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A SURVEY OF MACROFUNGI IN EDO/DELTA REGION OF NIGERIA, THEIR MORPHOLOGY AND USES

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ABSTRACT

A survey of macrofungi and their ethnomycology was carried out in Edo and Delta states (latitudes 4.87° to 7.12° E and longitudes 5° to 7.6° N) of Nigeria. The survey covers six selected local government areas (Burutu, Etsako East and West, Ovia South-West and Ukhumwonde) scattered across different vegetation zones in the region. Fifty three (53) species of macrofungi were encountered at the end of the survey, 26 species comprising of 23 basidiomycetes and 3 ascomycetes were fully enumerated. *Auricularia auricula, Pleurotus* spp, *Schizophyllum commune* and *Volvariella volvaceae* are eaten by 77% of the sampled communities. Analyses of their nutrient contents recorded over 55% per gram fibre, 11.77% per gram protein, between 7.16 and 12.63% per gram carbohydrate. *Amanita phalloides, Daldinia concentrica, Ganoderma lucidum, Ganoderma resinaceus and Nothopanus sp* are more frequently employed in the treatment of varying degrees of anemic, blood pressure, gastro-intestinal, homoeostatic, oral and rheumatic ailments. Lowland forest regions recorded greater species diversity and richness than other regions studied. Mushroom hunters, 45% women and 26% youths (ages 18-28), hunt for the in the wild to supply the mushroom needs of the inhabitants of the Edo/Delta region. The hunters are mostly guided by divergent and unwritten mushroom hunting codes while picking in the wild.

KEYWORDS: Survey, Macrofungi, Edible, Ethnomycology, Edo/Delta region.

INTRODUCTION

The diverse and scattered forests (mangroves, lowland rainforests and savannah) in Southern Nigeria have a rich diversity of mushroom flora and habitat (Hopkins, 1987, Hepper and Keay, 2000). Mushrooms, which are less conspicuous members of the forest habitat, grow lushly on a variety of dead and living wood or wood parts, damp humus soils, decaying forest floor litters and dung in forests, plantations, farmlands, meadows and occasionally in gardens and yards of living houses (Arora, 1986, Hawksworth, 1991). Many rural inhabitants in Nigeria collect and eat wild mushrooms. These people also use them for mythical and medicinal purposes (Alabi, 1991, Akpaja *et al*., 2003). The rich mushroom resource in Nigeria and other developing countries of the world is constantly threatened with the danger of extinction by pollution, population increase, urbanization, erosion, farm practices and reckless mushroom hunting from the wild (Hawksworth, 1991, Burdsall and Volks, 1992, Harkonen *et al*., 1994, Fanelli *et al*., 2000, Isikhuemhen, 2001).

Small and medium scale mushroom growing industries in Nigeria and most African countries are yet to develop to the level of what obtains in America, Europe and Asia (Osemwegie *et al*., 2002, Chang and Mshigeni, 2001). In areas where mushrooms are grown in large scale to meet both consumption and foreign exchange needs of the people, extensive studies have been done on the naming and proper documentation of mushroom flora in the wild. Their biodiversity, habitat pattern and distribution, ethnomycology study, and domestication of wild mushrooms are also very extensively studied (Chang, 1980, Chang, 1996, Burdsall and Volks, 1992, Chang and Mshigeni, 2001, Kekawa, 2001). In Nigeria however, there is paucity of information on the biology, eco-diversity, cultivation and nutrient values of indigenous edible mushrooms in the Edo/Delta region (Alofe, 1991, Fasidi and Ekuere, 1993, Isikhuemhen and Okhuoya, 1995, Alofe *et al*., 1996, Osemwegie *et al*., 2002). Reports on the description, documentation and ethnomycological uses of indigenous wild mushrooms are however localized. Zoberi (1972, 1973) identified less than three hundred macrofungi in Nigeria while Oso (1975) and Alabi (1991) documented some macrofungi common in Yoruba land. Mushrooms of Akwa-Ibom and South East Nigeria were also studied and recorded by Nicholson (1989, 2000). Also, the ethnomycology of selected edible mushrooms in some eastern communities was studied by Akpaja *et al*. (2003). The present study is aimed at describing and documenting the various mushrooms found in the Edo/Delta region of Nigeria and their uses. It also attempted to verify and evaluate the nutrient contents of some common macrofungi.

