

Taphrophila (Dothideales: Tubeufiaceae) and two species of *Tubeufia* with dark setae

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The genus *Taphrophila* is placed in the Tubeufiaceae (Dothideales). The *Mirandina* anamorph of the type species, *T. cornu-capreoli*, has been obtained in single ascospore culture. It has also been found together with the teleomorph on *Carex acutiformis* in Devon. *T. argyllensis* sp. nov. is described from Argyll, Scotland, on rotting leaves of *Deschampsia caespitosa*. 'Ophiobolus' *trichellus* has been re-found on *Ammophila arenaria*, and is now named *Tubeufia trichella*. *Tubeufia hebridensis* sp. nov., which has been published as 'Ophiobolus cf. *trichellus*' by Dennis (1980), is described. A key to the species treated and to other *Tubeufia* species with dark brown setae is provided.

When Scheuer (1988) described the monotypic genus *Taphrophila*, it was tentatively placed in the Herpotrichiellaceae. This disposition was not discussed further because it was based on a superficial similarity to *Acanthostigmella genuflexa* Höhn. (cf. Barr, 1978; Ellis & Ellis, 1985, 507 and fig. 1990) and to some species of *Capronia* Sacc. There is now enough evidence to place *Taphrophila* in the Tubeufiaceae. The presence of typical, attached pseudoparaphyses has been confirmed. Such pseudoparaphyses are apparently absent in the Herpotrichiellaceae, as Janex-Favre (1988) has shown in an ontogenetic study of *Dictyotrichiella semi-immersa* Candousseau & Sulmont (cf. also Müller *et al.*, 1987). Because the genus *Tubeufia* Penzig & Sacc. *sensu* Barr (1980) also comprises species with brownish pseudothecia and very dark brown setae in sect. *Acanthostigmina* (Höhn.) Barr, *Taphrophila* could accordingly be placed as a *sectio* within *Tubeufia*. Here it is kept separate because of its distinctive, dichotomous setae and the very thin peridium. The non-helicosporous *Mirandina* anamorph of *T. cornu-capreoli* may provide another good argument for retaining *Taphrophila* as distinct from *Tubeufia* (cf. Barr, 1980, 137f.).

***Taphrophila cornu-capreoli* Scheuer, *Bibl. Mycol.* 123: 172 (1988)** (Figs 1–2)

Pseudothecia unilocular, superficial, light brown, \pm spherical, ca 40–60 μm diam. Peridium consisting of two layers of flattened cells, the inner hyaline, the outer with yellowish-brown, slightly thickened cell walls; individual cells ca 6–10 \times 2.5–4 μm . In its upper half the peridium bears dark brown, unicellular, thick-walled, dichotomously branching setae with pointed ends. The ostiolar pore is lined with scant, hyaline, broadly rounded periphysis-like cells. *Pseudoparaphyses*

present in mature fruitbodies but mostly very scant. *Asci* ellipsoid to oval, 28–40 \times 10–12 μm . *Ascospores* hyaline, usually 5-septate, symmetric-fusiform, 21–30 \times (2.2–) 2.5–3 (–3.6) μm , guttulate.

Culture: On malt extract agar single-ascospore cultures grow very slowly, only ca 2 mm wk⁻¹. The mycelium is dark olive-brown, almost without any aerial mycelium, except for the central part where it is very dense and velvet-like. On oat agar slopes the colonies grow slightly faster and after some weeks in a cool cabinet with near-uv light at 10 °C the anamorph develops. On malt extract agar the formation of the anamorph can be stimulated by cutting the colony into pieces and incubating them half immersed in sterile water under the same conditions.

Anamorph: The conidia are formed on hyphal ends or branches which often continue growth after conidia have developed. Conidia are formed singly or densely grouped on easily distinguished denticles that leave a slightly flattened scar on the conidium. Conidia hyaline or very pale olivaceous, needle-shaped, broadest below the middle, ca 50–95 (–100) \times 3–4.3 μm , (6–) 8–11– (13–) septate, guttulate, somewhat flexuous.

Only on one occasion (14 Jan. 1989) has this anamorph been collected on the natural substratum. According to the season and to the stage of decay of the *Carex* leaves, there are almost no pseudothecia in this specimen. The mycelium proved to be intramatrical as well as superficial. The conidia are usually hypogenous, formed either \pm singly on denticles on the creeping superficial hyphae or in small clusters on short conidiophores of rather irregular shape (Fig. 2). Conidiophores seem to be formed mainly around the stomata through which the hyphae pass.

