



## Mushroom Diversity of Dhenkanal District, Odisha, India: Source of Alternative Foods and Medicines

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### Authors' contributions

This work was carried out in collaboration among all authors. Author SK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript with author YR. Authors YR, FB and MPS did field work and author RSD managed the analyses of the study and managed the literature searches. All authors read and approved the final manuscript.

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### ABSTRACT

**Aims:** The demand for nutraceutical and their products are increasing in modern era throughout the world. The prime sources of nutraceutical are floral & faunal wealth including microbial diversity. Among them, wild mushroom play a vital role and provide food for local communities which have medicinal values too. Keeping this in view, an attempt has been taken to enumerate the wild mushroom available in Dhenkanal district of Odisha state.

**Place and Duration of Study:** The survey was carried out in selected areas of Dhenkanal district of Odisha state in 2019 and species are photographed followed by identification using Flora's book and available literature.

**Results:** Survey revealed that 60 species of wild mushrooms are recorded belonging to 33 genus and 25 families. It was observed that 10 species are edible and consumed by local communities rest are poisonous or bitter which could be used to isolate bioactive compounds to treat lethal disease.

**Conclusion:** The present study highlights the diversity of wild mushroom in Dhenkanal district of Odisha and their food & medicinal potentials for future nutraceuticals & pharmaceuticals.

**Keywords:** Wild mushroom; diversity; bioactive compounds; biowealth; nutraceutical; Odisha.

## 1. INTRODUCTION

Mushroom and other microbial biomass like single cell protein, algae, yeast etc are alternative sources of food and medicines for rural and tribal communities throughout the world. Mushroom collection from wild is a primitive practices among the aboriginals for fulfilling the need of food and nutraceutical [1]. They are collecting them as seasonal foods as they are part of fungal biota having rich protein and low fat [2]. Biologically, they are macro-fungal mass, bearing spore, having pileus, gills, volva and scales. The pileus, commonly known as cap has gills underneath that bears spores and is attached with stipe. The shape and size varies from juvenile to mature [3]. About 140,000 species of mushrooms are reported throughout the world. Among them about 700 species are edible and having medicinal values [4]. The most common edible mushroom throughout world are *Agaricus bisporus*, *Boletus edulis*, *Cantharellus cibarius*, *C. tubaeformis*, *Pleurotus eryngii*, *Morchella conica*, *P. ostreatus*, *Volvariella volvaceae*, *Lentinula edodes*, *Tuber borchii*, *Flammulina velutipes*, *Hericium erinaceus*, *Calvatia gigantea*, *Phallus rubrovolva* etc and the reported medicinal mushroom are *Agaricus blazi*, *Ganoderma pfeifferi*, *Lentinula edodes*, *G. lucidum*, *G. concinnum*, *Inonotus obliquus*, *Trametes versicolor*, *Flammulina velutipes*, *Omphalotus olearis*, *Phellinus linteus*, *Podaxis pistillaris*, *Schizophyllum commune* etc. [5-6].

Odisha state enjoys the diverse landscapes and provide fertile platforms for wild mushroom diversity. The local communities use them for food, medicines and to get petty cash. The most common edible mushrooms found in the state are *Lycoperdon pyriformi*, *Amanita caesarea*, *A. loosii*, *Calvatia utriformis*, *Macrolepiota procera*, *Langermannia gigantea*, *Termitomyces clypeatus*, *T. eurhizus*, *T. heimii*, *T. medius*, *T. microcarpus*, *Xerula radicata*, *Pleurotus ostreatus*, *P. pulmonarius*, *Volvariella volvaceae*, *Suillus luteus*, *Tricholoma lobayense*, *Boletus aestivalis*, *B. edulis*, *Tuber rufum*, *Lentinula edodes*, *Lentinus fusipes*, *L. polychrous*, *L. tubergium*, *Microporous xanthopus*, *Nigroporus vinosus*, *Polyporus sulphureus*, *Lactarius resimus*, *Russula aurata*, *R. brevipes*, *R. nigricans*, *R. rosea*, *R. vesca*, *R. virescens*, *R. xerampheleina* etc [7-9].

