

## Type studies of corticioid Hymenomycetes (Basidiomycota) with aculei

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Type specimens of ten, resupinate, corticioid basidiomycetes with aculei described by various authors were examined. Five species are later synonyms: *Acia conferta* P.H.B. Talbot (= *Phanerochaete subquercina*), *Hydnum squalinum* Fr.: Fr. (= *Cerrena unicolor*), *Melzerodontia udamentiens* P. Roberts (= *Phlebia badia*), *Mycoleptodon ljubarskii* Pilát (= *Hydnophlebia chrysorhiza*), *Odontia griseo-olivacea* Höhn. (= *Phlebia uda*). The new combination, *Scopulodontia webbii* (= *Hydnum webbii* Berk.), is proposed. *Phaeoradulum guadelupense* Pat. is a species of unknown affinities. Three species were tentatively identified to species: *Hydnum bresadolae* Qué. (= *Dentipellis* cf. *fragilis*), *Hydnum stalagmodes* Berk. & M.A. Curtis (= *Phlebia* cf. *fuscoatra*), and *Odontia palumbina* Höhn. (= *Scopuloides* cf. *rimosa*). The misapplication of the name *Hydnum squalina* is discussed.

Keywords: *Hydnum limonicolor*, *Odontia latemarginata*, *Odonticum monfraguense*, *Odonticum flavicans*.

Corticioid basidiomycetes that develop aculei are numerous and often challenging to identify to species. The term aculei refers to fertile protuberances of all types, sizes, shapes, textures, and colors. Although many corticioid basidiomycetes with aculei are well-studied and well-known, there are still a number of overlooked species. This paper is the result of an on-going study of resupinate, corticioid basidiomycete type specimens; previous studies focused on types of Patouillard (Nakasone 2003) and Bresadola (Nakasone 2008). In this paper type studies of ten poorly known aculeate corticioid basidiomycetes described by several mycologists are studied. One new combination are proposed, and five names are found to be taxonomic synonyms. The taxa originate from Austria, Brazil, Cameroon, Guadeloupe, Italy, Japan, Philippines, Russia, Sweden, and South Africa.

### Materials and Methods

Thin, freehand sections from basidiomata were mounted in a mixture of aqueous potassium hydroxide (2 % w/v) and aqueous phloxine

(1 % w/v) or Melzer's reagent (Kirk *et al.* 2001) and examined with an Olympus BH2 compound microscope. Cyanophily of basidiospore and hyphal walls were observed in a solution of cotton blue (0.1 % w/v in 60 % lactic acid). Drawings were made with a camera lucida attachment. Q-values were obtained from dividing average basidiospore length by width (Kirk *et al.* 2001). These values are approximate as the basidiospore sample sizes are small because of the condition and precious nature of the type specimens. If fewer than six spores were measured in a specimen, the Q-value was not calculated. Capitalized color names are from Ridgway (1912), and other color names follow Kørnerup & Wanscher (1978). Herbarium designations are from Holmgren & Holmgren (1998). CortBase (Parmasto *et al.* 2004) and the Aphyllorphales database at CBS (<http://www.cbs.knaw.nl/databases/aphyllo/database.aspx>) were consulted frequently throughout this study. Literature citations follow Stafleu & Cowan (1976) for books and Bridson & Smith (1991) and Bridson (2004) for journals.

### Taxonomy

***Acia conferta*** P.H.B. Talbot, Bothalia 6: 64. 1951. – Fig. 1.  
= ***Phanerochaete subquercina*** (Henn.) Hjortstam

Holotypus. – SOUTH AFRICA, Natal Province, Pieter Martizburg, Town Bush, on indigenous wood, Oct 1934, *leg.* W.C. Rump 275 (PREM 28494).

Basidioma resupinate, effuse, 85 × 30 mm, adnate, subceraceous, spinose, Buckthorn Brown, Tawny Olive, or brown [6(D–E)6], extensively cracked between aculei; aculei terete, up to 1 mm long, 3–4 aculei per mm, single or fused at base, apex obtuse with multiple, small tufts; margin fimbriate, appressed. Hyphal system monomitic with simple-septate generative hyphae. Subicular hyphae (Fig. 1A) 2–5 µm diam, simple septate, moderately branched, walls hyaline, thin, smooth. Hymenium a dense palisade of immature basidia. Mature basidia not observed. Basidiospores (Fig. 1B) ellipsoid, (5.3) 5.4–6.2 (6.5) × (3) 3.1–3.4 (3.5) µm, Q = 1.7 (n = 7), walls hyaline, thin, smooth, not reacting in Melzer's reagent.

