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A capture-mark-recapture study on coexisting dormouse species (*Eliomys quercinus* and *Glis glis*) in the Grand Duchy of Luxembourg – Preliminary results

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Abstract

The present study is the first research project on dormice in Luxembourg and one of the few studies on coexisting dormouse species. From April 2009 till October 2011, 221 garden dormice *(Eliomys quercinus)* and 125 edible dormice *(Glis glis)* were marked on 1 ha in different habitat types. Garden dormice showed a clear preference for the vineyards with dry stone walls, whereas only very few edible dormice were trapped there. Edible dormice obviously seem to avoid these open habitats. The ability of the garden dormouse to colonise this habitat type could be an explanation for the higher density of this species at the study site. Additional factors include: its higher reproductive potential (birth earlier in the season, no failure of reproduction in non-masting-years, possibility of two litters a year) and much higher recapture rates of juveniles after hibernation.

Keywords: sympatry, habitat use, live trapping, PIT tagging

1. Introduction

Dormice or Gliridae are a rodent family, consisting of 28 species, which are exclusively found in the Old World (Holden 2005). Three species occur in Luxembourg: the edible dormouse (*Glis glis*), the garden dormouse (*Eliomys quercinus*) and the common dormouse (*Muscardinus avellanarius*). All of them are protected at national level.

The coexistence of rather similar species should be promoted by a differentiation of their ecological niche; the availability of information on resource exploitation is therefore important for understanding interspecies relationships. Studying coexisting species at a research site over several years might give an important insight into their ecology, such as niche partitioning and use of space.

The present study is the first project on dormice in Luxembourg. From 2009 to 2011, population dynamics and habitat partitioning of the garden and edible dormouse in sympatric condition were examined. Studies on coexisting dormouse species are scarce, often used different methods (e.g. nest box checks) and investigated different species combinations (Müller-Stieß 1996, Bakó & Hecker 2006, Ściński & Borowski 2006, Sevianu & Filipaş 2008, Mikeš et al. 2010).

2. Study site and methods

The study site 'Kelsbaach' (180 m a.s.l., 6.42195 E, 49.66552 N) is situated in the eastern part of Luxembourg near the river Moselle at the German border. The 'Kelsbaach' is also a nature reserve (75 ha) and Habitats Directive site (285 ha). It is characterised by high habitat diversity on a small scale. Apart from the edible and the garden dormouse being present at the site, the common dormouse was also found in a nearby overgrown vineyard in 2010 and 2011, but could never be trapped.

Due to the limited comparability of the season 2009, when the traps were partially placed at different sites and with only one trap per point, the data of this year are only reported as total number of marked animals (Fig. 1).

In 2010 and 2011, 240 wooden live traps (Deutsche Fallenfabrik, Franz Keim, Nr.406006, long version: 27 cm × 8 cm × 6 cm) were arranged at 80 points (3 traps per point) in a grid of 10–15 m, covering about 1 ha. The grid included three adjacent areas of almost equal size: a scree forest with moist micro climate, thermophilic shrubs and a vineyard with dry stone walls. The characteristic element for all sites covered by the traps is a limestone escarpment (height: up to 30 m). Due to the linear structure of the habitat types, only 3–4 parallel rows of traps could be installed per site. In 2010, the traps in the scree forest were placed on fence posts with wooden platforms (height: 1.5 m) close to trees or shrubs in order to reduce the number of bycatch (mice); in 2011, the traps at the two remaining sites were also attached to posts due to the presence of badgers.

The traps were activated at dusk and checked at dawn during two sessions per month, each consisting of three nights (2009 and 2010) respectively two nights (2011). The reduction of trapping nights resulted from the experience that many animals were trapped during all three nights of a round, and it was hoped to reduce stress for these multiple recaptures. A mixture of musli, sunflower oil, jam and apple was used as bait. After a brief immobilisation (1–2 min) with isoflurane by a local veterinary surgeon, the new captures were microchipped, weighed and sexed. Furthermore, for genetic analysis a small tissue sample (3 mm in diameter) was taken from the ear by a biopsy punch during anaesthesia. The samples were taken in accordance with legal and ethical rules (license nr. 68513GWsc by the Ministry of Environment). If an animal was retrapped during the following sessions, it was immediately released after identification and weight check.

In statistical analysis, Yates´ correction for the χ^2-test was applied whenever only one degree of freedom was available.

