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Type studies of corticioid Hymenomycetes (Basidiomycota) with aculei – Part II

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Nakasone K. (2012): Type studies of corticioid Hymenomycetes (Basidiomycota) with aculei – Part II. – Czech Mycol. 64(1): 23–42.

Type specimens of fifteen, resupinate, crustose basidiomycetes with aculei described by various authors were examined. Nine taxa are later synonyms: *Hydnum albiceps* Berk. & Rav. (= *Phlebia fascicularis*), *Hydnum chrysodon* Berk. & M.A. Curtis (= *Hydnophlebia chrysorhiza*), *Hydnum hypochrum* Berk. & Broome (= *Dentipellis leptodon*), *Hydnum micheneri* Berk. (= *Steccherinum ciliolatum*), *Hydnum pallidum* Cooke & Ellis (= *Xylodon fimbriiformis*), *Hydnum schweinitzii* Berk. & M.A. Curtis (= *H. chrysorhiza*), *Irpex furfuraceovelutinus* Rick (= *Kneiffiella stereicola*), *Irpex galzinii* Bres. (= *Amyloporia sinuosa*), and *Merulius elliottii* Massee (= *H. chrysorhiza*). *Irpex fimbriiformis* Berk. & M.A. Curtis (≡ *X. fimbriiformis*) is accepted as a distinct species. Five new combinations are proposed: *Cristinia decolorans* for *Irpex decolorans* Cooke, *Dentipellis ohiensis* for *Hydnum ohiense* Berk., an earlier name for *Dentipellis dissita* (Berk. & Cooke) Maas Geest., *Odonticium depauperatum* for *Irpex depauperatus* Berk. & Broome, *Peniophorella tessulata* for *Kneiffia tessulata* Berk. & M.A. Curtis, an earlier name for *Peniophorella rudis* (Bres.) K.H. Larss., and *Schizopora archeri* for *Irpex archeri* Berk.

Key words: type studies, corticioid fungi, *Phanerochaete chrysorhiza*.

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Práce popisuje výsledky studia typových položek patnácti druhů hub s rozlitými korovitými plodnicemi a ostnitým hymenoforem, popsaných různými autory. Devět z nich představuje synonyma již dříve popsaných druhů, jeden je akceptován jako samostatný druh a dalších pět je přeřazeno do jiných rodů.

INTRODUCTION

In the first 100 years of systematic mycology, basidiomycetes with crustose or corticioid habit and aculeate hymenophore were described in genera such as *Acia* P. Karst., *Grandinia* Fr., *Hydnum* L., *Irpex* Fr., *Kneiffia* Fr., *Odontia* Pers., *Radulum* Fr., and *Sistotrema* Fr. As systematics progressed and incorporated new methods, especially DNA sequence, the remarkable plasticity of basidioma and hymenophore form was revealed. The variation in the aculeate hymenophore is truly marvelous and difficult to describe accurately. Today, aculeate species

with a crustose habit are classified in over fifty genera distributed in 11 of the 17 orders in the Agaricomycetes. Thirty-nine types with aculei were studied in previous works, including those described by Bresadola and Patouillard (Nakasone 2003, 2008, 2009). In this paper, an additional fifteen types are studied. The species are from Australia, Brazil, Cuba, France, Saint Vincent and the Grenadines, Sri Lanka (2 species) and the United States (8 species).

MATERIALS AND METHODS

Holotype and isotype specimens were examined whenever possible. Thin, freehand sections from basidiomata were mounted in a mixture of aqueous potassium hydroxide, KOH, (2 % weight/volume) and aqueous phloxine (1 % w/v) or in Melzer's reagent (Kirk et al. 2008) and examined with an Olympus BH2 compound light microscope. Cyanophily of basidiospore and hyphal walls was determined by mounting samples in 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 of at least 30 spores (Kirk et al. 2008); values based on 10–30 spores are indicated by an asterisk. Capitalized color names are from Ridgway (1912), and other color names follow Kornerup & Wanscher (1978). Specimen data were sometimes combined from holotype and isotype labels; data not included on the original labels are placed in brackets. Herbarium designations are from Thiers (2012). MycoBank (Crous et al. 2004) was consulted frequently throughout this study.

RESULTS AND DISCUSSION

Hydnum albiceps Berk. & Ravenel in Cooke, Grevillea 20(93): 2. 1891. (invalid name)

= ***Phlebia fascicularis*** (Rick) Nakasone & Burds.

Basidioma resupinate, effuse, robust, odontioid, ceraceous to corneus, brown [6(D-E)6, 6E8]; aculei conical, slender, up to 5 per mm, single or fused at base forming coarse warts with multiple apices, apices white to light yellow; margin not observed. Hyphal system monomitic with clamped generative hyphae. Subiculum a dense, agglutinated tissue, individual hyphae not observed. Subhymenium, hymenium, basidia, and basidiospores not observed.

Specimens examined. [U.S.A.,] S[outh] C[arolina], lingo carioso *Liquidambar*, Martio, H.W. R[avenel], no. 935, K(M)160375 and 160376, as *Hydnum albiceps* (K).

Notes. *Hydnum albiceps* was published without a description, thus the name is invalid. *Hydnum albiceps*, K(M)160376, from Cooke's herbarium, appears to be from the same gathering as the larger specimen, K(M)160375, from Berkeley's herbarium. Although sterile, the specimens are readily identifiable as *P. fascicularis*. The collection from Ceylon, K(M)160377, named *Radulum membranaceum* f. *albiceps*, has cylindrical basidiospores and encrusted cystidia and is *Phlebia nothofagi* (G. Cunn.) Nakasone.

Hydnum chrysodon Berk. & M.A. Curtis, Grevillea 1(7): 98. 1873.
= ***Hydnophlebia chrysorhiza*** (Torr.) Parmasto

Basidioma resupinate, effuse, thin, ceraceous, spinose with smooth, shiny areas between aculei, Ochraceous Tawny to Buckthorn Brown or Tawny-Olive, with fibrous context; aculei slender, conical with an acute apex, about 3 per mm, up to 1.5 mm long, yellow (in protologue) or slightly darker brown than area between aculei; margin appressed to slightly detached, fibrillose, somewhat cordonic. Hyphal system monomitic with simple-septate generative hyphae. Aculei a fascicle of partially agglutinated, more or less parallel hyphae; tramal hyphae 3–4.3 µm diam, simple septate, sparingly to moderately branched, walls hyaline, thin to slightly thickened, smooth. Subiculum a partially agglutinated tissue; subicular hyphae 3.5–8(–10) µm diam, moderately branched, walls hyaline, thin to 1.5 µm thick, smooth. Subhymenium, hymenium, basidia, and basidiospores not observed.

Type specimens examined. [U.S.A.], South Carolina, Society Hill, in frustulis quercinis, January 1849, M.A. Curtis 2511 (K: K(M)169880 holotype; FH: HUH00351027 isotype).

