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The Mapping of Lichens in Bohemia: Aims, Problems and Present State

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With 9 figures

Problems resulting from the sensitivity of lichens to environmental changes have been extensively studied in many countries. There are abundant data on distribution of lichens in selected areas surrounding sources of pollution. Yet the situation in larger areas is poorly known and this poor knowledge is very often based on data covering large time intervals. Additionally, the distribution of rare lichens is better known than the one of common species. However, the knowledge of the distribution of common epiphytic lichens and especially of its change in time is very important for monitoring environmental changes. For this reason, projects of mapping the present distribution of lichens were started in some European countries.

In Czechoslovakia, as in the F.R.G. and Austria (Wirth 1984), coordinate grid squares of 10' to 6' were used. This grid is used in Czechoslovakia for the mapping of higher plants, birds and amphibians, too. Mapping was restricted to sensitive epiphytic lichens. We concentrated mainly on common species. In Slovakia mapping of epiphytic lichens started in 1975 (Pišút 1985), in Bohemia and Moravia in 1978 (Anděl & Liška 1978); in both cases records from 1970 onwards were regarded.

A specific problem of Czechoslovak lichenology is the discontinuity of floristic research in the western part of the country. Systematic investigation was very intensive at the end of the 19th century and in the first decades of the 20th century. Active research of almost a whole generation of lichenologists (F. Kovář, E. Bayer, J. Anders, A. Hilitzer) ceased in the twenties and the thirties. V. Kuťák, J. Podzimek, J. Suza and M. Servít finished their work in the fourties and fifties. A lack of amateur lichenologists as well as a specialization of some lichenologists on studies on the eastern parts of Czechoslovakia resulted in a scarcity of data on the actual distribution of many lichens. Furthermore, lichenology in Czechoslovakia has been officially declared to be a nonperspective field of research and has not been financially supported therefore.

The whole area of Bohemia and Moravia comprises 679 grid-squares. The mapping project in Bohemia and Moravia was started by me together with P. Anděl who, however, withdrew later. Hence, field investigations have not proceeded as fast as, e. g., in Austria (Türk & Wittmann 1984) and the F.R.G. (Wirth 1987). In order to get satisfactory maps as soon as possible, I decided to concentrate my mapping efforts on the western part, i. e. Bohemia. Despite the problems mentioned above, a large part of Bohemian territory is finished at present. Only a small part in the north and a few scattered grid-squares have not been mapped yet (Fig. 1).

The distribution maps are the basic result of the grid mapping. These maps can be used in various ways. For example, knowledge of the present distribution of some lichen species (Figs. 2 and 3) was used in the Red Data Book of the Czechoslovak fauna and flora. Furthermore, working in large areas makes it possible to demon-