## 2. MATERIALS AND METHODS

### 2.1 Study Area

Dhenkanal district is known as home of Lord Shiva in Odisha state of India (20°40'53.81"N; 85°43'11.65"E). It is situated in the central part of Odisha state and famous for Lord Shiva temple, a sacred grove which conserves the rich floral & faunal wealth, a source of alternative food and medicines [10]. Geographically, it has red sandy loam soil and enjoys the semi-evergreen forest, moist mixed deciduous forests, dry mixed deciduous forests and dry bamboo brakes. The most common floras of study areas are *Shorea robusta*, *Xylia xylocarpa*, *Anogeissus acuminata*, *Cassia fistula*, *Cleistanthus collinus*, *Dillenia pentagyna*, *Diospyros Montana*, *Dalbergia paniculata*, *Mallotus philippinensis*, *Strychnos nux-vomica*, *Schleichera oleosa*, *Streblus asper*, *Terminalia tomentosa*, *T. belerica*, *T. chebula*, *Helicteres isora*, *Cipadessa baccifera*, *Hemidesmus indicus*, *Smilax zeylanica*, *Millettia auriculata*, *Cryptolepis buchanani*, *Careya arborea*, *Bridelia retusa*, *Combretum roxburghii*, *Butea superba*, *Holarrhena antidysentrica*, *Woodfordia fruticosa*, *Lannea coromandelica* etc [10-14].

### 2.2 Ethnobotanical Survey

The survey was done during the year 2019 and photographed the samples followed by identification using published literature and books [7,15-16]. The food values and medicinal values were confirmed from local communities and forest watchers of Dhenkanal Forest Division, Forest & Environment Department, Government of Odisha, and India. The ethnobotanical values were collected by Team APRF (Yasaswinee Rout, Rajkumari Supriya Devi & Sanjeet Kumar) from the survey and analyzed to find the gap in the science of mushrooms for future drug or nutraceutical development. The forest of Dhenkanal is rich with *Shorea robusta*, *Xylia xylocarpa*, *Anogeissus acuminata*, *Cassia fistula*, *Cleistanthus collinus*, *Dillenia pentagyna*, *Diospyros* species. In some place, Bamboo species in noted down.

## 3. RESULTS

Survey results revealed that 60 species of wild mushroom enumerated from Dhenkanal district (Table 1 and Fig. 1). They belong to 33 genus and 25 families including 13 mushrooms that are

new to mushroom wealth of Odisha (Table 1 and Fig.1). Those are *Bisporella citrine* (Plate 1a), *Cyathus striatus*, *Leucocoprinus brebissonii*, *Marasmius capillaries* (Plate 1d), *Marasmius siccus* (Plate 1f), *Mycena acicula*, *Mycena adscendens* (Plate 1g), *Mycena haematopus* *Trametes elegans* (Plate 1h), *Trametes gibbosa* (Plate 1i), *Clavulinopsis aurantiocinnabarina* (Plate 1b), *Xylaria filiformis* (Plate 1k), *Xylobotryum portentosum*. A total of 10 edible mushroom species (*Amanita caesarea*, *Leucocoprinus cepestipes*, *Russula nigricans*, *R. rosea* (Plate 1j), *R. xerampelina*, *Schizophyllum commune*, *Termitomyces clypeatus*, *T. heimii*, *T. microcarpus*, *Volvariella volvaceae*) were recorded during the study. Among them *Amanita caesarea*, *Termitomyces microcarpus*, *T. heimii*, *T. clypeatus* and *Volvariella volvacea* are more palatable and frequently consumed by local communities in respective seasons. The survey revealed that *Ganoderma lucidum*, *Ganoderma tsuga* are commonly used as medicines to reduce cholesterol, cure immune system problems and induce sleeping. The local communities collect the *Ganoderma* species from the wild and sold to the traders for medicinal purposes. *Auricularia auricula* used to cure various stomach diseases by the local herbalists.

