

## A NEW VIOLET SPECIES OF *INOCYBE* (AGARICALES) FROM URBAN AND RURAL LANDSCAPES IN WESTERN AUSTRALIA

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### ABSTRACT

A violet species of *Inocybe*, for which the name *I. geophylla* var. *lilacina* has often been misapplied, is described as new from urban bushlands and *Eucalyptus* forests and plantations in southern Western Australia. The name *I. violaceocaulis* is proposed to accommodate this species that is characterised by the violet to lilac colour, elliptic basidiospores, the presence of pleurocystidia, infrequent caulocystidioid cells, presence of a veil, and host association with myrtaceous plants. The taxonomy and systematic position of *I. violaceocaulis* within *Inocybe* are discussed.

P.B. Matheny & N.L. Bougher (2005). A new violet species of *Inocybe* (Agaricales) from urban and rural landscapes in Western Australia. *Australasian Mycologist* 24 (1): 7–12.

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### INTRODUCTION

The taxonomy of *Inocybe* species in Australia is poorly known (Grgurinovic 1997, Miller & Hilton 1987). Recently, however, re-examination of J.B. Cleland's type material of *Inocybe* from South Australia, studies of herbarium material at PERTH and CSIRO in Perth, and first-hand collections of *Inocybe* species from Western Australia have shown that numerous taxa are undescribed, and that European names have been misapplied to Australian species (Watling 1985). One of the most conspicuous of these undescribed taxa in southern Western Australia is a violet-coloured representative of *Inocybe* with smooth basidiospores and pleurocystidia. This species occurs in urban bushlands in and around Perth, sand dune systems, and in native karri (*Eucalyptus diversicolor*) forests in south-west Western Australia. Many herbarium collections at PERTH that correspond to this species were labelled '*Inocybe geophylla* var. *lilacina* (Peck) Gillet' or referred to this north temperate name. However, members of the *I. geophylla* (Fr. : Fr.) Kumm. group differ in several morphological details as well as phylogenetic history. As a result, *I. violaceocaulis* is proposed for this new violet-coloured *Inocybe* from Western Australia.

