

# A RETROSPECTIVE UPDATE ON THE *AURICULARIA* SPECIES IN GHANA AND THEIR NUTRITIONAL, ETHNOMYCOLOGICAL AND PHARMACOLOGICAL VALUES FOR HEALTH

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## ABSTRACT

The genus *Auricularia* contains mushrooms that are known for their edibility, ecological value; as decomposers and nutrient cycling. They also contain medically useful bioactive compounds; mostly polysaccharides with numerous pharmacological activities (antioxidant, anti-tumour, immunomodulatory, hypolipidemic, antidiabetic, anti-microbial, hepatoprotective etc.). They also contain nutritive compounds useful as nutraceuticals and are cultivated worldwide. We set out to update the collecting localities of *Auricularia* in Ghana with the view to extend the list of national occurrence. Field trips were made from August 2022 to July 2023 to Ashanti, Oti, Western North and Eastern Regions to record new localities of *Auricularia*. A desktop study collated the nutritional, medicinal and other bioactive compounds resident in the mushroom to assess potential for economic exploitation for health delivery. Morphological, anatomical and other characteristics of the fruiting bodies were determined to authenticate the samples obtained. *Auricularia cornea* was recorded for the first time on cocoa tree (*Theobroma cacao*) and cassava (*Manihot esculenta* L) sticks in Adansi North (Ashanti Region), Bowiri Amanfro and Bowiri Kyiriahii (Oti Region); Baakokrom, Sefwi Bekwai in the Bibiani-Anwhiaso Bekwai Municipality (Western North Region) as well as the Cocoa Research Institute of Ghana- New Tafo Akim (Eastern Region). There are seven *Auricularia* (*A. auricula-judae*, *A. delicata*, *A. fuscosuccinea*, *A. hunteri*, *A. mesenterica*, *A. polytricha* and *A. cornea*) in Ghana. The morphometric, anatomical and other physical characteristics agree with the reported data in the pertinent literature for *A. cornea*. The plethora of bioactive, nutritive and pharmacologically useful ingredients of the basidiomata makes the mushroom a potential source of economic value and gives credence to its exploitation for health delivery in our developing economy.

**Keywords:** *Auricularia*, Ghana, Collecting localities, Pharmacological, Bioactive and Nutritional components, Medicinal values.

## Introduction

The genus *Auricularia* consists of mushrooms originally described in Europe and belong to the Phylum Basidiomycota; Family

Auriculariaceae; Order Auriculariales (Kirk *et al.*, 2008). They are widely distributed and recognized for their ecological, economic values and medicinal properties (Wu *et al.*,

2021). Most species of *Auricularia* play an important role in the degradation and nutrient cycling processes in the forest ecosystem usually inhabiting angiosperm woods (dead trees, stumps, fallen trunks and branches and rotten wood). A few, however, are seen growing on gymnosperm wood (Wu *et al.*, 2021; Dai and Bau, 2007; Baldrian and Lindahl, 2011).

Records show that seven (7) *Auricularia* species have been found in Ghana on different substrates, and locations between 1999 and 2023 (Piening, 1962; Motey, 2006; Wu *et al.*, 2021). The recent record was on *A. auricular-judae* found growing on dead wood, milk bush (*Thevatia peruviana*), pencil cactus or fire sticks (*Euphorbia tirucalli*; Euphorbiaceae, Malpighiales) (Odamtten *et al.*, 2021). *Auricularia polytricha* (Mont.) Sacc. is also spread worldwide and has been recorded in the Atewa and Achimota Forest Reserves in Ghana (Motey, 2006). The current name is *Auricularia nigricans* (Sw.) Birkebak, Looney & Sánchez-García. In India, *A. polytricha* has been collected from the host tree *Samanea saman* (Garasiya *et al.*, 2007).

*Auricularia* mushrooms are known for their bioactive compounds mostly polysaccharides with numerous pharmaceutical and biological activities such as antioxidants, antitumour agent, immunomodulatory, hypolipidemia, antidiabetic, antimicrobial, anticoagulant, and hepato-protective (Chiu *et al.*, 2014; Ying *et al.*, 1987). *Auricularia* species are also used as food (nutraceuticals) and medicine worldwide (Kadnikova *et al.*, 2015). For example, several species are widely used as important edible and medicinal mushrooms in China and other East Asian countries (Dai & Yang, 2008; Wu *et al.*, 2014). *A. heimuer* was for instance considered as a delicacy of the emperor in Eastern Zhou Dynasty 2000 years ago (Zhang *et al.*, 2005). It has been cultivated for over 1400 years (Zhang *et al.*, 2015). For example, cultivation in China alone, in 2019,

was 7.1 billion kg (fresh weight) of *A. heimuer* valued at over ¥36.5 billion (36.5 billion Yuan = \$5.08 billion USD, as of July 2023). This species is the second most important edible species after *Lentinula edodes* (Berk) Pegler, (Shiitake). Several species within the genus *Auricularia* (*A. cornea*, *A. auricula-judae*, *A. delicata*, *A. fuscossuccinea* *etc.*) are cultivated on commercial scale in China and Southeast Asia and Africa (Khan *et al.*, 2023; Liu *et al.*, 2021; Bastos *et al.*, 2023; Khurena *et al.*, 2020; Thongklang *et al.*, 2020).

