

**PSATHYRELLA ECHINATA (CLELAND) GRGURINOVIC—TAXONOMY
AND ECOLOGY OF A WIDELY DISTRIBUTED AGARIC IN AUSTRALIA AND
NEW ZEALAND (INCLUDING AUCKLAND ISLAND)**

E. Horak

Nikodemweg 5, AT-6020 Innsbruck, Austria.

Abstract

The examination of type and authentic material demonstrated that *Psathyrella echinata* (Cleland) Grgurinovic (= *Psilocybe echinata* Cleland = *Psathyra tasmanica* Masee & Rodway, syn. inval.) is the valid name for a common saprobic agaric widely distributed both in wet sclerophyll and temperate rain forests in Australia and New Zealand (South Isl., Auckland Isl.). A full description and illustrations both of the macroscopical and microscopical characters of *Psathyrella echinata* with an apparent Gondwanan pattern of distribution are presented.

Key words: Basidiomycota, Coprinaceae, systematics, Gondwana relict distribution.

E. Horak (2006). *Psathyrella echinata* (Cleland) Grgurinovic—taxonomy and ecology of a widely distributed agaric in Australia and New Zealand (including Auckland Island). *Australasian Mycologist* 25 (2): 45–50.

Introduction

In the early sixties, I stayed in the Herbarium Kew (London, UK) and browsed through material and descriptive notes relating to New Zealand and Tasmanian agarics and boletes. Examining specimens filed under '*Psathyra* (*Psathyrella*) *tasmanica*' my attention was caught by the simple drawings of a small agaric distinctly characterized by conspicuous, spiny, recurved squamules all over the pileus and the lower portion of the stipe. The lack of material did not allow the examination of microscopical characters and subsequently my short notes on '*Psilocybe tasmanica* Masee & Rodway' fell into oblivion.

Several years later in New Zealand (Fiordland, 1967), I stumbled upon a group of psathyrelloid basidiomes with a shaggy-squamulose pileus sitting on wood/bark of southern beech (*Nothofagus fusca*). The

following year I gathered this agaric again on New Zealand's South Island in a similar habitat. Microscopical analysis revealed that I was dealing with a *Psathyrella* whose most distinctive features are thick-walled, fusoid pleurocystidia crowned with crystals or an amorphous incrustation at the apex and rather small ovoid basidiospores.

In 1991, I spent a few days in the Hobart Herbarium and to my surprise I found not only Rodway's original sketches of '*Psathyra tasmanica*' (the drawings in Kew are copies for Masee's perusal) but also a short description on the back of the envelope containing dry specimens of this Tasmanian fungus. Upon microscopical examination of the poorly preserved exsiccate, I realized that '*Psathyra tasmanica*' was contaxic with my specimens encountered in New Zealand. A few days after I unveiled the taxonomic status of '*Psilocybe*

tasmanica in the Hobart Herbarium, I myself was running into fresh, topotypical material of this striking species (ZT 4815, collected in Collinsvale). An excellent photograph of Tasmanian specimens can be found in Fuhrer and Robinson (1992: 57, as '*Psilocybe echinata*') and in Fuhrer (2005: 163, as '*Psathyrella echinata*').

Collecting mushrooms at later occasions on the Australian mainland, I found basidiomes of this remarkable species both in New South Wales (1981) and in Western Australia (1985).

While screening J.B. Cleland's publications, my interest was aroused by reading the protologue of '*Psilocybe echinata*' whose basidiomes are described as having a shaggy pileus and stipe. Subsequent examination of four authentic collections (now kept at AD) gathered by J.B. Cleland at Mt Lofty near Adelaide demonstrated that two of the four collections labelled '*Psilocybe echinata*' actually are identical to the Tasmanian '*Psathyra tasmanica*'. The two other collections filed under '*Psilocybe echinata*' (AD 9779, AD 9781) were misidentified by Cleland. The microscopical features found in the course of my re-examination indicated that the latter two samples actually represent *Psilocybe toogaadyalis*, eventually described by Grgurinovic (1997).

Several years later, the material kept under '*Psilocybe echinata*' (AD 9777) was finally selected by Grgurinovic (1997) as the lectotype for Cleland's taxon which at the same occasion was transferred to its correct taxonomic position viz. *Psathyrella echinata*.

