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RESEARCH ARTICLE

OCCURRENCE OF MACROFUNGI IN GARBHANGA RESERVE FOREST, KAMRUP DISTRICT, ASSAM (INDIA)

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Abstract

Macrofungal diversity are gaining importance due to the fact that these group of organisms serve as important source of food as well as medicine. The present investigation was carried out in Garbhanga Reserve Forest of Kamrupdistrict of Assam. The study sites were selected randomly and macrofungi were collected during the monsoon season, 2015. Sixteen different macrofungi were collected from the forest. Among the collected macrofungi, four belonged to Agaricaceae, two to Xylariaceae and two to Tricholomataceae, one each to Cantharellaceae, Polyporaceae, Ganodermataceae, Auriculariaceae, Clavariaceae, Phallaceae, Hericiaceae.

Introduction:-

Diversity of macro fungi is depleting fast day by day due to climate change, deforestation, and habitat destruction by unorganised method of mushroom collection and urbanization. Fungi are important organisms that serve many vital functions in forest ecosystem including decomposition, nutrient cycling, symbiotic relationships with tree and other plants, biological control of other pathogens. Mushrooms are causing decay in living trees in one hand and are beneficial to many species of birds and mammals as sources of food on the other hand. More over this group of organisms are utilised by the origin and aboriginal races of different nook and corners of the globe as food as well as medicine. Less than 5 percent of the estimated 1. 5 million species of fungi have been described, and their exact roles and interactions in ecosystem are largely unknown (Ostry*et al*.,2010). The diversity of fungi and their natural beauty occupy a prime position in world scenario. India has been a cradle of these beautiful organisms. Only a fraction of the total fungal wealth of India has been subjected to scientific scrutiny. About 10,000 fungal genera are reported from the world, of which more than 2000 genera and 14,000 species are known from India which represents approximately $1/5^{th}$ of the total myco biodiversity existing at the global level which holds second largest biotic community after insects (Bilgrami*et al*.,1997). Mushrooms are used extensively in cooking as they are of low-calorie, serving as important source of vitamins, essential minerals, protein, fat and carbohydrate. Many macro fungal species produce secondary metabolites that can be toxic, mind-altering, antibiotic, antiviral, antibacterial(Yoon *et al.* , 1994), anti cancerous activity(Lee *et al.* , 2005). Mushrooms with psychoactive properties have played vital role in various native medicines. Some mushrooms are used in the treatment for diseases, dyeing wool and other natural fibres.

Materials and method:-

Study area:-

Garbhanga Reserve forest of Kamrup district, Assam is located at 26°1'40"N and91°43'31"E situated on the foot hills of Assam and Meghalaya. The total forest cover is about 110km² and it is situated in an altitude of 100-200m. The forest type is mostly mixed deciduous with a few scattered tropical evergreen pockets. The forest has diverse habitats ranging from an upland forest with a thick rainforest canopy to open forested area with grassy patches and

dense underground vegetation along the stream. It is a home of elephants, Jungle Myna, Pin stripped tit Babbler, Asian koel, Indian Cuckoo, Spotted Owl, Brown Fish-Owl. Different types of valuable climbers, shrubs, herband sapling plants are also available. Habitat like wood, soil, litter and grass were taken into account for the collection of macro fungi.

Sampling and Data collection:-

Macro fungi from Garbhanga Reserve forest were collected from July to September, 2015 with systematic and periodic survey (Mueller *et al*. 2004; Bresinsky and Besl,1990). The habitat and morphological characters of the macro fungi were noted and photographed, prior to its picking from natural habitat. Sporocarps were extracted from the substrata with special care to avoid damage to the base of the stipe and cleaned. After collection the specimens with soft and delicate texture were preserved in 2% formaldehyde and 4% with leathery texture. Hard textured macro fungi were sun dried and also in hot air oven over a temperature of 40-50°C and stored in air tight container. Frequency of occurrence of macro fungi was observed and was calculated by standard formula given below.

