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Retreating Lichens in Southernmost Sweden

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With 10 figures

Summary

The current status of 94 lichen species, of which 83 are extracted from the Swedish Red Data list, has been investigated in Skåne, the southernmost province of Sweden. The results, including over 1000 field records, indicate a retreat connected with environmental problems, especially air pollution. 41 species have disappeared, 16 species are considered endangered, 11 species are considered vulnerable, 7 species have become rare and 7 other species are care-demanding. Three species are increasing in frequency. Maps of past and present distributions are presented for *Bacidia rosella, Fellhanera bouteillei, Gyalecta ulmi, Lecanactis amylacea, Opegrapha vermicellifera, Parmelia revoluta, Phlyctis agelaea, Pyrenula nitida, Ramalina obtusata* and *Sticta fuliginosa*.

1. Introduction

The double organism nature of lichens makes them, perhaps more than any other organisms, extremely sensitive to any changes in the environment which can cause instability in the well-balanced physiological system between the two bionts forming the thallus.

Since the pioneer work of Nylander (1866) during the last century it has been well-documented that the lichen flora vanishes from regions with strongly polluted air. Comprehensive research data concerning the retreat of the lichen vegetation related to air pollution have been published during the last decades in many western countries (Hawksworth et al. 1973; Leblanc & Rao 1975; Wirth 1976). A relatively large amount of papers has been published also in the Nordic countries, discussing the changes in the lichen vegetation of local regions related to air pollution (Arvidsson & Skoog 1984, Hedlund 1983, Hultengren 1987, Ramkær 1984, Skye 1968, Søchting & Ramkær 1982). A negative ultrastructural change in the lichen thalli associated with the general acidification was, however, not established until this decade (Holopainen & Kärenlampi 1984). The physiological response mainly concerns a general degradation of chlorophyll causing drastic changes in the respiratory rates (Fields 1988).

During the last few years, however, several other factors, e. g. a general change in the use of land and the improved methods in forestry have also been considered as being involved in the retreat of lichen vegetation (Esseen 1983, Hallingbäck 1986, Löfgren & Moberg 1984). More attention is also paid to the importance of maturity and continuity of the lichen localities (Andersson & Appelqvist 1987).

2. Methods

This project, which started in 1987, was originally planned to register changes in the lichen vegetation primarily in the province of Skåne. Later on other provinces in southernmost Sweden were also included. The province of Skåne in particular is very suitable for this kind of project because of the well documented changes in the cultural landscape during this century

(Emanuelsson et al. 1985). Additionally several local investigations on the lichen flora had been carried out earlier which make a comparison in time possible (Almborn 1955, Degelius 1941, Malme 1934, 1935). Almborn's investigation of the southern lichen element in Scandinavia was also a valuable source of information (Almborn 1948).

The original plans mainly concerned a reinvestigation of earlier known localities from the investigations mentioned above. These plans, however, have now been modified to include also the registration of newly discovered localities. An increase in frequency based only on a reinvestigation of old localities would otherwise be impossible to detect. Additionally, we have also included a system of judging the vitality status and the size of the populations of the investigated species.

Today, the list of investigated species within the project comprises 94 species of which 83 are compiled from the list of 214 endangered lichen species in Sweden (FLORAVÅRDSKOMMITTÉN 1987).

3. Results

The investigation concerning the 94 lichen species so far comprises over 1000 records form field observations. Some trends and statistics regarding various categories of threats including comments on certain species are presented. Air pollution, modern forestry, change in the use of land, removal of old solitary trees and tree avenues are all important factors which affect the lichen flora negatively. Very often, not just one threat, but combinations of these cause the retreat of the lichen vegetation. It is also clear that a certain degree of maturity and continuity in the habitat is required for successful regeneration and dispersal of many corticolous lichens (Andersson & Appelqvist 1987, Arvidsson et al. 1988). When lichens grow at localities with long continuity (climax habitat) they seem to be able to withstand more air pollution than elsewhere.

