Taxonomy of *Pseudolagarobasidium* (Polyporales, Basidiomycota)

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**Abstract** *Pseudolagarobasidium* (Polyporales, Basidiomycota) is a small, monophyletic genus of crustose, wood-inhabiting fungi with spines and a saprobic, endophytic, or parasitic habit. Seven species are accepted in the genus including two new species, *P. belizense* from Belize and *P. pusillum* from Australia. Sequence analysis of the internal transcribed spacer of the ribosomal RNA gene places *P. belizense* in a monophyletic clade with *P. acaciicola* and an undescribed foliar endophyte. New combinations proposed include *P. modestum* for *Irpex modestus* Berk., *P. pronum* for *Hydnum pronum* Berk. & Broome which is an earlier name for *P. calcareum*, and *P. venustum* for *Radulodon venustum* Hjortstam & Ryvarden. *Irpex colliculosum* Berk. & Broome from Sri Lanka is conspecific with *P. subvinosum*. Two species, *Sistotrema ochroleucum* and *Radulodon concentricum* are not accepted in *Pseudolagarobasidium*. *Pseudolagarobasidium* is compared with *Radulodon* and similar genera. A key to the species of *Pseudolagarobasidium* is provided.

**Keywords** *Pirex concentricus* · *Pseudolagarobasidium acaciicola* · *P. leguminicola* · *Hydnum ayresii* · Microbinding hyphae

**Introduction**

*Pseudolagarobasidium* J.C. Jang & T. Chen is a small genus of crustose, wood-inhabiting basidiomycetes with spines. It was proposed in 1985 to accommodate the new taxon, *P. leguminicola* J.C. Jang & T. Chen, associated with a stem and root rot of *Leucaena leucocephala* (Lam.) de Wit in Taiwan (Jang and Chen 1985). Wu (1990) synonymized *P. leguminicola* with *Hydnum subvinosum* Berk. & Broome and transferred *H. subvinosum* and *H. calcarenum* Cooke & Massee to *Pseudolagarobasidium*. Later, Hjortstam (1995) transferred *Radulum concentricum* Cooke & Ellis to *Pseudolagarobasidium*, and the new species *P. acaciicola* Ginns from South Africa was described (Wood and Ginns 2006). Based on morphological studies, Stalpers (1998) placed *Pseudolagarobasidium* in synonymy under *Radulodon* Ryvarden. Sequence analyses of the nuclear large subunit ribosomal RNA (nLSU) gene, however, showed that *Pseudolagarobasidium* is a well-supported, monophyletic genus distinct from *Radulodon* and *Pirex concentricus* (Ellis & Cooke) Hjortstam (Hallenberg et al. 2008).

An unusual crustose species with small spines was collected from Doyle’s Delight Peak, the highest peak in the Maya Mountains of Belize, is a mycologically productive site that has yielded a number of new taxa (Baroni et al. 2007; Baroni et al. 2008; Ginns et al. 2010; Lindner et al. 2011; Ryvarden et al. 2009). DNA sequence analyses indicated that the crustose species belonged in *Pseudolagarobasidium*, and morphological examination confirmed that it was an undescribed species.

In this paper, we describe and illustrate two new species of *Pseudolagarobasidium* from Belize and Australia and propose the transfer of *Irpex modestus* Berk. and *Radulodon venustus* Hjortstam & Ryvarden to *Pseudolagarobasidium*. Type specimens of *Hydnum pronum* Berk. & Broome and *Irpex colliculosus* Berk. & Broome were examined and found to be congeneric with *Pseudolagarobasidium*. An emended description of *Pseudolagarobasidium* and key to the seven accepted species are presented.

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Materials and methods

Morphological methods
Thin, freehand sections from basidiomata were mounted in Melzer’s reagent (Kirk et al. 2008) or 1% (weight/volume) aqueous phloxine and 1% (w/v) aqueous potassium hydroxide. Cyanophily of basidiopore and hyphal walls was observed in 0.1% cotton blue in 60% lactic acid (Kotlaba and Pouzar 1964; Singer 1986). Line drawings were made with a camera lucida attachment on an Olympus BH2 compound microscope. Photographs were taken with an Olympus DP12 camera attached to an Olympus SZH stereomicroscope.

DNA sequence methods
DNA sequences of the internal transcribed spacer region (ITS) of the ribosomal RNA were obtained from cultures following methods detailed in Greslebin et al. (2004) and from basidiomata as described in Palmer et al. (2008).

Taxon selection and phylogenetic analyses
Initial BLAST searches placed DCL04-31 near Pseudolagarobasidium in the Polyporales. Taxa chosen for the phylogenetic analyses were selected after consulting Hallenberg et al. (2008), Lee and Lim (2010), and results from BLAST searches. In addition to newly generated sequences, Pseudolagarobasidium belizense (JQ070173, holotype), Radulodon americanus Ryvarden (JQ070174, JQ070175), and R. casearius (Morgan) Ryvarden (JQ070176), ITS sequences of the following taxa were included in the phylogenetic analyses: Antrodiella albocinnamonea Y.C. Dai & Niemelä (FJ613650), Cerrena aurantipora J.S. Lee & Y.W. Lim (FJ821532), C. consors (Berk.) K.S. Ko & H.S. Jung (FJ821527), C. unicolor (Bull.) Murrill (FJ810175, FJ821534, FJ821537), Pseudolagarobasidium acaciicola (AM849050, DQ517882, DQ517883), Spongipellis delectans (Peck) Murrill (HQ728301), S. litchi (Schwein.) Murrill (HQ728307), S. unicolor (Schwein.) Murrill (HQ728313).

Results
Phylogenetic analysis
There were 20 nucleotide sequences in the ITS dataset and 657 base pairs in the full alignment with 308 variable and 200 parsimony informative sites. Sequence divergence between sequences was calculated in which ambiguous positions were removed for each sequence pair (data not shown). Within the Pseudolagarobasidium clade (Fig. 1), sequence divergence ranged from 0 to 12%. ITS sequence of P. acaciicola AM849050, isolated from soil in India, was the most divergent in the clade, differing by 10% from P. acaciicola DQ517883 and 9% from DQ517882, both from South Africa, and 12% from P. belizense and Basidiomycota RCBC XG8D.

After all positions containing gaps and missing data were eliminated, there remained 498 positions in the final ITS dataset. In both ML and MP analyses, P. belizense always clustered with P. acaciicola and Basidiomycota RCBC XG8D. The ML tree with the highest log likelihood (−2315.2104) is shown in Fig. 1. With the MP method, 47 most parsimonious trees were recovered with a consistency index of 76.7%, retention index of 84.5%, and composite index of 64.8%. The MP consensus tree is similar to the ML tree except that the Spongipellis Pat. and Radulodon clades were not joined together. In the ML bootstrap tree, the Pseudolagarobasidium clade is supported
at 86% and slightly higher with the MP bootstrap analysis at 92%.

