



# Mushrooms of University of Ibadan Botanical Gardens ( 1)

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## ABSTRACT

Nigeria, African most populated black Country is known for her various beautiful vegetation patterns. During the rainy seasons, these Nigerian vegetation type usually support the luxuriant growth of diverse types of higher fungi such as mushrooms and toadstools (poisonous mushrooms). These macrofungi are usually exploited for food, medicines, bioremediation, biodegradation and other important uses. Likewise, toadstools could inflict irreversible damages to human cells, tissues, organs and systems. Consumption of poisonous mushrooms could lead to stomach pains, discomfort and death. Few toadstools also possess hallucinogenic properties and their bioactive compounds' can be employed as pharmaceutical drugs. In this present study, the morphology, characteristics, uses and habitat of wild mushrooms and toadstools collected from the University of Ibadan Botanical Gardens (UIBG), Ibadan, Nigeria were discussed .

**Keywords:** Macrofungi, mushrooms, toadstools, UIBG, vegetation

## INTRODUCTION

West African countries including Nigeria have abundant wild macrofungi. These may include mushrooms, toadstools, polypores, puffballs, auricularia and other forms that are widespread in nature (Jonathan, 2019; Chikwem *et al.*, 2019; Adeoye-Isijola, 2021). Fungi remains one of the earliest forms of organisms that have been useful to mankind from time immemorial (Jonathan *et al.*, 2012; Jonathan and Awotona, 2010). In Nigeria, many people in both urban and rural areas are familiar with wild mushrooms because of their usefulness in food, industries, environment and medicine (Gbolagade and Fasidi, 2005; Jonathan *et al.*, 2019; Adeoye-Isijola *et al.*, 2021; Asemoloye *et al.*, 2022). Many major tribes in Nigeria regard edible mushrooms as their delicacies especially the Yoruba speaking people of the south-western region (Zoberi, 1972; Oso 1975, 1977, 1981; Aina *et al.*, 2012). The collection, diversity, composition and uses of wild Nigeria mushrooms have been documented (Gbolagade *et al.*, 2006; Fasidi *et al.*, 2008,). Knowledge of higher fungi ecology and distribution are not only important for the successful conservation and management of the ecosystem but, also for the optimum exploitation of many benefits to

human race. Few scientists have carried out surveys on Nigeria macrofungi but, their findings have not been sufficiently covered diversities of mushrooms, their identification and economic. Commercial growing of indigenous mushrooms should be encouraged because poisonous mushroom consumption could cause damages to human lives..

The word ‘mushroom’ is a general term without any taxonomic significance (Jonathan,2019). This is because mushroom does not belong to a particular fungal group, class or order. They could occur in any class of fungi .Mushroom sporocarps or fruiting bodies are the reproductive structures of unseen fungal hyphae which is embedded in the substrates (agricultural wastes, compost, soil, wood etc). Although they could be found among different major classes of fungi, they are usually common in the classes of Ascomycetes and Basidiomycetes (Alofe *et al.*, 1998; Wasser and Weis,1999)

A typical mushroom fruit body is the reproductive structure of some fungi. Mushroom sporocarp is similar to fruit of a typical plant, except that the "seeds" that it produces are in millions of microscopic bodies called spores. They are borne in the pores of mushroom gills under the cap which produces innumerable spores which are blown away by wind, or are spread by other means, such as animal feeding (Jonathan *et al.*, 2008; Otunla *et al.*,2018; Olayinka *et al.*, 2019).

Jonathan (2019), classified mushrooms into three broad main groups. These are edible, toadstools and non-edible mushrooms. Nigerian edible mushrooms have been found to be very rich food. They are used as additives, condiment, spices and flavor (Gbolagade *et al.*, 2006). Nigerian mushrooms have been found to contain high protein, vitamins and fibre contents (Ogundana and Fagade,1982; Gbolagade *et al.*, 2006). The food values of Nigerian edible mushrooms have been found to lie between meat and vegetables (Gbolagade *et al.*, 2007; Jonathan *et al.*, 2012). In Africa countries especially in Nigeria, nature has provided more than enough edible wild mushrooms species in our forests for eating, but the fear of consumption of toadstools which are poisonous mushroom species have been keeping people away from eating excellently edible mushroom species. It is interesting to note that some people do not eat mushroom at all for fear of being poisoned by unknown toadstools. The term ‘mycophobia’ is therefore coined to describe fear of eating mushroom in order to avoid being poisoned from poisonous mushroom toxins (Jonathan, 2019).

