Species of *Xerula* from sub-Saharan Africa

Petersen, R.H.*

Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996 USA

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Seven species of *Xerula* from sub-Saharan Africa are described. Two (*X. africana*, stat. nov., *X. alveolata*, comb. nov.) were already in the literature although superficially characterized. The others (*X. crassibasidiata*, *X. kenyae*, *X. mammicystis*, *X. semiglabripes*, *X. tetrasperma*) are described as new, as well as *X. tetrasperma* f. *marginata*.

Key words: distribution, morphology, new taxa.

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*Corresponding author: R.H. Petersen; e-mail: repete@utk.edu

Introduction

The earliest citation of a putative *Xerula* from sub-Saharan Africa was a report of *Agaricus* (*Collybia*) *radicata* Relhan: Fries, from South Africa by Kalchbrenner (1880), recited by Doidge (1950). Kalchbrenner (1881: 56) later described *Agaricus* (*Collybia*) *radicatus* var. *brachypus*, cited incorrectly by Saccardo (1905) as var. *brachypoda*, but correctly cited by Doidge (1950). Reid (1975) tried in vain to locate the type specimen for Kalchbrenner's variety, but literature on African agarics which currently could be inferred as *Xerula* remained static for many years. The paper by De Seynes (1897) has remained totally overlooked although two species, *Collybia oronga* and *C. anombe*, surely are members of *Xerula* (see Appendix). Malençon and Bertault (1975: 342) reported *Oudemansiella radicata* and *O. badia* from Morocco, but that physiographic region must be considered Mediterranean, hardly similar to tropical or subtropical African areas to the south.

Pegler (1977) surveyed the agarics of East Africa and included several specimens from Kenya under the name of *O. radicata*, reporting that the African basidiomata differed not at all from the European taxon.

In a canvas of *Xerula* specimens at Kew, Dörfelt (1984) chose one as the type of *Xerula radicata* var. *africana*. Pegler and Young (1987) cited two examined specimens under the name *O. radicata* var. *africana*, of which the holotype from Tanzania provided a spore for SEM imaging. The second specimen, from Kenya, was not illustrated. Recent examination of these two specimens (this study) reveal that they represent two distinct taxa.

Some authors (Clémençon, 1979; Pegler and Young, 1987; Yang and Zang, 1993; Yang, 2000; Yang and Zhang, 2003) have placed collybioid basidiomata with rooting, pseudorhizal stipes (*Xerula*), together with micromorphologically similar basidiomata fruiting on dead wood in the genus *Oudemansiella*. Others have preferred to keep these groups separate (Dörfelt, 1984 and numerous other papers; Redhead *et al*., 1987; Petersen and Methven, 1994; Petersen and Nagasawa, 2006). I prefer to keep these generic concepts separate and only pseudorhizal basidiomata are treated here.

This paper intends to summarize current morphological knowledge of sub-Saharan *Xerula* taxa, including those mentioned above and several additional collections.

Materials and methods

Specimens discussed here were borrowed from the herbaria of the Royal Botanic Gardens, Kew; the University of Helsinki, Finland; the Jardin Botanique National de Belgique; Royal Botanic Garden, Edinburgh; Plant Protection Research Institute, Pretoria, and New York Botanical Garden.

PhC = phase contrast microscopy, under which some structures are refringent. Colors within quotation marks are from Ridgway (1912): colors cited alphanumerically are from Kornerup and Wanscher (1976). Notes with specimens concerning fresh conditions were especially scanty, but where possible have been incorporated into species descriptions. E = spore length divided by spore width; E^m = median E of at least ten spores; L^m = median length of at least ten spores.

Results

Key to subSaharan African Xerula taxa

[Basidiospores 7 × 4 µm; pleurocystidia ten pin-shaped; pileus with significant, acute umbo …… *Collybia oronga*, *C. anombe*; see Appendix]

1. Basidia 2-spored; hyphae clampless 6
1. Basidia 4-spored; hyphae clamped 2

2. Pileipellis constructed of only clavate to sphaeropedunculate pileocystidia (sect. *Radicatae*) 3
2. Pileipellis constructed of clavate to sphaeropedunculate pileocystidia as well as extended, cylindrical pileal hairs (sect. *Albotomentosae*) 5

3. Cheilocystidia mammilate; basidiospores 17.5-21 × 11-13 µm (E^m = 1.58; L^m = 19.20 µm), elongate-ovate to subamygdaliform; pileus surface minutely farinose (30×); Nigeria..... **5. *X. mammicystis***
3. Cheilocystidia fusiform to clavate; basidiospores L^m = <18.00 µm); pileus surface smooth to suede-like 4

4. Basidiospores 15-21 × 10-15 µm (E^m = 1.37; L^m = 17.84 µm), ellipsoid to sublimoniform, delicately dimpled; pleurocystidia large (commonly -180 µm long), fusiform-capitulate with extended neck; sub-Saharan Africa ..... **7. *X. tetrasperma*** (Lamellae with brown-black margins ....**7A. f. *marginata*)**
4. Basidiospores 13-17.5 × 10.5-13 µm (E^m = 1.38; L^m = 15.32 µm), ellipsoid, smooth; pleurocystidia never more than 150 µm long, bottle-shaped with short neck; Kenya .....**6. *X. semiglabripes***

5. Pleurocystidia utriform; basidia 85-105 × 11-16 µm; basidiospores 13-18 × 10-15 µm (L^m = 15.08 µm); Kenya, Ethiopia .....**4. *X. kenyae***
5. Pleurocystidia sublecythiform; basidia 75-88 × 20-22 µm; basidiospores 16-19 × 13-15 µm (L^m = 17.35 µm) .....**3. *X. crassibasidiata***

6. Pileipellis constructed only of clavate to sphaeropedunculate pileocystidia; basidiospores 18-23 × 14-16 µm (L^m = 21.2 µm), sublimoniform..... ..... **1. *X. africana***
6. Pileipellis constructed of clavate to sphaeropedunculate pileocystidia as well as extended, cylindrical pileal hairs; basidiospores 16-20 × 13-17 µm, subglobose to broadly ellipsoid (L^m = 16.0 µm); South Africa, Tanzania ..... **2. *X. alveolata***

1. *Xerula africana* (Dörfelt) R.H. Petersen, **stat. nov.** (Figs 1-6)
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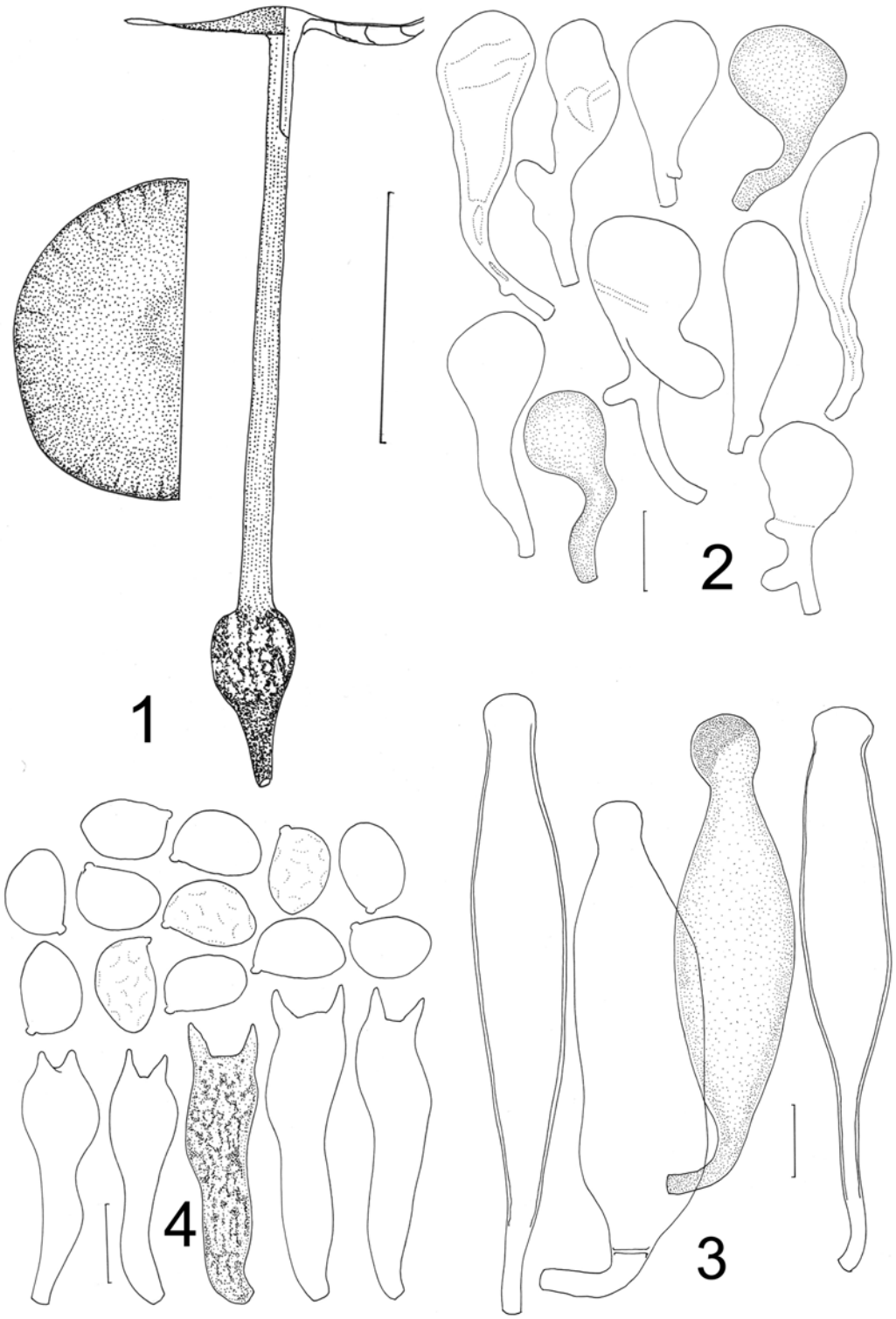
Basionym: *Xerula radicata* var. *africana* Dörfelt, Feddes Repert. 95: 195 (1984).

≡ *Oudemansiella radicata* var. *africana* (Dörfelt) Pegler & T.W.K. Young, Trans. Brit. Mycol. Soc. 87: 598 (1987).

Holotype (des. Dörfelt, l.c.): TANZANIA, Kilimanjaro Province, Mt. Kilimanjaro W slope, W. Kilimanjaro Forest Station, S 5o, E 37o 8', 10.II.1973, coll. L. Ryvarden (no. 10178), [K(M) 124281]. [annot. Dörfelt. 1982]

Pileus (Fig. 1) 20-60 mm broad, shallowly convex with low, shallow umbo, deep brown over disc and there minutely roughened, with some deep brown ridges inconsistently radiating from umbo base up to 1/3 the pileus limb, outward somewhat paler, near neutral brown; margin entire, dark brown, thin. *Lamellae* adnate with descending tooth, white when fresh, light ochraceous buff after drying, subventricose, up to 6 mm deep, close, not marginate, in four ranks; margin appearing slightly cartilaginous, minutely fringed with cheilocystidia; interlamellar hymenophore smooth (not ribbed). *Stipe* apex flaired, white, 3-4 mm broad, lined but not channeled to deeply lined, tapering upward gradually from 4 mm broad near ground line to 3 mm broad above, brownish, with minutely hispid sori of caulocystidia (30×); pseudorhiza swollen rather abruptly, then tapering to long root with scanty wooly, pale mycelium among debris.

Pileipellis constructed of a single element. *Pileocystidia* (Fig. 2) 46-82 × 17-30 µm, pedicellate, commonly with a short pedicel spur, narrowly clavate over disc, broadly



Figs 1-4. *Xerula africana*; holotype. **1.** Basidioma (illustrative reconstruction). **2.** Pileipellis elements. **3.** Pleurocystidia. **4.** Basidia and basidiospores. Bars: 1 = 40 mm, 2-4 = 20 µm.

clavate to subsphaeropedunculate toward pileus margin, thin- to thick-walled (wall never more than 1 µm thick, always over pedicel and lower bulb), hyaline to olivebrown (especially in pedicel), without clamp connection, contents homogeneous, weakly pigmented in watery tan. *Pleurocystidia* (Fig. 3) 117-208 × 23-40 µm, long-pedicellate, elongate-fusiform to fusiform-capitulate, the capitulum sometimes pronounced (-20 µm broad), sometimes a rounded extension of the pleurocystidial neck, hyaline, thick-walled (wall up to 2 µm thick) proximally, thin- to firm-walled over capitulum, without clamp connection; contents homogeneous, sometimes subrefringent (PhC) in capitulum. *Basidia* (Fig. 4) 57-72 × 15-20 µm, clavate from somewhat pinched base, often somewhat bulbous apically, strictly 2-spored, without clamp connection; contents sludgy to multigranular. *Basidiospores* (Fig. 4) 18-23 × 14-16 µm (E = 1.23-1.50; E^m = 1.39; L^m = 21.2 µm), ellipsoid, ovate to sublimoniform, thin-walled, delicately dimpled; contents multiguttulate, refringent (PhC). *Lamellar margin* sterile, a solid palisade of free cheilocystidia, extending significantly in KOH. *Cheilocystidia* (Fig.5) 38-108 × 8-22 µm, often clavate when small, sometimes developing a mammilate to digitate apical extension, to fusiform or clavate-fusiform, thin-walled, hyaline, without clamp connection; contents homogeneous. *Apical caulocystidia* (Fig. 6) occurring in a turf or as erumpent fascicles, similar to cheilocystidia, 40-110 × 13-23 µm, clavate to elongate-fusiform, thin-walled, hyaline, without clamp connection; contents homogeneous. *Mid-stipe surface* an appressed layer of coralloid (almost ramealis) hyphae 3-5 µm diam, producing scattered (not in fascicles) caulocystidia; *caulocystidia* (Fig. 6) up to 25 individuals in erumpent sori, 50- > 225 × 10-17 µm, clavate when small, fusiform, elongate-fusiform to cylindrical when larger, with narrow pedicel, without clamp connection, hyaline, thin-walled; contents homogeneous, not refringent.

