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HABITAT REQUIREMENTS OF THE COMMON DORMOUSE (*Muscardinus avellanarius*) AND THE FAT DORMOUSE (*Glis glis*) IN MATURE MIXED FOREST IN LITHUANIA

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Abstract

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Habitat requirements of two dormice (Gliridae) species were assessed in mature 75–180 years old mixed forest stands, according to correlations between nestbox use and habitat parameters measured within 2500 m^2 areas around nestboxes. Use of nestboxes by the common dormouse (*Muscardinus avellanarius*) was positively related to the cover and number of hazel (*Corylus avellana*), number of honeysuckle (*Lonicera xylosteum*) plants, number of logs lying on the ground and age of forest stands, and correlated negatively with the number of coniferous trees forming the tree canopy. Use of nestboxes by the fat dormouse (*Glis glis*) was positively correlated with the total cover of oak (*Quercus robur*) trees, and negatively with the number of logs lying on the ground and number of dead trees and trunks. The two sympatric dormouse species showed different habitat requirements. *Muscardinus avellanarius* preferred thinner forest stands with well-developed understorey, while *Glis glis* preferred denser forest stands with well-connected tree canopies. Comparing their use of nestboxes suggested that mature forest stands were much more suitable for *G. glis* than for *Muscardinus avellanarius*. However, living conditions for *M. avellanarius* become better when mature forest stands thin out naturally, and understorey develops in gaps formed in the forest.

Key words: dormice, forest stands, understorey, tree canopy, forest aging, use of nestboxes

Introduction

Habitats of the common dormouse (*Muscardinus avellanarius*) and the fat dormouse (*Glis glis*) in different countries are described in many publications (e.g. Lozan, 1970; Gaisler et al., 1977; Airapetyants, 1983; Müller-Stiess, 1996; Rossolimo et al., 2001; Hecker et al., 2003; Juškaitis, 2003). However, quantitative assessment of habitat requirements of these two species was carried out in only a few studies: for *Muscardinus avellanarius* – in Great Britain (Bright, Morris, 1990) and Italy (Capizzi et. al., 2002; Panchetti et al., 2007), for *Glis glis* – in Switzerland (Eiberle, 1977), Germany (Schlund et al., 1993, 1997) and Italy (Capizzi et. al., 2003). It should be noted that in all these cases, habitat requirements of only one, but not both, dormouse species were studied, and all these studies were carried out to the south of Lithuania.

Lithuania occurs in the northern part of the distributional ranges of *Muscardinus avellanarius* and *Glis glis* (Mitchell-Jones et al., 1999), and habitats of both these dormouse species in Lithuania are different from in southern parts of their distributional ranges because of different forest stand composition: e.g. absence of beech (*Fagus sylvaticus*), but presence of Norway spruce (*Picea abies*) in Lithuania (Navasaitis et al., 2003). In general, the status of these two dormouse species is different in Lithuania from that found in central and southern Europe. In Lithuania, *Glis glis* is a red-listed species with only nine localities known, and *Muscardinus avellanarius* is common and widespread across almost all of the country (Juškaitis, 2003). *M. avellanarius*, but not *Glis glis,* is included in Annex IV of the Habitat Directive (Council Directive 92/43/EEC). The aim of the present study was to analyse habitat requirements of two sympatric dormouse species – *Muscardinus avellanarius* and *Glis glis* – living in mature mixed forest in Lithuania.

Study area

The study site was situated in central Lithuania, Kaišiadorys district (54°52´ N, 24°09´ E), in the western part of the Gastilionys forest (area 555 ha) where mature mixed forest stands prevailed. This part of the forest was not homogeneous, with many different comparatively small forest stands. According to the forest inventory data from 2003, the composition of the main forest stands in which studies were carried out was:

