

Šustek 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

Zoocenózy urbánnych a suburbánnych celkov so zvláštnym
akcentom na podmienky Bratislavy, Bratislava 1985,
pp. 203 - 207

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THEORETICAL DISTRIBUTIONS OF THE SPECIES/ABUNDANCE RELATION
IN CARABID AND STAPHYLINID COMMUNITIES AS MEASURE OF URBA-
NISATION PRESSURE

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The enormously large scale of intensity of the anthropo-
genous pressure on animal communities in urban landscape ma-
kes possible simultaneous existence caenoses changed anthro-
pogenously into very diverse degree in a small area. The de-
gree of their changes can be in some cases comparable with the
status of caenoses in some nature reservation, while in many
other caenoses it exceeds the limits usual even in heavy pol-
luted and exploited free landscape. Due to it, the urban
landscape offers an unique occasion to study the degradation
and regeneration of biocenoses. Besides, communities from
the whole gradient of urbanisation pressure can serve as a
standard for more reliable interpretation of bioindicative
investigations in free landscape and for valorization of the
urban environment as well.

One of more possibilities to characterize degradative
changes in a caenosis is use of several theoretical distribu-
tions of the species/abundance relation /Pielou 1975/. The aim
of present paper is to show by means of three of them the se-
quence of the changes in carabid and staphylinid communities
in the gradient from free landscape to the centre of Bratisla-
va and Brno. The communities chosen for this purpose repre-
sent a part of the material sampled by author on 39 sites in
both towns and 9 sites in free landscape. The material totals
22 732 individuals from urban and 32 404 individuals from non
urban habitats belonging to 167 species of carabids and 210
species of staphylinids. The beetles were sampled by pitfall
trapping. For fitting the empirical species/abundance distri-
butions, the Prestonian, loggeometric and log-poissonian
distribution /Pielou 1975/ was applied. As a cri-

terium for classification of the species into individual octaves the relation

$$/i - 1/ \lg_2 A_j \quad i$$

was used $/i =$ number of octave, $A_j =$ abundance of j -th species/. The octaves are numbered from 0. χ^2 was used to measure the fitness of individual theoretical distributions /Fig. 1/.

The natural communities /Lednica - lowland forest, Pavlovské kopce, Bolersadice - forests/ with high alpha diversity and equitability, are characteristic by good fitness of the empirical and Prestonian or loggeometric distribution, independently on their caenotic appartenance. There are relatively little differences in species number in individual octaves. The modal octave, as a rule, is shifted on the right of the veil line. With increasing disturbance /gradients Nesyt - Sad J. Kráča, Bolersadice - southern slope of Špilberk/ the modus of the empirical distribution is shifted to the left and it often coincides with the 0-th or first octave. The species number in higher octaves decreases. When studying the whole material /not presented in Fig. 1/ the species number in middle octaves seems to decrease more than in the higher octaves. In this case, the loggeometric distribution fits the empirical one at the best.

The caenoses of cultural steppe in free landscape /Pezinok, fig. 1/ have very similar species/abundance distribution as the intermedierly disturbed communities on sluvia and in forests. Also in this case, the loggeometric distribution becomes the best model of the empirical one. In all caenoses, this state coincides with low alpha-diversity and relatively high productivity.

In the caenoses from suburban habitats, the higher octaves of the empirical distribution become subsequently empty. In the most disturbed caenoses in the town centre, only the 0-th octave remains occupied approximstely by the same species number as in the natural or intermedierly disturbed caenoses. The species number in other octaves is much mor lower or they are empty. Also in such caenoses the lognormal distribution remains the best model. The Prestonian distribution is the less adequate. In the most disturbed communities, characterized by high equitability the adequency of logpoissonian distribution increases.