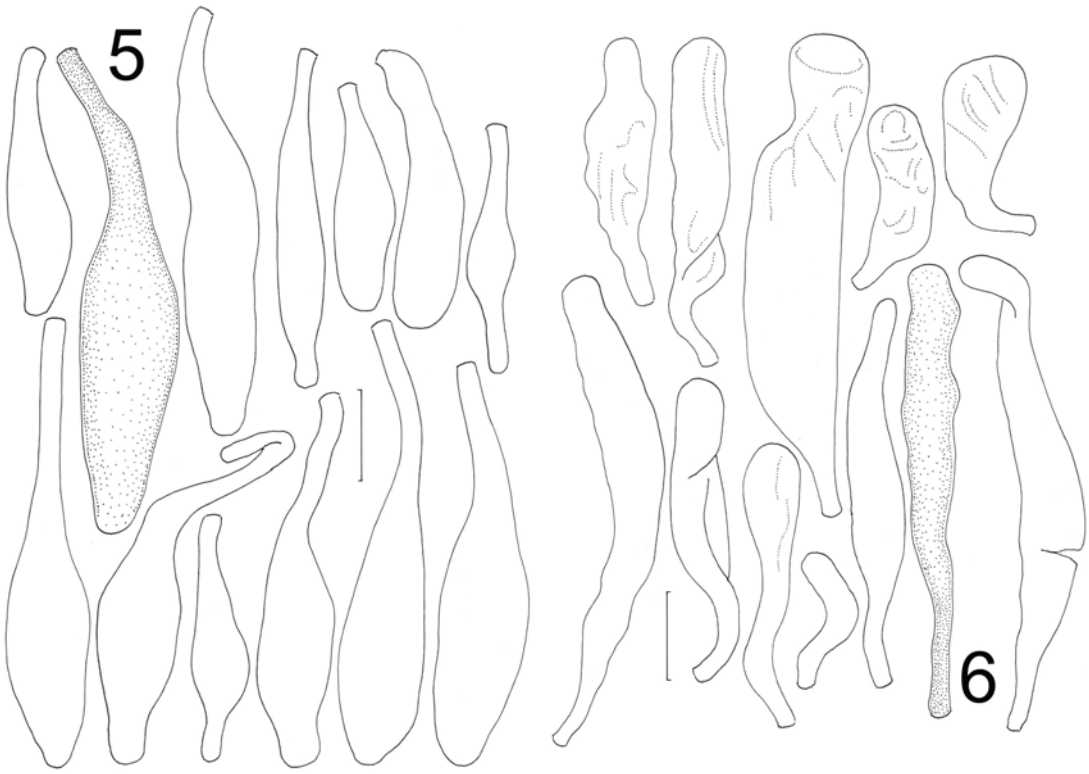
Commentary: Absence of pileal hairs places these specimens in sect. *Radicatae*. Spores are unusually large, which caused Redhead *et al*. (1987) to compare some North American collections to this taxon. Pegler and Young (1987), however, failed to recognize the 2-spored basidia in placing the taxon under *O. radicata*. Pegler (1977) cited several collections from Kenya as *O. radicata*, but none of those collections was cited by Pegler and Young (1987), and are found here under *X. semiglabripes* and *X. tetrasperma*.

Redhead *et al*. (1987) referred some North American collections to this name, but all were described (and confirmed in this study) as 4-spored. The character which separated them from other North American material was spore size, reported by Redhead *et al*. (1987) as 20-25 × 12.5-14.5 µm. No citation of type or authentic material of *X. radicata* var. *africana* was furnished in that study.

Dörfelt's (1984) description of *X. radicata* var. *africana* was superficial, as follows (in its entirety, transl.): "The sample consists of one single fruitbody (Taf. XXIII, Fig. 10); cap diameter 5.8 cm, stipe length 13.5 cm, stipe diameter about 3 mm, of the thickened base 10 mm, rhizomorphic appendix 2.5 cm long, then torn; cap graybrown, stipe concolorous, somewhat lighter, lamellae of exsiccate brownish white, without darker margin.

"Spores measure 18.5-26 × 12.5-16 µm, average 21.5 × 13.5 µm; cystidia mostly somewhat capitate (Taf. XXIII, Figs 11, 12) and most narrower than in the typical variety, relatively abundant, 60-80 µm long, 12-25 µm diam (at widest point), 10-14 µm (neck), 12-18 µm (capitulum); stipe macroscopically smooth, microscopically found to be a single compact hymenodermium.

Discussion: The great variability of *Xerula radicata* relative to many characters (form, color, structure of lamellar margin) leaves a circumscription with only a few fixed, relatively constant characters. Understanding of spore size points out that tropical collections have relatively large spores. Typical spore mass of tropical samples lies around 19.5 × 12 µm, but there exists all transitions to compressed (also, only essentially shorter). Spores of middle-European samples often reach 15 × 11 µm typical dimensions. The fruitbody from Kilimanjaro has typical spores 21.5 × 13.5 µm, and capitulate cystidia exhibit no transition (neither for African collections!), so I accept only a single variety. Whether this is an endemic entity on Kilimanjaro or a



Figs 5-6. *Xerula africana*; holotype. **5.** Cheilocystidia. **6.** Upper, apical caulocystidia; lower; mid-stipe caulocystidia. Bars = 20 µm.

tropical taxon with wider distribution is at present unclear." Not included, of course, were the 2-spored basidia and absence of clamp connections.

Mid-stipe caulocystidia are well-developed but scattered almost individually rather than in erumpent fascicles as in *X. furfuracea*. Cheilocystidia and all caulocystidia (apical and mid-stipe) are similar, typically elongate-fusiform.

This specimen resembles BPI 841566 (viz. *X. incognita* var. *bispora*) in spore and general pleurocystidial shape. Even these characters fail, however. Spore dimensions in BPI 841566 are 17-20 × 12-14 µm (E^m = 1.43; L^m = 18.64 µm; i.e. somewhat shorter than those of *X. africana*); pleurocystidia are 83-155 × 26-42 µm, broadly clavate with broadly rounded apex to subcapitate (i.e. wider and less capitulate than those of *X. africana*). Less obvious; pileicystidia of *X. incognita* var. *bispora* do not exhibit the "spur" common on the pedicel in *X. africana*.

Specimens examined: PEOPLES REPUBLIC OF CONGO, Katanga Prov., Muhulu de la Luiswishi, 1210 m, 19.XI.1971, leg D Thoen (as *Oudemansiella* aff. *longipes*), Thoen no. 4992, no. 70447-25 (BR). SOUTH AFRICA, Transvaal Prov., Pretoria, 5.IV.1921, coll AM Bottomley (as *Collybia radicata*), no 14519 (PREM). TANZANIA, Kilimanjaro Province, Mt. Kilimanjaro W slope, W. Kilimanjaro Forest Station, S 5°, E 37° 8′, 10.II.1973, coll. L. Ryvarden (no. 10178) [K(M) 124281; **holotype**].

2. *Xerula alveolata* (Kalchbr.) R.H. Petersen, **comb. nov.** (Figs 7-11)
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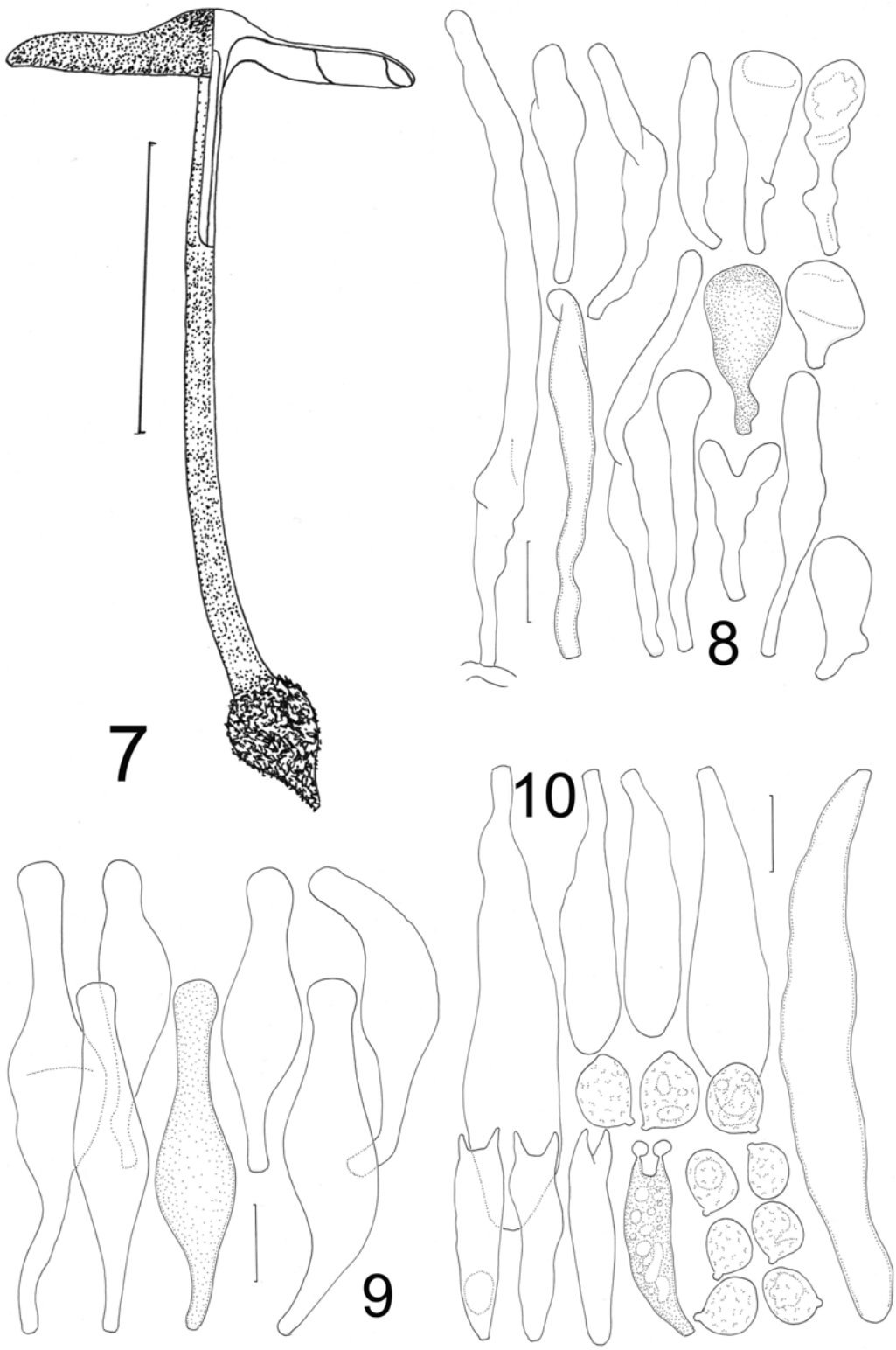
Basionym: *Agaricus alveolatus* Kalchbr., Grevillea 9: 110 (1881).

≡ *Collybia alveolata* (Kalchbr.) Sacc., Syll. Fung. 5: 202 (1887).

***Lectotype* (*hic. design.*)**: SOUTH AFRICA, Cape Prov., no date, coll MacOwan, s.n. [K(M) 144264]. [annot. DA Reid: "Clearly not type but could serve as lectotype."]

Basidiome (Fig. 7) collybioid, gracile, rooting. *Pileus* 33-57 mm broad, dark brown to dark nut brown (near "Saccardo's umber"),



Figs 7-10. *Xerula alveolata*; Saarimäki 555 (H). **7.** Basidioma (illustrative reconstruction). **8.** Pileipellis elements. **9.** Pleurocystidia. **10.** Basidia, basidiospores and cheilocystidia. Bars: 7 = 40mm, 8-10 = 20 µm.

mostly plane but with low umbo, smooth, matt, minutely laccate (30×), with subtle blackish radiating streaks or reticulate pattern near margin, outward with scattered paler flecks; umbo darker, minutely roughened (30×), in part appearing frosted (i.e. hyaline hairs); margin entire, not striate, perhaps incurved, thin; flesh white, outward very thin. *Lamellae* adnate with significant decurrent tooth, white when fresh, near "light ochraceous buff" after drying (in one specimen developing deep rust color from necropigment), close to subdistant, somewhat ventricose, up to 10 mm deep, in three tiers; margin entire, smooth, sometimes with evidence of cheilocystidial palisade, delicately marginate in limited areas. *Stipe* 85-160 mm long to ground level, 2-5 mm broad upward, tapering slightly upward, swollen to 6-8 mm broad just above pseudorhiza, pale and somewhat flaired apically, neutral brown downward, longitudinally lined, obscurely furfuraceous, hollow; *pseudorhiza* beet-shaped, 7-10 mm broad at widest point, then tapering gradually to at least 35 mm long, involving significant soil so as to obscure color, minute areas of thin pale tomentum between soil particles. Taste mild; *odor* weak.

Pileipellis constructed of a single variable element. *Pileocystidia* (Fig. 8) pedicellate, thin-walled, hyaline to pigmented, not apparently clamped, of two types (with intermediates): 1) 27-52 × 13-24 µm, sphaero-pedunculate, short-pedicellate, apparently arising from wide or inflated hyphae; contents homogeneous, pigmented olive brown in small individuals, subhyaline in larger individuals; and 2) pileal hairs 50-198 × 6-14 µm (at widest point), pedicellate, clavate or extended into a subcylindric or cylindric extension, commonly slightly inflated proximally (as though an extension of a clavate individual), thin-walled, hyaline, not apparently clamped. *Pleuro-cystidia* (Fig. 9) 78-122 × 19-30 µm, pedicel-late, fusiform with wide, bluntly rounded extension to fusiform with prolonged neck and capitulum (sublecythiform), not clamped, hyaline, thin-walled; contents homogeneous; capitulum not refringent. *Basidia* (Fig. 10) 47-75 × 12-19 µm, narrowly clavate with slightly pinched base, 2-spored, occasionally sclerified, without clamp connection; contents multigut-tulate when young, with guttules coalescing to 3-4 by maturity. *Basidiospores* (Fig. 10) from hymenium 14.5-18 × 11-15 µm [E = (1.15-) 1.23-1.44; E^m = 1.23; L^m = 16.2 µm], subovate, ellipsoid to subtly sublimoniform, delicately dimpled, thin-walled, hyaline; contents opalescent to uniguttulate. *Basidiospores* from stipe apex and/or pileus surface 16-21 × 13-18 µm (E = 1.00-1.33; E^m = 1.18; L^m = 18.5 µm), subglobose, broadly ellipsoid, occasionally sublimoniform, thin- to thick-walled (wall never more than 1 µm thick), delicately dimpled. *Lamellar margin* sterile, extending significantly in KOH, a solid palisade of cheilocystidia. *Cheilocystidia* (Fig. 10) (36-) 56-146 × (8-)13-30 µm, pedicellate, clavate in smaller individuals, sometimes subtly capitulate, fusiform to broadly cylindrical in larger individuals with slender pedicel, hyaline, firm-walled, without clamp connection; contents homogeneous. Stipe apex minutely scurfy with white tomentum (composed of spores plus caulocystidia). *Apical caulocystidia* (Fig. 11) 50-165 × 15-25 µm, a turf of clavate to lobed individuals, producing broadly cylindrical individuals with narrow pedicel, hyaline, thin- to thick-walled (wall up to 1 µm thick); contents homogeneous. Stipe midsection apparently with a thin, appressed layer of surface hyphae 6-11 µm broad, perhaps involved in slime, producing a lawn of side branches often gathered into erumpent fascicles; caulocystidia (Fig. 11) 49-223(-300) × 12-20 µm, clavate in smaller individuals, extended to fusiform, elongate-fusiform to cylindric in longer individuals, rarely furcate near apex, usually with slender pedicel, thin-, firm- or thick-walled (wall never more than 1 µm thick); contents homogeneous, perhaps slightly pigmented toward tan.