Non edible mushrooms will not inflict any poisoning, cell damage, illness or death if consumed but they are not edible because of their leathery, rubbery and tough textures .Eating them will be like eating wood or a leaf (Oso 1977; Jonathan, 2019). Examples include *Microporus xanthopus*, *Dadelea*, *Panus vulvulus*, *Ganoderma lucidum* and *Polyporus* species. These mushrooms

Toadstools could cause serious health problems complications after ingestion. Poisonous mushrooms may look so similar with the edible wild mushrooms and always, these resemblances may be so confusing to the mushroom collectors. Toadstool consumption have killed thousands of people in the world. Prominent people such as Emperor Claudius of the Roman Empire died in AD 54 as a result of poisonous mushroom consumption. Toadstool poisoning was also responsible for the death of Pope Clement VII of the Catholic Church in 1534 and the death of Holy Roman Emperor Charles VI in 1740. Amazingly, poisonous mushroom consumption is still killing people in Nigeria till today. A person that consumed toadstools may not show symptoms immediately after eating. It may take up to 6 hours before the appearances of symptoms . Before symptoms show up, damages could have been inflicted on the internal organs of the patient. Toadstools have major types of damaging toxins. These toxins are produced naturally by the poisonous mushrooms. It has been reported that there is no known mechanisms of toxin removal such as cooking, canning or freezing that can destroy poisonous mushroom toxins. Toadstool toxins are of four different types: (i) Protoplasmic toxins: These are toxins that could destroy living cells, and inflict organ failure. (ii) Neurotoxins: These fungal toxins can cause various neurological symptoms such as hallucinations, a spastic colon, excessive sweating, depression, convulsions, and coma. (iii)Intestinal irritants: Those toxins can cause nausea, vomiting, diarrhea and abdominal cramps. (iv) Disulfiram -like toxins that only exhibit symptoms if and only when alcohol is consumed within three days after consumption; the victim will usually experience a short-lived acute toxic syndrome (Oso,1981; Jonathan, 2019).

### **Distinguishing characteristics of edible mushrooms and poisonous mushrooms.**

**Scales and warts:** Scales and warts are primary veil remains that attaches with the sporocarp while it was young. Sometimes these patches may look more like rows of raised dots. Edible mushrooms possess smooth caps without noticeable raised scales or warts. On the contrary, toadstools may have different coloured cap (usually red with white spots) with noticeable scales and raised lumps (Jonathan, 2019).

**Shape of Pileus:** Mushrooms may have bun-shaped or convex pileus(cap) with a wide low-hump. Others like *Chanterellas* sp may possess concave and wavy or even trumpet-shaped pileus. Poisonous mushrooms may however, have convex caps when young and this flattens as they mature. Many edible mushrooms have pileus that stretches from the stipe. Annulus or annular ring may also develop around the stipe. Toadstools may not possess annulus. Both edible and poisonous mushrooms may possess volva (universal veil remnant). The volva of edible mushrooms is usually thin while that of poisonous mushrooms are thick with noticeably swollen base like the rest of the stalk(Jonathan, 2019).

**Spore print:** Spore prints may be used as one of important features of mushroom for identification mushrooms. Spore prints can be white, grey, yellow, brown, hyaline, black etc depending on the mushroom species. Some of the common poisonous mushrooms such as *Amanita* may possess white-colored spore prints. Usually. The characteristic spore print of all aminitas (including *A. phalloides*) is white. When viewed under a light microscope, the spores of Amantas are usually transparent and the shape may be globular or egg-shaped. The diameter of each spore may range between 8–10 µm. The spore print of toadstools usually stain blue with lugol iodine (Jonathan, 2019).

**Gills:** Mushroom gills may also be used as a identification feature. Edible mushrooms usually possess gills that are attached to the pileus and not to the stipe. This indicates that in edible mushroom species, gills may retain their attachment to the pileus even when the stipe is removed from the mushroom's base. In toadstools, gills usually remain attached to the stipe after removal. Usually, gills of a young edible mushroom pileus are usually pink in colour which may change to brown or black as the mushroom matures. Young poisonous mushroom may possess other colour. When staining, the gills of poisonous *Amanita* usually stain lilac or pink with concentrate H<sub>2</sub>SO<sub>4</sub> (Jonathan, 2019).