Notes. Although sterile, *H. chrysodon* is readily identifiable as *Hydnophlebia chrysorhiza*. The fibrillose, cordonic margin, slender aculei, and broad, simple-septate hyphae are characteristic of *H. chrysorhiza* which occurs throughout the eastern and southeastern United States (Burdsall 1985). An overall shiny, hygrophanous aspect of the types suggests that they were over-mature or improperly dried. Gilbertson (1965) erroneously reported frequent clamp connections in the isotype specimen.

Hydnum hypochrum Berk. & Broome, J. Linn. Soc., Bot. 14: 60. 1875.
= ***Dentipellis leptodon*** (Mont.) Maas Geest.

Basidioma resupinate, widely effuse, up to 77 × 25 mm in holotype, adnate, soft, spinose with smooth areas between aculei, orange white (5A2) to greyish orange [5B(3–4)]; aculei conical to cylindrical with an obtuse, rounded or subacute apex, smooth, 2–4 per mm, up to 0.5 mm long; cracks numerous, exposing cottony context. Hyphal system monomitic with clamped generative hyphae. Subiculum

a tissue of non-agglutinated subicular and gleoplerous hyphae; subicular hyphae 3–4.5 µm diam, clamped, moderately branched, even, straight, walls hyaline to pale yellow, thin to 1 µm thick, smooth; gleoplerous hyphae 3.5–6 µm diam, clamped, sparsely branched, even or slightly constricted, filled with oil-like material, walls hyaline, thin to thickened, smooth. Hymenium a palisade of gloeocystidia and basidia. Gloeocystidia numerous, originating in aculei trama, subiculum, and hymenium, clavate, obclavate or fusoid, 24–40 × 5–7 µm (in hymenium), clamped at base, filled with oil-like material, walls hyaline, thin, smooth. Mature basidia not observed. Basidiospores abundant, ellipsoid, 3–4 × (2.3–)2.5–3.2 µm, average of holotype 3.6 ± 0.2 × 2.7 ± 0.2 µm, Q = 1.3, walls hyaline, slightly thickened, smooth in KOH, sparsely echinulate in Melzer's reagent, amyloid.

Type specimen examined. [Sri Lanka], Ceylon, Dolosbagey, on dead wood, May 1868, G.H.K. Thwaites 608 (K: K(M)174147 holotype; NY: NY00776198 isotype).

Notes. This is the widely distributed species *Dentipellis leptodon*. Although the types are in good condition, mature basidia were not observed. Numerous, echinulate, doliform conidiospores of an alien species were observed in the holotype. It is important to note a discrepancy between the number of the holotype specimen, Thwaites 608, and that given in the protologue, Thwaites 600.

Hydnum micheneri Berk., Grevillea 1(7): 101. 1873.
= ***Steccherinum ciliolatum*** (Berk. & M.A. Curtis) Gilb. & Budington

Basidioma resupinate, effuse, 28 × 20 mm, adnate, up to 325 µm thick, subceraceous to soft, odontioid with smooth areas between aculei, greyish orange (5B4) or Cinnamon-Buff; aculei numerous, slender, conical with apical bristles, up to 5 per mm, about 180 × 60 µm, often fused at base, concolorous with area between aculei; cracks numerous; margin smooth, sterile, fimbriate to cordonic. Hyphal system dimitic with clamped generative and aseptate skeletal hyphae. Aculei a fascicle of indistinct tramal and skeletal hyphae, the latter developing into encrusted, tramal cystidia. Subiculum a dense tissue of subicular and skeletal hyphae interspersed with large, hyaline crystals; subicular hyphae 3–5 µm diam, clamped, moderately branched, walls hyaline, thin, smooth; skeletal hyphae 2–5.5 µm diam, aseptate, unbranched, walls hyaline, up to 2 µm thick, smooth. Hymenium degraded. Cystidia abundant in aculei, embedded or partially exserted, encrusted at distal end with coarse hyaline crystals, up to 10 µm diam including encrustations. Mature basidia not observed. Basidiospores rare, broadly cylindrical, 3.2–3.5 × 1.8–2.1 µm, walls hyaline, thin, smooth, not reacting in Melzer's reagent.

Type specimen examined. [U.S.A.], Penns[ylvania], Michener 4368 (K: K(M)160370 holotype).

Notes. *Hydnum micheneri* is identical with *Steccherinum ciliolatum*. The holotype is in poor condition with a degraded hymenium. In addition, aculei and basidiospores are shorter than typical for the species, but otherwise the holotype compares favorably with published descriptions (see Gilbertson 1965, Lindsey & Gilbertson 1978, Maas Geesteranus 1974) and herbarium specimens studied at CFMR.

Hydnum ohiense Berk., London J. Bot. 4: 307. 1845.

≡ ***Dentipellis ohiensis*** (Berk.) Nakasone, **comb. nov.**
(MycoBank MB564706)

= *Hydnum dissitum* Berk. & Cooke, J. Linn. Soc., Bot. 15: 387. (1876) 1877.

≡ *Dentipellis dissita* (Berk. & Cooke) Maas Geest., Persoonia 7(4): 551. 1974.

Basidioma resupinate, effuse, up to 20 × 15 mm, adnate, thin, spinose with smooth areas between aculei, pale orange (5A3), greyish orange (5B4) to brownish orange (5C5); aculei slender, conical, 2–3 per mm, up to 4 × 0.3 mm, single, smooth, brittle, brown (7E8). Hyphal system monomitic with clamped generative hyphae. Subiculum composed of subicular and gloeoperous hyphae; subicular hyphae 2–5.5 µm diam, clamped, moderately branched, walls hyaline, thin, smooth; gleoplerous hyphae 2–5.5 µm diam, clamped, sparingly branched, filled with oil-like material, walls hyaline, thin to 1 µm, thick, smooth. Subhymenium, hymenium, cystidia and basidia not observed. Basidiospores abundant, broadly ellipsoid, 4.3–5 × 3.2–3.6(–4) µm, walls hyaline, slightly thickened, smooth or with minute, irregular, amyloid granules.

Type specimens examined. [U.S.A.], Ohio, [Cincinnati], Taylor's woods near the dam, underside of rotting log, 19 March 1842, [T.G. Lea] no. 41 (K: K(M)160371 holotype; K: K(M)160372 and K(M)160374, as *Hydnum fernandesianum* Mont. var. *ohiense* Berk., and BPI: US0259729 isotypes). New York, Onativia, on bark, Nov[ember] 1890, O.F. Cook no. 800, (BPI: US0277642 epitype designated here).

Representative specimens examined. Canada, Ontario, Norfolk County, Turkey Point, on *Quercus* sp., 24 October 1954, R.F. Cain, TRTC31211 (BPI: US0348425); Algonquin Provincial Park, Cainsbay Lake, on *Betula lutea* Michx., 22 October 1966, R.F. Cain, TRTC4452 (BPI: US0348426). U.S.A., New York, Warrensburg, on *Acer* sp., 23 September 1961, R.L. Gilbertson 3023 (BPI: US0348416). District of Columbia, Takoma Park, Sligo Creek, on burnt rotten log, 26 October 1919, E.C. Leonard 1432 (BPI: US0277518).

