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A checklist of wild mushrooms in three urban parks in Kolkata, India

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Abstract

In addition to having nutritional benefits, macrofungi have also been used medicinally. As a result, it is crucial to both the economy and the environment. This study was conducted from May 2020 to June 2022 in three urban parks in Kolkata, a major city in the Indian state of West Bengal. Twenty-eight fungal specimens were identified in this investigation, out of which 99% of the taxa are Basidiomycota, while only 1% is Ascomycota. The taxa belonged to 18 families and eight orders. Sixteen species were discovered in wood, notably over the dry stems of bamboo, and ten were discovered in soil, particularly in grasslands, over rotten dry leaves, and one over organic debris. Eleven of the specimens are edible, whereas the other eight are not. Out of 28 species, 32.14% of species are unknown. Among the three urban parks, viz., Ecopark, Central Park, and Elliot Park, macrofungal diversity was found to be the highest in Ecopark, followed by Central Park and Elliot Park. This study demonstrates the macrofungal diversity in three urban parks in Kolkata. The current study creates new opportunities for the investigation and use of wild mushrooms in urban parks in Kolkata.

Keywords – Basidiomycota – Edible – Habitat – Macrofungi – Urbanization

Introduction

The term “macrofungi” refers to fungi that produce macroscopic fruiting bodies, such as gilled fungi, jelly fungi, coral fungi, stink-horns, bracket fungi, puff-balls, and bird's nest fungi (Hawksworth et al. 1996, Bates 2006, Richards & Murray 2003). In general, macrofungi can be found on woody substrates, litter, and soil (Lodge et al. 2004). They exhibit patterns of diversity that are related largely to landscape patterns and host availability. The frequency and duration of sampling are dictated largely by the local plants. The richness of fruiting species is maximized only during brief periods and differs over the years (Lodge et al. 2004). High humidity during the monsoon period supplies ideal atmospheric conditions for the growth of many saprophytes, including mushrooms (Kumar et al. 2013). Current environmental issues of global warming and climate change would antagonistically affect the rehabilitation and growth pattern of delicate fungi, which require a specific microclimate (Kumar et al. 2013). It becomes extinct and faces the threat of extinction because of habitat destruction. Basidiomycota is a significant phylum of fungi, with over 40,000 described species (He et al. 2022). The number of fungi recorded in India exceeds 27,000 species, the largest biotech community after insects (Swapna et al. 2008). Macrofungi were considered ideal for evolution as biosorbents because it has demonstrated that many fungal species

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exhibit high biosorption potentials (Muraleedharan et al. 1995). There are few reports on macrofungi of West Bengal and other parts of India (Butler & Bisby 1931, Ribeiro et al. 2008, Basu et al. 2013, Pradhan et al. 2013, Dutta & Acharya 2014, Das et al. 2015, Singha et al. 2017, Chakraborty 2019) but none of them shows the diversity of macrofungi in urban parks.

Materials & methods

Study area

Three urban parks, Elliot Park (22°32'55.84"N 88°20'51.19"E), Central Park (22°35'12.17"N 88°24'53.90"E) and Ecopark (22°36'11.00"N 88°28'1.00"E) in Kolkata, were selected as the study area (Fig. 1). These parks are all located in the central part of Kolkata. In the summer (April-May), the maximum temperature in Kolkata reaches 41° C. During the winter (December-February), the temperature drops to 9° C while the average rainfall is 1836.5 mm per year. The soil type is alluvial because it is located in the Indo-Gangetic plain (Das et al. 2009). The majority of this metropolis is under construction, so few urban parks are important for preserving biodiversity. The study was conducted from May 2020 to June 2022. Fungi are found mainly in the rainy season, following the first shower and also during spring. The observations were carried out by visiting field sites randomly.

Fig. 1 – Maps of study areas: A) Elliot park, B) Central park, C) Ecopark (Source: Google Earth Pro)

Specimen collection and identification

Each mushroom was snapped in its natural surroundings by a Redmi Note 10 Lite phone. Their morphological features, such as cap structure, gill arrangement, pore presence, as well as ecological characteristics, such as collecting location and substrate (wood, soil, etc.), were investigated. Sometimes, uprooting the specimens to allow visual examination required digging implements and a blade.

