

狭义干蘑属 (蘑菇目) 概要及新的系统学处理*

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摘要: 对狭义干蘑属 (*Xerula* s. str.) 的范围进行了重新界定, 该属仅包括模式种干蘑 (*X. pudens*) 及其周围的几个种。属的特征是担子果金钱菌状, 有假根; 菌盖及菌柄表面干燥, 被有黄色至褐色直立、披针形的刚毛; 菌褶边缘无不育带; 子实层有近梭形的小担子。这些特征可以将干蘑属的物种从干蘑属-小奥德蘑属复合群中分开。现知干蘑属包含六种, 本文提供了这些种的检索表, 并对各种进行了描述、图示或讨论。其中, 硬毛干蘑 (*X. strigosa*) 是一新种, 它与干蘑 (*X. pudens*) 和中华干蘑 (*X. sinopudens*) 相似, 但与干蘑不同在于其担孢子较长, 锁状联合稀少, 侧生囊状体顶端壁薄; 与中华干蘑的区别在于其侧生囊状体壁厚, 顶端有头状至近头状膨大并覆盖有结晶, 担孢子宽椭圆形至椭圆形。中华干蘑和小刺干蘑 (*X. setulosa*) 分别为我国和哥斯达黎加的新记录种。干蘑属虽然广布北半球, 但未见东亚-美洲或欧亚广布的物种分布类型。

关键词: 生物地理学; 命名; 物种多样性; 分类

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Synopsis and Systematic Reconsideration of *Xerula* s. str. (Agaricales) *

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Abstract: The genus *Xerula* s. str. has been revised and is circumscribed as an assemblage of taxa strictly around the type of the genus, *X. pudens*. The collybioid basidioma with a pseudorhiza; the dry surfaces of the pileus and the stipe covered with erect, lanceolate, yellow to brown, thick-walled setae; the subacerosse basidioles in the hymenium and the fertile lamellar edge delimit *Xerula* species from other taxa of the *Xerula-Oudemansiella* complex. Currently, *Xerula* contains six species. A key to the species, descriptions, illustrations or discussions of the taxa are provided. *Xerula strigosa* represents a new species resembling *X. pudens* and *X. sinopudens*. *Xerula sinopudens* and *X. setulosa* are records new to China and Costa Rica respectively. Although *Xerula* is widely distributed in the Northern Hemisphere, no species of it has an East Asian-American or European-Asian distribution pattern.

Key words: Biogeography; Nomenclature; Species diversity; Taxonomy

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The genus *Xerula* was initially proposed by Maire (1933) to accommodate *Agaricus longipes* Bull. [*X. pudens* (Pers.) Singer]. He emphasized the pubescent basidioma and the absence of a gelatinized layer on the pileal surface in *A. longipes*, that are not found in *A. radicans* (Rehman: Fr.) Fr. [*Oudemansiella radicata* (Rehman: Fr.) Singer]. Moser (1955) treated *Xerula* and *Mucidula* Pat. (1887) as synonyms of *Oudemansiella* Sp. (1881), which was based on the neotropical *O. platensis* (Sp.) Sp. Singer (1962a, b, 1964, 1986) adapted Moser's treatment, yet regarded *Xerula* as a subgenus within the genus *Oudemansiella*.

Dörfelt (1979, 1980a, b, 1981, 1983, 1984) accepted and greatly enlarged the genus *Xerula* to include species both with a dry or viscid pileus. He transferred the sections *Albotomentosae* Clénçon, *Protoxerula* Clénçon and *Radicatae* Clénçon from *Oudemansiella* to *Xerula* based on the similarities of the absence of an annulus, the presence of a pseudorhiza, a hymeniform pileipellis, and gymnocarpic development of basidiomata, and, thus, restricted *Oudemansiella* to the species with an annulus on the stipe without a pseudorhiza and hemiangiocarpic or bivelangiocarpic development of basidiomata [e. g., *O. canarii* (Jungh.) Höhn. and *O. mucida* (Schrad.) Höhn.]. His concept was accepted by many authors, and many species have been transferred from *Oudemansiella* to, or newly described in, *Xerula*. Several section names, e. g. *Albotomentosae* (Clénçon) Dörfelt, *Hyalosetae* Dörfelt, *Radicatae* and *Xerula* have been proposed in the genus *Xerula* that has been divided into three subgenera, viz. *Xerula*, *Radicatae* Dörfelt and *Ixoflammula* Contu (Boekhout and Bas, 1986; Redhead *et al.*, 1987; Petersen and Methven, 1994; Boekhout, 1999; Halling and Mueller, 1999; Contu, 2000; Petersen, 2000; Hbrak, 2005; Petersen and Nagasawa, 2006; Petersen and Baroni, 2007; Petersen, 2008a, b, c).

Meanwhile, many authors did not accept Dörfelt's revised concept of *Xerula* and *Oudemansiella*, and treated *Xerula* as a subgenus of *Oudemansiella* (Clénçon, 1979; Singer, 1986; Pegler and Young,

1987; Rexer and Kost, 1989a, b; Yang and Zang, 1993; Corner, 1994; Yang, 2000; Mizuta, 2006).

A recent analysis of the internal transcribed spacers region (ITS) data set showed that *X. pudens* and a related species, *X. hispida* Halling et G. M. Mueller formed a separated clade from the complexes of "*O. canarii*" (in fact *O. platensis*) and *X. fufuracea* (Peck) Redhead [*O. radicata* var. *fufuracea* (Peck) Pegler] (Binder *et al.*, 2006). Our own molecular phylogenetic reconstruction with increased taxon sampling and using sequences of the ITS and the large subunit of nuclear ribosomal DNA (nLSU) also reveals that *Xerula* s. str. and *Oudemansiella* are independent, monophyletic lineages and should be treated as separate genera (Zhang *et al.*, 2003; unpublished data of Zhang). In this paper, we reported our studies of *Xerula* in its strict sense.

Materials and Methods

Macromorphological characters were described based on fresh material, colored photos, and/or field notes. For micro-morphological studies, sections were cut with a razor blade from basidiomata and mounted on slides in 5% KOH, and then observed and measured under a compound microscope. Color designations (e. g., 5E7) are from Kernerup and Wanscher (1981) while color names with first letters capitalized (e. g., Cinnamon Brown) are from Ridgway (1912). In the basidiospore descriptions, the abbreviation [*n/m/p*] indicates *n* basidiospores measured from *m* basidiomata of *p* collections in 5% KOH solution; *Q* means "length/width ratio" of a spore in side view; *Q* is average *Q* of all basidiospores \pm sample standard deviation. Herbaria are abbreviated according to Holmgren *et al.* (1990) with one exception: HKAS = Herbarium of Cryptogams, Kunming Institute of Botany of the Chinese Academy of Sciences, which is not listed in the index or relative publications.

Taxonomic Description

Xerula Maire, *Treb. Mus. Ciènc. Nat. Barcelona* 15, Sè. Bot. 2: 66. 1933.