The *Auricularia* species in Ghana have a plethora of biologically active secondary metabolites of high therapeutic applications (Sevindik, 2018; Badshah *et al.*, 2015; González-Palma *et al.*, 2016; Gebreyohannes *et al.*, 2019 a,b; Khan *et al.*, 2023; Shahar *et al.*, 2023, Zakaria *et al.*, 2022; Zhao *et al.*, 2023) and also a wide range of secondary antioxidants, anti-diabetic, anti-viral, antithrombotic, anti-inflammatory and antitumour properties worthy of exploitation for health improvement (Bill and Glover, 2016; Walkota and Temesgen, 2018). Recent studies indicate that over 136 mushrooms extracts including those from *Auricularia*, have antimicrobial activity against gram positive and gram negative bacteria (Islam *et al.*, 2021; Oli *et al.*, 2020; Deka *et al.*, 2017). There are other economically beneficial compounds such as polysaccharides serving as functional foods for human health (Liu *et al.*, 2021; Khatun *et al.*, 2012; Gupta *et al.*, 2019; Kadnikova *et al.*, 2015; Mapoung, 2021). *Auricularia* fruiting bodies also contain mineral elements (Ca, Na, K, Mg, Fe, As, Cu, Zn, Co, Cr, Mn, Pb, Ni), vitamins B1, B2, B3, B6, D3, glucose, galactose, xylose, mannose, amino acids, carbohydrates, low fats, crude protein (Li *et al.*, 2023; Wangkheirakpam *et al.*, 2018; Gupta *et al.*, 2018 *etc.*).

The West African *Auricularia* mushrooms are used in folklore medicine

for various ailments including sore throats, sore eyes, jaundice, astringents, blood tonic etc. (Compagnie du champignon sylvestre, 2020; Apertorgbor et al., 2006).). In Chinese restaurants, *Auricularia* species are used to prepare dishes such as hot and sour soup which is available in Ghana Chinese restaurants. In summary, the *Auricularia* species have such a potent source of pharmaceutical factory for bioactive healing compounds and nutraceuticals for beneficial use in our health delivery system.

In view of the apparent economic importance of *Auricularia* species in the country, we set out to update their occurrence in the Oti, Ashanti, Western North, and Eastern Regions of Ghana having done similar surveys in the Greater Accra, Eastern and Ashanti Regions in our earlier reports (Odamtten *et al.*, 2021; Motey, 2006; Piening, 1962). Our objectives were: To update the occurrence of *Auricularia* species in the Ashanti, Eastern, Oti and Western North Regions of Ghana with

the view of assessing the possibility of future commercial cultivation and the exploitation of their nutritive, pharmacological and ethnomycological values in our health delivery system.

### Experimental

A field trip was undertaken from August 2022 to July 2023 to Bowiri Amanfrom: 7°20'56"N 0°27'56"E (Oti Region); Bowiri Kyiriah: 7°19'56"N 0°27'24"E (Oti Region) in August 2022; Adansi North: 6°16'20"N 1°28'4"W, altitude 244±8 metres (Ashanti Region) in October 2022; Baakokrom in Sefwi Bekwai: 6°10'52"N 2°18'22"W, altitude 127±38 metres in the Bibiani-Anhwiaso-Bekwai Municipal (Western North Region) in June 2023; and Cocoa Research Institute of Ghana CRIG-Tafo: 6°13'52"N 0°20'41"W, altitude 222±3 metres (Eastern Region) in July 2023 (Fig. 1). Cocoa farms were inspected for the presence of the fruiting bodies of *Auricularia* on trees, twigs and trunks on floor debris.



Fig. 1: Regions in Ghana where the survey for *Auricularia* has been carried out from 1949-2023; ▼: *Auricularia* species recorded.

### *Anatomical studies*

The anatomy of the hymenium (fertile layer) was studied using the method described by Odamtten *et al.* (2021). Photographs were taken under a photomicroscope (Computer Model Leica ICC50W) with software (Leica LAS EZ version, 1.8.0).

