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A Survey of Mushrooms in two Local Government Areas of Ekiti State, Nigeria

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A survey on mushroom occurrence was carried out in Ado and Ikere local government areas of Ekiti State, Nigeria. The collected mushrooms were taxonomically identified. Out of a total of 109 samples, 19 species were obtained out of which 11 are edible while 8 are inedible. The edible ones include *Schizophyllum commune* Fr;Fr., *Polyporus spp.* P. Micheli ex Adans., *Lentinus squarrosulus (*Mont.), *Termitomyces robustus* (Beeli) Heim., *Psathyrella candolleana* Fr;Fr., *Lactinus piperatus* Linn., *Lentinus tuber-regium* (Fr) Singer, *Termitomyces mammiformis* F., *Hydnochaete spp* D. Davis., *Agaricus campestris* L. and *Lentinus sajo-caju* Fr. while the inedible ones are *Auricularia spp* Bull., *Chlorophyllum spp* (Massee)., *Trichaptum biforme* (Fr). , *Ganoderma applanatum* (Pers)., *Coprinus nivenus* Fr., *Cyathus spp* Haller., *Geastrum spp* Pers. and *Stereum spp* (Willd.) Pers. These mushrooms were distributed among different substrates which include soils, bark of trees, dead wood/trees and dead leaves. The cap size and stipe length of the mushrooms were also determined. The average cap size ranged from 3.00cm in *Psathyrella candolleama* to 24.9cm in *Trichaptum biforme* while the average stipe length ranged from 1.20cm in *Hydnochaete spp* to 15.60cm in *Termitomyces mammiformis.* Stipes were absent in *Auricularia spp, Trichaptum biforme, Ganoderma applanatum* and *Geastrum spp.* Variations were also observed in the cap colour, cap shape, stipe colour, stipe shape and gills of the mushrooms. Annulus was absent in all the mushrooms except *Agaricus campestris*. The rich diversity of mushrooms in the two local government areas of Ekiti State, Nigeria suggests huge socio-economic potential.

Keywords: Mushrooms, Occurrence, Edible mushrooms, Inedible mushrooms, Ekiti State.

INTRODUCTION

Mushrooms are microfungi with distinctive fruiting bodies which can be either epigeous or hypogeous and large enough to be seen with the naked eyes and to be picked by hand (Chang and Miles, 1991). Mushrooms are special types of edible fungi, forming umbrella like fruiting bodies. They belong to the class Basidiomycetes and order Agaricales. They do not possess chlorophyll like green plants for manufacturing their food (Bahl, 1998). Wild edible mushrooms are popular in some rural communities and their appearance during the planting season when food is scarce in these areas is seen by the locales as nature's food providence (Odebode, 2005).

The practice of traditional mushroom hunting from the wild when in season is still prevalent (Oso, 1975) and the harvest is either used fresh by the locales for nutritional and medicinal purpose (Odebode, 2005) or retailed in local markets to augment family income (Osemwegie *et al.,* 2010). The protein content of mushrooms has been reported to be twice that of vegetables and four times that of oranges (Ban, 1993), significantly higher than that of wheat (Aletor, 1990) and of high nutritional quality comparing favourably with meat, egg and milk (Thatoi and Singdevsachan, 2014).

Relative to plants and animals, there is dearth of information on diversity of mushroom, especially in Africa (Osemegwie and Okhuoya, 2009) and this has been attributed to the higher interest in higher plants and animals as sources of food and medicine for man (Osemwegie *et al.,* 2010). Due to low research interest in Nigerian mushrooms, the potentials it offers for food, medicine and foreign exchange are not being fully exploited as obtainable in other countries of the world. The mushroom on earth has been estimated to be about 140,000 yet only 14,000 (10%) are known (Hawksworth, 2001).

With its favourable climatic conditions of tropical rain forest in the south and sub-Saharan climate in the north, Nigeria has diverse species of mushrooms (Osemegwie and Okhuoya, 2009). Among the problems of mushroom resource exploration and exploitation in Africa is the lack of infrastructure and technical supports from national and international agencies, scarcity of mushroom scientists, poor political and legislative support, poor knowledge of mushroom biodiversity and bad press reports (Labarere and Menini, 2000). Of significant importance to the growth of the mushroom industry is the understanding of the diversity, phenology, substrate specificity

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and scientific classification (Nwordu *et al.,* 2013). Knowledge of mushroom ecology and distribution are not only important for the successive conservation and management of the ecosystem, but also for the optimum exploitation of the many benefits to mankind. The dearth of such information on Nigeria's rich mycoflora contributed in some parts to the poor status of the mushroom industries in the country (Okhuoya and Iskhuemhen, 1999). Boa (2004) reported that studies on mushroom diversity in many developing countries such as Nigeria were scattered.