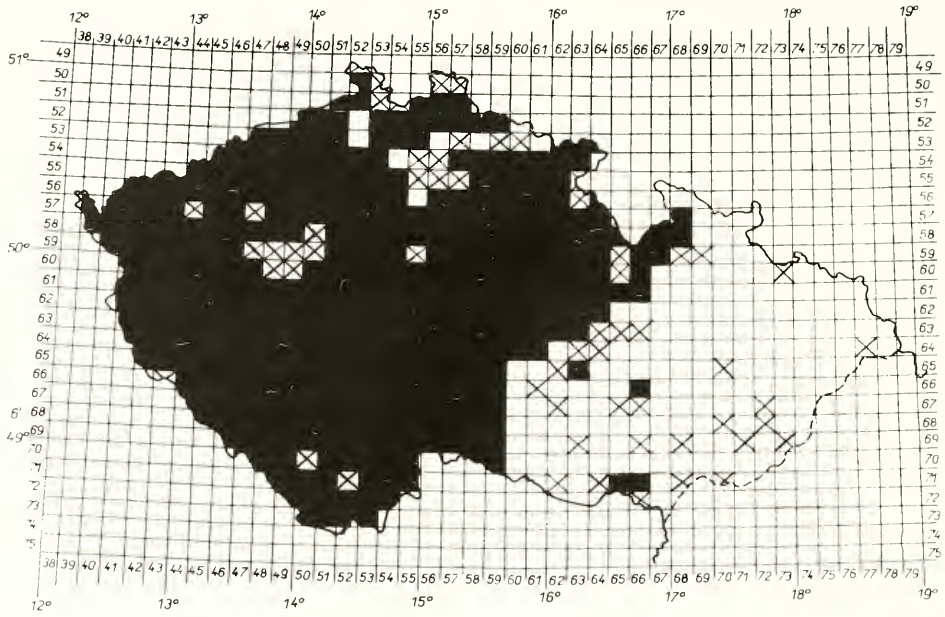

Fig. 1. The present state of lichen mapping in Bohemia and Moravia. – *Crossed grid squares* have not been completely investigated yet.

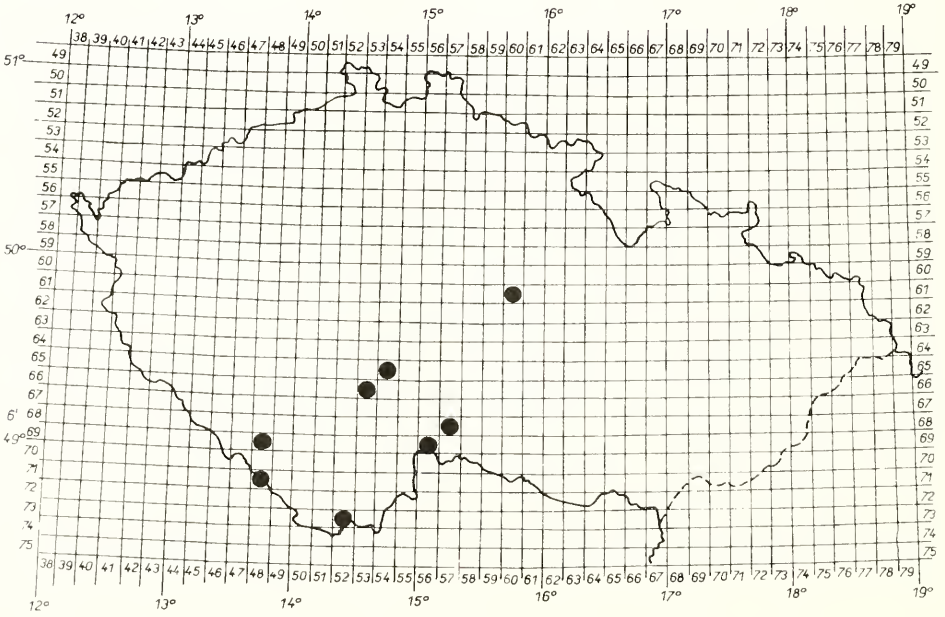

Fig. 2. Preliminary distribution of *Anaptychia ciliaris* in Bohemia after 1970.

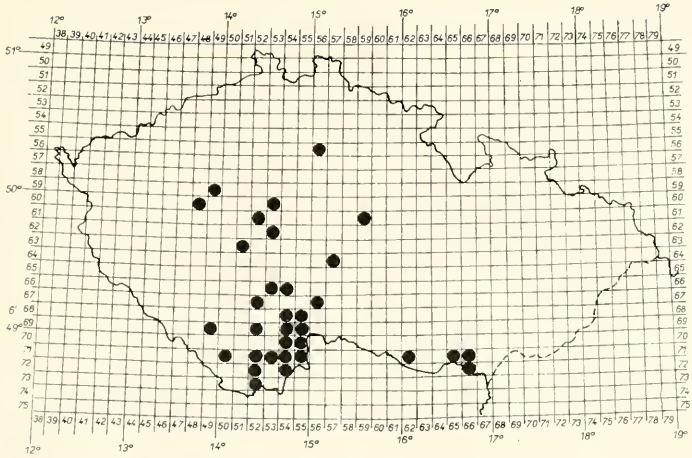

Fig. 3. Distribution of *Parmelia caperata* in Bohemia and Moravia after 1970.