*Acia conferta* is conspecific with *Phanerochaete subquercina*. In addition, three paratype specimens named *A. conferta* (PREM 40524–40526) were examined. These have clamp connections and subfusiform cystidia and may be conspecific with *Phlebia subceracea* (Wakef.) Nakasone.

***Hydnum bresadolae*** Quél. in Bres., Fungi Trident. 1: 14. 1881.  
= ***Dentipellis*** cf. ***fragilis*** (Pers.: Fr.) Donk

Holotypus. – ITALY, Trento, Val di Sole, Caldes, ad ligna mucidi *Larix*, 1880, *leg.* G. Bresadola (S, F88637).

Basidioma consisting of two small pieces, ca.  $4 \times 3$  and  $3 \times 2.5$  mm, resupinate, effuse, subceraceous, spinose, fragile, brittle, light brown (6D6); aculei slender, narrowly conical with an acute apex,  $430\text{--}750 \times 70\text{--}90$   $\mu\text{m}$ ; margin not observed. Hyphal system monomitic with clamped generative hyphae. Aculei composed of agglutinated tramal hyphae arranged in parallel; tramal hyphae  $1.5\text{--}2$   $\mu\text{m}$  diam, clamped, walls hyaline, thin, smooth, possibly cyanophilous. Context and hymenium degraded; subiculum, subhymenium basidia and cystidia not observed. Basidiospores abundant, broadly ellipsoid, usually collapsed,  $(4) 4.8\text{--}5.6 (5.8) \times (3.2) 3.9\text{--}4.3 (4.5)$   $\mu\text{m}$ ,  $Q = 1.3$  ( $n = 9$ ), walls hyaline, thin to slightly thickened, smooth in KOH and phloxine, minutely warted or roughened in Melzer's reagent, acyanophilous, amyloid.

Later, but not in the protologue, Bresadola (1882, p. 26) noted that the basidiospores of *H. bresadolae* were echinulate. His illustration (Bresadola 1881, plate 11, fig. 2) shows a basidioma with numerous aculei and a pallid, distinctly cottony or fibrous margin. Because of the fragmentary and degraded condition of the holotype, it was not possible to identify this specimen with certainty. It appears most similar to *D. fragilis* with respect to basidiospore shape and size. However, the short aculei and coniferous substrate of the holotype of *H. bresadolae* differ from the description of *D. fragilis* by Ginns (1986).

Mycologists have differing opinions on the status of *H. bresadolae*. Quélet (1888, p. 433) considered *H. bresadolae* to be similar to *H. limonicolor* Berk. & Broome, whereas Bourdot & Galzin (1928, p. 411) placed both species in synonymy with *Sistotrema muscicola* (Pers.) S. Lundell. Legon & Henrici (2005, p. 393), however, consider *H. limonicolor* a *nomen dubium*. Hjortstam (1987, p. 75) believed *H. bresadolae* to be congeneric with *Mycoacia* but did not formally make the transfer.

In addition to the holotype, two other specimens of *H. bresadolae* from S, F106889 and F15772, possibly from the same gathering as the holotype, were examined. Both these specimens consisted of woody fragments but no basidiomata with aculei were observed. A single collection labeled *H. bresadolae*, Tyrol meridional, Sept 1881, from L. Quélet's herbarium at PC was examined. This specimen has simple-septate hyphae and smooth, amyloid, ovoid basidiospores and appears to be a species of *Mucronella*.

***Hydnum squalinum*** Fr.: Fr., Syst. mycol. I: 420. 1821.

- ≡ *Sistotrema squalinum* (Fr.: Fr.) Persoon, Mycol. Europe 2: 199. 1825, as '*squalidum*'.
- ≡ *Dryodon squalinus* (Fr.: Fr.) Quél., Enchir. Fung. p. 193. 1886, as '*squalinum*'.
- ≡ *Acia squalina* (Fr.: Fr.) P. Karst., Medd. Soc. Fauna Fl. Fenn. 5: 42. 1879, as '*squalida*'.

- ≡ *Acia squalina* (Fr.: Fr.) Bourdot & Galzin, Hymen. France p. 418. 1928.
- ≡ *Mycoacia squalina* (Fr.: Fr.) M.P. Christ., Dansk Bot. Ark. 19(2): 177. 1960.
- = ***Cerrena unicolor*** (Bull.: Fr.) Murrill

Typi. – SWEDEN, Småland, Femsjö, *leg.* Fries (holotypus: UPS; isotypus: BPI US0260448).

