Various nest box types and their suitability for the common dormouse *Muscardinus avellanarius*

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Abstract
The common dormouse, Muscardinus avellanarius is known to use nestboxes for birds and dormice throughout its distributional range. As it is known to avoid nestboxes occupied by other nestbox users such as the edible dormouse, Glis glis, and hole-nesting passerines such as blue tit, Cyanistes caeruleus, Syn. Parus caeruleus offering a nestbox type that can be exclusively used by the common dormouse might help minimizing competition.

Therefore we set up a scheme comprising four different types of wooden nestboxes varying in area (6 x 6 cm, 12 x 12 cm respectively) and entrance hole (21 mm, 32 mm respectively) that were placed next to each other at 15 stations spaced at intervals of 30 m along a hedgerow to ensure that the dormice had the same set of choices at each of the stations. By doing weekly nestbox checks and documenting the nestbox users found we investigated which nestbox types were used by the common dormouse and whether preferences were detectable. While the edible dormouse and hole-breeding passerines avoided the nestboxes with small entrance holes, the common dormouse used them only seldom and tended to use nestboxes with big entrance holes.

Key words: preferences, entrance hole, Glis glis, competition

Introduction

The common dormouse, Muscardinus avellanarius is known to build its own nests that can be found from ground level to the top of trees (Eden 2009) and also to use nestboxes designed for birds as well as for dormice throughout its distributional range. Given bad weather conditions the use of nestboxes for rearing young may have a positive effect on the survival rate of the juveniles (Juškaitis 2008a). As nestboxes are also being used by other species such as hole-breeding passerines, e. g. great tit, Parus major, blue tit, Cyanistes caeruleus, Syn. Parus caeruleus and the edible dormouse, Glis glis competition can be observed. The presence of a tits‘ nest after the breeding season can cause avoidance of the nestbox by the common dormouse (Juškaitis & Büchner 2010) as it may be infested by more than a thousand fleas (Peus 1953). Avoidance can also be observed for the presence of nests of the edible dormouse (Zaytseva & Novakowski 2011) as the common dormouse is known to escape when confronted with the superior species‘ odor. As far as the competition between the common dormouse and hole-breeding passerines are concerned different observations can be found: They range from peaceful coexistence in the same nest box to expulsion of dormice by the tits (Gatter & Schütt 1999) as well as killing of dormice by great and blue tit (Juškaitis & Büchner 2010). The common dormouse is also known to predate on birds‘ eggs (Juškaitis 1995a). When being confronted with the taller edible dormouse it is always inferior and runs the risk of being either driven out of the nestbox or even killed (Juškaitis & Büchner 2010).

In the course of a long term study on hole-breeding passerines and other nestbox users over 38 years an advancement of egg laying in great and blue tit by one week as well as an advanced occupancy of nestboxes by the edible dormouse of up to seven weeks could be observed and linked to risen temperatures in spring (Koppmann-Rumpf et al 2003,

Scherbaum-Heberer et al. 2011). Earlier use of nestboxes causes an intensified competition for the common dormouse. This aspect emphasizes the necessity of creating a nestbox that might reduce the number of prospective competitor species by choosing nestbox measurements that prevent access of the edible dormouse and birds. At the same time they should allow the common dormouse to enter and use it. Designing nestboxes whose measurements, i.e. area and entrance hole, can be almost exclusively used by the common dormouse we hoped that if they were also preferred by this species this might be an option to not only detect its presence but also to provide shelter in existing sample areas comprising nestboxes for birds.

Another superior competitor for nestboxes are woodmouse, Apodemus sylvaticus and yellow-necked mouse, Apodemus flavicollis whose skull measurements are close to those of the common dormouse and therefore cannot be excluded from using specially designed nestboxes. The same is true for insects that being so small can enter even very small holes and use small nestboxes.

Material and methods

The data used for this study were obtained from a sample area near the town of Schluechtern (50° 19' N; 9° 28'E), Germany, in 2012 and 2013. It contains a total of 60 nestboxes that were installed along a species-rich hedgerow (e.g. blackthorn, Prunus spinosa, hawthorn, Crataegus laevigata) which surrounds an orchard.

Based on studies by Juškaitis (1997) we decided to use nestboxes made of wood, i e. European Larch, Larix decidua. To provide enough space for the construction of dormouse nests the minimal diameter of 4.5 cm was taken into consideration (Vilhemsen 1996). Concerning the size of the entrance hole diameters of less than 28 mm are recommendable to keep the edible dormouse from using the nestbox (Juškaitis & Büchner 2010). As blue tits are known to use entrance holes with a diameter of 26 mm, we chose entrance holes of 21 mm to make sure this species would not enter the nestbox. To ensure that nestboxes with such small entrance holes would not be avoided by the common dormouse a three-year-pilot test had been carried out and presence of the common dormouse and even reproduction in the nestboxes could be proven (Scherbaum-Heberer et al 2012).