1) 30% pine (*Pinus sylvestris*) (175 years old), 30% oak (*Quercus robur*) (180), 10% spruce (*Picea abies*) (130), 10% spruce (70), other trees were aspen (*Populus tremula*), lime (*Tilia cordata*), hornbeam (*Carpinus betula*) (60–100 years old). Hazel (*Corylus avellana*), rowan (*Sorbus aucuparia*) and honeysuckle (*Lonicera xylosteum*) were the main understorey species. Plot area = 8.8 ha;
2) 40% oak (180 years old), 20% pine (180), 20% spruce (120), 10% spruce (80), other trees were lime and birches (*Betula pendula*, *B. pubescens*) (70 years old); hazel, rowan and honeysuckle were dominant in the understorey. Plot area = 2.9 ha;
3) 30% spruce (130 years old), 10% spruce (80), 30% oak (160), 30% pine (160), other trees were aspen and birches (80). Young spruce trees, hazel, rowan and glossy buckthorn (*Frangula alnus*) formed the understorey. Plot area = 3.4 ha;
4) 30% spruce (130 years old), 20% spruce (65), 20% pine (160), 20% oak (170), other trees were aspen and birches (80); hazel and rowan grew in the understorey. Plot area = 1.4 ha;

5) 60% birch (75 years old), 20% pine (75), 10% spruce (75), 10% oak (140), other trees were aspen, hornbeam, lime (70); 55 years old spruce-trees grew in the sub-canopy. The understorey (hazel, rowan) was sparse. Plot area = 1.4 ha.

The forest is located in the Kauno marios Regional Park, however protection status was very different in separate parts of the study area. Some plots were protected as woodland key habitats or fall into botanical-zoological or landscape reserves within the regional park. However, other areas were situated in the recreation zone of the regional park. Forest management, including clear felling, was significant in most of the forest.

Material and methods

In the study area, 30 wooden nestboxes were put up in spring 1990, and the number of nestboxes was increased to 50 in 1992. Internal dimensions of nestboxes were 14×14×28 cm, entrance hole diameter was 45 mm. Most nestboxes were located along forest roads and rides, and distances between boxes were about 50 m. Most of them were put up in old hazels at a height of 3–4 m. Nestboxes were checked twice during the season: in late May – early June and in September, aiming to investigate abundance dynamics and ecology of *Glis glis* (e.g. Juškaitis, 2000, 2006). The second dormouse species (*Muscardinus avellanarius*) occurred in this forest and also used nestboxes.

Habitat parameters were evaluated in the surroundings of 31 nestboxes, around which the forest was not clear-felled during the whole study period. Habitat parameters were recorded in areas of 50×50 m around nestboxes (2500 m^2) in June–September 2005. Around each nestbox, all trees and shrubs were counted and their species determined. They were assigned to canopy, sub-canopy or understorey. Young trees higher than 1 m and with diameter at breast height (DBH) < 7.5 cm were counted additionally. Cover of potential food plants in the field layer was estimated visually in six quadrats (10×10 m) chosen randomly in surrounding of each nestbox.

Considering the habitat variables used in previous analogous studies (Bright, Morris, 1990; Schlund et al., 1993, 1997; Capizzi et al., 2002, 2003), 72 variables around each nestbox were derived from direct field measurements, forest inventory data and different combinations of these. They are presented in 15 following groups:

1. number of tree stumps with diameter > 10 cm; number of logs lying on the ground; total number of dead trees and trunks (height > 1 m); number of heaps of branches;
2. distance (in m) between the nestbox tree and the nearest tree with DBH > 30 cm;
3. areas covered by forest roads, rides and small clearings;
4. diversity of canopy forming trees and diversity of understorey according to Shannon-Wiener index;
5. number of species of fruiting plants forming the field layer (raspberries (*Rubus idaeus*), bilberries (*Vaccinium myrtillus*), stone brambles (*Rubus saxatilis*), red bilberries (*Vaccinium vitis-idaea*), brambles (*Rubus caesius, R. nessensis*), strawberries (*Fragaria vesca*); cover of separate species (in %); total cover of raspberries and brambles; other combinations (e.g. total cover of bilberries, strawberries and stone brambles);
6. densities per hectare of canopy trees, sub-canopy trees, young trees and understorey;
7. numbers of coniferous tree species in canopy, sub-canopy, understorey, young trees and total number of coniferous tree species;
8. numbers of deciduous tree species in canopy, sub-canopy, understorey, young trees and total number of deciduous tree species;
9. numbers of adult trees – oak, lime, pine, birches, spruce, aspen, ash (*Fraxinus excelsior*), maples (*Acer platanoides, A. pseudoplatanus*), elm (*Ulmus glabra*), hornbeam – and their different combinations (e.g., total number of oak-, lime- and hornbeam-trees);
10. canopy cover (in m^2) of adult oak-trees; cover of young oak-trees; total cover of adult and young oak-trees; number of oak-trees, which canopy cover > 50 m^2; average diameter of adult oak-trees;
11. number of specimens of different understorey species – hazel, glossy buckthorn, honeysuckle, rowan, common buckthorn (*Rhamnus cathartica*), spindles (*Euonymus verrucosus*, *E. europeus*), bird cherries (*Padus avium,*