**Taxonomy**

*Pseudolagarobasidium* J.C. Jang & T. Chen, Trans. Br. Mycol. Soc. 85(2): 374. 1985, emended

Generic type: *Pseudolagarobasidium leguminicola* J.C. Jang & T. Chen (=*Hydnum subvinosum* Berk. & Broome)

**Basidiomata** resupinate, effuse, adnate, soft, subceraceous, membraneous, or crenate, context homogeneous, non-agglutinated; hymenial surface spinose, odontioid, or raduloid, occasionally reticulate to subporoid; *aculei* soft, fragile, brittle, terete to conical, single, often fused at base or throughout length to form flattened, truncate aculei or plates. **Hyphal system** monomitic or dimitic, generative hyphae with clamp connections, walls hyaline, yellow to light brown, cyanophilous, often finely encrusted with oil-like particles (observed in water mounts) that readily dissolve in KOH; microbinding hyphae aseptate, frequently branched, nonstaining. **Aculei** a dense fascicle of non-agglutinated trama with trama cystidia embedded or curving into hymenium. **Subiculum** composed of a thin, dense layer of agglutinated hyphae arranged more or less parallel to substrate that ascend to form a non-agglutinated trama, except in one species where the subiculum is partially agglutinated throughout. **Hymenium** composed of cystidia and basidia in a dense palisade. **Cystidia** originating in aculei trama, subiculum, or subhymenium (trama cystidia) and hymenium (hymenial cystidia), cylindrical, clavate, or subfusiform, clamped at base, contents homogeneous, staining deeply in phloxine and cotton blue, sulfovanillin negative, walls hyaline, thin, often finely encrusted with oil-like particles (observed in water mounts) that readily dissolve in KOH, cyanophilous. Basidia clavate to cylindrical, sometimes with a median constriction, contents homogeneous, clamped at base, walls hyaline, thin, often finely encrusted with oil-like particles (observed in water mounts) that readily dissolve in KOH, 4-sterigmate. Basidiospores globose to ellipsoid with a small, inconspicuous apiculus, contents homogeneous, walls hyaline, thin to slightly thickened, smooth, not or weakly cyanophilous, not reacting in Melzer’s reagent. **Arthroconidia** may be present in basidiomata or cultures. **Incompatibility system** bifactorial. **Inhabiting** wood and bark of angiosperms as saprobes or parasites, possibly as endophytes.

The features that distinguish this genus are the soft-textured basidiomata, non-agglutinated hyphae throughout the aculei and context (except in one species), the distinct, even, clamped hyphae of the aculei trama, the numerous trama and hymenial cystidia with homogeneous contents that stain deeply in phloxine and cotton blue, and the small, globose to ellipsoid basidiospores. Oil-like particles are produced throughout the basidiomata but are observed only in water mounts because they readily dissolve in KOH and other mounting media. Because the basidiomata context is not agglutinated, hyphae and microscopic elements are readily observed in squash mounts. Microbinding hyphae are easily overlooked but are usually present in the subiculum adjacent to the substrate or in mycelial pockets in the woody substrate beneath the basidiomata. Also noteworthy is the variable hymenophore, ranging from spinose to reticulate. Microscopically, the species included in the genus are remarkably consistent with respect to aculei microstructure.
and shape and size of hymenial elements but differ in texture, color, and aculei morphology. Bifactorial incompatibility system (tetrapolar mating system) was reported for *P. pronum* (Maekawa and Hasebe 2002) and *P. subvinosum* (Chang and Chen 1984).

Species of *Pseudolagarobasidium* are primarily saprobes although several are endophytes or facultative or opportunistic pathogens. *Pseudolagarobasidium subvinosum* causes a stem canker or root rot (Jang and Chen 1985; Petch 1923; Sankaran and Sharma 1986; Wood and Ginns 2006) whereas *P. acaciicola* and *P. pronum* are associated with a die-back disease (Wood and Ginns 2006). In addition, molecular analyses of the nuclear large subunit ribosomal DNA placed undescribed endophytic fungal isolates from healthy stems of *cacao* and leaves of mangrove in the monophyletic *Pseudolagarobasidium* clade (Chokpaiboon et al. 2010; Hallenberg et al. 2008).

**Key to the species of Pseudolagarobasidium**

1. Basidioma chalky, dull cream-colored to light brown......................................................... *P. pronum*
2. Basidioma subcereaceous to submembranous, yellow to dark brown.............................. *P. belizense*
3. Basidioma yellow to brownish orange........ *P. venustum*
4. Basidioma gray to brownish gray...................... *P. modestum*
5. Basidioma gray to dark brown......................... *P. pusillum*
6. Basidioma gray to brownish orange......................... *P. belizense*
7. Basidioma yellow to brownish orange........ *P. venustum*
8. Basidioma gray to brownish gray...................... *P. modestum*
9. Basidioma gray to dark brown......................... *P. pusillum*

**Pseudolagarobasidium acaciicola** Ginis and Wood & Ginns, Can. J. Bot. 84: 752. 2006.

*Basidioma* resupinate, effuse, adnate, thin, up to 250 μm thick between aculei, soft, membranous; aculei terete or compressed, raduloid, up to 4 aculei per mm, up to 2.5 (−4) mm long, single or fused, often forming a subporoid or reticulate hymenophore, light brown [6D(4–5)], brown [6E5], dark brown [6 F(5–6)], Avellaneous, Wood Brown, Saccardo’s Umber, Sepia, or purple. *Hyphal system* dimitic with clamped generative and aseptate microbinding hyphae; microbinding hyphae scarce, observed in substrate or at base of aculei. Subicular and aculei trama hyphae not agglutinated, even, distinct, walls hyaline to yellow, up to 1.1 μm thick, cyanophilous. *Cystidia* of two types: (a) trama cystidia numerous, originating in aculei trama and subhymenium then curving into hymenium, obclavate, narrowly clavate, cylindrical, or capitellate, 25–72×6−10 μm, clamped at base; (b) hymenial cystidia scarce, originating in hymenium, subfusciform with subacute apex, 10–13×3–6.5 μm, clamped at base. *Basidia* clavate, 18–24×4.5–6 μm, clamped at base. *Basidiospores* ellipsoid, (4.3–)4.8–5.8 (−6.5)×(2.9–)3.2–4(−4.3) μm, averages of three specimens 5–5.6×3.5–3.7 μm, Q=1.4–1.5, walls hyaline, slightly thickened, smooth, weakly cyanophilous, not reacting in Melzer’s reagent. Arthroconidia produced in culture, 5–12×2–5 μm (Wood and Ginns 2006).

**Habitat and distribution:** Saprobie on wood, also pathogenic, attacking root crowns of *Acacia cyclops*; known from South Africa.

**Specimens examined:** SOUTH AFRICA, Western Cape Province, Stellenbosch, on soil around seedlings, 17 June 2004, A.R. Wood, PREM 58239 and PREM 58240 (PREM); Pietermaritzburg, on Doore stomp, P.A. van der Bijl 602 and 669, as *IrpeX modestus* (PREM); Durban, Natal, P.A. van der Bijl 674, as *IrpeX modestus* (PREM).

