

Tubulicrinopsis gen. nov. (Basidiomycota, Aphyllophorales) and notes on *Amauromyces pallidus*

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The genus *Tubulicrinopsis* Hjortstam & Kotir. is described with three new species, *T. ellipsospora* Kotir., Hjortstam & Kulju, *T. granulosa* Hjortstam, Miettinen & Kotir. and *T. cystidiata* Kotir. & Miettinen, and the new combination *T. farinacea* (Boid., Lanq. & Gilles) Kotir. & Hjortstam is proposed. *Tubulicrinopsis ellipsospora*, *T. granulosa* and *T. cystidiata* were collected in north European forests and *T. farinacea* has hitherto been reported from Réunion, Argentina and Taiwan as *Amauromyces farinaceus*. The species of *Tubulicrinopsis* are somewhat similar to the species of the genera *Tubulicrinis* and *Sistotremastrum* in having thick-walled basidial bases. The type of *Amauromyces pallidus* Jülich was studied. The species are described and illustrated, and a key to the genus *Tubulicrinopsis* is given. *Botryobasidium ellipsosporum* Holubová-Jechová is reported from Finland for the first time.

Key words: *Amauromyces*, Aphyllophorales, *Botryobasidium ellipsosporum*, *Sistotremastrum*, taxonomy, *Tubulicrinopsis*, *Tubulicrinis*

Two species have been described in the genus *Amauromyces*: *A. pallidus* Jülich (Jülich 1978) from Australia and *A. farinaceus* Boid., Lanq. & Gilles from Réunion (Boidin *et al.* 1993). Five specimens of corticioid fungi were collected in Finland and Norway, and initially determined either as *A. pallidus* or *A. farinaceus*. These five specimens clearly belong to the same genus. We studied the type materials of *A. pallidus* and *A. farinaceus*, and it became clear that *A. pallidus*, the type of *Amauromyces*, has little to do with *A. farinaceus*. The Nordic specimens are close to

A. farinaceus, but represent three new species, which are described here. We describe the new genus *Tubulicrinopsis* to accommodate *A. farinaceus* and these new species.

For comparison we also describe and illustrate *Amauromyces pallidus*.

Material and methods

The material studied is preserved in the herbaria GB, H, JOE, K, L, LY and OULU and/or in the