P. serotina), elderberries (*Sambucus racemosa, S. nigra*), mezereon (*Daphne mezereum*), dwarf serviceberry (*Amelanchier spicata*);

12. hazel density per hectare; total cover of hazel (in m^2); numbers and total cover (in m^2) of hazel shrubs, which cover was less than 2 m^2, more than 2 m^2, 4 m^2, 10 m^2, 15 m^2 and 20 m^2, respectively; the proportion of hazel in total cover of understorey;
13. total number of plants supplying “soft-mast“ (hawthorn (*Crataegus rhipidophylla*), brambles, honeysuckle, glossy buckthorn, rowan, dwarf serviceberry, Tatarian dogwood (*Cornus alba*), European cranberrybush (*Viburnum opulus*), spindles, common buckthorn);
14. total number of trees supplying “hard-mast“ (oak, ash, maple, hornbeam, elm, horse chestnut (*Aesculus hippocastanum*);
15. forest stand age according to dominant tree species; average diameter of young and adult trees.

The index of nestbox use by dormice was considered to be an indicator of habitat suitability for dormice in the areas surrounding nestboxes. Indices were calculated using data from nestbox controls in 1991–2005 (except the year 2003, when nestboxes were checked only in spring). Use of nestboxes by dormice in separate years was scored in points:

0 point – dormice did not use nestbox at all;
1 point – short-term use/visit of nestbox (dormouse found in empty nestbox, small amount of excrement or food remains);
2 points – long-term use of nestbox during one activity season (dormouse nest, large amount of excrement or food remains, one or several dormice found in nest);
3 points – female with juveniles used nestbox;

Numbers of points from different years were totalled up, and the sum was divided by the number of years during which a nestbox was monitored.

Relations between habitat parameters in the surroundings of nestboxes and indices of nestbox use by *Muscardinus avellanarius* and *Glis glis* were analysed using Spearman rank correlations (Fowler, Cohen, 1996). All habitat parameters significantly related to the indices of nestbox use were checked for inter-correlation using Spearman correlation coefficients. From variables which were highly inter-correlated ($r_s \geq 0.7$), the variable having the highest correlation with the indices of nestbox use was selected. All statistical analyses were performed using the STATISTICA 6.0 program package (StatSoft, 2001).

Results

Both *Glis glis* and *Muscardinus avellanarius* used nestboxes put up in mature mixed forest, but to a different extent. Average indices of nestbox use in *Glis glis* (0.89 ± 0.46) were significantly higher ($t = 9.05$; $p < 0.0001$; $n = 31$) than in *Muscardinus avellanarius* (0.10 ± 0.14). During the study period, *Glis glis* or signs of their activity were found in all nestboxes analysed, while *Muscardinus avellanarius* never used many of the nestboxes (Fig. 1). Statistically significant negative correlation ($r_S = -0.38$; $p = 0.036$; $n = 31$) was found between indices of nestbox use in these dormouse species (Fig. 1). Correlation between numbers of nestboxes used by *M. avellanarius* and *Glis glis* in different years was positive, but not significant ($r_s = 0.37$; $p = 0.174$; $n = 15$).

Muscardinus avellanarius and *Glis glis* had different habitat requirements in mature mixed forest: correlation coefficients between the same habitat parameters and indices of nestbox use in two dormouse species had reverse values in many cases (Table 1). Significant negative correlations were found between use of nestboxes by *G. glis* and number of logs lying on the ground as well as total number of dead trees and trunks, while these relationships were positive in *Muscardinus avellanarius* (Table 1). *M. avellanarius* avoided nestboxes,

