Received: 3 December 2022 | Revised: 19 January 2023 | Accepted: 20 January 2023

DOI: 10.1002/fft2.215

FOOD FRONTIERS Open Access

REVIEW ARTICLE

Ethnomycological prospect of wild edible and medicinal mushrooms from Central and Southern Africa—A review

Claudete Bastos[1,2,3,5] | **Ângela Liberal**[1,2] | **Margarida Moldão**[3] | **Luís Catarino**[4] | **Lillian Barros**[1,2]

[1]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, Bragança, Portugal

[2]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, Bragança, Portugal

[3]Linkink Landscape Environment Agriculture and Food – LEAF, Associated Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, Lisboa, Portugal

[4]Centre for Ecology, Evolution and Environmental Changes, (cE3c) & CHANGE – Global Change and Sustainability Institute, Faculty of Sciences, University of Lisbon, Lisbon, Portugal

[5]Instituto Superior Politécnico do Cuanza Sul, Sumbe, Angola

Correspondence
Margarida Moldão, Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, Bragança, Portugal.
Email: mmoldao@isa.ulisboa.pt

Lillian Barros, Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, Bragança, Portugal.
Email: lillian@ipb.pt

Claudete Bastos and Ângela Liberal contributed equally to this work.

Funding information
Foundation for Science and Technology

Abstract

In several regions of Africa, the daily diet is partly dependent on the edible products from wild animals, plants, and mushrooms, driven by their availability, wide distribution in the local environment, and the low incomes of the general population. The documentation of ethnomycological information is particularly important to validate or correct the identification of specimens and the preservation of these natural resources with cultivation potential, thus improving their consumption and utilization for medicinal purposes. The number of wild edible mushroom species consumed varies between different regions of Africa, with around 300 species being documented in the literature. However, despite its rich biodiversity, the African continent is still underexploited, which is reflected in poor food contribution to populations that are often in need. Here, the safe use of mushrooms is guided by the insufficiency of studies that validate their nutritional and medicinal properties, since they are key factors in the suppression of protein deficiency in the everyday diet of the populations and a source of bioactive compounds useful for the formulation of added-value functional products. Thus, it becomes essential to investigate African mushrooms, not only from the identification point of view, but also in terms of nutritional, chemical, and bioactive characterization, hence deepen the knowledge about this valuable natural resource. Bearing these in mind, the main objective of this study is to systematize the knowledge available in scientific publications and specialized websites, thus gathering information about the valuable profits that come from using these widely appreciated natural products.

KEYWORDS
edible and medicinal fungi, ethnomycology, non-timber forest products

1 | INTRODUCTION

In different regions of the African continent, the people's diet depends in part on edible products from wild animals, plants, or mushrooms, driven not only by the high cost of living, but also by the profusion of such products in local environment (Soro et al., 2019). Here, the myriad uses of wild edible fungi (WEF) are key factors in the livelihood of local habitants in different segments, established over millennia (Boa, 2004).

Mushrooms are a group of macrofungi that reach their nutrition through being saprotrophs, parasites, or symbiotics, such as mycorrhiza, with a distinctive fruiting body and mycelia (Sánchez, 2017). In addition to being appreciated for their high nutritional value, rich in proteins, carbohydrates, microelements (phosphorous, potassium, calcium, copper, magnesium, iron, zinc), and vitamins, also presenting low fat amounts, these non-timber forest products (NTFPs) are the basis of various dietary, ethnic, cultural, religious, and medicinal issues, depending on the ethnic groups. In times of food shortages or scarcity, mushrooms are even considered meat or fish substitutes (Ndong & Degreef, 2011), making them essential for the subsistence of forest-dependent populations, not just from a nutritional point of view, but also in the medicinal, economic, social, cultural, and spiritual segments (Guissou et al., 2008; Yorou & de Kesel, 2001).

Recent data show that about 2189 edible species of mushrooms from 99 countries have been identified, of which 2006 are suitable for safe consumption, and 183 species require a pre-treatment prior to safe intake or are related with allergic responses by some individuals (Li et al., 2021). In some developing countries, the local knowledge about mushrooms varies across cultures and personal beliefs. Within local communities, this knowledge is passed from one generation to the next, this being one of the few fragile but effective ways of perpetuating knowledge about useful fungi (Boa, 2004; Li et al., 2021). Thus, over the years, forest dwellers have been developing different techniques for exploiting their lands and related resources, not only because they are a possible source of income, but also of food, medicines, and other valences (Ngalim, 2011). WEF are typically harvested in large quantities for later consumption, being sold during their fruiting periods, representing an excellent source of additional income for women and youth in Eastern (Walshaw, 2004), Central (Malaisse et al., 2008; Ndong & Degreef, 2011), and Western Africa (Yorou et al., 2014). In most African regions where the Bantu population lives, mushrooms are mostly picked by women and their children and, among the Central African pygmies, men also participate in this harvest. When commercialized, a very important factor to take into account is that in developing countries, mushroom pickers generally belong to marginalized groups, regardless of gender, thus representing an important source of family income for these communities during the harvest season (Pérez-Moreno et al., 2021). Few data concerning the commercialization of mushrooms, namely in African countries, are available in the literature. Among the Bofi and Bantu communities of the Central African Republic, fungi are a valuable commodity (Malaisse et al., 2008), with sporophores often being sold at roadside stalls or markets in some regions of Angola and Democratic Republic of Congo.

WEF have been consumed for thousands of years, dating back to the Upper Paleolithic period, over 18,700 years ago (Power et al., 2015). The number of wild mushrooms consumed varies between different regions of Africa. In the last few years, the annual average consumption per person reaches about 30 kg in Haut-Katanga in the Democratic Republic of Congo (Degreef & de Kesel, 2017). In addition, in Zimbabwe, a family consumes up to 20 kg of fresh mushrooms per year. These values rise abruptly when we talk about Mozambique, where approximately 160 kg of mushrooms are consumed per family (Boa et al., 2000). Similarly, a strong tradition of mushroom consumption exists in Malawi, where the average annual consumption of *Termitomyces schimperi* can reach 30/35 kg per family (Halling, 2006).

Usually, mushrooms preparation is limited to brushing and/or washing the fruiting bodies with water before processing. Other more resistant species, such as those of the genus *Lentinus*, are additionally bleached before preparation (Boa, 2004). Species with small fruiting bodies are often used as condiments and added to sauces to complement meat or fish dishes. Some species of *Lactarius* are occasionally eaten raw, as in Zambia (Pegler & Piearce, 1980; Piearce, 1981). In addition, pygmies usually readily consume all mushrooms they picked. On the other hand, different traditional methods for mushroom preservation can be used, including sun drying and, the most common in Tropical Africa, with fire or smoking for 3–4 days, being subsequently packaged, stored at room temperature, and often sold along the year (Boa, 2004).

Despite the rich biodiversity of the African continent, this remains largely unexplored resulting in poor food and medicinal contribution to the often malnourished populations (Yongabi et al., 2004). One of the regions on the African continent where mushrooms are consumed the most and where wild mushrooms are most important both as a food source and as a source of income for families is Central and Southern Africa (e.g., https://www.efta-online.org/). Thus, the aim of this review is to gather information on the wild mushroom species used in Central and Southern Africa and their main uses, with a focus on edible and medicinal species. Here, the term "mushroom" will be used to describe the edible or medicinal fruiting bodies of fungi, since others are generally not considered mushrooms, but basidiocarps.

2 | ETHNOMYCOLOGICAL PANORAMA OF MUSHROOMS IN AFRICAN FORESTS, DIVERSITY, AND IMPORTANCE OF THEIR USE BY RURAL COMMUNITIES

In the African continent, the ethnomycological knowledge of mushrooms, namely regarding their historical uses as food, medicines, source of income, and sociological impacts, is warned (Osarenkhoe et al., 2014). The defective identification and documentation of edible and medicinal species of mushrooms give rise to particular inconsistencies regarding their use in folk medicine, food, and mythological beliefs. In West Africa, the underexploitation and underutilization of mushrooms are related to factors of anthropogenic, ethnographic, and environmental origin, which is why ethnomycological data are scarce, random, limited, and inconsistent from a taxonomic point of view (Osarenkhoe et al., 2014). Thus, the growing investment in ethnomycological studies can be the basis for understanding the global and undeniable importance of fungi for past and modern civilizations (Lampman, 2010).

There are various ethnomycological reports in different regions of the African continent, which are however incoherent and based on the people's culture (Osarenkhoe et al., 2014). These works are a reflection of the understanding of genetic resources and highly influenced by popular taxonomy, this is why ethnomycological development, mushroom diversity, and taxonomy research are restricted, making these the apparent causes of the inconsistent global scientific nomenclature. Additionally, assigning traditional (dialectical) names only to useful mushrooms and not to poisonous ones, or those with unknown uses, is a limiting factor in the quality of ethnomycological information (Kinge et al., 2011).

2.1 | Diversity of wild edible mushrooms in the African continent

In West Africa, sedentary agriculture dates back to the fifth millennium, and it is not clear when the commodification of mushrooms began in this region, nor how much this influenced knowledge about mushrooms. In this region, like others on the same continent, climatic conditions, such as precipitation, are the primary factor that favors the availability, composition, and propagation of different mushroom species (Traill et al., 2013).

Globally, fungi diversity is estimated at around 1.5 million species (Hawksworth, 2001; O'Brien et al., 2005), although only about 7% of these are known (Hawksworth, 2002). This percentage decreases even further in West Africa, where only about 3% of all fungi species are known (Yorou, 2010). Despite these numbers, knowledge of edible mushroom species in Central, Southern, and East Africa is quite extensive (Buyck, 1994; Harkonen, 1995; Parent & Thoen, 1977), with around 300 species of edible mushrooms identified and described in these regions (de Kesel et al., 2002; Ducousso & Thoen, 2003; Yorou et al., 2014). Although West Africa is recognized as one of the regions with the highest prevalence of fungi, there is still no correct estimate of their diversity on the African continent (Osarenkhoe et al., 2014). In parallel, several ethnomycological studies have been conducted all over the world, namely in India (Malik et al., 2017; Sharma et al., 2022), Mexico (A. M. Lampman, 2007; Reyes-López et al., 2020), China (Brown, 2019), and other countries, thus improving the knowledge about mushrooms and their overall characteristics and beneficial assets and contributing to the documentation of several mushroom species still underexploited.

Most studies on edible mushrooms in Tropical Africa are pioneering, and current inventories are generally quite incomplete (de Kesel et al., 2017). However, some of the investigations that have already been carried out had made it possible to somehow expand the list of edible species, of which more than 300 are registered and distributed in several countries on the African continent (Degreef & de Kesel, 2017) (Figure 1). Some of the edible African mushrooms documented in the literature are presented in Table 1.

Data available in the literature show the prevalence of *Russulaceae* family in Central and Western Africa, with about 42 mushroom species being identified, namely those referring to *Lactarius* (4), *Lactifluus* (22), and *Russula* (16) genera. The *Cantharelaceae* family comes next, with about 27 species of *Cantharelus* being recorded, followed by *Agaricaceae* (18), *Amanitaceae* (15), and *Termitomyces* (13) families. In contrast, several other families and/or species are less prevalent in these African regions, such as *Boletinellaceae*, *Callistosporiaceae*, *Hymenogastraceae*, and *Morchellaceae*. As for the ecological type, the great majority of edible mushrooms are saprotrophic and mycorrhizal, with 93 and 91 identified species recorded, and 13 symbiotic species.

In many regions of Central Africa, edible mushrooms are known only by their vernacular names. Since the beginning of the 20th century, these have been the subject of more than 250 scientific publications (Halling, 2006; Ndong & Degreef, 2011). Most vernacular names have only local usage. However, several of these are also used in different geographical areas. Some of these names include *ochui vió* in Gabon, ubwoba in Burundi, bowa in Malawi, ubuyoga in Tanzania mbowa, ubuaba or uhwa in Zambia, *boua* in Central African Republic and the Democratic Republic of Congo, and *tortulho*, *chelene*, and *ndenda* in Angola (Buyck, 1994; Harkonen, 1995; Kissanga et al., 2022; Malaisse et al., 2008; Ndong, 2010; Pegler & Piearce, 1980).

2.2 | Traditional and medicinal uses of mushrooms in Central and Western Africa

Traditional knowledge of mushrooms in developing countries is of particular importance in uncovering relationships between humans and fungi in a given environment, both in the past and in the present civilizations (Molares et al., 2020; Sitotaw et al., 2020). In these countries, traditional knowledge about the different purposes of many mushroom species has been transmitted orally through centuries, from one generation to another across the world. This indigenous knowledge encompasses several uses, beliefs, and considerations about wild mushrooms (Molares et al., 2020), these being considered the "Food of the God" by the Romans, as a product capable of providing strength and vital capacity, according to Greek beliefs, as gifts from the god Osiris by ancient Chinese and Japanese communities, or even used in ritualistic presentations in ancient India and Iran (Dutta & Acharya, 2014). In Tropical Africa, however, knowledge of the traditional uses of mushrooms as well as documentation of their diversity is scarce. Despite this, and as mentioned earlier, some studies with particular emphasis on Central, East, and West Africa stated that there is a great diversity of edible and medicinal mushrooms in these regions (Soro et al., 2019). The multidisciplinary use of mushrooms has placed them in a prominent place in commercial crops with affordable prices, functioning as food, medicine, and a wide range of other potential uses, such as mycofungicides, biofertilizers, new medicines, animal feed supplement, and bioremediants, functioning as tools in the sustainable management of

TABLE 1 Documented wild edible mushrooms in Central and Southern Africa.