Dr B. C. Sutton (pers. comm.) has suggested that this anamorph belongs to the form genus *Mirandina* Arn. ex Mats., which has recently been treated as a *sectio* of *Dactylaria*

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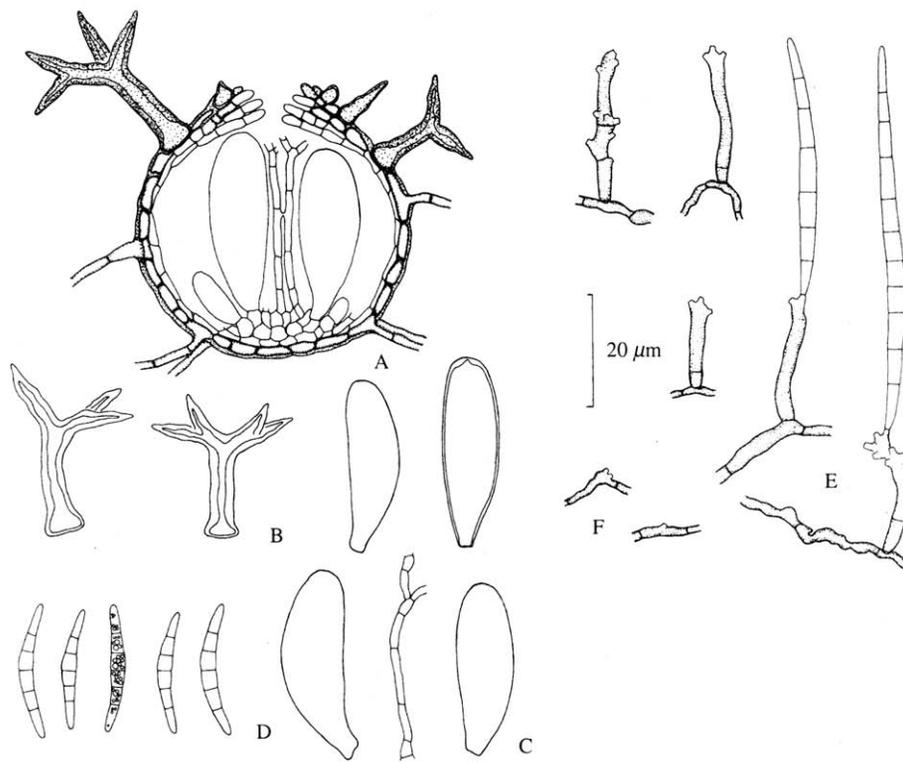


Fig. 1. *Taphrophila cornu-capreoli* on natural substrata. A, Pseudothecium in median section; B, Setae; C, Asci and pseudoparaphysis; D, Ascospores; E, Conidiophores of *Mirandina* anamorph with conidia and denticles; F, Denticles on creeping hyphae. (A–D, Holotype. E, F. 14 Jan. 1989).

