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Wild Mushroom Diversity of Rairangpur Forest Division, Odisha, India & Its Medicinal Uses

Arun Kumar Mishra[1*], Sweta Mishra[2*], Shruti Rathore[3], Vinay Naik[4], Usha Patil[5] and Sanjeet Kumar[2]

[1]Divisional Forest Office, Rairangpur Forest Division, Odisha, India.
[2]Biodiversity and Conservation Laboratory, Ambika Prasad Research Foundation, Odisha, India.
[3]LCIT School of Pharmacy, Bilaspur, Chhattisgarh, India.
[4]Department of Botany, GGV Bilaspur, Chhattisgarh, India.
[5]Department of Dravyaguna, Sri Jayendra Saraswati Ayurveda College and Hospital, Nazarethpet, Chennai, India.

Authors' contributions

This work was carried out in collaboration among all authors. Authors AKM and SK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SM, SR and VN managed the analyses of the study. Authors UP and SM managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Rairangpur forest division, Mayurbhanj, Odisha is a hub of diverse floral and faunal species. Apart from flora and fauna, it has a rich diversity of fungal species. The present study highlights the diversity of macro fungi with special reference to its medicinal and economic values available in Rairangpur Forest Division, Odisha.
Place and Duration of Study: Field surveys were carried out at regular intervals (Pre monsoon and Post monsoon) in Rairangpur Forest Division during 2019-2020.
Results: Mushroom samples were collected and then identified with the help of standard available literatures and books. 99 wild mushroom species belonging to 56 genera of 37 families were noted.
Conclusion: It was found that 41 species were edible in which 15 mushrooms were consumed by

**Corresponding author: E-mail: swetamishra0703@gmail.com;*

different tribal communities in the study area. The rest species are poisonous or bitter in taste and further research on them could lead to isolate some bioactive compounds which could be a better preventive against many lethal diseases.

Keywords: Mushroom; Odisha; protected areas; nutraceutical.

1. INTRODUCTION

Mushroom belongs to the group of organisms known as Macrofungi which falls under phyllum Ascomycotina and Basidiomycotina. Mushrooms lack chlorophylls and so they cannot prepare their own food. They get their nutrition from dead and decaying organic substances or living plant and animal, so they have saprophytic or parasitic or symbiotic mode of nutrition [1]. Fungi are heterotropic in nature and they are quite specific in their nutritional and ecological requirements. These are the richest and most diverse group in the world [2]. Micro fungi play a vital role in bio-degradation and bio-deterioration [3]. Mushroom plays important role in ecological processes. A good information is embedded as traditional knowledge with the indigenous tribal people with regard to mushrooms and the forest ecosystem. They are also aware of the wild edible and non-edible mushrooms [4]. Such mushrooms flourish the forest floor well in the rainy season. Mushrooms are fleshy, spore bearing fruiting body of a fungus and are the major biological constituent in forest ecosystem [5]. From the ancient time wild mushrooms have been fulfilling the need of food and nutraceutical among the aboriginals. There are about 15,00,000 fungi present all over the world in which 14,000 are recognized as mushroom species, among these 1154 mushrooms are reported as edible [6]. Total 140,000 mushroom species have been reported till date and among them 700 species are palatable with many therapeutic properties [7]. Mushrooms are cosmopolitan in nature and occur seasonally in several habitats all over the world. One third of total global fungal diversity exists in tropical region [8]. They are rich in polysaccharides, oligosaccharides, unsaturated fatty acids, terpenoids, peptides, protein, amino acids and minerals element. In addition to this they also contain bioactive compounds such as terpenoids, steroids, phenolic compound, flavonoids, nucleotides and their derivatives [9]. Mushroom protein contains all the essential amino acids that are especially rich in lysine and leucine and an excellent source of vitamins like vitamin B and vitamin C. They are also used for preparing alcohol beverage. They are also rich in minerals like magnesium, selenium, phosphorus, copper and potassium and dietary fiber chitin and B glucagon. The most cultivated edible mushroom worldwide is *Agaricus bisporus* (common mushroom) followed by *Lentinus edodes* (Shiitake mushroom), *Pleurotus* spp. (in particular Oyster mushroom), and *Flammulina velutipes* (Enoki mushroom). Now a days many organic pollutants are decomposed by mushrooms such as *Trametes versiocolor* [10-11].

