

***Macrolepiota procera* (Scop.) Singer (Agaricomycetes) – a new generic record of edible mushroom for Nagaland, Northeast India**

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Abstract. Kumar R, Pandey S, Rishi RR, Giri K. 2017. *Macrolepiota procera* (Scop.) Singer (Agaricomycetes) - a new generic record of edible mushroom for Nagaland, Northeast India. *Asian J Agric* 1: 6-8. In August 2013, an interesting mushroom was collected from the Puliebbie forest range in Kohima District of Nagaland state of India. The mushroom was identified as *Macrolepiota procera* (Scop.) Singer based on the macroscopic and microscopic characters.

Keywords: *Macrolepiota procera*, mushroom, Nagaland, new generic record

INTRODUCTION

The Northeast region of India abounds in forest wealth, including a wide range of flora and fauna. Nagaland, one of the Northeastern states of India, is a unique hotspot of rich biodiversity and has served as the habitat for a wide variety of mushroom species. The altitude varies from 194 m to 3,841 m and is characterized by the luxurious growth of conifers and mixed forests. Nagaland enjoys a humid tropical climate, where the plain areas and foothills both have a subtropical climate. The low to moderate ranges have varying degrees of slopes and have a submontane climate. Monsoon season lasts for five months, i.e. from May to September, with May, June, and July being the wettest months. Due to varied topography, annual rainfall ranges from 1000 mm to 3000 mm at different places with an average of 2000 mm. (<http://www.moef.nic.in/sites/default/files/sapcc/Nagaland.pdf>). These climatic conditions are conducive for the natural occurrence of a variety of mushroom species. Kumar et al. (2013) reported 15 wild edible mushroom species from 12 locations in different districts of Nagaland.

Mushroom genera having different forms and morphological characters comprise the white and green spored members of the Agaricaceae such as *Chamaemyces*, *Chlorophyllum*, *Coniolepiota*, *Cystolepiota*, *Eriocybe*, *Lepiota*, *Leucoagaricus*, *Leucocoprinus*, and *Macrolepiota* are called lepiotaceous fungi (Vellinga 2004 a, b). Historically mycologists characterized and defined these lepiotaceous taxa mostly from Netherlands in southern Limburg near Breukelen and Amsterdam (Kelderman 1994; Chrispijn 1999). They are also known in other countries (Bon 1993; Guinberteau et al. 1998; Henrici 2001; Sundberg 1967). *Macrolepiota* has about 40 species, and some of these have been used as foodstuffs and potentially cultivated. Using molecular and morphological data, the position and composition of *Macrolepiota* within the Agaricaceae and its phylogenetic relationship with other members of the family have been investigated.

Macrolepiota procera clustered together with *M. mastoidea* and *M. clelandii* (Vellinga et al. 2003). Morphologically, *Macrolepiota* is readily recognized by its big and fleshy basidiocarp; universal veil that splits up into coarse to fine squamules on the pileus; thick walled spores with a germ pore, and an often complicated, double annulus. The majority of the characters of lepiotaceous fungi have been accepted from previous studies (Vellinga 2004; Vellinga et al 2011; Asef and Muradov 2012; Seyidova and Hüseyin 2012).

Macrolepiota procera, the parasol mushroom, is a well-known and highly esteemed edible mushroom in much of Europe, while *Macrolepiota albuminosa* is found in Chinese cuisine. They are harvested directly from natural habitats, grasslands, pastures, forest boundaries, hills, etc. (Boa 2004; Hu 2005; Kirk et al. 2008).

MATERIALS AND METHODS

Systematic and periodical surveys of Puliebbie forest range in Kohima District of Nagaland state of India were undertaken from June 2012 to December 2013. Field surveys and mushroom collection was done according to guidelines mentioned in "A Guide Collecting and Preserving Fungal Specimens for the Queensland Herbarium" (https://fungimap.org.au/Leonard2010_QLD_fungi_collect_manual_v3.2web.pdf). The specimens were immediately wrapped in aluminum foil or wax paper after taking photographs. Few specimens were preserved in 2 % formaldehyde at the time of collection. In the laboratory, the specimens were first dried in an oven at 40-50 oC. The specimens were then kept in plastic containers with some naphthalene balls in the Forest Protection Division, Rain Forest Research Institute, Jorhat, Assam. Identification numbers were assigned to the specimens for further studies. To obtain the spore prints, the face of the mushroom cap was placed over black and white paper (half white and half black) and covered with a bell jar overnight.