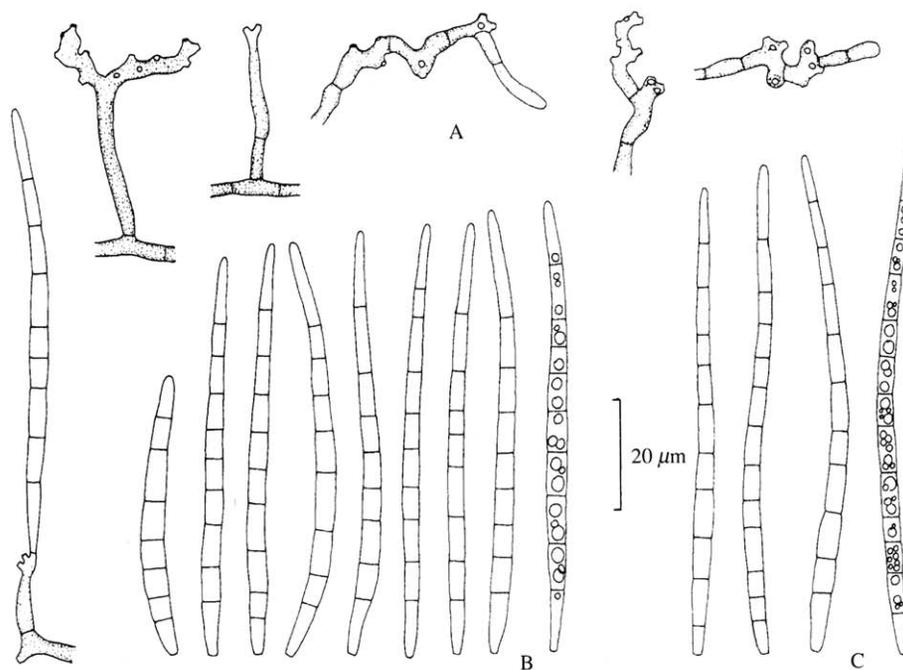


Fig. 2. *Mirandina* anamorph of *Taphrophila cornu-capreoli* in culture. A, Conidiophores and creeping hyphae with denticles; B, Conidia from culture on oat agar; C, Conidia from culture on malt extract agar. (all 4 Aug. 1988).

Sacc. by De Hoog (1985, 26ff). According to De Hoog's drawings, it resembles *M. breviphora* Mats. and *Dactylaria congregata* De Hoog. Culture characters of the *Mirandina* species treated by De Hoog also seem to agree with the anamorph of *T. cornu-capreoli*: the mycelia are dark-coloured,

often with an olivaceous tint, with little aerial mycelium and similarly slow growth.

Specimens examined: On *Carex acutiformis* Ehrh., Exminster Marshes, Exeter, Devon, SX 955 883, 4 Aug. 1988, Ch. Scheuer (GZU; EXR, HME 4355; IMI 334 247); 13 Nov. 1988, Ch. Scheuer (GZU); 14