Notes. *Hydnum ohiense* is conspecific with *Dentipellis dissita*, and because *H. ohiense* has priority, the new combination *D. ohiensis* is proposed. An epitype is designated because the holotype and isotypes are in poor condition; no hymenium was observed in the types, although basidiospores were numerous. The holotype has critical, identifying information on its label but is fragmentary with only a few intact aculei. Isotype K(M)160372 is larger with numerous, well-developed aculei. The isotype at BPI is very small (8 × 5 mm) with a conidial fungus present on the adhesive that surrounds the specimen.

Hydnum ohiense is mentioned only a few times in the literature. Maas Geesteranus (1974) studied the type and concluded that it was a species of *Gyrodontium*, whereas Hjortstam (1998) suggested that it was congeneric with *Gloeodontia*. Morgan (1887) reported *H. ohiense* from the Miami Valley of Ohio; however, a specimen named *H. ohiense* from Morgan's herbarium at ISC is *Phlebia uda* (Fr.) Nakasone.

Berkeley (1845) noted that *H. ohiense* resembled '*H. fernandesium* Mont.' It is likely that he was referring to the specimen at Kew, K(M)160373, with the printed label '*Hydnum fernandesianum* var. *ohiense* Berk.' and the handwritten label '*Hydnum fernandesianum* Montag. m.s.' The latter name was never published. The specimen is from Chile, Juan Fernandez Island, Bertero 1717 (Montagne 1853) and was first named *Hydnum membranaceum* v. *dryinum* Fr. (Montagne 1835, p. 351). Later, Montagne (1843) renamed it *Hydnum leptodon* Mont. The specimen at Kew, K(M)160373, is an isotype of *H. leptodon*; on the packet the locality is given incorrectly as U.S.A., Ohio.

Hydnum pallidum Cooke & Ellis, Grevillea 9(51): 103. 1881 (illegitimate name), non *H. pallidum* Raddi, Mem. Nat. Fis. Soc. Ital. Sci. 13, part 2: 353. 1807.

≡ *Odontia pallida* (Cooke & Ellis) Rick, Iheringia 5: 162. 1959 (illegitimate name), non *O. pallida* Petch, Ann. Roy. Bot. Gard. Peradeniya 9(2): 136. 1924.

= ***Xylodon fimbriiformis*** (Berk. & M.A. Curtis) Kuntze

Basidioma resupinate, effuse, up to 300 µm thick, spinose, area between aculei subfelty to subporoid or smooth and extensively cracked, Light Buff to Pinkish Buff; aculei fragile, readily detached, narrowly conical to compressed, 2–3 per mm, 400–750 × 140–200 µm, mostly single, sometimes fused at base or throughout length; margin appressed, rapidly thinning out. Hyphal system monomitic with clamped generative hyphae. Aculei a fascicle of distinct, but collapsed tramal hyphae with dark, particulate material embedded in trama and encrusting hymenium which dissolves in Melzer's reagent, at apex terminal end cells slightly differentiated; tramal hyphae 2–3.5 µm diam, clamped, moderately branched, walls hyaline, thin, smooth; apical end cells narrowly obclavate to cylindrical, apex subacute or slightly bulbous, 22–32 × 4–5 µm, clamped at base, walls hyaline, thin, smooth. Subiculum with coarse, hyaline crystals embedded in context; subicular hyphae similar to tramal hyphae. Hymenium a palisade of cystidia and basidia. Cystidia originating in hymenium of two types: (1) subfusiform, occasionally constricted, tapering to subacute apex, 15–25 × 3–6 µm, clamped at base, walls hyaline, thin, smooth; (2) obclavate to cylindrical with apical bulb, often with one or more constrictions, 14–23 × 3–6 µm, clamped at base, walls hyaline, thin, smooth. Mature basidia not observed. Basidiospores broadly ellipsoid, sometimes with a large oil-like guttule, 4–5(–5.4) × (2.9–)3.5–4(–4.3) µm, average of types 4.5–4.6 × 3.4–3.7 µm, Q = 1.2*–1.3*, walls hyaline, thin, smooth, ± cyanophilous, not reacting in Melzer's reagent.

Type specimens examined. U.S.A., New Jersey, Newfield, on old oak [stump of *Quercus* sp.], J.B. Ellis 3118 (K: K(M)169890 holotype; NY: NY00776181 isotype, mixed collection with *Trechispora nivea* (Pers.) K.H. Larss).

Notes. *Hydnum pallidum* is synonymous with *Xylodon fimbriiformis* despite minor differences in basidioma color, cystidium abundance, and basidiospore size. Gilbertson (1964) considered specimen NY00776180 to be an isotype of *H. pallidum* and placed it in synonymy with *Odontia stipata* (Fr.) Quél. Although this specimen has the same collection number, Ellis 3118, it is not *H. pallidum* but is similar to *Xylodon asper* (Fr.) Hjortstam & Ryvarden and *Hyphodontia* sp. 1, Langer 5302 (see Kotiranta & Saarenoksa 2000).

Hydnum schweinitzii Berk. & M.A. Curtis, J. Acad. Nat. Sci. Philadelphia 3: 216. 1856.

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

Basidioma resupinate, effuse, adnate, 9 × 9 mm, spinose with smooth, finely rimose areas between aculei, yellow; aculei terete or compressed, 3–4 aculei per mm, up to 1 mm long, single or fused; margin not observed. Hyphal system monomitic, generative hyphae simple septate with scattered, single clamp connections. Subicular hyphae (4–)5–7(–14) µm diam, simple septate with rare, single clamp connections, walls hyaline, thin, smooth. Hymenium degraded, cystidia and basidia not observed. Basidiospores scarce, cylindrical, (4–)4.5–5 × 2–3 µm, walls hyaline, thin, smooth, not reacting in Melzer's reagent.

Type specimen examined. [U.S.A., New York], Torrey, Herb. Schwein[itz] (K: K(M)139489 holotype).

Notes. Although the hymenium is degraded, the general aspect of the basidioma and aculei, the broad, simple-septate hyphae, and basidiospores are sufficient to identify this specimen as *Hydnophlebia chrysorhiza*. The holotype packet has '*Hydnum membranaceum*' written below '*H. schweinitzii* B. & C.' Schweinitz (1832, p. 162) listed this species as *Hydnum membranaceum* Fr. but recognized that it was different from the Friesian species. Twenty-four years later, Berkeley & Curtis (1856) proposed the name *H. schweinitzii* for this taxon.

Irpex archeri Berk. in J.D. Hooker, Bot. of the antarct. voy., Vol. III. Fl. Tasman. Part 2: 257. 1860. Figs. 1a, 2

≡ ***Schizopora archeri*** (Berk.) Nakasone, **comb. nov.**
(MycoBank MB564707)

≡ *Xylodon archeri* (Berk.) Kuntze, Revis. gen. pl. 3(2): 541. 1898.

