

---

**STUDIES ON THE MORPHOLOGY AND TAXONOMY OF SOME SPECIES OF TRICHOLOMATACEAE IN ZARIA, KADUNA STATE — NIGERIA.**

---

**Ali, B. D<sup>\*1</sup>; Khan, A.U<sup>2</sup> and Musa, H<sup>2</sup>**<sup>1</sup>*Department of Biological Sciences, Adamawa State University, Mubi, Adamawa*<sup>2</sup>*Department of Biological Sciences, Ahmadu Bello University, Zaria, Kaduna**E-mail: [lammababs@yahoo.com](mailto:lammababs@yahoo.com)***ABSTRACT**

A detail morphological description of six taxa belonging to the family *Tricholomataceae* was carried out. The taxa were described and identified using conventional keys, as *Hygrophoropsis aurantiaca*, *Pleurotus* sp, *Ompholatus olivascens*, *Cantharellus infundibuliformis*, *Cantharocybe gruberi* (A. H. Sm) H. E. Bigelow & A. H Sm. and *Clitocybe alexandri*. This is the first report on *Tricholomataceae* from Northern Nigeria. The species were deposited in the herbarium of the Department of Biological Sciences, Ahmadu Bello University, Zaria.

**Keywords:** *Morphology, Taxa, Tricholomataceae, Nigerian Agaricales.*

**INTRODUCTION**

Tricholomataceae is by far the largest and most diverse family of pale-spored agarics which contains many genera (1). Though, most of the species are terrestrial, many grow on wood—whereas other pale spored families are almost exclusively terrestrial, but a few, such as *Marasmius oreades*, grow in grass (1). The numerous genera and species of the fungi classified here are characterized by white or pale lilac-drab or pale buff to yellowish spore deposits and by the lamellae trama being composed of hyphae with typically parallel to interwoven arrangement, rarely slightly divergent (2, 3, 4). The lamellae is attached, annulus present or absent, pileus and stipe not separating clearly and readily and spore walls smooth or roughed (1). The *Ompholatus* is a genus with golden-yellow to olive-yellow to bright orange mushrooms growing from hard wood trees, stumps and roots (4). *Pleurotus* is an artificial grouping of pale-spored, wood inhabiting agarics with a consistently off-centre to lateral or absent stalk. It is small to large wood-inhabiting mushrooms usually growing shelf like. Pileus is smooth or hairy, dry or viscid. Flesh is soft, rubbery, pliant, or tough with adnate or decurrent gills. Spores are usually smooth, not amyloid except for *Panellus* (1). The genus *Clitocybe* is a large and complex group of soft, fleshy, pale-spored mushrooms with no veil and a central usually fleshy stem. The spore colour is typically white, buff, or yellowish. Spores are smooth or roughed but not ridged or angular; usually not amyloid. Over 200 species of *Clitocybe* occur in North America. About 50 species are listed for California (1). The *Cantharellus* are colourful and conspicuous mushrooms with a more or less vase-shaped to funnel-shaped fruiting body. In *Cantharellus*, the pileus is broadly convex to plane or vase-shaped and often brightly coloured; gills are usually present and the spores are smooth. The pileus is usually depressed to vase-shaped or trumpet-shaped at maturity, surface not typically viscid (1). Tricholomataceae embraces more genera than any other family of gilled mushrooms, and its taxonomy is still in a state of flux. Many of the genera are defined by osteric chemical and microscopic characteristics which present obvious problems when

attempting to construct or use a key based solely on field characters (1). There are reports on new taxa of Tricholomataceae from Central America (5), Britain (6) and Northeast Brazil (7). A few records of Agaricales exist in the published literatures from the northern Nigeria but none exist on Tricholomataceae in this region (9, 10). This work is aimed at studying the morphology and taxonomy of some species of Tricholomataceae in Zaria, northern Nigeria.

## **MATERIALS AND METHODS**

### **Mushroom Collection**

The mushrooms were collected from the wild within Ahmadu Bello University Main Campus, Zaria, during rainy season. The basidiomata of the mushrooms were photographed using digital camera. During the collection, hand trowel was used to dig up the base of mushrooms from the soil. The habitat, locality, and date of collection were recorded in a field notebook. The collected mushrooms were carefully kept in cellophane paper bags and covered accordingly. Basket was used to convey the mushrooms to the laboratory for morphological studies. Macroscopic analysis of the Basidiomata followed Gillman (10), Arora (1), Kenderick (11) and Kuo (12) as follows:

Annulus and volva were observed to note whether present or absent. Where present, their various shapes were recorded.

### **Anatomical Studies**

Spore prints from the collected mushrooms were obtained following the procedure suggested by Christensen (13). Colour of the spore prints were observed and noted under incandescent light. Spores taken from the spore prints were mounted in Melzer's reagent and observed under oil immersion of the light microscope to note various characters such as shape, surface, wall thickness, and colour. Measurement of spores' sizes was carried out using a calibrated microscope. Ten mature spores were measured and the range of lengths and widths of spores were recorded following the method of Kuo (12).

### ***Basidia, Cystidia, and Lamellae Trama***

A thin cross section of the lamellae was made using a microtome to reveal the hymenial layer for both sides of the trama. The arrangement of the lamellae trama was observed under the microscope to note shapes of the basidia and cystidia. The number of basidiospores borne on the basidium and their arrangement were observed and recorded.