MATERIALS AND METHODS

Study area

The study was limited to forest vegetations, spread across Edo and Delta States (latitudes 4.87° to 7.12° E and longitudes 5° to 7.6° N) of Nigeria. The undulating topography of the region supports series of flowing rivers from different geologic sources and rich but scattered mats of tropical forest vegetations, which include mangrove forest in the south-south, lowland rainforest in the south and savannah forest spreading towards the rocky terrain in the Northern part of the region (Fig.1). The climate is characterized by 6-8 months of rainfall usually starting from April and 3-5 months of dry weather during which there is 1-3 months of harmattan season. Rainfall distribution however differs from the southern forest to the northern savannah region, ranging from 500-3000mm. The region has an altitude of between 50-200m a.s.l. (Fig.1)

Foray and collection of mushrooms

The survey and collection commenced in December 2002 through to December 2003 covering both the rainy and dry seasons. Two Local Government areas of wide forest spread were selected per each vegetation belt and visited twice in a month for 3 months within the dry season and 5 months within the rainy season respectively. Thus forests in Burutu and Warri South local government areas representing mangrove, Ovia South-West and Ukhumwonde local government representing lowland rain forest vegetation and, Etsako West and East local government areas representing savannah vegetation. Observed mushrooms were photographed with a 3.2 megapixel Samsung digital camera, described by highlighting shape, texture, color and nature of

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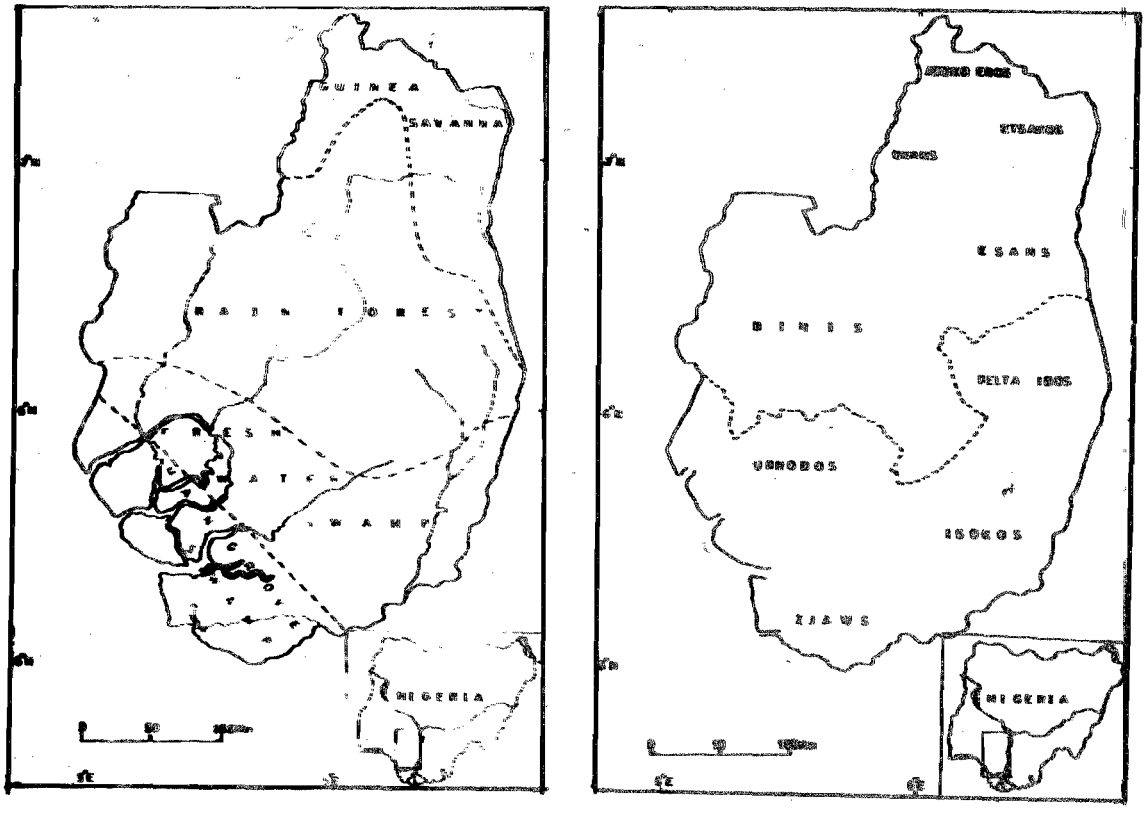

Fig. 1. Vegetation distribution and major tribal spread in the Edo/Delta region

the fruit body or mushroom, and named using mushroom field guides by Pegler and Piearce (1980), Nicholson (1989), Arora (1991) and Kuyper *et al.* (2002), containing colored photographs of hitherto identified mushrooms from within and outside Nigeria. Mushrooms were collected randomly from heterogeneous forests across different vegetations throughout the study area. Most of the wood macrofungi were removed from their substrata with a penknife while the soil types were uprooted from their sustrata with a hand trowel. Each collected mushroom is carefully air blown to remove soil debris and sand before it is place in a hamper basket laid with a banana leaf. The collections were never heaped on each other. The mushrooms were then air dried bagged separately in dry polyester bags and stored in a fridge for nutrient analysis. The ephemeral types were preserved in a jar containing 40% formalin acetic acid (FAA) or distilled water.