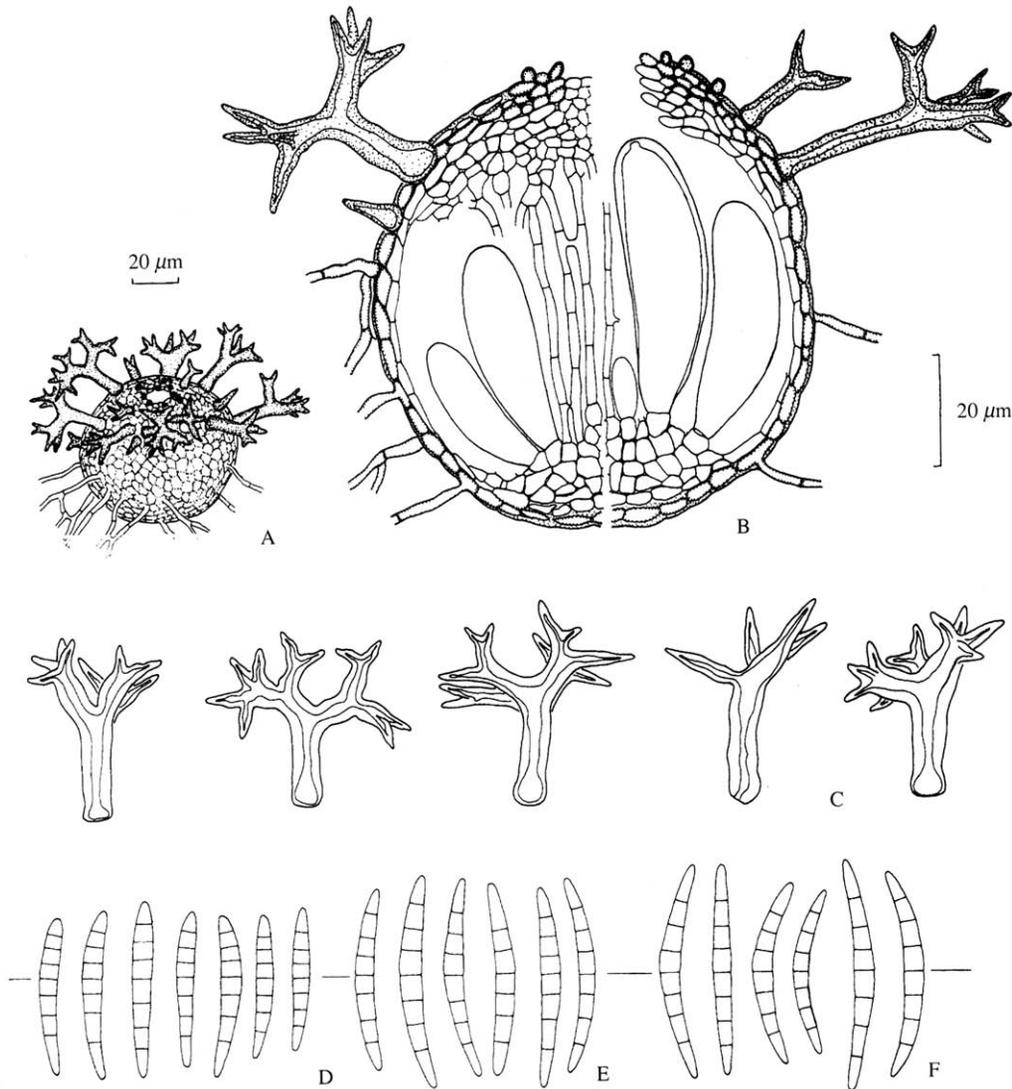


Fig. 3. *Taphrophila argyllensis*. A, Habit of pseudothecium; B, Pseudothecium in median section, left half with the ostiole still closed; C, setae; D, Small, clavate-fusiform ascospores, apparently from young pseudothecia; E, Ascospores with the fourth septum slightly above the middle; F, Symmetric-fusiform ascospores with the fourth septum mostly in the middle. (A–D. Isotype, GZU. E, F. Topotype, GZU).

Jan. 1989, Ch. Scheuer (mainly the anamorph; GZU; IMI 342 131); on *Carex paniculata* L., valley of the river Pöls, 2 km S of St. Johann am Tauern, Triebener Tauern, Styria, Austria, 12 Aug. 1984, Ch. Scheuer (Holotypus, GZU).

In a recent paper (Scheuer, 1989) *T. cornu-capreoli* has been recorded as new to Britain. The culture experiments have been carried out with samples from the same locality in Devon (see above).

Taphrophila argyllensis Scheuer, Spooner & Wilberforce, sp. nov. (Fig. 3)

Mycelium circum ascomata sparsum, superficiale, hyphis fuscis, ca 1.5–2 µm latis compositum. *Pseudothecia* unilocularia, superficialia, globosa, 40–80 µm diam., luteo-brunnea, circum verticem appendicibus atrofuscis, dichotome ramificantibus, unicellularibus, parietibus crassis, ad ca 40 µm longis ornata. Appendices basi vix inflata, 'stipite' patulo simplicique, et pluris ramis dichotomis extremis acutis compositi sunt. Canalis ostioli cellulis brevissimis hyalinis, periphysiformibus vestitus est. *Peridium* in parte laterali duobus stratis cellularum applanatarum compositum: Stratum internum hyalinum, stratum externum cellulis 5–7 × 2–3 µm magnis compositum, pariet-

ibus luteo-brunneis, paulum incrassatis. *Pseudoparaphyses* in loculo maturo sparsissimae, in loculo paulum immaturo, praesertim in 'fasciculo' centrali sub ostiolo, plus conspicuae sunt. *Asci* bitunicati (fissitunicati), ellipsoides ad ovales, 35–50 × 11–14 µm, octospori. *Ascospores* inasco fasciculatae vel obliquae, hyalinae, plerumque 7-septatae, anguste fusoides vel fusoideo-clavatae, leviter curvatae, (23–) 25–40 (–41) × 3–4 µm; breviores praesertim fusoideo-clavatae.

A specie similima, *T. cornu-capreoli*, praesertim ascosporis 7-septatis et appendicibus ramosioribus differt, et in omni parte maior est.

Typus hab. in foliis putrescentibus *Deschampsiae caespitosae* (L.) P. B., in loco 'Clach-a-Mhuilinn' dicto, Crannag-a-Mhinisteir, Oban, Argyll, Scotia occidentalis, 9 Aug. 1988, P. Wilberforce (Holotypus K, Isotypus GZU, 6 Topotypi K, 1 Topotypus GZU).

Mycelium around the pseudothecia superficial, sparse, light brown, individual hyphae 1.5–2 µm wide, sometimes bundled to form thin strands. *Pseudothecia* unilocular, superficial, globose, ca 40–80 µm diam., yellow-brown, with a fringe of dark brown, unicellular setae around the ostiolar region. Setae up to ca 40 µm long, consisting of a slight basal node, a

