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***Phaeocollybia purpurea* (Cortinariaceae), a new species from Wuyishan, China**

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Abstract — A new species in *Phaeocollybia*, *P. purpurea*, is described in this paper based on collections from Wuyishan, Fujian Province, China. The new taxon is distinct within the genus for its persistently purple basidiomata, non-viscid pileus, and small basidiospores. The morphological characters used to distinguish the new species from its related species are also provided and discussed in this paper.

Key words —taxonomy, morphology, *Agaricales*, *Hymenogastraceae*

Introduction

Phaeocollybia R. Heim is an agaric genus, characterized by its umbonate pileus, subterranean pseudorhiza, brown ornamented basidiospores, and the presence of tibiiform diverticula (Smith 1957, Horak 1977, Redhead & Malloch 1986, Norvell 1998, 2000). The genus is widely distributed in moist temperate (Smith 1957, Horak 1977, Redhead & Malloch 1986, Rees & Wood 1996, Norvell 2000) and tropical zones (Singer 1970, Horak 1980, Horak & Halling 1991, Halling & Horak 2008). However, the ecological status of *Phaeocollybia* still remains uncertain. Smith (1957) inferred that the genus might contain both saprobes and mycorrhiza-formers, while Singer (1986) considered that members of the genus were not obligatorily ectomycorrhizal. Norvell (1998) presented evidence for consideration of *Phaeocollybia* as a mycorrhizal genus.

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Phaeocollybia is commonly placed in *Cortinariaceae* (Singer 1986, Kirk et al. 2008, Norvell & Exeter 2009) while Matheny et al. (2006) proposed a molecular-based classification placing the genus in *Hymenogastraceae*, for which further molecular research may provide more evidence. Of the 96 names published in *Phaeocollybia* (CABI 2010), ~50 species are currently accepted by Kirk et al. (2008). *Phaeocollybia* species have been mostly documented from North America and Mexico (Smith 1957, Singer 1970, Smith & Trappe 1972, Horak 1977, Redhead & Malloch 1986, Guzmán et al. 1987, Bandala et al. 1989, 1996, Norvell 2000, 2002, 2004, Norvell & Redhead 2000, Redhead & Norvell 2004, Norvell & Exeter 2007, Halling & Horak 2008), with some from Europe (Pearson 1952, Horak 1977), Asia (Horak 1974, 1977, 1980), South America (Singer 1970, Horak 1977, Horak & Halling 1991), and Oceania (Horak 1973, 1977, Rees & Wood 1996).

The first *Phaeocollybia* species described from China was *P. similis* (Bres.) Singer, based on a collection from Yunnan (Horak 1977). Later, more species were found in China, including a new species, *P. sparsilamellae* P.G. Liu (Liu 1995). Currently, there are 10 species of the genus reported from China (Bi et al. 1994, Deng et al. 2005, Yuan & Sun 1995, Wen et al. 2001, Liu & Qian 2002, Fan 2009).

During a recent expedition to Wuyishan, Fujian Province, China, an undescribed *Phaeocollybia* species was found. A full description of the new taxon is provided in this paper.

Materials and methods

The fresh basidiomata were photographed after collected from the field in the summer of 2009 and the macro-morphological characters were recorded in detail before drying in an oven at around 45°C. Color names were taken from Ridgway (1912). A 20% KOH solution was used on fresh pileus and stipe surfaces, lamella, and context for chemical reaction. Observation of the reactions was performed under ultraviolet light at a wave length of 360 nm. The specimens are housed in the Mycological Herbarium, Institute of Microbiology, Chinese Academy of Sciences (also as Herbarium Mycologicum Academiae Sinicae, HMAS). Descriptions and line drawings of the micromorphological characters were based on dried collections. Thin sections were prepared by hand with a razor blade. The sections of dried basidiomata were mounted in 5% KOH solution. Basidiospores, basidia, tramal hyphae, context, and cutis of pileus and stipe were measured using an ocular micrometer. At least 30 basidiospores and 20 basidia of each mature collection were measured. The microscopic structures were drawn with the aid of a camera lucida.



