



## Two interesting *Pterula* species from Maharashtra, India

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### Abstract

Two interesting species of clavarioid fungi *Pterula indica* sp. nov. and *P. verticillata* collected from Pune, Maharashtra, India are described, illustrated and discussed with closely allied species. Of these, *Pterula indica* is a new species characterized by the reddish brown to dark brown basidiomes, branched polychotomously below, dichotomously at the apex with white to yellowish white, acute apices, and having cylindric, smooth basidiospores and hyphoid to cylindric cystidia with short mucronate apex. *Pterula verticillata* is distinguished by pale orange to peach basidiomes that branched polychotomously below, verticillately to irregularly above, and having cylindric, smooth basidiospores and hyphoid cystidia with rostrate apex.

**Key words** – Basidiomycota – clavarioid fungi – fungal diversity – macrofungi – taxonomy

### Introduction

A worldwide monograph of clavarioid fungi was provided by Corner (1950, 1970) in which, all the recognized taxa were critically revised and classified. Later, Petersen extensively studied the type specimens and contributed significantly on the knowledge of taxonomy of clavarioid fungi occurring in different regions (1966, 1967a,b, 1968a,b, 1969, 1971a,b, 1978a,b, 1979, 1984, 1988a,b). Pegler & Young (1985) studied the basidiospore structures in *Ramariopsis* and allied genera such as *Clavulinopsis* and *Scytinopogon*. Garcia-Sandoval et al. (2005), Dentinger & Laughlin (2006) and Kautmanová et al. (2012) studied the phylogenetic analysis of clavarioid fungi. Several clavarioid fungi have been recently described from different regions (Zhang et al. 2005, Olariaga & Salcedo 2009, Young & Fechner 2009). Thind (1961) made a significant contribution on Indian clavarioid fungi and compiled a monograph 'The *Clavariaceae* of India'. The species included were largely collected from Himalayas and a few from West Bengal, India. One of the genera of clavarioid fungi, *Pterula* Fr. (*Pterulaceae* Corner) is characterized by the erect, branched to simple, filiform and minute basidiomes having dimitic hyphal system with hyaline skeletal hyphae in the context. The genus comprises of about 50 species distributed worldwide particularly in tropics (Kirk et al. 2008). However, only two species *P. decumbens* Corner, Thind & Dev (Corner et al. 1957) and *P. penicillata* Lloyd (Thind 1961) have been described so far from India. However, Thind (1961) clearly stated that the identity of *P. penicillata* collected by P.L. Day is doubtful and no description was provided. Instead of describing the fungus, Lloyd (1919-1925) merely provided one illustration for this fungus and he thought the fungus was similar to the collection made from USA. Corner (1950) felt based on the illustration provided by Lloyd (1919-1925) that it could be *P. verticillata* Corner. Apparently, there are no

other reports of this genus from India. The knowledge on diversity of clavarioid fungi from Western Ghats of southern India is scanty. A total of only 19 species viz., *Clavaria zollingeri*, *Clavulina cristata*, *C. rugosa*, *Clavulinopsis aurantiocinnabarina*, *C. corniculata*, *C. dichotoma*, *C. fusiformis*, *C. laeticolor*, *C. luteoalba*, *Ramaria apiculata*, *R. cokeri*, *R. eumorpha*, *R. flava*, *R. Formosa*, *R. gracilis*, *R. pallid*, *R. versatilis*, *Ramariopsis kunzei* and *R. pulchella* have been recorded from Kerala state (Mohanan 2011) and only one species *Ramaria zippelii* has been recorded from Western Ghats of Maharashtra (Senthilarasu 2013). Hence, a study was initiated on clavarioid fungi of Western Ghats. In the present paper, *Pterula indica* collected from Pune University Campus, Pune is described, illustrated and discussed with similar taxa. *Pterula verticillata* is being reported for the first time from Western Ghats.

## Methods

Thin sections were made from dried specimens, revived in 10% KOH, and stained in 2% Phloxine. Approximately 50 basidiospores from sections were measured excluding the apiculus and ornamentation. The range of spore measurements with extreme values in parentheses precedes the mean spore measurement in parentheses. The colour terms and notations are from Kornerup & Wanscher (1978). The type specimens are deposited at Ajrekar Mycological Herbarium (AMH), MACS' Agharkar Research Institute, Pune, India.

## Results

*Pterula indica* G. Senthilarasu **sp. nov.**  
MycoBank 561873.

Figs. 1, 3B

Etymology – The epithet 'indica' refers that this species is collected and described from India.