*Pycnoporous cinnabarinus* are commonly used to cure wounds. Thus all the species need advance research to isolate new active compounds for formulation of new drugs and need food technological practices on 10 edible mushrooms of the study areas to reduce food problems.

#### 4. DISCUSSION

Odisha states enjoy the diverselandscape and provide fertile platforms for wildmushroom diversity. Earlier 11 edible mushrooms [17] have reported from Odisha state. These were *Termitomyces microcarpus*, *T. heimii*, *T. eurrhizus*, *T. clypeatus*, *Amanitacaeserea*, *A. loosii*, *Russula lepida*, *R. brevipes*, *Tuber rufum*, *Lentinus fusipes* and *Microporusxanthopus* whereas present study noted that *Amanita caesarea*, *Leucocoprinus cepestipes*, *Russula nigricans*, *R. rosea*, *R. xerampelina*, *Schizophyllum commune*, *Termitomyces clypeatus*, *T. heimii*, *T. microcarpus*, *Volvariella volvaceae* are consumed in study areas by local communities. Recently 20 edible mushrooms [18] are reported from Northern Odisha, India. The results on food values from present study and literature indicate that need estimation of

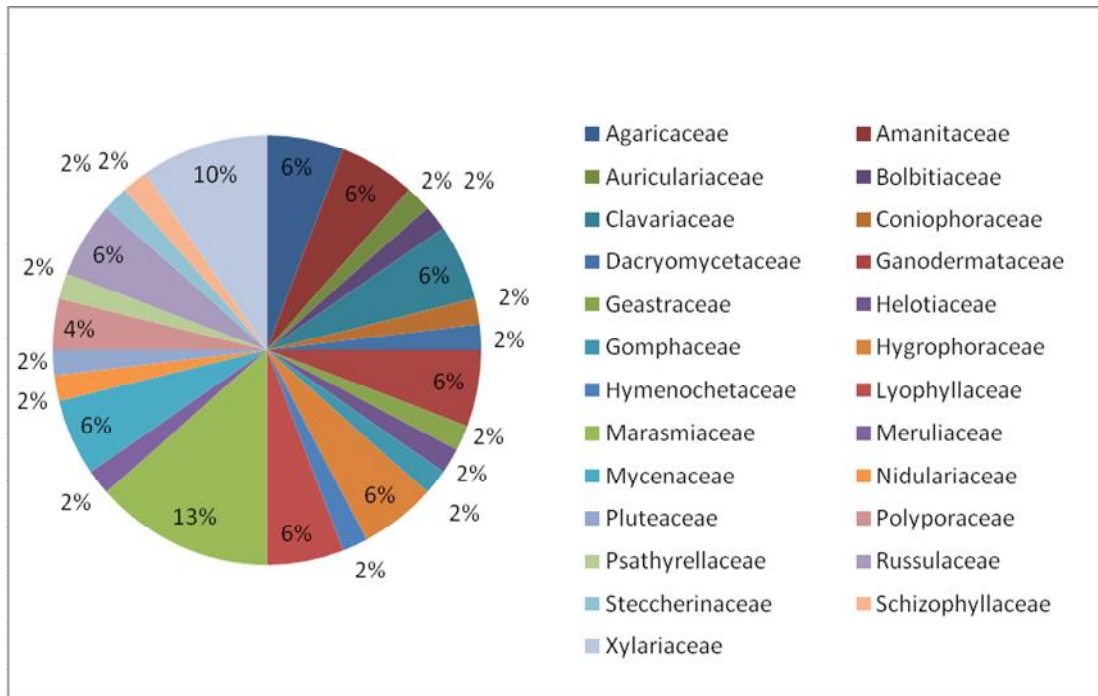


Fig. 1. Diversity of genus under each family in study areas

**Table 1. Mushroom diversity and edibility in Dhenkanal, Odisha, India**

<b>Scientific name</b>	<b>Vernacular name</b>	<b>Family</b>	<b>Use(s)</b>
<i>Amanita caesarea</i>	Caesar's mushroom	Amanitaceae	Edible
<i>Amanita ovalispora</i>	Boedijn's Mushroom	Amanitaceae	Non edible
<i>Amanita vaginata</i>	Grisette	Amanitaceae	Non edible
<i>Auricularia auricula-judae</i>	Wood ear	Auriculariaceae	Medicinal
<i>Bisporella citrina</i>	Yellow fairy caps	Helotiaceae	Non edible
<i>Bjerkandera adusta</i>	Smoky bracket	Meruliaceae	Non edible
