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Hyaloscyphaceae in Japan (6)**: the genus *Hyphodiscus* in Japan and its anamorph *Catenulifera* gen. nov.

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Abstract Three *Hyphodiscus* species are described and illustrated: *Hyphodiscus otanii* sp. nov., *Hyphodiscus hymeniophilus*, and *H. theiodeus*, which is new to Japan. Culture studies revealed *Phialophora*-like anamorphs. *Catenulifera* gen. nov. is proposed for the anamorph of *Hyphodiscus*. The history of the genus is reviewed. *Hyphodiscus* can be delimited to members with gelatinized excipulum, *Cistella*-like hairs with more coarse granulation, small asci, ascospores with conspicuous globules, cylindrical, flexuous paraphyses, and a *Catenulifera* anamorph.

Key words Discomycetes · Hyaloscyphaceae · *Hyphodiscus* · Japan · New species

Introduction

Since the establishment of the genus *Hyphodiscus* Kirschst. (Kirschstein 1907) based on *H. gregarius* Kirschst., the genus has remained monotypic for a long time. In the original sense, the genus was characterized by gelatinized excipulum and spherical ascospores. Zhuang (1988) found that *H. gregarius* was identical with *Lachnellula theiodea* (Cooke et Ellis) Sacc., which Korf (1962) had studied, regarding it as a deviating element in the genus *Lachnellula* P. Karsten. As the basionym of *L. theiodea* (*Peziza theiodea* Cooke et Ellis 1878) was published earlier than *H. gregarius*, a new combi-

nation, *H. theiodeus* (Cooke et Ellis) Zhuang, was proposed for the type of the genus (Zhuang 1988).

The genus remained monotypic until Baral (1993) expanded the generic delimitation to include two more species with nonspherical ascospores, *H. viridipilosus* (Graddon) Baral and *H. hymeniophilus* (P. Karsten) Baral. He synonymized the genus *Incrupilella* Svrček (Svrček 1986) with *Hyphodiscus*, because the type species, *I. flexipila* Svrček, was found to be conspecific with *H. viridipilosus* (Baral 1993).

Raitviir and Galán (1994) added another species, *H. gemmarum* (Boud.) Raitviir et Galán, by transferring *Pezizella gemmarum* (Boud.) Dennis (basion. *Helotium gemmarum* Boud.), whose taxonomic position had long been ambiguous. Thus, the genus includes at present four species.

Only one anamorph has been reported: *Phialophora rhodogena* (F. Mangenot) W. Gams for *H. hymeniophilus* (Helfer 1991).

In the course of studies of Japanese Hyaloscyphaceae, three *Hyphodiscus* species, including one new species and two new records for Japan, were found. Cultural studies revealed characteristic anamorphs for all these members. This article is concerned with the taxonomy of these materials.

The appropriate classification of *Hyphodiscus* has long been a matter of discussion. Eriksson and Hawksworth (1993) placed the genus in the Dermateaceae. Baral (1994) objected against this classification and suggested that the genus would “better be placed in the Hyaloscyphaceae.” A morphological similarity to *Lachnellula* P. Karsten was indicated by Korf (1962), Zhuang (1988), and Baral (1994), but the phylogenetic relationship remains uncertain (Korf 1962; Zhuang 1988). The ectal excipular structures of *Hyphodiscus* species are unusual for the Hyaloscyphaceae and are more reminiscent of the Helotiaceae. However, Verkley (1993, 1996) illustrated ultrastructural features of the asci which show that *H. gemmarum* should be included in Hyaloscyphaceae, rather than in the Helotiaceae. Here, I tentatively treat *Hyphodiscus* in the family Hyaloscyphaceae.

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Materials and methods

Methods for collection, single ascospore isolation, cultivation, and examination of apothecia followed Hosoya and Otani (1997). Miura's agar (1 g glucose, 1 g KH_2PO_4 , 0.2 g $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.2 g KCl, 2 g KNO_3 , 0.2 g yeast extract, 13 g agar, 1000 ml distilled water; pH adjusted to 6.5–7.0) was used as a supplement to induce conidial production and to observe conidia-producing structures. Cultures were incubated under dark condition at 23°C. Color names and codes followed Kornerup and Wanscher (1978).

Results

Catenulifera, a new anamorph for *Hyphodiscus*

The three species of *Hyphodiscus* collected in the present study showed characteristic *Phialophora*-like anamorphs with remarkably long collarettes and cuneiform-clavate conidia with truncate base borne in chains or droplets. The correlation of *P. rhodogena* with *H. hymeniophilus* was confirmed. The anamorphs of the two other species resembled that of *H. hymeniophilus* in the morphology of conidia, conidiogenous cells, and the mode of conidial production. These anamorphs were classified in section *Catenulatae* W. Gams of *Phialophora* (Gams and Holubová-Jechová 1976), which, however, is still heterogeneous (Gams 2000). The anamorphs of the two other species cannot be assigned to any *Phialophora* in the section *Catenulatae* and hence are regarded as new species.

The type species of *Phialophora* sect. *Catenulatae* is *Phialophora lasiosphaeriae* W. Gams, the anamorph of *Lasiosphaeria hirsuta* (Fr.) Ces. et De Not. (Lasiosphaeriaceae, pyrenomycetes) (Gams and Holubová-Jechová 1976). Inclusion of the discomycete anamorph *P. rhodogena* in the genus causes great heterogeneity of the genus (Gams 1995) when a section of an anamorphic genus has to include teleomorphic taxa differing beyond the familial rank. To keep the anamorphic genus as homogeneous as possible, the anamorphic species of *Hyphodiscus* should be excluded from *Phialophora* sect. *Catenulatae* and be included in another genus as suggested by Gams (2000). A new anamorphic genus, *Catenulifera*, is therefore proposed to include anamorphs of *Hyphodiscus*. The establishment of the genus entails a new combination for the type species.

Catenulifera Hosoya, gen. nov.

Coloniae hyalinae, rubidae vel brunneolae, tarde crescentes. Conidiophora solitaria, plerumque ad instar phialidum simplicium, adsunt, interdum paucicellularia, micronematica vel macronematica, mononematica. Phialides discretae vel integratae, cylindricae vel ampulliformes; collaria cylindrica vel cupulata, infundibuliformia vel expansa. Conidia plus minusve cuneata vel dacryoidea, ad basim truncata, aseptata, laeves, hyalina, catenulata vel capitulis aggregata.

Colonies hyaline, red or brown, growing slowly. Conidiophores arising solitarily from vegetative hyphae, appearing mostly as simple phialides or consisting of a stalk with 1–3 phialides, micronematicous or macronematicous, mononematicous. Phialides discrete or integrated, cylindrical to ampulliform; collarettes cylindrical to cup-shaped, funnel-shaped or flaring. Conidia more or less cuneate or dacryoid with a truncate base, aseptate, hyaline, arranged in chains or slimy droplets.

Species typica. ***Catenulifera rhodogena*** (F. Mangenot) Hosoya, comb. nov. (teleomorph: *Hyphodiscus hymeniophilus* (P. Karsten) Baral)

Scopulariopsis rhodogena F. Mangenot, Revue Gén. Bot. **59**:442, 1952 (basionym).

Phialophora rhodogena (F. Mangenot) W. Gams, Stud. Mycol. **13**:67, 1976.

