A rare agaric (Agaricomycetes: Agaricaceae) from a sacred grove of Eastern Ghats, India

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Clarkeinda trachodes (Berk.) Singer, is a rare tropical Asian monotypic agaric (Leelavathy et al. 1981; Singer 1986; Pegler 1986; Zhu-Liang 1991; Carmine & Contu 2002) belonging to the family Agaricaceae. It is a large lepiotoid agaric, characterized by the presence of volva and annulus. The spore print is olive brown and the spores are small with truncated germ pore. This species has been reported earlier from only six places around the globe—Sri Lanka (Pegler 1986), India (Leelavathy et al. 1981), Malaysia (Pegler 1986), Indonesia, China (Zhu-Liang 1991) and Italy (Carmine & Contu 2002). This forms the second report of this species from India indicating that this species is well represented in southern India.

It is similar to *Chlorophyllum* but with marked differences: the basidiocarp with a large plate like fawn coloured scales in the centre (mostly star shaped) of the pileus, dextrinoid spores with a compound wall and presence of volva. Matured spores exhibit metachromatism in cresyl blue. This specimen also shows similarity with *Macrolepiota rhacodes* in having the plate like squamules on the surface of the cap but differs in the absence of bulbous base and presence of volva.

Sacred groves are patches of natural vegetation surviving in man-modified landscapes which are dedicated to local deities and protected by religious tenets and cultural traditions, with religious fervor. They are a social institution, which permit management of biotic resources through participation of people of the local community. Although the practice of conserving the local biodiversity through sacred groves is very old, the importance has been acknowledged only recently (Ramanujam & Cyril 2003). In India, during 1997, the existence of thousands of such sacred groves was recorded along the plains and hills of the Indian subcontinent and confirmed their floristic richness confined within islets of diverse habitats (Ramakrishnan et al. 1998). They are a rich repository of biodiversity, a myriad of valuable ecosystem services and serve as ideal study sites to address many ecological issues related to forest ecosystem dynamics and management (Tripathi 2005). In Tamil Nadu, there are around 503 sacred groves (Anthwal et al. 2006). In most localities, sacred groves are being increasingly exposed to various kinds of threats leading to either qualitative degradation or total disappearance. There have been numerous studies on medicinal herbs, diversity of plants and insects, ecology and anthropology (Gadgil & Vartak 1976; Tripathi 2005). However, studies on the diversity of mushrooms in such sacred groves is lacking.

As a part of systematic studies on the agarics of southern India, Kolli Hills were studied for the past four years (March 2006 – August 2010). Kolli Hills are the part of Eastern Ghats, which is one of the richest floristic areas in the world (Bhusan 2003) with hills rising from 200–1415 m with deep ravines and high peaks (Chittibabu & Parthasarathy 2000; Ramachandran et al. 2007), having a wide range of ecosystems and species diversity, located at the tail end of the Eastern Ghats in Namakkal District in the state of Tamil Nadu (Fig. 1). They are part of the Talaghat stretch. Kolli Hills are known for sacred groves and

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Figure 1. The location of collection area

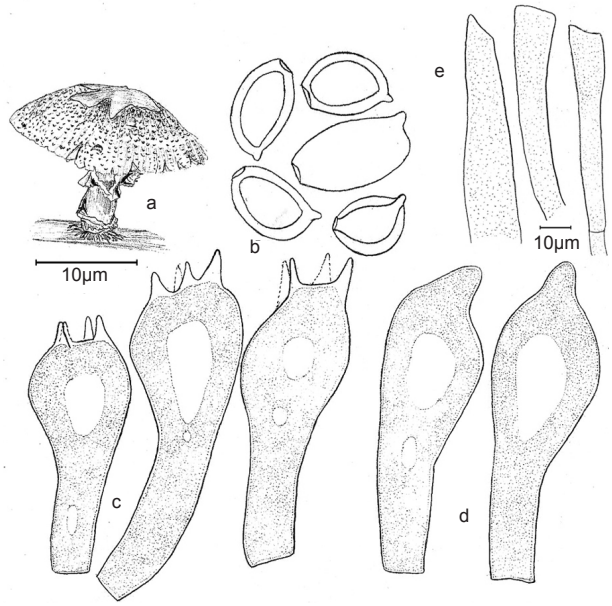

Figure 2. Clarkeinda trachodes
a - habit; b - spores; c - basidia; d - pleurocystidia; e - pileal cystidia

other ritual practices (Mulligan et al. 2007).