Frequency study:-

Frequency of fungal species(%) = Number of site in which the species is present X 100
Total number of sites

Result and Discussion:-

Fourteen species of macro fungi belonging to eleven families were identified. Family Agaricaceae had four species; Tricholomatacea and Xylariacea had two species while all other families i.e. Polyporaceae, Hericiaceae, Ganodermataceae, Phallaceae, Auriculariaceae, Clavariaceae, Russulaceae, Cantharellaceae were found to have one species each. Nine macrofungi viz. *Agaricus impudicus*, *Agaricus arvensis*, *Auricularia auricula-judae*, *Cantharellus cibarius*, *Clavaria straminea*, *Lepista nuda*, *Lycoperdon pyriforme*, *Macrolepiota procera* were edible and *Phallus indusiatus* (edible in Chinese and South Asian cuisine) where as other macro fungi viz. *Daldinia concentrica*, *Ganoderma lucidum*, *Hericium* sp, *Russula sanguinaria*, *Trametes hirsuta*, *Tricholoma* sp, *Xylaria hypoxylon* were in edible. A brief description of these species is mentioned below.

***Agaricus arvensis* Schaeff:-**

The cap measures 14. 2 cm in diameter. Creamish white in colour, smooth, the cap is spherical. The flesh is white and firm. Basidiospores are elliptical and smooth measuring 7. 8 x 4.5-5.8 µm.

***Agaricus impudicus* (Rea) Pilát:-**

Cap is10 cm wide, and appears brownish. The stipe is white, 8cm tall and 1. 2 cm thick, cylindrical and wider towards the bottom. Gills are free; crowded; greyish pink. Basidiospores are smooth and ovoid measuring 3.8- 6. 5x 3. 9- 4.2µm.

***Auricularia auricula-judae* (Bull.)J. Schröt:-**

The fruit body is 8 centimetres in length. It is somewhat shaped like an ear, though the fruit bodies can also be cup-shaped. It is attached to the substrate laterally. It is tough, gelatinous with elastic texture when fresh. The outer surface is a bright reddish-tan-brown with a purplish hint and covered in tiny, downy hairs of a grey colour. Basidiospores are allantoid shaped measuring 14-17 x 5-8µm.

***Cantharellus cibarius* Fr:-**

It is orange to yellow, meaty and funnel-shaped. On the lower surface, underneath the smooth cap, it has gill-like ridges that run almost all the way down its stipe, which tapers down seamlessly from the cap. It emits a fruity aroma. Basidiospores are smooth and ellipsoidal measuring 7-10x 3-6 µm.

***Clavaria straminea* Cotton:-**

Basidiumsimple, 45 x 1. 2 mm, insmall clusters, mostlytubular with acute apex, smooth ridged, spiralled, pale dull yellow,distinct stipe with yellowish orange colour. Basidiospores are globose 5 -7.5 x 5 - 7 µm, thin-walled, smooth and hyaline.

***Daldinia concentrica* (Bolton) Ces. & De Not:-**

Cap is 4. 4cm wide. Thefruiting bodies are grayish black in colour. The surface of mature Carbon balls were with finely dotted bumps. Numerous concentric layers of fungus tissue (i. e. , stromal tissue) are revealed when Carbon balls are cut vertically. Ascosporesare ellipsoidal measuring 10-15x 5-8µm.

***Ganoderma lucidum* (Curtis) P. Karst:-**
It is a polypore mushroom corky and flat, with a conspicuous red-varnished, kidney-shaped cap measures 12cm. Spores 9-11 x 5. 2-7µm; elliptical.

