

Ecological Aspects of Rodent Communities in Agrarian Ecosystems of Moldova

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Abstract. The transformations of anthropogenic ecosystems in the last decades provoked significant structural-functional changes in rodent communities, as well as modification of dominance status of some wide spread species. In the 80s the dominant species were those from genus *Apodemus*, with 63%, of which *A. sylvaticus* and *A. uralensis* had the abundance of 55%, being constant on the agricultural fields. The genus *Mus* species had the abundance of 25% and were the main species on agricultural fields. *M. musculus* was more frequent and more abundant (15%). After 2000 the abundance of some rodent species increased (*A. agrarius*, *M. spicilegus*) and of other species decreased (*A. sylvaticus*, *A. uralensis*, *M. musculus*). In the last years abundance decreasing of *M. spicilegus* was registered. The *Microtus* vole population is in depression phase its abundance decreasing from about 20% in 2006 to 3% in 2009 and is still low. *A. sylvaticus* is the most prosperous species among rodents, being dominant and constant in the republic ecosystems.

Keywords: rodents, agrarian ecosystems, communities, structure, abundance, ecological significance

INTRODUCTION

The rodents are important elements of terrestrial ecosystems and have a great functional importance. They are consumers of secondary and tertiary production and serve as trophic source for many reptiles, predatory birds and carnivorous mammals, thus being important links within the trophic chain. At the same time, the majority of rodent species are very prolific, with increased density in various ecosystems and with large limits of ecological valence. All this favors this group to be the most cosmopolitan, the most spread and to quickly adapt to environmental changes.

The excessive reproduction of rodents, followed by extended invasions lead to switch in the trophic regime and many species from herbivorous become omnivorous. There are well known the cases of mass destruction of forage crops and cereals, of orchards, gardens and tree plantations. The most harmful species are the eurytopic and synanthropic ones, inhabiting the open type biotopes, such as agrarian ecosystems and other types of agrocenoses. For the Republic of Moldova the rodent control is one of the most important economic problems, because about 80% of its territory is occupied by agrocenoses and the main economic branches of the country are the agrarian production and alimentary industry.

Being in permanent contact with the soil and due to the specific features of their organisms, the rodents are carriers and vectors of many parasites and infectious diseases. Namely the agricultural environment favors the contacts between man and rodents, which make the man exposed to diseases transmitted by rodents.

MATERIALS AND METHODS

The material was collected between 1977- 2010 in different types of agrarian ecosystems and agrocenoses of the Republic of Moldova. The determination of rodent species composition and of the population density was carried out by the methods of animal number relative assessment – trap-nights [1, 4] and by live traps. The following parameters were registered at the caught animals: species, sex, age, morphological and physiological indexes, physiological and reproductive state. The animals from the dominant rodent species were kept alive for further parasitological investigations.

To characterize the biotopic distribution of the species there were used the index of frequency: $F = 100p/P$, where P – number of samples, p – samples in which the species is present, and the index of species dominance (abundance) $D = 100n/N$, where n – number of individuals of certain species in the sample, N – total number of individuals.

The importance of certain taxonomic group in ecosystems was emphasized by calculating the ecological significance (W_A) according to the following formula $W_a = F_a \cdot D_a / 100$, where F_a - frequency of group_a and D_a – abundance index. The species of taxonomic groups with the significance less than 1% was considered accidental; 1,1 – 5 % - accessory; 5,1-10% – characteristic and $W > 10\%$ - constant for the studied biocenosis. The statistical and factorial analyses, the graphic interpretation of the results were accomplished using the computer programs Statgraf, Microsoft Excel, Word.

RESULTS AND DISCUSSIONS

In last several decades modifications of the Republic of Moldova landscape occurred. Vast single-crop agricultural fields from the agrarian complex of 70-80-s that occupied large territories are currently divided in small fields and parcels, many of which are abandoned and uncultivated. The processes of natural ecosystems degradation continue on the whole territory of the republic. In such conditions drastic changes in rodent communities were registered during the study years, as well as modification of dominance status of some wide spread species was established. During the study years 14 rodent species were registered, of which 8 species had increased abundance in agoecosystems: *Apodemus sylvaticus*, *A. flavicollis*, *A. agrarius*, *A. uralensis*, *Mus musculus*, *M. spicilegus*, *Microtus sp.* and *Clethrionomys glareolus*.

