A NEW SPECIES OF *GYMNOPILUS* FROM NORFOLK ISLAND

B.J. Rees[1] and H. Lepp[2]

[1] *School of Biological Science, University of New South Wales, UNSW, SYDNEY, 2052, N.S.W., AUSTRALIA.*
[2] *P.O. Box 38, Belconnen, A.C.T. 2616, AUSTRALIA.*

Abstract

Gymnopilus norfolkensis, a new species of *Gymnopilus* P. Karsten subgenus *Annulati* Hesler is described from old stumps of *Araucaria heterophylla* (Norfolk Island Pine) and from woodchips of *Psidium cattleianum* var. *cattleianum* (Cherry Guava) on Norfolk Island. In common with similar species from Australia, South America and North America, the species has dark, purple scales and a well developed, fibrillose annulus which disappears shortly after maturity. It is a robust species in which purple colours persist, the stipe of which is frequently enlarged at the base at maturity.

Introduction

Although the majority of *Gymnopilus* species have colours in the yellow to brown colour range, several have been described as having green or red to purple colours at maturity in the surfaces of the pileus and stipe and also in their flesh. These colours are frequently, but not always, ephemeral, lingering on in the scales of the pileus and at the base of the stipe before disappearing altogether in older collections (Rees & Wood 1996). The taxonomic value of these colours has been questioned by Horak (1977, 1989) but colours are nevertheless useful in determining species if seen in young fruit bodies. The fibrillose annulus, characteristic of these species, is also lost shortly after maturity, resulting in a need for detailed examination of very similar microscopic characters to determine a species' identity.

In Australian species, these purple and green colours mask the presence of the characteristic lemon-gold to rust-coloured styrylpyrone pigments found in most, but not all, species of *Gymnopilus*. Their concentration is highest in very young basidiomata (Gill & Steglich 1987), but is commonly low in the purple-coloured species (Rees & Ye 1999). The chemical nature of the evanescent purple pigments has not been investigated, but Petch (1907) and later Pegler (1986) have suggested their presence may be moisture-related in *Gymnopilus dilepis* (Berk. & Broome) Singer from Sri Lanka.

Singer (1951) described several red to purple-coloured species in his key to *Gymnopilus* section *Annulati* including *G. purpuratus* (Cooke & Massee) Singer. This species name was applied to collections of purple-coloured *Flammula* species in Australia by Cleland & Cheel (1918) and Cleland (1934–1935). *Gymnopilus purpuratus* was first described from tree fern stems of unknown origin in Kew Gardens (Cooke 1889) and was regarded as exotic to Great Britain. Singer (1969) later described the same species in greater detail from Chile. Key features in his description include the purple pileus flesh and the tendancy to develop blue colours when touched or scratched. The species was also described as having warty spores without a plage or suprahilar depression and cheilocystidia which were deep fulvous-brown and resinously encrusted. No information was included regarding pleurocystidia.

Grgurinovic (1997) has renamed Cleland's collections of *Flammula purpurata* from Australia *Gymnopilus mullaunius*, on the basis of the presence of a plage on the spores and the absence of resinously encrusted cheilocystidia. The Kew type of *G. purpuratus* is incomplete as several large fruit bodies illustrated by Cooke (1888) and later Massee (1893) are no longer present. Only two small fruit bodies, one cm or less in diameter, remain. The spores of the type and also Singer's collections of *G. purpuratus* have a small suprahilar depression and plage, and both also possess vesiculose pleurocystidia. The intensity of the resinous encrustations in *Gymnopilus* species tends to fade with time, but faded gold colours are present in the cheilocystidia of the holotype and Chilean collections of *G. purpuratus* but not in the Australian species *G. mullaunius*. The latter species also lacks pleurocystidia.

Similar pink to purple-coloured species of *Gymnopilus* have been described from North America by Peck (1874, 1890, 1904, 1908) and Seidl (1989), from Mexico by Guzmán-Dávalos (1991), from Sri Lanka by Berkeley & Broome (1871) and from Zimbabwe by Høiland (1998). Small variations in colour, spore size and presence or absence of cheilo- and pleurocystidia are frequently used to delimit species. Where possible, comparison of microscopic features of closely related taxa must be carried out side by side on one slide in an attempt to differentiate species. Characters, such as pileus flesh colour when young, are not always documented, and the ephemeral nature of the purple colours and velar remains renders characters prone to misinterpretation and identification difficult.