Basidiomata collybioid, growing on the ground but connected to buried wood by a pseudorhiza. Pileus convex to plane, umbonate or slightly depressed, yellowish, brownish to dark brown, unpolished and dry, neither viscid nor gelatinized, covered with yellowish and brownish setae. Lamellae sinuate to adnexed,

thick, subdistant, whitish. Stipe non-annulate, radiate, surface covered with yellowish to brownish setae; pseudorhiza tapering. Basidiospores globose, subglobose, broadly ellipsoid or ellipsoid, thin-walled, smooth, inamyloid. Basidia clavate, mostly 4-spored, occasionally 2-spored; basidioles fusiform to subacrose. Pleurocystidia fusiform to ventricose, thin- to thick-walled, prominent. Lamellar edge fertile; cheilocystidia

scattered, often similar to pleurocystidia. Hymenophoral trama regular to subregular. Pileipellis hymeniform composed of clavate, pyriform, sphaeropedunculate or nearly globose cells. Pileocystidia (pileosetae) and caulocystidia (cauloseetae) setaceous, ventricose at the base, tapering towards apex, thick-walled, yellowish to brownish. Clamp connections common, rare or absent.

Type of genus: *Xerula pudens* (Pers.) Singer

Key to the species of *Xerula*

1. Clamp connections common to very common; Europe
 2. Pileus with relatively short (< 1 mm) setae; pleurocystidia thick-walled (up to 6 μm), often with a capitate to subcapitate and yellowish crystalline deposited apex (usually ca. 2 μm thick-walled) *X. pudens*
 2. Pileus with long (up to 3 mm long) setae; pleurocystidia thin-walled (mostly < 1 μm thick) with an occasionally subcapitate apex rarely with crystalline deposits *X. melanotricha*
1. Clamp connections rare or absent; East Asia or America
 3. Basidia 4-spored; pleurocystidia fusiform, capitate to subcapitate; Asia
 4. Basidiospores subglobose to broadly ellipsoid ($Q = 1.05 - 1.20$); pleurocystidia thin-walled (mostly 0.5 μm thick), usually with non-capitate apex without crystalline deposits; mostly in subtropical and tropical areas *X. sinopudens*
 4. Basidiospores broadly ellipsoid to ellipsoid ($Q = 1.10 - 1.40$); pleurocystidia thick-walled (mostly 1 - 3 μm thick), often with a capitate to subcapitate apex covered with crystalline deposits; mostly in temperate and subtropical areas *X. strigosa*
 3. Basidia 2 or 4-spored; pleurocystidia slender fusiform, usually with a non-capitate apex; Central and South America
 5. Basidia 2-spored; basidiospores subglobose to subovoid; Central and northern South America *X. hispida*
 5. Basidia 4- or a mixture of 2- and 4-spored; basidiospores subglobose or broadly ellipsoid to ellipsoid; Central and South America *X. setulosa*

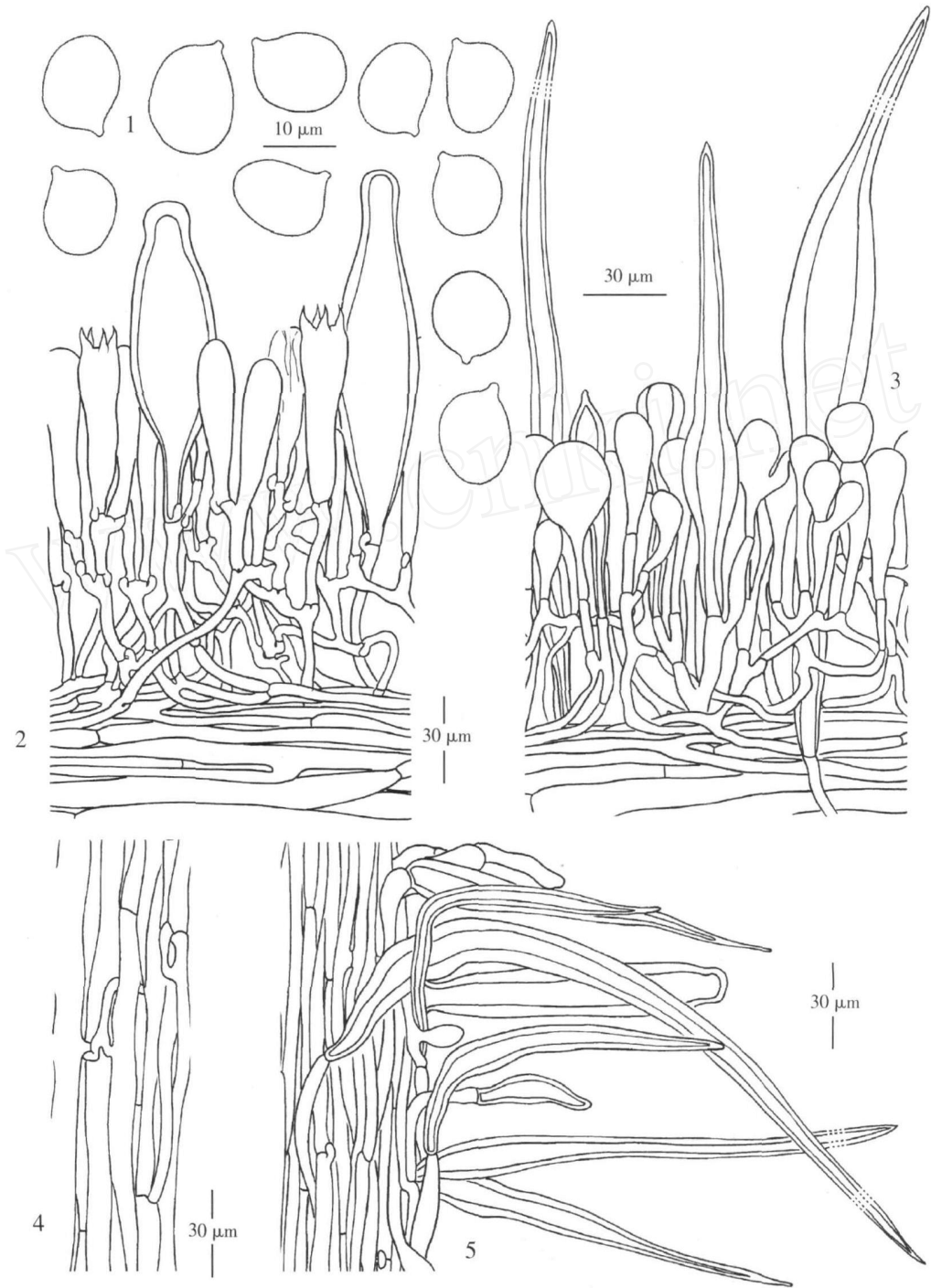
Xerula pudens (Pers.) Singer, Lilloa **22**: 289. 1951. — *Agaricus radicans* var. *pudens* Pers., Syn. Meth. Fung. **2**: 313. 1801. — *Gymnopus pudens* (Pers.) Gray, Nat. Arr. Brit. Pl. (London): 605. 1821. — *Agaricus pudens* (Pers.) Pers., Mycol. Eur. **3**: 140. 1828. — *Collybia pudens* (Pers.) S. Lundell, Fung. Exs. Suec. no. 1717. 1949. — *Oudemansiella pudens* (Pers.) Pegler et Young, Trans. Br. Mycol. Soc. **87**: 590. 1987.