Scientific name	Common names	Countries	References
Saprophytes			
Agaricaceae			
Agaricus bingensis Heinem.	Boua	Benin, Democratic Republic of Congo	(Heinemann, 1956)
Agaricus bukavuensis Heinem. & Gooss.-Font.	Boua	Democratic Republic of Congo	(Heinemann, 1956)
Agaricus campestris L.	Boua, Bowa, Ubuyoga, Mbowa	Cameroon, Democratic Republic of Congo, Ethiopia, Kenya, Madagascar, Malawi, Somalia, Tanzania, Zambia	(Abate, 1999; de Kesel et al., 2017; Heinemann, 1956; Pegler & Rayner, 1969)
Agaricus croceolutescens Heinem. & Gooss.-Font.	Boua	Democratic Republic of Congo	(de Kesel et al., 2017; Heinemann, 1956)
Agaricus goossensiae Heinem.	Boua, Ochiu vió	Benin, Burkina Faso, Democratic Republic of Congo, Gabon, Ghana, Mali	(de Kesel et al., 2002; Heinemann, 1956; Ndong & Degreef, 2011; Pegler, 1969)
Agaricus kivuensis Heinem. & Gooss.-Font.	Boua	Democratic Republic of Congo	(de Kesel et al., 2017; Heinemann, 1956)
Agaricus subsaharianus L.A. Parra, Hama & De Kesel	Ubuyoga	Tanzania	(Hama et al., 2010; Harkonen, 2002)
Agaricus volvatulus Heinem. & Gooss.-Font.	Boua	Democratic Republic of Congo, Benin	(Heinemann, 1956)
Agaricus sp.	Ochiu vió	Ivory Coast, Gabon, Namibia	(Soro et al., 2019)
Chlorophyllum hortense (Murrill) Vellinga	Boua	Democratic Republico f Congo	(de Kesel et al., 2002; Degreef et al., 1997; Degreef & de Kesel, 2017)
Chlorophyllum palaeotropicum Z.W Ge & A. Jacobs	–	Benin	(Degreef & de Kesel, 2017)
Cystodermella elegans (Beeli) Harmaja	Ubuyoga	Kenya, Rwanda, Tanzania	(de Kesel et al., 2002)
Leucocoprinus cretaceus (Bull.) Locq	–	Benin	(Degreef et al., 2016; Pegler, 1972)
Macrolepiota africana (R. Heim) Heinem.	Boua, Ochiu vió, Bowa, Ubuyoga, Mbowa	Central African Republic, Cameroon, Democratic Republic of Congo, Gabon, Kenya, Rwanda, Tanzania, Zambia	(de Kesel et al., 2002)
Macrolepiota dolichaula (Berk. & Broome) Pegler & R.W. Rayner	Boua, Ochiu vió, Bowa, Ubuyoga, Mbowa	Paleotropical, Benin, Democratic Republic of Congo, Gabon, Kenya, Malawi, Ouganda, Rwanda, Tanzania, Zambia, Zimbabwe	(de Kesel et al., 2017; Heim, 1967; Heinemann, 1969, 1973)
Macrolepiota procera (Scop.) Sing.	Boua, Ochui vió, Ubuyoga, Mbowa	Central African Republic, Democratic Republic of Congo, Gabon, Tanzania, Zambia	(Degreef et al., 2016; Degreef & de Kesel, 2017; Ndong & Degreef, 2011; Pegler, 1969, 1972; Sharp, 2011; van Damme, 2021)
Micropsalliota bambusicola (Heinem.) Heinem.	Boua	Democratic Republic of Congo	(Malaisse et al., 2008; Ndong & Degreef, 2011; Pegler, 1972; Pegler & Piearce, 1980)
Podaxis pistillaris (L.) Fr.		South Africa, Benin, Mali, Zimbabwe	(Degreef & de Kesel, 2017)
Auriculariaceae			
Auricularia auricula-judae (Bull.) Quél.	Boua, Bowa	Cameroom, Democratic Republic of Congo, Malawi, Rwanda	(Degreef et al., 2016; Douanla-Meli, 2007; Morris, 1987)
Auricularia cornea Ehrenb.	Ubwoba, Bowa, Mbowa, Boua, Ochiu vió, Ubuyoga, Mbowa	South Africa, Benin, Burundi, Cameroom, Democratic Republic of Congo, Comores, Ivory Coast, Ethiopia, Gabon, Ghana, Madagascar, Malawi, Mali, Nigeria, Ouganda, Rwanda, Tanzania, Zambia, Zimbabwe	(Degreef et al., 2016; Douanla-Meli, 2007; Morris, 1987)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Auricularia delicata (Mont. ex Fr.) Henn.	Ubwoba, Bowa, Mbowa	Benin, Burundi, Democratic Republic of Congo, Malawi, Rwanda, Zambia	(de Kesel et al., 2002, 2017; Degreef et al., 1997, 2016; Harkonen, 2002; Härkönen et al., 2015; Ndong, 2009; Ndong & Degreef, 2011; Oso, 1975; Zoberi, 1973)
Boletinellaceae			
Phlebopus sudanicus (Har. & Pat.) Heinem.	Boua, Bowa, Mbowa	Tropical Africa, Benin, Burkina Faso, Democratic Republic of Congo, Malawi, Zambia	(de Kesel et al., 2002, 2017; Härkönen et al., 2015)
Callistosporiaceae			
Macrocybe lobayensis (R. Heim) Pegler & Lodge	Boua	South Africa, Benin, Democratic Republic of Congo, Ivory Coast, Ghana, Nigeria	(de Kesel et al., 2002; Degreef & de Kesel, 2017; Gryzenhout, 2010; Härkönen et al., 2015; Ndong & Degreef, 2011; Pegler, 1972)
Strophariaceae			
Gymnopilus zenkeri (Henn.) Singer	Boua, Ochiu vió, Bowa	Democratic Republic of Congo, Gabon, Malawi	(Degreef & de Kesel, 2017; Morris, 1987; Ndong, 2009; Ndong & Degreef, 2011)
Lyophyllaceae			
Termitomyces aurantiacus (R. Heim) R. Heim	Boua, Ubuyoga	Benin, Cameroon, Democratic Republic of Congo, Tanzania	(de Kesel et al., 2002, 2017; Härkönen et al., 2015)
Termitomyces clypeatus R. Heim	Boua, Ochiu vió, Bowa, Ubuyogam Mbowa	South Africa, Benin, Cameroon, Central African Republic, Democratic Republic of Congo, Gabon, Ghana, Kenya, Malawi, Nigeria, Ouganda, Tanzania, Zambia.	(de Kesel et al., 2002, 2017; Härkönen et al., 2015)
Termitomyces fuliginosus R. Heim	Boua, Ochiu vió	Democratic Republic of Congo, Gabon, Guinea, Sierra Leone	(de Kesel et al., 2002, 2017; Douanla-Meli, 2007; Harkonen, 2002; Härkönen et al., 2015; Heim, 1951, 1967; Malaisse et al., 2008; Morris, 1987; Ndong & Degreef, 2011; Oso, 1975; Pegler, 1969; van Dijk et al., 2003)
Termitomyces le-testui (Pat.) R. Heim	Boua, Ubuyoga, Mbowa	Tropical Africa, Benin, Burundi, Cameroon, Central African Republic, Republic of Congo, Democratic Republic of Congo, Ivory Coast, Kenya, Tanzania, Togo, Zambia	(Heim, 1951; Ndong, 2010; Ndong & Degreef, 2011)
Termitomyces mammiformis R. Heim	–	Cameroon	(Buyck, 1994; de Kesel et al., 2002; Degreef et al., 1997; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Malaisse et al., 2008; Ndong & Degreef, 2011; Pegler, 1972; Yorou et al., 2014)
Termitomyces medius R. Heim & Grassé	Boua, Mbowa	Benin, Democratic Republic of Congo, Togo, Zambia,	(Yongabi et al., 2004)
Termitomyces microcarpus (Berk. & Broome) R. Heim	Ubwoba, Boua, Ochiu Vió, Bowa, Ubuyoga, Mbowa	South Africa, Benin, Burundi, Cameroon, Central African Republic, Democratic Republic of Congo, Gabon, Kenya, Malawi, Nigeria, Uganda, Rwanda, Sierra Leone, Tanzania, Zambia, Zimbabwe	(de Kesel et al., 2002; Härkönen et al., 2015; Pegler & Piearce, 1980)
Termitomyces reticulatus Van der Westh. & Eicker	Boua	South Africa, Beni, Democratic Republic of Congo, Ghana, Togo, Zambia	(de Kesel et al., 2002, 2016; Harkonen, 2002; Härkönen et al., 2015; Morris, 1987; Ndong, 2009, 2010; Ndong & Degreef, 2011; Nzigidahera, 2007; Pegler, 1972; Sharp, 2011)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Termitomyces robustus (Beeli) R. Heim	–	Cameroon	(Degreef et al., 2016; Härkönen et al., 2015)
Termitomyces schimperi (Pat.) R. Heim	Boua, ubwoba, bowa, ubuyoga, mbowa, ubuaba ou uhwa	Burundi, Cameroon, Central African Republic, Democratic Republic of Congo, Ethiopia, Ghana, Guinea, Malawi, Mozambique, Namibia, Rwanda, Tanzania, Togo, Zambia	(Yongabi et al., 2004)
Termitomyces singidensis Saarim. & Härk.	Boua	Togo, Democratic Republic of Congo	(Apetorgbor et al., 2005; de Kesel et al., 2002; Degreef et al., 2016; Degreef & de Kesel, 2017; Härkönen et al., 2015; Malaisse et al., 2008; Morris, 1987; Njouonkou, 2011; Nzigidahera, 2007; Pegler & Piearce, 1980; Yorou et al., 2014)
Termitomyces striatus (Beeli) R. Heim	Boua, ubwoba, Boua, ochui vió, Bowa, Ubuaba	Benin, Burundi, Cameroon, Republic of Congo, Republic Central African, Democratic Republic of Congo, Uganda, Gabon, Ghana, Guinea. Kenya, Malawi, Mali, Nigeria, Ruanda, Serra Leoa, Togo, Zâmbia	(Degreef & de Kesel, 2017)
Termitomyces titanicus Pegler & Piearce	Ubwoba, boua, bowa, mbowa, ubuaba ou uhwa,	Burundi, Cameroon, Democratic Republic of Congo, Malawi, Zambia, Zimbabwe	(Buyck, 1994; de Kesel et al., 2002; Degreef et al., 1997, 2016; Härkönen et al., 2015; Malaisse et al., 2008; Ndong, 2009, 2010; Ndong & Degreef, 2011; Njouonkou et al., 2016; Nzigidahera, 2007; Parent & Thoen, 1977; Yorou et al., 2014)
Dacrymycetaceae			
Dacryopinax spathularia (Schwein.) G.W. Martin	Boua	South Africa, Benin, Democratic Republic of Congo, Ruanda, Zimbabwe	(Degreef et al., 2016; Degreef & de Kesel, 2017; Gryzenhout, 2010; Sharp, 2014)
Marasmiaceae			
Favolaschia calocera R. Heim	Boua, Ubuyoga, Mbowa	Democratic Republic of Congo, Tanzania, Zambia	(Harkonen, 2002; Härkönen et al., 2015)
Favolaschia tonkinensis (Pat.) Kuntze	Ubuyoga	Rwanda, Tanzania	(Harkonen, 2002; Härkönen et al., 2015)
Marasmius arborescens (Henn.) Beeli	Tortulho, Ubwoba, Boua, Ochui vió, Ubuyoga	Angola, Burundi, Cameroon, Democratic Republic of Congo, Gabon, Ghana, Kenya, Malawi, Nigeria, Uganda, Rwanda, Tanzania, Togo	(Ndong, 2009; Ndong & Degreef, 2011)
Marasmius bekolacongoli Beeli	Ubwoba, Boua, Ochiu vió, Ubuyoga	Benin, Burundi, Cameroon, Democratic Republic of Congo, Gabon, Kenya, Nigeria, Ouganda, Rwanda, Tanzania, Togo, Zimbabwe, Malawi	(Antonin, 2007; Ndong, 2009; Ndong & Degreef, 2011)
Marasmius brunneolus (Beeli) Singer	Boua	Democratic Republic of Congo, Nigeria, Zimbabwe	(Sharp, 2014; Walshaw, 2004)
Marasmius buzungolo Singer	Boua, Ochiu vió	Democratic Republic of Congo, Gabon	(Antonin, 2007; Beeli, 1928)
Marasmius heinemannianus Antonin		Benin	(Antonin, 2007; Ndong, 2009; Ndong & Degreef, 2011)
Trogia infundibuliformis Berk. & Broome	Boua, Ochui vió,	Democratic Republic of Congo, Gabon, Prince	(Antonin, 2007)
Morchellaceae			
Morchella crassipes (Vent.) Pers.	Ubuyoga	Kenya, Rwanda, Tanzania, Zimbabwe	(Degreef & de Kesel, 2017)
Omphalotaceae			
Lentinula edodes (Berk.) Pegler	Boua	Democratic Republic of Congo	(Degreef & de Kesel, 2017)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Marasmiellus inoderma (Berk.) Singer ex Furneaux	Boua, Ochui vió	Benin, Democratic Republic of Congo, Gabon, Nigeria, Togo	(Degreef & de Kesel, 2017)
Neonothopanus hygrophanus (Mont.) De Kesel & Degreef	Boua, Ochiu vió, Ubuyoga	Benin, Burkina Faso, Democratic Republic of Congo, Gabon, Ghana, Guinea, Kenya, Niger, Ouganda, Rwanda, Sierra Leone, Tanzania, Togo, Zanzibar	(Buyck, 1994; Degreef et al., 1997; Degreef & de Kesel, 2017; Härkönen et al., 2015; Walshaw, 2004)
Paxillaceae			
Paxillus brunneotomentosus Heinem. & Rammeloo	Ubwoba, Boua	Burundi, Democratic Republic of Congo, Kenya, Rwanda	(Akyüz & Kirbağ, 2010)
Physalacriaceae			
Armillaria borealis Marxm. & Korhonen	Boua	Democratic Republic of Congo, Rwanda	(Degreef et al., 2016)
Armillaria cepistipes Velen.	–	Rwanda	(Degreef et al., 2016)
Armillaria heimii Pegler	Boua, Ochiu vió, Bowa, Ubuyoga, Mbowa	South Africa, Cameroom, Central African Republic, Republic of Congo, Democratic Republic of Congo, Ivory Coast, Gabon, Kenya, Liberia, Madagascar, Malawi, Ouganda, Rwanda, Tanzania, Zambia, Zimbabwe	(Degreef et al., 2016)
Armillaria lutea Gillet	–	Rwanda	(Abomo-Ndongo et al., 2002; Degreef et al., 2016; Mohammed & Guillaumin, 1994; Morris, 1987; Mwenje et al., 2003; Ndong, 2009; Ndong & Degreef, 2011; Pegler, 1972)
Armillaria ostoyae (Romagn.) Herink	–	Rwanda	(Degreef et al., 2016)
Armillaria tabescens (Scop.) Emel	–	Rwanda	(Degreef et al., 2016)
Oudemansiella canarii (Jungh.) Höhn.	Boua	Tropical Africa, Democratic Republic of the Congo	(Degreef et al., 2016)
Pleurotaceae			
Pleurotus cystidiosus O.K. Mill.	Ubwoba, Boua	Benin, Burundi, Democratic Republic of Congo, Rwanda	(Akyüz & Kirbağ, 2010)
Pleurotus djamor (Rumph. ex Fr.) Boedijn	Boua, Ubuyoga	Pantropical. Benin, Democratic Republic of Congo, Rwanda, Tanzania	(Buyck, 1994; de Kesel et al., 2002; Degreef et al., 2016)
Pleurotus flabellatus Sacc	Boua, Ochiu vió, Bowa, Ubuyoga	Paleotropical. Cameroon, Democratic Republic of Congo, Gabon, Kenya, Malawi, Ouganda, Rwanda, Tanzania	(Degreef et al., 2016; Harkonen, 2002; Pegler, 1972)
Pleurotus fuscosquamulosus D.A. Reid & Eicker	–	Ivory Coast	(Degreef et al., 2016; Harkonen, 2002; Morris, 1987; Ndong, 2009; Ndong & Degreef, 2011; Pegler, 1972)
Pleurotus luteoalbus Beeli	Boua	Cameroon, Democratic Republic of Congo, Kenya	(Degreef & de Kesel, 2017)
Pleurotus ostreatus (Jacq.) P. Kumm.	–	Cameroon	(Njouonkou, 2011; Pegler, 1972)
Pleurotus pulmonarius (Fr.) Quél.	–	Cameroon	(Yongabi et al., 2004)
Pleurotus tuber-regium (Fr.) Singer			(Yongabi et al., 2004)
Pleurotus sajor-caju (Fr.) Singer	–	Cameroon	(Yongabi et al., 2004)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Pluteaceae			
Volvariella gloiocephala (DC.) Boekhout & Enderle	–	Cameroon	(Yongabi et al., 2004)
Volvariella parvispora Heinem.	Boua	Democratic Republic of Congo	(Yongabi et al., 2004)
Volvariella volvacea (Bull.) Singer	–	Cameroon	(Degreef & de Kesel, 2017)
Volvopluteus earlei (Murrill) Vizzini, Contu & Justo	Boua	Benin, Democratic Republic of Congo, Mali	(Yongabi et al., 2004)
Polyporaceae			
Echinochaete brachypora (Mont.) Ryvarden	Boua	Cameroon, Democratic Republic of Congo	(Degreef & de Kesel, 2017; Douanla-Meli, 2007)
Favolus spatulatus (Jungh.) Lév	Boua, Bowa, Ubuyoga, Mbowa	Democratic Republic of Congo, Malawi, Tanzania, Zambia	(Degreef & de Kesel, 2017; Douanla-Meli, 2007)
Favolus tenuiculus P. Beauv	Boua, Ochiu vió, Bowa, Ubuyoga, Mbowa	Benin, Cameroon, Democratic Republic of Congo, Gabon, Malawi, Mali, Rwanda, Tanzania, Togo, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015)
Lentinus brunneofloccosus Pegler	Boua	Central African Republic	(de Kesel et al., 2017; Degreef et al., 2016; Harkonen, 2002; Härkönen et al., 2015; Morris, 1987; Sharp, 2014; van Dijk et al., 2003)
Lentinus cladopus Lév	Boua, Bowa, Ubuyoga, Mbowa	Cameroon, Ivory Coast, Democratic Republic of Congo, Kenya, Malawi, Ouganda, Central African Republic, Rwanda, Tanzania, Tchad, Zambia, Zimbabwe	(Malaisse et al., 2008; Mpulusu et al., 2010; Ndong, 2009, 2010; Ndong & Degreef, 2011)
Lentinus retinervis Pegler	Boua	Cameroon, Democratic Republic of Congo	(Degreef et al., 2016; Njouonkou, 2011; Ryvarden et al., 1994; Sharp, 2011)
Lentinus sajor-caju (Fr.) Fr	Ochui vió, Ubuyoga	South Africa, Cameroon, Gabon, Tanzania,	(Njouonkou, 2011)
Lentinus squarrosulus Mont.	Boua	Benin, Cameroon, Central African Republic, Democratic Republic of Congo, Gabon,	(Douanla-Meli, 2007; Gryzenhout, 2010; Härkönen et al., 2015; Ndong & Degreef, 2011)
Pycnoporus sanguineus (L.) Murrill	Boua	Democratic Republic of Congo	(de Kesel et al., 2002; Degreef & de Kesel, 2017; Douanla-Meli, 2007; Malaisse et al., 2008; Ndong, 2009, 2010; Ndong & Degreef, 2011; van Dijk et al., 2003)
Porotheleaceae			
Gerronema hungo (Henn.) Degreef & Eyi	Boua, Ochiu vió	Cameroon, Democratic Republic of Congo, Gabon	(Harkonen, 2002)
Psathyrellaceae			
Coprinellus disseminatus (Pers.) J.E. Lange	Boua	Democratic Republic of Congo	(Degreef & de Kesel, 2017)
Psathyrella atroumbonata Pegler	Boua, Bowa, Ubuyoga	Benin, Democratic Republic of Congo, Kenya, Malawi, Nigeria, Rwanda, Tanzania	(Degreef & de Kesel, 2017)
Psathyrella candolleana (Fr.) Maire	Boua, Bowa, Ubuyoga	Benin, Democratic Republic of Congo, Malawi, Nigeria, Ouganda, Tanzania	(Degreef et al., 2016; Morris, 1987; Oso, 1975; Pegler, 1972)
Psathyrella tuberculata (Pat.) A.H. Sm.		Benin, Rwanda	(Morris, 1987; Oso, 1975; Pegler, 1972)
Rickenellaceae			
Cotylidia aurantiaca (Pat.) A.L. Welden	Ubuyoga	Burundi, Ruanda	(Degreef et al., 2016)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Sarcoscyphaceae			
Cookeina speciosa (Fr.) Dennis	Boua	Democratic Republic of Congo, Ivory Coast	(Degreef & de Kesel, 2017)
Schizophyllaceae			
Schizophyllum commune Fr.	Bwoba, Boua, Ochiu vió, Bowa, Ubuyoga, Mbowa	South Africa, Benin, Burundi, Cameroon, Central African Republic, Democratic Republic of Congo, Gabon, Kenya, Madagascar, Malawi, Mali, Nigeria, Ouganda, Tanzania, Zambia, Zimbabwe	(Degreef & de Kesel, 2017)
Strophariaceae			
Agrocybe broadwayi (Murrill) Dennis	–	Ivory Coast, Kenya	(Pegler, 1972)
Agrocybe elegantior Watling	Boua	Ivory Coast, Democratic Republic of Congo	(Pegler, 1972)