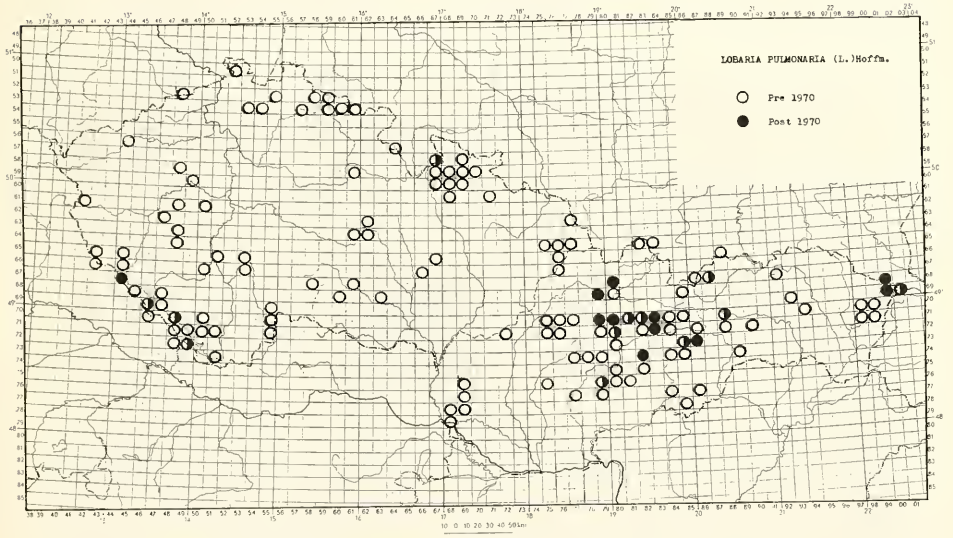

Fig. 4. Changes in the Czechoslovak distribution of *Lobaria pulmonaria*.

