Plantae Scientia – An International Research Journal in Botany Publishing Bimonthly Open Access Journal

Plantae Scientia : Volume 03, Issue 04, July 2020

ISSN 2581-589X

RESEARCH ARTICLE

Calvatia Species: Wild Edible Puff Balls from Amravati Region (M.S.)

Hedawoo Ganesh B.

P.G. Department of Botany, Shri Shivaji Science College, Amravati.

Corresponding Author: drgbhedawoo@gmail.com

Manuscript Details

Manuscript Submitted : 10/05/2020
Manuscript Revised : 13/06/2020
Manuscript Accepted : 01/07/2020
Manuscript Published : 15/07/2020

Available On

https://plantaescientia.com/ojs

Cite This Article As

Hedawoo GB (2020) *Calvatia* Species: Wild Edible Puff Balls from Amravati Region (M.S.), *Pla. Sci.* 2020; Vol. 03 Iss. 04:30-34.

Indexed In

Crossref, Index Copernicus International (ICI), Directory of Research Journal Indexing (DRJI),Scientific Indexing Services (SIS), CiteFactor,

ABSTRACT

India has a rich treasure of natural resources and macromycetes is one of them. Studies on wild mushrooms with special reference to their edibility, utility and medicinal value with the early references on larger fungi may be beneficial for humanity. Traditional aborigines knew the medicinal importance of edible and wild mushrooms and these are now being screened for their bioactivity in various ailments. From several bio-geographical regions of India, at least 2000 edible species of larger fungi were reported. But, the Central India region has not been investigated extensively for mushroom flora. Therefore, mycofloristic surveys were undertaken. During mycofloristic study two *Calvatia* species (puff-balls) *viz. Calvatia cyathiformis* and *Calvatia fragilis* were investigated from Amravati region. Reviewed literature on *Calvatia* species predicts that these species are new for Vidarbha (M.S.) and are edible in nature with good therapeutic potential. Edibility was confirmed by the interaction with tribal people of Korku and Pardhi community. Taxonomic identification, edibility, nutritional status and therapeutic potential of *Calvatia*-complex were noted by referring the standard literature. In developing countries like India, mushrooms like *Calvatia* are boon for progress in the fields of food, medicine and unemployment.

Keywords: *Calvatia cyathiformis*, *Calvatia fragilis*, Amravati, Edibility, Therapeutic potential

INTRODUCTION

Calvatia Fr. (Basidiomycotina, Gasteromycetes) is a cosmopolitan Lycoperdaceae member of about 35-45 species of mostly medium to large-sized epigeous puff balls. The name *Calvatia* derives from the word calvus (Latin) meaning "bald". The genus is soft and is characterized by stalked- sessile, globose- subglobose, pyriform- subpyriform sporophore. Fruiting body dehisces by irregular fragmentation of the peridium.

The basis of taxonomic analysis of macromycetes is still morphological, since structure is relatively easy to observe and record. Followed by synthesis consists of examining the data critically in order to classify it in a useful way. The basic taxonomic category is the species, comprising individuals separated from others by discontinuities. Such taxonomic studies will lay the foundation and path for futuristic meaningful investigations. There are 140 records of *Calvatia* species available on website, out of them 58 are valid names under the genus (http:www.indexfungorum.org).

Traditional mycological knowledge of most of Indian ethnic groups has proven to be extensive and profound, consuming nearly 283 species of wild mushrooms out of 2000 species recorded world over (Purkayastha and Chandra, 1985). The nutritional and medicinal properties of many macrofungi are well known and documented in Europe, China, Japan and several other Asian countries where mushrooms are still used in traditional and modern medicine for treatment of major diseases (Dickinson and Lucas, 1983).

MATERIALS AND METHODS

Fruiting bodies of *Calvatia* were collected from Amravati (M.S.) during mushroom survey in the month of July-August. Standard techniques for collection, preservation and description were followed (Atri and Saini, 2000). Morphological observations were based on fresh specimens. Drying of specimens and microscopic observations was done by implementing standard techniques (Thind and Thind, 1982; Kaul, 1999). Identification, edibility and medicinal properties were noted by referring the standard literature (Atkinson, 1961; Cunningham, 1979; Purkayastha and Chandra, 1985; Lange, 1993; Rai *et.al*., 2005; Hedawoo and Gawande, 2010; Verma *et.al*., 2018; Gunasekaran *et.al*., 2018). Edibility was confirmed by interacting with tribal people who consume specific mushroom of that region (Hedawoo and Mohite, 2008). The specimens were deposited in the museum, P.G. Department of Botany, Amravati (M.S.).