Hypholoma subviride (Berk. & M.A. Curtis) Dennis	Ubwoba	Burundi, Ruanda	(Degreef & de Kesel, 2017)
Tremellaceae			
Tremella fuciformis Berk.	–	Ivory Coast	(Degreef & de Kesel, 2017)
Tricholomataceae			
Lepista sordida (Schumach.) Singer	Boua	Benin, Democratic Republic of Congo, Rwanda, Togo, Zimbabwe	(Degreef et al., 2016; Degreef & de Kesel, 2017; Sharp, 2011)
Leucopaxillus brasiliensis (Rick.) Singer & A.H. Sm.		Benin	(Degreef et al., 2016; Degreef & de Kesel, 2017; Sharp, 2011)
Tricholomopsis aurea (Beeli) Desjardin & B.A. Perry	Ubwoba, Boua	Burundi, Democratic Republic of Congo, Rwanda, São Tomé, Togo, Zimbabwe	(Degreef & de Kesel, 2017)
Mycorrhizal			
Amanitaceae			
Amanita aff subviscosa Belli	–	Ivory Coast	(Soro et al., 2019)
Amanita afrospinosa Pegler & Shah-Smith	Tortulho, Ubwoba, Mbowa,	Angola, Benin, Burundi, Kenya, Zambia	(Soro et al., 2019)
Amanita bweyeyensis Fraiture, Raspé & Degreef	Ubwoba, Ubuyoga	Burundi, Rwanda, Tanzania	(Beeli, 1935; Pegler & Shah-Smith, 1997)
Amanita congolensis (Beeli) Tulloss, B.E. Wolfe, K.W. Hughes, Kudzma & D. Arora	–	Ivory Coast	(Degreef & de Kesel, 2017; Harkonen, 2002)
Amanita crassiconus Bas	Ubwoba, Mbowa	Benin, Burundi, Nigéria, Senegal, Zambia	(Soro et al., 2019)
Amanita flammeola Pegler & Piearce	Boua, Mbowa	Democratic Republic of Congo, Zambia	(de Kesel et al., 2002; Degreef & de Kesel, 2017; Härkönen et al., 2015)
Amanita loosei Beeli	Ubwoba, Boua, Bowa, Ubuyoga, Mbowa, ubuaba ou uhwa, Boua, Ubuaba, Ubuyoga	Sudano-Guinean and Zambezian regions, Angola, Benin, Burundi, Togo, Democratic Republic of Congo, Kenya, Malawi, Tanzania, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Härkönen et al., 2015; Pegler & Piearce, 1980)
Amanita mafingensis Härk. & Saarim.	Boua, Bowa, Ubuyoga, Mbowa	Democratic Republic of Congo, Malawi, Tanzania, Zambia	(Degreef & de Kesel, 2017; Harkonen, 2002; Nzigidahera, 2007; Ryvarden et al., 1994; Sharp, 2011)
Amanita masasiensis Härk. & Saarim	Boua, Ubuyoga, Mbowa	Benin, Democratic Republic of Congo, Mozambique, Tanzania, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015)
Amanita pudica (Beeli) Walleyn	Ubwoba, Boua, Mbowa	Burundi, Democratic Republic of Congo, Zambia	(de Kesel et al., 2002; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Sharp, 2011)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Amanita robusta Beeli	Boua	Democratic Republic of Congo	(Buyck, 1994; Degreef & de Kesel, 2017; Härkönen et al., 2015)
Amanita rubescens Pers.	Ubwoba, Bowa Mbowa, Ubuaba ou Uhwa, Boua, Ochiu vió, Bowa, Mbowa	Cosmopolitan South Africa, Benin, Burundi, Cameroon, Democratic Republic of Congo, Gabon, Malawi, Togo, Zambia	(Degreef & de Kesel, 2017)
Amanita strobilaceovolvata Beeli	Boua, Mbowa	Ivory Coast, Benin, Democratic Republic of Congo, Zambia	(Beeli, 1935; Gryzenhout, 2010; Härkönen et al., 2015; Morris, 1987; Ndong, 2009; Sharp, 2011)
Amanita xanthogala Bas		Ivory Coast	(Beeli, 1935; de Kesel et al., 2002; Härkönen et al., 2015; Soro et al., 2019)
Amanita subviscosa Beeli	Boua	Benin, Democratic Republic of Congo	(Soro et al., 2019)
Boletaceae			
Afroboletus luteolus (Heinem.) Pegler & T.W.K. Young	Ubwoba, Boua, Bowa, Ubuyoga, Mbowa	Benin, Burundi, Democratic Republic of Congo, Malawi, Tanzania, Togo, Zambia	(Buyck, 1994; de Kesel et al., 2002; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Morris, 1987)
Boletus loosii Heinem.	Ubwoba, Boua, Ubuyoga, Mbowa	Burundi, Democratic Republic of Congo, Tanzania, Zimbabwe	(Buyck, 1994; de Kesel et al., 2002; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Morris, 1987)
Mycoamaranthus congolensis (Dissing & M. Lange) Castellano & Walleyn	Boua, Bowa, Ubuyoga,	Democratic Republic of Congo, Malawi, Zimbabwe	(Degreef & de Kesel, 2017; Härkönen et al., 2015; Pacioni & Sharp, 2000; Verbeken et al., 2000)
Octaviania ivoryana Castellano, Verbeken & Thoen	Boua, Ochiu vió, Ubuyoga	Benin, Burkina Faso, Democratic Republic of Congo, Gabon, Ghana, Guinea, Kenya, Niger, Ouganda, Rwanda, Sierra Leone, Tanzania, Togo, Zanzibar	(Verbeken et al., 2000)
Xerocomus spinulosus Heinem. & Gooss.-Font.	Boua	Democratic Republic of Congo	(de Kesel et al., 2002; Degreef & de Kesel, 2017; Verbeken et al., 2000)
Xerocomus subspinulosus Heinem.	Ubwoba, bowa	Benin, Burundi, Democratic Republic of Congo, Togo	(Degreef & de Kesel, 2017)
Cantharellaceae			
Cantharellus addaiensis Henn.	Boua, Ubuyoga, Mbowa	Benin, Democratic Republic of Congo, Tanzania, Zambia, Zimbabwe	(de Kesel et al., 2002; Degreef et al., 2016; Degreef & de Kesel, 2017; Nzigidahera, 2007)
Cantharellus afrocibarius Buyck & V.Hofst.	Boua, Mbowa	Democratic Republic of Congo, Zambia	(Degreef et al., 1997; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Heinemann, 1956; Pegler & Piearce, 1980; Ryvarden et al., 1994)
Cantharellus congolensis Beeli	Tortulho, Boua, Ochui vió, Mbowa	Angola, Benin, Cameroon, Democratic Republic of Congo, Gabon, Togo, Zambia, Zimbabwe	(de Kesel et al., 2016; Härkönen et al., 2015)
Cantharellus conspicuus Eyssart., Buyck & Verbeken	Boua	Benin, Democratic Republic of Congo, Zimbabwe	(de Kesel et al., 2002, 2016; Härkönen et al., 2015; Ndong & Degreef, 2011; Sharp, 2011; Yorou & de Kesel, 2001)
Cantharellus defibulatus (Heinem.) Eyssart. & Buyck	Tortulho, Ubwoba, Boua	Angola, Burundi, Democratic Republic of Congo	(de Kesel et al., 2016)
Cantharellus densifolius Heinem.	Boua, Mbowa,	Central African Republic, Democratic Republic of Congo, Togo, Zambia	(Buyck, 1994; Degreef et al., 2016; Nzigidahera, 2007)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Cantharellus gracilis Buyck & V. Hofst	Boua	Democratic Republic of Congo	(Degreef et al., 2016; Härkönen et al., 2015)
Cantharellus guineensis De Kesel & Yorou	–	Benin	(Degreef & de Kesel, 2017)
Cantharellus humidicola Buyck & V. Hofst.	Boua, Ubuyoga	Democratic Republic of Congo, Mozambique, Tanzania	(de Kesel et al., 2016; Degreef et al., 2016)
Cantharellus isabellinus Heinem.	Boua, Ubuyoga	Benin, Cameroon, Democratic Republic of Congo, Tanzania	(Degreef & de Kesel, 2017)
Cantharellus longisporus Heinem.	Boua	Democratic Republic of Congo,	(Degreef et al., 2016; Degreef & de Kesel, 2017; Harkonen, 2002; Morris, 1987; Ndong, 2009; Ndong & Degreef, 2011; Pegler, 1972; Sharp, 2014)
Cantharellus luteopunctatus (Beeli) Heinem.	Boua	Cameroon, Democratic Republic of Congo, Kenya	(Harkonen, 2002)
Cantharellus microcibarius Heinem.	Boua	Democratic Republic of Congo	(Degreef & de Kesel, 2017; Heinemann, 1956)
Cantharellus mikemboensis De Kesel & Degreef	Boua, Ubuyoga, Mbowa	Democratic Republic of Congo, Kenya, Mozambique, Tanzania, Zambia, Zimbabwe	(de Kesel et al., 2017; Degreef & de Kesel, 2017)
Cantharellus minutissimus Buyck & V. Hofst.	Boua	Democratic Republic of Congo	(Degreef et al., 2016; Degreef & de Kesel, 2017)
Cantharellus miomboensis Buyck & V. Hofst.	Boua, Ubuyoga, Mbowa	Democratic Republic of Congo, Kenya, Mozambique, Tanzania, Zambia, Zimbabwe	(Degreef & de Kesel, 2017)
Cantharellus platyphyllus Heinem	Ubwoba, Boua, Ochiu vió,Ubuyoga, Mbowa	Benin, Burundi, Democratic Republic of Congo, Gabon, Mozambique, Tanzania, Togo, Zambia, Zimbabwe	(Degreef et al., 2016; Degreef & de Kesel, 2017)
Cantharellus pseudomiomboensis De Kesel & Kasongo	Tortulho, Boua	Angola, Democratic Republic of Congo	(Buyck, 1994; de Kesel et al., 2002; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Ryvarden et al., 1994; Sharp, 2011)
Cantharellus rhodophyllus Heinem.	Boua, Ochiu vió	Central African Republic, Democratic Republic of Congo, Gabon	(de Kesel et al., 2016; Degreef & de Kesel, 2017)
Cantharellus ruber Heinem.	Tortulho, Ubwoba, Boua, Ubuyoga, Mbowa	Angola, Burundi, Democratic Republic of Congo, Tanzania, Zambia	(Heinemann, 1956; Ndong & Degreef, 2011)
Cantharellus rufopunctatus (Beeli) Heinem.	Boua	Democratic Republic of Congo	(Degreef & de Kesel, 2017; Nzigidahera, 2007; Sharp, 2014)
Cantharellus solidus De Kesel, Yorou & Buyck	–	Benin	(de Kesel et al., 2016)
Cantharellus splendens Buyck	Tortulho, Ubwoba, Boua	Angola, Burundi, Democratic Republic of Congo	(de Kesel et al., 2011)
Cantharellus stramineus De Kesel	Boua	Democratic Republic of Congo	(Buyck, 1994; Degreef & de Kesel, 2017)
Cantharellus subcyanoxanthus Buyck, Randrianj. & Eyssart.	Ubwoba, Boua, Ubuyoga, Mbowa	Burundi, Democratic Republic of Congo, Madagascar, Tanzania, Zambia	(Heinemann, 1956)
Cantharellus sublaevis Buyck & Eyssartier	Tortulho, Boua, Mbowa	Angola, Democratic Republic of Congo, Zambia	(Degreef & de Kesel, 2017)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Cantharellus symoensii Heinem.	Ubwoba, Boua, Ubuyoga, Mbowa	Burundi, Democratic Republic of Congo, Tanzania, Zambia, Zimbabwe	(Buyck, 1994; Degreef et al., 1997; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015)
Cortinariaceae			
Mackintoshia persica Pacioni & C. Sharp	Tortulho, Boua, Mbowa	Angola, Mozambique, Democratic Republic of Congo, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Harkonen, 2002; Sharp, 2011)
Hydnaceae			
Clavulina albiramea (Corner) Buyck & Duhem	Boua, Bowa, Ubuyoga, Mbowa	Democratic Republic of Congo, Madagascar, Malawi, Tanzania, Zambia	(Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Sharp, 2011)
Laetiporaceae			
Laetiporus discolor (Klotzsch) Corner	Ubuyoga, Mbowa	Tanzania, Zambia, Zimbabwe	(Harkonen, 2002; Härkönen et al., 2015; Sharp, 2014; Verbeken & Walleyn, 2010)
Paxillaceae			
Gyrodon miretipes Heinem. & Rammeloo	Tortulho, Ubwoba	Angola, Burundi	(Degreef et al., 2016; Degreef & de Kesel, 2017)
Suillaceae			
Suillus granulatus (L.) Roussel	Ubwoba, Ubuyoga, Mbowa	Burundi, Rwanda, Tanzania, Zambia	(Degreef et al., 2016; Harkonen, 2002; Härkönen et al., 2015; Ryvarden et al., 1994)
Russulaceae			
Lactarius chromospermus Pegler	Ubwoba, Boua, Ubuyoga, Mbowa	Burundi, Democratic Republic of Congo, Tanzania, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Sharp, 2014; Verbeken & Walleyn, 2010)
Lactarius kabansus Pegler & Piearce	Ubwoba, Boua, Ubuyoga, Mbowa	Burundi, Democratic Republic of Congo, Kenya, Mozambique, Tanzania, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Sharp, 2014; Verbeken & Walleyn, 2010)
Lactarius tenellus Verbeken & Walleyn	Ubwoba, Boua, Bowa, Ubuyoga, Mbowa	Benin, Burundi, Cameroon, Democratic Republic of Congo, Kenya, Malawi, Tanzania, Togo, Zambia, Zimbabwe	(Buyck, 1994; de Kesel et al., 2016; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Nzigidahera, 2007; Verbeken & Walleyn, 2010)
Lactifluus annulatoangustifolius (Beeli) Buyck	Boua, Ochiu vió, Mbowa	Benin, Cameroon, Democratic Republic of Congo, Gabon, Guinea, Liberia, Madagascar, Zambia, Zimbabwe	(de Kesel et al., 2002; Degreef & de Kesel, 2017; Verbeken & Walleyn, 2010)
Lactifluus brunnescens (Verbeken) Verbeken	Ubwoba, Boua, Bowa, Mbowa	Burundi, Cameroon, Democratic Republic of Congo, Malawi, Zambia, Zimbabwe	(Verbeken & Walleyn, 2010)
Lactifluus densifolius (Verbeken & Karhula) Verbeken	Ubwoba, Boua, Bowa, Ubuyoga, Mbowa	Benin, Burundi, Democratic Republic of Congo, Malawi, Mozambique, Tanzania, Togo, Zambia	(Degreef & de Kesel, 2017; Njouonkou et al., 2016; Verbeken & Walleyn, 2010)
Lactifluus edulis (Verbeken & Buyck) Buyck	Ubwoba, Boua, Bowa, Ubuyoga, Mbowa	Benin, Burundi, Democratic Republic of Congo, Malawi, Mozambique, Tanzania, Togo, Zambia, Zimbabwe	(Buyck, 1994; de Kesel et al., 2002; Degreef & de Kesel, 2017; Harkonen, 2002; Maba et al., 2015; Nzigidahera, 2007; Verbeken & Walleyn, 2010)
Lactifluus flammans (Verbeken) Verbeken	Bowa, Mbowa	Benin, Malawi, Togo, Zambia	(Buyck, 1994; de Kesel et al., 2002; Degreef & de Kesel, 2017; Härkönen et al., 2015; Karhula et al., 1998; Maba et al., 2015; Verbeken & Walleyn, 2010)
Lactifluus gymnocarpoides (Verbeken) Verbeken	Tortulho, Ubwoba, Boua, Ubuyoga, Mbowa	Angola, Benin, Burkina Faso, Burundi, Ivory Coast, Guinea, Kenya, Madagascar, Tanzania, Togo, Mozambique, Senegal, Democratic Republic of Congo, Zambia, Zimbabwe	(de Kesel et al., 2002; Verbeken & Walleyn, 2010)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Lactifluus gymnocarpus (R. Heim ex Singer) Verbeken	Boua, Ochiu vió, Bowa, Ubuyoga, Mbowa	Benin, Camaroom, Democratic Republic of Congo, Ivory Coast, Gabon, Guiné, Libéria, Malawi, Senegal, Tanzania, Togo, Zambia	(de Kesel et al., 2002; Härkönen et al., 2015; Sharp, 2014; Verbeken & Walleyn, 2010; Yorou et al., 2014)
Lactifluus heimii (Verbeken) Verbeken	Ubwoba, Boua, Bowa, Ubuyoga, Mbowa	Burundi, Democratic Republic of Congo, Malawi, Tanzania, Togo, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Morris, 1987; Ndong, 2009; Ndong & Degreef, 2011; Pegler & Piearce, 1980; Verbeken & Walleyn, 2010; Yorou et al., 2014)
Lactifluus laevigatus (Verbeken) Verbeken	Ubwoba, Boua, Bowa, Ubuyoga, Mbowa	Burundi, Democratic Republic of Congo, Malawi, Tanzania, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Sharp, 2014; Verbeken & Walleyn, 2010)
Lactifluus longipes (Verbeken) Verbeken	Boua, Ochiu vió	Cameroon, Democratic Republic of Congo, Gabon, Togo	(Degreef & de Kesel, 2017; Verbeken & Walleyn, 2010)
Lactifluus longisporus (Verbeken) Verbeken	Ubwoba, Boua, Bowa, Mbowa	Benin, Burundi, Democratic Republic of Congo, Kenya, Madagascar, Malawi, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Verbeken & Walleyn, 2010)
Lactifluus luteopus (Verbeken) Verbeken	Ubwoba, Boua, Bowa, Uboyoga, Mbowa	Benin, Burkina- Faso, Burundi, Democratic Republic of Congo, Malawi, Tanzania, Togo, Zambia, Zimbabwe	(de Kesel et al., 2002; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Verbeken & Walleyn, 2010; Yorou et al., 2014; Yorou & de Kesel, 2001)
Lactifluus medusae (Verbeken) Verbeken	Boua, Bowa, Ubuyoga, Mbowa	Democratic Republic of Congo, Malawi, Mali, Mozambique,Tanzania, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Verbeken & Walleyn, 2010)
Lactifluus pelliculatus (Beeli) Buyck	Boua	Democratic Republic of Congo	(Degreef & de Kesel, 2017)
Lactifluus pseudovolemus (R. Heim) Verbeken	–	Benin, Madagascar	(Verbeken & Walleyn, 2010)
Lactifluus pumilus (Verbeken) Verbeken	Ubwoba, Uboyoga, Mbowa	Benin, Burundi, Kenya, Senegal, Tanzania, Zambia, Zimbabwe	(Verbeken & Walleyn, 2010)
Lactifluus rubiginosus (Verbeken) Verbeken	Ubuyoga, Mbowa	Tanzania, Zambia	(Härkönen et al., 2015; Verbeken & Walleyn, 2010)
Lactifluus rubroviolascens (R. Heim) Verbeken	Boua, Bowa, Mbowa	Benin, Cameroon, Democratic Republic of Congo, Kenya, Madagascar, Malawi, Zambia	(Degreef & de Kesel, 2017; Verbeken & Walleyn, 2010)
Lactifluus tanzanicus (Karhula & Verbeken) Verbeken	Ubuyoga	Tanzania	(Härkönen et al., 2015; Verbeken & Walleyn, 2010)
Lactifluus velutissimus (Verbeken) Verbeken	Ubwoba, Boua, Ubuyoga, Mbowa	Burundi, Democratic Republic of Congo, Kenya, Malawi, Tanzania, Zambia, Zimbabwe	(Degreef & de Kesel, 2017; Härkönen et al., 2015; Verbeken & Walleyn, 2010)
Lactifluus volemoides (Karhula) Verbeken	Ubuyoga, Mbowa	Benin, Kenya, Tanzania, Zimbabwe	(Harkonen, 2002; Verbeken & Walleyn, 2010)
Lactifluus xerampelinus (Karhula & Verbeken) Verbeken	Ubuyoga, Mbowa	Tanzania, Zambia, Zimbabwe	(Harkonen, 2002; Härkönen et al., 2015; Sharp, 2014; Verbeken & Walleyn, 2010)
Russula acuminata Buyck	Boua	Cameroon, Democratic Republic of Congo	(Buyck, 1994)
Russula cellulata Buyck	Tortulho, Ubwoba, Boua, Ubuyoga, Mbowa	Angola, Benin, Burundi, Democratic Republic of Congo, Kenya, Mozambique, Tanzania, Togo	(Buyck, 1994; Buyck & Nzigidahera, 1995; Degreef et al., 1997; Degreef & de Kesel, 2017; Harkonen, 2002; Kissanga et al., 2022; Nzigidahera, 2007)