The aim of this study was to document the mushrooms indigenous to two local government areas of Ekiti State, Nigeria. Preliminary morphological studies of the mushrooms were also carried out to aid future taxonomic studies.

MATERIALS AND METHODS

Sample collection and identification

Fully matured mushroom species (109 samples) were collected from Ado Ekiti and Ikere Ekiti in Ekiti State, Nigeria. Samples were transported to the laboratory in paper bags lined with fresh leaves within 6 to 8 hours of collection to preserve freshness (Nwordu *et al.*, 2013) and their substrates were noted. The local names of each species were provided by the locales in each town while the taxonomic classification was done at the herbarium of the Department of Plant Science, Ekiti State University, Ado Ekiti, Nigeria. Coloured Mushroom Field Guide Book (Shelley and Geoffrey, 2004) and internet facility (google.com) were also used for species identification.

Morphological studies

Two dimensional characteristics (cap size and stipe length) were measured. For each of the species, 3 plants were measured and the means and standard deviations computed. The shapes and colours of the stipes and caps were noted. Also, the nature of gills and the occurrence of annulus were noted.

RESULTS

Of a total of 109 samples collected, 19 species were obtained out of which 11 are edible while 8 are inedible (Table 1). The edible mushrooms include *Schizophyllum commune, Polyporus spp, Lentinus squarrosulus, Termitomyces robustus, Psathyrella candolleana, Lactinus piperatus, Lentinus tuber-regium, Termitomyces mammiformis, Hydnochaete spp, Agaricus campestris* and *Lentinus sajo-caju* while the inedible ones are *Auricularia spp, Chlorophyllum spp, Trichaptum biforme, Ganoderma applanatum, Coprinus nivenus, Cyathus spp, Geastrum spp* and *Stereum spp.* Their local names, families, substrates and status are shown in Table 1.

Results revealed that the mushrooms were distributed among 13 different families which are; *Schizophyllaceae, Lycophyllaceae, Pleurotaceae, Agaricaceae, Coprinaceae, Russulaceae, Hymenochaetaceae, Polyporaceae, Auriculaceae, Ganodermataceae, Nidulariaceae, Geasteraceae* and Stereaceae.

Results also revealed that the mushrooms were distributed among various substrates which include soil, leaf litters, ploughed land, dead wood/trees, barks of trees, palm fronds and rotten/decaying leaves. Table 2 shows the morphological profile of the mushrooms. The colour of the cap of *Auricularia spp, Trichaptum biforme, Polyporus spp., Ganoderma applanatum, Lentinus tuber-regium, Cyathus spp Stereum spp* and *Lentinus sajo-caju* were brown though few had black or cream patches. *Schizophyllum commune, Termitomyces mammiformis, Coprinus nivenus, Termitomyces robustus, Geastrum spp* an *Hydnochaete spp* were white while *Chlorophyllum spp* and *Lactinus piperatus* were light orange and deep orange respectively. *Agaricus campestris* was light purple while *Lentinus squarrosulus, Psathyrella candolleana* and *Lentinus sajo-caju* were cream. The cap of *Auricularia spp, Lentinus squarrosulus* and *Ganoderma applanatum* were kidney shaped. *Schizophyllum commune, Lentinus tuber-regium, Termitomyces robustus, Lactinus piperatus, Hydnochaete spp* and *Lentinus sajo-caju* were flat.

