## Short Communication

# Camera traps equipped with macro lenses as a tool for monitoring arboreal small mammals: a case study in an agroecosystem (NE Italy)

Alessandro Nardotto[1*], Cristian Bertolin[2]

**Abstract** - Despite their increasing use, camera traps as a monitoring tool for arboreal small mammals leave room for further improvements to increase their effectiveness. In the summer of 2023, we conducted a small mammal survey in a wooded area of a lowland agroecosystem in the Veneto region, using standard camera traps equipped with macro lenses for close-up shooting. This camera trap technique made it possible to contact three species of small mammals in the tree-shrub layer: Eurasian red squirrel *Sciurus vulgaris*, wood mouse *Apodemus sylvaticus*, and black rat *Rattus rattus*. The use of macro lenses combined with the standard camera trapping technique made it possible to obtain better quality images and more information even on smaller species compared to more traditional camera traps.

**Key words**: arboreal species, camera trapping, macro lenses, small mammals.

**Riassunto** - Foto-trappole con lenti macro come strumento di monitoraggio dei piccoli mammiferi arboricoli: un caso di studio in un agroecosistema (NE Italia).

Nonostante il loro crescente utilizzo, l'utilizzo delle fototrappole come strumento di monitoraggio dei piccoli mammiferi arboricoli è ancora impreciso e necessita di miglioramenti per aumentarne l'efficacia. Nell'estate del 2023 abbiamo condotto un'indagine sui piccoli mammiferi in un'area boschiva di un agroecosistema di pianura del Veneto, utilizzando fototrappole standard dotate di obiettivi macro per la messa a fuoco ravvicinata. Questa tecnica ha permesso di contattare tre specie di piccoli mammiferi nello strato arboreo-arbustivo: scoiattolo rosso eurasiatico *Sciurus vulgaris*, topo selvatico *Apodemus sylvaticus* e ratto nero *Rattus rattus*. L'uso di obiettivi macro combinato con la tecnica standard di fototrappolaggio ha permesso di ottenere immagini di migliore qualità e maggiori informazioni anche sulle specie più piccole rispetto alle fototrappole tradizionali.

**Parole chiave**: fototrappolaggio, obiettivi macro, micro mammiferi, specie arboricole.

[1]Via Guizze 55/3, Villorba (TV), Italy.
[2]Via Barbasso 58, Morgano (TV), Italy.
E-mail: c.bertolin@barbassonature.com

* Corresponding author: info.wildlifeservices@gmail.com



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## INTRODUCTION

Camera trapping is a technique widely used to evaluate the presence of different animal species (Rovero & Zimmermann, 2016). This technique was first used to study medium- to large-sized mammals (Seydack, 1984; Karanth, 1995; Sanderson & Trolle, 2005), and only in the last few decades has its use been extended to other taxonomic groups as well (Williams *et al*., 2014; Moore *et al*., 2021). Although this technology is developing rapidly, studies applying this method to research on small animals are still scarce, despite increasing use worldwide (De Bondi *et al*., 2010; Littlewood *et al*., 2021), and in the Italian context (Di Cerbo & Biancardi, 2013; Viviano *et al*., 2022).

Micromammals, i.e., mammals weighing less than 1 kg (Nappi, 2001), including rodents (Rodentia) and insectivores (in particular, Soricidae and Talpidae), although often overlooked, are a group of species that are particularly sensitive to alterations in various environmental components and are in some cases strong indicators of healthy ecosystems (Avenant & Cavallini, 2007). They are also the main food source for secondary consumers, such as various birds, carnivorous mammals, and reptiles, and thus contribute to the complexity of the zoocenoses (Amori *et al*., 2008). For the above-mentioned reasons, research on their presence and ecology should be considered of primary importance.

Studies using camera trapping at the ground level have demonstrated their great capacity and potential to provide ecological information for conservation and management purposes, including for small mammals (Meheretu *et al*., 2022; Nardotto, 2022). Nevertheless, this powerful technique has only recently been applied to the study of arboreal species and systems (Moore *et al*., 2021), and only a few studies have used macro lenses in combination with camera traps (Gracanin & Mikac, 2022).

The aim of this study is to present an original method involving the use of macro lenses combined with camera trapping and to evaluate its effectiveness as a valid tool for identifying small arboreal mammals.

## MATERIALS AND METHODS

This study is part of a broader faunal monitoring project of the species present in the lands of "Cattolica Agricola Sarl" based in Roncade (TV), north-eastern Italy. In particular, we conducted this research for four months, from June to September 2023. The research was carried

out in a lowland wooded area of approximately 16 ha set in an extensive agricultural context (45.58189 N, 12.43598 E). Our forest sampling area was characterized by the presence of a shrubby layer of predominantly native plants such as European cornel *Cornus mas* L., common dogwood *Cornus sanguinea* L., common hawthorn *Crataegus monogyna* Jacq., elm leaf blackberry *Rubus ulmifolius* Schott and of an arboreal layer of mixed essences dominated by poplar *Populus* sp. and secondarily by oak *Quercus robur* L., black alder *Alnus glutinosa* (L.) Gaertn., and some exotic species.

