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Wood-inhabiting fungi in southern China 1. Polypores from Hunan Province

Yu-Cheng Dai[1], Marja Härkönen[2] & Tuomo Niemelä[2]

[1)] *Institute of Applied Ecology, Chinese Academy of Sciences, Wenhua Road 72, Shenyang 110016, China*
[2)] *Finnish Museum of Natural History, Botanical Museum, P.O. Box 7, FIN-00014 University of Helsinki, Finland*

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Polypores (Basidiomycota) from Hunan Province, south-central China, were investigated during 1999–2002. Based on nearly 600 collections, 102 poroid species were identified from the study area; some species identifications are given as tentative. Sixty-two species are new to Hunan, including ten species new to China. In addition, three new species, *Cyclomyces lamellatus* Y.C. Dai & Niemelä, *Phellinus collinus* Y.C. Dai & Niemelä and *Polyporus pumilus* Y.C. Dai & Niemelä are described and illustrated. The first one differs from the other species in the genus *Cyclomyces* by having imbricate basidiocarps, radially lamellate hymenophore and prominent setae. *Phellinus collinus* is characterized by a perennial habit, shining pore surface, very thin context, and the lack of setae; it has oblong-ellipsoid, golden yellow and often collapsed basidiospores. *Polyporus pumilus* is very characteristic in the genus because it has extremely small, pendent basidiocarps; its pores are smaller than in general in *Polyporus*. Distribution patterns of the species are discussed, in particular the occurrence of northern (temperate/boreal) and southern (subtropical/tropical) elements in the area.

Key words: Aphyllophorales, Basidiomycota, China, polypores, taxonomy

Introduction

Wood-inhabiting fungi are an important element of forest ecosystems, as they take care of the decomposition of coarse woody debris: fallen trunks, branches and stumps. Polypores are the major group of wood-rotting Basidiomycota; no wonder that the species of this group have been intensively studied and systematically documented in, e.g., Europe and North America (Gilbertson & Ryvarden 1986–1987, Ryvarden & Gilbertson 1993, 1994). From temperate and boreal East Asia, some mycological books including polypores have been published (Ito 1955, Teng 1963, Imazeki & Hongo 1965, Lyubarskiy & Vasilyeva 1975, Imazeki *et al*. 1988, Zhao 1989, Li 1991, Zhao & Zhang 1992); besides, further polypore species were recorded from the area in several more concise reports (Ryvarden 1977, Hjortstam & Ryvarden 1982, Hattori & Zang 1995, Núñez & Ryvarden 1999, Dai 2000, Núñez *et al*. 2001, Hattori *et al*. 2002).

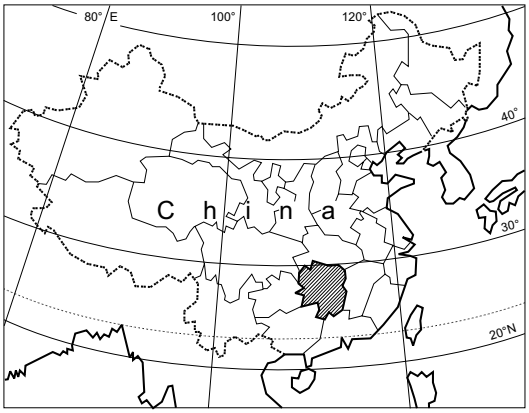

Fig. 1. The situation of China in SE Asia and its division into provinces; Hunan Province shaded.

Fig. 2. Hunan Province, main watercourses, and research areas (black squares).

Recently three comprehensive monographs on polypores from East Asia were published (Dai 1999, Núñez & Ryvarden 2000, 2001). A few floras on or including polypores in subtropical and tropical Pacific Asia have been published by Corner (1983–1991), Parmasto (1986), Quanten (1997) and Chang (2001), and the species described by Corner from tropical Asia and West Pacific archipelago were treated in detail by Hattori (2000, 2001a, 2001b, 2002). In addition, Hattori and Ryvarden (1996), Suhirman and Núñez (1998), Hattori and Lee (1999), and Dai and Zhou (2000) recently reported still more species from subtropical or tropical Asia.

This is the first paper in a planned series dealing with wood-inhabiting fungi of southern China. Most of these fungi are poroid members of the Aphyllophorales, but some other groups, e.g., corticiaceous fungi, are included more briefly.

Hunan Province lies in south-central China, and spans an area of 211 829 km^2 between 24°39´–30°08´N and 108°47´–114°15´E. Original vegetation of the province is mostly evergreen broad-leaved forest, with altitudinal limit at 1200–1400 m in the south and at 500–800 m in the north. The dominant components of the forests are species of the Fagaceae, Lauraceae, Magnoliaceae, and Theaceae; the commonest gymnosperm tree is *Pinus massoniana*, while in plantations other coniferous trees are common: *Cryptomeria fortunei*, *Cunninghamia lanceolata* and *Metasequoia glyptostroboides*. Detailed descriptions of the geography and vegetation of Hunan Province have been published by Högmander and Jie (2000) and Ukkola *et al*. (2001).

Studies on poroid wood-inhabiting fungi in Hunan were started by Teng (1936). Altogether 86 species of polypores have been recorded from the province according to Zeng (2001) prior to our study. In the present paper we just list the species identified so far from our own collections, but previously reported species, when the voucher specimens were not examined, are excluded. Some of our collections are still under investigation, and forthcoming papers will deal with them.

Materials and methods

A research programme on the cryptogams of Hunan, carried out jointly with Chinese and Finnish biologists, has been going on since 1997 (Härkönen 2000). The author MH took part in the collecting trips in 1999–2001 as a mycologist. For the studies on wood-rotting fungi, YCD made two more field trips to the same area in 2000 and 2002.

The materials were collected from seven forest reserves and national parks (*see* the localities in Figs. 1 and 2) in Hunan in 1999–

2002, and about 600 specimens were collected. The studied materials are deposited at the Botanical Museum of the University of Helsinki (H) and at the Herbarium of the Institute of Applied Ecology, Chinese Academy of Sciences (IFP); duplicates will be preserved at the Herbarium of the Hunan Forest Botanical Garden.

