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Importance of the Šumava Mts. for the biodiversity of lichens in the Czech Republic

Význam Šumavy pro biodiverzitu lišejníků v České republice

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Abstract
Changes in the distribution of selected epiphytic lichens in the Czech Republic are demonstrated. A reconstruction of previous distributions was made from a compilation of published records and/or herbaria revisions. The grid-mapping method based on the Central-European coordinate grid system (MTB) was used. The present distribution of *Cetraria sepincola, Lobaria pulmonaria, Nephroma bellum* and *Menegazzia terebrata* is reduced, while some species (*Evernia divaricata, Lobaria amplissima, Nephroma parile, N. resupinatum, Pachyphiale fagicola, Sphaerophorus globosus*) are restricted to the Šumava Mts. only and *Evernia mesomorpha* is now extinct in the Czech Republic. Air pollution, forest changes, habitat destruction are main factors responsible for this decline. For many epiphytic lichens, the Šumava Mts. represent the last refuge. Species survive in relict habitats (peat-bogs, primeval forests) and are unable to colonize new substrata.

Key words: air pollution, distribution, epiphytic lichens, environmental changes, grid-mapping, threatened lichens

Introduction

Lichens occur practically everywhere and can survive in situations where other plants cannot grow (e.g. on rocks, in sandy places, at high altitudes). Moreover, they grow slowly and their life span takes many years (even hundreds or thousands of years). However, lichens are very susceptible organisms to environmental changes, namely to air pollution by sulphur dioxide. The direct effect of this pollutant (i.e. its toxicity), as well as indirect effects (i.e. acidification of the environment), are important factors in their decline. However, lichens are very sensitive also to other environmental changes caused by modern forestry (clear-cutting, reduction of number of old trees, changes in microclimate, reduction in quantity of decaying wood in forests, changes in age structure and species ratios in the tree stand, plantation of new monocultural forests, new tracks in forests, etc.), changes in agriculture and landscape planning (high doses of fertilizers, use of biocides, intensive agricultural techniques, loss of alleys and roadside trees, reclamation of soil), tourism (accessibility of previously isolated localities, trampling, eutrofication of streams in mountains, rock climbing), loss of substrata as well as disturbance and destruction of habitat. Moreover, lichens are not easy to cultivate and they can survive only in natural habitats.

Historical as well as actual distribution of the majority of lichens in the Czech Republic is

poorly known for various reasons. Firstly, the number of lichenologists is very low in comparison with the number of botanists interested in the distribution of vascular plants. Moreover, data on the distribution of many lichen species are very old (e.g. from the last century) and need revision. Data concerning macrolichens were summarized in the Czechoslovak Lichen Flora (Černohorský & al. 1956), but a part dealing with crustose species was not published. Surveys of lichen distribution in the territory of the Czech Republic were rather scarce in last thirty years. However, qualitative and quantitative lichen flora changes were significant during this period, owing to increasing levels of air pollution.

Changes in the lichen flora induced the compilation of black lists (extinct and missing species) and red lists (threatened species) in many countries (e.g. Cieslinski & al. 1992, Clerc & al. 1992, Rassi & Väisänen 1987, Scholz 1992, Türk & Wittmann 1986). Unfortunately, the red list of threatened lichens of the Czech Republic has not been published yet. However, some lichen species were included in the recently published Red Book of threatened plants and animals of the Slovak and Czech Republics (Pišút & Liška 1995). Changes in lichen biodiversity are only roughly estimated.

The aim of this project is to demonstrate the changes in distribution with the use of selected threatened and rare lichen species.

Methods

Particular epiphytic lichen species were selected for their high susceptibility to air pollution. Knowledge of the distribution of each species is influenced by various factors. An important character is appearance (size, colour, distinction from other similar taxa etc.). Conspicuous species are frequently collected (even by non-lichenologists) and a lot of published records and specimens in herbaria, which can be used for the reconstruction of previous distributions, are available. Rarity is another factor: on the one hand it is naturally a limiting factor for distribution data, on the other hand rare species are more attractive for specialists. Therefore, data on the distribution of common species are a relatively sparse. Similarly, a specialized ecology has an amiguous impact: on the one hand it is difficult for non-lichenologists to find such species, on the other hand these species are highly attractive for specialists. Therefore, both large (e.g. *Sphaerophorus globosus*, *Lobaria* spp.) and inconspicuous (e.g. *Pachyphiale fagicola*) species, species with a broad ecological amplitude (most species were epiphytes) and specialized lichens (e.g. *Cetraria sepincola*), previously relatively frequent (e.g. *Lobaria pulmonaria*) and rare species (e.g. *L. amplissima*) were studied.