***Lepista nuda* (Bull.)H. E. Bigelow &A. H. Sm:-**
Cap 8cm in length; broadly convex with an uplifted, wavy margin in the centre; surface smooth and somewhat finely cracked over the centre; flesh purplish with brown shades, Gills are attached to the stem by a notch. Stipe: 6. 8 cm long; 1 cm thick at apex; enlarged at the base; dry; finely hairy; pale purple coloured. Spores are smooth and ellipsoid measuring 5.1-7 x 3.3-5 µm.

***Lycoperdon pyriforme* Schaeff:-**
The fruiting body of the puffball measures 4. 5 cm in width and 2.7 cm in height, pear-shaped, creamish coloured. Spores are round and smooth measuring 3.2-4.3 µm.

***Macrolepiota procera* (Scop.) Singer:-**
Cap is 6 cm with little bump in the centre of the cap; scales are brown in colour; long slender stem with 10.4 cm in length. The flesh is whitish and soft. The gills are crowded, and free from the stem. Spores are thick walled, smooth and ellipsoidal measuring 10-17 x 6-10 µm.

***Phallus indusiatus* Vent:-**
The mushroom measures 11. 6cm tall and girded with a net-like structure called the indusium (or less technically a "skirt") that hangs down from the conical to bell-shaped cap. The net like openings of the indusium was polygonal in shape. The cap is 2. 2 cm wide and its reticulated (pitted and ridged) surface are covered with a layer of greenish-brown and foul-smelling slime. The top of the cap has a small hole. The stalk is 6.5 cm long and 1.5cm thick. The hollow stalk is white, roughly equal in width throughout its length. Spores are elliptical measuring 2.5-3.2 x 1-1.4 µm.

***Russula sanguinaria* (Schumach.) Rauschert:-**
The cap is 5.5 cm in diameter. It is rose coloured and often having paler areas. The cap skin peels at the margin only. The stipe is firmly robust and white in colour. It is streaked vertically. The cream to pale ochre gills are adnate to slightly decurrent, narrow and forking. The flesh is white in colour. Spore measures 6-9 x 5-7 µm.

***Trametes hirsuta* (Wulfen) Pilát:-**
The cap measures 9.2 cm across and 6. 1 cm deep; it is semicircular, irregularly bracket-shaped, fusing laterally with other caps, very densely hairy; finely, radially furrowed; with concentric zones of texture; zones with gray, whitish, and brownish shades not contrasting markedly; margin brownish. Pore Surface: Whitish. Spore measures 5-8 x 1.5-2. 5 µm; smooth and cylindrical.

***Xylaria hypoxylon* (Linn.) Grev:-**
Ascocarps are cylindrical with dimensions of 3-8 centimetres tall × 2–6.4 mm thick. The erect ascocarps are twisted or bent, and typically sparsely branched. Mature ascocarps are charcoal-black, and have minute pimple-like bumps called perithecia on the surface. The ascospores are kidney-shaped, black, and smooth with 7-10× 2-4µm.

***Trametes hirsuta* (Wulfen) Pilát**

Hericium sp.

***Ganoderma lucidum* (Curtis) P. Karst**

***Cantharellus cibarius* Fr.**

***Xylaria hypoxylon* (L.) Grev.**

***Phallus indusiatus* Vent.**

***Clavaria straminea* Cotton.**

***Agaricus arvensis* Schaeff.**

***Lycoperdon pyriforme* Schaeff.**

***Auricularia auricula-judae* (Bull.) J. Schröt.**

***Macrolepiota procera* (Scop.)Singer**

***Lepista nuda* (Bull.)H. E. Bigelow &A. H. Sm.**

***Agaricus impudicus* (Rea) Pilát.**

***Russula sanguinaria* (Schumach.)**

***Tricholoma* sp.**

***Daldinia concentrica* (Bolton) Ces. & De Not.**

Table 1:- Distributionof macrofungi in different species.