The microscopic methods used in the study are as presented by Dai (1999). In the text the following abbreviations are used: L = mean spore length (arithmetical mean of all spores), W = mean spore width (arithmetical mean of all spores), Q = variation in the L/W ratios between the specimens studied (quotient of the mean spore length and the mean spore width), n = the number of spores (or other structures) measured from a given number of specimens. In presenting the variation in the size of spores, pores, hyphae, setae and basidia, 5% of the measurements were excluded from each end of the range, and are given in parentheses; IKI stands for Melzer's reagent, KOH for 5% potassium hydroxide, and CB is the abbreviation of Cotton Blue. CB+ means cyanophilous and CB– acyanophilous; IKI– means both inamyloid and indextrinoid.

An alphabetical list is given of polypores found by us; the authors of scientific names are abbreviated mostly according to Brummitt and Powell (1992). The concept of polypores is circumscribed here in a wide sense, including the Polyporaceae, Ganodermataceae, and poroid species in the Hymenochaetaceae and the corticiaceous fungi.

Results

Checklist

Species printed in boldface are new to Hunan Province; the names marked with an asterisk (*) are new to China; those with an octothorp (#) are new to science. In the list the abbreviation "aff." means a taxon closely related to the given species; "cf." means probably the given species, although some differences were observed; "*s. lato*" refers to a taxon whose characters are rather variable, pointing to a species complex. In some cases the latter has been proved with molecular studies or pairing tests.

Abortiporus cf. *biennis* (Bull.) Singer
Antrodia* aff. *carbonica (Overh.) Ryvarden & Gilb. — *see* below
Antrodia malicola (Berk. & M.A. Curtis) Donk
Antrodiella aurantilaeta (Corner) T. Hattori & Ryvarden
****Antrodiella* cf. *incrustans*** (Berk. & M.A. Curtis) Ryvarden
Antrodiella romellii (Donk) Niemelä *s. lato*
Antrodiella semisupina (Berk. & M.A. Curtis) Ryvarden *s. lato*
Antrodiella zonata (Berk.) Ryvarden
Bjerkandera adusta (Willd. : Fr.) P. Karst.
Bondarzewia berkeleyi (Fr.) Bondartsev & Singer
****Ceriporia* aff. *mellita*** (Bourdot) Bondartsev & Singer — *see* below
****Ceriporiopsis* cf. *umbrinescens*** (Murrill) Ryvarden — *see* below
Coltricia cf. *cinnamomea* (Jack.) Murrill
#Cyclomyces lamellatus Y.C. Dai & Niemelä — *see* below
Cyclomyces xeranticus (Berk.) Y.C. Dai & Niemelä
Daedaleopsis confragosa (Bolton : Fr.) J. Schröt.
Daedaleopsis tricolor (Bull.) Bondartsev & Singer
Datronia mollis (Sommerf.) Donk
Datronia stereoides (Fr. : Fr.) Ryvarden
Earliella scabrosa (Pers.) Gilb. & Ryvarden
****Favolaschia nipponica*** Kobayasi
****Fibroporia* cf. *radiculosa*** (Peck) Parmasto — *see* below
Fomes fomentarius (L. : Fr.) Fr.
Fomitiporia punctata (P. Karst.) Murrill
Fomitiporia robusta (P. Karst.) Fiasson & Niemelä
Fomitopsis feei (Fr.) Kreisel
Fomitopsis pinicola (Sw. : Fr.) P. Karst.
Fomitopsis spraguei (Berk. & M.A. Curtis) Gilb. & Ryvarden
Funalia cervina (Schwein. : Fr.) Y.C. Dai
Ganoderma australe (Fr.) Pat.
Ganoderma lipsiense (Batsch) G.F. Atk.
Ganoderma lucidum (W. Curtis : Fr.) P. Karst.
Ganoderma* cf. *microsporum R.S. Hseu
Ganoderma* cf. *nigrolucidum (Lloyd) D.A. Reid
Ganoderma* cf. *shandongense J.D. Zhao & L.W. Hsu
Gloeophyllum sepiarium (Wulfen : Fr.) P. Karst.