Administration of questionnaire

Information about the cultural relevance of collected mushrooms was obtained by direct interview in local languages using an interpreter and structured questionnaire. The questionnaire was constructed to obtain information on age of respondents, rate of eating mushrooms, propensity for identifying edible and medicinal mushrooms from the wild and the origin of such knowledge, places in the wild where these mushrooms are found, local name or names of such mushrooms, category of collectors and reasons for hunting mushrooms. The respondents were randomly selected people of between 18 and 70 years of age, who live in communities around the forest sites surveyed. A total of 6 Local Government Areas each of which comprises of communities of different and mixed tribes around sampled forests were visited (Fig.1). In each community visited, 30 persons comprising of 5 chiefs/elders were administered with questionnaires. Information from respondents was analyzed using simple statistical methods based on percentages and mean. Relationships among variables were determined using correlation and regression analyses.

Nutrient analysis

Edible mushrooms common to the communities sampled were analyzed for total carbohydrate using per caloric acid and ethanol extraction method described by Association of Official Analytical Chemists (A.O.A.C, 1975), protein using the modified Kjedahl method as described by Williams (1964) and fibre as described by A.O.A.C (1975). The mushrooms were each pulverized and analyzed for total lipid content by Soxhlet extraction using petroleum ether and phosphovanillin method according to Frings and Dunn (1970). Weighed samples of each of the mushroom to be analyzed for mineral elements were first ashed at 600 °C and extracted with dilute HCL (1:20 v/v) according to A.O.A.C (1975). The total calcium and magnesium of each mushroom were determined by the 0-cresolpthalein dyes and calmagite binding methods respectively (Henry and Dryer, 1963, Albertelly and Fowler, 1982). Similarly, the zinc and iron contents were determined using the EDTA binding method (A.O.A.C, 1975). Most of the collected mushrooms were later dried or preserved in 40% formalin acetic acid (FAA) and kept in the Mushroom Biology Unit of the Department of Botany, University of Benin, Edo State.

RESULT

About 53 species of macrofungi were collected during the study with 26 species comprising 23 members of the subdivision Basiodiomycotina and 3 members of the subdivision Ascomycotina fully identified, named and physically described

(Table 1). *Amanita phalloides, Auricularia auricula, Coprinus atramentarius, Cyathus sp, Coltrichia sp, Cookeina sp, Ganoderma spp, Flammulina velutipes, Pleurotus tuber-regium, Pleurotus squarrulosus* and *Schizophyllum commune* (Fig. 2c) showed wide distribution across vegetation strata. These mushrooms were observed growing more on dead wood (felled or standing) with the exception of the cup mushrooms, namely *Cyathus sp* and *Cookenia sp.*(Fig. 2d) that were observed growing on decayed twigs. *A. auricula, P. tuber-regium, P. squarrosulus, S. commune* and *V. volvaceae* were more readily eaten throughout the communities visited and occurred all year round with the exception of *V. volvacea* (Fig. 2c). They were non-tree selective or restricted in their distribution to particular vegetation and are more abundant at the peak of the rainy season (June – August).