Two camera traps (Browning Spec Ops Elite HP5) have been partially modified by placing a macro lens (+2 close-up lens 37mm) in front of the camera lens (Fig. 1) to facilitate species identification. The cameras were then mounted on shrub branches at a height of about 100-150 cm above the ground. A wooden tray was then placed in front of each camera with a food attractant consisting of dried fruit and nuts to maximize the possibility of intercepting all the species of arboreal micromammals present in the area. In total, four camera trapping points were deployed during the study period. The camera traps were set in video mode (20 seconds) with an interval of 0 seconds between each shooting session, thus minimising the time between videos; they were activated only when the PIR registered movement. The morphological identification of the filmed species was performed following Amori *et al*. (2008) and Paolucci & Bon (2022).

## RESULTS, DISCUSSION AND CONCLUSIONS

During the study period, we totalled 210 camera trapping nights (i.e., number of camera traps × days of activation), with 239 out of 352 videos involving the target species. The analysis of all the videos taken by each camera allowed for the identification of three mammal species: Eurasian red squirrel *Sciurus vulgaris* L. 1758, wood mouse *Apodemus sylvaticus* L. 1758, and black rat *Rattus rattus* L. 1758. In particular, the wood mouse was identified based on its historically reported regional distribution (Bon, 2017), as in the lowland areas of the region this is the only species ever reported of the genus *Apodemus*. Furthermore, we can exclude *A. agrarius* Pallas 1771, a congeneric species living in the region, due to the lack of a conspicuous black stripe on the back, a yellowish throat spot, and a sharp contrast between the white ventral parts


Fig. 1 – Arboreal mammal species documented during our camera trapping surveys. Top left: wood mouse; top right: black rat; bottom left: Eurasian red squirrel; bottom right: one of the camera traps equipped with macro lens. / Specie di mammiferi arboricoli documentate durante le sessioni di fototrappolaggio. In alto a sinistra: topo selvatico; in alto a destra: ratto nero; in basso a sinistra: scoiattolo rosso eurasiatico; in basso a destra: una delle trappole dotate di obiettivo macro.

and the reddish-brown dorsal parts that characterise *A. flavicollis* (Paolucci & Bon, 2022). Besides, it was possible to discriminate this from other similar-sized rodent species, such as the house mouse *Mus domesticus* L. 1758 present in the area (AN, *pers. obs.*), because of the different shape of the muzzle and coat colour. Similar considerations are valid for the discrimination between the black rat and the brown rat *Rattus norvegicus* L. 1758, which in many camera trapping studies were difficult to tell apart with certainty.

The investigation made it possible to highlight the absence of the hazel dormouse *Muscardinus avellanarius* L. 1758, the only species of arboreal micromammal potentially present in the Venetian plain, which is protected by the Habitats Directive (Annex IV, 92/43/EC). Of the species active in the arboreal-shrub layer observed during the investigation, the Eurasian red squirrel and the black rat are certainly those with the most arboreal habits (Amori *et al*., 2008; Bon, 2017). Although the wood mouse is mainly active at ground level (Jennings, 1975; Flowerdew,1991; Amori *et al*., 2008), it also shows a marked climbing aptitude, reaching up to 3-4 metres in height on shrubs (Montgomery, 1980; Gurnell, 1985). Although frequently reported, the arboreality of this species has been little investigated (Nardotto, 2023).

The wood mouse was the rodent species most frequently filmed by the camera traps (144 different events), and in some cases (22) even during daylight hours, suggesting that the species, in this context, is not exclusively nocturnal. Black rat was instead detected only at night (67), while the Eurasian red squirrel only during the day (28). What was observed seems to indicate a substantial difference in the activity rhythms of these two species, with the smaller species (the black rat) active in the tree layer exclusively when the squirrel is not. However, in the absence of data on activity rhythms, which were not among the objectives of our study, no conclusions can be drawn at present.

This study confirmed the suitability of camera traps to document the arboreal micromammal communities unobtrusively and rapidly in an agroecosystem. Moreover, the implementation of these devices with macro lenses consents to obtain good quality images, essential for the recognition of small mammals often difficult to discriminate in the field. Although direct trapping or the use of hair tubes are extremely valuable methods in studying arboreal micromammal communities, they require more time and effort compared to camera trapping (Di Cerbo & Biancardi, 2013; Wearn & Glover-Kapfer, 2019). Furthermore, the use of camera traps prevents animals from being injured or even dying; accidents are frequently observed when using traditional trapping methods (Proulx & Barrett, 1989).

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