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A Systematic Review of Biodiversity and Conservation of Indigenous Mushrooms (Basidiomycotina, Ascomycotina) of Central Africa Countryside: Uses, Distribution and Checklists

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ABSTRACT

Significant socio-economic, spiritual, nutritional and medicinal needs of the countrysides in Central Africa region are obtainable from macrofungi. Conversely, anthropogenic activities and climate change have led to a reduction in the habitats of mushrooms which has led to some mushrooms becoming endangered. A dearth of information on the ecology, management and composition of mushrooms in Central Africa exists. Hence a review was systematically carried out on published mycological research outcomes from Central African countryside, to delineate the way forward. It was observed that the level of indigenous mycological knowledge was very high (> 60%) in all the tribes. The highest number of edible mushrooms was from Democratic Republic of Congo (DRC) (377 species), followed by Cameroon (50 species). The dataset showed that 448 edible mushrooms have been identified based on citable publications and 27 tribes/localities evaluated. Additionally the dataset showed 116 author-identified mushrooms that inhabitants did not identify and use. The most popular edible mushrooms from 79 key edible mushrooms were *Russula* (9 spp.), *Termitomyces* (8), *Cantharellus* (8), *Plerotus* (5), *Amanita* (5), *Marasmius*, *Lactarius* and *Lactifluus* (4 spp. each). The topmost consumed species were *Pleurotus tuber-regium* (14 out of 27 localities), *Auricularia cornea* (13), *Cantharellus congolensis* (12), *Marasmius bekolacongoli* (12), *Schizophyllum commune* (11) and *Cantharellus floridulus* (11). Mushrooms for mythology uses: (*Phallus indusiatus* and *Dictyophora* sp.), Mythology+food: (*Termitomyces robustus*), Medicinal: (*Daldinia concentrica*, *Ganoderma applanatum* and *Ganoderma lucidum*), Medicinal+food: (*Polyporus dictyopus*, *Schizophyllum commune* and *Termitomyces clypeatus*) and Food+mythology+medicinal: (*Termitomyces microcarpus* and *Termitomyces titanicus*). Irrefutably, these previous ethnomycological and ecological studies have scarcely made a significant impact on fungi biodiversity.

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1. Introduction

Indigenous mushrooms act as food, medicines, essential source of income for many poor communities and recreational foragers globally. Yet, we have been told that fungi are our enemies although fungi are involved in important ecosystem services^[1,2]. Fungi play important roles in biodegradation of organic waste, serve as food in ecosystem, aid in bioremediation, are used in industrial production processes, aid in traditional medicine practice, provide nutraceuticals and bioactive agents for society^[3,2].

Sub-Saharan Africa, including Central Africa, is highly vulnerable to the sways of climate change. This scenario will affect water catchments, biodiversity, frequency of flooding, hydrological drought incidence and landslides. Climate change will certainly upset food security and self-sufficiency in Central Africa countrysides given that crops cultivated there are mostly unimproved indigenous varieties. The rapid changes in worldwide species distribution and abundance, mostly due to over-exploitation of the species, habitat destruction, and ambiguous governmental policies on biodiversity, climate change, pollution, and invasive species^[4,5,2].

Central Africa region has countrysides with different vegetation types ranging from semi-arid thorn bushes in Chad to swampy equatorial forests in the Congos and from lush highlands in the West Cameroons to undulating rain forest plains in the eastern fringes of Central Africa Republic. This rich diverse vegetation coupled with different levels of soil fertility gives the region unique niches for great biodiversity of fauna and flora.

Nevertheless a noticeable reduction in the habitats for macrofungi has led to some of them becoming endangered or even extinct. This has thus necessitated direct steps in fungi biodiversity conservation. The activities of man directly and indirectly affect mycoflora through reduction of humidity, reduction of substrate availability, release of toxins on the earth surface, over-exploitation of mycoflora, etc. Natural climate change solutions were estimated to have a maximum potential of 23.8 petagrams of CO₂ equivalent per year and (95% CI 20.3-37.4), barring constraints by food security, fibre security, and biodiversity conservation^[6,7].

Sadly enough, research on climate change adaptation is inadequate, inept and apathetic in the Central African region. The adaptation to climate change can be possible with sustainable management of natural resources, fungi inclusive^[3]. It has been pointed out that so far mushroom research in Central Africa has been mostly concerned with the taxonomy, ecological and ethnomycological studies^[8]. These studies could bring back guarantees for better

standards of living in the countrysides and even towns.

