A NEW SPECIES OF *PHAEOCOLLYBIA* FROM WESTERN AUSTRALIA

B.J. Rees[A] *and K. Syme*[B]

[A] *School of Biological Science, University of New South Wales, Sydney, N.S.W. 2052.*
[B] *RMB 1020, South Coast Highway, Denmark, W.A. 6333.*

Abstract

A new species, *Phaeocollybia graveolens*, is described from Western Australia. In common with previously described Australian species of the genus it is found in association with eucalypts, especially *Eucalyptus diversicolor* (Karri) and *Corymbia calophylla* (Marri), and also with *Allocasuarina decussata*. The species has numerous clamp-connections indicating it belongs in Section *Radicatae*. It is the first species from this section to be recorded from Australia.

Although northern hemisphere coniferous species are regarded as the usual symbionts for *Phaeocollybia* Heim (Redhead & Malloch, 1986), the genus has been found in Australia, New Zealand and New Guinea in association with other hosts such as the relict Gondwanan genus *Nothofagus* (Fuhrer & Robinson, 1992; Horak, 1973) and with *Leptospermum* and *Eucalyptus* (Horak, 1973; Rees & Wood, 1996).

In common with many other genera in the Cortinariaceae, species of *Phaeocollybia* possess rust brown spores. These have an inconspicuous ornamentation which is often hard to discern in bright-field microscopy. *Phaeocollybia* species also possess a characteristic pseudorhiza which has been shown recently to be associated with ectomycorrhizal host roots (Norvell, 1998).

In his key to genera included with the original description of the genus Heim (1931), and later Singer (1986), noted the presence of a fugacious, pruinose veil in *Phaeocollybia*. In a detailed and comprehensive examination of *Phaeocollybia* species from the temperate rainforests of western North America, Norvell (1998) has described the presence of a primordial sheath enveloping the developing fruiting body. Fragments of this sheath remain as scaly patches on the pileal surface or as tibiiform diverticula on the pseudorhiza at maturity. Both pileo- and caulocystidia have been described from all Australian taxa of *Phaeocollybia* (Rees & Wood, 1996). The presence of caulocystidia below ground level has been described for many northern hemisphere species (Laber, 1991; Redhead & Malloch, 1986; Redhead & Norvell, 1993).

Species have been grouped traditionally on the basis of the shape of the cheilocystidia, the presence or absence of clamp-connections and on spore size (Bandala & Montoya, 1994; Singer, 1970; 1986; 1987; Smith, 1957). Three species and one variety already described from Australia (Rees & Wood, 1996) have no clamp-connections but they are present in abundance in the following new species described from Western Australia.

Materials and Methods

Fresh collections of basidiomata were photographed and their field characters described following Largent (1977). Colour in the fresh state was recorded using Kornerup & Wanscher (1981) before drying the collections at approximately 45°C for permanent storage. Dried fungal tissue was rehydrated in aqueous KOH (5% W/V) to observe colour of tissue and spore size. Aqueous Congo Red (1% W/V) was later added to these preparations to enhance contrast for examination and drawing. Spores were also examined in Melzer's Reagent for comparison with other Cortinariaceous genera. Numbers stated in brackets are for total number of spores/number of basidiomata from which they were sampled/number of different collections from which they were examined. Measurements do not include spore ornamentation or apiculus. Spore size range, mean and standard deviation are included and also Q, the ratio of the sum of the lengths divided by the sum of the breadths. Hand-cut transverse sections of lamellae were examined for pleurocystidia as these structures can often be overlooked in squashes.

Scanning electron microscopy was carried out on dried lamellar fragments which had been rehydrated and critical-point dried from acetone following the method of Cheeseman & Grund (1985). Potassium rather than sodium phosphate buffer (0.025M) was used for rinsing as potassium ions are more common than sodium ions in fungal tissue. Specimens were mounted on copper strips and coated with gold/palladium before examination in a field emission scanning electron microscope (FESEM) Hitachi Model S 900.