3.1. Species sensitive to acidification

Among species which presumably have disappeared mainly because of acidification several different categories can be discerned:

(1.) Large species which require continuous humidity and some species with cyanobacteria within the genera *Collema, Dendriscocaulon, Leptogium, Lobaria, Nephroma, Pannaria, Parmeliella* and *Sticta.*

(2.) Small species which grow on exposed twigs of trees and shrubs e. g. *Fellhanera bouteillei* and *Xanthoria lobulata.*

(3.) Species growing on wood, fences and old wooden buildings e. g. *Calicium abietinum* and *Cyphelium trachylioides.*

(4.) Species occurring mainly in forests and pasture-land with scattered trees e. g. *Bacidia rosella, Lecanactis amylacea* and *Parmelia revoluta.*

3.2. Species sensitive to new methods in forestry

Some species which earlier formed elements in the genuine woodland must have been extremely sensitive to the new rational methods in forestry which have developed during the last few decades, e. g. *Lecanora glabrata, Opegrapha vermicellifera, Pyrenula nitida* and *Thelotrema lepadinum.* Several newly discovered localities have been registered which, however, should be interpreted as representing very old populations rather than an increase in frequency.

3.3. Disappearing species with a northern distribution

Some other interesting species which appear to have retreated drastically belong to a northern element in the Nordic lichen flora, i. e. *Cladonia bellidiflora, C. cyanipes, Peltigera venosa, Umbilicaria cylindrica, U. hyperborea* and *U. proboscidea*. Out of a total of 20 different records from 14 earlier known localities for these northern species only one could be reconfirmed during 1988. It is known that species growing near the border of their distribution area are often more sensitive to changes in their environment than in central parts of their area.

4. The 94 investigated species in the province of Skåne

41 species have vanished: *Arthonia byssacea, A. tumidula, Bactrospora dryina, Bryoria bicolor, Calicium abietinum, Cladonia cyanipes, Collema fragrans, C. furfuraceum, C. occultatum, C. subflaccidum, C. subnigrescens, Cyphelium trachylioides, Dendriscocaulon umhausense, Evernia divaricata, Fellhanera bouteillei, Leptogium cyanescens, L. palmatum, Letharia vulpina, Maronea constans, Moelleropsis nebulosa, Nephroma laevigatum, Pachyphiale cornea, Pannaria conoplea, P. rubiginosa, Parmelia caperata, P. centrifuga, P. reddenda, Parmeliella plumbea, Peltigera venosa, Ramalina calicaris, R. thrausta, Schismatomma abietinum, S. graphioides, Sphinctrina anglica, S. leucopoda, Sticta fuliginosa, S. sylvatica, Umbilicaria cylindrica, U. hyperborea, U. proboscidea* and *Xanthoria lobulata*.

16 species must be regarded as endangered: *Bacidia rosella, Calicium quercinum, Chaenotheca hispidula, Coniocybe coniophaea, C. peronella, Diploicia canescens, Gyalecta truncigena, Lecanactis amylacea, Lobaria amplissima, Menegazzia terebrata, Opegrapha ochrocheila, Parmelia revoluta, Pertusaria velata, Phaeophyscia endophoenicea, Ramalina obtusata* and *Usnea florida*.

11 species have been registered as vulnerable: *Catinaria laureri, Cladonia bellidiflora, C. parasitica, Enterographa crassa, Leptogium gelatinosum, Lobaria virens, Normandina pulchella, Pertusaria multipuncta, Phlyctis agelaea, Pyrenula nitidella* and *Sphinctrina turbinata*.

7 species have been registered as rare: *Arthonia leucodontis, Catillaria sphaeroides, Cladonia incrassata, Gyalecta flotowii, G. ulmi, Lecanora glabrata* and *Parmelia tiliacea*.

7 species have been considered care-demanding: *Arthonia impolita, Lobaria pulmonaria, Opegrapha vermicellifera, Parmelia elegantula, Pyrenula nitida, Thelotrema lepadinum* and *Xanthoria calcicola*.

6 species which are on the Swedish Red Data list have been considered as not threatened in Skåne: *Arthonia spadicea, Arthothelium ruanum, Microcalicium arenarium, Opegrapha viridis, Physconia grisea* and *Schismatomma decolorans*. *A. spadicea* and *A. ruanum* seem to have increased in frequency within the province probably due to an increase of suitable localities. *S. decolorans* is a sorediate species on old oak trees and formerly known from only a few localities. It seems to be competitive and not much affected by air pollution which is probably the reason why it has increased in frequency.