2. MATERIALS AND METHODS

2.1 Study Area

Rairangpur is situated at Mayurbhanj district of Odisha, between 22°16′45″ N and 86°11′45″ E. It has an average elevation of 248 m with an annual average temperature of (35-35) ^{o} C. The region receives total annual average rainfall of about 695 mm [12]. Ho, Santal, Mankadia, Bhuina, Bathudi, Munda are the main tribal communities of this region. It is also surrounded by hills and Mining areas. Geographically it enjoys Dry Deciduous, Moist Deciduous and especially Sal forest. The most frequent flora of the study areas are *Shorea robusta, Cassia fistula, Diospyros melanoxylon, Alangium salvifolium, Terminalia alata, Terminalia bellirica, Terminalia arjuna, Cipadessa baccifera, Cryptolepis buchanani, Careya arborea, Butea monosperma, Ougeinia oojeinensis, Celastrus paniculatus, Madhuca longifolia, Holarrhena pubescens, Smilax zeylanica, Schleichera oleosa, Haldina cordifolia* etc [13]. Many types of Orchids are present in Rairangpur like *Vanda tessellata, Acampe praemorsa, Acampe carinata, Aerides odorata, Hebenaria commelinifolia* etc. which makes the forest charming and beautiful. The forest enjoys some parasitic plants like *Viscum articulatum, Dendrophthoe falcata, Striga densiflora, Aeginetia indica, Macrosolen capitellatus* etc as well as some carnivorous plants like *Drosera burmannii, Utricularia aurea, Utricularia caerulea* etc.

2.2 Collection of Medicinal Values

The survey was made during the year 2020-2021 and photographed the samples was taken for easy identification using publish Research paper and books [14-17]. The regular field trips were

carried out in different places of Rairangpur Forest Division (Badampahar, Suleipat, Bangiriposi Ghati, Sanajhili, Badajhili, Jhiliondungri, Bisoi etc). The local communities, tribal's, forest watcher of Rairangpur forest division confirm the food and medicinal values of wild edible Mushrooms. The ethnobotanical survey was done by Team APRF. From the survey information were collected regarding the edibility, medicinal value and nutraceutical values of mushroom from the villagers. Rairangpur is rich in resource of edible mushroom, which grow wild in forest and grassland (Plate 2).

3. RESULTS

A total of 99 mushroom species belonging to 56 genera of 37 families were identified from Rairangpur Forest Division during survey. Table 1 represents the list of collected mushroom species during the survey period. Family Agaricaceae and Polyphoraceae (11species) was reported the most dominant while Russulaceae (8 species), Marasmiaceae (7 species), Amanitaceae (5 species), Lyophyllaceae (5 species), Xylariaceae (5species), Hymenochaetaceae (4species), Ganodermataceae (4species), Clavariaceae (3 species), Mycenaceae (3 species), Hygrophoraceae (3 species), Auriculariaceae (2 species), Geastraceae (2 species), Gomphaceae (2 species), Lepiotaceae (2 species), Psathyrellaceae (2 species), Pluteaceae (2 species), and Bolbitiaceae, Coniophoraceae, Dacrymycetaceae, Entolomataceae, Fomitopsidaceae, Helotiaceae, Hydnangiaceae, Meripilaceae, Meruliaceae, Peniophoraceae, Pleurotaceae, Pyronemataceae, Schizophyllaceae, Sclerodermataceae, Sillaceae, Steccherinaceae, Stereaceae, Tricholomataceae, Tuberaceae have contains only one species (Fig 1). During field and ethnobotanical survey 41 species of mushrooms were reported as edible. The most common edible mushrooms *are Amanita caesarea, Clavaria amoena, Lactarius resimus, Leucocoprinus cepestipes, Lactarius resimus, Macrolepiota dolichaula, Microporous xanthopus, Russula nigricans, Termitomyces clypeatus, Tuber rufum, Volvariella volvaceae, T. heimii, T. microcarpus, R. rosea, R. xerampelina, Schizophyllum commune,*. Among them *Agaricus campestris, Tuber rufum, Volvariella volvaceae* are considered highly delicious. During survey some medicinal mushrooms are observed which are used by tribal and local communities, these are *Ganoderma, Agaricus, Auricularia, Trametes* etc. *Ganoderma tsugae* is used to boost immune system, induce sleeping and to reduce cholesterol level. According to them *Agaricus* species has anti-ageing activity. *Volvorella volvacea* used to lower blood pressure, *Lycoperdon pyriformi* used to cure wound and *Termitomyces mocrocarpus* used for curing rheumatism and diorrhoea. Local tribal communities collect wild medicinal mushrooms species like *Ganoderma*, *Auricularia*, *Trametes* and sold the traders for their livelihood. They used *Auricularia auricular* to cure various stomach disease and *Pycnopoporous cinnabarinus* to cure wounds (Plate 1).