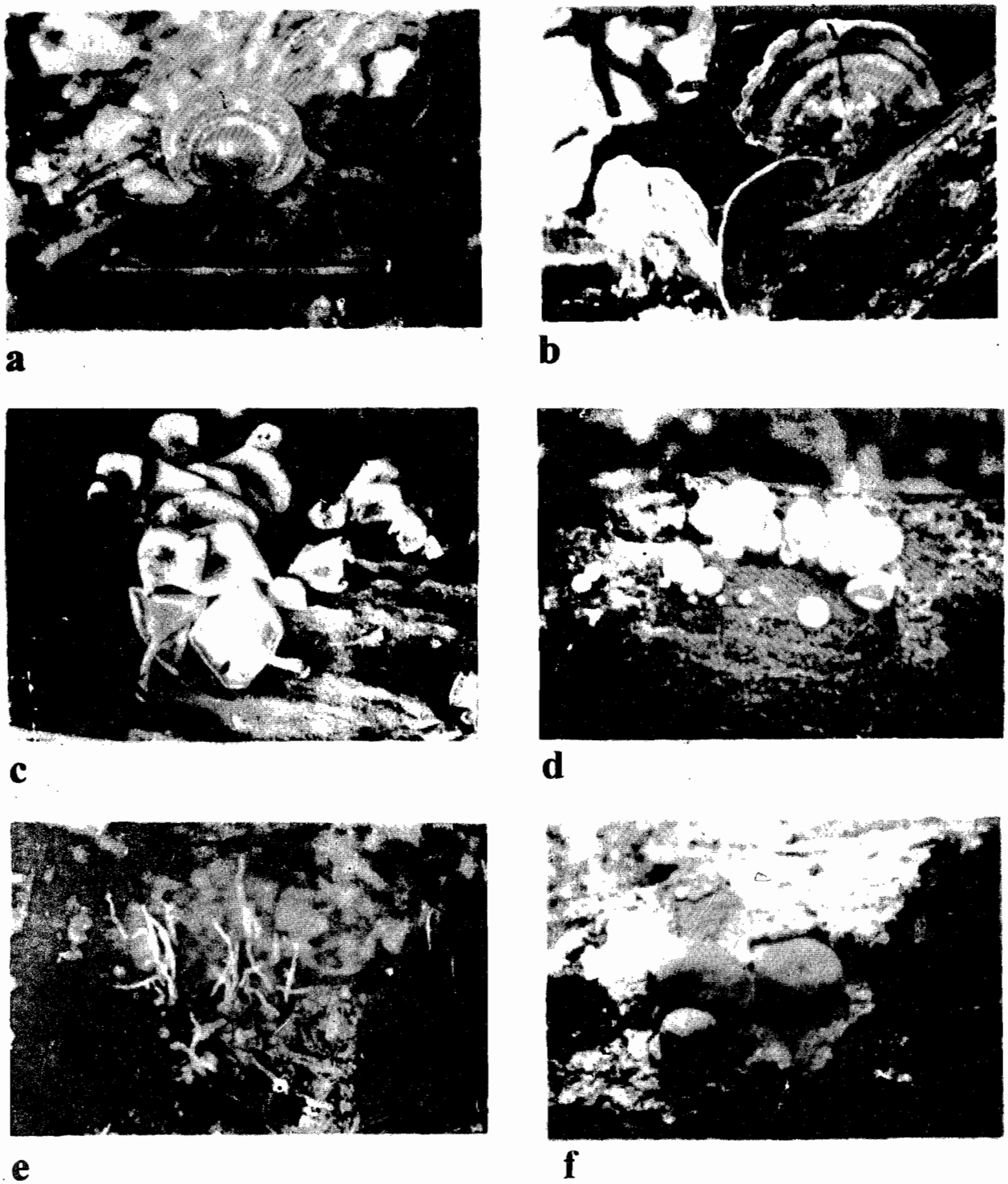

Fig. 2. Some mushrooms of Edo/Delta region *Ganoderma lucidum* (a), *Trametes versicolor* (b), *Pleurotus squarrosulus* (c), *Cookenia sp* (d)., *Xylaria heterophylla* (e) and *Daldinia concentrica* (f) (Photograph by O. O. Osewegie, Department of Botany, UNIBEN.

Seventy seven percent (77%) of the rural population (suburban people) of the Edo/Delta region consumes mushrooms. About 58% of this population eats on the average 4-9 different mushroom species per week. Approximately 54% of the respondents hunt for variety of mushrooms in heterogeneous forests in the raining season. Seventy one percent (71%) of women and youths (ages 18-28) carry out mushroom hunting.

The protein content in *C. johnsonii* 17.06% per gram, *G. applanatum* 17.00% per gram and *P. squarrosulus* 15.20% per gram respectively. All the mushrooms evaluated except *M. rotula*, had high fibre content ranging from 52.6% to 67.3% per gram (Table 2).

