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***Trappeindia himalayensis* gen. et sp. nov., a sequestrate fungus with potential affinity to *Strobilomyces* (Basidiomycotina, Boletales)**

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ABSTRACT

An unusual sequestrate fungus forming ectomycorrhizae with *Cedrus deodora* (Roxb.) Laud. forms sporocarps in the northwestern Himalayas of India during spring. It has a dark brown to black peridium with a solid, white to brown, loculate gleba containing spherical, reticulate spores. It resembles no described genus and is described here as *Trappeindia himalayensis* gen. et sp. nov.

Keywords: mycophagy, ectomycorrhiza

INTRODUCTION

When the snow melts in the northwestern Himalayas of India, from March through May, local people harvest a sequestrate fungus from among roots and adherent soil of *Cedrus deodora*. This fungus fruits abundantly and presumably forms ectomycorrhizae with *Cedrus deodora* and has been routinely collected by one of us (SLS) since 1987. Each sporocarp is directly connected by a small rhizomorph to an ectomycorrhiza. The sporocarps appear serially along the root, giving it a beaded appearance. Some sporocarps are exposed due to compaction by grazing animals or by soil erosion from heavy rains. It lacks an odor but is said to have the taste of boiled potatoes.

METHODS

Different parts of Himachal Pradesh that have *Cedrus deodora* forests were visited regularly from March through May to collect basidiomata and associated mycorrhizae. Macroscopic and microscopic studies followed the methods presented in Castellano et al. (1999; 2003). Colors of fresh fruiting bodies are in general terms by the authors. Dried specimens were hand-cut and mounted in 5% KOH or water for microscopic observation. Spore dimensions are based on measurement of at least 20 randomly selected spores and include ornamentation. All measurements of structures are from mature sporocarps. Light photomicrographs are from material mounted in 5% KOH. Dried spores were mounted on pegs with double-sided tape and coated with gold for scanning electron

microscopy with an AmRay 3300 FE field emission scanning electron microscope (SEM). Herbaria are abbreviated according to Index Herbariorum (2011).

TAXONOMY

***Trappeindia* Castellano, S.L. Miller, Singh & Lakhanpal, gen. nov.**

Etym.: “*Trappeindia*,” named in honor of Dr. James M. Trappe, eminent truffle taxonomist, and India from which country this taxon is described.

Basidiomata subglobose to globose, slightly lobed, dark brown to black when fresh and glabrous when dry. *Gleba* loculate, with locules polygonal to elongate, with spores lining surface, moist, tramal tissue white, spores brown, as dried becoming hard, brittle and pale to dark brown; columella absent. *Rhizomorphs* stout, concolorous with peridium, attached at base of basidiomata. *Peridium* of thin-walled, much branched, loosely interwoven hyphae, with dark brown pigment crystals. *Trama* of hyaline, gelatinized, forming a loosely interwoven mediostratum of highly branched, occasionally irregularly swollen, hyphae, divergent; clamp connections not seen. *Basidia* in a palisade, cylindrical to irregularly elongate, thin-walled, hyaline. *Basidioles* hyaline, clavate. *Cystidia* absent. *Clamp connections* absent. *Spores* globose to subglobose, symmetrical, ornamentation with irregular reticulation; spores in KOH hyaline to brown.

Species typica: *T. himalayensis* Castellano, S.L. Miller, Singh & Lakhanpal, gen. et sp. nov. Mycobank for genus name – MB 801207 Mycobank for species name – MB 801208

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Basidiomata 0.5-4.0 cm, subglobose to globose or slightly lobed, dark brown to black when fresh and as dried, glabrous, with a distinct basal point of attachment. *Gleba* loculate, locules polygonal to elongate, empty with spores lining surface, moist, tramal tissue white, spores brown, as dried hard, brittle and pale to dark brown; columella absent. *Rhizomorph* single, stout, ± 1 mm in diam, concolorous with peridium, attached at base of basidiomata. *Taste* of boiled potatoes. *Odor* not distinctive.

Peridium 140-300 μ m thick, of thin-walled, much branched, brown near surface, hyaline towards gleba,

coarse, loosely interwoven hyphae, 3-5 μ m in diam, incorporating much debris or dark brown pigment crystals. *Trama* of hyaline, gelatinized, forming a loosely interwoven mediostratum of highly branched, occasionally irregularly swollen, hyphae, 2.5-4.5 μ m in diam, divergent; clamp connections not seen. *Basidia* in a palisade, cylindrical to irregularly elongate, thin-walled, hyaline, 5-8 x 40-45 μ m, sessile, 1-2-spored; sterigmata up to 6.3 μ m broad and up to 24 μ m long, collapsing when spores detach. *Basidioles* hyaline, clavate, 5-8 x 10-15 μ m. *Cystidia* absent. *Clamp connections* absent.