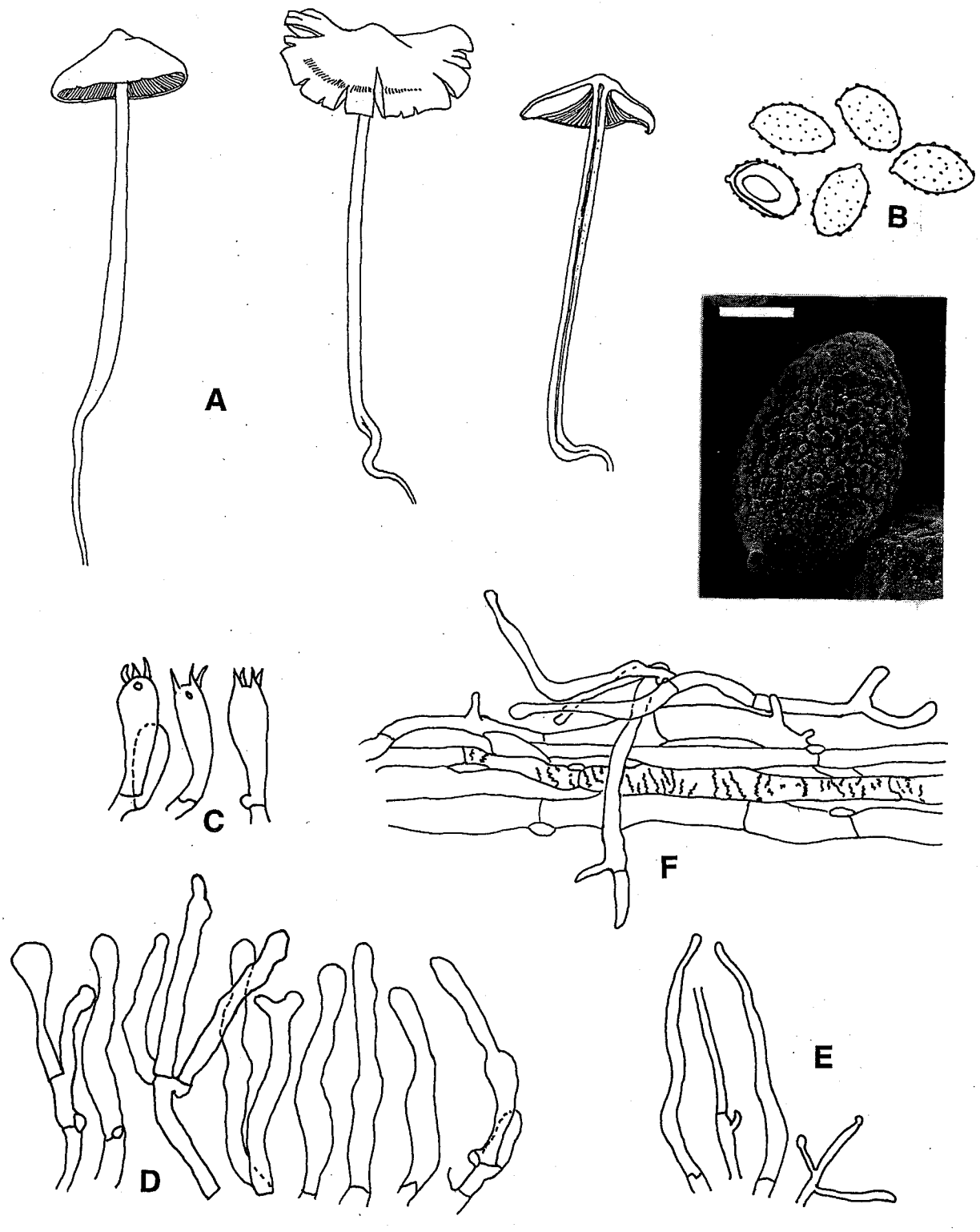

Figure 1. ***Phaeocollybia graveolens*** *(KS 931/97).* **A,** habit; **B,** basidiospores; **C,** basidia; **D,** cheilocystidia; **E,** caulocystidia; **F,** suprapellis structure. Scale bar = 1 cm for A, 5 µm for B, 10 µm for C, D and E. Inset: ornamented surface of basidiospores seen in field emission scanning microscopy. Scale bar = 2 µm. © Bettye Rees.