Gloeophyllum* cf. *subferrugineum (Berk.) Bondartsev & Singer
Gloeophyllum trabeum (Pers. : Fr.) Murrill
Heterobasidion insulare (Murrill) Ryvarden *s. lato* — *see* below
Inonotus cuticularis (Bull. : Fr.) P. Karst.
Irpex lacteus (Fr. : Fr.) Fr. *s. lato*
Junghuhnia nitida (Pers. : Fr.) Ryvarden
Laetiporus sulphureus (Bull. : Fr.) Murrill *s. lato*
Lenzites betulinus (L. : Fr.) Fr.
Megasporoporia major (G.Y. Zheng & Z.S. Bi) Y.C. Dai
Microporellus obovatus (Jungh.) Ryvarden
Microporus affinis (Blume & Nees) O. Kuntze
Microporus vernicipes (Berk.) O. Kuntze
Microporus xanthopus (Fr.) Pat.
Nigroporus vinosus (Berk.) Murrill
Oxyporus cuneatus (Murrill) Aoshima
Oxyporus obducens (Pers. : Fr.) Donk
Oxyporus populinus (Schumach. : Fr.) Donk
****Perenniporia* cf. *corticola*** (Corner) C. Decock
Perenniporia formosana T.T. Chang
Perenniporia narymica (Pilát) Pouzar
Perenniporia ochroleuca (Berk.) Ryvarden
Phellinus baumii Pilát *s. lato*
#Phellinus collinus Y.C. Dai & Niemelä — *see* below
Phellinus contiguus (Pers. : Fr.) Pat.
Phellinus gilvus (Schwein. : Fr.) Pat. *s. lato*
Phellinus inermis (Ellis & Everhart) G. Cunn.
Phellinus pectinatus (Klotzsch) Quél.
Phellinus senex (Nees & Mont.) Imazeki
Phellinus torulosus (Pers.) Bourdot & Galzin
Physisporinus vitreus (Pers. : Fr.) P. Karst.
Physisporinus xylostromatoides (Bres.) Y.C. Dai
Piptoporus soloniensis (Dubois : Fr.) Pilát
Polyporus alveolaris (DC. : Fr.) Bondartsev & Singer
Polyporus* cf. *guianensis Mont.
****Polyporus melanopus*** Fr.
#Polyporus pumilus Y.C. Dai & Niemelä — *see* below
Postia alni Niemelä & Vampola
Postia caesia (Schrad. : Fr.) P. Karst.
Postia pileata (Parmasto) Y.C. Dai & Renvall
Postia stiptica (Pers. : Fr.) Jülich
Postia subcaesia (A. David) Jülich
Postia tephroleuca (Fr.) Jülich
Pycnoporus cinnabarinus (Jacq. : Fr.) P. Karst.
Pycnoporus sanguineus (L. : Fr.) Murrill
Pyrrhoderma adamantinum (Berk.) Imazeki
Pyrrhoderma scaurum (Lloyd) Ryvarden
Rigidoporus eminens Y.C. Dai
Rigidoporus microporus (Fr.) Overeem
****Sarcoporia salmonicolor*** (Berk. & M.A. Curtis) Teixeira — *see* below
Schizopora flavipora (Cooke) Ryvarden
Skeletocutis amorpha (Fr. : Fr.) Kotl. & Pouzar
Skeletocutis nivea (Jungh.) Jean Keller
Skeletocutis odora (Sacc.) Ginns
Skeletocutis vulgaris (Fr.) Niemelä & Y.C. Dai
Tinctoporellus epimiltinus (Berk. & Broome) Ryvarden
Trametes gibbosa (Pers. : Fr.) Fr.
Trametes hirsuta (Wulfen : Fr.) Pilát
Trametes modesta (Fr.) Ryvarden
Trametes ochracea (Pers.) Gilb. & Ryvarden
Trametes orientalis (Yasuda) Imazeki
Trametes versicolor (L. : Fr.) Pilát
Trichaptum abietinum (Pers. : Fr.) Ryvarden
Trichaptum byssogenum (Jungh.) Ryvarden
****Trichaptum perrottetii*** (Lév.) Ryvarden
Tyromyces chioneus (Fr.) P. Karst.
**** Tyromyces* cf. *wakefieldiae*** Kotl. & Pouzar — *see* below

Descriptions

Cyclomyces lamellatus Y.C. Dai & Niemelä, *sp. nova* (Fig. 3)

Carpophorum annuum, pileatum, imbricatum; hymenophorum lamellatum, auratum vel brunneum, lamellae 2–4 per mm. Systema hypharum monomiticum, hyphae septatae, efibulatae; setae adsunt in trama vel hymenio. Sporae cylindricae, hyalinae, IKI–, CB(+), 3.6–4.8 × 1.4–1.8 µm.

TYPE: China. Hunan Prov., Liuyang Co., Daweishan Nat. Park, Limuqiao, mixed broad-leaved forest with *Cunninghamia lanceolata*, on angiosperm, 29.IX.2000 *Marja Härkönen 950* (holotype in H; isotype in IFP).

ETYMOLOGY. — *Lamellatus* (Lat., adj.) referring to the hymenophore which is made up of radial gills.

Fruitbody. — Basidiocarps annual, pileate, occasionally effused-reflexed, caps imbricate, often fused together laterally, consistency coriaceous when dry; pileus semicircular, projecting up to 1 cm, 2 cm wide and 2 mm thick at base.

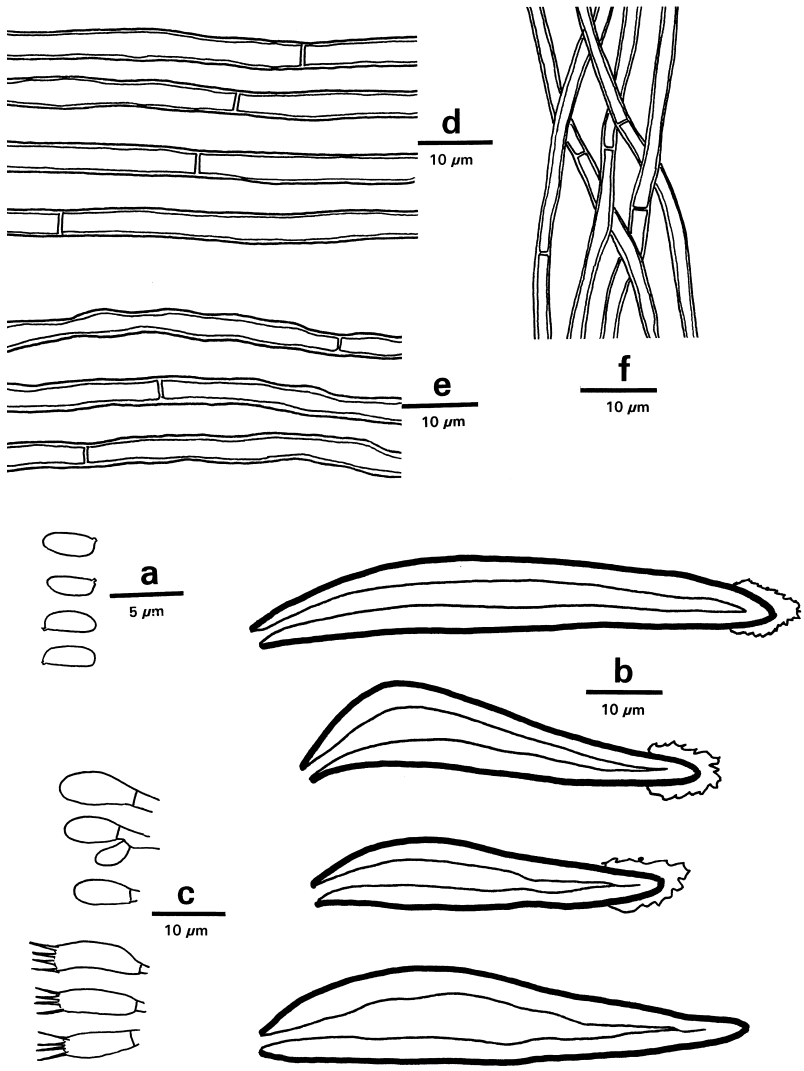

Fig. 3. Microscopical structures of *Cyclomyces lamellatus* (drawn from the holotype). — **a**: Spores. — **b**: Setae. — **c**: Basidia and basidioles. — **d**: Upper contextual hyphae. — **e**: Lower contextual hyphae. — **f**: Tramal hyphae.