The reconstruction of previous distribution is possible using compilations of published records and herbaria revisions. Published records must be evaluated individually and selectively. Most of the published records are possible to use in the case of large and well distinguished species, where determination is not difficult. Inconspicuous and/or confusing species need revision. Specimens are available in numerous institutional herbaria and in private collections. It is difficult to revise all specimens in all herbaria due to very time-consuming work and the availability and condition of herbaria/specimens. For these reasons, reconstruction of the previous distribution of various species is based on different proportions of published records and specimen revisions. The following herbaria were examined: Mycological Department, National Museum, Prague (PRM), Department of Botany, Charles University, Prague (PRC), Department of Systematic Botany and Geobotany, Masaryk University, Brno (BRNU), Regional Museum Litoměřice (LIT). In addition, private collections were examined: collection of R.Dětinský (Dět.), Jana Horáková (Hor.), J.Liška (Liš.), Z.Palice (Pal.) and A.Vězda (Věz.).

The grid-mapping method based on the Central-European coordinate grid system was used.

The same method is used for the mapping of other organisms in the Czech Republic (e.g. vascular plants, birds, amphibians) as well as for the mapping of lichens in other countries (Germany, Austria, Slovakia). Therefore, our data can be used for biodiversity evaluation as well as mapping at a large scale. Empty circles represent the distribution before 1970, full circles represent the actual distribution afer 1970 (mainly records of the authors).

Results

Cetraria sepincola (Ehrh.) Ach.

C. sepincola is a widespread species known from both hemispheres (Europe, Asia, North and South Americas, Australia and New Zealand), in temperate and austral zones, but in warm regions it occurs only in mountains. Its distribution in Europe is mainly Boreal (Scandinavia, Atlantic and central Europe, rarely in the Alps and Balkan mountains). It is a glacial relict in Central Europe. It is an epiphytic species occurring in Boreal forests, forest-tundra and peat-bogs in montane and subalpine altitudes. It grows on twigs of *Pinus mugo* above timber-line, at lower altitudes almost only on thin birch twigs (rarely on other trees, e.g. *Salix*, *Alnus*, *Picea*, on wood, one record is on *Vaccinium myrtillus* and also on *Cerasus vulgaris*!). Substrate specificity is interesting because it is rare in European macrolichens. High fructification of this species is also interesting: it is almost always collected with numerous apothecia on the thallus margin. *C. sepincola* is an acidophilous, photophilous, aerohygrophilous, ombrophilous and nitrophobous species, vanishing owing to air polution (sulphur dioxide and nitrogen compounds) and habitat destruction (peat exploatation and desiccation of drained peatlands).

In the Czech Republic it was formerly recorded in the majority of mountains. Its present distribution is limited to western and southern Bohemia (mainly peat-bog habitats) and north Moravia (e.g. peat-bog "Rejvíz" in the Jeseníky Mts.). At present, *C. sepincola* is frequently distributed in the Šumava Mts. only. In the Krkonoše Mts. and the Jizerské hory Mts., the last records are from the 60s, and it is probably extinct there. Its distribution on the territory of the Czech and Slovak Republics was published by Suza (1938).

C. sepincola is in the category of endangered or vulnerable species in the Red lists of Germany, Switzerland, Slovakia, Poland and Austria.