Gymnopilus norfolkensis is one of approximately 400 collections representing some two hundred species of fungi found on Norfolk Island by Heino Lepp during three visits. The island is a Federal Territory of Australia and lies closer to New Zealand than to New South Wales, Australia. Its mycota is substantially undescribed. Although the flora of both countries is related through Gondwanan connections (Green 1994), New Zealand separated from the Gondwanan land mass earlier than Australia, and has many plant species which do not occur naturally on the Australian continent. Norfolk Island collections of fungi may show similar affinities. *Gymnopilus purpuratus* has not been reported from New Zealand, but material representing two similar taxa, *G. purpureo-nitens* (Cooke & Massee) Pegler and *G. dilepis* are held at PDD. These may be misidentified.

Materials and Methods

Fresh collections of basidiomata were photographed and described following Largent (1977) and Largent *et al.* (1978). Colours were recorded from fresh tissue using Kornerup & Wanscher (1981). KOH (5% W/V) was used to rehydrate tissues for microscopic description with the exception of the pileus tissue which was also rehydrated in water. Aqueous Congo Red (1% W/V) was used for contrast in drawing, and spores were also examined in Melzer's Reagent to determine dextrinoidity. 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.

Results

Gymnopilus norfolkensis B.J. Rees & Lepp, *sp. nov.* (Figure 1, Plate 1.)
Etymology: from Norfolk Island.
Pileus *Gymnopilo purpurato* similis sed squamulis purpureis in basibus brunneo-flavidis, lamellis olivaceo-flavidis, stipite purpurato crasso ad basin saepe ampliato, pleurocystidiis numerosissimis differt.
Holotypus: Norfolk Island, off Anson Bay Rd, near Puppy's Point. In open grassland with occasional shrubs. 29.iv.1995, *H. Lepp, HL 1283* (CANB) hic designatus.

Pileus to 70 mm wide, convex with an incurved margin, covered in purple, erect, short scales (14F4–14F5) over a yellowish brown base, margin pale yellow; dull, dry, not hygrophanous; context pale yellow, 4A3–4A5, reasonably thick; substantial, fibrillose, appendiculate, velar remains present at margin. *Lamellae* adnate, yellow with faint olivaceous tones (4B8–4C8), moderately close, two sets of lamellulae. *Stipe* 40 × 19–26 mm in largest fruit body, 40 × 10–14 mm in others, terete to ventricose to distinctly enlarged at base, concolorous with pileus (14F4–14F5) grading to pale yellow at the apex and 14D6 towards the base; dry and longitudinally striate with fine purple fibrils over the yellow background colour, basal tomentum buff-coloured in exsiccati; hollow in large basidiomata, or with a narrow, hollow central channel in others; a fibrillose annulus, concolorous with the lamellae still persisting in some, but not all, basidiomata.
Odour: of burnt plastic. *Taste*: bitter. *Spore print*: not available.

Chemical tests: 5% KOH on pileus surface turns black (+ve). Lemon-yellow to rust-coloured pigment diffusing from lamella tissue mounted in 5% KOH.

Basidiospores [30/3/2] 6.4–7.2 (–8.0) × 4.0–5.2 (–5.5), (mean = 7.7 ±0.3 × 5.1 ±0.3) µm, *Q* = 1.51, ellipsoidal to ovoid, slightly flattened on one side in profile, light gold, weakly dextrinoid, verruculose, with slightly darker rust-coloured ornamentation, prominent plage present but no germ pore or perisporium. In addition a large proportion of smaller spores 4.0–5.2 × 3.2–4.0 µm, even more weakly dextrinoid and with poorly developed ornamentation, are present in basidiomata at all stages of maturity. *Basidia* 22.0–25.0 × 5.5–7.0 µm, clavate, 1, 2, and 4 spored, sterigmata 3 µm long, many of which are filled with deep gold pigment. *Cheilocystidia* numerous, 15.0–30.0 × 6.0–8.0 µm, utriform to ventricose with a pedicellate base, gradually tapering to a rounded or capitate apex 3–4 µm wide, accompanied by spathulate to saccate forms, hyaline or yellow-brown. *Pleurocystidia* similar to cheilocystidia, abundant and conspicuous because of the uniform, dark rust-coloured, encrusting pigment. These are more numerous towards the base of the lamellae. *Hymenophoral trama* subparallel, consisting of clamped hyphae 3–10 µm wide. *Caulocystidia* absent, only a few marginally capitate to clavate endings on some hyphae. *Pileipellis* a disrupted cutis consisting of clamped, hyaline cells 5–7 (–12) µm wide with slight, colourless encrustation, ending in finger-like, tapering terminal cells. In addition hyphae filled with yellow to olive-green pigment are present which are also lightly encrusted, and brown hyphae 3–10 µm wide, with granular contents. *Clamp connections* present in all tissues.