Families	No. of species
Agaricaceae	4
Tricholomataceae	2
Xylariaceae	2
Polyporaceae	1
Hericiaceae	1
Ganodermataceae	1
Phallaceae	1
Auriculariaceae	1
Clavariaceae	1
Russulaceae	1
Cantharellaceae	1
Total species	16

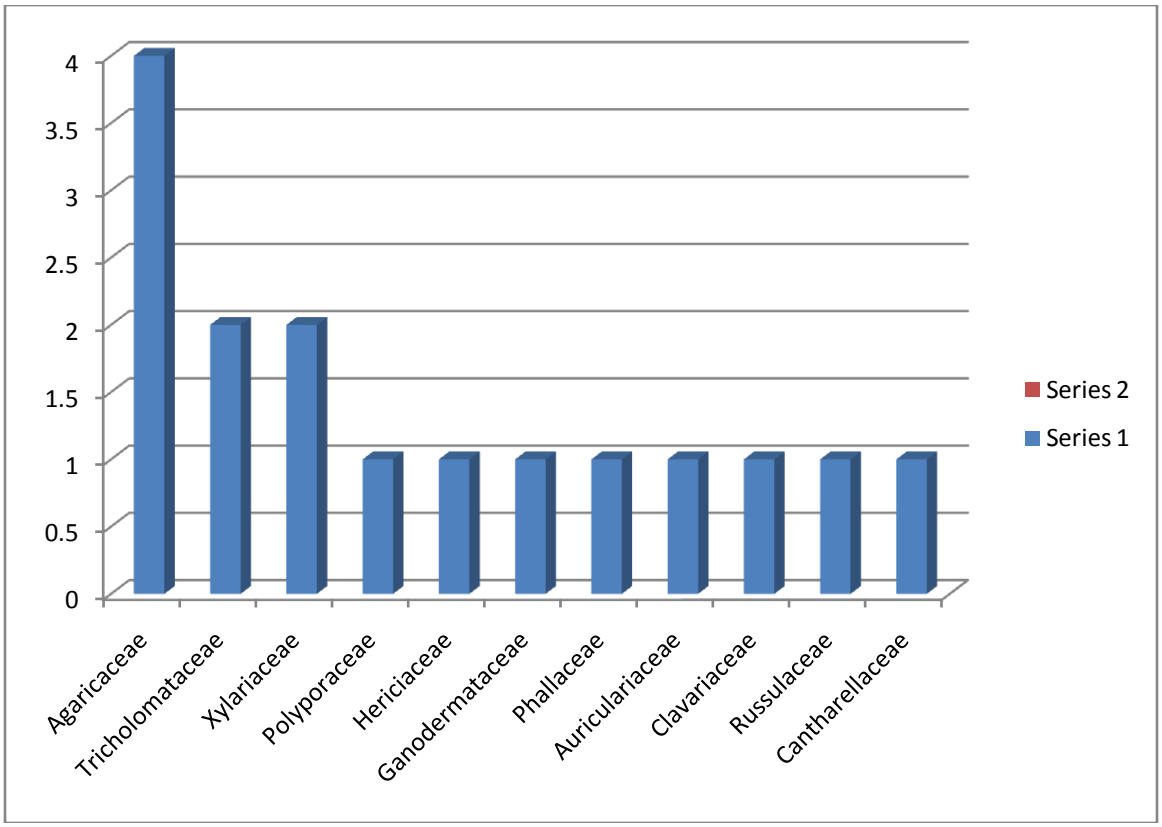

Fig 1:- Macrofungal distribution in families.

Table 2:- Economic Importance of Identified Macrofungi.