Records after 1970:

5769d: Jeseníky, peat-bog Rejvíz, 1992, Liš.
6241a: Český les, Písařova Vesce near Tachov, 1 km S of village, 1985, Liš.
6271b: Jesenické podhůří, between villages Staré Oldřůvky and Nové Oldřůvky, 1992, Liš.
6656d: Českomoravská vysočina, village Pelec near Kamenice n.L., on *Cerasus vulgaris*, 1989, Hor.
6753d: Třeboňská pánev, peat-bog reserve Soběslavská blata, between villages Záluží and Zálší, 1988, Liš.
6946d: Šumava, peat-bog Mlynářská slať, on *Picea abies* twigs, 1050 m, 1995, Pal.
6947a: Šumava, peat-bog Jezerní slať, 1989, Hor.
6947a: Šumava, Povydří, near „Turnerova chata", 1994, Liš.
6947c: Šumava, peat-bog near village Kvilda, 1994, Liš.
6956b: Českomoravská vrchovina, Albeř, east margin of lake Osika, 1977, Liš.
7046a: Šumava, valley of Luzenský potok brook near Březník, 1994 Liš.
7047b: Šumava, peat-bog Chalupská slať, 1995, Liš.
7149a: Šumava, Černý Kříž, on roadside *Betula*, 745 m, 1993, Pal.
7149a: Šumava, peat-bog reserve Mrtvý luh, 1993, Liš.

7154b: Třeboňská pánev, peat-bog reserve Červené blato, 1993, Liš.
7249a: Šumava, slope of Plechý mountain, on *Vaccinium myrtillus* (!), 1995, Pal.
7249a: Šumava, reserve Jezerní luh under Plešné jezero lake, *Betula* sp., 910 m, 1995, Pal.

Evernia divaricata (L.) Ach.

E. divaricata is a subcontinental Boreal species, widespread in central and southern Europe. In the Czech Republic it was formerly recorded in montane regions (rarely found at low altitudes, e.g. near Jílové u Prahy (central Bohemia), Slavonice and Znojmo (southern Moravia), recently it has been found only in the Šumava Mts.

Formerly the bark of conifers was the predominant substratum of *E. divaricata* (pH of their bark is lower that one of deciduous trees). However, this species has recently become more frequent on bark of deciduous trees. This change in substrate preference is caused by the acidification of environment and the pH of deciduous tree barks has become more suitable for its survival in polluted areas. *E. divaricata* is very sensitive to air polluttion and requires high air humidity. It grows mostly individually and is not a dominant lichen of epiphytic communities.

E. divaricata is in the category of endangered species in the Red Lists of Slovakia and Poland, in Austria is extinct out of the Alps.

Records after 1970:

6845d: Šumava, Železná Ruda, near Laka lake, on *Picea abies*, ca 1100 m, 1993 Liš.
6946b: Šumava, slope of Oblík mountain near Javoří Pila, *Fagus sylvatica*, 1994 Liš.
6947c: Šumava, Filipova Huť, on *Salix* sp., ca 1100 m, 1995 Dět.
6947c: Šumava, Kvilda, on the edge of the peat-bog Jezerní slať, on *Picea abies*, 1060 m, 1994 Pal.
7046b: Šumava, Modrava, Březník, on *Sorbus aucuparia*, 1140 m, 1992 Dět.
7046b: Šumava, Modrava, Březník, on *Sorbus aucuparia*, 1140 m, 1994 Pal.
7046b: Šumava, Modrava, Březník, valley of the Luzenský potok brook, on *Picea abies*, 1160 m, 1994 Pal.
7148b: Šumava, Stožec, Černý Kříž, near hunting shelter, on *Fagus sylvatica*, ca 900 m, 1992 Pal.
7149c: Šumava, Stožec, Černý Kříž, valley of the Hučina brook, on *Picea abies*, 780 m, 1993 Pal.
7149d: Šumava, Černý les mountain ca 2 km E of Záhvozdí, on *Fagus sylvatica*, ca 900 m, 1992 Dět.
7249a: Šumava, Jezerní slať ca 6 km W of Nová Pec, on *Pinus* sp., 905 m, 1992 Dět.
7249a: Šumava, Nová Pec, near Plešné lake, on *Picea abies*, ca 1250 m, 1994 Pal.

Evernia mesomorpha Nyl.

A circumboreal species, most frequent in northern Asia, in Europe continentally distributed. In the Czech Republic it was collected in southern Bohemia (Černý Kříž in the Šumava Mts. and near Veselí nad Lužnicí) and in southern Moravia (near Tišnov). It was found predominantly on bark (in the Czech Republic on *Pinus silvestris* only), rarely on wood or siliceous rocks. In the Czech Republic it is extinct now, in Europe it is a rare and vanishing species, sensitive to air pollution. Decreasing air humidity as a result of peat-bog desiccation could be also responsible for its decreasing (Suza 1938).