(Continues)

TABLE 1 (Continued)

Scientific name	Common names	Countries	References
Russula ciliata Buyck	Ubwoba, Boua, Ubuyoga, Mbowa	Benin, Burundi, Democratic Republic of Congo, Kenya, Mozambique, Tanzania, Zambia, Zimbabwe	(Buyck, 1994; de Kesel et al., 2017; Harkonen, 2002; Härkönen et al., 2015; Sharp, 2011)
Russula compressa Buyck	Ubwoba, Boua, Ubuyoga, Mbowa	Benin, Burundi, Democratic Republic of Congo, Tanzania, Zambia, Zimbabwe	(Buyck & Nzigidahera, 1995; de Kesel et al., 2017; Harkonen, 2002; Härkönen et al., 2015; Sharp, 2011)
Russula congoana Pat.	Tortulho, Boua, Ubuyoga, Mbowa	Angola, Benin, Democratic Republic of Congo, Tanzania, Zambia, Zimbabwe	(de Kesel et al., 2002; Degreef & de Kesel, 2017; Harkonen, 2002; Härkönen et al., 2015; Sharp, 2011)
Russula flavobrunnea Buyck	Tortulho, Ubwoba, Boua	Angola, Burundi, Democratic Republic of Congo	(Buyck & Nzigidahera, 1995)
Russula grisea Fr.	–	Ivory Coast, Benin, Algeria	(Soro et al., 2019)
Russula meleagris Buyck	Boua	Benin, Cameron, Democratic Republic of Congo,	(Buyck, 1994; Degreef & de Kesel, 2017)
Russula ochrocephala Buyck	Boua	Cameroon, Democratic Republic of Congo, Senegal	(Buyck, 1994; Degreef & de Kesel, 2017)
Russula oleifera Buyck	–	Ivory Coast, Benin	(Buyck & Nzigidahera, 1995)
Russula phaeocephala Buyck	Tortulho, Ubwoba, Boua, Ubuyoga	Angola, Burundi, Zambezian Region, Democratic Republic of Congo, Tanzania	(Soro et al., 2019)
Russula roseoviolacea Buyck	Ubwoba, Boua	Burundi, Democratic Republic of Congo	(Degreef & de Kesel, 2017)
Russula sejuncta Buyck	–	–	(Buyck, 1994; de Kesel et al., 2017; Degreef & de Kesel, 2017)
Russula sese Beeli	Boua	Democratic Republic of Congo	(Degreef & de Kesel, 2017)
Russula sesemoindu Beeli	Boua	Democratic Republic of Congo	(Degreef & de Kesel, 2017)
Russula striatoviridis Buyck	Boua	Democratic Republic of Congo	(Degreef & de Kesel, 2017)

agroforests (Kaewchai et al., 2009; Osemwegie et al., 2012; Wasser, 2011).

The high nutritional value and pharmacological properties that come from mushrooms richness in bioactive compounds make them a worldwide appreciated product. In Table 2, the proximate composition of some wild edible mushrooms is presented. WEF are characterized by low-energy levels and high amounts of minerals, essential amino acids, vitamins, and fibers (Leal et al., 2013). Edible mushrooms are also a good source of proteins, with some species such as *Volvariella volvacea* and *Termitomyces robustus* showing values above 40 g/100 g od fresh matter (Adejumo et al., 2015). Carbohydrates such as glucose, chitin, glycogen, and glucan can also be found in fresh mushrooms' fruiting bodies (Rahi & Malik, 2016). Their individual low-fat profile, allied to the remaining nutritional assets of mushrooms, makes these suitable food to be incorporated into low-calorie diets (Barros et al., 2013). Due to their high moisture content, enzymatic activity, and high respiration rate, the mushroom's shelf life is usually short (1–3 days at room temperature). Hence, in Africa, mushrooms are often dried to prolong their shelf life and ensure their availability during the off-season period (Boa, 2004). When compared to meat and fish, mushrooms are an excellent and cheap source of proteins and essential amino acids, such as valine, leucine, isoleucine, threonine, and methionine (Rzymski et al., 2016), presenting as an ideal low-cost source of food and nutrition. Despite their rich nutritional profile, mushrooms proximate composition may vary widely, which may be attributed to several factors that include the fruiting body maturity, time of harvest, soil characteristics (pH and the availability of nutrients), environmental factors (rainfall and temperature), and genetics (Gebrelibanos et al., 2016).

Mushrooms are also a rich source of essential microelements (Table 3), which play important roles in biological systems, being co-factors of numerous enzymatic mechanisms (Rahi & Malik, 2016). Data available on the literature reveal the presence of several micronutrients, in different amounts according to the mushroom species. For example, potassium seems to be the major element occurring in *Coprinus cinereus* (3232 ± 2.6 mg/100 g) and *Pleurotus flabellatus* (1537 ± 2.4 mg/100 g), while in *V. volvacea*, phosphorus (1699 ± 2.57) and iron (426 ± 2.4) stood out. Interesting concentrations of sodium (686 ± 3.0) and calcium (549 ± 0.6) were also found in *P. flabellatus* and *Lentinus squarrosulus*. Other microelements such as copper, manganese, and magnesium seem to occur more restrictedly in different species of mushrooms. As for vitamin C, *C. cinereus* and *L. squarrosulus* present highest concentrations (58 and 55 mg/100 g, respectively).

The bioaccumulation of minerals by mushrooms in their fruiting bodies from the environment in which they are inserted is well described in the literature (Kalač, 2010; Rajarathnam et al., 1998) and depending on ecological and genetic factors, superior mushroom species are generally rich in mineral constituents (Schmitt et al., 1977; Vetter, 1990). In this field, different factors can influence the accumulation of minerals in mushrooms, namely the species, the morphological part of the fruiting body, the evolving stage and age of the

TABLE 2 Nutritional composition (% dry weight) and energy (kcal) of wild edible mushrooms from Central and Southern Africa.

Samples	Moisture (% fw)	Ash (mg/100 g)	Crude protein (g/100 g)	Crude fiber (g/100 g)	Fat (%)	Carbohydrate g/100 g)	Energy (kcal)	References
Agaricus campestris	85.1	3.5	38.9	–	2.7	54.9	562	(Beluhan & Ranogajec, 2011)
Amanita rubescens	90.9	4.6	26.0	–	7.2	62.2	380	(Ouzouni & Riganakos, 2007)
Macrolepiota procera	87.7	5.4	23.9	–	2.3	68.4	480	(Ouzouni & Riganakos, 2007)
Pleurotus flabellatus	93	6.1	21	11	1.3	60	302	(Mshandete & Cuff, 2007)
Pleurotus ostreatus	88.3–92.8	5.65–7.6	24.9–32.31	5.97	15.38–21	33.57–65.4	–	(Adejumo et al., 2015; Beluhan & Ranogajec, 2011)
Pleurotus pulmonarius	89.01	7.95	23.63	8.16	11.63	37.64	–	(Adejumo et al., 2015)
Pleurotus sajor-caju	.	6.8	29.3	–	0.9	63.0	–	(Gogavekar et al., 2014)
Pleurotus sajor-caju	–	6.4	15.3	–	2.9	75.4	–	(Obodai et al., 2014)
Pleurotus tuber-regium	–	6.3	13.3	.	1.3	79.1	–	(Obodai et al., 2014)
Suillus granulatus	92.3	5.2	16.5	–	4.0	74.3	307	(Ouzouni & Riganakos, 2007)
Termitomyces robustus	88.6	13.71	41.19	5.27	9.07	19.36	–	(Adejumo et al., 2015)
Termitomyces robustus	–	6.3	13.3	–	1.3	79.1	–	(Obodai et al., 2014)
Volvariella volvacea	87.64	16.10	42.63	5.14	10.60	13.17	–	(Adejumo et al., 2015)
Volvariella volvacea	91	10	28	9.8	3.3	50	305	(Mshandete & Cuff, 2007)

TABLE 3 Microelements and vitamin C composition of selected edible mushrooms from Africa.

Samples	Calcium (mg/100 g)	Sodium (mg/100 g)	Potassium (mg/100 g)	Magnesium (mg/100 g)	Phosphorus (mg/100 g)	Zinc (mg/100 g)	Iron (mg/100 g)	Manganese (mg/100 g)	Copper (mg/100 g)	Vitamin C (mg/100 g)	Methods	References
Coprinus cinereus	214 ± 2.6	338 ± 2.3	3232 ± 2.6	32 ± 2.1	1142 ± 3.0	141 ± 3.4	248 ± 2.2	14 ± 3.1	23 ± 0,1	55 ± 1.91	AOAC procedures	(Mshandete & Cuff, 2007)
Lentinus squarrosulus	549 ± 0.6	–	–	–	–	–	–	–	–	58 ± 0.14		(Okoro & Achuba, 2012)
Pleurotus flabellatus	120 ± 2.2	686 ± 3.0	1537 ± 2.4	40 ± 1.9	1616 ± 2.97	145 ± 2.3	209 ± 2.5	10 ± 1.8	22 ± 0.2	33 ± 1.19		(Adejumo et al., 2015; Mshandete & Cuff, 2007)
Pleurotus ostreatus	87,50	6.52	2.68	51.27	–	–	–	–	–	10.16		(Adejumo et al., 2015)
Pleurotus pulmonarius	40.25	3.59	7.25	20.75	–	–	–	–	–	14.1O		(Adejumo et al., 2015)
Termitomyces microcarpus	38.45	2.67	4.34	40.75	–	–	–	–	–	12.15		(Adejumo et al., 2015)
Termitomyces robustus	54.10	3.92	4.56	32.42	–	–	–	–	–	10.25		(Adejumo et al., 2015)
Volvariella volvacea	37.15	1.58	2.62	25.22	1699 ± 2.57	68 ± 2.2	426 ± 2.4	52 ± 1.7	16 ± 0.42	6.57		(Adejumo et al., 2015; Mshandete & Cuff, 2007)

FIGURE 1 Main distribution of wild edible mushrooms in African countries. *Source*: Degreef and de Kesel (2017); www.EFTA-online.org.

mycelium, the biochemical arrangement of the medium, and the intervals of fruiting of mushrooms (García et al., 1998; Soylak et al., 2005). Minerals such as iron, copper, zinc, and manganese are essential metals in different biological systems, whereas lead and cadmium can be toxic even in trace amounts (Schroeder, 1976). However, when ingested in excessively high doses, essential minerals can also produce toxic effects (Soylak et al., 2005).