### *Host plant for the edible *Auricularia cornea**

The host plants were mainly cocoa (*Theobroma cacao* L) tree branches and decomposing wood and twigs of cassava (*Manihot esculenta* L). Photographs of the fruiting bodies (Basidiomata) on the hosts were taken using iPhone XR (Model Number: MT3T2LL/A).

### *Desk-top study*

This was a collection of information from the pertinent literature on the nutritional, pharmacological, ethno-mycological and medicinal values of *Auricularia* species in Ghana.

### **Results**

Table 1 summarizes *Auricularia* species recorded in Ghana from 1949-2023. *A. delicate* was found in Aiyola Forest Reserve 6°9'0" N and 0°57'0" W in Degree Minute (Eastern Region) and Asuansi Forest (Ashanti Region) in 1949 (Piening, 1962; Motey, 2006). *A. fuscocuccinea* was also found growing on the rubber plant (*Hevea brasiliensis*) in Tarkwa (Western North Region), in 1949 and *A. mesenterrica* was found at Nsuaem in the Ashanti Region in 1949 (Table 1) (Piening, 1962; Motey, 2006). The more recent find was *A. polytricha* in the Achimota Forest (Motey, 2006) and *A. auricula-judae* at Adenta (Greater Accra Region) (Odamtten *et al.*, 2021). Figures 1a-b and 2-3 show the morphological characteristics of *A. polytricha* and *A. auricula-judae*, respectively.

**TABLE 1**  
Record of *Auricularia* species in Ghana from 1949 – 2023

<i>Auricularia</i> Species	Location of Storage	Substrate; (Place and Date of Collection)	References
<i>A. auricula - judae</i> (Bull) Quet	Ghana Herbarium	Dead orange branch, (USA;1959) Pencil cactus or fire stick ( <i>Euphorbia tirucalli</i> ) (Adenta Municipality Greater Accra, Ghana, 2021)	Motey (2006) Odamtten <i>et al.</i> (2021)
<i>A. delicata</i> (Mont ex Fr.) Henn	Ghana Herbarium	<i>Cola nitida</i> , wood substrate ( Ghana; Asuasi 1949; Aiyola Forest )	Motey (2006) Piening (1962)
<i>A. fuscosuccinea</i> ( Mont ) Farl.	Ghana Herbarium	Rubber Plants; <i>Hevea brasiliensis</i> (Tarkwa, Ghana. 1949, 1956 )	Motey (2006) Piening (1962)
<i>A. hunteri</i> (Llyod)	Ghana Herbarium	Deadwood, ( Ashanti Region, Ghana; Undated)	Piening (1962)
<i>A. mesenterica</i> Dickx. Pat	Ghana Herbarium	Deadwood; ( Nsuaem Ashanti Region, Ghana 1949	Piening (1962)
<i>A. polytricha</i> ( Mont ) Sacc.	Ghana Herbarium	Deadwood (Aburi Gardens Ghana 1956; Achimota 2010; USA 1956	Motey (2006) Piening (1962)
<i>A. cornea</i> Ehrenb.	China; Beijing Musuem of National History	Deadwood, ( PGRI, Aboretum CSIR Ghana, Bunso Nov. 2016 )	Wu <i>et al.</i> (2021)
<i>A. cornea</i> Ehrenb.	Ghana Herbarium	Cocoa trees, cassava sticks (Adansi North, Ashanti, 2022 Region; Bowiri Amanfro and Bowiri Kyiriahi, Oti Region 2022; Baakokrom, Western North Region, 2023; Cocoa Research Institute of Ghana CRIG- Tafo, Eastern Region, 2023)	Collected by J. Addo This Paper

\*\* Obtained from USA; Ghana Herbarium @ Department of Plant and Environmental Biology, University of Ghana, Legon; PGRI: Plant Genetic Resource Institute CSIR, Bunso, Ghana

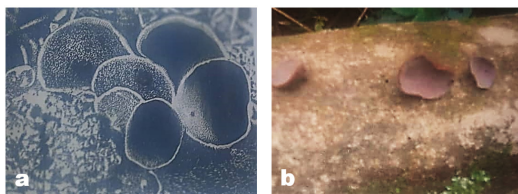


Fig 2: (a) Drawing of *A. polytricha* from Achimota Forest; (b) Live specimen of *A. polytricha* growing on fallen log in Achimota Forest



Fig. 3: *Auricularia auricular-judae* growing on *Euphorbia tirucalli* in Accra, Ghana. (a) rainy season and (b) dry season



Fig. 4: Gelatinous fruiting body of *Auricularia auricular-judae* found in Accra, Ghana

In our recent survey in the Ashanti, Oti, Eastern, and Western North Regions of Ghana, we encountered for the first-time fruiting bodies of *A. cornea* growing on cocoa trees (*Theobroma cacao*) and cassava (*Manihot esculenta*) stems. The morphometric and some physical characteristics of the fruiting basidiomata of *A. cornea* are presented in Table 2 viz-a-viz what is reported in the pertinent literature.