DISCUSSION

The study showed that approximately 66% of wild indigenous edible and native health care mushrooms are fleshy, wood inhabiting agaric macrofungi (non-polyporous macrofungi). The reason given for this by respondents relates to the texture, taste, fibrous nature, water-soluble contents and water content of agaric or fleshy mushrooms (Arora, 1989, Alabi, 1991, Harkonen *et al.*, 1994, Kuyper *et al.*, 2002). About 54% of the respondents hunt for a wide range of edible mushroom species in heterogeneous forests during the raining season either for self-consumption or marketing. This preference for heterogeneous forests as a sustainable source of a diverse edible and medicinal mushroom could be related largely to the variable pattern of substratum, carbon sources and host availability. This supported the findings of Harkonen *et al.* (1994) and Kuyper *et al.* (2002). Anachronistic cultural belief that the rains begets good sprout of mushrooms was given as the reason for increased mushroom hunting and mycophagy activities during the rainy season (Arora, 1986, Alabi, 1991, Burdsall and Volks, 1992, Fanelli *et al.*, 2000, Akpaja *et al.*, 2003). Little is however known about how environmental, edaphic and substrata variables as well as topographic properties affect fruiting phonologies and species diversity of mushrooms in any parts of Nigeria. Paucity of proper mushroom cultivation industries and technology in Nigeria may have accounted for the overall reliance by the rural communities of the region on mushroom hunting for their dietary, economic sustenance and tradomedical needs (Arora, 1989, Alabi, 1991, Harkonen *et al.*, 1994). About 71% of women and children depend on the mushrooms obtained from the wild for seasonal but sustainable small-scale business (Arora, 1989, Burdsall and Volks, 1992, Lodge *et al.*, 2004).

About 53 species of macrofungi were collected during the study with 26 species comprising 23 members of the subdivision Basiodiomycotina and 3 members of the subdivision Ascomycotina fully identified, named and physically described (Table 1). *Amanita phalloides, Auricularia auricula, Coprinus atramentarius, Cyathus sp, Coltrichia sp, Cookeina sulcipes, Ganoderma spp, Flammulina velutipes, Pleurotus tuberregium, Pleurotus squarrulosus* and *Schizophyllum commune* (Fig. 2c) showed wide distribution across vegetation strata. These mushrooms were observed growing more on dead wood (felled or standing) with the exception of the cup mushrooms, namely *Cyathus sp* and *Cookenia sp.* that were observed growing on twigs. *A. auricula, P. tuberregium, P. squarrulosus, S. commune* and *Volvariella volvaceae* were more readily eaten throughout the communities visited probably because they occurred all year round with the exception of *V. volvacea* (Fig. 2c and d). Although they were observed to be non-tree selective or restricted in their distribution to a particular vegetation, they are however more abundant at the peak of the rainy season (June – August) (Alabi, 1991, Hawksworth, 1991, Harkonen, *et al.*, 1994). These edible mushrooms are collected from the wild, usually sun-dried or air-dried for marketing; otherwise, they are preferred fresh for culinary purposes. Although the relative abundance and frequency of occurrence of each collected mushroom was not properly noted but the study recorded an average of 3-6 new species per survey. The narrow species diversity could be due to a combination of factors that ranged from poor national policy on forest conservation and improper management of mushroom habitat destruction by appropriate national agencies to pollution, natural disasters (bush burning, flooding), increasing population growth, farm practices especially taungya, and unchecked spread of deforestation activities. Unconscious deforestation such as firewood gathering and logging is however more rampant in the region as it constitutes one of the major occupations of people. Further more, lack of large and efficient workforce to underwent the challenges of measuring macrofungi diversity, composition and species richness, tracking specimens before their decay, coping with the time scale of sporocarp succession and variability, and fruiting pattern, could also be reasons for the narrow data recorded during the study (Hawksworth, 1991, Lodge *et al.*, 2004).

These edible mushrooms after collection from the wild are usually sun-dried or air-dried for marketing; otherwise, they are preferred fresh for culinary purposes. An average of 3-6 new species of mushrooms are encountered per foray even though the relative abundance and frequency of occurrence of each collected mushroom was not properly noted. The narrow species diversity observed during the study could be due to a combination of factors that may include the poor implementation of existing national policy on forest conservation, low literacy level, mushroom habitat destruction by pollution, natural disasters (bush burning, flooding), population growth pressure, farm practices especially taungya, and deforestation activities (Arora, 1989, Burdsall and Volks, 1992, Lodge *et al.*, 2004). Deforestation activities such as firewood gathering and logging ranked as the biggest threat to mushroom resources diversity in the region because it is a popular occupation or vocation of the people in the region. Further more, lack of large workforce and finance to undertake the challenges of measuring macrofungi diversity, composition and species richness, tracking specimens before their decay, coping with the time scale of sporocarp succession and variability, and fruiting pattern in the region, may also be the reasons for the narrow data obtained from the study (Hawksworth, 1991, Lodge *et al.*, 2004).

Mushrooms in the region are collectively called *Etun* or *Utun* or *Itu* with slight dialectic difference depending on the tribe. It was observed during the study that there is no specific local name that separates each mushroom collected from the other. This observation is supported by Nicholson (1989) but ran contrary to the study of Akpaja *et al.*, 2003.

