INGOLD, C. T. (1965). Hyphomycete spores from mountain torrents. *Transactions of the British Mycological Society* **48**, 453–458.
INGOLD, C. T., DANN, V. & MCDOUGALL, P. J. (1968). *Tripospermum camelopardus* sp.nov. *Transactions of the British Mycological Society* **51**, 51–56.
IQBAL, S. H. (1971). New aquatic hyphomycetes. *Transactions of the British Mycological Society* **56**, 343–352.
JONES, E. B. G. (1965). Observations on a new fungus from Malham Tarn. Paper read to the British Mycological Society, November meeting, London.
JONES, E. B. G. & EATON, R. A. (1969). *Savoryella lignicola* gen. et sp.nov. from water cooling towers. *Transactions of the British Mycological Society* **52**, 161–165.
JONES, E. B. G. & OLIVER, A. C. (1964). Occurrence of aquatic hyphomycetes on wood submerged in fresh and brackish water. *Transactions of the British Mycological Society* **47**, 45–48.
KIRK, P. (1969). Aquatic hyphomycetes on wood in an estuary. *Mycologia* **61**, 177–181.
NILSSON, S. I. (1962). Second note on Swedish freshwater hyphomycetes. *Botaniska Notiser* **155**, 73–86.
NILSSON, S. (1964). Freshwater hyphomycetes, taxonomy, morphology, and ecology. *Symbolae Botanicae Upsaliensis* **18**, 1–130.
PERROTT, E. (1960). *Ankistrocladium fuscum* gen.nov., sp.nov., an aquatic hyphomycete. *Transactions of the British Mycological Society* **43**, 556–558.
PRICE, I. P. & TALBOT, P. H. B. (1966). An aquatic hyphomycete in a lignicolous habitat. *Australian Journal Botany* **14**, 19–23.
RANZONI, F. V. (1954). The aquatic hyphomycetes of California. *Farlowia* **4**, 353–398.
SCOTT, W. W. & UMPHLETT, C. J. (1963). Some new and unusual fungi from Virginia. II. Aquatic hyphomycetes. *Virginia Journal of Science* **14**, 47–64.
SLÁDEČKOVÁ, A. (1964). Aquatic deuteromycetes as indicators of starch campaign pollution. *International Revue der gesamten Hydrobiologie* **48**, 35–42.
THORNTON, D. R. (1963). The physiology and nutrition of some aquatic hyphomycetes. *Journal of General Microbiology* **33**, 23–31.
TUBAKI, K. (1966). An undescribed species of *Hymenoscyphus*, a perfect stage of *Varicosporium*. *Transactions of the British Mycological Society* **49**, 346–349.
WEBSTER, J. (1961). The *Mollisia* perfect state of *Anguillospora crassa*. *Transactions of the British Mycological Society* **44**, 559–564.

EXPLANATION OF PLATE 24

Tricladium varium

Figs. 1–2. Elongate main axis of conidium.
Figs. 3–7. Initiation of the first lateral branch.
Figs. 8–9. Initiation of the second lateral branch.
Figs. 10, 12. Mature conidia.
Figs. 11, 13. Germinating conidia.

All under phase-contrast. Figs. 1–12, ×950; Fig. 13, ×450.

THICK-WALLED SCLEROTIAL MEDULLARY CELLS IN *COPRINUS LAGOPUS*

HENRY WATERS, R. D. BUTLER AND DAVID MOORE

Department of Botany, The University, Manchester

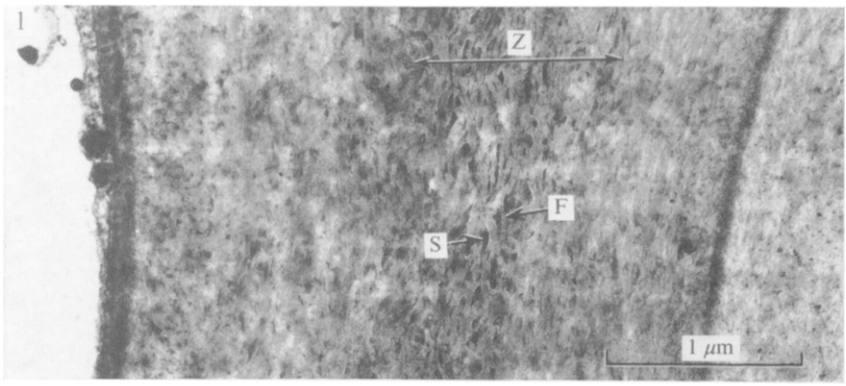
The current concept of wall structure in mature vegetative hyphae is that it consists of an outer non-fibrillar layer surrounding an inner layer