Basidioma resupinate, effuse, 20 × 15 mm, up to 210 µm thick, membranous, spinose to spathulate, Cinnamon-Buff to Clay Color or Buckthorn Brown, arising

from a mostly degraded, sterile, Pinkish Buff, woolly to felty mat; aculei brittle, readily detached at base, conical, terete or compressed, up to 4 per mm, up to 1 mm long, fusing laterally to form erect, branched, irregular plates or spathulate structures with fringed apices; margin adnate, loose felty or abrupt. Hyphal system subdimitic with clamped generative hyphae and thick-walled sclerified hyphae. Aculei or dissepiments composed of non-agglutinated, sclerified and tramal hyphae, at apex sclerified hyphae emergent; tramal hyphae 2–4 µm diam, clamped, sparsely branched, walls hyaline, thin to slightly thickened, smooth or encrusted with small, hyaline crystal clusters; sclerified hyphae 1.5–4.5 µm diam, clamped, rarely branched, walls hyaline, up to 1.5 µm thick then thinning toward apex, smooth or lightly encrusted with coarse, hyaline crystals especially at aculeus apex, ± cyanophilous. Subiculum a dense, thin, basal layer of agglutinated hyphae arranged parallel to substrate, then becoming an open textured tissue of loosely intertwined, non-agglutinated subicular and sclerified hyphae; subicular hyphae similar to tramal hyphae described above; sclerified hyphae as in aculei. Subhymenium up to 20 µm thick, a dense tissue of short-celled hyphae; subhymenial hyphae 2.2–2.5 µm diam, clamped, moderately branched, walls hyaline, thin, smooth. Hymenium a dense palisade of cystidia and basidia. Cystidia arising from subhymenium and hymenium of two types: (a) scattered, subfusiform, tapering to an acute apex, 23–36 × 4–7 µm, clamped at base, staining deep pink in phloxine, walls hyaline, thin, smooth; (b) scarce, capitate to tibiform, with or without a resinous apical cap, 14–15 × 3.8–5 µm, clamped at base, walls hyaline, thin, smooth. Basidia scarce, clavate to cylindrical, 12–14 × 4–4.5 µm, clamped at base, 4-sterigmate, walls hyaline, thin, smooth. Basidiospores often collapsed, narrowly ellipsoid to cylindrical with a small apiculus, (5–)5.5–6(–6.5) × 3–3.7(–4) µm, average of isotype, 5.9 ± 0.3 × 3.4 ± 0.3 µm, Q = 1.7, walls hyaline, thin, smooth, acyanophilous, not reacting in Melzer's reagent.

Type specimens examined. [Australia], Tasmania, on [dead decorticate] wood, Archer (K: K(M)169893 holotype; K(M)169894 isotype).

Notes. Despite its unusual hymenophore, *Irpex archeri* is congeneric with *Schizopora* based on basidioma texture, sclerified hyphae, cystidia, and basidiospores. The hymenophore is poroid in most species of *Schizopora* but can be reticulate, dentate-lacerate, irpicoid, or spinose. In *S. archeri*, Berkeley (1860) described the hymenophore as palmate teeth although a coralloid structure is drawn in the accompanying figure. Maas Geesteranus (1974) reported the hymenophore to be "sparassioid-poroid with dissepiments various incised or branched so as to resemble irpicoid plates." *Schizopora archeri* and *S. roseotingens* Hjortstam & Ryvarden are the only taxa in *Schizopora* with primarily aculeate hymenophores. The latter species is distinguished from the former by smaller basidiospores (4–4.5 × 2–2.2 µm) and absence of subfusiform cystidia. The

