



# Identification of Edible Mushroom Species in the City of Lodja and Its Surrounding (Sankuru Province) in Democratic Republic of Congo

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## **Abstract:**

*The study was carried out in order to constitute a database necessary for the valorization of edible mushroom in the city of Lodja and its surrounding by the identification of the different species of mushrooms, the types of substrates on which grow as well as their natural habitats. The results obtained show that 20 species of edible mushrooms have been identified, 70% of which grow during the rainy season compared to 30% in the dry season. Concerning the habitat, 60% of mushrooms are harvested in forests, 25% are multipurpose and 15% are harvested on grassy formations. Regarding the specificity of substrates, 40% of species grow on land, 30% colonize dead palm trees, 15% use either dead palm tree and trees or dead wood, 10% grow on dead wood and only 4% evolve on plant detritus. In terms of abundance, 50% are abundant, 30% are less abundant and 20% are rare in the environment. Finally, 4 species (20%) namely: *Ntelia amanitalosis*, *Lentinus tigrinus*, *Cantharellus rufopunctatus* and *Marasmius oreades*, present potential for mushroom cultivation. Hence, the need to domesticate them in order to study their performance and diversify local production.*

## **Keywords:**

*Identification; Mushrooms; Lodja*

## I. Introduction

Food is considered to be an essential element in human life because it preserves health and reduces the risk of chronic diseases. (FAO, 2011). However, approximately 68% of the world's population suffers from protein deficiency (OCHA, 2012). Proteins of plant origin, not having great biological value, are deficient in certain essential amino acids contrary to animal proteins (Olivieretal, 199; De Faily, 2000). This would suggest that a significant proportion of the Earth suffers from serious caloric and protein deficits (Bouvieret al., 2010; Lushiku, 2012).

Through their importance, non-timber forest products provide income to populations and are also key subsistence products. They allow populations to participate in the effective strategy of conservation and safeguarding of biodiversity, particularly in tropical regions. In addition, non-timber forest products (NTFPs) such as mushrooms form a potential protein source, a primary necessity for indigenous communities living near and/or in plant formations (Olivier et al, op cit.; Benjamin, 2007; Zahid et al, 2010). They thus play a role in compensating for animal and plant proteins for populations dependent on cereals and other crops.

Indeed, mushrooms have good nutritional value; they also contain a large quantity of mineral salts and vitamins and are an interesting source of protein than most fresh vegetables. They effectively contribute to the coverage of vitamin needs, particularly vitamin group B.

The volvaria (*Volvariellavolvacea*), for example, is a very important source of protein with a nutritional value comparable to that of eggs (Oei, 2003; Belewu and Belewu, 2005). Moreover, because of the presence of certain appreciated chemical compounds for their medicinal properties, mushrooms are attracting increasing interest from the health food industry (Halpern, 2007). The genus *Pleurotus* also contains a compound that inhibits reductase, an enzyme used in the biosynthesis of cholesterol. Consumption of oyster mushrooms can reduce the level of cholesterol in the body and also prevent high blood pressure and constipation (Quimio, 2004).

In Côte d'Ivoire, the results of the physicochemical analysis of three species of edible mushrooms, *Psathyrella tuberculata*, *Termitomyces letestui* and *Volvariella volvacea*, revealed that they are energetic foods ( $281.26 \pm 34.84$  kcal/100 g), rich in proteins ( $15.86 \pm 0.22\%$ ), carbohydrates ( $45.45 \pm 7.46\%$ ) and ash ( $20.59 \pm 6.77\%$ ). On the other hand, they are relatively poor in lipids ( $4.00 \pm 0.76\%$ ) and reducing sugars ( $3.63 \pm 1.44\%$ ). These mushrooms contain polyphenols ( $6.84 \pm 0.02$ ), provide very significant antioxidant activity ( $18.10 \pm 5.66\%$ ) and have high humidity ( $14.09 \pm 1.66\%$ ) (Kouame et al., 2018).

Mushrooms constitute one of the non-wood forest products highly appreciated by the population as a food product and are considered as a substitute for meat (De Keseletal, 2002). This is also the case in the DRC in general and in the province of Sankuru in particular, where in certain villages, nearly 40% of women participate in mushroom picking as a source of income and food (Degreed, 1992).

Food availability being insufficient, the food situation remains worrying for the population of Sankuru in general and that of Lodja in particular. To try to alleviate this scourge of food insecurity and improve the food situation of the population of the city of Lodja and also to know the species that could be produced in mushroom cultivation, based on data from the literature, the identification of some species of mushrooms encountered in our environments is an emergency. Because, currently, more than 200 species of edible mushrooms are known worldwide, of which 30 species are cultivated on a commercial scale (Laurena, 2021).