Pileal surface yellowish brown to rust brown, concentrically sulcate, tomentose; margin golden yellow, acute. Hymenophore mostly lamellate, some parts variably round-pored, or with elongated pores or distinct lamellae, yellowish brown, margin golden yellow; lamellae 2–4 per mm, dissepiments thin, slightly lacerate. Context brown, corky, up to 1 mm thick, duplex, with layers separated by a thin black line, upper layer tomentose, lower layer dense. Lamellae concolorous with hymenophore surface, coriaceous, up to 0.5 mm deep.

Hyphal structure. — Hyphal system monomitic; all septa without clamp connections; tissues darkening but otherwise unchanged in KOH.

Context. — Hyphae in lower dense contextual layer hyaline to yellowish, thin- to fairly thick-walled with a wide lumen, frequently simple septate, occasionally branched, more or less straight; hyaline hyphae (1.8–)2–3(–3.4) μm in diam. (n = 30/1), yellowish hyphae (2.7–)3–5(–5.2) μm in diam. (n = 30/1); hyphae in the black zone brown, distinctly thick-walled with a narrow lumen or subsolid, strongly agglutinated, (2.3–)2.5–4(–4.3) μm in diam. (n = 30/1); hyphae in the upper tomentum golden brown, thick-walled with a wide lumen, frequently simple septate, unbranched, (2.8–)3–5.5(–5.7) μm in diam. (n = 30/1).

Lamellae. — Tramal hyphae hyaline to yellowish, thin- to thick-walled with a dis-

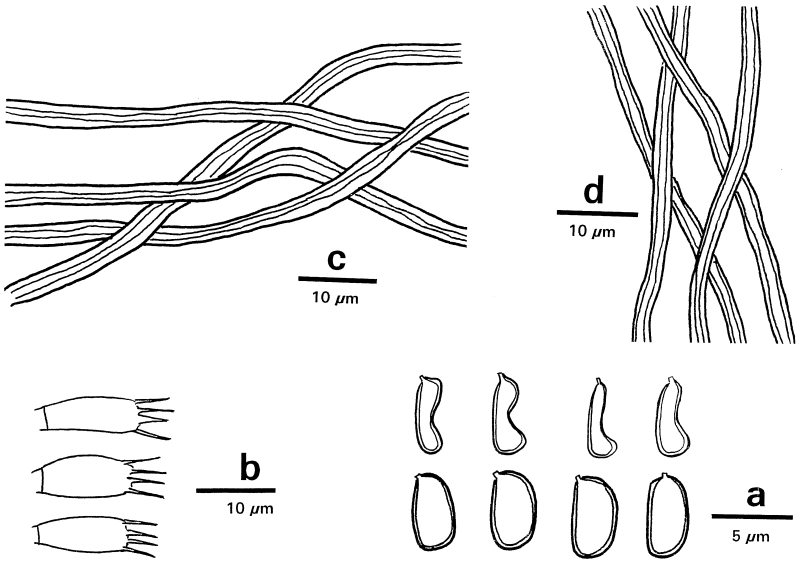

Fig. 4. Microscopical structures of *Phellinus collinus* (drawn from the holotype). — **a**: Spores. — **b**: Basidia. — **c**: Contextual skeletal hyphae. — **d**: Tramal skeletal hyphae.

tinct lumen, frequently simple septate, rarely branched, more or less flexuous, loosely interwoven, slightly CB+, (1.8–)2–4.5(–4.7) μm in diam. (n = 30/1). Hymenial setae frequent, subulate, arising from trama, occasionally found in context, trama and dissepiment edges, dark brown, distinctly thick-walled, sometimes apically encrusted, (50–)62–95(–110) × (9–)11–17(–20) μm (n = 30/1); basidia clavate, with four sterigmata and a simple basal septum, (8–)9–13(–15) × 3–4(–4.2) μm (n = 18/1); basidioles in shape similar to basidia, but smaller.

Spores. — Basidiospores cylindric, hyaline, thin-walled, smooth, IKI–, weakly CB+, (3.5–)3.6–4.8(–5.2) × (1.2–)1.5–1.8(–2.2) μm, L = 4.27 μm, W = 1.64 μm, Q = 2.43–2.79 (n = 60/2).

Additional specimens (paratypes) examined. — **China**. Hunan Prov., Liuyang Co., Daweishan Nat. Park, Limuqiao, mixed broad-leaved forest with *Cunninghamia lanceolata*, on rotten trunk of *Camellia*, 28.IX.2000 *Härkönen 903* (H, IFP). Shangzhi Co., Badagongshan Nat. Res., in forest plantation, 26.IX.1999 *Härkönen 325* (H); secondary evergreen broad-leaved forest, alt. 1455 m, on twig of angiosperm, 20.IX.2000 *Härkönen 590* (H, IFP); secondary forest in warm temperate zone, alt. 1400 m, on branch of *Camellia*, 21.IX.2000 *Härkönen 684* (H, IFP).

Cyclomyces lamellatus is characterized by imbricate basidiocarps, small and thin pilei, lamellate hymenophore, prominent setae, and by cylindric basidiospores. *Cyclomyces fuscus* has lamellate hymenophore as well, but its lamellae are arranged concentrically, and its hymenophore surface is dark brown. Spores of *C. fuscus* are oblong-ellipsoid, and its setae are smaller than those in *C. lamellatus*, 30–62 × 5–10 μm.

