HABITAT PREFERENCES OF SMALL MAMMALS OCCURRING IN TWO STUDIED WETLANDS OF ŽITNÝ OSTROV AREA

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Abstract: The wetlands in fragmented agriculture landscape of Žitný ostrov offer changeable conditons, due to natural and anthropic pressure. Despite the high risk of extinction in such a fragmented habitat, there are no studies on habitat preferences of protected small mammals from this area. Hence we examined communities of small terrestrial mammals with occurrence of *Microtus oeconomus mehelyi* Éhik, 1928 on the territories of two wetlands at Žitný ostrov area. Totally 1092 individuals from 13 species of small mammals were recorded by live trapping. Habitat preferences of detected species were evaluated by direct gradient analysis of CCA. Species *Apodemus flavicollis* (Melchior, 1834) and *Clethrionomys glareolus* (Schreber, 1780) show high affinity for trees. Species *Crocidura leucodon* (Hermann, 1780), *Crocidura suaveolens* (Pallas, 1811), *Microtus arvalis* (Pallas, 1778), *Sorex minutus* Linnaeus, 1766, *Micromys minutus* (Pallas, 1771) prefer habitats with lower vegetation. The studied wetland habitats represent suitable conditions especially for dominant species *Microtus oeconomus* (Pallas, 1776) and *Apodemus agrarius* (Pallas, 1771). *M. oeconomus* preferred lower *Carex* overgrown, while its frequency decreases with increasing coverage of trees. On the contrary, *A. agrarius* preferred higher vegetation.

Key words: habitat preference; *Microtus oeconomus*; small mammals; wetland, Slovakia.

INTRODUCTION

Small mammals directly depend on habitat they occupy, in terms of available food sources and habitat structure. Among them wetlands as highly productive biotopes offer suitable conditions for the wide range of small mammals species, which there form numerous and rich communities.

Yet wetlands at Žitný ostrov are just fragments from their former area originally maintained by the Danube inland delta. The drainage of landscape, intensive agriculture and the regulation of the Danube river constricted the wetlands to their actual extent, characterised by scattered wetlands of various sizes surrounded by farming land. A considerable amount of theriological papers from this area deals with the issue of habitat loss and impact of landscape changes on small mammals (e.g. Darola & Štollmann 1984, Dudich et al. 1985, Ambros et al. 1999). A lot of studies were done on occurrence of endangered subspecies *Microtus oeconomus mehelyi* Éhik, 1928 whose isolated populations occur in fragmented wetlands (Kratochvíl & Rosický 1955, Ambros et al. 1999, Krištofík 2001). It is

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inconvenient that, despite the high risk of extinction in fragmented habitats, there are no studies on habitat preferences of small mammals from the wetlands of Žitný ostrov, not even of the protected species.

Due to the fragmentation of wetlands at the Žitný ostrov, besides the typically hydrophilic species there frequently appear other, rather xeric species, yet with temporary and less abundant occurrence. In addition, during last years the species *Apodemus agrarius* has appeared at Podunajská nížina lowland and substantially changed the situation in the wetland communities of small mammals (Ambros et al 2010, Tulis et al. 2016). A study on requirements of small mammals in the wetland habitats is needed for objective explanation of their interspecific relations and for the choosing of measures concerning the wetlands.

The aim of this study was to identify habitat preferences of small mammal species in two wetlands of Žitný ostrov area.

MATERIAL AND METHODS

Small mammals were trapped at four trapping sites. Two of them were set near Veľké Kosihy village and other two near Čiližská Radvaň village, Slovakia. All the sites represented typical natural or semi-natural wetland habitats, mostly species-poor and formed mainly by dominant species like sedge (*Carex* sp.), reed (*Phragmites* sp.) and bulrush (*Typha* sp.). Sampling sites near Čiližská Radvaň are situated in a remnant of large wetland (Čiližské močiare wetlands) between the village and Čiližský potok stream. Sampling sites near Veľké Kosihy are in extensive reed bed area of Nature Reserve Dunajské trstiny (104 ha) that is small part of former meander of the Danube river. The four trapping sites are also passively projected with a zero weight onto the CCA ordination chart (Fig. 1), so the position at the chart corresponds to the prevailing habitat of the respective site.

