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Research Article

Survey of wild edible mushrooms from three local governments in Ile-Ife

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Abstract

The recent rise in the consumption of wild edible mushrooms, combined with limited information available on their edibility, necessitated a survey of wild edible mushrooms from three Local Government Areas (LGAs) in the Ile-Ife metropolis. Cases of morbidity and mortality due to the consumption of poisonous mushrooms are based on the inability of collectors to differentiate between edible and non-edible mushrooms. Therefore, there is a need to survey, collect, and develop a catalogue of various wild edible mushroom species in Ile-Ife using specific morphological tools such as colour, shape of cap, gills, and gill attachment, stipe, annulus, spore prints, and substrates. A pilot field survey was conducted during the rainy season of 2018 on two randomly selected farms within each LGA in Ife-Ife. In situ pictures of the mushrooms in their various environments were taken, and spore prints of the mushrooms were also recorded. The different morphological features of the collected mushrooms were compared using the 'Standard Catalogue'. Twenty-three wild edible mushroom species with contrasting morphological features were collected from various substrates. The mushrooms collected possessed different spore prints, such as black, white, cream, pink, and brown. Diverse wild edible mushrooms consisting of fifteen, five, and four species were collected from Ife-Central, Ife-North, and Ife-South local government areas, respectively, and a catalogue was developed. The developed catalogue would serve as a guide for collectors and consumers when hunting for wild edible mushrooms.

1. Introduction

Mushrooms are the fruiting bodies of some macro-fungi that produce spores [1]. They are found in the Phylum Basidiomycota and class Basidiomycetes. They are saprophytic and digest their food by secreting enzymes that degrade food extracellularly [2]. Mushrooms lack chlorophyll and cannot obtain energy from the sun through photosynthesis, as like green plants [3]. Instead, during the vegetative growth stage, mushroom mycelia secrete enzymes that break down compounds such as cellulose and lignin present in the substrate. The hyphae then absorb the degraded compounds, and the mycelium enlarges [3].

Mushrooms grow above the ground and mainly consist of two parts: mycelium and fruiting bodies [4]. The mycelium is composed of a tree-like structure called, hyphae, which remain within the substrate. The pileus of the fruiting body may be attached laterally (with no stem), or, if there is a stem, it is usually eccentric, and the gills are decurrent around it, i.e., pleurotoid. Mushroom gill attachment types vary; they can be adnate (gills widely attached to the stem),

adnexed (gills narrowly attached to the stem), decurrent (gills running down the stem for some distance), emarginate (gills notched immediately before attaching to the stem), free (gills not attached to the stem), seceding (gills attached but breaking away from the stem at the margin), sinuate (gills smoothly notched and running briefly down the stem), or sub-decurrent (gills running briefly down the stem). The shape of the cap also varies. Different cap shapes include: campanulate (bell-shaped), conical (triangular-shaped), convex (outwardly rounded), depressed (with a low central region), flat (with a uniform top), infundibuliform (deeply depressed), ovate (shaped like half an egg), umbilicate (with a small deep depression), and umbonate (with a central bump or knob) [4].

Mushrooms are consumed as food [5] due to their pleasant taste and aroma. It has been widely employed in traditional medicine [6], bioremediation [7], and waste conversion [8, 9]. Edible mushrooms are invaluable sources of dietary nutrients (proteins, fibres, vitamins and minerals) and nutraceuticals (antioxidant and antitumor agents in the fight against cancer) [10]. However, deadly or poisonous mushrooms are known to produce toxic substances (e.g. alpha amanitin) that are harmful and have lethal effects when consumed [11]. Wild edible mushrooms have been collected from time immemorial, however, concerns have emerged regarding the consumption of unidentified mushrooms within the environment, and the inability of collectors to distinguish between edible and non-edible/poisonous ones.

In nature, mushrooms are widely dispersed and are the earliest form of fungi known to humans [12]. The numerous forests and agroforests in Nigeria remain the primary sources of wild marketable, edible, and medicinal mushrooms, following the dearth of mushroom cultivation industries. The rate of decline in mushroom genetic resources due to the growing agroforest industries, the current change in climate, rate of deforestation, bush burning, and overexploitation of both timber and non-timber products are threatening mushroom diversity [12, 13]. In Nigeria, mushrooms are often overlooked in many biodiversity studies compared to plants and animals [14]. Although an array of edible mushrooms consumed in Nigeria has been reported by Akpaja et al. [14-19], mushrooms are rarely studied, and are relatively underutilized in Nigeria [20].