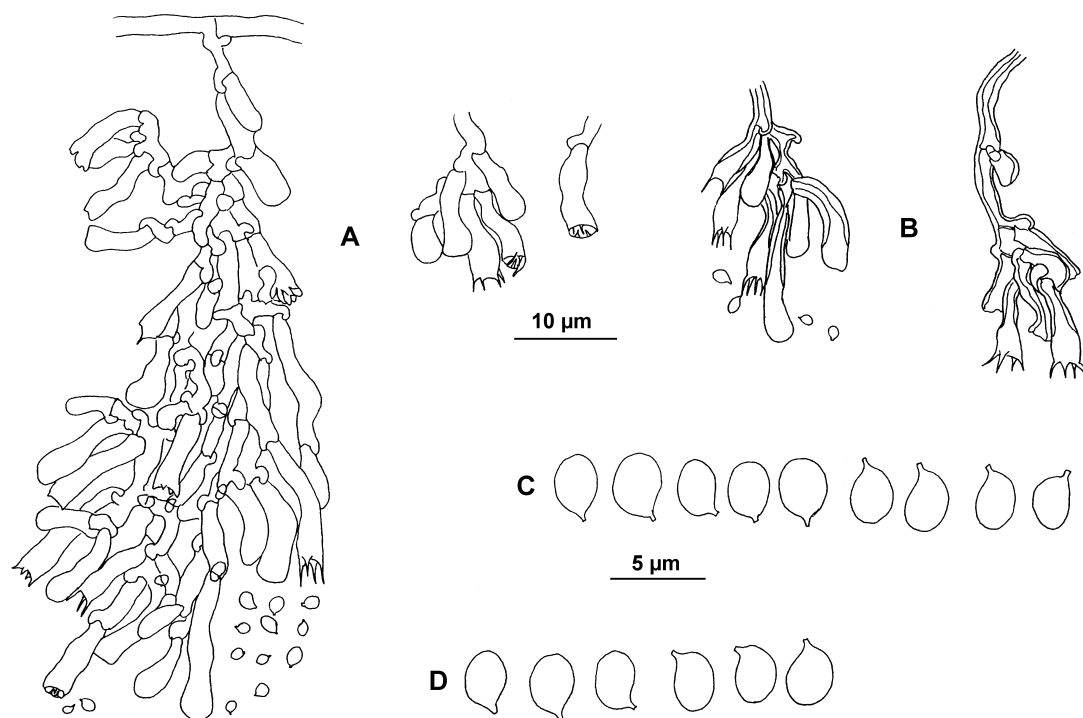


Fig. 1. *Tubulicrinopsis ellipsospora* (A–C from Junninen 2998d, holotype; D from Kulju 85b/01). — A: Section through basidiocarp in KOH showing thin-walled hyphae and basidia. — B: Basidia and hyphae in CB showing thick-walled hyphae and basidia. — C and D: Spores.

reference herbarium of Heikki Kotiranta (H.K.).

Thirty spores per specimen were measured, and the measurements were made in Cotton Blue (CB). In addition, Melzer's reagent (IKI) and 5% potassium hydroxide (KOH) were used as mounting media.

The following abbreviations are used: L^* = mean spore length, W^* = mean spore width, Q = range of the variation in L/W ratio, Q^* = quotient of the mean spore length and width (L^*/W^*). None of the measurements derive from spore print.

Biological provinces and collecting sites in Finland are indicated according to the Finnish national uniform grid system (27°E), as applied to biological material by Heikinheimo and Raatikainen (1981).

Tubulicrinopsis Hjortstam & Kotir., gen. nov.

Fructificatio resupinata, effusa, farinosa, subgrandinoidea vel poroso-reticulata. Systema

hyphale monomiticum, hyphis et basidiis basilater crassitunicatis, fibulatis. Basidia 10–17 × 3.5–4 µm. Cystidia nulla vel crassitunicata, basaliter cum fibula. Sporae ellipsoideae, vel cylindriceae, 3–5 × 1.5–2.5 µm, leves, non amyloideae.

ETYMOLOGY: Reminding *Tubulicrinis*.

TYPE SPECIES: *Tubulicrinopsis ellipsospora* Kotir., Hjortstam & Kulju.

Tubulicrinopsis ellipsospora Kotir., Hjortstam & Kulju, sp. nova (Fig. 1)

Species Tubulicrinopsis farinaceae similis sed basidia membranis minus crassis et sporae ellipsoideae 3 × 2–2.4 µm.

HOLOTYPE: Finland. Pohjois-Karjala: Lieksa, Karjula, poor 30–40 years old pine forest, on decorticated *Pinus sylvestris*, with *Pseudomerulius* sp., *Sistotremastrum suecicum* and *Trechispora farinacea*, 63°23'N, 30°08'E, 22.VIII.2002 Junninen 2998d (H; isotype GB).

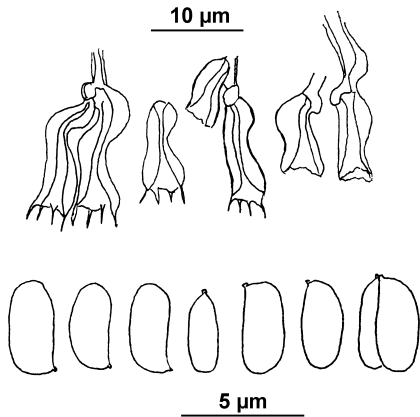


Fig. 2. *Tubulicrinopsis farinacea* (from Boidin LY 14195, holotype). Basidia and spores.

Basidiocarp relatively small, 2–5 cm along the wood, resupinate, thin, farinose or tufted, pale cream-coloured or slightly greenish. Subiculum almost lacking; the tufts are joined together with very narrow hyphal strings leaving the substrate visible.