**Smells:** Odour is another common feature that can be used to differentiate between toadstools and edible mushrooms. Mushrooms may possess distinct smells or a unique smell which can help collectors to differentiate species that are physically similar. For example *Chanterelles spp* usually possess distinctive fruity smell while *Agaricus xanthodermus* are known for their almond odor. The odor of poisonous mushroom (*Amanita phalloides*) is initially faint and honey-sweet, but usually strengthening within several hours to become sickly-sweet.

Here, we presented some few Nigerian mushrooms and toadstools collected from UIBG and we also suggest possible ways that they could be either exploited or avoided (Jonathan, 2019).

### **MATERIALS AND METHODS**

Test mushrooms used in this study were collected from Botanical Gardens of the University of Ibadan. Latitude N 7° 22' 39.1296" and Longitude E 3° 56' 49.344". The undisturbed type of Tropical rain forest supported the luxuriant growth of various types of mushrooms and other varieties of other higher fungi. The collections were carried out during two years rainy seasons April and October, 2022 and April to October, 2023. The collected mushrooms were identified by the color of their pileus, stipe, annular ring, gill, spore print, pore types, and other features described by Alexopolous *et al.* (1996), Wasser and Weis (1999) and Jonathan (2019).

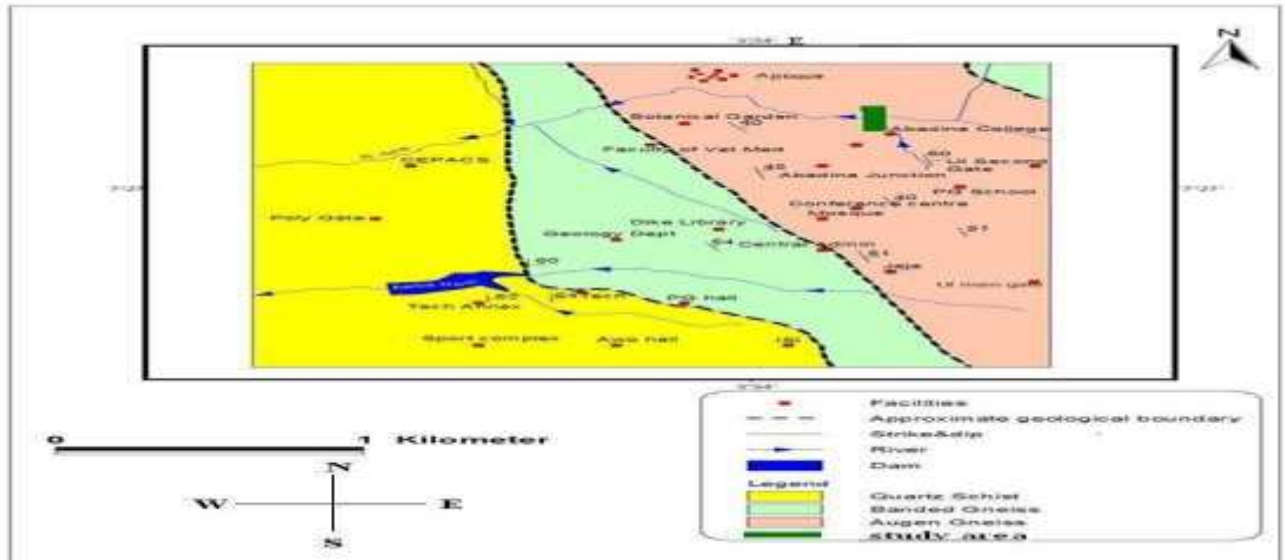


Figure 1: Map of University of Ibadan showing Botanical Gardens location

## RESULTS AND DISCUSSION

This study have shown that the soil, lawns and decaying wood at the University of Ibadan Botanical Gardens are rich in many tropical macrofungi such as mushrooms, puffballs, polypores and auricularias. The descriptions of mushrooms and other higher fungi collected during the period under this study were outlined below



Plate 1: *Pleurotus tuber-regium*



Plate 2: *Lentinus subnudus*

### *Pleurotus tuber-regium* (Fries.) Singer

**Brief description:** *Pleurotus tuber-regium* Fries Singer (Plate 1), is a wood destroying fungus in the family of Pleurotaceae, popularly known as king tuber mushroom and ‘Osun Owu’ among Yoruba tribe of South-Western Nigeria (Oso, 1977). The gill is closely placed, cap is flat, light brown with cream spots with cream long and tapering stipe with no annulus. .During the unfavorable weather condition, it usually form sclerotia which appear like yam tubers.