Some pictures of specimens collected are given after the result. Following all of these observations, the specimens were correctly identified with the support of some journal articles (Chakraborty 2019, Ganguly et al. 2021) and books 'The Fungi of India' (Butler & Bisby 1931), 'Common Wild Mushrooms of West Bengal' (Acharya & Pradhan 2017).

Results

More than 200 specimens were photographed throughout this study. Thirty-nine species were separated among these. Unfortunately, the majority of the region in West Bengal has not been explored, so there is insufficient data to warrant the identification of all mushrooms. Therefore, some of them are yet unknown. Table 1 exhibits the data for the 28 macro-fungi that were identified. A total of 28 species were found throughout the survey. Out of the entire group, only one belonged to the Ascomycota, and the rest belonged to the Basidiomycota. Table 1 shows that 13 families are members of the Agaricales, eight families are members of the Polyporales and Auriculariales, Russulates, Dacrymycetales, Phallales, Trechisporales, and Xylariales belonged to only one family each. The identified specimens belonged to 18 families and eight orders based on the information gathered. Most species belong to the Agaricales. The highest number of species belonged to the Agaricaceae 4 (14%), followed by Ganodermataceae 3 (11%) and Polyporaceae 3 (11%) (Fig. 2). The Agaricaceae, Bolbitiaceae, Lyophyllaceae, Marasmiaceae and Phallaceae mushrooms were found on soil, whereas the families of mushrooms that have a habitat in wood include Crepidotaceae, Hydnangiaceae, Pleurotaceae, Schizophylaceae, Fomitopsidaceae, Meripilaceae and Polyporaceae. Most of the macrofungi were found on the wooden substratum (57%), followed by soil (39%) and organic matter (4%) (Fig. 3). Over organic matter, only one family, named Hypoxylaceae, was identified (Table 1). Eleven of the 28 species were edible, eight were inedible, and the rest were unknown in status (Fig. 4). Among the three study areas, Ecopark has the highest species diversity (Table 2), followed by Central Park and Elliot Park (Fig. 5). The photographs of some observed specimens are given in Fig. 6.

Table 1 List of the fungi found in urban parks of Kolkata, West Bengal, India, is described in terms of their taxonomic identity, and significance.

Order	Family	Scientific Name	Habitat	Significance	Medicinal value
Agaricales	Agaricaceae	*Agaricus campestris*	Soil	Edible	Antioxidant, antimicrobial and anticancer
Agaricales	Agaricaceae	*Leucocoprinus cepistipes*	Soil	Unknown	Lack of information
Agaricales	Agaricaceae	*Chlorophyllum molybdites*	Soil	Inedible	Lack of information
Agaricales	Agaricaceae	*Lepiota* sp.	Soil	Inedible	Several species contain amatoxins and are lethally poisonous, if consumed.
Agaricales	Bolbitiaceae	*Conocybe* sp.	Soil	Unknown	Contains psilocybin, a psychoactive substance, and was accomplished using Sandoz's synthetic Indocybin®, which has modest effects on physiological functioning. Psilocybin has some toxic effect that often led to death.

Table 1 Continued.