Holotypus. Herb. CBS 335.53, ex decaying wood of *Betula* sp. (culture preserved under the same number, CBS 335.53).

Although the anamorphs of two other *Hyphodiscus* species were found to be undescribed species of *Catenulifera*, no anamorph binomials are required for them, so long as the teleomorph taxonomy is consistent.

Descriptions

1. *Hyphodiscus hymeniophilus* (P. Karsten) Baral, Z. Mykol. **59**:7, 1993. Figs. 1–3, 10

Peziza hymeniphila P. Karsten, Synopsis Peziz. et Ascobol. Fenn., p. 21, 1861.

Pseudohelotium hymeniophilum (P. Karsten) Sacc., Syll. Fung. **8**:303, 1889 (ut "*hymeniophyllum*").

Micropodia hymeniphila (P. Karsten) Boud., Hist. Classific. Discom. Europe, p. 128, 1907.

Helotium hymeniophilum (P. Karsten) P. Karsten, Not. Sällsk. Faun. Fl. Fenn. Förh. **11**:143, 1870.

Cistella hymeniphila (P. Karsten) Korf, Mycotaxon **14**:2, 1982.

Cistellina hymeniphila (P. Karsten) Svrček, Česká Mykol. **41**:202, 1987 (ut "*hymeniophylla*").

Peziza stericola Cooke, Grevillea **1**:130, 1873 (fide Dennis, 1956: 188).

Calloria stericola (Cooke) W. Phillips, Br. Discom., p. 328, 1887.

Trichopeziza stericola (Cooke) Sacc., Syll. Fung. **8**:424, 1889.

Dasyphypha stericola (Cooke) Masee, Br. Fung. Flora **4**:356, 1895.

Urceolella stericola (Cooke) Boud., Hist. Classific. Discom. Europe, p. 130, 1907.

Cistella stericola (Cooke) Dennis, Mycol. Pap. **32**:60, 1949.

Clavisdisculum stericola (Cooke) Raitviir, Scripta Mycol. **1**:79, 1970.

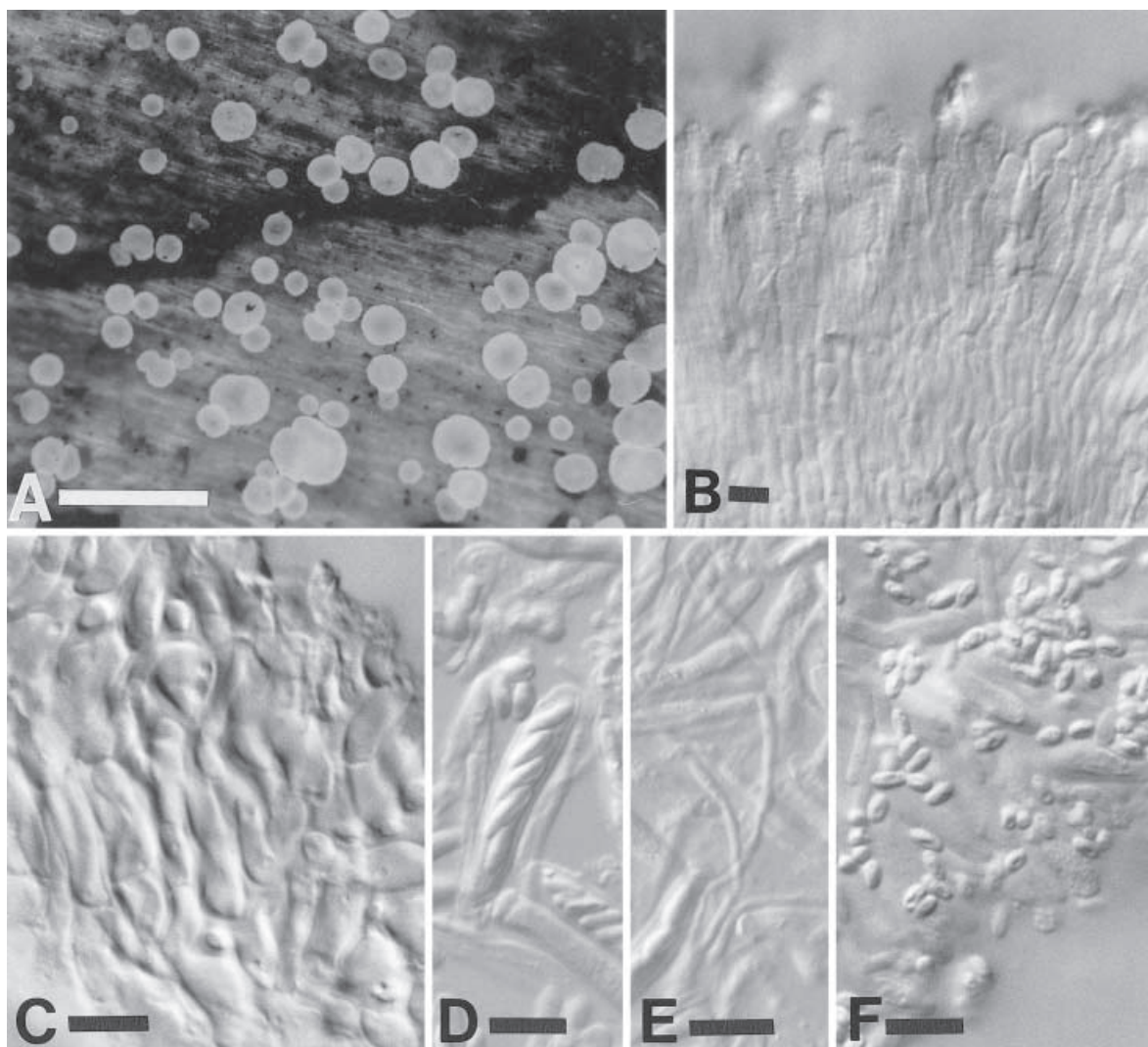


Fig. 1. *Hyphodiscus hymeniophilus* (A, TRL-825; B, C, F, TRL-454; D, E, TRL-698). **A** Fresh apothecia. **B** Hairs and ectal excipular cells at the margin. Note the short, coarsely granulate hairs. **C** Excipular cells

at the base. Note gelatinized walls. **D** Asci. **E** Paraphyses. **F** Ascospores. Note guttulae in some ascospores. **Bars** **A** 1 mm; **B–F** 10 μ m

Cistellina stereicola (Cooke) Raitviir, Scripta Mycol. **8**:157, 1978.

Durella polyporicola Svrček, Česká Mykol. **21**:146, 1967.

Tapesia atosanguinea Fuckel, Symb. Mycol., p. 303, 1870 (fide Höhnelt, 1918: 597).

Patellea pseudosanguinea Rehm, Rabenh. Kryptogamenfl., p. 284, 1889 (fide Höhnelt, 1918: 597).

Peziza sauciella P. Karsten, Not. Sällsk. Fauna Fl. Fenn. Förh. **10**:185, 1869.

Helotium saucellum (P. Karsten) P. Karsten, Not. Sällsk. Fauna Fl. Fenn. Förh. **11**:242, 1870.

Phialea sauciella (P. Karsten) Sacc., Syll. Fung. **8**:270, 1889.

Micropodia sauciella (P. Karsten) Boud., Hist. Classific. Discom. Europe, p. 128, 1907.

Cistella sauciella (P. Karsten) Nannf., Nova Acta Regiae Soc. Sci. Upsal. ser. 4, **8**:270, 1932.