*Hydnum squalinum* has been misinterpreted by many mycologists and has a long, confusing history. The holotype is at UPS in Herb. Fries with notes by Romell who identified it as *Daedalea unicolor* (Bull.: Fr.) Murrill (Maas Geesteranus 1974, p. 465). This specimen is effused-reflexed with an irpicoid hymenophore and dimitic hyphal system with clamped generative and thick-walled skeletal hyphae. The hymenium is degraded and only a single, cylindrical basidiospore ( $6.3 \times 2.7 \mu\text{m}$ ) was seen. The isotype specimen at BPI is similar except that no basidiospores were observed. On this packet is written '*Hydnum squalinum* orig!, Femsjö, Fries' in Fries' hand. Because there is nothing in the holotype and isotype specimens to contradict Romell's conclusion, I accept his identification.

There is no consensus among mycologists on the correct application of the name *H. squalinum*. The confusion began with Fries (1838, p. 515) who placed *Boletus obliquus* Bolton in synonymy with *H. squalinum* and suggested that *Hydnum fuscescens* (Schwein.) Spreng., *Sisotrema taurinum* Pers., and *S. fagineum* Secr. may be considered varieties. However, *B. obliquus* is generally accepted as a synonym of *Serpula lacrymans* (Wulfen: Fr.) J. Schröt. (Fries 1821, p. 328), *H. fuscescens* a synonym of *Hydnochaete olivacea* (Schwein.: Fr.) Banker (Banker 1914), and *S. taurinum* a species of *Mycoleptodon*, now *Steccherinum* (Bourdot 1932). Bresadola (1897, p. 94) concluded that "*Hydnum squalinum* aut. Pl. non Fr." was a synonym of *Hydnum macrodon* Pers., usually interpreted to be *Dentipellis fragilis*. Later, Rea (1922) misapplied the name *H. squalinum* to the species known as *Mycoaciella bispora* (Stalpers) J. Erikss. according to Legon & Henrici (2005). Also, Bourdot & Galzin's (1928) concept of *Acia squalina* was erroneous. Michel & Duhem (2003) studied all five specimens of *A. squalina* in Bourdot's herbarium at PC and identified both of the de Crozals specimens (PC 39099, 39103) as *Odonticium monfraguense* M.N. Blanco *et al.* (= *Odonticium flavicans* (Bres.) Nakasone) and the other three specimens (PC 31450, 32346, 33072) as *Phlebia badia* (Pat.) Nakasone. I have examined the same five specimens from Bourdot's herbarium and concur with Michel and Duhem's identifications. Finally, Christiansen (1960) described *Mycoacia squalina* from Denmark, but he misapplied the name to specimens of *Sarcodontia crocea* (Schwein.) Kotl. according to Legon & Henrici (2005) and Hansen & Knudsen (1997).

***Hydnum stalagmodes*** Berk. & M.A. Curtis, Proc. Amer. Acad. Arts Sci. 4: 123. 1858.

= ***Phlebia* cf. *fuscoatra*** (Fr.: Fr.) Nakasone

Typi. – JAPAN, Bonin Islands, *leg.* C. Wright, U.S. North Pacific Exploring Expedition 1853–56 (holotypus: K, K(M)140058; isotypi: K, K(M)140057, K(M)140059; BPI US0260451).

Basidioma resupinate, effuse, ceraceous, hydnyaceous, brown [6D(7–8), 7E8]; aculei conical, slender, tapering to apex, 3–4 mm long, 3–4 aculei per mm, fused together into larger clusters, dark brown with a hygrophanous appearance, often glaucous from crystalline materials on surface, sometimes with embedded columns of pale yellow, crystalline materials. Hyphal system monomitic with clamped generative hyphae. Aculei composed of fascicles of agglutinated tramal hyphae and embedded crystals, no hymenial layer observed; tramal hyphae 2.5–3.5 µm diam, clamped, walls hyaline, thin, smooth. Hymenium degraded, basidia and cystidia not observed. Basidiospore, only one observed, cylindrical, 7 × 2.5 µm, wall hyaline, thin, smooth, not reacting in Melzer's reagent.

Because of the poor condition of the specimens, it is impossible to make an identification. Based primarily on macroscopic features, *H. stalagmodes* is *Phlebia fuscoatra*. This would be consistent with Berkeley's observation that it was "somewhat like *Hydnum membranaceum* and *udum*," since *P. fuscoatra* was often identified as *H. membranaceum* by mycologists. Maas Geesteranus (1974, p. 567), however, suggested that *H. stalagmodes* was a heterobasidiomycete.

