A New Species of *Nectriella* with Ornamented Spores from Iceland, with a Key to the Lichenicolous Species

by

D.L. Hawksworth

Commonwealth Agricultural Bureaux, Farnham House, Farnham Royal, Slough SL2 3BN, UK

With 2 figures

Abstract: *Nectriella ornamentata* D. Hawksw. sp. nov. is described from a *Peltigera* species collected in Iceland. It is unique in the genus in having coarsely warted ascospores borne in asci which are 4-spored when mature. The circumscription of the genus *Nectriella* Nitschke is discussed and a key to the five lichenicolous species now recognized is presented. *N. ornamentata* is also compared with *Nectria lichenophila* Speg. and *Polycoccum crassum* Vězda, both of which have similarly sized 1-septate spores and 4-spored asci. Attention is drawn to the frequent occurrence of pyrenocarpous fungi with 4-spored asci on *Peltigera*.

Generic circumscription in the nectrioid pyrenomycetes has traditionally been based on the septation of the ascospores. Samuels (1976), Samuels & Rossman (1979) and Rossman (1979, 1982) have correctly recognized the artificial nature of such an approach. Instead, these authors have identified separate groups of species within a widely circumscribed *Nectria* Fr., relegating many former genera to synonymy. These groups have been distinguished on the basis of the anatomical structure of the perithecium wall, apical apparatus of the asci, the type of anamorph produced, and to a lesser extent ascospore ornamentation; many of the groups separated out in this way include species with different types of ascospore septation.

These authors have concentrated their efforts on taxa forming superficial perithecia, usually on a hyphal subiculum. *Nectriella* Nitschke (*in* Fuckel, 1870: 175) is separated from *Nectria* primarily because the perithecia are, at least at first, immersed in the host tissue (e.g.

Dennis, 1968: 252). This separation can also be expected to be artificial, some of the immersed taxa being more closely allied to some superficial groups than others currently also placed in *Nectriella*. However, as the genus *Nectria* is becoming exceptionally unwieldy, I prefer to retain *Nectriella* for immersed taxa lacking a subiculum for the moment pending a re-appraisal of the species placed there based on a critical comparison with the superficial *Nectria* species-groups. Such an investigation falls outside the scope of this note.

The generic name *Nectriella* Nitschke was said to be typified by *N. fuckelii* Nitschke by Seaver (1909: 45) and this has been accepted by most later workers (Weese, 1914: 128; Clements & Shear, 1931: 281; Rogerson, 1971: 895). However, Müller & von Arx (1962: 621) lectotypified the name by *N. robergei* (Mont. & Desm.) Weese (syn. *N. carnea* Fuckel). The typification of the genus was considered in detail by Arnold (1967: 251) and she concluded that the most appropriate interpretation was to consider *N. fuckelii* as the holotype of the generic name. Müller (*in* Arnold, 1967: 252) indicated that *N. robergei* had been selected in place of *N. fuckelii* only because no type material of the latter had been located. It seems possible that the lichen-inhabiting *Nectriella* species, and also the algicolous *N. laminariae* O. Eriksson (Eriksson, 1964), form a coherent group distinguishable from superficial *Nectria* species by the prosenchymatous walls of the perithecia, as well as by their method of origin within the host tissue and perhaps the type of anamorph (*Illosporium* Fr. in *Nectriella robergei;* see Hawksworth, 1979: 231-238). In the absence of material of *N. fuckelii* I have not been able to compare its wall structure with that of the lichenicolous taxa, and so cannot conclusively state whether these taxa are correctly place in that genus. *Pronectria* Clem. is also available for this group.

Notwithstanding these uncertainties as regards the generic disposition, this paper describes an additional species of *Nectriella* from a *Peltigera* and provides a key to the lichenicolous species now referred hesitatingly to that genus.

Nectriella ornamentata D. Hawksw. sp. nov. (Figs 1A-H, 2A)

Perithecia immersa sed erumpescentia, dispersa, singularia, obpyriformia ad subglobosa, aurantiaco-rubra vel sanguinea, 300-325 × 250-280 μm, glabra; muri prosenchymatici, ex hyphis irregularibus et crassis compositi. Asci cylindrici, 70-90 × 7-12 μm, 4-spori ubi maturi. Ascosporae elongato-ellipsoideae, hyalinae, 1-septatae, ornamentatae, cum tuberculis hyalinis 2.5 μm latis, (19-)25-31(-33) × 7-9(-10) μm.

