

RESEARCH ARTICLE

Carnivorous Mushroom from Eastern Ghats

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Abstract

Hohenbuehelia is a common nematophagous mushroom usually occurring on dead woods is now suspected and found that, it has also developed the tendency to feed on the insects too. It has been collected and identified from Kolli Hills, Eastern Ghats, India.

Keywords: *Hohenbuehelia*, nematophagous mushroom, insects, Kolli Hills, Eastern Ghats.

Introduction

Hohenbuehelia is a nematophagous fungus known to be edible, but rather tough (Tom volk, 2000). It has also been portrayed as carnivorous fungi (Thorn and Barron, 1984; Tom volk, 2000). It is a pleurotoid mushroom grows on wood or on woody debris and is usually without stipe. It has white spore prints and often smells pleasant and taste mealy. The key characteristic features of the genus include glutinous pileus, metuloid cystidia, gelatinous context and a nematophagous tendency. The term 'nematophagous' is the ability to feed on nematodes especially, the species of *Hohenbuehelia* (Tom volk, 2000).

Hohenbuehelia looks similar with *Pleurotus* and *Crepidotus*, there's often no stipe and attached laterally or eccentrically to the substrate. *Hohenbuehelia* has very narrow, crowded gills that are decurrent and the white spore distinguishes it from *Crepidotus* which is a dark spored species. When compared with *Pleurotus* it usually has much thinner flesh rather a thick flesh in *Pleurotus*. There are also some significant microscopic differences between the two genera. The easiest way to distinguish *Hohenbuehelia* from *Pleurotus* is that, *Hohenbuehelia* has a gelatinous layer between the context and the cap cuticle. Below the pilepellis there is roughly parallel hyphae embedded in a gelatinous matrix. This gelatinous layer makes this mushroom much more rubbery and tougher in texture. Below that is the context or flesh of the pileus and followed by the gill. Another distinguishing feature is the presence of metuloid cystidia in the hymenium. The metuloid cystidia of this species do not have horns or prong like that of *Pluteus* instead it has a dense coating of crystals on their surface. These also have much thicker walls. Both *Hohenbuehelia* and *Pleurotus* can supplement their protein needs by trapping nematodes, which are small flat worms that are very abundant in wood and soil (Thorn and Barron, 1984; Hibbett and Thorn, 1994).

During our biodiversity studies in Eastern and Western Ghats of South India it has been collected in troops on dead wood found in Solakkadu region of Kolli hills, Tamil Nadu. *Hohenbuehelia*, previously known to feed on nematodes, now found to feed even on insects based on the observations made in the field. This species, *Hohenbuehelia petaloides* has already been reported from, Lucknow, Chennai, Alagar hills, Orrisa and Kerala (Manjula, 1983).

Materials and methods

Macroscopic characters of fresh specimens were noted after the collection. Photographs of the fresh specimens were taken both in the collection place as well as in the laboratory (Atri *et al.*, 2003; Kaviyaran *et al.*, 2009). Spore print was taken to know the colour of the spore. Kornerup and Wanscher's (1978) book was followed to determine colour of the fresh specimens. The terms for the description are was that of Largent (1986) and in some cases Vellinga (1998).

The specimens were tagged with collection number and dried in electric drier and were preserved in sealed polythene bags along with naphthalene balls in order to protect from insect and pest attack. The preserved specimen was revived in 3–5% Potassium hydroxide (KOH) or 10% (NaOH) solution. Stains such as cresyl blue, cotton blue and 1% aqueous phloxine were used. Amyloidity reaction of spores and tissues were studied using Melzer's reagent (chloral hydrate–100 g; potassium iodide– 5 g and distilled water (100 mL). The basidiospore shape was determined according to the Q-coefficient (length-width ratio) (Bas, 1969) of at least 20 randomly selected but mature basidiospores. The measurement does not include the apiculus and were made in KOH at 2000X with a calibrated optical micrometer in a trinocular Labomed (CXL plus) microscope. The line diagrams were drawn with the aid of the POM prism type camera lucida. Photographs of some of the microscope structures have also been taken.

In case of cystidia the crystals have fallen off during the preparation of this specimen for photography. The preserved specimen was deposited in the Herbarium of Madras University Botany Laboratory (MUBL) with accession number (Herb. MUBL No. 3644) for future microscopic observations. Identification of the specimen was done using standard identification keys (Pegler, 1977, 1983, 1986; Singer 1975; 1986).

Results and discussion

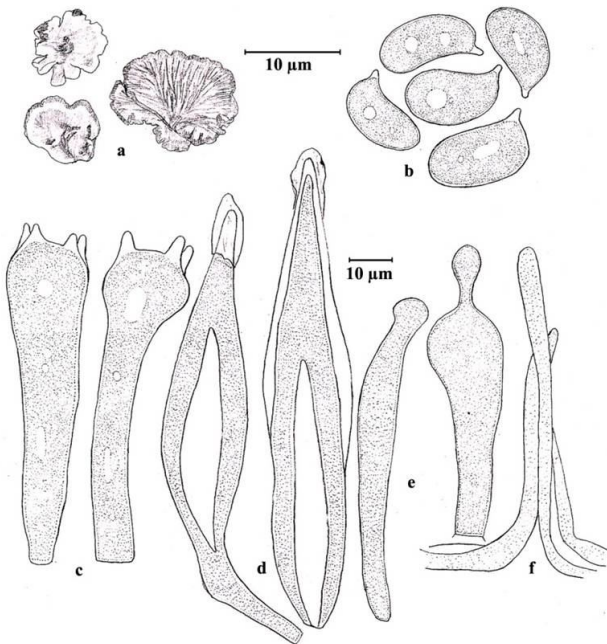
Hohenbuehelia petaloides (Bull. ex Fr.) Schulzer Verh. Zool.-Bot. Ges. Wien 16: 45 (1866).