Commentary: These specimens are segre-gated from other similar basidiomata as follows: 1) pileipellis with extended pileocys-tidial hairs; 2) 2-spored basidia; 3) subglobose to broadly ellipsoid (rarely sublimoniform) spores; 4) pleurocystidia fusiform-capitate with extended, broadly rounded neck; and 5) well-developed midstipe caulocystidia. The taxon belongs in sect. *Albotomentosae*. Pileipellis "hairs" are extensions of clavate pileocystidia, but sphaeropedunculate individuals are more

plentiful in some areas of pileipellis than in others. The areas with copious extended pileocystidia seem to be somewhat roughened (20×) or minutely furry. This texture does not assume a pattern, but is distributed over much of the umbo, extending only slightly into the pileus limb. Portions of the umbo and adjacent areas are very delicately frosted (20×) with these hyaline hairs.

Two-spored basidia could be attributed to *X. africana*, together with the fusiform-sublecythiform pleurocystidia, but spores are rarely sublimoniform (most subglobose), and basidia are small with undersized sterigmata. Moreover, the pileipellis found in *X. africana* does not exhibit extended hairs. Spore dimensions, pileocystidial hairs and two-spored basidia could place the specimens in *X. chiangmaiae* var. *raphanipes*, but pleurocystidia of that taxon are rotund-capitulate, not sublecythiform, and its distribution in southeast to northern Indo-Asia would seem to exclude sub-Saharan Africa.

A furfuraceous to scabrous stipe surface of well-developed caulocystidia is common to other African taxa (*q.v.*), but two-spored *X. africana* does not exhibit this character. *Xerula kenyae* produces utriform pleurocystidia and four-spored basidia. Singer (1964) considered *A. alveolatus* to be a synonym under *Oudemansiella radicata*, a judgement followed by Pegler (1977). In other publications, Pegler (1960) and Pegler and Young (1987) did not take up the name.

Although only three specimens have been examined, it may be that this species occurs on the southeast coast of Africa, and should be sought in Madagascar.

Handwritten notes in MacOwan's hand pasted over the type basidiomata stipes: "I think this is what Kalchbr. has described as 'A. alveolatus' a grege 'radicati & aff.' But my sending was not numbered as I only then found one plant. For certainty it must await the publication of his work." This indicates that the note was written BEFORE MacOwan received Kalchbrenner's work, and may indicate that Kalchbrenner had given the species a provisional name when this specimen was collected.

Although Reid annotated the collection as a candidate for lectotype, he designated it as a paratype in publication (Reid, 1975). I cannot find any reference to the specimen by Kalchbrenner (1881) who merely cited the type as "Somers[et] East, MacOw., *sine* No." This reference could be applied to the original MacOwan specimen (no longer known) or the present specimen. Because MacOwan implied that this specimen was sent to Kalchbrenner before the published proposal of the species, there is at least some chance that it was in the hands of Kalchbrenner at the time of compiling the publication (Kalchbrenner, 1881). Therefore, following Reid's suggestion, the specimen is here designated as lectotype of *Agaricus alveolatus*.

Specimen examined: SOUTH AFRICA, Natal Prov., Winterskloof, vic Pietermaritzburg, grounds of Cowan House, 29° 50′ S, 30° 05′ E, 23.I.1975, coll NG Sinnott & s.n. [K(M) 144264; lectotype]. TANZANIA, T3, Tanga Region, Pare District, South Pare Mts., Mbaga Manka village, in small patch of natural montane forest, collection site 29, degree ref. system square 04 37 BB, 1.XII.1990, coll. Tiina Saarimäki & al., no. 555 (H).

3. *Xerula crassibasidiata* R.H. Petersen, **sp. nov.** (Figs 12-17)

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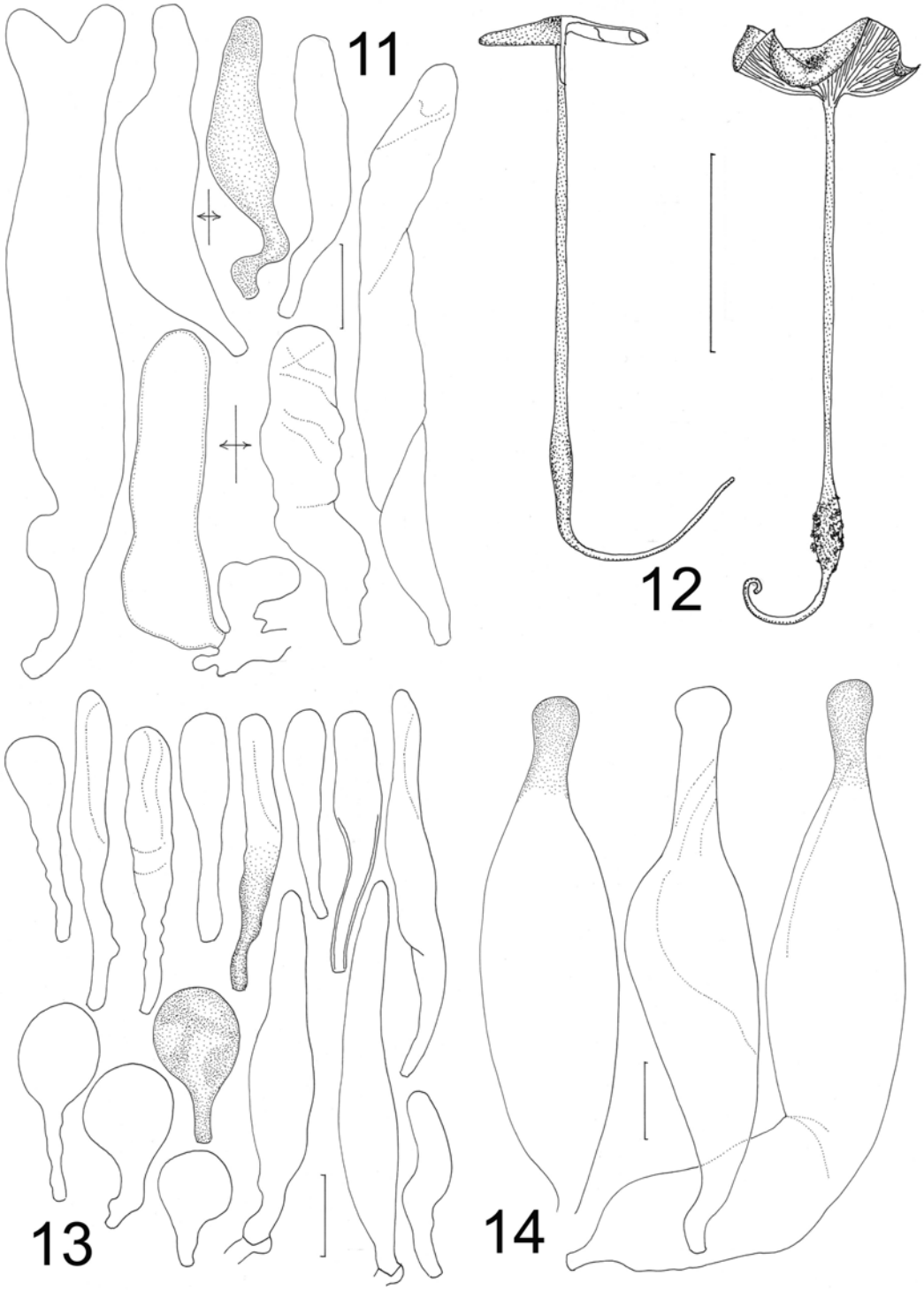
Basidiomata collybioidea, gracilis, radicatia. *Pileo* 30-32 mm lato, brunneo, convexo, centro umbonato, viscido, innate atroburnnea radialiter striatulo; margine levi. *Lamellis* albis, adnatis, subventricosis, non-marginatis. *Stipite* 85-105 × 3-4 mm, apice albo, deorsum griseobrunneis; pseudorhiza dauciformis, longis.

Pileocystidiis 27-150 × 7-15 µm, clavatis vel subsphaeropedunculatis, firme tunicatis. Pleurocystidiis 147-220 × 24-41 µm, pedicellatis, fusiformis-capitulatis, hyalinis, fibulatis. Basidiis 45-88 × 18-22 µm, clavatis, tetra-sporibus. Basidiosporis 15-20 × 11-15 µm (E^m = 1.30; L^m = 17.4 µm), late ellipsoidis, hyalinis. Cheilocystidiis 41-150 × 7-31 µm, fusiformis, fusiformi-mammilatis, fibulatis. Caulocystidiis 45-300 × 10-23 µm, cylindricis, fibulatis, hyalinis ad pallide fuscis.

Holotype: BURUNDI, Prov. T.Muramvya, Teza, S 03° 13' E 29° 34', 2500 m, 22.XII.1978, coll. J. Rameloo (as *O. radicata*, no. K 6238) (BR 032225,21).

Basidiomata (Fig. 12) collybioid, gracile, rooting. *Pileus* ca 30-32 mm broad, plane with shallow umbo, slimy but appearing dry when dried; disc matt to minutely furry, dark brown ("bister," 5D4) usually with a few dark brown radial streaks formed by darker colored pileicystidia (not raised in ridges), occasionally with raised, almost black, coarse radial ridges from umbo, becoming narrower over limb, and then delicately reticulate near and over margin,



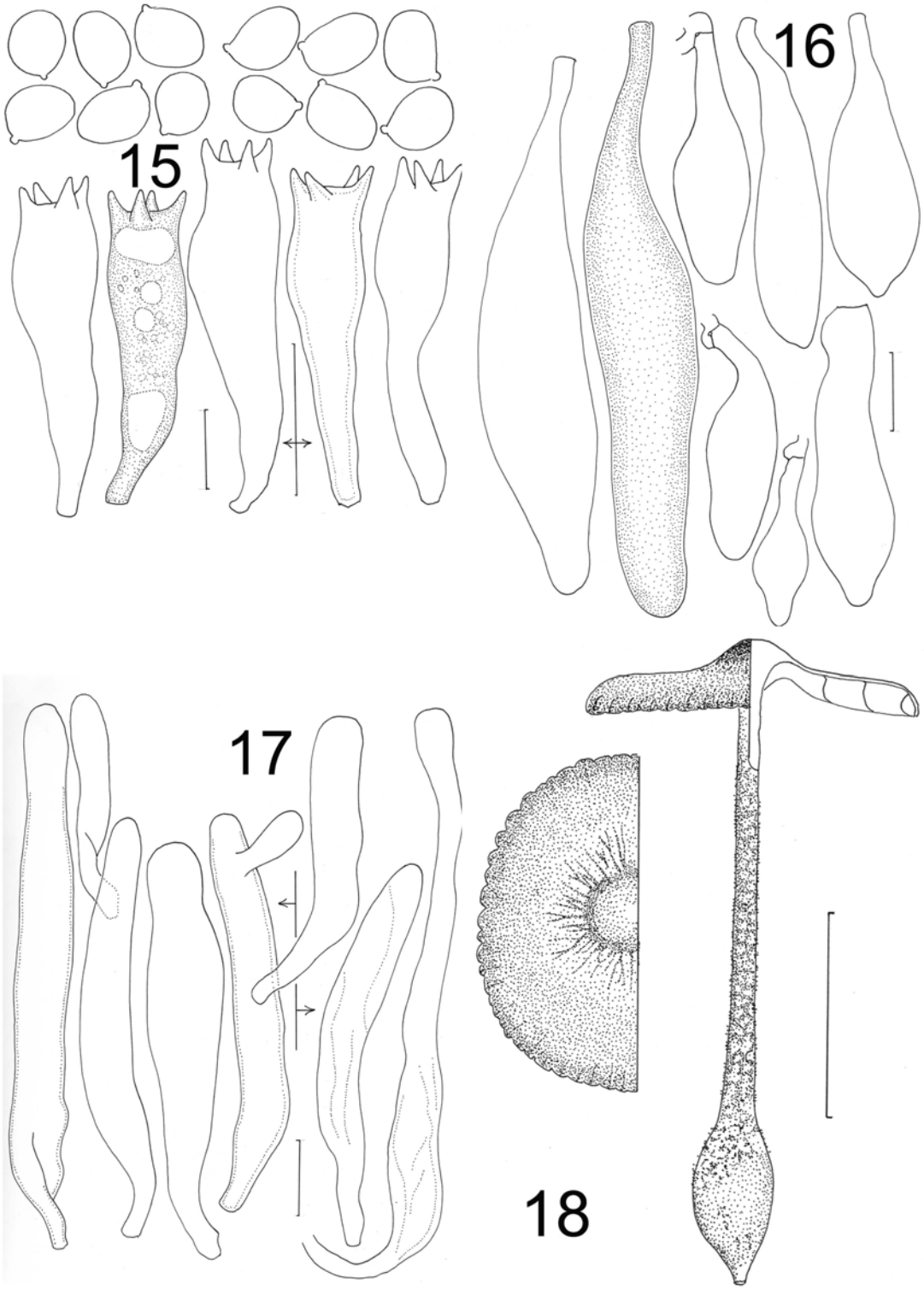
Figs 11-14. *Xerula* species. **11.** *X. alveolata*; Saarimäki 555 (H). Left, apical caulocystidia; right, mid-stipe caulocystidia. **12-14.** *X. crassibasidiata*. **12.** Basidiomata (illustrative reconstruction). Left, **holotype**; right, Rameloo 6580. **13.** Elements of pileipellis (holotype). Upper, pileicystidia from disc; lower, pileicystidia from pileus margin. **14.** Pleurocystidia (**holotype).** Bars: 11, 13, 14 = 20 µm, 12 = 40 mm.

at 40x with slender, hyaline, flexuous, scattered hairs; outward brown (4D4), appearing smooth, with margin somewhat darker; margin entire, not striate or crenate, sometimes undulate; flesh white, loosely compact over stipe, very thin outward, extending beyond interlamellar hymenophore but not beyond lamellae. *Lamellae* white when fresh, becoming light ochraceous buff to ochraceous buff in time when dried, adnate with small decurrent tooth, subventricose, in four ranks (the outermost extremely small), close, entire, not marginate; interlamellar space with hymenophore, ribbed at margin. *Stipe* 85-105 mm long to ground level, 2 mm broad near apex, 3 mm toward ground line; apex white, slightly flaired, appearing glabrous, silky to minutely pustulate with white sori; stipe midsection hardly lined, downward pallid tan ground color with lattice layer brown and minutely hispid or with densely scattered, minute amorphous caulocystidial dots; *pseudorhiza* hardly swollen, carrot-shaped, sometimes with fine white, tangled tomentum, apparently extended at least 65 mm, tapering slowly downward, appearing glabrous, off-white or brown.