Hyphal system monomitic, all hyphae clamped. The few subicular hyphae relatively thin-walled (in CB, IKI, KOH), 3–4 µm in diameter, fairly long-celled, giving rise to broom- or tree-like structures (tufts) with unequally thick-walled (in CB, IKI), 2–2.5 µm wide, richly branched hyphae, which are very thin-walled in KOH. Cystidia none. Basidia clavate, subclavate or subcylindrical, sometimes sinuous, basally thick-walled in CB and IKI, thin-walled in KOH, basally clamped, 10–15(–17) × 3.5–4 µm, with four, up to 4 µm long, very thin sterigmata, which bend inwards after the sporulation. Spores ellipsoid or lacrymoid, (2.6–)3–3.5 × 1.9–2.2(–2.4) µm, thin- or very thin-walled, CB–, IKI–, with a prominent apiculus [3–3.5 × 2–2.4 µm, $L^* = 3.2$ µm, $W^* = 2.2$ µm, $Q = 1.3$ –1.6, $Q^* = 1.5$ (Junninen 2998d), 2.6–3.4 × 1.9–2.2(–2.4) µm, $L^* = 3$ µm, $W^* = 2.1$ µm, $Q = 1.2$ –1.7, $Q^* = 1.4$ (Kulju 21/05), (2.6–)2.8–3.1 × 1.9–2.3 µm, $L^* = 3$ µm, $W^* = 2.1$ µm, $Q = 1.3$ –1.6, $Q^* = 1.5$ (Kulju 85b/01)].

All the collections derive from poor *Pinus sylvestris*-dominated heath forest site types, where they grew on decorticated, small pines in advanced stages of decay together with an unnamed *Pseudomerulius* species.

ADDITIONAL SPECIMENS (paratypes). — **Finland.** Kainuu: Vaala, Rokua National Park, fairly poor pine dominated heath forest site type, on decorticated, strongly decayed *Pinus sylvestris* 18 cm in diam., together with *Pseudomerulius* sp., 64°33'N, 26°21'E (Grid 27°E 7161808:477180), 16.VIII.2005 Kulju 21/05 (H, OULU); Oulun Pohjanmaa: Oulu, Pikkarala, Asemakylä, on *Pinus sylvestris*; also *Pseudomerulius* sp., 64°54'N, 25°46'E (Grid 27°E 7202038:441280), 2.IX.2001 Kulju 85b/01 (GB, OULU, H.K.).

***Tubulicrinopsis farinacea* (Boid., Lanq. & Gilles) Kotir. & Hjortstam, *comb. nova* (Fig. 2)**

BASIONYM: *Amauromyces farinaceus* Boid., Lanq. & Gilles, Bull. Soc. Mycol. France 109: 93. 1993.

The species was well described by Boidin *et al.* (1993). *Tubulicrinopsis farinacea* is externally very similar to *T. ellipsospora*. Microscopically it differs from *T. ellipsospora* in having basidia which in ripe conditions are very thick-walled, (1.3–)1.5–1.8(–2) µm thick. Also the microstructure is tougher, and the typical broom-like growing habit is more difficult to discern. The clearest difference is in the spores, which are cylindrical (not ellipsoid or lacrymoid), sometimes slightly bent, (3.6–)4–4.5(–4.8) × (1.6–)1.8–2.1 µm, $L^* = 4.1$ µm, $W^* = 1.9$ µm, $Q = 1.9$ –2.6, $Q^* = 2.2$, very thin-walled, CB–, IKI–, with a very small apiculus (Boidin, LY 14195, holotype). *Tubulicrinopsis granulosa* comes very close; see its description for differences.

Tubulicrinopsis farinacea is reported also from Argentina (Greslebin 2002) and Taiwan (Chen & Oberwinkler 2004).

SPECIMEN EXAMINED: **Réunion.** Bébour, I-90, on decorticated *Cryptomeria japonica*, 21.III.1990 Boidin (LY 14195, holotype).

***Tubulicrinopsis granulosa* Hjortst., Miettinen & Kotir., *sp. nova* (Fig. 3)**

Species Tubulicrinopsis farinaceae similis sed basidia membranis minus crassis et asymmetricis incrassates.

HOLOTYPE: Norway. Hedmark: Løten, Sortåa, on decorticated *Pinus sylvestris*, 1 Sep. 1984 Høgholen 115/84 (K 109875!).