Order	Family	Scientific Name	Habitat	Significance	Medicinal value
Agaricales	Bolbitiaceae	*Bolbitius coprophilus*	Soil	Unknown	Lack of information
Agaricales	Crepidotaceae	*Crepidotus* sp.	Wood	Inedible	Some of them produced a novel antibiotic, strobilurin.
Agaricales	Hydnangiaceae	*Laccaria laccata*	Wood	Edible	Lack of information
Agaricales	Lyophyllaceae	*Termitomyces* sp.	Soil	Edible	Mushroom contain have potential uses as antioxidants, immunomodulators, anti-tumors, antimicrobials and also has a potential for treating neurodegenerative disorders.
Agaricales	Lyophyllaceae	*Calocybe indica*	Soil	Edible	Great source of natural components and antioxidants with potential application in pharmaceuticals and in treating managing different diseases.
Agaricales	Marasmiaceae	*Marasmius haematocephalus*	Soil	Unknown	Lack of information
Agaricales	Marasmiaceae	*Marasmius rotula*	Soil	Unknown	Have 'Mro'APO enzyme which is the first fungal peroxygenase that can be produced in high yields.
Agaricales	Pleurotaceae	*Pleurotus ostreatus*	Wood	Edible	Have antidiabetic, antibacterial, anticholestrolic, antiarthitic, antioxidant, anticancer, eye health and antiviral activities,
Agaricales	Schizophyllaceae	*Schizophyllum commune*	Wood	Edible	Have anticancer, antitumor and immunomodulating properties.
Polyporales	Fomitopsidaceae	*Daedalea quercina*	Wood	Inedible	Quercinol isolated from *D. quercina* showed anti-inflamatory activity.
Polyporales	Meripilaceae	*Rigidoporus lineatus*	Wood	Edible	Lack of information
Polyporales	Polyporaceae	*Coriolopsis occidentalis*	Wood	Unknown	Lack of information
Polyporales	Polyporaceae	*Pycnoporus cinnabarinus*	Wood	Inedible	Have antioxidant activity.
Polyporales	Polyporaceae	*Polyporus varius*	Wood	Unknown	Some of them possess cytotoxic nephroprotective, hepatoprotective, immune-enhancing, anti-inflammatory, antioxidative and antimicrobial activities.
Polyporales	Ganodermataceae	*Ganoderma lucidum*	Wood	Inedible	Boosts immune system, have antioxidant activity in vitro.
Polyporales	Ganodermataceae	*Ganoderma applanatum*	Wood	Edible	Lack of information
Polyporales	Ganodermataceae	*Ganoderma* sp.	Wood	Unknown	Lack of information

Table 1 Continued.

Order	Family	Scientific Name	Habitat	Significance	Medicinal value
Auriculariales	Auriculariaceae	*Auricularia* sp.	Wood	Edible	Mushroom extracts exhibited a variety of pharmacological properties such as antioxidant, blood lipid-lowering, anti-inflammation, antitumor, and anti-radiation activities.
Russulales	Bondarzewiaceae	*Amylosporus* sp.	Wood	Unknown	Lack of information
Dacrymycetales	Dacrymycelaceae	*Dacryopinax spathularia*	Wood	Edible	Lack of information
Phallales	Phallaceae	*Phallus indusiatus*	Soil	Edible	Used to treat many inflammatory, stomach and neural diseases.
Trechisporales	Hydnodontaceae	*Trechispora* sp.	Wood	Inedible	Lack of information
Xylariales	Hypoxylaceae	*Daldinia concentrica*	Organic matter	Inedible	Lack of information

Table 2 Presence of macrofungi in three urban parks at Kolkata West Bengal, India

	Location		
Scientific Name	**Ecopark**	**Central Park**	**Elliot Park**
Agaricus campestris	1	1	
Leucocoprinus cepistipes	1	1	1
Chlorophyllum molybdites	1	1	1
Lepiota sp.	1		
Conocybe sp.	1	1	1
Bolbitius coprophilus	1	1	1
Crepidotus sp.	1	1	1
Laccaria laccata	1		
Calocybe indica	1		
Termitomyces sp.	1	1	
Marasmius rotula	1		1
Marasmius haematocephalus	1	1	
Pleurotus ostreatus	1		
Schizophyllum commune	1	1	1
Daedalea quercina	1	1	
Rigidoporus lineatus	1		
Coriolopsis occidentalis	1	1	1
Pycnoporus cinnabarinus	1		
Polyporus varius	1		1
Ganoderma lucidum	1	1	
Ganoderma applanatum	1		
Ganoderma sp.	1		
Auricularia sp.	1		
Amylosporus sp.	1		
Dacryopinax spathularia	1	1	1
Phallus indusiatus	1		
Trechispora sp.	1	1	1
Daldinia concentrica	1		