straight, unbranched stalk \pm at right angles to the surface of the peridium, and a dichotomously branched distal part with acute tips. Ostiolar channel sparsely lined with very short, hyaline periphysis-like cells. *Peridium* consisting of two (occasionally three) layers of flattened cells, the outer one yellow-brown, with slightly thickened cell walls, individual cells $5\text{--}7 \times 2\text{--}3 \mu\text{m}$, the inner one hyaline, with very thin cell walls. *Pseudoparaphyses* very scanty in mature loculi, but in slightly immature loculi, when the ostiolar channel is still closed, pseudoparaphyses can be observed without difficulty, especially in the centre of the loculus, right below the small polygonal cells that fill the ostiolar channel. *Asci* bitunicate (fissitunicate), ellipsoid to oval, $35\text{--}50 \times 11\text{--}14 \mu\text{m}$, 8-spored. *Ascospores* arranged obliquely or in a fascicle, hyaline, narrowly symmetric-fusiform or clavate-fusiform, usually slightly curved, with ends tapered but rounded, $(23\text{--})25\text{--}40$ (-41) $\times 3\text{--}4 \mu\text{m}$, usually 7-septate. The shorter ascospores (up to *ca* $28\text{--}30 \mu\text{m}$) are mostly clavate, with the 4th septum suprmedian. In the larger ascospores the 4th septum may be both suprmedian or median, or even slightly submedian.

Specimens examined: On rotting leaves of *Deschampsia caespitosa* (L.) P. B., all from Argyll, Western Scotland: Clach-a-Mhuilinn, Oban, 9 Aug. 1988, P. Wilberforce (Holotype K, Isotype GZU); 20 Aug. 1989 (Topotype GZU); 26 June 1987, 27 June 1987, 24 Mar. 1988, 12 Aug. 1988 (Topotypes Herb. P. Wilberforce); 7 June 1988, 5 July 1988 (Topotypes K); Barcaldine, Glen Salach, 3 July 1988; Glen Nant, National Nature Reserve, Taynuilt, 26 June 1987, 30 Mar. 1988, 15 July 1988; Druim Mor, Oban, 16 Aug. 1988; South End of Loch Seil, 24 Feb. 1988.

Taphrophila argyllensis differs from *T. cornu-capreoli* in being larger in all dimensions and in having 7-septate instead of 5-septate ascospores. The considerable variation which it exhibits in spore size and proportions (Fig. 3D–F) is not unusual within the Tubeufiaceae, cf. Barr (1980) and Nogrsek (1990). In this family the septa seem to be laid down at a rather early stage of development, when asci and spores are rather small and the ostiolar pore is still firmly closed. Consequently, the stage of development cannot be judged from ascospore septation only (cf. Fig. 4C, ascospores of *Tubeufia trichella*). For the time being, these differences in spore symmetry and spore proportions between individual fruit bodies can only be accepted as variation within the species. No further differences to suggest that more than one taxon is involved have yet been observed.

Tubeufia trichella (Sacc., Bomm. & Rouss.) Scheuer, comb. nov. (Fig. 4)

Ophiobolus trichellus Sacc., Bomm. & Rouss. in Bommer & Rousseau, *Bull. soc. r. bot. Belg.* **29**: 259 (1890). Later cited erroneously as '*O. trichellus* Bomm., Rouss. & Sacc.' in Sacc., *Syll. Fung.* **9**: 934 (1891).

Ophiochaeta trichella (Sacc., Bomm. & Rouss.) Sacc., *Syll. Fung.* **11**: 352 (1895).

Pseudothecia scattered or gregarious, usually epiphyllous, superficial, occasionally abundant on the detritus-rich portion above the leaf sheath, brown, globose, up to *ca* $100 \mu\text{m}$ diam., with a rather variable fringe of dark brown, simple or \pm irregularly branched setae. These setae measure *ca* $20\text{--}40$ (-47) μm in length, and are thick-walled and slightly torulose,

tapering to a slightly rounded or \pm acute tip. The ostiolar channel is lined with short, hyaline, periphysis-like cells. *Peridium* composed of 3–5 layers of slightly flattened cells, cell walls of the outer 2–3 layers slightly thickened, (yellow–) brown, individual cells *ca* $4\text{--}8 \times 2.5\text{--}4 \mu\text{m}$ in longitudinal section, cell walls of the inner layers thin, hyaline. *Pseudoparaphyses* present in mature loculi, *ca* $1.5\text{--}2 \mu\text{m}$ thick. *Asci* \pm cylindrical, $(45\text{--})50\text{--}70$ (-75) $\times (10\text{--})12\text{--}14$ (-15) μm , 8-spored. *Ascospores* hyaline, flexuous, cylindric-filiform, $(40\text{--})55\text{--}65$ (-70) $\times 2.4\text{--}2.8$ (-3) μm , $(10\text{--})12\text{--}14$ (-15) septate, with small guttules. Before the ascus expands at maturity the ascospores are usually coiled in the ascus.