Cistella rubescens Raschle, Nova Hedwigia **30**:664, 1978 (fide Helfer, 1991: 21).

Apothecia gregarious, sessile or arising from a point; disc shallow cupulate, mostly 200–300 μ m, up to 400 μ m diameter, pale orange (5A3) to light orange (5A4), finely pruinose when dry; margin slightly elevated, concolorous, occasionally paler; receptacle concolorous or often slightly paler, pruinose due to hairs. Ectal excipulum *textura prismatica*, composed of cells 7.5–16 \times 3–6.5 μ m, thin-walled, arranged almost perpendicular to the surface at the margin, becoming thicker-walled (up to 2 μ m), almost agglutinated, and more intricately toward the base. Hairs typically clavate, occasionally cylindrical with obtuse tip, up to 30 μ m long, 3–5 μ m wide, sometimes irregularly expanded locally to 7 μ m, thin-walled, aseptate or 1–2 septate, hyaline, not stained by Melzer's solution (MLZ), coarsely granulate with granules of about 0.5 μ m diameter, covering the apical cell or sometimes two cells at the apex. Asci (25–)30–35(–40) \times 5–7 μ m, cylindrical clavate, sometimes long-stipitate, arising from croziers, 8-spored; apex rounded, pore MLZ– without KOH pretreatment, small

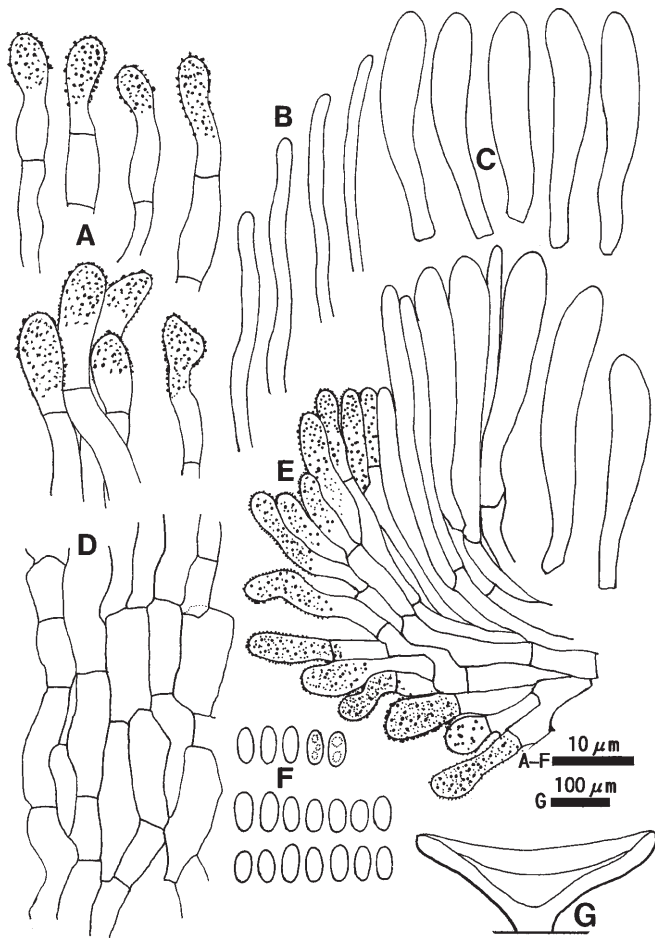


Fig. 2. *Hyphodiscus hymeniophilus* (TRL-454). **A** Hairs. **B** Paraphyses. **C** Asci. **D** Ectal cells in squash mount. **E** Vertical section showing the margin. **F** Ascospores. Guttulae are drawn in two spores. **G** Schematic drawing of an apothecial section showing outline of the structure. Hairs not drawn

but clearly MLZ+ after pretreatment in 3% KOH. Ascospores $4\text{--}5 \times 2\ \mu\text{m}$, ellipsoidal, almost vertically and horizontally symmetrical, aseptate, hyaline, smooth, biguttulate or multiguttulate in MLZ. Paraphyses cylindrical, flexuous, simple or branched at the base, aseptate, sometimes septate, $2\ \mu\text{m}$ wide; apex rounded, as long as the asci.

Anamorph: *Catenulifera rhodogena* (F. Manganot) Hosoya.

Colonies of SANK 14896 and 14996 on potato dextrose agar (PDA) reaching 20 mm diameter (23°C , 2 weeks), plane to velvety, radially sulcate, pruinose, composed of immersed to superficial mycelium. Yellowish-White (3A2), Partially Red (10A6) due to mycelial color; concentric zonation of 2 mm wide developed in the middle; reverse concolorous; context soft glutinous. Aerial mycelium little developed; a few mycelial strands developing only from the inoculum. Margin distinct, entire, hyphae not immersed. Red color localized in the hyphal plasm, not diffusing.

Conidiophores semimacronematous to macronematous, simple or branched. Phialides integrated, $15\text{--}20\ \mu\text{m}$ long, $1.5\ \mu\text{m}$ wide at the apex, $2\ \mu\text{m}$ thick at the base, cylindrical to

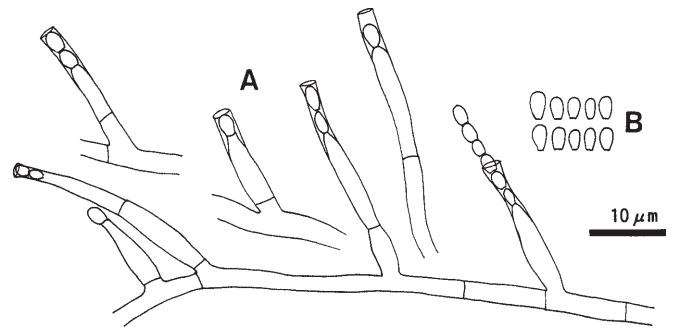


Fig. 3. *Catenulifera rhodogena*, anamorph of *H. hymeniophilus* (SANK 14896). **A** Various aspects of conidia-producing structure. **B** Conidia

ampulliform. Collarette long and cylindrical, sometimes rather funnel-shaped. Conidia $2.5\text{--}3 \times 2\ \mu\text{m}$, guttulate with rounded apex and truncate base, aseptate, smooth, hyaline, borne in chains or in droplets.

Specimens examined. Honshu: Showa-no-mori, Amagi-yugashima-machi, Izu, Shizuoka Prefecture, on decaying coniferous wood, 13-II-92, TRL-454 (single-ascospore culture SANK 14896); Wada-mura, Nagano Prefecture, on decaying coniferous wood, 23-IV-93, TRL-698; Iizuna-kogen, Togakushi-mura, Nagano Prefecture, on unidentified wood, 5-X-93, TRL-825 (single-ascospore culture SANK 14996).

Notes. *Hyphodiscus hymeniophilus* has many synonyms (Baral and Krieglsteiner 1985; Dennis 1949, 1956; Korf 1982; Nannfeldt 1932; Raitviir 1978; Raschle 1978; Weber 1992). It is typically known to be fungicolous, but Baral (1993) pointed out its fruiting was not restricted to fungi, and the hosts are sometimes very difficult to recognize.

