



Ethnomycological research: A status report in West Africa in general and Benin in particular

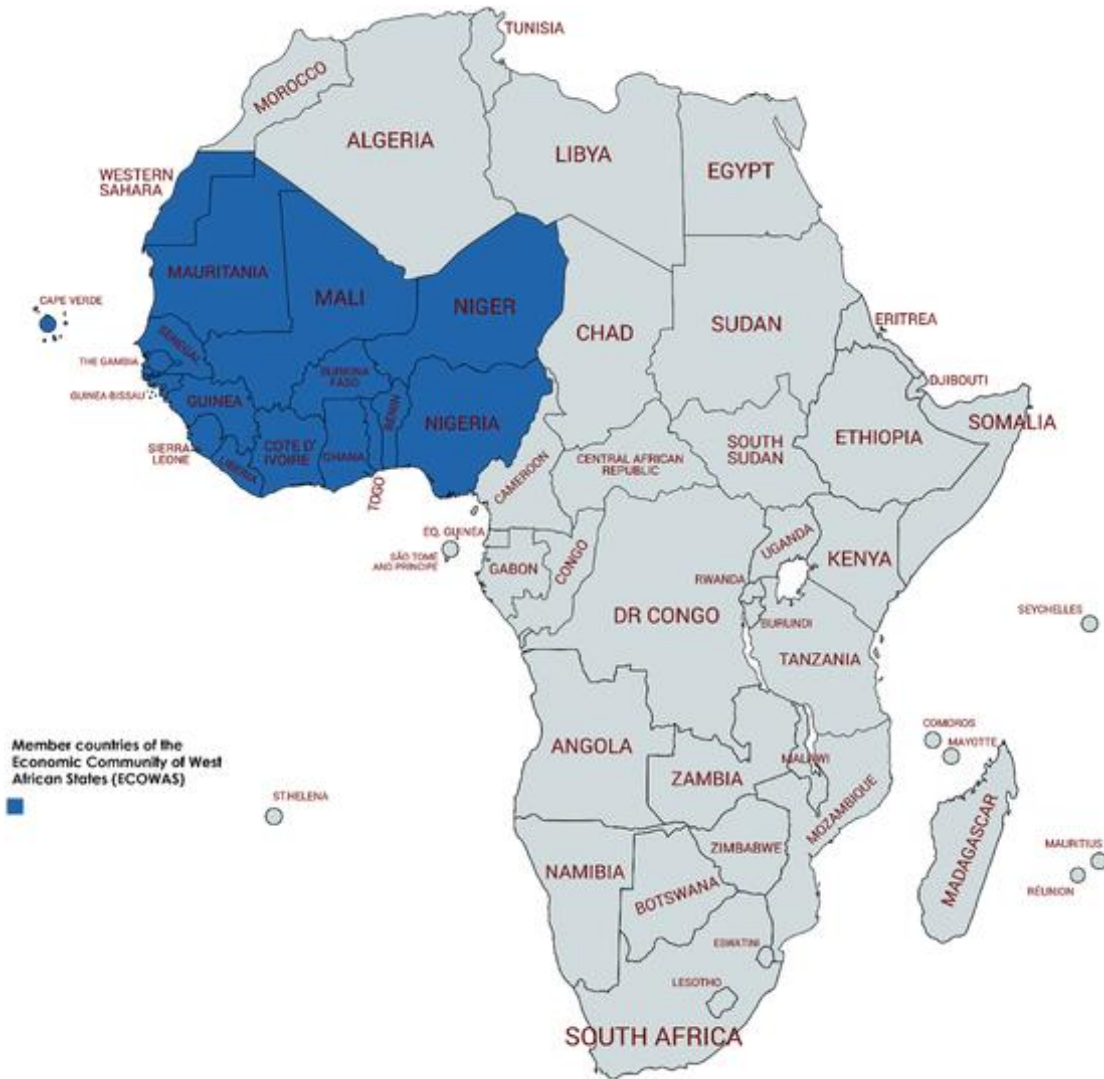
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Olyvia Gwladys Fadeyi / 09.12.2023/ Ethnobiology workshop in Kenya

Content (1/1)

- General info
- Diversity of wild edible mushrooms in the African continent
- Traditional and medicinal uses of mushrooms in Western Africa
edible mushrooms
- Identification of edible and inedible wild mushrooms and
toxicology problems
- Specific case from Benin
- Conclusion