Indigenous mushrooms are diverse, and morphological identification is insufficient for taxonomy [21] because it can be misleading. Therefore, identifying mushrooms requires a basic understanding of their macroscopic structures. The colour of the powdery print (which is called a spore print) has been used to help classify mushrooms. For most mushrooms, the spore print is formed when the cap is cut off and placed gill-side down (usually overnight). A powdery impression reflecting the shape of the gills (spore print) is formed [22, 23]. Morphological identification also utilizes the size, color, and consistency of the cap and stalk; mode of attachment of the gills to the stalk; spore color in mass; and chemical tests or reactions [22-25]. A general rise in mushroom consumption has been observed in Ile-Ife, but little is known about the diversity of edible mushrooms that could be found in the Ile-Ife. Hence, there is a need to survey, collect, identify, and catalogue the various wild edible mushrooms in the locality using morphological tools, and isolate pure cultures of selected mushrooms.

2. Materials and methods

2.1. Study area

The three Local Government Areas within Ile-Ife metropolis were selected for this study, these include: Ife Central (Latitude 7°33′N and Longitude 4°32′E); Ife North (Latitude 7° 30' 59.99" N and Longitude 4° 26 59.99" E); and Ife South (Latitude 7°12′N and Longitude 4°36′E), respectively. Two towns within each LGA were purposively surveyed due to prevalent agricultural and agroforestry activities: Ipetumodu and Asipa (Ife North), Olode and Odemuyiwa (Ife South), while Obafemi Awolowo University Teaching and Research Farm, a field within the University Campus (including the botanical garden), and Kajola village (Ife Central) LGA. A map of the study area is presented in Fig. 1.

2.2. Sample collection

Survey and collection started from Ife North, through Ife South and then Ife Central LGA. Samples were randomly collected from two farms within each LGA. Systematic and periodic surveys based on information provided by the farmers and rainfall patterns were

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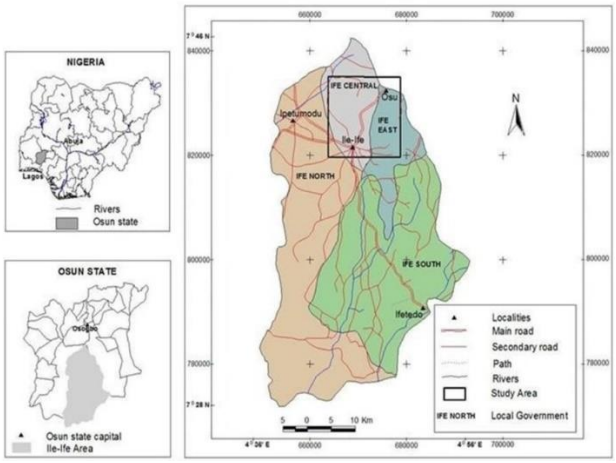

Figure 1. Map of Ife central, Ife north and Ife south local government area of Osun state.

carried out on farms and gardens in each LGA. While farms and gardens in Ife Central LGA were surveyed daily due to their proximity to the research station, those in Ife North LGA were visited four times on a weekly basis, and surveys for wild edible mushrooms were carried out twice in Ife South, considering the available resources for the study. The materials used for the sample collection included a sharp knife, scissors, sample bags, a digital camera, and a data book. Pictures of the mushroom samples were taken *in situ* with the digital camera before and after collection. Observations of the substrate and environmental condition from which the mushroom samples were collected. Collections were carried out during the rainy season from May to October, during the day, following reported method [23].

2.3. Mushroom identification

Samples of mushrooms collected from the field were identified *in situ* using a Mushroom Chart Book by Anna Del Conte and Laessoe [24], and an Android application: 'The Mushroom Identifier' version 2.29, to confirm the scientific name, family, and genus of each sample.

2.4. Morphological classification of collected mushrooms

The morphological features such as the shape of the pileus, pileal attachment to the stipe, colour of the fruiting body, gill arrangement and attachment, and shape of the stipe were observed and compared with those in the Mushroom Chart Book for identification [24, 25].

2.5. Spore print determination

Spore prints of the mushroom samples were determined by placing the pileus with their hymenium layer facing down on a white and dark surface for 3 to 6 h for the print of the spheres to be revealed on the collecting surface, and the imprinted colours were recorded.

2.6. Mushroom tissue culture

Two centimeters of the identified mushroom's pileus was surface sterilized and blotted with a pair of sterile paper towels. The blotted tissues were aseptically transferred onto Potato Dextrose Agar (PDA, HiMedia, 39 g/L) media in a laminar flow and incubated for 7 days at room temperature. Pure cultures were obtained via single sporing and stored in slant bottles for further analysis.

