



MORPHOLOGICAL CHARACTERIZATION OF WILD MACRO FUNGI FROM NASHIK DISTRICT, MAHARASHTRA, INDIA.

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Abstract:

Maharashtra has a rich diversity of wild mushrooms, both edible and inedible which are used as food and medicinal resources. This study was carried out to characterize some wild mushrooms collected from different regions of Nashik district. The characterization was done in the field, based on the key features (colour, shape and association with other plants), and photographs were taken. Conventional characterization was done using different key references, manuals, monographs and databases. Most of the species of wild mushrooms were found to share the same ecological habitat. The current study identified 25 species namely; *Panaeolus papilionaceus*, *Pleurotus ostreatus*, *Auricularia auricular-judae*, *Microporus xanthous*, *Agaricus moelleri*, *Ganoderma lucidum*, *Scleroderma citrinum*, *Agaricus xanthodermus*, *Mycena megaspore*, *Cortinarius rubellus*, *Agaricus campestris*, *Cortinarius croceus*, *Coprinopsis atramentaria*, *Schizophyllum album*, *Nigroporous vinosus*, *Schizophyllum radiatum*, *Psathyrella multipedata*, *Schizophyllum commune*, *Coprinopsis lagopus*, *Trametes elegans*, *Ganoderma resinaceum*, *Formitopsis pinicola*, *Ganoderma tsugae*, *Leucocoprinus cepistipes*, *Russula virescens* belonging to 14 different families of wild macro fungi. The information obtained from these fungal specimens holds potential significance for further studies and practical applications due to their wide-ranging uses.

Keywords: Characterization; Conventional; Monographs; Database; Mushrooms.

Introduction:

The term "fungus" originates directly from Latin (Simpson, 1979). Historically, taxonomists believed fungi were closely related to plants due to similarities in form and growth conditions. However, subsequent research revealed that fungi belong to a distinct biological kingdom that diverged from other life forms nearly a billion years ago (Baldauf & Palmer, 1993; Bruns et al., 2006). The exact number of fungal species is still unknown, with estimates ranging from 2.2 to 3.8 million (Hawksworth & Lücking, 2017; Hyde et al., 2020). Currently, around 144,000 fungal species have been formally identified and documented (Willis et al., 2018; Wijayawardene et al., 2020). Fungi are globally distributed but are especially abundant in moist soil environments. Forests and grasslands provide optimal conditions for fungal growth. These organisms play essential ecological roles and thrive in a variety of habitats. In 2011, Ranadive and colleagues compiled a checklist of 170 fungal species from Pune District in Maharashtra, spanning 86 families (Ranadive et al., 2011). Further research in 2013 focused on fungi from the Western Ghats of Maharashtra, identifying and publishing 110 Aphylophorales specimens online (Hakimi et al., 2013). Studies of fungal diversity in the Latur region were conducted by Chouse and Mali (Chouse et al., 2020), while Gore and Mali

described 37 Aphyllophorales species from the Marathwada region based on both morphological and microscopic features (Gore et al., 2021). Although several species have been documented across Maharashtra, large portions of the state remain underexplored in terms of fungal diversity (Gavit et al., 2022). The current research area includes many moist locations and forested zones that are likely rich in fungal species but have not yet been thoroughly studied.

Material & Methods:

Sample Collection and Preservation: Wild macrofungi samples were gathered from several locations within the Nashik district, including Igatpuri, Kalwan, Satana, Dindori, Trimbakeshwar, and Peth. Fruiting bodies were collected in clean polythene and paper bags, each labeled with the date, collection site, and host plant name, following the methodology described by Gilbertson and Ryvardeen (1986). After collection, the specimens were sun-dried, wrapped in butter paper, and stored in brown paper folders for subsequent analysis.

Photographic Documentation:

The specimens were photographed in situ, using the good configuration (Magnification) camera.

Morphological Examination:

The fungal specimens were analyzed based on key morphological features such as shape, gill structure, coloration, cap form, texture, surface characteristics, margin, presence of mycelium, and hyphal structure. A comprehensive description was prepared for each specimen, focusing on these diagnostic traits. These descriptions were then compared with existing references, including the works of Ranadive and the *Index Fungorum*, to accurately identify the species.

