

Suspek 1985

Slovenská zoologická spoločnosť pri SAV v Bratislave
Zoologický ústav Univerzity Komenského v Bratislave

Zborník referátov z konferencie

**„ZOOCENÓZY URBÁNNYCH
A SUBURBÁNNYCH CELKOV
SO ZVLÁŠTNÝM AKCENTOM
NA PODMIENKY BRATISLAVY“**

Bratislava 1985

INFLUENCE OF SOME PROPERTIES OF BUILT UP AREAS ON THE COMMUNITIES OF CARABIDAE AND SCAPHILINIDAE IN THE URBAN LANDSCAPE

Z. Šustek

Institute of Experimental Biology and Ecology, Slovak Academy of Sciences

One of the prerequisites for optimization of the relations between man and urban environment is definition of such properties of the urban structure which enable the animals to penetrate the town and to constitute there autonomous coenoses. The aim of the present paper is to show the effect of buildings height, buildings density, area of greenery islands and of their distance from the town boundary on abundance, species richness and alpha diversity of carabid and staphylinid coenoses in urban habitats. The material for this paper was sampled by pitfall trapping on 39 sites in Bratislava and Brno and on 9 sites in free landscape. It consists of 22 732 individuals from urban habitats and 32 404 individuals from free landscape belonging to 167 species of carabids and to 210 species of staphylinids. Shannon-Wiener formula was used as a diversity index. The individuals numbers are standardized on 1 trap and on 1 vegetation period.

The buildings height fluctuates in both towns from 0 to 40 m /Fig. 1/. The upper limit of the dependent variables declines approximately linearly to the sites with the buildings height of 35 m. The lower limit of species number and of alpha diversity has the same declining trend. The lower limit of individuals number coincides with abscissa. The aluvial and forest coenoses concentrate within the zone with lower buildings. The coenoses of cultural steppe occur within the whole range of buildings height.

The buildings density fluctuates from 10-15 % in the town boundary to 60% in the centre /Fig. 2/. The upper limit of all dependent variables drops suddenly within the range 10-30 %.

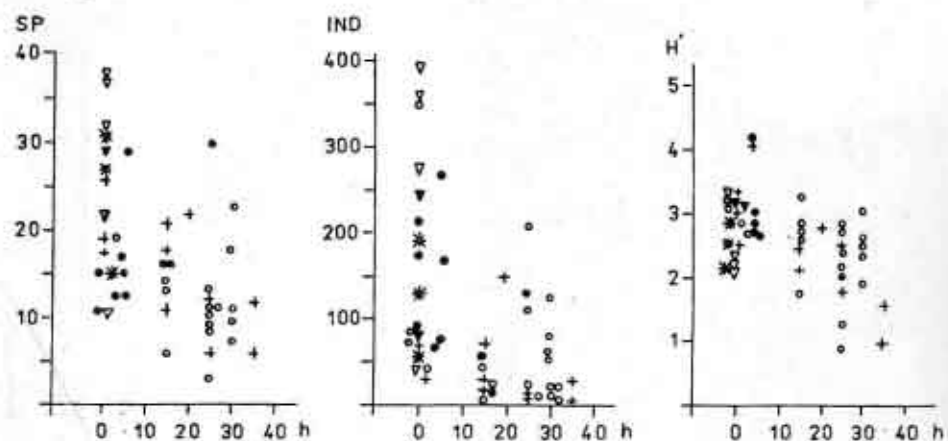


Fig. 1 Effect of buildings height /h/ on species number /SP/, individuals number /IND/ and alpha diversity /H'/ of carabids / - aluvial coenoses in free landscape, - forest coenoses in free landscape, - coenoses of cultural steppe in free landscape, - aluvial coenoses in the town, - forest coenoses in the town, - coenoses of cultural steppe in the town/.

In the areas with higher buildings density it remains nearly unchanged. The lower limit of species and individuals number coincides with abscissa, while the lower limit of alpha diversity passes parallelly with the abscissa on the level of 1 bit. The forest and aluvial coenoses concentrate within the range 0-30%. The coenoses of cultural steppe are dispersed homogeneously within the whole range of buildings density.

The area of the greenery islands fluctuates from 0.01 to 100 ha /Fig. 3/. Only the forest coenoses exhibit positive correlation of the area and species and individuals number. This relation is rather free in the aluvial coenoses and in the coenoses of cultural steppe. In some coenoses from the centre of Bratislava are reached even higher values than in the free landscape /Americké nám., Kyjevské nám., nám. 4. apríla squares/ due to good conditions for migration or introduction. The positive correlation between species richness observed in carabid coenoses in London /Davis 1970/ and in bird coenoses in Budapest /Sasvári 1964/ is obscured in Bratislava by the enormously good state of some large parks /Donský park, Kalvária, Sitina/. These parks, however acquired their properties

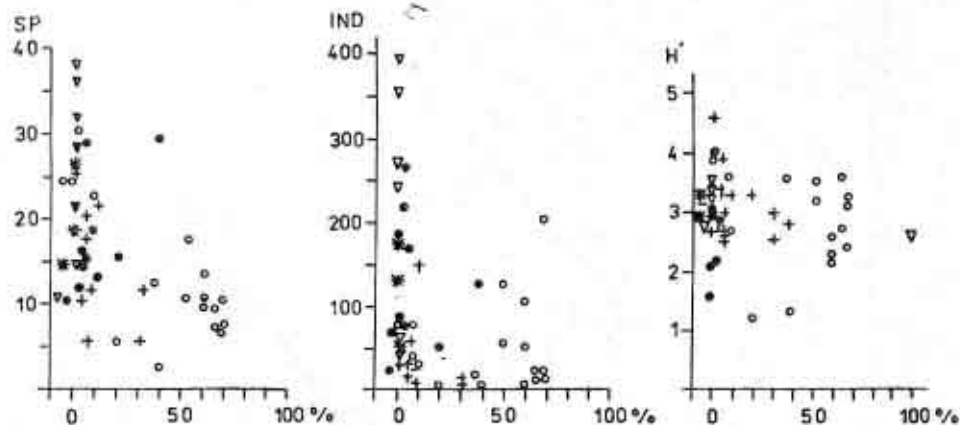


Fig. 2 Effect of buildings density [%] on species [SP] and individuals number [IND] and on alpha diversity [H'] of Carabidae /symbols see fig. 1/