Raschle (1978) and Baral (1993) reported the presence of red-stained substrate under *H. hymeniophilus*. Residues of xylariaceous fungi were found beneath the apothecia in TRL-454. The other two specimens were found to be associated with a dematiaceous fungus, but host-parasite relationships were not clearly observed. The substratum was not remarkably reddish, although apothecia were somewhat orange.

Catenulifera rhodogena is morphologically similar to the anamorph of *H. otanii*, but differs in more delicate phialides and smaller conidia. The reddish colony coloration distinguishes the anamorph of *H. hymeniophilus* from the anamorph of two other *Hyphodiscus* species.

2. *Hyphodiscus otanii* Hosoya, sp. nov. Figs. 4–6, 10

Apothecia gregaria vel sparsa, subsessilia vel brevistipitata, plana vel vadose cupulata, ad $300\ \mu\text{m}$ alta, ad $400\ \mu\text{m}$ diametro, rubro-brunnea; margo elevatus, leviter incurvatus, pruinosis. Excipulum ectale "textura intricata" ex cellulis crassitunicatis valde gelatinosis $10\text{--}15 \times 3\text{--}4\ \mu\text{m}$ compositum. Excipulum medullare "textura intricata," valde gelatinosum. Pili cylindrici, sursum clavati ad apicem obtusi, semel vel pluries septati, tenuitunicati, plerumque $20\ \mu\text{m}$ sed etiam ad $35\ \mu\text{m}$ longi, $3\text{--}4\text{--}5\ \mu\text{m}$ lati, minute granulati, hyalini vel pallidi. Asci $31\text{--}36 \times 4.5\text{--}5\ \mu\text{m}$, cylindraceo-clavati, ex hamulis surgentes, octospori, apice

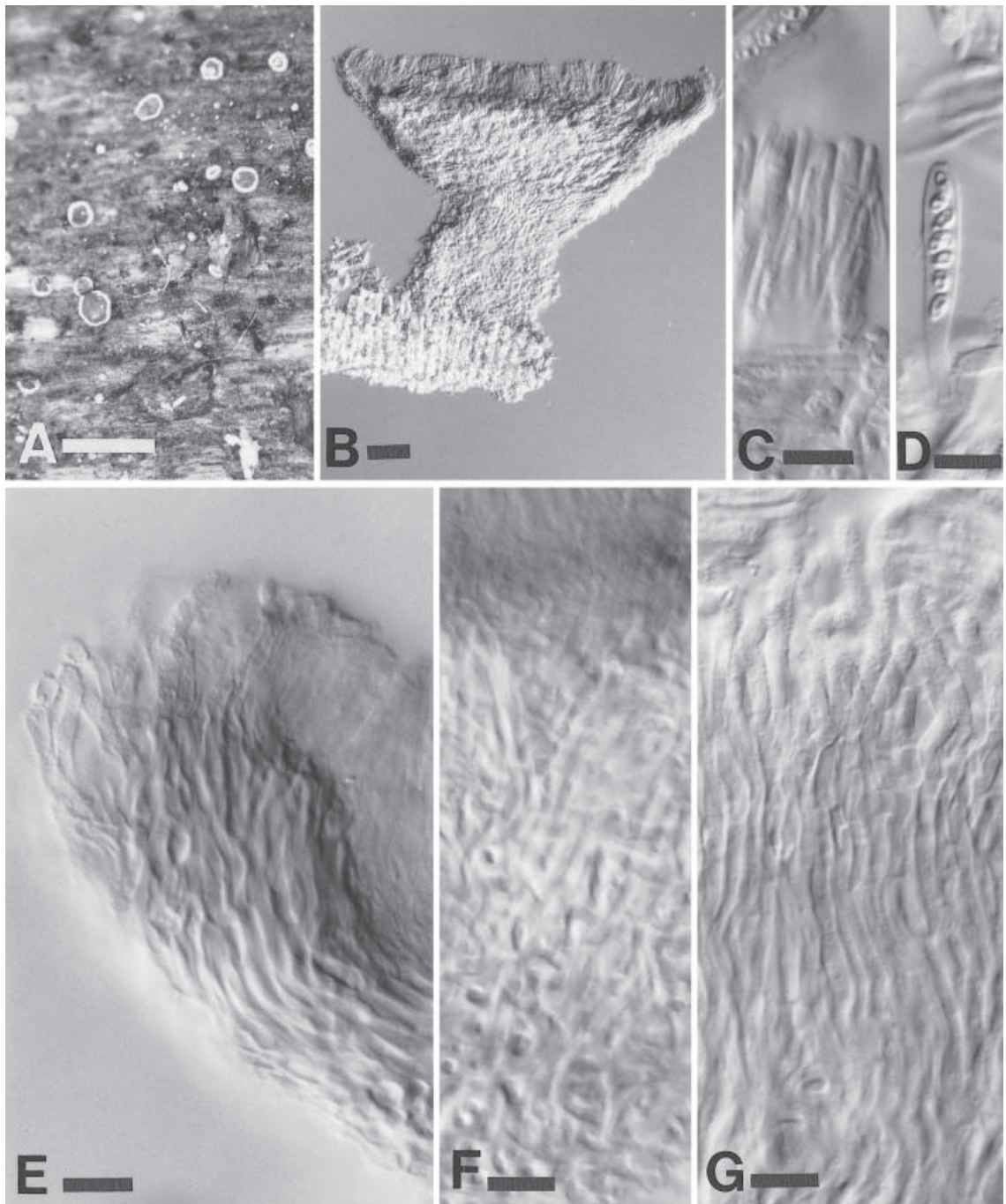


Fig. 4. *Hyphodiscus otanii* (TNS-F-7099). **A** Dry apothecia. Note white margin due to hairs. **B** Section of the apothecium. Note excipular structure with glassy appearance, resulting from gelatinization, and presence of the stipe. **C** Paraphyses. **D** Ascus with ascospores. Note presence of guttulae in ascospores. **E** Vertical section through the

margin shows gelatinized excipular cells and hairs. **F** Part of the medullary excipulum. Note intricate highly gelatinized hyphal weft. The upper part shows the subhymenium. **G** Part of the gelatinized ectal excipulum and hairs. Note ectal excipulum composed of highly gelatinized hyphal cells. Bars **A** 1 mm; **B–G**, 10 μ m

leviter complanato vel rotundato, poro iodo sine 10% KOH non vel obscure caerulescenti et cum iodo 10% KOH adjecto valde caerulescenti. Ascospores $3-4(-5.5) \times 2-2.5 \mu\text{m}$, ellipsoideae, laeves, hyalinae, duas vel plures guttulas continentes. Paraphyses cylindratae, flexuosae, aseptatae, apice obtusae, ad $2 \mu\text{m}$ latae, ascos non superantes.

Anamorphosis: *Catenulifera* sp.

Holotypus. TNS-F-7099, Tazawa Lake, Tazawakomachi, Akita Prefecture, on decorticated coniferous wood, 16-V-95, TRL-1177 (single-ascospore culture SANK 15696).

Etymology. Named in memory of my teacher Dr. Y. Otani, National Science Museum.