The 60 nestboxes varying in area and entrance hole (see table 1 and fig. 1) were alligned in goups of four next to each other and every group was connected to a fence pole. A total of 15 fence poles carrying the same combination of nestboxes to ensure the same set of choices for the common dormouse throughout the sample area were set up along the hedgerow spaced at intervals of 30 m. The nestboxes were installed close to the surrounding vegetation to ensure access by the dormice.

Table 1: Measurements of nestboxes (i. e. size of entrance hole and area).

nestbox type	1	2	3	4
entrance hole [mm]	21	32	21	32
area [mm]	60 x 60	120 x 120	120 x 120	60 x 60

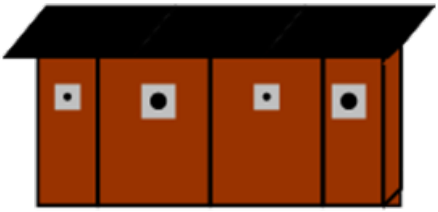

Figure 1. Combination of four different nestboxes varying in area and entrance hole (not true to scale).

Weekly nestbox checks were carried out from March until the disappearance of the common dormouse in autumn usually in November. All birds‘ and mammal species that had evidently used the nestbox (i. e. individuals, nests, feces) were registered. After the fledging of birds when no evidence of a second brood was obvious the nests were taken out to prevent avoidance of the nestboxes by the common dormouse.

The total number of nestboxes used by the common dormouse were compared by applying the Chi2-test, in case of a simple contingency table with one degree of freedom the continuity correction was applied.

Results

In 2012 only one started tits‘ nest, probably blue tit and evidence of the common dormouse in two nestboxes could be detected for nestbox type 1 (see fig 2) Nestbox type 2 was used by three different hole-breeding passerine species: A total of nine nestboxes were used by the tree sparrow, Passer montanus, great tit was found in two nestboxes and blue tit occupied four nestboxes. Nine nestboxes showed evidence of the edible dormouse whereas the common dormouse could be found in one nestbox. Nestbox type 3 showed no occupancy by any of the considered species. For nestbox type 4 a total of 10 boxes revealed use by the common dormouse and four cases for the edible dormouse could be registered.

In 2013 (see Fig. 3) nestbox type 1 showed no evidence of occupancy by the species

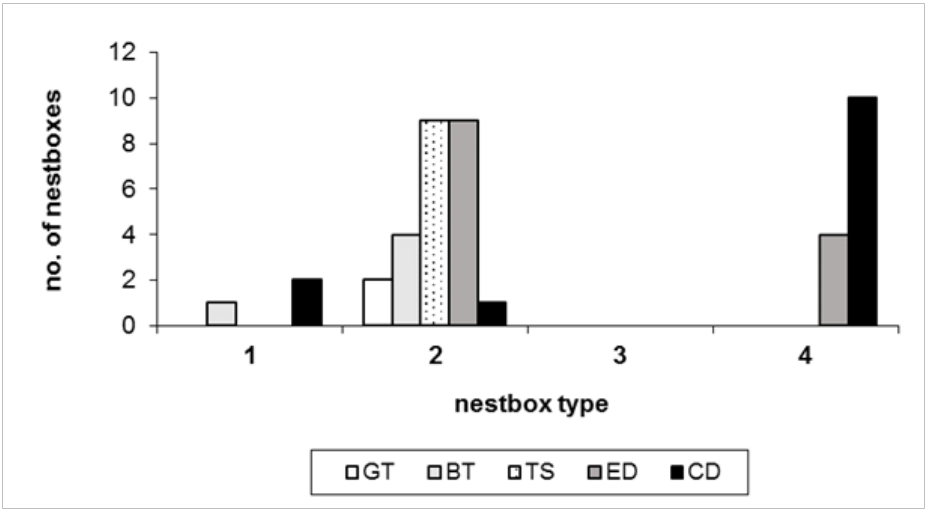

Figure 2. Total number of nestboxes used by different species per nest box type in 2012. Abbreviations: GT = great tit; BT = blue tit; TS = tree sparrow; ED = edible dormouse; CD = common dormouse.