<i>Clavaria amoena</i>	Coral mushroom	Clavariaceae	Non edible
<i>Clavaria vermicularis</i>	White spindles	Clavariaceae	Non-Edible
<i>Clavulinopsis aurantiocinnabarina</i>	Spindle shaped orange coral	Clavariaceae	Non-Edible
<i>Coltricia cinnamomea</i>	Shiny Cinnamom Polypore	Hymenochaetaceae	Non edible
<i>Coniophora puteana</i>	Black Mould	Coniophoraceae	Non edible
<i>Conocybe apala</i>	White dunce cap	Bolbitiaceae	Non edible
<i>Coprinus disseminatus</i>	Fairy incap	Psathyrellaceae	Non edible
<i>Cyathus striatus</i>	Fluted bird's nest	Nidulariaceae	Non-edible
<i>Dacryopinax spathularia</i> (Plate 1c)	Sweet Osmanthus Ear	Dacrymycetaceae	Non-Edible
<i>Ganoderma australe</i>	Shelf	Ganodermataceae	Non edible
<i>Ganoderma lucidum</i>	Lingzhi mushroom	Ganodermataceae	Medicinal
<i>Ganoderma tsuga</i>	Hemlock Shelf	Ganodermataceae	Medicinal
<i>Geastrum fimbriatum</i>	Earthstar fungi	Geastraceae	Non edible
<i>Hygrocybe aurantiosplendens</i>	Orange waxcap	Hygrophoraceae	Non edible
<i>Hygrocybe cantharellus</i>	Waxcap	Hygrophoraceae	Non edible
<i>Hygrocybe russocoriaceae</i>	Cederwood	Hygrophoraceae	Non edible
<i>Lepiota clypeolaria</i>	Shield dapperling	Agaricaceae	Non edible
<i>Leucocoprinus brebissonii</i>	Skullcap Dapperling	Agaricaceae	Non-edible
<i>Leucocoprinus cretaceus</i>	Sawdust mushroom	Agaricaceae	Non edible
<i>Leucocoprinus cepestipes</i>	Gobra Chhattu	Agaricaceae	Edible
<i>Macrolepiota dolichaula</i>	Kingfisher mushroom	Agaricaceae	Non-Edible
<i>Macrolepiota procera</i>	Parasol mushroom	Agaricaceae	Non-Edible
<i>Marasmius anomalus</i>	Pennington	Marasmiaceae	Non edible
<i>Marasmius capillaris</i>	NIL	Marasmiaceae	Non-edible
<i>Marasmius elegans</i>	Velvet parachute	Marasmiaceae	Non edible
<i>Marasmius haematocephalus</i>	Pink Bonnet	Marasmiaceae	Non edible