### MATERIALS AND METHODS

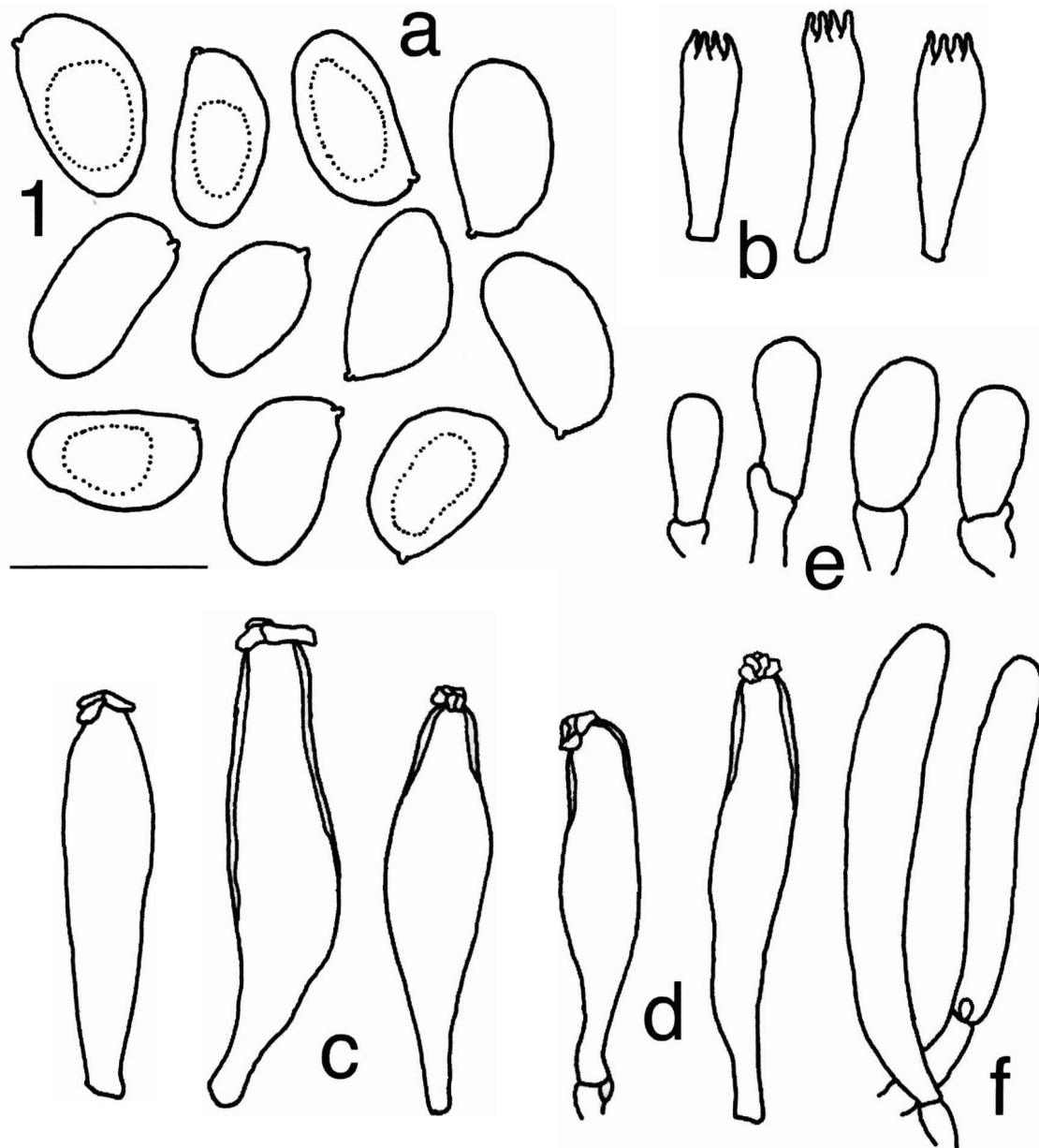
Colour notes of field collections were documented with Munsell Color Charts (1954), Ridgway (1912) and Kornerup & Wanscher (1967). Sections of fresh and dried material were placed in or rehydrated with 3% KOH and examined under a compound light microscope. Italicised measurements refer to mean dimensions following Matheny, Aime & Henkel (2003). The ratio of spore length to width is presented as the *q* value. Line drawings were done with the aid of a drawing tube. Herbarium abbreviations follow Holmgren, Holmgren & Barnett (1990). For explanation of anatomical characters, e.g. cauloparacystidia, see Kuyper (1986).

### TAXONOMY

*Inocybe violaceocaulis* Matheny & Bougher  
sp. nov. (Figs 1–3).

*Etymology*: in reference to the violet-coloured stipe.

Pileus primo violaceus deinde 'Cinnamon-Brown' vel umbrinus, 1.5–3.5 cm latus, nec squarrosus, siccus, caro immutabilis, odor spermaticus. Lamellae



**Figure 1.** Microscopic characters of *Inocybe violaceocaulis* (holotype). Fig. 1a. Basidiospores. Fig. 1b. Basidia. Fig. 1c. Pleurocystidia. Fig. 1d. Cheilocystidia. Fig. 1f. Caulocystidioid cells. The scale bar is equal to 10  $\mu\text{m}$  for basidiospores and 25  $\mu\text{m}$  for other cells.

adnexae vel subadnatae, primo violaceotinctae vel pallidus-griseus deinde brunneae, pallidae-fimbriatae. Stipes 2–4 cm  $\times$  4–9 mm, cortina praeditus, basis non marginato-bulbosus, solidus, fibrillosus, ‘Light Wistaria Violet’ vel ‘Plumbago Gray’, basis cremeotinctus. Basidiosporae laeves, ellipticae, 7.5–9.5  $\times$  5–5.5  $\mu\text{m}$ . Cauloparacystidia nulla. Pleurocystidia 52–63  $\times$  11–15  $\mu\text{m}$ , fusiforma. In sylvis eucalyptinis vel urbanis. Holotypus hic designatus in PERTH (E7030 / PBM 2164), isotypus in WTU.