Polyporus spp and *Cyathus spp.*were tapering, *Termitomyces mammiformis, Coprinus nivenus, Psathyrella candolleana, Geastrum spp* and *Agaricus campestris* were conical, *Chlorophyllum spp* was cup shaped while *Stereum spp* was spherical. Stipes were absent in *Auricularia spp., Geastrum spp, Trichaptum biforme, Ganoderma applanatum* and *Geastrum spp.* The colour of the stipes varied from white in *Schizophyllum commune, Coprinus nivenus, Termitomyces robustus* and *Psathyrella candolleana* to cream in *Chlorophyllum spp, Lentinus squarrosulus, Hydnochaete spp Lentinus sajo-caju, Lentinus tuber-regium* and *Termitomyces mammiformis* and brown in Polyporus spp, Cyathus spp, Stereum spp and *Lactinus piperatus.*

Variations were also observed in the spacing of the gills. Gills of *Auricularia spp, Schizophyllum commune, Coprinus nivenus, Lactinus piperatus* and *Lentinus sajo-caju* were widely spaced*; Trichaptum biforme, Lentinus squarrosulus, Ganoderma applanatum, Termitomyces mammiformis* and *Termitomyces robustus* were crowded while *Lentinus tuber-regium, Psathyrella candolleana* and *Agaricus campestris* were closely spaced. Annulus was absent in all the mushroom species except *Agaricus campestris.* Table 3 shows the dimensional characteristics (cap size and stipe length) of the mushrooms. The cap size ranged from 3.00cm in *Psathyrella candolleana* to 24.9 cm in *Trichaptum biforme* while the stipe length ranged from 1.20cm in *Hydnochaete spp* to 15.60 cm in *Termitomyces mammiformis.*

DISCUSSION

The occurrence of mushroom species has been reported by several researchers in different parts of the world (Buyck, 1994; Oei, 2003; Adejumo, *et al., 2015;* Andrew *et al.,* 2013; Osemwegie and Okhuoya, 2009). In comparison with previous studies (Hyde *et al.,* 1997; Andrew *et al.,* 2015), variations were observed in the checklist of species observed from each of the studies. This may be attributed to variations in the ecosystems that were studied which may differ in climate, physiognomy, synecology, litter fall dynamics and composition, succession and geography.

The variations may also be due to differences in the composition of the biota, level of competitiveness amongst biota and the level of human disturbances. The number of species recorded during a study may be a function of the area surveyed coupled with the duration and time of foray (Arnold, 1992; Osemwegie, 2006; Cifuentes and Villaruel-Ordaz, 2006). The distribution of the mushrooms on different substrates is in accordance with previous studies (Tibuhwa, 2011; Adejumo *et al.,* 2015; Nwordu *et al.,* 2013). The morphological characters and the dimensional characteristics recorded in this study compared favourably with that of Adejumo *et al. (*2015) and Nwordu *et al.* (2013).

Table1. Taxonomic profile, substrates and edibility status of the mushrooms

S/N	Scientific name	Local name	family	Substrate	Status
1	*Schizophyllum commune*	Ese adiye	Schizophyllaceae	Leaf litters	Edible
2	*Termitomyces mammiformis*	Osun rooro	Lycophyllaceae	Soil	Edible
3	*Lentinus tuber regium*	Osun Owu	Pleurotaceae	Ploughed land	Edible
4	*Lentinus squarrosulus*.	Osun awo	Polyporaceae	Dead wood	Edible
5	*Agaricus campestris*	Osun tractor	Agaricaceae	Ploughed land	Edible
6	*Psathyrella candolleana*	Osun wowo	Psathyrellaceae	Dead wood	Edible
7	*Termitomyces robustus*	Osun ogogo	Lycophyllaceae	Soil	Edible
8	*Lactinus piperatus*	Osun ata	Russulaceae	Dead tree	Edible
9	*Hydnochaete* spp.	Atipa – tipa	Hymenochaetacea	Mango tree	Edible
10	*Lentinus sajo-caju*	Owu oyibo	Polyporaceae	Cultivated soil	Edible
11	*Polyporus* spp.	Eleuruju	Polyporaceae	Wood	Edible
12	*Auricularia* spp.	Unknown	Auriculariaceae	Dead tree	Inedible
13	*Chlorophyllum* spp.	Unknown	Agaricaceae	Trees	Inedible
14	*Trichaptum biforme*	Unknown	Polyporaceae	Hardwood	Inedible
15	*Ganoderma applanatum*	Unknown	Ganodermataceae	Dead wood	Inedible
16	*Coprinus nivenus*	Unknown	Agaricaceae	Palm frond	Inedible
17	*Cyathus* spp.	Unknown	Nidulariaceae	Wood	Inedible
18	*Geastrum* spp.	Unknown	Geastraceae	Rotten leaves	Inedible
19	*Stereum* spp.	Unknown	Stereaceae	Tree bark	Inedible