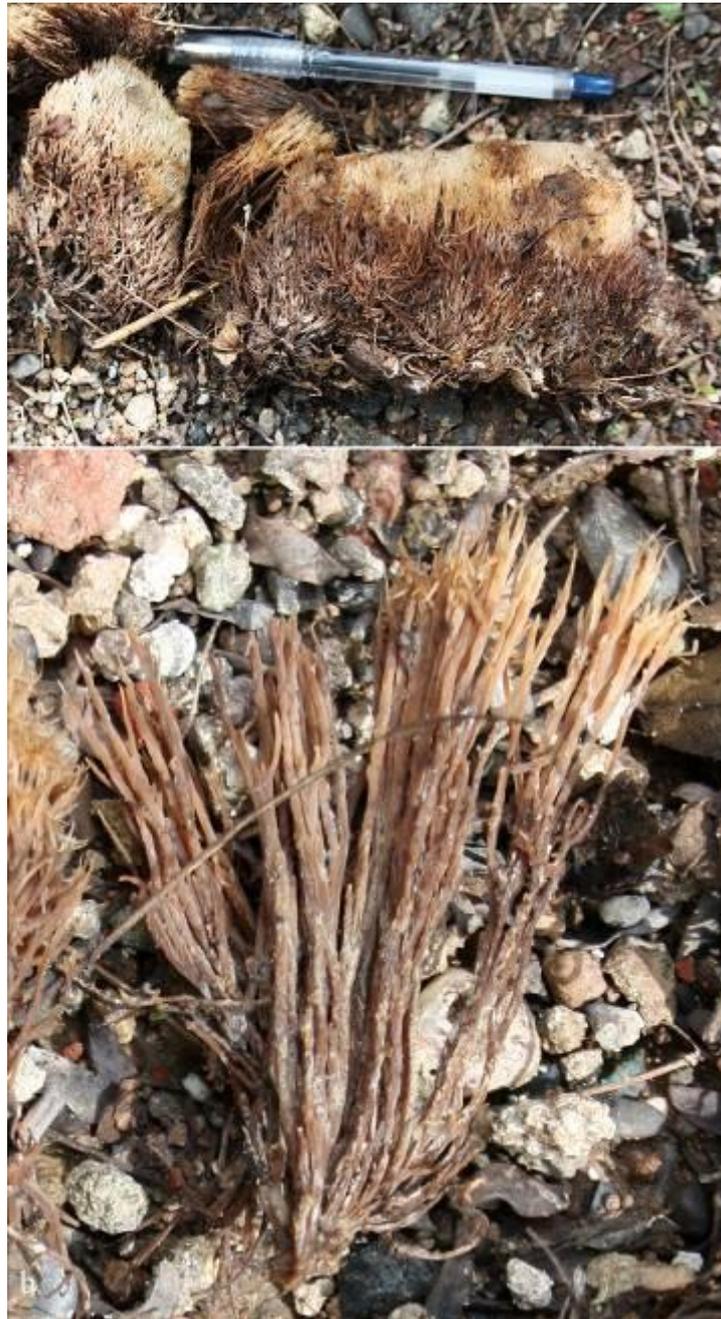
Differs from *P. verticillata* in having reddish brown to dark brown basidiomes with branches polychotomous below and dichotomous at the yellowish white apex and hyphoid to cylindrical cystidia with mucronate apex.

Material examined – India, Maharashtra state, Pune, Pune University Campus (18°31'18.4"N 73°49'53.6"E), on ground (soil), *Acacia* forest, 19.10.2010, *Dalbergia* plantations, 28.09.2011. Collected by G. Senthilarasu (Holotype AMH 9430).

**Basidiomes** terrestrial, 50–75 × 50–200 mm, gregarious or in clumps, erect, branched polychotomously below, dichotomously at the apex, tubular. **Stipe** short, up to 10 × 20 mm, brittle; surface reddish brown (8E8) to dark brown (8F8), becoming dark, apices white to yellowish white (4A2), subulatus, acute, glabrous.

**Basidiospores** (4.5)5–7 × (2)3–3.5(4), (6.12±0.53 × 2.96±0.12) µm, Q = 2.06, cylindrical, hyaline, smooth, thin-walled, 1–2 guttulate. **Basidia** 20–32 × 7.5–9.5 µm, cylindrical clavate, bisporic to tetrasporic, sterigmata up to 4 × 1 µm, thin-walled, guttulate. **Cystidia** 18–26.5 × 4.5–5.5 µm, hyphoid to cylindrical with short mucronate apex, hyaline, thin-walled. **Hyphal system** dimittic, skeletal hyphae up to 8.5 µm diam., thick-walled, subhyaline to yellowish brown, not inflated; generative hyphae 2–5 µm diam., hyaline, not inflated, thin-walled with clamp connections.

*Pterula indica* is very striking species growing largely on soil, is easily recognized by the reddish brown to dark brown basidiomes with white to yellowish white apices. *Pterula verticillata* differs from *P. indica* in having pale orange to peach basidiomes that branched profusely in verticillate manner. In addition, the branches are shiny and lucidus in *P. verticillata*. Whereas, the basidiomes of *P. indica* are branched polychotomously below and dichotomously at the apex. *Pterula subulata* Fr. differs from *P. indica* in having subulate, white to grayish basidiomes and presence of large, ovoid spores (8–10 × 5–7 µm vs 4.5–7 × 2–4 µm). *Pterula gracilis* (Desm. & Berk.) Corner (Corner 1950) has white, shiny, translucent, slightly hairy, simple and unbranched basidiomes. Whereas, *P. indica* has reddish brown to dark brown, profusely branched, dull, smooth basidiomes having white, acute apices.