E. mesomorpha is in the category of endangered species in the Red Lists of Slovakia and Poland.

Lobaria amplissima (Scop.) Forss.

L. amplissima is a species of Atlantic-Mediterranean distribution in Europe, outside Europe it is known from northern Africa, the Caucasus Mts. and Asia Minor. It is an epiphytic lichen

growing on bark of deciduous trees (*Fagus sylvatica*, *Acer pseudoplatanus*, rarely on *Sorbus aucuparia*). It is an indicator species of primeval beech forests, susceptible to forest changes and to air pollution.

In the Czech Republic it is a rare species and was reported from the Šumava Mts. only. Its present distribution is represented by two near-by isolated localities (i.e., two thalli growing on two trees only!). It is in danger of becoming extinction in the territory of the Czech Republic. *L. amplissima* is not able to colonize other trees and therefore its existence is limited by the presence of its present substrata. *L. scrobiculata*, a species of similar ecology, is extinct in the Czech Republic.

L. amplissima is in the category of endangered species in high danger of becoming extinction in the Red lists of Slovakia, Austria, Germany and Switzerland.

Records after 1970:

6946d: Šumava, Javoří Pila, Medvěd mountain, 1994, Pal.
6946d: Šumava, Javoří Pila, Smrkový vrch mountain, 1994, Pal.

Lobaria pulmonaria (L.) Hoffm.

L. pulmonaria is a widespread lichen known from both hemispheres (Europe, North Africa, Asia, North America; south Africa, Australia). It grows in Europe mainly in mountains in Atlantic and central Europe, also in the Ukrainian Carpathians and in the Balkan mountains. In the Czech Republic, *L. pulmonaria* was formerly relatively frequent in all mountains and rarely also at low altitudes. Actually, it is an endangered lichen and grows only in mountains in south Bohemia (Šumava and Novohradské hory) and north Moravia (slope of Králický Sněžník mountain). In the 50s, it was found also in other mountains (Českomoravská vrchovina, Jeseníky, Beskydy) where it is extinct now. The changes in its distribution have been studied by Liška & Pišút (1990) and Liška (1994). *L. pulmonaria* is an indicator species of primeval forests (beech and beech-fir forests); it grows on the bark of old trees (predominantly on *Fagus sylvatica* and *Acer pseudoplatanus*), was formerly found also on mossy rocks. It prefers cool humid regions (in mountains) in habitats with high air humidity. It is susceptible to air pollution (also to low background concentrations) and other environmental changes namely decreasing air humidity, in addition to modern forestry (cutting of old trees, canopy thinning). *L. pulmonaria* is a decreasing species through Europe, it is now „a classical" example of decreasing lichen and it is included in all red lists in the category of endangered species. All localities in the territory of the Czech Republic are in landscape protection areas/ nature reserves; in spite of this, *L. pulmonaria* is in danger of becoming extinction.

Records after 1970:

5767c: Kralický Sněžník, the Morava river valley, 1974, F. Krahulec (1994 Liš. revisited)
6744d: Šumava, slope of Ostrý mountain, 1983, Liš.
6946d: Šumava, Javoří Pila, 1972, J. Sofron (1995 Dět. et Liš. revisited)
6946d: Šumava, Medvěd mountain, 1983 (1995 revisited), Liš.
7048b: Šumava, Boubín mountain – SW of summit, 1989, V.Skalický
7048b: Šumava, Nature Reserve Boubínský prales, 1993, Liš.
7148b: Šumava, near the Stožec chapel, 1992, Liš.
7148b: Šumava, Radvanovický hřbet mountain near village České Žleby, 1995, Dět.
7148b: Šumava, Spáleniště mountain, 1995 Liš.
7149d: Šumava, Černý les mountain, 1995, Dět.
7249a: Šumava, above Plešné jezero lake, 1984, Liš.
7249a: Šumava, slope of Smrčina mountain, 1995, Liš., Dět. et Pal.
7354a: Novohradské hory, Nature Reserve Žofínský prales, 1994, Pal.

Menegazzia terebrata (Hoffm.) Massal.