Phaeocollybia graveolens Rees & Syme *sp. nov.*

Etymology: from the Latin meaning 'strong-smelling'.

Pileus 18–31 mm latus, conicus dein obtuse convexus, umbonate angusto, atrobrunneus. *Lamellae* adnexae vel sublibrae, cinereo-aurantiacae dein brunneae. *Stipes* centralis pseudorhiza longe protracta. *Sporae* 6.2–7.5 × 3.9–4.5 µm, melleae, ellipsoideae verruculosaeque. Cheilocystidia cylindracea, apicibus ampliatis.

Holotypus: Australia, Western Australia, Denmark, Mt Shadforth Reserve, 15.vi 1996, *K. Syme KS 880/96* (PERTH).

Pileus circular, conical at first, becoming broadly convex with a narrow central umbo, 18–31 mm broad, often with concentric ridges near the margin, dark brown (8F5), slightly paler at the margin, drying yellowish brown to brown (5D6–6E7–7E6) but remaining darker at the centre, often with scattered, white, appressed scales on umbo when dry, the surface silky, dry, appressed fibrillose, the margin smooth, entire, incurved, becoming rimose, sometimes splitting almost to centre at maturity; context firm, thin, 2–3 mm thick at the centre, pale orange (5A3). *Lamellae* (L:30–48, l:172–210), adnexed, sometimes sinuate or free, close, narrow, 2–3 mm broad, greyish orange to light brown (5B5–6D4), becoming brown (6D6) when mature, the edge fimbriate becoming rimose and glistening white, with abundant lamellulae (more than two sets). *Stipe* central, 68–125 × 2–3 (apex) to 5–7 (base) mm wide including pseudorhiza 35–60 mm long, tapering upwards from a slightly swollen base just below soil surface, not abruptly radicating, at times terete, but more often compressed, canaliculate, with developing central split, often twisted, the surface dry, silky, with a thin, fine whitish basal tomentum, brown to dark brown (6E7–7F8), darker at apex, brownish orange at base (7C7), the pseudorhiza pale greyish orange (6B5), fistulose with partial chambers when mature; flesh concolorous or slightly paler, longitudinally fibrous. *Odour* very strong and unpleasant. *Taste* unpleasant, but mushroom-like. *Spore print* greyish orange (5B3) to yellowish brown to brown (5E5).

Chemical tests: 5% KOH on cap surface -ve (dull, dark brown). No reaction with 10% $FeSO_4$. No pigment diffusing from lamellar tissue when mounted in 5% KOH.

Basidiospores [30/3/2], 6.2–7.5 × 3.9–4.5 ($\bar{x}$ = 6.5±1.5 × 4.2±0.2) µm, Q = 1.54, ellipsoidal to amygdaliform, pale rusty melleous, inamyloid, verruculose, without suprahilar plage, without germ pore and perisporium. *Basidia* 20.0 × 6.0 µm, clavate, 4-spored, the sterigmata to 3–4 µm long. *Cheilocystidia* in clusters along the lamellar margin, cylindrical, 25–41 × 3–5 µm, frequently with an enlarged apex 4–6 µm wide, thin-walled, hyaline. *Pleurocystidia* not observed. *Hymenophoral trama* parallel, consisting of clamped hyphae 2.6–9.7 µm wide. *Caulocystidia* present at apex and base of stipe, cylindrical to tapering or occasionally branching, 40–45 × 2–3 µm. *Pileipellis* a cutis consisting of radially parallel, clamped hyphae with no evidence of gelatinisation. The subpellis cells are lightly encrusted, while those of the suprapellis bear lateral stumpy or capitate endings. *Scanning electron microscopy* confirms the presence of a low level of ornamentation which is unchanged in the suprahilar area. Figures 1 & 2.

Habit and habitat: gregarious on soil in thick, wet leaf litter among sword sedge, below *Corymbia calophylla* (Marri), *Eucalyptus diversicolor* (Karri) and *Allocasuarina decussata.*

Distribution: Australia.