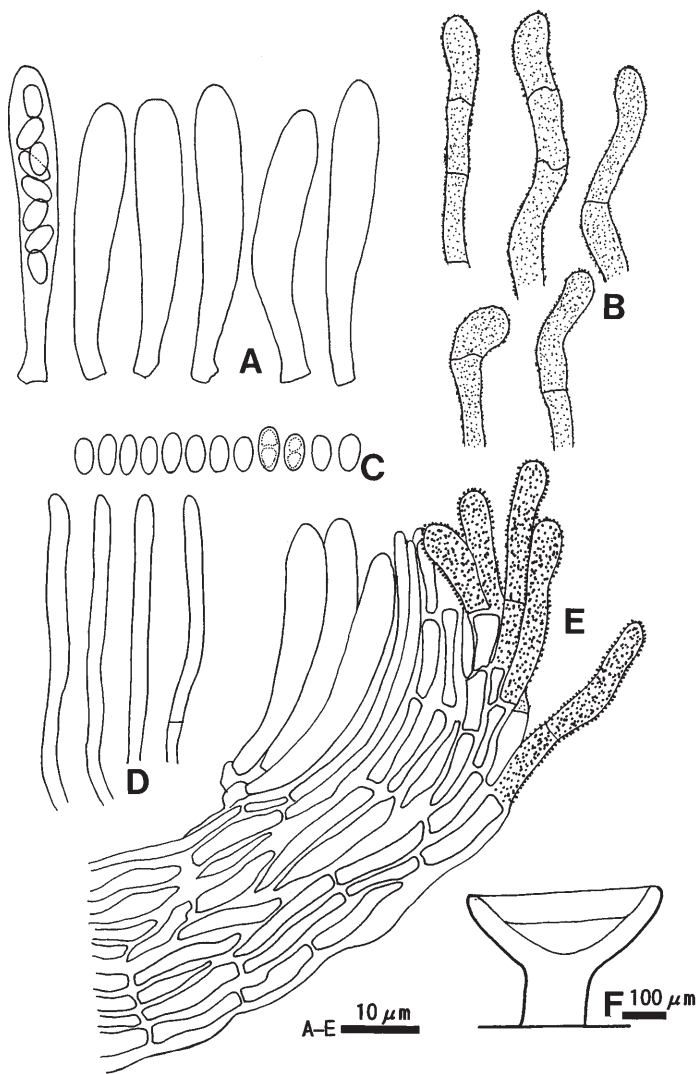


Fig. 5. *Hyphodiscus otanii* (TNS-F-7099). **A** Ascus; one at left shows ascospores. **B** Hairs. **C** Ascospores, two showing guttules, observed under Melzer's solution (MLZ). **D** Paraphyses. **E** Vertical section showing the margin. **F** Schematic drawing of an apothecial section showing the outline of the structure. Hairs not drawn

Apothecia gregarious to scattered, subsessile to short but stoutly stipitate, up to 300 μm high; disc plane to shallow concave, occasionally finely pruinose, mostly 200–300 (–400) μm diameter, Reddish-Brown (9F8) when dry; margin elevated, occasionally slightly incurved due to hairs, pruinose, white; receptacle concolorous with the disc, obscured by Greenish-Yellow (3B4) hairs, pruinose. Ectal excipulum *textura intricata* of cells with thick and strongly gelatinized walls, 10–15 \times 3–4 μm ; walls hyaline, MLZ– with or without 10% KOH pretreatment. Medullary excipulum *textura intricata*, of closely interwoven hyphae narrower than those in the ectal excipulum, strongly gelatinized. Hairs cylindrical, with obtuse to clavate apex, short, one- to multiseptate, thin-walled, straight to slightly curved at the margin, straight to undulating or entangled with each other on the excipulum, mostly 20 μm , up to 35 μm long, 3–4 (–5) μm wide at the widest point; covered by fine hyaline to

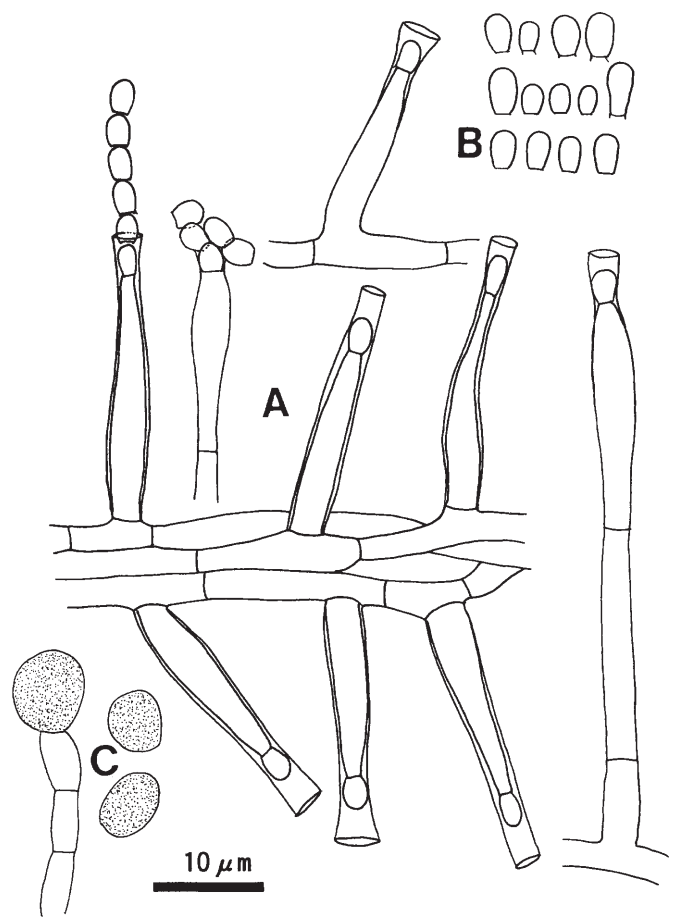


Fig. 6. *Catenulifera* anamorph of *H. otanii* (SANK 15696). **A** Various aspects of conidia-producing structure. **B** Conidia. **C** Chlamydsopore-like structure

pale-colored granules, up to 0.5 μm diameter, resistant to heat and 10% KOH. Ascus 31–36 \times 4.5–5 μm , cylindrical clavate, arising from croziers, 8-spored; apex somewhat flattened or rounded, often thick-walled, pore MLZ– or MLZ+/- without 10% KOH pretreatment, MLZ++ with 10% KOH pretreatment, IKI–. Ascospores 3–4 (–5.5) \times 2–2.5 μm , ellipsoidal, smooth-walled, hyaline, smooth, often containing two to several guttules, biseriate or irregularly seriate in the ascus. Paraphyses cylindrical, flexuose, aseptate; apex obtuse, becoming slightly thicker, 2 μm thick at the widest point, not exceeding the ascus.

Anamorph: *Catenulifera* sp.

Colonies of SANK 15696 on PDA slow-growing, reaching 15 mm diameter (23°C in 2 weeks), umbonate, radially sulcate, Pale Yellow (4A3), deeper colored with age; reverse Yellowish-White (3A2) to Yellowish-Gray (3B2), deeper colored with age. Context glutinous. Mycelium of 2–4 μm wide hyphae, immersed to superficial. Aerial mycelium little developed, funiculose. Sectors and zonation absent. Margin distinct, entire, flat, mycelium not immersed into the agar. Soluble pigment not produced, but material of Grayish-Yellow (3B5) produced on and around the colony margin.