*Pseudolagarobasidium acaciicola* is characterized by brown basidiomata with flattened, fused aculei, dimitic hyphal system, and ellipsoid basidiospores. It is most similar to *P. modestum* which has slightly smaller basidiospores; see discussion under *P. modestum*. Another morphologically similar species, *P. subvinosum* has slightly larger basidiospores and more prominent hymenial cystidia compared to *P. acaciicola*. Arthroconidia are produced in cultures and basidiomata of *P. subvinosum* and *P. pronum* also. For a complete description with illustrations of basidiomata and cultures see Wood and Ginns (2006). The specimens of van der Bijl cited above were originally identified as *IrpeX modestus*; however, the basidiospores were more similar in size to those of *P. acaciicola* than to *P. modestum*. Molecular analyses of the nLSU sequences show that *P. acaciicola* has a basal position in the genus (Hallenberg et al. 2008), although with ITS data (Fig. 1) *P. belizense* is basal to *P. acaciicola*.

**Pseudolagarobasidium belizense** Nakasone & D.L. Lindner, sp. nov. (Figs. 2, 3 and 11)

MycoBank MB 563650

**Etymology:** from Belize, the type locality.

Differ *Pseudolagarobasidium* specibus basidiomatinibus brunneis pallide, aculeis≤400 μm longis, hyphis subiculi agglutinatis.

*Basidioma* resupinate, widely effuse, thin, up to 350 μm thick between aculei, subcereaceous to subcretaceous, odontioid to raduloid with distinct, smooth, subcereaceous or subfleiby areas between aculei, Tilleul-Buff, Drab Gray or...
greyish orange [5B(2–3)], no color change with KOH; cracks scattered, inconspicuous; hymenial surface composed of aculei, conical, terete, 3–4 aculei per mm, up to 400×100 μm, smooth, gradually tapering to an acute or rounded, penicillate, sterile apex, apices cream-colored or concolorous with base of aculei, sometimes fused together at base or along entire length forming flattened raduloid structures with broadly tufted apices; margin gradually thinning out, adnate, irregularly fibrilllose, concolorous or paler than mature areas.

Hyphal system dimitic with clamped generative and aseptate microbinding hyphae. Aculei composed of a dense core of non-agglutinated tramal hyphae arranged in parallel with a few embedded cystidia that curve into subhymenial and hymenial layers, at apex terminal hyphae undifferentiated, smooth; tramal hyphae 1.5–5 μm diam, clamped, sparingly branched, even, walls hyaline, slightly thickened, coated with a thin layer of oil-like particles that dissolve in KOH, cyanophilous; subicular hyphae 1.5–2.5 μm, a dense, partially agglutinated trama of distinct, ascending, scattered, inconspicuous; greyish orange 

Habitat and distribution: Saprobic on bark and wood of angiosperms; known only from the type locality, Belize.

Specimen examined: BELIZE, Cayo District, just south-southeast of Doyle’s Delight Peak, on bark and wood of angiosperm, 11 August 2004, D. Lindner, DLC 04–31 (BPI, holotype; CFMR, isotype).

Pseudolagarobasidium belizense is characterized by grayish tan-colored basidiomata, small, subceraceous aculei <500 μm long, and agglutinated subicular hyphae. It is the only species in Pseudolagarobasidium in which the ascending subicular hyphae are agglutinated. Microbinding hyphae occur randomly in the subiculum and substrate. Because of its unique color and small aculei, P. belizense is readily distinguished from other species in the genus with basidiospores of similar size. Pseudolagarobasidium venustum, also known from the Americas, has pale yellow to pale orange basidiomata. ITS sequence analyses place P. belizense basally in the monophyletic Pseudolagarobasidium clade (Fig. 1).

Pseudolagarobasidium modestum (Berk.) Nakasone & D. Lindner, comb. nov. (Figs. 4, 5 and 12)

MycoBank MB 563651
≡ Irpex modestus Berk. in Cooke, Grevillea 19(92): 109. 1891.
≡ Xylodon modestus (Berk.) Kuntze, Rev. Generum Plant. III(2): 541. 1898.
≡ Hydnum ayresii Berk. in Cooke, Grevillea 20(93): 2. 1891.

Basidioma resupinate, widely effuse, thin, up to 300 μm thick excluding aculei, soft, spinose, raduloid, or reticulate, between aculei smooth, feltly or porose, sometimes subceraceous with numerous, short, irregular cracks, yellowish brown (5D5), dull brown [6(E–F)(4–5)], or Saccardo’s Umber; hymenial surface composed of aculei 3–5 per mm, up to 1 mm long, soft, brittle, terete at first then compressed or fusing laterally into plates and reticulated ridges, apices subacute to obtuse, pubescent to hoary; margin gradually thinning out, adnate, indistinct, Tawny Olive.

Hyphal system dimitic with clamped generative and aseptate microbinding hyphae. Aculei composed of a central fascicle of non-agglutinated tramal hyphae with tramal cystidia curving into hymenium; tramal hyphae 3.5–5 μm diam, clamped, sparsely branched, walls hyaline to brownish yellow, up to 1.5 μm thick, smooth or nearly apex encrusted with tiny, black granules (in I. modestus holotype), cyanophilous. Subiculum a narrow, dense tissue of collapsed, agglutinated, thin-walled hyphae arranged parallel to substrate, then hyphae curving toward hymenium to form a non-agglutinated trama of slightly thick to thick-walled subicular hyphae, microbinding hyphae, and embedded oil-like particles that dissolve in KOH; subicular hyphae 2.5–5 μm diam, clamped, moderately branched, walls hyaline to yellow, thin to 1 μm thick, smooth, cyanophilous; microbinding hyphae scarce, 1–1.5 μm diam, aseptate, frequently branched at
right angles, nonstaining, walls hyaline, thick, smooth. Subhymenium up to 20 μm thick, a dense, non-agglutinated tissue of ascending, irregular, short-celled hyphae; subhymenial hyphae 2.2–2.5 μm diam, clamped, frequently branched, walls hyaline, thin, smooth. Hymenium a dense palisade of cystidia and basidia. Cystidia of two types: (a) trimal cystidia abundant, originating in subiculum or aculei trama, enclosed, obclavate, to subfusiform, 45–165×7–13 μm, clamped at
Pseudolagarobasidium modestum is characterized by brown basidiomata with a spinose to reticulate hymenial surface, dimitic hyphal system, brownish yellow, thick-walled tramal hyphae in the aculei, and small ellipsoid basidiospores. Basidiospores were scarce or absent in the specimens examined. *Pseudolagarobasidium modestum* differs from *P. acaciicola* in having slightly smaller basidiospores. In contrast, *P. subvinosum* has slightly larger basidiospores and more prominent hymenial cystidia compared to *P. modestum* and *P. acaciicola*. Moreover, the aculeus tramal hyphae in *P. modestum* are particularly robust with distinctly thickened, brownish yellow walls whereas in *P. subvinosum* they are only slightly thickened and pale yellow. It is possible that *P. modestum* is simply a small-spored variety of *P. acaciicola* or *P. subvinosum*; however, we propose that *P. modestum* be recognized as a distinct species at this time until more specimens from Mauritius are available for study. Genetic and sequence data also may help resolve this issue.
We concur with van der Byl (1934) and Maas Geesteranus (1974) that *Hydnum ayresii* is a later synonym of *P. modestum* whereas Hjortstam and Larsson (1995) and Nakasone (2001) placed *H. ayresii* in synonymy with *P. subvinosum*.

