SOME AGARICS OF THE KOSCIUSZKO NATIONAL PARK

A.E.Wood

School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, 2052, New South Wales, Australia

Abstract

Some members of the Agaricales that have been collected in the alpine areas of the Kosciuszko National Park in New South Wales are reported. *Amanita griselloides*, *Galerina oreophila* and *Galerina tibiiformis* have been described previously. *Cystoderma amianthinum*, *Hypholoma* aff. *elongatum* and *Pholiota* aff. *henningsii* are reported for the first time.

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Introduction

While the general picture of Australia is of an arid continent, there are significant areas of alpine vegetation. One of these areas is the Kosciuszko National Park, in the Snowy Mts, south of Cooma in New South Wales. The flora of this park has been well studied, particularly the outstanding *Kosciuszko Alpine Flora* by Costin, Gray, Totterdell & Wimbush (1979). There has not been any similar publication on the larger fungi, and this paper is a small contribution to this process. The area chosen is the alpine area above the tree-line (1830 m), which seems the most convenient mycological border, as it excludes all ectomycorrhizal fungi that are associated with the roots of the various species of *Eucalyptus* that are found in the subalpine areas. Anecdotal evidence suggests that in some seasons there are large numbers of *Cortinarius* species found under these eucalypts.

The alpine vegetation consists of short and tall heath, short and tall alpine herbfield and feldmark, with considerable areas of fen and bog. Within the Family Myrtaceae, the few members present are *Kunzea muelleri* Benth., *Baeckea gunniana* Schauer and *Baeckea utilis* F.Muell. ex Miq. The latter two species are found in wetter areas and along streams, while the first species is more extensive and in some areas within heathlands it is often the dominant species. It would be expected that the *Kunzea* species would be most likely to have ectomycorrhizal species associated with its roots. Since this has not been found to be the case so far, it raises some questions as to the significance of ectomycorrhizae in these locations. This is in clear contrast to the experience in the northern hemisphere where dwarf *Salix* is a very important partner for a whole range of fungi (Favre 1955, 1960).

The alpine areas of the northern hemisphere have been explored much more extensively. The basic work was that by Favre (1955, 1960) that was followed by a series of Arctic and Alpine Conferences (Laursen & Ammirati 1982, Laursen *et al.* 1987, Petrini & Laursen 1993) which, together with continuing work from various taxonomists, has resulted in the alpine flora being more well-known than that of the southern hemisphere. It will be interesting to discover which species are cosmopolitan over both areas.

The present report arises out of a project to study the alpine fungi of the Kosciuszko National Park. This involved irregular collecting in the area in autumn over the 20 year period 1982–2002. Most collections were made in areas above Charlottes Pass in heath or bog sites. The collections were made at some time during the period from late February to late March. These visits usually lasted about ten days in the respective years and have resulted in a significant number of collections being made, and a significant number of repeat collections over several years. However, it should be noted that larger fruit bodies were rare under these conditions. Finally, it is clear that this sample does not represent the total flora and more long-term collecting is needed.

Materials and Methods

Material was mounted in 5% KOH solution and stained with Congo Red. To study chrysocystidia, material was mounted in 0.1% aqueous Patent Blue solution. The collections were made in the area around Charlottes Pass in

the Kosciuszko National Park (36°27'S, 148°20'E). Specimens are housed in the J.T. Waterhouse Herbarium, University of New South Wales (UNSW). The collections at UNSW all have extensive detailed field notes and are mostly accompanied by colour photographs taken under standard conditions.

Spore shapes are those proposed by Bas (1969): Q = 1.00–1.05 globose; 1.05–1.15 subglobose; 1.15–1.30 broadly ellipsoidal; 1.30–1.60 ellipsoidal; 1.60–2.00 elongate; 2.00–3.00 cylindrical, where Q represents the mean length:breadth ratio. Spore measurements indicate the range of sizes found in the various collections.

Nomenclature for the shapes of spores and cystidia follows that set out in the introduction of the Flora Agaricina Neerlandica (Vellinga 1988) and Josserand (1983). The generic concepts follow Singer (1986).

The figures show the microscopic features at standard magnifications: spores ×2000, cystidia and basidia ×1000. The scale bar represents 10 μm at ×2000 magnification. Measurements of the spores exclude the apiculus.

Species examined

Amanita griselloides D.A.Reid, *Victorian Naturalist* 95: 47 (1978)
Collections of this species from New South Wales have been described in detail by Wood (1997).

Material examined: Kosciuszko National Park, near Charlottes Pass, alpine heath, 15.ii.92, *A.E. Wood & A. Stricker* UNSW 92/21; 92/22.