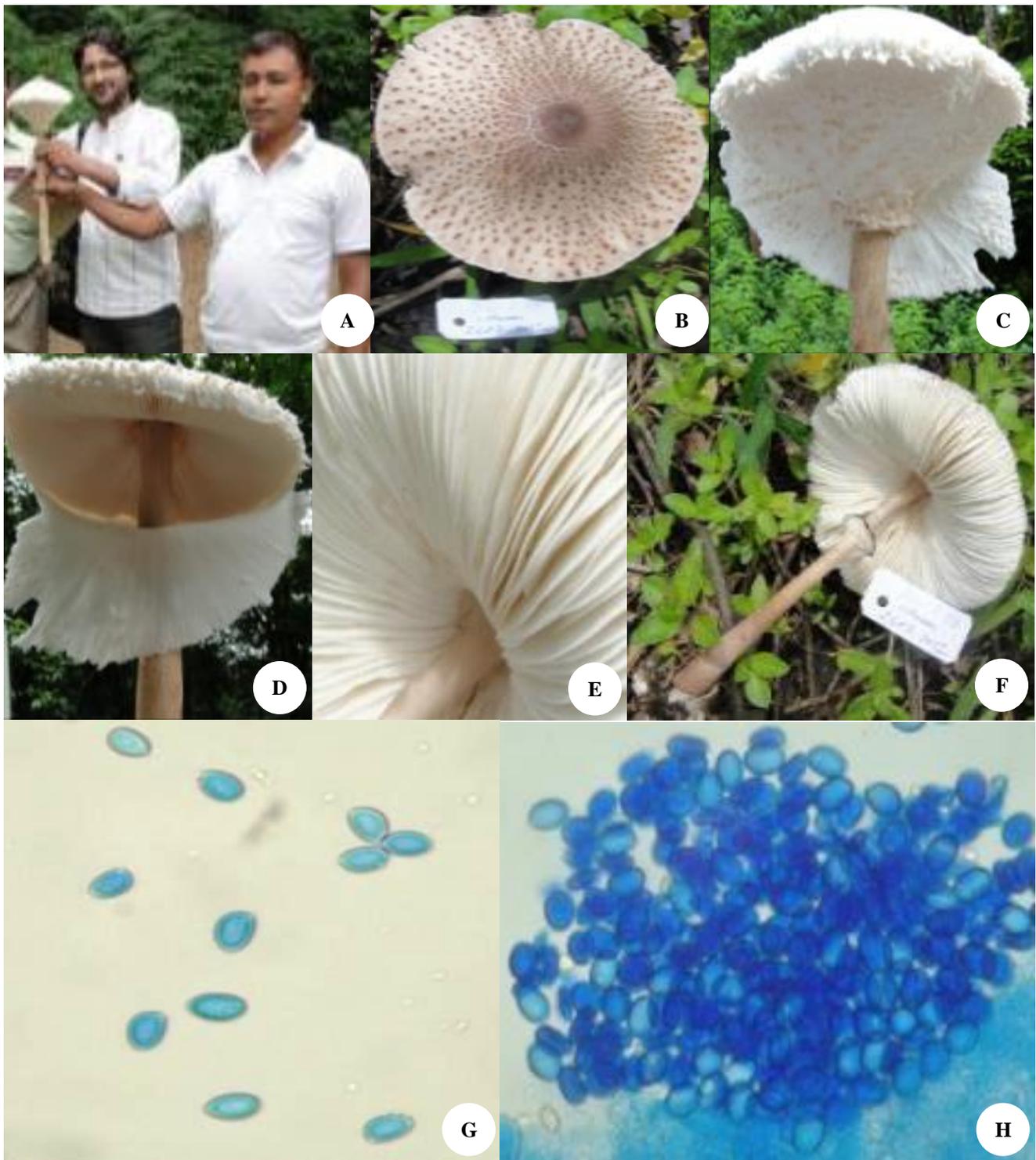


Figure 1. A. Team of scientist and research associates, B-F. Different views of *Macrolepiota procera*, G-H. Spores of *Macrolepiota procera*