**TABLE 2**  
*Morphometric and some physical characteristics of the fruiting body of Auricularia cornea in Ghana*

Parameter	Current Paper	Literature data	Reference
Length (cm)	4.2-8.1±0.6	8.0-9.0 cm, 1-2 mm thick	Wu <i>et al.</i> (2021) Fig. 5-8
Width (cm)	3.6-4.3±0.5	-	- Fig. 5-8
Colour	Variable; reddish to orange brown, white	Variable; reddish brown, buff to white, orange	Wu <i>et al.</i> (2021) Fig. 5-8
Shape (Basidiomata)	auriculate	auriculate	Wu <i>et al.</i> (2021) Fig. 5-8
Shape/habit (Basidiomata)	adnate, cespitose, non-stipitate, solitary.	adnate, solitary, cespitose.	Wu <i>et al.</i> (2021) Fig. 5-8
Shape (Spores)	allantoid to sausage-shape; thin walled and smooth.	allantoid, hyaline thin walled, smooth	Wu <i>et al.</i> (2021) Fig. 12
Internal Anatomy	medulla present in middle of cross-section; abhymenial hairs with swollen base.	medulla present in the middle or cross-section; abhymenial hair with swollen base.	Wu <i>et al.</i> (2021) Fig. 9-11
Distribution	Africa, North and South America, Asia, Europe; throughout the year.	Africa, North and South America, Asia, Europe; throughout the year.	Li <i>et al.</i> (2021)

Fig 5a and b show *A. cornea* on cassava stem from the Adansi North in the Ashanti Region. Fig 6a and b show *A. cornea* on a cocoa tree branch at Bowiri Kyiriahi in the Oti Region looking morphologically different but shows the abaxial side of the fruit body (Fig 6b). Fig 7a-b represent *A. cornea* basidiomata in the dry state found at Bowiri Amanfrom in the Oti Region while Fig 8a-b and Fig 9 show the same fungus on cocoa tree trunk at Baakokrom in Sefwi Bekwai (Western North Region) and

Cocoa Research Institute of Ghana (Eastern Region), respectively. Clearly, the sizes of the basidiomata differ from one locality to another although they are the same fruiting body of the same fungus (Fig 5-9).

The cross-section of the fruiting body of *A. cornea* shows a medulla present in the middle of the cross-section (Fig 10) shown by an arrow. There is an abhymenial hairs on the exterior of the hymenium (Fig 11) formed from a “hartig net” of mycelium below the hymenial

layer (Fig 12) appearing on the upper surface and microscopically by the presence of an obvious medulla.

Table 3a-c show the results of a desktop study for information on the nutritional, pharmacological (bioactive compounds) and ethnomycological (medicinal) uses of *Auricularia* species in Ghana. Clearly, *Auricularia* species in Ghana have a plethora of active ingredients that can be exploited for human health benefits such as antioxidants, antitumours, immunomodulatory, hyperlipidemic, antidiabetic, anticoagulant, antimicrobial, nutraceuticals and hepatoprotective.



Fig. 5a: *Auricularia cornea* fruiting bodies on Cassava sticks in a cocoa farm at Adansi North (Ashanti Region)



Fig. 5b: Enlarged fruiting body of *Auricularia cornea* on cassava stick (from at Adansi North: Ashanti Region)



Fig. 6a: Top portion of the basidioma of *A. cornea* growing on a cocoa tree branch at Bowiri Kyiriah in the Oti Region



Fig. 6b: Reflex fruiting body of *A. cornea* growing on a cocoa tree branch in the Oti Region



Fig. 7a: *A. cornea* basidioma growing on dead cocoa tree branches (note the dehydrated fruiting body) at Bowiri Amanfrom, Oti Region)





Fig. 7b: Varying sizes of *A. cornea* basidioma harvested from dead cocoa tree branches (note the dehydrated fruiting body) at Bowiri Amanfrom, Oti Region); x: abaxial y: adaxial side of the fruit body



Fig. 9: *A. cornea* basidiomata growing on cocoa tree stem at Cocoa research Institute of Ghana (CRIG) in New Tafo Akim (Eastern Region)



Fig. 8a: *A. cornea* basidiomata growing on cocoa tree stem at Baakokrom in Sefwi Bekwai (Western North Region)



Fig. 10: Microscopic structure showing cross-section of basidioma of *A. cornea* (Medulla is shown by the yellow arrow)