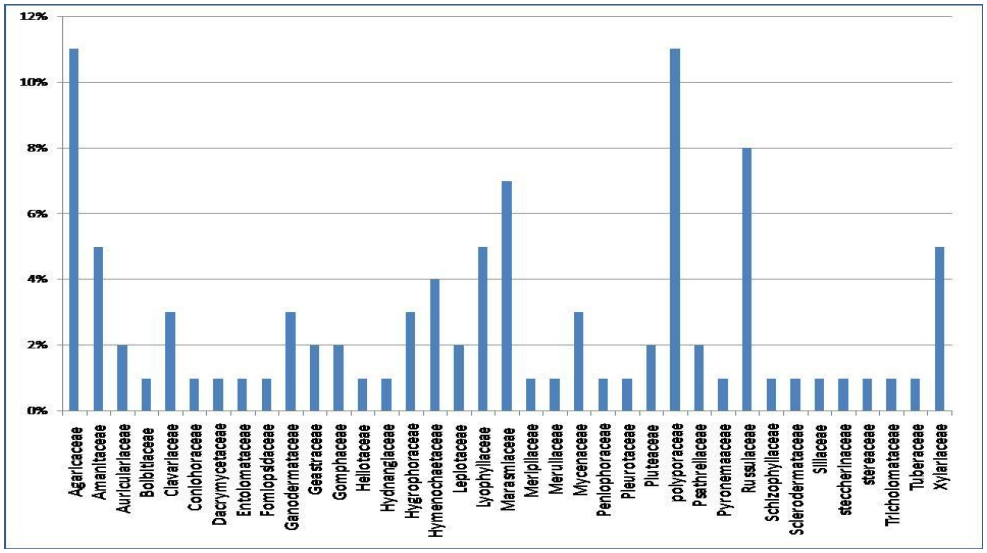

Fig. 1. Diversity of mushroom in study areas

Table 1. Wild mushroom diversity of Rairangpur forest division, Odisha, India

Botanical Name	Family	Class	Edibility
Agaricus campestris	Agaricaceae	Agaricomycetes	Edible
Agaricus trisulpharatus	Agaricaceae	Agaricomycetes	Non-edible
Aleuria aurantia	Pyronemataceae	Pezizomycetes	Non-edible
Amanita australis	Amanitaceae	Agaricomycetes	Edible
Amanita caesarea	Amanitaceae	Agaricomycetes	Edible
Amanita loosii	Amanitaceae	Agaricomycetes	Edible
Amanita ovalispora	Amanitaceae	Agaricomycetes	Non-edible
Amanita vaginata	Amanitaceae	Agaricomycetes	Non-edible
Auricularia auricular-judae	Auriculariaceae	Agaricomycetes	Edible
Bisporella citrinea	Helotiaceae	Leotiomycetes	Non-edible
Bjerkandera adusta	Meruliaceae	Agaricomycetes	Non-edible
Clavaria amoena	Clavariaceae	Agaricomycetes	Edible
Clavaria vermicularis	Clavariaceae	Agaricomycetes	Edible
Clavulinopsis aurantiocinnabarina	Clavariaceae	Basidiomycetes	Non-edible
Coltricia cinnamomia	Hymenochaetaceae	Agaricomycetes	Non-edible
Coniophora puteana	Coniophoraceae	Agaricomycetes	Non-edible
Conocybe apala	Bolbitiaceae	Agaricomycetes	Non-edible
Coprinus disseminates	Psathyrellaceae	Agaricomycetes	Non-edible
Dacryopinax spathularia	Dacrymycetaceae	Dacrymycetes	Non-edible
Daldinia concentrica	Xylariaceae	Sordariomycetes	Non-edible
Entoloma sinuatum	Entolomataceae	Agaricomycetes	Non-edible
Fomitopsis pinicola	Fomitopsidaceae	Agaricomycetes	Non-edible
Ganoderma australe	Ganodermataceae	Agaricomycetes	Non-edible
Ganoderma lucidum	Ganodermataceae	Agaricomycetes	Non-edible
Ganoderma tsugae	Ganodermataceae	Agaricomycetes	Edible
Geastrum fimbriatum	Geastraceae	Agaricomycetes	Edible
Geastrum saccatum	Geastraceae	Agaricomycetes	Edible
Gomphus floccosus	Gomphaceae	Agaricomycetes	Non-edible
Grifolia frondosa	Meripilaceae	Agaricomycetes	Edible
Hirneola auricular	Auriculariaceae	Agaricomyceytes	Edible
Hygrocybe aurantiosplendens	Hygrophoraceae	Agaricomycetes	Non-edible
Hygrocybe cantharelius	Hygrophoraceae	Agaricomycetes	Non-edible
Hygrocybe russocoriacea	Hygrophoraceae	Agaricomycetes	Non-edible
Laccaria fraterna	Hydnangiaceae	Agaricomycetes	Non-edible
Lactarius deliciosus	Russulaceae	Agaricomycetes	Edible
Lactarius resimus	Russulaceae	Agaricomycetes	Edible
Langermannia gigantean	Agaricaceae	Agaricomycetes	Edible
Lentinus fusipes	Polyporaceae	Agaricomycetes	Edible
Lentinus torulosus	Polyporaceae	Agaricomycetes	Edible
Lentinus tubergium	Pleurotaceae	Agaricomycetes	Edible
Lenzites betulina	Polyporaceae	Basidiomycetes	Non-edible
Lepiota clypeolaria	Agaricaceae	Agaricomycetes	Non-edible
Lepiota cristata	Agaricaceae	Agaricomycetes	Non-edible
Leucocoprinus brebissonii	Agaricaceae	Agaricomycetes	Non-edible
Leucocoprinus cepestipes	Agaricaceae	Agaricomycetes	Non-edible
Leucocoprinus cretceus	Agaricaceae	Agaricomycetes	Non-edible
Lycoperdon perlatum	Agaricaceae	Agaricomycetes	Edible
Lycoperdon pyriformi	Agaricaceae	Agaricomycetes	Edible
Macrolepiota clelandii	Lepiotaceae	Agaricomycetes	Edible