**Pseudolaragobasidium pronum** (Berk. & Broome) Nakasone & D.L. Lindner, **comb. nov.** (Figs. 6, 7 and 13) MycoBank MB 563652

≡ *Hydnum pronum* Berk. & Broome, J. Linn. Soc., Bot. 14(2): 59. 1875.

≡ *Odontia prona* (Berk. & Broome) Rick, Egatea 17: 275. 1932.

≡ *Hydnum calcareum* Cooke & Massee in Cooke, Grevillea 21(98): 38. 1892.

≡ *Irplex calcareus* (Cooke & Massee) Wakef., Bull. Misc. Inf. Kew 8: 367. 1915.

≡ *Odontia calcarea* (Cooke & Massee) G. Cunn., Trans. Royal Soc. N. Z. 86: 70. 1959.

≡ *Radulodon calcareus* (Cooke & Massee) Jülich, Persoonia 9(4): 466. 1978.

≡ *Pseudolagarobasidium calcareum* (Cooke & Massee) Sheng H. Wu, Acta Bot. Fenn. 142: 112. 1990.

**Basidioma** resupinate, widely effuse, up to *10×4 cm*, 0.3–1 mm thick between aculei, soft, submembranous, spongy with areas between aculei distinct, smooth, subcereous to cetraceous, hymenial layer flaking off readily, yellowish white (*4A2*), pale yellow (*4A3*), orange white (*5A2*), greyish orange (*5B4*), Light Ochraceous-Buff, Pinkish Buff, Cinnamon Buff, Avellaneous, Wood Brown, or Drab, no color change with KOH; cracks absent or extensive, revealing white, fibrous context; context white, soft, membranous, fibrous; **hymenial surface** composed of fragile, brittle, soft, cetraceous or chalky aculei, 2–5 aculei per mm, up to *4×0.3 mm*, terete to conical, single or fused at base or along entire length, sometimes prone, occasionally reticulate, gradually tapering to an acute or rounded, penicillate, sterile apex; apices white or concolorous with base of aculeus; margin abrupt or gradually thinning out, up to 2.5 mm wide, appressed, sterile, slightly raised, velvety, white, yellowish white (*4A2*) to pale yellow (*4A3*), with fibrillose or fimbriate edges.

**Hyphal system** dimitic with clamped generative and aseptate microbinding hyphae. **Aculei** composed of non-agglutinated trimal hyphae arranged in a fascicle with embedded trimal cystidia curving into hymenium, at apex terminal hyphae undifferentiated, smooth; tranal hyphae 2–5 μm diam, clamped, sparingly branched, even, walls hyaline to pale yellow, thin to 1 μm thick, smooth or encrusted with oil-like particles, cyanophilous. **Subiculum** composed of two layers filled with small, yellowish brown, oil-like particles that dissolve in KOH: (a) basal layer next to substrate 100–215 μm thick, dense, composed of subicular hyphae arranged more or less parallel to substrate, often collapsed, compressed, partially agglutinated, intermixed with microbinding hyphae, (b) hyphae curving away from substrate to form an upper, open, loose tissue of non-agglutinated subicular and microbinding hyphae; subicular hyphae 2–5 μm diam, clamped, moderately branched, even, walls hyaline, thin, smooth or encrusted with oil-like particles, cyanophilous; microbinding hyphae observed in subicum and at the base of aculei, 0.5–2 μm diam, aseptate, sparingly to frequently branched, lumen narrow or lacking, walls hyaline, thick, smooth, nonstaining. **Subhymenium** up to 80 μm thick, composed of irregular, short-celled hyphae in a dense, non-agglutinated tissue; subhymenial hyphae 1.5–3 μm diam, clamped, frequently branched, walls hyaline, thin, smooth. **Hymenium** up to 35 μm thick, a dense palisade of cystidia and basidia. **Cystidia** of two types: (a) trimal cystidia abundant, arising from aculei trama, subiculum, and subhymenium, embedded or slightly protruding, broadly cylindrical, clavate, or obclavate, sometimes stellate, often with a distinct stalk, apex obtuse, occasionally papillate or branched, 40–70(–105)×5.5–10 μm, tapering to 2–4.5 μm diam at base, with a basal clamp, homogenous contents staining deeply in phloxine and cotton blue, walls hyaline, thin, finely encrusted with oil-like particles, cyanophilous; (b) hymenial cystidia numerous, arising from upper subhymenium, broadly clavate, obclavate or subsufiform, apex obtuse, 16–30×8–9 μm, with a basal clamp, contents and walls as described for trimal cystidia. **Basidia** clavate, often stalked, 15–28×5–7 μm, clamped at base, walls hyaline, thin, finely encrusted with oil-like particles, 4-sterigmate. **Basidiospores** subglobose to broadly ellipsoidal with a small, distinct apiculus, 4–5.5×3–3.7(–4.3) μm, averages of four specimens 4.3–5.1×3.3–3.6 μm, Q=1.3–1.4, walls hyaline, thin, smooth, weakly cyanophilous, not reacting in Melzer’s reagent. Arthroconidia 4–20×2–4 μm, present in cultures and sometimes in basidionema (Maekawa and Hasebe 2002).

**Habitat and distribution:** Saprophytic, rarely pathogenic, on wood and bark of angiosperms; known from mainland China (Wu 2008), Taiwan, Japan, Sri Lanka, Malaysia, Australia, and Sierra Leone.

**Specimens examined** (as *H. calcareum* or *P. calcareum* except as noted): AUSTRALIA, New South Wales, Blue Mountains, Katoomba, 1914, W.N. Cheesman, K(M)562576 (K); Victoria, Kangaroo ground, on fallen rotten trunks, 12 July 1953, E.M. Davies 3643, K(M)56910 (K); Victoria, Kurrumburra, Martin 1027, K(M)56909 (K, **holotype** of *H. calcareum*; NY, **isotypes** NY00072514, NY00776159); Western Australia, Kununurra, on *L. leucocephala*, 5 March 1993, R.G. Shivas, PERTH 02340968 and 1986, R.G. Shivas PERTH 00734527 (PERTH as *P. subvinosus*). CEYLON (Sri Lanka), Central Province, December 1868, G.H.K. Thwaites 975, K(M)167192 (K, **holotype** of *H. pronum*). JAPAN, Okinawa Prefecture, Ishigaki City, Nakura, on hardwood (bark), 19 September 1991, T. Hattori, TFM–F–16295 (TFM); Iriomote Island, Nakama River, on hardwood (bark), 24 September 1993, T. Hattori, TFM–F–16917 (TFM).
Pseudolagarobasidium pronum is characterized by soft, brittle, cretaceous or chalky aculei, microbinding hyphae, and small basidiospores. It has the softest texture in the genus, and unlike other species, the microbinding hyphae are easily observed. Although Maekawa and Hasebe (2002) reported the presence of arthroconidia in many specimens of P. pronum from China and Japan, we observed arthroconidia in only one specimen from Japan, TFM–F–169117. Pseudolagarobasidium pronum is mostly likely to be confused with P. subvinosum because of an overlap in basidiospore size. However, the lighter colored, softer, chalky basidiomata and microbinding hyphae of P. pronum can be used to distinguish it from the darker colored P. subvinosum. Sequence analyses of the nLSU show a close relationship between P. pronum and P. subvinosum (Hallenberg et al. 2008). Pseudolagarobasidium pusillum, also from Western Australia, has much smaller basidiospores.