Seventy one percent of women (45%) and youths (26%, ages 18-28) hunt mushrooms their way to farms and, firewood, snail and palm nut gathering. About 80% of respondents above 45 years old interviewed showed good heritable identification knowledge of edible and medicinal mushrooms from the wild and gave different unwritten codes used in separating poisonous mushrooms from edible ones while on mushroom hunting expeditions. These unwritten codes include (i) avoiding colourful, multicoloured, latex or exudates-producing mushrooms, (ii) avoiding any mushroom whose pilial margin is unbitten or undisturbed by any kind of forest animal as it is a strong indication that such mushroom is not fit for consumption, (iii) picking mushrooms growing on forest woods as soil, grassland and meadow mushrooms are culturally feared to be non-edible or poisonous, (iv) and finally, avoiding mushrooms growing in and around shrines and grave yards/cemetery as they have fetish connotations. These have

Table 1: Enumeration and description of some of the collected macrofungi in alphabetical order of genus

Amanita phalloides (Vail. ex. Fr.) Secretan
Family: Amanitaceae
Habitat: Moist shady places, commonly found in forests with heterogeneous trees especially in the south east and west of the region (Attitude: 9m – 15m asl)
VZ: RF
Uses: Treatment of oral thrush, hallucinogen and sold in their markets for economic gain.
Description: Cap pale green to greenish-yellow with thin patches of universal veil tissue. Stipe bulbous with a volva. Stalk central.

Auricularia auricula Judae (Bull.) Pat.
Family: Auriculariaceae
Habitat: Moist decayed felled logs of different angiospermic trees in forests, scrubs and crop fields.
VZ: RF and MF
Uses: Edible (by all the tribes)
Description: Basidioma pliant and rubbery, cosmopolitan, bracket or ear or pinna shaped. Tan to deep brown color. ... may have ribbed or vein exterior. Gelatinous and ses...

Clitocybe dealbata (Sow. ex. Fr) Gillet.
Family: Tricholomataceae
Habitat: Decaying leaf litters or felled tree branches of rubber trees and lawn.
VZ: RF
Uses: Unknown
Description: Matured pileus may be flat or slightly concave, without umbo, pale to dull white in colour. Stalk is central and tapers downward. non-annulated, lack veil and volva

Coltrichia sp.
Family: Hymenochaetaceae
Habitat: Found on both living and dead trees all seasons.
VZ: RF and SF
Uses: Unknown
Description: Cap concave, funnel shaped, papery texture, lack lamellae, non-polyporous. Milky outer surface and brownish inner surface. Inner surface shows color zonation. Margin may be smooth or wavy, stipitate, stipe equal and central.

Cookeina sulcipes (Berk) Kunt
Family: Magnoliaceae
Habitat: Dead twigs in shady forest floors.
VZ: RF
Uses: Unknown
Description: Pink cluster of cup shaped sessile hairy sporocarp

Coprinus acuminatus (Romagn) P.D. Orton
Family: Coprinaceae
Habitat: Forest litters, decay buried tree branches and oil palm inflorences.
VZ: RF
Uses: Edible
Description: Cap is pale brownish grey, scaly towards center and grooved at the margin.

Ganoderma resinaceum Boud; Syn. *Formes resinaceum* (Boud) Sacc.
Family: Ganodermataceae
Habitat: Dead trees in thick and light forests.
VZ: RF and SF
Uses: Unknown
Description: Bracket shaped sporophore, concentrically grooved, glossy with a reddish brown to reddish pink upper surface. Whitish to milky lower surface with multipores. Sporophore is sessile or with rudimentary stipe.

Geastrum minimum Schwein
Family: Geastraceae
Habitat: Shady dry or slightly moist places at the base of living trees or on dead logs.
VZ: RF
Uses: Unknown
Description: Sporocarp has 4-6 rayed outer perichum straddling and attached to the substrate. The inner white to cream sessil peridium remain exposed, the texture is papery.

Flammulina velutipes (Curt. Fr.) Sing.
Family: Tricholomataceae
Habitat: Moist shady places mostly in dead forest trees, sometime on life trees.
VZ: RF
Uses: Edible
Description: Cap is converse to plane, moist when fresh, smooth may be orange brown to yellowish brown. Gill is whitish, attached and crowded. The stipe is tough, may be basally clavate or even in diameter from the posterior to anterior end.