(Figs. 1 - 5)

Pileus yellowish brown to dark brown, covered with yellowish brown setae on the surface. Basidiospores (Fig. 1) [80/4/4] (8.0) 9.0 - 12.5 (15.0) \times (7.5) 8.0 - 11.0 (13.0) μm [$Q = (1.0) 1.05 - 1.25 (1.29)$, $Q = 1.14 \pm 0.07$], subglobose to broadly ellipsoid, occasionally globose. Pleurocystidia (Fig. 2) 140 - 180 \times 25 - 35 μm , fusiform, often capi-

tate to subcapitate, thick-walled (up to 6 μm), the apex always slightly thick-walled (ca. 2 μm thick) and with yellowish crystalline deposits. Pileipellis (Fig. 3) hymeniform, composed of broadly clavate, pyriform or sphaeropedunculate cells. Pileocystidia (Fig. 3) 70 - 270 \times 9 - 17 μm , erect, lanceolate with ventricose base and tapering tips, thick-walled (up to 4 μm thick). Stipe trama (Fig. 4) monomitic, composed of parallel, sometimes branching, hyaline, colorless, thin-walled hyphae connected with slender, colorless, thin-walled and often short celled hyphae 2 - 4 μm diam. Stipitipellis (Fig. 5) composed of appressed, parallel, light yellowish, thin-walled hyphae 3 - 8 μm diam. Caulocystidia (Fig. 5) 60 - 240 \times 12 - 20 μm . Clamp connections common.

Habitat — Mostly on buried rotten wood in broad-leaved forest of *Fagus* and *Quercus*, etc.



Figs. 1-5. *Xerula pudens*. 1. Basidiospores; 2. Hymenium with basidia and pleurocystidia, subhymenium and lamellar trama; 3. Pileipellis and pileocystidia; 4. Stipe trama; 5. Stipitipellis and caulocystidia. All figures are from TENN 59330

Distribution —EUROPE: Austria, Belgium, Croatia, Denmark, England, Estonia, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Poland, Romania, Slovakia, southwestern Russia (Caucasus), Sweden, and Switzerland (Ronikier, 2005a).

Materials examined —AUSTRIA: 28-IX-2001, R. H. Petersen 11469 (TENN 59330). DENMARK: 28-VII-2002, P. B. Hansen & S. Vesterholt 11469 (HKAS 45057). GERMANY: 4-IX-1990, R. E. Halling 6507 (NY 184, HKAS 43811). SWEDEN: 7-X-

2005, S. Lundell & J. A. Nannfeldt 1717 (NY 183).

Notes: The name *X. longipes* (Bull.) Maire has frequently been used for this taxon, but according to Dörfelt (1982), the basionym of *X. longipes*, *Agaricus longipes* Bull. (1785), is a homonym of *Agaricus longipes* Scopoli (1772), a nomen dubium of a fungus from a mine. Thus, *X. pudens* is the correct name of this species. Two varieties are recognized, *X. pudens* var. *pudens* and *X. pudens* var. *fusca* (Lucan ex Qu \acute{e} .) Dörfelt. The collections cited above fit the concept of *X. pudens* var. *pudens* (Dörfelt, 1980a).

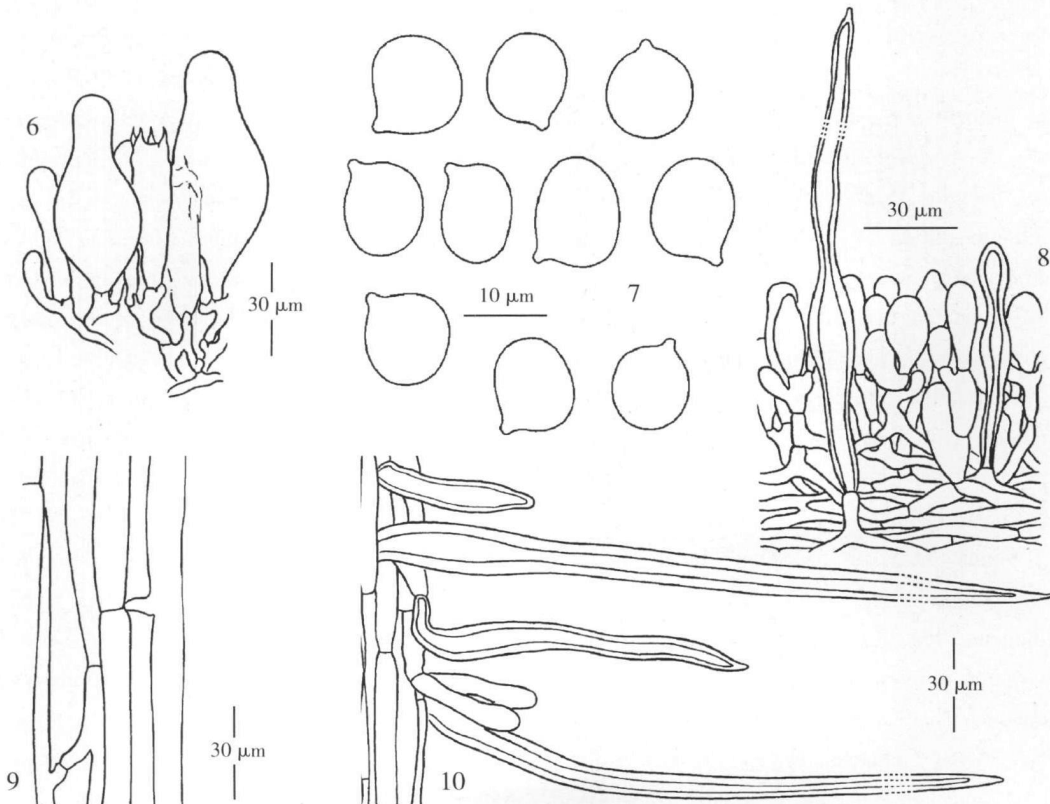
Xerula melanotricha Dörfelt, Feddes Repert. **90**: 367. 1979. — *Oudemansiella melanotricha* (Dörfelt) M. M. Moser in Gams, Kryptogamenfl. 11b/2, rev. ed. **5**: 156. 1983. (Figs. 6 - 10)

Pileus dark brown or blackish brown, with up to 3 mm long and dark brown setae. Basidiospores (Fig. 7) [100/5/5] (8.0) 9.0 - 11.0 (11.5) \times (7.0) 7.5 - 10.0 (10.5) μm [Q = (1.00) 1.05 - 1.29, Q =

1.13 \pm 0.07], subglobose to broadly ellipsoid. Pleurocystidia (Fig. 6) fusiform, thin-walled, occasionally subcapitate, the apex usually without crystalline deposits. Pileipellis (Fig. 8) hymeniform, composed of broadly clavate to sphaeropedunculate cells. Pileocystidia (Fig. 8) up to 3 mm long (but mostly 100 - 350 long), 10 - 20 μm diam, thick-walled (up to 5 μm thick). Stipe trama (Fig. 9) composed of parallel, occasionally branching, hyaline, colorless, thin-walled hyphae 2 - 15 μm diam. Stipitipellis (Fig. 10) composed of appressed, parallel hyphae 3 - 8 μm diam. Caulocystidia (Fig. 10) 40 - 300 \times 8 - 20 μm , thick-walled. Clamp connections common.

Habitat — Mostly on buried rotten wood in conifer forest of *Abies*.

Distribution — EUROPE: Austria, Croatia, the Czech Republic, France, Germany, Greece, Italy, Poland, Romania, Slovakia, southwestern Russia (Caucasus), and Switzerland. NORTH AFRICA: Algeria (Contu, 2000; Ronikier, 2005b).



