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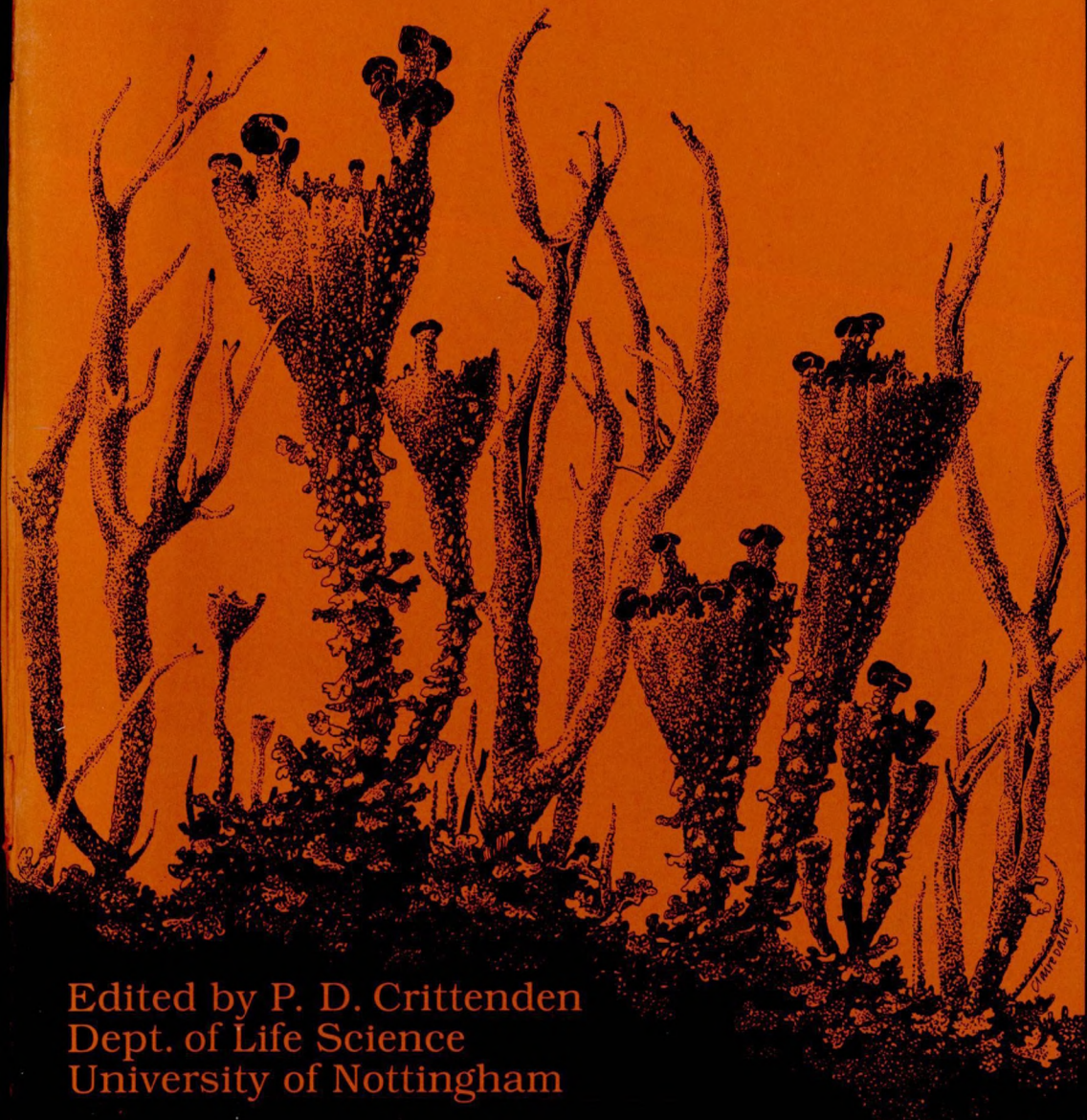
+ key to non-yellow species of *Rhizocarpon*



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WHY HAVE SPECIES OF *LOBARIA* DECLINED IN THE PAST CENTURY?

David Hawksworth's note (1995) on the decline of *Lobaria* spp in Cumbria between 1969 and 1994 has made me reflect on the causes of this decline. He considers acid rain and the complete loss of elms in the 1960s and 1970s to be major factors. Seaward and Hitch (1982) have pointed out that *Lobaria* species all require moderately basic bark (pH 5 to 5.5), and that they have disappeared in historic times from central England and east Britain where winter SO_2 concentrations exceed 25 to 35 $\mu g/m^3$ air. Some, but not all, British species of *Lobaria, Pseudocyphellaria* and *Sticta* have a cyanobacterial photobiont. In theory, these species should be able to grow without an external nitrogen supply, and may well excrete nitrogen. Excessive amounts of externally applied nitrogen as ammonia or nitrogen oxides are almost certainly toxic.

In Dorset atmospheric SO_2 concentrations are low and four species of *Lobaria* still survive despite losses from some sites. The best remaining sites are large parks and woods, including one on an army range, where agricultural operations are minimal, and grazing is chiefly carried out by deer or by cattle at a low density. It is possible that ammonia from the urine of animals kept at high density, or from manure plastered onto trees in fields by muck-spreaders, has assisted the decline of the *Lobarion*.

This hypothesis has yet to be tested. Air pollution monitors rarely give more than imprecise estimates of SO_2, and sometimes the pH of rain, but ammonia concentrations are neglected. One needs a series of measurements over many years to detect trends, which are expected to vary greatly with location. The toxicity of ammonia towards *Lobaria* spp. could be tested using fairly inexpensive laboratory methods, but I am not aware that this has been done. In remote environments SO_2 produced naturally is neutralised by the natural production of NH_3. The quantities of both gases produced have been greatly perturbed by man's activities, and where either is in excess the imbalance might have potentially lethal effects on lichens.

References

Hawksworth, D L (1995). Great Wood and environs twenty-five years on. *British Lichen Society Bulletin* **77**: 25-27.

Seaward, M R D & Hitch, C J B (1982). *Atlas of the Lichens of the British Isles*. Cambridge: Institute of Terrestrial Ecology.

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