Therefore, some questions deserve to be answered: what are the species of mushrooms found in Lodja and its environment? At what season of the year are there more mushrooms in the area of Lodja? On what types of substrates do they grow? What are the species of mushrooms most appreciated by the population of Lodja? What species can be used in mushroom cultivation?

Thus, this research aims to identify the wild species of mushrooms encountered in the city of Lodja and its surroundings as well as their habitats with a view to determining, based on literature data, those presenting potential to be used for mushroom cultivation. Additionally, identify the types of growing substrates these mushrooms grow on; list the species most appreciated by the population and determine the season of the year during which mushrooms are most abundant in the environment.

## II. Research Method

### 2.1 Study Environment

This study took place in the city of Lodja and its surroundings, Sankuru province, in the Democratic Republic of Congo. The city of Lodja has an area of 316 km<sup>2</sup> with an estimated population of 276 455 inhabitants. It is located at an altitude of 700 to 800 m (CAID, 2021). Located in the heart of the Lodja territory, it is limited to the east by the Nambelo-Luhembe sector; to the west by the Olemba sector; to the north by the N'vunge sector and to the south by the Kondo-Tshumbe sector. It is characterized by low annual temperature variation, abundant rainfall and persistent humidity all year. This temperature makes it possible to divide the year into four periods: a well-marked rainy season from mid-August to mid-December; a short dry season from mid-December to mid-February; a season of low rainfall from mid-February to mid-May and a major dry season from mid-May to mid-August (Wembodinga, 2014).

### 2.2 Material

The biological material consists of different species of wild mushrooms inventoried during our research. The non-biological material consisted of an Itel A56 brand Android phone with the intelligent application "Picture Mushroom" thanks to which each species of mushrooms collected was identified; a pen and a field notebook to record the various data collected in the field (species, substrate, season of appearance) and plastic bags to keep the mushroom specimens collected for identification.

### 2.3 Method

The documentary technique allowed us to use previous work to gather relevant information on the identification of mushrooms. The identification of the collected specimens was facilitated by the use of the "Smart Application": after taking the photos, the application gave the scientific names of each species photographed. The images taken and the names proposed by the intelligent application were compared with those contained in the works of DeKesel et al (2002), Kamouet al (2015), Boa (2006), Buyck (1994). As for the vernacular names in Tetela, they were given and confirmed by the groups of local populations with whom we had interviews, in the presence of freshly collected specimens and photos.

## III. Result and Discussion

### 3.1 Results

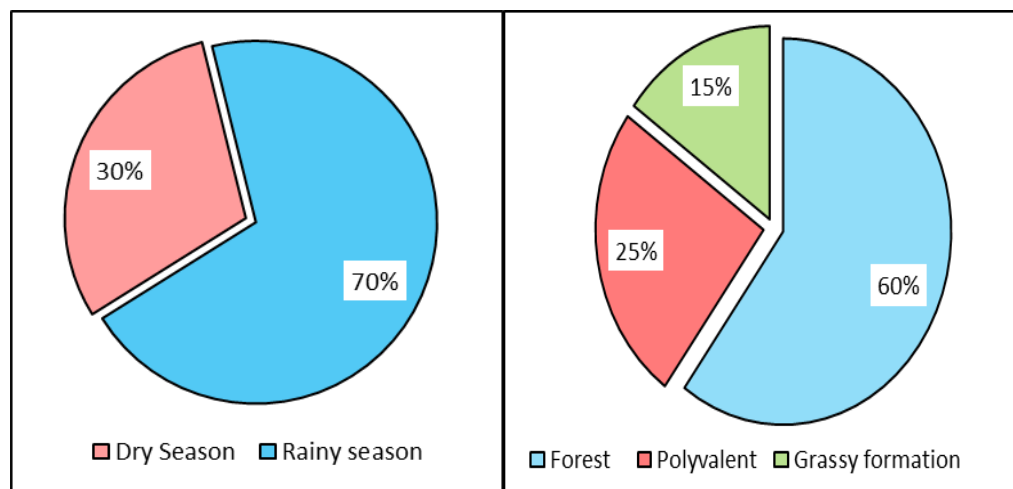
The results obtained in relation to the wild mushroom species identified during our research are presented in tabular and graphical form.