Figs. 6-10. *Xerula melanotricha*. 6. Basidia and pleurocystidia; 7. Basidiospores; 8. Pileipellis and pileocystidia; 9. Stipe trama; 10. Stipitipellis and caulocystidia. All figures are from GMM 6994 (F)

Materials examined—GERMANY: 1-IX-1986, K. H. Rexer 1605 (HKAS 49782). RUSSIA: Caucasus, 17-IX-2003, G. M. Mueller 6994, 7015, 7030 and 71031 (F).

Notes: *Xerula melanotricha* can be confused with *X. pudens*. For the separation of them see the key above.

Xerula strigosa Zhu L. Yang, L. Wang et G. M. Mueller, **sp. nov.** (Figs. 11 - 20)

Mycobank: MB 512372

Etymology: Named because of the thick-walled setae on the surface of the pileus and the stipe.

Pileus 20 - 50 mm latus, convexus vel plano-convexus, interdum sub-umbonatus vel depressus, flavo-brunneus vel atro-brunneus, non-viscidus, pubescens; pubes flavo-brunneae, acerosae. Caro tenuis, albida, inodora. Lamellae sinuatae vel adnatae, subdistantes, albae; lamellulae praesenites. Stipes 50 - 80 \times 3 - 6 mm, subcylindricus, ad basim incrassatus, ochraceus, apicem versus pallidior, pubescens; pubes flavo-brunneae; pseudorhiza praesentes. Basidiosporae 11.0 - 15.0 \times 9.0 - 11.5 μ m, lato-ellipsoideae vel ellipsoideae, inamyloideae. Basidia 45 - 80 \times 10 - 18 μ m, clavata, 4-sporigera. Pleurocystidia 120 - 150 \times 25 - 40 μ m, fusioidea, parietibus crassis (1 - 3 μ m), capitata vel subcapitata. Cheilocystidia pleurocystidis similis, subfusioidea, saepe capitata. Epicutis pilei ex hyphis lato-clavatis, subfusioideis, pyriformis sphaeropedunculatis composita. Pileocystidia lanceolata, 8 - 20 μ m lata, usque ad 1 mm longa, sursum attenuata, setacea, erecta, parietibus crassis (1 - 3 μ m), fulvo-brunnea. Caulocystidia pileocystidis similis. Fibulae absentes vel raro. Holotypus: J. F. Liang 162 (HKAS 48778), 1 August 2005, alt. 3 200 m, Yulong County, Yunnan, China.

Basidiomata (Fig. 11) medium-sized. Pileus 20 - 50 mm in diam, convex to plano-convex, sometimes slightly umbonate or depressed over disc, yellowish brown (5E7 + 5E8; Cinnamon Brown) to dark brown (6F6 + 6F8; Natal Brown) to pale grayish brown (4B3 + 5B3; Pale Drab-Gray), unpolished, not viscid, covered with erect and yellowish brown (5D7 + 5E7;

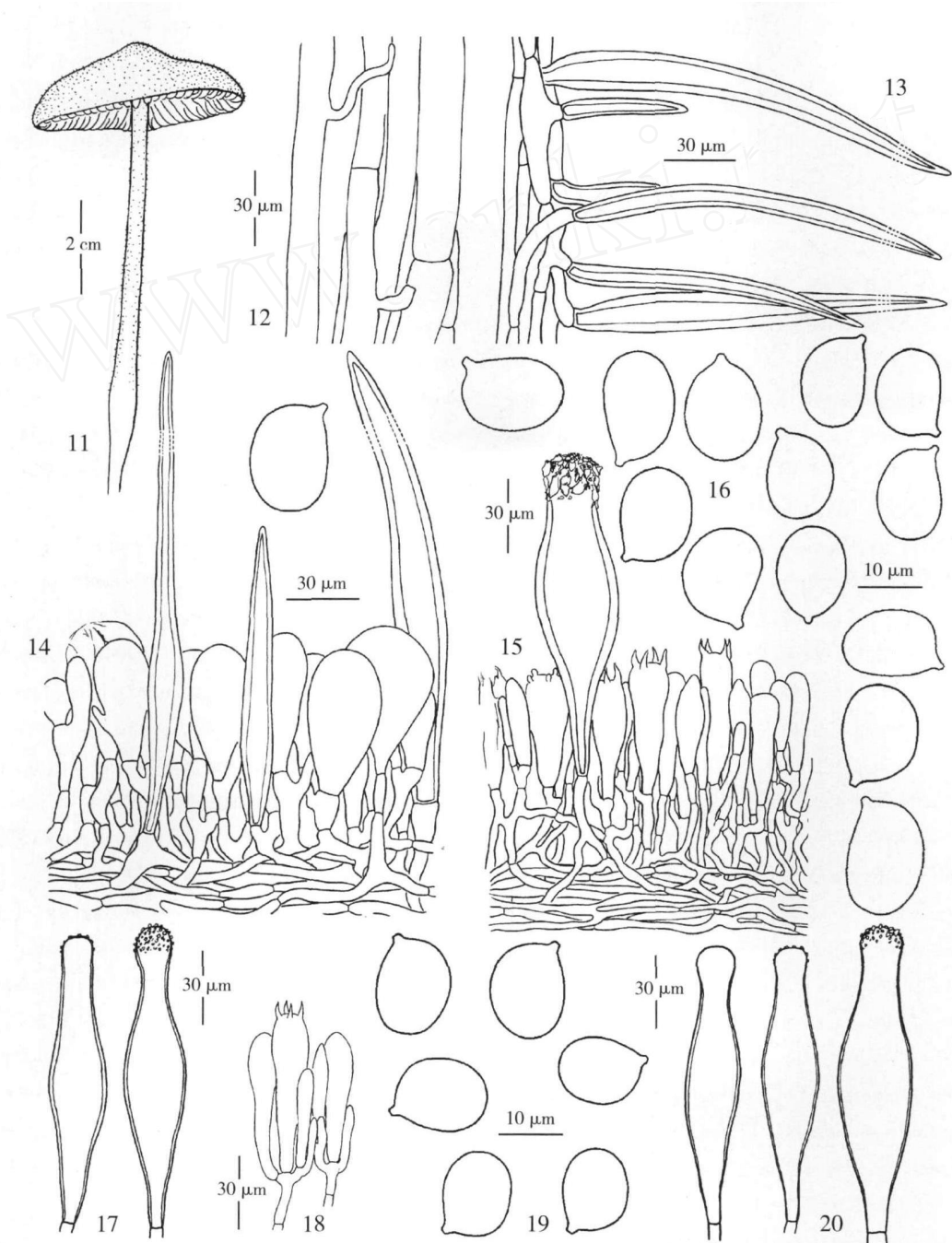
Cinnamon Brown) setae, the margin smooth to faintly striate; context whitish (7A2 + 8A2; Pale Flesh Color), up to 4 mm thick at disc. Lamellae sinuate to adnexed or adnate, subdistant, whitish (7A2 + 8A2; Pale Flesh Color), up to 5 mm in height, with lamellulae. Stipe 50 - 80 \times 3 - 6 mm (pseudorhiza excluded), subcylindrical, slightly broader below, yellowish brown (5D7 + 5E7; Cinnamon Brown), paler towards the apex, with yellowish brown (5D7 + 5E7; Cinnamon Brown) setae; pseudorhiza up to 60 mm long, tapering. Spore print white. Smell mild.