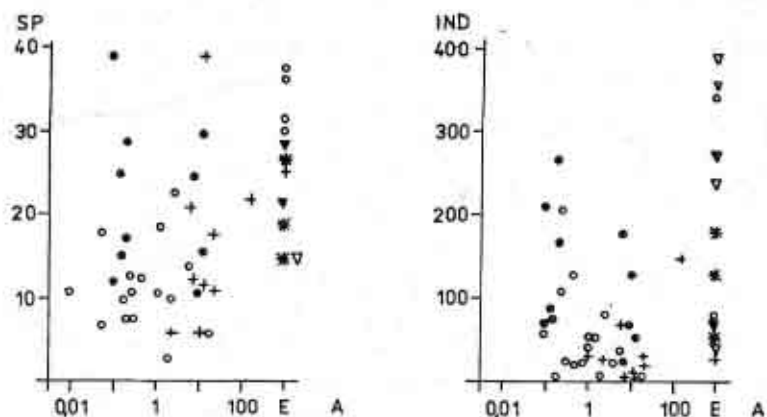


Fig. 3 Effect of the area on the species [SP] and individuals [IND] number of carabids [E - non urban habitats, other symbols see fig. 1/.

before their enclosure into the town.

The distance of a greenery island from the town boundary /diagram not presented here/ has approximately the same effect on the species and individuals number and on alpha diversity of both families as buildings height and density. The declining of upper limit of all dependent variables is approximately the same as in London /Davis 1977/. Its extrapolation shows that the migration of carabids and staphylinids is limited by the

distance exceeding 15 km. In spite to Davis /1978/ the distance from the similar site in the town has only negligible on the studied ceenoses.

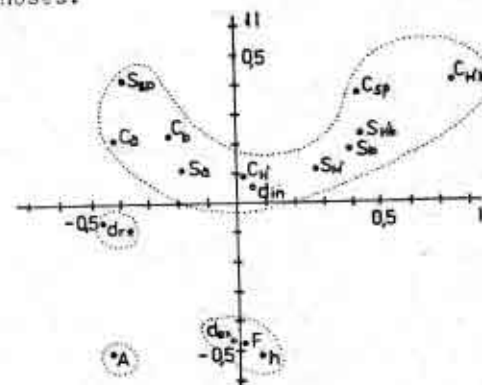


Fig. 4 Factor analysis of some properties of the built up areas on the carabid [C] and staphylinid [S] ceenoses [A - area of greenery island, h - buildings height, F - buildings density, d_{ex} - distance from town boundary, d_{in} - distance from similar ceenosis in free landscape, sp - species number, a - abundance, b - biomass, H' - alpha diversity, d_{in} - distance from the nearest greenery island/.

The factor analysis /Fig. 4/ shows that the buildings height and density and the distance from the city boundary effect synergistically the dependent variables. Only the greenery island area represent a distinctly separated factor. From the figure 4 follows that the mutual relation of dependent variables is free similarly as their dependence on all factors studied. It is shown also by the homogenous disperzion of all values of dependent variables between lower and upper limit. The changes of upper limit of all dependent variables indicate that the critical buildings density is close to 30 % and critical height is close to 20 m. Both factors are positively correlated in the quarters built up until the end of fifties. In more recent quarter, the buildings height exceeds far 20 m, but the density doesn't exceed critical 30-40 %. Ecological analyses /Sustek 1984/ show that the negative effect of building height can be mitigated considerably by low building density combined in modern quarters with small distance from

the town boundary. Conformly to it, the observation of night migration of carabids in Brno shows the great importance of streets direction for the migration of insects into the town. The streets radial to a park make possible the migration deeply into the town centre, while the tangential streets with high and close buildings inhibit the migration.

On the basis of the above facts, it can be concluded that the modern urbanistic conception of new quarters and satellite towns offer relatively good conditions for the establishing relatively natural ecosystems even in the territories with high inhabitent density. It seems, that the esthetically and psychologically motived trends to return to the traditional conception of the close street with high buildings, which appears in present, should be considered from the ecological point of view to be a step back. The negative aspects of modern quarters should be solved by other means than by the return to the conceptions originated from the medieval fortified towns.

References

- DAVIS, B. N. K., 1978: Urbanisation and the diversity of insects. Symposium of the Royal Entomological Society of London 9, Oxford, London, Edinburgh, Melbourne, p. 126 - 138.
- SASVÁRI, L., 1984: Bird abundance and species diversity in the parks and squares of Budapest. *Folia Zoologica*, 33, p. 249 - 262.
- ŠUSTEK, Z., 1984: Bioidikačné vlastnosti bystruškovitých a trobčikovitých /Coleoptera, Carabidae et Staphylinidae/ stredoeurópskeho veľkomesta. Thesis, 360 pp., 24 tab., 338 fig.

Ing. Zbyšek Šustek, Ústav experimentálnej biológie a ekológie
JREV SAV, Obrancov mieru 3, 814 34 Bratislava, Czechoslovakia.