Note- 1 means the presence of species

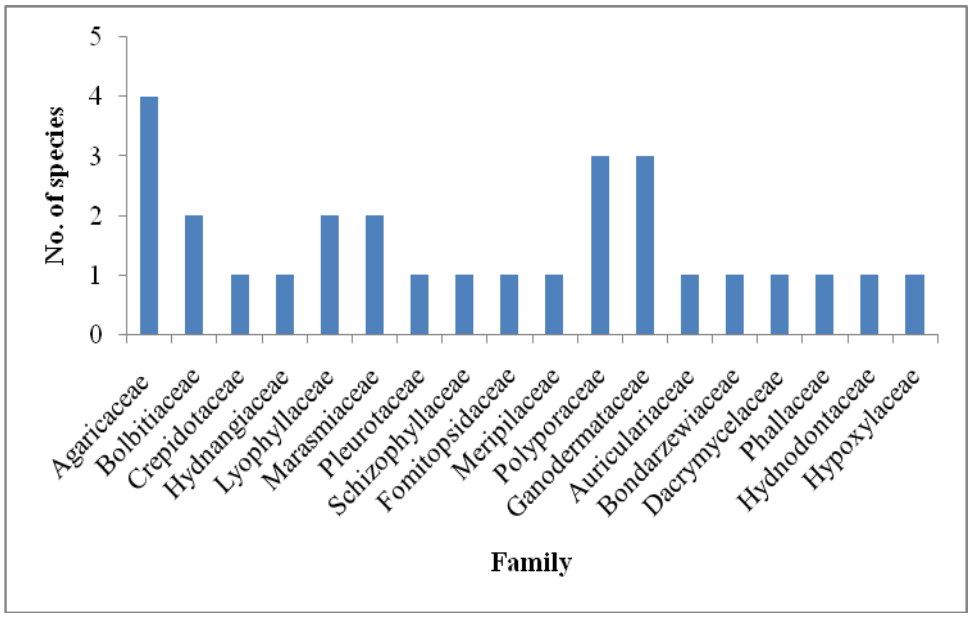

Fig. 2 – Family wise distribution

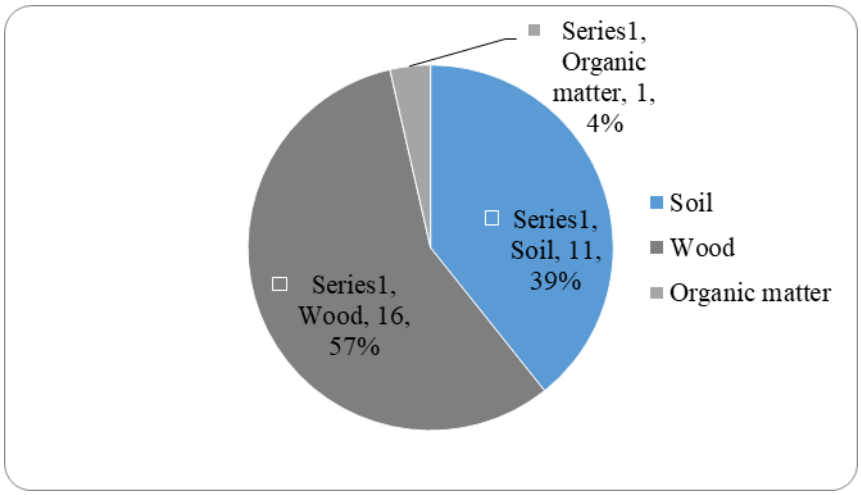

Fig. 3 – Habitat wise distribution

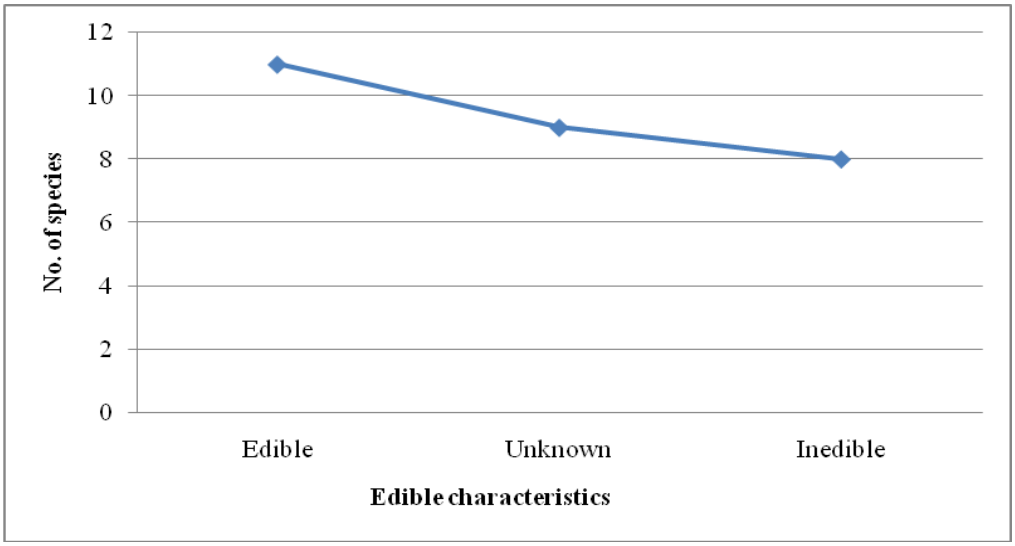

Fig. 4 – Distribution of species on the basis of edible characteristics.