Basidiospores (Figs. 16, 19) [280/24/20] (9.5) 11.0 - 15.0 (16.5) \times (8.5) 9.0 - 11.5 (15.5) μ m [Q = (1.03) 1.10 - 1.40 (1.47), Q = 1.24 \pm 0.10], broadly ellipsoid to ellipsoid, rarely subglobose, colorless, hyaline, inamyloid, thin-walled. Basidia (Figs. 15, 18) 45 - 80 \times 10 - 18 μ m, clavate, 4-spored, rarely 2-spored; sterigmata 5 - 7 μ m long; basal septa rarely clamped; basidioles fusiform to subacrose. Pleurocystidia (Figs. 15, 17, 20) scattered, 120 - 150 \times 25 - 40 μ m, fusiform, hyaline, thick-walled (mostly 1 - 3 μ m thick, occasionally up to 5 μ m thick), often capitate to subcapitate; the apex always thin-walled and with yellowish crystalline deposits. Lamellar edge fertile, with scattered cheilocystidia which are similar to pleurocystidia in shape but somewhat smaller in size. Subhymenium (Fig. 15) tightly interwoven, composed of cylindrical cells 3 - 5 μ m diam. Lamellar trama regular, composed of thin-walled filamentous hyphae 4 - 8 μ m diam. Pileipellis (Fig. 14) 55 - 150 μ m thick, hymeniform, composed of broadly clavate, subfusiform, pyriform or sphaeropedunculate cells (30 - 60 \times 10 - 30 μ m), thin-walled, often with dark brown vacuolar pigment. Pileocystidia (Fig. 14) up to 1 mm long, 8 - 20 μ m diam, erect, lanceolate with ventricose base and tapering tips, thick-walled (mostly 1 - 3 μ m thick, sometimes up to 5 μ m thick), with yellowish brown cell wall. Pileal trama composed of tightly interwoven, hyaline, colorless, thin-walled, filamentous hyphae 6 - 15 μ m diam. Stipe trama (Fig. 12) monomitic, composed of parallel, sometimes branching, hyaline, colorless, thin-walled hyphae (12 - 18 μ m diam) connected with slender, colorless, thin-

walled and often short celled-hyphae ca. 4 μm diam. Stipitipellis (Fig. 13) composed of appressed, parallel, hyaline, light yellowish, slightly thin-walled (ca. 2 μm) hyphae 4 - 10 μm diam. Caulocystidia (Fig. 13) similar to pileocystidia. Clamp connections rare.

Habitat—On buried rotten wood in conifer forest of *Pinus* and subtropical broad-leaved forests of *Lithocarpus* and *Quercus*, etc.

Known distribution—Central and northern Yunnan Province and southern Sichuan Province, southwestern China at 1 500 - 3 200 m elevation.



Figs. 11- 20. *Xerula strigosa*. 11. Basidioma; 12. Stipe trama; 13. Stipitipellis and caulocystidia; 14. Pileipellis and pileocystidia; 15. Hymenium with basidia and a pleurocystidium; 16. Basidiospores; 17. Pleurocystidia; 18. Basidia at different stages of development; 19. Basidiospores; 20. Pleurocystidia. Figures 11- 17 are from the holotype, while figures 18- 20 from HKAS 42657

Materials examined—CHINA: Yunnan Prov. : Binchuan County, Jizu Mountain, 8-VIII-1985, G. P. Xiao 424 (HKAS 15402, as *X. pudens* in Yang and Zang, 1993; Ying and Zang, 1994); 16-VII-2003, L. F. Zhang 23 and 25 (HKAS 38229 and 38231 respectively). Chuxiong, Wuding County, Shizi Mountain, 14-VIII-2003, L. F. Zhang 280 (HKAS 42557). Kunming, VIII-2006, K. Hosaka CH04-274b (HKAS 52590); 26-VIII-2004, L. Wang 398 and 399 (HKAS 46276 and 43467 respectively); 27-VIII-2007, L. Wang 521 (HKAS 52157); 25-VI-2007, L. Wang 522 (HKAS 52357); 12-VIII-1990, Z. L. Yang 1047 (HKAS 22758, as *X. pudens* in Yang and Zang, 1993; Ying and Zang, 1994); 17-VI-2005, Z. L. Yang 4474 (HKAS 48326); 8-IX-2007, Z. L. Yang 4954 (HKAS 52271); X-1980, S. Zeng (HKAS 7015, as *X. pudens* in Yang and Zang, 1993; Ying and Zang, 1994); 30-VI-2003, L. F. Zhang 178 (HKAS 42440); 31-VIII-2003, L. F. Zhang 331 (HKAS 42657). Lijiang, IX-X-1916, anonym s. n. (WU 12869, as *Collybia longipes* in Lohwag, 1937). Qujing, 14-VIII-1999, Z. L. Yang 2618 (HKAS 34061). Shangri-La County, 17-VIII-2000, Z. L. Yang 4524 (HKAS 36615). Songming County, Baiyi Town, 22-VI-1998, X. H. Wang 411 (HKAS 32069a). Yulong County, Laojun Mountain, 1-VIII-2005, J. F. Liang 162 (HKAS 48778, **holotype**). Sichuan Prov., Xichang, 19-IX-1999, Z. L. Yang 2670 (HKAS 34136).

Notes: *Xerula strigosa* is characterized by its broadly ellipsoid to ellipsoid basidiospores, fusiform and thick-walled pleurocystidia with capitate or subcapitate apex often with yellowish crystalline deposits, and the rarity of clamp connections.

Xerula strigosa closely resembles the European *X. pudens*, and, thus, was incorrectly regarded as the latter in the last century (Lohwag, 1937; Yang and Zang, 1993; Ying and Zang, 1994), although Horak (1987) indicated that the material WU 12869 differs from European *X. pudens* by "much larger spores and cystidia of different shape". Our study revealed that unlike *X. pudens*, *X. strigosa* exhibits longer basidiospores, a rare presence of clamp connections on the

septa of basidia and hyphae in lamellar trama, and a thin-walled apex of pleurocystidia.

Sharing yellowish brown setae on yellowish brown to dark brown pileus and rarity of clamp connections with *X. sinopudens*, which has been found in Japan, Indonesia, Papua New Guinea, and China, *X. strigosa* also strongly resembles the latter. Due to their morphological similarity and overlap in distribution range (e. g. in Kunming), they can be easily confused with each other. When immature, the basidiospores of *X. strigosa* are shorter and smaller than in mature specimens, and the pleurocystidia may only be slightly thick-walled, which reflect the characters of *X. sinopudens* (see the key of this paper). Our molecular phylogenetic analyses (data not shown) support treating both a distinct species. Ecologically *X. strigosa* mainly occurs in temperate regions or occasionally in subtropical areas, while *X. sinopudens* prefers warmer habitats, and is distributed in the south at lower altitudes (Yang and Zang, 2003).

Xerula strigosa may also be confused with *X. hispida*, originally described from Central America. One example is that Mueller *et al.* (2001) reported a "*X. hispida*" collection (F 1129046) from Yunnan Province of China. Our molecular phylogenetic studies (data not shown) revealed that this is a collection of *X. strigosa*. Morphologically, *X. hispida* differs from *X. strigosa* by its 2-sterigmate (rarely 4) basidia and slender fusiform pleurocystidia without a capitate apex.