Result: Traditional methods was used to characterize the wild mushrooms by examining various traits, including cap color, surface texture, gill or tube structure and ecological grouping. Additional field characteristics were also recorded, such as spore print color, odor, taste, curvature of the cup edge and firmness of the fruiting body. The taxonomic identification of the collected specimens was carried out using established literature and identification keys provided by various researchers. To ensure accurate classification, references were made to the works of Bakshi (1971), Stewart (1972, 1980), Ryvardeen and Johansen (1980), Gilbertson and Ryvardeen (1986), and Sharma (2000). A total of 25 macrofungal species, classified into 14 different families, were characterized during field surveys carried out across various regions of the Nashik district (Table 1).

Table 1. The list of species of macro fungi, Morphological characters, classified into families, edibility, accession number and sample code in various areas of Nashik district.

Sample code	Fungi Spp.	Family	Morphological Characters	Taxonomic Classification (Edibility)
S -01	<i>Panaeolus papilionaceus</i> (Bull.)	Bolbitiaceae	The fruiting body is conic, grayish brown, cap across 1-5 cm, campanulate in age, margin are toothlike, flesh thin. The Gills are adnate to adnexed, one or two tiers of intermediate gills, pale gray in colour, blackish appearance in age with whitish edges. The stipe across 6-12 cm by 2-4 mm, colour of stipe gray-brown to reddish brown.	Inedible/Mildly Toxic
S -02	<i>Pleurotus ostreatus</i> (f.)	Pleurotaceae	The fruiting body has a broad, fan shaped, cap spanning across 2-30 cm, white in colour, margin smooth and lobed or wavy. The gills are white to cream and descend on the stalk if present. The stipe is off-center with a lateral attachment to wood.	Edible
S -03	<i>Auricularia auricular-judae</i>	Auriculariaceae	The fruiting body has normally up to 90 mm across and upto 3 mm, cup shaped, Upper surface is a reddish with a purplish tint and finely pilose, gelatinous, elastic texture when fresh. Smooth in younger specimen, undulating with folds and wrinkles.	Edible
S -04	<i>Microporus xanthopus</i> (Fr.)	Polyporaceae	The fruiting body is a thin, funnel shaped cap and concentrically zoned in various shades of brown with diameter of 7.2 to 10.1 cm. The shades are lateral pileus lustrous. The cap is supported by yellow foot stem which has the height of 2.1 to	Inedible

			2.6 cm.	
S -05	<i>Agaricus moelleri</i> (Wasser)	Agaricaceae	The fruiting body has a greyish-brown patch in the centre and grey-brown scaling on the surrounding off-white background cap. It is 5 to 9 centimeters in diameter, yellows when bruised. It is ovate when young, flattening later. The stem has a drooping ring, and stains yellow very easily when bruised, this colour then changes to brown over time, flesh bruises yellow only faintly, and is more noticeable in the base. The gills are crowded, and free, as is typical for an <i>Agaricus</i> . They are pink on young specimens, but brown to black on older fruit bodies.	Inedible (Poisonous)
S -06	<i>Ganoderma lucidum</i> (sensu auct.asiatic)	Ganodermataceae	The fruiting body has tawny to russet coloured, large dark cap with glossy surface, 1.5 cm diameter of kidney shaped cap, woody texture, without gills, Fruiting body almost always has stipe present. Context tissue is pink-buff to cinnamon-buff and corky, showing concentric growth zones and no resinous or melanoid deposits.	Inedible (Medicinal use only)
S -07	<i>Scleroderma citrinum</i> (Pers.)	Sclerodermataceae	The fruit body is stemless, white in coloured, rounded, across 4 to 10 cm. It has attached to the ground. The tough thick skin of this earth ball is initially white, cream or yellow and may turn ochre-brown or green as it ages. It has irregular shapes and variable size.	Inedible (Poisonous)
S -08	<i>Agaricus xanthodermus</i> (Genev.)	Agaricaceae	The fruiting body is initially convex, some young specimens having a squarish shape, though flattening with age. The cap has 5-15 cm in diameter, whitish , light brown tints towards the center, dry and smooth, scaly when old. The gills progress from pale-pink to a chocolate colour. Stipe is white , 5-12 cm tall and 1-3 cm wide.	Inedible (Poisonous)
S -09	<i>Mycena megaspore</i> (Kauffman.)	Mycenaceae	The Pileus 10-40 mm across, conical campanulate, flattening with age, and often radiately wrinkled, dark sepia brown to almost black when young, pallescent with age. Stipe is 30-130 mm, hollow, cartilaginous-tough, smooth to longitudinally finely rugulose or becoming fissured, pruinose, glabrescent for the greater part, lubricous when wet, pallid to whitish above, base densely covered with long.	Inedible (Unknown)
S -10	<i>Cortinarius rubellus</i> (Cooke)	Cortinariaceae	The fruiting body has a conical to convex , cap of 2.5 - 8 cm in diameter, tawny to date brown with paler margins, and is covered in fine, fibrous scales. The gills are ochre- or caramel-colored. They have an adnate connection to the stipe. The stipe is 5.5 - 11 cm tall, and 0.5 - 1.5 cm thick with a bulbous base.	Inedible (Poisonous)