Sl no.	Economic status	Number of Sps.
1.	Edible	9
2.	Medicinal	4
3	Inedible	7

Economic value of the Macrofungi:-

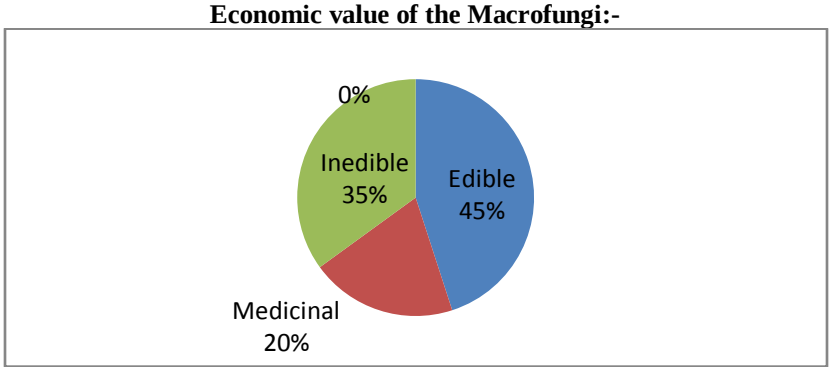

Fig 2:- Pie diagram showing the economic status of the macrofungi.

Table 3: Frequency of occurrence ofMacrofungi studied in Garbhanga Reserve Forest

Name of the species	Class	Family	Host/Substratum	Economic Importance	Frequency of Occurence
Agaricus arvensis Schaeff.	Agaricomycetes	Agaricaceae	Grows on decomposed plant material, litter, soil.	Edible	35
Agaricus impudicus (Rea.) Pilat.	Agaricomycetes	Agaricaceae	Saprobic grows on well-drained soil, Leaf litter.	Edible	45
Auricularia auricula-judae (Bull.) J. Schröt.	Agaricomycetes	Auriculariaceae	Living and decaying deciduous trees.	Edible, Medicinal	55
Cantharellus cibarius Fr.	Agaricomycetes	Cantharellaceae	Growing alone, scattered, gregariously, or in clusters in organic debris--in woods.	Medicinal, edible	52
Clavaria straminea Cotton.	Agaricomycetes	Clavariaceae	Decomposed plant material and litter.	Edible	33
Daldinia concentrica (Bolton) Ces. & De Not.	Sordariomycetes	Xylariaceae	Living trees, dead wood.	Inedible	31
Ganoderma lucidum (Curtis) P. Karst	Agaricomycetes	Ganodermataceae	Living tree, dead wood logs.	Medicinal Inedible	16
Lepista nuda (Bull.)H. E. Bigelow&A. H. Sm.	Agaricomycetes	Tricholomataceae	OnLeaflitter,decomposing plant material.	Edible	22
Lycoperdon pyriforme Schaeff.	Agaricomycetes	Agaricaceae	Decomposed plant material, Litter.	Edible	43
Hericium sp.	Agaricomycetes	Hericiaceae	Living tree and dead wood logs.	Inedible	25
Macrolepiota procera(Scop.) Singer	Agaricomycetes	Agaricaceae	Grows on decomposed plant material, litter, soil	Edible	38
*Phallus indusiatus*Vent.	Agaricomycetes	Phallaceae	Bamboo culms, decomposing plant material	Edible (South Asian cuisine).	15
Russula sanguinaria (Schumach.) Rauschert.	Agaricomycetes	Russulaceae	Living and dead wood logs, Sandy soil.	Inedible	27
Trametes hirsuta (Wulfen) Pilát	Agaricomycetes	Polyporaceae	Living and dead wood logs.	Inedible.	42
Tricholoma sp.	Agaricomycetes	Tricholomataceae	Grows on decomposed plant material, litter, soil	Inedible	12
Xylaria hypoxylon (Linn.) Grev.	Sordariomycetes	Xylariaceae	Living and Dead logs.	Inedible	47

Conclusion:-

The wild macrofungal species are consumed by various ethnic tribes and nearby villages of Garbhanga Reserve Forest and are harvested completely on the basis of ethnomycological knowledge of the local people. Due to loss of natural habitat, deforestation and urbanization many macrofungal species are on threat. The diversity, distribution and development of macrofungi are largely affected by the changing scenarios of the climatic change. Hence, there is a need for long term monitoring of macrofungal species and their conservation.

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