M. terebrata is a widespread lichen known from both hemispheres; in the Southern Hemisphere is reported from south Africa (Madagascar), South America, New Zealand and Tasmania. Its European distribution includes a large area from Atlantic Norway, south Sweden, oceanic and suboceanic central Europe to Mediterranean mountains. In the Czech Republic it was formerly present in many mountains, rarely being recorded at low altitudes (valleys near Znojmo in south Moravia and in the Moravian Karst north of Brno). Today it is found in south Bohemia only (the Šumava Mts., the Nature Reserve Žofínský prales in the Novohradské hory Mts.).

M. terebrata is a representative of virgin and untouched mountain beech, beech-fir and Norway spruce forests). It grows on bark of deciduous as well as coniferous trees, rarely on mossy rocks. It prefers wet, cool regions with high air humidity in protected mountain habitats and in deep humid valleys. It is an acidophilous and nitrophobous lichen, very sensitive to air pollution.

It is included in the red lists of many countries in various categories: endangered (Germany, Slovakia, Poland) and species in danger outside of the Alps (Austria).

Records after 1970:

6845c: Šumava, Železná Ruda, valley of the Debrnický potok brook, 1994, Pal.
7149c: Šumava, mountain Srnčí vrch 2 km S of village Černý Kříž, 1995, Pal.
7249a: Šumava, Nová Pec, N slope of Hraničník mountain, 1994, Pal.
7354a: Novohradské hory, Nature Reserve Žofínský prales, 1993, Liš.

Nephroma bellum (Sprengel) Tuck.

Circumpolar, hemiboreal to Alpine species, confined to high altitudes in continental regions. In the Czech Republic it was formerly recorded in montane regions (Krkonoše, Šumava, Jeseníky, Beskydy, Českomoravská vrchovina). Recently, it was found in the Šumava Mts. only. It grows on mossy rocks as well as on the bark of deciduous trees in humid areas. *N. bellum* is a characteristic species of primeval forests, and is very sensitive to air pollution and other environmental changes.

At present, it grows in the last relict localities and it is not able to colonize new substrata. It is in danger of extinction over a large part of Europe. *N.bellum* is included in the category of endangered species in the Red Lists of Austria, Poland; in Germany is critically endangered, in Slovakia it is extinct.

Records after 1970:

7249a: Šumava, Nová Pec; glacier cirque of the Plešné jezero lake, on *Acer pseudoplatanus* near a small avalanche track, ca 1250 m 1996, Pal.

Nephroma parile (Ach.) Ach.

This is a species of bipolar distribution known from cold areas of temperate and Boreal zones, also from the Arctic (Greenland). In the Czech Republic it was formerly recorded in montane regions (Krkonoše, Šumava, Jeseníky, Beskydy, Českomoravská vrchovina), in central Bohemia and in the valley of the Dyje river. Recently, it was found in the Šumava Mts. only. It grows on the bark of deciduous trees, rarely on conifers or on boulders in humid areas in montane or submontane zones. *N. parile* is a characteristic species of primeval forests. It is very sensitive to air pollution and other environmental changes (canopy thinning, timber mining).

At present, it grows in the last relict localities and is not able to colonize new substrata. It is in danger of becoming extinct in a large part of Europe.

N. parile is included in the category of endangered species in the Red Lists of Slovakia, Poland, Germany.

Records after 1970:

6845a: Šumava, Železná Ruda, near Černé jezero lake, on *Acer pseudoplatanus*, ca 1250 m, 1995 Pal.

6946c: Šumava, Modrava, crest Medvědí hřbet near Rachel mountain, on *Acer pseudoplatanus*, ca 1150 m, 1994 Pal.

6946d: Šumava, Modrava, Smrkový vrch mountain near Javoří Pila, on *Acer pseudoplatanus* and *Fagus sylvatica*, ca 1100 m, 1994 Pal.

6946d: Šumava, Modrava, Medvěd mountain, on *Acer pseudoplatanus* and *Fagus sylvatica*, 1130 m, 1994 Pal.

6947a: Šumava, Modrava, valley of the Zhůřský potok brook near „Turnerova chata", on *mossy boulder*, ca 850 m, 1995 Pal. & Dět.

7249a: Šumava, Nová Pec, near Plešné jezero lake, on *Acer pseudoplatanus*, ca 1250 m, 1993 Pal.

Nephroma resupinatum (L.) Ach.

