must await more information about chemical structure of their substrates—the walls themselves.

I. García Acha
M. J. R. Aguirre
F. Lopez-Belmonte
J. R. Villanueva

Instituto de Biología Celular, CSIC,
Velázquez 138, Madrid.

[1] Weibull, C., *Ann. Rev. Microbiol.*, **12**, 1 (1958).
[2] Eddy, A. A., and Williamson, D. H., *Nature*, **179**, 1252 (1957).
[3] Bachmann, B. J., and Bonner, D. M., *J. Bact.*, **78**, 550 (1959).
[4] Rodriguez Aguirre, M. J., García Acha, I., and Villanueva, J. R., *Antonie van Leeuwenhoek*, **30**, 33 (1964).
[5] Cocking, E. C., *Nature*, **187**, 927 (1960).
[6] García Acha, I., Rodriguez Aguirre, M. J., and Villanueva, J. R., *Microbiol. Espan.*, **16**, 141 (1963).
[7] García Acha, I., and Villanueva, J. R., *Canad. J. Microbiol.*, **9**, 139 (1963).
[8] Welsch, M., *J. Gen. Microbiol.*, **18**, 491 (1958).
[9] Gascón, S., and Villanueva, J. R., *Canad. J. Microbiol.*, **9**, 651 (1963).
[10] García Acha, I., Rodriguez Aguirre, M. J., and Villanueva, J. R., *Proc. Eighth Jornadas Bioquímicas Latinas*, Lisbon, 132 (1965).
[11] Skujins, J. J., Potgieter, H. J., and Alexander, M., *Arch. Biochem. Biophys.*, **111**, 358 (1965).
[12] Tanaka, H., and Phaff, H. J., *J. Bact.*, **89**, 1570 (1965).
[13] Lloyd, A. B., Noveroske, R. L., and Lockwood, J. L., *Phytopathol.*, **55**, 871 (1965).

Semi-fossil Lichen Fungi in Scottish Hill Soils

Recent investigations[1] into the micromorphological features of hill soils in north-east Scotland have revealed the presence, within the soil profile, of what appear to be perithecia containing dark-coloured muriform spores. These perithecia are apparent in profiles from Meall-an-t-Slughain, Aberdeenshire (at heights of 2,050 ft. and 2,300 ft.), Ben Rinnes, Banffshire (2,500 ft.), and Morven Aberdeenshire (2,025 ft., 2,800 ft. (two) and 2,850 ft.). The profiles are developed on parent materials derived from both granite (Meall-an-t-Slughain and Ben Rinnes profiles) and basic igneous rocks (Morven profiles). Peat cover is either absent or amounts to no more than 2–3 in., except on one of the 2,800 ft. profiles on Morven, which has a peat cover 14 in. thick, the base of the peat being pollen dated within the Sub-Boreal period.

In many Ascomycetеae the whole ascus undergoes digestion at maturity, thus setting free the ascospores[2], and it is likely that this has occurred in the perithecium shown in Fig. 1. The size of the ascospores (Fig. 2) is rather variable, and though the majority are of the order of 40μ × 20μ some are considerably larger, up to 60μ in length. The size of the perithecia is also rather variable; the majority are approximately 160μ in diameter, but one from the 2,800 ft. Morven profile without peat cover was approximately 270μ in diameter. Some of the perithecia exhibit well-developed ostioles (Fig. 1).

Dr. T. D. V. Swinscow of the British Lichen Society and Mr. P. James of the Department of Botany, British Museum (Natural History), have confirmed (personal communication) our opinion that the structures described are the fungal components of a pyrenocarpic lichen, probably a species of *Polyblastia*[3], although it is impossible to recognize algal tissue in the soil sections.