In the agrarian landscape of the 80s-90s the structure of rodent communities from anthropogenic ecosystems was determined by the biotope mosaicity, the degree and type of their exploitation, the background of predatory pressure and anthropogenic factors [2, 3, 6].

In the large areas of agricultural fields cultivated with wheat, crops, fodder herbs, vineyards, tree orchards the dominant species were those from genus *Apodemus*, with 63%, of which *A. sylvaticus* and *A. uralensis* had the abundance of 55%, being constant ($W > 25$) on the agricultural fields and in the majority of the agrocenoses (fig. 1). The species *A. agrarius* in this period had an accidental significance ($W < 1\%$), being recorded in some acacia shelter belts and forest edge.

The house mouse and mound building mouse (genus *Mus*) had the dominance of 25% and were dominant species on agricultural fields. The species *M. musculus* was more frequent and more abundant (15%) due to the presence of refuge stations (haystacks formed after harvesting, available during august-may period and even longer).

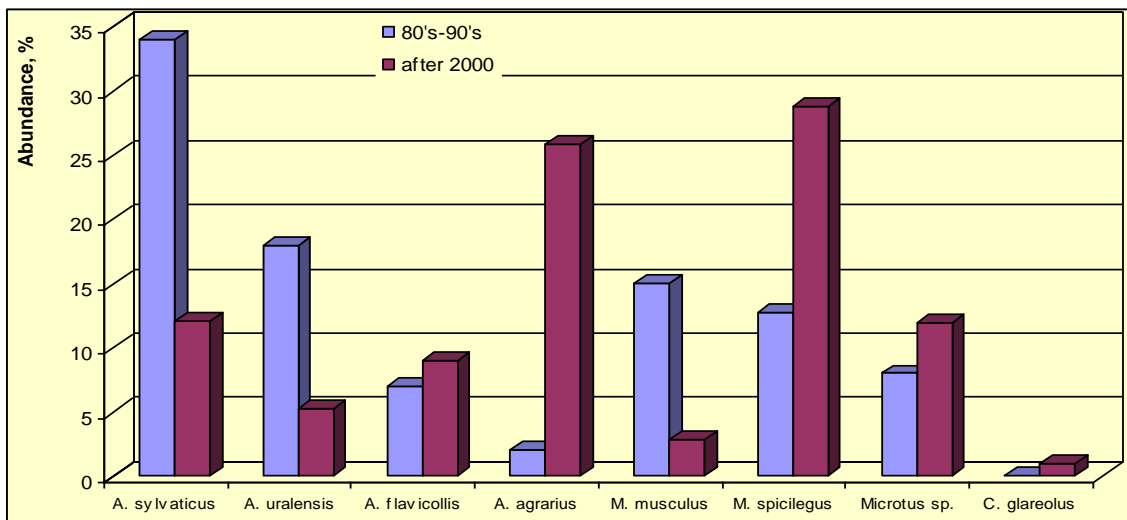


Fig. 1. Evolution of rodent community structure in agrarian ecosystems

After 2000 the modifications of agrarian ecosystems from the last two decades caused structural changes in rodent communities. The dominance of some species increased (*A. agrarius* from 2,1% to 25,8%, *M. spicilegus* from 12,7% to 28,8%), while the dominance of other rodent species decreased (*A. sylvaticus*, *A. uralensis* and *M. musculus* to 12,1%, 5,2% and 2,8% respectively).