Pileipellis constructed of a single variable element. *Pileocystidia from disc* (Fig. 13) 27-150 × 7-15 µm (at widest point), varying from narrowly clavate to clavate, often extended into a cylindrical shaft with bluntly rounded apex, thin-walled (pedicel occasionally slightly thick-walled; wall never more than 0.7 µm thick); contents more or less homogeneous, hyaline to olive-brown, especiallly in pedicel. *Pileocystidia from near pileus margin* (Fig. 13) 20-48 × 9-27 µm, broadly clavate to sphaeropedunculate, perhaps obscurely clamped, thin-walled; contents homogeneous, usually olive-brown; pileal hairs 60-112 × 11-16 µm (at widest point), pedicellate, extended pileocystidia, slightly inflated proximally, tapering to obtusely rounded tip, thin- to thick-walled (wall never more than 1 µm thick) except for thin-walled apex, hyaline to weakly olivetan; contents more or less homogeneous. *Pleurocystidia* (Fig. 14) well-developed, sparse, arising deep in lamellar trama, 147-220 × 24-41 µm, short-pedicellate, fusiform with extended neck (7-11 µm diam) and distinct capitulum (11-15 µm diam), thickwalled over median portion (wall never more than 2 µm thick), hyaline, clamped; contents homogeneous, subrefringent in upper neck and capitulum. *Basidia* (Fig. 15) 45-88 × 18-22 µm, clavate with hardly pinched base, 4-spored; contents multigranular when immature, coalescing to several-guttulate near maturity; several sclerotized basidia present. *Basidiospores* (Fig. 15) 15-20 × 11-15 µm (E = 1.13-1.48; E^m = 1.30; L^m = 17.4 µm), broadly ellipsoid to subovate, smooth or very delicately pock-marked, hyaline; contents opalescent when immature, uniguttulate when mature, refringent.

Lamellar margin sterile, extending significantly in KOH, a solid beard of well-developed cheilocystidia. *Cheilocystidia* (Fig. 16) 41-150 × 7-31 µm, digitate to narrowly clavate when young, extending to fusiform with various expressions of mammilate or subcapitulate apex, conspicuously clamped, hyaline; contents homogeneous. *Caulocystidia* at stipe apex (Fig. 17) appressed, sparse in pallid sori scattered over stipe apex, 45- > 300 × 10-23 µm, hyaline, thin-to thick-walled (wall up to 2 µm thick), with rounded apex, clamped. Stipe midsection with extensive loose, lattice of wide hyphae (6-8 µm diam, thin-walled, clamped), producing superficial sori of caulocystidia arising from a tangle of tortuous, thin-walled, pigmented hyphae producing small, sharply pointed olive-tan individuals and several (-15) larger individuals; contents of small individuals homogeneous, olive-brown; caulocystidia (Fig. 17) 57-190 × 9-21 µm, with slender base, hyaline, thin- to thick-walled (wall up to 2 µm thick), inconspicuously clamped; contents homogeneous, often slightly refringent at very apex.

Commentary: Pegler (1977) reported several collections of *Oudemansiella radicata* from Kenya, but later (Pegler and Young, 1987) included additional collections from sub-Saharan Africa, including *O. radicata* var. *africana*. Examination of additional collections reveals several taxa, including *X. crassibasidiata* and *X. kenyae* (q.v.). Of these taxa, two (*X. alveolata*, *X. crassibasidiata*) belong in sect. *Albotomentosae*, for both produce extended pileicystidia as "hairs." The two taxa are separated by differences in basidia (extremely long and narrow in *X. alveolata*, long but broad in *X. crassibasidiata*) and



Figs 15-18. *Xerula* species. **15-17.** *X. crassibasidiata*. **15.** Basidia and basidiospores. Left, **holotype**; right, Rameloo 6580. **16.** Cheilocystidia. **17.** Caulocystidia. Left, caulocystidia from stipe apex; right, caulocystidia from stipe midsection. **18.** *Xerula kenyae*; **holotype**. Basidioma (illustrative reconstruction). Bars: 15-17 = 20 µm, 18 = 40 mm.

spores (13-18 × 10-15 µm in *X. alveolata*). In sect. *Radicatae* (no pileisetae, no extended pileicystidia), *Xerula africana* (= *O. radicata* var. *africana* ss. Pegler and Young, 1987) is 2-spored, with its 4-spored analog as *X. tetrasperma*. The difference between pileocystidia from the disc and from the margin reflects the situation in several other species. It would appear that the disc, not as expanded as the limb, has less room for pileocystidial swelling than the outer pileus. But pileal hairs are present in all areas of the pileus surface, although somewhat shorter outward than over the disc. Furthermore, not more than 1:250 pileipellis elements is a pileal hair. Therefore such structures are inconspicuous in sections or squashes and invisible at 10×. Intermediates are clavate, thick-walled and hyaline (not olive-tan like pileocystidia).

A single basidiome (BM 466) from high altitude in Malawi (6000 ft.) differs from typical *X. crassibasidiata* in its stout form (pileus 110 mm broad, stipe 40 × 6-8 mm, lamellae subdistant, ventricose, up to 10 mm deep, with distinct decurrent tooth) and olivaceous color (noted as "greenish" in notes on the fresh specimen). Otherwise, microscopic characters fit nicely.

Specimens examined: BURUNDI, Prov. T.Muramvya, Teza, S 03° 13' E 29° 34', 2500 m, 22.XII.1978, coll. J. Rameloo (as *O. radicata*, no. K 6238) (BR 032225, 21); same location, 20.XII.1978, leg J. Rameloo (as *O. radicata*; no. 6146), K 1766 (BR no. 032224,30); Prov. Bururi, Bururi, Forêt de Bururi, S 02° 57' E 29° 37', 7.II.1979, 1950 m, leg. J. Rameloo (as *O. radicata*, no. 6580), (BR 032226,22). MALAWI, Nyita Nat. Park, surroundings of Chelinda Lodge, 6.XII.1981, leg K. Rameloo, no. 7688 (BR 032231,27); Zomba Mt., 27.XII.1981, coll B Morris, BM 466 [K(M) 144256]. ZAMBIA, Chowo Forest, 7.XII.1981, leg J Rameloo, no 7716 (BR no. 032233, 29); same location, 9.XII.1981, leg K. Rameloo, no. 7755 (BR 032234, 30); Manyanjere Forest, 16.XII.1981, leg J Rameloo, no 7938 (BR 032237,33).

4. *Xerula kenyae* R.H. Petersen, **sp. nov.**

(Figs 18-23)

MycoBank: 511154

Basidiomata collybioidea, crasis, atro-brunneis. *Pileo* 44-57 mm lato, convexiumbonato, glabro, vel innate atrobrunneo radialiter striatulo. *Lamellis* albis, crassis, ventricosis, adnatis, non-marginatis. *Stipe* 100-150 × 4-8 mm, apice albo, deorsum brunneo; pseudorhiza inflata.

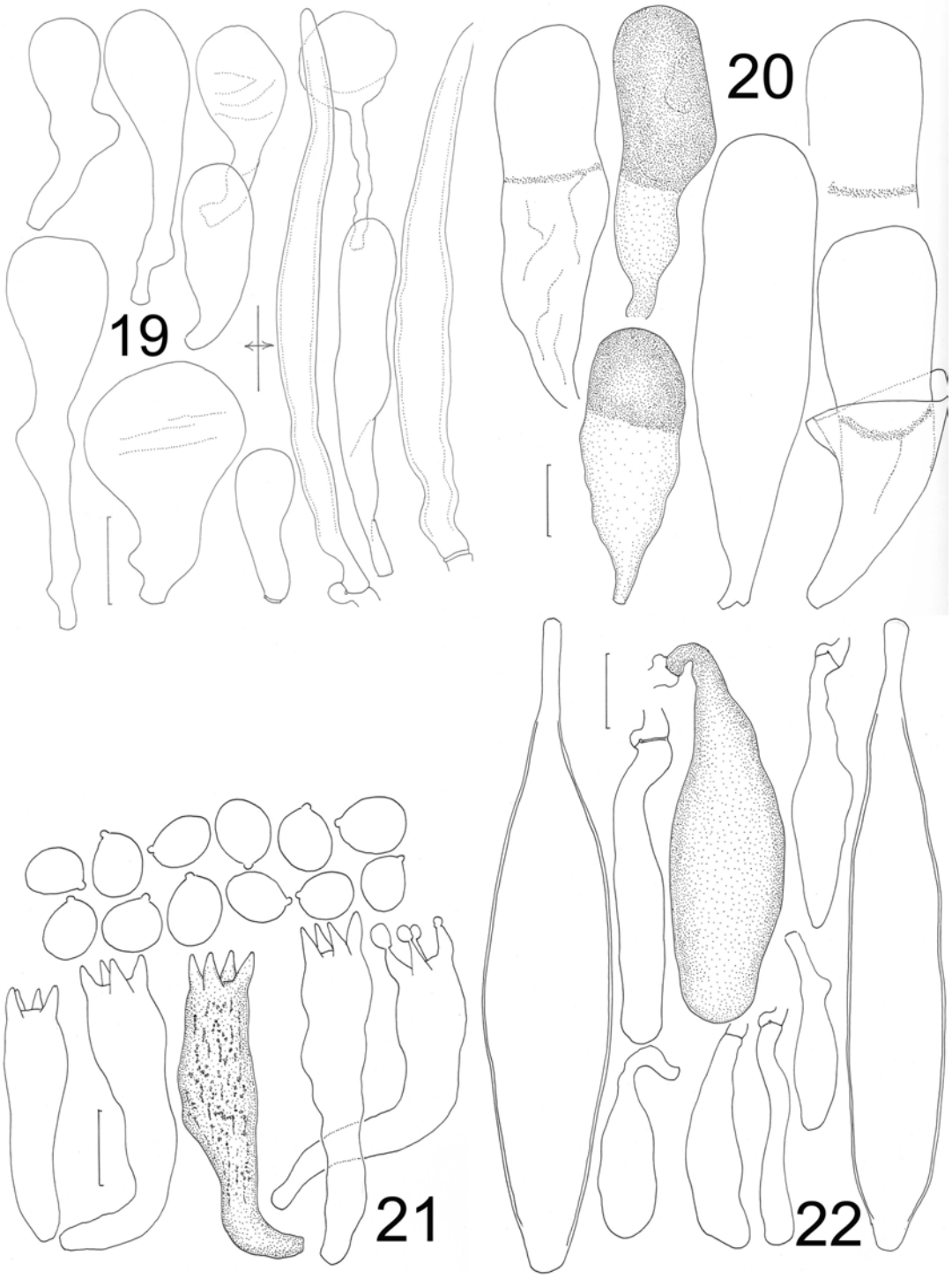
Pileocystidiis 26-40 × 10-38 µm, subsphaeropedunculatis, sine fibulis, crassi-tunicatis; trichomis pilioris 107-136 × 9-13 µm, hyalinis, fibulatis. *Pleurocystidiis* 72-136 × 22-36 µm, utriformis, tenuitunicatis. Basidiis 66-88 × 14-21 µm, clavatis, fibulatis, tetrasporibus. *Basidiosporis* 15-21 × 15-17 µm (E^m = 1.22; L^m = 17.8 µm). *Late* ellipsoidiis. *Cheilocystidiis* 41-156 × 8-40 µm, clavatis ad cylindricis, firme tunicatis. *Caulocystidiis* 76-137 × 12-23 µm, cylindricis ad vermiformis, olivaceo-brunneis, fibulatis.

***Holotype*:** KENYA, Rift Valley Prov., vic. Timboroa, Cengalo, IV.1970, coll. J.K. Dedan, I.A.S. Gibson no. 2172 [K(M) 124280]. On litter under young *Pinus radiata* plantation. [annot. H. Dörfelt, 1982, as *X. radicata*].

Basidiomata (Fig. 18) collybioid, stout, generally dark brown. *Pileus* 44-57 mm broad, abruptly and significantly umbonate, matt, without laccate surface; umbo and narrow radial streaks darker (near "sepia" or "Natal brown") and appearing minutely furry (30x), area surrounding umbo somewhat darker than "sayal brown," becoming neutral nut brown outward to margin; margin smooth to crenate with occasional narrow, radial, blackish ridges, entire, probably incurved when fresh, thin. *Lamellae* white when fresh, now "light ochraceous buff" (i.e. little or no necropigment), thick, close, ventricose (up to 8 mm deep), with short decurrent tooth, in 3-4 tiers, not marginate. *Stipe* 100-150 mm long to ground line, 4-6 mm diam near apex, 8 mm diam near ground line, off-white apically and there closely lined, soon dark brown, hardly longitudinally lined or channeled, tapering gradually upward, swollen somewhat at ground line, distinctly but minutely furfuraceous or scabrous, probably lacerate when fresh, with extensive meandering patches of darker brown caulocystidia; flesh apparently woody, white to ivory color; pseudorhiza 10-13 mm broad, more or less beet- or carrot-shaped (tapering gradually), dark brown with pallid buff thatch over upper 5 mm. Spore print white.

Habitat: Ethiopia: at edge of bamboo zone near top of mountain (3000 ft elev.). In drier area of montane forest, with *Dombeya*, *Schefflera*, *Aningeria*, etc. Kenya: on litter under young *Pinus radiata* plantation.