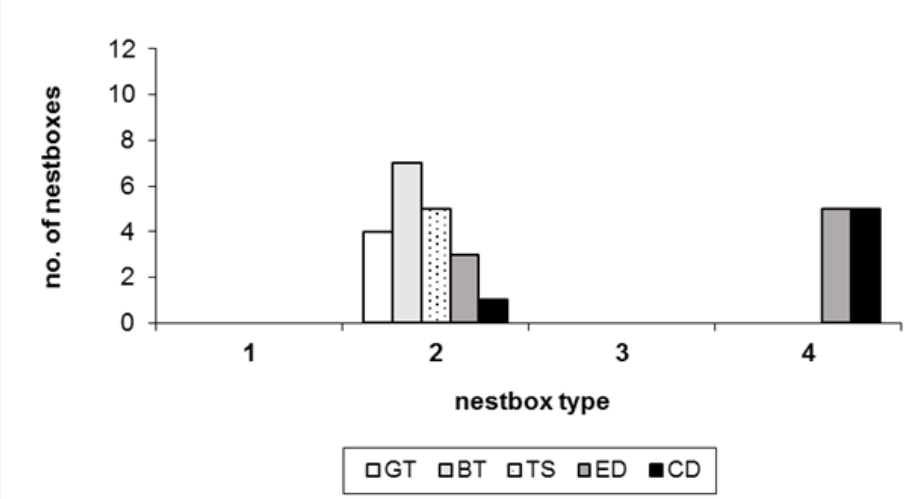

Figure 3. Total number of nestboxes used by different species per nest box type in 2013. Abbreviations: GT = great tit; BT = blue tit; TS = tree sparrow; ED = edible dormouse; CD = common dormouse.

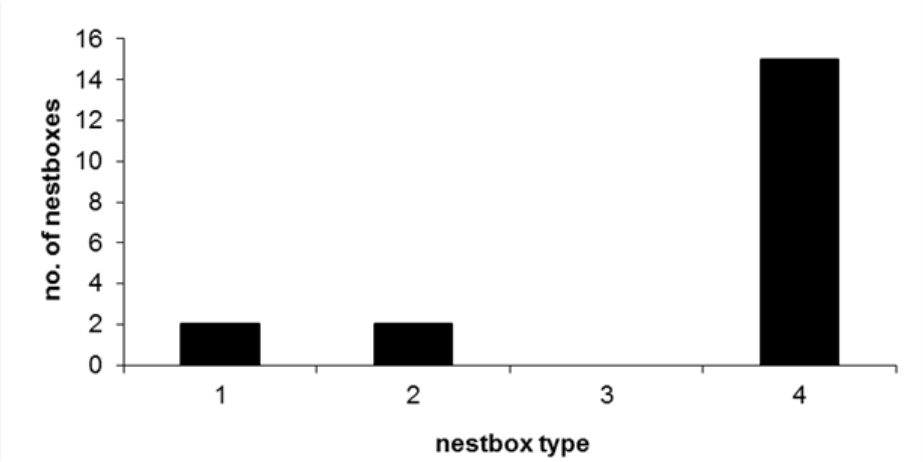

Figure 4. Total number of nestboxes used by the common dormouse per nest box type in both years of investigation

considered whereas nestbox type 2 again showed use by the three aforementioned passerines' species as a total of seven nestboxes were occupied by blue tit, a total of four by great tit and five boxes by the tree sparrow. Three nestboxes were used by the edible dormouse and one was occupied by the common dormouse. Nestbox type 3 again showed no use by any of the considered species. Evidence of both dormice species could be found in a total of five boxes of nestbox type 4.

When summarizing both years it becomes clear that nestbox type 4 is the one that the common dormouse uses most intensively. The total number of nestboxes used is significantly higher than that of nestbox types 1 and 2 ($Chi2 = 6{,}368$; $df = 1$; $p < 0{,}05$).

When considering the chronology of use for every single nestbox it becomes evident that even contemporary use by the edible dormouse terminates the common dormouse's presence in the nestbox concerned.

Discussion

The results clearly show that entrance holes with a diameter of 21 mm (nestbox type 1 and 3) are capable of excluding use by the edible dormouse as well as hole breeding passerines and could in principle help to minimize competition. Nestbox type 4 with a small area and a big entrance hole obviously excludes passerines but does not eliminate use by the edible dormouse which in spite of its comparably bigger size uses the box. The idea that the common dormouse might possibly take the safer nestboxes with small entrance holes instead could not be confirmed as there is few or no evidence of use for nestbox types 1 and 3. Given the choice the common dormouse used nestbox type 4 most intensively. The comparably few cases of use for nestbox type 2 may be due to the intensive use by passerines and the edible dormouse.

As mentioned above there is clear evidence of use of nestboxes with small entrance holes by the common dormouse for day's sleep and reproduction. The deciding factor might be the array of nestboxes. In the mentioned pilot test prior to the present study (Scherbaum-Heberer et al. 2012) the nestboxes were put up individually whereas here they were put up in groups of four next to each other. So the idea of minimizing competition by putting up nestboxes with small entrance holes next to nestboxes for birds cannot be supported by the results as the common dormouse prefers big entrance holes. Installing exclusively nestboxes with small holes in a given area may help to find evidence of dormice as well as supporting the survival rate of its young in bad weather conditions. Possibly putting them up at a certain distance might also help to provide shelter for both birds and dormice.

Acknowledgements

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