

A CONTRIBUTION TO THE KNOWLEDGE OF *CORTINARIUS* AND ALLIED GENERA OF SOUTHERN TASMANIA, AUSTRALIA

1. *Cortinarius* subgenus *Cortinarius*

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Abstract

Sites in southern Tasmania, Australia, from which taxa of *Cortinarius* were collected for this study, are described. A new species of *Cortinarius* subgenus *Cortinarius* is described from eucalypt forests. A key is provided to species of subgenus *Cortinarius* known from Australasia and Malesia.

Key Words: Agaricales, Cortinariaceae, *Cortinarius*, Tasmania.

Introduction

Species of *Cortinarius* and *Dermocybe* are widespread in forests in Southern Tasmania but as yet the taxa are poorly known. The purpose of this series of papers is to report and describe the cortinars found in the region with comments on taxonomy, ecology and chemistry.

Southern Tasmania, as used here, is not a recognised geographical region, but is that part of Tasmania that lies south of latitude 42°30' and includes the city of Hobart. The term 'Southern Tasmania' was used by Hogg & Kirkpatrick (1974) in a study of the phytosociology and synecology of eucalypt forests and woodlands, but the study area was confined to a 26 km² plot centred around Risdon Vale, 16 km from Hobart. In the present contribution, the sites visited cover a much wider area of the south of Tasmania.

Study areas

The most frequently visited locality was Mt Wellington, especially its wet, south-eastern-facing gullies. Mt Wellington (42°55'S 147°15'E) is situated just west of Hobart and attains a height of 1,270 m. The habitat of the Mt Wellington survey area was divided up into zones determined largely by the dominant species of eucalypt (Ratkowsky & Ratkowsky 1976, 1977). The most productive zones mycologically were permanently wet gully communities and wet sclerophyll forests mainly on the south-eastern face and slopes of the mountain, and the area surrounding Myrtle Forest Creek (42°52'S 147°09'E) above the settlement of Collinsvale. The wet gully communities (up to 600 m elevation) are dominated by *Nothofagus cunninghamii* (Fagaceae), *Bedfordia salicina*, *Olearia argophylla* (Asteraceae), *Pomaderris apetala* (Rhamnaceae), and *Prostanthera lasianthos* (Lamiaceae) but devoid of eucalypts except for *Eucalyptus regnans* on steep and well-drained sides of gullies. Wet sclerophyll forests are on either Permian mudstones with *Eucalyptus obliqua* as the dominant tree species, or dolerite deposits at somewhat higher elevations (600–800 m), dominated by *E. delegatensis*. The understorey species include the species of the gully communities mentioned above, plus the myrtaceous shrubs *Leptospermum scoparium* and *L. lanigerum*, the wattles *Acacia verniciflua* and *A. dealbata* (Mimosaceae), *Pultenaea juniperina* and *Oxylobium ellipticum* (Fabaceae), and *Olearia phlogopappa* and *O. viscosa* (Asteraceae). Dry sclerophyll forests, on dolerite at elevations up to 500 m, have *Eucalyptus viminalis* and *E. pulchella* as the dominant tree species. These forests are less productive of fungi than wet sclerophyll, except for certain wet gullies within these basically dry environments, such as Cartwright Creek that drains the otherwise dry sclerophyll habitat of Mt Nelson, an eastern outlier of Mt Wellington proper. Triassic sandstone outcrops at middle elevations (600–750m) were also sparsely productive of fungi. Other environments on Mt Wellington including the treeless highest zone (1220–1270 m), the montane woodlands on dolerite (1100–1220 m) dominated by stands of *Eucalyptus coccifera*, and the dolerite zone from at 800–1100 m dominated by *Eucalyptus urnigera*, *E. coccifera* and *E. johnsonii* forests yielded relatively few collections.

Collections were also made at sites on the Tasman Peninsula (Cape Pillar Track 43°10'S 147°56'E, Fortescue Bay 43°09'S 147°57'E, Pirates Road 43°04'S 147°53'E), Forestier Peninsula (McGregors Peak 42°58'S 147°56'E), Sandspit River Forest Reserve (42°42'S 147°51'E) and South Bruny Island (43°22'S 147°18'E). Several localities in various wet forests to the south and west of Geeveston (43°10'S 146°55'E) were regularly visited, as well as several sites in and around Mt Field National Park (42°41'S 146°42'E), west of Hobart. One

oldgrowth rainforest plot, situated near the Little Florentine River (42°44'S 146°25'E) in Tasmania's south-west, was also visited as part of the survey.