3. Results and discussion

A total of 23 different species belonging to 19 different genera of wild edible mushrooms were identified (some, up to the *species* level and some to the *genera* phenological level) across the surveyed locations. Three species of *Termitomyces* and two species of *Pleurotus* were identified. Since the study was conducted during the rainy period in the surveyed region, our results are similar to those of Aminuzzaman et al. [26] and Shah et al. [27]. The identified mushrooms are presented in Tables 1-3, while *in-situ* pictures of the mushrooms, spore prints, and tissue cultures of selected mushrooms are presented in Figs. 2-5, respectively.

Coprinus sp., *Clitocybula lacerata*, *Termitomyces clypeatus*, *Termitomyces microcarpus*, *and Lentinus squalrosulus* were identified in Ife North LGA. In addition, *Termitomyces clypeatus, T. microcarpus, Lycoperdon* sp., and *Marasmiellus* sp., were collected from the Ife South LGA. Furthermore, *Auricularia* sp., *Volvopluteus gloeicephalus*, *Termitomyces globulus*, *Laccaria* sp., *Favolus* sp., *Hypholoma* sp., *Panellus* sp., *Clitocybe* sp., *Armillaria* sp., *Russula* sp., *Macrolepiota procera,* and *Parasola conopilus* were collected in Ife Central LGA (Table 4). More mushroom species were collected in Ife Central LGA compared to other LGAs, which is attributable to the frequency of visits and surveys in the LGA. The different species of mushrooms identified in Ife Central LGA indicated the rich biodiversity available in the LGA.

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Table 1. Mushroom samples identified at Ife central local government area.

S/N	Scientific names of mushrooms	Common/Local Name/Indigenous Name	Substrate	Location
1	*Auricularia* sp.	Jelly ear mushroom/etí ológbò	Tree trunk	OAU botanical garden
2	*Armillaria* sp.	Honey cap mushroom	Littered leaves	OAU Campus lawn (Faculty of Education)
3	*Clitocybe* sp.	Funnel cap Mushroom	Littered leaves	OAU Campus lawn (Faculty of Education)
4	*Favolus* sp	Honeycomb mushroom/ Olú awọ	Dead tree	OAU botanical garden
5	*Hypholoma* sp.	Olú wòwó	Decayed tree	OAU botanical garden
6	*Lepiota* sp.	Olú kòtòpó	Dead tree	Lawn close to OAU gate
7	*Laccaria* sp.	Amytheist Mushroom	Heap of mulch	OAU Campus lawn (Social sciences)
8	*Marasmius oreades*	Scotch Bonnet	Decomposed woods	OAU botanical garden
9	*Macrolepiota procera*	Shaggy Parasol	Soil (loam)	OAU botanical garden
10	*Parasola conopilus*	Brittle storm mushroom	Soil (loam)	OAU teaching and research farm
11	*Pleurotus florida*	Olú igi	Dead tree	OAU teaching and research farm, Kajola village
12	*Pleurotus pulmonarius*	Olú igi	Littered leaves	OAU Campus lawn (Education and social sciences)
13	*Termitomyces globulus*	Olú ewè/ Olú ògògó	Soil (loam)	Ife Market
14	*Russula cyanoxantha*	Charcoal burner mushroom	Soil (loam)	OAU botanical garden
15	*Volvopluteus gloeicephalus*	Field Mushroom	Grass, Soil covered with Straws	OAU teaching & research farm, Kajola village

Table 2. Mushroom samples identified at Ife north local government area.

S/N	Scientific names of mushrooms	Common/Local Name/ Indigenous Name	Substrate	Location
1	*Coprinus* sp.	Olú ihá or Olú ekù	Palm oil chaff/Spadix	Asipa and Edun-abon
2	*Clitocybula lacerata*	Olú igi	Tree trunk	Asipa and Edun-abon
3	*Lentinus squalrosulus*	Olú igi	Tree trunk	Asipa
4	*Termitomyces microcarpus*	Olú ọrán	Soil (loam)	Asipa
5	*Termitomyces clypeatus*	Tàkèlè	Soil (loam)	Asipa

Table 3. Mushroom samples identified at Ife south local government area.

S/N	Scientific names of mushrooms	Common/Local Name/Indigenous Name	Substrate	Location
1	*Lycoperdon* sp.	Puffballs/Olú- ẹyin	Soil (loam)	Olode
2	*Marasmiellus* sp.	Olú jànpá	Oil Palm branch	Olode and Odemuyiwa village
3	*Termitomyces clypeatus*	Tàkèlè	Soil (loam)	Olode
4	*Termitomyces microcarpus*	Olú ọrán	Soil (loam)	Olode

The presence of *Termitomyces* spp. in the three LGAs suggested the relative abundance of this genus across the studied locations. *Termitomyces* spp. are associated with ant hills in a mycorrhizal/saprophytic relationship which is present in the studied locations. In addition, Oso [28] and Alabi [29] reported that