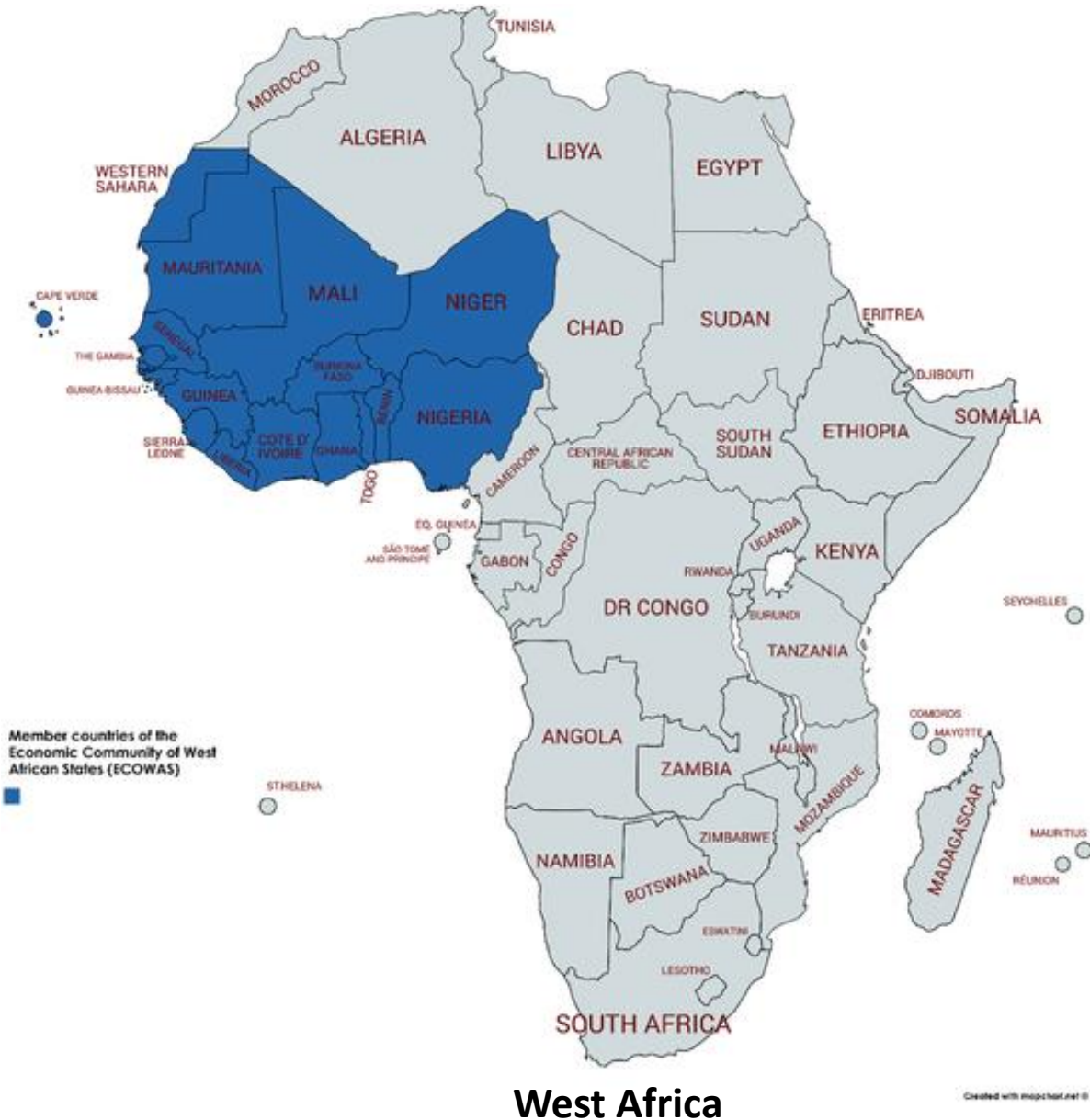
General info (2/3)



□ Underexploitation and underutilization

- anthropogenic,
- ethnographic,
- environmental origin.

General info (3/3)



❑ Ethnomycological data

- scarce,
- random,
- limited, and inconsistent from a taxonomic point of view.

Diversity of wild edible mushrooms in the African continent (1/4)