Phellinus collinus Y.C. Dai & Niemelä, *sp. nova* (Fig. 4)

Carpophorum perenne, pileatum; facies pororum brunnea, pori rotundi, 5–6 per mm. Systema hypharum dimiticum, hyphae septatae, efibulatae. Sporae oblongae vel ellipsoideae, crassitunicatae, aureae, IKI–, CB(+), 4.1–5 × 3–3.5 μm.

Type: China. Hunan Prov., Liuyang Co., Daweishan Nat. Park, Limuqiao, mixed broad-leaved forest with *Cunninghamia lanceolata*, on a standing, decayed angiosperm tree, 28.IX.2000 *Marja Härkönen 925* (holotype in H; isotype in IFP).

Etymology. — *Collinus* (Lat., adj.), referring to the occurrence of the species in low mountains and foothills.

Fruitbody. — Basidiocarps perennial, pileate, caps imbricate, laterally fused; pileus triquetrous, projecting up to 2.5 cm, 5 cm wide and 2.5 cm thick at base. Pileal surface dark brown, concentrically sulcate, old specimens covered by mosses; margin yellowish brown, acute. Pore surface dull brown, shining, margin yellowish brown; pores round, (4–)5–6(–7) per

mm (n = 36/2), dissepiments entire. Context thin, brown, hard corky, up to 2 mm thick, a distinct black crust present at upper surface. Tubes brown to greyish brown, corky, up to 2.3 cm long.

Hyphal structure. — Hyphal system dimitic; all septa without clamp connections; tissues darkening but otherwise unchanged in KOH.

Context. — Generative hyphae hyaline, thin-walled, frequently simple septate, occasionally branched, (1.3–)1.5–3(–3.3) μm in diam. (n = 25/1); skeletal hyphae dominant, rust brown, thick-walled with a narrow lumen or subsolid, unbranched, flexuous, loosely interwoven, (1.5–)1.8–3.2(–3.5) μm in diam. (n = 28/1); hyphae in the upper crust similar as in context, but strongly agglutinated.

Tubes. — Generative hyphae infrequent, hyaline, thin-walled, frequently simple septate, occasionally branched, (1.3–)1.5–2.8(–3) μm in diam. (n = 30/1); skeletal hyphae dominant, golden yellow, thick-walled with a distinct lumen, unbranched, slightly flexuous, loosely interwoven, (1.5–)1.6–3(–3.2) μm in diam. (n = 30/1); secondary mycelium present in old tube cavities, those hyphae hyaline, thin-walled, frequently simple septate and branched, CB+, 1.4–2.8 μm in diam. Hymenial setae not seen. Subhymenium indistinct; basidia short clavate to barrel-shaped, with four sterigmata and a simple basal septum, (10–)11.5–15(–17) × (4–)4.5–5.5(–5.8) μm (n = 22/1); basidioles in shape similar to basidia, but slightly smaller.

Spores. — Basidiospores abundant, oblong to ellipsoid, golden yellow, thick-walled, smooth, IKI–, CB+ when juvenile, (4–)4.1–5(–5.2) × (2.9–)3–3.5(–3.7) μm, L = 4.68 μm, W = 3.13 μm, Q = 1.42–1.58 (n = 60/2), mature spores usually collapsed in microscopic mounts made of dried specimens.

Additional specimens (paratypes) examined. — **China**. Hunan Prov., Liuyang Co., Daweishan Nat. Park, Limuqiao, mixed broad-leaved forest with *Cunninghamia lanceolata*, on decayed tree of angiosperm, 28.IX.2000 *Härkönen 928* (H, IFP); on stump of angiosperm, 22.XII.2000 *Dai 3259* (IFP, H). Nanyue Co., Hengshan Park, on dead *Castanea*, 1.VII.2002 *Dai 3537* (IFP, H). Sichuan Prov., Ermei Co., Ermei Mts., on dead angiosperm tree, 18.X.2002 *Dai 4273* (IFP, H).

Phellinus collinus is characterized by a perennial habit, shining pore surface, very thin context, the lack of setae, and by oblong-ellipsoid and golden yellow basidiospores, which tend to be deflated in dried herbarium material.

Phellinus collinus is somehow similar to *P. fushanus*. Type material of the latter species was studied; it has smaller pores (7–8 per mm), quite thick context (up to 8 mm), and its pore surface is matted. Its tramal hyphae are distinctly parallel, and skeletal hyphae in trama are thicker (3–4 μm in diam.) than those in *P. collinus*. Basidiospores of *P. fushanus* are very pale yellowish, slightly thick-walled, weakly cyanophilous, not collapsed, and smaller (3–3.6 × 2–2.3 μm).

Phellinus grenadensis resembles *P. collinus*. Type material of the former species was studied, and it can be separated from *P. collinus* by its larger and broadly ellipsoid spores (5–5.5 × 3.2–4 μm). In addition, the contextual skeletal hyphae of *P. grenadensis* are frequently simple septate, while they are not septate in *P. collinus*. In many members of the *Phellinus* generic complex both the generative hyphae (hyaline, fairly thin-walled, branched) and skeletal hyphae (brown, thick-walled, non-branched) are readily simple-septate (cf., e.g., Niemelä & Mrema 2002); the whole terminology of hyphal systems should be revised when dealing with the hymenochaetoid fungi.

Phellinus kawakamii has somewhat similar pores and spores as *P. collinus*, but its basidiocarps have very thick context (up to 6 cm), contextual skeletal hyphae are frequently simple septate, and it produces chlamydospores.

Other specimens examined. — *Phellinus fushanus*. **Taiwan**. Ilan, Fushan Nature Forest, X.1995 *Chang* (TFRI 685, type). — *Phellinus grenadensis*. **Grenada**. "In the mountain forests of Annandale", II.1906 *Broadway* (NY, holotype).

Polyporus pumilus Y.C. Dai & Niemelä, *sp. nova* (Fig. 5)

Carpophorum annuum, substipitatum, pendulum, minutum; facies pororum cremea; pori rotundi, 8–10 per mm. Systema hypharum dimiticum, hyphae generatoriae fibulatae, hyphae ligativae contexti 3–5 µm in diam. Sporae cylindricae, hyalinae, IKI–, CB–, 5.2–7.2 × 2.3–3 µm.