In 2000-2006 period in agrocenoses some structural-functional modifications of rodent communities were recorded by comparing with the last decades of the past century. The abundance and the frequency of the species *A. agrarius* increased considerably (fig. 1), this species was constantly recorded in agrocenoses, as well in forests. *A. uralensis* is a species with low abundance – less than 8%. *A. sylvaticus* has high abundance in agrocenoses with annual cultural plants, where it is the dominant species [7]. In agroecosystems the wood species *C. glareolus* was registered in reproductive period in agrocenose at 200m distances from wood and *A. flavicollis* was present in rather low proportion (5-8%).

Due to the modifications of agrocenosis structure, the abundance of the species *M. spicilegus* increased (fig. 1). The dominance of *M. musculus*, along with the disappearance from the agricultural landscape of the haystacks, decreased considerably (2-3%).

Along with the disappearance from the agricultural landscape of the vast Lucerne fields and emergence of many small fragmented abandoned sectors the number cyclicality of *Microtus* genus species is deregulated and a slight increasing of its dominance occurred, and between 2004-2008 the *Microtus* population was in the phase of numeric growth.

In 2000-2006 in agrocenoses all over the country (fig. 2) *M. spicilegus* is the most abundant and numerous species, its ecological significance in agroecosystems is the highest ($W= 25\%$). If in previous decades the mounds of this species could be registered in autumn period after the harvest gathering only on the edges of the large one-crop fields, at present the mounds can be observed in large quantity on the whole surface of the lands after the harvesting, starting with the second half of the summer. In such lands the species density is very high – about 150-250 individuals per ha. In opposite the species *M. musculus* that 20 years ago found favorable conditions in the spring – autumn season in agricultural lands and reached high densities in autumn period, at present can be recorded rather rare and in low frequency in agrocenoses. This fact is duet o the changes in the agriculture type, to the mosaicity of agrocenoses, to the disappearance of the haystacks that offered shelter and trophic resources in cold period, as well as to the competition with *M. spicilegus* species.

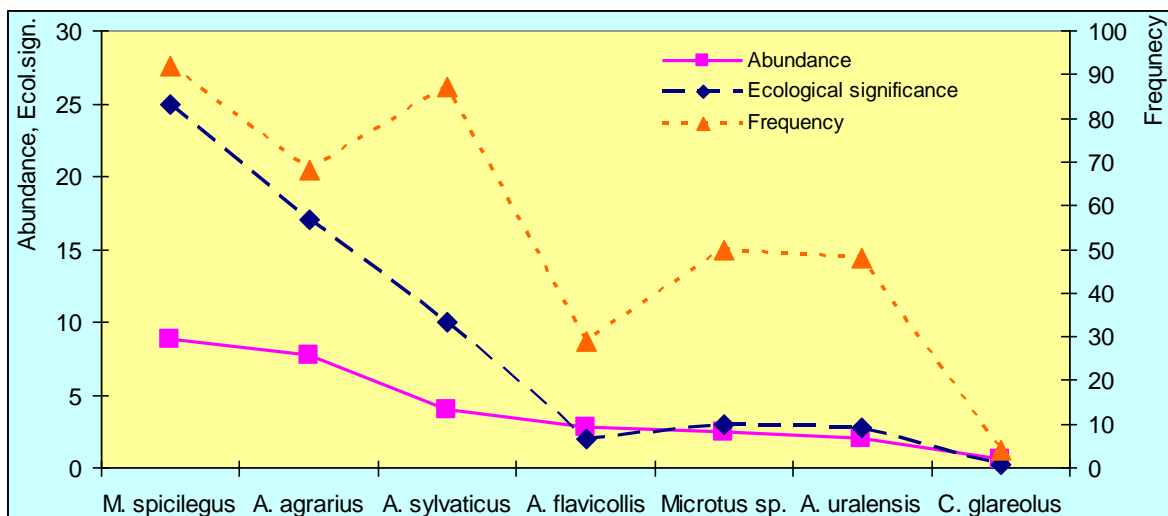


Fig. 2. Species structure of small rodent communities in agrarian ecosystems in 2000 - 2006

A. agrarius became the second dominant species in agroecosystems. Although it is more hygrophilous species its adaptation to the existence in more arid biotopes can be observed, where it find favourable trophic and shelter conditions.