Fig. 8b: Varying sizes of the basidioma of *A. cornea* harvested on cocoa tree stem at Baakokrom in Sefwi Bekwai (Western North Region)

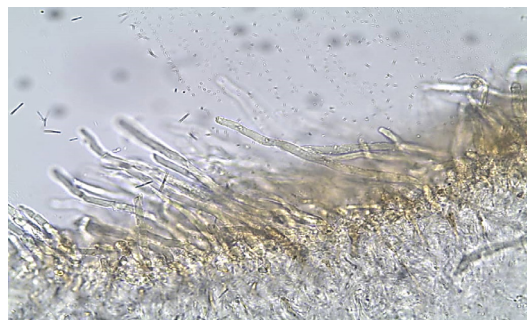


Fig. 11: Abhymental hairs on the surface of basidioma of *A. cornea*

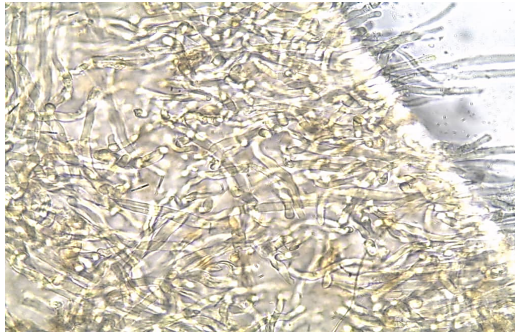


Fig. 12: Network of mycelium strand below the hymenium giving rise to basidia of *A. cornea*

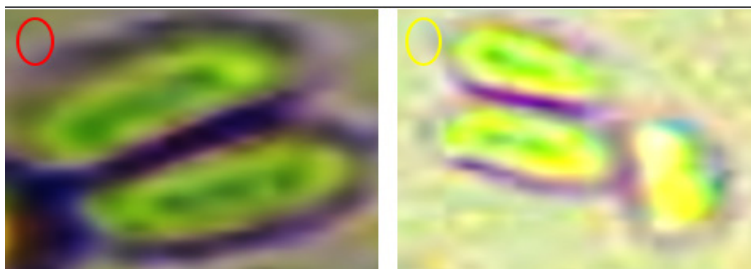
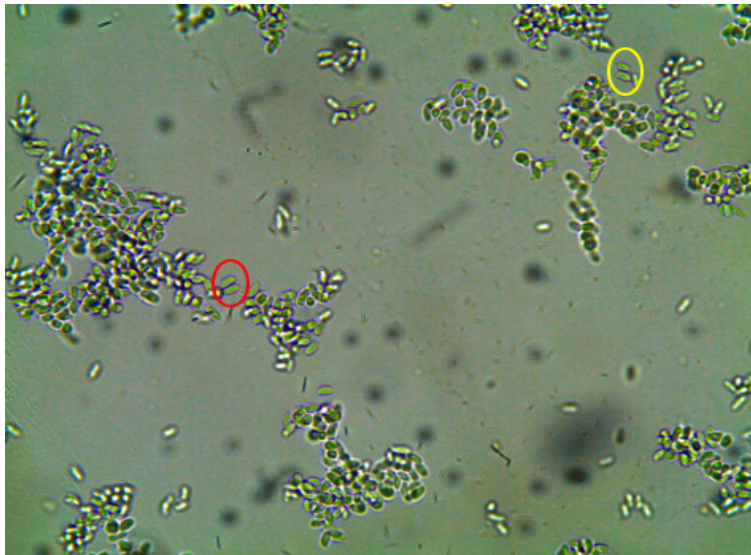


Fig. 13: Basidiospores of *A. cornea* (Note the allantoid, sausage shaped of the hyaline spores); Red and Yellow circles are showing the enlargement of the spores

**TABLE 3a**  
*The Nutritional, Pharmacological (Bioactive) and Ethnomycological (Medicinal)*  
*Values of Auricularia species in Ghana*