➤ Climatic conditions

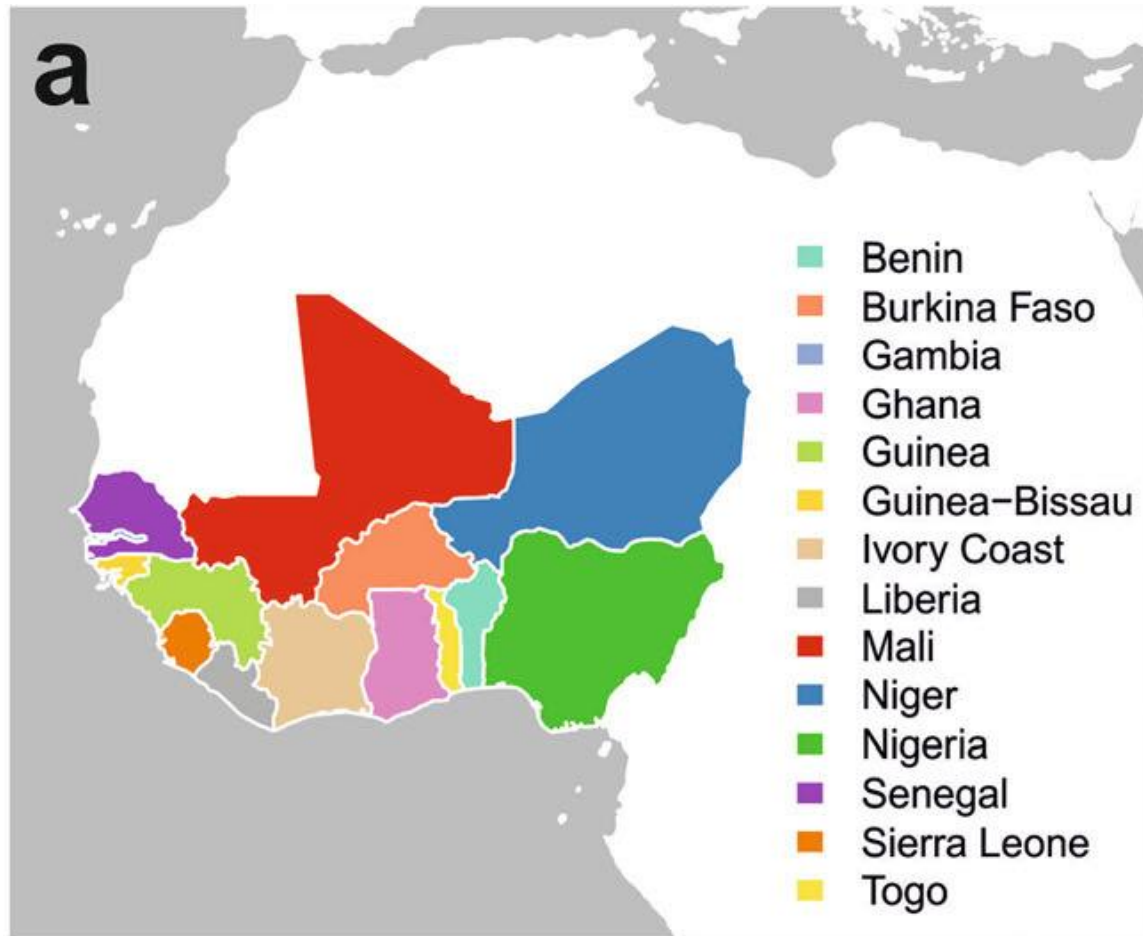


Diversity of wild edible mushrooms in the African continent (2/4)

□ Globally

- 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).

Diversity of wild edible mushrooms in the African continent (4/4)