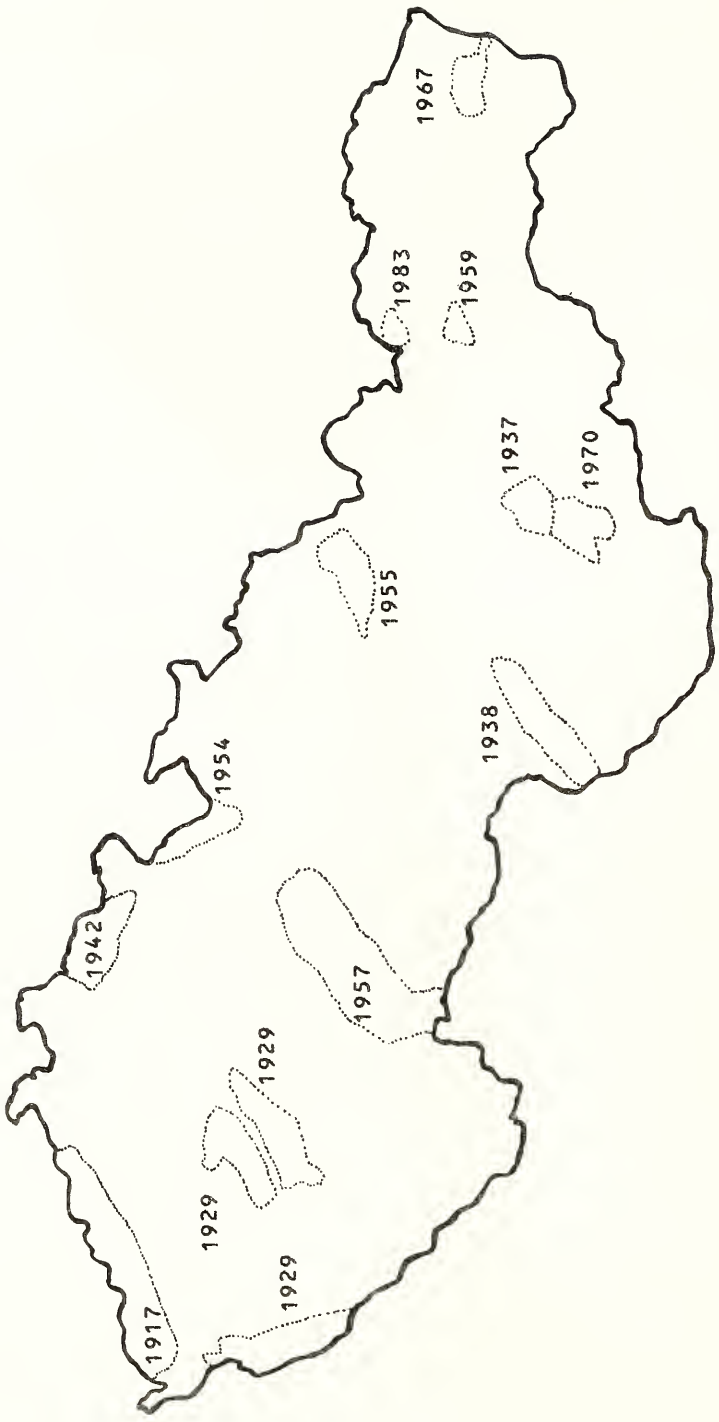

Fig. 5. Date of last records of *Lobaria pulmonaria* at sites where it is now extinct.