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Figure 2a. Fruiting bodies of mushroom samples identified in Ile-Ife metropolis
(A. *Auricularia* sp. **B.** *Armillaria* sp. **C.** *Laccaria* sp. **D.** *Volvopluteus gloeicephalus* **E.** *Favolus* sp. **F.** *Lepiota* sp. **G.** *Clitocybe* sp. **H.** *Hypholoma* sp. **I.** *Marasmiellus* sp. **J.** *Lentinu squalrosulus* **K.** *Lycoperdon* sp. **L.** *Macrolepiota procera.*

Figure 2b. Fruiting bodies of mushroom samples identified in Ile-Ife metropolis.
(**M.** *Marasmius oreades* **N.** *Panellus* sp. **O.** *Pleurotus florida* **P.** *Pleurotus pulmonarius* **Q.** *Termitomyces clypeatus* **R.** *Termitomyces microcarpus* **S.** *Termitomyces globulus* **T.** *Coprinus* sp. **U.** *Parasola conopilus* **V.** *Russula cyanoxantha* **W.** *Clitocybula lacerate).*

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Figure 3. Spore prints of selected mushroom fruiting bodies.
(A. *Marasmiellus* sp. **B.** *Lepiota* sp. **C.** *Lentinus squalrosulus* **D.** *Armillaria* sp. **E.** *Panellus* sp. **F.** *Hypholoma* sp. **G.** *Volvopluteus gloeicephalus* **H.** *Coprinus* sp. **I.** *Pleurotus pulmonarius* **J.** *Clitocybe* sp).

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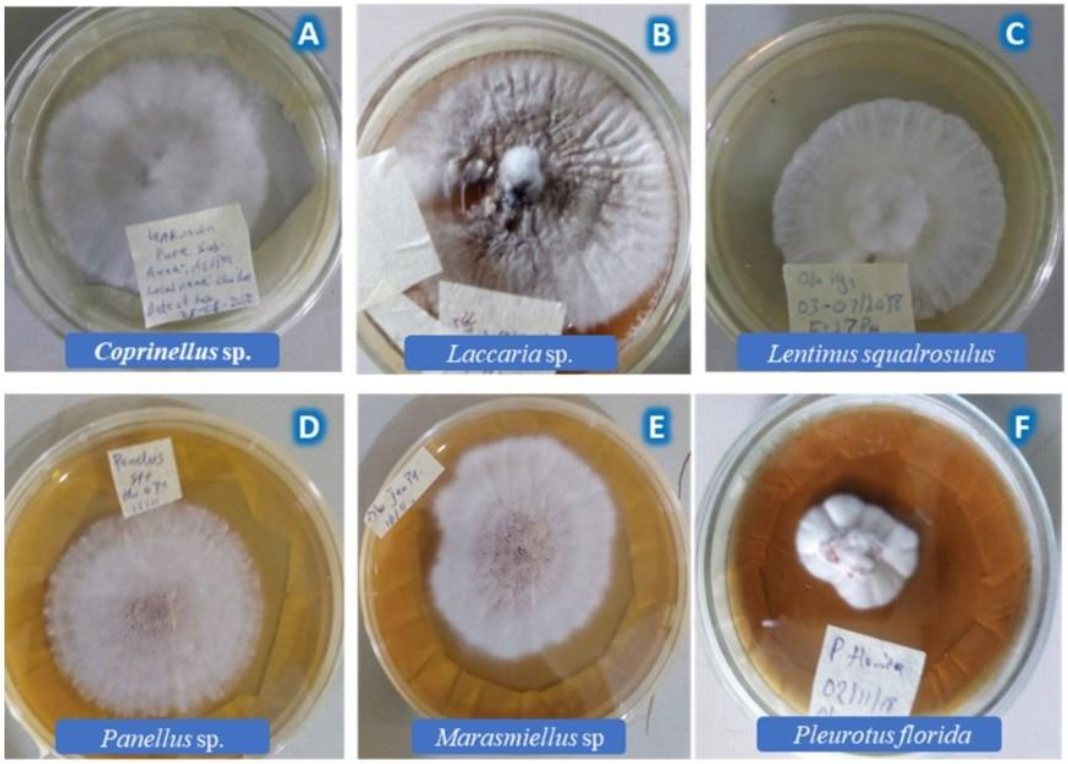

Figure 4. Culture plates of selected mushroom species on potato dextrose agar.