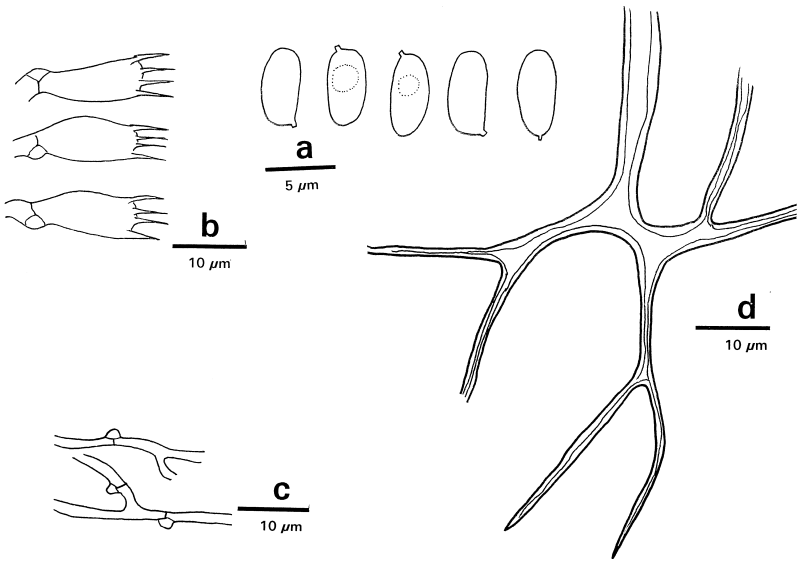

Fig. 5. Microscopical structures of *Polyporus pumilus* (drawn from the holotype). — **a**: Spores. — **b**: Basidia. — **c**: Generative hyphae from context. — **d**: Skeleto-binding hyphae from context.

TYPE: China. Hunan Prov., Xinning Co., Shunhuangshan For. Park, Zhengjiang Valley, secondary evergreen broad-leaved forest, on twig of angiosperm, 24.IX.2001 *Marja Härkönen 1442* (holotype in H; isotype in IFP).

ETYMOLOGY. — *Pumilus* (Lat., adj.), dwarf-sized, referring to small basidiocarps.

Fruitbody. — Basidiocarps annual, very small, up to 5 mm in longest dimension, leathery when fresh, becoming hard upon drying. Pilei with a constricted base (substipitate), more or less pendent, projecting up to 3 mm, 5 mm wide, and 1.5 mm thick at base; margin undulating, acute, sometimes reflexed. Upper surface smooth, cream to pale straw coloured, concentrically zonate. Pore surface cream when fresh, becoming pale straw-coloured; pores round, randomly arranged, (7–)8–10 per mm (n = 40/2); dissepiments thin, entire. Section: context cream, hard corky, up to 0.5 mm thick; tube layer concolorous with poroid surface, tubes hard, up to 1 mm long.

Hyphal structure. — Hyphal system dimitic, generative hyphae with clamp connections, hyaline, thin-walled; skeleto-binding (ligative) hyphae thick-walled with a narrow lumen or subsolid, dendritically branched and tapering in the end, unchanged in KOH.

Context. — Hyphae of the context proper strongly interwoven, agglutinated; generative hyphae uncommon, occasionally branched, 2–2.8(–3) μm in diam. (n = 30/2); skeleto-binding hyphae dominant, winding, CB+, IKI–, skeletal part (2.5–)3–5(–5.4) μm in diam. (n = 25/2).

Tubes. — Tramal hyphae tightly interwoven, strongly agglutinated; generative hyphae infrequent, hyaline, thin-walled, frequently branched, 1.8–3(–3.4) μm in diam. (n = 23/2); skeleto-binding hyphae dominant, mostly subsolid, CB+, IKI–, skeletal part (2–)2.5–4 μm in diam. (n = 20/2). No cystidia or cystidioles, but hyphal pegs frequent. Basidia broadly clavate, with a basal clamp and four sterigmata, (12–)13–16(–18) × (5.6–)6–7(–7.5) μm (n = 20/2); basidioles in shape similar to basidia, but slightly smaller. Rhomboid crystals frequently present in between tramal hyphae.

Spores. — Basidiospores cylindrical, hyaline, thin-walled, smooth, usually bearing one guttule, CB–, IKI–, (5–)5.2–7.2(–8) × (2.2–)2.3–3(–3.1) μm, L = 6.17 μm, W = 2.57 μm, Q = 2.15–2.66 (n = 60/2).

ADDITIONAL SPECIMEN (PARATYPE) EXAMINED. — **China**. Hunan Prov., Nanyue Co., Hengshan Park, on twig of angiosperm, 1.VII.2002 *Dai 3531b* (IFP).

Macroscopically *Polyporus pumilus* does not resemble typical members of the genus *Polyporus* because of its pendent habit, minute basidiocarps and very small pores, but in the microscope similarities are obvious: its hyphal structure is dimitic with skeleto-binding hyphae

which are distally arboriform to dendriform with whip-like tips, and hyphal walls are cyanophilous. Also basidiospores are characteristic of *Polyporus*: hyaline, thin-walled, and cylindric. There is no distinct, differentiated stipe in *Polyporus pumilus*, but the same situation is seen in some other species of the genus, for instance, *P. alveolaris, P. leptocephalus* (= *P. varius*) and *P. pseudobetulinus*. Small basidiocarp size is not totally alien to the genus *Polyporus*; many other species produce dwarf pilei when they grow in very thin twigs or branchlets (e.g., *P. ciliatus*, *P. leptocephalus*).

Dichomitus has the same hyphal structure as in *Polyporus*, and no doubt the two genera are closely related. Species of *Dichomitus* are either totally resupinate (*D. albidofuscus*, *D. stenospora*) or at least broadly effused along the wood surface (*D. squalens*, *D. campestris*).