Conidiophores semimacronematous to macronematous, simple, borne on single or fasciculate hyphae; phialides discrete, $17\text{--}26 \times 2.5\text{--}3\mu\text{m}$, cylindrical to elongate ampulliform, sometimes slightly inflated up to $4\mu\text{m}$ below, smooth-walled; collarette well developed, up to twice as long as the conidia, cylindrical or flaring. Conidia $(2.5\text{--})3\text{--}4(\text{--}5) \times 2\text{--}3\mu\text{m}$, cuneiform, with obtuse apex and truncate

base, aseptate, sometimes equipped with a fringe of cell wall remnant at the base, smooth, hyaline, borne in chains or droplets. Chlamyospore-like structure observed, spherical with somewhat truncate base, aseptate, brown, borne terminally on the hyphae.

Notes. *Hyphodiscus otanii* and *H. theiodeus* have many morphological features in common, particularly sulfur-

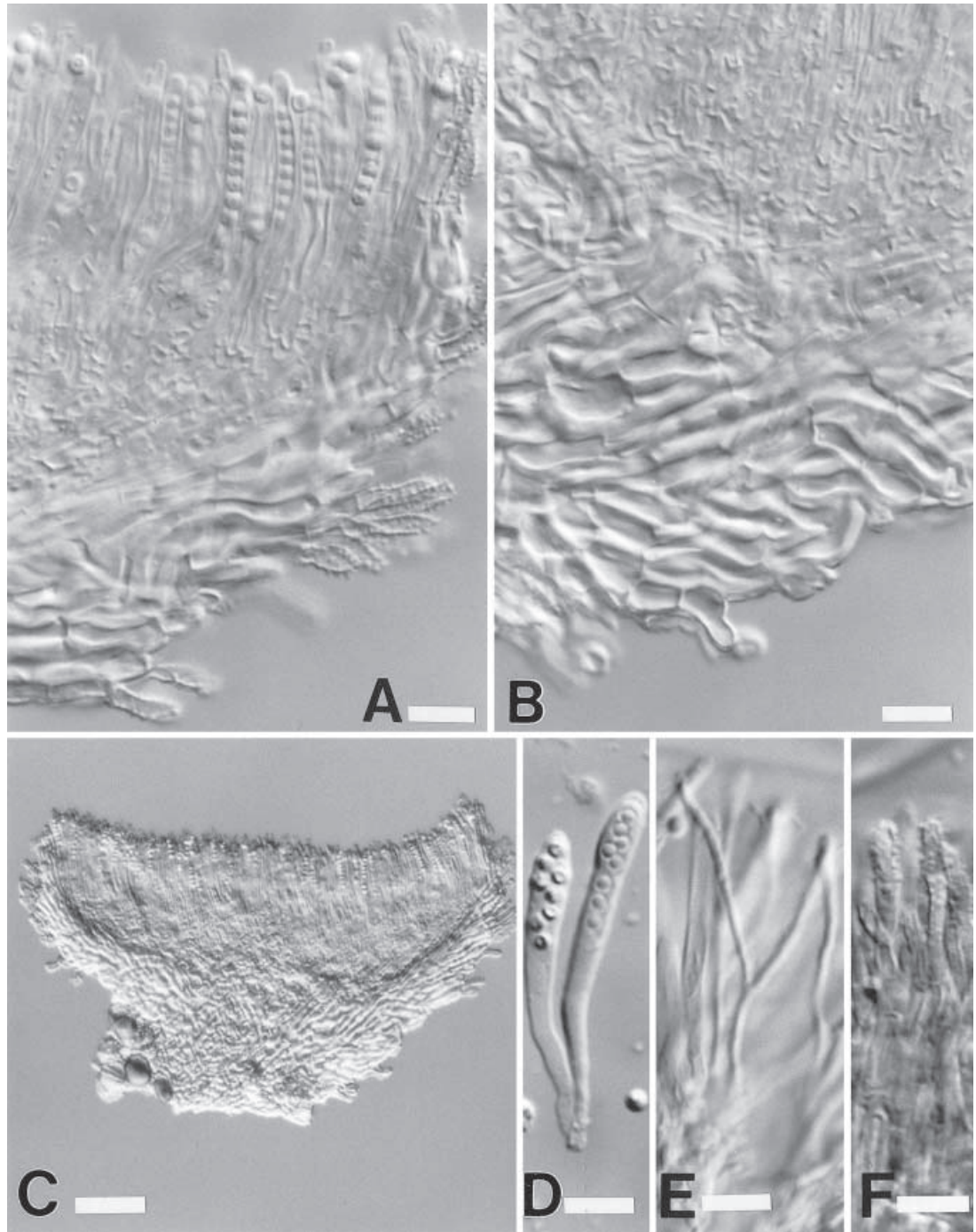


Fig. 7. *Hyphodiscus theiodeus* (TRL-1765). **A** Section of the apothecium. Note excipular structure with glassy appearance resulting from gelatinization. **B** Close-up of ectal excipulum showing intricate hyphae with gelatinization. **C** Vertical section of apothecium. Note highly

gelatinized tissue. **D** Asci with ascospores. Note the characteristic spherical ascospores with a globule. **E** Paraphyses. **F** Hairs with coarse granulation. Bars **A, B, D–F** $10\mu\text{m}$; **C** $50\mu\text{m}$

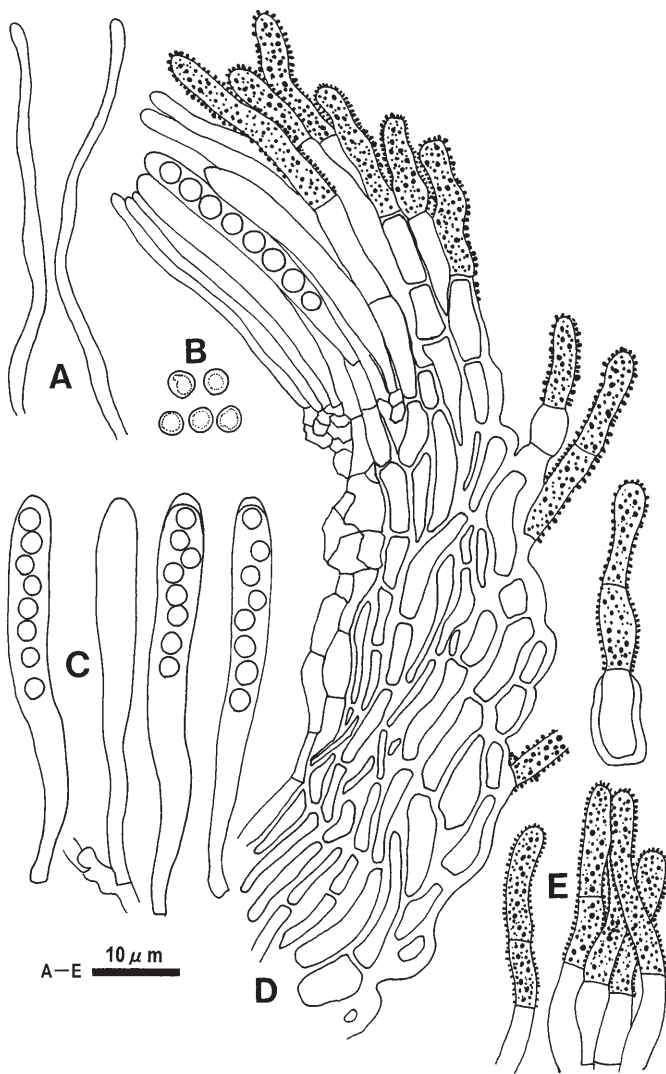


Fig. 8. *Hyphodiscus theioides* (TRL-1765). **A** Paraphyses. **B** Ascospores. **C** Asci. Second from left shows the crozier at the base. **D** Vertical section showing the margin. **E** Hairs

colored material covering the hairs and a highly gelatinized excipulum. However, *H. otanii* differs from *H. theioides* in having ellipsoidal ascospores.