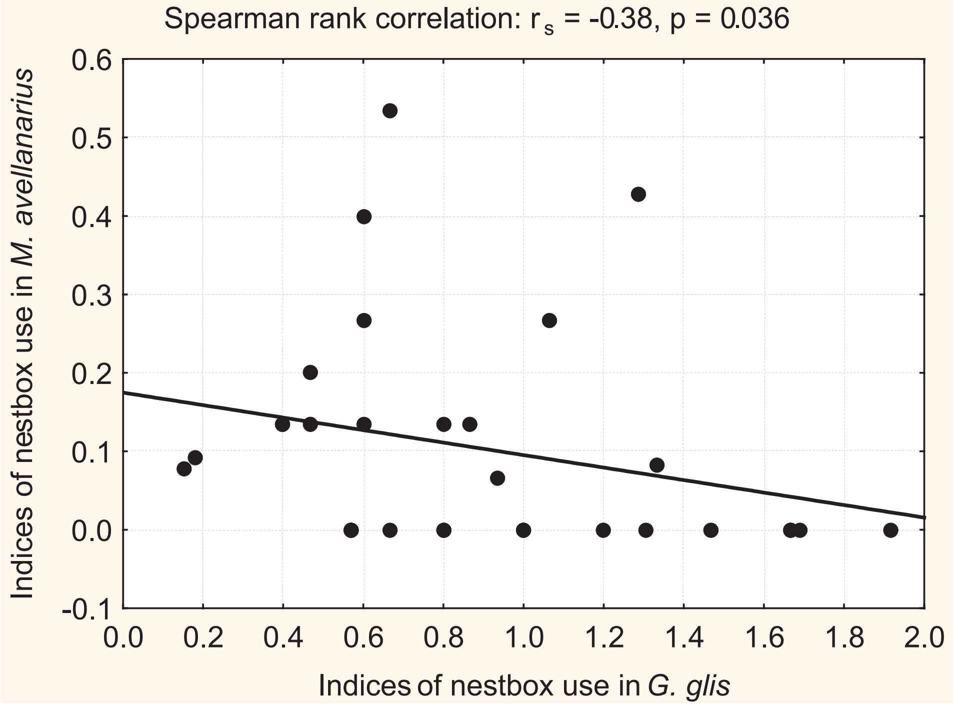

Fig. 1. Spearman rank correlation between indices of nestbox use in *G. glis* and *M. avellanarius* in mature mixed forest (n = 31, some points overlap).

Table 1. Spearman rank correlations between habitat parameters and indices of nestbox use in *M. avellanarius* and *G. glis* in mature mixed forest. Only those cases are presented where a correlation was significant at $p < 0.05$ in at least one dormouse species ($^{(*)}$ = $p < 0.1$; * = $p < 0.05$; ** = $p < 0.01$).

Habitat parameters	Coefficients of Spearman rank correlation	
	M. avellanarius	*G. glis*
number of logs lying on the ground	0.38*	-0.37*
total number of dead trees and trunks	0.21	-0.54**
number of coniferous trees in canopy	-0.40*	0.32$^{(*)}$
total cover of all oak-trees	-0.09	0.47**
age of forest stand	0.52**	-0.09
number of hazels, which cover > 4 m^2	0.41*	0.06
number of honeysuckles (*Lonicera xylosteum*)	0.40*	-0.17
number of dwarf serviceberry (*Amelanchier spicata*)	-0.38*	0.33$^{(*)}$
cover of stone brambles (*Rubus saxatilis*)	0.36*	-0.22

in which high numbers of coniferous trees formed the canopy in the surroundings, while the analogous correlation was positive in *Glis glis* (Table 1).

The important habitat parameters for *Muscardinus avellanarius* defining the understorey within areas surrounding the nestboxes were cover and number of hazels and number of honeysuckle plants (Table 1). Among all hazel shrubs, *M. avellanarius* was more associated with the larger shrubs which covered more than 4 m^2. Indices of nestbox use by *M. avellanarius* were also related to other habitat parameters: positively to the age of forest stands and cover of stone brambles, and negatively to numbers of dwarf serviceberry. For *Glis glis*, habitat parameters defining the tree canopy were important, particularly total cover of oak trees and number of coniferous trees (Table 1).

Discussion

In mature mixed forest, indices of nestbox use in *Glis glis* were significantly higher than in *Muscardinus avellanarius*. Competition for nestboxes, when *Glis glis* probably forced out smaller dormouse species (Bako, Hecker, 2006), could influence different levels of nestbox use by the two dormouse species. If so, it could be expected, that in the years with low abundance of *G. glis*, the number of nestboxes used by *Muscardinus avellanarius* should increase and vice versa. However, the correlation between numbers of nestboxes used by these two dormouse species in different years was positive, although not statistically significant. For this reason, we suppose that differences in nestbox use by the two dormouse species were determined by different habitat requirements, although competition for nestboxes in separate years was also possible (Juškaitis, 1997).