The characteristic significance ($W_a = 9,8$) for *A. uralensis* in agrocenoses was recorded only in southern regions of the republic in specific biotopes.

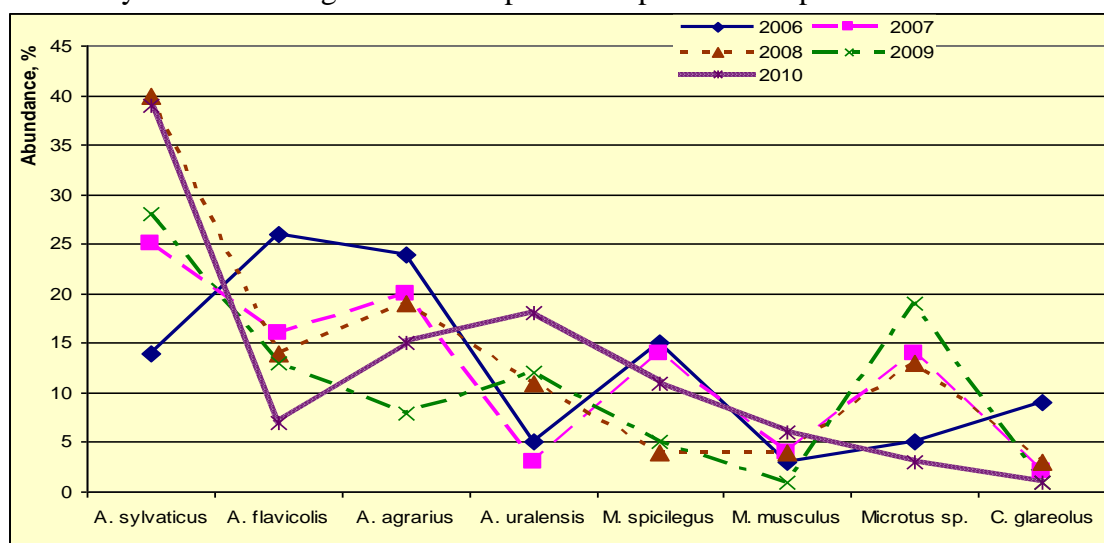


Figure 3. Structure dynamics of small rodent communities in the last years in the agricultural ecosystems of Moldova

In the last years abundance decreasing of the species *M. spicilegus* and *Microtus* are registered (fig. 3). The populations of *M. spicilegus* species, intensely inhabits the wheat fields and build on the stubbles summer mounds. The late ploughing (September – October), particular for the last years, that destroy the mounds leads practically to the destruction of this species population that can't re-establish its mounds toward the cold period of the year [7]. The filed vole population is in depression phase its abundance decreasing from about 20% in 2006 to 3% in 2009 and is still low. In actual conditions *A. sylvaticus* is the dominant species and constitute about 40% in various agrarian ecosystems. This species with large limits of

ecological valence has the ability to quickly adapt to the ecological conditions modifications. Therefore, in the last two years the wood mouse is the most prosperous species among the rodents, being dominant and constant in the republic ecosystems.

CONCLUSIONS

- During the study years 14 rodent species were registered, of which 8 species had increased abundance in agoecosystems: *Apodemus sylvaticus*, *A. flavicollis*, *A. agrarius*, *A. uralensis*, *Mus musculus*, *M. spicilegus*, *Microtus sp.* and *Clethrionomys glareolus*.
- In 80's-90's the dominant species were *A. sylvaticus*, *A. uralensis* and *Mus musculus*, while after 2000 were *A. agrarius*, *M. spicilegus*, followed by *A. sylvaticus*.
- In the last years the rodent community structure changed again, *A. sylvaticus* being the dominant species in the majority of agrocenoses, followed by *A. agrarius* and *A. flavicollis*. *Microtus* species are in depression phase, while *M. spicilegus* survival is rather difficult due to mound destruction in middle and late autumn.

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