Notes: This species has a very wide distribution within New South Wales, in eucalypt forest around Sydney and further north into wetter forests, with some collections around Sydney being under *Allocasuarina littoralis* (Salisb.) L.A.S. Johnson. So while most of those collections were presumed to be in association with *Eucalyptus* spp., this was not the only putative mycorrhizal partner and several others were present. These collections were made in heath under *Kunzea muelleri* in an almost pure stand beside one of the creeks running off from the upper Snowy River.

Cystoderma amianthinum (Scop.) Konrad & Maublanc, *Icones Selectae Fungorum* 3: 2 (1927)
Pileus to 1.5 cm diam., conical to convex or a little flatter, pale buff or slightly pale apricot, not pellucid striate, covered with fine granules that are the same colour over the whole surface, particularly in young specimens; margin sometimes with fine white appendiculate velar remains. *Lamellae* narrowly adnate, thin, fairly crowded, with one series of lamellulae, pure white. *Stipe* to 3 × 0.4 cm, firm, equal, solid, buff to pale buff, with a small membranous, or sometimes more irregular ring, finely squamulose and granulose below, the granules the same colour or a little darker towards the base.

Spores 5.7–6.6 × 3.0–3.6 μm, Q = 1.79–1.96, white, amyloid, thin-walled, without germ pore. *Basidia* four-spored. Without visible cystidia. *Pileal cuticle* of ±globose thin-walled cells, 25–30 μm diam.

Material examined: Kosciuszko National Park, near Charlottes Pass, alpine heath, beside walking track among mosses, 11.iv.82, *A.E. Wood et al.*, UNSW 82/76; same locality, habitat and collectors, 2.iv.83, UNSW 83/300; same locality and habitat, 29.ii.96, *A.E. & J.E. Wood*, UNSW 96/3.

Notes: These collections seem to fit well within the descriptions of the species from the northern hemisphere (see Breitenbach & Kränzlin 1995, Moser 1983). Their descriptions note a considerable variation of the cap colour, which have sometimes been recognised as a distinct series of varieties (see Bon 1999). All of these leave our collections well within the concept of the species. This should be compared with *Cystoderma muscicola* (Clel.) Grgur. (see Grgurinovic 1997) which has the same colours but with distinctly larger spores—both longer and broader (5.8–8.2 × 3.6–4.8 μm, Q = 1.6), and which should be regarded as a different species unless further collections show that the sizes of the spores intergrade.

Favre (1955) reported this species from alpine areas of Switzerland, and noted that it was more common in subalpine areas. Since all the local collections were made alongside roads or tracks, it raises the question whether it may have been introduced. If it was introduced from road materials, this could only have come from subalpine areas within the National Park and it should be regarded as a naturally occurring species.

Galerina oreophila A.E. Wood, *Australian Systematic Botany* 14: 638 (2001)
Collections of this species from New South Wales have been described in detail by Wood (2001).

Material examined: Kosciuszko National Park, near Charlottes Pass, alpine bog with moss, 9.iv.82, *A.E. Wood et al.*, UNSW 82/69; 82/71; 27.ii.84, UNSW 84/431; same location, *A.E. & J.E. Wood*, 5.iii.96, UNSW 96/9; 96/9a; 96/11.

Notes: Most of the collections of this species have been found in alpine areas, but some other locations have been recorded. It is close to *Galerina nyula* Grgur. (see Grgurinovic 1997), but seems clearly distinct (see Wood 2001). It is also close to *Galerina hypnorum* (Schrank : Fr.) Kühner as it is now understood, but earlier records of this species in Australia have been mostly found to represent other species. That species has slightly smaller, narrower spores which are less strongly ornamented and cystidia that are somewhat more narrowly fusiform or lageniform.

Galerina tibiiformis A.E. Wood, *Australian Systematic Botany* 14: 624 (2001)
Collections of this species from New South Wales have been described in detail by Wood (2001).

Material examined: Kosciuszko National Park, near Charlottes Pass, alpine *Sphagnum* bog, 4.iii.96, *A.E. & J.E. Wood*, UNSW 96/7; 28.ii.00, UNSW 00/1; 00/4; 00/5; 29.ii.00, UNSW 00/7; 00/8; 00/9; 00/10.

Notes: *Galerina tibiifomis* has only been found in alpine areas and is very distinctive because of the habitat among *Sphagnum* and the abruptly capitate cystidia.

Hypholoma* aff. *elongatum (Pers. : Fr.) Ricken, *Blätterpilze* 250, 1912. Fig. 1. a–c
Pileus to 1.5 cm diam., rounded conical to convex or expanded with age, smooth, dry, not pellucid-striate, various shades of buff to a little warmer with peach or apricot shades. *Lamellae* narrowly adnate, thin, crowded, one or two series of lamellulae, pale milk coffee to pallid grey-brown, margin the same colour; lamellae when dry dull buff to dull pallid ferruginous. *Stipe* to 3 × 0.2 cm, equal, firm to a little tough, dry, off white to pale colour of cap, smooth, with fine white partial veil when young, soon disappearing and leaving no trace.