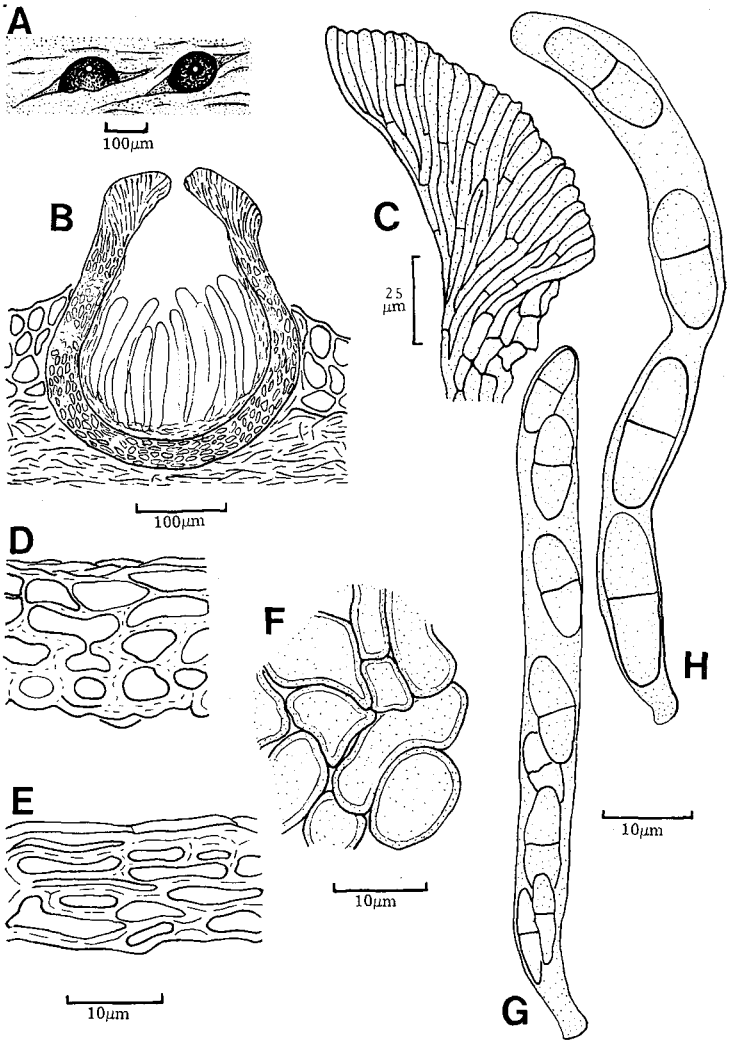

Fig. 1. *Nectriella ornamentata* (IMI 247733 — holotype). A, Perithecia erupting through the upper cortex of the host; B, vertical section of a perithecium; C, vertical section of the upper part of the perithecial wall adjacent to the ostiole showing the parallel arrangement of the hyphae; D-E, vertical sections through lower parts of the perithecial wall showing the prosenchymatous structure and variation in the shape of the cells; F, surface view of cells from the emerged part of the perithecial wall; G, young ascus in which eight spore initials have been produced; H, young ascus at a later stage in which only four spores are evident.

Typus: Islandia, Jokuldalur, in thallo *Peltigerae,* 26.vi.1970, *P.B. Topham* (IMI 247733 — holotypus).