5. Comments on some of the investigated species

Bacidia rosella

Within the investigated region *Bacidia rosella* occurs on *Fagus sylvatica* in humid forests but it can also be found growing on trees in avenues. The species must be regarded as endangered within the region but it has also become rare in the whole country. Only a few localities are known from Skåne where *B. rosella* occurs in a very limited number of individuals (Fig. 1). The increased acidification and changed methods in forestry presumably are the main reasons for the decline, but since *B. rosella* belongs to a more temperate Central European element climatological changes may also be involved.

Fellhanera bouteillei

This species occurs on branches of spruce (*Picea abies*) where it obviously prefers the lower branches which are more protected from precipitation. *Fellhanera bouteillei* is regarded vulnerable in the whole country, but it seems to have disappeared from Skåne where it was formerly known from relatively many localities (Fig. 2). Like some other species which grow mainly on exposed branches, this species appears to be very sensitive to acidification.

Gyalecta ulmi

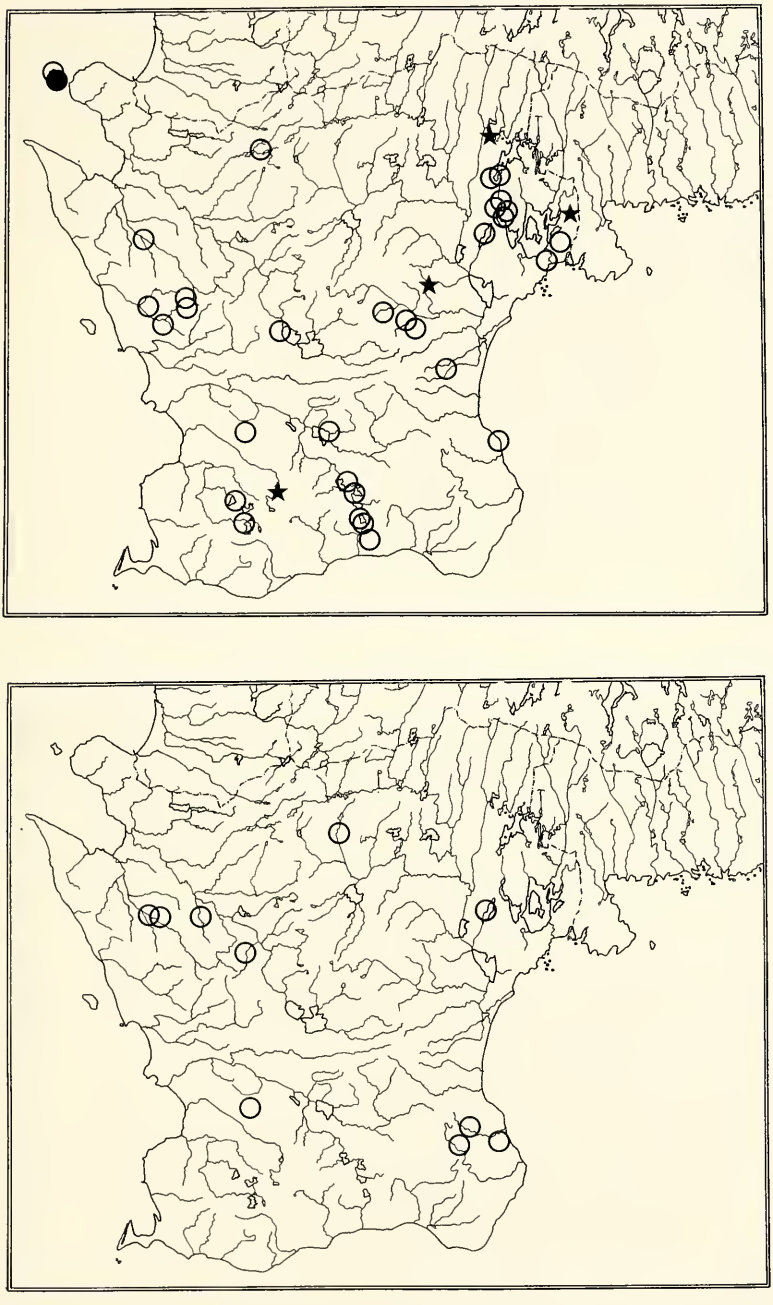
This species occurs mainly on deciduous trees in localities with long continuity and maturity. In the whole country *G. ulmi* is regarded as care-demanding but it has become rare in Skåne. The retreat of the species is presumably related to the removal of suitable habitats. Four of the presently known localities are located in wooded meadows in the northeasternmost part of Skåne, where the populations are actually rather large (Fig. 3).

