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Authors: Adamík, Peter, and Weidinger, Karel

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SHORT NOTE

Direct evidence for nest predation by the edible dormouse (*Glis glis*, Rodentia) in open-cup nesting songbirds

Peter ADAMÍK* and Karel WEIDINGER

Palacký University, Faculty of Science, Department of Zoology, Olomouc, Czech Republic; e-mail: peter.adamik@upol.cz, karel.weidinger@upol.cz

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Abstract. For most rodent species, there is a lack of detailed studies of their diet to understand their predatory impact on other vertebrate taxa. For this reason, rodent predation on bird nests remains a largely unexplored field. Here we provide the first direct evidence, with the use of time-lapse video surveillance, that edible dormouse *Glis glis* depredated or attempted to depredate eggs and nestlings of two open-nesting passerine species, the Eurasian blackcap *Sylvia atricapilla*, and the common blackbird *Turdus merula* in a central European woodland. In the blackcap, we detected three predation events. In the first two cases, edible dormouse drove away incubating/brooding females and preyed upon either the eggs or the nestlings. The third case documents egg predation on an abandoned nest. In the blackbird, we document a single case of dormouse attacking a brooding female. The female and nestlings managed to escape. The fifth case documents an attempt to forage on eggs in an abandoned song thrush *Turdus philomelos* nest. Our observations provide evidence for dormice predation on passerine birds and highlight the value of direct nest surveillance for documenting rodent predation on birds.

Key words: carnivory, nest predator, camera trapping, dormice, nest success, rodent predation

Introduction

Determining diet is a key prerequisite for a variety of questions in animal ecology, including our understanding of species interactions. Despite an enormous effort by researchers to investigate the diet composition of various taxa, we still have an incomplete picture of a wide range of species (Kissling et al. 2014, Verde Arregoitia & D'Elía 2021). This deficiency is often due to difficulties in obtaining data in the field or because studies are performed at small spatial and temporal scales (Nielsen et al. 2018). Rodents are no exception, and cryptic or arboreal species are especially difficult to study. One exception are the dormice, as they readily accept artificial nest boxes as den sites. This behaviour enables easy collection of their faeces, thanks to which we have robust estimates of their main diet types over the active season (e.g. Fietz et al. 2005, Nowakowski & Godlewska 2006, Hürner & Michaux 2009, Gil-Delgado et al. 2010, Juškaitis & Baltrūnaitė 2013a, Vekhnik & Dyuzhaeva 2022, Sato et al. 2023). One clear pattern emerges from the available studies: dormice do depredate bird nests early in the breeding season (Juškaitis 2006, Adamík & Král 2008b, Trout et al. 2012). In an extreme case,

* *Corresponding Author*

in early spring, birds were shown to represent over 80% of the diet of forest dormouse *Dryomys nitedula* (Juškaitis & Baltrūnaitė 2013b), and up to 26% in the diet of the edible dormouse *Glis glis* (Juškaitis et al. 2015). However, nearly all available data on carnivory in dormice comes from cavity-nesting birds. There is limited evidence from non-cavity nesting systems of dormice predation. Food remains of several open-cup nesting species were found in the diet of garden dormouse *Eliomys quercinus* in Spanish orange groves (Gil-Delgado et al. 2009, 2010). To our knowledge, the first direct evidence comes from a single documented case of nest predation by hazel dormouse *Muscardinus avellanarius* on garden warbler *Sylvia borin* eggs (Sell 1998). Surprisingly, similar data on larger but more patchily distributed dormouse species are lacking. Therefore, we have a limited perspective on interactions and the predatory impact of dormice on other vertebrate taxa, including open-cup nesting songbirds. To fill this gap, we present data on predation events or attempted predation by the edible dormouse of three open-nesting songbird species.

Material and Methods

The data presented here were obtained as part of a long-term project monitoring species-specific predation on open songbird nests in various habitats. The fieldwork was done (by K. Weidinger) in Hostýnské vrchy (49.38 N, 17.76 E), a mountain area in the eastern part of the Czech Republic. The area is covered mainly by temperate deciduous/mixed forest stands of various ages. The main tree species is common beech *Fagus sylvatica* with an admixture of maple *Acer* spp., wild cherry *Prunus avium*, and Norway spruce *Picea abies*. Nest monitoring was conducted over three seasons (2015: May 27-August 7, 2016: April 5-August 1, 2017: April 5-August 8). When a nest was found at the field site, we used time-lapse video monitoring to document the breeding cycle. Video monitoring systems consisted of a video camera (diameter: 20 mm, length: 45 mm) with invisible IR illumination (940 nm), a portable security digital video recorder (DVR, Yoko RYK-9107), and a 12V/65Ah battery. The video recorder was housed in a plastic box (125 × 95 × 50 mm) and connected to the camera by a 5 m cable. All outer parts of the system were camouflaged by brown-green spotted painting. The camera was attached to the nest-supporting branch using a dark wire at a distance approximately 20-50 cm from the nest so that the nest contents were visible. We used no additional support for the camera and tried to minimise any damage to vegetation covering the nest. The box with DVR and battery were camouflaged with natural material in ground vegetation/litter. We set the DVR to record continually with a frequency of 10 fps at 640 × 480 pixel resolution and medium quality. These settings allowed eight days of recording on a 32 GB memory card. We checked the monitored nests at 7-day intervals while changing the memory card and battery. Due to time constraints, we reviewed in detail only those video recordings during which there was a visible change in the contents of the monitored nest. For this reason, we could not detect unsuccessful predation attempts unless they were associated with the forced fledging of the young.