There are no evaluations on the conservation studies of macrofungi, no comprehensive threat assessment for macrofungi, no culture collection and maintenance centres, no national organs to promote fungal protection and conservation, poor public perception and knowledge of macrofungal diversity, lack of personnel, and no public and stakeholder education and training on macrofungi flora^[9]. There is a dearth of information on the cultivation, nutritional content and bioactive compounds from fungi especially mushrooms in the Central Africa region. Researchers have lamented the inconsistencies in biodiversity sources which makes it very difficult to standardize taxon names, harmonize taxonomic names, properly merge data on taxon names and track original sources of taxonomic information^[10,2]. To establish these facts, this review was carried out with the objective of synthesizing the diverse research outcomes on mushroom research in Central Africa region.

2. Materials and Methods

Normally in literature review studies, materials and methods are skipped but because of novelty of systematic reviews to some fields of life sciences especially agricultural sciences unlike in the medical and pharmaceutical sciences, it was deemed necessary to include a brief dialogue on materials and methods utilized in this appraisal. Systematic reviews use repeatable logical methods to identify directly related data, collect the secondary data and analyze them during evidence synthesis on formulated research questions^[11].

The systematic review procedures generally deal with defining the research question, searching for relevant data sources, extraction of relevant data, assessing the eligibility of the data, analyzing and combining the data. A systematic review uses a rigorous and transparent method for research synthesis, with the aim of assessing and, where possible, minimizing bias in the findings. Systematic reviews can be used for informed-decision making in different disciplines^[10-13].

Many systematic reviews may be based on some “mixed-methods” reviews which adhere to the normal systematic review standards for gathering, analyzing and reporting evidence but do not use meta-analysis. This utilitarian study employed “mixed studies” or “mixed methods review” techniques (especially PRISMA, and “rapid review” methods)^[11,13-16].

Rapid review methods of knowledge synthesis are carried out by streamlining or omitting any procedures of conducting traditional systematic reviews (that are cumbersome) thus accelerating the process of producing

essential knowledge for stakeholders in an efficient manner^[17-19]. Furthermore, the criteria of this research were also based on “PRISMA” methods of systematic review. PRISMA refers to “Preferred Reporting Items for Systematic reviews and Meta-Analyses” protocol for research reviews^[20,21,2].

In this review sources of information were tracked to the original and both the current and original source recorded in the checklist to ensure duplication of sources was eliminated. Old sources were not suitable for citation in most journals so the creation of stand-alone checklists was adopted to avoid editorial conflict with age of reference sources. Hence the rules for creation of checklists may not be the rules for this journal. The checklists are not peer reviewed using the same standard of this journal. The author is solely responsible for their preparation as source materials. Some checklists were so long that they may reach 50 pages or more which would certainly stress the reviewer and take up ample time needed for peer reviewing.

Often the case reports are diverse, differ vastly, and the evidence supporting the stated properties of mushrooms may be incomplete or ambiguous^[1,2]. Going for systematic reviews, calls for adeptness on the side of the researcher to be able to determine the relevance or not of sources and data. This study was carried out using internet-based-research publications^[21,22,1,2,10] specifically on macrofungi (Basidiomycotina and Ascomycotina) from the six Central African countries:

These countries include Central African Republic (CAR), Gabon, Chad, Republic of Congo (R. Congo), Democratic Republic of Congo (DRC), Equatorial Guinea and the Cameroons. Only online research publications that had any relation with macrofungi and their management in the region were included. The critical keywords utilized include Central African Republic, C.A.R., Gabon, Chad, Republic of Congo, R. Congo, Democratic Republic of Congo, DRC, Equatorial Guinea and Cameroons, mushrooms, ethnomycology, edible mushrooms, macrofungi, forest resources, deforestation, forest people, biodiversity conservation, medicinal mushrooms, uses, mushrooms checklists, and central Africa. Doubtful names, sources and materials were eliminated and common names were not included in the count of macrofungi encountered. Literature on fungi that were deemed unrelated to the groups termed mushrooms, polypores and macrofungi were not included. The checklists include all relevant names of mushrooms throughout time. Studies carried out by researchers in the countrysides were highly appreciated.

In this way, this study provides an exhaustive summary of current data relevant to our objectives. The identifica-

tion of the mushrooms by name by indigene especially in the countrysides as well as giving their uses were considered most important. The study depended on sources from the following official languages, spoken in the region, (while searching on-line): English, French, Portuguese and Spanish. In some instances some authors offered to give the uses of some mushrooms by themselves, their views were considered and highly appreciated, since our aim is to be as inclusive as possible^[1,2].