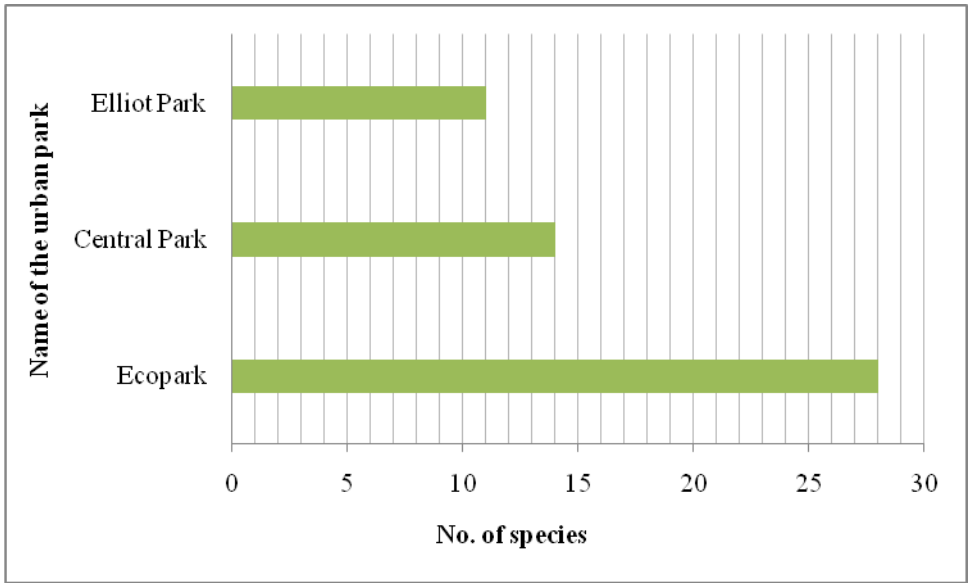

Fig. 5 – Mushroom comparison in three study areas

Fig. 6 – a *Termitomyces* sp. b *Schizophyllum commune.* c *Marasmius* sp. d *Dacryopinax spathularia.* e *Auricularia* sp. f *Phallus* sp.

Discussion

A total of 28 species of macrofungi belonging to 18 families and eight orders support the aforementioned perspectives. In this study, Agaricales was found to be the most dominant group of macrofungi, with high generic and species diversity and the order with the highest number of families. Agaricales are ubiquitous, mostly terrestrial, with habitats ranging from woodland to grassland varying, greatly between genera. In this area, soil and wood are where most fungi thrive because of the well-maintained grassland and multiple artificially constructed semi-natural wooden

barriers available in these types of urban parks, which naturally provide natural habitats for Agaricales. In this location, according to the results, the wood habitats (57%) were the richest in fungi because of the presence of wooden boundaries in different sections and the timber of the threes (Fig. 3), which are unaffected by human involvement for the majority of the time. In comparison, the soil-growing fungi were often removed along with the grass for park maintenance. In a large metropolis, 28 species may appear moderate in terms of the forest area, but from the perspective of the ecological environment, it was poor. However, despite all that construction waste, these kinds of urban parks nonetheless made a significant contribution, reducing the probability of extinction of a species in densely human-populated areas.

Massive urbanization has occurred in Kolkata during the past 25 years. That destroyed the green cover rapidly. In this metropolitan city, only some urban parks are left with natural habitats under maintenance. So, in these circumstances, an urban park's biodiversity study is essential. There is, as such, no previous record of fungi in those urban parks in the city. Other districts in West Bengal have national parks and sanctuaries but lack in urban city. Rabindra Sarovar and Shuvas Sarovar, and, on the other hand, the Victoria Memorial on the border of Howrah-Kolkata Shibpur Botanical Garden, Kolkata, has only the remaining green space. This is the first study on macrofungi diversity in an urban park, which provides baseline data on the fungi. However, a great deal more research is still needed to fully comprehend the broad biological significance of macrofungi.

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