Botanical Name	Family	Class	Edibility
Macrolepiota dolichaula	Lepiotaceae	Agaricomycetes	Edible
Macrolepiota procera	Agaricaceae	Agaricomycetes	Edible
Marasmius anomalus	Marasmiaceae	Agaricomycetes	Edible
Marasmius capillaris	Marasmiaceae	Agaricomycetes	Non-edible
Marasmius elegans	Marasmiaceae	Agaricomycetes	Non-edible
Marasmius haematocephalus	Marasmiaceae	Agaricomycetes	Non-edible
Marasmius plicatulus	Marasmiaceae	Agaricomycetes	Non-edible
Marasmius rotula	Marasmiaceae	Agaricomycetes	Non-edible
Marasmius siccus	Marasmiaceae	Agaricomycetes	Non-edible
Microporous xanthopus	Polyporaceae	Basidiomycetes	Edible
Mycena acicula	Mycenaceae	Agaricomycetes	Non-edible
Mycena adscendens	Mycenaceae	Agaricomycetes	Non-edible
Mycena haematopus	Mycenaceae	Agaricomycetes	Non-edible
Nigroporous vinosus	Steccherinaceae	Agaricomycetes	Non-edible
Parasola conopilus	Psathyrellaceae	Agaricomycetes	Non-edible
Peniophora incarnata	Peniophoraceae	Agaricomycetes	Non-edible
Phellinus gilvus	Hymenochaetaceae	Agaricomycetes	Non-edible
Phellinus igniarius	Hymenochaetaceae	Agaricomycetes	Non-edible
Pisolithus arrhizus	Sclerodermataceae	Agaricomycetes	Non-edible
Pluteus lutescens	Pluteaceae	Agaricomycetes	Edible
Polyporous sulphureus	Polyporaceae	Agaricomycetes	Edible
Porodaedalea pini	Hymenochaetaceae	Basidiomycetes	Non-edible
Pycnoporus cinnabarinus	Polyporaceae	Agaricomycetes	Non-edible
Pycnoporus sanguineus	Polyporaceae	Agaricomycetes	Non-edible
Ramaria stricta	Gomphaceae	Agaricomycetes	Non-edible
Russula brevipes	Russulaceae	Agaricomycetes	Edible
Russula cyanoxantha	Russulaceae	Agaricomycetes	Edible
Russula emetica	Russulaceae	Agaricomycetes	Non-edible
Russula nigricans	Russulaceae	Agaricomycetes	Edible
Russula rosea	Russulaceae	Agaricomycetes	Edible
Russula xerampelina	Russulaceae	Agaricomycetes	Edible
Schizophyllum commune	Schizophyllaceae	Agaricomycetes	Non-edible
Suillus luteus	Sillaceae	Agaricomycetes	Edible
Termitomyces clypeatus	Lyophyllaceae	Agaricomycetes	Edible
Termitomyces eurrhizus	Lyophyllaceae	Agaricomycetes	Edible
Termitomyces heimii	Lyophyllaceae	Agaricomycetes	Edible
Termitomyces medicus	Lyophyllaceae	Agaricomycetes	Edible
Termitomyces microcarpus	Lyophyllaceae	Agaricomycetes	Edible
Trametes elegans	Polyporaceae	Agaricomycetes	Non-edible
Trametes gibbosa	Polyporaceae	Agaricomycetes	Non-edible
Trametes sanquinea	Polyporaceae	Agaricomycetes	Non – edible
Trametes versicolor	Polyporaceae	Agaricomycetes	Non-edible
Tricholoma lobayense	Tricholomataceae	Agaricomycetes	Edible
Tuber rufum	Tuberaceae	Pezizmycetes	Edible
Volvariella volvacea	Pluteaceae	Agaricomycetes	Edible
Xylaria cubensis	Xylariaceae	Sordariomycetes	Non-edible
Xylaria filiformis	Xylariaceae	Sordariomycetes	Non-edible
Xylaria hypoxylon	Xylariaceae	Sordariomycetes	Non-edible
Xylaria longipes	Xylariaceae	Sordariomycetes	Non-edible
Xylobolous subpileatus	Stereaceae	Agaricomycetes	Non-edible