Xerula sinopudens R. H. Petersen et Nagasa., Rep. Tottori Mycol. Inst. **43**: 41. 2006. Figs. 21 - 30

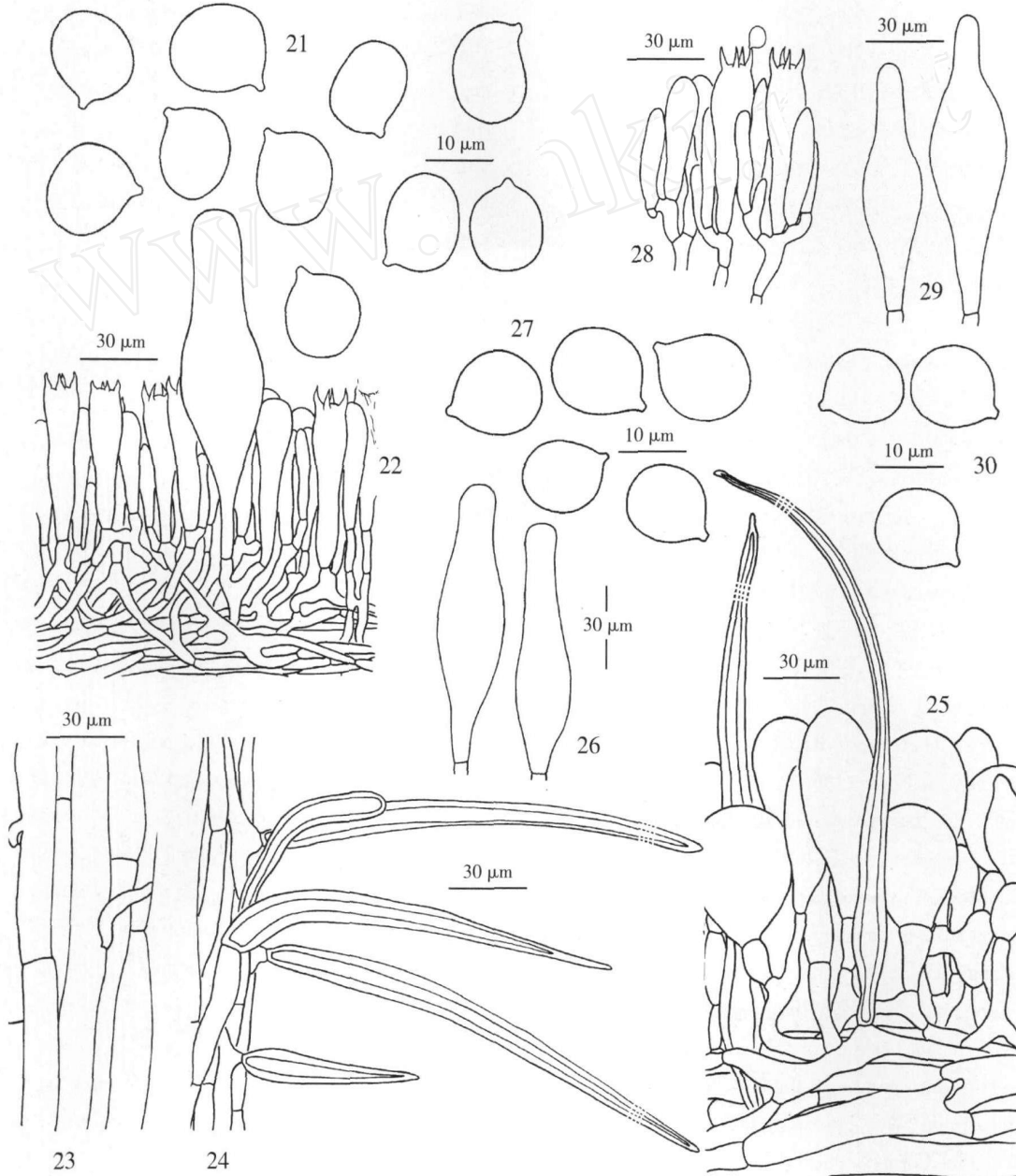
Pileus yellowish brown or brownish, covered with yellowish brown setae. Basidiospores (Figs. 21, 27, 30) [250/25/25] (10.5) 11.0 - 13.0 × (9.0) 9.5 - 11.5 μm [Q = (1.00) 1.05 - 1.20 (1.28), Q = 1.12 ± 0.07], subglobose to broadly ellipsoid, sometimes globose. Pleurocystidia (Figs. 22, 26, 29) broadly fusiform, thin-walled (up to 0.5 μm), occasionally subcapitate, the apex without crystalline deposits. Stipe trama (Fig. 23) monomitic, composed of parallel, branching, hyaline, colorless, thin-walled hyphae connected with slender, colorless, thin-walled and of-

ten short celled-hyphae 2 - 5 μm diam. Stipitipellis (Fig. 24) composed of appressed, parallel, light yellowish hyphae 3 - 10 μm diam. Caulocystidia (Fig. 24) similar with pileocystidia. Clamp connections rare.

Habitat—Mostly on buried rotten wood in tropical and subtropical broad-leaved forests of *Lithocarpus*, occasionally in conifer forests.

Distribution—ASIA: Indonesia, Japan, and Papua New Guinea (Petersen and Nagasawa, 2006). New to China.

Materials examined—CHINA: Hunan Prov., Mangshan, 2-IX-2007, P. Zhang 644 (HKAS 52715). Yunnan Prov., Baoshan, 22-VI-2003, L. F. Zhang 219 (HKAS 42502); 25-VI-2003, L. F. Zhang 255



Figs. 21- 30. *Xerula sinopudens*. 21. Basidiospores; 22. Hymenium with basidia and a pleurocystidium; 23. Stipe strama; 24. Stipitipellis and caulocystidia; 25. Pileipellis and pileocystidia; 26. Pleurocystidia; 27. Basidiospores; 28. Basidia at different stages of development; 29. Pleurocystidia; 30. Basidiospores. Figures 21- 25 are from HKAS 43304, while figures 26- 27 and figures 28- 30 are from HKAS 42101 and E 186523 respectively