N. resupinatum is a Holarctic species known from Europe, Asia (Caucasus Mts., Japan, Russia), northern Africa, North America and Greenland. It grows in moist and shaded habitats, preferring mossy trunks and boulders. In the Czech Republic, it was recorded in montane regions (Krkonoše, Šumava, Českomoravská vrchovina, Kralický Sněžník, Jeseníky, Beskydy), and also in western Bohemia. At present, it survives in two localities in the Šumava. It is a very sensitive lichen to air pollution.

N. resupinatum is extinct in Slovakia, and it is included in the Red Lists of Poland and Germany in the category of endangered species, in Switzerland is a vulnerable species.

Records after 1970:

6946d: Šumava, Modrava, Smrkový vrch mountain near Javoří Pila, on *Acer pseudoplatanus*, 1130 m, 1994 Pal.

7148b: Šumava, Stožec, near the Stožec chapel, on *Acer platanoides*, 940 m, 1995 Pal.

Pachyphiale fagicola (Hepp) Zw.

A small inconspicuous species known from Europe, Asia, North and South Americas. It grows usually on subneutral bark (*Acer pseudoplatanus*, *Ulmus glabra*, *Populus tremula*), rarely on conifers in submontane and montane regions in montane forests, old woodlands and on wayside trees. It is an ombrophobous and aerohygrophilous species. In the Czech Republic it is a rare lichen, recently was found in two localities in the Šumava Mts. only. A reconstruction of its previous distribution is based on a study by Vězda (1958).

P. fagicola is involved in the category of endangered species in the Red Lists of Slovakia, Poland and Germany.

Records after 1970:

7148d: Šumava, Nové Údolí, near the railway station, on *Acer pseudoplatanus*, 830 m, 1992 leg. Dět., det. Věz., (1995 Pal. revisited)

7249a: Šumava, Nová Pec, near Plešné jezero lake, on *Acer pseudoplatanus*, ca 1250 m, 1995, Pal.

Sphaerophorus globosus (Hudson) Vainio

S. globosus is a widespread species known from oceanic regions in the Northern (Europe, Asia, North America) and Southern Hemispheres (South America; Australian records refer to other species). In Europe it is distributed in the Arctic, Boreal and Atlantic regions, in central Europe and also in humid montane areas in Mediterranea. In the Czech Republic, it was formerly recorded in many mountains (Krušné hory, Český les, Šumava, Ještědský hřbet, Jizerské hory, Krkonoše, Králický Sněžník, Beskydy) as well as in deep valleys at low altitudes (Labské pískovce and Ralská pahorkatina areas). The majority of herbarium specimens were collected in southern Bohemia (the Šumava Mts.) and northern Moravia (the Jeseníky Mts.); during last four decades was recorded in the Šumava Mts., Králický Sně ník Mts. and the Jeseníky Mts., (where the last record is from 1972). Rapid forest damage, as a result of increasing levels of air pollution, caused probably extinction of this species in the territory of Moravia. Therefore, the Šumava Mts. represent last refuges of *S. globosus* in the Czech Republic; they are in the climax Norway spruce forests in the highest parts of the mountain crest on the border with Austria and Germany (mountains Plechý, Smrčina and Rachel – the latter locality is on German territory) and above lake Plešné jezero (here it grows on mossy boulder).

It was formerly recorded on various substrata in mountains (rarely at low altitudes) in regions of suboceanic climate (high rainfall, high air humidity, periods of foggy weather). It grows in protected habitats on inclined and vertical surfaces of granite rocks, together with other lichens (e.g. *Parmelia omphalodes*, *P. saxatilis*, *Bryoria bicolor*) and mosses, on mineral soil and also on bark of old deciduous and coniferous trees (mainly *Fagus sylvatica* and *Abies alba*) in primeval beech-fir and Norway spruce forests. It grows as an epiphyte together with other lichens (*Mycoblastus sanguinarius*, *Hypogymnia vittata*, *Cladonia* spp.) and bryophytes (*Orthodicranum montanum* and *Ptilidium pulcherrimum*).