To determine an approximate estimate of how often predation events by edible dormouse occurred, we counted the numbers of video-monitored nests after the emergence of the first dormouse from hibernation. Dates of emergence were taken from the nearby Nízký Jeseník Mts., where the dormice are monitored in nest boxes almost daily (Adamík & Král 2008a, the dates were: May 8, May 11 and May 15, P. Adamík, unpublished data).

Results and Discussion

We documented five predation events by edible dormice during the study period. Three cases are related to depredating Eurasian blackcap *Sylvia atricapilla* nests. In the first two cases, the edible dormouse drove away incubating/brooding females and preyed upon either the eggs or the nestlings – the third case documents egg predation on an abandoned nest. In the common blackbird *Turdus merula*, we document a single case of dormouse attacking a brooding female. The female and nestlings managed to escape. The fifth case documents an attempt to forage on eggs in an abandoned song thrush *Turdus philomelos* nest. Below, we provide detailed information on all five events.

Case 1

Blackcap nest with four eggs at the incubation stage, situated in a spruce tree at 0.9 m height (location 49.3758100 N, 17.7594611 E, 718 m a.s.l.). On 20 June 2015 at 1:10 (timing is expressed as summer CET), an edible dormouse flushed the incubating female from the nest. The dormouse consumed the first egg directly at the nest (Fig. 1a, see Data Availability Statement). At 1:29, the dormouse returned to the nest and took the second egg. At 2:32, the female returned to the nest but did not incubate the eggs. Instead, she agitatedly moved near the nest cup and accidentally