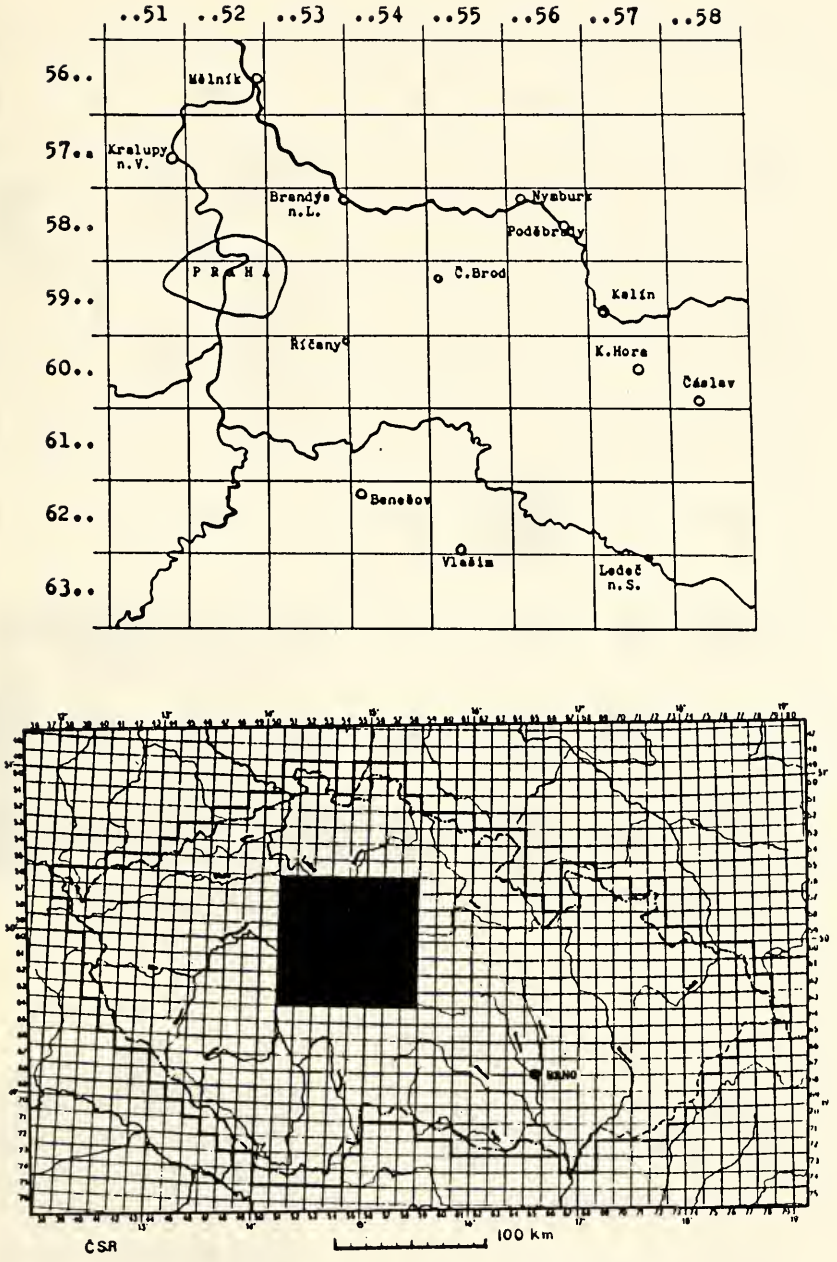

Fig. 6. Investigation area in central Bohemia.