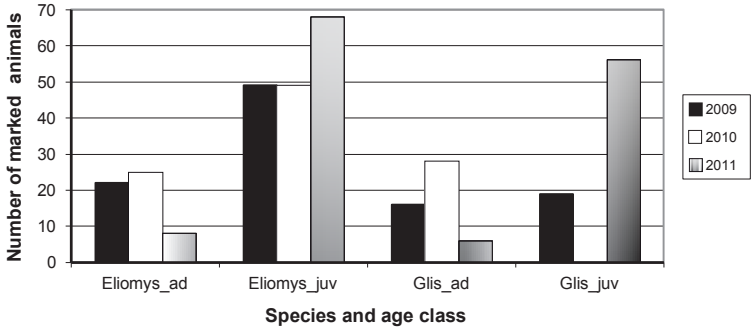

Fig. 1 Total number of marked animals (2009–2011).

3. Results

The total number of animals tagged is shown in Fig. 1. Altogether, more garden dormice (n = 221) than edible dormice (n = 125) were marked until October 2011. Juvenile edible dormice could only be found in 2009 and 2011. In 2010, the edible dormice obviously did not reproduce. There were no significant departures from homogeneity between the numbers of adult garden dormice and edible dormice in both years (2010: $\chi^2 = 0.075$, d.f. = 1, n.s.; 2011: $\chi^2 = 0.071$, d.f. = 1, n.s.). The same applies for the juvenile garden dormice and edible dormice in 2011 ($\chi^2 = 0.976$, d.f. = 1, n.s.) However, there were significant results for comparisons between adult and juvenile garden dormice for both years (2010: $\chi^2 = 7.149$, d.f. = 1, $p < 0.01$; 2011: $\chi^2 = 45.803$, d.f. = 1, $p < 0.001$) as well as for adult and juvenile edible dormice in 2011 ($\chi^2 = 38.726$, d.f. = 1, $p < 0.001$).

When comparing numbers of adult garden dormice between 2010 and 11, a significant departure from homogeneity could be observed ($\chi^2 = 6.323$, d.f. = 1, $p < 0.05$). The same applies for juvenile garden dormice ($\chi^2 = 3.868$, d.f. = 1, $p < 0.05$) and adult edible dormice ($\chi^2 = 12.121$, d.f. = 1, $p < 0.001$). Due to the different number of trapping nights per round (three in 2010 vs. two in 2011), the individuals that were exclusively trapped during the third night of a round in 2010 were discarded for these comparisons.

Figures 2 and 3 show the number of animals trapped through the year in 2010 and 2011. At the beginning of the season (April), only the adult garden dormice were active, followed by adult edible dormice (May/June), juvenile garden dormice (July/August) and juvenile edible dormice (August/September, only in 2011). Lactating female garden dormice were found from June to October in 2011. Furthermore, small juveniles of about 20 g were registered between July and October 2011.

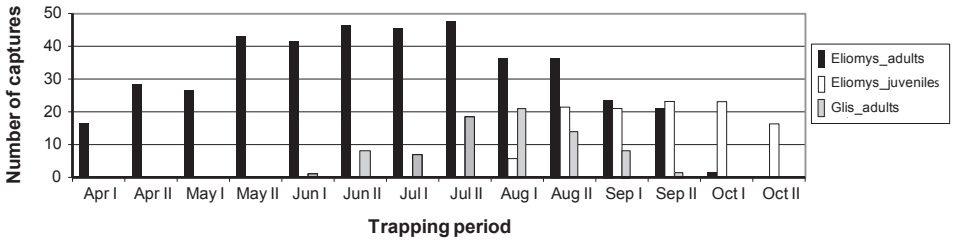

Fig. 2 Number of captures during the season 2010.

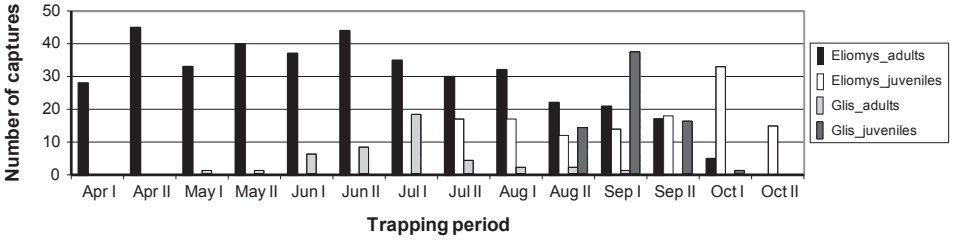

Fig. 3 Number of captures during the season 2011.

In 2010, 73% of the garden dormice marked as juveniles in 2009 were recaptured, but only 21% of the one-year-old edible dormice were retrapped. In 2011, the recapture rate of the 2-year-old garden dormice (born and marked in 2009) was 35%, but just 7% for edible dormice. The recapture rate for one-year-old garden dormice in 2011 was 57%. Juveniles from 2009 that were exclusively trapped on the plateau, where the traps were removed after the first season, were discarded for these calculations.