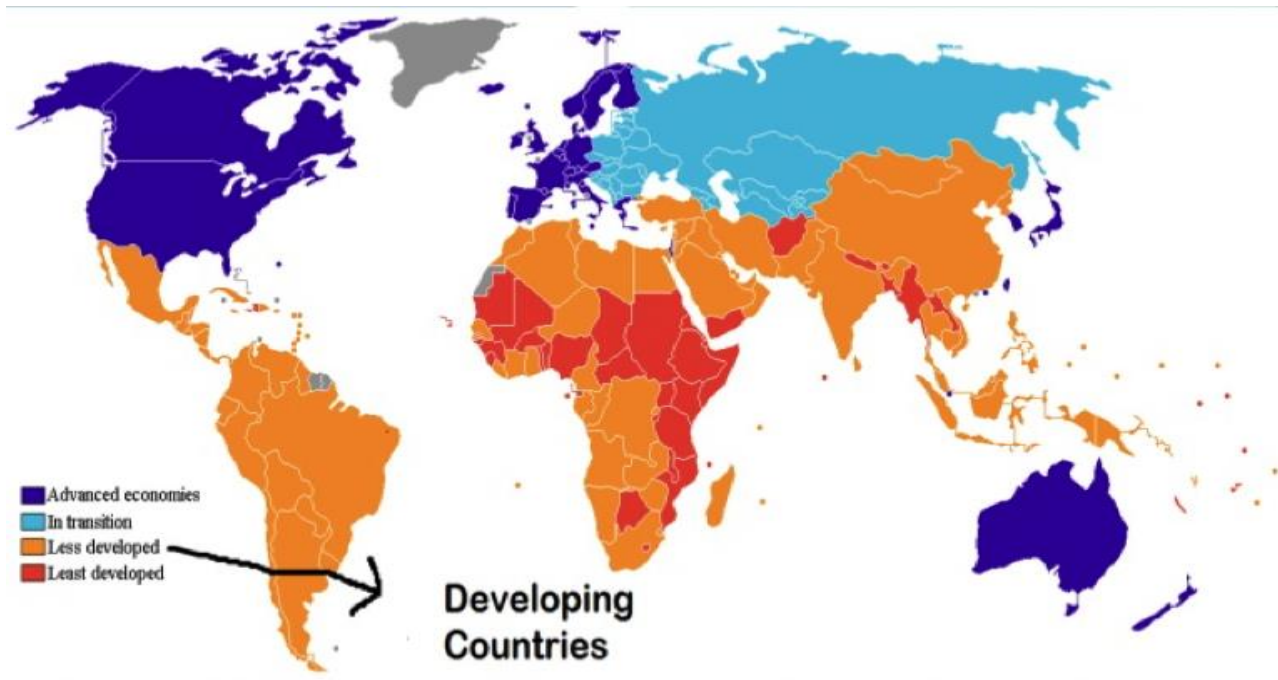


- More than 16,000 records of fungi representing 4843 species infraspecific taxa
- 860 publications 'West Africa'
(Piepenbring et al., 2020)

Fig. Numbers of fungal species and estimations for fungal species richness in West Africa and West African countries

Traditional and medicinal uses of mushrooms in Western Africa edible mushrooms (1/9)

□ Traditional knowledge of mushrooms



Relationships

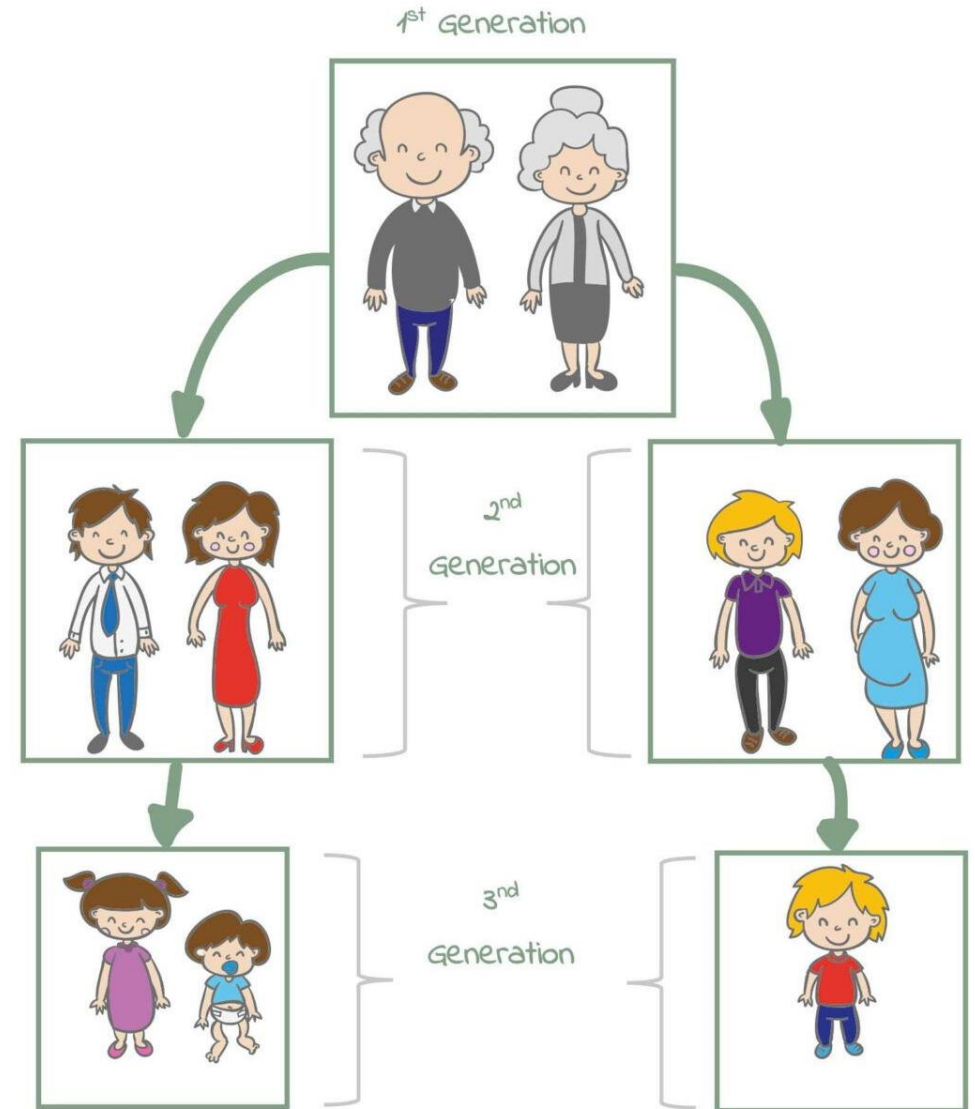
- Humans and fungi in a given environment,
- The past and in the present civilizations

(Molares et *al.*, 2020; Sitotaw et *al.*, 2020)

The Transmission of Knowledge



3 Generation Family tree For Kids



One generation to another
(Molares et al., 2020)¹⁰

Traditional and medicinal uses of mushrooms in Western Africa edible mushrooms (3/9)

□ Nutritional importance

- Low-energy levels and high amounts of minerals,
- Essential amino acids,
- Vitamins, and fibers

(Leal et *al.*, 2013)

Good source of proteins



Volvariella volvacea

- 40 g/100 g of fresh matter (Adejumo et *al.*, 2015).