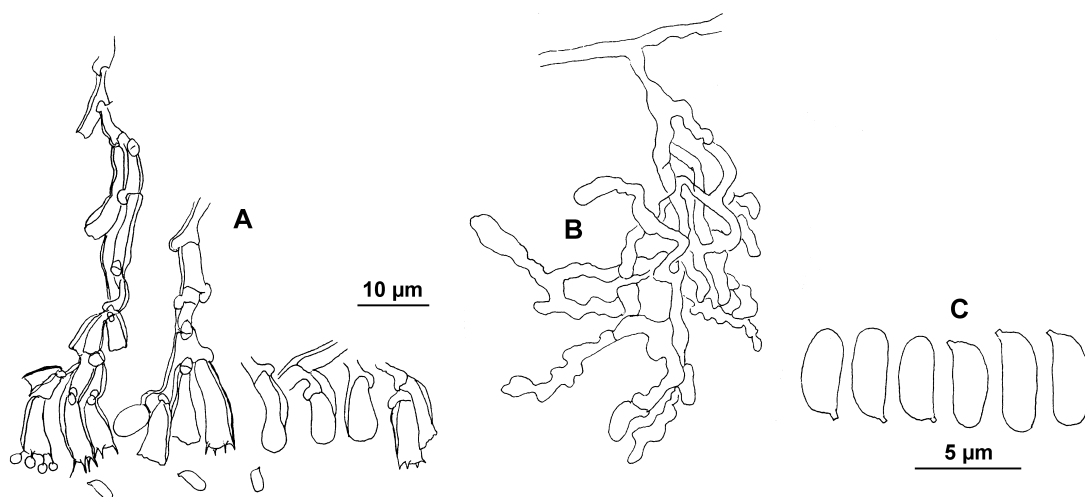


Fig. 3. *Tubulicrinopsis granulosa* (from Høgholen K 109875, holotype). — **A:** Details from the basidiocarp in CB, showing asymmetrically thick-walled hyphae and basidia. — **B:** Section through basidiocarp in KOH. — **C:** Spores.

Basidiocarp resupinate, relatively thin, grandinioid or granulose, yellowish, margin not differentiated, distinct. Hyphal system monomitic, all hyphae clamped. Subicular hyphae relatively straight, asymmetrically thickened (walls 1–1.5 µm, seldom up to 2 µm thick), 3–4 µm wide giving rise to a broom- or tree-like structures (tufts) where the basidia are born. Tramal hyphae 3–3.5 µm wide, asymmetrically thick-walled. All hyphae CB–, IKI–, walls dissolving partly or totally in KOH. Cystidia none. Basidia cylindrical, basally clamped, asymmetrically thick-walled (walls 1 µm thick), (8–)10–11.5 × (3.5–)4 µm, with four, very thin, up to 3 µm long sterigmata. Spores cylindrical, often apically blunt, (3.5–)3.7–4.6 × (1.6–)1.8–2.1 µm, $L^* = 4$ µm, $W^* = 1.9$ µm, $Q = 1.8$ –2.4, $Q^* = 2.1$, with a relatively large apiculus, thin-walled, CB–, IKI– (Høgholen, K 109875, holotype).

Tubulicrinopsis granulosa resembles very much *T. farinacea*. However, the tree-like structure in *T. granulosa* is better visible, the thickenings of the hyphae and basidia are predominantly asymmetrical so that only one side of the hyphae or basidia are thick-walled, and also the walls are thinner in *T. granulosa*. The size and shape of the spores are also very close to those of *T. farinacea*, but in the latter species the spores are often slightly curved and the apiculus is very small.

***Tubulicrinopsis cystidiata* Kotir. & Miettinen, sp. nova** (Fig. 4)

Fructificatio resupinata, effusa. Systema hyphale monomiticum, hyphis et basidia basaliter crassitunicatis, fibulatis. Basidia 11–16.5 × 3.5–4 µm. Cystidia crassitunicata, fibulata. Sporae ellipsoideae, 3.5–4 × 2.2–2.8 µm, leves, non amyloideae.

HOLOTYPE: Finland. Etelä-Häme: Lammi, Pappilankylä, Biol. Station N, luxuriant mixed forest, on decorticated, strongly decayed *Picea abies* under *Botryobasidium ellipso sporum*; with *B. subcoronatum*, *Gloiothele citrina* and *Phlebiella pseudotsugae*, 61°03'N, 25°01'E (Grid 27°E 6773300:395027), 6.VII.2003 Miettinen 7164d (H).