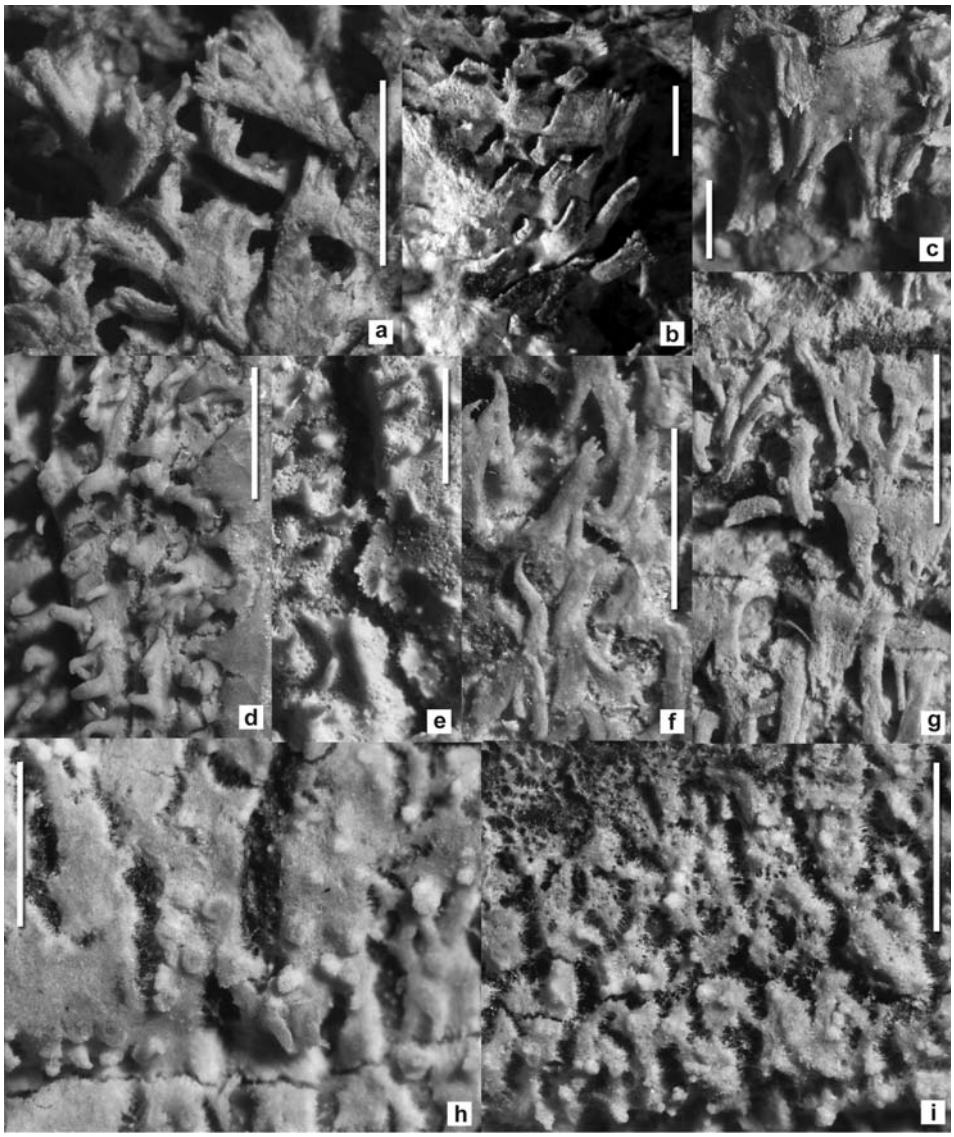
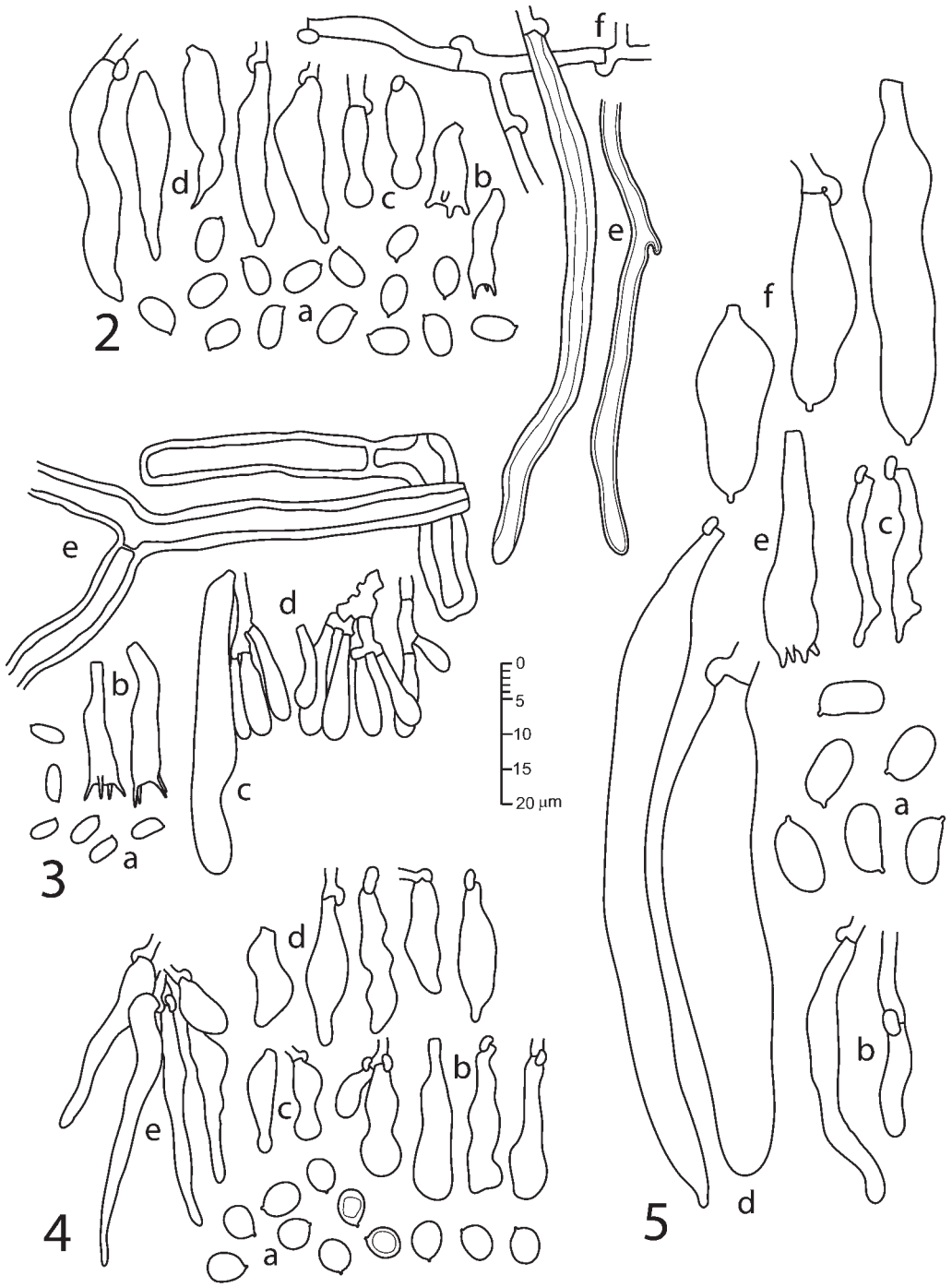


Fig. 1. Hymenophore close-up of type specimens. **a** – *Irpex archeri* K(M)169894, isotype. **b** – *Irpex decolorans* K(M)62571, holotype. **c** – *Irpex decolorans* NY00391397, isotype. **d** – *Irpex depauperatus* US0262482, isotype. **e** – *Irpex depauperatus* K(M)167190, holotype. **f** – *Irpex fimbriiformis* HUH00351025, isotype. **g** – *Irpex fimbriiformis* K(M)169895, holotype. **h, i** – *Kneiffia tessulata* HUH00351020, isotype. Scale bar equals 1 mm.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hyphal system of *Schizopora* is sometimes described as subdimitic because the sclerified generative hyphae are similar to skeletal hyphae. Sclerified hyphae observed in *S. archeri* were nearly identical in width to tramal and subicular hyphae and were not as morphologically distinct as the skeletal hyphae in *Fibrodontia* Parmasto, for example.

The hymenium is better preserved in the isotype with more intact basidia, cystidia, and basidiospores than in the holotype. See Berkeley (1860, p. 257, Plate 183, Fig. 1) and Maas Geesteranus (1949) for descriptions of the type of *I. archeri*. Cunningham's description appears to be that of a different species especially in regard to its monomitic hyphal system, narrow basidiospores, and hymenophore of angular pores.

Irpex decolorans Cooke, Grevillea 19(92): 109. 1891. Figs. 1b–c

≡ ***Cristinia decolorans*** (Cooke) Nakasone, **comb. nov.**
(MycoBank MB564708)

≡ *Xylodon decolorans* (Cooke) Kuntze, Revis. gen. pl. 3(2): 541. 1898, as '*decolor* Berk. & Br., Cke.'

Basidioma resupinate, effuse, up to 45 × 20 mm, adnate, crustaceous to corneous, smooth, subphlebioid or aculeate, light brown (6D6), brown (6D7), Tawny, Cinnamon or Sayal Brown, often with a pruinose cast, occasionally cracking extensively between aculei revealing a fibrous, tan-colored context; aculei conical, terete with sterile, bristly apices, up to 3 per mm, up to 2.5 × 1 mm, smooth, often basally or laterally fused, concolorous with area between aculei then cream-colored at apex; margin abrupt, distinct, loosely attached to substrate, up to 2 mm wide, fibrillose. Hyphal system monomitic with clamped generative hyphae. Aculei a fascicle of conglutinate hyphae, hymenial layer degraded; tramal hyphae 2.5–6 µm diam, clamped, occasionally branched, walls hyaline, slightly thickened or up to 1 µm thick, smooth, cyanophilous. Subiculum a dense tissue of conglutinate hyphae arranged parallel to substrate; subicular hyphae 3.2–5 µm diam, clamped at base, rarely branched, walls hyaline, thin to 2 µm thick, smooth or occasionally finely encrusted with tiny crystals, cyanophilous. Subhymenium up to 35 µm thick; subhymenial hyphae 1.5–3 µm diam, clamped, much branched, short-celled, walls hyaline, thin, smooth. Hymenium degraded, cystidia and

Figs. 2–5. Line drawings of microcharacters. **2** – *Irpex archeri* K(M)169894, isotype. a, basidiospores; b, basidia; c, capitate cystidia; d, subfusiform cystidia; e, sclerified tramal hyphae; f, subicular hypha. **3** – *Irpex depauperatus*, K(M)167190, holotype. a, basidiospores; b, basidia; c, cystidium; d, developing basidia in hymenium; e, subicular hyphae. **4** – *Irpex fimbriiformis*, HUH00351025, isotype. a, basidiospores; b, immature basidia; c, obclavate cystidia; d, subfusiform cystidia; e, obclavate terminal end cells in aculeus apex. **5** – *Kneiffia tessulata*, HUH00351020, isotype. a, basidiospores; b, hyphal end cells in aculeus apex; c, dendrohyphidia; d, cystidia. From K(M)169891, holotype. e, basidium; f, papillate cystidia.

basidia not observed. Basidiospores abundant, broadly ellipsoid with oil-like contents, 3.6–4.5(–5) × (2.5–)2.9–3.5 µm, average of isotype 4.0 ± 0.3 × 3.1 ± 0.3 µm, Q = 1.3, walls hyaline, slightly thickened, smooth, cyanophilous, not reacting in Melzer's reagent.