Pileipellis near disc constructed of a single element. *Pileocystidia* 26-140 × 10-38 µm, pedicellate, clavate to sphaeropedunculate, often with pedicel spur, thin- to firm-walled over bulb, often somewhat thick-walled (wall never more than 0.7 µm thick) over pedicel,



Figs 19-22. *Xerula kenyae*. **19.** Pileipellis elements. Left, from disc; right, from pileus margin. Ash 3448. **20.** Pleurocystidia; **holotype**. **21.** Basidia and basidiospores; holotype. **22.** Cheilocystidia; holotype. Bars= 20 µm.

without clamp connections; contents homogeneous, subhyaline. *Pileipellis near pileus margin* constructed of a single variable element. *Pileocystidia* (Fig. 19) 36-55 × 18-33 µm, of two sorts: a) sphaeropedunculate, thin-walled, obscurely clamped; contents homogeneous, subhyaline; and b) clavate, 47-83 × 12-17 µm, hardly pedicellate, without evidence of

clamp connections; contents homogeneous, subhyaline to distinctly olive-brown; *pileal hairs* occasional, 107-136 × 9-13 µm, hardly inflated, clamped, tapering to narrowly rounded apex, thick-walled (wall never more than 1 µm thick); contents homogeneous to heterogeneous, hyaline. *Pleurocystidia* (Fig. 20) sparsely scattered, not prominent, projecting from hymenium only with hemispherical dome, 72-136 × 22-36 µm, shortly pedicellate, utriform, thinwalled; contents hyaline and homogeneous proximally, deeply yellow refringent apically, and perhaps solidified (note the thin wall as a loose sheath in one example). *Basidia* (Fig. 21) 66-88 × 14-21 µm, clavate with slightly pinched base, clamped, hyaline, 4-spored, usually geniculate, often sclerified in distal 2/3 (and there with refringent wall); contents with scattered granules or sludge but not congested. *Basidiospores* (Fig. 21) (13-)15-21 × (11-)15-17 µm (E = 1.08-1.31(-1.45); E^m = 1.22; L^m = 17.8 µm) broadly ellipsoid, never sublimoniform, hyaline, thin-walled, delicately dimpled, broadly rounded distally, rarely somewhat torulose adaxially; contents multi-guttulate. *Lamellar margin* sterile, a solid palisade of cheilocystidia. *Cheilocystidia* (Fig. 22) 41-186 × 8-40 µm, clavate when small, inflating and elongating to broadly clavate or fusiform, usually thin-walled but thick-walled (wall never more than 1.5 µm thick) over bulb in largest individuals. Stipe surface a scabrous lattice of caulocystidia. *Caulocystidia from stipe apex* (Fig. 23) 76-137(-<300) × 12-23 µm, slightly narrowed proximally, obscurely clamped, cylindrical to vermiform, thick-walled (wall indistinct inward, up to 3 µm thick); contents heterogeneous, more or less hyaline. *Mid-stipe caulocystidia* in stellate sori, 78-137 × 12-19 µm, narrowly fusiform, cylindrical to lanceolate, obscurely clamped, thick-walled (wall up to 3 µm thick); contents homogeneous, distinctly olive-brown. *Tomentum of pseudorhiza* surface composed of slender (2-4 µm diam), hyaline, aseptate, thin- to firm-walled hyphae as individuals or more commonly in ropes or synnemata of up to several hundred individuals.

Commentary: Dörfelt (1984) examined specimens of *Xerula* from Kew herbarium. From them, he segregated one from Tanzania and proposed it as the holotype of *X. radicata* var. *africana* (reported above). Another, from Kenya, he annotated as *X. radicata ss*. Dörfelt. Pegler and Young (1987) considered this Kenyan specimen as one of two cited specimens under *Oudemansiella radicata* var. *africana*. The holotype specimen of *X. radicata* var. *africana* clearly belongs in sect. *Radicatae*, where it was placed by Pegler and Young (1987; see above). The second cited specimen (described above) must be placed in sect. *Albotomentosae* (viz. Clemençon, 1979) based on presence of pileal hairs in the pileipellis. The umbo and dark radial streaks seem roughened, as though furry (viz. pileus surface in *Lentinellus ursinus*) and surface of the pileus appears suede-like or smooth (but not laccate; i.e. no evidence of viscid surface), and is largely composed of clavate to sphaeropedunculate pileicystidia with few pileal hairs.

Further separation from X. *africana* is supported by: 1) 4-spored basidia of *X. kenyae* vs. 2-spored in *X. africana*; 2) spore shape (broadly ellipsoid in *X. kenyae* vs. sublimoniform in *X. africana*) and spore size (18.5-23 × 14-16 µm; L^m = 21.2 µm for holotype of *X. africana*); 3) fusiform-capitulate, thick-walled pleurocystidia of *X. africana* vs. utriform, apically refringent and thin-walled pleurocystidia of *X. kenyae*; 4) decidedly darker brown fruitbody color in *X. kenyae* than that *X. africana*; and 5) pigmented caulocystidia in extensive erumpent sori in *X. kenyae* vs. hyaline, sparsely scattered caulocystidia of *X. africana*. The extent of the caulocystidial distribution in *X. kenyae* gives the stipe a scabrous, lacerated appearance, a character previously reported only for *Oudemansiella endochorda* (Berk. & Broome) Pegler.

Xerula kenyae appears to be part of a morphological complex which includes *X. furfuracea* from eastern North America and *X. chiangmaiae*, a taxon from southeast Asia to Nepal (Petersen and Nagasawa, 2006). In all three species, pileal hairs are not inflated proximally and are of comparable dimensions. Cheilocystidia are unusually well-developed and spores are similar in shape and dimensions. Separating the three taxa are the following: 1) pleurocystidia of *X. furfuracea* and *X. chiangmaiae* distinctly capitate and without the refringent apex characteristic of *X. kenyae* (in

X. furfuracea they are often rotund fusiform-capitulate); 2) mid-stipe caulocystidia in *X. furfuracea* and *X. chiangmaiae* occur in scattered fascicles, while those of *X. kenyae* are so extensive as to give the stipe a scabrous-lacerate appearance; and 3) basidiomatal color (especially pileus) in *X. kenyae* is significantly darker brown (sepia brown) than that in *X. furfuracea* ("clay color," "sayal brown") but comparable to that in *X. chiangmaiae* ("bister" to "Saccardo's umber"). The pileus in *X. chiangmaiae* is sometimes radially streaked just as in *X. kenyae*.

A third specimen [MALAWI, Machemba Hill, 9.II.1980, coll B Morris, BM 98 (K[M] 144259)] conforms to *X. kenyae* in macromorphology (i.e. dark brown pileus, support microscopic examination. It would represent an expanded geographic distribution in sub-Saharan east Africa.

Specimens examined: ETHIOPIA, Kaffa Prov. (Katta of label), Mount Karkarha (Karkarta of label) (Mount Bamboo), c. 10 mi SSE of Mezan Tefari (Mezan Tetari of label), 35°25′ E, 6° 58′ N, 18.II.1976, coll J Ash, Ash 3448 [K(M) 144260]. KENYA, Rift Valley Prov., vic. Timboroa, Cengalo, IV.1970, coll. J.K. Dedan, I.A.S. Gibson no. 2172 [K(M) 124280].

5. *Xerula mammicystis* R.H. Petersen, **sp. nov.** (Figs 24-29)

MycoBank: 511155

Basidiomata collybioidea, gracilis, radicata. *Pileo* 25-30 mm lato, plano-convexo, vix umbonato, sicco, olivaceo-brunneo asolivaceo-nigro; margine crenato. *Lamellis* albis, adnatis, non-marginatis, subventricosis. *Stipite* 85-100 × 1-1.5 mm, apice albo, deorsum brunneo ad atrobrunneo, minuto piloso; pseudorhiza non-expansis, longis.

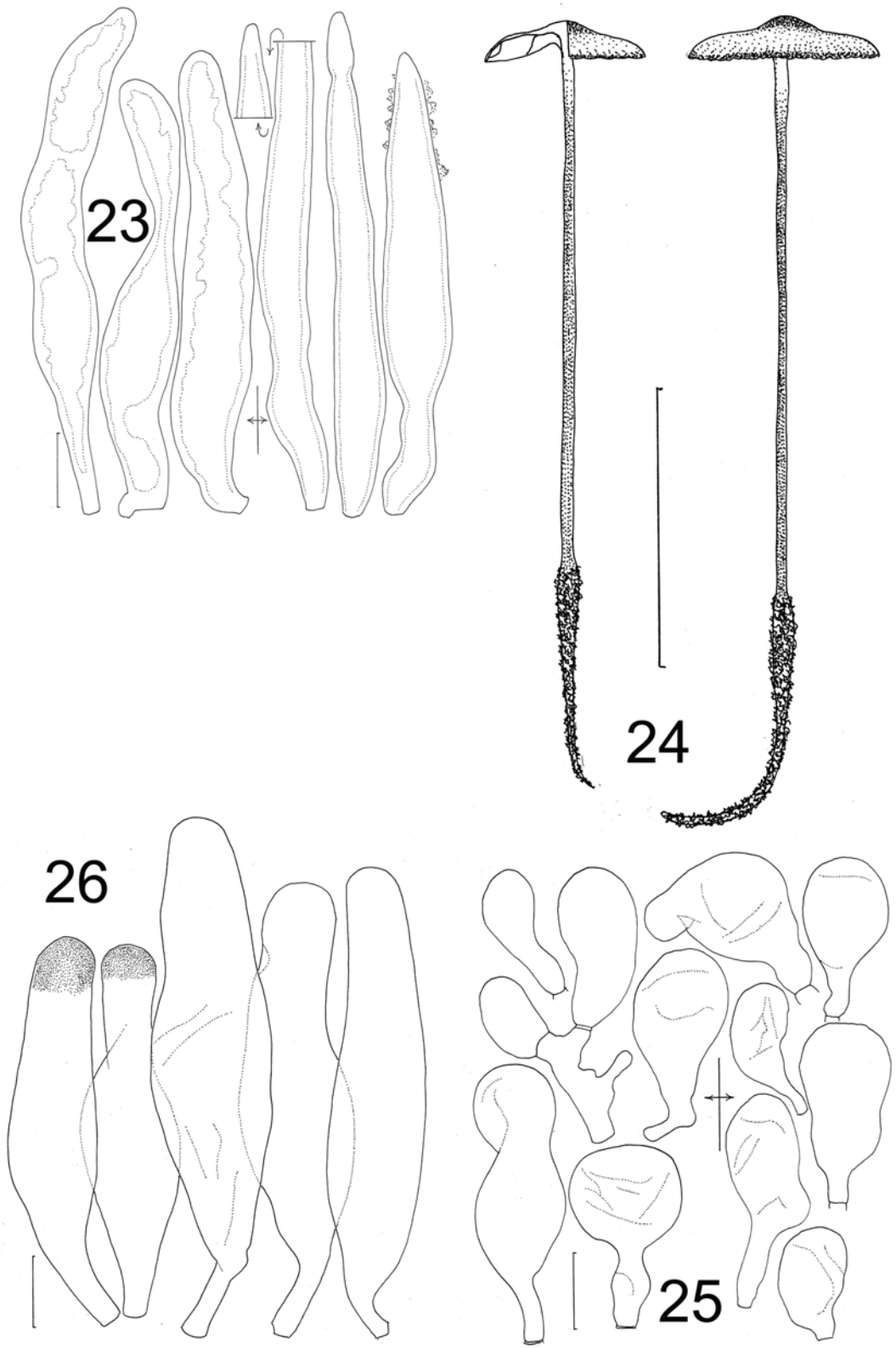
Pileocystidiis 24-82 × 14-30 µm, pedicellatis, subsphaeropedunculatis, sine fibulis, pallide olivaceis. *Pleurocystidiis* 110-150 × 25-34 µm, fusiformis cum apex elongates, fibulatis, hyalinis. *Basidiis* 61-83 × 15-20 µm, clavatis, tetra-sporibus, fibulatis. Basidiosporis 17.5-21 × 11-13 µm (E^m = 1.58; L^m = 19.2 µm), ellipsoidiis ad subamygdaliformis. *Cheilocystidiis* 39-136 × 17-40 µm, pediucellatis, clavatis ad fusiformis, mammilatis, fibulatis, hyalinis. Caulocystidiis 85-178 × 15-19 µm, cylindricis ad clavatis, crassi-tunicatis.

Holotype: NIGERIA, Cross River State, Obudu Ranch, 29.IV.1990, coll RA Nicholson (as *O. radicata* var. *africana*), Nicholson 400 [K(M) 16682].

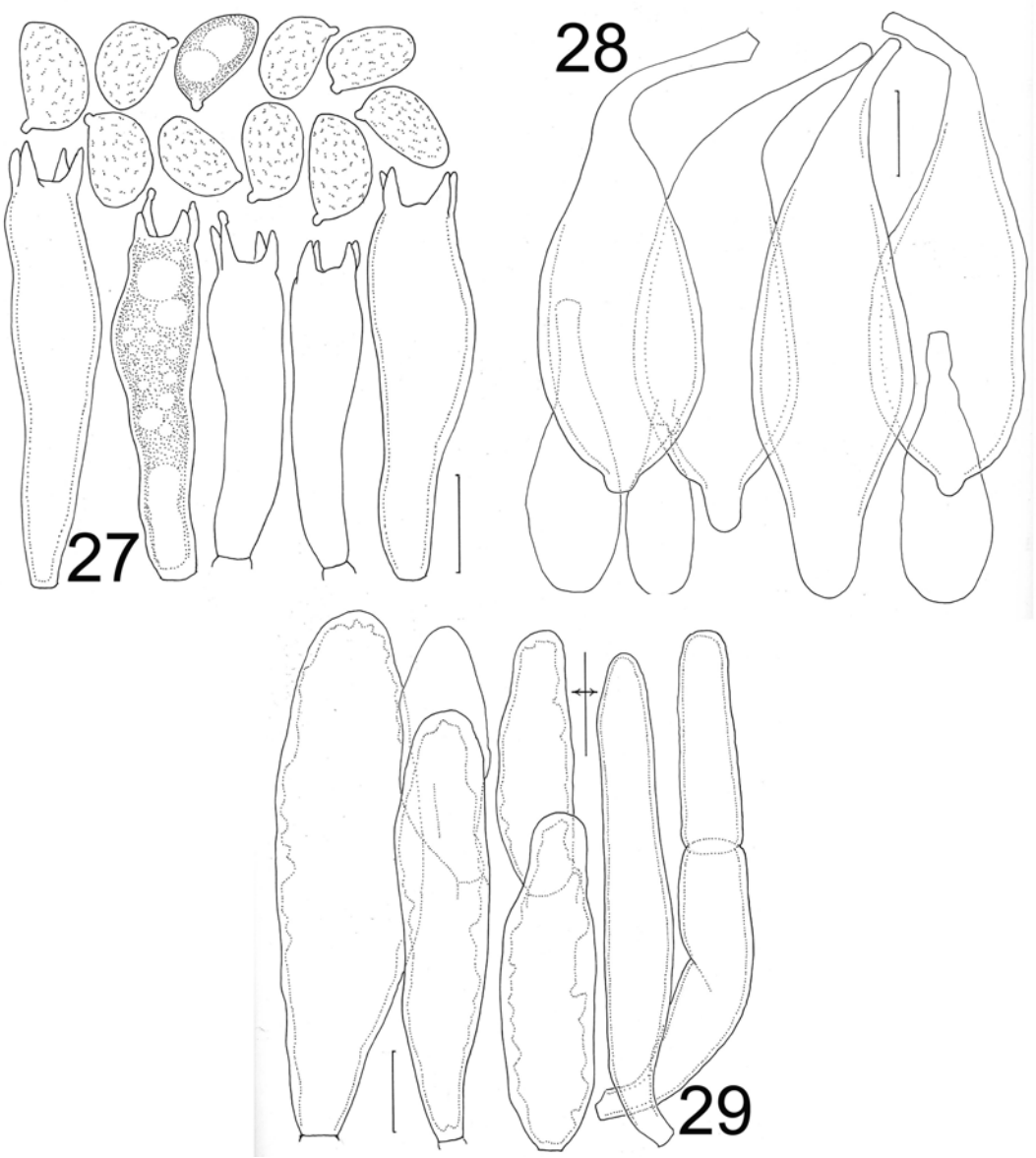
Basidiomata (Fig. 24) gracile, collybioid, rooting. *Pileus* 25-30 mm broad, plano-convex with shallow, broad umbo, smooth to suede-like (dry, with no evidence of viscidity) over umbo, crenate over margin, matt (minutely farinose at 35×), deep olive-brown over disc, deep olive over limb, olive-black over margin; margin downturned. *Lamellae* white when fresh, now "light ochraceous buff," adnate with decurrent tooth, not marginate, subventricose, up to 7 mm deep, in three ranks, minutely frosted with hyaline pleurocystidia (30×). *Stipe* 85-100 mm to ground line, 1-1.5 mm broad through length, flaired slightly apically, white to off-white apically, soon brown to dark brown, hardly lined, apically minutely rough-ened (30×) with white caulocystidia, downward minutely roughened (30×) with brown caulocystidia; *pseudorhiza* without expansion, rooting at least 40 mm, brown with sparse off-white tomentum.