Plate 1. Mushroom diversity in study area; a) *Lycoperdon pyriforme,* b) *Daldinia concentrica,* c) *Microcarpus xanthopus,* d) *Russula emetic*, e) *Tuber rufum*, f) *Schizophyllum commune*

Plate 2. Mushroom diversity in study area; g) *Clavaria vermicularis*, h) *Marasmius haematocephala*, i) *Geastrum fimbriatum*, j) *Russula rosea*, k) *Macrolepiota procera*, l) *Russula cyanoxantha*

Plate 3. Mushroom diversity in study area; m) *Amanita ovalispora*, n) *Lentinus fuscipes*, o) *Ganoderma lucidum*, p) *Microporous xanthopus*, q) *Dacryopinax spathularia*, r) *Trametes sanguine*

Plate 4. Field survry for the documentation of mushroom diversity

4. DISCUSSION

Mushrooms are diverse organism which plays a vital role in maintaining forest ecosystem and biodiversity. Odisha, with its diverse landscapes provides fertile platform for wild mushroom diversity. Earlier 11 mushrooms are reported from Odisha state which are edible [18]. These are *Amanita caeserea, T. heimii, T. eurrhizus, A. loosii, Termitomyces microcarpus, T. clypeatus, Tuber rufum, Russula lepida, R. brevipes, Lentinus fusipes and Microporus xanthopus.* Later in 2013 Sachan et al. reported 14 edible mushroom species from Similipal Biosphere Reserve [19]. Panda et al. in 2019 were reported about 20 edible mushroom species like *Lycoperedon pyriforme, Lycoperedon pyriformi, Volvariella volvacea, Amanita egregia, Termitomyces microcarpus, Termitomyces eurhizus, Termitomyces heimii, Russula rosea* etc. from Northern Odisha, India [6]. Recently in 2020 Rout et al. reported 60 wild mushroom from Dhenkanal district of Odisha in which 20 mushrooms are edible [7].

5. CONCLUSION

Rairangpur Forest Division with its varied topography and diverse vegetation enjoys a rich diversity of mushrooms in wild habitats. This region is rich in resources of edible macrofungi. A total of 99 mushroom species belonging to 56 genera of 37 families were identified from Rairangpur Forest Division during survey and it was found that 41 species were edible in which 15 mushrooms were consumed by local and tribal communities. The rest species are poisonous or bitter in taste and further research on them could lead to isolate some bioactive compounds which could be a better preventive against many lethal diseases. The above results provide more scopes to identify the edible and non-edible mushrooms for future food and medicines. Therefore it is very important to explore, document and conserve these natural wealth.

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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