Basidiocarp plane pruinose. Pileus 2–2.5 cm dia., dry, convex to plane, greyish orange when moist, olive brown (4E6) on drying, with reddish brown (8E8) disc, smooth; margin undulating, smooth. Lamellae decurrent, cream yellow (6E4), edge brown entire, crowded with lamellulæ of six lengths, sometimes bifurcating. Stipe absent (Fig. 1A).



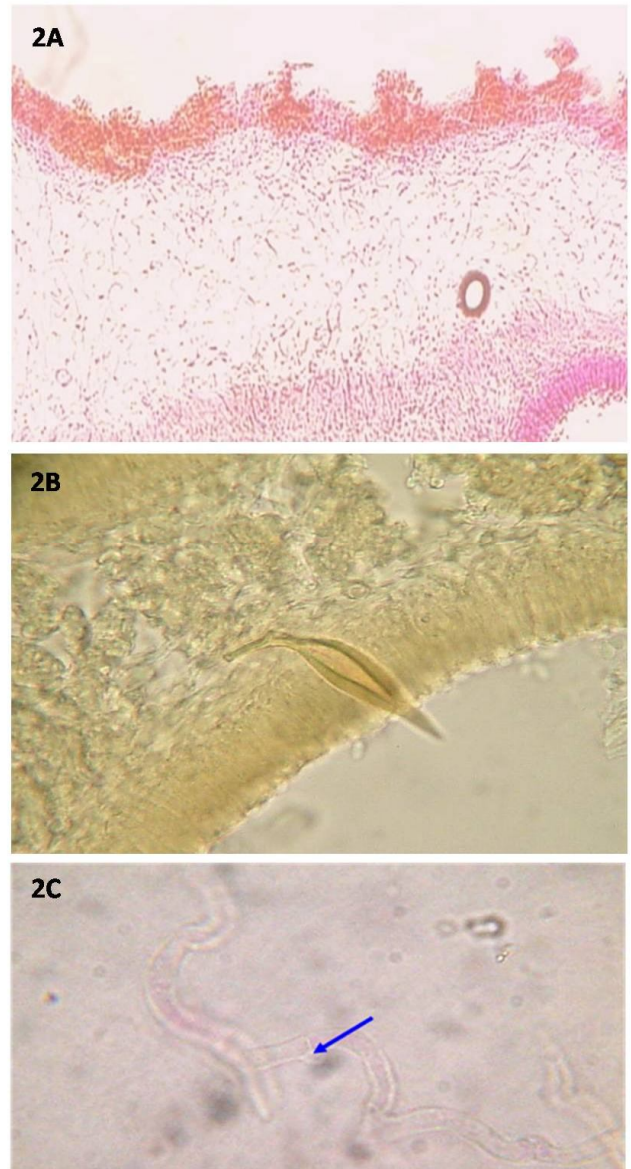
Fig. 1A. Habit along with the insect fed by the mushroom.

Fig. 1B. Microscopic feature of the mushroom.



a. Habit, b. spores, c. basidia, d. metuloid cystidia, e. Cheilocystidia, f. Pileipellis

Fig. 2A. Gelatinous context; 2B. Metuloid cystidia; 2C. Clamp connection in the gelatinous context.



Context white, thin, inamyloid, with upper thick gelatinized layer loosely interwoven hyaline matrix consisting of hyphae with clamp connection, and lower non-gelatinized layer tightly interwoven with similar hyphae (Fig. 2A,C). Spores 5.4–9 × 3.2–4.3 (7.2 ± 0.67 × 3.75 ± 0.5) µm, Q = 1.92, ovoid ellipsoid to cylindric ellipsoid, hyaline, thin walled, in amyloid. Basidia 14–27.2 × 3.2–7.6 µm, clavate to inflated clavate bearing four sterigmata. Lamellae edge heteromerous with crowded cheilocystidia. Cheilocystidia 16.83–34.65 × 6.9–8.9 µm, lageniform or inflated fusiform and always with a mucronate, frequently constricted apex 9.9–10.89 × 5.4–3.9 µm, thin walled, hyaline. Metuloid 65–96 × 16–19 µm, fusoid ventricose with an attenuate pointed apex, golden brown, thick walled and encrusted with crystals at the apex (Fig. 2B).

Pleurocystidia with rounded apex, 64–70 × 7–14 µm, thin walled and hyaline. Hymenophoral trama regular to sub regular, hyaline with parallel hyphae, 2–5.4 µm dia., sub hymenium interwoven. Pileal surface an uncontinous trichodermium, towards the base of the pileus the surface hyphae becoming suberect and aggregated into short fascicles to give rise to an irregular villose appearance (Fig. 1B).

A closer view on the specimen of the present collection showed that the mycelium was found to envelop the entire insects, in some cases the insects have been completely destroyed by the mycelial hyphae in order to obtain the nutrition requirement that is, it meets its nitrogen requirement (Fig. 1A). These fungi have 'sticky knobs' on the hyphae that grow through the wood (Vellinga, 2008). It has been reported that these fungi usually perform only in the mycelium which is buried in the substrate but not through fruiting structure (Vellinga, 2008). But this could be unusual that when an insect finds its shelter in between the gills, the sticky knobs attach to curious insects and paralyze them and the hyphae enters and devour them as in the case of nematodes. The body of the insect becomes stuck, the hyphae then grow into the body of the insect and digest it, providing them with the nitrogen it needs. Further study on the identification of insect, and the insect eating mechanism is being carried out for the better understanding.

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