Pseudolagarobasidium pronum is widely distributed across three continents, Africa, Asia, and Australia. For other descriptions and illustrations, see Jülich (1978), Maekawa and Hasebe (2002), Nakasone (2001), Reid (1955), Wakefield (1915), and Wu (1990). Maekawa and Hasebe (2002) also studied cultures and determined that P. pronum has a tetrapolar mating system.

The hymenium of the holotype and isotype specimens of H. calcareum is poorly preserved; no basidia and few basidiospores were observed. The holotype of H. pronum is in better condition with dark-colored areas on the aculei which indicate bruising or improper drying. Maas Geesteranus (1974) provides a brief description of the H. pronum holotype, but basidiospores were not observed. Despite the condition of the types, there can be no doubt that H. pronum and H. calcareum are conspecific.

Shivas and Brown (1989) reported that Pirex subvinosum is associated with a dieback of L. leucocephala in Western Australia; however, we identified their specimen, PERTH 00734527, as P. pronum based on basidiodia texture and presence of microbinding hyphae in the subiculum. Although no basidia or basidiospores were observed, another specimen collected in 1993 from the same area and host species, PERTH 02340968, has basidiospores typical for P. pronum.

Pseudolagarobasidium pusillum Nakasone & D.L. Lindner, sp. nov. (Figs. 8 and 14)

Mycobank MB 563654

Etymology: Refers to the small basidiospores.

Differs Pseudolagarobasidiate speciesbus basidiosporis pusillis (3.4–)3.6–4.3–(4.7)×2.9–3.2–(3.6) μm.

Basidioma resupinate, widely effuse, thin, up to 225 μm thick between aculei, spiny with distinct, smooth areas between aculei, occasionally with large, knobby structures bearing aculei, Buffy Brown, greyish orange (5B4), at first dark brown in KOH or water then fading; cracks scattered; hymenial surface composed of fragile, subcreaceous to membranous aculei, up to 3 aculei per mm, up to 3 mm long, mostly terete to conical, sometimes compressed or fused laterally, smooth, occasionally with warty outgrowths, gradually tapering to a subacute, sterile apex, apices cream-colored or concolorous with base of aculeus; margin not observed.

Hyphal system dimitic with clamped generative and aseptate microbinding hyphae; microbinding hyphae abundant in mycelial mats embedded in substrate, 0.5–2 μm diam, aseptate, frequently branched at right angles, walls hyaline, thick, smooth. Aculei composed of a core of non-agglutinated, distinct tranal hyphae arranged more or less parallel and embedded cystidia that curve into hymenium, at apex terminal hyphae smooth, undifferentiated; tranal hyphae 2.5–5 μm diam, clamped, sparingly branched, even, walls hyaline to yellow, up to 0.5 μm thick, smooth, cyanophilous. Subiculum up to 180 μm thick, composed of a dense, agglutinated tissue of distinct hyphae arranged more or less parallel to substrate, then hyphae ascending to form a less dense tissue of interwining hyphae and cystidia; subicular hyphae 1.5–5 μm diam, nodose septate, moderately branched, even, walls hyaline to light brown, slightly thick, rarely thick, coated with a thin layer of oil-like particles (observed only in water mounts), cyanophilous. Subhymenium up to 35 μm thick, a dense, compact tissue of partially agglutinated, often indistinct, sometimes collapsed, short-celled hyphae and cystidia; subhymenial hyphae 2–3.5 μm diam, clamped, frequently branched, short-celled, walls thin, hyaline to pale yellow, smooth. Hymenium up to 30 μm thick, composed of cystidia and basidia. Cystidia of two types: (1) tranal cystidia originating in subiculum and aculei trama, embedded or barely protruding, clavate to obclavate, apices subacute to obtuse, rounded, 48–95×8.5–10 μm, with a basal clamp, homogeneous contents staining dark pink in phloxine and dark blue in cotton blue, sulfovanillin negative, walls hyaline, thin, cyanophilous; (2) hymenial cystidia arising from subhymenium and hymenium, cylindrical, clavate, fusiform to subfusiform, 18–30×6–8 μm, clamped at base, contents and walls as described for tranal cystidia. Basidia clavate, 17–23×4.5–5 μm, clamped at base, 4-sterigmate, walls distinct, hyaline, slightly thick, smooth, cyanophilous. Basidiospores broadly ellipsoid, with a small, distinct apiculus, (3.4–)3.6–4.3–(4.7)×2.9–3.2–(3.6) μm, average 3.8±0.3×3.1±0.2 μm, Q=1.2, walls hyaline, slightly thickened, smooth, cyanophilous, not reacting in Melzer’s reagent.
Habitat and distribution: Saprobic on Acacia in Western Australia.

Specimen examined: AUSTRALIA, Western Australia, Kununurra, 15°46′S, 128°44′E, on Acacia trachycarpa E. Pritz, 5 March 1993, R.G. Shivas s.n., PERTH 02340925 (PERTH, holotype).

Pseudolagarobasidium pusillum is characterized by grayish brown basidiomata, long, terete aculei, and the smallest basidiospores in the genus. Pseudolagarobasidium pronum is reported from Western Australia also but has chalky basidiomata, larger basidiospores, and arthroconidia.

Pseudolagarobasidium subvinosum (Berk. & Broome) Sheng H. Wu, Acta Bot. Fenn. 142: 113. 1990. (Fig. 15)  
≡ Hydnum subvinosum Berk. & Broome, J. Linn. Soc., Bot. 14: 60. 1875.  
≡ Irpex subvinosus (Berk. & Broome) Petch, Dis. Tea Bush p. 173. 1923.  
≡ Pirex subvinosus (Berk. & Broome) Hjortstam, Windahlia 17: 58. 1987.  
≡ Radulodon subvinosus (Berk. & Broome) Stalpers, Folia Cryptogam. Estonica 33: 137. 1998.  
≡ Irpex colliculosus Berk. & Broome, J. Linn. Soc., Bot. 14: 61. 1875.  
≡ Xylodon colliculosus (Berk. & Broome) Kuntze, Rev. Generum Plant. (Leipzig) 3(2): 541. 1898.  
≡ Pseudolagarobasidium leguminicola J.C. Jang & T. Chen, Trans. Br. Mycol. Soc. 85(2): 374. 1985.