Traditional and medicinal uses of mushrooms in Western Africa edible mushrooms (4/9)

□ Nutritional importance

- Carbohydrates such as glucose,
- Chitin,
- Glycogen,
- Glucan,
- Low-fat profile.

(Rahi & Malik, 2016)



Traditional and medicinal uses of mushrooms in Western Africa edible mushrooms (5/9)

- Makes these suitable food and low cost nutrition(Barros et al., 2013)



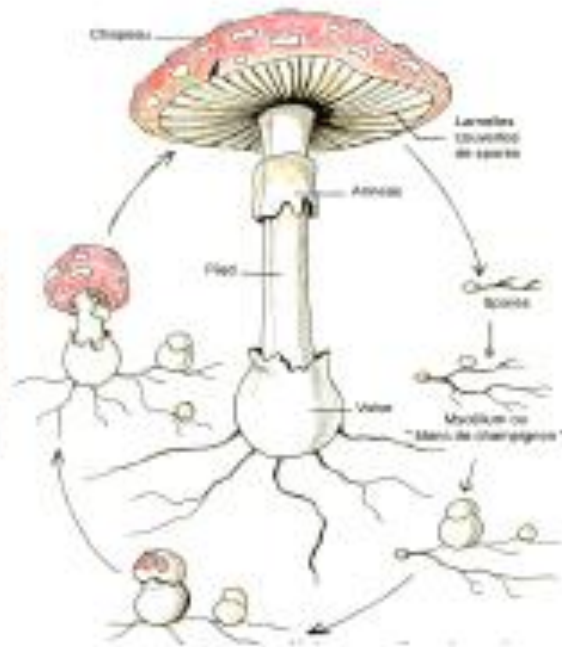
Traditional and medicinal uses of mushrooms in Western Africa edible mushrooms (6/9)

□ Use in medicine

➤ Two (02) categories of metabolites

Primary metabolites e.g,

*Sugars, amino acids,
vitamins*



Growth and development

*Secondary metabolites e.g,
saponin, alkaloids*



**Responsible for the colour : Colors, tastes,
odors, applications 'pharmaceutical
industry'**

Traditional and medicinal uses of mushrooms in Western Africa edible mushrooms (7/9)

□ Use in medicine

Polysaccharides, bioactive compounds present in medicinal mushrooms, exhibiting different spectrum of bioactivities

- antitumor,
- anti-proliferative,
- antidiabetic,
- anti-inflammatory,
- antimicrobial assets.

Traditional and medicinal uses of mushrooms in Western Africa edible mushrooms (8/9)

□ Use in medicine



Its antimicrobial assets

- *Scherichia coli*,
- *Staphylococcus aureus*,
- *Bacillus subtilis*,
- *Candida albicans* (Wisbeck et al., 2002)

Asia, Europe, South America

Traditional and medicinal uses of mushrooms in Western Africa edible mushrooms (9/9)

□ Use in medicine



- Stomachache,
 - Hemorrhoids,
 - Rheumatism,
 - Arthritis,
 - Neoplasia,
 - Insecticide and antibiotic.
- (Oyetayo, 2011; Soro et al., 2019; Yongabi et al., 2004)

Identification of edible and inedible wild mushrooms and toxicology problems (1/2)

Benefits that come from the regular consumption of mushrooms :

- 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-Goncalves et *al.*, 2018).

Identification of edible and inedible wild mushrooms and toxicology problems (2/2)