<i>Auricularia</i> Species	Nutritional Values	Medicinal Values	References
<i>A. auricula - judae</i> ( Bull ) Quet	Protein, energy, fat, fibre, carbohydrate, ash, calcium, P, K, Fe, carotene, vitamins, <b>Functional food.</b> <b>Edible</b>	Cancer treatment, for piles, stomach tonic, nourishes lungs, stop heamorrhage, invigorates, blood circulation, hypertension, rheumatic pains, lumbago, cramps, numbness, tetanus, dysentery, obstruction of arteries and veins, dysentery enterilis, menorrhya leuarrhoea cures, haemorrhoids and uterine bleeding, gastric disorders, removal of excessive phlegms, alkaloids, polyphenols, terpenes, saponins, steroid immunomodulatory laxative	Mensah (2021) Bastos <i>et al.</i> (2023) Kumar <i>et al.</i> (2021) Liu <i>et al.</i> (2021) Islam <i>et al.</i> (2021) Mapoung <i>et al.</i> (2021) Ying <i>et al.</i> (1987) Apetorgbor <i>et al.</i> (2006) Wu <i>et al.</i> (2021) Bao <i>et al.</i> , (2020) Shabar <i>et al.</i> (2023) Wasser, (2002) Wasser and Weis (1999) Bandara <i>et al.</i> (2019) Khatun <i>et al.</i> (2012) Kadnikova <i>et al.</i> (2015)
<i>A. delicata</i> (Mont ex Fr.) Henn.	Nutraceutical, flavonoids, <b>Edible</b> high nutritional benefits: fibre 3.6% ash, 12.5% crude protein, 1.7% fat, ash, glucose, xylose, Carbohydrates (66.1%), mannose, galactose, amino acids (34.7%), Ca, Na, K, Mg, Fe, As, Cu, Zn, Co, Cr, Mn, Pb, Ni. Vitamin D, Se, Vitamin B6, B1, B2, B3, D3	Cures gastrointestinal and liver ailments, hepatoprotective, anti - microbial, hyperlipidemic, anti-inflammatory compounds, cardiovascular terpenoids, phenolics flavonoids, polysaccharides, chitin, melanin, anticancer, antidiabetic, antipoxidant, immunomodulatory, diabetics, dysentery, cures haemorrhoids, uterine bleeding.	Wangkheirakpam <i>et al.</i> (2018) Gupta <i>et al.</i> (2019) Wasser, (2014) Wasser, (2002) Khurena <i>et al.</i> (2020) Kadnikova, (2015) UCLA Health (2023) Li <i>et al.</i> , (2023) Xiao <i>et al.</i> (2020) Ying <i>et al.</i> (1987)

**TABLE 3b**  
*The Nutritional, Pharmacological (Bioactive) and Ethnomycological (Medicinal)*  
*Values of Auricularia species in Ghana*

<i>Auricularia</i> Species	Nutritional Values	Medicinal Values	References
<i>A. fuscusuccinea</i> (Mont.) White / Black	<p><math>\beta</math>-glucosidase xylan-1,4-p xylosidase; endo-1-4-<math>\beta</math>-xylanase, 1,4-<math>\beta</math>-endo-glucanase, pectinases; total sugars (9.9 - 10.9%); protein (8.6 - 12.5%); fibre (11.7 - 12.5%); fat (4.5%); total carbohydrates (68.9% - 71.2%); free amino acids (alanine, arginine, cysteine, glutamic acid, glycine, isoleucine, histidine, lysine, methionine, phenylalanine, proline, threonine, tryptophan, tyrosine, serine, valine Minerals (Ca, K, Mg, Na, P, Cr, Cu, Fe, Mn, Ni, Zn)</p> <ul style="list-style-type: none"> <li>• <b>Edible</b></li> </ul>	<p>Antiviral Antitumour Antioxidant Polysaccharides Anti-inflammatory Antibacterial Hypocholesterolemic Hypoglycaemic Anticancer Nourishes lung, immune system Hepatoprotective</p>	<p>Mau <i>et al.</i>(1998) Kadnikova <i>et al.</i>(2015) USDA (2018) Wu and Xu (2015) Misaki <i>et al.</i>(1981) Misaki and Katuta, (1995) Chang and Wasser (2017) Chang <i>et al.</i>(2019) Zhao <i>et al.</i>(2015) Agyei and Dankwah (2011) Bandara <i>et al.</i>(2019) Riaz <i>et al.</i>(2022) Mensah (2021) Lin <i>et al.</i>(2013)</p>
<i>A. mesenterica</i> (Dicks) Pers.	<p>Sparse information on nutrient content. Nutraceutical, reducing sugars, contains polysaccharides</p> <ul style="list-style-type: none"> <li>• <b>Edible</b></li> </ul>	<p>Antioxidant, hepatoprotective, nourishes blood, stops pain and bleeding; Anticancer potential, high levels of phenols, flavonoids; immunoprotective</p>	<p>en. wikipedia. org Cheung (2010) Zhang <i>et al.</i>(2016) Sharma <i>et al.</i>, (2018) Ying <i>et al.</i>(1987)</p>

TABLE 3c

*The Nutritional, Pharmacological (Bioactive) and Ethnomycological (Medicinal) Values of Auricularia species in Ghana*

