зимових колоній кажанів ілюструє динаміка індексу групування протягом зимівлі. Індекс групування поступово зростає протягом зимівлі, досягаючи максимуму в лютому, після чого його значення починає зменшуватися.