S -11	<i>Agaricus campestris</i> (f.)	Agaricaceae	The fruiting body hemispherical , white having fine scales, cap is 3 - 12 cm in diameter. The gills are initially pink to dark brown. The stipe is across 3 -10 cm tall and 1 – 2 cm wide, white, thin.	Edible
S -12	<i>Cortinarius croceus</i> (Schaeff.)	Cortinariaceae	The fruiting body is convex, slightly umbonate cap, 2.5 to 5.5 diameter vary in colour from yellow brown to reddish brown. The gills are adnate or emarginated, yellow or light orange, distinctive. The stem is 3 to 8 cm long and 3 to 8 mm in diameter, cylindrical, solid, surface is covered with yellow or yellow brown veil remnants.	Inedible (Unknown)
S -13	<i>Coprinopsis atramentaria</i> (Bull.)	Psathyrellaceae	The Fruiting body has 3–10 cm in diameter, greyish or brownish-grey cap is initially bell-shaped, is furrowed, and later splits. The colour is more brownish in the centre of the cap. The very crowded gills are free; they are whitish at first but rapidly turn black and easily deliquesce. The short stipe measures 5–17 cm high by 1–2 cm in diameter, grey in colour, and lacks a ring.	Edible
S -14	<i>Schizophyllum album</i>	Schizophyllaceae	The caps are 1–4 cm wide with white or grayish hairs. They grow in shelf-like arrangements, without stalks. The gills, which produce basidiospores on their surface, split when the species dries out, earning this species the common name split gill. It is common in rotting wood. The mushrooms can remain dry for decades and then revived with moisture.	Inedible (Medicinal use only)
S-15	<i>Nigroporous vinosus</i>	Steccherinaceae	The fruit body have brownish caps are leathery to smooth, and sometimes has concentric zones, reddish-brown to purplish-brown to dark violet colored, tubes are up to 3 mm long.	Inedible
S -16	<i>Schizophyllum radiatum</i> (Fr.)	Schizophyllaceae	The pileus 15 – 30 mm wide and 30 – 45 mm long, whitish brown in colored, flabelliform, semicircular, margin smooth, ragged, tightly rolled toward the hymenium, Hymenium formed of split gills, 430 – 750 µm in length.	Inedible (Medicinal use only)
S -17	<i>Psathyrella multipedata</i> (Peck)	Psathyrellaceae	The cap is across 0.5 – 3 cm , conical or convex shaped, reddish or clay brown color. Gills are adnate or adnexed, light gray brown with white edges, stem 4 – 10 cm long and 3 – 6 mm in diameter, white at the apex, brown in base.	Inedible (Poorly Edible)
S -18	<i>Schizophyllum commune</i> (f.)	Schizophyllaceae	The caps are 1–4 cm wide, white or grayish hairs. They grow in shelf-like arrangements, without stalks. The gills, which produce basidiospores on their surface, split when the species dries out. It is common in rotting wood.	Inedible (Medicinal use only)
S -19	<i>Coprinopsis lagopus</i> (f.)	Psathyrellaceae	The fruit body size vary tremendously. This fungus gives rise to very small fruit bodies,cap surface is pale to very dark brown, center whitish to silvery gray concave to convex, stem length 1 mm	Inedible