Habit and habitat: occurring singly or in dense, caespitose clumps at the base of old Norfolk Island pine stumps or on woodchips of cherry guava.

Distribution: Norfolk Island.

Material studied: Norfolk Island, off Anson Bay Rd, near Puppy's Point. 29°01'30"S, 167°55'08"E, 65 m, on old stump of Norfolk Island Pine, *Araucaria heterophylla* (Salisb.) Franco in open grassland with occasional shrubs, 29.iv.1995, *H. Lepp, HL 1283* (holotype: CANB) here designated; Norfolk Island Nat. Pk, Lower Palm Glen, 29°00'50"S, 167°35'08"E, 200 m, on chips of cherry guava (*Psidium cattleianum* Sabine var. *cattleianum* Sabine) in open, grassy area alongside mixed, subtropical rainforest, 16.v.1997, *H. Lepp, HL 1715* (CANB).

Material studied for comparison: *Gymnopilus luteofolius* (Peck) Singer, USA. New York State, Forestburgh, viii.1874, *C.H.Peck* (holotype: NYS). *Gymnopilus mullaunius* Grgurinovic, AUSTRALIA. New South Wales, Mosman, Atholl Gdns, 12.v.1918, *J.B.Cleland, 4895* (AD); Neutral Bay, 26.v.1919, *J.B.Cleland, 4894* (holotype: AD). *Gymnopilus purpuratus* (Cooke & Massee) Singer, ENGLAND. Kew Gardens (holotype: K); CHILE. Llanquihue, Ensenada, 11.v.1967, *R. Singer, M7080* (SGO); -10 km south of Colaco, 9.v.1967, *R. Singer, M6808* (SGO); Valdivia, Hueycolla, 1–4.v.1967, *R. Singer, M6580* (SGO). *Gymnopilus thiersii* Seidl, USA. California, San Mateo County, Wunderlich Pk, 13.iii.1987, *M. Seidl MTS 2291* (holotype: SFSU).