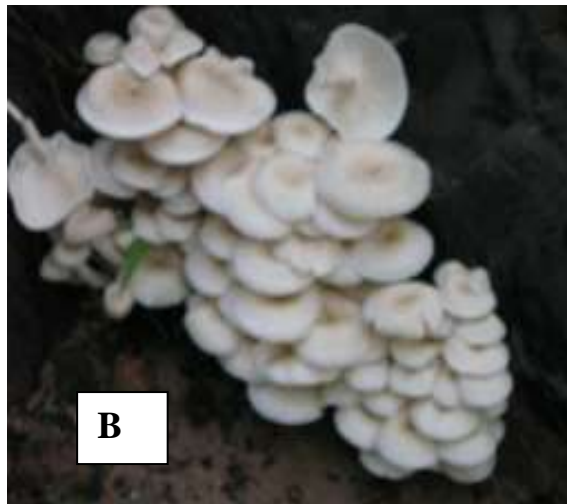
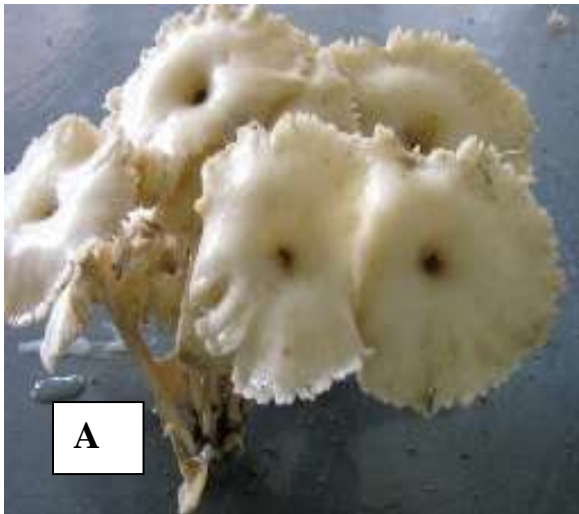
### **Taxonomic Studies**

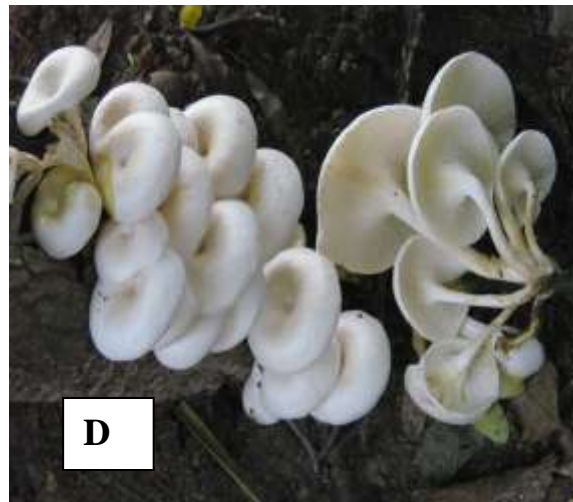
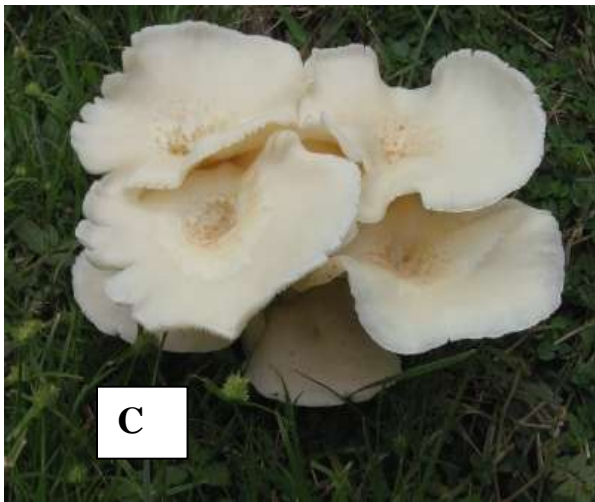
After recording the morphological features of the collected mushrooms, they were compared with documented species using the keys of Smith (2), Zoberi (4), Gillman (10), Kerrigan (14), Arora (1), Kenderick (11), and Kuo (12) to ascertain their taxonomic positions.