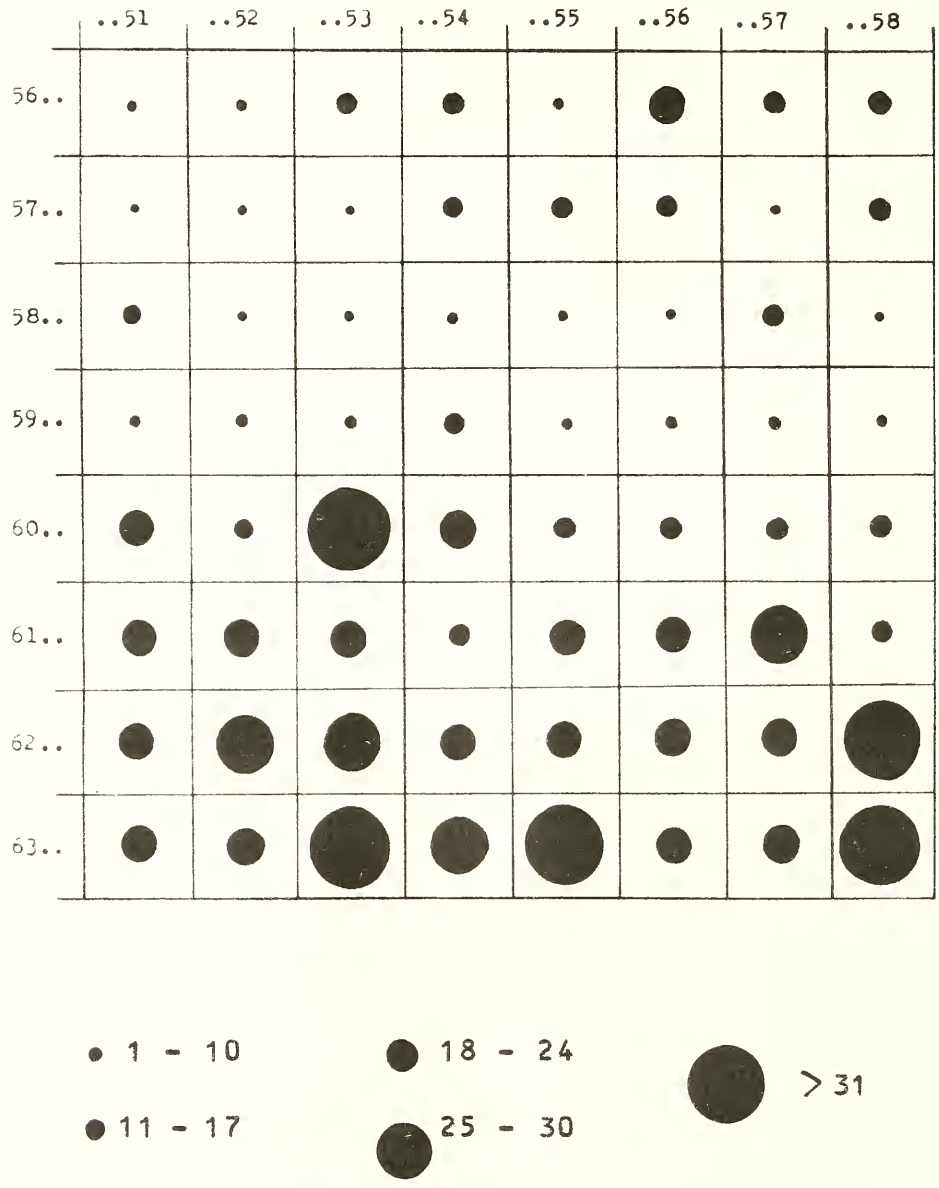

Fig. 7. The total number of epiphytic lichen species per grid square in the investigation area.

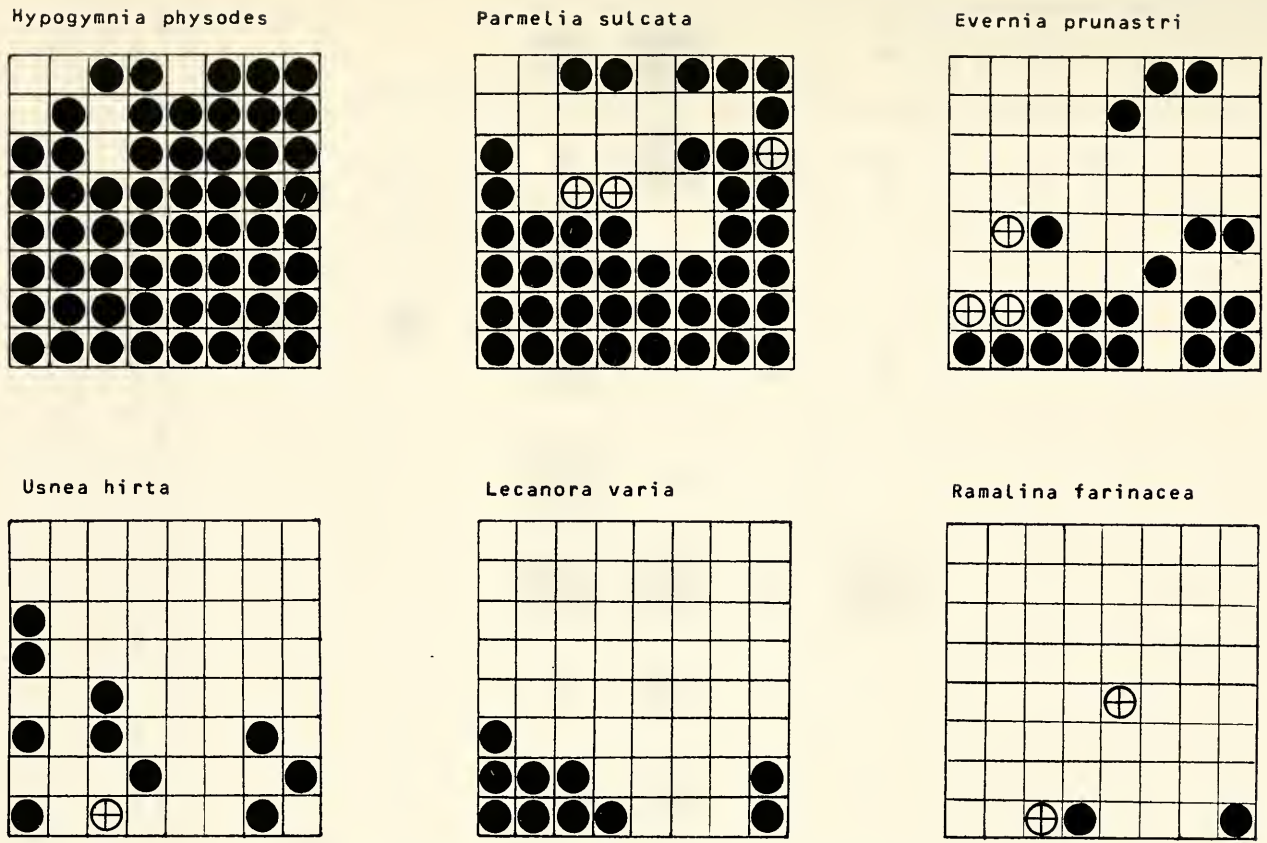

Fig. 8. Distribution maps of species of different bioindicative value. – Area see fig. 6.