**Habitat:** This mushroom was found growing from the sclerotium on decaying wood at the University of Ibadan Botanical Gardens dead near the rock side to the Eastern part of the Gardens.

**Uses:** It could be eaten as food and or used as food supplement (Jonathan, 2019) .The antimicrobial efficacy of this mushroom have been confirmed (Gbolagade and Fasidi, 2005 )

### *Lentinus subnudus* Berk.

**Brief description:** *Lentinus subnudus* also known as *Lentinus squarrosolus* (Plate 2) is a fungus in the family of Polyporaceae. The carpophores of this mushroom grew in large numbers on the bark of dead wood. The fruitbodies are whitish in colour with good aroma when cooking.

**Habitat:** The carpophores of *Lentinus subnudus* were found growing on decaying wood in their great numbers at the University of Ibadan Botanical gardens.

**Uses:** It is eaten as food and/or used as food supplement.It has been reported that *Lentinus subnudus* has antimicrobial properties(Gbolagade and Fasidi, 2005).

### *Volvariella esculenta* (MASS) Singer

**Brief description:** *Volvariella esculenta* (MASS) Singer, (Plate 3) is a Nigerian edible mushroom which belongs to the phylum basidiomycota, order agaricales family pluteaceae (Alexopoulos *et al.*, 1996). It is more easily mistaken for *Amanita*. It lacks annular ring, and have volva at the stipe base. deep salmon pink gills and spore prints.

**Habitat:** The fruit bodies of this mushroom were found in hollow trunks of rotten palm trees at the University of Ibadan Botanical gardens .

**Uses:** It is called locally as ‘Ogiri agbe’ (farmers seasoning) because of its meaty taste, desired flavour and medicinal values, It is an edible mushroom, popularly called gilled mushroom. it is highly proteinous, rich in fibre and vital nutrients commonly eaten as meat supplement. It can be used as a blood booster.



Plate 3 *Volvariella esculenta*



Plate 4 *Termitomyces robustus*

### *Termitomyces* species

**Brief description:** All *Termitomyces* species belong to the division basidiomycota, order agaricales, family lycophyllaceae. They are associated with termite nest and are. All species of *Termitomyces* are excellently edible

**Habitat:** Different *Termitomyces* species collected from University of Ibadan Botanical Gardens in this study were *Termitomyces robustus* (Plate 5), *Termitomyces titanicus* ( Plate 6), *Termitomyces*

*microcarpus* (Plate 7) ,*Termitomyces globulus* (Plate 8),*Termitomyces striatus* (Plate 9), *Termitomyces clypiatus* (Plate 10) and *Termitomyces robustus* (Plate 11)

### *Termitomyces robustus*

**Brief description:** *Termitomyces robustus* (Plate 4), a species of agaric fungus, popularly known as termite mushroom, or 'Olu ikan' by the Yoruba people (meaning Termite mushroom). the cap is flat, with crowded gills while stipe is tapering with no annulus.

The fruit bodies were found growing on the soil associated with termite nests at the University of Ibadan Botanical Gardens near Orogun river. This fungus cannot be cultivated commercially because of its complex nutritional requirements (Jonathan, 2019).

**Uses:** Food, medicine (It is used in association with lemon grass to treat stomach complications), mythology (if you see them in your dream, it signifies death but when you see them when walking on the way it brings good luck). It possessed anti oxidant and antimicrobial properties.

### *Termitomyces titanicus*

**Brief description:** *Termitomyces titanicus* (Plate 5) belongs to family Lyophyllaceae (a species of agaric fungus), It is referred to as 'Olufeere' by the Yoruba speaking people of South Western Nigeria meaning. It is characterized with very big and flat cap.

