Mammalian Biology 76 (2011) 570–576

Contents lists available at ScienceDirect

Mammalian Biology

journal homepage: www.elsevier.de/mambio

Original Investigation

Traditional and diversified crops in South Moravia (Czech Republic): Habitat preferences of common vole and mice species

Eva Janova[a,*], Marta Heroldova[a], Adam Konecny[a], Josef Bryja[a,b]

[a] Institute of Vertebrate Biology, Academy of Sciences of the Czech Republic, Brno, Czech Republic
[b] Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic

ARTICLE INFO

Article history:
Received 9 September 2010
Accepted 14 April 2011

Keywords:
Microtus arvalis
Apodemus sylvaticus
Agroecosystems
Agricultural landscape
Crop

ABSTRACT

Substantial changes in the composition of crops in Central Europe during the last two decades (increasing areas of maize, rape and sunflower fields) have significantly influenced the structure and dynamics of animal communities, though there is a lack of data available for small rodents. In this study, we assessed the importance of these three crops for rodents and compared it with traditional crops (alfalfa, barley, wheat). We observed that herbivorous species (especially the common vole) do not live in crops which do not have green leaves near the ground (e.g. sunflower, maize), while mobile granivorous species can inhabit all types of crop. We confirmed the presumed differences in habitat preferences; however we rejected the hypothesis of a general increase of rodent abundance during the vegetative season in managed fields. We found that (1) maize and sunflower had no importance for common voles, but they were favored habitats for wood mice; (2) numbers of wood mice in rape decreased during the season, while abundances of common voles increased; (3) common vole populations tended to increase during the season in all suitable crops (alfalfa, barley, wheat, tendency in maize and rape); (4) wood mice populations seemed stable in all crops; i.e. without a seasonal increase. It can be concluded that even if the new crop fields are an important part of the agricultural landscape, they are only a temporal habitat for small mammals, especially granivorous species.

Introduction

Many changes in agricultural land usage have occurred during recent decades in Central Europe. New practices, such as privatization and the introduction of the Agri-Environmental Scheme (AES) under the European Union, have influenced agricultural management. For example, based on data from the Czech Statistical Office (www.czso.cz; Fig. 1) areas planted with wheat have been stable since the 1970s, while areas of barley and alfalfa increased in the 1970s and 1980s and subsequently decreased slightly in the last 10 years. Notwithstanding these changes, these crops have traditionally been the main agricultural crops planted in Central Europe. However, the area used for the cultivation of rape, sunflower and maize has significantly increased in the Czech Republic since the 1980s and 1990s in response to the increasing demand for these crops. The area of maize has increased fivefold in the last decade, and the area covered by rape has increased continuously during the last 20 years, making it one of the dominant crops in the Czech Republic. Sunflower is widely grown in the south-east of the Czech Republic (South Moravia), although its total production in the entire country is not high (Fig. 1).

There are numerous studies on the occurrence and dynamics of small rodents in agroecosystems from Scandinavia (Loman 1991) and the UK (e.g. Tew and Macdonald 1993; Tattersall et al. 1999a,b; Tew et al. 2000; Todd et al. 2000), but these regions are outside the range of the common vole, which is one of the most important rodent pests in Central Europe (e.g. Kratochvil et al. 1959; Babinska-Werka 1979; Zapletal et al. 2001; Zejda et al. 2002). Therefore, it is difficult to compare the composition of rodent communities and their effects on agricultural production in different geographical regions. The majority of studies from Central Europe were carried out some time ago and do not reflect recent changes in crop composition. They are usually focused on small mammals in traditional crops, while only partial (and often unpublished) data are available about rodents in "new" crops (i.e. maize, rape and sunflower).

Traditional crops such as alfalfa and winter wheat are important habitats for overwintering and reproduction in small mammals (e.g. Zejda and Nesvadbova 2000; Heroldova et al. 2005; Aschwanden et al. 2007). The lack of information for the new crops; in particular whether rodents reproduce in these fields and how much their densities increase during the vegetative season, makes it difficult to predict the impact of new agricultural practices on small mammal populations and *vice versa*. Fragmented evidence

* Corresponding author. Tel.: +420 543422549; fax: +420 543211346.
E-mail address: janova.eva@seznam.cz (E. Janova).

1616-5047/$ – see front matter © 2011 Deutsche Gesellschaft für Säugetierkunde. Published by Elsevier GmbH. All rights reserved.
doi:10.1016/j.mambio.2011.04.003

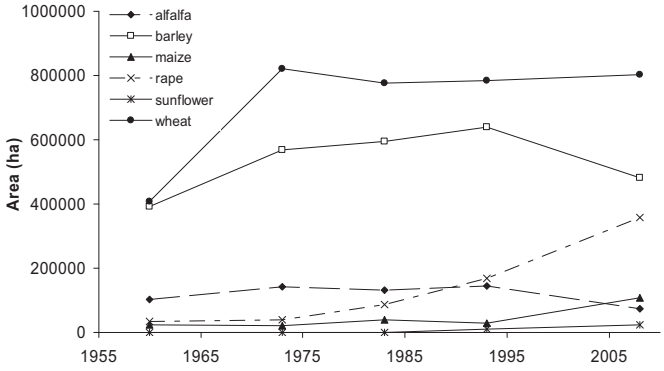

Fig. 1. Areas (ha) of main agricultural crops in the Czech Republic from 60s to the present. Data from www.czso.cz.