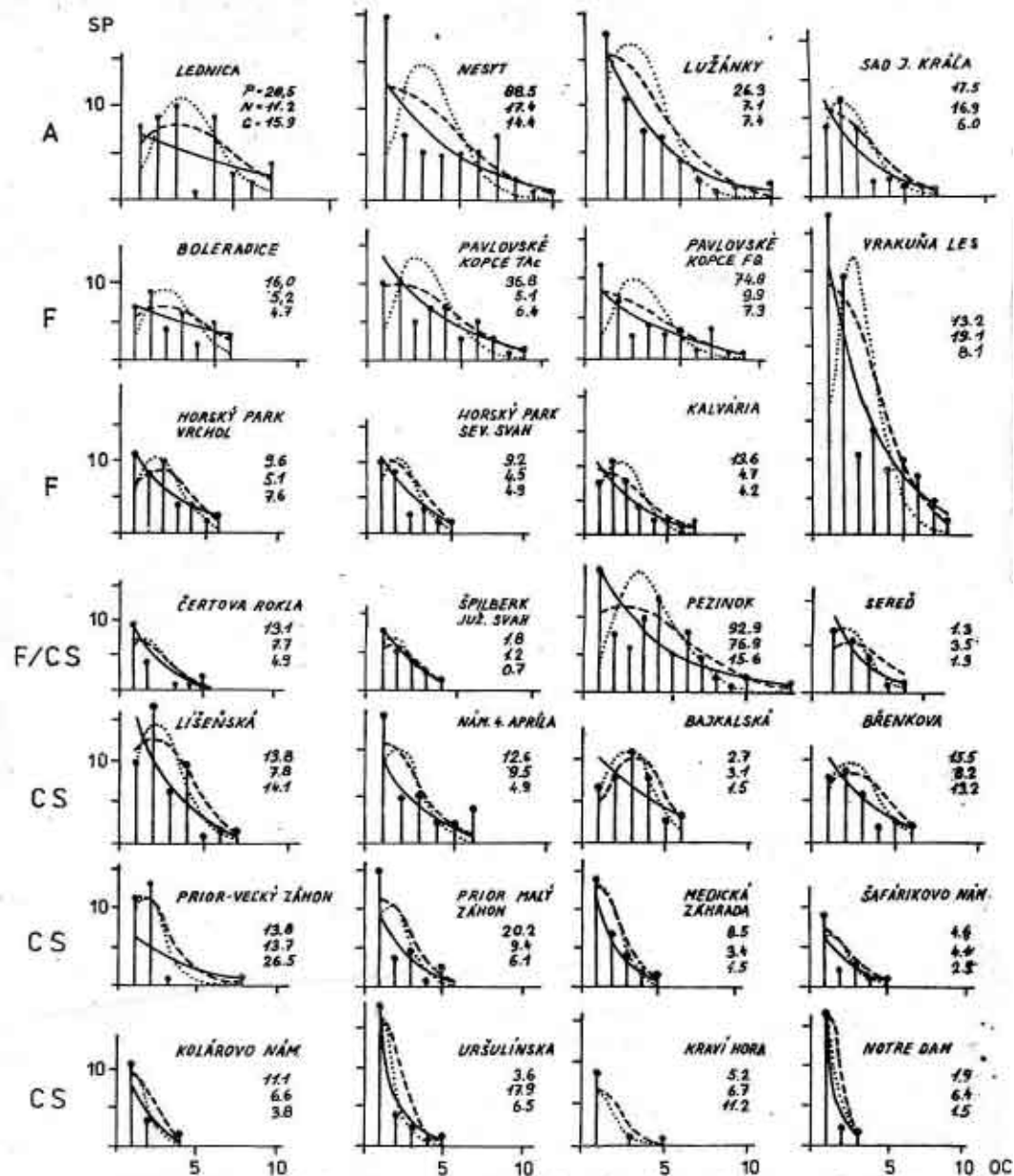


Fig. 1 Empirical, log-poissonian /pointed/, Prestonian /dashed/ and loggeometric /solid/ distribution of species/abundance relation /A - sluvial caenoses, F - forest caenoses, CS - caenoses of cultural steppe, SP - species number, OCT - octave number, P, N and G - χ^2 of log-poissonian, Prestonian and loggeometric distribution/.

The tendency to quicklier decrease of species number in central octaves can be interpreted as a result of the synergismus of lower ecological tolerance and of the decreasing of populstion density which effects negatively the populat-ion growth rate and, in more extreme cases, it leads to the extinction of the species.

The lower octaves, especially the 0-th octave, preserve their species number until the extremely high degrees of disturbance due to their saturation by a considerable number of migrants. The species number and species spectrum in these octaves represent de facto a reflexion of gamma diversity of the surrounding landscape. This can be shown by very un-distinct character of the communities originating from the town centre /Šustek 1984/. Usually the most abundant and mobile species from surroundings constitute such communities.

By means of theoretical distributions three stages of the caenoses degradation can be distinguished, viz. the natural, intermediarly disturbed and fully destroyed communities. According to the historical analyses carried out in Bratislava and Brno /Šustek 1984/, to each degradation stage correspond one stage of regeneration, viz. pionier /or chronical-ly/pionier/ stage, intermediarly and completly regenerated stages with the same properties.

The natural /and completely regenerated/ stage is characterized by good fitness of the Prestonian and loggeometric distribution with the empirical one. This property correspond with high alpha diversity and productivity. The Prestonian distribution seems to loss its adequacy soon after begining of disturbance.

The intermediarly disturbed /or regenerated/ caenoses are characterized by good fitness of loggeometric distribution. These property coincides with usually low alpha diversity and equitability and high production.

The completely destroyed caenoses /or pionier/ are characterized with loggeometric distribution and by the increase of adequacy of log-poissonian distribution. These properties coincide with high equitability and /usually/ diversity and low production.

Permanent stress of bad trophical or climatival conditions seems to have probably very similar effect on the species/abundance distribution as anthropogenous disturbance. So, the good

dance distribution as the anthropogenous disturbance. So, the good typization of caenoses in various conditions represents an important prerequisite for reliable application of theoretical distributions of species/abundance relation and of other criteria in bioindicative investigation.

References

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