The correct taxonomic identification of mushrooms is challenging

- 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

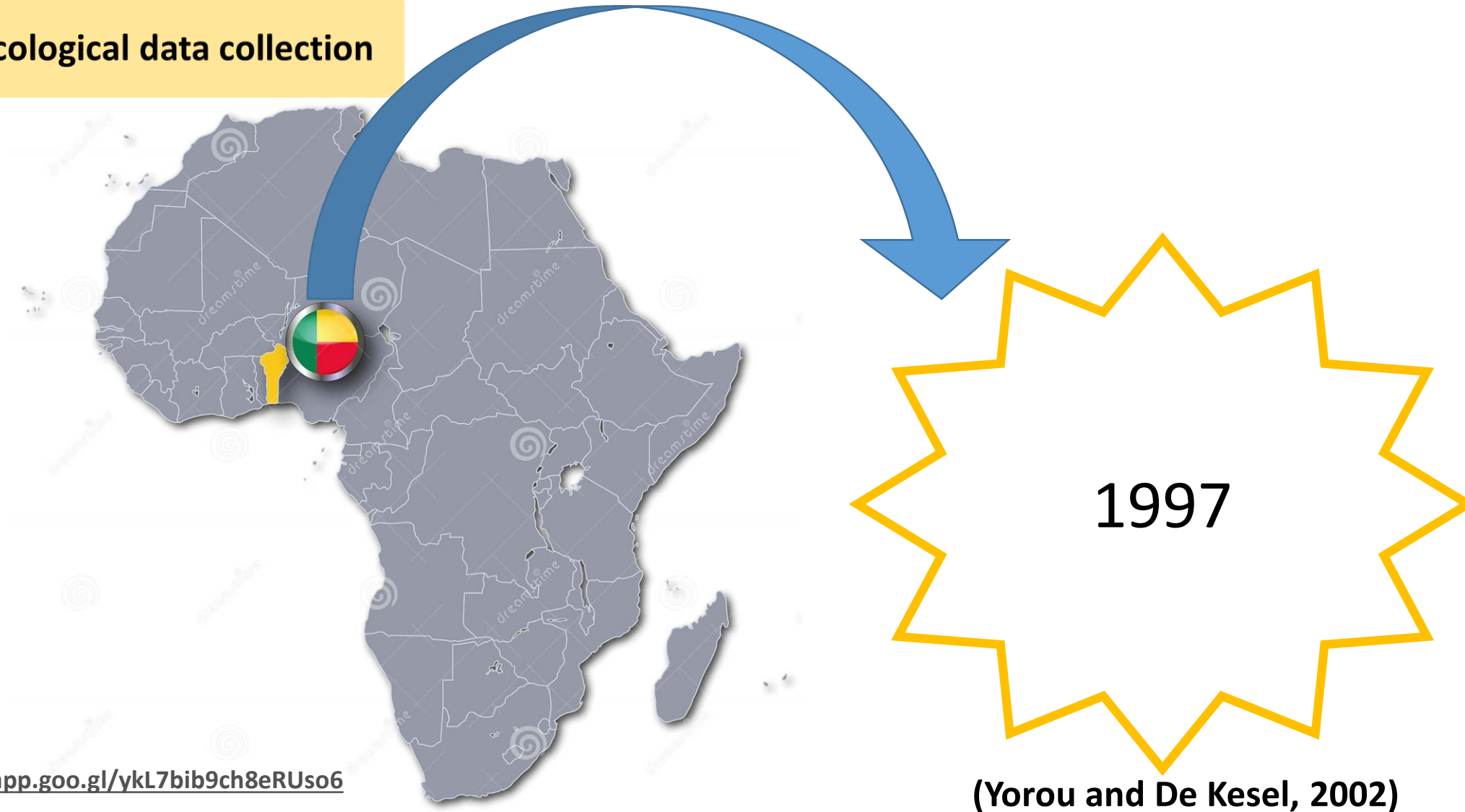
(Kissanga et *al.*,2022).

Specific case from Benin (1/32)



Specific case from Benin (2/32)

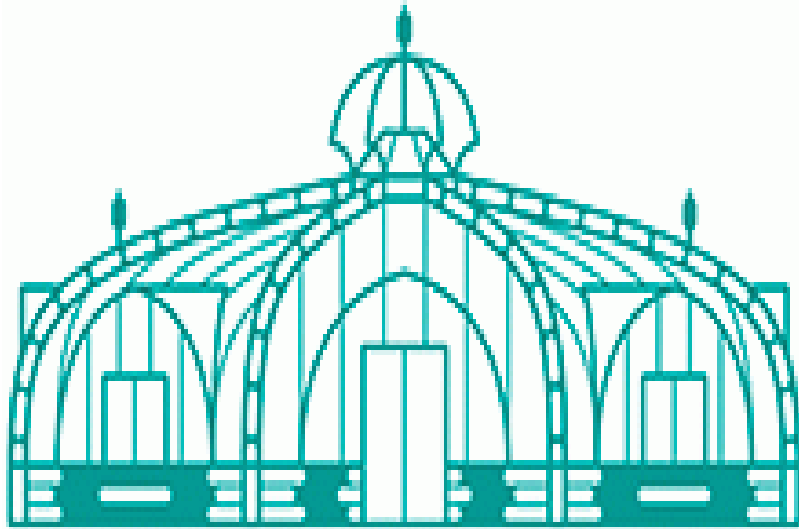
❖ Start of ethnomycological data collection



<https://images.app.goo.gl/ykL7bib9ch8eRUso6>

Fig. Africa map showing Benin

Specific case from Benin (3/32)



Botanic Garden Meise

<https://images.app.goo.gl/Fb19gHfb8KJZVvNX9>



International Center for Integrated Ecodevelopment (CECODI)