Habitat: unknown; 1600 m elev.

Pileipellis near disc constructed of a single element. *Pileocystidia* (Fig. 25) 24-74 × 14-30 µm, pedicellate or hardly so, sphaeropedun-culate to strangulate, thinwalled, without clamp connection; contents homogeneous, weakly olive. Pileocystidia from pileus margin similar, 33-62 × 14-23 µm, short- to long-pedicellate, sphaeropedunculate to strangulate, thin-walled, without clamp connection; contents homoge-neous, weakly olive. Subpellis hyphae clamped. *Pleurocystidia* (Fig. 26) 110-150 × 25-34 µm, pedicellate, fusiform with extended neck (but not expanded into a capitulum), thin-walled, clamped; contents homogeneous, hyaline, sometimes refringent at apex. *Basidia* (Fig. 27) 61-83 × 15-20 µm, clavate, from wide base, 4-spored, often sclerified, obscurely clamped; contents multiguttulate and refringent at maturity. *Basidiospores* (Fig. 27) 17.5-21 × 11-13 µm (E = 1.42-1.74; E^m = 1.58; L^m = 19.2 µm), ellipsoid, sub-elongate-ovate to slightly amygdaliform, delicately dimpled, appearing thick-walled (but probably not so); contents opalescent when immature, obscurely guttulate at maturity but hardly refringent. *Lamellar trama* composed of two hyphal widths: 1) 13-25 µm broad, restricted at septa, thick-walled (wall up to 1.0 µm thick), hyaline, obscurely clamped; and 2) 3.5-5.5 µm diam, thin-walled, prominently clamped, hyaline. *Lamellar margin* sterile, a solid beard of cheilocystidia, extended significantly in KOH. *Cheilocystidia*



Figs 23-26. *Xerula* species. **23.** *X. kenyae*. Caulocystidia. Left, from stipe apex; right, from stipe midsection. Ash 3448. **24-26,** *Xerula mammicystis*, **holotype**. **24.** Basidiomata (illustrative reconstruction). **25.** Pileocystidia. Left, from pileus disc; right, from pileus margin. 26. Pleurocystidia. Bars: 23, 25, 26 = 20 µm, 24 = 40 mm.



Figs 27-29. *Xerula mammicystis* (**from holotype**). **27.** Basidia and basidiospores. **28.** Cheilocystidia. **29.** Caulocystidia. Left, from stipe apex; right, from stipe midsection. Bars = 20 µm.

(Fig. 28) welldeveloped, of two types: 1) 39-68 × 17-23 µm, pedicellate, broadly clavate, thinwalled, clamped; contents homogeneous, hyaline in small individuals, distinctly pigmented olive-brown in largest; and 2) 122-136 × 38-40 µm, long-pedicellate, clamped, fusiform to broadly fusiform, usually mammilate, thick-walled (wall up to 3 µm thick over bulb); contents homogeneous, hyaline. *Caulocystidia from stipe apex* (Fig. 29) 52-125 × 20-36 µm, not pedicellate, broad at base (5-7.5 µm broad), obscurely clamped, thin-walled but with coagulated protoplasm appearing irregularly thickwalled, hyaline, in discrete sori. *Caulocystidia from stipe midsection* (Fig. 29) arising from heavily pigmented outer stipe surface layer, in indiscrete sori, 85-178 × 15-19 µm, slender proximally, cylindrical to rarely clavate, thick-walled (wall 1-2 µm thick), obscurely clamped; contents homogeneous, distinctly olive-brown.

Commentary: With only two basidiomata of the type specimen to represent the species, little can be reported about infraspecific

variation. Separation from other African taxa includes: 1) large, ellipsoid to subamygdaliform spores; 2) 4-spored basidia; 3) deep olive color of pileus; 4) minutely roughened to farinose texture of pileus; 5) mammilate, well-developed cheilocystidia; and 6) unexpanded pseudorhiza. In spite of pigmented cheilocystidia, lamellae are non-marginate. Caulocystidia from stipe apex are reminiscent of cheilocystidia; well-developed, significantly inflated, hyaline and clamped.

Specimen examined: NIGERIA, Cross River State, Obudu Ranch, 29.IV.1990, coll RA Nicholson (as *O. radicata* var. *africana*), Nicholson 400 [K(M) 16682].

6. *Xerula semiglabripes* R.H. Petersen, **sp. nov**. (Figs 30-35)

MycoBank: 511156

Basidiomata collybioidea, gracilis, radicata. *Pileo* 40-60 mm lato, convexo, vix umbonato, atrobrunneo, extra brunneo, levis; margine levi. *Lamellis* albis, subventricosis, adnatis, non-marginatis. *Stipite* 80-100 × 2 mm, apice pallidis, deorsum brunneis, glabris; pseudorhiza inflata, radicata.

Pileocystidiis 24-42 × 10-26 µm, sphaeropedunculatis, fibulatis, olivaceo-brunneis. Pleurocystidiis 85-141 × 20-38 µm, pedicellatis, fusiformis ad fusiformis-subcapitulatis, hyalinis, tenuitunicatis, fibulatis. Basidiis 46-58 × 13-18 µm, clavatis ad urniformis, tetra-sporis, fibulatis. Basidiosporis 13-17.5 × 10.5-13 µm (E^m = 1.38; L^m = 15.3 µm), ellipsoideis. Cheilocystidiis 33-100 × 10-30 µm, pedicellatis, clavatis ad late fusiformis. Caulocystidiis 31-77× 11-16 µm, clavatis ad cylindricis, hyalinis, firme tunicatis, fibulatis.

Holotype: KENYA, Central Prov., Kiambu Dist., Muguga (EAAFRO), 13.III.1968, coll DN Pegler (K47, as *O. radicata* var. *africana*) [K(M) 129460] [annot. H. Dörfelt, as *X. radicata*].

Basidiome (Fig. 30) collybioid, gracile, rooting. *Pileus* 40-60 mm broad, shallowly convex with low, gradual umbo, dark brown over disc ("Saccardo's umber"), somewhat lighter over limb and margin (darker than "sayal brown"), smooth, not laccate; margin thin, inrolled. *Lamellae* adnate with little evidence of decurrent tooh, white when fresh, after drying light ochraceous buff, not marginate (but in dried specimens margin appearing hygrophanous, cartilaginous and somewhat darker than lamellar face), hardly ventricose, in three ranks. *Stipe* 80-100 mm long to ground line, 2 mm broad in midsection; apex pallid, flaired, minutely silky but not ornamented; mid-stipe brown, glabrous with no sign of caulocystidia (25×); *pseudorhizal swelling* seven mm broad, brown; pseudorhizal extension involved in clay soil, brown, glabrous (not with normal pallid tomentum).

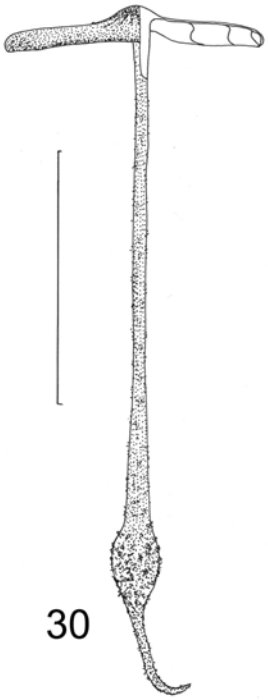
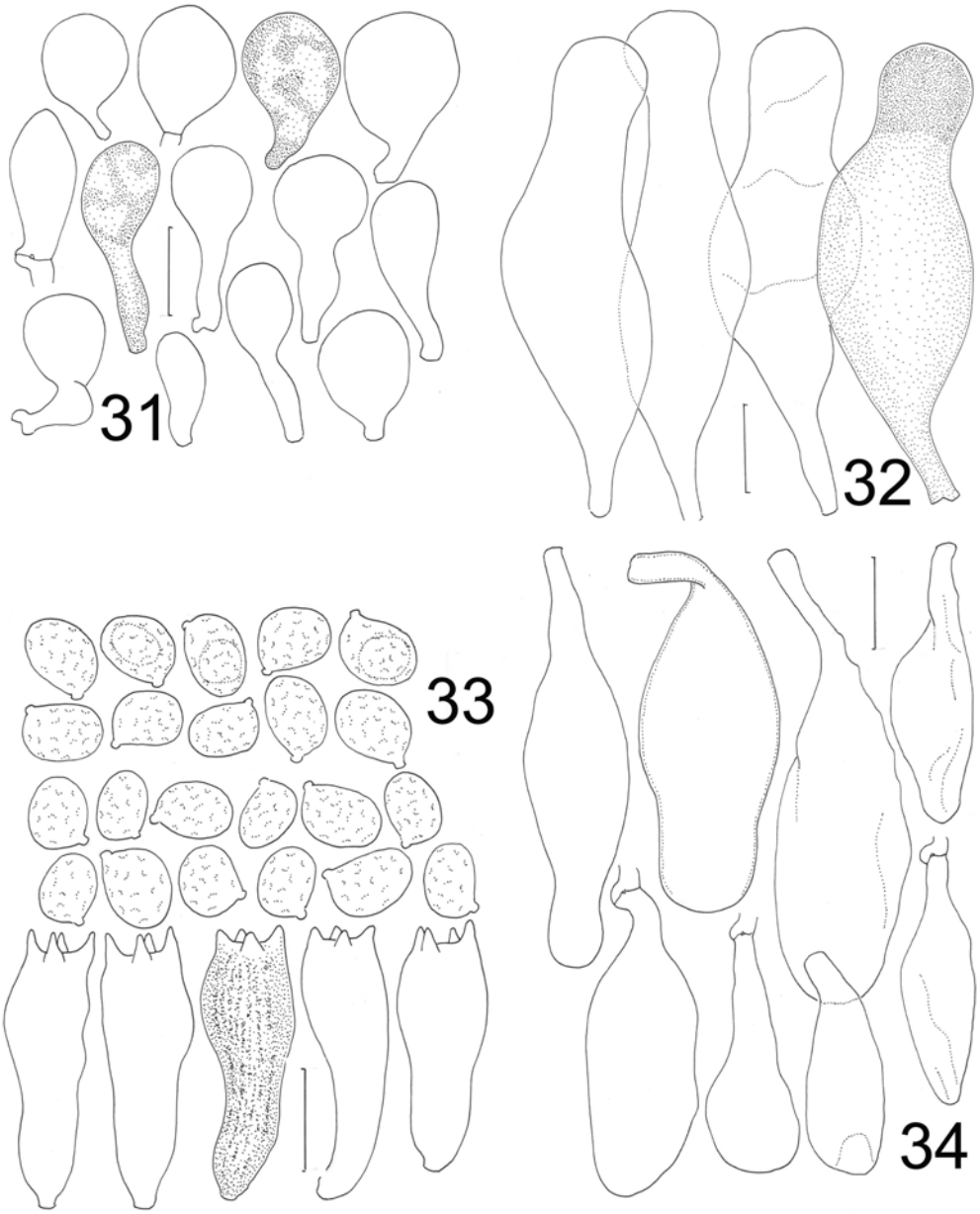


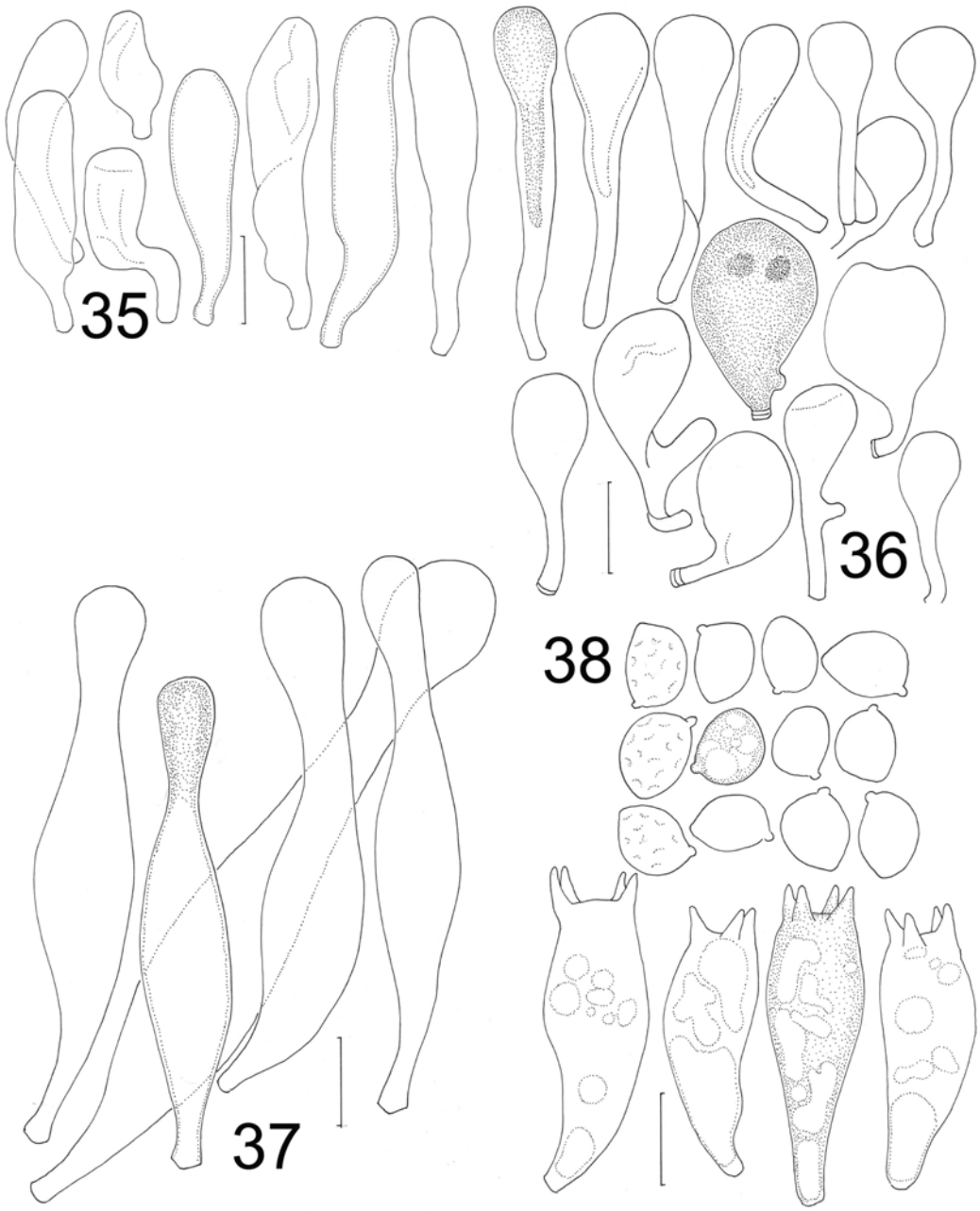
Fig. 30. *Xerula semiglabripes*; (**from holotype**). Basidioma (illustrative reconstruction). Bar = 40 mm.