Basidiomata resupinate, widely effuse, thin to moderately thick, up to 600 μm thick between aculei, soft, membranous to subceraceous, spinose to raduloid, occasionally reticulate or sparassoid, often with distinct, smooth, felt or subporose areas between aculei, Light Ochraceous Buff, light brown to brown [6(D–F)(4–6)], purple or violet when fresh, no color change with KOH; cracks scattered, inconspicuous; hymenial surface composed of soft, brittle, easily detached aculei, up to 3–4 aculei per mm, up to 3.5×1 mm, small, terete to conical at first, often fused at base or along entire length forming flattened raduloid structures, smooth, gradually tapering to a subacute or obtuse, penicillate or broadly tufted, cream-colored, sterile apices; margin gradually thinning out, adnate, smooth, feltly, cream-colored, irregularly fibrillose to fimbriate.

Hyphal system monomitic with clamped generative hyphae, possibly dimitic with microbinding hyphae observed in mycelia pockets in substrate in one specimen. Aculei composed of a dense fascicle of non-agglutinated tramal
hyphae with embedded tramal cystidia curving into hymenium, apex with smooth, undifferentiated terminal hyphae; tramal hyphae 2.7–5(–6) μm diam, clamped, sparingly branched, even, walls hyaline to yellow, thin to slightly thickened, occasionally up to 1 μm thick, coated with a thin layer of oil-like particles that dissolve readily in KOH, cyanophilous. *Subiculum* up to 500 μm thick, a dense tissue of distinct, non-agglutinated hyphae oriented parallel to substrate, then ascending, forming a less dense trama, with small yellowish brown, oil-like particles that dissolve in KOH embedded throughout; subicular hyphae 3–5.5 μm diam, clamped, moderately branched, even, walls hyaline, yellow, or light brown, slightly thick, rarely thick, coated with a thin layer of oil-like particles. *Subhymenium* thickening, up to 50 μm thick, a tissue of vertically arranged, frequently branched, short-celled hyphae and cystidia; subhymenial hyphae 3–3.5 μm diam, clamped, frequently branched, short-celled, walls hyaline, thin, with a fine coating of oil-like particles, weakly cyanophilous. *Hymenium* up to 40 μm thick, a palisade of cystidia and basidia. *Cystidia* of two types: (a) tramal cystidia numerous, originating in subiculum or aculei trama, embedded or barely protruding, cylindrical, obclavate to clavate, apex obtuse, rounded or subacute, sometimes stalked, 16–21–31×(4.5–)5–6.5 μm, clamped at base, 4-sterigmate, walls distinct, hyaline, thin, with a fine coating of oil-like particles, weakly cyanophilous; (b) hymenial cystidia arising from subhymenium and hymenium, broadly fusiform, obclavate or clavate, apex obtuse to subacute, sometimes stalked, 16–21–31×(4.5–)5–6.5 μm, clamped at base, 4-sterigmate, walls distinct, hyaline, thin, with a fine coating of oil-like particles, weakly cyanophilous. *Basidiospores* ellipsoid to broadly ellipsoid, with a small, distinct apiculus, 5–6(–6.5)×(3–)3.5–4.5(–5) μm, averages of five collections 5.4–6.1×3.9–4.3 μm, Q= 1.3–1.5, walls hyaline, thin to slightly thick, smooth, weakly cyanophilous, not reacting in Melzer’s reagent. Arthrocondia produced in basidiomata and cultures, 10–13×4–7 μm (Jang and Chen 1985).

**Habitat and distribution:** Saprobic or parasitic, on bark and wood of various angiosperms; known from Taiwan, Sri Lanka, India, and Zaire.

**Specimens examined:** INDIA, Kerala, on corticate hardwood, 9 November 1984, J.K. Sharma no. 52, K(M)56912 (K). CEYLON (Sri Lanka), Peradeniya, November 1867, G. H.K. Thwaites, K(M)56911 (K, holotype of *H. subvinosum*; BPI US0260529, isotype); no location, on dead wood, G.H.K. Thwaites 366, K(M)167189 (K, holotype of *I. colliculosus*). TAIWAN, Hualien, Hsiulin, Hsiang, on branch of *L. leucocephala*, September 1986, S.-H. Wu 8609 (H). BELGIAN CONGO (Zaire), Kisantu, 23 April 1910, H. Vanderyst, (BPI, US0263676; S, F180882); Bele, 23 April 1910, H. Vanderyst, F180883 (S).

*Pseudolagarobasidium subvinosum* can be distinguished from other species in the genus by its large, ellipsoid basidiospores. Although microbinding hyphae were found in the substrate, not in the basidioma, of the holotype collection, it is probable that these hyphae occur in other specimens, too. Herbarium specimens are uniformly a shade of brown, but fresh basidiomata were described as deep purple, pale lavender, and blue by Petch (1923) and deep violet or purplish by Jang and Chen (1985). Although *P. subvinosum* is often confused with *P. pronum*, the basidiomata of the former are usually darker brown and lack microbinding hyphae whereas in the latter they are softer, chalky, off-white to light brown, with microbinding hyphae in the subiculum. Basidiospores of *P. subvinosum*, on average, are larger than those of *P. pronum* although there is an overlap in size.

The holotype of *H. subvinosum* at K is in better condition than the isotype at BPI, but basidiospores were abundant in both specimens. Microbinding hyphae were found in pockets of white tissue in the substrate directly beneath the basidioma of the holotype. The holotype of *Irpez colliculosus* is in good condition although few basidiospores were observed. The average size, 6.1×4.2 μm (n=14), Q=1.4, is typical for *P. subvinosum*. See Maas Geesteranus (1974) for brief descriptions of holotypes of *H. subvinosum* and *I. colliculosus*.

We follow Wu (1990) who placed *P. leguminicola* in synonymy under *P. subvinosum*. Hjortstam and Larsson (1995) and Nakasone (2001) synonymized *Hydnum ayresii* with *H. subvinosum*; however, we propose that *H. ayresii*, a later synonym of *Irpez modestus*, be recognized as a distinct species. See discussion under *P. modestum*.

See Jang and Chen (1985), Petch (1923), Sankaran and Sharma (1986), and Wu (1990) for additional descriptions and illustrations of *P. subvinosum*. Culture descriptions are provided by Jang and Chen (1985) and Sankaran and Sharma (1986). Chang and Chen (1984) report that *P. subvinosum* has a tetrapolar mating type system. *Pseudolagarobasidium subvinosum* is pathogenic on *L. leucocephala* causing a stem canker in India (Sankaran and Sharma 1986) and a stem and root rot in Taiwan (Jang and Chen 1985). Earlier, Petch (1923) described *P. subvinosum* on diseased roots of *Acacia decurrens* Willd., *Tephrosia candida* DC., and *Camellia sinensis* (L.) Kuntze in Sri Lanka. Although *Pirex subvinosum*, PERTH 734527, was reported from Australia by Shivas and Brown (1989) to cause a stem canker of *L. leucocephala*, we re-identified their specimen as *P. pronum*; for further discussion see *P. pronum*.