FIG. 1. Basidiomata of *Phaeocollybia purpurea* (HMAS 250001, holotype).

Taxonomy

Phaeocollybia purpurea T.Z. Wei, S.Z. Fu, P.P. Qu & Y.J. Yao, sp. nov. FIGS 1–2.

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Pileus 2.0–6.0 cm *latus*, *primo* conicus, *dein* umbonato-applanatus, *superficie* *primo* obscuro-violaceus, *atro-griseo-purpureus* vel *brunneo-purpureus*, *dein* brunneus vel *purpurate ferrugineo-brunneus*, *glaber*, *sericeus*, *nonviscidus*. *Lamellae* *adnatae*, *confertae*, *ad* 4 mm *latae*, *primo* pallide violaceo-griseae, *dein* violaceo-griseae vel *griseo-violaceae*, *demum* *brunneo-purpureae* *interdum* *maturitate* *ferruginescenter suffusae*. *Stipes centralis*, 2.0–5.5 × 0.3–0.6 cm, *cylindraceus*, *superficie* *atro-purpureo-griseus* vel *atro-griseo-violaceus*, *glaber*, *sericeus*, *fistulosus*. *Pseudorhiza* *ad* 8.0 cm *longa*, *concolor*. *Basidiosporae* 3.5–5.0 × 3.0–4.0 μm, *ovoideae* vel *ellipsoideae*, *brunneolae* vel *ferrugineo-brunneae*, *leviter verrucosae*. *Basidia* 18.0–24 × 5.0–6.0 μm, *clavata*, *tetraspora*.

TYPE—CHINA, Fujian Province, Wuyishan National Nature Reserve, in broad leaved forest, 27°44.935'N, 117°40.652'E, alt. 715 m, 18 June 2009, T.-Z. Wei 300, *Holotype* HMAS 250001; *Isotype* K(M) 166177.

ETYMOLOGY—*purpurea*, from the Latin for 'purple', referring to the color of the basidiomata.

BASIDIOMATA scattered to gregarious. PILEUS 2.0–6.0 cm diam., conical at first, then convex, finally expanding to applanate with a bluntly pointed umbo; margin decurrent at first and then straight; surface dull violet (Dusky violet), dark grayish purple (Dull Dusky Purple) to brownish purple (Deep Livid Purple) when young, changing to brown (Liver Brown) or rust-brown (Hay's Russet) with distinct purplish tint, center more or less darker; smooth, glabrous, silky, hygrophanous, neither viscid nor lubricous when moist, opaque. CONTEXT up to 4.0 mm thick at center, fleshy, purple close to pileus cuticle, elsewhere pale gray with purplish tint. LAMELLAE adnate, up to 4.0 mm broad, ventricose, crowded,

with lamellulae; pale violet gray (Pale Violet Gray) when young, then violet-gray (Deep Violet Gray) to grayish violet (Dark Grayish Blue-Violet), brownish purple (Dark Livid Purple) with rust tint when mature; edge pallid, uneven in age. STIPE central, above-ground part 2.0–5.5 × 0.3–0.6 cm, cylindrical, with subterranean pseudorhiza; surface dark purplish gray (Vinaceous-Slate) to dark grayish violet (Dark Grayish Blue-Violet), occasionally tinted rust from basidiospores, smooth, glabrous, silky; hollow, with concolorous cortex; cortex 1.0–1.5 mm thick, brittle, cartilaginous. PSEUDORHIZA up to 8.0 cm long, rhizomorphic, cylindrical and hollow above, tapering below and solid, concolorous with stipe surface or slightly darker; cortex 1.5–2.0 mm thick, cartilaginous. VEIL REMNANTS not observed. BASIDIOSPORE DEPOSIT brownish rusty.

