

## THE OCCURRENCE OF *VOLVARIELLA VOLVACEA* (BULL. : FR.) SINGER IN THE NORTHERN TERRITORY, AUSTRALIA

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### Introduction

During the last thirteen years, three collections of a species of *Volvariella* Speg. have been made in and around Darwin in the Northern Territory, occurring on various substrates including composted paper and bamboo (Fig. 1), composting banana leaves and wet hay bales. A brief description of the fungus based on the Darwin material is given below:

*Pileus* mostly 4–7 cm in diameter, ovoid when immature, expanding to convex, umbonate, dry, greyish brown becoming almost black at the umbo with dark brown to black appressed fibrils which are often radially arranged, margin non-striate. *Lamellae* at first white, becoming flesh-coloured at maturity, free. *Stipe* 5–11 cm long, 4–8 mm in diameter, cylindrical, often enlarging to a slightly bulbous base, white and fibrillose. *Volva* large with a free margin, brown to grey-brown. *Spores* ovoid to ellipsoidal, smooth, 7.2–9.8 x 4.8–6 µm, non-amyloid, faintly tinted with a slightly thickened wall. *Basidia* clavate, hyaline, 30–35 x 7–8 µm, with four sterigmata. *Cheilocystidia* clavate to mucronate-clavate, hyaline, 35–45 x 15–20 µm. *Pleurocystidia* similar to cheilocystidia, occasionally longer and wider up to 60 x 28 µm. Clamps absent.

*Specimens examined*: **Northern Territory**; on composted paper and bamboo in garden, Leanyer, Darwin, 20 March 1991, B. Conde (DAR 67260); in banana plantation, Middle Point, Darwin, 11 Feb. 1998, B. Conde (DAR

73081); on wet hay bales (*Brachiaria humidicola* cv. Tully) in swamp at Middle Point near Darwin, 7 April 1999, B. Conde (DAR 74636).

Based on the descriptions given by Scaffer (1957), Pegler (1977, 1983) and comparative examination of an available collection (DAR 54631, intercepted in quarantine, ex Hong Kong) and identified by J. Walker, the fungus has been identified as *V. volvacea* (Bull. : Fr.) Singer, commonly known as the 'paddy straw mushroom'. *Volvariella volvacea* is widely distributed throughout the tropics and is cultivated throughout Asia utilising a variety of substrates including rice straw and cotton wastes. This appears to be the first confirmed report of *V. volvacea* in Australia.

Singer (1986) included only four taxa of *Volvariella* in his *Stirps Volvaceae viz. V. bakeri* (Murr.) Singer, *V. volvacea* (Bull. : Fr.) Singer, *V. esculenta* (Mass.) Singer and *V. displasia* (Berk. & Br.) Singer. *Volvariella bakeri* according to Shaffer (1957) has a dark fibrillose pileus with similar sized basidiospores but they are ovoid to oval or obovoid in contrast to *V. volvacea* which has ellipsoidal basidiospores. *Volvariella esculenta*, which was described from tropical western Africa, lacks the fibrillose pileus of *V. volvacea* (Massee 1908).

The other closely related species referred to as *V. displasia* (Berk. & Br.) Singer is widely



Figure 1. Fruiting bodies of *Volvariella volvacea* in garden at Leanyer, Darwin in 1991.

cultivated in India where it is known as the straw or banana mushroom. It differs from *V. volvacea* by its lack of pigment, grey-coloured fibrils on the pileus and volva and, smaller basidiospores (Samajpati 1982). However, according to Pegler (1986), *V. diplasia* is lignicolous in its habit and is more closely related to the widespread temperate species *V. bombycina* (Schaeff. : Fr.) Singer, the differences between them being mainly confined to basidiospore form and size. Singer (1961) and Samajpati (1982) have both suggested that the fungus which is cultivated in India and known as *V. diplasia* may, in fact, be only a white form of *V. volvacea*. This view accords with that of Pegler (1986) who regarded the lignicolous habit of *V. diplasia* and, its more robust nature, to be a significant character of difference between the two species. Other species with a dark appressed fibrillose pileus include *V. pseudovolvacea* (Berk. & Br.) Singer, *V. apalotricha* (Berk. & Br.) Pegler and *V. terastia* (Berk. & Br.) Singer; however, these taxa have much shorter basidiospores than *V. volvacea*, being mostly 4.5–6.5  $\mu\text{m}$  long.

Several other species of *Volvariella* have previously been reported as occurring in Australia (May & Wood 1997) including

*V. speciosa* (Fr. : Fr.) Singer and *V. speciosa* var. *gloiocephala* (DC. : Fr.) Singer, both of which have spores which are significantly longer than those of *V. volvacea* and lack the dark fibrils of that species. *Volvariella pusilla* (DC. : Fr.) Singer, regarded as synonymous with *V. parvula* (Weinm.) Speg. by Pegler (1983, 1986) and, *V. taylori* (Berk. & Br.) Singer both have basidiospores which are shorter than those of *V. volvacea*. *Volvariella apalotricha* (Berk. & Br.) Singer has been reported from Christmas Island only (May and Wood 1997). The closest species to *V. volvacea* is *V. bombycina* which has similar sized basidiospores but also lacks the darkened fibrils on the pileus. In addition, the cystidia of *V. bombycina* are generally much larger than those of *V. volvacea* and the habit is lignicolous (Schaffer 1957). *Volvariella cycnopotamia* (Berk.) Singer, described from the Swan River in Western Australia has sub-globose spores (Pegler 1965) and *V. clarkeae* Grgurinovic (Grgurinovic 1997) has a non-fibrillose, smoky brown pileus and a distinctly swollen base which is not present in the material from Darwin.

*Volvariella californica* (Earle) Singer (syn. *Locellina californica* Earle) was reported to occur in Australia by Cheel (May and Wood

1997). Examination of a single collection in Herb DAR collected in the Royal Botanic Gardens, Sydney in August 1908 and identified by Cheel as *L. californica* has been examined. The collection has been badly damaged by insects and few details are discernible. Notes on the packet indicate the pileus to be yellow-brown and spores measuring 14–15 x 8.5 µm. No volva is present; however, the flesh-coloured lamellae and spore size, measured as (12–) 14–16 (–18) x (8–) 10–12 µm indicate that the collection is probably referable to *V. gloiocephala* (DC. : Fr.) Boekh. & Enderle which is known from Australia. *Volvariella californica*, which has basidiospores that measure 14–18 x 8–9 µm, is included in *Stirps Speciosa* by Singer (1986) with other large-spored (> 12 µm) species and is currently known only from the USA.

*Volvariella volvacea* has probably been introduced to Darwin sometime before 1990 and has subsequently become more widespread within the Darwin area. In cultivation, *V. volvacea* has a requirement for subtropical to tropical conditions with optimal temperatures of 32–36°C for vegetative growth (Hall *et al.* 1998). Its habit of occurring on composted materials suggests that it could spread quite readily and become a weedy species in the vicinity of Darwin.

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