Taxonomic jargon was reduced to the basic generic and species epithets. This was deemed necessary to help rural dwellers, reviewers, policy makers, non-mycologists and non-experts read and perfectly understand the status of macrofungi biodiversity in the region. The checklist is thus simpler, since this author has not changed the original author’s citations. The checklists are prepared as supplementary sources. The citation of sources was cross checked to ensure that duplication of mushroom sightings was avoided. Thus prior knowledge of taxonomy or systematics by readers may not be essential to read through this study and comprehend it.

The problem of synonymy of mushroom names was avoided as much as possible but some names may be unofficially recognized even as of today based on the fact that taxonomy is dynamic. This may be due to official bottle-necks and so on. So we work with what we have. The supplementary materials may also aid those who want to appreciate the level of the ethno-mycological knowledge in the region. Given these observations one can see that a checklist of flora and fauna is very difficult to generate. One may disqualify a source that is genuine but the process of updating the data on its validity has not been fast enough. Meanwhile a separate manuscript is being processed that deals only with the SYSTEMATICS of these mushrooms and others for the whole continent.

The secondary data collected included the sources of information, names of locations, frequency of citation, names, uses, distribution, and tribal preferences of the macrofungi in a systematized manner to avoid repetitions. The analysis combined all the data from all eligible sources to ensure inclusion of all countries. The analysis was carried out using Genstat Discovery 2nd Edition version and IBM Statistical Packet for Social Sciences version 25.

3. Results and Discussion

Some authors gave only genus name when discussing the mushrooms they collected in the field so the list may in future contain more than 500 macrofungi species while 116 species were not given any use therefore in future the number of edible species could be more (Figure 1). Genus names were accepted only if no other author had cited a

source giving any name of an indigenous species in the genus. The highest number of edible mushrooms was from Democratic Republic of Congo (DRC) (377 species), followed by Cameroon (50 species), Republic of Congo (31 species), Gabon (19 species) and Central Africa Republic (CAR) (14 species). As stated earlier, some researchers only identified the mushrooms to genus taxon so the actual count of species could be higher. Details of these mushrooms are available as supplementary materials.

The most popular genera and number of species per genus (whereby each species is consumed by three or more tribes/groups) in Central Africa region are presented in Figure 2. It shows that the most popular genera were *Amanita* (5 spp.), *Cantharellus* (8 spp.), *Lactarius* and *Lactifluus* (4 spp. each), *Marasmius* (4 spp), *Pleurotus* (5 spp.), *Russula* (9 spp.) and *Termitomyces* (8 spp.).

Outcomes of species of macrofungi in Central Africa with other uses apart of food or with multiple uses are presented in Figure 3. They were 13 mushrooms that had medicinal uses (sole or dual uses), nine mushrooms had nutritional uses (for food combined with other uses) and five mushrooms had mythological uses (for mythological beliefs alone or combined with another use). Species of macrofungi in Central Africa with other or multiple uses included the following: mushrooms for Mythology use alone (included *Phallus indusiatus* and *Dictyophora* species), mushrooms for Mythology and Food purpose (included *Termitomyces robustus*, and mushrooms with triple uses included *Termitomyces microcarpus* and *Termitomyces titanicus*.

Meanwhile mushrooms with medicinal use alone (included *Daldinia concentrica*, *G. applanatum*, *Ganoderma lucidum*, *Ledmukwali marova* and *Lentinus squarrosolus*, while mushrooms with Combined Medicinal and Food uses (included *Calvatia cyathiformis* *Lentinus tuberregi-*

um, *Polyporus dictyopus*, *Schizophyllum commune*, *Termitomyces clypeatus*, and *Termitomyces striatus*. Therefore they were nine mushrooms used as food and other uses simultaneously. Details of these mushrooms are available in the supplementary materials.

A detail presentation of multiple uses of mushrooms in Central Africa was presented in Figure 4, in order to make it easy to understand the breakdown. It shows that six mushrooms were used for food and medicinal purposes simultaneously, one mushroom had food and mythological uses concomitantly, while two mushrooms had triple uses simultaneously (i.e. food, medicinal and mythological uses). Thus only two mushrooms had sole mythological use and five mushrooms had sole medicinal use.