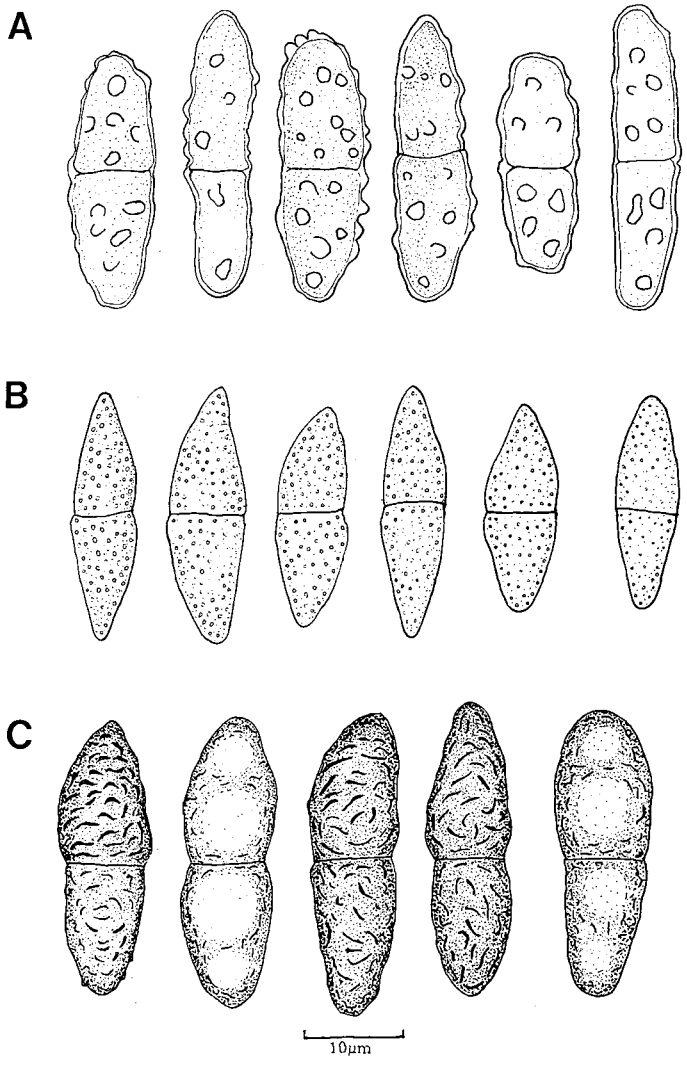

Fig. 2. A, *Nectriella ornamentata* ascospores (IMI 247733 — holotype); B, *Nectria lichenophila* ascospores (LPS 1.587 — holotype); C, *Polycoccum crassum* ascospores (hb. Vězda — holotype).

Perithecia scattered, arising singly, immersed at first, arising below the cortex of the host but becoming erumpent, breaking through the upper cortex when mature, to about one third exposed at maturity, obpyriform to subglobose, orange-red to almost blood red, translucent, shiny, glabrous, the exposed part mainly 100-125 µm when viewed from above, in vertical section 300-325 × 250-280 µm; ostiole

slightly depressed, not papillate, 20-30 μm wide, periphyses not seen; peridium prosenchymatous, mainly composed of thick-walled hyphal cells, mainly 15-25 μm thick but to 40 μm near the ostiole, individual cells with walls to 2 μm thick, cells very irregular in shape, sometimes strongly radially compressed, 7-17 × 2.5-3.5 μm, when uncompressed with lumina 4-6 μm wide, in surface view almost pseudoparenchymatous in parts with irregularly shaped cells 8-15 μm diam, hyphae splaying out and almost parallel around the ostiole where they form a dense tissue of thick-walled hyphae each 2-3 μm thick, wall yellowish to yellowish-green in thin section, turning purplish with potassium hydroxide. *Paraphyses* absent, at least in mature ascomata. *Asci* arising from the base of the perithecial cavity, numerous, cylindrical, short-stalked, unitunicate, without any apical thickening or annulus, 70-90 × 7-12 μm, 8 spore initials are produced at first but some become re-absorbed so that the asci are consistently 4-spored at maturity. *Ascospores* ± uniseriately arranged in the asci when mature, elongate-ellipsoid, rounded at the ends, 1-septate, not or very slightly constricted at the septum, cells mainly equal in length but the lower tending to be slightly longer and narrower, hyaline, occasionally becoming tinged with brown after release from the asci, walls uneven, ornamented with conspicuous hyaline irregularly shaped tubercles, tubercles to about 2.5 μm wide, (19-)25-31(-33) × 7-9(-10) μm. *Anamorph* unknown.

Nectriella ornamentata is only known from the holotype collected in Iceland. The infected parts of the *Peltigera* thallus appear to be dead; the upper cortex is discoloured and whitish. Whether this fungus is a pathogen and responsible for the death of the host tissue or whether it is an opportunistic saprophyte is unclear on the basis of the single collection available.

Comparison with Similar Species

This new species is clearly separated from all the lichenicolous species so far referred to *Nectriella* on the basis of the massively ornamented spores and the asci being 4-spored at maturity.