***Hydnum webbii*** Berk., Journal Botany, London 3: 190. 1844. – Fig. 4.

= ***Scopulodontia webbii*** (Berk.) Nakasone, **comb. nov.**

MycoBank no.: MB 515512

Typi. – PHILIPPINES, *leg.* Cuming, 1841, no. 2172, Herb. Berk. 2172 (holotypus: K, K(M)140056; isotypi: BPI US0260626, NY 00776150).

Basidioma resupinate, effuse, broken into smaller pieces about 12–18 × 7 mm, adnate, ~360 µm thick excluding tubercles, ceraceous to corneous, tuberculate, dark brown, dark gray to light brown, covered with a fine, white bloom; tubercles (Fig. 4) with rounded apices, about 470 × 180 µm, 3–4 tubercles per mm, finely velutinous from projecting cystidia but shiny where rubbed-off; margin not observed. Hyphal system monomitic with clamped generative hyphae. Subiculum ~180 µm thick, a compact, agglutinated tissue of indistinct hyphae; subicular hyphae 4–5.5 µm diam, walls yellow, thin to thick. Subhymenium up to 180 µm thick, an agglutinated, compact matrix with embedded crystals, metuloid cystidia, and scattered lacunae. Hymenium degraded, only metuloid cystidia observed. Cystidia numerous throughout context and hymenium, fusiform, 35–42 × 8–10 µm,

clamped at base, walls hyaline, thin or thickened at base, heavily encrusted over upper half with hyaline crystals. Basidia and basidiospores not observed.

Although basidia and basidiospores were not observed in the holotype and isotype specimens, there can be no doubt that this taxon is conspecific with *Odontia latemarginata* Pat. Maas Geesteranus (1974, p. 569) also did not observe basidia and basidiospores in the holotype. The rounded, finely fuzzy aculei and encrusted, embedded cystidia are characteristic and distinctive for this taxon. Since *H. webbia* is the oldest name for this species, the new combination is proposed above. Nakasone (2003) provides a description and further synonymy. *Phlebia* (*Mycoacia*) sp., Roberts K344, described from Cameroon (Roberts 2000) is conspecific with *S. webbia*. Known from Vietnam, Brunei, Philippines, and New Zealand (Nakasone 2003), *S. webbia* was reported recently from Ecuador (Hjortstam & Ryvarden 2008).

***Melzerodontia udamentiens*** P. Roberts, Kew Bull. 55(4): 819. 2000. – Fig. 5.

= ***Phlebia badia*** (Pat.) Nakasone

Holotypus. – CAMEROON, Southwest Province, Korup National Park, Transect P, on (bark) of part fallen branch, 50 m alt., 4 April 1997, leg. P.J. Roberts K890 (K, K(M)58759).

Basidioma resupinate, effuse, 20–35 × 20 mm, closely adnate, appressed, thin, ceraceous, odontoid to spinose, aculei brown [6E(7–8)] with a reddish tinge, smooth areas between aculei light orange (5A4), toward margins aculei yellowish brown [5D(6–5)] and smooth areas between aculei light yellow (4A4), extensively cracking on drying to expose pale yellow, homogeneous context; aculei (Fig. 5) slender, terete, up to 1.5 mm long, 3–5 aculei per mm, tapering to an acute point, single or fused laterally at base, with a shiny, smooth surface, apex white or yellow, paler than aculeus base; margin thinning out, finely farinaceous, greyish yellow (4C4), outer most edge white, farinaceous or abrupt, smooth, waxy, fibrillose. Hyphal system dimitic with simple-septate generative and thick-walled skeletal hyphae. Aculei composed of a central core of dextrinoid skeletal hyphae and large, embedded crystals. Hymenium a palisade of cystidia and basidia. Cystidia difficult to isolate and observe, clavate, about 13 × 4.5 µm, apically capped with a globular substance. Mature basidia not observed. Basidiospores ellipsoid, (3.5) 3.8–4.2 (4.5) × (1.8) 1.9–2.1 µm, Q = 2.0 (n = 12), walls hyaline, thin, smooth, not reacting in Melzer's reagent.

*Melzerodontia udamentiens* is conspecific with *Phlebia badia* although the basidiospores in the latter species are somewhat larger, (3.5–) 4.5–5 (–6) × 2–2.5 (–3) µm (Nakasone 2002). *Phlebia badia* is re-



ported from Vietnam, Brazil, Costa Rica, United States (Florida), Iran, and Malawi (Nakasone 2002, Hjortstam & Ryvarden 2004).