The six most commonly edible species of mushrooms in Central Africa based on the number of tribes/localities that consumed it are presented in Table 1. Based on number of tribes or localities that consume these mushrooms, it was observed that *Pleurotus tuberregium*, *Auricularia cornea*, *Cantharellus congolensis* (or in the same position *Marasmius bekolacongoli Beeli* (Basidiomycota; Agaricales; Marasmiaceae) followed by *Schizophyllum commune* (or in the same position *Cantharellus floridulus* in descending order of popularity were reported in the region.

The details of medicine only or medicine and another purpose mushrooms of Central Africa that were reported are shown in Table. 2. The list shows that Cameroon had most of the medicinal macrofungi biodiversity. Cameroon had 13 out of the 16 macrofungi reported. The actual figures may change with time as more information becomes available. The counts are not exclusive please so 13 medicinal fungi were not found only in Cameroon rather 13 types of medicinal mushrooms out of 16 types available in the region were found in Cameroon.

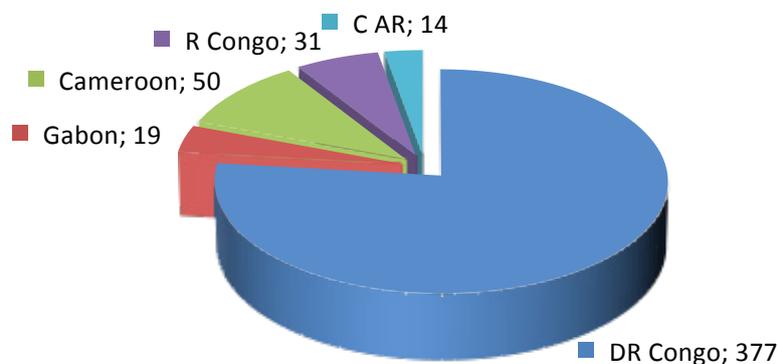


Figure 1. The total number of edible mushroom species identified in each country in Central Africa.

NB: CAR: Central Africa Republic, R. Congo: Republic of Congo, DR Congo: Democratic Republic of Congo

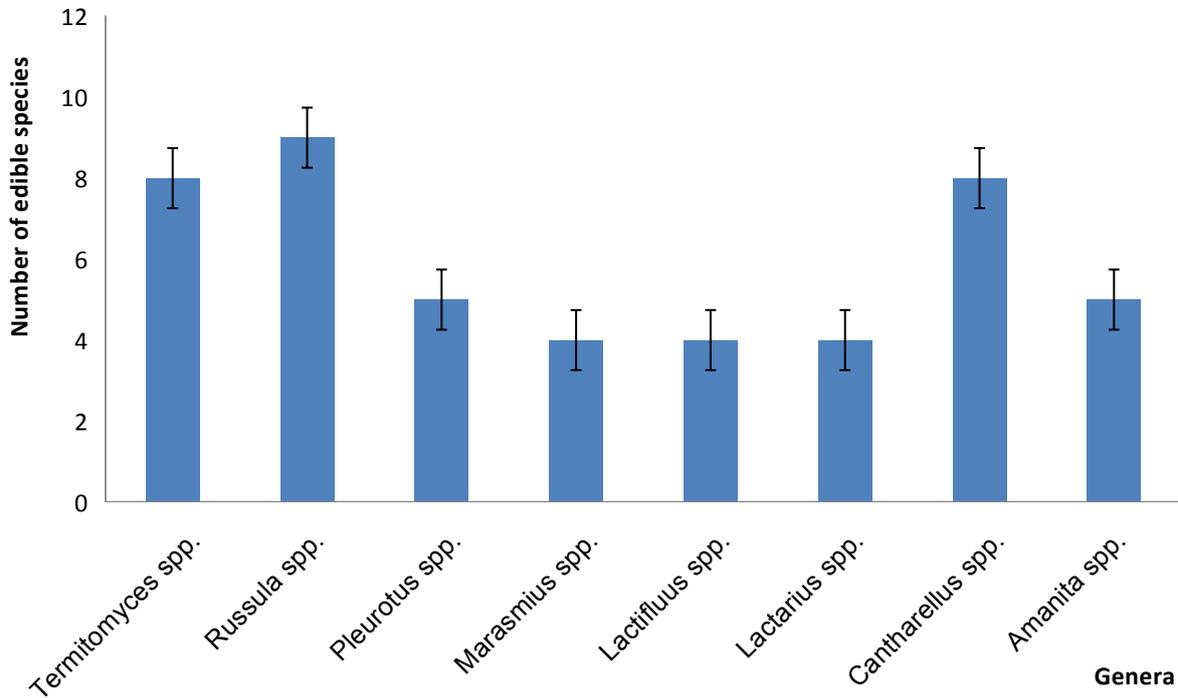


Figure 2. The most popular genera and number of species per genus (whereby each species is consumed by three or more tribes/groups) in Central Africa.