Type specimens examined. Cuba, on rotting logs, [C.] Wright 835, as "*Irpex decolor* B. & C." (K: K(M)62571 holotype; FH: HUH00301398 isotype).

Notes. *Irpex decolorans* is congeneric with *Cristinia* based on the aculeate hymenophore, monomitic hyphal system, and slightly thick-walled, cyanophilous, ellipsoid basidiospores; thus, the transfer is proposed. The type materials are in poor condition with degraded hymenia. *Cristinia eichleri* (Bres.) Nakasone also has a raduloid to irpicoid hymenophore but with larger, globose to subglobose basidiospores, 5–6 µm diam. Hjortstam & Larsson (1995) considered *I. decolorans* a species of *Radulodon* whereas Nakasone (2001) erroneously proposed a relationship to *Pseudolagarobasidium subvinosum* (Berk. & Broome) Sheng H. Wu.

Irpex depauperatus Berk. & Broome, J. Linn. Soc., Bot. 14: 61. 1873, non *I. depauperatus* Massee, Bull. Misc. Inform. Kew 157. 1901, illegitimate name.

Figs. 1d–e, 3

≡ ***Odonticium depauperatum*** (Berk. & Broome) Nakasone, **comb. nov.** (MycoBank MB564709)

≡ *Xylodon depauperatus* (Berk. & Broome) Kuntze, Revis. gen. pl. 3(2): 541. 1898.

Basidioma resupinate, effuse, up to 50 × 15 mm, loosely adnate, thin, up to 350 µm thick, odontioid to raduloid with distinct, smooth, fragile, subceraceous, subfelty to subporoid areas between aculei, yellowish white (4A2), greyish orange [5B(2–3)], Light Buff or Pale Ochraceous-Buff, not reacting to KOH; aculei readily detached, terete to conical, smooth, gradually tapering to an entire, acute or obtuse apex, up to 3(–4) per mm, up to 360 × 215 µm, often fused laterally to form ridges or compressed raduloid structures, concolorous with areas between aculei or darkening toward apex; margin gradually thinning out, adnate, irregularly fibrillose, concolorous or paler than area between aculei. Hyphal system monomitic with simple-septate generative hyphae. Aculei a dense fascicle of non-agglutinated tramal hyphae in parallel and abundant, embedded, small, hyaline crystals especially at base, enclosed by thin, dense subhymenial and hymenial layers, at apex hyphae undifferentiated; tramal hyphae 3–5 µm diam, simple septate, sparingly branched, sometimes with H-connections, even, walls hyaline, thin or slightly thickened at apex then thickening toward base, up to 2 µm thick, smooth. Subiculum a moderately dense tissue of loosely intertwined, thick-walled hyphae, up to 300 µm thick; subicular hyphae 5–9 µm diam, simple septate, moderately branched often at right angles, walls hyaline, up to 2.2 µm thick, smooth or

finely coated with particulate, resinous material. Subhymenium up to 20 µm thick, a dense, non-agglutinated tissue of irregular, short-celled hyphae; subhymenial hyphae 1.5–2.5 µm diam, simple septate, frequently branched, short-celled, walls thin, hyaline, smooth. Hymenium a dense palisade of basidia. Basidia narrowly clavate to cylindrical, (13–)18–20(–25) × 3–4.5 µm, simple septate at base, 4-sterigmate, walls hyaline, thin, smooth. Basidiospores abundant, cylindrical, often collapsed, with an inconspicuous apiculus, 4–5 × (1.5–)2–2.5 µm, average of isotype 4.5 ± 0.3 × 2.1 ± 0.2, Q = 2.1, walls hyaline, thin, smooth, acyanophilous, not reacting in Melzer's reagent.

Type specimens examined: [Sri Lanka], Ceylon, Central Province, on wood, Dec[ember] 1868, G.H.K. Thwaites 981 (K: K(M)167190 holotype; BPI: US0262482 isotype).

Notes. *Irpex depauperatus* is characterized by small aculei, wide, thick-walled, simple-septate subicular hyphae, small basidia, and small, cylindrical basidiospores. It is closely related to *Odonticium romellii* (S. Lundell) Parmasto and *O. flavicans* (Bres.) Nakasone which have a tougher texture and narrower, shorter basidiospores, respectively. Although fragmentary, the type specimens are in good condition. See Maas Geesteranus for a description of the holotype specimen.

Irpex fimbriiformis Berk. & M.A. Curtis, Grevillea 1(10): 145. 1873, as '*fimbriæformis*'. Figs. 1f–g, 4

≡ ***Xylodon fimbriiformis*** (Berk. & M.A. Curtis) Kuntze

≡ *Hyphodontia fimbriiformis* (Berk. & M.A. Curtis) Ginns & M.N.L. Lefebvre, Mycol. Mem. 19: 88. 1993.

Basidioma resupinate, effuse, up to 17 × 10 mm, thin, fragile, spinose to raduloid with smooth, subfelty to subporoid areas between aculei, greyish orange [5B(4–5)], Light Ochraceous-Buff, Warm Buff, to Cinnamon-Buff; aculei conical, smooth, tapering to an acute apex, 3–5 per mm, up to 1 mm long, single or fused at base or laterally forming triangular or compressed raduloid structures; margin appressed, fimbriate, concolorous with hymenophore. Hyphal system monomitic with clamped generative hyphae. Aculei a fascicle of non-agglutinated, nearly parallel hyphae, at apex hyphal end cells obclavate, gradually tapering to a subacute or obtuse apex, 25–38 × 3–5 µm, clamped at base, walls hyaline, thin, smooth. Subicular hyphae 3–3.5 µm diam, clamped, moderately branched, walls hyaline, slightly thickened, smooth. Hymenium a palisade of cystidia and basidia. Cystidia originating from hymenium and subhymenium of two types: (1) subfusiform, occasionally with median constriction, apex subacute to obtuse, 10–22 × 4–6 µm, clamped at base, walls hyaline, thin, smooth; (2) rare, obclavate or cylindrical with one or more constrictions, with an apical bulb, 11–20 × 4–6 µm, apical bulb 2.5–3 µm diam, clamped at base, walls hyaline, thin, smooth. Basidia scarce,

clavate, sometimes with a median constriction, often with a distinct, slender stalk, 20–23 × 5 µm, clamped at base, 4-sterigmate, walls hyaline, thin, smooth. Basidiospores broadly ellipsoid with an inconspicuous apiculus, 4.3–5.3(–5.5) × (3–)3.2–4.2(–4.5) µm, average of isotype 4.9 ± 0.3 × 3.9 ± 0.4 µm, Q = 1.3, often containing oil-like material, walls hyaline, thin, smooth, cyanophilous, not reacting in Melzer's reagent.