In the meantime, however, my personal contacts with '*Psathyra tasmanica*' vs '*Psilocybe echinata*' continued. In 2001 and again in 2005, I picked up additional collections in New Zealand (S-Island). In addition, about a couple of years ago, I was quite surprised to identify four collections as *Psathyrella echinata*, that originally were gathered by G. Laursen in several habitats on the subantarctic Auckland Islands.

The aforementioned numerous records reported from Australia and New Zealand (including Auckland Islands) prompted a literature search in order to find out whether this rather common and conspicuous agaric

can be found under other names in pertinent local publications and up-dated checklists e.g.: Bougher and Syme (1998), Chang and Kantvilas (1993), Cooke (1892), Grgurinovic (1997), Hilton (1982, 1988), Horak (1971), Johnston and Buchanan (1995), May and Wood (1997), Pennycook (2004), and Segedin and Pennycook (2001).

For the occurrence of *Psathyrella echinata* no indication was found either in the New Zealand literature or in lists of mycota reported from the Subantarctic Islands (Horak 1982, Kerry 1984, Singer 1959). The evaluation of Australian publications, however, has shown that *Psilocybe echinata* also occurs in Victoria (Willis 1963) and is a widely distributed agaric in the wet sclerophyll forests of Tasmania (Fuhrer and Robinson 1992, Ratkowsky and Gates 2005 a, b). In addition, while screening the Australian literature, I also was led to the assumption that the records of the European *Psathyrella pygmaea* (Bull. : Fr.) Singer are likely to represent misidentified material of *Ps. echinata*. Both agarics are characterized by comparatively small basidiospores and crystal-bearing, often distinctly metuloid pleurocystidia and thus belong to *Psathyrella* subgen. Homophron, sect. Cystidiosae (Horak 2005, Kits v. Waveren 1985, Singer 1986, Smith 1972). Despite the lack of conspicuous veil remnants and much smaller, broadly utriform pleurocystidia, several Australian authors (Macdonald and Westerman 1979, Pearce and Malajczuk 1990, Sinnott 1976) probably have *Psathyrella echinata* repeatedly mistaken for *Psathyrella pygmaea*.

Despite the many records, the nomenclatural problem in connection with the name *Psathyra tasmanica* Masee & Rodway listed earlier was still not resolved. According to the rules of ICBN (Art. 32.1) the binomial of this species is invalid because the name listed in Rodway (1900) as '*Psathyra tasmanica* Mass. et Rod., n.s.' is neither supported by a published description nor a reference (Chang and Kantvilas 1993). From the nomenclatural point of view, the descriptive notes scribbled on the envelope kept at the Kew Herbarium are not adequate enough to consider '*Psathyra tasmanica*' as a valid name. Consequently, the correct name for this shaggy agaric is *Psathyrella echinata* (Cleland) Grgurinovic (1997), with *Psathyra tasmanica* Masee & Rodway (1900) as an invalid synonym. It appears that Rodway (as he

routinely did) proposed and listed the name for the Tasmanian species in advance, but obviously Masee never got around to formally publish the (new) species. In this context it is also noteworthy to point out that Cleland annotated the lectotype collection of *Psilocybe echinata* (AD 9777) with the remark '*Psilocybe tasmanica*' and consequently he must have been aware of Rodway's earlier but invalidly published name for the Tasmanian agaric.

Ecology

According to the presently known distribution records which distinctly reflect a Gondwanan pattern, *Psathyrella echinata* predominantly occurs in wet sclerophyll and temperate rain forests both in Australia and New Zealand (South Island, Auckland Island). Confirmed substrates upon which *Ps. echinata* have been found are wood and bark on fallen, rotting logs of various species of *Eucalyptus*, *Metrosideros* (both Myrtaceae) and *Nothofagus* (Nothofagaceae).

Materials and Methods

Free-hand sections from fresh and dry basidiomes (pileipellis, edges of lamellae and stipitipellis) were soaked in 4% KOH and subsequently stained with Congo Red. The drawings of the microscopical characters were executed with the help of a camera lucida mounted on a Wild Microscope M 11.

Taxonomy and ecology

Psathyrella echinata (Cleland) Grgurinovic 1997.

Larger fungi of South Australia. Botanic Gardens and State Herbarium, Flora and Fauna of South Australia Handbooks Committee. Adelaide, p. 491.

Bas.: *Psilocybe echinata* Cleland 1934a. *Toadst. Mushr. South Australia*, p. 143.

Psilocybe echinata Cleland 1934b. *Trans. & Proc. Roy. Soc. S. Australia* 58: 212 (superfl. Latin diagnosis).