*Pseudolagarobasidium venustum* (Hjortstam & Ryvarden) Nakasone & D.L. Lindner, comb. nov. (Figs. 9, 10 and 16) MycoBank MB 563655
Radulodon venustum Hjortstam & Ryvarden, Mycotaxon 74: 250. 2000.

Basidioma resupinate, widely effuse, thin, up to 300 μm thick between aculei, ceraceous, subceraceous, or submembranous, odontoid to raduloid with distinct, smooth or subporose areas between aculei, pale orange (5A3), greyish orange (5B4), Light Buff, Warm Buff, Light Ochraceous Buff, Cream-Buff, or Pinkish Buff, bruised areas light brown; no color change with KOH; cracks numerous, exposing a white, fibrous context; hymenial surface composed of aculei, up to 4 aculei per mm, up to 3 mm long, small, terete to conical, smooth, then gradually tapering to a subacute apex, apices white to cream-colored, often fused at base or along entire length to form flattened, raduloid structures, sometimes prone, often developing abundant, tiny warts or knobs along aculei, margin adnate, abrupt or rapidly thinning out, short fibrillosse, pale yellow (4A3) to orange white (5A2).

Hyphal system monomitic with clamped generative hyphae, possibly dimitic—microbinding hyphae observed in substrate of one specimen. Aculei a dense fascicle of non-agglutinated tramal hyphae with tramal cystidia curving into hymenium, at apex terminal hyphae undifferentiated, smooth; tramal hyphae 2–5.5 μm diam, clamped, sparingly branched, even, walls hyaline, slightly thickened, smooth, weakly cyanophilous. Subiculum up to 250 μm thick, a dense, partially agglutinated tissue with hyphae oriented parallel to substrate, then ascending to form a less dense tissue of primarily non-agglutinated, vertical hyphae and embedded tramal cystidia; subicular hyphae 3–5.5 μm diam, clamped, moderately branched, walls hyaline, up to 0.7 μm thick, smooth, weakly cyanophilous. Subhymenium up to 30 μm thick, a dense tissue of partially agglutinated, indistinct hyphae; subhymenial hyphae 2–4 μm diam, clamped, frequently branched, short-celled, walls hyaline, thin, smooth. Hymenium up to 20 μm thick, a dense palisade of cystidia and basidia. Cystidia of two types: (a) tramal cystidia numerous, originating in upper subiculum and aculei trama, embedded or slightly protruding, cylindrical, subfusiform, or obclavate, tapering to a subacute or obtuse apex, 40–95 × 6–9 μm, with a basal clamp connection, contents homogenous, staining dark pink in phloxine and dark blue in cotton blue, walls hyaline, thin to slightly thickened, smooth, weakly cyanophilous; (b) hymenial cystidia arising in subhymenium and hymenium, cylindrical, broadly fusiform, or obclavate, 20–35 × 4.5–8 μm, clamped at base, contents and walls similar to tramal cystidia. Basidia clavate, occasionally slightly constricted, (10–)15–21(–27) × (4–)5–6.3 μm, clamped at base, 4-sterigate, walls hyaline, thin, smooth. Basidiospores broadly ellipsoidal, with an inconspicuous apiculus, (3.5–)4–5(–5.5) × (2.8–)3.2–3.7(–4.3) μm, averages of two specimens 4.2–4.9 × 3.4–3.5 μm, Q = 1.2–1.4, walls hyaline, thin, smooth, weakly cyanophilous, not reacting in Melzer’s reagent.

Habitat and distribution: Saprobic on bark and wood of palm and angiosperms; known from Brazil and Colombia.

Specimens examined: BRAZIL, São Paulo, Reg. Santos, Cananeia, Ilha do Cardoso, on bark of palm, 2 February 1987, D. Pegler, K. Hjortstam, L. Ryvarden, Hjortstam 16838, K(M)77909 (K, holotype); 2–5 February 1987, D. Pegler, K. Hjortstam, L. Ryvarden, LR 24717 (O; K, K(M) 129182). COLOMBIA, Dept. Magdalena, Parque Nacional Natural Tayrona, Estación Cañaveral, 0–30 m, 17–19 June 1978, L. Ryvarden 15910/B (O).

Pseudolagarobasidium venustum is characterized by pale yellow to orange basidiomata, aculei studded with knobs or warts, and lacking oil-like particles in the context. Microbinding hyphae were observed only in the substrate under the basidioma of the holotype specimen. It is probable that microbinding hyphae are present in the substrate and basidioma of other collections. It is most similar microscopically to P. belzense, which is distinguished by its drab, brownish gray basidioma, smaller aculei, and abundant oil-like particles found throughout the context. Pseudolagarobasidium venustum was transferred from Radulodon because of the non-agglutinated tramal hyphae in the aculei, abundant tramal cystidia, and lack of oil-like particles in basidiospores.

Taxa not accepted in Pseudolagarobasidium

Pseudolagarobasidium concentricus (Cooke & Ellis) Hjortstam, Mycotaxon 54: 190. 1995.
≡ Radulum concentricum Cooke & Ellis in Cooke, Grevillea 14(69): 13. 1885.
≡ Pirex concentricus (Cooke & Ellis) Hjortstam & Ryvarden, Mycotaxon 24: 289. 1985.

Pirex concentricus is accepted as the correct name for this species. Its narrowly clavate basidia, lack of cystidia, and narrowly ellipsoid basidiospores precludes P. concentricus from Pseudolagarobasidium. Moreover, in phylogenetic studies, P. concentricus is placed with Terana caerulea (Schrad. ex Lam.) Kuntze in a clade that is distantly related to Pseudolagarobasidium (Hallenberg et al. 2008; Moreno et al. 2011). See Gilbertson (1964), Hallenberg and Hjortstam (1985), and Kropp and Nakasone (1985) for descriptions and illustrations of P. concentricus.

Pseudolagarobasidium ochroleucum (Lév.) Hjortstam & K.H. Larss., Windahlia 21: 52. 1995, invalid.
≡ Sistotrema ochroleucum Lév., Ann. Sci. Nat., Bot., ser. 3, 5: 145. 1846.
≡ Lenzites acutus Berk. in Hooker, London J. Bot. 1: 146. 1842.

Basidioma effuse, 26 × 5 mm, coriaceous, hydnaceous, light brown [6D(4–6)]; aculei coarse, large, flattened, single or fused, up to 16 × 6 mm, smooth or studded with a few odontoid structures; context brown; margin not observed. Hyphal system trimitic with clamped generative, aseptate...
skeletal, and asceptate binding hyphae. Generative hyphae in-
distinct, irregular, clamped, thin-walled, staining in phloxine.
Skeletal hyphae present in aculeus trama, terminating in hym-
enum, 4–5 μm diam, asceptate, unbranched, walls yellow, up to
2.5 μm thick, smooth. Binding hyphae 2–4 μm diam, asceptate,
frequently branched, rigid, walls yellow, up to 1.5 μm thick,
smooth. No hymenium, basidia, or basidiospores observed.