Table 2. Morphological profile of the mushrooms

S/N	Scientific name	Cap color	Cap shape	Stipe color	Stipe shape	Gills	Anulus
1	*Schizophyllum commune*	White	Flat	White	Short club shaped	widely spaced	Absent
2	*Termitomyces mammiformis*	White with Cream patches	Conical	Cream with brown	Long and tapering	Closely spaced	Absent
3	*Lentinus tuber regium*	Light brown with cream spots	Flat	Cream	Long and tapering	Closely spaced	Absent
4	*Lentinus squarrosulus*	Cream	kidney shaped	Cream	Tapering	Crowded	Absent
5	*Agaricus campestris*	Light purple	Conical	Cream	Long	Closely spaced	Present
6	*Psathyrella candolleana*	Cream to brown	Conical	White	Tapering	Closely spaced	Absent
7	*Termitomyces robustus*	White	Flat	White	Tapering	Crowded	Absent
8	*Lactinus piperatus*	Deep orange to brown	Flat	Brown	Long	Widely spaced	Absent
9	*Hydnochaete* spp.	White	Flat	Creamy	Short	Widely spaced	Absent
10	*Lentinus sajo-caju*	Cream to brown	Flat	Creamy	Tapering	Smooth	Absent
11	*Polyporus* spp.	Brown with cream patches	Funnel shaped	Light brown	Long	Smooth	Absent
12	*Auricularia* spp.	Brown	Kidney shaped	___	___	Widely spaced	Absent
13	*Chlorophyllum* spp.	Light orange	Cup shaped	Cream	Short club shaped	Smooth	Absent
14	*Trichaptum biforme*	Greenish brown	Rudimentary	____	____	Closely crowded	Absent
15	*Ganoderma applanatum*	Greenish brown	Rudimentary	____	____	Closely crowded	Absent
16	*Coprinus nivenus*	White with black patches	Conical	White	Long	Widely spaced	Absent
17	*Cyathus* spp.	Golden Rrown	Tapering	Brown	Tapering	Wrinkled	Absent
18	*Geastrum* spp.	White	Conical	___	____	Smooth	Absent
19	*Stereum* spp.	Brown and cream	Spherical	Brown	Short	Wrinkled	

Table 3. Dimensional characteristics of the mushrooms

S/N	Species	Cap size (cm)	Stipe length (cm)
1	*Schizophyllum commune*	19.70±2.01	1.41±2.10
2	*Termitomyces mammiformis*	19.60±2.26	15.60±1.83
3	*Lentinus tuber regium*	16.50±1.31	7.80±1.26
4	*Lentinus squarrosulus*.	13.80±1.05	3.90±0.09
5	*Agaricus campestris*	5.30±0.19	4.50±0.23
6	*Psathyrella candolleana*	3.00±0.83	4.00±0.51
7	*Termitomyces robustus*	10.00±2.12	7.00±1.59
8	*Lactinus piperatus*	4.00±1.01	1.50±0.88
9	*Hydnochaete* spp.	6.70 ±1.10	1.20±0.90
10	*Lentinus sajo-caju*	21.90±3.62	5.10±2.47
11	*Polyporus* spp.	20.50±2.22	4.30±1.19
12	*Auricularia* spp.	6.53±1.10	___
13	*Chlorophyllum* spp.	5.33±0.27	1.70±0.32
14	*Trichaptum biforme*	24.90±3.54	___
15	*Ganoderma applanatum*	13.80±2.05	___
16	*Coprinus nivenus*	9.75±2.40	12.30±1.74
17	*Cyathus* spp.	11.80±1.21	3.15±1.30
18	*Geastrum* spp.	7.00±1.11	___
19	*Stereum* spp.	9.15±1.15	1.43±0.09

CONCLUSION

The rich diversity of mushrooms in Ekiti State offers huge socio-economic potentials. However, they need to be properly documented for optimum application. Hence, this study is an important first step towards producing a checklist of mushrooms in Ekiti State. The economic considerations apart, this study has also provided a baseline reference for further ecological, ethno mycological and diversity study of mushrooms in the state. Furthermore, it has contributed to the knowledge on distribution of mushrooms in Nigeria, which had earlier been poorly reported.

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