***Mycoleptodon ljubarskii*** Pilát, Bull. Soc. Mycol France 52(3): 326. 1936, as "*ljubarskyi*."

= ***Hydnophlebia chrysorhiza*** (Torr.) Parmasto

Holotypus. – RUSSIA, Primorsk Territory, Asia orientalis, Schkotowo, on *Acer mono* Maxim., 25 Aug 1935, Ljubarsky (PRM 25042).

Basidioma resupinate, effuse, very soft, fragile, spinose, aculei easily separated from subiculum, hyphal strands in margin not well-developed. Hyphal system monomitic, generative hyphae simple-septate with scattered single clamp connections. Subicular hyphae 5–9 µm diam, simple-septate with scattered single clamp connections, moderately branched, lateral H-connections observed, walls hyaline, thin, smooth or encrusted with a thin layer of crystals. Hymenium degraded, no cystidia or basidia observed. Basidiospores ellipsoid to cylindrical, (3.5) 3.6–4.4 (4.5) × (2) 2.1–2.4 (2.5) µm, Q = 1.8 (n = 6), walls hyaline, thin, smooth, not reacting in Melzer's reagent.

The condition of the holotype is poor, but based on my observations and previously published descriptions (Pilát 1936, Nikolajeva 1961, p. 152), I conclude that this taxon is *H. chrysorhiza*. The basidiospores observed are slightly shorter than typical for the species, 4–5 × 2–2.5 µm (Burdsall 1985). According to Maas Geesteranus (1974, p. 558) the isotype at UPS is poorly preserved also. Widely distributed in eastern United States (Burdsall 1985), *H. chrysorhiza* occurs in East Asia also. It is reported from the Ussurian region of Primorsk Territory, Russia (Nikolajeva 1961, as *Sarcodontia fragilissima* (Berk. & M.A. Curtis) Nikol.), Japan (Maekawa 1993), and Sichuan Province in southwestern China (Maekawa *et al.* 2002).

***Odontia griseo-olivacea*** Höhn., Ann. Mycologici 3: 548. 1905.

≡ *Acia griseo-olivacea* (Höhn.) Bourdot & Galzin, Hymen. France p. 415. 1928.

= ***Phlebia uda*** (Fr.) Nakasone

Typi. – AUSTRIA, Wiener Wald, Deutsch Wald, Kellerwiese, an Fagus, 23 Jul 1905, leg. v. Höhn., no. 746 (holotypus: FH 00258831; isotypus: S, F106891).

Basidioma resupinate, adnate, widely effuse, up to 30 × 25 mm, thin, subceraceous to crustaceous, odontoid to spinose, smooth between aculei, greyish orange (5B4), light brown [D(4–5)], or brown (6D4), turning dark brown in KOH; aculei slender, cylindrical, up to 0.5 mm long, 2–4 aculei per mm, single but often fused at base, darker brown at base then paler toward apex, apices penicillate to tufted, white; margin thinning out, adnate, fimbriate, light brown to off-white.

Hyphal system monomitic with clamped generative hyphae. Aculei with a core of partially agglutinated, parallel hyphae and acicular crystals, at apex terminal hyphae not differentiated but heavily encrusted with coarse, hyaline crystals; tramal hyphae 2.5–3.2  $\mu\text{m}$  diam, clamped, sparingly branched, walls hyaline, thin, smooth. Subicular hyphae similar to tramal hyphae. Subhymenium up to 25  $\mu\text{m}$  thick, a dense tissue of vertical, short-celled hyphae; subhymenial hyphae 2–2.5  $\mu\text{m}$  diam, clamped, frequently branched, walls hyaline, thin, smooth. Hymenium a dense palisade of immature basidia and cystidia. Cystidia subulate, (12–) 18–25  $\times$  3–7  $\mu\text{m}$ , clamped at base, often with an apical, globose cap of yellowish brown, mucilaginous material, 5–10  $\mu\text{m}$  diam. Mature basidia not observed. Basidiospores short cylindrical, (4.7) 4.8–5.2 (5.5)  $\times$  (2.1) 2.2–2.4 (–2.5)  $\mu\text{m}$ ,  $Q = 2.2$  ( $n = 12$ ), walls hyaline, thin, smooth, acyanophilous, not reacting in Melzer's reagent.

Although the basidiospores are slightly narrower than usual, *O. griseo-olivacea* is conspecific with *Phlebia uda*. The holotype is in good condition and turned dark brown with the application of potassium hydroxide, whereas Höhnelt (1905) observed a bright violet or lilac color change with ammonia.