Marasmius rotula (Scope. ex. Fr)
Family: Tricholomataceae
Habitat: Decaying forest trees, twigs and leaf litters.
VZ: RF
Uses: Unknown
Description: Radially grooved whitish cap, slightly, depressed, distant gills, stipe thin, slender and black.

Nothopanus sp.
Family: Pleurotaceae
Habitat: Wet and dry logs
VZ: RF and MF
Uses: Treatment of fever
Description: Bracket shaped with gill-like lower surface and smooth upper surface. Leathery texture and bitter taste.

Pleurotus squarrosulus (Fr.) Kummer
Family: Pleurotaceae
Habitat: Wet logs, living tree branches, found in varying kind of vegetation.
VZ: RF and MF
Uses: Edible
Description: Cap may be deeply concave or funnel shaped, squamose. Upper surface, stipe may be central or lateral. Gill decurrent and regular. Margin is slightly curved.

Coprinus atramentarius Ulje and Bas
Family: Coprinaceae
Habitat: Decay logs more commonly palm and decomposed leaf litters heaps.
VZ: RF, wet SF and occasionally MF.
Uses: Unknown
Description: Cap is oval to bell-like grayish brown, stipitate, stalk white and hollow. Basidioma autolyse after 1 or 2 hours.

Crepidotus mollis (Bull.) Kummer
Family: Crepidotaceae
Habitat: Decay trees in forest or on farmlands. Some firewood and building planks.
VZ: RF and SF
Uses: Consumed more commonly by the Esans, Binis and the Ijaws.
Description: Fruit body bean to shell shape, laterally attached small stip to sessil with a pallid to cream coloration.

Cyathus sp.
Family: Nidulariaceae
Habitat: Moist shady places, decaying forest twigs, felled tree branches on or buried under forest leaf litters and burnt patches.
VZ: RF and MF
Uses: Unknown
Description: Cap appears like tiny inverted cones, brownish and tomentose outside. Sessile with whitish inner perichols.

Daedalia africana Ryv.
Family: Polyporaceae
Habitat: Palm trees in dry forests scrubs or burnt farmlands or destroyed tree plantation.
VZ: RF and SF
Uses: Unknown
Description: Bracket shaped basidioma leathery texture, pale grayish. Daedeloid undersurface, non-stipitate.

Daldinia concentrica (Bolton: Fr.) Ces and De Not
Family: Xylariaceae
Habitat: Dead logs and burnt forests
VZ: RF and MF
Uses: Stomach upsets. It also serve as indicator for wood suitability as firewood.
Description: Ball or tuber shaped, reddish brown to chocolate brown colour, non-stipitate, hard, stony and resupinate.

Ganoderma lucidum (Leyss) P. karst
Family: Ganodermataceae
Habitat: Dead dry logs in shady forests and scrubs.
VZ: RF and SF
Uses: Native medicine as tonic or herb tea
Description: May be sessile or laterally stipitate, cap glossy or shinning upper surface, which is brightly wine to pale red in colour. Corky texture.

Pleurotus tuber-regium (Fr.) Singer
Family: Pleurotaceae
Habitat: Mostly on dead or living trees.
VZ: RF
Uses: Edible, treatment of mumps, stomach upset. It is also a source of commerce.
Description: Funnel shaped cap, with a smooth milky colored inner surface. Stipitate, stipe is central and slightly clavate at the base. Gills regular and document.

Schizophyllum commune Fr.
Family: Schizophyllaceae
Habitat: Dry and slightly moist logs in forests and sawmills.
VZ: RF and SF
Uses: Medicine and food
Description: Cluster of fan-shaped non-stipitate sporocarps with rough upper surface and false gills on the undersurface. White to cream colour. Gill/lamellae is off-white with central stipe, tapering upward and slightly swollen at the base

Stereum purpureum (Pers. Ex Fr.) Fr.
Family:
Habitat: Dry and wet logs in forests and wood mills
VZ: RF, SF and ANF
Uses: Unknown
Description: Sporophore is greenish brown to grayish-brown. Sessile with concentric zones of different shades of brown. Fan or bracket shaped, tomentose, leathery, polyporous brown.

Trametes versicolor (L.: Fries) Pilat Syn. Coriolus versicolor (Nees ex Fr.) Quel.
Family: Polyporaceae
Habitat: Decay wood/log in forests and sawmills.
VZ: RF, MF and SF
Uses: Unknown
Description: Fruit body is bracket or shelf or fanlike, slightly tomentose, multicolored concentric zones. It is also thin, tough, fibrous or leathery with a white pale to milky lower surface.