Because of the presence of granulate hairs beset with yellow granules, recognizable even with the naked eye, *H. otanii* also shows similarity to *H. viridipilosus* (Baral 1993). As the detailed structure of *H. viridipilosus* was shown neither in Baral (1993) nor in Graddon (1974), the type specimen of *Incrupila viridipilosa* Graddon (K(M) 32583 = W.D.G. 2265) was studied. *Hyphodiscus viridipilosus* turned out to have smaller apothecia (mostly 150–200 µm, up to 250 µm diameter), smaller asci and ascospores, and shorter hairs. The granulation on the hair was different: *H. viridipilosus* had a coarse and resinous incrustation with globular to hemispherical grains up to 1 µm diameter, whereas *H. otanii* had a finer granulation. The hymenial color of *H. otanii* was darker than that of *H. viridipilosus*. Both had biseriate ascospores within the asci arising from croziers.

The anamorph of *H. otanii* is distinguished from that of *H. hymeniophilus* in having larger conidia, more robust

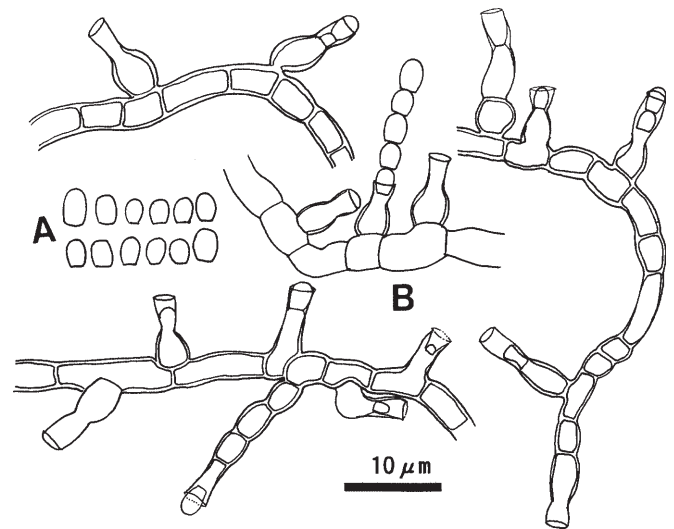


Fig. 9. *Catenulifera* anamorph of *H. theioides* (SANK 32800). **A** Conidia. **B** Various aspects of conidia-producing structure

phialides, and the presence of chlamydospores. It is also distinguished by an olivaceous color in older culture. It clearly differs from the anamorph of *H. theioides* in having larger, more slender phialides.

3. *Hyphodiscus theioides* (Cooke et Ellis) Zhuang, Mycotaxon **31**:414, 1988. Figs. 7–9, 10

Peziza theioides Cooke et Ellis, Grevillea **7**:7, 1878.

Lachnellula theioides (Cooke et Ellis) Sacc., Syll.

Fung. **8**:391, 1889 (ut "*theioides*").

Mollisiella austriaca Höhn., Ann. Mycol. **1**:396, 1903.

Pithyella austriaca (Höhn.) Boud., Hist. Classif.

Discom. Europe, p. 125, 1907 (1906).

Hyphodiscus gregarius Kirschst., Verh. Bot. Ver. Prov. Brandenb. **48**:44, 1907 (1906).

Apothecia gregarious, sessile to subsessile; disc flat or shallow concave, up to 400 µm diameter, brownish-red (8C7) when dry; receptacle grayish-yellow (2B6) when dry, covered with fine hairs bearing sulfur-colored crystals. Ectal excipulum *textura intricata*, composed of very thick-walled elongate cells interweaving and agglutinated with each other, subhyaline, walls gelatinous up to 2 µm thick. Medullary excipulum *textura intricata*, less gelatinized, of 2–3 µm wide hyphae. Hairs cylindrical with obtuse apex, sometimes becoming slightly enlarged at the apex, 0–1-septate, thin-walled, pale-colored, mostly 15–25 µm long, 3–4 µm wide, covered with coarse to tuberculate granules and sulfur-colored crystals, most abundant at the apical region. Asci 45–50 × 4–5 µm, cylindrical clavate, arising from croziers, 8-spored; apex thick-walled, MLZ+, staining slightly without KOH pretreatment, clearly MLZ+ after 10% KOH pretreatment, but weakly MLZ+ after 3% KOH pretreatment, IKI–. Ascospores 3 µm diameter, spherical to subspherical, nonseptate, smooth, containing one large oil guttule, uniseriate in the asci. Paraphyses cylindrical to filiform, 1.5–2 µm wide but irregular in width, septate, simple or branched at the base, with obtuse apex, not exceeding the asci.