***Odontia palumbina*** Höhn., Denkschr. K. Akad. Wiss. Wien, Math.-Naturw. Kl. 83: 10. 1907. – Fig. 6.

= *Scopuloides* cf. *rimosa* (Cooke) Jülich

Holotypus. – BRASILIEN, São Paulo, Santos, Raiz da Serra, Jun 1901, leg. v. Höhnelt no. 746 (FH 00258832).

Basidioma resupinate, effuse, up to 35  $\times$  13 mm, thin, up to 90  $\mu\text{m}$  thick, ceraceous to corneous, odontoid, smooth to finely granulose or scabrous between aculei, brown [6E(4–5)], Light Drab to Drab; aculei (Fig. 6) abundant, cylindrical with bristly sides and apices, up to 270  $\times$  90  $\mu\text{m}$ , 4–6 aculei per mm, single or occasionally fused at base; margin abrupt, distinct, adnate or slightly detached on drying, fibrillose. Hyphal system monomitic with simple-septate generative hyphae. Aculei composed of embedded, septate cystidia in the central axis and numerous, protruding and embedded metuloid cystidia; septate cystidia cylindrical and gradually tapering toward apex, up to 75  $\times$  6–11  $\mu\text{m}$ , walls hyaline, up to 1.5  $\mu\text{m}$  thick, lightly encrusted with hyaline granules; metuloid cystidia fusiform, 35–50  $\times$  8–12  $\mu\text{m}$ , tapering to 1.5–3  $\mu\text{m}$  diam toward base, simple-septate at base, walls hyaline, thick, distal end heavily encrusted with coarse, hyaline crystals, partially dextrinoid. Subiculum a dense, agglutinated tissue of collapsed hyphae; subicular hyphae 4–7.5  $\mu\text{m}$  diam, simple-septate, walls hyaline, thin to thickened, smooth. Subhymenium not observed. Cystidia metuloid, as described above. Basidia not observed. Basidiospores



rare, mostly collapsed, allantoid,  $2.9\text{--}3.6 \times 0.7\text{--}1.8\ \mu\text{m}$ , walls hyaline, thin, smooth, not reacting in Melzer's reagent.

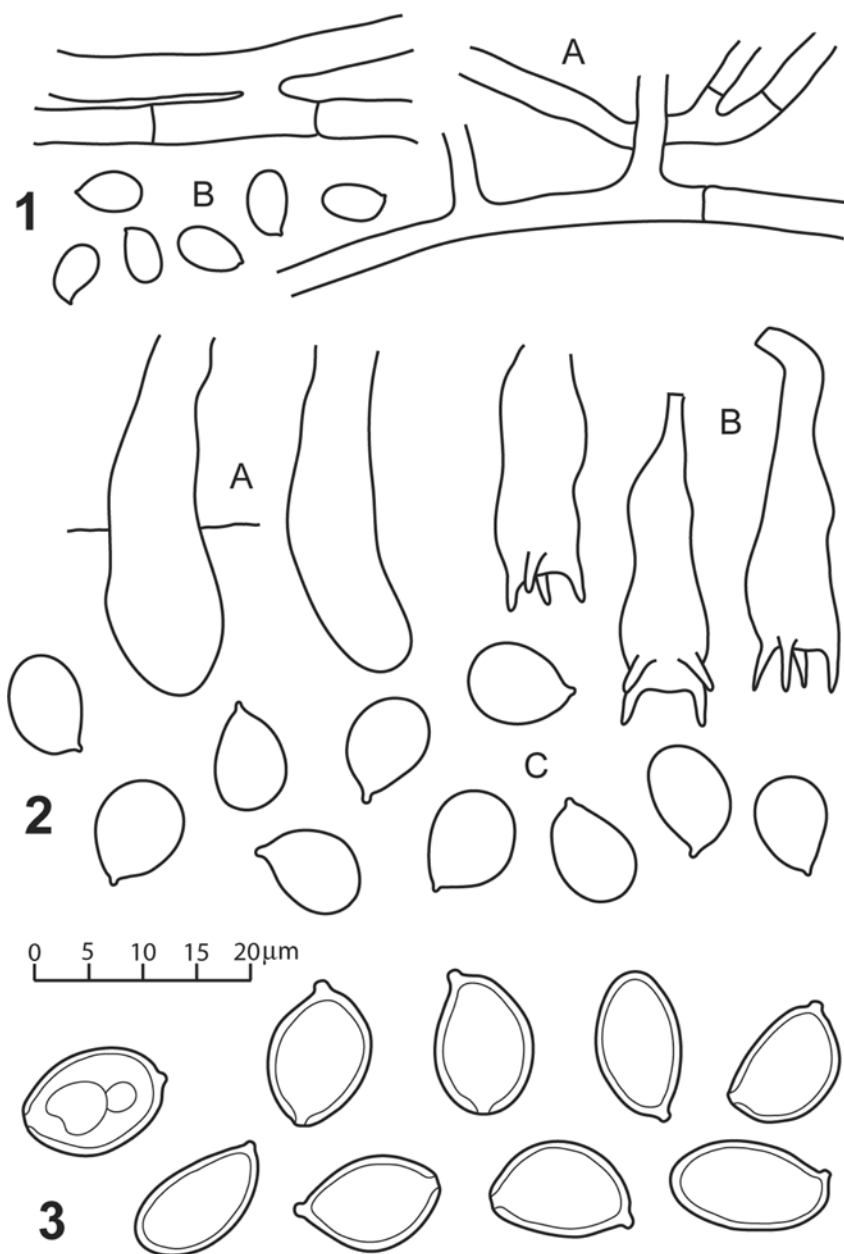
This taxon resembles *Scopuloides rimosa* because of the abundant aculei; however, the basidiospores are smaller than expected for the species. The holotype specimen appears to be in good condition, but only three, questionable basidiospores were seen. The small, ovoid basidiospores,  $1\text{--}1.5 \times 1\ \mu\text{m}$ , described in the protologue were not observed but are possibly the pinched apices of the collapsed, immature basidia.