Notes on selected species

Antrodia aff. *carbonica*

Basidiocarp annual, resupinate, corky when dry. Pore surface cream coloured; pores angular, becoming irregular with age, 3–5 per mm, dissepiments thin, entire. Subiculum thin, wood coloured, corky; tubes concolorous with pore surface. Hyphal system dimitic, generative hyphae frequently branched and bearing clamp connections; skeletal hyphae dominant, thick-walled, rarely branched, winding, IKI+, CB–. Cystidia and cystidioles not seen. Basidiospores oblong, hyaline, thin-walled, smooth, IKI–, CB+, 5.5–6 × 2.5–3 μm.

The two collections from Hunan have similar size of pores and similar dimensions of basidiospores as typical *Antrodia carbonica*, and their skeletal hyphae are equally amyloid. The last mentioned colour reaction is the most important character for *A. carbonica*. However, the basidiospores of the Hunan collections are cyanophilous, which does not match with *A. carbonica*. In addition, skeletal hyphae are strongly branched in *A. carbonica*, while they are very rarely branched in our materials. We did not find any other name suitable for our collections, and treat them therefore as *A.* aff. *carbonica*.

Specimens examined. — **China**. Hunan Prov., Yunshan Nat. For., road from Huasheyao to Fenghuangling and Wulingan, alt. 845–1200 m, secondary evergreen forest, on decayed branch of an angiosperm tree, 19.IX.2001 *Härkönen 1293* (H); on decayed angiosperm tree, 19.IX.2001 *Härkönen 1325* (H).

Ceriporia aff. *mellita*

Basidiocarp annual, resupinate, soft, white, with rhizomorphs. Pore surface white to cream coloured; pores angular, becoming irregular with age, 2–3 per mm; dissepiments thin, lacerate with age. Subiculum thin, white and cottony; tubes concolorous with pore surface, fragile. Hyphal system monomitic, hyphae frequently branched and bearing simple septa, usually covered with some crystals. Cystidia and cystidioles not seen. Basidiospores allantoid, hyaline, thin-walled, smooth, bearing one or two guttules, IKI–, CB–, 4–5 × 1.5–2 μm.

The taxon has distinct rhizomorphs and allantoid basidiospores. Ryvarden and Gilbertson (1993) treated *Ceriporia mellita* as a synonym of *C. purpurea*, but Pieri and Rivoire (1997) considered them to be two independent species. The Hunan collection has similar basidiospores as they are in *C. mellita sensu* Pieri and Rivoire, and its hyphal structure is very close to the description of the species, but typical *C. mellita* has no rhizomorphs in its margin. We have not studied the type material of *C. mellita*, and for the time being treat our specimen as *C.* aff. *mellita*.

Specimen examined. — **China**. Hunan Prov., Shangzhi Co., Badagongshan Nat. Res., on branch of an angiosperm tree, 28.IX.1999 *Härkönen 416* (H).

Ceriporiopsis cf. *umbrinescens*

Basidiocarp annual, resupinate, very thin, 0.5 mm thick, soft corky to fragile when dry. Pore surface wood coloured to luteous when dry; pores angular, becoming irregular with age, 4–5 per mm; dissepiments thin, slightly lacerate with age. Subiculum very thin, ca. 0.2 mm thick; tubes concolorous with pore surface, fragile, ca. 0.3 mm long. Hyphal system monomitic, hyphae

frequently branched and bearing clamp connections. Cystidia and cystidioles not seen. Basidiospores oblong ellipsoid, hyaline, thin-walled, smooth, IKI–, CB–, 4.5–5.5 × 2.5–3 μm.

The sole specimen was collected from a twig fallen from an angiosperm tree, and it fits well with the description of *Ceriporiopsis umbrinescens*. The type of the species was growing on a palm in Jamaica. According to Lowe (1966) the species has thin-walled cystidioles, but we did not find such structures in our material. Therefore our identification is still tentative.

SPECIMEN EXAMINED. — **China**. Hunan Prov., Wugang, road to Qilian, secondary evergreen forest, on twig of angiosperm tree, 21.IX.2001 *Härkönen 1355* (H).

Fibroporia cf. *radiculosa*

Basidiocarp annual, resupinate, cottony soft and separable, 4 mm thick, becoming soft corky upon drying. Margin thin and narrow, bearing distinct, yellow rhizomorphs. Pore surface bright yellow, brownish when dry; pores angular, 1.5–2 per mm (n = 25/2); dissepiments thin, orifices regular when young, strongly lacerate with age. Subiculum up to 1 mm thick, cottony or soft corky, pale yellow when dry; tubes concolorous, soft corky or fragile, up to 3 mm long. Hyphal system dimitic in subiculum, monomitic in trama; generative hyphae bearing clamp connections, skeletals infrequent, winding, thick-walled with a narrow lumen, (2.7–)3–4.5(–4.8) μm (n = 27/2). No cystidia or cystidioles. Basidiospores ellipsoid, thin- to slightly thick-walled, hyaline, smooth, IKI–, CB–, (4.6–)4.8–7(–8) × (2.5–)2.8–4(–4.2) μm, L = 5.64 μm, W = 3.20 μm, Q = 1.70–1.83 (n = 60/2).

There is some controversy on the identity of *Fibroporia radiculosa* (*Antrodia radiculosa*). The North American specimens studied by us have a dimitic subiculum, but monomitic tube trama, while in Europe the species seems to be dimitic throughout, and spores are smaller in European specimens. Being a dimitic brown-rot species, it is often included in *Antrodia*, but spore characteristics point towards the small genus *Fibroporia* (*see* Niemelä & Mrema 2002). In the microscope our Chinese collections are very much reminiscent of the American *F. radiculosa*, but we could not decide if the decay is white-rot or brown-rot, and therefore our determination is still tentative.

SPECIMENS EXAMINED. — **China**. Hunan Prov., Changsha, Yuelushan Park, mixed broad-leaved forest with *Pinus massoniana*, on fallen trunk of *Pinus*, 4.VII.2002 *Dai 3577* (IFP, H). Nanye Co., Hengshan Park, mixed broad-leaved forest with *Pinus massoniana*, on fallen branch of *Pinus*, 1.VII.2002 *Dai 3530* (H, IFP); fallen trunk of *Cryptomeria fortunei*, 2.VII.2002 *Dai 3552* (IFP).