BASIDIOSPORES 3.5–5.0 × 3.0–4.0 μm, ellipsoid ovoid to ellipsoid with eccentric apiculus and bluntly round to pointed apical callus in profile, brownish to rusty brown, finely punctate to verruculose, thick-walled, inamyloid. BASIDIA 18.0–24 × 5.0–6.0 μm, clavate, 4-spored, with long (up to 6 μm) sterigmata, hyaline to subhyaline, thin-walled, basally clamped. LAMELLA EDGE heterogeneous, crowded with abundant cheilocystidia and few basidia. CHEILOCYSTIDIA abundant, 20–29(–40) × (2.3–)3.5–5.0 μm, clavate to ampullaceous, usually with a mucronato-capitate apex atop a short narrow refractive neck, hyaline, thin-walled. PLEUROCYSTIDIA none found. HYMENOPHORAL TRAMA 60–120 μm wide, regular, of thin-walled hyphae; hyphae 4.0–12.0 μm diam., hyaline, rare yellowish, thin-walled. SUBHYMENIAL LAYER 3.0–6.0 μm wide, of repent branched hyphae; hyphae 2.0–3.5 μm diam, thin-walled, hyaline to subhyaline. PILEIPELLIS bilamellate, compact, yellowish brown, of thick-walled gelatinized hyphae gel-encrusted with yellow-brown pigments often concentrating at septa; suprapellis 20–50 μm wide, hyphae 2.5–5.0 μm diam.; subpellis 80–150 μm wide, hyphae 5.0–15.0 μm diam, most elements thick-walled. PILEAL TRAMA of branched hyphae, hyphae normally 4.0–8.0 μm diam., sometimes inflating to 16 μm diam., thin-walled, hyaline to brownish, rarely with purplish content when observed in water. STIPITIPELLIS of longitudinally parallel hyphae, hyphae 1.5–4.0 μm diam., thick-walled, pale brown. STIPE TRAMA bilamellate, vessel hyphae longitudinally parallel, hyphae 5.0–20 μm diam., thick-walled (up to 3 μm wide); inner surface of longitudinally subparallel hyphae, hyphae 1.5–4.0 μm diam., thin-walled, hyaline, rare subhyaline. PSEUDORHIZA strongly sarcodimitic with thick-walled vessel hyphae predominant. TIBIFORM DIVERTICULA thin-walled, hyaline, up to 12.0 μm long, 0.5–1.0 μm diam., abundant on pseudorhizal pellis and basal mycelium, subcylindrical and with globose apex, with no septum between base and hypha. CLAMP CONNECTIONS abundant in stipe trama, less frequent but present at basidial bases, cheilocystidia, pileipellis, and stipitipellis.

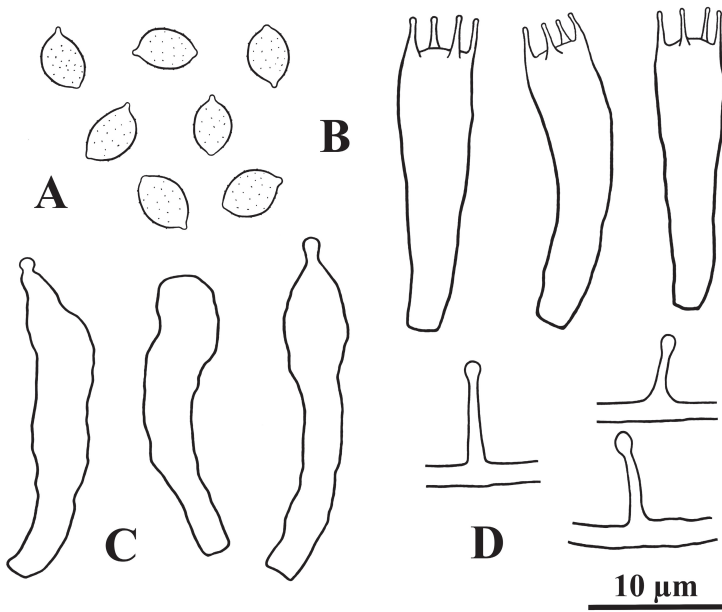


FIG. 2. *Phaeocollybia purpurea* (HMAS 250001, holotype).
A. basidiospores; B. basidia; C. cheilocystidia; D. tibiiform diverticula.