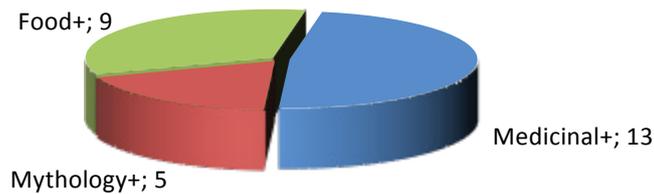


Figure 3. Number of macrofungi in Central Africa with other none food (only) uses or with multiple uses

NB: + indicates another use

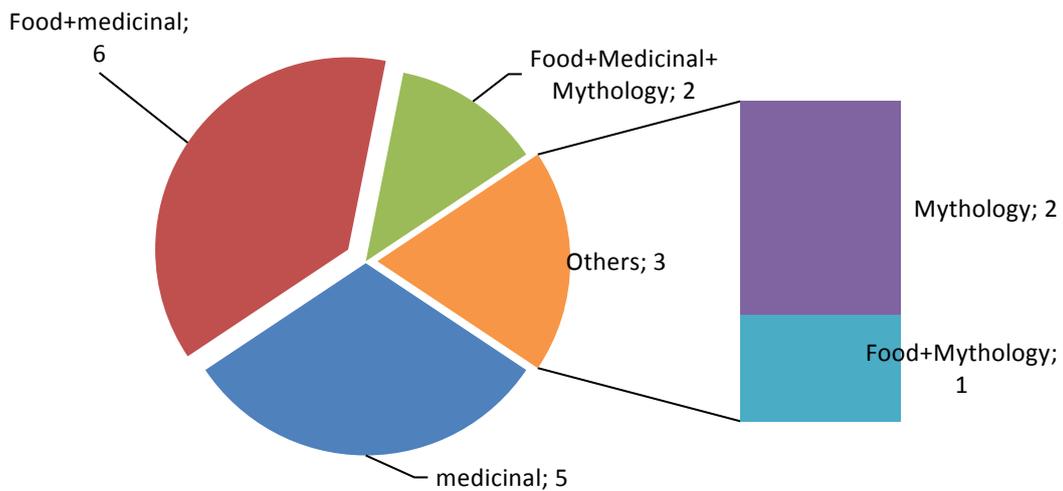


Figure 4. Mushrooms from Central Africa region that have other uses or combined uses.

Table 1. Six most common edible species of mushrooms in Central Africa based on the number of tribes/localities / countries where they are consumed.

Most Common Edible Species in Central Africa	No. of Tribes over 27 Tribes	Countries
<i>Pleurotus tuberregium</i>	14	Cameroon, DRC, R. Congo.
<i>Auricularia cornea</i>	13	DRC, R. Congo, Gabon.
<i>Cantharellus congolensis</i>	12	Cameroon, DRC, R. Congo, Gabon.
<i>Marasmius bekolacongoli</i>	12	Cameroon, DRC, R. Congo, Gabon.
<i>Schizophyllum commune</i>	11	DRC, CAR, Cameroon, Gabon.
<i>Cantharellus floridulus</i>	11	DRC, Cameroon, Gabon.

NB: DRC = Democratic Republic of Congo, R. Congo = Republic of Congo, CAR = Central Africa Republic

Table 2. Species of medicine only or medicine and another purpose mushrooms of Central Africa