Figures 4 and 5 show the number of captures of the two species in the different habitats in 2010 and 2011. If an animal entered a site repeatedly during the season, this was included only once in the statistics. Garden dormice were mostly found in the vineyards with dry stone walls (51% in both 2010 and 2011) and shrubs (38% in 2010, 35% in 2011); only 11% (2010) and 14% (2011) of the garden dormice were captured in the scree forest. The edible dormice, on the other hand, preferred the shrubs and the scree forest and avoided the vineyards (16% in 2010, 5% in 2011). Comparisons between numbers of garden dormice found in the different habitat types showed significant departures from homogeneity in both years (2010: $\chi^2 = 39.839$, d.f. = 2, $p < 0.001$; 2011: $\chi^2 = 30.845$, d.f. = 2, $p < 0.001$). The same applies for edible dormice for 2010 ($\chi^2 = 6.013$, d.f. = 2, $p < 0.05$) and 2011 ($\chi^2 = 29.277$, d.f. = 2, $p < 0.001$). For these comparisons, the expected frequencies were adjusted by weighting factors corresponding to the different numbers of traps at the sites.

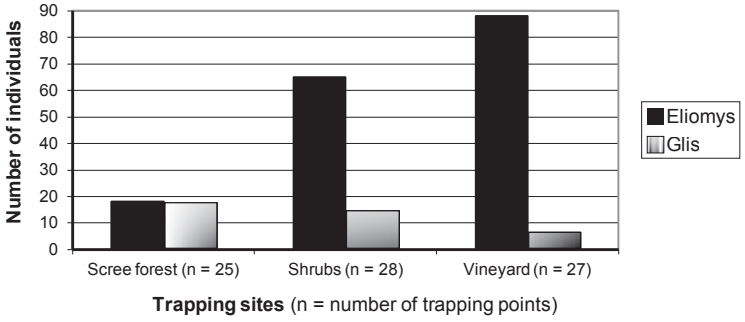

Fig. 4 Number of individuals trapped per site (2010).

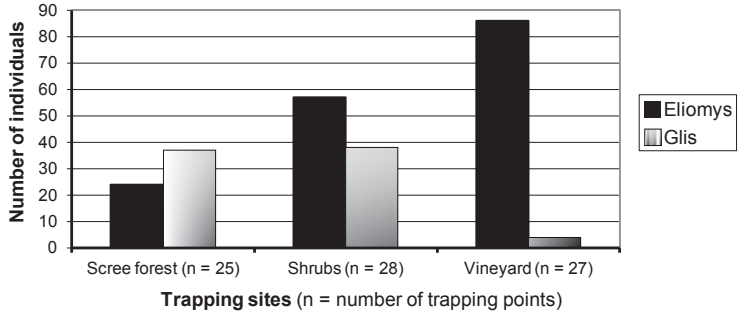

Fig. 5 Number of individuals trapped per site (2011).

4. Discussion

The garden and the edible dormouse differ in many aspects: the garden dormouse is smaller, has a longer activity period, is considered rather carnivorous or omnivorous and not dependent on vegetation cover to such a large extent (Storch 1978). All these factors should facilitate coexistence between the two species.

Other studies have already shown that a coexistence of different dormouse species can be possible: Bakó & Hecker (2006) and Sevianu & Filipaş (2008) studied populations of edible dormice, forest dormice *(Dryomys nitedula)* and common dormice by nest box checks and nest tubes in Hungary and Romania. In both studies, the large edible dormouse dominated the other species, though one should also bear in mind that the smaller species might still use the habitat around the boxes occupied by edible dormice. Live trapping and radio tracking might give a better insight into habitat use; for instance, Ściński & Borowski (2006) found that edible and forest dormice largely overlapped their ranges. In the study by Müller-Stieß (1996), which was performed in the Bavarian forest, the edible and the common dormouse concentrated in the mixed montane forests between 850 and 1150 m a.s.l., whereas the garden dormouse preferred the valleys below 850 m a.s.l. and spruce forests and screes above 1150 m a.s.l..

In the present study, the edible dormouse seems to avoid open habitat with reduced cover, since only a few of them were captured in the vineyard (Figs 4–5). The few findings of edible dormice in this habitat type were almost all close to the escarpment, indicating that the animals might have climbed down from the forested plateau. The garden dormouse, on the other hand, is considered a ground dwelling animal, and Storch (1978) reported that they can even be found in sand dune systems (Guadalquivir, Spain) or stone steppes (Crau, France). Thus, this species has access to many additional nesting sites inside the dry stone walls that are obviously not used by edible dormice.