(HKAS 42583). Caoligong Mountain, 11-VIII-1973, X.J. Li 615A (HKAS 3505A, as *X. pudens* in Yang and Zang, 1993; Ying and Zang, 1994). Jingdong County, Ailao Mountain, 20-VII-2006, Y.C. Li 607 (HKAS 50361). Jinghong, Dadugang, 30-VIII-2004, X.H. Wang 1795 (HKAS 5899). Kunming, VIII-2006, K. Hsaka CH04-274a (HKAS 52589); 1-IX-2007, Z.L. Yang 4948 (HKAS 52265). Longling County, 5-IX-2002, Z.L. Yang 3459 (HKAS 41528); 9-IX-2002, Z.L. Yang 3514 (HKAS 42098); 10-IX-2002, Z.L. Yang 3542 (HKAS 42101); 11-IX-2002, Z.L. Yang 3560 (HKAS 42099); 12-IX-2002, Z.L. Yang 3585 (HKAS 42093). Luxi County, 11-VIII-1980, M. Zang 6552 (HKAS 6552, as *X. pudens* in Yang and Zang, 1993; Ying and Zang, 1994). Tengchong County, 20-VII-2003, L. Wang 209 (HKAS 43304); 27-VIII-2007, Z.L. Yang 3835 (HKAS 42988). Yingjiang County, 13-VII-2003, Z.L. Yang 3641 (HKAS 42782); 14-VII-2003, Z.L. Yang 3669 (HKAS 42805). INDONESIA: North Borneo, Kinabalu, 19-I-1964, E.J.H. Corner RSNB 5014A (E 186519, as *X. longipes* in Corner, 1996); 25-I-1964, E.J.H. Corner RSNB 5014B (E 186520, as *X. longipes* in Corner, 1996); 10-III-1964, E.J.H. Corner RSNB 5014C (E 186521, as *X. longipes* in Corner, 1996); 9-IV-1964, E.J.H. Corner RSNB 5014D (E 186522, as *X. longipes* in Corner, 1996); 20-IV-1964, E.J.H. Corner RSNB 5014E (E 186523, as *X. longipes* in Corner 1996). JAPAN: Tottori, 26-VI-II-1987, E. Nagasawa 87-178 (TMI 13445); 22-VI-1995, E. Nagasawa (TMI 19467).

Notes: *X. sinopudens* was regarded *X. pudens* in China as well as in other regions of East Asia (Yang and Zang, 1993; Ying and Zang, 1994). However, the European *X. pudens* has common clamp connections, smaller basidiospores measuring $9.0 - 12.5 \times 8.0 - 11.0 \mu\text{m}$, and much thicker-walled (up to $6 \mu\text{m}$) pleurocystidia. We agree with Petersen and Nagasawa (2006) that Corner's collections of *X. longipes* should be regarded as *X. sinopudens* because of the rarity of clamp connections, thin-walled pleurocystidia with a non-capitate apex and without crystalline deposits (Figs. 28 - 30).

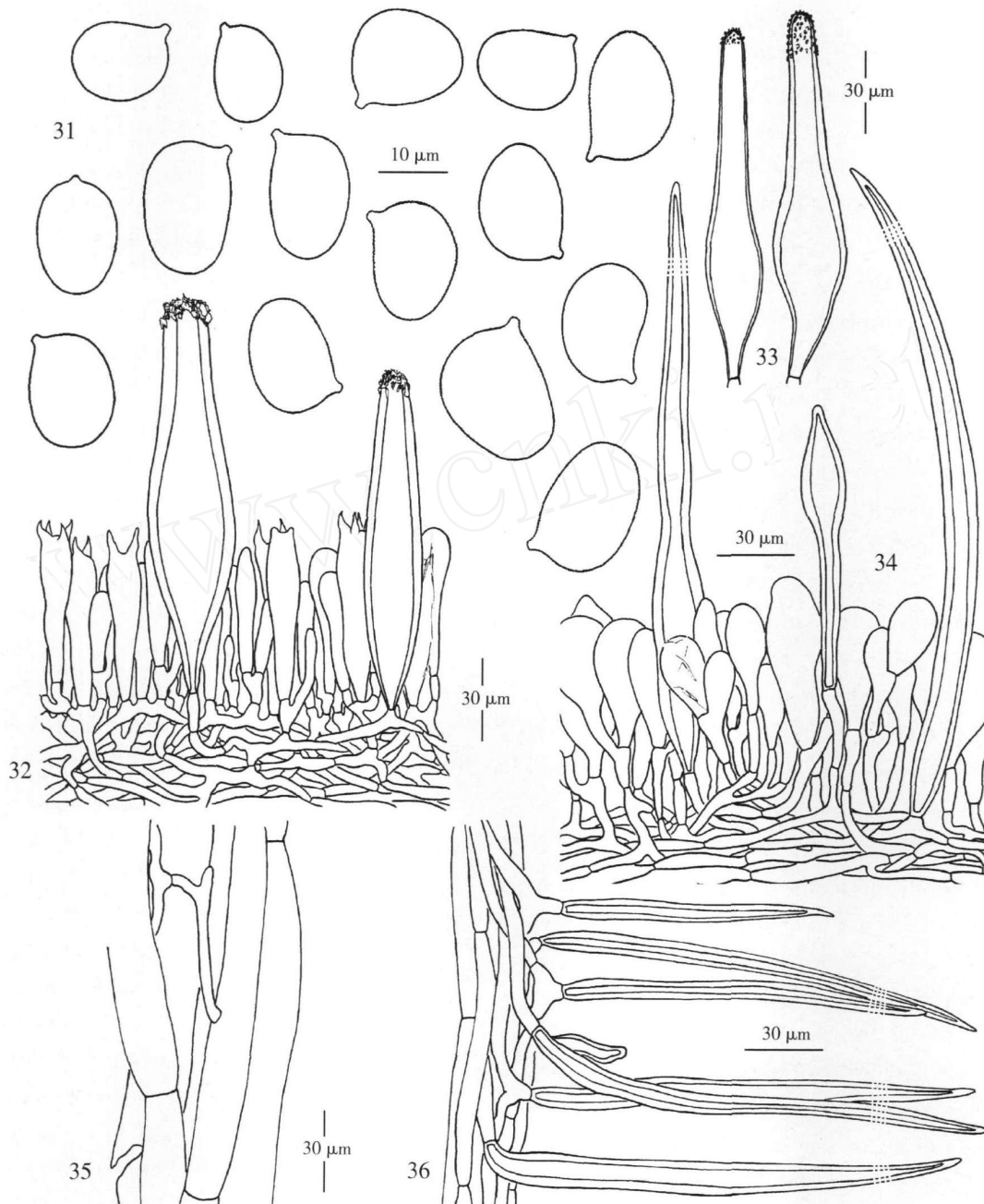
Bi *et al.* (1997) cited two collections under the name *Oudemansiella longipes*. Reexamination revealed that both of them are neither *X. strigosa* nor *X. sinopudens* but members of *O. radicata* var. *fufuracea* complex.

Xerula setulosa (Murrill) R. H. Petersen et T.J. Baroni, Mycotaxon **101**: 114. 2007. —*Gymnopus setulosus* Murrill, North American Flora **9**: 373. 1916. —*Collybia setulosa* (Murrill) Murrill, Mycologia **8**: 219. 1916. —*Marasmius setulosus* (Murrill) Singer, Lilloa **22**: 326. 1951 (non *M. setulosus* Murrill, Bull. Torrey Bot. Club **67**: 150. 1940). —*Marasmius murrillianus* Singer, Lilloa **25**: 488. 1952. —*Lentinus pilosus* Rick, Lilloa **2**: 310. 1938 [non *Lentinus pilosus* (Fr.) Fr., Epicrisis Syst. Mycol. 395. 1838]. —*Xerula pilosa* (Rick) Singer, Lilloa **26**: 86. 1953. —*Oudemansiella pilosa* (Rick) Singer, Sydowia **15**: 59. 1962. Figs. 31 - 36

Basidiomata miniature, brownish to dark brown, covered with yellowish brown setae. Pileus margin often with radially arranged striations. Basidiospores (Fig. 31) [$40/2/2$] ($10.5 - 11.0 - 16.0 (16.5) \times (8.5) 9.5 - 12.0 (13.0) \mu\text{m}$ [Q = (1.04) 1.09 - 1.50, Q = 1.20 \pm 0.11]), subglobose or broadly ellipsoid to ellipsoid. Basidia (Fig. 32) 4- or a mixture of 2- and 4-spored. Pleurocystidia (Figs. 32 - 33) slender fusiform, thick-walled ($2 - 5 \mu\text{m}$), occasionally subcapitate, the apex always thin-walled and with yellowish crystalline deposits. Stipe trama (Fig. 35) monomitic, composed of parallel, branching, hyaline, colorless, thin-walled hyphae connected with slender, short celled hyphae ca. $2 - 5 \mu\text{m}$ diam. Stipitipellis (Fig. 36) composed of appressed, parallel hyphae $3 - 7 \mu\text{m}$ diam. Caulocystidia (Fig. 36) similar with pileocystidia. Clamp connections rare.