Culture: On malt extract agar and oat agar the colonies are dark olive brown. They grow even more slowly than those of *Taphr. cornu-capreoli*, and have a thicker, velvet-like, greyish aerial mycelium.

Specimens examined: On decaying leaves of *Ammophila arenaria* (L.) Link, Isles of Scilly, St Mary's, Bar Point, 28 Sep. 1988, Ch. Scheuer; Isles of Scilly, St Martin's, Great Bay, 26 Sep. 1988; Braunton Burrows, Barnstaple, Devon, 5 Aug. 1988; 22 Nov. 1988; Dawlish Warren, Exeter, Devon, 9 Oct. 1988; 7 Nov. 1988; 5 Dec. 1988; 6 Jan. 1989 (all GZU).

The type specimen of *O. trichellus* (on *Ammophila arenaria*. Knocke, Belgium, Aout 1890, leg. M. Rousseau) from Herb. BR does not contain any fruit bodies of this fungus. The original description, however, matches the specimens from Devon perfectly, better than the fungus from the island of St Kilda published by Dennis (1980, see below) as '*O. cf. trichellus*'. It remains to be investigated whether further type material survives amongst Saccardo's collection in Herb. PAD, because otherwise a neotypification will be necessary.

An unusual form of *T. trichella* has been found on a related host, *Calamagrostis epigejos* (L.) Roth (steep slopes with coastal limestone rocks, Branscombe, E of Sidmouth, Devon, 14 Feb. 1989, J. Webster; GZU). On this host the pseudothecia are superficial to almost completely immersed in rather soft, decayed leaf sheaths and leaves. The setae of the immersed fruit bodies are of course reduced to a few remnants around the ostiole. Probably similar collections have previously been placed in *Cochliobolus* Drechsler. All the other characters agree with the description given above.

Tubeufia hebridensis Dennis, sp. nov.

(figs see Dennis, 1980, 744 as *Ophiobolus cf. trichellus*)

Pseudothecia unilocularia, superficialia, dispersa, macroscopice brunneo-atra, ovoidea, *ca* $60\text{--}100 \mu\text{m}$ diam., in parte superiore setis unicellularibus, atrofusci, erectis, sensim attenuatis, acutis, haud torulosi, *ca* $70\text{--}110 \times 8 \mu\text{m}$ magnis ornata. *Peridium* paucis stratis cellularum applanatarum parietibus tenuibus brunneisque compositum. *Asci* bitunicati (fissitunicati), \pm cylindrici, *ca* $100 \times 11 \mu\text{m}$, octospori. *Ascospores* in asco fasciculatae, \pm hyalinae, rectae, anguste cylindraceo-fusiformes extremis paulum rotundatis, $55\text{--}65 \times 3 \mu\text{m}$, $(5\text{--})7\text{--}9$ -septatae, multiguttulatae.

Holotypus hab. in foliis putridis *Molinia caeruleae* (L.) Moench, in insula 'Hirta', in insulis 'St Kilda' dictis, in vicinitate occidentali insularum 'Outer Hebrides', Scotia, Sep. 1978, R. W. G. Dennis (K).