Basidiocarp resupinate, thin, porose-reticulate, white or ochre-coloured, margin not differentiated, distinct. Hyphal system monomitic, all hyphae clamped. Subicular hyphae thick-walled (walls up to 0.5 µm), 3–5 µm wide, giving rise to the main stem of the tree- or broom-like tuft, which divides into smaller branches bearing the basidia. Subhymenial hyphae richly branched, thin- or more often thick-walled, 3–3.5 µm in diam. Cystidia originate from subhymenium, in some parts common, thick-walled (walls up to 1 µm thick) except from the apical part, 1–6 celled, with very small clamps, (26–)53–75 × 5–6 µm, very faintly cyanophilous, IKI–, KOH–. Basidia cylindrical or subcylindrical, basally thick-walled and clamped, 11–15(–16.5) × 3.5–4

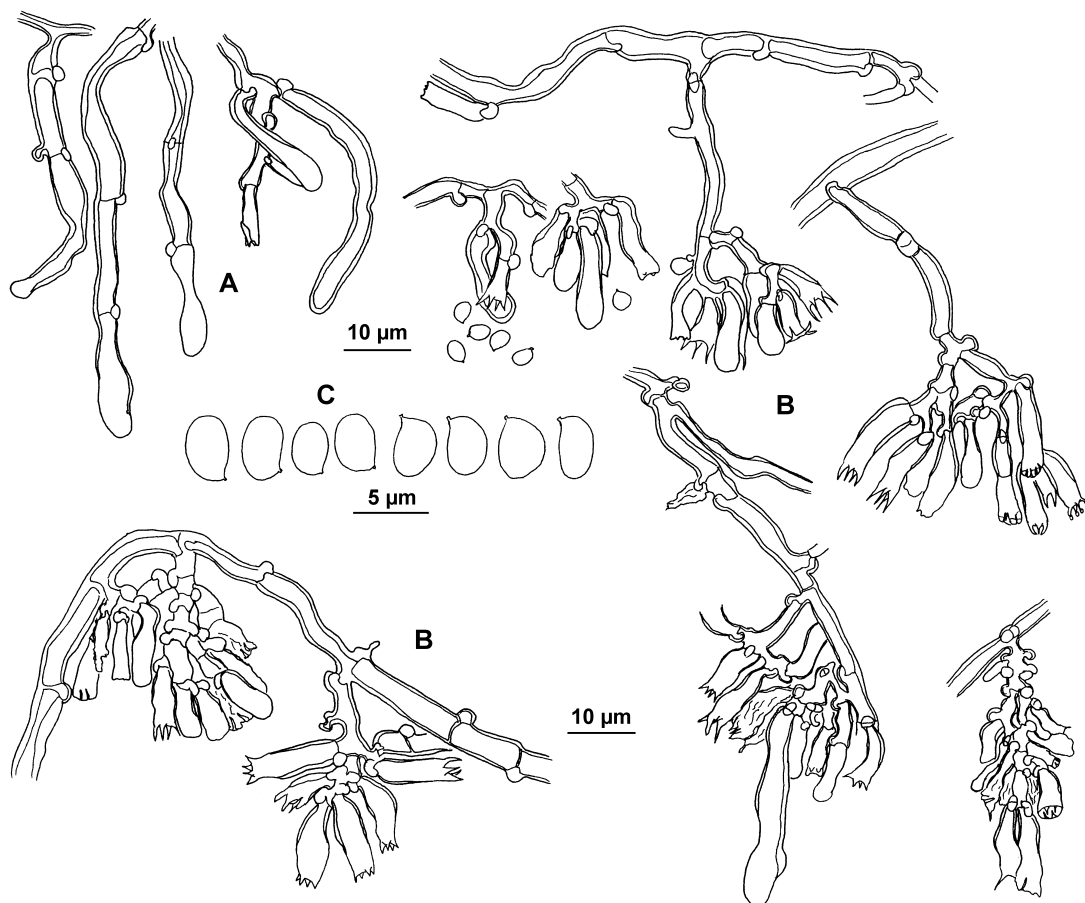


Fig. 4. *Tubulicrinopsis cystidiata* (from Miettinen 7164d, holotype). — **A:** Thick-walled cystidia. — **B:** Sections through basidiocarp showing thick-walled hyphae, basidia and cystidia. — **C:** Spores.