Lecanactis amylacea

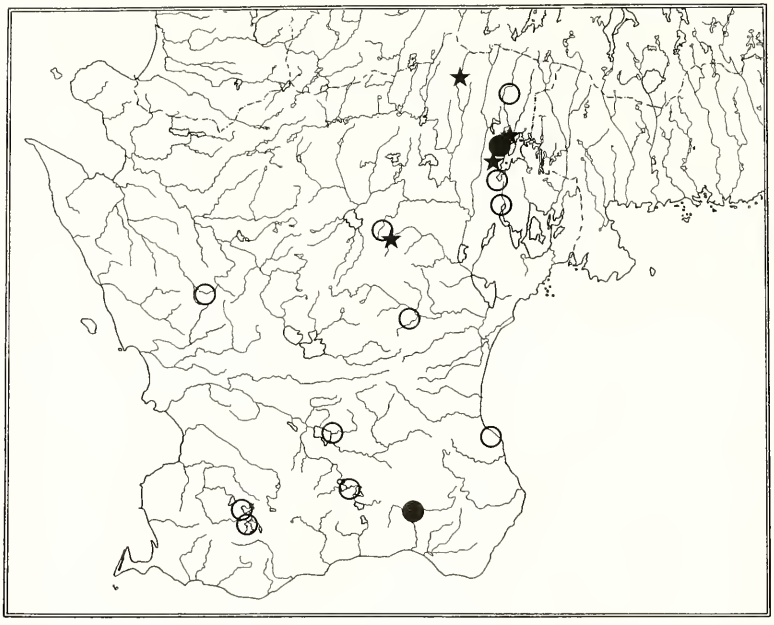
Lecanactis amylacea mainly occurs on rough bark of old oak trees (*Quercus robur*) growing as solitary trees or in groups in pasture-land. The species must be regarded as endangered in the whole country also including Skåne where it was earlier known from a number of localities (Fig. 4) and then often associated with *Arthonia impolita*. At present *L. amylacea* is only known from two localities within the province, at both with only very few individuals. On many localities where *L. amylacea* formerly grew together with *Arthonia impolita* only the latter still exists. This indicates that *L. amylacea* is very sensitive to air pollution and that this may be the main reason for the retreat of this species.

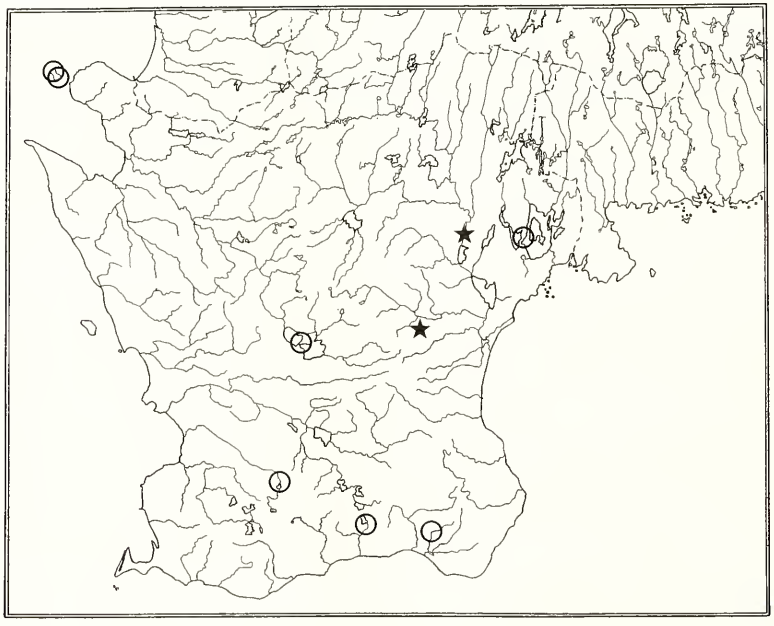
Opegrapha vermicellifera

Opegrapha vermicellifera which belongs to a Central European element mainly occurs on deciduous trees in shaded habitats. It is considered to be rare in the whole country, but is care-demanding in Skåne. The species has disappeared from a number of earlier known localities in Skåne but several new localities have also been discovered (Fig. 5). The species is often very inconspicuous and may have been overlooked previously.