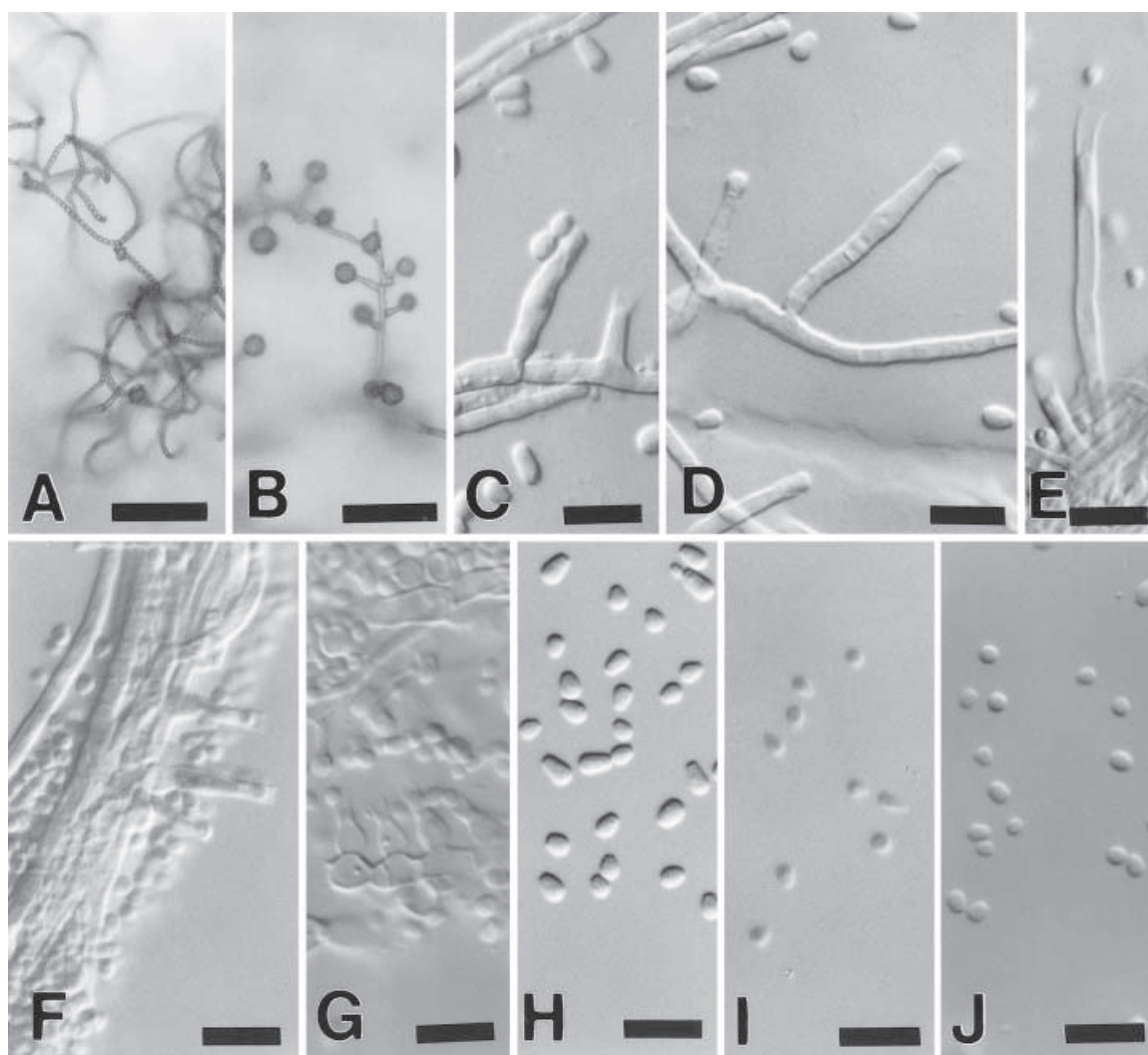


Fig. 10. *Catenulifera* spp., anamorph of *Hyphodiscus* spp. **A** Part of colony of *Catenulifera* anamorph of *H. otanii* (SANK 15696) on potato dextrose agar (PDA) observed under 10× objective lens. Note the conidial arrangement in chains. **B** Part of colony of *C. rhodogena*, anamorph of *H. hymeniophilus* (SANK 14896) on PDA observed under 10× objective lens. Note the conidia held together in droplets. **C–E**. Various aspects of conidia-producing structure in *Catenulifera* anamorph of *H. otanii* (SANK 15696). **F** Phialides borne on fasciculate

hyphae in *Catenulifera rhodogena*, anamorph of *H. hymeniophilus* (SANK 14896). **G** Phialides borne on inflated basal cell in *Catenulifera* anamorph of *H. theiodeus* (SANK 32800). **H–J** Conidia. Note their cuneiform shape with truncate base. **H** Conidia of *Catenulifera* anamorph of *H. otanii* (SANK 15696). **I** Conidia of *C. rhodogena*, anamorph of *H. hymeniophilus* (SANK 14896). **J** Conidia of *Catenulifera* anamorph of *H. theiodeus* (SANK 32800). Bars **A, B** 50 μm; **C–J** 10 μm

Anamorph: *Catenulifera* sp.

Colonies of SANK 32800 on PDA 13 mm diameter (23°C, 2 weeks), convex at the center, sulcate, Yellowish-Brown (5F6), Grayish-Yellow (3A4) crystals formed in the medium around the colony; reverse concolorous, obscured by Grayish-Yellow (3C4) crystals. Aerial mycelium little developed, partly velvety. Some Red (11A6) sectors with concentric zonation developing with age, paler toward the margin. Context tough and glutinous. Margin distinct, entire, flat. Soluble pigment not produced in 2 weeks, but pigment of Grayish-Yellow (3B5) produced around the colony margin with age.

Conidiophores semimacronematous to macronematous, simple, borne singly or in groups; phialides mostly discrete, sometimes intercalary or integrated, often arising from a somewhat inflated basal cell, 7–10 μm long, inflated to 3–4 μm

and often thicker-walled at the base, cylindrical to ampulliform, smooth-walled; collarete well-developed, cylindrical to flared, up to twice as long as the conidia. Conidia 2–3.5 × 2–2.5 μm, cuneiform, with obtuse apex and truncate base, aseptate, smooth, hyaline, borne in chains or droplets.

Specimen examined. TRL-1765 (culture SANK 32800), Towada Lake, Towadako-machi, Aomori Prefecture, on unidentified decaying wood, 13-VI-2000.

Notes. *Hyphodiscus theiodeus* is easily distinguished from the other members of *Hyphodiscus* by having spherical ascospores. The anamorph of *H. theiodeus* is distinguished from the two other anamorphs of *Hyphodiscus* in having shorter, often ampulliform phialides. The color of an old colony of *H. theiodeus* somewhat resembles that of *H. otanii* but is distinguished by having deeper olivaceous to deep greenish tinge.

Discussion

Generic delimitation of *Hyphodiscus*

The members of the genus *Hyphodiscus* described here have the following features in common: gelatinized excipulum (usually highly, but at least in part); small asci; ascospores with conspicuous oil guttules; cylindrical, flexuous paraphyses with obtuse apex not exceeding the asci; and short, few-celled, superficially *Cistella*-like hairs, but usually more coarsely granulated. Associations with other fungi are characteristic for some members. Particularly, *H. hymeniophilus* is found on fungal substrata, and *H. viridipilosus* is also reported to be associated with other fungi (Zhuang 1988). The teleomorph–anamorph relationship between *Hyphodiscus* and *Catenulifera* supports the taxonomic consistency of *Hyphodiscus* suggested by the morphological characters of the apothecia. Such types of conidiophores have been reported to be limited to the Helotiaceae and their allies (Berthet 1964) suggesting a relationship of *Hyphodiscus* to the Helotiaceae rather than the Hyaloscyphaceae.

Intrafamilial position of *Hyphodiscus*

When Nannfeldt (1932) established the family Hyaloscyphaceae, he did not include the genus *Hyphodiscus*. Neither Korf (1973) nor Raitviir (1970) seem to have included the generic concept of *Hyphodiscus* in the Hyaloscyphaceae. Raitviir (1978, 1987) seems to have included *Hyphodiscus* in the subfamily Lachnoideae of the Hyaloscyphaceae, because *Cistellina* Raitviir, a *pro parte* synonym of *Hyphodiscus*, is listed. In this classification, however, the hair characters seem overemphasized. Raitviir and Galán (1994) later placed *H. gemmarum* in the tribe Polydesmiae, subfamily Arachnopezizoideae of the Hyaloscyphaceae. Baral (1994) commented that the genus is “very close to both *Proliferodiscus* J.H. Haines et Dumont and *Lachnellula*.” The general characters of *Hyphodiscus* seem to deviate from most genera of the family, that is, the tribes Hyaloscyphaceae and Lachneae, but no positive relationship can be recognized to the rest of the family either. The genus seems to form a unique group within the family, but it is still premature to draw any conclusion on the generic placement within the family.

Key to the species of *Hyphodiscus* hitherto described

1. Apothecia externally invested with yellow granules or crystals 2
2. Ascospores spherical *H. theiodesus*
2. Ascospores ellipsoidal 3
3. Ascospores (2.8–)3–3.8(–4.5) × 1.4–1.9 μm
..... *H. viridipilosus**
3. Ascospores 3–4(–5.5) × 2–2.5 μm *H. otanii*
1. Apothecia not vested by yellow granules or crystals
..... 4

4. Apothecia sessile to short-stipitate; often on residues of mushrooms or other fungi
..... *H. hymeniophilus*
4. Apothecia short- to long-stipitate; not on other fungi *H. gemmarum**

*Not yet reported in Japan.

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