Pseudothecia unilocular, superficial, scattered, blackish brown,

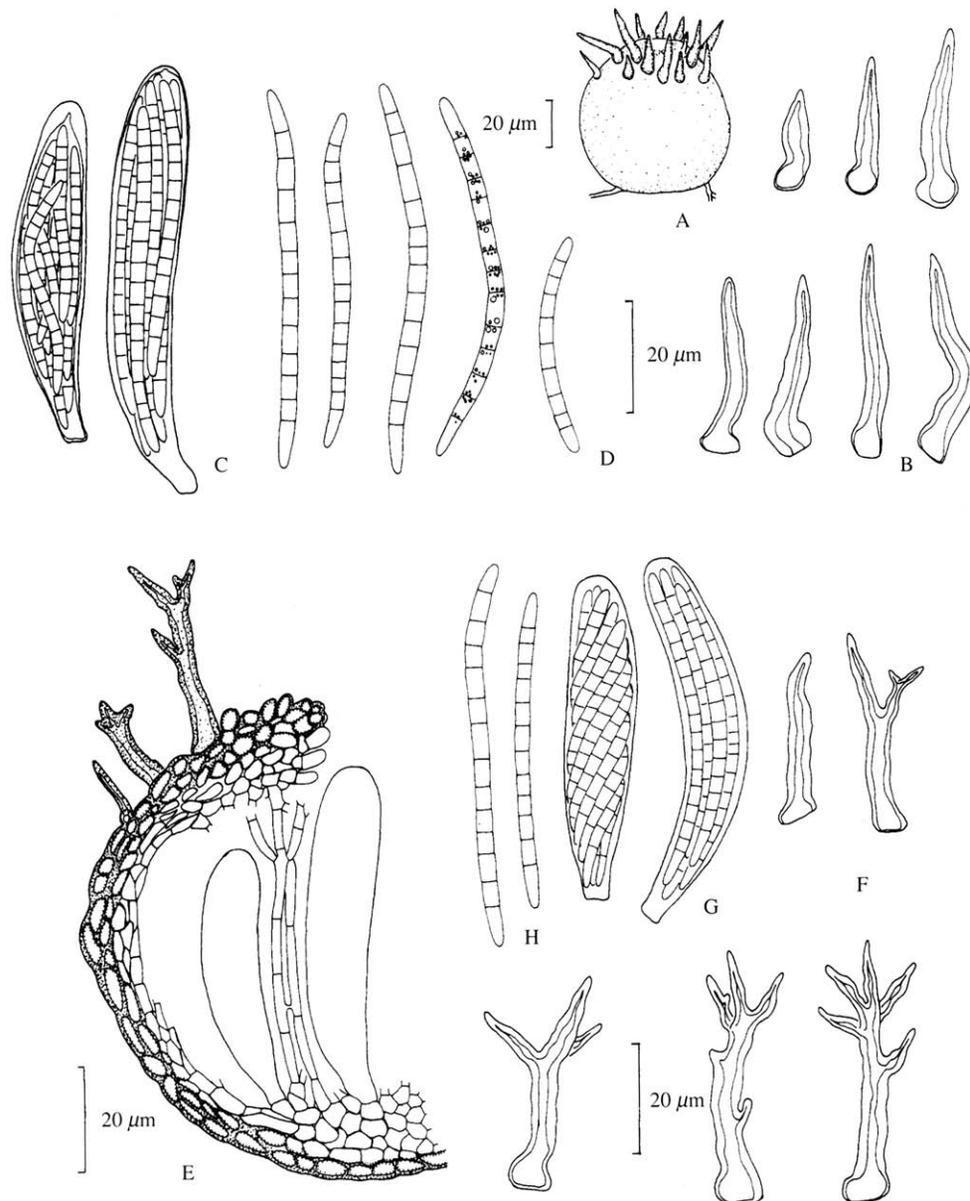


Fig. 4. *Tubeufia trichella*. A, Schematic habit of a rather small pseudothecium with simple setae; B, Simple setae; C, Asci; D, Ascospores; E, Relatively large pseudothecium with branched setae in longitudinal section; F, Branched setae and a simple seta from the same pseudothecium; G, Asci, the left one fully mature, but not yet expanded; H, Ascospores. (A–D. 4 Aug. 1988. E. 9 Oct. 1988. F–H. 6 Jan. 1989).

ovoid or conical, 60–100 μm diam., bearing over the upper part erect, stiff, very dark brown setae. They measure ca 70–110 \times 8 μm and are unicellular, thick-walled, smoothly tapering, not torulose, and sharply pointed. *Peridium* consisting of a few layers of slightly flattened cells with rather thin, brown walls. *Asci* bitunicate (fissitunicate), \pm cylindrical, ca 100 \times 11 μm , 8-spored. *Ascospores* arranged in a fascicle, \pm hyaline, narrowly cylindrical-fusiform with slightly rounded ends, 55–65 \times 3 μm , (5–) 7–9-septate, multiguttulate.

This species has already been briefly described and figured by Dennis (1980, 743f, 1983, 26f) under the name '*Ophiobolus* cf. *trichellus*'. Indeed the fungus matches the original description of this species rather well, but the ascospores and the setae differ quite considerably from those of *T. trichella* on *Ammophila*. The type specimen of *T. hebridensis* is scanty, but

as the 'genuine' *O. trichellus* has apparently been refound on its typical substratum, the species on *Molinia* that has been mistaken for *O. trichellus* needs a separate name.

Acanthophiobolus helicosporus (Berk. & Br.) John Walker resembles *T. trichella* and *T. hebridensis* only superficially. However, the diagnostic characters of *A. helicosporus* are included in the key below, because both *T. trichella* and *T. hebridensis* may key in *Acanthophiobolus* rather than *Tubeufia sensu* Barr (1980) in the current identification handbooks (Prof. E. Müller, ETH Zürich, pers. comm.).