***Phaeoradulum guadelupense*** Pat., Bull. Soc. Mycol. France 16: 178. 1900. – Figs. 2–3, 7–8.

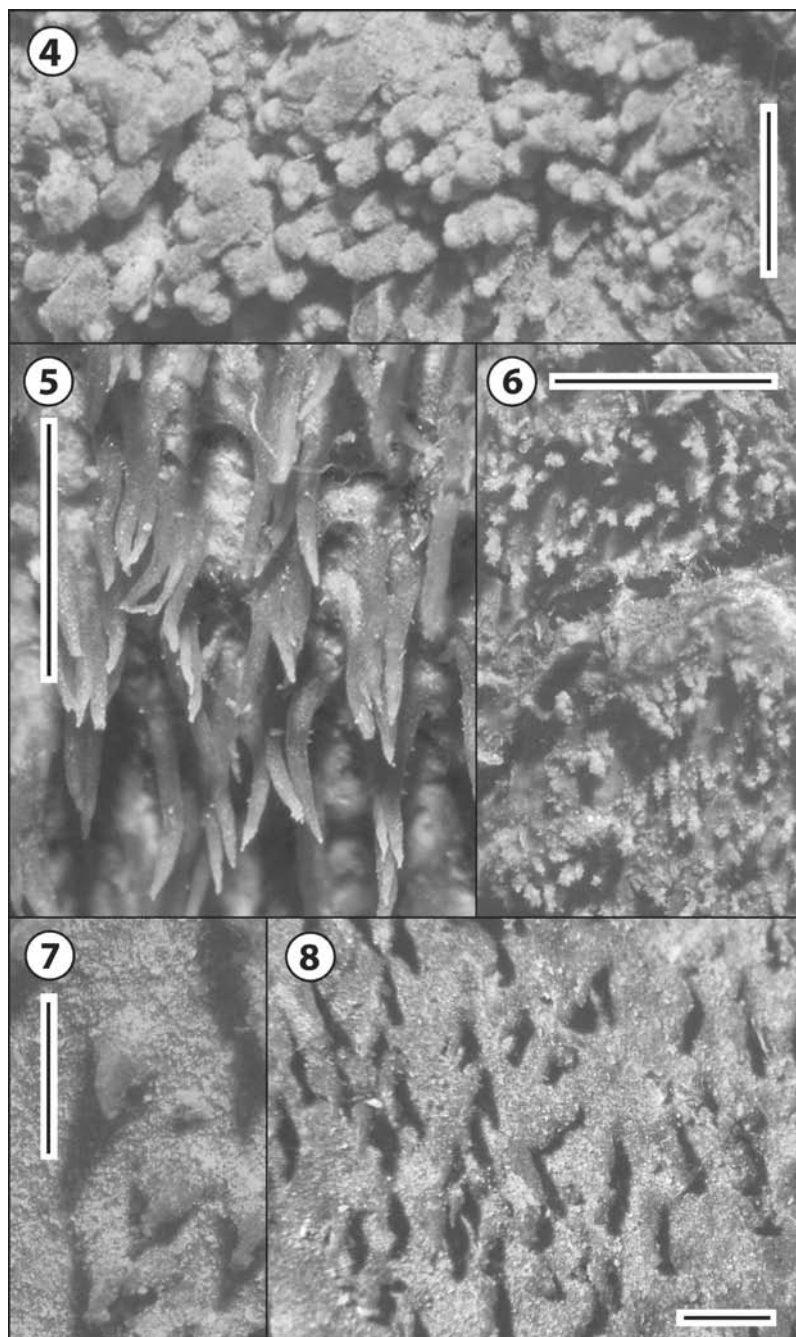
Holotypus – GUADELOUPE, sur tige pourrissant d'une *Daphnopsis caribea* Griseb., no. 28 (FH 00258830).