Thus, it is essential to assess the microelement content in different species of mushrooms, subject to different cultivation conditions, thus evaluating their contribution to the ingestion of different toxic elements on a daily basis, defining at the same time safety limits in their ingestion.

In addition to its valuable nutritional properties, mushrooms also hold several medicinal assets. In fact, the growing globalization and consumption of dietary and medicinal products with a natural component included mushrooms in the list of alternative medicine products.

It is well assumed that the use of different species of wild mushrooms comes from ancient experiences and opportunistic discoveries. Some of the traditional medicinal uses of wild African mushrooms are described in Table 4. The medicinal properties of mushrooms of the genera *Pleurotus* are known in several continents, such as Asia, Europe, South America, and Africa. *Pleurotus ostreatus* is traditionally known for its antimicrobial assets, mainly against *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, and *Candida albicans* (Wisbeck et al., 2002). The extract obtained from this mushroom species (traditionally known as shimeji mushroom) also proved to be effective as an antioxidant agent in vitro, showing a positive correlation between the total phenolic content and the antioxidant capacity (Stefanello et al., 2012). In Cameroon, *Ganoderma lucidium* is usually dried and mixed with palm oil to be used as an ointment to treat skin conditions. This valuable medicinal species has also been traditionally used to treat stomachache, hemorrhoids, rheumatism, arthritis, neoplasia, among others, and its extract may also be used as an insecticide and antibiotic (Oyetayo, 2011; Soro et al., 2019; Yongabi et al., 2004). Other species of the same genera have also been used to whet newborn's appetite (Soro et al., 2019), as a hypertensive (Oyetayo, 2011), and to treat sick cows (Mdachi et al., 2004). Several health benefits were also traditionally named to *Daldinia concentrica*, which has been used in Nigeria to treat hernia, stomachache, in the reduction of big navel of newborn babies and invigoration of kidneys activity, among other valences (Oyetayo, 2011; Soro et al., 2019). Despite the scarce knowledge concerning the traditional use of mushrooms and their invisible vegetative forms (mycelium), the use of sclerotia from *Pleurotus tuber-regium* in the preparation of soups and for the treatment of mumps has also been reported in Nigeria (Isikhuemhen & Okhyoya, 1996).

The drawbacks for the application of fungi in modern medicine and for production on an industrial scale are based on the fact that most of these organisms are available seasonally only. In addition, the amount of bioactive ingredients is highly dependent on the collection time, procedures, season, and environment. Additionally, the concentration of heavy metals and radioactive isotopes are limiting factors for its application for medicinal purposes (Enshasy et al., 2013).

Different compounds are responsible for the therapeutic capabilities of different species of mushrooms, making them exploitable at the pharmaceutical level (Table 5) (Reis et al., 2011; Soares, 2007). Polysaccharides are the main bioactive compounds present in

TABLE 4 Traditional medicinal uses of wild mushrooms from Africa.

Scientific name	Common/local name	Country	Medicinal use	References
Calvatia cyathiformis (Bosc) Morgan	–	Nigeria	Treatment of leucorrhea, bareness, and hiccups	(Oyetayo, 2011)
Daldinia concentrica (Bolton) Ces. & De Not.		Côte d'Ivoire, Nigeria	Hernia, stomachache, pediatrics (stomachache), reduction of big navel of newborn babies, invigoration of kidney's activity, treatment of stomach ulcer and upset, skin disease, and whooping cough and prevention of excessive growth of fetus to ease the delivery	(Oyetayo, 2011; Soro et al., 2019)
Ganoderma spp.	Ubuyoga	Tanzania	Treatment of sick cow	(Mdachi et al., 2004)
Ganoderma sp.	–	Côte d'Ivoire	Pediatrics (whet newborn appetite)	(Soro et al., 2019)
Ganoderma applanatum (Pers.) Pat.	–	Nigeria	Antioxidant and used for lowering blood sugar level, as well as antihypertensive	(Oyetayo, 2011)
Ganoderma lucidum (Curtis) P. Karst.	–	Côte d'Ivoire, Nigeria, Cameroon	Stomachache, make giving birth easier, use as antibiotic after giving birth, hemorrhoid, healing wound, rheumatism, insecticide, treatment of arthritis and neoplasia; traditional medicine to treat skin infections, boils, abscesses, and tumors. It is also used as a component in other medicinal preparations	(Oyetayo, 2011; Soro et al., 2019; Yongabi et al., 2004)
Lentinus tuber-regium (Fr.) Fr	–	Côte d'Ivoire	Pediatric, burnt's wound	(Soro et al., 2019)
Lentinus squarrosulus (Mont.)	–	Nigeria	Treatment of mumps and heart diseases	(Oyetayo, 2011)
Pleurotus tuber-rigium (Fr.) Quél.	–	Nigeria	Treatment of headache, cold, fever, stomachache, and constipation	(Oyetayo, 2011)
Fomitopsis officinalis (Vill.) Kotl. & Pouzar	–	Nigeria	Treatment of hernia, cough, and catarrh	(Oyetayo, 2011)
Termitomyces microcarpus (Berk. & Br.) Heim	Ubuyoga	Nigeria, Tanzania	Treatment of gonorrhea, health promoter and inducer of breast lactation	(Tibuhwa, 2012)
Schizophyllum commune Fr.	–	Nigeria	Treatment of diabetes	(Oyetayo, 2011)
Volvariella volvacea (Bull.) Singer	–	Côte d'Ivoire, Nigeria	Fat removal, antibiotic and antineoplastic	(Oyetayo, 2011; Soro et al., 2019)

medicinal mushrooms, exhibiting different spectrum of bioactivities, such as antitumor, anti-proliferative, antidiabetic, anti-inflammatory, and antimicrobial assets. In this class of compounds, special emphasis must be given to glucans, mainly β-glucans, which perform different bioactivities, such as antimicrobial and hypoglycemic, also promoting the boost of immunity through the production of activating macrophages (Disler et al., 2019; Minato et al., 2019; Yang et al., 2018). The presence of glucans has been reported in different species of wild mushrooms, such as *Pleurotus pulmonarius* and *P. tuber-regium*, namely mannogalactoglucan, xyloglucan (Reis et al., 2012), while other polysaccharides such as tremellastin and tchizophyllan were identified in *Tremella fuciformis* and *Schizophyllum commune*, respectively (Reis et al., 2012). Terpenes, in turn, are responsible for the antioxidant, anticancer, and anti-inflammatory activities including other biological activities exercised by mushrooms (Ruan & Popovich, 2012; Sánchez-Moreno, 2002). The fruiting bodies of *G. lucidium* hold in their composition different triterpenes, such as ganoderic, lucidenic, and lanostane-type triterpenic acids (Akihisa et al., 2007; Bartels, 2003; Iwatsuki et al., 2003; Tang et al., 2006). In addition, in this species, different cerebrosides and steroids were identified (Hassan et al., 2019; Reis et al., 2012). The phenolic compounds occurring in mushrooms can also be responsible for their antioxidant properties, which can act as peroxidase decomposers, metal inactivators, oxygen scavengers, or free radical inhibitors. These may include phenolic acids, oxidized polyphenols, hydroxybenzoic acids, flavonoids, tannins, hydroxycinnamic acids, stilbenes, and lignans (D'Archivio et al., 2010). Mushrooms may also produce several bioactive proteins and peptides such as lectins, as is the case of *V. volvacea*, fungal immunomodulatory proteins, ribosome-inactivating proteins, and laccases (Sánchez-Moreno, 2002).

From the data presented and numerous additional data reported in the literature, it is possible to identify a direct relationship between the traditional and mostly medicinal uses of wild mushrooms from different African countries with the occurrence of different classes of bioactive compounds in mushrooms. This extrapolation to the current scientific reality validates the ancestral knowledge of ancient peoples, perpetuated over the centuries, about the beneficial

TABLE 5 Bioactive compounds and properties of selected wild mushrooms.

Mushroom species	Class of compound	Bioactive component or extraction Solvent	Bioactivity	Active dose	References
Auricularia auricular L.	Polysaccharides	Linear (1-3)-β-D-glucan	Antitumor	–	(Reis et al., 2012)
Ganoderma applanatum (Pers.) Pat.	Steroids	Ergosta-4,6,8(14),22-tetraen-3-one 80% ethanol (a) and water (b) 80% ethanol (a) and 50% methanol (b) Water (a), 5% NaOH (b), and 2% ammonium oxalate (c) Water	Antitumor Anti-proliferative Anti-inflammatory Immuno-stimulatory Antimicrobial	0.5 mg/mL (a) (++), 1 mg/mL (b) (+) 1 mg/mL (a) (+++), 1 mg/mL (b) (+++) 1 mg/mL (a) (+++), 1 mg/mL (b) (+), 1 mg/mL (c) (+) Against *P. aeruginosa*, *P. fluorescens*, *B. subtilis*, *S. epidermidis*, (MIC = 100 mg/mL (isolate 1), 10 mg/mL (isolate 2), and M. luteus (+++)	(Hassan et al., 2019; Reis et al., 2012; Smith et al., 2017)
Ganoderma lucidum (Curtis) P. Karst.	Cerebrosides Triterpenes/steroids Organic germanium Polysaccharides	(4E,8E)-N-D-2′-Hydroxypalmitoyl-1-*O*-β-D-glucopyranosyl-9-methyl-4,8sphingadienine (4E,8E)-N-D-2′-Hydroxystearoyl-1-*O*-β-D-glucopyranosyl-9-methyl-4,8sphingadienine Methanol and water Lucidenic acid *O* Lucidenic lactone Cerevisterol Lucidumol A and B Ganoderiol F Ganodermanondiol Ganodermanontriol Ganoderic acids A , F , H , W , X , Y , T Methanol and water Bis-β-carboxyethylgermanium sesquioxide:O3$_{(GeCH2CH2COOH)2}$ Mannogalactoglucan (1-3)-β-Glucuronoglucan Water	Antitumor Antimicrobial	- MIC = 0.1 mg/mL (+++) against *S. epidermidis*	(Hassan et al., 2019; Reis et al., 2012)
Pleurotus djamor (Rumph. ex Fr.) Boedijn		Hydro-alcoholic extracts, pentadecanoic, hexadecanoic, octadecadienoic, octadecanoic acid	Anthelmintic activity	40 mg/mL	(Pineda-Alegría et al., 2017)
Pleurotus ostreatus (Jacq.) P. Kumm.	Trace elements Polysaccharides	Selenium Pleuran 80% ethanol, 50% methanol Water Water and alcohol Ethanol extract	Antitumor Anti-proliferative , anti-inflammator Immuno-stimulatory Antioxidant (a), Antimicrobial Antibacterial	(a) (++), 1 mg/mL (+++) 1 mg/mL (++) EC50 = 1.05 μg/mL (++) (DPPH assay), MIC = 7.83 μg/mL (+) against *S. agalactiae* (CIM = 0,15 mg/mL) contra *B. subtilis*	(Adebayo et al., 2018; Deo et al., 2019; Negri, 2012; Reis et al., 2012)

(Continues)

TABLE 5 (Continued)

Mushroom species	Class of compound	Bioactive component or extraction Solvent	Bioactivity	Active dose	References
Cordyceps sinensis (Berk.) Sacc. *Cordyceps militaris* (L.) Fr.	Peptides	Cordymin	Anti-inflammatory	–	(Wang et al., 2012; Wong et al., 2011)
Pleurotus pulmonarius (Fr.) Quél.	Polysaccharides	Mannogalactoglucan Xyloglucan Mannogalactan Glucoxylan	Antitumor	–	(Reis et al., 2012)
Pleurotus tuber-regium (Fr.) Singer	Polysaccharides	Alkali-soluble glucan Polysaccharide Water and alcohol	Antitumor Anti-proliferative (a) Antimicrobial (b)	MIC = 6.03 μg/mL (b) (++) against *S. agalactiae*	(Reis et al., 2012; Zhang & Cheung, 2011)
Schizophyllum commune Fr.	Polysaccharides	Schizophyllan, SPG	Antitumor	–	(Reis et al., 2012)
Tremella fuciformis Berk.	Polysaccharides	Tremellastin (glucuronoxylomannans)	Antitumor	–	(Reis et al., 2012)
Volvariella volvacea (Bull.) Singer	Glycoproteins and proteins	Lectins	Antitumor	–	(Reis et al., 2012)
Craterellus cornucopioides (L.) Pers.	Phenolic compounds	Myricetin	Antioxidant		(Palacios et al., 2011)
Agaricus bisporus (J.E.Lange) Imbach	Phenolic compounds	Pyrogallol	Antioxidant		(Witkowska et al., 2011)
Albatrellus ovinus (Schaeff.) Kotl. & Pouzar	Phenolic compounds	Grifolin and grifolin derivatives	Antioxidant		(Nukata et al., 2002)

properties of mushrooms, which serves as the basis for greater knowledge and curiosity at a scientific level about the valences of this valuable NTFP. Although some of the mushroom species referenced in Tables 3 and 4 are not specifically referenced for Central and Southern Africa, their mention seems relevant to highlight the countless potential of mushrooms regarding their composition in bioactive compounds and, consequently, to its bioactive capacity.

3 | IDENTIFICATION OF EDIBLE AND INEDIBLE WILD MUSHROOMS AND TOXICOLOGY PROBLEMS

Despite the numerous benefits that come from the regular consumption of mushrooms, both nutritionally and medicinally, some risks may also be associated with their consumption (Širić et al., 2017).

The correct taxonomic identification of mushrooms is challenging as no single tool can allow unambiguous species identification in most cases. An integrative taxonomical approach seems to be the best practice, aiming at evaluating diagnostic characters, either phenotypic, molecular, or both, also combining genealogy (phylogeny), phenotype (including autecology), and reproductive biology data (Kissanga et al., 2022). Molecular biology techniques have been increasingly used to identify species and, although there is currently no single tool for identifying fungi, DNA barcoding has succeeded as a tool to identify fungi genera and species (Seifert, 2009).

The harvesting of wild mushrooms for own consumption is a risky activity since the correct identification of species is essential for its conscious and safe consumption (Machado-Gonçalves et al., 2018). There are many references regarding edible fungi in different countries of tropical Africa and, in parallel, some authors have been focusing on the identification of toxic or unedible species. Despite their nutritional and medicinal assets, wild mushrooms may contain high concentrations of potentially toxic elements (PTEs), such as toxic metals, rare earth elements (REEs), and radionuclides, which may be transferred to the human food chain throughout its consumption (Gwenzi et al., 2021). The accumulation of toxic metals (e.g., arsenic, cadmium, and lead) by mushrooms is independent of whether the species is edible or not. However, it depends on soil quality parameters and the nature of the environment (Rasalanavho et al., 2019).

Several long-term monitoring investigations in Europe and Asia have been focusing on mushrooms' potential toxicity. A study that monitored the ^{137}Cs radioactive isotope activity of mushrooms over a period of 25 years in the Czech Republic reported that this activity was influenced by the mushroom species (Škrkal et al., 2013). A similar study monitored the toxicological effects and nutritional value of edible wild mushrooms in Polish forests for half a century. The study reported that PTEs and REEs in soil had a strong correlation with their concentration in the fruit bodies of four different mushroom species (Mleczek et al., 2021; Siwulski et al., 2020). Despite the lack of long-term monitoring studies in Africa, an increasing number of investigations also reported PTEs in mushrooms from various countries, including Cameroon, Ethiopia, Ghana, Nigeria, South Africa, Zambia, and Zimbabwe (Abulude & Ndamitso, 2018; Chungu et al., 2019; Gebrelibanos et al., 2016; Nharingo et al., 2015; Quarcoo, 2013; Rasalanavho et al., 2019).