## **DESCRIPTION OF THE STUDIED TAXA**

### ***Hygrophoropsis aurantiaca* (Plate 1A, Figs. 1-4)**

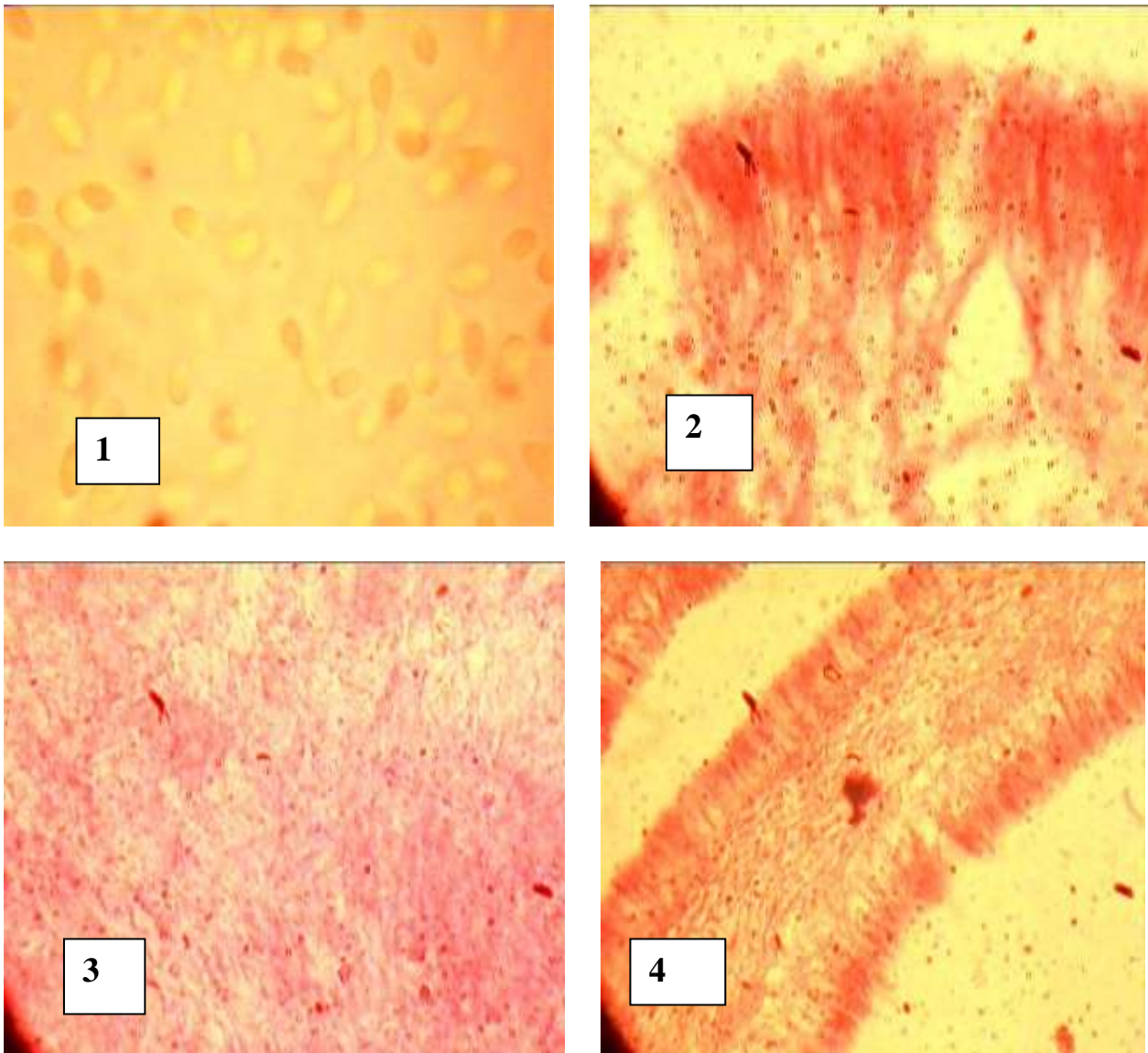
*Habit and habitat:* found growing on soil in clustered. *Spore print:* white/cream. *Pileus:* orange, 5.0-7.0 cm broad, convex when young, changes to plane at maturity, smooth and moist, thin, margin straight, edges appendicular. *Lamellae:* cream, subdistant, forked or decurrent, thick, and moist. *Stipe:* 7.0-9.0 cm long, 0.2-0.5cm thick, cream, tough, centric, equal, somewhat twisted. *Basidiospores:* 4.0-6.75 x 2.5-3.5µm. *Spore characteristics:* elliptic, rough, thin-walled, inamyloid. *Basidia* tetrasporic. *Lamellae trama* Parallel. *Cystidia* unusually lance-shaped. The morphological details in this collection conformed to the description given by Arora (1). It however, differs in having a dark cream spore print with a smooth and fleshy pileus, smaller spore size which are slightly rough (Fig.1). The pileus is usually brown at the centre and lighter or brighter toward the margin, but in some forms it is completely brown and in others it is whitish. The typically bright orange, decurrent, dichotomously forked gills and white spore print are the principal field marks of this variable fungus. Also, *Hygrophoropsis* has flimsier flesh, a browner pileus, is less robust, differently shaped (not as wavy or frilled) and sometimes grows on rotten wood (1).





**Plate 1.** Basidiomata. **A.** *Hygrophoropsis aurantiaca*,. **B.** *Pleurotus* sp. **C.** *Ompholatus olivascens*. **D.** *Cantharellus infundibuliformis*. **E.** *Cantharocybe gruberi*. **F.** *Clitocybe alexandri*.