*Pileus* 1.5–3.5 cm, conical in youth, expanding with

age to obtusely conical or campanulate to planoconvex, with a large but low obtuse umbo; margin decurved, undulate with age; surface dry but somewhat lubricous when moist, smooth at the centre but may becoming diffracted-scaly with age, silky-fibrillose to fibrillose towards the margin, the fibrils diverging around the centre with age, the margin occasionally split; ground colour brown or umbrinous—‘Cinnamon Brown’, ‘Dresden Brown’, or ‘Snuff Brown’, generally a lighter shade or ‘Tawny-Olive’ towards the margin (10YR 4/3–4/4–5/3–5/4), with a lilac superficial layer at least when young, which wears away with age to reveal the



**Figure 2.** Basidiomata of *Inocybe violaceocaulis* (E7045) in native *Eucalyptus diversicolor* (Karri) forest, Karri Valley, Western Australia.



**Figure 3.** Basidiomata of *Inocybe violaceocaulis* (E8055) collected under introduced *Eucalyptus maculata* and *Lophostemon (Tristania) confertus* in Perth, Western Australia.

umbrinous ground colour; context pallid, unchanging where bruised, up to 5 mm thick under the disc; odour spermatic; taste not remarkable. *Lamellae* narrowly adnate, seceding, close, up to 40 reaching the stipe, with a few tiers of lamellulae, light gray (10YR 6/1), at times with a weak lilac tinge, when young becoming yellowish brown (10YR 5/4), the edges white-fimbriate, ventricose, up to 5 mm wide. *Stipe* 2–4 cm × 4–6 mm at the apex, enlarged to swollen at the base, at times rounded-bulbous, there up to 9 mm diam.; basal mycelium white but sparse and not conspicuous; cortina fugacious, pale violet; surface fibrillose, nowhere agglutinated, pruinose at extreme apex or not at all, lilac or grayish lilac—‘Light Wistaria Violet’ to ‘Plumbago Gray’ (15–16B4) throughout except for the pallid to cream-tinged base; dried specimens retaining their violaceous tinges; cortex coloured like the surface, central and lower context pallid. *Stipe* (and *pileus*) surface orange with 15% KOH.

*Basidiospores* 7.5–8.6–9.5 (–10.0) × 5.0–5.2–5.5 μm,  $Q = 1.36–1.66–1.90$  (n = 42/3), smooth, mostly elliptic but on occasion subreniform to subamygdaliform, at times with a suprahilar depression, the apices rounded, yellowish brown in KOH with thickened walls, the apiculus distinct, in deposit dark brown (6F8) (Fig. 1a). *Basidia* 25–32 × 7–8 μm, 4-sterigmate, clavate, hyaline (Fig. 1b). *Pleurocystidia* 52–63 × 11–15 μm, fusiform, usually without a distinct neck, thin-walled to only slightly thick-walled, the walls 0.5–1.5 μm thick, hyaline; apices obtuse, sparsely crystalliferous; with a basal pedicel (Fig. 1c). *Cheilocystidia* similar to pleurocystidia (Fig. 1d), mostly thin-walled; paracystidia clavate, thin-walled, hyaline (Fig. 1e). *Caulocystidioid cells* infrequent, restricted to extreme apex, 55–78 × 13–16 μm, fusiform to subcylindric, thin-walled, hyaline, the apices mostly bare (Fig. 1f); cauloparacystidia not observed; superficial hyphae interwoven, hyaline, at times faintly violet in mass in KOH but pigments cytoplasmic and not incrustated, the hyphae cylindric, 4–11 μm diam. *Pileipellis* a cutis of smooth, cylindric hyphae, 5–12 μm diam., parallel to somewhat interwoven, no clear velipellis hyphae on mature pilei, light or faint cinnamon in mass; tramal hyphae hyaline, refractive hyphae not observed. *Clamps* present.