Scientific name	Vernacular name	Family	Use(s)
<i>Marasmius plicatus</i>	Pleated mushroom	Marasmiaceae	Non edible
<i>Marasmius rotula</i> (Plate 1e)	Pinwheel Mushroom	Marasmiaceae	Non edible
<i>Marasmius siccus</i>	Orange Pinwheel mushroom	Marasmiaceae	Non edible
<i>Microporus xanthopus</i>	Yellow footed	Polyporaceae	Non edible
<i>Mycena acicula</i>	Orange bonnet	Mycenaceae	Non edible
<i>Mycena adscendens</i>	Frosty bonnet	Mycenaceae	Non edible
<i>Mycena haematopus</i>	Bleeding fairy helmet	Mycenaceae	Non edible
<i>Nigroporus vinosus</i>	Poroid mushroom	Steccherinaceae	Non edible
<i>Pluteus lutescens</i>	Goldleaf	Pluteaceae	Non edible
<i>Polyporus sulphureus</i>	Chicken of the woods	Polyporaceae	Non-Edible
<i>Pycnoporus cinnabarinus</i>	Cinnabar polypore	Polyporaceae	Medicinal
<i>Ramaria stricta</i>	Strict branch coral	Gomphaceae	Non edible
<i>Russula nigricans</i>	Blackening Brittlegill	Russulaceae	Edible
<i>Russula rosea</i>	Rosy Brittlegill	Russulaceae	Edible
<i>Russula xerampelina</i>	Crab Brittlegill	Russulaceae	Edible
<i>Schizophyllum commune</i>	Splitgill mushroom	Schizophyllaceae	Edible
<i>Termitomyces clypeatus</i>	Gilled mushroom	Lyophyllaceae	Edible
<i>Termitomyces heimii</i>	Termite mushroom	Lyophyllaceae	Edible
<i>Termitomyces microcarpus</i>	Termite mushroom	Lyophyllaceae	Edible
<i>Trametes elegans</i>	NIL	Polyporaceae	Non-Edible
<i>Trametes versicolor</i>	Turkey Tail	Polyporaceae	Non edible
<i>Trametes gibbosa</i>	Lumpy bracket	Polyporaceae	Non-Edible
<i>Volvariella volvacea</i>	Straw mushroom	Pluteaceae	Edible
<i>Xylaria cubensis</i>	NIL	Xylariaceae	Non edible
<i>Xylaria filiformis</i>	NIL	Xylariaceae	Non-edible
<i>Xylaria hypoxylon</i>	Stag's horn	Xylariaceae	Non edible
<i>Xylaria longipes</i>	Dead Moll's Finger	Xylariaceae	Non edible
<i>Xylobotryum portentosum</i>	NIL	Xylariaceae	Non-edible



Plate 1. Some common wild mushrooms of study areas, a) *Bisporella citrina*, b) *Clavulinopsis aurantiocinnabarina*, c) *Dacryopinax spathularia*, d) *Marasmius capillaris*, e) *Marasmius rotula*, f) *Marasmius siccus*