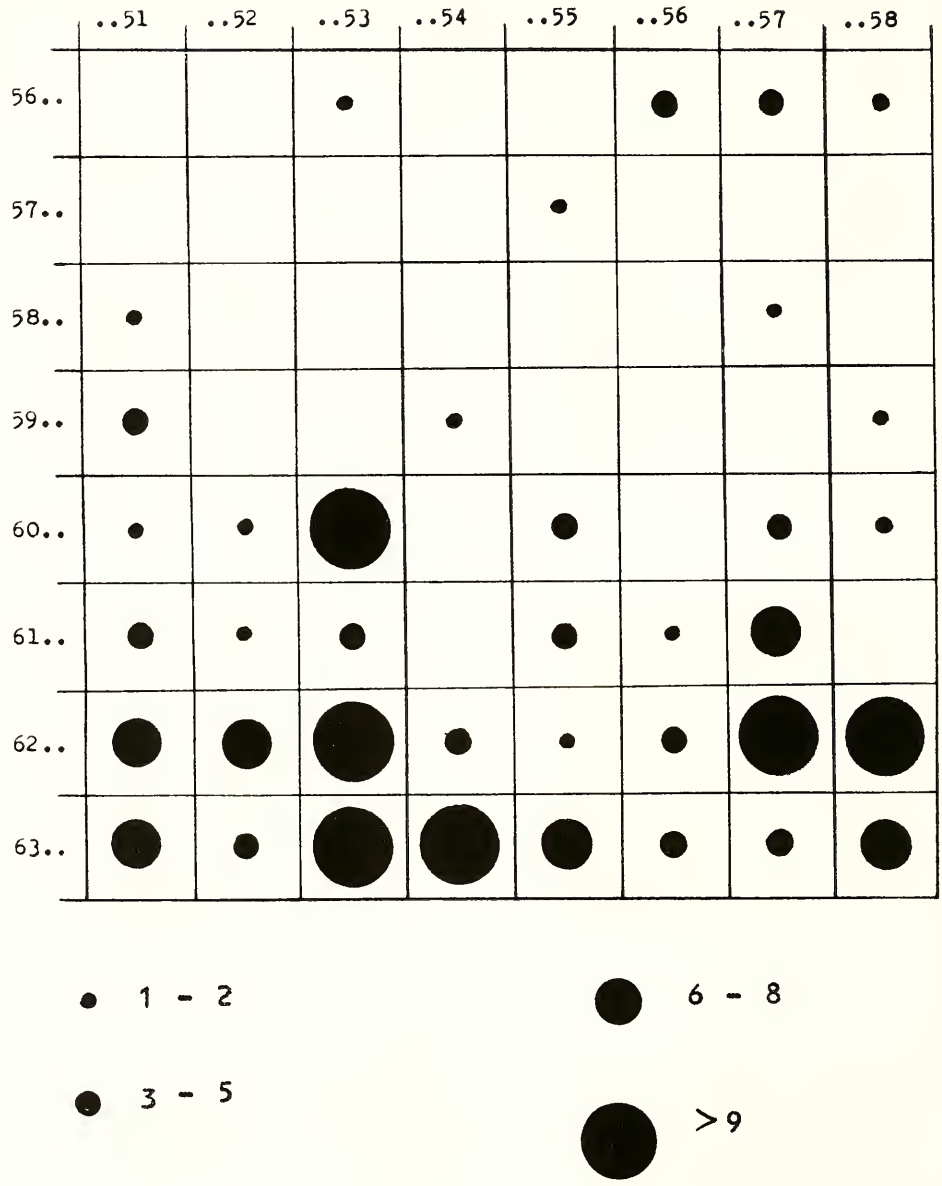

Fig. 9. The total number of selected bioindicator species in grid-squares (air pollution impact evaluation). – Bioindicator species considered: *Bryoria fuscescens, Candelaria concolor, Cetraria chlorophylla, Evernia prunastri, Hypogymnia tubulosa, Lecanora varia, Parmelia acetabulum, P. caperata, P. subrudecta, P. tiliacea, Pertusaria albescens, P. amara, Physcia stellaris, Physconia distorta, Platismatia glauca, Pseudevernia furfuracea, Ramalina farinacea, R. fastigiata, R. fraxinea, R. pollinaria, Usnea* cf. *hirta, Xanthoria polycarpa.*

strate effects of various factors operating at larger scales (e. g. climate, altitude, substrate), among them landscape deterioration. Also air pollution impact is of great importance. This will be treated in detail in the contribution by I. Pišút (this vol.). By comparing distribution maps we can distinguish species with different degrees of sensitivity. This enables us to define a scale of bioindicators.

Regarding the time factor allows to extract much more information from the maps. The changes in distribution are enormous, especially in many epiphytic lichens. *Lobaria pulmonaria* was selected as an example to demonstrate such changes (Liška & Pišút 1990). This species is very conspicuous both in size and morphology; thus it might be assumed that it has been collected more frequently than other species and therefore more data (published records and specimens in herbaria) are available for reconstruction of its former distribution (Fig. 4). *Lobaria pulmonaria* was formerly common in all mountain regions of Czechoslovakia. Nevertheless, beginning with the end of the nineteenth century its decline was recorded by various authors (Zahlbruckner 1894, Los 1928, Anders 1935). Interesting data (Fig. 5) are provided by the last records of this lichen in mountains of western parts of Czechoslovakia (in which it is extinct now):

1917 – Krušné hory
1929 – Český les, Křivoklátsko, Hřebeny a Brdy
1942 – Krkonoše
1955 – Beskydy
1957 – Českomoravská vysočina.

Obviously, there is a correspondence of this sequence with a degree of deterioration of these regions today. It is interesting that sparse data recorded in the earliest period of lichenological research exist even from the most polluted Krušné hory-area. In central Bohemia *L. pulmonaria* vanished in the thirties.