Specimens examined: (INDIA), Bombay, Polydore Roux (K,
K(M)167194; BPI, US0262114, isotypes of S. ochroleucum).

Because of its coriaceous texture and trimitic hyphal
system, S. ochroleucum is not congeneric with Pseu-
dolagarobasidium. The isotypes examined were fragments, so it
was not possible to determine the true form and structure of
the basidioma. We follow Ryvarden (1981) who examined
the holotype specimen of S. ochroleucum at PC and placed it
in synonymy with L. acutus.

Discussion

Pseudolagarobasidium is established as a monophyletic
genus based on morphological and molecular data. The
seven accepted species are distributed widely in Africa,
Asia, Australia, and Central and South America. Most spe-
cies are known from fewer than three collections; only P.
pronum and P. subvinosum can be considered not uncom-
mon. The varied nutritional associations associated with species
of Pseudolagarobasidium, from saprobic, parasitic, and
endophytic, are noteworthy. Species of Pseudolagarobasidium
treated herein are saprobes although some can be described
as facultative pathogens. Endophytic taxa are known from
DNA sequences obtained from healthy stems of Theobroma
cacao from Brazil and Cameroon (Crozier et al. 2006;
Hallenberg et al. 2008) and leaves of Xylocarpus granatum
König from Thailand (Chokpaiboon et al. 2010).

The ITS sequence of P. acaciicola UDSC-RCK,
AM849050, isolated from soil in India, differs significantly
from other P. acaciicola sequences and may be a different
species. Our phylogenetic results also suggest that Antrodiella
albocinnamomea (FJ613650) and the unidentified taxon ‘Fun-
gal sp. ref 1’ (EU384826) should be classified in Cerrena.

Both nLSU and ITS phylogenetic analyses provide strong
evidence that Pseudolagarobasidium is a monophyletic genus
in a Polyporales clade that includes Radulodon, Cerrena
Gray, and Spongipellis (Hallenberg et al. 2008; Lee and Lim
2010; Moreno et al. 2011). The four genera are distinct and
readily recognizable displaying a wide range in habit (effuse
to pileate), hymenophore configuration (odontoid to poroid),
and texture (soft and fragile to tough and cartilaginous). They
have in common basidia with four sterigmata and hyaline
basidiospores that do not react in Melzer’s reagent.

Pseudolagarobasidium is most similar to Radulodon based
on morphology and molecular data. Stalpers (1998) considered Pseudolagarobasidium a synonym of Radulodon
based on overall similarities of the generic types. Later, Nak-
sone (2001) restricted Radulodon to species with a dimitic
hyphal system. In this study, we discovered that most species
of Pseudolagarobasidium are dimitic also, developing micro-
binding hyphae in addition to clamped generative hyphae.
Microbinding hyphae, however, are scarce or apparently
absent in most specimens of P. subvinosum and P. venustus.
Although there is some overlap, Radulodon basidiomata are
ceraceous or cartilaginous with mostly agglutinated, hyaline
hyphae whereas in Pseudolagarobasidium they are soft to sub-
ceraceous and fragile or brittle with mostly non-agglutinated,
hyaline to light brown hyphae in the aculeus trama and sub-
culum. At the microscopic level, Radulodon species develop
only hymenial cystidia, hyphidia maybe present or absent,
and the acyanophilous, slightly thick-walled basidiospores
usually contain an oil-like globule. In contrast, Pseudolagarobasi-
dium species develop abundant trimal and hymenial cystidia
and lack hyphidia. Basidiospores in Pseudolagarobasidium
lack oil-like particles and may have thin or slightly thickened
walls that are acyanophilous or weakly cyanophilous.

As of December 2011, MycoBank (Crous et al. 2004)
included 13 species of Radulodon of which five are provi-
sionally accepted: R. americanus Ryvarden (generic type),
R. casearium (Cooke & Massee) Jülich, R. cirrhatinus Hjortstam
& Spooner, R. erikssonii Ryvarden, and R. revolubilis Hjort-
stam & Ryvarden. This list differs slightly from Nakasone’s
(2001) treatment which included the first four taxa and R.
calcareus. With our current understanding of the generic
circumscription of Radulodon, we consider R. americanus,
R. casearium, and R. erikssonii to comprise Radulodon sensu
stricto. Preliminary ITS sequence data, however, indicate that
R. americanus and R. erikssonii are conspecific (K.-H. Larsson,
pers. comm.). Radulodon s. str. species have a ceraceous
to subceraceous basidioma, spinose hymenophore, dimitic hyphal
system with clamped generative and asceptate microbinding
hyphae, simple hyphidia, and slightly thick-walled, acyanophi-
lious basidiospores containing a refractive, oil-like globule.

The placement R. cirrhatinus and R. revolubilis remain
unresolved. Radulodon cirrhatinus from Malaysia appears to
straddle two genera. It has non-agglutinated tissues, long
aculei, and small, subglobose basidiospores with cyanophilous
walls, as in Pseudolagarobasidium, but oil-like gloules
in the basidiospores which are characteristic of Radulodon.
It has a monomitic hyphal system (Hjortstam et al. 1990), for
the skeletal hyphae described by Nakasone (2001) are probably
better characterized as sclerified generative hyphae. Interest-
ingly, it occurs in southeast Asia where several Pseudolagar-
obasidium species are present. Radulodon revolubilis from
Venezuela has a resupinate, cartilaginous basidioma with a
sublamellate to irpicoid or lacerate hymenophore, monomitic
hyphal system, and small, subglobose basidiospores with
slightly thickened, cyanophilous walls. This taxon appears to
be congeneric with *Spongipellis* but more study is required before a formal transfer is proposed.

*Radulomyces* M.P. Christ. and *Sarcodontia* Schulzer are similar to *Pseudolarobasidium* in developing resupinate basidiomata, aculei, clamped hyphae, and globose to ellipsoidal basidiospores. *Radulomyces*, however, is distinguished by its ceraceous, hygrophanous basidiomata, large basidia and basidiospores, hyphidia, and lack of cystidia. In addition, its hyphae, basidia and basidiospores are filled with oil-like particles. Molecular analyses of the nLSU sequences show that *Radulomyces* is closely related to *Typhula* (Pers.) Fr. and *Macrotyphula* R.H. Petersen in the Pterulaceae Corner (Larsson et al. 2004). The generic type of *Fr.* and *Radulomyces* is closely related to *Merulius* (Schwein.) Kotlaba, has a distinctive, nearly fleshy basidiomata bearing ceraceous, slender, yellow to brown aculei 5–15 mm long. At the microscopic level, hyphae in the subiculum are thick-walled and terminally inflated, cystidia are absent, and the slightly thick-walled basidiospores contain oil-like particles. It is associated with cultivated apple trees and other angiosperms. Molecular sequence analyses place it in the Merulaceae Rea (Larsson 2007).

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