**Figs. 1-4.** Microscopic features of *Hygrophoropsis aurantiaca*.

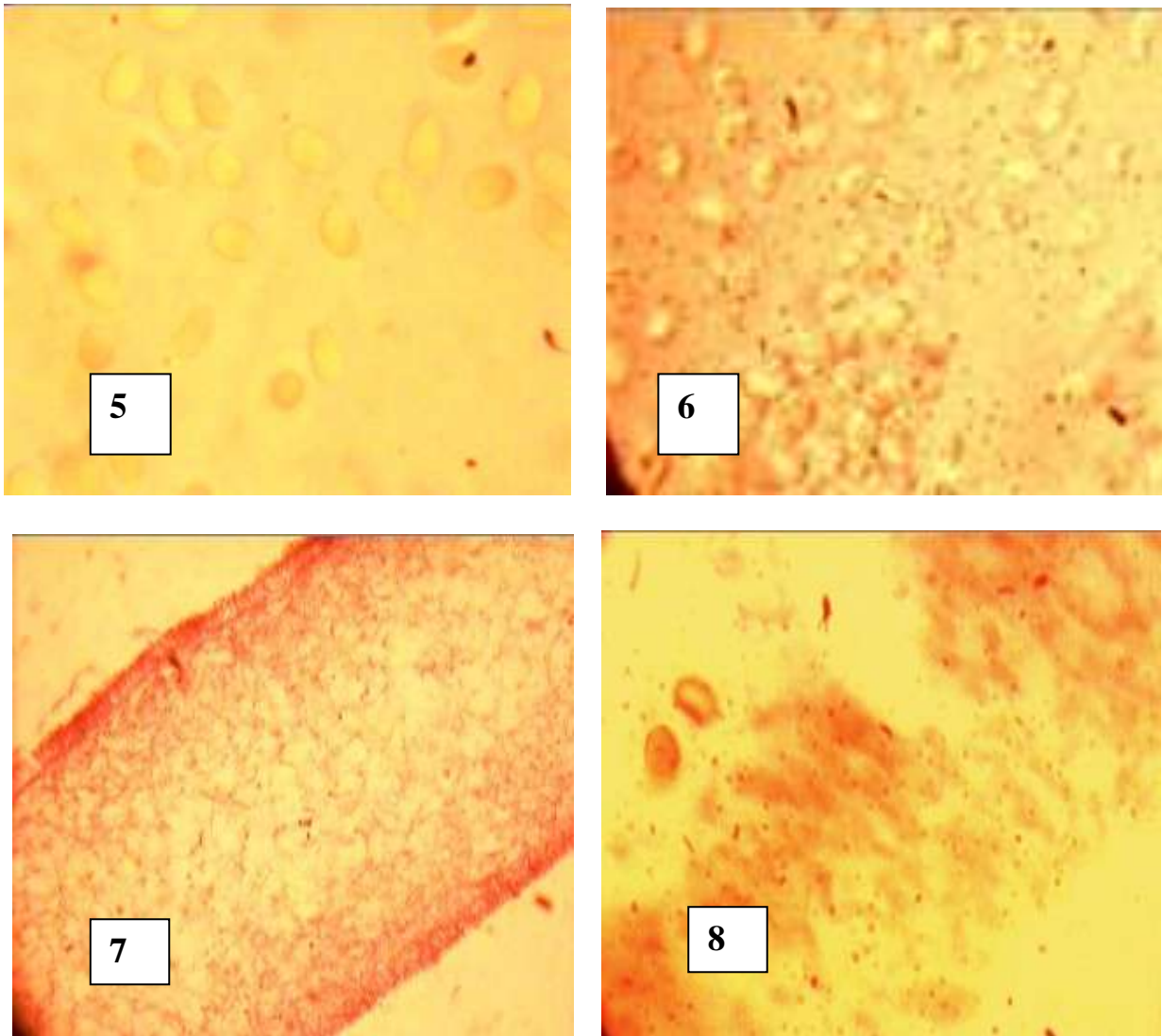
- 1.** Basidiospores in Melzer's reagent dextrinoid x 1000 **2.** Cystidia x 1000.  
**3.** Lamellae trama parallel x 400 **4.** Pileus cuticle filamentous x 40.

***Pleurotus* sp. (Plate 1B, Figs. 5-8).**

*Habit and habitat* gregarious, found growing on dead wood. *Spore print* cream; *Pileus* 5-9 cm broad, cream, convex with an in-rolled margin, centrally depressed, smooth and thick, edges crenulated. *Lamellae* cream, close, decurrent, netted, with lamellulae, thick, edges serrated. *Stipe* 7-9 cm long; 0.5-0.8 cm thick, tightly stuffed, centric, equal, smooth, and silky. *Basidiospores*: 4-5.5 x 2.5-3µm. *Spore characteristics* elliptical, rough, thin-walled, and inamyloid. *Basidia* tetrasporic. *Lamellae trama* interwoven:

This collection was compared with the macroscopic and microscopic features provided by Arora (1) and was found to possess characteristics similar to species in the genus *Pleurotus*.

The most common genus *Pleurotus* can be recognized by its rather soft, fleshy fruiting body.



Figs 5-8:

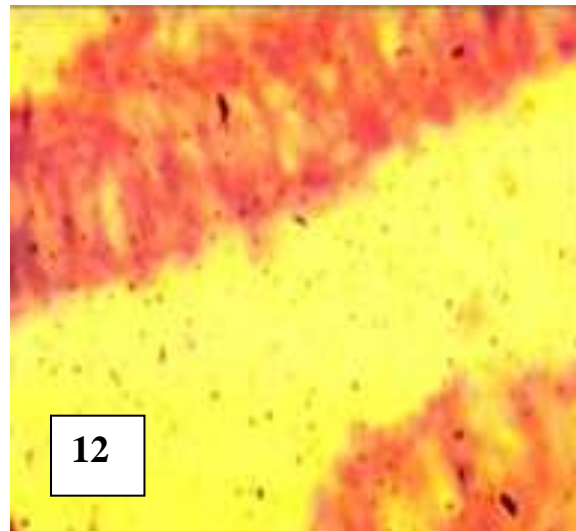
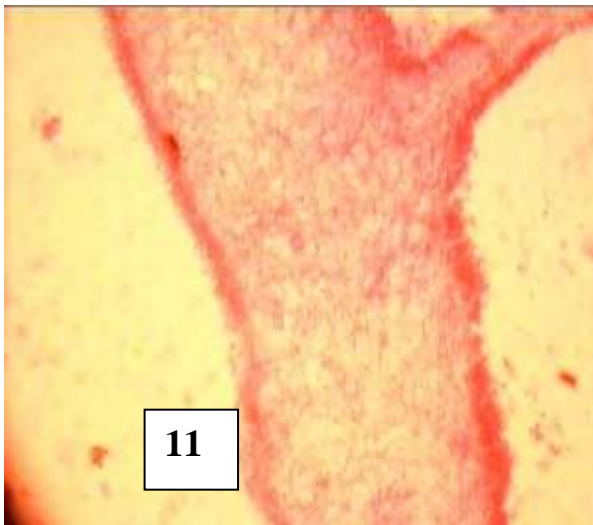
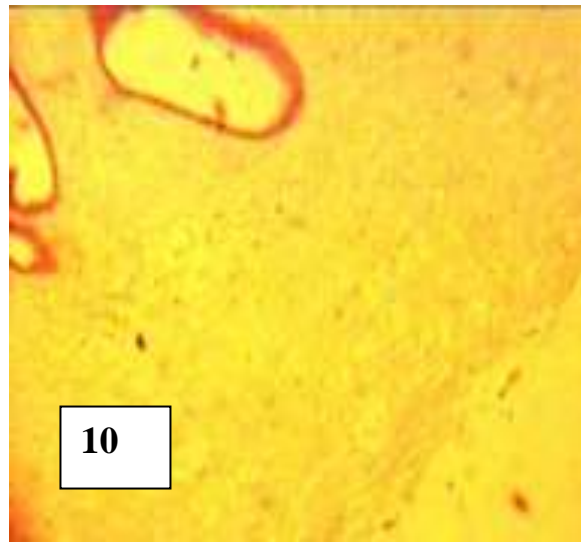
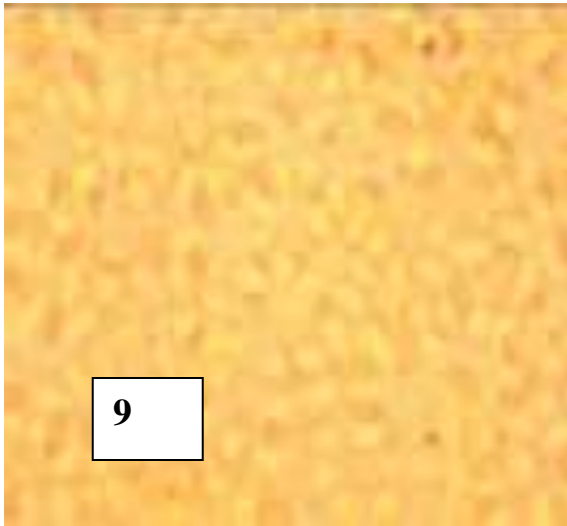
Microscopic features of *Pleurotus* sp.