Correspondingly, the last records of this species in mountains of Slovakia give a similar picture (Fig. 5):

1937 – Kremnické vrchy
1938 – Malé Karpaty
1959 – Slovenský raj
1967 – Vihorlat
1970 – Štiavnické vrchy (only one damaged thallus)
1983 – Belianske Tatry (only one damaged thallus).

Whereas *Lobaria pulmonaria* was recorded from 130 grid squares all over Czechoslovakia before 1970, it occurs in the western part of Czechoslovakia only in 5 grid squares and in Slovakia only in 18 grid squares. In almost all of these cases the thalli are visibly damaged.

Data sets obtained by the mapping can further be exploited for large scale bioindication applying an approach in which each grid square is evaluated both on the basis of quantity (number of recorded species) and quality (bioindication value of each species) (Liška 1989). An example of such large scale bioindication for an area in Central Bohemia is presented in Fig. 6.

The total number of epiphytic lichens gives a rough image of the situation (Fig. 7). However, not all species have an identical bioindicative significance. Using distribution maps of selected bioindicators of different sensitivities (i. e. a qualitative scale), we get a picture of air pollution gradients in the landscape (Fig. 8). The total number of species may also be a good indicator. To increase its predictive power we excluded

toxitolerant species, species of wide ecological amplitude and species which are problematic concerning identification; in other words, we used the total number of good indicator species only (Fig. 9). If we compare results based on these different characters, the last mentioned approach provides a good method not only for an evaluation of the epiphytic lichen flora itself, but also for an evaluation of the air pollution impact.

This contribution tried to demonstrate that lichen grid-mapping yields valuable results which can be interpreted for various purposes. Furthermore, it provides a base-line for monitoring and evaluating future changes.

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