At each of four trapping sites there were 121 live traps spaced 5 m apart, arranged in grid 11 by 11. The trapping actions were realised in the spring, summer and autumn in 2012, each action lasted four nights. The traps were checked twice daily, in the morning and evening. All together 1092 individuals of small mammals were trapped from 13 species: *Microtus arvalis* (Pallas, 1778), *Microtus oeconomus* (Pallas, 1776), *Clethrionomys glareolus* (Schreber, 1780), *Apodemus agrarius* (Pallas, 1771), *Apodemus flavicollis* (Melchior, 1834), *Apodemus sylvaticus* (Linnaeus, 1758), *Micromys minutus* (Pallas, 1771), *Mus musculus* Linnaeus, 1766, *Crocidura leucodon* (Hermann, 1780), *Crocidura suaveolens* (Pallas, 1811), *Neomys fodiens* (Pennant, 1771), *Sorex araneus* Linnaeus, 1758, *Sorex minutus* Linnaeus, 1766. The correlation of small mammals with environment variables was evaluated by ordination analysis (canonical-correlation analysis – CCA). The trapping frequencies of respective species at each trapping point were used as values of the explained variable. As environmental factors we used variables describing the layers and the coverage of vegetation. All the variables were measured for each trapping point, alltogether at 484 trapping points. The significance of factors was tested by Monte Carlo permutation test.

RESULTS AND DISCUSSION

Horizontal ordination axis of the CCA ordination reflects the most significant environmental gradient. The coverage by woody plants and also coverage of vegetation higher than 2 m significantly correlates positively with this axis. On the contrary, significant negative correlation can be observed for the coverage by *Carex* sp. and for the coverage by vegetation lower than 1 m (Fig. 1). The horizontal axis passes from right to left from overshadowed stands with higher vegetation and with occurrence of the wood plants to stands with meadow character and with higher intensity of the sunlight. The cover by *Carex* sp., by dry *Carex* sp., and the coverage by reed positively correlates with the second axis, while the coverage by vegetation in interval from 0 to 1 m and the occurrence of uncovered soil correlates with the second axis negatively.

First axis represents 73.5% of species variability relating directly to the environment variables. Together with the second axis they explain 85.1% and cumulative percentage of variability is 97.3%. So using CCA results, both the coverage and also the layers of vegetation had an impact on habitat selection of small mammals. The layers (in vertical intervals) can be connected with different shading intensity, while the coverage by different plants defines the nature of environment.

Wetlands are one of the most productive habitats in the world. They are typical by the high fauna diversity. During three years research in two wetland biotopes in Podunajská nížina lowland Krištofík (2001) detected all together 13 species of small mammals in Veľký Meder and 15 species in Medveďov. Hulejová Sládkovičová et al. (2013) in their short time faunistic research of 21 wetland localities in Podunajská nížina lowland detected 4.5 species of small mammals in average per locality (min-max 1-9, SD = 2.56). Therefore the 13 species in our study seems to be relatively high number, however detected with different methods and the trapping effort, and thus incomparable with the other studies. Just Gubányi et al. (2001) used similar method in reed overgrown in NPR Fertő-Hanság and trapped nine species, but the trapping was carried at only one site. Considering the trapping

effort, Gubányi et al. (2001) detected 0.372 species per 100 trapping nights while we trapped just 0.207 species per 100 trapping nights.

The most important community members at all trapping sites were species *M. oeconomus*, *S. araneus* and *A. agrarius*. All together they represent 88.6% of all trapped individuals. For all these species that prefer higher moisture (Krištofík & Danko 2012) the studied area offers very suitable live conditions. Their abundance and parallel dominance is explainable by high carrying capacity of habitat and mainly by different preference of food and hiding requirements. *M. oeconomus* feeds on plant food, mostly on reed and sedge that both form also very important part of habitat (Kratochvíl & Rosický 1955). *A. agrarius* is omnivore but it strongly prefers different kinds of seeds that it also stocks for winter (Holišová 1967). And finally *S. araneus* is carnivorous and insectivorous (Feriancová-Masárová & Hanák 1965). However, with higher density of above mentioned species, their differentiation in the habitat preferences is not so obvious. It is evidenced also by position of these dominant and highly numerous species in the centre of the chart, thereby without significant correlation with certain habitat variables (Fig. 1). The dependence of the habitat preferences of small mammals on their numbers, fertility and on the prevailing conditions of habitat was mentioned in Pucek (1983) and Hlôška (2005).