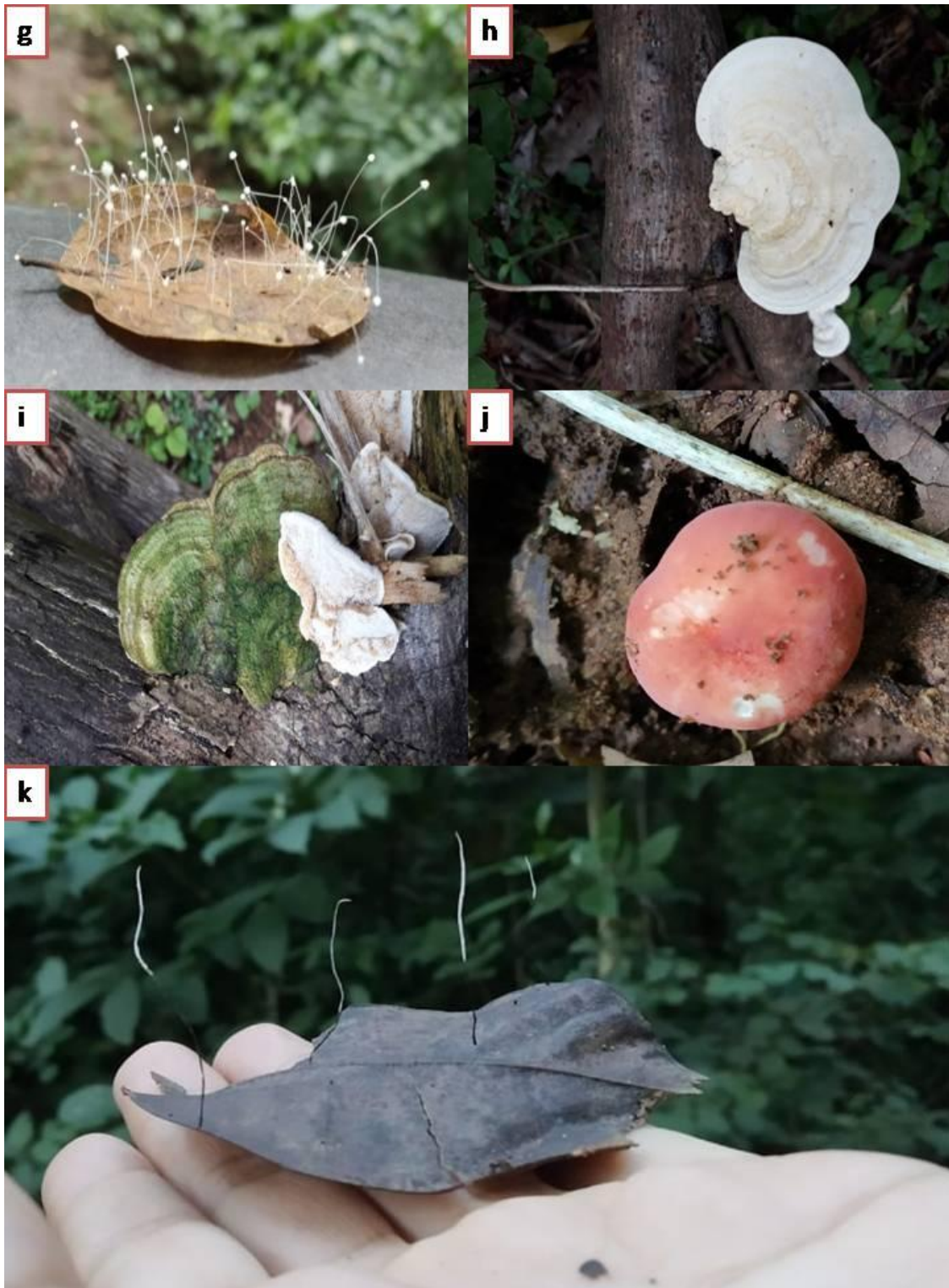


Plate 1. g) *Mycena adscendens*, h) *Trametes elegans*, i) *Trametes gibbosa*, j) *Russula rosea*, k) *Xylaria filiformis*

nutraceutical values of locally available wild mushroom species for creating an optional food for national or international levels through horticulture. Literature indicate that *Ganoderma* species is used to reduce cholesterol [19], improve immune systems and induce sleeping whereas *Auricularia* species is traditionally used against stomach diseases [20]. It was also noted that *Pycnoporus cinnabarinus* is used to cure the wounds [21, Present study]. The studies done by researchers showed that there is ample scope in formulation of drugs or nutraceuticals from *Amanita vaginata*, *Macrolepiota procera*, *Ganoderma austral*, *Geastrum fimbriatum*, *Trametes versicolor* etc which is easily available in study areas.

## 5. CONCLUSION

The above results indicate that the region will give more scopes to identify the edible, medicinal and non edible mushrooms for future food and medicines [22-25]. Need more and more exploration work in country as well as all over the world to evaluate the nutraceutical potential of wild mushrooms for reducing food and drug resistant problems.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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