**Habitat:** Fruit bodies of *T. titanicus* were found growing at the University of Ibadan Botanical Gardens on 'combs' which are formed by tough woody fragments associated with termite nests.

**Uses:** It is used as food, immunomodulators, and antitumors (Oso, 1975; Jonathan, 2019).

### *Termitomyces microcarpus* (Berk. & Broome)

**Brief description:** *Termitomyces microcarpus* (Plate 6) is popularly refers to as termite *agarics* characterized with small caps. It is called 'eemi ikan' by the Yoruba people meaning termite excreta

**Habitat:** The fruitbodies of this mushroom were found growing in groups or clusters in deciduous University of Ibadan forests litters near the roots stumps associated with termite nests.

**Uses:** Edible, Mythology (mythologically, when you roast them on fire, groundnuts will not do well in the farm (Oso, 1977). It contain antioxidants and antimicrobials properties



Plate 5 *Termitomyces titanicus*



Plate 6 :*Termitomyces microcarpus*





PLATE 7: *Termitomyces globulus*



PLATE 8: *Termitomyces striatus*



PLATE 9: *Termitomyces clypiatus*



PLATE 10: *Termitomyces robustus*



PLATE 11 *Termitomyces fuliginosus*



Plate 12 *Lycoperdon pusillum*



Plate 13: *Lycoperdon giganteum*



Plate 14. *Lycoperdon pyriforme*

***Lycoperdon pusilum* (Pers.) ,*Lycoperdon giganteum* (Pers.) and *L. pyriforme***

**Brief description:** *Lycoperdon pusilum* (Pers.)(Plate 12), *L. giganteum* (Pers.) (Plate 13) and *L. pyriforme* (Schaeff) (Plate 14) are three distinct species of puffballs which belong to the same family of Lycoperdaceae. They are popularly known as ‘olu aiye kekere’ ,‘olu aiye nla’ and ‘olu iwosan’ respectively by the Yoruba people of South western Nigeria .These three puffballs usually appear whitish when they are young but turns brown when their sporophores get older .Because of the small size(2-3 cm in diameter), sporophores, *L. pusilum* are usually referred to as small puffballs while *L. giganteum* are called giant puffballs (sporophores30-50cm in diameter). *L. giganteum* are readily noticed because of it giant sizes. The spores of *L. pyriforme* are extremely dry, making a mature puffball pretty much a sack of fine powder. The carpophore of *L. pyriforme* is pear-shaped or spherical in shape and usually measure about 1.5 to 4.5 cm in diameter and 2 to 4.5 cm in length

**Habitat:** The sporophores of these puffballs were found growing under the tree canopies and richly loamy soils of the University of Ibadan Botanical Gardens.

**Uses:** All puffballs are edible and generally used for the healing of wounds (Jonathan and Fasidi, 2003). This powder has been used in some ancient cultures in thehealing of wounds due to its anti-coagulation properties.

***Schizophyllum commune* Fr.**

**Description:** *Schizophyllum commune* belongs to the class Agaricomycetes, order Agaricales, family Schizophyllacea (Plate 15). It usually grow in numbers on the log of wood. The fruit bodies resemble small -like tightly packed structure. It may be soft when young. Gills may vary from creamy yellow to pale white in colour it has white short clubbed to flat cap with widely spaced gills with stipe having no annulus.

**Habitat:** This fungus was found on leaf litters and decaying woods at the University of Ibadan Botanical Gardens.

**Possible uses:** It is edible and has antifungal, antiviral and immunomodulatory properties (Jonathan, 2019).



*Phallus indusiatus* (Vent.Ex) Pers.

**Description:** *Phallus indusiatus* (Plate16) belongs to division Ascomycota, class Agaricomycetes, order Phallales and family Phallaceae. It is popularly referred to as bamboo fungus, bamboo pith, long net stinkhorn, crinoline stinkhorn or veiled lady. *Akufodewa* by the Yoruba people. The name is derived from a combination of the Yoruba words *ku* ("die"), *fun* ("for"), *ode* ("hunter"), and *wa* ("search"), and refers to how the mushroom's stench can attract hunters who mistake its odour for that of a dead animal (Jonathan *et al.*, 2008).