RESULTS AND DISCUSSION

During mycofloristic survey of Amravati-Melghat region, diversified mushroom forms were collected and studied *viz.* gill fungi, coral fungi, bracket fungi, jelly fungi, saddle fungi, teeth fungi, sponges, puff balls, earth stars, stink horns and bird's nest fungi (Hedawoo, 2010). Amongst them the morpho-taxonomic characters of two larger puff ball species were studied. The description of identified *Calvatia* species is as follows-

Taxonomic description of collected species

1. *Calvatia cyathiformis* (Bosc.) Morgan [Syn.- *Lycoperdon lilacinum* (Berk.) Massee]

Sporophores- found in small group on sandy, grassy, barren land in the month of July-August. **Fruiting body**- 8.0-9.5 cm. high and 6.5-8cm. in diameter, pyriform to turbinate in shape at maturity, tapering abruptly into a large, well developed, strongly crenulate rooting base. It was white, creamy in developing stage, but turning into brown with pinkish tinge at maturity. **Peridium**- exterior smooth or more frequently floccose, cream coloured or bay brown, often areolate, thin, fragile, fugacious, flaking away irregularly from the apical portion. Sterile rooting base well developed, deeply wrinkled, composed of spongy mycelium, persistent, cellular at the periphery, semi-compact within, separated by a prominent diaphragm. **Gleba**- white when young and purplish at maturity, sometimes with a grayish tinge, at first compact, soon pulverulent. **Sub-gleba**- persistent as a cup-like base even after the dispersion of the spores. **Capillitium**- threads long, branched, septate, equal, pallid olivaceous. **Basidiospores**- globose to elliptical, rough, covered with prominent irregular warts, purple brown, 4.5-6.2 µm in diameter. Spore mass dark purple with age. Epithet *cyathiformis* means shaped like a flask. It is edible when young and the internal flesh is completely white.

Collected from- Goshala of Tapovan region.

2. *Calvatia fragilis* (Vitt.) Morgan

Sporophores- scattered on grassy, sandy soil with composting matter in the month of July-August. **Fruiting body**- 4.0- 5.2 cm. high and 5.0-5.5 cm. in diameter, ovate but the basal region abruptly ending into a blunt tip, straw coloured. **Peridium**- two layered, inner layer thick when young and fresh and becomes thin with age, usually deep purple brown, brittle and sometimes withered irregularly from upper region. **Gleba**- soft, purple brown with age. **Sub-gleba**- reduced to almost nil. **Capillitium**- branched, tappering at both ends, short, segmented and brown.

Basidiospores- usually spherical, brownish, smooth, sometimes minutely verrucose, 3.0-4.2 µm in diameter.

Collected from- Base of Tapovan hill.

Family Lycoperdaceae includes the genus *Lycoperdon*, *Calvatia* (puff balls) and *Geastrum* (Earth stars). *Calvatia* is differ from *Lycoperdon* by showing the following distinguishing characters. The characters of the *Calvatia* species are the prominent sterile base, conspicuous diaphragm, purple coloured and large mass of irregularly verrucose spores. It dehisces by irregular rapture of the exoperidium. The peridium and gleba are decidedly fragile and readily disappear with maturity, consequently the sterile base is often the only remaining portion of some species like *Calvatia cyathiformis* (FIGURE-1). *Calvatia cyathiformis* sporophores were collected from barren field of Tapovan Goshala area, where the soil quality was light, sandy, organic rich, grassy and intermixed with weedy plant debris. *Calvatia fragilis* species were occurred at the basal region of Tapovan hill where similar soil ecology was existed with respect to pedology. Collected species are terrestrial saprophytes and as such responsible for the breakdown and recycling of organic matter naturally.

Several research studies have been conducted on taxonomic works on the genus *Calvatia* (Khare, 1976; Cunningham, 1979; Lange,1993; Martin, 1997; Coetzee, 2006; Kshirsagar *et.al.*, 2020). Recentely, Verma *et.al.* (2018) made compilation on *Calvatia* species reported from different parts of India. He recorded total 16 *Calvatia* species from 8 different states of India. The states and reported species are as follows- Jammu and Kashmir represents the maximum diversity of *Calvatia* and 5 species were reported, followed by Himachal Pradesh (3 species), Assam, Madhya Pradesh and Uttarakhand (2 species each), West Bengal and Meghalaya (1species each). *Calvatia cyathiformis* found common and are reported from the states of Gujrat, Assam and West Bengal, while *Calvatia fragilis* was reported from Himachal Pradesh only. References regarding distribution of *Calvatia* species in Central India showed that these two species were previously recorded by researchers from Chhattisgarh (Ahlawat *et.al.*, 2008) and Maharashtra (Nair and Patil, 1977; Chavan and Barge, 1977). But *Calvatia cyathiformis* and *Calvatia fragilis* are new reports from Vidarbha (M.S.). *Calvatia cyathiformis* is one of the most easily recognized and widely reported species from India, which showed identifying character with persistent cup-like sterile sub-gleba even after the dispersion of spores. However, *Calvatia fragilis* is clearly distinguished by having a distinctly ovate sporophore with reduced to almost nil sub-gleba.