Our study shows that development of the understorey was very important for *M. avellanarius*: they preferred forest stands with higher cover and number of hazels and higher numbers of honeysuckle. Fruits of these plants are the preferred food of *M. avellanarius* (Juškaitis, 2007a). Negative correlations between nestbox use by *M. avellanarius* and numbers of coniferous trees in the canopy and sub-canopy shows that *M. avellanarius* avoid forest stands with a shaded understorey, where cover of hazel and numbers of honeysuckle were reduced. The development of the understorey was also found to be significant in earlier studies at two sites in Lithuania (Juškaitis, 1997) and in analogous studies in Great Britain (Bright, Morris, 1990) and Italy (Capizzi et. al., 2002; Panchetti et al., 2007).

Our analysis of habitats requirements of the two dormouse species reflects the situation in mature forest, in which the age of the dominant tree species was 75–180 years. When forest stands grow and become older than 110 years, some trees die and fall dawn, and consequentially these forest stands thin out naturally (Kasperavičius, Kuliešis, 2001). In the resulting new open spaces, the understorey starts to grow, particularly hazel. This natural succession process explains why positive a relationship was found between use of nestboxes by *M. avellanarius* and the number of logs lying on the ground, as well as total number of dead trees and trunks.

The positive correlation with the age of forest stands in *M. avellanarius* was somewhat unexpected. Until now, it has been maintained that *M. avellanarius* prefer early successional stages of woody vegetation, i.e. overgrown clearings and coppices (e.g. Airapetyants, 1983; Berg, 1996; Bright, Morris, 1996; Vilhelmsen, 2003; Juškaitis, 2007b, c). In overgrown clearings, *M. avellanarius* become scarce, when young trees reach the height of several meters (Kahman, Frisch, 1950; Wachtendorf, 1951). Natural succession towards an old growth forest with closing canopy and a declining shrub layer worsens habitat suitability for *M. avellanarius* (Berg, 1996; Bright, Morris, 1996). Data obtained in the present study show that the age of the forest stand and its suitability for *M. avellanarius* is not a one-way relationship. In matured and thinned out forest stands, conditions for *M. avellanarius* start to get better again. Numbers of hazel and honeysuckle – two understorey species important for *M. avellanarius* – were positively related to the age of the forest stands.

Significant correlations with two more habitat parameters in *M. avellanarius* can be explained by inter-correlations between habitat parameters. For example, number of dwarf serviceberry shrubs was correlated positively with the number of spruce-trees in the subcanopy and negatively with the age of forest stands; cover by stone brambles was correlated positively with the number and cover of hazel.

Analysis of habitat requirements of *Glis glis* in mature mixed forest has shown that these dormice prefer forest areas with high total cover of oak-trees. Wide canopies of oak-trees create good connections with canopies of other trees for arboreal movement by dormice. Also mature oak-trees fruit well, and oak acorns are an important food source for *G. glis* in autumn (Vietinghoff-Riesch, 1960; Eiberle, 1977; Schlund et al., 1997). Holes in old oak trees may serve as shelters for *G. glis* (Eiberle, 1977; Airapetyants, 1983; Müller-Stiess, 1996; Rossolimo et al., 2001). Significant positive correlations between nestbox occupation by *G. glis* and proportion or number of oak-trees in forest stands were also found in Switzerland (Eiberle, 1977) and in deciduous forest in Germany (Schlund et al., 1997).

It might be expected, that old forest stands with hollow trees should be preferred by *G. glis*, but no significant correlation with the age of the forest stands was found in our study. A significant negative correlation between the occupation frequency of nestboxes by *G. glis* and the age of tree stands in deciduous forest was found in Germany (Schlund et al., 1993, 1997). Our studies, as well as studies carried out in Germany (Schlund et al., 1993, 1997) and Switzerland (Eiberle, 1977), were based on the supposition that use of nestboxes by *G. glis* was related directly to habitat suitability for this species. However, in old forest stands, some dormice may live in natural tree holes and not use nestboxes (Eiberle, 1977; Schlund et al., 1997). In Poland, *G. glis* rarely used nestboxes in a forest with old hollow trees, although dormice were caught there using live traps (Jurczyszyn, 2001; G. Vaivilavičius, pers. comm.).