Other authors reported that edible dormice are able to cross open space: Negro et al. (2011) found that 36.7% of all experimentally translocated animals returned though they had to cross an 80 m ski slope. In other studies, edible dormice were able to cross 46 m (Bieber 1994) or at least 200 m (von Vietinghoff-Riesch 1960, Worschech 2011) of open habitat, but these dispersal events were detected for only a very few of the marked animals (Bieber 1994: 2.5%, Worschech 2011: 1.5%). However, living permanently in more or less open landscapes (like the garden dormouse) or crossing these habitat types to reach more favourable sites (for example during dispersal of juveniles) are two different processes.

Since not all traps were attached to fence posts in 2010, this might have resulted in smaller numbers of the edible dormice at those sites with the traps still placed on the ground. This is because this rather arboreal species might avoid climbing down to enter the ground traps. However, the ratio of individuals (scree forest vs. thermophilic shrubs) is almost the same for the two years (1.2 : 1 in 2010 and 1 : 1 in 2011). In the vineyard, the animals have to move on the ground (irrespective of the placement of the traps) due to the absence of trees and bushes. Furthermore, during monitoring of the surrounding habitat by foto traps, edible dormice were found on numerous occasions on the ground. The edible dormice radio-tracked by Negro et al. (2011) even had their daytime resting sites mostly on the ground.

The relatively low number of new adult edible and garden dormice in 2011 (Fig. 1) might be an indication that the majority of the adult population has already been marked and that there is not much immigration from adjacent sites. Vaterlaus (1998) found similar results, with decreasing numbers of newly marked adults during the course of his study. The mast year 2011 with its warm spring was obviously a good season for both species, resulting in record numbers of juveniles (Fig. 1). The high temperatures early in the season 2011 are also

probably the reason why adult edible and juvenile garden dormice were trapped earlier than the year before (Figs 2–3). Edible dormice are able to skip their reproduction in non-mast-years (e.g. Bieber 1998, Kryštufek et al. 2003, Pilastro et al. 2003), which obviously happened in 2010, when no juveniles could be trapped (Fig. 1).

In the Alps, the recapture rates of juvenile garden dormice were 32–36 % after their first winter (Bertolino et al. 2001). The results of the present study (57 % and 73 %) rather correspond to the dense population described by Vaterlaus (1998) in the Rhine valley (with similar climatic conditions compared to the 'Kelsbaach'), where rates were 60 % and 86 % in two years.

The findings of lactating females and small juvenile garden dormice from June/July to October in 2011 could be an indication that there are two litters per year, or simply reflect the range from early to late single litters from different animals. However, Schaub & Vaterlaus (2001) reported that two litters a year are possible for garden dormice in the Rhine valley. Vaterlaus (1998) found two litters per season in every year of his study: In 1995, they were born in June and August; in 1996 and 1997, the females gave birth in May and July. These animals were kept in captivity (outdoors), but Vaterlaus (1998) assumed that two litters were also possible for non-captive garden dormice. Moreover, he had several juvenile animals giving birth at the age of only four months. Additionally, Ellinger (2005) found two females which successfully reproduced twice in one year. The estimated birth dates of the juveniles were mid-May and end of July. These animals were found in nest boxes in a montane spruce forest at 860 m a.s.l. in the Black Forest, Germany.

Blohm & Hauf (2005) also reported two litters a year for the edible dormouse. However, since juveniles were only found during a very short period (September) in 2009 and 2011, this is considered a less likely event than two litters from garden dormice at the 'Kelsbaach'.

The low recapture rate for the edible dormouse (21 %) is similar to the value (29 %) recorded by Bieber (1995). Edible dormice are born quite late in the season and have less time to accumulate fat for hibernation, which might result in high mortality. However, one should bear in mind that this age group may also disperse after its first winter, and the animals that were not retrapped need not necessarily have died. Thus, the difference in the recapture rates may also indicate a different suitability of the habitats for the two species (with higher emigration rates for juvenile edible dormice), but this hypothesis has to be corroborated by more data in the long term.

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6. References

Bakó, B. & Hecker, K. (2006): Factors determining the distribution of coexisting dormouse species (Gliridae, Rodentia). – Polish Journal of Ecology **54** (3): 379–386.

Bertolino, S., Viano, C. & Currado, I. (2001): Population dynamics, breeding patterns and spatial use of the garden dormouse (*Eliomys quercinus*) in an Alpine habitat. – Journal of Zoology, London **253**: 513–521.