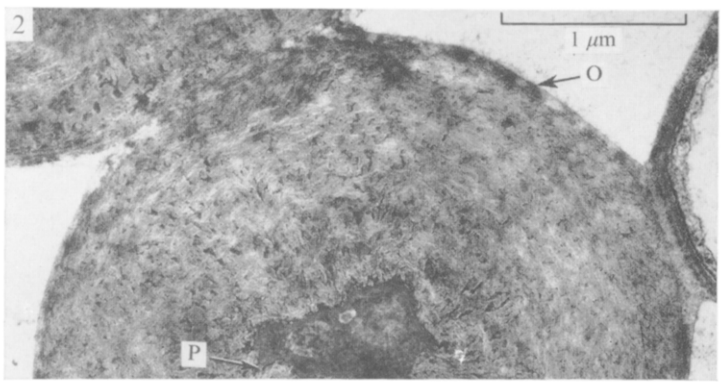
composed of numerous fibrils. The outer layer varies in the number and composition of lamellae (Hunsley & Burnett, 1970). Sectioned hyphae of *Coprinus lagopus* (Fr.) Fr. (Pl. 25, fig. 3) reflect this concept, and although the wall in *Coprinus* is thinner it correlates well with the structure of the hyphal walls in *Schizophyllum* Fr. (Hunsley & Burnett, 1970).

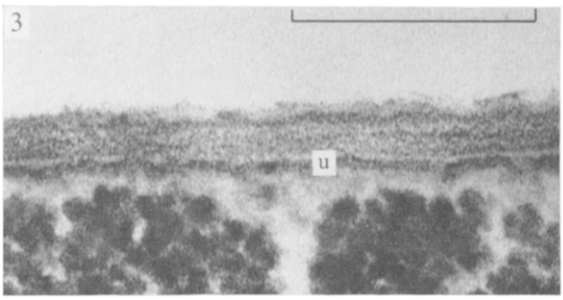
A great deal is known about the substructure and composition of vegetative hyphal walls (Aronson, 1965; Bartnicki-Garcia, 1968) but much less is known of the changes imposed on this architecture in the production of thick walls. Although wall thickening is unusual in the fungi, uniformly thickened walls have been observed in the medullary cells of sclerotia in *Typhula* (Pers.) Fr. sp. and *Sclerotium rolfsii* Sacc. (Scurti & Converso, 1965; Chet, Henis & Kislev, 1969). Thickened walls have also been described in the fibre hyphae of hyphal strands in *Armillaria* (Fr.) Kummer and *Trametes* Fr. (Schmid & Liese, 1968). Chet *et al.* (1969) have emphasized the close similarity between the thickened walls of medullary cells of *Sclerotium* and the fibre hyphae of *Armillaria* and *Trametes*. Walls with localized areas of thickening have been described in the vegetative hyphae of *Phytophthora* de Bary (Gooday & Hunsley, 1971).

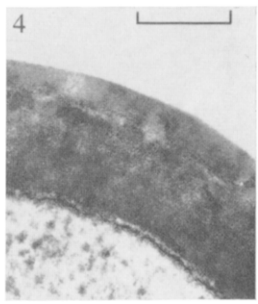
The published micrographs indicate that, apart from the obvious increase in depth, thickened hyphal walls do not differ fundamentally in substructure from those regions of the vegetative hyphal wall which have a fibrillar substructure. Our observations on thick-walled cells found in the sclerotial rind of *C. lagopus* (Pl. 25, fig. 4), in the leathery carpophore of *Coriolus versicolor* (L. ex Fr.) Qué 1. (Pl. 25, fig. 5) and in the sclerotial medulla of *Typhula variabilis* Reiss (Pl. 25, fig. 6) all revealed a basic structure which can best be interpreted as a centripetal extension of the innermost fibrillar layer of the primary hyphal wall.

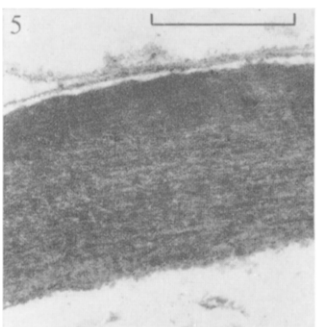
It is now evident that not all fungal walls are of this basic type. The mature sclerotia of *C. lagopus* contain, as well as the thick-walled rind cells, thick-walled medullary cells possessing walls with a completely different substructure. These uniformly thickened walls are some 20 times thicker than the walls of vegetative hyphae and despite their restricted lumina the majority of the cells are living. In both transverse and longitudinal sections of glutaraldehyde-fixed material (Pl. 25, figs. 1, 2) the walls are bilayered, the outer layer (80–100 nm) representing the original hyphal wall within which the inner secondarily thickened wall has been deposited. This inner layer (1·5–2·0 μm) is divided into an outer compact zone and an inner less compact zone, the zonation reflecting different degrees of compaction rather than a change in basic substructure. It is clear that both zones of the inner layer are composed of unusually thick fibrils with a granular substructure embedded in an electron dense matrix. These fibrils were most apparent in the inner less compact zone (Pl. 25, fig. 1) and with a diameter of 33 nm are approximately three times thicker than those previously described in fungal walls (Hunsley & Burnett, 1968). The thick fibrils are arranged parallel to the longitudinal axis of the cell and are much branched, interwoven and contorted which explains the apparent lack of single fibril profiles in transverse sections (Pl. 25, fig. 2).