*Habitat*: in small clusters or singly on grassy lawns in parks and landscaped areas under *Eucalyptus gomphocephala* DC., *E. marginata* Sm., and *Corymbia calophylla* (Lindl.) K.D. Hill & L.A.S. Johnson, under introduced *Eucalyptus maculata* Hook. and *Lophostemon (Tristania) confertus* (R.Br.) Peter G. Wilson & J.T. Waterh., in 5 year-old *E. globulus* Labill. plantation, in Karri forest

under *E. diversicolor* F. Muell., *Allocasuarina decussata* (Benth.) L.A.S. Johnson, and *Agonis flexuosa* (Willd.) Sweet, also in moist old sand dunes under *Agonis flexuosa*; Perth to Denmark, Western Australia; May through August and October.

*Material examined*: AUSTRALIA. Western Australia: **E0747**, in bush near NE carpark of CSIRO, Perth, 21 June 1990, leg. N. Bougher; **E0801**, on red earth soil in 1986 plantings of *Eucalyptus globulus*, Carpenters block off 7 Day Rd, near Manjimup, leg. N. Malajczuk and G. Hardy, 11 October 1991; **E0898** (KS 648/93), in deep litter in Karri forest under *E. diversicolor*, *Corymbia calophylla*, *Allocasuarina decussata*, and *Agonis flexuosa*, Mt Shadforth Res., adjoining NW corner lot 406, 22 May 1993, leg. K. and A. Syme; **E3737** (ZT2760), in bush under *C. calophylla* and *E. marginata*, Kings Park, Perth, 26 June 1985, leg. E. Horak; **E5916**, north side of Herdsman lake under introduced *Eucalyptus*, on edge of mowed grass next to park, Perth, 12 July 1997, leg. N. & M. Bougher; **E7013** (PBM 2164) (holotype, PERTH; isotype, WTU), on lawn under *E. gomphocephala* in front of CSIRO reception bldg, Perth, 6 Aug. 2001, leg. P.B. Matheny; **E7014** (PBM 2165), same locality as E7013, 7 Aug. 2001, leg. P.B. Matheny; **E7016** (PBM 2167), on lawn under *E. gomphocephala*, Bold Park east of Perry Lakes Stadium, Perth, 7 Aug. 2001, leg. P.B. Matheny; **E7017** (PBM 2168), Bold Park but different location than above, 7 Aug. 2001, leg. P.B. Matheny; **E7019** (PBM 2170), Bold Park along Brookdale Ave, under *E. gomphocephala*, 8 Aug. 2001, leg. P.B. Matheny; **E7025** (PBM 2176), Bold Park, east of Perry Lakes Stadium under *E. gomphocephala*, 16 Aug. 2001, leg. P.B. Matheny; **E7026** (PBM 2177), same locality as E7025, 16 Aug. 2001, leg. P.B. Matheny; **E7045** (PBM 2198), on ground in Karri forest under *E. diversicolor* along trail around the Karri Valley Resort, Karri Valley, 19 Aug. 2001, leg. P.B. Matheny; **E7053** (PBM 2205), in lawn on ground under *E. marginata*, Subiaco entry into Kings Park, Perth, 27 Aug. 2001, leg. P.B. and S.D. Matheny; **E8053** (CSIRO), Cunningham Terrace Park, Daglish, Perth, 31°57'05.2"S, 115°48'30.2"E, among mulch and woodchips under introduced *E. marginata* and *E. gomphocephala*, 9 July 2004, leg. N.L. Bougher and R. Hart; **E8055** (CSIRO) corner of Morden Road and Ednah Street, Wembley Downs, Perth, 31°55'15.0"S, 115°46'36.4"E, in grassy lawn under planted *E. maculata* and *Lophostemon (Tristania) confertus*, 16 July 2004, leg. N.L. Bougher; **PERTH 05302331** (KS 333/91), in moist old sand dunes in moss below *Agonis flexuosa*, near Limpoo River, Juniperina Creek area, 14 Aug. 1991, leg. K. Syme; **PERTH 00755702**, in sandy soil, Cannington, no date, leg. R. Hilton; **OKM 24599** (VPI), on the

ground under *Agonis* at Lurie Hall, UWA campus, Perth, 22 May 1991, leg. O.K. and H. Miller, and L. and M. Bailey.