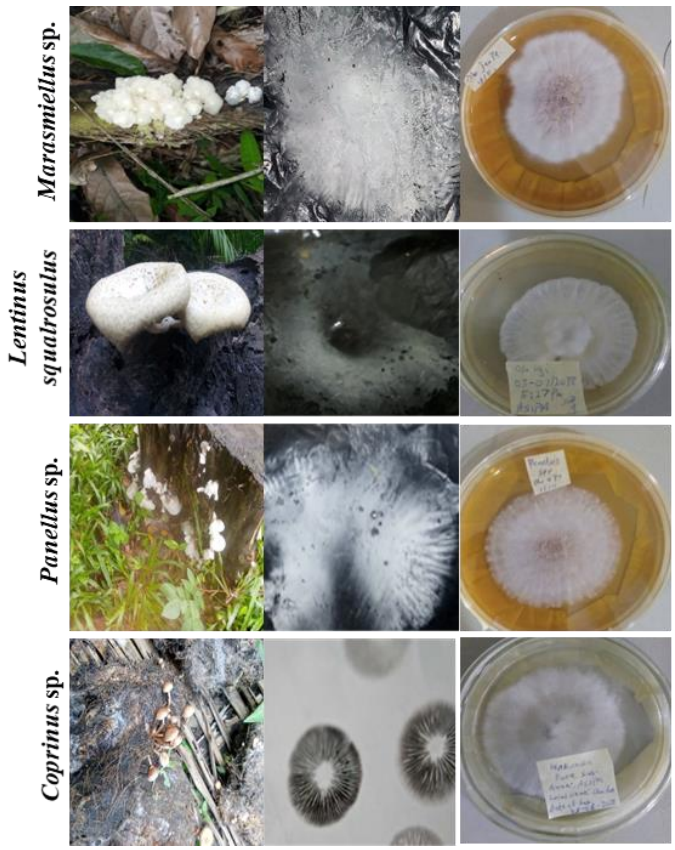

Figure 5a. Selected fruiting bodies were identified based on their sporophores, spore prints, and culture.

Figure 5b. Selected fruiting bodies were identified, showing their sporophores and spore prints.

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Figure 5c. Selected fruiting bodies were identified showing their sporophores and culture.

Termitomyces clypeatus, *T. globulus,* and *T. microcarpus* are significant to the Yoruba culture and are commonly found in the southwestern states of Nigeria, which host the survey location of the present study.

Similarly, *Lentinus squalrosulus* has been reported in some states of Nigeria, such as Oyo, Osun, Ondo, and Bayelsa [19]. However, *Coprinus* sp. was reported in the Delta and Edo states (South-south region of Nigeria) [19, 20]. Gbolagade et al. [19] reported the presence of *Lycoperdon* sp. in Oyo, Ogun and Edo states while *Auricularia* sp. has been reported to be found in the South Western states of Nigeria such as Oyo, Ogun, Ekiti and Ondo [19] and in some Southern states of Nigeria such as Delta, Edo and Bayelsa [19, 20]. *Volvopluteus* sp. has been reported to grow in Edo and Delta states [20].

Species of *Pleurotus* are in high demand for consumption and are widely spread across the area surveyed in the present study. *Pleurotus* spp. are repositories of great nutritional value, such as protein, essential amino acids and dietary fibre, and are poor in fat content but enriched with excellent fatty acid content [30, 31]. This mushroom species has also been reported in Ondo, Oyo, Ogun, Ekiti, and some Southern parts of Nigeria, such as Bayelsa and Delta states [16, 18-20].

Species of *Favolus, Hypholoma, Panellus, Clitocybe, Armillaria, Russula, Macrolepiota,* and *Parasola* are not commonly harvested mushroom species, and information about their diversity in Nigeria is scarce. This could be attributed to the low rate of spread of their sporocarp in the wild [20]. In addition, the preference of collectors and consumers for the common and widespread edible mushrooms (*Pleurotus*, *Lentinus,* and *Termitomyces*) in the immediate environment may also result in the neglect of these species. However, *Macrolepiota* spp. has been reported by Osemwegie et al. [23] to be found in some major ecological zones of Nigeria, such as the South West and South-South [19, 20].

Spore prints of the selected mushroom species (Fig. 4) were collected for the laboratory identification. The colours were diverse and included white, black, pink, rusty brown, and creamy white. These colours are same as those for some of the wild edible mushrooms reported by [22, 24, 25]. The tissues of the identified mushrooms were inoculated on PDA, however, only a few species grew on the media. While mushrooms are classified ecologically as saprophytic, mycorrhizal or parasitic [32], and saprophytic mushrooms are often easily cultivated on growth media. In the present study, only a few species were successfully cultured on growth media, indicating that some of the collected mushrooms may fall within the mycorrhizal category, thus, requiring additional growth conditions. The culture plates of the tissues grown on the growth medium are presented in Fig. 5. *In-situ* images of the mushroom, spore print, and tissue culture plates are presented in Fig. 5a-5c. These include *Coprinus* sp., *Laccaria* sp., *Lentinus squalrosulus, Panellus* sp., *Pleurotus florida,* and *Marasmiellus* sp. Bankole and Salami [6] and Son et al. [33] had reported the growth of different mushroom species on PDA. It would be valuable for further studies to investigate the growth conditions of indigenous wild edible mushrooms for cultivation and domestication purposes.