Species *A. flavicollis* and *C. glareolus* significantly correlated with the first canonic/ordination axis. They exhibited high affinity for woody species that offer shade. These two species are dominant in floodplain forests on Žitný ostrov (Cyprich et al. 1984, Májsky 1985, Pachinger & Haferkorn 1998). Species *C. glareolus* is more numerous in reed beds (Dudich 1985, Ambros et al. 1999) because it

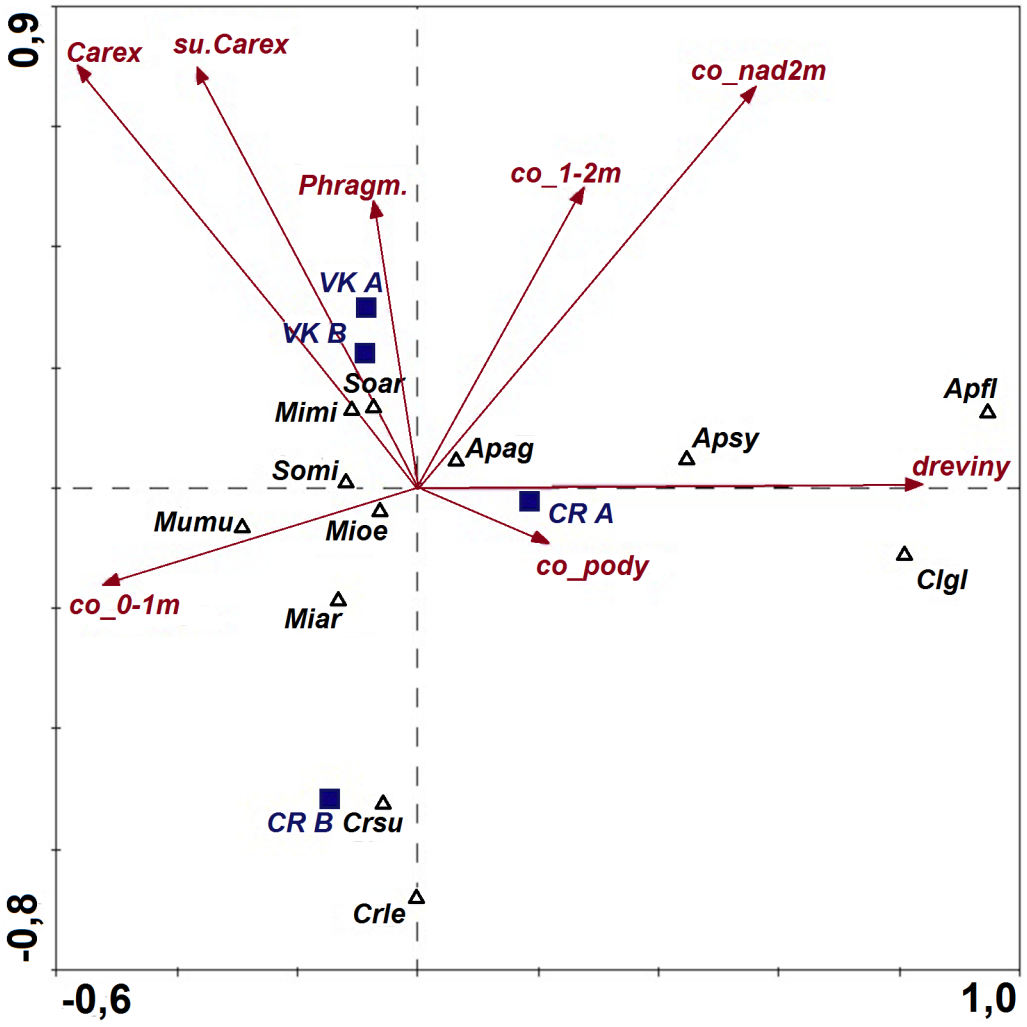

Figure 1. CCA ordination chart of small mammals and environmental variables.