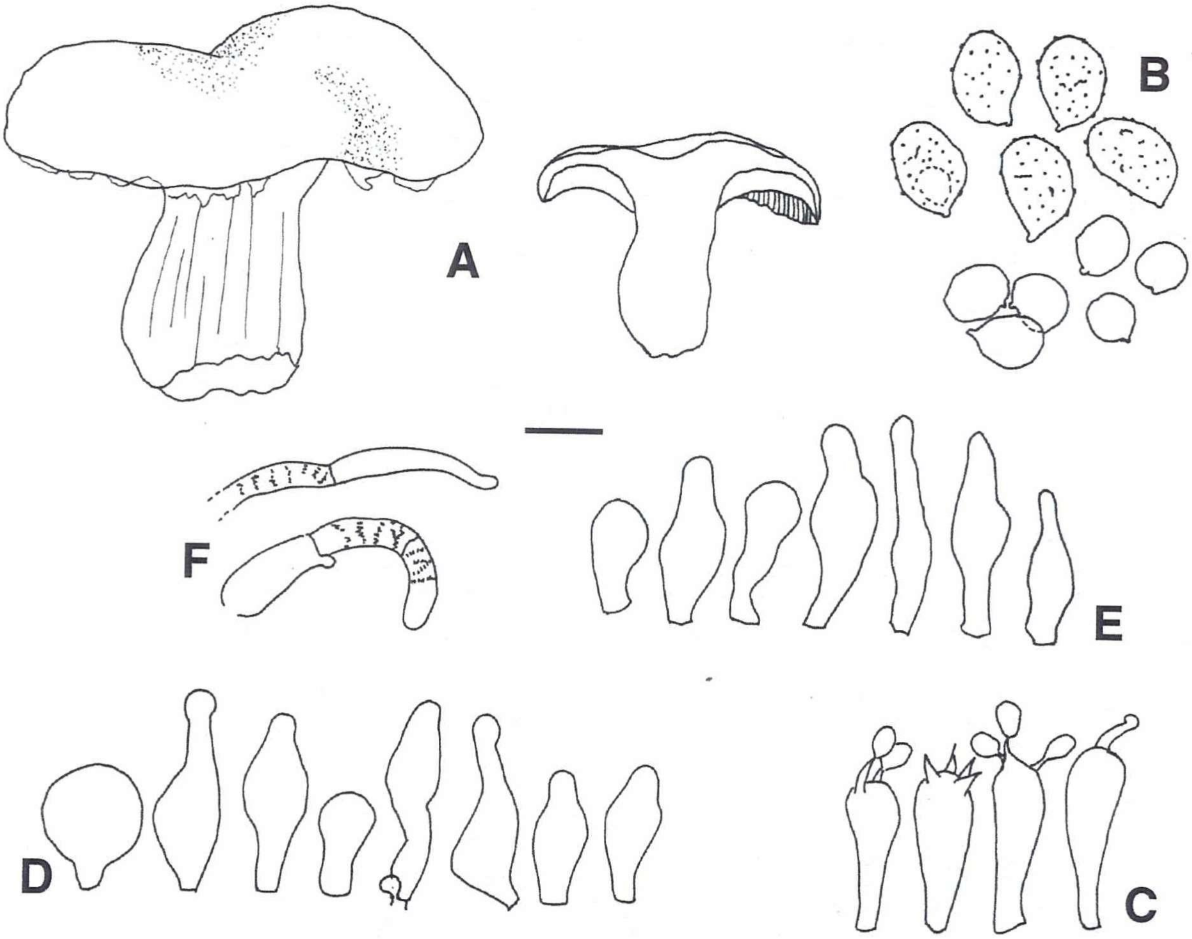
The large, purple pileus with its short tapering warts over a yellow-brown background, and purple stipe with an enlarged base, easily distinguish *Gymnopilus norfolkensis* from other red to purple-coloured *Gymnopilus* species (Plate 1). Microscopically these differences are supported by the marginally smaller size of mature basidiospores, and by the presence of a high proportion of spathulate to saccate cystidia (Figure 1, D & E). Cheilo- and pleurocystidia are extremely numerous and deeply pigmented.

Gymnopilus norfolkensis bears a close resemblance to *Gymnopilus purpuratus* (Cooke & Massee) Singer. Vesiculose pleurocystidia are present in both the Kew type material and in the Chilean collections of the latter species. Singer (1969) has described strongly encrusted, capitate cheilo- and pleurocystidia in *G. purpuratus*, a feature shared with *G. norfolkensis*, but the latter has smaller spores with a larger plage and ventricose to utriform or spathulate cystidia.

Gymnopilus mullaunius, a similar, purple-coloured species described from Australia (Grgurinovic 1997) differs from *G. norfolkensis*, by having a slighter stature and occasional, ephemeral, teal to ink blue colours in the scales during development. The scales in *G. mullaunius* are also smaller and more appressed. Basidiospores are marginally larger in *G. mullaunius* and a well delimited plage is present in both species. Cheilocystidia are smaller overall in *G. mullaunius* and no pleurocystidia have been found. *Gymnopilus moabus* Grgurinovic, another species from Australia originally described by Cleland as *Flammula purpureo-nitens*, has persistent, deep, wine-red colours, and strongly verrucose basidiospores and cylindrical to tibiiform cheilocystidia.