Syn.: *Psathyra tasmanica* Masee & Rodway, in Rodway 1900. *Pap. & Proc. Roy. Soc. Tasmania* 1898-1899: 98 (nom. inval., Art. 32.1).

Illustrations: *Psilocybe echinata* (lectotype: Cleland 1934a: Pl. 3d, 3e). Macdonald and Westerman (1979, as *Psathyrella pygmaea*). Fuhrer and Robinson (1992: as *Psilocybe echinata*, photograph). Grgurinovic (1997: Fig. 325). Fuhrer (2005: as *Psathyrella echinata*, photograph). *Psathyra tasmanica* ('holotype', drawings in sched., HO, K).

Distribution: Australia (NSW, TAS., VIC., WA), New Zealand (South Island, Auckland Islands).

Material examined:

AUSTRALIA:

SA: Adelaide, Mt Lofty: subcaespitose at base of rotten stump (*Eucalyptus* sp. ?), 15 June 1924, leg. Cleland (AD 9777, **lectotype** of '*Psilocybe echinata*'); same locality, Mt Lofty, gregarious to subcaespitose on dead wood and adjacent ground, 27 June 1921, leg. Cleland (AD 9775, **syntype** of '*Psilocybe echinata*').

NSW: Wauchope, Hastings State Forest, Banda-Banda, on rotten wood in wet sclerophyll forest (dominated by *Nothofagus moorei*), 14 Aug. 1981, leg. E. Horak 1249 (ZT).

WA: Northcliffe, Forest Park, on rotten wood of *Eucalyptus calophylla*, 21 June 1985, leg. E. Horak 2711 (ZT).

TAS.: Locality unknown (probably Hobart), on dead wood and bark, 16 June 1898, leg. Rodway (84), det. Masee ('*Psathyra tasmanica*' Masee & Rodway: authentic material in HO, K). Hobart, Mt Wellington, 700 m, on rotten wood in mixed wet sclerophyll forest (dominated by *Eucalyptus regnans-obliqua*, *Nothofagus cunninghamii*, *Dicksonia antarctica*), 3 April 1991, leg. E. Horak 4815 (ZT). Hobart, Mt Field National Park, Lyre Bird Trail, on rotting wood, 28 Feb. 2006, leg. G. Gates (ZT 12526).

NEW ZEALAND (districts as defined in Crosby *et al.* (1998):

SOUTH ISLAND: Fiordland, Te Anau, Eglinton, on rotten wood/bark of *Nothofagus fusca*, 10 Nov. 1967, leg. E. Horak 67-195 (ZT). Buller, S of Ahaura, on rotten wood/bark of *Nothofagus fusca*, 18 Mar. 1968, leg. E. Horak 68-180 (ZT). Buller, Springs Junction, Lake Daniells Track, 500 m, on soil and on rotten debris under *Nothofagus fusca*, 18 Apr. 2001, leg.

E. & A. Horak (ZT 9325, PDD 72575). Lewis Pass, Nina Valley, 580 m alt., on rotten wood/bark under *Nothofagus fusca/menziesii*, 13 Apr. 2005, leg. E. & A. Horak (ZT 12073; PDD 82766).

SUBANTARCTIC NEW ZEALAND:

AUCKLAND ISLANDS.

Enderby Island (S 50°32', E 166°13'): Hardwicke Site, on *Metrosideros umbellata*, 20 Mar. 2000, leg. G. Laursen 9705: same locality, Terror Cove, on rotting wood, 22 Mar. 2000, leg. G. Laursen. Sandy Bay, Stella Hut, on *Metrosideros umbellata*, 21 Mar. 2000, leg. G. Laursen. Terror Cove, on moss-covered rotting wood, 22 Mar. 2000, leg. G. Laursen (all specimens in Herb. Laursen, Fairbanks, AL, USA).

Misidentified material in Herb. Cleland (as '*Psilocybe echinata*'): SA, Adelaide, Mt Lofty: attached by a mycelial base to twig, etc.,

18 Sept. 1920, leg. Cleland (AD 9779); same locality, on wood, 20 June 1952, leg. Hansford in Cleland (AD 9781).

Both collections represent *Psilocybe toogaadyalis* Grgurinovic, collected by J.B. Cleland at or near the type locality of '*Psilocybe echinata*' at Mt Lofty. Basidiospores 7–8 x 4.5–5 (–5.5) x 3.5–4.5 µm (length x face view x side view), hexagonal to mitriform, slightly thick-walled, germ pore distinctive. Basidia 18–24 x 6–7 µm, often urniform-constricted, 4-spored. Cheilocystidia 30–55 x 6–7 µm, very slender fusoid with long, gradually tapering neck.