Nectriella ornamentata was also compared with *Nectria lichenophila* Speg. (Spegazzini, 1889; 528; syn. *N. spegazzinii* Vouaux) which was described from thalli of *Heterodermia* cf. *podocarpa* (Bél.) Awasthi

collected in Brazil (Apiaphy, invierno, 1881, *J. Puiggari,* LPS 1.587 — holotype!). *N. lichenophila* recalls the new species in having 4-spored asci and 1-septate ascospores 22-28 × 6.5-8 μm but in Spegazzini's fungus the ascospores are strongly attenuated at both ends so that they appear almost bifusiform; in addition the ascospores have a distinct minutely verrucose ornamentation which is quite remote from that of *Nectriella ornamentata* (Fig. 2B). *Nectria lichenophila* has entirely superficial orange perithecia 200-300 μm diam, white tomentose with thick-walled uneven hairs 3-5 μm thick; this fungus is consequently appropriately retained in *Nectria* s. lat.

Type material of *Polycoccum crassum* Vězda (1970) was also studied as that fungus also has 4-spored asci and 1-septate ascospores (26-)28-32(-35) × (8-)9-10.5 μm (Czechoslovakia, Tatra Magna, Belanské Tatry, Jelení hřbet pr. Skalná vráta, alt. 1600 m, on *Peltigera lepidophora,* July 1963, *A. Vězda,* hb. Vězda — holotype!). This fungus proved to be correctly placed in *Polycoccum* Sauter ex Körber. It has black carbonaceous ascomata, 300-400 μm diam, with cellular walls, and which include true bitunicate asci and persistent branched and anastomosing cellular pseudoparaphyses 2-2.5 μm wide. The ascospores of *P. crassum* become dark brown prior to discharge from the asci, and have rugulose walls and not tuberculate ornamentation (Fig. 2C).

Key to the Lichenicolous Species of Nectriella

1 Ascospores smooth-walled; asci 8-spored at maturity.....2
Ascospores with coarsely tuberculate walls; asci 4-spored at maturity; on *Peltigera*.....*Nectriella ornamentata* D. Hawksw.

2(1) Ascospores mainly exceeding 20 μm in length.....3
Ascospores not exceeding 20 μm in length.....4

3(2) Ascospores (18-)20-26(-28) × (5-)6-7(-8) μm; on *Peltigera*
.....*Nectriella erythrinella* (Nyl.) Weese
Ascospores 22-28(-33) × 3.5-4(-4.5) μm; on *Peltigera*
.....*Nectriella tenuispora* D. Hawksw.

4(2) Ascospores not exceeding 7 μm in width.....5
Ascospores 15-16 × 8 μm; on *Collema*.....*Nectriella tenacis* (Vouaux) Weese

5(4) Perithecia brownish red to orange; ascospores (11-)12-15(-17) × (4-)4.5-7 μm; anamorph *Illosporium carneum* Fr.; on *Peltigera*
.....*Nectriella robergei* (Mont. & Desm.) Weese
Perithecia deep red; ascospores (10-)11-14(-15) × 4.5-6(-7) μm; anamorph absent (? always); on *Anaptychia*.....*Nectriella tincta* (Fuckel) R. Sant.

Nectriella tincta is compared with *N. laminariae* by Eriksson (1964). The ascospores of *N. erythrinella, N. robergei* and *N. tenuispora* are illustrated and compared by Hawksworth (1978). *N. tenacis* is a somewhat dubious taxon of which I have not seen authentic material.

Fungi with 4-spored Asci on Peltigera

The discovery of a further pyrenomycete with 4-spored asci on *Peltigera* brings the number showing this feature on that host to six, viz. *Actinopeltis peltigericola* D. Hawksw., *Dacampiosphaeria rivana* (de Not.) D. Hawksw., *Lasiosphaeriopsis salisburyi* D. Hawksw. & Sivanesan (also 2-spored), *Nectriella ornamentata* D. Hawksw., *Paranectria superba* D. Hawksw. and *Polycoccum crassum* Vězda. In addition the genus supports one species with consistently 2-spored asci, *Norrlinia peltigericola* (Nyl.) Theissen & Sydow. For further information on these species see Hawksworth (1980, 1982).

It appears that there is a strong selective pressure for pyrenomycetes on *Peltigera* to produce 2- or 4-spored asci and large ascospores. Hawksworth (1980) suggested that this was as large spores contain a greater amount of reserve nutrient material and increased potential for genetic variation (when multi-nucleate); these features can be viewed as adaptations to a mode of life where contact with a new host thallus is only rarely going to be possible.

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