Type specimens examined. [U.S.A.], Pennsylvania, on wood, 1851, Dr. Michener no. 185, Curtis 3762 (K: K(M)169895 holotype; FH: HUH00351025 isotype).

Notes. *Irpex fimbriiformis* is characterized by small aculei with obclavate, terminal end cells at the apex, subfusiform and capitate cystidia, and broadly ellipsoid basidiospores. *Xylodon spathulatus* (Schrad.: Fr.) Kuntze has similar basidiospores but differs by its yellow hymenophore, undifferentiated terminal end cells at the aculei apices, cystidia with a resinous apical cap, and monilioid, fusiform gloeocystidia. Some authors, however, consider *I. fimbriiformis* synonymous with *X. spathulatus* (Crous et al. 2004; Hjortstam & Ryvarden 2007, 2009).

Gilbertson (1965) synonymized *I. fimbriiformis* with *Odontia stipata* (Fr.) Quél. According to Eriksson et al. (1981), however, in Europe the name *O. stipata* was applied to *Fibrodontia gossypina* Parmasto or *Hyphodontia arguta* (Fr.) J. Erikss. Similarly, in the United States, most of the *Hydnum stipatum* Fr. specimens I examined from NY collected or identified by H. J. Banker were *H. arguta* although Miller & Boyle's (1943) concept is consistent with *F. gossypina*.

Irpex furfuraceovelutinus Rick, Iheringia, Bot. 5: 188. 1959.

≡ *Phanerochaete furfuraceovelutinus* (Rick) Rajchenb., Nordic J. Bot. 7: 556. 1987.

= ***Kneiffiella stereicola*** (Bres.) Nakasone

Basidioma resupinate, widely effuse, adnate, soft, felty with scattered spines, greyish orange [5B(4–5)]; aculei elongate, conical, tapering to an acute apex, 2–4 per mm, up to 2 mm long. Hyphal system subdimitic, generative hyphae regularly clamped or simple septate. Hymenium mostly collapsed, composed of cystidia and basidia. Cystidia originating in aculei trama and subiculum, clavate to cylindrical, clamped at base, slightly protruding. Mature basidia not observed. Basidiospores rare, broadly ellipsoid, 3.3–4.8 × 2.9–3.7 µm, walls hyaline, thin, smooth, not reacting in Melzer's reagent.

Type specimen examined. Brazil, São Leopold, Est. R[io] G[rande do] Sul, on dead wood, 20 December 1939, J. Rick, no. 6382 (NY: NY0068695 probable isotype).

Notes. *Irpex furfuraceovelutinus* is a later synonym of *Kneiffiella stereicola*. See Rajchenberg (1987) for a complete description and illustration of the holotype; Maas Geesteranus (1974, p. 479) also examined the holotype.

It is likely that the specimen at NY is an isotype of *I. furfuraceovelutinus* for the Instituto Agronômico, Campinas, Herbário da Seção de Fitopatologia label in the packet has "type" on it as well as the correct date, location, and PACA number, 16597. However, two other PACA numbers were also listed, 16589 and 16598; none of which were included in the protologue.

Irpex galzinii Bres., Ann. Mycol. 6: 42. 1908.

≡ *Trametes galzinii* (Bres.) Pilát, Atlas Champ. Eur. 3: 325. 1940.

= ***Amyloporia sinuosa*** (Bres.) Rajchenb., Gorjón & Pildain

Basidioma resupinate, effuse, adnate, spinose, dentate, or reticulate, greyish orange (5B4), light brown [6D(4–5)], to brown (7F4) with pruinose coating; hymenophore variable (1) spinose with aculei conical, terete or compressed, up to 4 per mm, up to 4 mm long, single or fused, smooth, dark brown; (2) dentate-lacerate dissepiments sometimes developing into spines, up to 4 mm long, smooth, yellowish brown; or (3) short-reticulate to short, dentate-lacerate, nearly poroid, dissepiments up to 1 mm long, light brown with fine, pruinose edges; margin not observed. Hyphal system dimitic with clamped generative and aseptate skeletal hyphae. Aculei and dissepiments mostly of skeletal hyphae and embedded, large, slightly eroded, pyramidal hyaline crystals; skeletal hyphae 1.8–4 µm diam, aseptate, rarely branched, lumen narrow or absent, occasionally with knobs or warts, walls hyaline, up to 2.2 µm thick, smooth. Subicular hyphae 2.5–4.5 µm diam, clamped, moderately branched, walls hyaline, thin to 0.5 µm thick, sometimes irregularly thickened, smooth. Subhymenium a dense tissue of degraded hyphae, up to 30 µm thick; subhymenial hyphae 1.2–1.5 µm thick, clamped. Hymenium a dense palisade of cystidia and basidia. Cystidia originating in subhymenium, enclosed, subfusiform, tapering to subacute apex, 10–20 × 3.5–5 µm, clamped at base, walls hyaline, thin, smooth. Basidia clavate to cylindrical, (14–)17–22 × (3–)4–5 µm, clamped at base, 4-sterigmate, walls hyaline, thin, smooth. Basidiospores allantoid, (4.7–)5–6 × 1.4–1.5(–2) µm, walls hyaline, thin, smooth, acyanophilous, not reacting in Melzer's reagent.

Type specimens examined. France, Aveyron, ad *Juniperum*, V 1905, Galzin 3972 (S: F15820 holotype; BPI: US0262764 isotype).

Notes. *Irpex galzinii* is characterized by a spinose to dentate-lacerate hymenophore, subicular hyphae with irregularly thickened walls, skeletal hyphae, subfusiform cystidia, and allantoid basidiospores. Brown-rot decay was observed in the holotype specimen. *Irpex galzinii* is most certainly a later synonym of *A. sinuosa*. Bourdot & Galzin (1928) and Pilát (1936) also observed this similarity. The holotype displays a range of hymenophore forms whereas the isotype has only long, dark brown, slender spines.

Kneiffia tessulata Berk. & M.A. Curtis, Grevillea 1(10): 147. 1873. Figs. 1h–i, 5
≡ ***Peniophorella tessulata*** (Berk. & M.A. Curtis) Nakasone, **comb. nov.** (MycoBank MB564710)
= *Odontia rudis* Bres., Ann. Mycol. 18: 42. 1920.
≡ *Peniophorella rudis* (Bres.) K.H. Larss., Mycol. Res. 111(2): 192. 2007.