The sites not on Mt Wellington were always wet sclerophyll sites with plant communities similar to those of the wet sclerophyll forests or gully communities of Mt Wellington. Generally, the elevations range from sea level to c. 500 m above sea level. The site at the Little Florentine River has a remnant rainforest, with *Nothofagus cunninghamii*, *Atherosperma moschatum* (Monimiaceae), *Anopterus glandulosus* (Escalloniaceae), and other rainforest species being dominant, with an almost total absence of species of *Eucalyptus*.

Collections

A.V. Ratkowsky made a large number of the collections between 1994 and 1996. Following her death in November 1996, D.A. Ratkowsky has made additional collections, either alone or, since April 1998 in the company of G. Gates. The collections of *Cortinarius* and allied genera were described, dried and stored at the Ratkowsky residence in Hobart. Descriptions and copies of photographic prints and slides, and samples of dried fruit bodies were sent to B. Gasparini at Trieste who identified them and prepared detailed descriptions. Macrochemical reactions reported were made on dried specimens. Holotype collections of taxa described in this series of papers are lodged in the Tasmanian Herbarium (HO), while isotype or paratype collections have been sent variously to the Herbarium of Oslo Botanical Museum (NO) or National Herbarium of Victoria (MELB) or retained in Herbarium Gasparini.

Material for microscopic examination was revived in 4% KOH. Microscopic characteristics were described and measured from material mounted in demineralised water. Measurements are the average of at least 25 measurements per collection, the range and standard deviation was also calculated for length (L), breadth (B) and their ratio L/B, with some extreme measures shown in brackets. Colorants used for contrast were Melzer's solution, Congo Red in ammoniacal solution, aqueous cresyl blue, and cotton blue in lactophenol. Spores of a few particularly interesting specimens were scanned with SEM in golden/palladium coating.

Taxonomy

Much work still needs to be done to assign a systematic position to Australian fungal taxa, and this is especially true of the Cortinariaceae. Tentative phylogenetic relationship has been suggested for *Dermocybe* and *Cortinarius* of the Northern Hemisphere (Høiland & Holst-Jensen 2000, Liu *et al.* 1997). A clearer understanding of the relationships between some taxa of *Cortinarius* in the Southern and Northern Hemispheres has been attempted recently by Chambers *et al.* (1999). Yet for many taxa the relationship is far from being clear. We have mostly maintained the classification proposed by Moser & Horak (1975) and Singer (1986).

Genus *CORTINARIUS* (Pers.: Fr.) Fr.

The subgeneric classification of *Cortinarius* has been reviewed recently by Singer (1986), Liu *et al.* (1997), Høiland & Holst-Jensen (2000), and Seidl (2000). Subgenus *Cortinarius* in this paper is used in the sense of Brandrud (1983), Moser (1987), and Singer (1986) but not Brandrud *et al.* (1990).

Subgenus *Cortinarius* (Pers.) S.F. Gray

Pileus fibrillose and/or squamulose, dry; basidiospores ellipsoidal, amygdaliform, ovoid or subglobose, sometimes showing a more or less distinct suprahilar plage; cheilocystidia almost always present; pleurocystidia and caulocystidia often present; epicutis trichodermal, sometimes with pileocystidia, of broad hyphae. Basidiomata containing a violet coloured vacuolar pigment, a 1:2 Feⁱⁱⁱ-catechol complex with a β -dopa ligand, from the shikimate-chorismate pathway.

1) *Cortinarius austroviolaceus* Gasparini *sp. nov.*

Etymology: from 'austro' meaning from the south, with violaceus meaning similar to *C. violaceus* (L : Fr.) S.F. Gray.

Illustration: Plate 1. Front cover.