Habitat—Under broad-leaved trees such as *Quercus* and *Coccoloba*, etc. (Petersen and Baroni, 2007).

Distribution—CENTRAL AND NORTHERN SOUTH AMERICA: Belize, Brazil (Rio Grande do Sul), Jamaica, Mexico, US (Puerto Rico) (Singer, 1964; Petersen and Baroni, 2007). New to Costa Rica.



Figs. 31-36. *Xerula setulosa*. 31. Basidiospores; 32. Hymenium with basidia and pleurocystidia; 33. Pleurocystidia; 34. Pileipellis and pileocystidia; 35. Stipe trama; 36. Stiptipellis and caulocystidia. All figures from Navarro 1216

Materials examined—COSTA RICA: 27-VI-2001, E. Navarro 1216 (INB); I. L. ϕ e 1472 (INB).

Notes: Petersen and Baroni (2007) suggested that *X. hispida* may be a 2-spored state of *X. setulosa*. Our molecular phylogenetic analyses (data not shown) showed that the two collections cited above do not cluster with the holotype of *X. hispida*.

Discussion

Taxonomy and Systematics of *Xerula* s. str.

In study of the evolutionary relationships of *Mycocaula diseae* Maire & Chemin, Binder *et al.* (2006) provided a multigene molecular phylogenetic study of the family Physalacriaceae and showed that "*O. canarii*" and *O. mucida* formed a well supported clade

with *X. fufuracea* (Peck) Redhead et al. [*O. radicata* var. *fufuracea* (Peck) Pegler] and *X. megalospora* (Clem.) Redhead, Gnns & Shoemaker (figure 3 of Binder *et al.*, 2006). *Xerula pudens* and closely related taxa were not included in this analysis. Interestingly, in the same publication, they presented another analysis of a densely sampled ITS data set that included *X. pudens* and *X. hispida*. These two species formed a separated clade from *X. fufuracea* and “*O. canarii*” although they all were located in the Physalacriaceae clade (figure 4 of Binder *et al.*, 2006). Our molecular phylogenetic analysis as inferred from ITS and nLSU sequences also shows that *Xerula* s. str. and *Oudemansiella* are independent lineages and should be treated as different genera (Zhang *et al.*, 2003; unpublished data of Zhang).

In this study, *Xerula* is proposed as a distinct genus in its strict sense, including *X. pudens* and its close allies, viz. *Xerula* sect. *Xerula* in the sense of Dörfelt (1984) and Contu (2000). Species of *Xerula* sect. *Radicatae* (Clénçon) Dörfelt should be excluded from *Xerula* and incorporated in the genus *Oudemansiella*. Species with collybioid basidiomata with a dry pileus and a pseudorhiza, and erect, thick-walled, lanceolate, yellowish or brownish pilei- and caulocystidia, subcerose basidioles and a fertile lamellar edge with scattered cheilocystidia belong to *Xerula*, while those with a gelatinous or viscid pileus and thin to slightly thick-walled and often collapsed, nearly colorless, non-lanceolate pilei- and caulocystidia or without dermatocystidia, without subcerose basidioles and a sterile lamellar edge with crowded cheilocystidia are *Oudemansiella*. Cheilocystidia are present in *Xerula* but just scattered among the basidia of the fertile edge, which were called marginal pleurocystidia by Corner (1996). The presence or absence of clamp connections, the form and the thickness of the wall of pleurocystidia, and the size and the shape of basidiospores are probably the best parameters to characterize the species of *Xerula* effectively.

Species of *X.* sect. *Albotomentosae* (Clénçon) Dörfelt and sect. *Hyalosetae* Dörfelt, such as *X. americana* Dörfelt, *X. caussii* Maire and *X. hongoi*

Dörfelt, would seem to fit the genus *Xerula*. Until more data on these taxa are available, however, formal inclusion is postponed. For example, *X. hongoi*, possesses a dry pileus, yellowish brown, thick-walled and lanceolate pilei- and caulocystidia and, thus, might be placed in *Xerula* s. str. However, its marasmioid basidiomata with a short pseudorhiza share common features with members of *Rhizomarasmium* R. H. Petersen (Petersen, 2000). In addition, *Xerula mediterranea* (Pacioni et Lalli) Quadr. et Lughini, on which *Xerula* subgen. *Ixflammula* was introduced (Contu, 2000), might also belong to *Rhizomarasmium* according to Petersen (2000).

Biogeography of *Xerula* s. str.

It was proposed that the European *X. pudens* and the American *X. hispida* occur in East Asia (*e. g.*: Lohwag, 1937; Imazeki and Hongo, 1965; Dörfelt, 1980a; Yang and Zang, 1993; Corner, 1996; Mueller *et al.*, 2001). Extensive and detailed studies have now shown that such putative Eurasian disjunct distributions of *X. pudens*, and eastern Asia and Central America/northern South America disjunctions of *X. hispida* are not well supported. Thus far, mushrooms of the genus *Xerula* s. str. can be found in many parts of the world. However, each species has a relatively limited distribution. To date, the total number of recognized *Xerula* species is six. Two of them, *X. pudens* and *X. melanotricha*, are distributed in Europe, two, *X. sinopudens* and *X. strigosa*, occur in East Asia and Southeast Asia, and two species have been found in Central and South America.

Species of *Xerula* from Africa and Oceania are poorly known. *Xerula melanotricha* was reported from Algeria, North Africa (Dörfelt, 1979, 1980a). *Xerula pudens* (under the name of *Oudemansiella longipes*) was recorded from New Zealand (Segedin and Pennycook, 2001), but its occurrence there needs to be verified. Information on the diversity of species and their distributions on both continents will be useful for better understanding the geography of *Xerula* s. str.

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书讯

新书介绍

Gifts from the Gardens of China ——The Introduction of Traditional Chinese Garden Plants to Britain 1698 - 1862; Jane Kilpatrick, 288 p, 2007; London: Frances Lincoln Ltd.

本书详细记载了清代英国从中国采集与引种植物的历史（包括业余爱好者和专业采集家），还有对当时中国的文化、社会考察与交流等情况。作者是英国剑桥大学出身的历史学者，不但收集到非常珍贵的详细资料，而且还是一个植物爱好者，并多次到中国进行野外实地考察。该书不仅记载了英国从中国引种植物的历史，还从另一个侧面向读者展示了当代英国植物爱好者对中国的园林与植物的酷爱程度，同时也包括对当年英法联军火烧圆明园的痛恨。该书书末附有在华的英国植物采集人员名单与采集情况简介。

马金双
(美国纽约布鲁克林植物园)