Spores 9.3–12.3 × 6.3–7.5 µm, Q = 1.60–1.66, ovoid, smooth, wall distinctly thickened, with small distinct apical pore, pale golden ferruginous, inner wall line seems reddish (in KOH). *Cheilocystidia* mostly abundant, fusiform to lageniform, chrysocystidia (40–45 × 10–15 µm) with prominent amorphous contents that stain blue in Patent Blue; also with some narrower leptocystidia which have dense yellowish contents in KOH and do not stain blue with Patent Blue. *Pleurocystidia* similar (30–50 × 10–15 µm) fusiform to lageniform, with staining amorphous central granule, also with some narrower leptocystidia with dense yellow contents which do not stain. *Pileal cuticle* of broadly interwoven hyphae, 6–10 µm wide, with a narrow layer below with subcellular to subglobose cells 20–30 µm wide and broadly cylindrical cells below.

Material examined: Kosciuszko National Park, Charlottes Pass, Stilwell Creek, bog with *Sphagnum* sp., 5.iii.96, *A.E. & J.E. Wood*, UNSW 96/10, 12, 12a, 12b.

Notes: This is clearly related to *Hypholoma elongatum* (see Noordeloos 1999 as *Psilocybe*) in that chrysocystidia are present, the veil is only present in young stages, there are no greenish colours seen in the pileus which is buff/peach and the spores are relatively large (>10 µm) and not amygdaliform. This is part of the species complex, with the spores appearing to match well, but the presence of leptocystidia with dense yellow contents, in addition to the chrysocystidia seems distinctive. Habitat and spore size is also distinctive when compared with other related species (see Breitenbach & Kränzlin 1995), as it is one of few *Hypholoma* species associated with sphagnum. There appear to be no reports of this species from Australia (May & Wood 1997).

Pholiota* aff. *henningsii (Bres.) P.D. Orton, *Transactions of the British Mycological Society* 43: 180 (1960). Fig 1, d–f.
Pileus to 1.5 cm diam., rounded conical to convex, occasionally more expanded with age, smooth, dry, hygrophanous, vaguely pellucid-striate, orange honey colour to pallid buff or buff-brown. *Lamellae* broadly adnate, thin, crowded, with two series of lamellulae, dull cream at first then pallid greyish brown with a vague reddish hue, margin the same colour, dry lamellae ferruginous to dull ferruginous. *Stipe* to 3 × 0.2 cm, equal,