Co_0-1m – the coverage by vegetation 0-1m high; co_1-2m – the coverage by vegetation 1-2m high, co_nad2m – the coverage by vegetation higher than 2 m; Carex – the coverage by *Carex* sp.; su.Carex – the coverage by dry *Carex* sp.; Phragm. – the coverage by reed; co_pody – the coverage by uncovered soil; dreviny – the coverage by woody plants; CRA - sampling site Čiližska Radvaň A; CRB - sampling site Čiližska Radvaň B; VKA – sampling site Veľké Kosihy A; VKB – sampling site Veľké Kosihy B; Apag – *Apodemus agrarius*; Apfl – *Apodemus flavicollis*; Apsy – *Apodemus sylvaticus*; Clgl – *Clethrionomys glareolus*; Crle – *Crocidura leucodon*; Crsu – *Crocidura suaveolens*; Miar – *Microtus arvalis*; Mimi – *Micromys minutus*; Mioe – *Microtus oeconomus*; Mumu – *Mus musculus*; Soar – *Sorex araneus*; Somi – *Sorex minutus*.

uses this habitat like alternative stands in agrocoenoses of the south of Slovakia (Baláž et al. 2003).

Vice versa, the negative correlation with this axis and thus the preference of stands with lower vegetation was expressed by the species *M. arvalis, S. minutus, M. minutus, C. suaveolens, C. leucodon* and *M. musculus*. For synanthropic species *M. musculus* the preference of this type of habitat is not explainable and its occurrence at only one of the four trapping sites can be due to its close neighborhood with agrocoenoses that are exploited by this species during the growing season (Daniel 1957, Májsky 1985). Also *M. arvalis* is known for its preference of drier habitats in opened agricultural land (Dudich 1985, Baláž & Ambros 2005). Its captures are reported also in the wetland habitats, where it pervades from the agrocoenoses (Daniel 1957, Krištofík 2001), like in our study.

In our studied sites *M. oeconomus* was highly dominant species, but it has a relatively low specialization for any of particular environmental factors. Although all the types of studied variables correspond to its habitat requirements, it prefers lower sedge overgrows. Its quantity decreases with increasing occurrence of woody plants. It is reported in literature that it depends on sedge meadows with reed and cattail (Gubányi et al. 2009). In Žitný ostrov area the occurrence of *M. oeconomus* is not rare but it usually forms only small isolated populations and takes small percentage in small mammals community (Gubányi et al. 2009, Miklós et al. 2011), suggesting significant distortion of the original wetland habitat. Therefore our study areas represent habitats with suitable conditions for this species and this assumption is obvious in its high dominancy. Following the established habitat preferences of the *M. oeconomus mehelyi* (this study) and known optimal width of movement corridors (Andreassen et al. 1996) we can increase performance of this species by facilitating its dispersal. Besides the maintenance of wetlands with suitable conditions, as the appropriate habitat management measure appears construction of the low and narrow sedgy corridors connecting the remaining wetlands.

In Slovakia, *A. agrarius* was detected in a wide range of habitats but it prefers more wet localities in open landscape. It is dominant mostly in floodplain forests and in alluvium of lowland rivers (Stanko et al. 1998). Even if the species *A. agrarius* in our study is also situated near the ordination chart centre, in contrast to the root vole, it shows certain preference for higher herbaceous overgrow with presence of woody plants, like other species of the genus *Apodemus*. The increasing numbers of *A. agrarius* during last 5 years (Tulis et al. 2016) and the closeness of its habitat preference to the *M. oeconomus* indicate potential for the interspecific competition.

S. araneus prefers drier *Carex* sp. overgrows in accordance with a short vector distance from this variable in the ordination chart. The preference for the wet habitats is obvious also from its frequent occurrence in wetlands (Cyprich et al. 1984, Dudich 1985, Ambros et al. 1999, Baláž & Ambros 2005). *S. araneus* is referred to be eudominant from habitats of *Phragmition communis* association (Krištofík 2001), in accordance with our research. Other species of small mammals were detected in lower numbers and only in some parts of the year.

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