CHEMICAL REACTION with 20% KOH blackening at all parts. FLUORESCENCE REACTION UNDER ULTRAVIOLET LIGHT bright yellow in lamellae, pale yellow with purplish tint in context, violet-purple in all other parts. TASTE of context mild. ODOR of context indistinct.

HABITAT—on ground in forest dominated by broadleaf species and mixed with a few conifers, near *Quercus* sp. and *Cunninghamia* sp.

ADDITIONAL SPECIMEN EXAMINED – CHINA, Fujian Province, Wuyishan National Nature Reserve, in broad-leaved forest, 27°44.935'N, 117°40.652'E, alt. 715 m, 22 June 2009, Wei T.-Z. 595, HMAS 250002.

The two collections examined here are placed in *Phaeocollybia* based on their pileal umbo, cartilaginous stipe, long pseudorhiza, brown verrucose basidiospores, and tibiiform diverticula. The newly described *P. purpurea* is mainly distinguished from other taxa in the genus by its violet to purple basidiomata. Four other *Phaeocollybia* species — *P. amygdalospora* Bandala & E. Horak (Bandala et al. 1996), *P. parvispora* Corner & E. Horak (Horak 1977), *P. pseudolugubris* Bandala & E. Horak (Bandala et al. 1996), *P. singularis* E. Horak & Halling (Horak & Halling 1991) — produce similar basidiomata

with lilac, purple or violaceous tints all-over when young. However, the violet to purple colors persist in the new species whereas the violet tones are lost over time in the four species cited above. Further, *P. purpurea* is separated from *P. amygdalospora*, *P. pseudolugubris*, and *P. singularis* by its non-viscid pileus when moist and its smooth glabrous pileus lacks the appressed squamules typical of *P. parvispora*.

Microscopically, its small basidiospore size ($3.0\text{--}5.0 \times 3.0\text{--}4.0 \mu\text{m}$) clearly separates *P. purpurea* from *P. amygdalospora* ($6.0\text{--}9.0 \times 4.0\text{--}5.0 \mu\text{m}$, Bandala et al. 1996), *P. pseudolugubris* ($8.0\text{--}10.0 \times 4.0\text{--}5.0 \mu\text{m}$, Bandala et al. 1996), and *P. singularis* ($8.0\text{--}9.5 \times 4.5\text{--}5.0 \mu\text{m}$, Horak & Halling 1991), all of which have amygdaliform to limoniform shaped spores. *Phaeocollybia parvispora* also has small ellipsoid basidiospores ($3.4\text{--}4.5 \times 2.5\text{--}3.0 \mu\text{m}$, Horak 1977), but they are considerably narrower than those of the new species.

Two other species, *P. arduennensis* Bon and *P. bicolor* E. Horak, produce similar cheilocystidia, clamps, and small spores. In addition, the brown pileus of *P. arduennensis* has a purplish tinge, and the lamellae of *P. bicolor* are lilac at first. However, the ochreous orange lamellae of *P. arduennensis* (Bon 1992) contrast with the violet to brownish purple lamellae in *P. purpurea*, while *P. bicolor* is distinguished by an avellaneous to light brown pileus and the absence of a pseudorhiza (Horak 1977).

DNA sequences derived from the nuclear ribosomal DNA internally transcribed spacer region (nrDNA-ITS) from our laboratory specimens and compared with sequences now on deposit in Genbank support *P. purpurea* as a distinct species in *Phaeocollybia* that clusters with *P. ratticauda* E. Horak (AF501568.1: voucher BRV 99/11) in the same terminal clade but with relatively long branches (unpublished data). *Phaeocollybia ratticauda* resembles *P. purpurea* in lilac coloration (lamellae and stipe) and small basidiospores ($5.0\text{--}6.0 \times 3.5\text{--}4.0 \mu\text{m}$). However, its dark brown to liver brown pileus (Horak 1973) differentiates *P. ratticauda* from *P. purpurea*. The results of our DNA sequence analyses of *Phaeocollybia* species will be published elsewhere.

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