4. Conclusions

Twenty-three species of wild edible mushrooms species were collected and identified, and a catalogue of the collected mushroom species was developed. This would provide a guide for collectors while hunting mushrooms in Ile-Ife. This is the first survey and biodiversity study of edible mushrooms in the Ile-

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Table 4. Summary of morphological features of different mushrooms collected across the three local government areas surveyed.

Mushroom	Colour	Cap Shape	Annulus	Stipe (Attachment)	Volva	Gills	Gill Attachment	Spore Print	Substrate
Auricularia sp.	Red	Folded	Absent	Absent	Absent	Pores	Free	Yellow	Tree trunk
Armillaria sp.	Brown	Convex	Absent	Present (Central)	Absent	Equal	Free	White	Littered leaves
Clitocybula lacerata	White	Infudibuliform	Absent	Present (Excentric)	Absent	Equal	Decurrent	White	Tree trunk
Clitocybe sp.	Creamy	Infudibuliform	Absent	Present (Central)	Absent	Varying length	Decurrent	Creamy	Littered leaves
Coprinellus sp.	Brown	Convex	Absent	Present (Central)	Absent	Equal	Adnexed	Black	Oilpalm spadix
Favolus sp.	White	Reniform	Absent	Present (Short& Lateral)	Absent	Maze-like	Decurrent	White	Dead Tree
Hypholoma sp.	Orange	Convex	Absent	Present (Central)	Absent	Forked	Adnate	Clayey	Tree trunk
Lentinus squalrosulus	White	Infudibuliform	Absent	Present (Lateral)	Absent	Equal	White	White (Smoothy)	Tree trunk
Laccaria sp.	Brown	Convex	Absent	Present (Central)	Absent	Equal	Adnate	White	Heap of Mulch
Lepiota sp.	White	Spherical	Absent	Present (Central)	Absent	Equal	Adnate	White	Dead Tree
Lycoperdon sp.	White	Ball	Absent	Present (Short & Central)	Absent	Pores	Free	White	Soil
Marasmiellus sp.	White	Flat	Absent	Present (Central)	Absent	Unequal	Notched	White	Palm Tree
Macrolepiota procera	Brown	Umbonate	Present	Present (Long & Central)	Absent	Equal	Free	White	Soil
Marasmius oreades	Brown	Umbonate	Absent	Present (Central)	Absent	Wide	Adnexed	Creamy-white	Decomposed Woods
Panellus sp.	White	Reniform	Absent	Present (Lateral)	Absent	Forked	Decurrent	White	Chopped Tree
Pleurotus florida	White	Spherical	Absent	Present (Excentric)	Absent	Equal	Decurrent	White	Dead Tree
Pleurotus pulmonarius	Buffy-Cream	Infudibuliform	Absent	Present (Excentric)	Absent	Equal	Decurrent	White	Littered leaves
Parasola conopilus	Creamy	Campanulate	Absent	Present (Central)	Absent	Equal	Notched	Creamt	Soil
Termitomyces clypeatus	White	Depressed	Absent	Present (Lateral)	Absent	Equal	Free	White	Soil
Termitomyces globulus	Dark-grey	Campanulate	Absent	Present (Long & Central)	Absent	Crowded	Sinuately Notched	White	Soil
Termitomyces microcarpus	White	Flat	Absent	Present (Central)	Absent	Equal	Free	White	Soil
Russula cyanoxantha	Black	Depressed	Absent	Present	Absent	Equal, Crowded, Flexible	Notched	White	Soil
Volvopluteus gloeicephalus	White (pink gills)	Flat	Absent	Present (Central)	Absent	Widely Spaced	Free	Pink	Grass, straws.

Ife metropolis. However, further study on mushroom biodiversity would be invaluable in providing useful information about more edible mushrooms available in the region and developing a substantive catalogue that would aid the proper identification of edible mushrooms.

Authors' contributions

Conceptualization, data curation, formal analysis, investigation, methodology, supervision, validation, writing – review & editing, F.A.B.; Investigation, formal analysis, writing–original draft, writing – review & editing, R.O.A.; Methodology, investigation, methodology, supervision, validation, writing – review & editing, A.O.S.

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mushroom identifier app: www.googleplay.com/The-mushroom-identifier, which was used for field identification of the mushrooms.

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Availability of data and materials

All data will be made available on request according to the journal policy.

Conflicts of interest

The authors declare no conflict of interest.