μm , with four, thin, up to $4 \mu\text{m}$ long sterigmata. Spores ellipsoid or broadly ellipsoid, $3.4\text{--}4(-4.2) \times 2.2\text{--}2.8(-2.9) \mu\text{m}$, $L^* = 3.7 \mu\text{m}$, $W^* = 2.6 \mu\text{m}$, $Q = 1.3\text{--}1.7$, $Q^* = 1.5$, with a very small apiculus, very thin-walled, CB–, IKI–.

The Finnish specimen grew intermixed with *Botryobasidium ellipsosporum*, which has not been found from Finland before. The structure of the basidiocarp of the *Tubulicrinopsis* is difficult to observe due to the *Botryobasidium*.

Key to the genus *Tubulicrinopsis*

1. Cystidia present *T. cystidiata*
1. Cystidia absent 2
2. Spores ellipsoid, $Q < 2$ *T. ellipsospora*
2. Spores cylindrical, $Q \geq 2$ 3
3. Basidial wall very thick, $1.5\text{--}2 \mu\text{m}$; southern species
..... *T. farinacea*

3. Basidial wall thick, $1 \mu\text{m}$, asymmetric; northern species
..... *T. granulosa*

Amauromyces Jül.

Jülich (1978) introduced the genus *Amauromyces* with the type species *A. pallidus* from Australia. The genus is characterized by a pale coloured, resupinate, ceraceous basidiocarp, monomitic hyphal system, very wide ($5\text{--}10 \mu\text{m}$) clamped tramal (= subicular) hyphae which swell and partly dissolve in KOH, thick-walled, smooth and clamped cystidia, clavate to flexuose-cylindrical basidia which are about $10\text{--}20 \mu\text{m}$ long, and hyaline, thin-walled, inamyloid, small, smooth, ellipsoid spores.

The description of *A. pallidus* is basically the same as the description of the genus, but