<i>Auricularia</i> Species	Nutritional Values	Medicinal Values	References
<i>A. polytricha</i> (Mont.) Sacc.	β- glucan Nutraceutical value Vitamins, Carbohydrates Functional food. mannose, rhamnose, glucose, galactose, xylose, glucomic acid, galacturonic acid Protein, fat, fibre, ash, vitamin B1, vitamin B2, vitamin PP, Ca, Fe, K, β carotene • <b>Edible as food</b>	Asthma, rheumatism, anticancer/ tumours, cough, fever, epilepsy, antioxidant, antimicrobial, antilepilectic activity, aphrodisiac, anti- inflammatory, ergosterol, phenols, flavonoids, immunomodulatory, hypolipidemic, hepatoprotective, renoprotective, removes lead from surroundings and foods, sexual performance, gastric disorders	Chiu <i>et al.</i> , (2012) Yeo and Shahidi (2021) Gupta <i>et al.</i> (2019) Teoh <i>et al.</i> (2018) Sharma <i>et al.</i> (2018) Gupta <i>et al.</i> , (2018) Sangphech <i>et al.</i> (2021) Zhao <i>et al.</i> (2023) Yang <i>et al.</i> (2023) Sillapechaiyaporn <i>et al.</i> (2022) Jia <i>et al.</i> (2019) Yu <i>et al.</i> (2014) Bandara <i>et al.</i> (2019) Ying <i>et al.</i> , (1987)
<i>A. cornea</i> Ehreb.	Ash, protein, fat, crude fibre, carbohydrates, dietary fibre, Ca, K, Mg, Na, Fe, Zn, Mn, Cu, Se, Cr, Polysaccharides, contains all essential amino acids • <b>Edible</b>	Antioxidants activity, hypoglycaemic response; leucorrhoea ( whitish mucous discharge); haemorrhoids; antibacterial, intestinal peristalsis; stimulation, constipation, convulsion, overweight, cancer, hypertension, reduces cholesterol, inflammation of joints, increases Oxygen supply to the blood, slows down ageing, heals post- partum weakness, tinnitus, lumbago, antitumour, immunomodulatory polysaccharides, diabetes, metabolic syndrome	Zakaria <i>et al.</i> (2022) Mensah (2021) Morris (1987) Bastos <i>et al.</i> (2023) Bandera <i>et al.</i> (2019) Zaidman <i>et al.</i> (2005) Wasser & Weis (1999) Wasser, (2002) Khan <i>et al.</i> (2023) Phithakrotchanakoon <i>et al.</i> (2022) Wang <i>et al.</i> (2019)

### Discussion

Our desktop study and collation of information on the occurrence of *Auricularia* species in Ghana shows that there are at least seven species recorded in Ghana namely *A. auricula-judae*, *A. delicata*, *A. fuscosuccinea*, *A. hunteri*, *A. mesenterica*, *A. polytricha* and *A. cornea* between 1949 and 2023 (Table 1). Prior to our 2022-2023 survey, the only location *A. cornea* has been recorded in Ghana was at the arboretum of the Plant Genetics Resources Institute, PGRI, at Bunso on 8<sup>th</sup> November, 2016 and lodged in the Chinese Natural History Herbarium, labelled as Y.C.Dai, Dai17352 (BJFC024110) (Wu *et al.*, 2021). It was collected by visiting Chinese team on fallen angiosperm trunk. Our present survey shows that *A. cornea* is more widespread in Ghana and can be found in the Ashanti, Oti and Western North Regions and constitutes a new record for Ghana.

*A. cornea* is characterized macroscopically by the variability in colour of fresh basidiomata, dense hair on the upper surface and microscopically by the presence of an obvious medulla. The basidiomata was gelatinous reddish brown to orange or buff to white, solitary or cespitose, sessile or substipitate in conformity with the description of Wu *et al.* (2021) for *A. cornea*.

In the cross-section of the fruiting body, the medulla was located either in the center or near the base of the hymenium. Crystals were scattered throughout the hymenium, with a network of mycelium forming a "hartig-net" structure beneath the outer peridium. Abhymenial hairs were present, featuring a slightly swollen base, hyaline, thin walls, and a wide or narrow lumen. The apical tips of these hairs were acute or obtuse and tufted. These observations align with the findings of Wu *et al.* (2021), Looney *et al.* (2013), and Li (1987). There was also good agreement with the dimensions of the length and width of the