Gymnopilus norfolkensis has no green colours recorded in either pileus or stipe and so cannot be confused with *Gymnopilus aeruginosus* (Peck) Singer, or *Gymnopilus brandlei* (Peck) Singer and the lamellae in these species are much paler. *Gymnopilus luteofolius* (Peck) Singer is perhaps the most similar of the North American species, but has larger, narrower spores and hyaline, more prominently capitate cystidia. The presence of numerous, conspicuous, pigmented pleurocystidia also serves to distinguish *G. norfolkensis* from *G. thiersii* Seidl, *G. purpureosquamulosus* Høiland and *G. subpurpuratus* Guzmán-Dávalos (which also has green colours on the pileus and a greyish white stipe). *Gymnopilus pulchrifolius* (Peck) Murrill is also recorded as having pink to green colours, but has no pleurocystidia. *Gymnopilus dilepis* (Berk. & Broome) Singer, a species with possible Gondwanan or pantropical connections, has more heavily ornamented spores, no pleurocystidia and a much more narrow stipe.

The differentiation of species of *Gymnopilus* with pink to purple or wine-red colours in the pileus and stipe and spores in the approximate size range 6.0–8.0 × 4.0–5.5 µm is fraught with difficulties. The ephemeral nature of the pigments described and the variation in the nature and persistence of the velar remains must result in



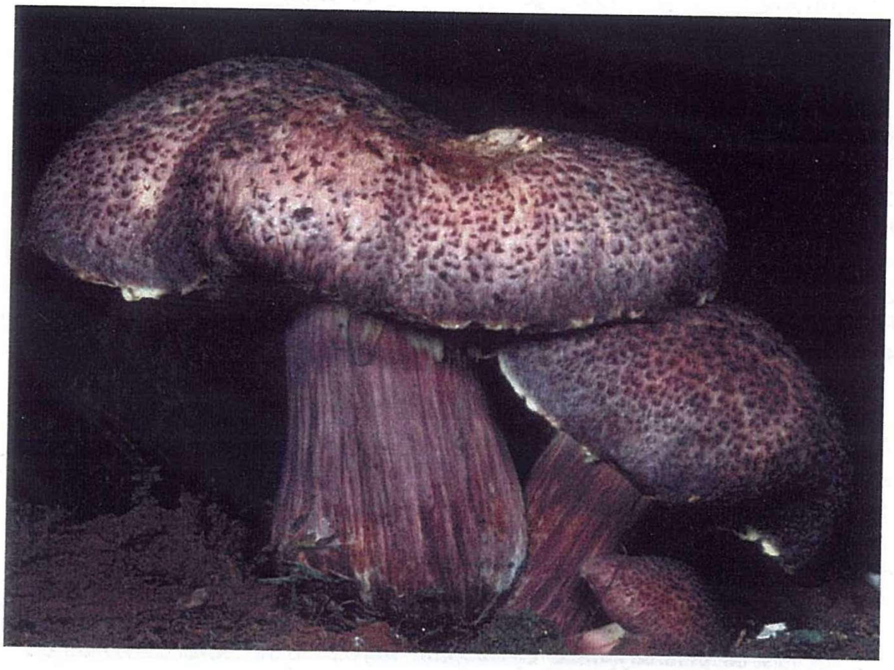


Figure 1. ***Gymnopilus norfolkensis*** *(HL 1283)*. **A**, habit; **B**, basidospores; **C**, basidia; **D**, cheilocystidia; **E**, pleurocystidia; **F**, pileus hyphal ends. Scale bar = 1 cm for A, 5 µm for B, 10 µm for C, D, E and F.
Plate 1. ***Gymnopilus norfolkensis*** *(HL 1283)* showing enlarged stipe base and persistent purple colour.

misidentification at times, or incorrect placement of species at subgeneric level. In Australia, collections of *G. mullaunius* which have lost all their purple colour and velar remains have been identified as *Gymnopilus crociphyllus* (Cooke & Massee) Pegler, another common Australian species with small spores. The tendancy to lose styrylpyrone pigments in old type collections poses additional problems necessitating careful, concurrent comparison of microscopic characters, with sometimes three or four collections involved. It has not been possible to secure recent collections of *G. purpuratus* from Chile for molecular or spore incompatability studies, and DNA cannot be extracted from old type collections either physically or for conservation reasons. However, DNA studies may provide the most reliable results for species differentiation in this group of very similar species.

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