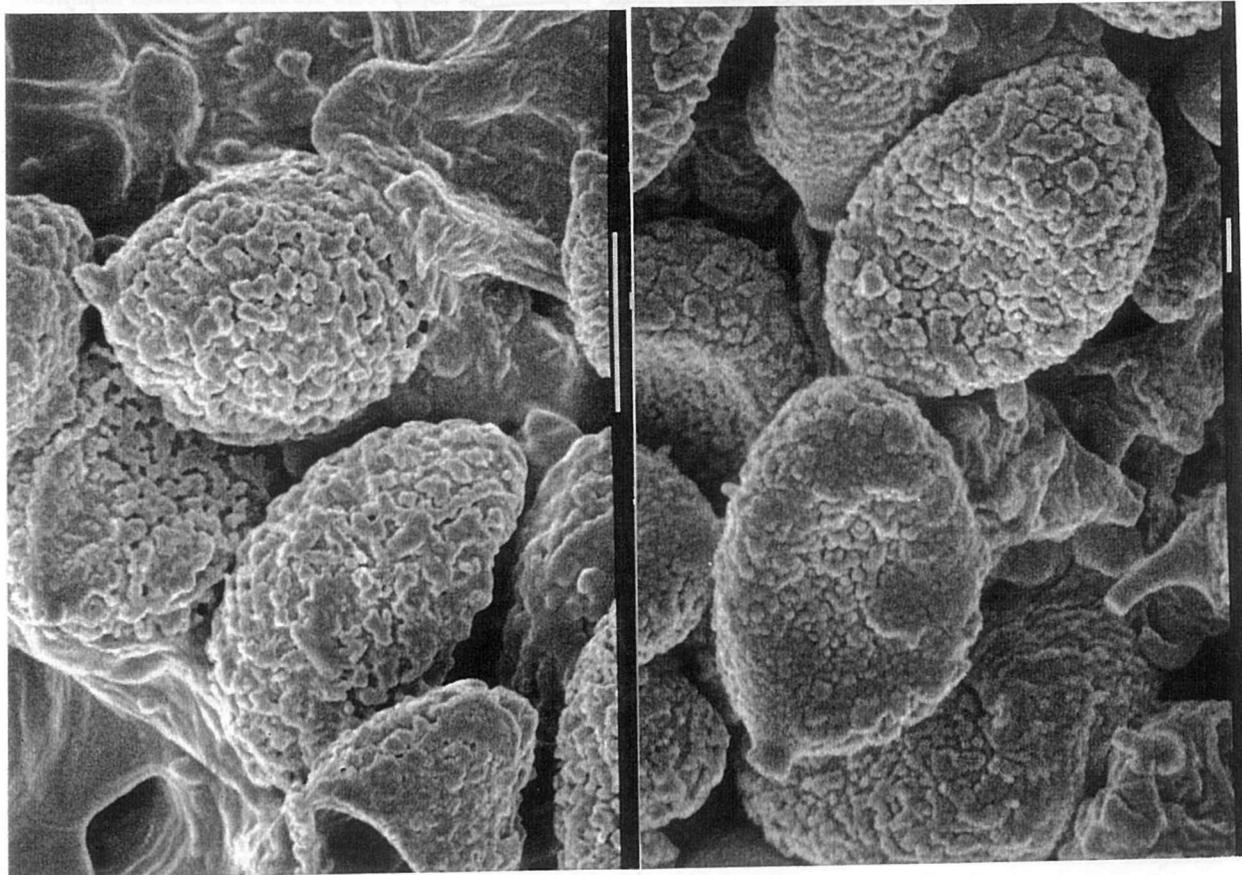
Pileo usque ad 80 mm lato, primum hemisphaerico, deinde plano-convexo, demum depresso, levi umbone obtuso praedito. Cuticula sicca, in iuventute subtiliter fibrillosa, deinde levi, numquam squamosa vel squamulosa, obscure violacea, in senectute brunneola. *Lamellis* fragilibus, confertioribus (L = 50–60), crassis, brevibus, adnatis deinde emarginatis, dilute violaceis deinde violaceo-rubiginosis. *Stipite* usque ad 90 mm longo, 15 mm crasso, subcylindraco vel leviter clavato, fibrilloso, violaceo. *Cortina* violacea. *Carne* griseo-violacea. Ope KOH cuticula roseam reactionem praebet. *Sporis* (6.7) 8.2–9.4 (9.7) \times (4.5) 5.1–5.9 μ m, Q = 1.5–

1.7, flavis in H₂O, in KOH rubescentibus, ellipsoideis vel subamygdaliformibus, sub microscopio optico levissime verrucosis, sed microscopio electronico confertissimis sub-labyrinthiformibus verrucis ornatis; zonam suprailearem circumscriptam numquam vidimus. *Basidiis* (2) or 4-sporigeris pariete rugulosa, clavatis, (26) 33–37 × 7.5–9.0 μm, cheilocystidiis lageniformibus vel ampullaceis, basi (sub)sphaerica, diam. 17 μm, angusto collo curvato, 22–24 μm longo, capitato, capite frequenter incrustato; pleurocystidia non vidimus; trama lamellarum regulari vel pseudoparenchymatica; epicute ex hyphis confusis 4.5–5.7 μm et raris hyphis terminalibus lanceolatis constituta, subcute subpavimentosa, hyphis polygonalibus vel (sub)globosis.