<https://images.app.goo.gl/nJiGMTr5D7mbreEb7>

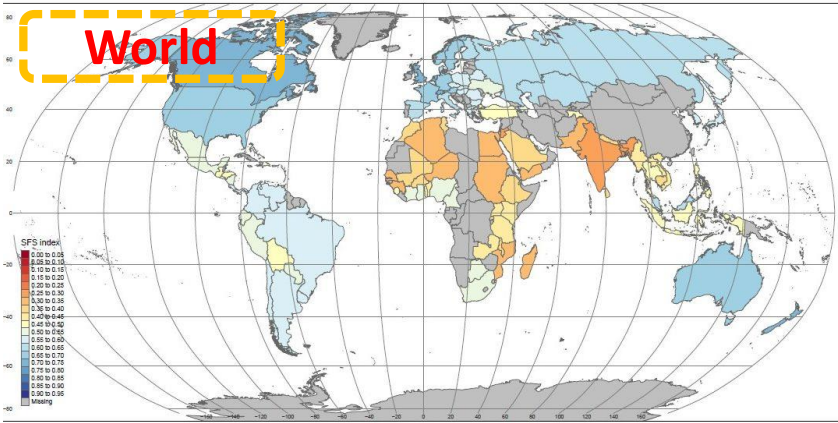


Fig. National University of Benin

<https://images.app.goo.gl/ntxbGvMBZczgDWiA6>

Specific case from Benin (4/32)

❖ Highest diversity of sociolinguistic groups



<https://images.app.goo.gl/8SB5UrNyYVqWrjy29>



<https://images.app.goo.gl/wnHw2pojbpLKjP4p8>

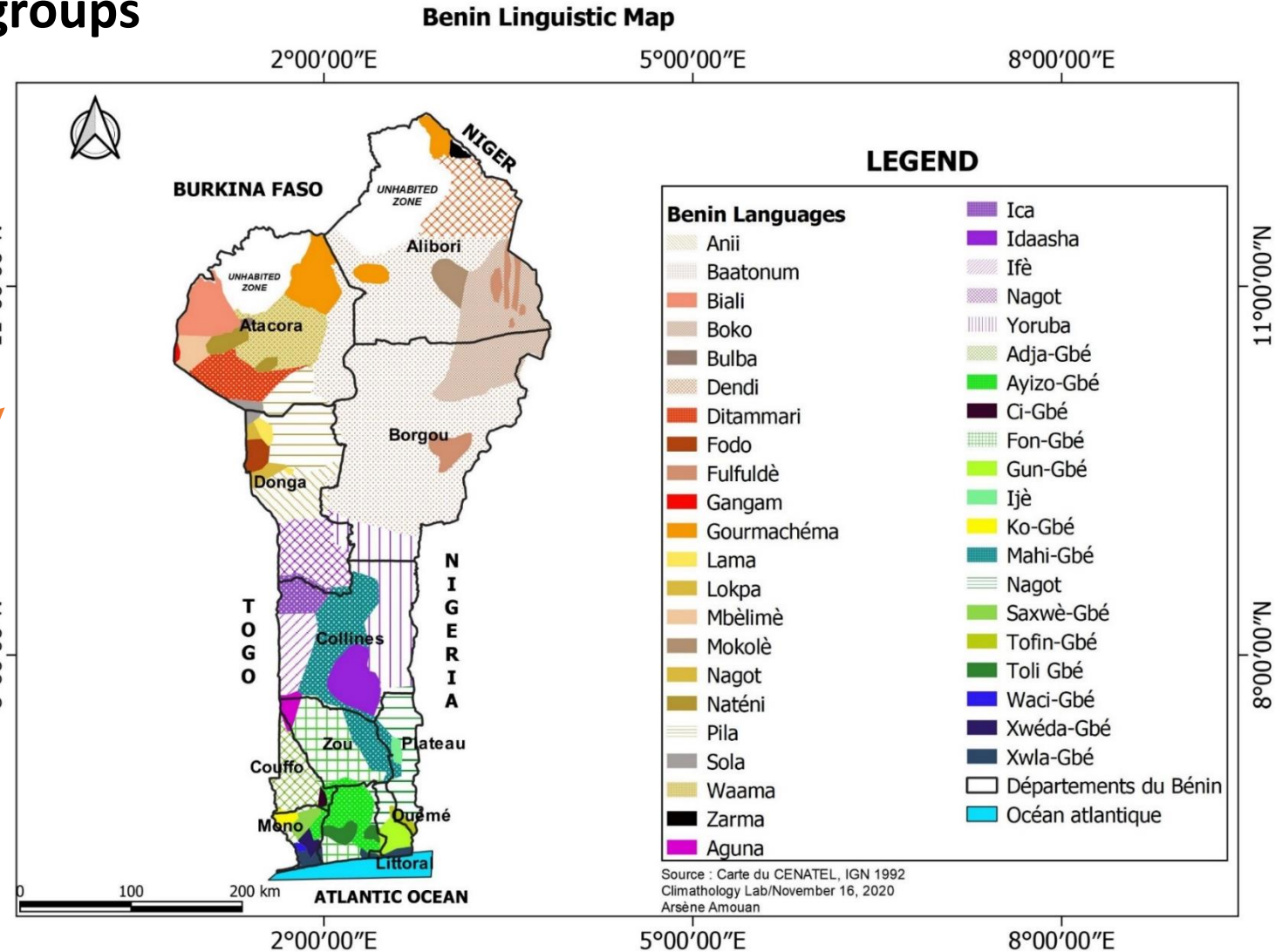


Fig. Benin Linguistic Map

Specific case from Benin (5/32)