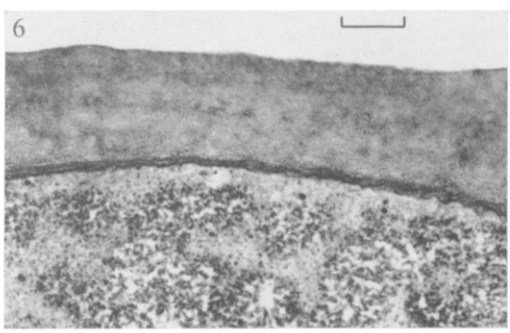












(*Facing p.* 169)

The function of these thick walls in relation to sclerotial morphogenesis and germination in *C. lagopus* is currently being investigated.

H.W. is in receipt of a S.R.C. Research Studentship.

REFERENCES

ARONSON, J. M. (1965). The cell wall. In *The Fungi*, vol. I (ed. by G. C. Ainsworth and A. S. Sussman), ch. 3, pp. 49–76. New York: Academic Press.

BARTNICKI-GARCIA, S. (1968). Cell wall chemistry, morphogenesis and taxonomy of fungi. *Annual Review of Microbiology* **22**, 87–108.

CHET, I., HENIS, Y. & KISLEV, N. (1969). Ultrastructure of sclerotia and hyphae of *Sclerotium rolfsii* Sacc. *Journal of General Microbiology* **57**, 143–147.

GOODAY, G. W. & HUNSLEY, D. (1971). Cellulose wall ingrowths in *Phytophthora parasitica*. *Transactions of the British Mycological Society* **57**, 178–179.

HUNSLEY, D. & BURNETT, J. H. (1968). Dimensions of microfibrillar elements in fungal walls. *Nature, London* **218**, 462–463.

HUNSLEY, D. & BURNETT, J. H. (1970). The ultrastructural architecture of the walls of some fungi. *Journal of General Microbiology* **62**, 203–218.

SCHMID, R. & LIESE, W. (1968). Structural and histochemical observations on fungal fibre hyphae. In *Electron Microscopy*, vol. 2 (ed. D. S. Bocciarelli), p. 415. Roma: Tipographia Pologlotta Vaticana.

SCURTI, J. C. & CONVERSO, L. (1965). Sulla struttura microscopica e ultromicroscopica degli sclerozi di *Typhula* sp. *Caryologia* **18**, 263–283.

EXPLANATION OF PLATE 25

Electron micrographs prepared from material fixed in glutaraldehyde and osmic acid, stained with uranyl acetate and lead citrate.

Figs. 1, 2. *Coprinus lagopus*. Longitudinal and transverse sections of sclerotial medullary cells. Note original hyphal wall (O), fibrils (F) in the less compact inner zone (Z) the large interfibrillar spaces (S) and the single fibril profiles (P).

Fig. 3. *Coprinus lagopus*. Section through vegetative hyphal wall. Note laminated substructure.

Fig. 4. *Coprinus lagopus*. Section through sclerotial rind cell wall showing thick inner layer.

Fig. 5. *Corelius versicolor*. Section through thick-walled cell from the subhymenial layer of the carpophore. Note uniformity of thickening and the striations due to the fibrillar substructure.

Fig. 6. *Typhula variabilis*. Transverse section through thick-walled medullary cell of the sclerotium. Note uniformity of thickening and the fibrillar substructure.

In Figs. 3–6 the scale is equivalent to 250 nm.

CONIDIAL GERMINATION IN *CERCOSPORA ARACHIDICOLA* HORI

B. A. OSO

Department of Botany, University of Ibadan, Nigeria

Cercospora spp., and in particular *C. arachidicola*, are the causal agents of the 'brown spot' of groundnut leaves (Chupp, 1953). This report concerns the conditions and mode of germination of conidia of *C. arachidicola*.

Abundant spores were obtained from infected leaves of groundnut on the Faculty of Agriculture farm, University of Ibadan. Freshly picked leaves were washed in tap-water and rinsed thoroughly in sterile distilled water before being incubated in a desiccator at 100% r.h. and room