Substrate: Saprobic. - On rotten wood/bark and debris of *Eucalyptus* spp. (Myrtaceae), *Metrosideros umbellata* (Myrtaceae) and *Nothofagus fusca* (Nothofagaceae).

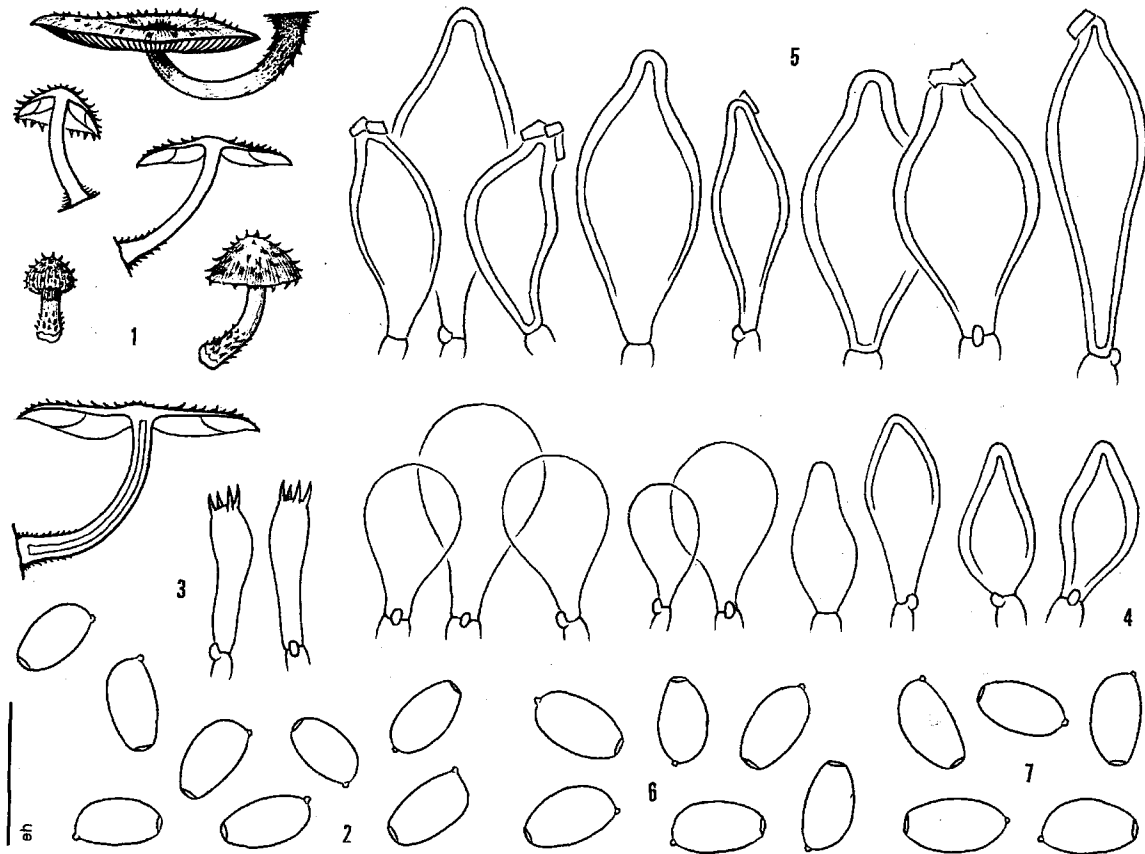


Figure 1: 1–6. *Psathyrella echinata* (Cleland) Grgurinovic (ZT 9777, from NSW): 1. Basidiomes. 2. Basidiospores. 3. Basidia. 4. Cheilocystidia. 5. Pleurocystidia. 6. *Psathyrella echinata* (lectotype AD 9777, from SA): Basidiospores. 7. *Psathyra tasmanica* Masee & Rodway (nom. inval., holotype HO, from TAS): Basidiospores. Scale bar: 10 mm (1), 5 µm (2, 6, 7), 10 µm (3, 4, 5).