**Fig. 1** – *Pterula indica*. Macroscopic features. a Basidiomes in situ (Holotype AMH 9430). b Individual basidiome. Photos by G. Senthilarasu.

***Pterula verticillata*** Corner

Figs 2, 3A

Specimens Examined – INDIA, Maharashtra state, Pune, Pune University Campus (18°31'18.4"N 73°49'53.6"E), on ground (soil), *Acacia* forest, 13.08. 2010, 28.09.2011. Collected by G. Senthilarasu. (AMH 9429, AMH 9458).

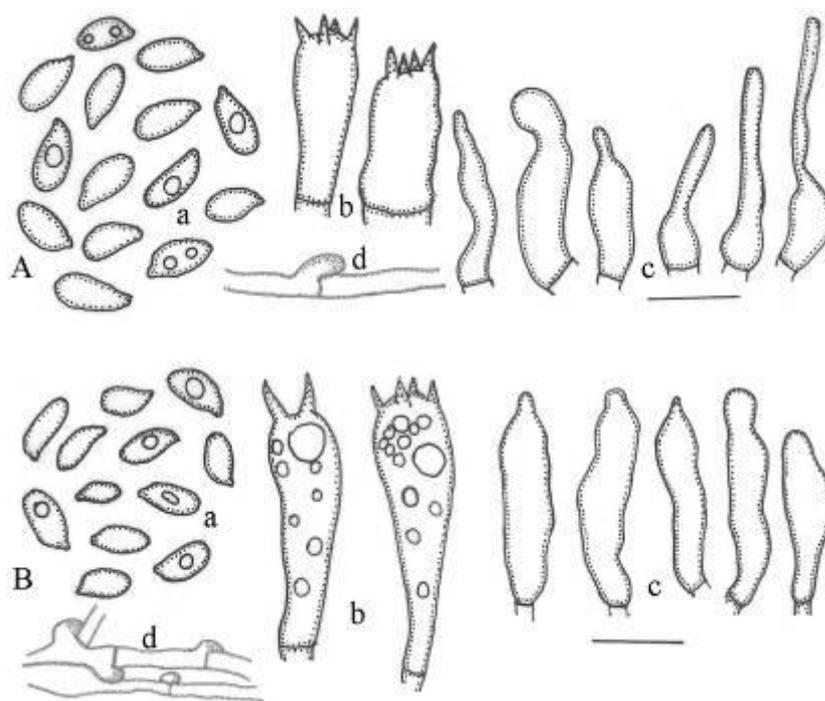
**Basidiomes** 20–40 × 20–50 mm, erect. **Stipe** rudimentary to well developed, 10–25 × 3–5 mm, cylindrical, main axis arising from mycelial threads, binding the base of the basidiomes closely to the substrate, initially colourless, translucent, profusely branched, polychotomous below, verticillately to irregularly branched above, cylindrical, sterile apices acute, branches initially translucent, becoming shiny in age, apices remaining translucent even in matured branchlets; surface pale orange (5A3, 6A3) to peach (7A4). **Axils** acute to subacute; branchlets divergent; very thin, becoming hairy on drying.

**Basidiospores** (5)6–7(7.5) × (2.5)3–3.5, (6.53±0.6 × 3.15±0.23) μm, Q = 2.07, cylindrical, hyaline, smooth, apiculus not prominent, guttulate, 1–2 small guttules present. **Basidia** 12–18 × 6–8 μm, cylindrical, becoming short clavate, bisporic to tetrasporic, sterigmata short and thin, guttulate, thin-walled. **Cystidia** 14–60 × 5–7 μm, hyphoid with long rostrate apex, hyaline, thin-walled. **Hyphal system** dimitic; skeletal hyphae up to 7 μm diam., thick-walled, wall up to 1 μm thick, brown; generative hyphae 1–4 μm diam., inflated to 10 μm diam., hyaline, yellowish brown in mass, thin-walled with clamp connections.

*Pterula verticillata* is a very distinctive species growing largely on soil, occupies large area of soil and the mycelium also extensively colonize the litter and produce basidiomes every year during monsoon (August–October). *Pterula verticillata* closely resembles *P. decumbens* (Corner et al. 1957) described from India. However, *P. decumbens* clearly differs from *P. verticillata* by its decumbent, brown basidiomes, and composed of main axis which gives off lateral branches, attached to the substratum by numerous rhizoidal branches. Whereas *P. verticillata* has erect, pale orange to peach basidiomata and the main axis gives off verticillate to irregular branches.



**Fig. 2** – *Pterula verticillata*. Macroscopic features. a. Basidiomes in situ. b. Individual basidiome. Photos by G. Senthilarasu.



**Fig. 3** – A *Pterula verticillata*. a. Basidiospores. b. Basidia. c. Cystidia. d. Generative hypha with clamp connection. B *Pterula indica*. a. Basidiospores. b. Basidia. c. Cystidia. d. Generative hyphae with clamp connections. Scale Bar = 10 µm.

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