*Commentary:* the name *I. geophylla* var. *lilacina* (Peck) Gillet has been misapplied for many years to this conspicuous violet-coloured *Inocybe* from Western Australia. Like members of the *I. geophylla* group the spores are elliptic and the cystidia at most slightly thick-walled. However, members of the *I. geophylla* group, which occur in north temperate regions, are characterised by numerous caulocystidia at the stipe apex, and agglutinated fibrils at the base of the stipe and on the pileal disc. *Inocybe violaceocaulis* (Figs 2 and 3) is distinguished by infrequent caulocystidioid cells at the extreme apex of the stipe, absence of agglutinated fibrils, and association with myrtaceous plants in Australia.

Several smooth-spored species of *Inocybe* with violet colouration from Indomalaya and Australasia have been documented by Horak (1980). *Inocybe ionides* Corner & E. Horak, described from Sabah, appears similar but lacks a cortina and has no pleurocystidia. *Inocybe subgeophylla* Hennings is not conspicuously lilac and occurs with fagaceous hosts in Indonesia. *Inocybe violeipes* E. Horak and *I. violaceovelata* E. Horak, described from Papua New Guinea, are squamulose and have stipes with belts of veil tissue. The latter does not have elliptic spores. No violet-coloured species with smooth basidiospores are reported from New Zealand (Horak 1977). An examination of Cleland's type collections of *Inocybe* at the State Herbarium of South Australia (AD) indicates that Cleland did not previously describe *I. violaceocaulis*. This species is also not described in Grgurinovic (1997).

Combined *rpb1*, *rpb2*, and nuclear large subunit (25S) ribosomal RNA nucleotide sequences strongly suggest that *I. violaceocaulis* (E7045 and E7013, GenBank accession numbers AY380404 and AY732208, respectively) evolved in a major clade with other smooth-spored species of *Inocybe* that possess pleurocystidia (Matheny 2005). Within this strongly supported group, *I. violaceocaulis* is nested in a clade with the following north temperate species: *I. pusio* P. Karst., *I. sindonia* (Fr.) P. Karst., *I. queletii* Maire & Konr. and *I. flocculosa* (Berk.) Sacc. Of these, only *I. pusio* shares violet pigmentation of the basidiocarps. Matheny (2005) indicates that *I. violaceocaulis* is sister to a clade containing *I. queletii* and *I. flocculosa*. This set of species, in addition to the lilac tinged *I. pusio*, is sister to a clade containing *I. geophylla* and related taxa. None of the taxa enumerated above evolved in the *I. geophylla* group and thus, are phylogenetically

distinct from it. The *I. geophylla* group contains the following north temperate species: *I. pudica* Kühn., *I. lilacina* (Peck) Kauffman, *I. agglutinata* Peck, *I. fuscodisca* (Peck) Masee and *I. armenica* Huijsman, most of which lack violet or lilac pigmentation (Matheny 2005). For a consideration of other European lilac-coloured taxa with pleurocystidia, see Esteve-Raventós & Villarreal (2001), Kuyper (1986), and Stangl & Veselsky (1982).

### Acknowledgements

We thank Mr Graham H. Bell of the State Herbarium of South Australia (AD) for the loan of J.B. Cleland's type collections of *Inocybe* and the curator and staff at PERTH for loans of *Inocybe* material. Orson K. Miller, Jr kindly shared with us his *Inocybe* collections from Australia. Travel and stay in Perth were funded to the first author by an anonymous donor and facilitated by staff at CSIRO Forestry and Forest Products in Perth, Western Australia. Work by the second author was undertaken as part of the Perth Urban Bushland Fungi project funded by Lotterywest. The accession, AY732208, was produced in the lab of David Hibbett and supported by the Assembling the Fungal Tree of Life project (DEB 0228657) funded by the National Science Foundation. We thank two anonymous referees for their constructive comments and suggestions.

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