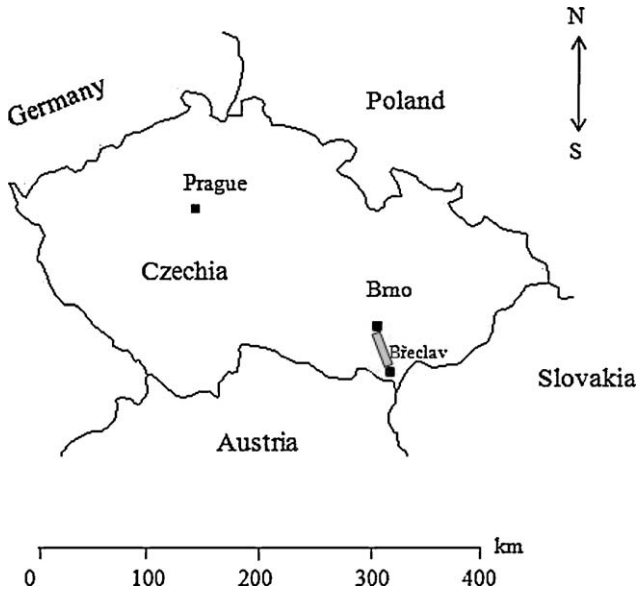

Fig. 2. The study area.

suggests that rape has a positive influence on overwintering and reproduction of the common vole (Truszkowski 1982; Balmelli et al. 1999; Zejda and Nesvadbova 2000; Heroldova et al. 2004), but is not preferred by mice during the vegetative season (Macdonald et al. 2000; Todd et al. 2000). On the other hand, no such published studies exist for maize and sunflower plots.

Crops with high abundances of rodents could be a source of pests after ploughing (Tew and Macdonald 1993; Jacob 2003; Jug et al. 2008) and high spring abundances in perennial crops could mean that these crops are important sites for overwintering of small mammals (Babinska-Werka 1979; Truszkowski 1982; Heroldova et al. 2004). Rodent species can successfully move from these fields to other crops according to food supply (Ylonen et al. 1991; Ouin et al. 2000). Empirical data about the effect of crop type on the population growth of rodent abundance is required and has enormous importance for agro-management.

The aim of this study was to compare the rodent communities over two seasons occurring in three "new" planted (maize, sunflower, rape) and three "traditional" (alfalfa, barley, wheat) crops. Two hypotheses were tested: (1) That there would be differences in abundances of small mammals in particular crops (traditional and new) at any given time and that abundances in "new" crops (or in some of them) are comparable with abundances in "traditional" crops (or in some of them). These could be a reflection of the availability of a favorable food supply and shelters and food preferences of particular species. (2) We tested the hypothesis that habitat suitability for reproduction and population increase is directly reflected in the increase of rodent abundance during the season. Therefore, the increase of small mammal abundance was not expected to be the same in the all crops. In case that the crop offers good conditions for reproduction and survival the numbers of small mammals was expected to increase considerably from spring till harvest time.

We predicted an increase in the numbers of small mammals in crops providing a stable food supply and low level of tillage (especially alfalfa). However, corn and crop with oily seeds such as sunflower and maize could be attractive preferentially for mice as a seasonal food supply.

Material and methods

The small mammals were studied in the years 2004–2006 in the crop fields in South Moravia, the Czech Republic. The study lasted three years, however the year 2006 was a year with very low small mammal densities. The total number of fields where one or more individuals was captured in the whole year was only ten, thus 2006 was not included in the analysis. The studied fields were situated in a broad strip around the highway from Brno to Břeclav, GPS coordinates 48°40′N–49°06′N and 16°29′E–16°53′E (Fig. 2), the size of strip was approximately 40 × 12 km and the difference in elevation was up to 80 m. All fields were in a flat landscape. The study area formed the northernmost part of Panonia lowland and 67.5% of the area of the studied region is used as arable land (www.czso.cz). Small mammals were captured in alfalfa, spring barley, maize, winter rape, sunflower and winter wheat crop fields. Between 6 and 13 different fields of each crop were sampled each year (Table 1). We studied 49 fields in 2004 and 63 fields in 2005, 20 of them were investigated in both years.

We tried to sample fields with each crop equally spread in the whole region. The trapping of small mammals was performed twice per year, at the beginning of the vegetative season of each crop and before the harvest (Table 2). We realize that the results could be biased by the different sampling times and by temporal variations such as weather, stage of moon cycle, etc. which may influence capture rates, nevertheless in the time of sampling we were limited by the stage of crops.

We are aware that the pre-crop (Zejda and Nesvadbova 2000) has an effect on assemblages of small mammals. Nevertheless the rest of pre-crops were cleared off at the end of summer and the fields were ploughed – this leads to the moving of small rodents to adjacent habitat (Ouin et al. 2000). At the time of the spring sampling there were six or more months since the last pre-crop biomass was present in the field. We think that this justifies the fact that the influence of pre-crop was omitted from our analysis.

The sampling was performed by snap trapping because the material of rodents was examined to check the presence of hanta, arena and cowpox viruses in the same time (Heroldova et al., 2010). Snap trapping is a method which is commonly used for the relative abundances estimating in United States (e.g. Krebs et al. 2002), Fennoscandia (e.g. Norrdahl and Korpimaki 2002; Ecke et al. 2010) as well as in the central Europe (e.g. Heroldova et al. 2005; Janova et al. 2008).

Snap traps were baited with fried wicks (soaked in fat and flour). Trap lines began about 50 m apart from the borders of the field to avoid the edge effect (Chudoba and Huminski 1980). Traps were exposed for one night in two lines in the same field; each line had 25 traps spaced 3 m apart. The next day the traps were moved to another field of the same crops, so the each trapping action lasted one week and crops were sampled during the whole week for multiple nights and fields. The one-night exposition of traps was sufficient for our previous studies in alfalfa and set-aside plots (Janova et al. 2003; Heroldova et al. 2005; Janova et al. 2008). The