References

1. Mattila, P.; Suonpää, K.; Piironen, V. Functional properties of edible mushrooms. Nutrition. 2000, 16(7), 694–6. https://doi.org/10.1016/s0899-9007(00)00341-5
2. Chang, S.T.; Miles, P.G. Mushroom biology-a new discipline. Mycol. J. 1992, 6, 64-65. https://doi.org/10.1016/S0269-915X(09)80449-7
3. Viziteu, G. Substrate-cereal straw and Corn Cobs. In: *Mushroom Growers'* Handbook1, Gush, R. (Ed.). *P* and F publishers, USA, 2000, ISBN-10: 0932551068:86-90.
4. Denchev, C.M. General aspects of Mushroom Fungi: Identification and sustainable exploitation of wild edible mushrooms in rural areas short edition. 2013, www.researchgate.net/publication/281625151.
5. Jebapriya, G.R.; Gnanasalomi, V.D.; Gnanadoss, J.J. Application of mushroom fungi in solid waste management. Int. J. Comp. Algor. 2013, 2, 279-285. https://doi.org/10.20894/ijcoa.101.002.002.007
6. Ejelonu, O.C.; Akinmoladun, A.C.; Elekofehinti, O.O.; Olaleye, M.T. Antioxidant profile of four selected wild edible mushrooms in Nigeria. J. Chem. Pharm. Res. 2013, 7, 286-295. ISSN: 0975-7384
7. Salami, A.O.; Elum, E.A. Bioremediation of a crude oil polluted soil with *Pleurotus pulmonarius* and *Glomus mosseae* using *Amaranthus hybridus* as a test plant. J. Bioremed. Biodegrad. 2010, 1(3), 113. https://doi.org/10.4172/2155-6199.1000113
8. Bankole, F.A. and Salami, A.O. Use of agro-wastes for the tissue culture process and spawn production of oyster mushroom (*Pleurotus florida*). J. Appl. Life Sci. Int. 2017, 14(1), 1-9. https://doi.org/10.9734/JALSI/2017/35858
9. Josephat, O.C.; Onyeke, C.C.; Chiejina, N.V. Evaluation of some organic substrates for the growth and yield of oyster mushroom Pleurotus ostreatus (Jacq.Fr.) Kumm in southeast Nigeria. J. Biol. Res. Biotechnol. 2020, 18(1), 1085-1093. https://doi.org/10.4314/br.v18i1.3
10. Adewoyin, A.G.; Ayandele, A.A. Comparative study of yield performance and nutrient composition of the edible mushroom *Pleurotus pulmonarius*, cultivated on different substrates. Afr. J. Plant Sci. 2018, 12(8), 148-154. https://doi.org/10.5897/ajps2018.1678
11. Idowu, O.O. Evaluation of different substrates and combinations on the growth of *Pleurotus pulmonarius* (Fries) Quelet (*Sajor-caju*). Niger. J. Hort. Sci. 2004, 8(1), 1-5. https://doi.org/10.4314/njhs.v8i1.3370
12. Higgins, C.; Margot, H.; Warnquist, S.; Obeysekare, E.; Mehta, K. Mushroom cultivation in the developing world: A comparison of cultivation technologies. 2017, https://doi.org/10.1109/ghtc.2017.8239314
13. Teke, A.N.; Bi, M.E.; Ndam, L.M.; Kinge, T. R. Nutrient and mineral components of wild edible mushrooms from the Kilum-Ijim forest, Cameroon. Afr. J. Food Sci. 2021, 15(4), 152-161. https://doi.org/10.5897/ajfs2021.2089
14. Okhuoya, J.A.; Akpaja, E.O.; Osemwegie, O.O.; Oghenekaro, A.O.; Ihayere, C.A. Nigerian mushrooms: Underutilized non-wood forest resources. J. Appl. Sci. Environ. Management. 2010, 14(1), 43–54. https://doi.org/10.4314/jasem.v14i1.56488
15. Idu, M.; Osemwegie, O.O.; Timothy, O., and Onyibe, I.H. A survey of plants used in traditional health care by the Waja tribe, Bauchi State, Nigeria. Plant Arch. 2007, 7, 535-538.
16. Akpaja, E.O.; Isikhuemhen, O.S.; Okhuoya, J.A. Ethnomycology and usage of edible and medicinal mushrooms among the Igbo people of Nigeria. Int. J. Med. Mushroom. 2003, 5, 313-319. https://doi.org/10.1615/interjmedicmush.v5.i3.100
17. Akpaja, E.O.; Okhuoya, J.A.; Ehwerheferere, B.A. Ethnomycology and indigenous uses of mushrooms among the Bini-speaking people of Nigeria: A case study of Aihuobabekun community near Benin City, Nigeria. Int. J. Med. Mushroom. 2005, 7, 373-374. https://doi.org/10.1615/intjmedmushrooms.v7.i3.270
18. Osemwegie O.O.; Eriyamremu G.E.; Abdulmalik, J. A Survey of Macrofungi in Edo/Delta region of Nigeria, their morphology and uses. J. Pure Appl. Sci. 2006, 12, 2, 1-9. https://doi.org/10.4314/gjpas.v12i2.16583
19. Gbolagade, J.S.; Ajayi, A.; Oku, I.; Wankasi, D. Nutritive value of common wild edible mushrooms from southern Nigeria. Global J. Biotechnol. Biochem. 2006, 1(1), 16-21. ISSN 1990-9241.
20. Osemwegie, O.O.; Okhuoya, J.A. Diversity of macrofungi in oil palm agroforests of edo state, Nigeria. J. Biol. Sci. 2009, 9, 584-593. https://doi.org/10.3923/jbs.2009.584.593