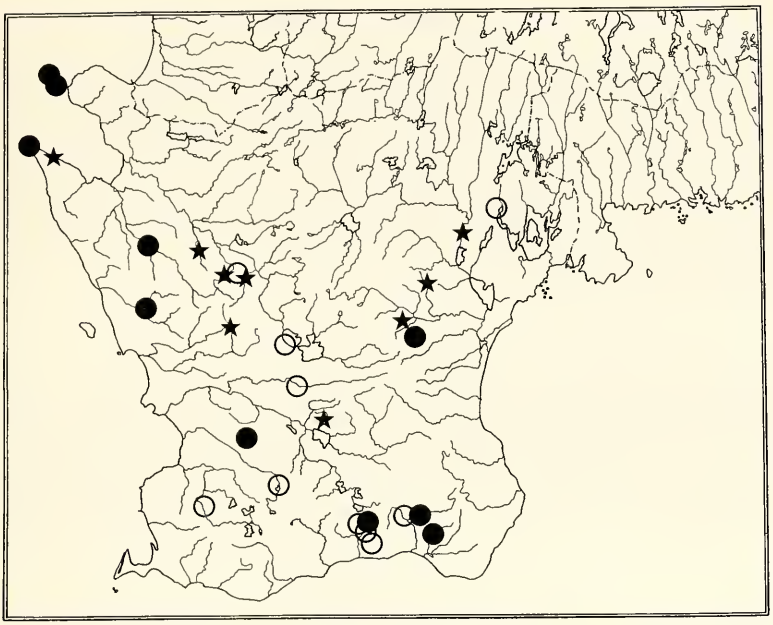


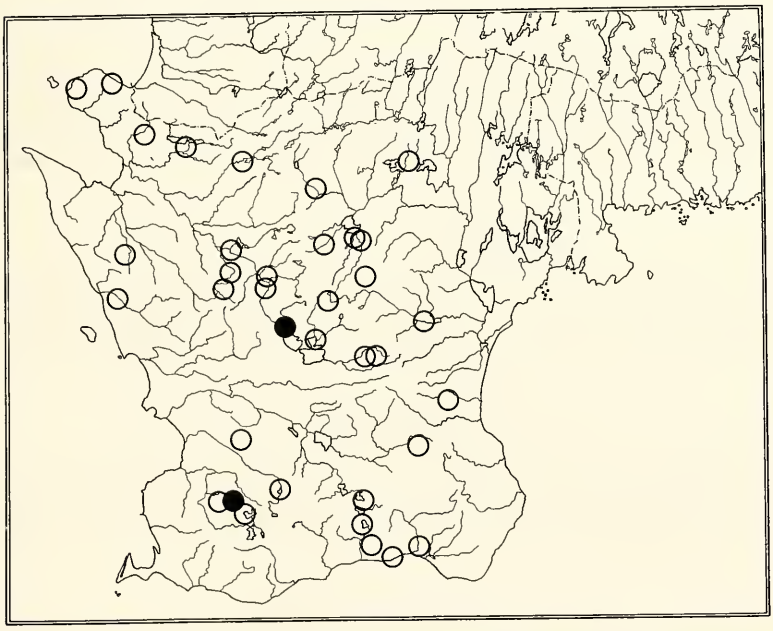
Figs. 1–2. Former and present records of lichen species in Skåne, the southernmost province of Sweden. – 1. (above) *Bacidia rosella*; – 2. (below) *Fellhanera bouteillei*. – Symbols for all figures: *open circle* = earlier known locality, *filled circle* = confirmed earlier locality, *star* = newly discovered locality.





Figs. 3–4. Former and present records of lichen species in Skåne. – 3. (above) *Gyalecta ulmi*; – 4. (below) *Lecanactis amylacea*.





Figs. 5–6. Former and present records of lichen species in Skåne. – 5. (above) *Opegrapha vermicellifera*; – 6. (below) *Parmelia revoluta*.