Habitatio in locis humidis sub *Eucalypto obliqua*. *Holotypus* Tasmania, Mt. Wellington, 22.v.1997, D.A. Ratkowsky, No. 508907, in HO conservatur, hic designatus.

Habit small to middle-sized cortinar, blue-violaceous in every part. *Pileus* to 80 mm (but mostly 40–60 mm) diam., subglobose in youth, later convex, plane, irregularly plane or even depressed, umbo flat. *Cuticle* originally fibrillose, later smooth, dry, not deep violaceous, but especially in old age permeated with dark brown. *Lamellae* fairly close (L = 50–60), fragile, shallow, thickly textured, adnate then emarginate, dull violaceous then rusty violet, lamellae edge partly fertile. *Stipe* to 90 × 15 mm, slightly clavate or equal, fibrillose, violaceous. *Cortina* violet. *Context* dull violaceous. *Chemical tests*: NH₄OH leaches out a red pigment, KOH on cuticle pink.

Basidiospores ellipsoidal or subamygdaloid, (6.7) 8.2–9.4 (9.7) × (4.5) 5.1–5.9 μm, L/B = 1.5–1.7, yellow in H₂O, reddening in KOH, appearing finely verruculose under the light microscope, clearly verrucose under SEM, warts shallow, very crowded, sub-labyrinthiform (Høiland 1983, type 1), plage absent, germ pore absent, not dextrinoid. *Basidia* (26) 33–37 × 7.5–9.0 μm, sub-cylindrical, (2) or 4-spored, walls rugulose. *Cheilocystidia* 20–42 × 10–17 μm, in groups, sometimes lageniform, capitate, tibiform, often ampullaceous with a large round base to 17 μm diam., neck 22–24 μm long, thin, incurved, capitate and often encrusted. *Pleurocystidia* not evident, perhaps some, cylindrical or filamentous, exceeding basidia by c. 5–7 μm. *Caulocystidia* not seen. *Trama* regular, of cylindrical to elliptical hyphae 45–52 × 9–22 μm. *Epicutis* trichodermal, hyphae 4.5–5.7 μm diam., entangled, occasionally with lanceolate terminal cells. *Hypodermium* with paving profile, hyphae polygonal or globulose. *Clamp connections* present.



A.

B.

Figure 1. SEM photographs of basidiospores of A. *C. violaceus* and B. *C. austroviolaceus*. Scale bars: A = 5 μm, B = 1 μm.