Thanks are due to Prof. John Webster (University of Exeter) for critically reading a first draft of the manuscript and to my colleagues in Graz for their kind help with the word processing program of our computer.

Key to *Acanthophiobolus helicosporus*, *Taphrophila* spp., and *Tubeufia* spp. with dark brown setae:

- 1 Setae branched 6
 1 Setae unbranched 2
 2 Setae very long, up to 280 µm, septate. Pseudothecia 150–300 µm diam., greyish-brown. Pseudoparaphyses very numerous. Asci very numerous, narrowly cylindrical, 110–170 × 6.5–8 µm. Ascospores thinly filiform, coiled in the ascus, 1.5–2 µm thick, hyaline, multiseptate. On broad-leaved *Carex* spp. and many other plants in damp places, preferably on monocotyledons (Walker, 1972, 444ff and Figs 21–25, 1980, 3ff). *Acanthophiobolus helicosporus* (Berk. & Br.) John Walker
 2 Not with this combination of characters, setae usually without septa 3
 3 On *Dryas* wood or bark. Pseudothecia 160–280 µm diam., peridium reddish-brown, 12–20 µm thick. Setae up to 20 µm long, pointed. Asci 61–85 × 12–17 µm. Ascospores clavate-fusiform to almost cylindrical, with a pointed lower end, 36–50 × 3–4 µm, 4–6-septate (Nogrsek 1990, 221ff). *Tubeufia alpina* L. Holm & Nogrsek
 3 Over old ascomycete stromata or on rotting wood 5
 3 On grasses 4
 4 Ascospores (10–) 12–14– (15–) septate, cylindric-filiform, flexuous, (40–) 55–65 (–70) × 2.4–2.8 (–3) µm. On *Ammophila arenaria* *Tubeufia trichella*
 4 Ascospores (5–) 7–9-septate, narrowly cylindric-fusiform, ± straight, 55–65 × 3 µm. On *Molinia caerulea* *Tubeufia hebridensis*
 5 Ascospores (19–) 32–45 (–54) × (2.5–) 3.5–5.5 (–6) µm, narrowly fusiform, often curved or bent, hyaline to light yellowish-brown, (2–) 5–7– (11–) septate. Pseudothecia 90–180 (–240) µm diam., in a thin brown subiculum. Peridium bright brown with a vinaceous tinge. Setae pointed, (10–) 30–90 (–104) × 4.5–6 (–7.5) µm. Asci 50–90 (–100) × (11–) 13–20 µm. On rotting wood of deciduous trees, over old ascomycete stromata. Anamorph not known with certainty, most probably a hyphomycete with coiled conidia (Barr, 1980, 163). Syns *Acanthostigmia minutum* (Fckl) Höhn., *Acanthostigma nectrioideum* Penz. & Sacc. *Tubeufia clintonii* (Peck) Barr
 5 Ascospores (40–) 56–80 (–125) × (2–) 2.5–3.5 (–4.5) µm, narrowly fusiform, often bent or slightly curved, hyaline, (6–) 11–13-septate. Pseudothecia 165–280 (–385) µm diam., seated in a yellowish to olivaceous green turf of conidiophores that becomes dull brown with age. Peridium vinaceous brown, 27–32 µm thick. Setae pointed, 37–90 × 4.5–7.5 µm. Asci 67–100 (–130) × 11–15 (–22) µm. Conidiophores 390–600 µm long, producing conidia on lateral, inflated conidiogenous cells. Conidia coiled three times, coil 16–25 µm wide, cells 1–2.5 µm wide. Usually on decorticated coniferous wood (Barr, 1980, 164) *Tubeufia scopula* (Cooke & Peck) Barr
 6 Ascospores cylindric-filiform, (40–) 55–65 (–70) × 2.4–2.8 (–3) µm, (10–) 12–14– (15–) septate. On *Ammophila arenaria* and *Calamagrostis epigejos* *Tubeufia trichella*
 6 Ascospores symmetric-fusiform or clavate-fusiform 7
 7 Ascospores 5-septate, 21–30 × (2.2–) 2.5–3 (–3.6) µm, symmetric-fusiform. On larger *Carex* spp., occasionally accompanied by a *Mirandina* anamorph with very long, needle-shaped conidia 50–95 (–100) × 3–4.3 µm *Taphrophila cornu-capreoli*
 7 Ascospores 7-septate, (23–) 25–40 (–41) × 3–4 µm, clavate-fusiform to symmetric-fusiform. On *Deschampsia caespitosa* *Taphrophila argyllensis*

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