**5-** Basidiospores in Melzer's reagent dextrinoid x 1000, **6-** Basidiospores in water x 1000, **7-** Lamellae trama interwoven x 400, **8-** Basidia with four basidiospores x 1000.

***Ompholatus olivascens* (Plate 1C, Figs. 9-12).**

*Habit and habitat* clustered on soil. *Spore print* pale; *Pileus* white when young to slightly dark brown at maturity, 7.0-9.0 cm broad, smooth, tough and fleshy, depressed, margin shape upturned, edge striate; *Lamellae* cream, close, and deep with numerous lamellulae, decurrent, thick and wet, edges crenated. *Stipe* 8.0-9.0 cm long, 1.0-1.2 cm thick, cream, tightly stuffed, tough and fibrous, almost equal, centric, forming a root-like base. Basidiospores 6.0 x 7.0-4.5 x 6.0 μm. *Spore characteristics* round to nearly round, thin-walled,

smooth, and inamyloid. *Lamellae trama* interwoven. The morphological features obtained in this collection conformed to the characteristics given by Arora (1) but differing by having scaly pileus at maturity. The bright yellow-orange to olive colour, decurrent lamellae, pale spores, and tendency to grow in clusters distinguish this handsome mushroom. The cantharelle (*Cantharellus cibarius*) is somewhat similar but has thick, shallow, blunt foldlike gills and white flesh .



**Figs 9-12.**

Microscopic features of *Ompholatus olivascens*

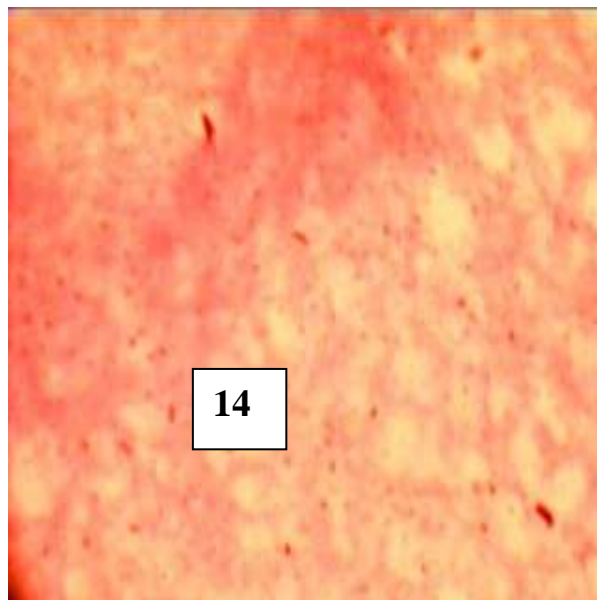
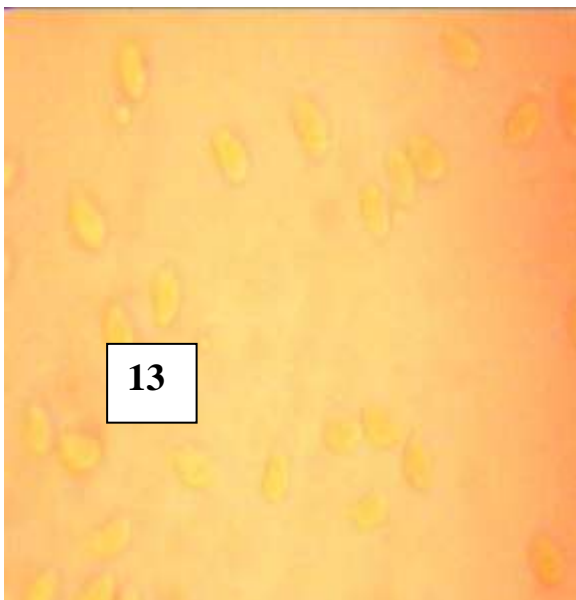
**9-** Basidiospores dextrinoid in Melzer's reagent x 1000, **10-** Pileus cuticle filamentous x 100, **11-** Lamellae trama interwoven x 400, **12-** Cystidia x 1000.