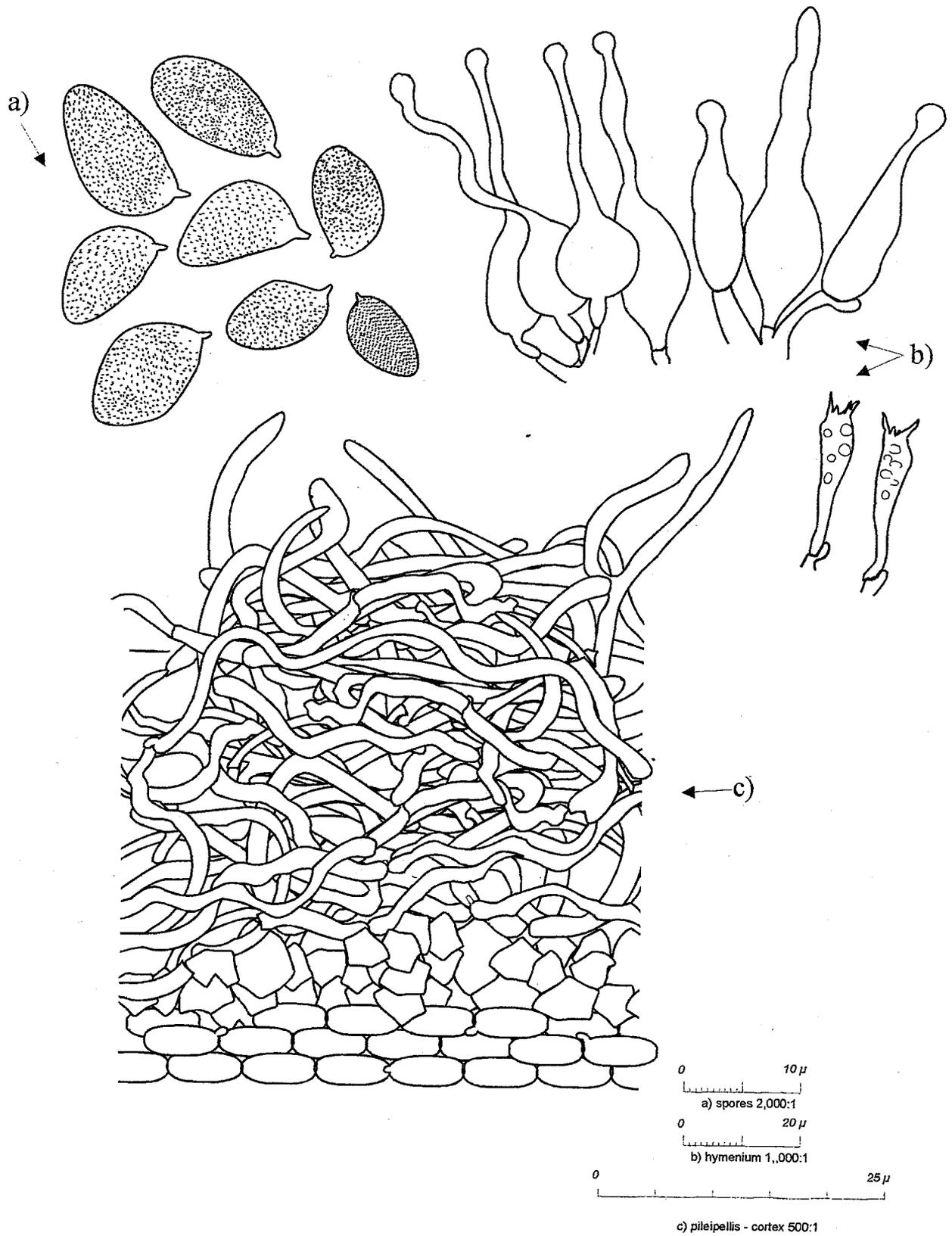


Figure 2. *Cortinarius austroviolaceus*. a. basidiospores, b. basidia and cheilocystidia, c. cuticle.

Holotype Tasmania, Mt Wellington, Old Farm Road, 22.v.1997, D.A. Ratkowsky, No. 508907 in HO (syntype N. 72987 in Oslo), under gorse (*Ulex europaeus*), but with *Eucalyptus obliqua* as dominant.

Other collections examined: Mt Field National Park, Falls Track, A.V. Ratkowsky, 21.v.1995, in wet sclerophyll with *Eucalyptus regnans* dominant; Mt Wellington, Old Farm Trail, G. Gates, 20.v.1998; under *E. obliqua*; Mt Wellington, Old Farm Road, G. Gates, S. McMullen-Fisher, G. Collins & D. Ratkowsky, 13.iv.1999, under *E. obliqua*; Mt. Wellington, Fern Tree, D.A. Ratkowsky & G. Gates, 4.v.1999, under *E. obliqua*; Mt Wellington, Fern Tree, near St Raphaels church, G. Gates & D.A. Ratkowsky, 20.v.1999, with *E. obliqua* dominant.

A collection of superficially similar fruit bodies from Cape Pillar Track (D.A. Ratkowsky & G. Gates, 29.v.1999) has smaller basidiospores and different cheilocystidia and may be another species.

Remarks: The comparatively smallish size, the pileus smooth fibrillose not squamulose or squamose as in *C. violaceus* (L : Fr.) Fr., the absence (or inconspicuous presence) of pleurocystidia, and absence of a suprahilar plage distinguishes this species from *Cortinarius violaceus* (L : Fr) S.F. Gray as well as other described species of this group. Interesting also are the cheilocystidia of characteristic ampullaceous or lageniform shape, nearly always capitate and the spores, by far the smallest found to date in the group, with low but distinct labyrinthiform warts. As can be noted from the SEM photograph, no evident plage or even noticeable thinning in the density of the warts is present on the basidiospores. However, *C. austroviolaceus* like all members of the *C. violaceus* group, possesses the same violaceous pigment, soluble in water and turning red with ammonia. Also the cuticular structure is similar, although macroscopically it is described as smooth or at most fibrillose in youth. In consideration of the ecological environments of the areas where the various collections were made, an association with species of *Eucalyptus* is presumed.