Gwenzi et al. (2021) noticed that human exposure to toxicity occurs mainly through the consumption of mushrooms and their products and, to a lesser extent, indirectly through the ingestion of edible insects and wild animals that feed on mushrooms. In Africa, the greatest risk of human exposure to mushroom toxicity may be due to (1) the widespread consumption of mushrooms from various ferrous and highly mineralized substrates such as streamers and mine dumps, (2) inadequate and poorly enforced environmental health and food safety regulations and policies, (3) lack of environmental and human health monitoring data and well-equipped health facilities to facilitate early detection and treatment of human health effects, (4) potential synergistic interactions between PTEs in mushrooms and other human food products and health stressors, such as a high burden of human disease and infections (Gwenzi et al., 2021). Although the health effects of individual PTEs are well known, evidence linking the human health risk to PTEs in mushrooms remains weak.

The Democratic Republic of Congo, particularly the Haut-Katanga province, has been the subject of a high number of investigations on edible mushrooms. de Kesel et al. (2017) reported that the consumption and sale selectivity of certain mushroom species is linked to the competition between these in nature. During the rainy season, marginal or low-quality species are generally abandoned in favor of mushrooms that are abundantly fruitful and have high-income potential. In Haut-Katanga, the population prefers ectomycorrhizal species (e.g., *Amanitas*, *Chanterelle*) that grow in close association with trees in the open forest and by *Termitomyces*. In the dry season, with the mushrooms' scarcity, the consumer resorts to saprotrophic species, less abundant and less appreciated, but this species persist in different parts of the riparian forests along the banks of the rivers.

The phenology of edible mushrooms (rate of sporophore appearance) varies with the season and is essentially dependent on precipitation. The sequence of species appearance is almost immutable and may be related to the state of soil hydration (Malaisse & Kapinga, 1986). The succession of species is known by local populations that go to specific places in the forest where harvest of sporophores at different times of the year occurs. In Haut-Katanga, Burundi, or Zambia (Bourdeaux et al., 2003), a strong succession of species is observed during the first weeks after the onset of the rains, with the replacement of most species from week to week. After the dry season (January to February), some of these species disappear, while others return in small numbers and new taxa bear fruiting bodies. From the first rains in October, *Termitomyces* appear on the surface of high termite mounds. In November, traditionally, the first edible amanitas appear, in particular *Amanita mafingensis*, *Amanita masasiensis* and specially *Amanita loosei*, available throughout the rainy season and consumed in abundance until April. The other ectomycorrhizal genera, with milk caps, such as *Russulla*, and *Cantharellus* appear later. Among the most popular species, *Lactifluus edulis* and *Lactarius kabansus* are often harvested from November to March. From the end of December, the different species follow one another in waves near the ectomycorrhizal trees in the open forest. Chanterelle's production peaks occur from January to Abril with the fruiting of *Cantharellus platyphyllus* being the most consumed and sold species in the markets of Haut-Katanga. Certain saprotrophic lignicolous species, such as *Auricularia* sp. or *S. commune*, have the ability to survive in extreme drought conditions and rehydrate once the rain return, so they can be harvested and consumed throughout the year.

According to de Kesel et al. (2017), the interpretation of ethnomycological data on the edibility of a species is often easy since its consumption by the local population is an undeniable proof. However, the ethnomycological identification of toxic mushrooms is dubious, as the identification of edible species among others considered toxic by local populations. However, very few poisonings from toxic fungi ingestion have been reported in tropical Africa, some of them being related to the consumption of contaminated pods during harvesting, drying, and transport, or from undercooked specimens. For the Burundi and Nigeria populations, fungus consumption by animals (monkeys, birds) is, erroneously, considered proof of its edibility. Even though the topic of wild fungal toxicity has often been addressed in ethnomycological surveys, the classification criteria used by local communities to differentiate edible from non-edible or toxic species are mostly nonobjective. For some, an unusual color change during processing, an unpleasant taste or smell, may also constitute evidence of its toxicity (de Kesel et al., 2002).

4 | CONCLUSIONS AND FUTURE PERSPECTIVES

Although highly biodiverse, the Central and Southern African forests have much of their mycological resources still underexploited or relatively unknown, with the limitation of the safe use of mushrooms from this and other regions being steered by the shortage of studies that allow validating their nutritional and medicinal properties.

Wild edible mushrooms are valuable and functional foods as they are a good source of different nutrients, especially proteins, carbohydrates, vitamins, and minerals. Furthermore, these hold a broad variety of bioactive compounds, which makes them a potential source of l medicines in the treatment and prevention of a wide range of diseases, such as cancer and immune illnesses. Although studies on mushrooms' bioactive properties from African countries are scarce, the literature demonstrates that species from different locations, such as *P. ostreatus* and *Ganoderma lucidum*, are highly bioactive and can be used to produce similar groups of bioactive compounds.

In sum, the evidence points excellent reasons to deepen studies on WEM species from the African continent, at the nutritional, chemical, and bioactive points of view, thus contributing to the identification, characterization, and further safe utilization of these valuable natural resources as food and medicine worldwide and particularly in Africa, where the access to this type of products is scarce.

ACKNOWLEDGMENTS

The authors are grateful to the Foundation for Science and Technology (FCT, Portugal) for financial support through national funds FCT/MCTES to CIMO (UIDB/00690/2020 and UIDP/00690/2020), SusTEC (LA/P/0007/2020), Margarida Moldão under the project (UIDB/04129/2020) of LEAF, research Unit, Luís Catarino (UIDB/00329/2020) of cE3c; national funding by F.C.T. and P.I., through the institutional scientific employment program-contract for L. Barros contract and C. Bastos (SFRH/BD/151519/2021) and Â. Liberal PhD research grants (BD/04585.2021).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ORCID

Claudete Bastos https://orcid.org/0000-0001-9519-2831
Lillian Barros https://orcid.org/0000-0002-9050-5189

REFERENCES

Abate, D. (1999). *Agaricus campestris* in upland Ethiopia. *Mycologist*, *13*(1), 28. https://doi.org/10.1016/S0269-915X(99)80075-5

Abomo-Ndongo, S., Tourvieille, J., & Guillaumin, J. J. (2002). The Buller phenomenon in *Armillaria heimii* Pegler, a bipolar diploid basidiomycete. *Cryptogamie, Mycologie*, *23*(4), 335–347.

Abulude, F., & Ndamitso, M. (2018). Assessment of heavy metals in mushroom species obtained in Akure, Nigeria. *AU eJournal of Interdisciplinary Research (ISSN: 2408-1906)*, *3*(2).

Adebayo, E. A., Martínez-Carrera, D., Morales, P., Sobal, M., Escudero, H., Meneses, M. E., Avila-Nava, A., Castillo, I., & Bonilla, M. (2018). Comparative study of antioxidant and antibacterial properties of the edible mushrooms *Pleurotus levis*, *P. ostreatus*, *P. pulmonarius* and *P. tuber-regium*. *International Journal of Food Science and Technology*, *53*(5), 1316–1330. https://doi.org/10.1111/ijfs.13712

Adejumo, T., Coker, M., & Akinmoladun, V. (2015). Identification and evaluation of nutritional status of some edible and medicinal mushrooms in Akoko Area, Ondo State, Nigeria. *International Journal of Current Microbiology and Applied Sciences*, *4*(4), 1011–1028.

Akihisa, T., Nakamura, Y., Tagata, M., Tokuda, H., Yasukawa, K., Uchiyama, E., Suzuki, T., & Kimura, Y. (2007). Anti-inflammatory and anti-tumor-promoting effects of triterpene acids and sterols from the fungus *Ganoderma lucidum*. *Chemistry and Biodiversity*, *4*(2), 224–231. https://doi.org/10.1002/cbdv.200790027

Akyüz, M., & Kirbağ, S. (2010). Nutritive value of wild edible and cultured mushrooms. *Turkish Journal of Biology*, *34*(1), 97-102. https://doi.org/10.3906/biy-0805-17

Antonin, V. (2007). *Monograph of Marasmius, Gloiocephala, Palaeocephala and Setulipes in tropical Africa*. National Botanic Garden of Belgium.

Apetorgbor, M., Apetorgbor, A., & Nutakor, E. (2005). Utilization and cultivation of edible mushrooms for rural livelihood in Southern Ghana. *17th Commonwealth Forestry Conference*, Colombo, Sri Lanka.

Barros, L., Pereira, C., & Ferreira, I. C. F. R. (2013). Optimized analysis of organic acids in edible mushrooms from Portugal by ultra fast liquid chromatography and photodiode array detection. *Food Analytical Methods*, *6*, 309–316. https://doi.org/10.1007/s12161-012-9443-1

Bartels, C. L. (2003). Botanical medicines: The desk reference for major herbal supplements, 2nd Edition. *Nutrition in Clinical Practice*, *18*(4), 342–342. https://doi.org/10.1177/0115426503018004342

Beeli, M. (1928). Contribution al étude de la Flore mycologique du congo. *Bulletin Du Jardin Botanique de l'Etat a Bruxelles*, Vol. *14*, 83–91.

Beeli, M. (1935). Amanita-amanitopsis. *Flore Iconographique Des Champignons Du Congo*, *1*, 1–4.

Beluhan, S., & Ranogajec, A. (2011). Chemical composition and non-volatile components of Croatian wild edible mushrooms. *Food Chemistry*, *124*(3), 1076–1082. https://doi.org/10.1016/j.foodchem.2010.07.081

Boa, E. R. (2004). *Wild edible fungi: A global overview of their use and importance to people*. Daya Books. https://books.google.com/books?hl=pt-PT&lr=&id=Zd2NlcNZgvcC&oi=fnd&pg=PR7&dq=Wild+edible+fungi:+a+global+overview+of+their+use+and+importance+to+people&ots=VjFWBhRFpL&sig=Kkby3zDD0GO4ExhOYU-Bg7DwSYQ

Boa, E. R., Ngulube, M., Meke, G., & Munthali, C. (2000). *Miombo wild edible fungi. First regional workshop on sustainable use of forest products*. Zomba, Forest Research Institute of Malawi & CABI.

Bourdeaux, Q., Buyck, B., Malaisse, F., Matera, J., Marlier, M., Wathelet, B., & Lognay, G. (2003). Wild edible mushrooms from a Zambezian woodland area (Copperbelt Province, Zambia). *Geo-Eco-Trop*, *27*(1–2), 33–44.

Brown, M. (2019). Yi ethnomycology: Wild mushroom knowledge and use in Yunnan, China. *Journal of Ethnobiology*, *39*(1), 131–157. https://doi.org/10.2993/0278-0771-39.1.131

Buyck, B. (1994). *UBWOBA: Les champignons comestibles de l'Ouest du Burundi. AGCD Publicacion Agricole*, 34, 123.

Buyck, B., & Nzigidahera, B. (1995). Ethnomycological notes from western Burundi. *Belgian Journal of Botany*, *128*(2), 131–138.

Chungu, D., Mwanza, A., Ng'andwe, P., Chungu, B. C., & Maseka, K. (2019). Variation of heavy metal contamination between mushroom species in the Copperbelt province, Zambia: Are the people at risk? *Journal of the Science of Food and Agriculture*, *99*(7), 3410–3416. https://doi.org/10.1002/jsfa.9558

D'Archivio, M., Filesi, C., Varì, R., Scazzocchio, B., & Masella, R. (2010). Bioavailability of the polyphenols: Status and controversies. *International Journal of Molecular Sciences*, *11*(4), 1321–1342. https://doi.org/10.3390/ijms11041321

de Kesel, A., Amalfi, M., Ngoy, B. K. W., Yorou, N. S., Raspé, O., Degreef, J., & Buyck, B. (2016). New and interesting *Cantharellus* from tropical Africa. *Cryptogamie, Mycologie*, *37*(3), 283–327. https://doi.org/10.7872/crym/v37.iss3.2016.283

de Kesel, A., Codjia, J., & Yorou, N. S. (2002). *Guide des champignons comestibles du Bénin*. https://hdl.handle.net/10067/403690151162165141

de Kesel, A., Kasongo, B., & Degreef, J. (2017). *Champignons comestibles du Haut-Katanga*. RD Congo AbcTaxa. http://www.abctaxa.be/volumes/volume_17_Champignons_comestibles_du_Haut_Katanga

de Kesel, A., Yorou, N. S., & Buyck, B. (2011). Cantharellus solidus, a new species from Benin (West-Africa) with a smooth hymenium. *Cryptogamie, Mycologie*, *32*(3), 277–283. https://doi.org/10.7872/crym.v32.iss3.2011.277

Degreef, J., & de Kesel, A. (2017). The Edible Fungi of Tropical Africa annotated database. https://www.efta-online.org/

Degreef, J., Demuynck, L., Mukandera, A., Nyirandayambaje, G., Nzigidahera, B., & de Kesel, A. (2016). Wild edible mushrooms, a valuable resource for food security and rural development in Burundi and Rwanda. *BASE*, Vol. *20*, 441–452. https://doi.org/10.25518/1780-4507.13181

Degreef, J., Malaisse, F., Rammeloo, J., & Baudart, É. (1997). Edible mushrooms of the Zambezian woodland area a nutritional and ecological approach. *Biotechnology, Agronomy and Society and Environment*, *1*(3), 221–231.

Deo, G. S., Khatra, J., Buttar, S., Li, W. M., Tackaberry, L. E., Massicotte, H. B., Egger, K. N., Reimer, K., & Lee, C. H. (2019). Antiproliferative, immunostimulatory, and anti-inflammatory activities of extracts derived from mushrooms collected in Haida Gwaii, British Columbia (Canada). *International Journal of Medicinal Mushrooms*, *21*(7), 629–643. https://doi.org/10.1615/IntJMedMushrooms.2019031193

Disler, R. T., Gallagher, R. D., Davidson, P. M., Sun, S.-W., Chen, L.-C., Zhou, M., Wu, J.-H., Meng, Z.-J., Han, H.-L., Miao, S.-Y., Zhu, C.-C., Xiong, X.-Z., Reis, M. S., Sampaio, L. M. M., Lacerda, D., de Oliveira, L. V. F., Pereira, G. B. M., Pantoni, C. B. F., di Thommazo, L., … Mistraletti, G. (2019). Factors impairing the postural balance in COPD patients and its influence upon activities of daily living. *European Respiratory Journal*, *15*(1), 433–445.

Douanla-Meli, C. (2007). *Fungi of Cameroon: Ecological diversity with emphasis on the taxonomy of Non-gilled Hymenomycetes from the Mbalmayo forest reserve*. J. Cramer.

Ducousso, M., & Thoen, D. (2003). Les champignons ectomycorhiziens des forêts naturelles et des plantations d'Afrique de l'Ouest : une source de champignons comestibles. *Bois et Forêts Des Tropiques*, *275*, 51–63.

Dutta, A. K., & Acharya, K. R. I. S. H. N. E. N. D. U. (2014). Traditional and ethno-medicinal knowledge of mushrooms in West Bengal, India. *Asian Journal of Pharmaceutical Clinical Research*, *7*(4), 36–41.

García, M. A., Alonso, J., Fernández, M. I., & Melgar, M. J. (1998). Lead content in edible wild mushrooms in Northwest Spain as indicator of environmental contamination. *Archives of Environmental Contamination and Toxicology*, *34*(4), 330–335. https://doi.org/10.1007/s002449900326

El Enshasy, H., Elsayed, E. A., Aziz, R., & Wadaan, M. A. (2013). Mushrooms and truffles: historical biofactories for complementary medicine in Africa and in the middle East. Evidence-Based Complementary and Alternative Medicine, 2013.

Gebrelibanos, M., Megersa, N., & Taddesse, A. M. (2016). Levels of essential and non-essential metals in edible mushrooms cultivated in Haramaya, Ethiopia. *International Journal of Food Contamination*, *3*(1), 2. https://doi.org/10.1186/s40550-016-0025-7

Gogavekar, S. S., Rokade, S. A., Ranveer, R. C., Ghosh, J. S., Kalyani, D. C., & Sahoo, A. K. (2014). Important nutritional constituents, flavour components, antioxidant and antibacterial properties of *Pleurotus sajor-caju*. *Journal of Food Science and Technology*, *51*(8), 1483–1491. https://doi.org/10.1007/s13197-012-0656-5

Gryzenhout, M. (2010). *Mushrooms of South Africa*. Struik Nature.

Guissou, K. M. L., Lykke, A. M., Sankara, P., & Guinko, S. (2008). Declining wild mushroom recognition and usage in Burkina Faso. *Economic Botany*, *62*(3), 530–539. https://doi.org/10.1007/S12231-008-9028-5

Gwenzi, W., Tagwireyi, C., Musiyiwa, K., Chipurura, B., Nyamangara, J., Sanganyado, E., & Chaukura, N. (2021). Occurrence, behavior, and human exposure and health risks of potentially toxic elements in edible mushrooms with focus on Africa. *Environmental Monitoring and Assessment*, *193*(5), 302. https://doi.org/10.1007/s10661-021-09042-w

Halling, R. E. (2006). Wild edible fungi: A global overview of their use and importance to people. Non-wood Forest Products 17. *Economic Botany*, *60*(1), 99–100.