RESULTS AND DISCUSSION

Mushroom collection and identification

In August 2013, an interesting mushroom was collected from the Puliezbie forest range in Kohima District of Nagaland state. Standard methods for collection,

preservation, and description were followed (Atri et al. 2005; https://fungimap.org.au/Leonard2010_QLD_fungi_collect_manual_v3.2web.pdf). Color notations in the macroscopic descriptions are from Kornerup and Wanscher 1978. Microscopic characters were studied from freehand sections mounted in 5 % KOH, stained with 1 % Congo

red. The spore shape quotient ($Q = L/W$) was calculated considering the mean value of length and width of 20 basidiospores. The specimens were kept in the Museum of Forest Protection Division, Rain Forest Research Institute, Jorhat, Assam with the identification number: ID No/RFRI/NL-000360. The morphological and microscopic characters revealed it to be *Macrolepiota procera*, a hitherto unrecorded species from Northeast India. The fungus, commonly called parasol mushroom is a basidiomycete fungus with a large, prominent fruiting body resembling a parasol. It belongs to the order Agaricales of the phylum Basidiomycotina. It is a soil-inhabiting saprophytic species growing either alone, scattered in woods, at the edges of woods, or in pastures on trails and other ground areas.

Nomenclature

Based on the presence or absence of clamp connection, Singer (1986) partitioned *Macrolepiota* into 2 groups namely *Macrolepiota* and *Macrosporae*. Bon (1996) divided the genus *Macrolepiota* into three sections. Molecular phylogenetic analysis recovered three major clades: macrolepiota clade, macrosporae clade and volvate clade.

Taxonomy

Cap 8-23 cm in diameter, oval, convex to broadly convex with age, white to cream, covered with brown, dark brown to grayish brown plate like squamules irregularly arranged towards the margin, below surface whitish, dark bump in the center. Lamellae are free, densely crowded, thin, white when young, white to cream colored when mature, lamellae in 2-3 lengths. Stem whitish, subcylindrical 17-33 x 1.2-2.4 cm, very fibrous and reaches full height before the cap has expanded, covered with brown squamules sometimes in irregular bands. Annulus, superior about 4 cm below the stem apex, underside brownish, upper side membranous whitish. Spore print white. Spores smooth; broadly elliptical with a small germ pore, thick-walled, hyaline, dextrinoid, congophilous, 10-16 x 9-13 μm . Basidia thin-walled, clavate, 4 spored, Pleurocystidia absent. Chelocystidia thin-walled, hyaline, in bunches forming a sterile edge, 19-37 x 9-23 μm . Clamp connection present.

Comments

Currently, there are about 117 species recognized worldwide (www.indexfungorum.org 2014). Several other genera are been found that are very similar to *Macrolepiota*. *Chlorophyllum* differs only in the distinctly green or ochre spores. The lamella trama is trabecular (Clemencon 1997), a character shared with *Leucoagaricus* Singer, *Leucoco prinus* Pat., and *Chlorophyllum* Mass. The spore print of genus *Chlorolepiota* is primrose yellow, provided with a germ pore (Vellinga et al. 2003). *Volvo lepiota* Singer also closely resembles *Macrolepiota*; a volva is present, the pileus covering is trichodermal, clamp connections present and the spores have a germ pore. (De Meijer 1996). *Macrolepiota procera* is an edible species

and has been of interest to cultivate, but knowledge on this genus is poor and fragmentary in Nagaland. To facilitate easy identification, a photograph of the fungus and spores is provided (Figure 1-8). To the best of our knowledge, this is the first report on *Macrolepiota procera* from Northeast India.

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