**Table 1.** List of mushroom species identified and inventoried in the city of Lodja and its surroundings

No.	Scientific name	Vernacular name (in Tetela)	Season	Habitat	Substrate	Abundance	Preference
1	<i>Agrocybe pediades</i>	-	D	Gf	E	3	2
2	<i>Amanite phaloïde</i>	-	D	F	E	2	0
3	<i>Auricularia auricula</i>	Atole	R	F	Dw	2	0
4	<i>Cantharellus rufopunetatus*</i>	Dikakandjadi *	R	P	E	1	2
5	<i>Chlorophyllum molybdites</i>	Ofu wadala	D	P	Pv	3	2

6	<i>Coprinopsis lagopus</i>	Atombaahonda	R	F	Dp	3	2
7	<i>Fallus indisiatus</i>	Ofu wakongolo	D	G&Gf	E	2	0
8	<i>Ganoderma lucidum</i>	-	D	F	Dw & Dp	3	0
9	<i>Gymnopilus junonius</i>	-	D	F	Dp	3	2
10	<i>Gymnopilus sp</i>	Ambolombolo	R	F	Dw & Dp	2	0
11	<i>Gymnopusdichrous</i>	Dongono d'atoko	R	F	Dp	2	2
12	<i>Hydrocube coccinae</i>	Kelekele	R	F	E	1	2
13	<i>Lentinus tigrinus*</i>	Mbadu*	R	F	Dw & Dp	3	3
14	<i>Leucocoprinus cretaceus</i>	Kolokolo	R	F	Pm	1	1
15	<i>Marasmius oreades*</i>	Ofu w'osoe*	R	Gf	E	3	3
16	<i>Ntelia amanitalosii*</i>	Seefu/Sardine*	R	P	Dp	3	3
17	<i>Psathyrellepiluli formis</i>	Supuedima	R	F	Dp	3	2
18	<i>Schizophyllum commune</i>	Tshukunu	R	F	Dw	1	3
19	<i>Termitomyces letestui</i>	Otolo	R	P	E	2	2
20	<i>Termitomyces microcarpus</i>	Mongé	R	Gf	E	3	3

**Legend:** - Name followed by \* = species of mushrooms that can be used in mushroom cultivation  
 - Seasons: R= Rainy; D= Dry  
 - Habitat: F = Forest; Gf = Grassy formation ; P = Polyvalent  
 - Substrate: Dw = Deadwood; Pd = Plant detritus; Pm = Dead Palm; E = Earth  
 - Abundance: 1 = Rare; 2 = Less abundant; 3 = Abundant  
 - Preference: 0 = not liked; 1 = Worse; 2 = Good; 3 = Very good



**Figure 1.** Distribution of mushrooms according to season (A) and habitat (B)

Looking at Table 1, it emerges from the results obtained that on 20 species of edible mushrooms identified in the city of Lodja and its surroundings, 14 species (i.e. 70%) grow during the rainy season compared to 6 (i.e. 30%) in dry season.

Regarding the habitat, 12 species of mushrooms (i.e. 60%) are collected in forests, 5 species (i.e. 25%) are polyvalent (i.e. they are collected in several habitats) and 3 species (i.e. 15%) are harvested from grassy formations.

Regarding the specificity of the substrates, 8 species (i.e. 40%) grow on earth, 6 species (i.e. 30%) colonize the dead palm, 3 species (i.e. 15%) use either the dead palm or dead wood, 2 species (i.e. i.e. 10%) grow on dead wood and only 1 species (i.e. 5%) evolves on plant detritus.

Regarding abundance, it appears that 10 species of mushrooms or 50% abundant, 6 species or 30% are less abundant and 4 species or 20% are rare in the environment.

From the results obtained according to the organoleptic assessment, it first emerges that 5 species of mushrooms (i.e. 25%) following: *Lentinus tigrinus*, *Marasmius oreades* *Ntelia amanitalosii*, *Schizophyllum commune*, *Termitomyces microcarpus* are very appreciated by the population of Lodja; then come 8 species or 40% (*Termitomyces letestui*, *Hydrocube coccinae*, *Coprinopsis lagopus*, *Cantharellus rufopunctatus*, *Gymnopus dichrous*, *Auricularia auricula*, *Gymnopilus* sp, *Psathyrellepiluli formis*) which are appreciated and only one species (*Leucocoprinus cretaceus*) is less appreciated by the population.

Referring to data from the literature of mushrooms cultivation, 4 species (*Ntelia amanitalosii*, *Lentinus tigrinus*, *Cantharellus rufopunctatus* and *Marasmius oreades*) can respond well to mushrooms cultivation due to their preference by the population and the ease of developing seeds in the laboratory.