Bieber, C. (1994): Dispersal behaviour of the edible dormouse (*Myoxus glis* L.) in a fragmented landscape in central Germany. – Hystrix (n. s.) **6** (1-2): 257–263.

Bieber, C. (1995): Ökologische Untersuchungen zur Populationsstruktur und -dynamik sowie zur Reproduktionsbiologie an drei Subpopulationen des Siebenschläfers (*Myoxus glis* L.). – PhD thesis, University of Marburg, Germany.

Bieber, C. (1998): Population dynamics, sexual activity, and reproduction failure in the fat dormouse (*Myoxus glis*). – Journal of Zoology, London **244**: 223–229.

Blohm, T. & Hauf, H. (2005): Wiederholter Nachweis von Zweitwürfen des Siebenschläfers (*Glis glis*) in der Uckermark (Nordost-Brandenburg). – Säugetierkundliche Informationen **5**: 595–601.

Ellinger, M. (2005): Habitatwahl und Populationsstruktur bei Gartenschläfern (*Eliomys quercinus* L.) in zwei Untersuchungsgebieten im Nordschwarzwald. – Diploma thesis, Fachhochschule Rottenburg, Germany.

Holden, M. E. (2005): Family Gliridae. – In: Wilson, D. E. & Reeder, D. M. (eds): Mammal Species of the World. A Taxonomic and Geographic Reference, 3rd ed. – Johns Hopkins University Press: 819–841.

Kryštufek, B., Hudoklin, A. & Pavlin, D. (2003): Population biology of the edible dormouse *Glis glis* in a mixed montane forest in central Slovenia over three years. – Acta Zoologica Academiae Scientiarum Hungaricae **49** (Suppl. 1): 85–97.

Mikeš, V., Hedrich, J. & Sedláček, F. (2010): Syntopic occurrence of the Garden Dormouse (*Eliomys quercinus*) and the Edible Dormouse (*Glis glis*) in a montane climax spruce forest (Rodentia: Gliridae). – Lynx, nova series (Praha) **41**: 193–200.

Müller-Stieß, H. (1996): Bilcharten im Nationalpark Bayerischer Wald. – In: Verein der Freunde des Ersten Deutschen Nationalparks Bayerischer Wald e.V. (eds): Schläfer und Bilche. – 6. Tagungsbericht, 1. Internationales Bilchkolloquium: 7–19.

Negro, M., Novara, C., Bertolino, S. & Rolando, A. (2011): Ski-pistes are ecological barriers to *Glis glis* and other forest small mammals. – 8th International Dormouse Conference, St. Marienthal/Ostritz, Abstract Book: 3–5.

Pilastro, A., Marin, G. & Tavecchia, G. (2003): Long living and reproduction skipping in the fat dormouse. – Ecology **84**: 1784–1792.

Schaub, M. & Vaterlaus, C. (2001): Annual and seasonal variation of survival rates in the garden dormouse (*Eliomys quercinus*). – Journal of Zoology, London **255**: 89–96.

Ściński, M. & Borowski, Z. (2006): Home ranges, nest sites and population dynamics of the forest dormouse *Dryomys nitedula* (Pallas) in an oak-hornbeam forest: a live-trapping and radio-tracking study. – Polish Journal of Ecology **54** (3): 391–396.

Sevianu, E. & Filipaş, L. (2008): Nest boxes occupancy by the three coexisting dormouse species and interspecific competition in the Transylvanian plain (Romania). – Studia Universitatis Babeş-Bolyai, Biologia LIII **2**: 39–50.

Storch, G. (1978): Familie Gliridae Thomas, 1897 - Schläfer. – In: Niethammer, J. & Krapp, F. (eds): Handbuch der Säugetiere Europas 1, Rodentia I. – Akademische Verlagsgesellschaft, Wiesbaden: 201–280.

Vaterlaus, C. (1998): Der Gartenschläfer (*Eliomys quercinus* L.): Ökologie, Populationsstruktur, Populationsdynamik und die Verbreitung in der Schweiz. – PhD thesis, University of Basel, Switzerland.

Vietinghoff-Riesch, A. Freiherr von (1960): Der Siebenschläfer (*Glis glis* L.). Monographien der Wildsäugetiere, Volume 14. – Gustav Fischer Verlag, Jena: 196 pp.

Worschech, K. (2011): Dispersal movements of edible dormice (*Glis glis* L.) between isolated small forest woodlots in the district of Altenburger Land (Germany: Thuringia). – 8th International Dormouse Conference, St. Marienthal/Ostritz, Abstract Book: 51–52.

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