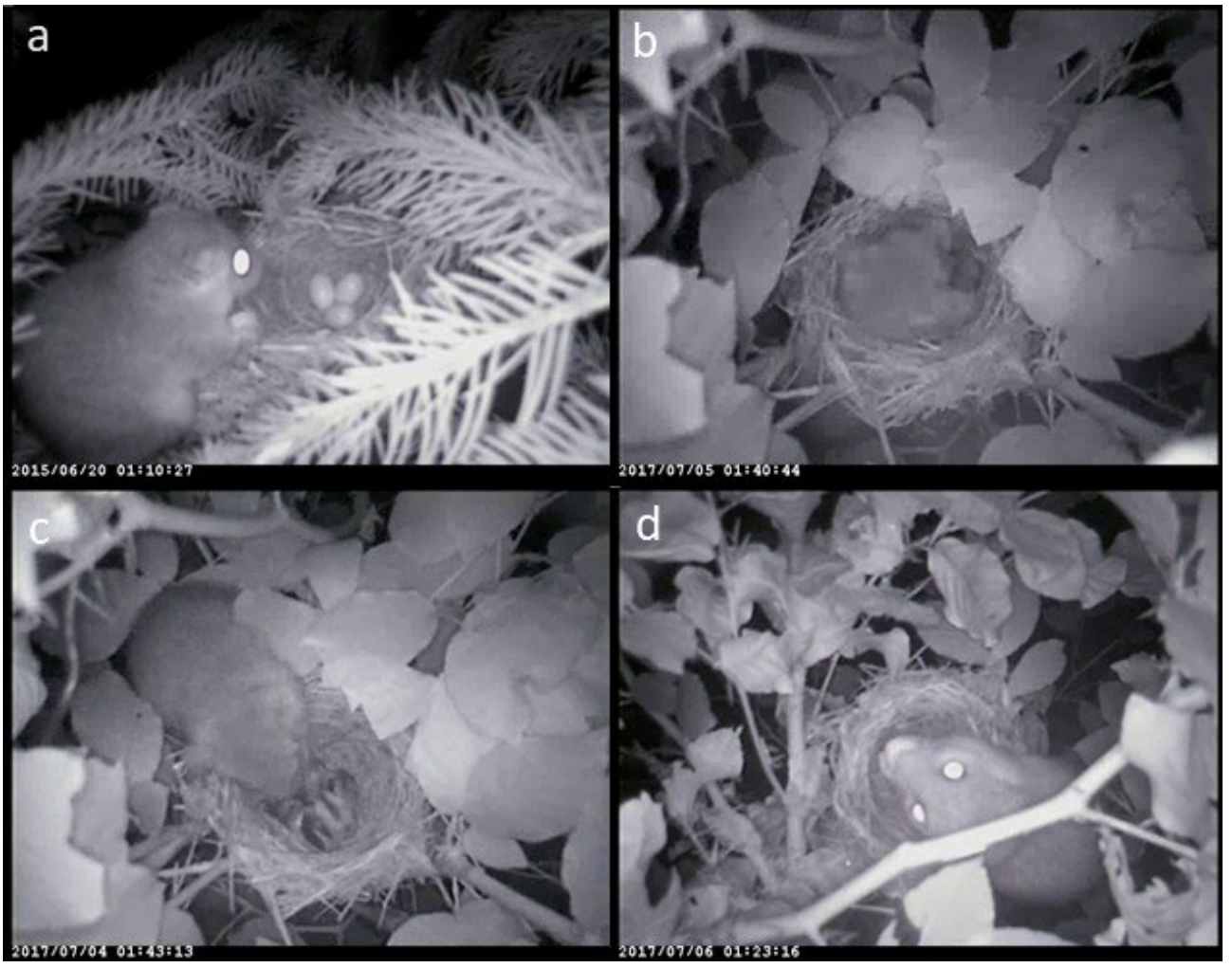

Fig. 1. Snapshots of predation events by edible dormice at three blackcap nests: a) Case 1 with dormouse preying upon eggs; b and c) Case 2 with dormouse depredating blackcap nestlings; and d) Case 3 with a dormouse taking eggs from an abandoned nest.

ejected the third egg. At 2:55, the dormouse took the third egg. Both parents later returned to incubate the empty nest.

Case 2

Blackcap nest with three nestlings (hatched 29 June 2017) and one egg, situated in a beech tree at 1.15 m height (location 49.3645836 N, 17.7214878 E, 530 m a.s.l.). On 4 July 2017 at 1:43, a dormouse flushed the brooding female and consumed the first nestling. The same day, but on the second night at 22:00, the dormouse preyed upon the second nestling; on 5 July at 1:40, it consumed the third nestling (Fig. 1b, c), and at 2:24, it took the single unhatched egg. The blackcap female did not abandon the nest between the predation events. The predation events were spread over two nights.

Case 3

An abandoned blackcap nest with five eggs (found already abandoned), situated in a beech tree at 1.8 m (location 49.3646006 N, 17.7213858 E, 530 m a.s.l.). On 5 July 2017 at 21:22, a first visit without egg predation; after that, a series of repeated visits over one night with predation of all five eggs: the first egg taken at 22:06, the second egg at 23:14, the third at 1:22 (Fig. 1d), the fourth at 2:57 and the fifth at 2:58.

Case 4

An abandoned song thrush nest, situated in a spruce tree at 1.9 m (location 49.3806742 N, 17.7273672 E, 452 m a.s.l.). The nest was visited by an *Apodemus* sp. mouse that, on 11 July 2017 at 1:23, brought an egg of an unknown bird species into the nest cup. On 11 July at 3:23, an edible dormouse visited the nest and handled an eggshell left by the *Apodemus* mouse.

Case 5

An active blackbird nest with a female brooding with three 12-day-old nestlings (hatched 1 July), situated in a spruce tree at 3.0 m (location 49.3684756 N, 17.7182342 E, 585 m a.s.l.). On 13 July 2017 at 2:18, a dormouse attacked the nest and the female defended the nestlings, which jumped out of the nest (‘forced

fledging'). The female continued brooding the empty nest, but at 2:22, the dormouse made another attack on the nest. The female deserted the nest while the dormouse made several visits (the last one at 3:41) throughout the night to collect the debris from the nest cup.

There is ample evidence for several dormice species depredating cavity-nesting birds (references above). In the garden dormouse, the evidence extends even to scavenging behaviour on other vertebrate carcasses (Paula et al. 2015, Díaz-Ruiz et al. 2018). It would be surprising not to detect a similar pattern of predation by dormice on open-nesting bird species. Given the arboreal activity of dormice, it must be easy for them to detect bird nests within their home range. For illustration, hazel dormice were found to utilise abandoned open-cup nests as a base for their summer nests (Berthold & Querner 1986, Fuchs 1987). Therefore, the potential list of bird species on which the dormice prey is extensive. The chance of detecting such events depends on the spatial occurrence of particular dormice species, as well as the temporal and sampling effort of a given field study. Given the patchy distribution of edible dormouse, it is difficult to document these events and assess the predation pressure exerted by dormice. For example, in our case, over the three years we conducted nest monitoring during the dormice activity season, we recorded 53 blackcap nests (three predation events by dormice), 42 song thrush nests (one event), 30 blackbird nests (one event), 33 dunnock *Prunella modularis* nests, 23 chiffchaff *Phylloscopus collybita* nests and five nests of other species. Therefore, we suggest a wider use of video-surveillance methods at bird nests in areas where dormice occur, and we recommend the authors of nest predation studies to explicitly state the occurrence/absence of dormice in their study locations.

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Author Contributions

Conceptualization: K. Weidinger, P. Adamík; Methodology: K. Weidinger; Formal analysis and investigation: P. Adamík, K. Weidinger; Writing original draft preparation: P. Adamík, K. Weidinger; Writing – review and editing: P. Adamík, K. Weidinger; Resources: K. Weidinger, P. Adamík.

Data Availability Statement

Complete video recordings of the predation events are available at Zenodo repository under the link: https://doi.org/10.5281/zenodo.13256017.

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