**Habitat:** They were found among the rotting bamboo stem and leaf material embedded in the soil.

**Uses:** Not edible because of its odour. It is rich in protein, carbohydrates, and dietary fibers. It contains various bioactive compounds, and has antioxidant and antimicrobial properties (Jonathan *et al.*, 2008).



Plate 15: *Schizophyllum commune*



Plate 16 *Phallus indusiatus*

### *Daldinia concentrica*

**Description:** *Daldinia concentrica* (Plate 17) is also as King Alfred's cake, cramp balls, and coal fungus. This fungus has worldwide distribution. It belongs to the division Ascomycota, class Sordariomycetes, order Xylariales and family Hypoxylaraceae. The sporophore of *D.concentrica* is hemi-spherical, with a hard, friable, shiny black surface body which is about 2 to 6 in diameter. This fungus resembles a chunk of coal, When the fruitbody is fresh it is purple or brown in colour but turned black when it is matured.

**Habitat:** The carpophores of *Lentinus subnudus* were found growing on decaying wood at the University of Ibadan Botanical gardens, it is purple or brown in colour.

**Possible uses:** It is inedible and Yoruba people of South western Nigeria use *D.concentrica* for the treatment of pneumonia (Jonathan, 2019). *D. concentrica* contains several unique compounds, including a purple polycyclic pigment. Many types of insects and other small animals make their home inside this species of fungus.



Plate 17 *Daldinia concentrica*:



Plate 18 *Panus fuvulus*

### *Panus fuvulus* (Berk.)

**Description:** *Panus fulvus* (Berk.) (Plate R) belongs to the kingdom fungi order agaricales, family polyporaceae and class Agaricomycetes. The fruitbodies which is light brown in colour usually grow either in solitary on stump of dead wood or in groups of 2 or 3 at the University of Ibadan Botanical Gardens. The sporophores usually grown under tree canopies in moist damped environment. The stipe is about 2 to 8cm in length and the pileus which is depression or hollow in the center.

**Habitat:** This fungus was found the decaying log of wood at the University of Ibadan Botanical Gardens under tree canopies under damped moist environment.

**Uses:** This polypore is not edible because of its leathery or thick fruitbodies. It is used by Yoruba people of South western Nigeria to treat wound (Jonathan, 2019)

### Other mushrooms

*Amanita virosa* (poisonous mushroom) (Plate 19) has a close resemble with *Volvariella volvacea* (edible mushroom) (Plate 20). These two mushrooms were collected from the leaf litters at the University of Ibadan Botanical Gardens. The two mushrooms shared some common characteristics such as possession of volva and annular ring. They also have similar colour and odour (Jonathan, 2019). *Amanita virosa* possessed killer potent poisons known as phalloidin and  $\alpha$ -amanitin which could kill within 5 hours to 4 days of consumption. Symptoms such as nausea, vomiting, diarrhea, abdominal discomfort and coma from  $\alpha$ -amanitin and phallioidin poisoning usually appear late, severe damage to vital organs such as liver, heart and kidney could have taken place long before appearance of symptoms for possible treatment. In most cases, consumption usually leads to death of the victims. (Jonathan, 2019).



Plate 19: *Amanita virosa*



Plate 20: *Volvariella volvacea*



Plate 21: *Amanita verna*



Plate 22: *Amanita caesarea*,



Plate 23: *Psilocybe mexicana*



Plate 24: *Agaricus xanthodermus*

### CONCLUSION

University of Ibadan Botanical Gardens is rich in vast number of edible, inedible and poisonous mushrooms because of the undisturbed natural vegetation. Commercial growing of indigenous mushrooms should be encouraged in Nigeria because consumption of poisonous mushrooms have caused a lot of undocumented death in our country. The safest way of identifying edible macro fungi from poisonous one is the authentication from a mushroom expert. Identification of edible species through guessing or books may be highly risky and lead to catastrophic experience. Empirical identification of poisonous and edible mushroom species through smell and taste can be misleading because some poisonous mushrooms may have pleasant smell and good taste.

**AKNOWLEDGEMENTS:** We appreciate efforts of Mr Olumide Oladiran, Mr Isreal Adediran and Mr Benedict Izuagieb of the Department of Botany for their assistance in the collection of few of these mushrooms from university of Ibadan Botanical Gardens.

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