S/N	Species	Other Uses	Tribe/Group/Location Where It Is Used
1.	<i>Lentinus squarrosulus</i>	Medicine	Mt Cameroon, Kilum-Ijim, Bamoum, Tshopo6#, Bakoya, Kota/bantu, Miombo1#, Mbenzele/Ngombe, Cameroon
2.	<i>Lemukwali marova</i>	Medicine	Hausa?
3.	<i>Calvatia cf. cyathiformis</i>	Food and medicine	Cameroon
4.	<i>Lentinus tuberregium</i> (Syn. <i>Pleurotus tuberregium</i>)	Food and medicine	Cameroon
5.	<i>Termitomyces striatus</i>	Food and medicine	Cameroon
6.	<i>Schizophyllum commune</i>	Food and medicine	Cameroon
7.	<i>Ganoderma applanatum</i>	Medicine	Cameroon
8.	<i>Ganoderma lucidum</i>	Medicine	Baligham, Bamoum, Cameroon
9.	<i>Daldinia concentrica</i>	Medicine	Mt Cameroon, Kilum-Ijim, Cameroon
10.	<i>Polyporus dictyopus</i>	Food, medicine	Kilum-Ijim
11.	<i>Termitomyces clypeatus</i>	Food, medicine	Baligham, Bamoum, Cameroon, Katanga
12.	<i>Termitomyces titanicus</i>	Food, medicine, mythology	Awing, Bamoum, Bakweri, Katanga, Baligham
13.	<i>Termitomyces microcarpus</i>	Food, medicine, mythology	Cameroon, Kilum-Ijim, Bamoum, Awing, Bakweri, Katanga
14.	<i>Termitomyces robustus</i>	Food, mythology	Cameroon, Baligham, DRC, Bakoya, Kota/bantu, Tshopo6#
15.	<i>Phallus indusiatus</i>	Mythology	DRC
16.	<i>Dictyophora</i> sp.	Mythology	Mount Cameroon

NB:

Tshopo6# = Six Tshopo localities/tribes = Kumu, Lokele, Ngando, Ngelema, Topoke, Turumbu that were reported by authors consulted

Miombo1# = 3 localities/tribes listed are Gisagara, Mikembo and Rumonge that were reported by authors consulted.

Miombo1# = one location in Miombo woodlands that was enumerated. Ashtag maintained for ease of cross referencing

This detailed appraisal of the data revealed that the number of species of macrofungi from Central Africa was in reality smaller than scientists have believed to be. This corroborated the findings of Kinge and Ndifon^[4,2] who reported far fewer mushrooms from Southern Africa than one would be made to believe. It would be beneficial to know the macrofungi that exist in Africa and where they are found given the level of deforestation and urbanisation in the region. Macrofungi biodiversity has not been studied much globally even when macrofungi are known to be packed full of essential resources for mankind, the environment and life on earth.

The species that were reported to be abundant have not been domesticated in the area instead exotic species which may be more difficult to cultivate are promoted in the region. The indigenous species of macrofungi are not being prioritized by the inhabitants which may be due to inadequate know-how on the importance of these mushrooms and their domestication^[23].

However, it was observed that saprotrophic fungi (15 spp.) were uncommon in the Miombo woodlands compared to the numbers in dense or montane tropical forests like those in Central Africa, which could be tied to lack of woody substrates due to constant bushfires in the Miombo woodlands and forest fires nowadays^[24-26].

The rich biodiversity of macrofungi in the region is poorly explored and exploited^[27]. Ethnomycological know-how is very rich in many of the countries in the region but with the coming of urbanisation and changes in anthropomorphic activities in the region, biodiversity conservation may likely suffer greatly. Jumbam et al.^[27] affirmed that mushrooms play important social, economic, and ecological roles in Cameroon. For instance species in the genera *Agaricus*, *Auricularia*, *Flammulina*, *Ganoderma*, *Pleurotus*, *Termitomyces* and *Volvariella* were reported to be used as food or in traditional medicine in many parts of the country.

Samples of some of the relevant studies encountered are hereby utilized mainly to show the rich ethnomycological know-how in the area as well as to enable someone to appreciate the checklists in the supplementary materials. For instance, Jumbam et al. (2019) reported that the Dja Biosphere Reserve in Cameroon has abundant ectomycorrhizal fungi (e.g. ectomycorrhizal fungi growing on *Gilbertiodendron dewevrei*).

These fungi have not been reported in Africa. These *Hericium* species encountered are important as sources of food and secondary metabolites. The *Hericium* sp. (*Russulales*) reported in the reserve could be studied for production of industrial and bioactive agents. Furthermore, Jumbam et al.^[28] reported that only three records of the

saprotrophic genus *Hericium* (in family *Hericiaceae* of *Russulales*) are available from Africa.

Termitomyces clypeatus is a medicinal and also edible mushroom which grows in various parts of Cameroon. The extracts of *T. clypeatus* significantly inhibited the growth of bacteria and yeast at different ratios compared to the control ($P < 0.05$)^[29]. This is a good source of medicines with no side effects. In fact, *Termitomyces* species are believed to have medicinal properties in Africa and Asia however *Termitomyces* species are used by Bamoum indigenes as food^[30]. This contrast shows that mushrooms may have been underutilized by mankind especially in this region. These linkages of gen on macrofungi could be essential in highlighting their centres of diversity, origin, dispersal and threat related human activities in future.