### **3.2 Discussion**

The city of Lodja and its surroundings are teeming with a significant diversity of wild mushrooms, with a total of 20 species recorded during this study. This great diversity is probably due to the presence of habitats conducive to the proliferation of different ecological groups of wild mushrooms. This diversity is still great than that of Fadeyi et al. (2017) who recorded 19 species and fewer than that of Yorou et al. (2002; 2014) who identified 33 edible species, in plant formations different from ours.

The edibility of certain species of the *Termitomyces* genus (*Termitomyces letestui*, *Termitomyces microcarpus*) from our study area has also been proven in certain West African countries such as Benin (Fadeyi et al, 2017), Togo (Kamouetal, op cit) and Ivory Coast (Koneet al, 2013).

According to the different groups of local populations with whom we spoke, mushrooms of the genus *Termitomyces*, *Marasmius* and *Lentinus* are widely exploited by the rural populations of Lodja as a source of income, thus contributing to the substantial reduction of poverty in rural areas. With the same ideas, Kone et al. (Op. cit) demonstrated that mushrooms of the *Termitomyces* genus are widely exploited by rural Ivorian populations as a source of income.

It should also be noted that, according to the results of the present study, the rainy season is the period when many mushrooms are found in the environment of Lodja. This is

explained by the abundance of rain making habitats favorable for the development of fungi. Thus, 60% of species are harvested in forests, 25% are polyvalent and 15% are harvested on grassy formations. Concerning the specificity of the substrates, 40% grow on earth, 30% colonize the dead palm, 15% use either the dead palm or dead wood, 10% grow on dead wood and 5% others evolve on plant detritus.

Similarly, in a study on the ecological, nutritional and socio-economic approach to edible mushrooms from the Kikwit region in the Democratic Republic of Congo, Madamo et al. (2017) indicate that forests constitute the habitat of the vast majority of these mushroom species. Mushrooms are lignine-dwelling or soil-dwelling hygrophytes that favor the undergrowth.

The results of this study showed the diversity of substrates on which the identified fungi grow. For the production of *V. volvacea* (*V. volvacea*), as for the production of mushrooms in general, several substrates are used: mainly rice straw (Nieuwenhuijzen, 2007), banana leaves (Belewu and Belewu, 2005), wheat straw (Dibaluka et al, 2010). Outside of these known substrates (oil palm stalks), the dead palm is also used as a substrate for the production of mushrooms in several regions of humid tropical Africa (Oulo, 2016).

Mushroom cultivation is compatible with other subsistence activities because it requires a minimum of physical activity, inputs and financial resources. In addition, it represents an activity to be undertaken successfully for the elderly as well as people with physical disabilities (Marshall and Nair, 2009).

## V. Conclusion

This study made it possible to learn about some species of wild mushrooms, among many others that abound in the city of Lodja and its surroundings. In total, 20 species of wild mushrooms were identified thanks to the smart application "Picture Mushroom", with which 14 species of mushrooms (*Schizophyllum commune*, *Hydrocube coccinae*, *Lentinus tigrinus*, *Coprinopsis lagopus*, *Gymnopus dichrous*, *Leucocoprinus cretaceus*, *Auricularia auricula*, *Gymnopilus* sp., *Psathyrellepiluli formis*, *Nteliaamani talosii*, *Termitomyces letestui*, *Cantharellus rufopunctatus*, *Marasmius oreades*, *Termitomyces microcarpus*) identified during the rainy season and 6 species of mushrooms (*Chlorophyllum molybdites*, *Fallusindisiatus*, *Gymnopilus junonius*, *Ganoderma lucidum*, *Amanita phalloides*, *Agrocybe pediades*) identified during the rainy season. dry season. Of these species, the majority, 60%, grow in the forest and have dead wood, dead palm trees (30%) and soil (40%) as substrates; other species are polyvalent.

According to organoleptic assessments, 5 mushroom species namely: *Lentinus tigrinus*, *Marasmius oreades*, *Ntelia amanitalosii*, *Schizophyllum commune* and *Termitomyces microcarpus* are very appreciated for consumption by the population of Lodja. Finally, ecological aspects lead us to consider that 4 species have potential for mushroom cultivation, namely *Ntelia amanitalosii*, *Lentinus tigrinus*, *Cantharellus rufopunctatus*, and *Marasmius oreades*. Hence the need to domesticate them in order to study their performance and thus diversify local production.

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ANNEX: Some specimens of identified mushrooms



*Gymnopus dichrous*



*Termitomyces letestui*



*Lentinus tigrinus*



*Gymnopilus sp*



*Cantharellus rufopunctatus*