Significant negative correlations between use of nestboxes and the number of logs lying on the ground, as well as the total number of dead trees and trunks, show that *G. glis* avoid thinned out forest stands. Gaps formed in matured forest stands inconvenience dormouse movement in tree canopies, where *G. glis* performs the majority of its activity (Müller-Stiess, 1996). Thin forest stands reduce protection from predators (e.g. owls), while dense forest stands provide it (Schlund et al., 1997). The last circumstance might explain a positive correlation in *G. glis* with the number of coniferous trees in the canopy.

Conclusion

Two sympatric dormouse species showed different habitat requirements in mature mixed forest. *Muscardinus avellanarius* preferred thinner forest stands with a well-developed understorey, while *Glis glis* preferred denser forest stands with connected tree canopies. These preferences correspond with results of radiotracking in the Bavarian Forest National Park, where *G. glis* used mostly the tree canopy, while *Muscardinus avellanarius* favoured the understorey (Müller-Stiess, 1996). According to indices of nestbox use, mature forest stands were much more suitable for *Glis glis* than for *Muscardinus avellanarius*. However, living conditions for *M. avellanarius* become better when matured forest stands thin out naturally, and understorey develops in the gaps thus formed. Our studies were carried out in mature forest stands and did not cover younger forest stands, or stands significantly dominated by coniferous trees or composed of pure conifers. Analogous studies in forests with larger variation in forest stand age and composition could give a more detailed understanding of habitat requirements of sympatric dormouse species.

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References

Airapetyants, A.E., 1983: The dormice (in Russian). Leningrad University Press, Leningrad, 192 pp.

Bako, B., Hecker, K., 2006: Factors determining the distribution of coexisting dormouse species (Gliridae, Rodentia). Pol. J. Ecol., *54*: 379–386.

Berg, L., 1996: Small-scale changes in the distribution of the dormouse *Muscardinus avellanarius* (Rodentia, Myoxidae) in relation to vegetation changes. Mammalia, *60*: 211–216.

Bright, P.W., Morris, P.A., 1990: Habitat requirements of dormice *Muscardinus avellanarius* in relation to woodland management in Southwest England. Biol. Conserv., *54*: 307–326.

Bright, P.W., Morris, P.A., 1996: Why are Dormice rare? A case study in conservation biology. Mammal Rev., *26*: 157–187.

Capizzi, D., Battistini, M., Amori, G., 2002: Analysis of the hazel dormouse, *Muscardinus avellanarius*, distribution in a Mediterranean fragmented woodland. Ital. J. Zool., *69*: 25–31.

Capizzi, D., Battistini, M., Amori, G., 2003: Effects of habitat fragmentation and forest management on the distribution of the edible dormouse *Glis glis*. Acta Theriol., *48*: 359–371.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

Eiberle, K., 1977: Zur Populationsdynamik des Siebenschläfers (*Glis glis* L.) im Lehrwald der ETHZ. Schweiz. Z. Forstw., *128*: 630–645.

Fowler, J., Cohen, L., 1996: Statistics for ornithologists. BTO Guide 22. British Trust for Ornithologist, 175 pp.

Gaisler, J., Holas, V., Homolka, M., 1977: Ecology and reproduction of Gliridae (Mammalia) in Northern Moravia. Folia Zool., *26*: 213–228.

Hecker, K., Bako, B., Csorba, G., 2003: Distribution ecology of the Hungarian dormouse species, based on the national biodiversity monitoring system. Acta Zool. Hung., *49*, Suppl. 1: 45–54.

Jurczyszyn, M., 2001: Reintroduction of the edible dormouse (*Glis glis*) in Sierakowski landscape park (Poland). Preliminary results. Trakya Univ. J. Sc. Res. Series B, *2*: 111–114.

Juškaitis, R., 1997: Use of nestboxes by the common dormouse (*Muscardinus avellanarius* L.) in Lithuania. Natura Croatica, *6*: 177–188.

Juškaitis, R., 2000: Abundance dynamics of common dormouse (*Muscardinus avellanarius*), fat dormouse (*Glis glis*) and yellow-necked mouse (*Apodemus flavicollis*) derived from nestbox occupation. Folia Theriol. Estonica, *5*: 42–50.