Basidioma resupinate, widely effuse, adnate, moderately thick, up to  $400\ \mu\text{m}$  thick, ceraceous to corneous, spinose, smooth between aculei, greyish brown (6D3) to brown [6E(4–6)], often with a white, farinaceous coating; aculei (Figs. 7–8) conical with entire apices, up to  $1 \times 0.3\ \text{mm}$ , unevenly distributed, 1–3 aculei per mm, with a farinaceous coating, smooth near apices; cracks none; context dense, corneous, dark brown; margin not observed. Hyphal system monomitic with simple-septate (?) generative hyphae. Subiculum a compact, hard, agglutinated tissue, up to  $250\ \mu\text{m}$  thick; composed of indistinct, collapsed hyphae arranged parallel to substrate; subicular hyphae  $3\text{--}5\ \mu\text{m}$  diam, simple-septate (?), walls hyaline to yellow, thickened, smooth. Subhymenium composed of collapsed hyphae. Hymenium composed of cystidia and basidia. Cystidia (Fig. 2A) fragile, only distal end observed, cylindrical to narrowly clavate,  $40\text{--}60 \times 8\text{--}10\ \mu\text{m}$  (from protologue), simple-septate (?) at base, protruding up to  $30\ \mu\text{m}$  beyond hymenium, walls hyaline, thin, smooth. Basidia (Fig. 2B) rare, fragile, usually collapsed, clavate,  $25\text{--}31 \times 8\text{--}9\ \mu\text{m}$ , simple-septate (?), walls hyaline, thin, smooth. Basidiospores (Fig. 2C) broadly ellipsoid to subglobose, tapering somewhat toward apiculus,  $(7.5) 8.3\text{--}9.5 (10.0) \times (6) 6.4\text{--}7.4 (7.8)\ \mu\text{m}$ ,  $Q = 1.3$  ( $n = 19$ ), walls hyaline to light brown, thin to slightly thickened, smooth, acyanophilous, not reacting in Melzer's reagent.

*Phaeoradulum*, a monotypic genus, is unrelated to any of the known resupinate, spinose basidiomycete genera although Hjortstam and Ryvarden (2007) suggested a relationship to the Coniophoraceae. The brown, hard, spinose basidiome with broadly ellipsoid, brown basidiospores are unique to this genus. The hyphae are probably simple-septate, but it was difficult to isolate individual hyphae that were not compressed or distorted. The fragile nature of the cystidia and basidia made it impossible to tease out whole, individual elements and observe if a basal clamp was present.



**Figs. 1–3.** Line drawings of microscopic elements. **1.** *Acia conferta* (holotype): A. Subicular hyphae. B. Basidiospores. **2.** *Phaeoradulum guadelupense* (holotype): A. Cystidia. B. Basidia. C. Basidiospores. **3.** Basidiospores of alien agaric in the holotype of *P. guadelupense*.



**Figs 4–8.** Photographs of basidiomata. **4.** *Hydnum webbii* (holotype). **5.** *Melzerodontia udamentiens* (holotype). **6.** *Odontia palumbina* (holotype). **7–8.** *Phaeoradulum guadelupense* (holotype). Bars = 1 mm.

The holotype has two distinct types of basidiospores — the broadly ellipsoid basidiospores (Fig. 2C) described above and larger, thick-walled, brown, ellipsoid basidiospores (Fig. 3) with an apical pore. The latter, alien basidiospores are more prominent and abundant. They are possibly from a gilled mushroom species in the Agaricaceae, Bolbitiaceae, Psathyrellaceae, or Panaeoleae. These basidiospores measure (11.5) 11.8–13.6 (15) × (7) 7.5–8.9 (9)  $\mu\text{m}$ ,  $Q = 1.6$  ( $n = 22$ ). In the protologue, Patouillard described the basidiospores as “lisses, ovoides, orangées brunes, 10–12 × 6  $\mu$ ” but does not mention the presence of an apical pore.

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