Bamoum indigenes in Cameroon use at least 40 species of mushrooms from eight genera: *Auricularia*, *Cantharellus*, *Ganoderma*, *Lactarius*, *Lactifluus*, *Pleurotus*, *Russula*, and *Termitomyces*. The genera *Lactarius*, *Lactifluus*, *Russula* and *Termitomyces* were reported to be used for food, while *Ganoderma* spp. and *Pleurotus tuberregium* were used for medicinal purposes. That is quiet impressive know-how in indigenous settings^[30]. Many people in Kilum-Ijim mountain forest reserve (Cameroon) depend on mushrooms as food and medicine, while the non-edible species were regarded as food from satan. This is a good way to keep people away from poisonous mushrooms. They listed eight edible mushrooms as follows: *Auricularia polytricha*, *Laetiporus sulphurous*, *Polyporus dictyopus*, *Polyporus tenuiculus*, *Termitomyces microcarpus*, *Termitomyces striatus*, *Termitomyces* sp.1, *Termitomyces* sp. 2, and nine medicinal mushrooms as follows: *Auricularia polytricha*, *Daldinia concentrica*, *Ganoderma applanatum*, *Lentinus squarrosulus*, *Polyporus dictyopus*, *Termitomyces microcarpus*, *Trametes versicolor*, *Vascellum pretense* and *Xylaria* sp., used in traditional health care. Again this corroborates the fact that Cameroonian ethnomycological knowledge is very rich^[31].

These researchers ranked the preference of eight edible mushroom species consumed in Kilum-Ijim forest (Cameroon) as follows in order of decreasing preference: *Auricularia polytricha*, *Laetiporus sulphureus*, *Polyporus dictyopus*, *Polyporus tenuiculus*, *Termitomyces* sp.1, *Termitomyces* sp. 2, *Termitomyces microcarpus*, and *Termitomyces striatus*. *Polyporus dictyopus* was reported for the first time as an edible mushroom species. This knowledge could help one to know which mushrooms should be promoted more but the importance of these macrofungi as a group is yet to be understood even in developed countries.

Field studies carried out on the Mount Cameroon resulted in the isolation and identification of 177 species of

macrofungi belonging to 83 genera from 38 families^[32]. This is impressive considering that the list is from only one mushroom biodiversity hotspot. One may be aware that little has been done on conservation of this hotspot. Logging companies have been bringing the area to the point of becoming a semi desert. In another study, the indigenes of the Awing in Cameroon, commonly use mushrooms as food, medicine or for mythological practices. They pointed out that these communities could distinguish between edible and poisonous mushrooms^[33]. This is knowledge that may not be available with time given that the forests are disappearing and people are migrating to towns where the macrofungi are non-existent except in films.

From surveys carried out in areas inhabited by Kumu, Ngelema, Turumbu, Ngando, Topoke, Lokele and Turumbu indigenes in DR Congo, it was reported that out of 73 macrofungal species, 68 species were edible, 9 species were medicinal, 7 species were used in mythology and 2 species for recreation by indigenes. However, species which served dual functions as food and medicine included *Schizophyllum commune* and *Pleurotus tuberregium*^[26].

These researchers emphasized that *Pleurotus tuberregium* was considered the most useful and important fungus based on its multiple usages (for food, medicine, recreation and myths) among the people from Tshopo (DRC). They warned that *S. commune* causes severe “*Schizophyllum* disease” in both healthy and immune-deficient people hence it should not be cultivated but they encouraged cultivation of saprotrophic fungi such as *Auricularia cornea*, *Marasmius buzungolo*, *Pleurotus tuberregium* and *Lentinus squarrosulus* to sustain the demand and avoid over-exploitation of wild macrofungi. This confirms the elaborate ethnomycological expertise in this region.

Results of surveys carried out in Miombo woodlands (unimodal rainfall areas between latitudes 5 - 17°S, which covers ~10% of Africa including much of eastern and southern parts of the Congo Basin) showed that edible mushrooms constituted highly valuable non-wood forest products exploited for food and trade by indigenes. They listed 77 species of edible mushrooms (whereby 59 species were ectomycorrhizal i.e. *Amanita* (8 spp.), *Cantharellus* (15 spp.), *Lactarius* (14 spp.), and *Russula* (10 spp.) in the Miombo woodlands^[35]. Ebika *et al.* reported presence of 51 species of edible macrofungi in Mbènzèlè and Ngombe areas (DRC)^[34]. These are other macrofungi hotspots that need protection and conservation. In fact this Miombo woodlands is a conservation unit in southern Africa but in Central Africa it lacks this status^[2]. This shows the urgency to create *in situ* conservatories in such macrofungi biodiversity hotspots.

