

TEMPORAL PATTERN OF DORMOUSE NESTBOXES USE BY DIFFERENT ANIMAL SPECIES

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SUMMARY. The temporal pattern of artificial nestboxes use by coexisting dormouse (*Gliridae*), passerine bird, amphibian and invertebrate species and the interspecific interaction between them were analyzed in a deciduous forest in the Transylvanian Plain. The active and/or breeding season for several species overlap for at least a time period and competition and predation were observed between them. The fat dormouse *Glis glis* outcompetes and/or predaes on bird and other dormouse species, but also peacefully coexists inside the same nestbox with the tree frog *Hyla arborea* and the Copper Underwing moth *Amphipyra pyramidea*. The Great Tit *Parus major* seems to be unaffected by the competition for nest sites or by nest predation.

Keywords: amphibian, interspecific competition, passerine bird, predation, secondary cavity nesters

Introduction

The communities formed by different species that nest in natural tree holes or artificial nestboxes are shaped by the relationships between them. Cavity nesting species interacts with each other through competition for nest sites (Aitken et al., 2002), but also by predation (Brightsmith, 2005). For secondary cavity nesters, the species that do not excavate their own nesting sites, the availability of tree holes can constitute a limiting factor and interspecific competition may appear (Rhodes et al., 2009; Pöysä and Pöysä, 2002; Juškaitis, 1995). In temperate deciduous forest of Europe, dormice and birds use the same nest sites – tree cavities and artificial nestboxes (Adamik and Král, 2008) and interactions between them have been reported, as competition, but also as predation (e.g. Walankiewicz, 2002; Koppmann-Rumpf et al., 2003; Juškaitis, 2006; Adamik and Král, 2008). When the activity and/or breeding periods are distinct in time, interaction can be avoided, but in recent years, due to climate

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change, shifts in phenology of fat dormice and several species of passerine birds have been recorded, leading to temporal overlapping of nestbox use and thus to a negative effect on passerine populations (Adamik and Král, 2008; Koppmann-Rumpf et al., 2003).

The study was initially focused on estimating the abundance and density of dormice species using nestboxes (Sevianu and David, 2011), but during the research we recorded high nestbox occupancy by other animal species. In this paper we analyze i) the temporal pattern of nestboxes use and ii) the interspecific interactions between three species of dormice (fat dormouse *Glis glis*, common dormouse *Muscardinus avellanarius* and forest dormouse *Dryomys nitedula*), two species of Passerine birds (European Starling *Sturnus vulgaris*, Great Tit *Parus major*) and also several other less frequent species.

Materials and methods

The study took place in Ciușului Forest, a 53 ha hornbeam and sessile oak forest, situated at low altitude (280-430m) in the Transylvanian Plain, Romania (For a detailed description of the study area, see Sevianu, 2009). In this forest, 100 dormouse wooden nestboxes were installed in the spring of 2005, in two parallel line-transects, 20 m apart. The nestboxes were mounted facing the tree trunks, in an attempt to prevent bird species from occupying them.

Data were collected monthly between March and October 2005-2012. One nestbox was considered occupied by a certain species when at least one individual was found inside or when the nest, brood, food remains or other sure signs were detected.

Results and discussion

In the forest analyzed during our study, the dormouse nestboxes were used by mammals, birds, amphibians and invertebrates. We encountered five mammal species: three species of dormice (*G. glis*, *M. avellanarius* and *D. nitedula*), a murid rodent (*Apodemus flavicollis*), and a microchiropteran bat (*Pipistrellus pipistrellus*); two bird species (*Parus major* and *Sturnus vulgaris*); one amphibian species (*Hyla arborea*) and three invertebrate species: a hornet (*Vespa crabro*), a moth (*Amphipyra pyramidea*) and an ant (*Lasius fuliginosus*). The presence of *P. pipistrellus* was recorded only once (two individuals), inside an empty nestbox, and can be considered an accidental species inside dormouse nestboxes.

European Starling was the first species to visit the nestboxes in the spring, as early as the beginning of March. Male Starlings arrive from migration before females and start building nests between late March and early April (Cramp and Perrins, 1994). Starlings deposited fresh plant material, mainly leaves and flowers of *Corydalis bulbosa* and *Aegopodium podagraria*, together with *Coryllus avellana* catkins, inside the nestboxes, either in empty nestboxes or as an addition to the newly started nests. Starlings have already been reported to carry plant material

inside dormice nestboxes (Juškaitis, 2010). This behavior is exhibited only by male starlings and seems to be linked with the pair formation and/or mate attraction (Brouwer and Komdeur, 2004), but the onset time reported varies from a maximum of 5 days before egg laying (Gwinner, 1997) to 18 days, on average 8.7 ± 1.0 days before laying of the first egg (Brouwer and Komdeur, 2004). At our study site we found fresh green material inside nestboxes maximum 28 days before the onset of egg laying, as early as the 11th of March, a much longer period before egg laying that previously reported.