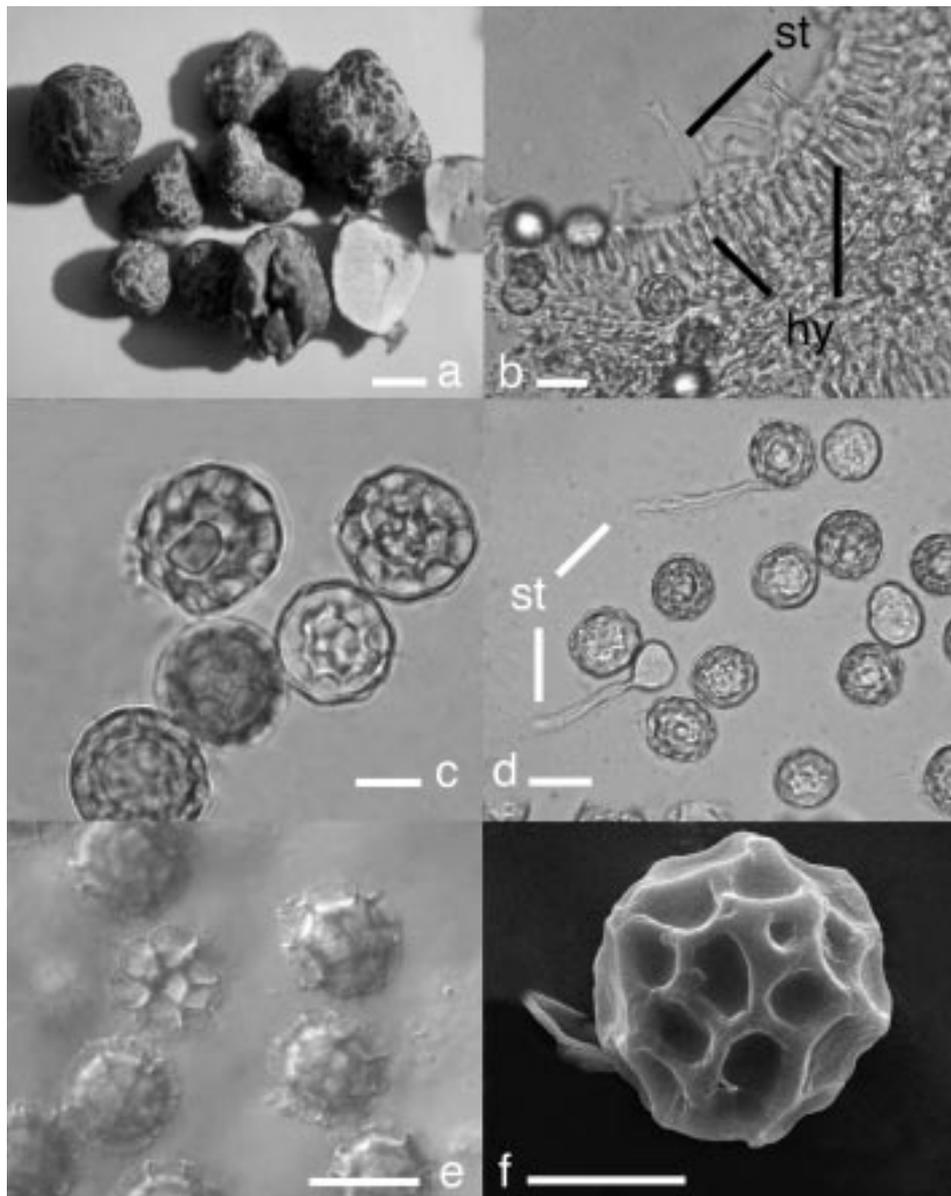


Figure 1. *Trappeindia himalayensis* (HPUB 2645). a. Sporocarps. b. hymenial layer (hy) showing the basidial palisade and sterigmata (st). c. photomicrograph of spores showing the surface aveolae and the aveolae in section. d. mature spores and two spores with sterigmata (st) still attached. e. spores under light microscopy with Nomarski contrast showing surface ornamentation and cross-sectional view. f. spore with SEM showing the irregular-sized aveolae. Scale bars: a = 2 cm; b = 20 μ m; c = 10 μ m; d, e = 20 μ m; f = 10 μ m

Spores globose to occasionally subglobose, symmetrical, 21.1-23.7 (-27.7) μm in diam (mean = 22.9 μm), ornamentation an irregular reticulation, aveolae 2-5 μm in diam and 2.5-3.5 μm tall, walls of the aveolae up to 1.5 μm broad, often curved at apex; sterigmal attachment occasionally evident and up to 5 μm broad; spores in KOH hyaline to pale brown when young, brown when mature, in Melzer's reagent yellow-brown when young and mature.

Holotypus: India, Himachal Pradesh, Junee Valley, Mandi Devidar, 16 April 1989, L. Singh (HPUB 2645; isotype OSC).

Etymology: "Species name : "*himalayensis*," Latin for the general location of the holotype and paratype specimens.

Habit, season and potential mycorrhizal partner: Hypogeous; March through May; under *Cedrus deodora*.

Other collections examined: **INDIA**, Himachal Pradesh, Junee Valley, Mandi Devidar, 15 April 1989, leg. L. Singh (HPUB 2641, 2642, 2643, 2644); same data as above except 20 April 1991 (HPUB 2649); **INDIA**, Himachal Pradesh, Chopal, 25 April 1989, leg. L. Singh (HPUB 2646).

DISCUSSION

Local people collect this species March through May, though we have voucher collections only from April and it is said to be the "resting stage" for *Boletus horakii* Lakhanpal *et al.* that fruits in the fall in the same localities. The common name is "Bankae" or "Janda." Local people readily consume it, both raw or after baking in burnt ash.

Affinities of this genus to other sequestrate genera are uncertain at this time. At first impression it appears similar to genera in the Sclerodermataceae due to glebal color and texture. It also has pigmented, reticulate spores as many *Scleroderma* species but *Trappeindia* produces its spores on 1-2 spored basidia in a palisade as opposed

to the nurse hyphae of *Scleroderma*. *Leucogaster* also produces hyaline, reticulate spores but the spores are enclosed in a perispore sac and their basidia are not arranged in a palisade. At this time a relationship to the genus *Strobilomyces* can be inferred by the inamyloid, reticulate spores of *T. himalayensis*, unusual in sequestrate Basidiomycotina (Trappe *et al.* 2009).

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