			and cap diameter of 0.75 mm. In general, dwarf fruit-bodies have stem lengths from 1–10 mm tall and cap of 0.75–3 mm in diameter, while large specimens have stems that are 5–18.5 cm tall and 2–5 mm wide, with cap diameters of 2–5 cm.	
S -20	<i>Trametes elegans</i> (Spreng.) (Fr.)	Polyporaceae	The Fruiting body shelf-like, or with a short up to 1 cm, stipe; up to 14 cm across and 1 cm thick, white in color ; corky and flexible when fresh; very finely hairy at first, soon bald or roughened in zones, grows on dead wood.	Inedible (Medicinal use only)
S -21	<i>Ganoderma resinaceum</i> (f.)	Ganodermataceae	The cap of the fruiting body has a light yellowish margin and a beautiful orange-tinged rufous brown top. A startling sight when young a not covered in its reddish-brown spore dust, this fungus sometimes forms tiers of brackets which occasionally merge. Individual brackets are 15 to 35 cm across and 4 to 8 cm thick when fully grown.	Inedible (Medicinal use only)
S -22	<i>Formitopsis pinicola</i> (f.)	Fomitopsidaceae	The cap is hoof-shaped or triangular, hard and tough, cap up to 30 cm or more across and 15 cm thick. Its surface is more or less smooth, orange-yellow with a white margin, later dark reddish to brown and then frequently with an orange margin.	Inedible (Medicinal use only)
S -23	<i>Ganoderma tsugae</i> (Murrill)	Ganodermataceae	The cap whitish when fresh, shiny reddish to brownish – orange varnish in upper surface, white margin, concentrically furrowed, across 5-30 cm, stipe 2.5 – 15 cm long and 1 – 4 cm thick.	Inedible (Medicinal use only)
S -24	<i>Leucocoprinus cepistipes</i> (Sowerby) (Pat.)	Agaricaceae	The Cap is 3–9 cm, convex, darker in the centre against the white colour of the rest of the cap, Stem has 6–9 cm in height. 4-10 mm thick, slightly yellow or pinkish brown. Gills are White, sometimes discolouring to pinkish brown with age. Free and crowded.	Inedible
S -25	<i>Russula virescens</i> (f.)	Russulaceae	The cap is at barrel-shaped, becoming convex and flattened with age with a diameter of up to 15 cm, gills are white to cream colored, and fairly crowded together; they are mostly free from attachment to the stipe. Gills are interconnected at their bases by veins. The stipe is cylindrical, white, and of variable height, up to 8 cm tall and 4 cm wide.	Edible

Conclusion:

The present study characterized a total of 25 wild mushroom species, including 5 edible, 20 inedible (Poisonous and some are used only medicinal purpose). Traditional classification methods helped enhance local knowledge by confirming additional edible types. However, incorrect identification of wild mushrooms can hinder the use of potentially beneficial species and may lead to serious health risks from consuming toxic varieties. Moreover, even non-edible mushrooms could serve as valuable sources of bioactive or medicinal substances. Thus, precise identification of wild mushroom species is crucial. Additional scientific research is required to determine the

safety and edibility of those mushrooms currently classified as unknown. Expanding the study and use of these largely overlooked species could offer new opportunities in nutrition, medicine, and the discovery of beneficial compounds.

Acknowledgement:

The authors would like to thank Department of Botany, KRT Arts, BH Commerce and AM Science (KTHM) College Nashik (Affiliated to Savitribai Phule Pune University, Pune) for providing all necessary infrastructural support to carry out the study and thank to Mahatma Jyotiba Phule Research and Training Institute (MAHAJYOTI) for financial support.

Conflict of Interest:

Author's share none competing or conflicting interest.

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