Edibility

All *Calvatia* species are edible (Morris, 1987), but only in the immature state before the commencement of spores maturation and while the gleba is still firm and white (Gray, 1973; Grigson, 1978). Edibility of *Calvatia cyathiformis* and *Calvatia fragilis* is supported by many researchers (Christensen, 1955; Atkinson, 1961; Krieger, 1967; Purkayastha and Chandra, 1985; Coetzee and Wyk, 2009). Edibility of above species was reported by the interaction with tribal people of Korku and Pardhi community and confirmed myself by eating the dish.

Nutritional Status

Aletor (1995) estimated 13.2% - 46% crude protein and had a gross energy value of 3.07 kcal/g. for *Calvatia cyathiformis*. Vetter (1990) compared the potassium, copper, manganese, zinc and phosphorus contents of *Calvatia*- complex with a large number of other edible macrofungi and found higher values of these elements in *Calvatia*- complex than other edible macrofungi.

Therapeutic potential

Calvatia species have found widespread use in the folk medicines. Barkeley (1857), who reported that, *Calvatia*-complex can be used in burnt cases due to their anaesthetic nature, also used to stop bleeding from wounds. In Nigeria, puff balls are used to cure sores, abrasion or buries, deep cuts, haemorrhages and urinary infections (Buswell and Chang, 1993). *Calvatia* species came into prominence with the discovery of Calvacin an antitumor agent in basidiocarps (Beneke, 1963; Lam *et.al.*, 2001). The discovery of the oncostatic properties of *Calvatia* species directly inspired an investigation into their possible antiviral activity (Cochran, 1978). According to Vitebro *et.al.* (1975), calvatic acid displays antibacterial, antifungal as well as antitumor effect. Wild mushrooms like *Calvatia* represent a major and untapped source of potent new pharmaceutical products. Traditional aboriginals knew the medicinal importance of edible and wild mushrooms and these are now being screened for their bioactivity in various ailments (Rai *et.al.*, 2005).

CONCLUSION

Mushrooms are important natural source of foods and medicines. In developing countries like India, mushrooms such as *Calvatia* species are boon for progress in the fields of food, medicine and unemployment. The mechanism of action of various secondary metabolites isolated from medicinal and wild edible *Calvatia* species like *Calvatia cyathiformis* and *Calvatia fragilis* is yet to be elucidated.

Reviewed literature on *Calvatia* species predicts that these species are new for Vidarbha (M.S.). In future, it may stimulate more research with regard to the food, nutritional value, medicinal properties and biotechnological investigations of this genus.

REFERENCES

Ahalawat, O.P., Kumar, S, Arumuganathan, T and R. P. Tewari, (2008). 25 years of AICRP (Mushroom). National Research Centre for Mashroom (ICAR). Chambaghat, Solan, H.P.pp: 95.

Aletor, V.A. (1995). Compositional studies on edible tropical species of mushrooms. Food Chem., 54: 265-268. https://doi.org/10.1016/0308-8146(95)00044-j

Atkinson, G. (1961). Mushrooms: Edible, Poisonous. Hafner Publi. Co.New York.,pp:322.

Atri, N.S. and S.S. Saini, (2000). Collection and study off Agarics -An introduction. Indian J. Mushroom. 18 (1&2): 1-5.

Beneke, E.S. (1963). Calvatia, calvacin and cancer. Mycologia, 55: 257-270. https://doi.org/10.1080/00275514.1963.12018020

Berkeley, Rev. M.J. (1857). Introduction to Cryptogamic Botany, London, II Bailliere, Food Ingred. J., 167:69-85.

Buswell, J.A. and S.T. Chang, (1993). Edible mushrooms, attributes and applications. In: Genetics and Breeding of edible mushrooms. Philadelphia, 297-394.

Chavan, P.B. and S.N. Barge, (1977). Some fleshy fungi from Maharashtra. Botanique. 8: 124-128.

Christensen, C.M. (1955). Common fleshy fungi. Burgess Publishing Co., Minneapolis, Minn. Pp: 246.

Cochran, K.W. (1978). Medical effects. Ed. Chang S.T., Hayes W.A. The biology and cultivation of edible mushrooms. Academic Press, New York. 169-187. https://doi.org/10.1016/b978-0-12-168050-3.50013-x

Coetzee, J.C. (2006). Contributions towards a new classification of Calvatia Fr. (Lycoperdaceae) in South Africa. Ph.D. dissertation, University of Pretoria, Pretoria, South Africa. https://doi.org/10.19043/ipdj.51.008

Coetzee, J.C. and A.E. Wyk, (2009). The genus Calvatia (Gasteromycetes, Lycoperdaceae): A review of its Ethnomycology and Biotechnological potential. African J. of Biotech. Vol.8 (22): 6007-6015. https://doi.org/10.5897/ajb09.360

Cunningham, G. (1979). The Gasteromycetes of Australia and New Zealand. John McIndoe, Printer, Dunedin, N.Z. pp: 236.