Parmelia revoluta

In the Nordic countries *Parmelia revoluta* occurs exclusively on *Alnus glutinosa* along streams, lake shores and in humid meadows. The species is considered vulnerable in the country but at present it is endangered in Skåne. From over 34 earlier known localities only 2 have been reconfirmed and it occurs in only a few individuals (Fig. 6). The retreat of this species is remarkable since many of the earlier known localities seem almost unchanged. The main causes for the retreat of this mainly suboceanic Western European species are presumably acidification in connection with general climatic changes.

Phlyctis agelaea

Phlyctis agelaea occurs on various deciduous trees both in forests and in open localities like avenues. This species is considered to be care-demanding in the whole country but it is vulnerable in Skåne. It has disappeared from a number of earlier known localities within the province but also a number of new localities have been discovered (Fig. 7). It occurs in only a few individuals in most of the known localities.

Pyrenula nitida

This very characteristic species occurs mainly on *Fagus sylvatica*. It is considered care-demanding in the whole country also including Skåne. In Skåne in particular *Pyrenula nitida* was earlier a characteristic element in the *Fagus* woodland where it is still found in many localities (Fig. 8). It is, however, very clear that the species is retreating in the province and in the whole country, since the vitality of the investigated populations seems to be declining and the number of individuals seldom seems to be very high. *Pyrenula nitida* is apparently very sensitive to air pollution.

Ramalina obtusata

Ramalina obtusata occurs on bark of deciduous trees particularly in avenues and in pasture-land. The species is considered to be care-demanding in the whole country but it is endangered in Skåne. One of the earlier known localities has been verified and one new locality was found in the northeasternmost part of the province (Fig. 9).

Sticta fuliginosa

Sticta fuliginosa was earlier known from six relatively humid localities in Skåne (Fig. 10). The *Sticta* species appear to be extremely sensitive to environmental changes and acidification and they must be regarded as endangered in all Western Europe.