Basidioma resupinate, effuse, in small fragments, up to 25 × 14 mm, thin, up to 215 µm thick, subceraceous, verruculose to odontioid with smooth areas between aculei, Cinnamon-Buff, Clay Color, or Tawny-Olive, extensively rimose exposing a white, fibrous context; aculei short cylindrical to conical, concolorous with areas between aculei, with subacute to obtuse, entire or finely pubescent, white apices, up to 5 per mm, up to 360 × 300 µm, single, smooth, often apices broken off; margin abrupt or gradually thinning out, up to 2 mm wide, subfelty, white to cream-colored. Hyphal system monomitic with clamped generative hyphae. Aculei a fascicle of hyphae with narrowly obclavate or cylindrical, hyphal end cells at apices, 16–40 × 4–5 µm, encrusted with coarse, hyaline crystals. Subiculum up to 50 µm thick, partially agglutinated hyphae arranged parallel to substrate then ascending, stephanocysts not observed; subicular hyphae 3–5(–7) µm diam, clamped, moderately branched, walls hyaline, slightly thickened to 1.5 µm thick, smooth to roughened. Subhymenium thickening, up to 160 µm thick, a dense tissue of partially agglutinated, ascending hyphae; subhymenial hyphae 2.2–5 µm diam, clamped, frequently branched, walls hyaline, thin, smooth. Hymenium a dense palisade of dendrohyphidia, cystidia, and basidia. Dendrohyphidia rare, filiform, tapering to subacute or obtuse apex, simple or with short, knobby branches, 28–40 × 3–5 µm, clamped at base, walls hyaline, thin, smooth. Cystidia numerous, embedded, arising from subhymenium, obclavate to subfusiform at first, then elongating, often with slight constrictions, typically with a distinct, small, hyaline apical papilla, 27–70(–100) × 7–12 µm, clamped at base, staining deeply in phloxine, walls hyaline, thin, smooth. Basidia rare, clavate, 33–43 × 7.5–9 µm, clamped at base, 4-sterigmate, walls hyaline, thin, smooth. Basidiospores scarce, collapsed, cylindrical to narrowly ellipsoid, 9–10(–11) × 4–5.5 µm, average of types 9.3–9.6 × 4.7–4.9 µm, Q = 1.9*–2*, walls hyaline, thin, smooth, acyanophilous, not reacting in Melzer's reagent.

Type specimens examined. [U.S.A., South Carolina], Car. Inf., Society Hill, [on decayed wood of] *Quercus* sp., Martio 1850, [M.A. Curtis] 2805 (K: K(M)169891 holotype; FH: HUH00351020 isotype).

Notes. *Kneiffia tessulata* is conspecific with *Peniophorella rudis*. Although stephanocysts were not observed, *P. tessulata* is otherwise morphologically identical to *P. rudis*. *Kneiffia tessulata* has priority over *P. rudis*; thus, the transfer to *Peniophorella* is proposed. Both type specimens are in fair condition with scarce basidiospores. Gilbertson (1965) also examined the isotype but did not observe basidia or basidiospores.

Peniophorella tessulata is widely distributed and has many synonyms; see Nietiedt & Guerrero (1998) for a list. Some authors, however, disagree with this inclusive species concept and distinguish *P. odontiaeformis* (Boidin & Berthet) K.H. Larss., which has narrower basidiospores, 3.5–5 µm diam, and shorter basidia, 14–18(–24) µm long, from *O. rudis* with its broader basidiospores, 6 µm diam, and larger basidia, 25–30 µm long (Boidin & Gilles 1991, Larsson 2007, Maekawa 1994).

Merulius elliottii Massee, J. Bot. 30: 162. 1892.

≡ *Pseudomerulius elliottii* (Massee) Jülich, Persoonia 10(3): 330. 1979.

≡ *Serpula elliottii* (Massee) Zmitr., Novosti Sist. Nizsh. Rast. 35: 82. 2001.

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

Basidioma resupinate, effuse, loosely attached to substrate, small, irregular patches, up to 12 × 10 mm, coalescing, soft, fragile, a white to yellow felty mat with scattered clusters of dense, irregular, agglutinated folds or warts, light orange (5A4) to greyish orange [5B(4-5)], over-mature areas shiny, hygrophanous; margin fimbriate, sterile with white to light orange (5A4) mycelial cords. Hyphal system monomitic, generative hyphae primarily simple septate with scattered, single clamps. Aculei an agglutinated fascicle of hyphae similar to that in subhymenium. Subiculum an open, loose tissue of non-agglutinated, heavily encrusted hyphae; subicular hyphae 4–9 µm diam, simple septate with scattered single clamps, walls hyaline, thin to 2 µm thick, encrusted with resinous or crystalline particles. Subhymenium a dense, agglutinated tissue of more or less parallel hyphae. Hymenium degraded, cystidia and basidia not observed. Basidiospores abundant, cylindrical to narrowly ellipsoid, 3.7–4(–4.5) × 1.9–2.3 µm, walls hyaline, thin, smooth, ± cyanophilous, not reacting in Melzer's reagent.

Type specimens examined. S[ain]t Vincent [and the Grenadines], Richmond Valley, on rotten vegetable matter in woods, 26 January 1892, W.R. Elliott 299 (K: K(M)169888 holotype; NY: NY0072513 isotype).

Notes. Although the type specimens are in poor condition with degraded hymenia, *Merulius elliotti* is identified as *Hydnophlebia chrysorhiza*. Despite the unusual hymenophore form, the mycelial cords, broad, simple-septate subicular hyphae, and basidiospore shape and size are typical for *H. chrysorhiza*. The type specimen may have been improperly dried or over-mature, thus, the aculei became gelatinized and agglutinated. Ginns (1976) also studied and described the type. In countries near Saint Vincent and the Grenadines, *H. chrysorhiza* is reported from Brazil (Baltazar & Gilbertoni 2009), Venezuela (Hjortstam et al. 2005), and Puerto Rico (Cantrell et al. 2006).

CONCLUSIONS

Dr. M. J. Berkeley, alone or with C. E. Broome, M. A. Curtis, or H. W. Ravenel, described ten of the fifteen species described herein. Type specimens of seven species of *Hydnum*, six of *Irpex*, and one each of *Kneiffia* and *Merulius* were examined. Five new combinations were proposed, including *Dentipellis ohiensis*, an earlier name for *D. dissita*, and *Peniophorella tessulata* for *P. rudis*. Of the nine species determined to be later synonyms, three were conspecific with *Hydnophlebia chrysorhiza*, specifically, *Hydnum chrysodon*, *Hydnum schweinitzii*, and *Merulius elliottii*.

Type specimens are often just fragments and poorly preserved, and the types studied herein are no exception. Often the hymenium was degraded, but basidiospores were present. It is not unusual for types to be contaminated with a conidial fungus growing over the hymenophore or on the adhesive which attaches the specimen to the label. Occasionally, specimens are mislabeled as types or are not identified as type specimens. In the case of *H. pallidum*, the isotype was discovered to be a mixed collection. Working with type specimens is always a challenge but usually rewarding.

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