Starlings may have up to three clutches per year, but at our study site we observed only one, laid in the first half of April, reported for central and east Europe as the first clutch (Cramp and Perrins, 1994; Gwinner, 1997), and strongly synchronized, as reported in literature (Meijer *et al.*, 1999). The nestbox usage by Starlings was overlapping with the beginning of the active and breeding season of common and forest dormouse. Starling is a much larger species than either of them, and we did not record any case of predation of those dormice species upon Starling adults, nestlings or eggs, desertion of nests by Starlings due to dormice visits or any take-over by a dormouse of a nestbox already occupied by a Starling. On the contrary, it seemed that by occupying the nestboxes in early spring, Starlings had limited the access to nest sites for the two smaller species of dormouse, which were already active in April (Sevianu, 2009). Starling is an aggressive nest competitor species for other birds (Kerpez and Smith, 1990) that even kills potential competitors for nest sites (Kessel, 1957), and it may defend its nest against the smaller species of dormouse. Our findings are supported by the fact that no Starling nest was reported destroyed by either species of dormice in other studies (Juškaitis, 2006). The adult Starlings and the fledglings of the first brood deserted the nestboxes by the end of May - early June. Other species started to use the nestboxes at this time: *Apodemus flavicollis*, *Vespa crabro* and *Lasius fuliginosus*, but only to a limited extent. The two invertebrate species continued to use the nestboxes until late summer - early autumn and prevented the use by other species. We recorded no cases of predation upon or taken over of an invertebrate used nestbox by any other species. We also recorded a slight increase in the number of nestboxes used by the common dormouse after the nestboxes were vacated by Starlings, but only for a short period of time, as a massive colonization of nestboxes by the fat dormouse started after the species ended hibernation (Sevianu, 2009). The fat dormouse, a much larger species, outcompeted the smaller dormouse species which were once again driven out of the nestboxes (Sevianu and Filipaş, 2008). In September fat dormouse started hibernation and deserted the nestboxes, some of them being once more occupied by the common dormouse.

The beginning of the active fat dormouse season overlapped with the end of the first clutch rearing by Starlings. The two species interacted inside the nestboxes and we documented two cases of sure predation upon Starling fledglings. The second Starling clutch should have started 40–50 days after the first one, by the end of May, beginning of June (Cramp and Perrins, 1994; Gwinner, 1997). At our study

site we could not record a second brood, and the last Starlings, adults and fledglings, deserted the nestboxes in early June. This kind of interaction between fat dormouse and Starling was, as far as we know, reported here for the first time. Predation on Starlings was prior documented only for the garden dormouse *Eliomys quercinus* (Yezerkas, 1961; Airapetyants, 1983, as cited in Juškaitis, 2006), a dormouse species not found at our study site. All species of dormice found in Europe have been reported to kill and/or destroy various species of bird nests, but it seems that those claims could not be supported for the common dormouse (for an extensive analysis, see Juškaitis, 2006). We found no signs of aggression upon Starlings, a much bigger species compared to the common dormouse, but also not on Great Tit, a smaller bird species that used nestboxes at our study site. Great Tit readily breeds in nestboxes when provided, even in small patches of woodland (smaller than 1 ha) (Loman, 2006), but, in contrast with the breeding colonies of Starlings, Great Tits are territorial birds that claim and defend a territory against conspecifics, realizing much lower densities (Kluyver, 1970). Great Tits nested inside the nestboxes during April – July at our study site. Although the time frame partially overlapped with the active season of all three dormouse species, no Great Tit nest was predated by dormice. We found this result rather interesting, as other studies documented quite a significant impact of both fat and forest dormouse on Great Tit populations, while the common dormouse made little impact (Juškaitis, 2006). In at least one occasion Great Tit continued breeding inside the nestbox even after a visit by the common dormouse (droppings found inside nestbox). Birds continuing breeding after common dormouse visits were reported also in Lithuania (Juškaitis, 2006), and other studies showed that Great Tits were able to defend their nests from common dormice, even by killing the intruders (Juškaitis, 1998).

We documented during our research nestbox sharing by different species. In July, August and September the fat dormouse shared some nestboxes with tree frogs and some with the Copper Underwing moth, and also in July the common dormouse shared a nestbox with the tree frog. The association between dormice and the tree frog was not obligate, as we found tree frogs inside empty nestboxes also, but the amphibian presence was perfectly tolerated by the dormice nesting inside. We encounter up to four tree frogs sharing a nestboxes with one or more fat dormice, even females with young. The nestbox sharing with several moth individuals, and the lack of any moth remains, might prove that the species was not eaten by either species of dormouse. As far as we know, there are no other records of nestbox sharing between those species.

Conclusions

The dormouse and bird species whose presence inside nestboxes is analyzed in this study are “secondary cavity nesters” that rely for suitable nest sites on natural cavities or on cavities excavated by “primary cavity excavators” (Aitken *et al.*, 2002), but who readily occupy artificial wooden nestboxes provided by humans.

The overlapping between the time periods when two or more species use the nestboxes for breeding and/or shelter triggers interaction between them. Starlings and fat dormice prevent the use of nestboxes by smaller dormouse species (*D. nitedula*, *M. avellanarius*) by outcompeting them. Fat dormouse also predated on Starlings. Great Tit seems to be unaffected by either species of dormouse or by Starlings. Fat and common dormouse can tolerate the presence of tree frogs and the Copper Underwing moth inside the nestboxes.

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