From ethnomycological investigation in Ogooué-Ivindo

(north east Gabon) it was observed that Bakoya Pygmies identified 93% of the species of mushrooms, Kota (60%) and Kwele (33%)^[24]. They reported that mushrooms are believed to have high nutritional and market value thus they are cherished. It goes without saying that Central Africans have a good knowledge of the natural resources that the forests hold. But at last the forests are disappearing at alarming rates in all the six countries of Central Africa (for the benefit of a few elites) leaving the masses like the forest people of Cameroon (Bantu, pygmies (i.e. Baka and Bagyeli)) without any renewable natural resources.

Mushrooms are used by Cameroon’s humid forest people (Bantu, pygmies) as sources of food, medicine and income. These people totally rely on the forests^[35]. The indigenes identified 32 families, 41 genera of macrofungi. The most appreciated mushrooms were *Armillaria camerounensis* and *Volvariella volvacea* (saprotrophs) and all species of *Termitomyces* and of *Cantharellus*. These species should be prioritized in the short run for speeding up cultivation and conservation of mushroom biodiversity. Yet even knowledge of the cultivation of these macrofungi is lacking. The concerned governments have not encouraged the concerned parties to take up macrofungi study, conservation, research and consumption. The number of persons involved in mushroom study and farming is still too low to encourage fruitful conservation and utilization of the indigenous macrofungi of the region. Finally it was observed that macrofungi are paid less attention in terms of biodiversity conservation. For instance when listing endangered biodiversity one will not see macrofungi listed (2, 35). Allow me to cite only one source verbatim showing the deficit in fungi diversity conservation “The reasons why biodiversity beyond animals and plants is so understudied can be attributed to the incredibly high numbers of taxa, the large proportion of unknown species the logistical difficulties of studying them, the lack of basic checklists and a huge lack of experts capable of identifying them. These difficulties are, however, not restricted to Africa, and are even evident in the higher income countries of Europe and North America... There are many conservation organizations and activities in Africa, but none include micro-fungi and most do not even include macrofungi. For instance, no fungi are documented on the red data list of any African country, nor are fungi necessarily recognized as important by relevant governmental and funding bodies unless they are of direct economic value. It is undoubtedly the result of general ignorance of their importance, coupled with difficulties in dealing with them in bioinventories”^[35].

The macrofungi of Central Africa are diverse, enchanting and very rich in many types of resources. Their story

cannot be told in a single short report. The above sources and more were utilized to show the rich biodiversity of food, medicinal, mythological and even recreational macrofungi in Central Africa region. Finally it is recommended that a continent-wide appraisal of the status of mushroom biodiversity be carried out. Also mushroom in situ and in vitro conservation policies should be drawn up by the respective governments. The rate of afforestation should be increased and deforestation discouraged because the forest render vital ecosystem services. The need for conservation of mushrooms as part of the biodiversity conservation should be brought to the fore front considering the importance of fungi.

4. Conclusions

It can be concluded that this appraisal of macrofungi biodiversity in Central Africa which was carried out to document the research outcomes on macrofungi issues in Central Africa revealed a lot about the region's needs, knowledge and practices as far as macrofungi are concerned. The study was carried out using online publications and the data were analyzed. The findings show that knowledge of macrofungi was very high in Democratic Republic of Congo, Central Africa Republic, Cameroon, Republic of Congo and Gabon. This study was limited by finances, different emphases and presentation methods of outcomes by the researchers. To sustain life on earth these macrofungi should be conserved, studied and utilized moreover databases should be created for these macrofungi.

Conflict of Interest

The author has declared no conflict of interest.

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Appendix / Supplementary materials available

Checklists are presented as stand-alone simplified supplementary materials. One may or may not consult these checklists depending on the reader's priorities. The checklists are simplified as much as possible and the names of macrofungi are presented exactly as the original researchers reported them. Taxonomic jargon was avoided so as to provide a utilitarian resource for all and sundry. The checklists include Tables S1 - S5. These tables are the original creation of the author and all sources are acknowledged and highly appreciated for their contribution to knowledge. The checklists cover up to 60 pages and should not be included herein. Please contact the journal editorial office if you require.