S. globosus is an endangered species sensitive to environmental changes, namely to the damage in the Norway spruce climax forest. Besides air pollution, loss of old trees is an important factor, because this species is characteristic for later successional stages. The decline of *S. globosus* was probably rapid: in the Jizerské hory Mts. it was a common species at the beginning of this century, whereas in the Krkonoše Mts. was rare species in 1926 (now is extinct here). In the Jeseníky Mts., the last record is from 1972; it was not found during excursion in 1994 and is probably now extinct there. Its susceptibility is different on various substrata: the most sensitive is on bark of old trees. Inability to reproduce (absence of apothecia) is the first symptom of damage.

It is in danger of becoming extinct in the Czech Republic regardless of its presence in protected areas. It is included in category of endangered species in the red lists of other countries (Germany, Austria, Slovakia).

Records after 1970:

5868: Hrubý Jeseník, Kepmík mountain, ca 1300 m, 1972 Věz. (not found here in 1994);
7249: Šumava, above Plešné jezero lake, 1250 m, 1994 Pal.
7249: Šumava, Norway-spruce forest on north slope of Smrčina mountain, ca 1250 m, 1993 Pal.
7249: Šumava, Plechý, Norway-spruce forest, 1350 m, 1992 Pal.

Conclusions

1. *Evernia mesomorpha* Nyl. is now extinct in the Czech Republic.
2. Distribution changes are sizable and concern formerly rare as well as frequent lichen species.

3. Changes have occured in species with various ecological requirements (skiophilous as well as photophilous, suboceanic as well as continental, species of acidophilous as well as subneutral bark).
4. Causes of decline in lichens include air pollution, modern forestry practices, forest changes and habitat destruction.
5. Change in the substratum preference of lichen can occur and results from the acidification of the environment.
6. The Šumava Mts. represent the last refuge for many epiphytic species. However, present records of many species represent only a few isolated localities or individual thalli. Species have lost their ability to colonize new substrata and the existence of its substratum (i.e. old tree) is a limiting factor for its survival. Therefore, there are many species in danger of becoming extinct.

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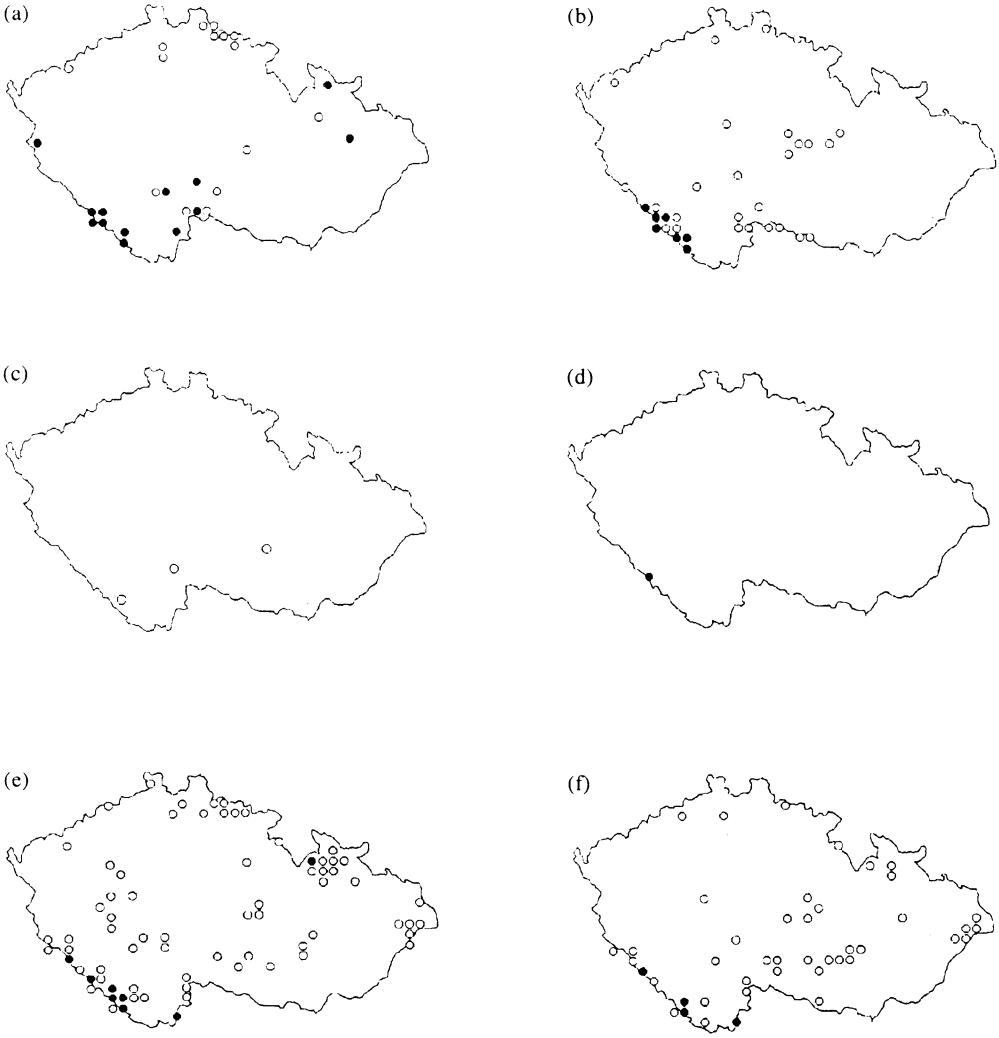
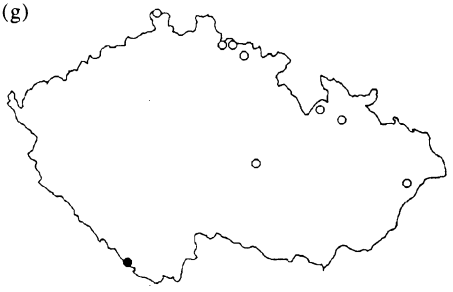
Fig. 1. – Distribution of (a) *Cetraria sepincola* (Ehrh.) Ach., (b) *Evernia divaricata* (L.) Ach., (c) *E. mesomorpha* Nyl., (d) *Lobaria amplissima* (Scop.) Forss., (e) *L. pulmonaria* (L.) Hoffm., (f) *Menegazzia terebrata* (Hoffm.) Massal., (g) *Nephroma bellum* (Sprengel)Tuck (h) *Nephroma parile* (Ach.) Ach., (i) *N. resupinatum* (L.) Ach., (j) *Pachyphiale fagicola* (Hepp) Zw. and (k) *Sphaerophorus globosus* (Hudson) Vainio in the Czech Republic; circles: pre 1970, dots: after 1970.