Hama, O., Maes, E., Guissou, M. L., Ibrahim, D. M., Barage, M., Parra Sánchez, L. A., Raspé, O., & de Kesel, A. (2010). Agaricus subsaharianus, une nouvelle espèce comestible et consommée au Niger, au Burkina Faso et en Tanzanie. *Cryptogamie, Mycologie*, *31*(3), 221–234.

Harkonen, M. (1995). An ethnomycological approach to Tanzanian species of Amanita. http://repository.costech.or.tz/handle/123456789/11878

Harkonen, M. (2002). Mushroom collecting in Tanzania and Hunan (Southern China): Inherited wisdom and folklore of two different cultures. *Tropical Mycology*, *1*, 149–165.

Härkönen, M., Niemela, T., Kotiranta, H., & Pierce, G. (2015). *Zambian mushrooms and mycology*. University of Helsinki's Finnish Museum of Natural History (LUOMOS).

Hassan, F., Ni, S., Becker, T. L., Kinstedt, C. M., Abdul-Samad, J. L., Actis, L. A., & Kennedy, M. A. (2019). Evaluation of the antibacterial activity of 75 mushrooms collected in the Vicinity of Oxford, Ohio (USA). *International Journal of Medicinal Mushrooms*, *21*(2), 131–141. https://doi.org/10.1615/IntJMedMushrooms.2018029710

Hawksworth, D. L. (2001). The magnitude of fungal diversity: The 1.5 million species estimate revisited. *Mycological Research*, *105*(12), 1422–1432. https://doi.org/10.1017/S0953756201004725

Hawksworth, D. L. (2002). Why study tropical fungi? *Tropical Mycology*, *2*, 204. https://doi.org/10.1079/9780851995434.0001

Heim, R. (1951). Les Termitomyces du Congo belge recueillis par Madame *M. Goossens-Fontana. Bulletin Du Jardin Botanique de l'État a Bruxelles*, *21*(3/4), 205–232. https://doi.org/10.2307/3666672

Heim, R. (1967). Etudes de mycologie centrafricaine. *Cah. Maboké*, *5*, 63–66.

Heinemann, P. (1956). Champignons recoltes au Congo Belge par Madame *M. Goossens-Fontana* II. Agaricus Fries s.s. *Bulletin Du Jardin Botanique de l'État a Bruxelles*, *26*(1), 1–127. https://doi.org/10.2307/3667096

Heinemann, P. (1969). Le genre Macrolepiota Sing. (Leucocoprineae) au Congo-Kinshasa. *Bulletin Du Jardin Botanique National de Belgique /Bulletin van de National Plantentuin van België*, *39*(3), 201–226. https://doi.org/10.2307/3667532

Heinemann, P. (1973). Leucocoprinees nouvelles d'Afrique centrale. *Bulletin Du Jardin Botanique National de Belgique /Bulletin van de National Plantentuin van België*, *43*(1/2), 6–13. https://doi.org/10.2307/3667558

Isikhuemhen, O. S., & Okhyoya, J. A. (1996). Cultivation of *Pleurotus tuberregium* (Fr.) Singer for production of edible sclerotia on agricultural wastes. *Mushroom Biology and Mushroom Products: Proceedings of the 2nd International Conference*, University Park, Pennsylvania.

Iwatsuki, K., Akihisa, T., Tokuda, H., Ukiya, M., Oshikubo, M., Kimura, Y., Asano, T., Nomura, A., & Nishino, H. (2003). Lucidenic acids P and Q, Methyl Lucidenate P, and other triterpenoids from the fungus *Ganoderma lucidum* and their inhibitory effects on Epstein-barr virus activation. *Journal of Natural Products*, *66*(12), 1582–1585. https://doi.org/10.1021/np0302293

Kaewchai, S., Soytong, K., & Hyde, K. D. (2009). Mycofungicides and fungal biofertilizers. *Fungal Diversity*, *38*, 25–50.

Kalač, P. (2010). Trace element contents in European species of wild growing edible mushrooms: A review for the period 2000-2009. *Food Chemistry*, *122*(1), 2–15. https://doi.org/10.1016/j.foodchem.2010.02.045

Karhula, P., Härkönen, M., & Saarimäki, T. (1998). Tanzanian mushrooms and their uses 6. Lactarius. *Karstenia*, *38*(2), 49–68. https://doi.org/10.29203/ka.1998.330

Kinge, T. R., Tabi, E. M., Mih, A. M., Enow, E. A., Njouonkou, L., & Nji, T. M. (2011). Ethnomycological studies of edible and medicinal mushrooms in the mount Cameroon region (Cameroon, Africa). *International Journal of Medicinal Mushrooms*, *13*(3), 299–305. https://doi.org/10.1615/IntJMedMushr.v13.i3.100

Kissanga, R., Liberal, Â., Diniz, I., Rodrigues, A. S. B., Baptista-Ferreira, J. L., Batista, D., Ivanov, M., Sokovit'c, M. S., Ferreira, I. C. F. R., Fernandes, Â., Barros, L., & Catarino, L. (2022). Biochemical and molecular profiling of wild edible mushrooms from Huila, Angola. *Foods*, *11*(20), 3240. https://doi.org/10.3390/foods11203240

Lampman, A. M. (2010). How folk classification interacts with ethnoecological knowledge: A case study from Chiapas, Mexico. *Journal of Ecological Anthropology*, *14*(1), 39–51. https://doi.org/10.5038/2162-4593.14.1.3

Lampman, A. M. (2007). Ethnomycology: Medicinal and edible mushrooms of the Tzeltal Maya of Chiapas, México. *International Journal of Medicinal Mushrooms*, *9*(1), 1–5. https://doi.org/10.1615/IntJMedMushr.v9.i1.10

Leal, A. R., Barros, L., Barreira, J. C. M., Sousa, M. J., Martins, A., Santos-Buelga, C., & Ferreira, I. C. F. R. (2013). Portuguese wild mushrooms at the "pharma-nutrition" interface: Nutritional characterization and antioxidant properties. *Food Research International*, *50*(1), 1–9. https://doi.org/10.1016/j.foodres.2012.10.012

Li, H., Tian, Y., Menolli, N., Ye, L., Karunarathna, S. C., Perez-Moreno, J., Rahman, M. M., Rashid, M. H., Phengsintham, P., Rizal, L., Kasuya, T., Lim, Y. W., Dutta, A. K., Khalid, A. N., Huyen, L. T., Balolong, M. P., Baruah, G., Madawala, S., Thongklang, N., … Mortimer, P. E. (2021). Reviewing the world's edible mushroom species: A new evidence-based classification system. *Comprehensive Reviews in Food Science and Food Safety*, *20*(2), 1982–2014. https://doi.org/10.1111/1541-4337.12708

Maba, D. L., Guelly, A. K., Yorou, N. S., & Agerer, R. (2015). Diversity of Lactifluus (Basidiomycota, Russulales) in West Africa: 5 new species described and some considerations regarding their distribution and ecology. *Mycosphere*, *6*(6), 737–759. https://doi.org/10.5943/mycosphere/6/6/9

Machado-Gonçalves, L., Tavares-Santos, A., Santos-Costa, F., Soares-Diniz, R., Câmara-de Carvalho-Galvão, L., Martins-de Sousa, E., & Beninni-Paschoal, M. A. (2018). Effects of *Terminalia catappa* Linn. Extract *on Candida albicans* biofilms developed on denture acrylic resin discs. *Journal of Clinical and Experimental Dentistry*, *10*(7), e642–e647. https://doi.org/10.4317/jced.54776

Malaisse, F., de Kesel, A., N'gasse, G., & Lognay, G. (2008). Diversité des champignons consommés par les pygmées Bofi de la Lobaye (République centrafricaine). *Geo-Eco-Trop*, *32*, 1–8.

Malaisse, F., & Kapinga, I. (1986). The influence of deforestation on the hydric balance of soils in the Lubumbashi environment (Shaba, Zaire). *JSTOR*, *119*(2), 161–178. https://www.jstor.org/stable/20794086

Malik, A. R., Wani, A. H., Bhat, M. Y., & Parveen, S. (2017). Ethnomycological knowledge of some wild mushrooms of Northern districts of Jammu and Kashmir, India. *Asian Journal of Pharmaceutical and Clinical Research*, *10*(9), 399–405. https://doi.org/10.22159/ajpcr.2017.v10i9.17641

Mdachi, S. J. M., Nkunya, M. H. H., Nyigo, V. A., & Urasa, I. T. (2004). Amino acid composition of some Tanzanian wild mushrooms. *Food Chemistry*, *86*(2), 179–182. https://doi.org/10.1016/j.foodchem.2003.08.030

Minato, K. I., Laan, L. C., van Die, I., & Mizuno, M. (2019). *Pleurotus citrinopileatus* polysaccharide stimulates anti-inflammatory properties during monocyte-to-macrophage differentiation. *International Journal of Biological Macromolecules*, *122*, 705–712. https://doi.org/10.1016/j.ijbiomac.2018.10.157

Mleczek, M., Siwulski, M., Budka, A., Mleczek, P., Budzyńska, S., Szostek, M., Kuczyńska-Kippen, N., Kalač, P., Niedzielski, P., Gąsecka, M., Goliński, P., Magdziak, Z., & Rzymski, P. (2021). Toxicological risks and nutritional value of wild edible mushroom species—A half-century monitoring study. *Chemosphere*, *263*, 128095. https://doi.org/10.1016/j.chemosphere.2020.128095

Mohammed, C., & Guillaumin, J. (1994). Armillaria in tropical Africa. *Aspects of tropical mycology* (pp. 207–217). Cambridge University.

Molares, S., Toledo, C. V., Stecher, G., & Barroetaveña, C. (2020). Traditional mycological knowledge and processes of change in Mapuche communities from Patagonia, Argentina: A study on wild edible fungi in Nothofagaceae forests. *Mycologia*, *112*(1), 9–23. https://doi.org/10.1080/00275514.2019.1680219

Morris, B. (1987). *Common mushrooms of Malawi*. https://www.scirp.org/%28S%28351jmbntvnsjt1aadkposzje%29%29/reference/referencespapers.aspx?referenceid=1360038

Mpulusu, S. D., Luyeye, F. L., de Kesel, A., & Degreef, J. (2010). Cultivation tests for some edible lignicolous mushrooms in the Kinshasa region (D.R. Congo) on different lignocellulosic. *Biotechnology, Agronomy, Society and Environment*, *14*(3), 417–422.

Mshandete, A., & Cuff, J. (2007). Proximate and nutrient composition of three types of indigenous edible wild mushrooms grown in Tanzania and their utilization prospects. *African Journal of Food, Agriculture, Nutrition and Development*, *7*(6), 1-16. https://doi.org/10.18697/ajfand.17.2615

Mwenje, E., Wingfield, B. D., Coetzee, M. P. A., & Wingfield, M. J. (2003). Molecular characterisation of *Armillaria* species from Zimbabwe. *Mycological Research*, *107*(3), 291–296. https://doi.org/10.1017/S0953756203007408

Ndong. (2009). *Estude Des Champignons de La Forêt Dense Humide Consommés Par Les Populations Du Nord Du Gabon* [Doctoral Thesis]. Université libre de Bruxelles, Brussels, Belgium.

Ndong. (2010). Diversity of species of Cantharellus, Lentinus and Termitomyces consumed by the pygmies of North Gabon. *Systematics and Conservation of African Plants. Proceedings of the 18th AETFAT Congress, Yaoundé*. https://www.cabdirect.org/cabdirect/abstract/20113044433

Ndong, & Degreef, J. (2011). Champignons comestibles des forêts denses d'Afrique centrale Taxonomie et identifi cation. *Abctaxa*.

Negri, K. (2012). *Estudo Comparativo de Diferentes Cogumelos Comestíveis Comercializados No Brasil: Ação Contra Radicais Livres, Espécies Reativas e Atividade Antibacteriana* [Master Thesis]. Universidade Estadual Paulista Júlio de Mesquita Filho, São Paulo, Brazil.

Ngalim, O. Y. (2011). Revenue components and conflicts in the use of natural resources in the peripheral zone Northeast of Korup National Park. *Memoire FASA/UDs*. https://silo.tips/download/revenue-components-and-conflicts-in-the-use-of-natural-resources-in-the-peripher

Nharingo, T., Ndumo, T., & Moyo, M. (2015). Human health risks due to heavy metals through consumption of wild mushrooms from Macheke forest, Rail Block forest and Muganyi communal lands in Zimbabwe. *Environmental Monitoring and Assessment*, *187*(12), 738. https://doi.org/10.1007/s10661-015-4974-8

Njouonkou, A. L. (2011). Taxonomie, systématique et étude phylogénétique des genres Lentinus Fr. et Pleurotus (Fr.) Kramer au Cameroun basée sur la morphologie et les séquences des régions ITS de l'ADNr et identification des enzymes extracellulaires oxydases de quelques champignons lignivores. PhD Thesis, University of Yaoundé I, Cameroun.

Njouonkou, A. L., de Crop, E., Mbenmoun, A. M., Kinge, T. R., Biyé, E. H., & Verbeken, A. (2016). Diversity of edible and medicinal mushrooms used in the noun division of the west region of Cameroon. *International Journal of Medicinal Mushrooms*, *18*(5), 387–396. https://doi.org/10.1615/IntJMedMushrooms.v18.i5.20

Nukata, M., Hashimoto, T., Yamamoto, I., Iwasaki, N., Tanaka, M., & Asakawa, Y. (2002). Neogrifolin derivatives possessing anti-oxidative activity from the mushroom *Albatrellus ovinus*. *Phytochemistry*, *59*(7), 731–737. https://doi.org/10.1016/S0031-9422(02)00050-X

Nzigidahera, B. (2007). Ressources biologiques sauvages du Burundi. Etat des connaissances traditionnelles. *INECN-CHM*, 115. https://bi.chm-cbd.net/fr/implementation/documents

Obodai, M., Ferreira, I. C. F. R., Fernandes, Â., Barros, L., Narh Mensah, D. L., Dzomeku, M., Urben, A. F., Prempeh, J., & Takli, R. K. (2014). Evaluation of the chemical and antioxidant properties of wild and cultivated mushrooms of Ghana. *Molecules*, *19*(12), 19532–19548. https://doi.org/10.3390/molecules191219532

O'Brien, H. E., Parrent, J. L., Jackson, J. A., Moncalvo, J. M., & Vilgalys, R. (2005). Fungal community analysis by large-scale sequencing of environmental samples. *Applied and Environmental Microbiology*, *71*(9), 5544–5550. https://doi.org/10.1128/AEM.71.9.5544-5550.2005

Okoro, I., & Achuba, F. (2012). Proximate and mineral analysis of some wild edible mushrooms. *African Journal of Biothecnology*, *11*(30), 7720–7724. https://doi.org/10.5897/AJB11.590

Osarenkhoe, O. O., John, O. A., & Theophilus, D. A. (2014). Ethnomycological conspectus of West African mushrooms: An awareness document. *Advances in Microbiology*, *04*(01), 39–54. https://doi.org/10.4236/aim.2014.41008

Osemwegie, O., Ekaye, S., & Ntekume, I. (2012). The effect of grower feed diet supplemented with *Ganoderma lucidum* against some enteric zoonotic parasites of pigeons (*Columba livia*). *Biokemistri*, *24*(3), 129–135.

Oso, B. A. (1975). Mushrooms and the Yoruba people of Nigeria. *Mycologia*, *67*(2), 311–319. https://doi.org/10.2307/3758423

Ouzouni, P., & Riganakos, K. (2007). Nutritional value and metal content profile of Greek wild edible fungi. *Acta Alimentaria*, *36*(1), 99–110. https://doi.org/10.1556/aalim.36.2007.1.11

Oyetayo, O. V. (2011). Medicinal uses of mushrooms in Nigeria: Towards full and sustainable exploitation. *African Journal of Traditional, Complementary and Alternative Medicines*, *8*(3), 275-283. https://doi.org/10.4314/ajtcam.v8i3.65289

Pacioni, G., & Sharp, C. (2000). Mackintoshia, a new sequestrate basidiomycete genus from Zimbabwe. *Mycotaxon*, *75*, 225–228.