fruiting body (Wu *et al.*, 2021) not excepting the auriculate shape of the basidiomata, the adnate, solitary and cespitose habits (Wu *et al.*, 2021). The spores were allantoid to sausage shape characteristics of the genus *Auricularia*. Although the substrate of the *A. cornea* collected from Bunso, in the Eastern Region was not stated, the *A. cornea* reported in this paper was found on cocoa branches, main stems and cassava sticks which constitutes a novel information and extends the list of hosts for *A. cornea* in Ghana. The perennial nature of flushing of the *Auricularia* species in Africa and their resilience to withstand the vicissitudes of the tropical weather should lend them amenable to be used for developing local techniques for commercial cultivation. Cultivation of several species of *Auricularia* is now well-known in South Eastern Asia and elsewhere (Kumar *et al.*, 2021; Shahar *et al.*, 2023; Phithakrotchanakoom *et al.*, 2022; Rebecca *et al.*, 2020; Bastos *et al.*, 2023; Thongklang *et al.*, 2020; Khan *et al.*, 2023 etc.). It will be instructive to study the local isolates using phylogenetic analyses by ITS sequence and combined ITS and ISU and rpb2 sequence as was done by Wu *et al.* (2015) for the Chinese and European species. This is more so because Wu *et al.* (2021) have shown *Auricularia* can be divided into five complexes on the basis of morphological and phylogenetic relations of species and they divided the genus into five (5) morphological complexes namely *A. auricula-judae* complex; *A. cornea* complex; *A. delicata* complex; *A. fuscosuccinea* complex and *A. mesenterica* complex. The variation in basidiomata morphology of the *A. cornea* obtained from the Oti, Ashanti and Western North Regions may belong to the same *A. cornea* complex. However, this morpho-variation may be due to differences in the microclimatic conditions such as humidity, temperature, and light exposure. For instance, higher humidity levels in one

area might promote the formation of larger and more vibrant basidiomata compared to a drier environment. Additionally, temperature fluctuations can affect the metabolic processes within the fungi, leading to differences in the size and maturation rate of the fruiting bodies. But this needs further investigations using phylogenetic relations.

The Northern, Upper West and East, Savannah, Bono and Brong Ahafo, Ahafo and central Regions (Fig. 1) are yet to be surveyed. The rich medicinal values of *Auricularia* species in Ghana are known and also revered elsewhere for their therapeutic properties and have also played a significant role in traditional medicine system in many cultures across the globe. The plethora of diverse bioactive secondary metabolites have numerous health benefits thus making *Auricularia* a subject of extensive scientific research and interest in recent years (Stamets and Zwickey, 2014). As outlined, these secondary compounds have shown promising applications for immunomodulation, anti-inflammatory effect, antioxidants properties, anticancer and antidiabetic potency to mention but a few (Wasser, 2002; González-Palma *et al.*, 2016; Gargano *et al.*, 2017; Gebrayohannes *et al.*, 2019 a, b; Oli *et al.*, 2020). In summary, the *Auricularia* mushroom in Ghana have such a potent source of pharmaceutical factory for bioactive healing compounds in the health delivery system that cannot be discounted. The WHO has a policy of encouraging the use of medicinal plants and medicinal fungi in the health delivery system worldwide (Chugh *et al.*, 2022) because about 130 therapeutic functions are believed to be formed by medicinal fungi and mushrooms including antitumour (Uzma *et al.* 2018; Deshmukh *et al.*, 2018), immunomodulatory (Singdevsachan *et al.*, 2016), antioxidant (Hameed *et al.*, 2017), cardiovascular, anti-parasitic, antiviral, antibacterial, radical

scavenging, hepatoprotective, detoxification and anti-diabetic (Chugh *et al.*, 2022), anti-hypercholesterolemia as well as protection against tumour development and inflammation (Qin and Han, 2014). Ongoing biodiversity conservation must include fungi (Cao *et al.*, 2021; Gonçalves *et al.*, 2021; Oyanedel *et al.*, 2022).

Furthermore, polysaccharides, alkaloids, proteins, fats, minerals, carotenoids, glycosides, terpenoids, folates, tocopherol, flavonoids, phenolic, volatile oils, ascorbic acids, lectins, enzymes and organic acids, many of which are formed by *Auricularia* species are bioactive molecules synthesized by different medicinal fungi (Chugh *et al.*, 2022) The pursuance of this research on documenting our medicinal fungi, promoting its use and ascertaining their efficacy in health delivery as well as their artificial cultivation will be a policy in tandem with WHO policy that cannot be neglected in future studies.

### Conclusion

The retrospective study of *Auricularia* species in Ghana has significantly expanded the known distribution and occurrence of these mushrooms, identifying new localities in the Ashanti, Oti, Western North, and Eastern Regions. With seven distinct species recorded, including the first-time documentation of *Auricularia cornea* on cocoa and cassava substrates, the diversity of these fungi is evident. *Auricularia* mushrooms possess a wealth of bioactive compounds, making them valuable for their nutritional, pharmacological, and ethnomycological properties. Their potential for commercial cultivation and exploitation for health benefits highlights the economic and medicinal importance of these species. The findings underscore the need for further research and development to harness the full potential of *Auricularia* mushrooms for health delivery in Ghana.

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