EFFECT OF HABITAT FRAGMENTATION DUE TO TRAFFIC IMPACT OF DIFFERENT INTENSITY ON EPIGEIC BEETLE COMMUNITIES IN CULTURAL LANDSCAPE OF THE CZECH REPUBLIC

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Abstract

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Epigeic beetles were studied along two roads with different character and traffic intensity (a highway and a 1st class road) in different areas with similar physical-geographic location. Pitfall trapping in transects of forested and unforested landscape along the roads was used for sampling in both areas. There were not found any specific beetle species in habitats along the roads. Species diversity was higher along the 1st class road than along the highway. Stronger effects of the highway on beetle communities were found in a narrow adjacent strip. This effect was not found along the smaller 1st class road. The equitability is lower in forested landscape along the highway (the activity of dominant species is higher) whereas in agricultural landscape this effect was not found. The frequency of generalists increased near the narrow strip beside the roads. The number of migrating specimens on the opposite side of 1st class road was low both in forested and unforested landscape (a few specimens out of one hundered marked individuals) and only one specimen was found on the opposite side of the highway.

Key words: habitat fragmentation, transport effect, epigeic beetle communities, migration possibilities, Central Europe

Introduction

A lot of data are available about the barrier effect of roads on great mammals that have large ranges or migrate within long distances in mainly natural or seminatural areas. There is less known about the impact of roads on smaller organims in a more modified landscape with a long history and intensive land use and land management (Underhill, Angold, 2000).

The Czech Republic is an example of this type of cultural landscape under long-time influence of man. The road network is relatively dense, but the highways with intensive traffic are sparse and they are represented by two highways in operation: Praha-Brno and Praha-Plzeň. The position of the Czech Republic in the centre of Europe determines this area for the construction of roads connecting Europe both in West-East and North-South directions. Therefore the construction of new highways in various parts of the Czech Republic is planned.

Epigeic beetles, mainly ground beetles (Carabidae), are frequently used for landscape ecological studies connected with the role of landscape structure, habitat fragmentation, connectivity of corridors and metapopulation dynamics (e.g. Brouat et al., 2003; Burel, 1992; Gibb, Hochulli, 2002; Hunter, 2002; Šustek, 1994, etc.). They are suitable for ecological studies due to numerous species and individuals and various ecological requirements (e.g. trophic relationship, habitat preference, migration possibilities) in nearly any terrestrial habitat (Boháč, 2003). With the exception of carabids, other groups of epigeic beetles, often dominant in communities (e.g. staphylinids or carryon beetles), are less known concerning their ecology in cultural landscape.

Epigeic beetles are not often studied in the road-side habitats. We only have some data about carabids studied in the vicinity of roads concerning their habitat preference, habitat borders and velocity in a heathland area in the Netherlands (Vermeulen, 1993; 1994).

The aim of this study was:

- to describe the difference in the diversity and activity of beetle communities along transects in studied areas with different character of roads and traffic intensity
- to find if the verges along roads can be used as habitats for studied beetles
- to find if the roads of various width and with different intensity of traffic are barriers for studied beetles.

Research sites and methods

Stand and site characteristics

Two model areas were selected with similar physical-geographic locations but different character of traffic. Both territories are situated in hilly cultural landscape with mosaics of forest and agricultural landscape. There are some differences in the profile of roads in studied areas (Fig. 1). The highway was situated higher or lower in the profile of terrain while the position of the road was more flat.

Model area along the highway – the Větrný Jeníkov territory lies in the Bohemian-Moravian Highlands close to the highway Praha–Brno. The model area is situated approximately in the half of the distance between Humpolec and Jihlava.

Unforested area is mainly covered by wheat fields on both sides of the highway. There were found 129 species of higher plants, more than in the forested area (119 species). Dense shrubs of trees (e.g. *Alnus incana* and its hybrids, *Ligustrum vulgare, Spiraea salicifolis, Rosa rugosa*) were characteristic for the slopes of the highway. The species composition of plants between the base of slope and the field was affected by various factors (water flush from the highway, salting effect during winter period, use of herbicides).

Forested area was covered by Norway spruce forest, or mixed pine – Norway spruce forest. There are differences in the number and species composition of higher plants along the transect with pitfall traps across the