Material studied: Australia, Western Australia, Denmark, Mt Shadforth Reserve, 34°58.7'S, 117°16.89'E, 70 m, 15.iii.1996, *K. Syme KS 880/96* (holotype: PERTH); Loc. 406, N.W. corner, 17.vii.1997, *K. Syme KS 931/97* (PERTH).

The presence of a ventricose stipe, and clamp-connections at the base of cheilocystidia and in the hyphae of the lamellar trama and universal veil remnants, demonstrates a close relationship of *Phaeocollybia graveolens* with *Phaeocollybia minuta* E. Horak from New Zealand. However, the fruiting bodies of the New Zealand species are extremely small while those of the Western Australian species are much more robust. In the Australian species, roughly one half of the stipe is buried below ground. In addition, the pileus and lamellae are deeper in colour than that recorded for *P. minuta* (Horak, 1973). Although the odour of *P. graveolens* is recorded as unpleasant, it is not raphanoid. Microscopically, the spores of *P. graveolens* are broader, slightly larger and more heavily ornamented than those of *P. minuta*, and the cheilocystidia longer and more obviously capitate. Spore size and

shape, and the presence of plentiful clamp-connections at the bases of cylindrical cheilocystidia and on the tramal and cuticular hyphae place *P. graveolens* in Section *Radicatae* as defined by Singer (1987) and Bandala & Montoya (1994). *Phaeocollybia graveolens* can be distinguished from *P. radicata*, the type species of the section, by its deep brown colour, larger spores and differently shaped cheilocystidia.

References

Bandala, V.M. & Montoya, L. (1994). Further investigations on *Phaeocollybia* with notes on infrageneric classification. *Mycotaxon* **52,** 397–422.

Cheeseman, G.N. & Grund, D.W. (1985). Preparation of agaric material for SEM examination: an improved method. *Mycotaxon* **23,** 451–455.

Fuhrer, B. & Robinson, R. (1992). *Rainforest fungi of Tasmania and south-east Australia.* (CSIRO: Melbourne, Australia.)

Heim, R. (1931). Le genre *Inocybe. Encyclopédie Mycologique* **1,** 70–72.

Horak, E. (1973). Fungi agaricini Novazealandi. *Beihefte zur Nova Hedwigia* **43,** 183–191.

Kornerup, A. & Wanscher, J. H. (1978). *Methuen Handbook of Colour* 3rd edn. (Eyre Methuen: London.)

Laber, D. (1991). Erganzung zu 'Die europäischen Arten der Gattung *Phaeocollybia* und ihr Vorkommen im südlichen Schwarzwald'. *Zeitschrift für Mykologie* **57,** 109–116.

Largent, D.L. (1977). *How to identify mushrooms to genus. I: Macroscopic features.* (Mad River Press, Inc.: Eureka, California.)

Norvell, L.L. (1998). Observations on development, morphology and biology in *Phaeocollybia. Mycological Research* **102,** 615–630.

Redhead, S.A. & Malloch, D.W. (1986). The genus *Phaeocollybia* (Agaricales) in eastern Canada and its biological status. *Canadian Journal of Botany* **64,** 1249–1254.

Redhead, S.A. & Norvell, L.L. (1993). *Phaeocollybia* in western Canada. *Mycotaxon* **46,** 343–358.

Rees, B.J. & Wood, A.E. (1996). The genus *Phaeocollybia* in South East Australia. *Mycotaxon* **57,** 97–116.

Singer, R. (1970). *Phaeocollybia* (Cortinariaceae—Basidiomycetes). *Flora Neotropica* **4,** 3–11.

Singer, R. (1986). *The Agaricales in Modern Taxonomy* 4th edn. (Koeltz: Koenigstein, Germany.) pp. 663–666.

Singer, R. (1987). *Phaeocollybia* in the oak woods of Costa Rica, with notes on extralimital taxa. *Mycologia Helvetica* **2,** 247–266.

Smith, A.H. (1957). A contribution toward a monograph of *Phaeocollybia. Brittonia* **9,** 195–217.

Figure 2. ***Phaeocollybia graveolens*** *(KS 880/96)* showing growth habit in groups and typical radicating pseudorhiza (× 1.1). Painting by Katrina Syme. © Katrina Syme.