Pileipellis constructed of a single element. *Pileocystidia* (Fig. 31) from near pileus margin 24-42 × 10-26 µm, pedicellate (usually short), sphaeropedunculate, occasionally clavate, obscurely clamped, thin-walled; contents coagulated olive-tan, homogeneous. *Pleurocystidia* (Fig. 32) 85-141 × 20-38 µm, broadly jar-shaped, fusiform-capitulate to broadly fusiform-capitulate, hyaline, thin-walled, clamped; contents homogeneous, subrefringent in capitulum. *Basidia* (Fig. 33) 46-58 × 13-18 µm, clavate to urniform-clavate from pinched base, 4-spored, obscurely clamped; sterigmata weak and small for this genus; contents axially sludgy. *Basidiospores* (Fig. 33) 13-17.5 × 10.5-13 µm (E = 1.17-1.59; E^m = 1.38; L^m = 15.3 µm), ellipsoid (not sublimoniform), smooth to delicately dimpled, flattened adaxially; contents uniguttulate when mature. *Lamellar margin* sterile, hardly extended in KOH, appearing as though repent (100×), a solid palisade of cheilocystidia. *Cheilocystidia* (Fig. 34) 33-100 × 10-30 µm,



Figs 31-34. *Xerula semiglabripes*. **31.** Pileipellis elements. **Holotype**. **32.** Pleurocystidia. **Holotype**. **33.** Basidia and basidiospores. Basidia and lower basidiospores, Pegler K112. Upper basidiospores, **holotype**. **34.** Cheilocystidia, Pegler K112. Bars = 20 µm.

clavate to broadly fusiform, often with suggestion of capitulum in smaller individuals, thin-walled, hyaline, inconspicuously clamped; contents homogeneous. *Stipe apex* soft, silky, with no evidence of caulocystidia. *Apical caulocystidia* represented by an arachnoid layer of slender (1.5-3 µm diam), thin-walled, hyaline hyphae with rare inflated (-18 µm diam) termini curling outward (semi-erect). Stipe midsection with somewhat more complex arachnoid layer, commonly gathered in sori of caulocystidial termini; *caulocystidia* (Fig. 35) 31-77 × 11-16 µm (usually on the short side), pedicellate with slender base, clavate to subcylindrical, hyaline, firm-walled (wall never more than 0.7 µm thick), inconspicuously clamped; contents homogeneous.



Figs 35-38. *Xerula* species. **35.** *X. semiglabripes*. Mid-stipe caulocystidia. **Holotype**. **36-38.** *Xerula tetrasperma*; (**from holotype**). **36.** Pileocystidia. Upper, from pileus disc; lower, from pileus margin. **37.** Pleurocystidia. **38.** Basidia and basidiospores. Bars = 20 µm.

Commentary: Ellipsoid, not sublimoniform, smooth or delicately dimpled spores dictate a place closer to *X. radicata* than to *X. tetrasperma*. From *X. radicata*, these specimens differ in pleurocystidial shape and well-developed caulocystidia in sori. Caulocystidial sori are at the limit of macroscopic visibility, whence the species epithet.

Of the specimens cited by Pegler (1977), two taxa are involved: *X. tetrasperma* (sublimoniform spores; extended, capitulate pleurocystidia); *X. semiglabripes* (ellipsoid spores, jar-shaped pleurocystidia). None of the specimens represents *X. radicata* (ellipsoid spores, repressed caulocystidia, utriform pleurocystidia). But with at least two different

taxa sheltered under Pegler's (1977) macroscopic description, it is difficult to tease apart that which applies to each taxon.

Specimens examined: KENYA, Central Prov., Kiambu Dist., Muguga (EAAFRO), 13.III.1968, coll DN Pegler (K47, as *O. radicata* var. *africana*) [K(M) 129460] [annot. H. Dörfelt, 1982, as *X. radicata*]; Central Prov., Nairobi Dist., Thika, Thiba River, 16.III.1968, coll DN Pegler (K112, as *O. radicata* var. *africana*) [K(M) 129456] [annot. H. Dörfelt, 1982, as *X. radicata*].

7. *Xerula tetrasperma* R.H. Petersen, **sp. nov.** (Figs 36-40)

MycoBank: 511157

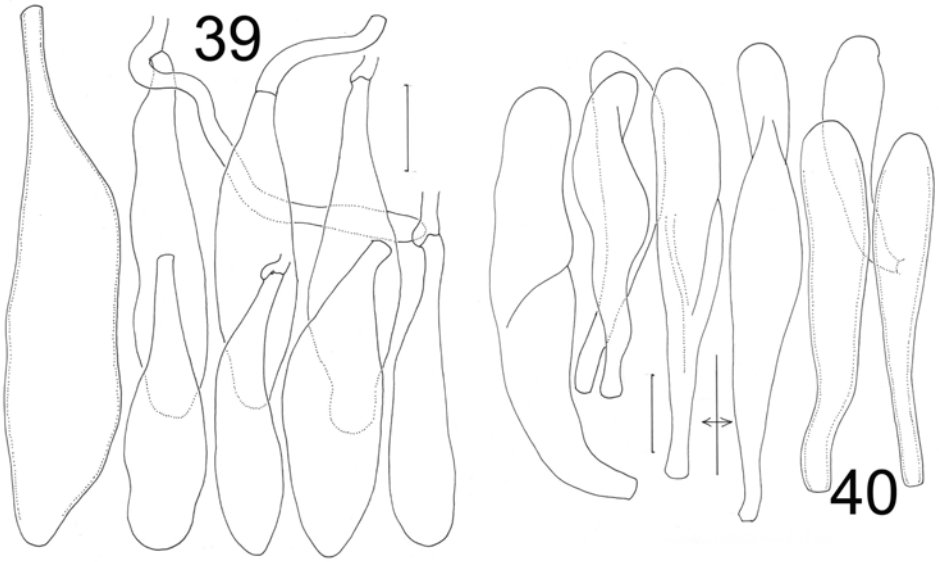
Basidiomata collybioidea, gracilis, radicata. *Pileo* 12-47 mm lato, plano ad conicoumbonato, brunneo (subinde albo), innate radialiter striatulato. *Lamellis* albis, adnatis, subventricosis, non-marginatis. *Stipite* - 140 × 2-5 mm, apice albis, deorsum brunneis, minutulifurfuraceis; pseudorhiza expansis, betiformis, atrobrunneis.

Pileocystidiis 25-80 × 9-27 µm, pedicellatis, clavatis ad sphaeropedunculatis, fibulatis, hyalinis ad olivaceo-brunneis. *Pleurocystidiis* 106-200 × 20-30 µm, pedicellatis, fusiformicapitulatis cum apex extensis, hyalinis, fibulatis. *Basidiis* 52-71 × 14-24 µm, late clavatis, tetrasporis. *Basidiosporis* 15-21 × 10-15 µm (E^m = 1.41; L^m 17.9 µm), ovatis ad sublimoniformis. *Cheilocystidiis* 31-130 × 7-28 µm, pedicellatis, elongato-digitatis, tenuitunicatis, fibulatis. *Caulocystidia* 26-220 × 7-22 µm, digitatis ad late cylindricis, tenui- ad crassitunicatis, fibulatis.

Holotype: TANZANIA, Southern Highlands Region, Iringa District, Mufindi, Lulando village, Lulando Forest Reserve, lower montane forest, Degree Ref. System Square: 08 35 DA, 15.XII.1990, leg. Tiina Saarimäki *et al*, no. 537 (H).

Basidiomata collybioid, gracile, rooting, quite similar to those of *X. kenyae*. *Pileus* 12-47(-80) mm broad, dark neutral brown (in herbarium), occasionally white or off-white, plane with a low, conical umbo, radially wrinkled, with (or without when white) delicate, radiating brown-black ridges or lines extending from umbo outward 3-4 mm, occasionally anastomosing, reappearing near margin and then widely lacy (i.e. anastomosing in large web-like pattern), otherwise smooth with evidence of laccate surface, suede-like; margin thin, sometimes wavy, subtly striate over lamellae, concolorous with pileus limb; flesh white, hygrophanous. *Lamellae* white to off-white when fresh, ochraceous buff after drying (i.e. no appreciable necropigment), adnate with significant decurrent tooth, usually seceding, somewhat ventricose, up to 6 mm deep, subdistant, nine/cm at margin, in three tiers, with a fourth tier merely an obscure raised ridge at the pileus margin; lamellar margin concolorous with lamellar face when fresh, after drying somewhat darker and appearing hygrophanous or occasionally abruptly delicately marginate to dark brown; interlamellar region ribbed, not solid hymenium. *Stipe* up to 140 mm long, 2-5 mm thick, flairing somewhat apically, abruptly swollen at ground line, profoundly hollow, white apically, downward pallid brown, minutely furfuraceous or scabrous with silky sheen; *pseudorhiza* up to 10 mm thick at widest point, beet-shaped, at least 14 mm long, dark brown.

Pileipellis involved in copious slime, constructed of a single element. *Pileocystidia* of umbo (Fig. 36) 25-80 × 9-27 µm, shortly to significantly pedicellate, usually clavate to occasionally sphaeropedunculate, occasionally lobed, firm-walled to appearing thick-walled (wall occluding pedicel lumen, perhaps by coagulation of protoplasm), perhaps obscurely clamped; contents homogeneous, commonly with or without two small amorphous dark bodies (?nuclei), hyaline to obviously pigmented olive tan; septum at pedicel base usually appearing thickened; pileicystidia from pileus margin (Fig. 36) similar, 36-67 × 11-27 µm, pedicellate, sphaeropedunculate (rarely clavate). *Pleurocystidia* (Fig. 37) sparsely to densely scattered, 106- > 200 × 20-30(-49) µm, pedicellate, fusiform-capitate with slender neck (8-13 µm) and minimal to accentuated, subrefringent capitulum (12-23 µm), conspicuously clamped, firm-walled; contents homogeneous, hyaline in bulb, subrefringent in upper neck and capitulum. *Basidia* (Fig. 38) 52-71 × 14-24 µm, broadly clavate with somewhat pinched base, 4-spored, refringent (PhC); contents multigranular when immature, becoming granularguttulate, then developing a large guttule (or 1-3) at base (never grossly multiguttulate), often grossly, axially sludgy. *Basidiospores* (Fig. 38) 15-21 × 10-15 µm (E = (1.15-)1.21-1.54(-1.77); E^m = 1.41; L^m = 17.9 µm) more or less ovate, subtly sublimoniform or even torulose (with a distal, adaxial hump),



Figs 39-40. *Xerula tetrasperma*, (**from holotype**). **39.** Cheilocystidia. **40.** Caulocystidia. Left, from stipe apex; right, from stipe midsection. Bars = 20 µm.

delicately dimpled or pock-marked, refringent (PhC); contents opalescent with non-refringent guttules nearly filling lumen. Spores sometimes somewhat collapsed, with axial lines, which may raise the E^m value somewhat. *Lamellar margin* sterile, significantly extended in KOH, a solid, irregular palisade of cheilocystidia. *Cheilocystidia* (Fig. 39) 31-130 × 7-28 µm, pedicellate, elongate-digitate when young, expanding to clavate and finally fusiform, sometimes subcapitate, thin- to firm-walled (in larger individuals firm-walled over midsection; wall never more than 1 µm thick, diaphanous over apex); conspicuously clamped, hyaline; contents homogeneous. *Stipe apex* minutely powdery (35×) with delicate, usually pyramidal, coherent fascicles of caulocystidia arising from a superficial layer of surface hyphae involved in slime. *Apical caulocystidia* (Fig. 40) 80-180 × 16-32 µm, clavate to fusiform, rarely with suggestion of capitulum, thin- to firm-walled, hyaline, obscurely clamped; contents homogeneous. *Stipe midsection* covered by a superficial layer of pigmented hyphae, from which erupt densely scattered caulocystidia and patches of gnarled to tortuous hyphae involved in mucus, and from which are produced coherent fascicles of well-developed caulocystidia. *Mid-stipe caulocystidia* (Fig. 40) 26->220 × 7-22 µm, digitate to clavate when small, broadly cylindrical with bluntly rounded apex when larger, thin- to thick-walled (wall never more than 1.5 µm thick), conspicuously clamped; contents homogeneous, of smaller, less well-developed individuals pigmented brownish, of larger individuals hyaline.

Commentary: These specimens exhibit the following characters similar to those of *X. africana*: 1) pileocystidia not extended into hairs, and of similar size and shape; 2) similar pleurocystidia which are somewhat unique in the genus; 3) basidia of similar dimensions and contents; 4) sublimoniform (to ellipsoid), dimpled spores. Conversely, the following characters are shared by *X. kenyae*: 1) blackish radial lines over pileus; 2) furfuraceous to scabrous stipe beset with well-developed caulocystidia; and 3) 4-spored basidia. Basidiomata macroscopically more closely resemble those of *X. kenyae*.

Three characters appear to separate *X. tetrasperma* from *X. africana*: 1) 4-spored basidia vs 2-spored; 2) spore dimensions slightly smaller; 3) radiating black streaks on pileus; and 4) scabrous stipe surface. The latter character is ameliorated by well-developed caulocystidia in *X. africana*, but not in discernable, discrete fascicles. All in all, *X tetrasperma* appears to be a four-spored form of *X. africana*.