Heterobasidion insulare s. lato

Heterobasidion annosum was reported from Hunan (Li *et al*. 1993), but according to our materials collected from the province, it is *H. insulare s. lato* that occurs in the area. Based on our previous study (Dai *et al*. 2002) *H. insulare* is a saprotrophic fungus, and its sexuality is heterothallic and bipolar. Unlike *H. annosum*, its hyphae from homokaryotic isolates bear clamp connections. Mating tests were made among the materials from Yunnan, Guizhou and Taiwan, and three intersterility groups were detected. We are not sure at the moment of the exact identity of the Hunan collections, but certainly they belong to the *H. insulare* complex. The basidiospores in the Hunan material are very similar to those collected from northeastern China, but tube orifices are entire in the Hunan specimens, while they are strongly lacerate in collections from northeastern China. We are continuing our studies on *H. insulare s. lato* because there are several at present poorly known intersterility groups in this complex in China and neighbouring countries (Dai *et al*. 2002). It seems that *H. insulare sensu stricto* does not occur at all in mainland Southeast Asia.

SPECIMENS EXAMINED. — **China**. Hunan Prov., Nanyue Co., Hengshan Park, on stump of *Pinus massoniana*, 2.VII.2002 *Dai 3561–3570* (IFP, H).

Sarcoporia salmonicolor

This species is usually placed in the genus *Hapalopilus* because of its salmon to ochraceous colours and strong red colour reaction in alkaline solutions, e.g., KOH. When Ko *et al*. (2001) studied phylogenetic relationships of

Hapalopilus and related genera, inferred from the mitochondrial small subunit ribosomal DNA sequences, they found out that the present species is fairly distant from typical *Hapalopilus* (e.g., *H. rutilans*, *H. croceus*). Therefore we follow the proposal presented by Ko *et al.* (2001) and keep *Sarcoporia salmonicolor* in a genus of its own.

Tyromyces cf. *wakefieldiae*

Basidiocarp annual, pileate, imbricate; pilei dimidiate, projecting up to 3 cm, 5 cm wide and 8 mm thick at base. Pileal surface cream coloured to pale brownish cream, velutinate, margin acute. Pore surface wood coloured to pale brownish when dry; pores angular, 6–7 per mm, dissepiments thin, slightly lacerate. Context cream coloured, corky, up to 7 mm thick; tubes concolorous with pore surface, more or less brittle when dry, ca. 1 mm long. Hyphal system monomitic, hyphae thin- to distinctly thick-walled, frequently branched, and bearing clamp connections. Cystidia and cystidioles not seen. Basidiospores ellipsoid, hyaline, thin-walled, smooth, IKI–, CB–, 4–4.5 × 2–2.5 μm.

The Chinese collection is reminiscent of *Tyromyces wakefieldiae*, but there are no dark brown concentric zones on its upper surface, and its pores are slightly smaller than in the species from Europe (4–5 per mm); pore mouths of the Chinese specimen are even to slightly serrate, not lacerate or even dentate as in Europe (Ryvarden & Gilbertson 1993).

Specimen examined. — **China**. Hunan Prov., Shangzhi Co., Badagongshan Nat. Res., on dead *Carpinus,* 21.IX.2000 *Härkönen 643* (H).

Discussion

The checklist summarises preliminary results of our collections. About ten species belonging to the genera *Antrodiella* and *Perenniporia* are not dealt with here: we did not find names for them from existing books and publications, and they are most probably new to science. 102 polypore species were identified so far, among them three species new to science; eight are new to China, and 66 new to Hunan. Some species identifications are tentative: seven taxa including *Antrodiella semisupina* are treated here collectively.

Among the 102 recorded species about half are new to Hunan, which is a strikingly high number. Even some most common species, e.g., *Antrodia malicola, Cyclomyces xeranticus, Fomitopsis feei, Ganoderma australe, Oxyporus populinus, Postia caesia* and *Schizopora flavipora* have not been reported there before. This example shows how little is known of the polypores in the province (and continental Southeast Asia as a whole); in particular the small-sized, short-lived and resupinate taxa need to be collected and studied intensively in forthcoming years.

Our identified material does not suffice for any thorough conclusions on the polypore species, their host relationships, distribution ranges or economical consequences, because 102 species make a small part of the total number only: we estimate that at least 250 polypore species should be found in Hunan. In the following, some preliminary observations are given.

Of the 102 identified polypores, 56 species (55% of the total number) were found also in northern China (*see* references in Introduction): the majority of them have a temperate to boreal distribution pattern throughout Eurasia. Examples are *Bjerkandera adusta, Daedaleopsis confragosa, Datronia mollis, Fomes fomentarius, Fomitopsis pinicola, Ganoderma lipsiense, Laetiporus sulphureus, Oxyporus populinus, Polyporus alveolaris, Postia caesia, Skeletocutis odora, Trametes hirsuta*, and *Trichaptum abietinum.* On the other hand, about 35 polypores characterising tropical climate are found in the study area, e.g., *Antrodiella aurantilaeta*, *A. zonata*, *Earliella scabrosa*, *Fomitopsis feei, Gloeophyllum* cf. *subferrugineum*, *Microporellus obovatus*, *Microporus affinis*, *M. vernicipes, M. xanthopus, Rigidoporus microporus, Tinctoporellus epimiltinus, Trametes modesta, T. orientalis* and *Trichaptum perrottetii*. Hunan is located in the warm temperate (meridional) zone of Asia, and polypore floras of both the temperate/boreal north and tropical/subtropical south overlap there. These fungi repeat the situation well-known among plants and many other organisms, that the demarcation between tropical

and temperate elements is not as sharp-delimited as it seems if Europe and Africa are compared, where the broad and hostile Saharan desert breaks the north/south transition. A continuous and climatically favourable Asian continental plate enables these elements to intermingle in a sophisticated, gradual and detailed way.

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