**Description of *Psathyrella echinata*
(Fig. 1: 1–7)**

Pileus 10–35 (–45) mm, at first hemispherical with incurved margin, later becoming convex or subumbonate-expanded, centre also depressed in mature specimens, deep umber or chocolate brown in young and moist basidiomes, opaque, strongly hygrophanous, upon drying fading to pale brown or beige-ochre, dry, surface subrugulose or wrinkled (especially in centre), glistening, substrate margin densely covered with conspicuous, persisting, appendiculate fibrils of cortina. Veil remnants on pileus consisting of conspicuous, strongly fibrillose, conical or pyramidal, usually at tips recurved, pale ochre-brown squamules and scales, readily detachable and later fallen or washed off in mature basidiomes. *Lamellae* 36–50 (–60) reaching stipe, 7–15 lamellulae, adnexed to subfree, ventricose, up to 4 mm broad, at first pale ochre-brown becoming deep chocolate brown or fuscous, even to subfimbriate edges whitish. *Stipe* 10–40 (–50) x 2–4 mm, central, cylindrical, equal but base often swollen or pestle-like, at first off-white becoming beige or pale brown, smooth or subpruinose at apex, base mostly covered with bristle-like, strigose rhizoids attached to substrate, dry, solid in young but hollow in aged specimens, brittle, solitary or cespitose. *Cortina* fibrillose, ephemeral. *Veil remnants* distinctive towards base of stipe, consisting of floccose or fibrillose, conical, at tips recurved, subpersisting squamules and scales, coloured like those on pileus surface, usually fallen off in aged specimens. *Context* concolorous, brittle. *Odour* and *taste* not distinctive.

Spore print black or fuscous. *Basidiospores* 5.5–6.5 (–7) x 3.5 (–4) µm, ovoid or subelliptical in face view and side view, never bean-shaped, dark brown, opaque, smooth, thin-walled, germ pore large and distinctive. *Basidia* 12–16 (–20) x 3–4 µm, cylindrical or subclavate, 4-spored (rarely 2-spored), clamped. *Cheilocystidia* 25–40 (–50) x (10–) 12–20 µm, vesiculose or broadly balloon-shaped, hyaline walls thin, sometimes thickened towards base, smooth but rarely also encrusted with pale brown pigment. *Pleurocystidia* 30–50 x 13–20 (–25) µm, numerous, distinctly fusiform, apical mucro nipple-shaped, conspicuously metuloid, membrane near apex up to 1.5 µm diam., walls (in KOH) brown, pale brown or hyaline,

apex often encrusted with hyaline crystals or covered with an amorphous incrustation (both not dissolving in KOH), occasionally diminutive pleurocystidia occur at lamellar edges intermixed with cheilocystidia. *Caulocystidia* scattered, shape and size like cheilocystidia. *Pileipellis* consisting of globose to ovoid cells (12–50 µm diam.) forming a multilayered epithelium, non-gelatinized walls thin, hyaline, in KOH with dark brown incrusting and/or plasmatic pigment. Veil remnants (squamules) on pileus consisting of loosely interwoven, polymorphic cells, shape ranging from globose, ovoid to subcylindric, terminal cells often conical or fusoid, hyaline walls thin or up to 1.5 µm diam., encrusted with pale yellow-brown pigment. Oleiferous hyphae in subcutis absent. *Stipitipellis* consisting of densely packed, cylindrical hyphae, 4–12 µm diam., walls smooth or weakly encrusted with pigment. *Clamp connections* numerous.

Acknowledgements

The author is grateful to the Curators of the Herbaria HO (Tasmania), K (UK), and PDD (New Zealand) for sending specimens on loan and the search for literature. G. Gates and D. Ratkowsky (Hobart) kindly provided additional, ecological information on Tasmanian records of *Ps. echinata* and are also thanked for reading and correcting the draft version of the present contribution. With regards to '*Psathyra tasmanica*', T. May (Melbourne) actively helped to resolve nomenclatural problems. G. Laursen (Fairbanks, Alaska) kindly provided specimens and data of collections gathered on Auckland Islands.

References

- Bougher, N.L. & Syme, K. (1998). *Fungi of Southern Australia*. Univ. Western Australia Press. 391 pp.
- Chang, Y.S. & Kantvilas, G. (1993). A catalogue of Leonard Rodway's collection of fungi. *Tasm. Herb. Occas. Publ.* 4, 1–52.
- Cleland, J.B. (1934a). *Toadstools and Mushrooms and other larger fungi of South Australia*. Part 1, 1–178 (Gov. Printer, Adelaide).