Palacios, I., Lozano, M., Moro, C., D'Arrigo, M., Rostagno, M. A., Martínez, J. A., García-Lafuente, A., Guillamón, E., & Villares, A. (2011). Antioxidant properties of phenolic compounds occurring in edible mushrooms. *Food Chemistry*, *128*(3), 674–678. https://doi.org/10.1016/j.foodchem.2011.03.085

Parent, G., & Thoen, D. (1977). Food value of edible mushrooms from Upper-Shaba region. *Economic Botany*, *31*(4), 436–445. https://doi.org/10.1007/BF02912557

Pegler, D. (1969). Studies on African Agaricales: II. *Kew Bulletin*, *23*(2), 219–249. https://doi.org/10.2307/4108958

Pegler, D. (1972). Lentineae (Polyporaceae), Schizophyllaceae et espèces lentinoïdes et pleurotoïdes des Tricholomataceae. *Flore Illustrée des Champignon D'Afrique Centrale*, *1*(1–6), 5–26.

Pegler, D., & Piearce, G. (1980). The edible mushrooms of Zambia. *Kew Bulletin*, *35*(3), 475–491. https://doi.org/10.2307/4110017

Pegler, D., & Rayner, R. (1969). A contribution to the agaric flora of Kenya. *Kew Bulletin*, *23*(3), 347–412. https://doi.org/10.2307/4117177

Pegler, D., & Shah-Smith, D. (1997). The genus *Amanita* (Amanitaceae, Agaricales) in Zambia. *Mycotaxon*, *61*, 389–417.

Pérez-Moreno, J., Mortimer, P. E., Xu, J., Karunarathna, S. C., & Li, H. (2021). Global perspectives on the ecological, cultural and socioeconomic relevance of wild edible fungi. *Studies in Fungi*, *6*(1), 408–424. https://doi.org/10.5943/sif/6/1/31

Piearce, G. D. (1981). Zambian mushrooms—Customs and folklore. *Bulletin of the British Mycological Society*, *15*(2), 139–142. https://doi.org/10.1016/s0007-1528(81)80013-2

Pineda-Alegría, J. A., Sánchez-Vázquez, J. E., González-Cortazar, M., Zamilpa, A., López-Arellano, M. E., Cuevas-Padilla, E. J., Mendoza-De-Gives, P., & Aguilar-Marcelino, L. (2017). The edible mushroom *Pleurotus djamor* produces metabolites with lethal activity against the parasitic nematode *Haemonchus contortus*. *Journal of Medicinal Food*, *20*(12), 1184–1192. https://doi.org/10.1089/JMF.2017.0031

Power, R. C., Salazar-García, D. C., Straus, L. G., González Morales, M. R., & Henry, A. G. (2015). Microremains from El Mirón Cave human dental calculus suggest a mixed plant-animal subsistence economy during the Magdalenian in Northern Iberia. *Journal of Archaeological Science*, *60*, 39–46. https://doi.org/10.1016/j.jas.2015.04.003

Quarcoo, A. (2013). Determination of heavy metals in *Pleurotus ostreatus* (Oyster mushroom) and *Termitomyces clypeatus* (Termite mushroom) sold on selected markets in Accra, Ghana. *Mycosphere*, *4*(5), 960–967. https://doi.org/10.5943/mycosphere/4/5/9

Rahi, D., & Malik, D. (2016). Diversity of mushrooms and their metabolites of nutraceutical and therapeutic significance. *Journal of Mycology*, *2016*, 7654123. https://doi.org/10.1155/2016/7654123

Rajarathnam, S., Shashirekha, N. N. J., & Bano, Z. (1998). Biodegradative and biosynthetic capacities of mushrooms: Present and future strategies. *Critical Reviews in Biotechnology*, *18*(2–3), 91–236. https://doi.org/10.1080/0738-859891224220

Rasalanavho, M., Moodley, R., & Jonnalagadda, S. B. (2019). Elemental distribution including toxic elements in edible and inedible wild growing mushrooms from South Africa. *Environmental Science and Pollution Research*, *26*(8), 7913–7925. https://doi.org/10.1007/s11356-019-04223-0

Reis, F. S., Heleno, S. A., Barros, L., Sousa, M. J., Martins, A., Santos-Buelga, C., & Ferreira, I. C. F. R. (2011). Toward the antioxidant and chemical characterization of mycorrhizal mushrooms from Northeast Portugal. *Journal of Food Science*, *76*(6), C824–C830. https://doi.org/10.1111/J.1750-3841.2011.02251.X

Reis, F. S., Martins, A., Barros, L., & Ferreira, I. C. F. R. (2012). Antioxidant properties and phenolic profile of the most widely appreciated cultivated mushrooms: A comparative study between in vivo and in vitro samples. *Food and Chemical Toxicology*, *50*(5), 1201–1207. https://doi.org/10.1016/j.fct.2012.02.013

Reyes-López, R. C., Montoya, A., Kong, A., Cruz-Campuzano, E. A., & Caballero-Nieto, J. (2020). Folk classification of wild mushrooms from San Isidro Buensuceso, Tlaxcala, Central Mexico. *Journal of Ethnobiology and Ethnomedicine*, *16*(1), 1–21. https://doi.org/10.1186/s13002-020-00408-x

Ruan, W., & Popovich, D. G. (2012). Ganoderma lucidum triterpenoid extract induces apoptosis in human colon carcinoma cells (Caco-2). *Biomedicine and Preventive Nutrition*, *2*(3), 203–209. https://doi.org/10.1016/j.bionut.2012.03.004

Ryvarden, L., Piearce, G., & Masuka, A. (1994). *An introduction to the larger fungi of South Central Africa*. Baobab Books.

Rzymski, P., Mleczek, M., Siwulski, M., Gąsecka, M., & Niedzielski, P. (2016). The risk of high mercury accumulation in edible mushrooms cultivated on contaminated substrates. *Journal of Food Composition and Analysis*, *51*, 55–60. https://doi.org/10.1016/j.jfca.2016.06.009

Sánchez, C. (2017). Bioactives from mushroom and their application. In M. Puri (Ed.), *Food bioactives: Extraction and biotechnology applications* (pp. 23–57). Springer. https://doi.org/10.1007/978-3-319-51639-4_2

Sánchez-Moreno, C. (2002). Methods used to evaluate the free radical scavenging activity in foods and biological systems. *Food Science and Technology International*, *8*(3), 121–137. https://doi.org/10.1106/108201302026770

Schmitt, J. A., Meisch, H.-U., & Reinle, W. (1977). Schwermetalle in höheren Pilzen, II /Heavy Metals in Higher Fungi, II. *Zeitschrift Für Naturforschung C*, *32*(9–10), 712–723. https://doi.org/10.1515/znc-1977-9-1008

Schroeder, H. A. (1976). *The Trace Elements and Nutrition* (Faber & Faber). https://scholar.google.com/scholar?hl=pt-PT&as_sdt=0%2C5&q=Schroeder%2C+The+Trace+Elements+and+Nutrition&btnG=

Seifert, K. A. (2009). Progress towards DNA barcoding of fungi. Resources. *Molecular Ecology Resources*, *9*(SUPPL.1), 83–89.

Sharma, R., Sharma, Y. P., Hashmi, S. A. J., Kumar, S., & Manhas, R. K. (2022). Ethnomycological study of wild edible and medicinal mushrooms in district Jammu, J&K (UT), India. *Journal of Ethnobiology and Ethnomedicine*, *18*(1), 1–11. https://doi.org/10.1186/s13002-022-00521-z

Sharp, C. (2011). A pocket guide to mushrooms in Zimbabwe. Some common species. Directory Publishers, Bulawawayo (Vol. 1).

Sharp, C. (2014). A pocket guide to mushrooms in Zimbabwe. Directory Publishers, Bulawawayo (Vol. 2).

Širić, I., Kasap, A., Bedeković, D., & Falandysz, J. (2017). Lead, cadmium and mercury contents and bioaccumulation potential of wild edible saprophytic and ectomycorrhizal mushrooms, Croatia. *Journal of Environmental Science and Health—Part B Pesticides, Food Contaminants, and Agricultural Wastes*, *52*(3), 156–165. https://doi.org/10.1080/03601234.2017.1261538

Sitotaw, R., Lulekal, E., & Abate, D. (2020). Ethnomycological study of edible and medicinal mushrooms in Menge District, Asossa Zone, Benshangul Gumuz Region, Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, *16*(1), 1–14. https://doi.org/10.1186/s13002-020-00361-9

Siwulski, M., Budka, A., Rzymski, P., Gąsecka, M., Kalač, P., Budzyńska, S., Magdziak, Z., Niedzielski, P., Mleczek, P., & Mleczek, M. (2020). Worldwide basket survey of multielemental composition of white button mushroom *Agaricus bisporus*. *Chemosphere*, *239*, 124718. https://doi.org/10.1016/j.chemosphere.2019.124718

Škrkal, J., Rulík, P., Fantínová, K., Burianová, J., & Helebrant, J. (2013). Long-term ^{137}Cs activity monitoring of mushrooms in forest ecosystems of the Czech Republic. *Radiation Protection Dosimetry*, *157*(4), 579–584. https://doi.org/10.1093/rpd/nct172

Smith, A., Javed, S., Barad, A., Myhre, V., Li, W. M., Reimer, K., Massicotte, H. B., Tackaberry, L. E., Payne, G. W., Egger, K. N., & Lee, C. H. (2017). Growth-inhibitory and immunomodulatory activities of wild mushrooms from North-Central British Columbia (Canada). *International Journal of Medicinal Mushrooms*, *19*(6), 485–497. https://doi.org/10.1615/IntJMedMushrooms.v19.i6.10

Soares, A. (2007). *Atividade antioxidante e compostos fenólicos do cogumelo Agaricus blazei Murrill*.

Soro, B., Koné, N. A., Vanié-Léabo, L. P. L., Konaté, S., Bakayoko, A., & Koné, D. (2019). Phytogeographical and sociolinguistical patterns of the diversity, distribution, and uses of wild mushrooms in Côte d'Ivoire, West Africa. *Journal of Ethnobiology and Ethnomedicine*, *15*, 5. https://doi.org/10.1186/s13002-019-0284-5

Soylak, M., Saraçoğlu, S., Tüzen, M., & Mendil, D. (2005). Determination of trace metals in mushroom samples from Kayseri, Turkey. *Food Chemistry*, *92*(4), 649–652. https://doi.org/10.1016/j.foodchem.2004.08.032

Stefanello, F. S., Cavalheiro, C. V., Dugatto, J. S., Kubota, E. H., & Silva, M. S. (2012). Avaliação da ativadade antioxidante in vitro do cogumelo shimeji (Pleutorus ostreatus). Simpósio de Segurança Alimentar, 4, 2012.

Tang, W., Liu, J. W., Zhao, W. M., Wei, D. Z., & Zhong, J. J. (2006). Ganoderic acid T from *Ganoderma lucidum* mycelia induces mitochondria mediated apoptosis in lung cancer cells. *Life Sciences*, *80*(3), 205–211. https://doi.org/10.1016/j.lfs.2006.09.001

Tibuhwa, D. D. (2012). Folk taxonomy and use of mushrooms in communities around Ngorongoro and Serengeti National Park, Tanzania. *Journal of Ethnobiology and Ethnomedicine*, *8*, 36. https://doi.org/10.1186/1746-4269-8-36

Traill, L., Brook, B., Wanger, & de Little (2013). Rainfall and temperature variation does not explain arid species diversity in outback Australia. *Research and Reports in Biodiversity Studies*, *3*, 1–8. https://doi.org/10.2147/rrbs.s40301

van Damme, P. (2021). Champignons comestibles des forêts denses d'Afrique centrale. Taxonomie et identification. *Afrika Focus*, *24*(2), 149–156. https://doi.org/10.1163/2031356x-02402016

van Dijk, H., Onguene, N. A., & Kuyper, T. W. (2003). Knowledge and utilization of edible mushrooms by local populations of the rain forest of South Cameroon. *Ambio*, *32*(1), 19–23. https://doi.org/10.1579/0044-7447-32.1.19

Verbeken, A., & Walleyn, R. (2010). *Fungus flora of tropical Africa: Monograph of lactarius in tropical Africa*. National Botanic Garden of Belgium.

Verbeken, A., Walleyn, R., Thoen, D., & Castellano, M. A. (2000). Some new or interesting sequestrate Basidiomycota from African woodlands. *Karstenia*, *40*(1–2), 11–21. https://doi.org/10.29203/ka.2000.346

Vetter, J. (1990). Mineral element content of edible and poisonous macrofungi. *Acta Alimentaria*, *19*(1), 27–40.

Walshaw, S. C. (2004). Tanzanian mushrooms. Edible, harmful and other fungi. *Economic Botany*, *58*(3), 487. https://doi.org/10.1663/0013-0001(2004)058[0487:dfabre]2.0.co;2

Wang, J., Liu, Y. M., Cao, W., Yao, K. W., Liu, Z. Q., & Guo, J. Y. (2012). Anti-inflammation and antioxidant effect of cordymin, a peptide purified from the medicinal mushroom *Cordyceps sinensis*, in middle cerebral artery occlusion-induced focal cerebral ischemia in rats. *Metabolic Brain Disease*, *27*(2), 159–165. https://doi.org/10.1007/s11011-012-9282-1

Wasser, S. P. (2011). Current findings, future trends, and unsolved problems in studies of medicinal mushrooms. *Applied Microbiology and Biotechnology*, *89*(5), 1323–1332. https://doi.org/10.1007/s00253-010-3067-4

Witkowska, A. M., Zujko, M. E., & Mirończuk-Chodakowska, I. (2011). Comparative study of wild edible mushrooms as sources of antioxidants. *International Journal of Medicinal Mushrooms*, *13*(4), 335–341. https://doi.org/10.1615/IntJMedMushr.v13.i4.30

Wong, J. H., Ng, T. B., Wang, H., Sze, S. C. W., Zhang, K. Y., Li, Q., & Lu, X. (2011). Cordymin, an antifungal peptide from the medicinal fungus *Cordyceps militaris*. *Phytomedicine*, *18*(5), 387–392. https://doi.org/10.1016/j.phymed.2010.07.010

Yang, Y., Zhao, X., Li, J., Jiang, H., Shan, X., Wang, Y., Ma, W., Hao, J., & Yu, G. (2018). A β-glucan from Durvillaea Antarctica has immunomodulatory effects on RAW264.7 macrophages via toll-like receptor 4. *Carbohydrate Polymers*, *191*, 255–265. https://doi.org/10.1016/j.carbpol.2018.03.019

Yongabi, K., Agho, M., & Carrera, D. (2004). Ethnomycological studies on wild mushrooms in Cameroon, Central Africa. *Micologia Aplicada*, *16*(2), 34–36.

Yorou, N. S. (2010). Champignons/mushrooms. In Atlas de la Biodiversité de l'Afrique de l'Ouest Tome - Bénin, Vol. 1. B. Sinsin & D. Lampmann Editors (pp. 324–331). https://www.researchgate.net/profile/Nourou-Yorou/publication/261646789_Champignons_Mushrooms/links/543d88f30cf25d6b1ad94c0c/Champignons-Mushrooms.pdf

Yorou, N. S., & de Kesel, A. (2001). Connaissances ethnomycologiques des peuples Nagot du centre du Bénin (Afrique de l'Ouest). *Systematics and Geography of Plants*, *71*(2), 627–637. https://doi.org/10.2307/3668707

Yorou, N. S., Koné, N., Guissou, M.-L., Guelly, A., Maba, D., Ekué, M., & de Kesel, A. (2014). Biodiversity and sustainable use of wild edible fungi in the Sudanian Centre of Endemism: A plea for valorisation. *Ectomycorrhizal Symbioses in Tropical and Neotropical Forests*, *13*, 241–286. https://doi.org/10.1201/b16536-16

Zhang, B. B., & Cheung, P. C. K. (2011). Use of stimulatory agents to enhance the production of bioactive exopolysaccharide from *Pleurotus tuber-regium* by submerged fermentation. *Journal of Agricultural and Food Chemistry*, *59*(4), 1210–1216. https://doi.org/10.1021/jf104425w

Zoberi, M. (1973). *Some edible mushrooms from Nigeria*. Nigerian Field.

How to cite this article: Bastos, C., Liberal, Â., Moldão, M., Catarino, L., & Barros, L. (2023). Ethnomycological prospect of wild edible and medicinal mushrooms from Central and Southern Africa—A review. *Food Frontiers*, *4*, 549–575. https://doi.org/10.1002/fft2.215