Bougher & Syme (1998) have described a similar species collected amongst litter in eucalypt forests in Western Australia. We therefore believe it to be a different species from the present one. Having carried out a molecular ITS analysis, Chambers *et al.* (1999) have suggested Bougher & Syme's material is not conspecific with Northern Hemisphere *C. violaceus*. We have not examined any of Bougher's collections, but we have no reason to doubt that the reported features are correct. Indeed the macroscopic and microscopic features of the Western Australian material resemble those of *C. atroazulinus* Moser, that was collected from under *Nothofagus* in New Zealand. According to Moser (1987) the microscopic characters (cheilocystidia absent, pleurocystidia rare) cast doubt whether *C. paraviolaceus* Moser belongs to the *Cortinarius violaceus* group.

Discussion

One of the peculiarities of this group is the violet coloured vacuolar pigment. Nussbaum *et al.* (1998) recently determined the structure of this compound. It is found to be constituted of a unique iron ink pigment (with (R)- β -dopa as the ligand of the 1:2 Fe^{III}-catechol complex) of the chorismate-shikimate pathway, derivatives from pulvinic acid. Pigments of this group (including L-dopa and derivatives of the phenoalanines) are widely distributed in nature (Steglich 1980). In the Agaricales *s. lat.* they are found in species of *Agaricus*, *Amanita*, *Hygrophorus* and *Hygrocybe*, but never before in Cortinariaceae.

The considerable diversification of species of subgenus *Cortinarius* in the South Pacific area (Moser 1987), as opposed to the comparatively few species elsewhere, suggests that this is a group of Gondwanan and possibly ancient origin. Molecular research (Chambers *et al.* 1999, Høiland & Holst-Jensen 2000, Liu *et al.* 1997) has indicated that *C. violaceus* and hence possibly the whole subgenus is the most extreme taxon amongst all the *Cortinarius* examined, thus supporting the hypothesis of a very ancient separation from other *Cortinarius s. lat.* This may lead mycologists one day to restrict the genus to this group only. In this case all other *Cortinarius* would have to be recombined into one or more other genera. In the opinion of Høiland & Holst-Jensen (2000), *Dermocybe* is a monophyletic taxon, but, using it as a segregate genus, would render the other *Cortinarius* paraphyletic. Liu *et al.* (1997) found subgenus *Cortinarius*, though somewhat proximate to *Dermocybe*, outside the *Cortinarius* phylogenetic frame. However, Seidl (2000) found the subgenera *Dermocybe* and *Cortinarius* nested within *Cortinarius*.

Key to described taxa of *Cortinarius* subgenus *Cortinarius* from Australasia and Malesia

- | | |
|--|-------------------------------------|
| 1. Average basidiospore length more than 10 μ m, cheilocystidium apex not capitate | 2 |
| 1: Average basidiospore length less than 10 μ m, cheilocystidium apex often capitate | |
| | <i>C. austroviolaceus</i> Gasparini |
| 2. Basidiospores with clearly visible perisporium | <i>C. subcalyptrosporus</i> Moser |
| 2: Basidiospores without visible perisporium | 3 |

3. Basidiospores often with distinct plage.....	4
3: Basidiospores without plage	6
4. Cheilocystidia absent, pileocystidia none.....	<i>C. paraviolaceus</i> Moser
4: Cheilocystidia and pileocystidia present.....	5
5. Basidiospores 10.5–16 × 7.5–8.5 µm, cheilocystidia 35–80 × 15–25 µm.....	<i>C. violaceus</i> (L. : Fr.) S.F. Gray
5: Basidiospores 9.2–11.8 × 6.5–8.0 µm, cheilocystidia 50–140 × 10–25 µm.....	<i>C. atroviolaceus</i> Moser
6. Basidiospores 9.0–12.5 × 5.5–6.5 µm, cheilocystidia 45–70 × 12–20 µm, under <i>Nothofagus</i>	<i>C. atrolazulinus</i> Moser
6: Basidiospores 10.5–13.5 × 5.5–7.5 µm, cheilocystidia 65–95 × 7.0–16 µm, under <i>Eucalyptus</i>	<i>C. violaceus sensu</i> Bougher & Syme (1998)

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