- Cleland, J.B. (1934b). Australian Fungi: Notes and descriptions. No. 10. *Trans. & Proc. Roy. Soc. South Australia* **58**, 212.
- Cooke, M.C. (1892). *Handbook of Australian Fungi*. Williams and Norgate. London. 457 pp.
- Fuhrer, B. & Robinson, R. (1992). *Rainforest Fungi of Tasmania and South-East Australia*. CSIRO Australia. 95 pp.
- Fuhrer, B. (2005). *A Field Guide to Australian Fungi*. The Green Book Company. Burnley, Vic. 360 pp.
- Grgurinovic, C.A. (1997). *Larger Fungi of South Australia*. Botanic Gardens and State Herbarium, Flora and Fauna of South Australia Handbooks Committee. Adelaide. 725 pp.
- Hilton, R.M. (1982). A census of the larger fungi of Western Australia. 1. *Journ. Roy. Soc. Western Australia* **65**, 1–15.
- Hilton, R.N. (1988). A census of the larger fungi of Western Australia. 2. *Journ. Roy. Soc. Western Australia* **70**, 111–118.
- Horak, E. (1971). A contribution towards the revision of the Agaricales (Fungi) from New Zealand. *New Zealand J. Bot.* **9**, 403–462.
- Horak, E. (1982). Agaricales in Antarctica and Subantarctica: distribution, ecology, and taxonomy. *ISAM* **1**, 82–122.
- Horak, E. (2005). *Röhrlinge und Blätterpilze in Europa*. Elsevier (München). 555 pp.
- Johnston, P.R. & Buchanan, P.K. (1995). The genus *Psilocybe* (Agaricales) in New Zealand. *New Zealand J. Bot.* **33**, 379–388.
- Kerry, E. (1984). The fungal flora of Macquarie Island. *Tasmanian Naturalist* **1984**, 16–21.
- Kits van Waveren, E. (1985). The Dutch, French and British species of *Psathyrella*. *Persoonia Suppl.* **2**, 1–300.
- Macdonald, R. & Westerman, J. (1979). *A Field Guide to Fungi of South-eastern Australia*. Hong Kong. 179 pp.
- May, T.W. & Wood, A.E. (1997). Catalogue and Bibliography of Australian Macrofungi. 1. Basidiomycota p.p. *Fungi of Australia* **2A**. Australian Biological Resources Study, Canberra. 348 pp.
- Pearce, M.H. & Malajczuk, N. (1990). Stump colonization by *Armillaria luteobubalina* and other wood decay fungi in an age series of cut-over stumps in karri (*Eucalyptus diversicolor*) regrowth forests in south-western Australia. *New Phytol.* **115**, 129–138.
- Pennycook, S.R. (2004). Bibliographic checklist of agarics, boletes, and related fungi from New Zealand. *Fungi of New Zealand/Nga Harore o Aotearoa* **1**, 165–362. Fungal Diversity Press. Hong Kong.
- Ratkowsky, D.A. & Gates, G.M. (2005a). A comparison of macrofungi in young silvicultural regeneration and mature forest at the Warra LTR Site in the southern forests of Tasmania. *Tasforests* **16**, 127–152.
- Ratkowsky, D.A. & Gates, G.M. (2005b). An inventory of macrofungi observed in Tasmanian forests over a six-year period. *Tasforests* **16**, 153–168.
- Rodway, L. (1900). Additions to the fungus flora of Tasmania. *Pap & Proc. Roy. Soc. Tasmania* **1898-1899**, 97–99.
- Segedin, B.P. & Pennycook, S.R. (2001). A nomenclatural checklist of agarics, boletes, and related secotioid and gasteromycetous fungi recorded from New Zealand. *New Zealand J. Bot.* **39**, 285–348.
- Singer, R. (1959). New and interesting species of Basidiomycetes. 6. *Mycologia* **51**, 375–400.
- Singer, R. (1986). *The Agaricales in Modern Taxonomy*. 4th edn, Koeltz Sc. Books, Koenigstein, Germany, 981 pp.
- Sinnott, N.H. (1976). Victorian Agaricales and Cantharellaceae. Distr. by author. Essendon.
- Smith, A.H. (1972). The North American species of *Psathyrella*. *Mem. New York Bot. Gdn* **24**, 1–633.
- Willis, J.H. (1963). *Victorian Toadstools and Mushrooms*. Field Naturalist Club Victoria. Melbourne. 88 pp.