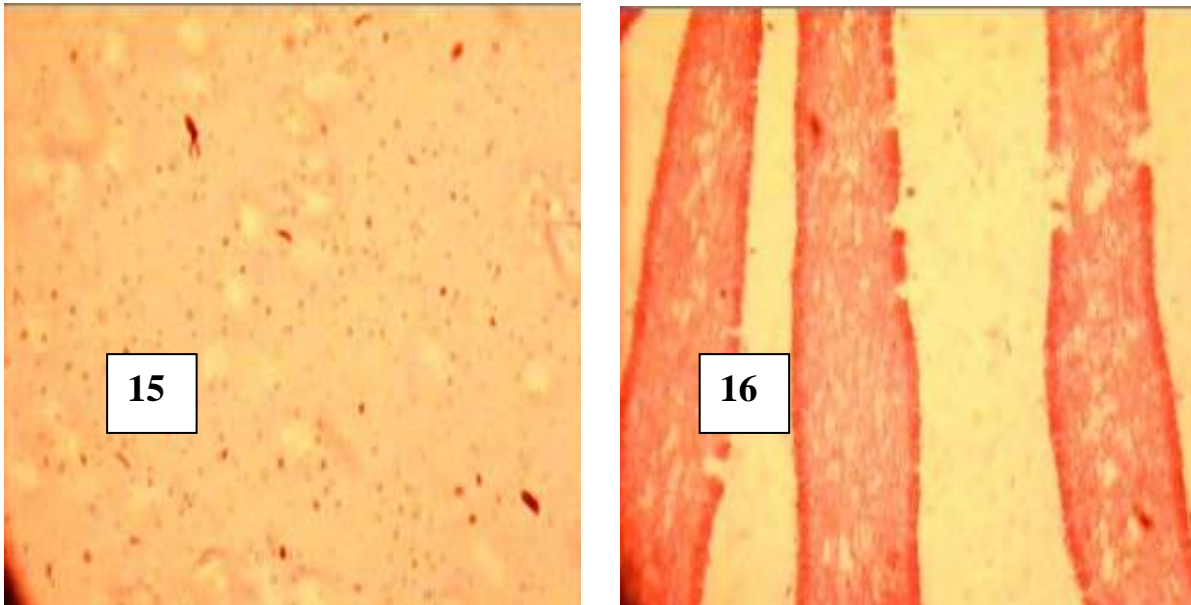
***Cantharellus infundibuliformis* (Plate 1D, 13-16).**

*Habit and Habitat* clustered, on dead log. *Spore print deposit* cream.

*Pileus* 4.0-6.0cm broad, fibrillose, convex with incurved margin, eventually becoming funnel-shaped in maturity. *Lamellae* cream, crowded, shallow, dry, decurrent, and occasionally forked. *Stipe* 4.0-8.0cm long, 0.4-0.7cm thick, dry, tough, centric to eccentric, equal, sometimes narrowing towards the base. *Basidiospores* 4-5.5 x 3.0-4.0  $\mu\text{m}$ , elliptic, rough, thin-walled, and dextrinoid. *Lamellae trama* interwoven. *Pileus cuticle* filamentous. The morphological feature in this collection is in conformity with the descriptions given by Arora (1) in both macroscopic and microscopic features and is typical of *Cantharellus infundibuliformis*. The most outstanding characters of this species of *Cantharellus* yellowish to gray or purple-tinged gills, and slender, hollow, yellow to yellow-orange stalk. The gills have a somewhat waxy look which can be mistaken for *Hygrocybe* and *Camarophyllus* but are characteristically 'cantharellesque'; thick, blunt, shallow, and conspicuous forked or veined and/or waxy (1).