6. Acknowledgements

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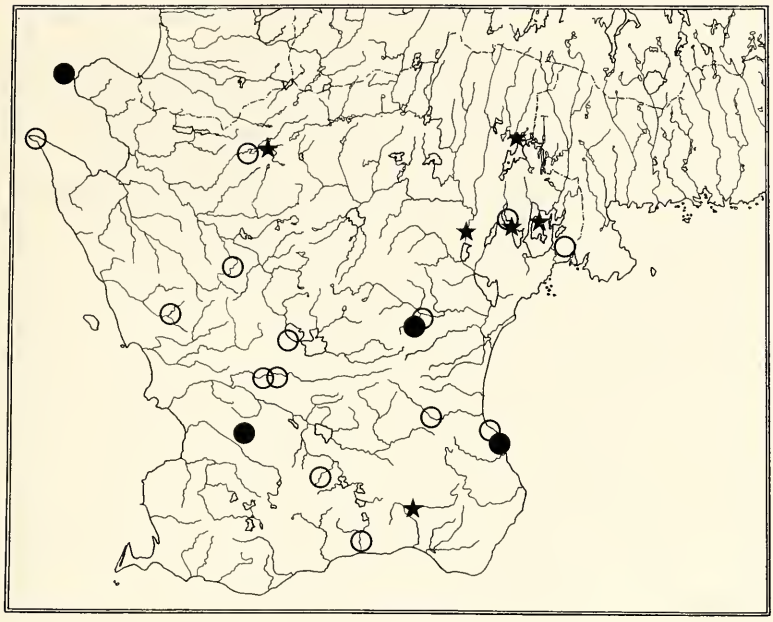
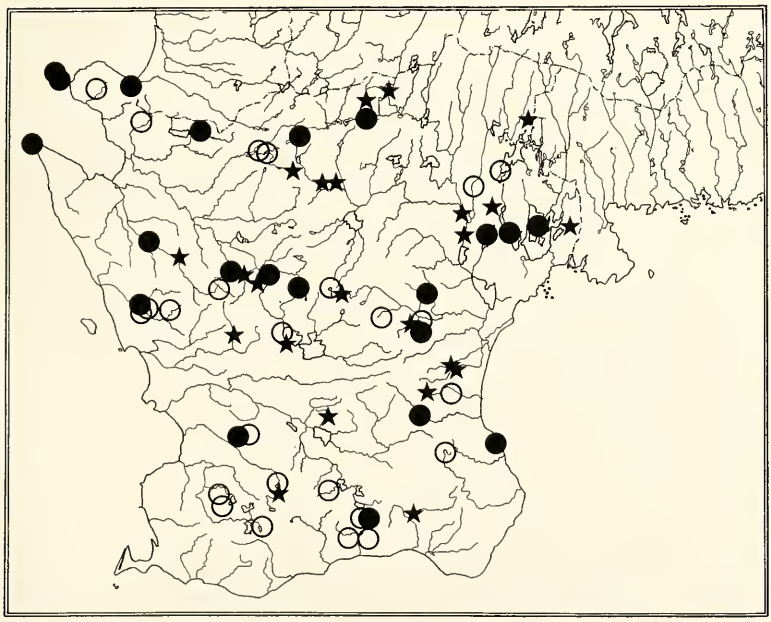
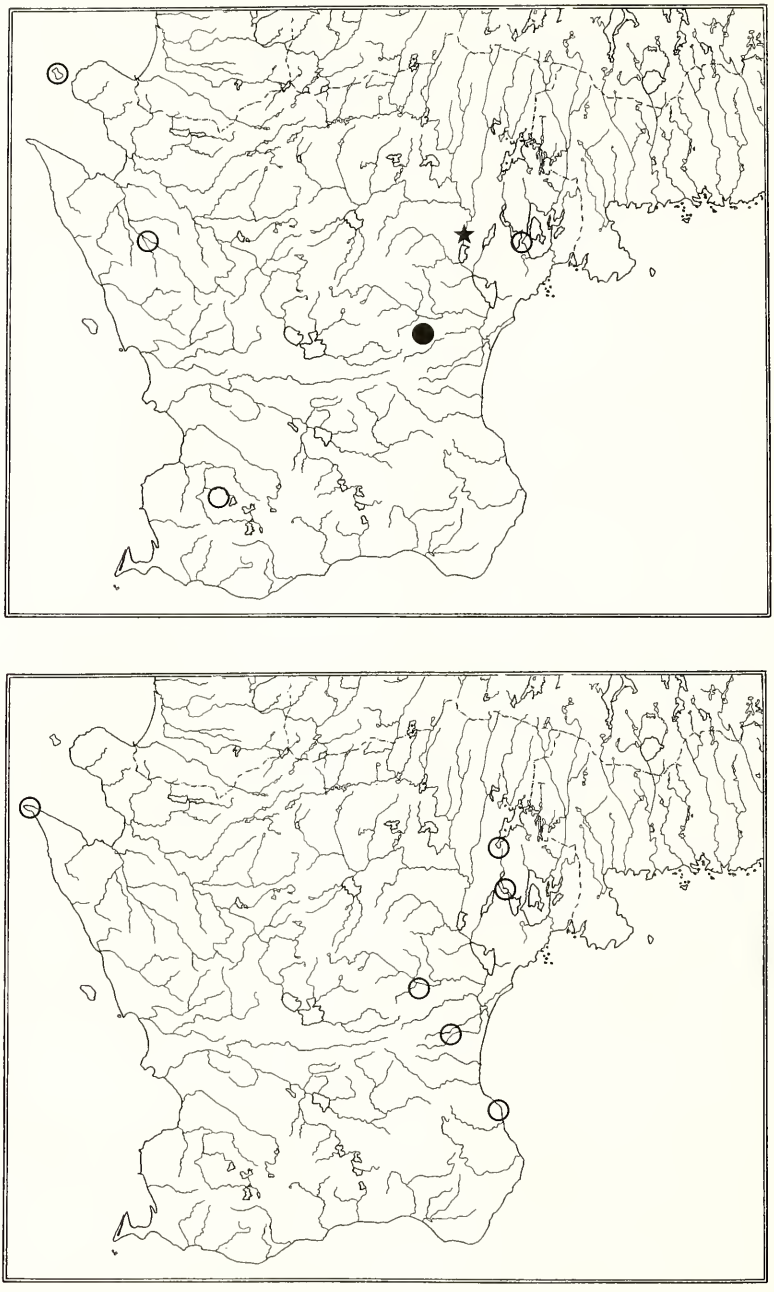




Figs. 7–8. Former and present records of lichen species in Skåne. – 7. (above) *Phlyctis agelaea*; – 8. (below) *Pyrenula nitida*.



Figs. 9–10. Former and present records of lichen species in Skåne. – 9. (above) *Ramalina obtusata*; – 10. (below) *Sticta fuliginosa*.

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