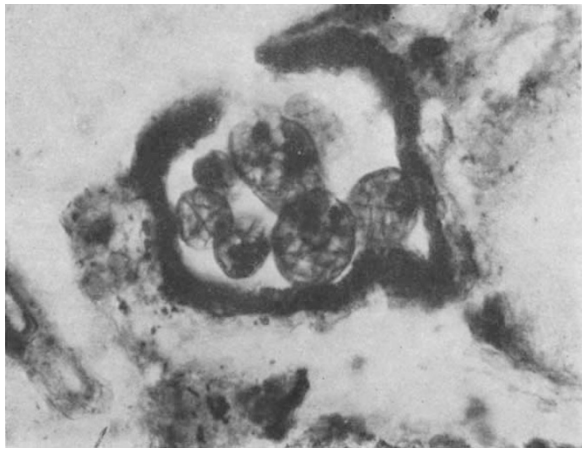

Fig. 1. Perithecium containing ascospores in thin soil section (×270)

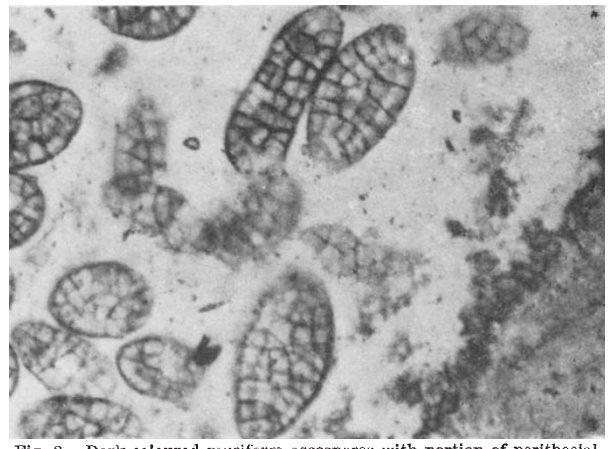

Fig. 2. Dark-coloured muriform ascospores with portion of perithecial wall in thin soil section (×375)

Within the soil profile, the presence of either perithecia or ascospores has been noted to depths of 9 in. below the mineral surface, though in the case of the 2,800 ft. Morven profile not covered by peat they are present to a depth of 19 in. The Morven profile with peat cover has a thin iron pan at 8–10 in. below the mineral surface, and above this ascospores have been found in association with a pollen assemblage of Atlantic age.

This appears to be the first record of fungal components of a lichen, in a semi-fossil state.

We thank Mr. S. E. Durno of the Macaulay Institute for the pollen data.

J. C. C. Romans
J. H. Stevens
L. Robertson

Department of Soil Survey,

D. Jones

Department of Microbiology,
Macaulay Institute for Soil Research,
Craigiebuckler, Aberdeen.

[1] Romans, J. C. C., Stevens, J. H., and Robertson, L., *Alpine Soils of North-East Scotland* (in preparation).
[2] Bessey, E. A., *Morphology and Taxonomy of Fungi* (Constable and Co., Ltd., London, 1952).
[3] Swinscow, T. D. V., *Lichenologist*, **1**, 169 (1960); 242 (1961).

Nitrogen Fixation by Lichens of Arid Soil Crusts

The nitrogen budgets for natural ecological systems are poorly understood, and the contribution of particular microflora in these associations has been only tentatively assessed[1–3]. This applies especially to arid zones where soils sometimes have a surface crust of lichens, some blue-green algae, and other cryptogams covering as much as 30 per cent of the total soil area. It is of considerable interest therefore to determine to what extent these lichens fix atmospheric nitrogen, since they might contribute appreciably to the maintenance of a favourable nitrogen balance in these areas.

About forty species of lichens are known to occur in the southern central arid zone in Australia, and twelve of the commonest were exposed to a gas mixture containing nitrogen enriched with nitrogen-15. Thus each lichen was incubated in a Warburg flask for 6 days at 21° C under artificial light, using the following gas mixture (in atmospheres): oxygen 0·2, nitrogen 0·2 (enriched with 35 atom per cent excess nitrogen-15), and helium 0·6. After this