**Figs. 13-16**

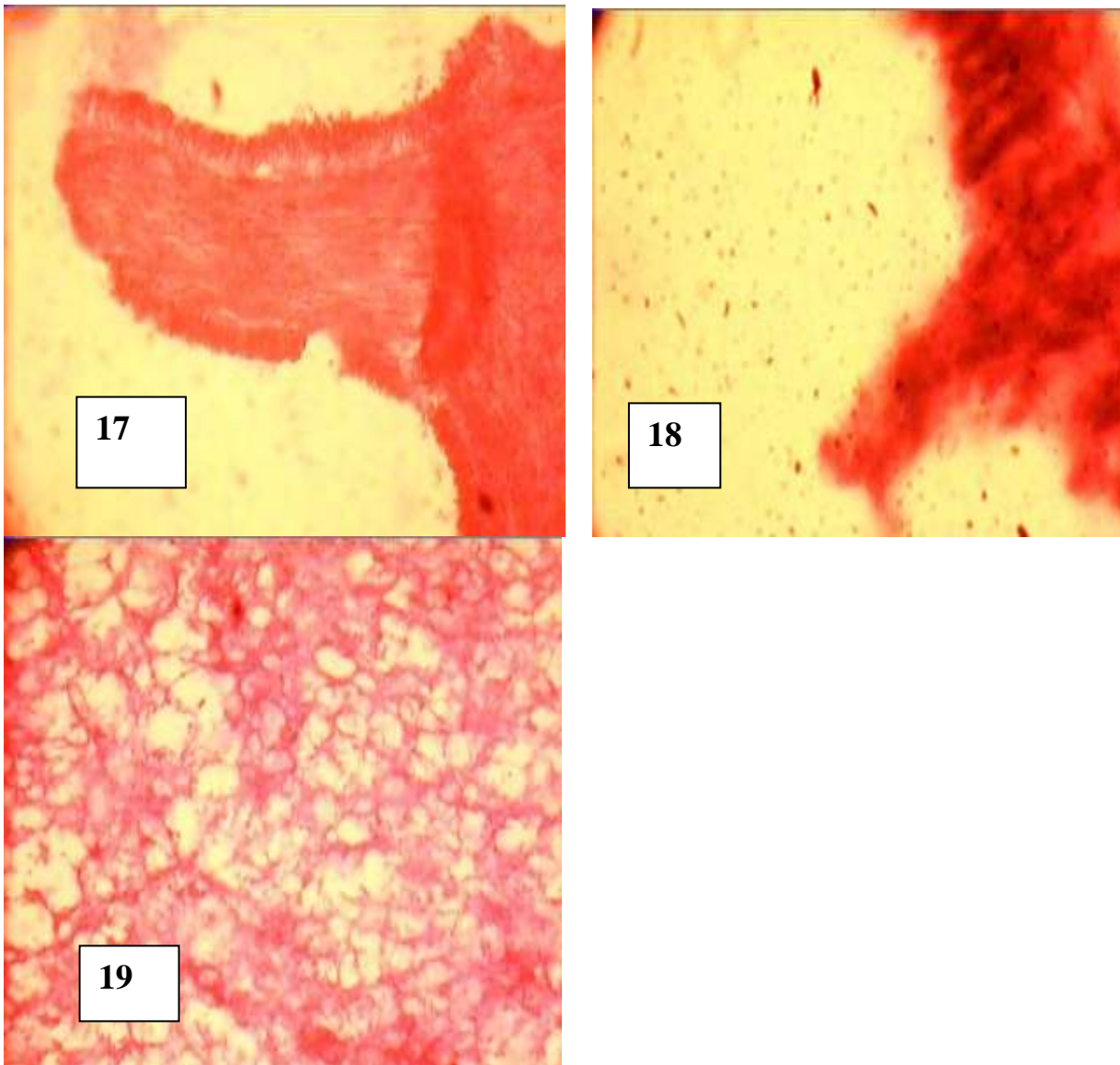
Microscopic features *Cantharellus infundibuliformis*

**13**-Basidiospores dextrinoid in Melzer's reagent x 1000, **14**- Pileus cuticle filamentous x 100, **15**-Basidiospores in water x 1000, **16**- lamellae trama interwoven x 400.

***Cantharocybe gruberi*** (A. H. Sm) H. E. Bigelow & A. H Sm. (**Plate 1E, Figs. 17-19**).

*Habitat and habit* on soil near *Casia samie*, scattered to gregarious.

*Pileus* 10-11 cm broad, white to cream colour, convex, smooth, thick, incurved, edge entire, margin extends beyond the lamellae. *Lamellae* cream to yellowish, sub distant, dried, and thick, adnate to free becoming slightly decurrent in age; edges entire. *Stipe* 3-4.5 cm long, 1-3 cm thick, short, white to yellowish, solid; granulose; easily snapped away, centric, with a bulbous base, shallowly embedded in the soil. The morphological characters in this collection were compared with the morphological details given by Kendrick (11) and were found to be same in macroscopic features. However, this collection slightly differs in having an adnexed to sub-decurrent lamellae, and a smooth pileus. The pileus in this species according to Arora (1) could be up to 20cm broad. The distinguishing characters of this species include white pileus that changes to pale yellow to lemon yellow, thick and shorter stipe of about 5cm long ( 11).



**Figs 17-19**

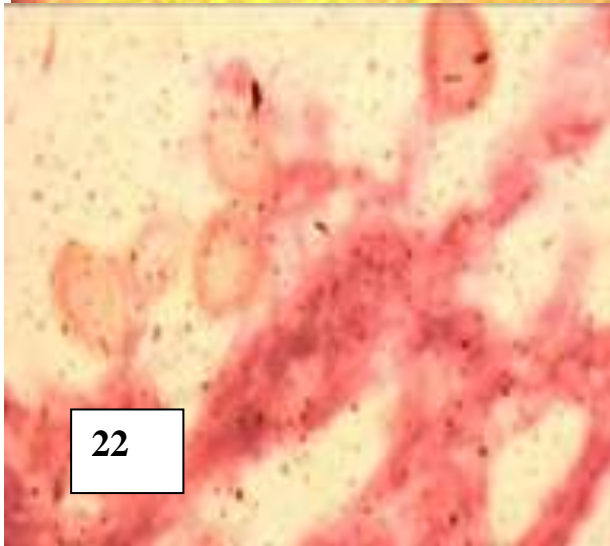
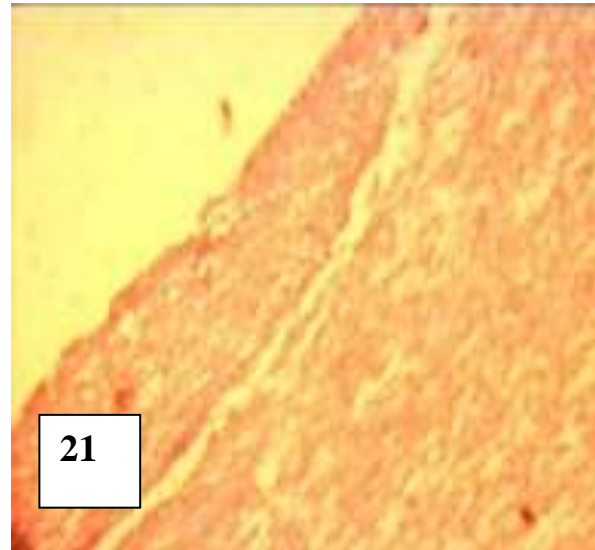
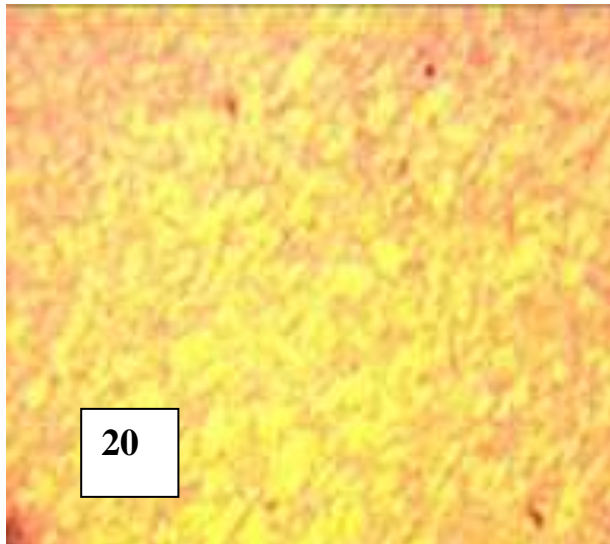
Microscopic features *Cantharocybe gruberi*