21. Ogundana, S.K.; Fagade, O.E. Nutritive value of nigerian edible mushrooms. J. Food Chem. 1982, 8, 263-268.
22. Abulude, F.; Ndamitso, O.; Muhammed, M. Fungi: a review on mushrooms. in: current trends in advancement of scientific research and opinion in applied microbiology and biotechnology, Edition: First Edition, Chapter: Chapter 5, Publisher: Science and Education Development Institute, Nigeria, Editors: Subha Gangully, 2013, 18 – 31.
23. Halling, R.E. Recommendations for collecting mushrooms for scientific study. In: Alexiades, M. N. and J. W. Sheldon (eds.), Selected Guidelines for Ethnobotanical Research: A Field Manual. The New York Botanical Garden Press, Bronx, 1996, 135-141.
24. Del Conte, A.; Laessoe, T. The Edible mushroom. Published by DK Publishing, 375 Hudson Street, New York, United States. 2008, lSBN 878-0-7666-3867-2.
25. Zervakis, G.I.; Venturella, G.; Denchev, C.M.; Fitsilis, P.T.; Gerogiannis, V.C.; Papaefthimiou, S.; Georgi, J.; Saitta, A.; Polemis, E.; Denchev, T.T.; Assyov, B.; Gargano, M.L. Identification and sustainable exploitation of wild edible mushrooms in rural areas (Mycoticon, LdV-ToI project): Development of an innovative training package to meet educational and income-generating demands in South Europe and to improve the use of mushrooms as high-value food. J. Biol. Res. 2015, 88(1), 10-11.
26. Aminuzzaman, F.M.; Rumainul M.I.; Chowdhury M.S.M. Biodiversity and morphological characterization of mushrooms at the tropical moist deciduous forest region of Bangladesh. Am. J. Exp. Agric. 2015, 8(4), 235-252. https://doi.org/10.9734/ajea/2015/17301
27. Shah, Z.A.; Ashraf, M.; and Ishtiaq, M. Comparative study on cultivation and yield performance of oyster mushroom (*Pleurotus ostreatus*) on different substrates (wheat straw, leaves, sawdust). Pakistan J. Nutr. 2004, 3, 158-160. https://doi.org/10.3923/pjn.2004.158.160
28. Oso, B.A. Mushroom in Yoruba mythology and medicinal practices. Eco. Bot. 1977, 31, 367-371. https://doi.org/10.1007/bf02866888
29. Alabi R.O. Mycology and Nigerian culture; Past, Present and Future; proceedings of 1st conference on African mycology. June 10-15, Mauritius, 1990, 43-52.
30. Salami, A.O.; Bankole, F.A.; Olawole, O.I. Effect of different substrates on the growth and protein content of oyster mushroom (*Pleurotus florida*). Int. J. Biol. Chem. Sci. 2016, 10(2), 475-485. https://doi.org/10.4314/ijbcs.v10i2.2
31. Alofe, V.A.; Odeyemi, O.; Oke, O.L. Three edible wild mushrooms from Nigeria: Their proximate and Mineral composition. Plant Food Human Nutr. 1996, 49 (1), 63-73. https://doi.org/10.1007/bf01092523
32. Hall, I.R.; Yun, W., Amicucci, A. Cultivation of edible ectomycorrhizal mushrooms. Trend. Biotechnol. 2003, 21(10), 433 – 438. https://doi.org/10.1016/s0167-7799(03)00204-x
33. Son, H; Heo, M; Kim, Y.; Lee, S. Optimization of fermentation conditions for the production of bacterial cellulose by a newly isolated Acetobacter sp. A9 in shaking cultures. Biotechnol. Appl. Biochem. 2001, 33(1), 1-5. https://doi.org/10.1042/ba20000065

https://doi.org/10.58985/jafsb.2025.v03i02.74