Basidiospores are not only sublimoniform but dimpled as well, quite like those of *X. megalospora* from eastern North America. From SEM images of basidiospores of *X. megalospora* and other species of *Xerula*, this dimpling seems common to the outer wall of spores in this generic complex (Petersen, 2007).

The Goossens specimen was accompanied by a copy of outline drawings of two small fruitbodies. The two basidiomata of the Allard specimen are in poor condition, covered with mold. The characters observed, however, seem to indicate the four-spored version of *X. africana*.

In K(M)144257, two basidiomata are included in a single packet, both collected in the same place on the same date. Similar in stature and size, one was noted as white, the other having no information in this regard and assumed to have exhibited a brown pileus (as it is now). Such "albino" forms are relatively common in some species (i.e. *X. megalospora* from eastern North America, *X. radicata* from Scandinavia, *X. orientalis* var. *margaritella* from Japan). Another specimen (cited under *X. crassibasidiata*) was also collected with identical data, attesting to the variation to be expected even in a single day's gatherings.

Specimens examined: DEMOCRATIC REPUBLIC OF CONGO, Djongo-Akuba, XII.1925, coll Mme Goossens-Fontana, Goossens no. 508, no. 32228,24 (BR); Vicariat apostolique du Kwano, Région des Bambata, II.1910, coll RP Allard, leg Hyaç. Vanderyst (as *Collybia radicata*), s.n. (BR 032227, 23). KENYA, Central Prov., Nairobi Dist., Nairobi, City Park, 10.III.1968, coll DN Pegler (K1; as *O. radicata* var. *africana*), [K(M) 129458]; same location, 12.III.1968, coll DN Pegler (K18, as *O. radicata* var. *africana*), [K(M) 129459]; same location, coll DN Pegler (K 371; as *O. radicata* var. *africana*), [K(M) 129457]; same location, 2.IV.1968, coll DN Pegler (K 372; as *O. radicata* var. *africana*), [K(M) 129455]; Nairobi, IV.1986, coll R Gatumbi & W Karia (as *O. radicata* var. *africana*), NAL 3854 [K(M) 144261]. MALAWI, Nyika Nat. Park, surroundings of Chelinda Lodge, 4.XII.1981,leg J Rameloo, no. 7658 (BR; SEM images 24044-24049); Zomba Mt., 27.XII.1981, coll B Morris, BM 477B [K(M) 144257]. SOUTH AFRICA, Natal Prov., Zululand, vic Sibayi, 29.III.1965, coll J Vahlmeyer (as *Oudemansiella radicata*), Vahlmeyer 726 (PREM 43114); Cape Prov., Somerset East, Boschberg Mts., 1845, coll P MacOwan (as *Collybia radicata*), MacOwan 1245 (PREM 22041). TANZANIA, Southern Highlands Region, Iringa District, Mufindi, Lulando village, Lulando Forest Reserve, lower montane forest, alt. c. 2000 m, Degree Ref. System Square: 08 35 DA, 15.XII.1990, leg. T. Saarimäki *et al*., no. 537(H; holotype). ZAMBIA, Chowo Forest, 14.XII.1981, leg J Rameloo, no 7899 (BR 032235,31); Manyanjare Forest, 15.XII.1981, leg J. Rameloo, no. 7903 (BR 032236,32).

7A. *Xerula tetrasperma* forma *marginata* R.H. Petersen, **f. nov.**
MycoBank: 511158

Basidiomata ad *X. tetrasperma*, vel lamellis marginatis; margine atrobrunneis. *Basidiosporis* 15.5-21 × 11-16 µm (E^m = 1.42; L^m = 18.8 µm).

Holotype: ZAMBIA, Chowo Forest, 7.XII.1981, leg J Rameloo, no. 7715 (BR 032232,28).

Basidiomata unusually large for this species, collybioid, rooting**.** *Pileus* 90 mm diam, shallowly convex with low umbo, dark brown, smooth, not laccate. *Lamellae* adnate, ventricose, white when fresh becoming ochraceous buff after drying, in three ranks; margin delicately, abruptly brown-black. *Stipe* 200 mm to ground line, off-white, minutely silky and flairing apically, downward sooty grayish tan, appearing smooth. Spore print off-white (2A2).

Pileipellis over pileus margin constructed of a single element; *pileocystidia* 26-55 × 8-27 µm, pedicellate (usually shortly so), clavate to sphaeropedunculate, thinwalled, conspicuously clamped; contents hyaline and homogeneous in clavate individuals, blotchy deep olive-brown in sphaeropedunculate individuals. *Pleurocystidia* occasional, prominent, 111-184 × 22-30 µm, lecythiform to matchstick-shaped with somewhat inflated proximal portion, hyaline, thin-walled, conspicuously clamped; contents homogeneous below, dull subrefringent over neck, subrefringent in capitulum. *Basidia* 52-72 × 14-22 µm, clavate from pinched base, four-spored, refringent; contents multiguttulate when immature, coalescing into several large guttules filling the basidium by maturity. *Basidiospores* 15.5-21 × 11-16 µm (E = 1.27-1.58; E^m = 1.42; L^m = 18.8 µm), ovate to sublimoniform, delicately dimpled, hyaline, refringent: contents opalescent. *Lamellar margin* sterile, greatly extending in KOH, a solid palisade of cheilocystidia. *Cheilocystidia* 36-100 × 9-20 µm, clavate to (occasionally) broadly fusiform, thin-walled (except rarely in

small subapical areas of firm wall), conspicuously clamped; contents homogeneous, hyaline proximally, pallid olive-tan near apex (individuals). *Apical and mid-stipe caulocystidia* typical. Sori over stipe apex widely scattered, merely pin-points. Sori over mid-stipe scattered, rarely pyramidal, usually repent, hardly visible (35×).

Commentary: Although spores are slightly larger than typical, all other microscopic characters agree with *X. tetrasperma*. Two macroscopic characters are atypical, however: 1) large size of basidiome; and 2) abruptly marginate lamellae. Although cheilocystidia are intracellularly pigmented, they are otherwise uninteresting. The marginate form of *X. radicata* seems also to form somewhat larger spores than the typical form.

Specimen examined: ZAMBIA, Chowo Forest, 7.XII.1981, leg J Rameloo, no. 7715 (BR 032232,28).

Discussion

A taxo-nomenclatural problem occurs over the correct rank of *Xerula africana* and *X. alveolata*. Redhead *et al* (1987) described *X. radicata* var. *bispora* based on an exsiccate specimen from Sweden. In that specimen, basidia were two-spored and hyphae (i.e. lamellar trama, subhymenium) were without clamp connections. Later, Petersen and Methven (1994) showed that the two-spored version of *X. radicata* was asexual. The unclamped hyphae were uninucleate and basidia did not undergo meiosis. Furthermore, single-basidiospore isolates from two-spored basidiomata did not yield a patterned self-cross (i.e. only a single mating type was found). Thus, technically, although all features of normal basidiomata were present, these two-spored basidiomata were essentially haploid clones.

The ICBN accepts as its premise the application of the Linnaean system of nomenclature, which is based exclusively on sexual reproductive structures. As a result, asexual stages have been segregated into a separate nomenclatural system based on "form-taxa" (i.e. form-species, form-genus, etc.). Under this dogma, the two-spored form of *X. radicata* should have been described as a "form-variety." This understandable error (Redhead *et al*., 1987, did not know of the asexual nature of their "form *bispora*") has gone uncorrected, and will not be so here.

This opens the question of the rank of *X. africana* and *X. alveolata*, both also two-spored. In both taxa, all examined tissues appear to be without clamp connections. Thus, it could be strongly suspected that these basidiomata are asexual, and since both taxa are known only from dried specimens, more data await analyses of fresh collections with nuclear stains. For now, the taxa are proposed at species rank, with the understanding that future research may change the situation.

All species described here are characterized by relatively large spores, as opposed to the several species from Europe, the Orient and North America with smaller, sometimes subglobose spores. Whether consistently large spores presents an evolutionary trend remains unknown, but the phenomenon was noted first by Dörfelt (1984). Likewise, the commonplace occurrence of dark radial streaks and/or ridges on an otherwise monotonous brown pileus seems to occur chiefly in Africa and Asia.

Pegler and Young (1987) produced scanning electron micrographs of *Xerula* spores (as *Oudemansiella*) and showed that although the spore surface appeared smooth under light microscopy, spore walls were variously sculptured at higher magnification.

Petersen and Hughes (2004) and Petersen (2007) showed that the sculptured wall was beneath the outer, smoother wall. Redhead *et al*. (1987) described the spores of *X. megalospora* as "finely roughened," a feature best seen under phase contrast microscopy just above the median plane of the spore. As experience with *Xerula* spores grows, however, this fine "dimpling" can be discerned on numerous spores, as described above. Whether an inner wall of any or all of these spores would be found significantly sculptured remains to be seen, although the report by Petersen (2007) would indicate so.

Appendix

Two specific epithets proposed by De Seynes (1897) must qualify as belonging to *Xerula*, but no type specimens (or other material) remain, and the protologue is

insufficient to link the names to taxa heretofore known or proposed here. No described species of *Xerula* from Africa produces spores as small as 7 × 4 µm. The names await neotypification. A third De Seynes species has been discussed as a possible *Xerula* and thus warrants some explanation. These species follow:

Xerula oronga **(**De Seynes) R.H. Petersen, **comb. nov.**

Basionym: *Collybia oronga* De Seynes, 1897. Recherches pour server à l'histoire naturelle et à la flore des champignons de Congo Français. Paris. pp. 4-5, pl II Figs. 1-12.

Pileus 70-80 mm broad, plano-depressed with proiminent acute umbo, umbrinous gray-isabelline (illustration shows reddish brown); margin down-turned, undulate, perhaps striatulate. *Lamellae* broad, thick, subdistant, adnexed to almost free with small decurrent tooth, rounded forward and back, gray-white; lamellar margin eroded or serrate. *Stipe* 90-100 mm long, elongated, straight upwards, strongly lined, perceptibly attenuate, subfibrillose, stuffed, pallid umber with whitish base; pseudorhiza hardly inflated, very short.

Pilepellis including subsphaeropedunculate pileicystidia. *Pleurocystidia* ten pin-shaped ("*subsporiferes*" of Fayod). *Basidia* ovoid with attenuate base, with short sterigmata, ?2-spored. *Basidiospores* 7 × 4 µm, hyaline, smooth, ovoid. Lamellar trama perhaps sarcodimitic, including inflated, barrel-shaped cells and slender, equal hyphae. *Cheilocystidia* prominent, broadly ellipsoid to subspherical, resembling pileicystidia.

Edible, on soil, Talagouga, February, Marc*h*.

Commentary: It is impossible to determine several characters diagnostic in the key above. For example, while pileicystidia are illustrated by De Seynes (Pl. II, Fig. 8), the presence of pileal hairs cannot be determined. Of three basidia illustrated, two are clearly 2-sterigmate, while the third basidium appears to exhibit a small, bent-over third sterigma. Although perhaps insignificant, no illustrated hyphae show clamp connections.

Xerula anombe (De Seynes) R.H. Petersen, **comb. nov.**

Basionym: *Collybia anombe* De Seynes, 1897. Recherches pour server à l'histoire naturelle et à la flore des champignons de Congo Français. Paris. p. 5, Pl. II. Figs. 13-17.

Pileus 20-30 mm broad, umbonate-subdepressed with prominent acute center, mouse-gray to umber, fleshy membranous; margin clearly striate. *Lamellae* wide, thick, subdistant, adnate, rounded forward and back, with crenate margin, in three ranks, white becoming sordid. *Stipe* 25-65 mm long, straight or with curved base, gray becoming white, stuffed.

Hymenium and *spores* as in *C. oronga*.

Edible, on soil, Talagouga, February, March.

Commentary: According to De Seynes (1897; 5-6, introduction) these two species have a good fresh odor of mushrooms; are edible and are much appreciated by the indigenous people.

De Seynes (transl.): "The general form of the basidiome of *C. oronga* bears some resemblance to that of *C. radicata* Relh., but the consistency and disposition of lamellae resemble *C. butyracea* Bull, but most of the other characters remove these two species from their place in sect. *Levipedes* Fr.

"In a section of lamellae one encounters almost isodiametric epidermal 'hyphocysts' [pileicystidia]. Distributed between the hymenial elements which extend very little are pleurocystidia of a particular form figured under *Naucoria melinoides* Bull. (*Flore Mycol. de Montpellier*, etc., pl. III, fig. 12). It is the type which M. Fayod called subsporiferal cystidia, a constriction separating the summit of the elongated cystidia from a spherical 'spore form.' The cheilocystidia ('hyphocysts') of lamellar margin are large and are similar in form and dimension to the cells of the exterior covering of the pileus with which they merge at the pileus margin."

Clitocybe verruculosa De Seynes, 1897. Recherches pour server à l'histoire naturelle et à la flore des champignons de Congo Français. Paris. Pp. 7-8, Pl. III. Figs. 8-10.

Commentary: Singer (1953) described *Xerula verruculosa* Singer for an organism collected in semitropical Argentina. He compared it to De Seynes' fungus, which he opined might be the same. Both organisms were further compared to *Xerula chrysopepla* (Berk. & M.A. Curtis) Singer [= *Cyptotrama asprata* (Berk.) Redhead & Ginns; ≡ *Xerula asprata* (Berk.) Aberdeen]. De Seynes' description, illustrations of a small basidioma with bright red, ornamented pileus, large pleurocystidia and polycystoderm warts on the pileipellis all point in this direction, but until authentic or topotype material can be examined, a transfer of *C. verruculosa* to *Cyptotrama* is insecure.

Agaricus radicatus var. ***brachypus*****,** Kalchbr., Grevillea 10: 52 (1881).

≡ *Collybia radicata* var. *brachypus* (Kalchbr.) Sacc., 1887. Syll. Fung. 5: 201. (as "*brachypoda*").

Holotype**:** SOUTH AFRICA, Cape District, Somerset East, no. 1424.

Pileus gibbous, brown. *Stipe* striate, usually gracile; base swollen and with short, acute pseudorhiza. Terrestrial. Between *Ag. radicatus* and *Agaricus* (*Collybia*) *butyraceus*. Ambiguous.

Commentary: Although cited by Doidge (1950), no specimen is known to have survived. Reid (1975) could not find a specimen at BPI, B, K, PC, S, SAM or UPS. A specimen at PREM has a handwritten annotation "1245 type," but there is no evidence of misnumbering and the handwriting is not reliably that of MacOwan or Kalchbrenner. Strangely, however, Reid's search did not include PREM. With a dearth of material from South Africa, no correlation can presently be made for this variety to a modern specimen, but the search for a neotype should continue.

It is coincidental that De Seynes (1895) should have picked out the same two taxa (*Ag. radicatus* and *Collybia butyracea*) for comparison of his *Collybia anombe*.

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