**17**- Lamellae trama parallel x 100, **18**- Cystidia x1000, **19**- Pileus cuticle cellular x 100.

***Clitocybe alexandri* (Plate 1H, Figs. 20-22).**

*Habit and habitat* clustered, lignicolous, found growing on dead log. *Spore print deposit* white. *Pileus* 7-8 cm broad; white, smooth but crack with age; convex with incurved margin; with a slight depression in the centre; extends beyond the lamellae, edge entire. *Lamellae* white, which turns to brown when matured; close, thick, crowded then slightly sub distant with age, adnate to slightly decurrent. *Stipe* 8-9 cm long; 2-4 cm thick, white, solid, centric to slightly eccentric, with numerous fibrils covering the entire surface; equal, or widening down forming an enlarged base with copious white tomentum imbedded in the substrate.

*Basidiospores* 7-9 x 5-6 $\mu$ m, broad elliptic, thick-walled, smooth, inamyloid. *Basidia* four-spored. *Pileus cuticle* filamentous. The morphological details in this collection conformed to the description given by Kendrick (11). However, this collection has larger fruit bodies, larger spore that are slightly thick-walled compared with the size recorded by Kendrick (11). This species was found growing in clusters on decayed wood. It is distinguished from other species by having fruit bodies darkening to brown in age, and white spore deposit, elliptic, smooth, inamyloid spores.



**Figs. 20-22**

Microscopic features *Clitocybe alexandri*

**20**-Pileus cuticle filamentous x 100, **21**- Lamellae trama interwoven x 100.

**22**-Basidium bearing four basidiospores x 1000.

## **CONCLUSION**

The species of Tricholomataceae were morphologically diverse in the study area. However, similarities were recorded which are considered basic characters of the groups such as white, creamy to lilac buff spore print and decurrent lamellae trama.

## **REFERENCES**

- Arora, D. (1986). *Mushrooms Demystified. A comprehensive Guide to the fleshy mushrooms*. Second edition, Ten Speed Press, Berkeley. 986pp
- Smith, A.H. (1971). *The mushroom hunter's field Guide*. University of Michigan Press, Michigan. 264pp.
- Thiers, H.D. (1982). *The Agaricales (Gilled Fungi) of California*. Mad River Press. 60p.
- Zoberi, M.A. (1972). *Tropical macro fungi*. Macmillan Press, London. 158pp.
- Ovrebo, C.L. and Baroni, T.J. (2007). New Taxa of *Tricholomataceae* and *Entolomataceae* (Agaricales) from Central America. *Fungal Diversity*, 27: 157-170.
- Watson, L. and Dallwitz, M.J. (2008) onwards. The families of mushrooms and toadstools represented in the British Isles. Version: 1<sup>st</sup> November 2012. <http://delta-inkkey.com/>.
- Araujo, J.P.M., Coimbra, V.R.M. and Wartchow, F. (2011). *Leucopaxillus gracillimus* (Tricholomataceae, Basidiomycota): new record from Northeast Brazil and notes on its distribution. *Kurtziana* 36(2):5-9.
- Ali, B.D., Khan, A.U., Dangora, D.B and Wuyep, P.W. (2010). The Agaricaceae of Northern Nigeria I: Their Morphology and Taxonomy. *African Journal of Biosci.*, 3 (2): 13-19.
- Ali, B.D and Khan, A.U. (2011). Morphology and Taxonomy of some species of Agaricales from Northern Nigeria. *International Journal of Biological Science*, 3 (1): 119-125.
- Gillman, L. (1978). Identification of common poisonous mushrooms. *In*: Rumack, B. H. and Salzman, E. (Ed), *Mushroom poisoning: Diagnosis and treatment*, CRC Press, Inc, Florida. Pp. 27-57.
- Kenderick, B. (2000). *The fifth Kingdom*; 3<sup>rd</sup> edition. Focus Publishing R. Pullins Company, Newburyport MA USA. 373pp.
- Kuo, M. (2004). The gilled mushrooms (Agaricales). Retrieved from the *Mushroomexpert.com*. Website: <http://www.mushroomexpert.com/agaricales.html>



Christensen, C.M. (1982). *Edible mushrooms*. University of Minnesota press, Minneapolis.  
118pp.

Kerrigan, R.W. (1986). *The Agaricales (Gill fungi) of California*. Mad River Press, Eureka, CA,  
400pp.