Juškaitis, R., 2003: New data on distribution, habitats and abundance of dormice (Gliridae) in Lithuania. Acta Zool. Hung., *49*, Suppl. 1: 55–62.

Juškaitis, R., 2006: Interactions between dormice (Gliridae) and hole-nesting birds in nestboxes. Folia Zool., *55*: 225–236.

Juškaitis, R., 2007a: Feeding by the common dormouse *Muscardinus avellanarius*: a review. Acta Zool. Lituanica, *17*: 151–159.

Juškaitis, R., 2007b: Habitat selection in the common dormouse (*Muscardinus avellanarius*) in Lithuania. Baltic Forestry, *13*: 89–95.

Juškaitis, R., 2007c: Peculiarities of habitats of the common dormouse, *Muscardinus avellanarius*, within its distributional range and in Lithuania: a review. Folia Zool., *56*, 4: 337–348.

Kahmann, H., Frisch, O., 1950: Zur Ökologie der Haselmaus (*Muscardinus avellanarius*) in den Alpen. Zool. Jahrb. Abt. Syst., *78*: 531–546.

Kasperavičius, A., Kuliešis, A., 2001: Analysis of growing stock variation in Lithuanian forest depending on environmental conditions and sample plots size (in Lithuanian). Environmental research, engineering and management, *3*, 17: 56–66.

Lozan, M.N., 1970: Rodents of Moldavia. Vol. 1 (in Russian). Redaktsionno-izdatel'skij otdel Akademii nauk Moldavskoj SSR, Kishinev, 168 pp.

Mitchell-Jones, A.J., Amori, G., Bogdanowicz, W., Kryštufek, B., Reijnders, P.J.H., Spitzenberger, F., Stubbe, M., Thissen, J.B.M., Vohralík, V., Zima, J., 1999: The Atlas of European mammals. Academic Press, London, 484 pp.

Müller-Stiess, H., 1996: Zur Habitatnutzung und Habitattrennnung der Bilcharten (Myoxidae) Haselmaus (*Muscardinus avellanarius* L.), Gartenschläfer (*Eliomys quercinus* L.) and Siebenschläfer (*Myoxus glis* L.) im Nationalpark Bayerischer Wald. In Müller-Stiess, H. (ed.), Schläfer und Bilche. Tagungsbericht 1. Intern. Bilchkolloquium, St. Oswald 1990. Verein der Freunde des Ersten Deutschen Nationalparks Bayerischer Wald e. V., Neuschönau, p. 1–20.

Navasaitis M., Ozolinčius R., Smaliukas D., Balevičienė J., 2003: Dendroflora of Lithuania (in Lithuanian). "Lututė" Publisher, Kaunas, 576 pp.

Rossolimo, O.L., Potapova, E.G., Pavlinov, I.Ya., Kruskop, S.V., Voltzit, O.V., 2001: Dormice (Myoxidae) of the world (in Russian). Moscow University Publisher, Moscow, 229 pp.

Panchetti, F., Sorace, A., Amori, G., Carpaneto, G.M., 2007: Nest site preference of common dormouse (*Muscardinus avellanarius*) in two different habitat types of Central Italy. Ital. J. Zool., *74*: 363–369.

Schlund, W., Strauss, M.J., Burkhardt, J.F., 1993: Siebenschläfer in Nistenkasten – eine Langezeitstudie zur Habitatwahl. Carolinea, *51*: 93–100.

Schlund, W., Scharfe, F., Strauss, M.J., Burkhardt, J.F., 1997: Habitat fidelity and habitat utilization of an arboreal mammal (*Myoxus glis*) in two different forests. Z. Säugetierkd., *62*: 158–171.

StatSoft, Inc., 2001: STATISTICA (data analysis software system), version 6. www.statsoft.com.

Vietinghoff-Riesch, A., 1960: Der Siebenschläfer (*Glis glis* L.). Monographien der Wildsäugetiere. Gustav Fischer Verlag, Jena, 196 pp.

Vilhelmsen, H., 2003: Status of dormice (*Muscardinus avellanarius*) in Denmark. Acta Zool. Hung., *49*, Suppl. 1: 139–145.

Wachtendorf, W. 1951: Beiträge zur Ökologie und Biologie der Haselmaus (*Muscardinus avellanarius*) im Alpenvorland. Zool. Jahrb. Abt. Syst., *80*: 189–204.