Obr. 1. – Rozšíření (a) *Cetraria sepincola* (Ehrh.) Ach., (b) *Evernia divaricata* (L.) Ach., (c) *E. mesomorpha* Nyl., (d) *Lobaria amplissima* (Scop.) Forss., (e) *L. pulmonaria* (L.) Hoffm., (f) *Menegazzia terebrata* (Hoffm.) Massal., (g) *Nephroma bellum* (Sprengel) Tuck (h) *Nephroma parile* (Ach.) Ach. (i) *N. resupinatum* (L.) Ach. (j) *Pachyphiale fagicola* (Hepp) Zw. a (k) *Sphaerophorus globosus* (Hudson) Vainio v České republice; kroužky: před r. 1970, body: po r.1970.



(g)



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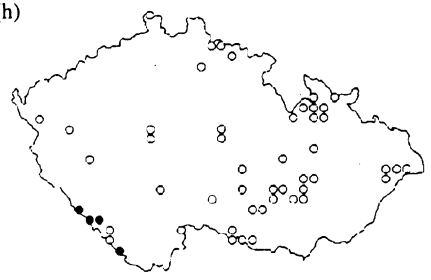

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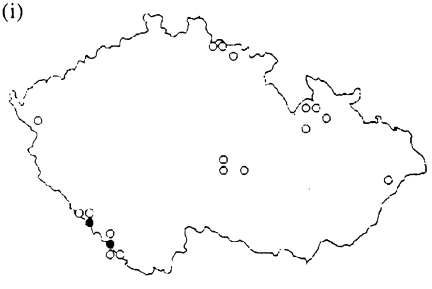

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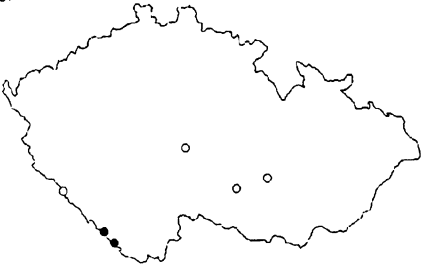

(k)