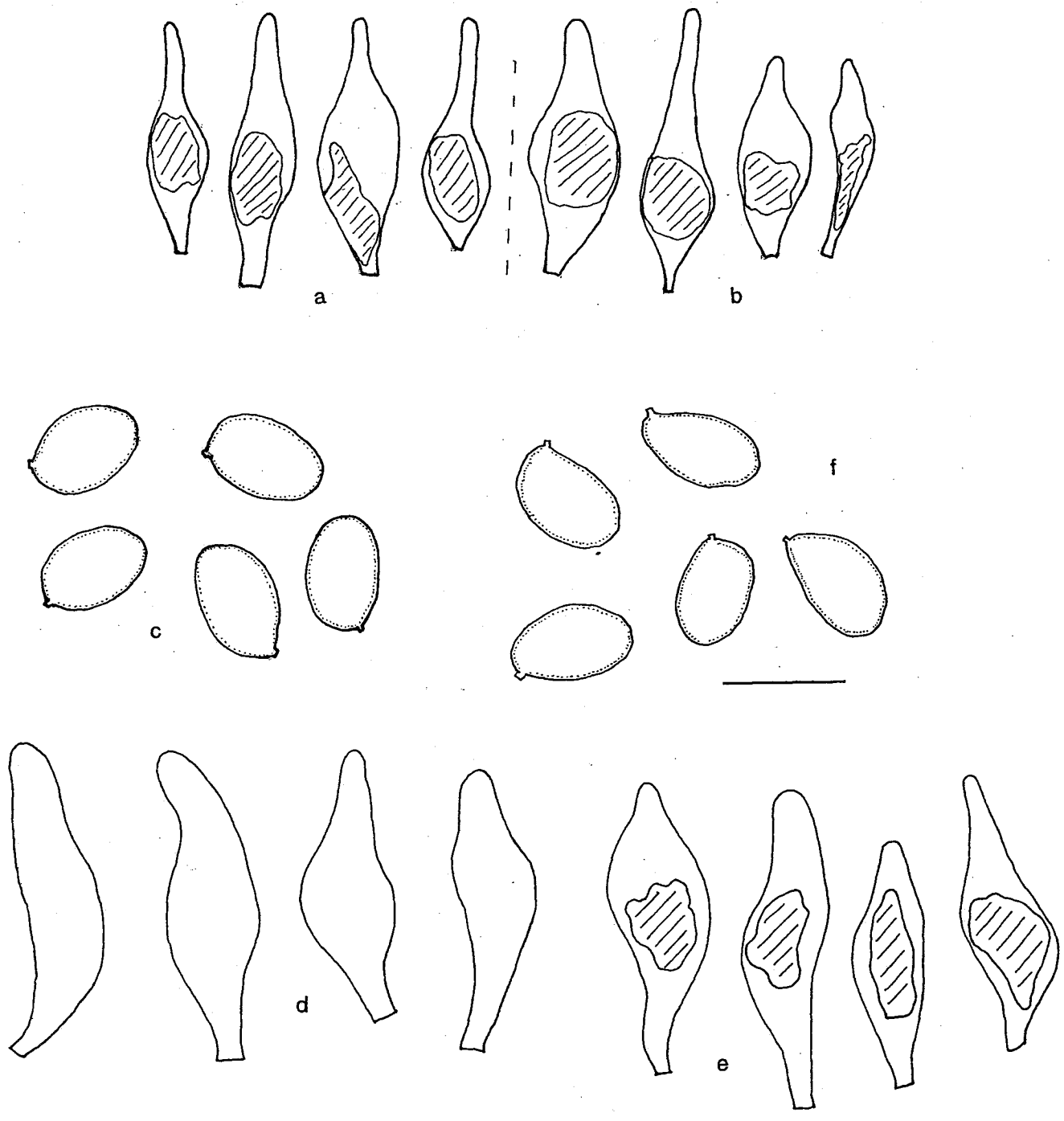

Figure 1 *Hypholoma* aff. *elongatum* (UNSW 96/10) a–c; a cheilochrysocystidia; b pleurochrysocystidia; c *spores*; *Pholiota* aff. *henningsii* (UNSW 82/64) d–f; d cheiloleptocystidia; e pleurochrysocystidia; f spores; scale bar a, b, d e, = 20 µm, c, f = 10 µm.

fairly firm, smooth, with very fine white cortina when very young, at maturity with only a few vague irregular silky white fibrils, the same colour as the cap or somewhat paler.

Spores 10.5–12.0 × 6.3–7.5 µm, Q = 1.55–1.70 ovoid to vaguely elliptic, smooth, pale golden to ferruginous, wall slightly to distinctly thickened, with vague reddish hue at the inner wall line (in KOH), with a fairly indistinct apical pore. *Cheilocystidia* mostly plentiful, mostly of fusiform or narrowly lageniform leptocystidia with dense yellow contents (40–55 × 10–15 µm), often also with some or many lageniform chrysocystidia, of fairly similar outline, but with median amorphous contents which stain blue in Patent Blue (40–50 × 14–18 µm). *Pleurocystidia* mostly a mixture of chrysocystidia and leptocystidia, similar to those found on the margin; in

some cases chrysocystidia were rare, but a few were always present. *Pileal cuticle* of interwoven pale golden thin-walled hyphae with diameter 8–10 µm, with subcuticular layer of more broad, cylindrical hyphae with a diameter of 10–12 µm, but not subcellular.

Material examined: Kosciuszko National Park, near Charlottes Pass, alpine bog beside road, 9.iv.82, *A.E. Wood et al.*, UNSW 82/64; 82/65; same locality, alpine bog, 1.iv.83, *A.E. Wood et al.*, UNSW 83/295; 83/296; Kosciuszko National Park, Charlottes Pass, Stilwell Basin, alpine bog with *Sphagnum* spp., 29.iii.91, *A.E. Wood*, UNSW 91/7; same site, 1.iii.96, *A.E. & J.E. Wood*, UNSW 96/4, 96/5.

Notes: Only a few species of *Pholiota* are associated with sphagnum. These collections have some similarities with *Pholiota henningsii,* but that species is much larger, has smaller spores and lacks chrysocystidia (see Jacobsson 1992, Noordeloos 1999). *Pholiota privigna* (Speg.) Singer *in* Dennis has some similarities, but the cystidia are differently shaped and have distinctly thickened walls. *Pholiota myosotis* (Fr. : Fr.) Sing. looks quite similar, but has a viscid pileus with olivaceous colours and larger spores. More collections are needed to allow the significant very large variation in the frequency of the various cystidial types to be assessed. Two other collections (UNSW 82/63; 82/67) have distinctly larger spores and seem clearly distinct.

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