Volvariella volvaceae (Fr.) Singer
Family: Plutaceae
Habitat: Soft decaying logs
VZ: RF
Uses: Edible
Description: Cap is broadly parabolic when immature and brownish grey with slightly blackish virgate streaks. Stipe is whitish, clavate with a basal brownish volva.

Xylaria heterophylla (Persoon ex Merat) Greville
Family: Xylariaceae
Habitat: Dry and wet logs in forests, scrubs, farmlands and lawns.
VZ: RF and SF
Uses: Unknown
Description: Clavate or club shaped basidiomata. Black with a white anterior tip. Grow in clusters, lack pileus and lamellae/gill.

VZ (Vegetation Zone), RF (Rain Forest), SF (Savannah Forests), MF (Mangrove Forests).

TABLE 2: Chemical parameters and food values of wild mushrooms (g%)

	Carbohydrate	Lipid	Species	Ash	Fibre	Ca^{2+}	Mag^{2+}	Zn^{2+}	Fe^{2+}
Amanita phalloides	8.480	11.04	12.66	12.96	52.60	1.720	0.070	0.220	0.024
Auricularia auricula	12.6	2.020	11.77	5.300	64.38	4.90	0.24	0.204	0.048
Collybia johnsonii	10.01	1.40	17.06	4.720	66.53	2.75	0.134	0.150	0.029
Ganoderma applanatum	2.500	6.830	17.00	2.070	67.34	0.48	0.024	0.240	0.167
Marasmius rotula	10.49	1.470	4.200	8.010	4.49	5.00	1.00	0.212	0.077
Pleurotus squarrusolus	7.16	6.800	15.20	9.09	56.65	3.45	0.180	0.150	0.020

greatly reduced the incidents of mushroom poisoning; at least one per 100 mushroom eater among the rural population. Comparatively, the poor mushroom eating habit of the city dwellers especially in Nigeria could be due to the non-availability of the mushrooms either in fresh, pickled or canned forms, poor knowledge of their dietary benefits to humans and mushroom eating phobia generated by bad publicity.

The levels of protein observed in *C. johnsonii* (17.06% per gram), *G. applanatum* (17.00% per gram) and *P. squarrosulus* (15.20% per gram) are comparable to and can substitute for those found in meat, milk and beans, which are regular stable foods in the region (Chang and Mshigeni, 2001) (Table 2). Regular consumption of mushrooms would help improve human protein intake and prevent diseases that could arise from protein deficiency. This is particularly important in a population whose regular dietary intake is different forms of carbohydrate (cassava, yam and maize). All the mushrooms evaluated except *M. rotula*, recorded comparatively high fibre content ranging from 52.6% to 67.3% per gram (Table 2). This implies that mushrooms can be recommended to individuals susceptible to the risk of high cholesterol and sugar-based foods to protect or help them manage cardiovascular problems, strokes, colon cancer and diabetes (Reddy, 1999). Studies have provided evidence for the involvement of lipids as anti-cancer and supporter of efficient renal functions in experimental rabbits (Walker, 1985). The lipid content of *A.phalloides, G. applanatum and P. squarrosulus* may have prompted their trials in cancer treatment studies especially in oriental countries (Jones, 1997; Liu, 1999 and Kekawa, 2001). Calcium (Ca) and Magnesium (Mg) levels in edible *A. auricula* and *P. squarrulosus* compare favourably with those of leafy vegetables, carrots and other fruits (Alofe, 1991, Alofe, *et al.*, 1996). It is not surprising therefore that the high levels of protein, carbohydrate, lipid and mineral observed in *A. auricula, P. tuberregium, P. squarrulosus* and *S. commune* could account for their wide-spread demand as dietary food supplements or food (Ogundana and Fagade, 1982, Alofe, 1991, Alofe, *et al.*, 1996) (Table 2). *G. lucidum, G. resinaceum, Nothopanus sp* amongst some other mushrooms, were reportedly use in traditional heath care practice in ways less frequent to the used of leafy plants which shows better longevity (Arora, 1989, Alabi, 1991, Akpaja *et al.*, 2003).

This study has however shown that the macromycetes, which are of innumerable ecological benefits to humans and the ecosystem, are grossly endangered and are fast disappearing. This calls for rigorous environment and forest protection laws, conscious implementation of rules and policies on environment and improvement of the knowledge of environment and forest values amongst the people of the region. Furthermore, studies on mushroom diversity, habitat diversity; description (microscopic and macroscopic), naming should be encouraged and properly documented to upgrade the hitherto mushroom database of the region and the country Nigeria. Naturists and researchers should be challenged to preserve and broaden the knowledge of indigenous ethnomycological uses of wild mushrooms in all parts of Nigeria.

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