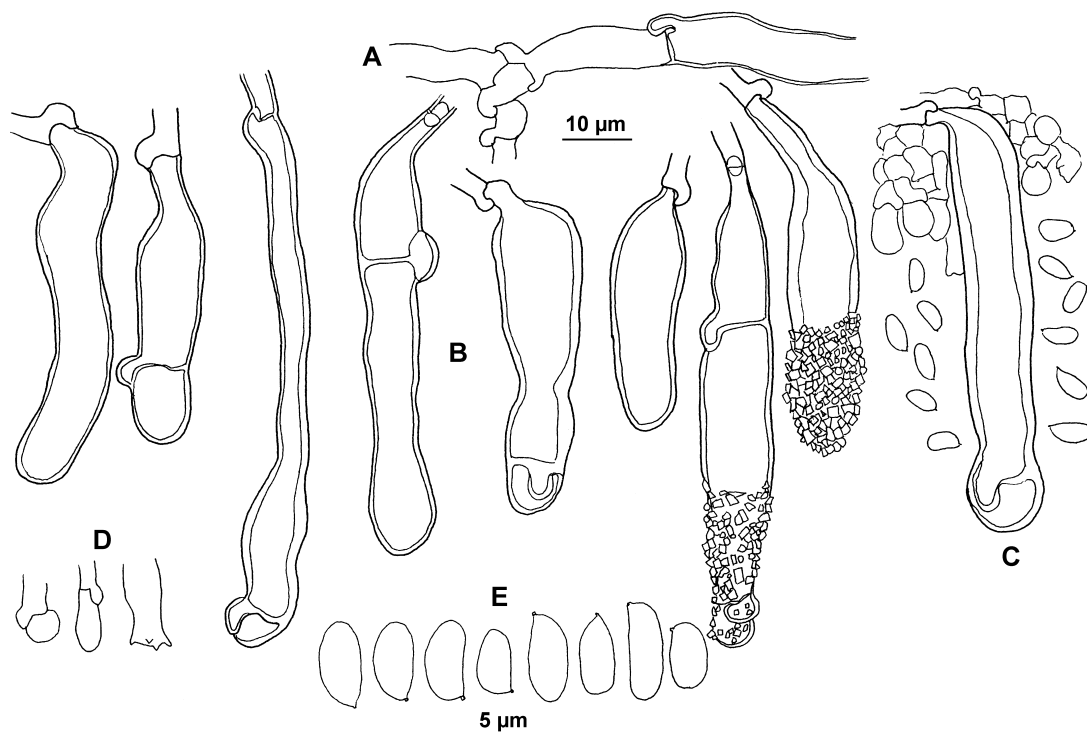


Fig. 5. *Amauromyces pallidus* (from Maas Geesteranus 15550, holotype). — **A:** Wide subicular hyphae (in IKI). — **B:** Thick-walled cystidia (first five ones in IKI, rest in KOH). — **C:** A cystidium together with basidioles, pseudoparenchymatous subhymenium and spores (in IKI). — **D:** Basidioles and a young basidium (in IKI). — **E:** Spores (in IKI).

gives more details and adds the sizes of cystidia ($40\text{--}80 \times 10\text{--}12\text{--}16\ \mu\text{m}$), basidia ($10\text{--}20 \times 4.6\text{--}5.0\ \mu\text{m}$) and broadly ellipsoid spores ($3.5\text{--}4 \times 2.2\text{--}2.4\ \mu\text{m}$). Moreover, the basidia are often basally somewhat thick-walled, which was also illustrated by Jülich (1978).

Amauromyces pallidus Jülich (Fig. 5)

Basidiocarp resupinate, smooth, ceraceous and hard when dry, pale grayish brown, minutely hispid due to the protruding cystidia ($\times 25$), margin not differentiated, thinning out.

Hyphal system monomitic, all hyphae clamped. Subicular hyphae wide, $8\text{--}10\ \mu\text{m}$ in diam., thick-walled (up to $1\ \mu\text{m}$), slightly swelling in KOH, CB–, IKI yellowish, mostly very difficult to discern due to some kind of gelatinous matter. Subhymenium consisting of relatively thin-walled, $2\ \mu\text{m}$ wide hyphae, even if most of the subhymenium seems to be composed of

pseudoparenchymatous tissue where individual hyphae are extremely difficult to see. Cystidia abundant, robust, 1–3 celled (mostly 2-celled), $(38\text{--})45\text{--}65\text{--}(75) \times (5\text{--})8\text{--}11\text{--}(14)\ \mu\text{m}$, thick-walled (up to $3\ \mu\text{m}$), CB–, IKI–, KOH–, clamped (also basally), smooth, or rarely encrusted (in IKI), projecting up to $60\ \mu\text{m}$ over the basidia. No entire ripe basidia seen, basidioles ovoid, basally clamped, very thin-walled, with four sterigmata. Spores cylindrical, $4\text{--}5.5\text{--}(6.6) \times 2\text{--}2.6\text{--}(2.3)\ \mu\text{m}$, $L^* = 4.9\ \mu\text{m}$, $W^* = 2.3\ \mu\text{m}$, $Q = 1.7\text{--}2.5$, $Q^* = 2.1$, with a very small apiculus, seldom glued in pairs, very thin-walled, CB–, IKI–.

SPECIMEN EXAMINED: **Australia**. Victoria, Mt Bride, S of Warburton, on wood of fallen decorticated *Eucalyptus*, 3 Oct. 1977 R. A. Maas Geesteranus 15550 (L 0053255, holotype).

Discussion

The species of the genus *Tubulicrinopsis* have a very characteristic way of growing as form-

ing broom- or tree-like structures. At least their basidial bases are clearly thick-walled. Similar basidia, though not so thick-walled, are familiar for the genera *Tubulicrinis* and *Sistotremastrum*. The sterigmata often bend inwards after the sporulation in the same way as in *Sistotremas-trum*. However, the basidial walls of *Sistotremas-trum* do not swell or dissolve in KOH and they normally bear six sterigmata. The cystidia of *Tubulicrinopsis cystidiata* bear very small clamps, like the cystidia of *Suillosporium cystid-iatum*. However, the cystidia of the latter are thin-walled, and the basidia and spores are quite different. We do not have any clear idea of the closest relatives of *Tubulicrinopsis*. The microscopical features point towards *Tubulicrinis*, but the dolipore septa with discontinuous (perforate) parentheses in *Tubulicrinopsis farinacea* (Chen & Oberwinkler 2004) seem to rule it out from the heterochaetoid clade in which *Tubulic-rinis* belongs (Larsson et al. 2004).

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