Dickinson, C and J. Lucas, (1983). The Encyclopedia of mushrooms. New York, Crescent Books.

Gray, W.D. (1973). The use of fungi as food and in food processing. Part II. CRC Press, Cleveland.

Grigson, J. (1978). The mushroom feast. Penguin, Middlesex.

Gunasekaran, S.; Chinnarajan, R. and A. Parasnis, (2018). Notes on Indian species of Calvatia and Langermannia including Calvatia natarajanii sp.nov. Phytotaxa. Vol.362(2): 160-179. https://doi.org/10.11646/phytotaxa.362.2.3

Hedawoo, G.B and P.A. Gawande, (2010). Some Gasteromycetes from Amravati-Melghat region (M.S.) India. In: Recent trends in Bio-Geo Sciences (Ed. S.K. Giri). 73-76.

Hedawoo, G.B. 2010. Wild Mushroom flora from Amravati Region, Maharashtra, India. J. Mycol. Pl. Pathol. Vol. 40(3): 441-444.

Hedawoo, G.B. and P.U. Mohite, (2008). Some wild edible mushrooms from Melghat Tiger Reserve Forest and Amravati Region. Biosci. Biotch. Res. Comm. 1(2): 163-167.

Kaul, T. (1999). Introduction to Mushroom Science. Oxford & IBH Publi. Co. Pvt. Ltd. New Delhi, pp: 198.

Khare, K.B. (1976). Some Gasteromycetes from Uttar Pradesh. Indian Phytopath. 29: 34-38.

Krieger, L.C.C. (1967). The Mushroom Handbook. Dover Publi., Inc., N. York, pp: 560.

Kshirsagar, Y, Baghela, A and M. Borde, (2020). Morphological, ultrastructural and phylogenetic study of Calvatia candida and Calvatia craniiformis reported from Northern Western Ghat of India. Current Res. in Environ. & Appli. Myco. 10(1): 103-112. https://doi.org/10.5943/cream/10/1/11

Lam, Y.W., NG, T.B. and H.X. Wang, (2001). Antiproliferative and antimytogenic activities in a peptide from puff ball mushroom Calvatia caelata. Biochem. Biophy. Res. Commun. 289:744-749. https://doi.org/10.1006/bbrc.2001.6036

Lange, M. (1993). Classifications in the Calvatia group. Blyttya. 51: 141-144.

Martin, M.P. (1997). Exoperidium and spores of Calvatia utriformis. Mycotaxon. 61: 381-387.

Morris, B. (1987). Common mushrooms of Malawi. Fungiflora A/S, Oslo.

Nair, L.N. and S.D. Patil, (1977). Fleshy fungi from Western India-I. Gasteromycetes. Kavaka.5:19-23.

Purkayastha, R. and A. Chandra, (1985). Manual of Indian Edible Mushrooms. T&T Printers and Publi. N. Delhi.pp:267.

Rai, M.K.; Tidke, G.and Wasser, S.P. (2005). Therapeutic potential of Mushrooms. Natural Product Radiance. 246-257.

Thind, K.S. and I.P.S. Thind, (1982). The Gasteromycetes of Himalayas-II. J. of Ind. Bot. Soc. 61: 19-32.

Verma, R.K.; Mishra, S.N.; Pandro, V and A.K. Thakur, (2018). Diversity and Distribution of Calvatia species in India: A new record from Central India. Intern. J. of Curr. Micro. and Appli. Sci. 7: 2540-2551. https://doi.org/10.20546/ijcmas.2018.709.316

Vetter, J. (1990). Mineral element content of edible and poisonous macrofungi. Acta Aliment. 19:27-40.

Viterbo, D, Gasco, A, Serafino, A and V. Mortarini, (1975). p-Carboxiphenylazoxy-cyanide-dimethyl sulphoxide: An antibacterial and antifungal compound from Calvatia lilacina. Acta Crystallogr. Sect. B, 31: 2151-2153. https://doi.org/10.1107/s0567740875007091

http://www.indexfungorum.org/names/Names.asp [Accessed on 6 July 2020].

2020| Published by © Plantae Scientia

Plate I

FIGURE-1: A. Sporophore of *Calvatia cyathiformis* B. Sporophore of *Calvatia fragilis* C. Scattered sporophores on grassy habitat D. Dehiscence by irregular fragmentation E. Dehisced purplish mass of basidiospores F. Persistent cup-like base (sub-gleba)