Materials and Methods

Collections were made as suggested by Largent (1977) and Atri et al. (2003). Macroscopic details such as shape, colour, dimension and odour of fresh basidiocarps were recorded. Terminologies used by Largent were followed for recording the characters of specimens. Kornerup & Wanscher's (1978) colour chart was followed to determine colour of the fresh specimens. The specimens were dried by using a mushroom drier, labeled and preserved in sealed polythene covers along with naphthalene balls in order to safeguard them from insects pests. The specimens were deposited in the Herbarium of Madras University Botany Laboratories (MUBL) for future studies (MUBL No. 3673).

The dried specimens were revived in 3% KOH. Stains such as 1% aqueous Phloxine, Acetocarmine and Melzer's reagent were used to study carminophilous reaction, amyloidity reaction of the spores (Largent 1977). Spore print was taken and spores, basidia, cystidia, hyphae, etc., measured using micrometric techniques. Line diagrams were drawn with the aid of camera lucida attachment (Fig. 2).

Taxonomy

Material examined: 22.v.2005, large fruit bodies (12 nos) of *Clarkeinda trachodes* were found to occur on soil in solitary as well as in troops in the shady places of sacred groves in Nariankadu of Kolli Hills (Nammakkal District), Tamil Nadu (Image 1 a,b). coll. M. Kumar & V.Kaviyarasan, (MUBL. No. 3673).

The culture of *C. trachodes* (VKMK06) is maintained in MUBL Culture Collection Centre.

Macroscopic description

Basidiocarp troops, terrestrial in grass land. Pileus 7.5–13 cm, broadly parabolic to convex or almost applanate to slightly uplifted; surface pale (4A1–4A2) with greyish-brown to clay squamules all over and brown plate like squamules (7E6–7F6) at disc on a white background; dry, squamose margin striate, rimose, appendiculate.

Lamellae free, sulphine yellow (3A2) when young and yellowish-grey (3B2) when old, up to 12mm wide, crowded with lamellulae of five lengths; edge thick and not smooth.

Stipe 8.5–9.2 × 1.4–2.2 cm, central, obclavate to cylindric, tapering upwards, with a bulbous base, hollow, surface white, bruising to yellowish-green (4A2–4B2), smooth.

Annulus persistent, complex, thick, very broad, pendulous, with squamules on the bottom of the annulus, white. Volva present, 1–3.5 cm deep, white, lobes usually closely appressed with stipe and in some

Image 1 (a,b). Habitat of *Clarkeinda trachodes*

specimen inconspicuous.

Context upto 1.3cm thick at the disc, white, changing to brownish-red when exposed, consisting of slightly interwoven, thin walled, hyaline hyphae of 2–7.63 µm diam., inflated upto 13µm diam. Spore print 'pale yellow'(1A3) to greyish-yellow (1B3).

Microscopic description

Spores 5.67–8.50 × 4.36–5.45 (7.08 ± 0.49 × 4.9 ± 0.43) µm, Q = 1.44, ellipsoid to ovate, truncate at the apex by a broad distinct, germ pore, hyaline, dextrinoid, not metachromatic with cresyl blue, smooth, thick complex wall. Basidia 17.45–21.82 × 4.90–8.72 µm, clavate, bearing four sterigmata, sterigmata short. Lamellar edge not sterile. Cheilocystidia not observed. Pleurocystidia 21.82–22.91 × 6.54–6.89 µm, not much broadly mucronate. Hymenophoral trama regular, 22.54–50.72 µm dia., hyaline, consisting of thin walled hyphae, 2–7 µm diam., inflated upto 15µm dia. Subhymenial layer well developed, 7–10 µm in dia., pseudoparenchymatous. Pileipellis pellicle formed by agglutinated trichodermial hyphae. Pileal surface a trichodermial palisade of thin walled erect hyphae, 6.76–15.49 µm dia., hyaline, terminal elements cylindrical. Clamp connections absent in all hyphae.

The species collected from Kolli Hills was compared with the previous Indian record of Leelavathy et al. (1981) and found that there is not much difference in all the macroscopic and microscopic characters except for a few slight variations like the smaller basidia.

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