❖ Sociolinguistic groups

❖ living around the natural habitats



<https://images.app.goo.gl/y1rZDRByjmnRVErB9>

❖ Natural habitats rich in wild fungi



<https://images.app.goo.gl/zPRpPd7XQXuzabJ59>

(Yorou and De Kesel, 2002)

Specific case from Benin (6/32)

❖ Develop skills and operating methods of key importance for mushrooms



<https://images.app.goo.gl/x3djRvQBAZhrjfs9>



<https://images.app.goo.gl/eGLDrB9K8jCJV7cx7>

(Yorou and De Kesel, 2002; De Kesel et al., 2002; Codjia and Yorou, 2014 ; Boni and Yorou, 2015; Fadeyi et al., 2017; Fadeyi et al., 2019).

Specific case from Benin (7/32)

❖ Period of use : rainy season (May to October)



<https://images.app.goo.gl/H7WmTmVfYZ4YCczUA>



<https://images.app.goo.gl/dxe3DH3AKy8ifJCc8>

Rarefaction
of wild meat



<https://images.app.goo.gl/LKJuG93Rxdbzsk1F9>

Switch to mushrooms
as main source of
protein



<https://images.app.goo.gl/jBa59CqT9NW7jrsT6>

Specific case from Benin (8/32)

❖ Food



Specific case from Benin (9/32)

- ❖ Source of income (Benbèrkè in the North)



Lactifluus gymnocarpoides



(Akounnou et al., 2020)

Pile of mushrooms (0,038 Euro)

Specific case from Benin (11/32)

❖ Source of income (Benbèrkè in the North)



1

(Akounnou *et al.*, 2020)

2

Bowl (3,05 to 4,58 Euro)

Specific case from Benin (12/32)

- ❖ **Source of income (Benbèrkè in the North)**
 - To feed the household,
 - To buy chemical products for field work.

Specific case from Benin (13/32)

- ❖ The most abundant species (*Amanita*, *Lactarius* and *Russula*)



Amanita masasiensis



Lactifluus gymnocarpoides



Russula congoana

- ❖ The most appreciated species



Termitomyces schimpieri
(Codjia and Yorou, 2014)



Termitomyces letestui

<https://images.app.goo.gl/WQTez8DKrh6fxdxB7>



Candolleomyces tuberculatus



Volvariella volvacea

(Codjia and Yorou, 2014)



Collybia sp.

Specific case from Benin (14/32)

- ❖ According to the sociolinguistic groups the most appreciated species have tastes similar to



Meat

<https://images.app.goo.gl/EjnmScHmhtpgorJj9>



Fish

<https://images.app.goo.gl/W5adnJgbUi3jRmnE6>



Poultry

<https://images.app.goo.gl/4WTcuxKTkvbM27wa8>

(Yorou and De Kesel., 2002)

Specific case from Benin (16/32)

❖ Cooking method: less demanding and non-toxic species



Termitomyces letestui



- Cleanly wash with water



- Put in sauces



(Fadeyi et al., 2017)

Specific case from Benin (17/32)

- ❖ Slightly bitter species are pre-cooked with potash and ash



Lactifluus gymnocarpoides

(Yorou and De Kesel., 2002; De Kesel et al., 2002; Boni and Yorou, 2015; Fadeyi et al., 2017)



Potash



Ash

<https://images.app.goo.gl/nTkQJPFqy3GZebe1>

Specific case from Benin (18/32)

❖ Cooking method: Amanita species with salt or potash



Amanita subviscosa



Amanita congolensis

➤ Crust on the fruits bodies surface



Salt



Potash

<https://images.app.goo.gl/cVm8C6JCiRDXxBBM7>

(Boni and Yorou, 2015; Fadeyi et al., 2017; Fadeyi et al., 2019)

Specific case from Benin (19/32)

❖ Cooking method: Amanita species



Amanita crassiconus

- **Washed and boiled in water**



- **Sun drying (1 week) before use**

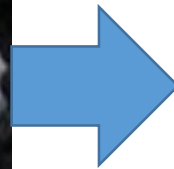
(Boni and Yorou, 2015)

Specific case from Benin (20/32)

❖ Cooking method: Hard



Lentinus squarrosulus



- **Washed and boiled in hot water (1 hour)**

(Fadeyi et *al.*, 2017)

Specific case from Benin (21/32)

- ❖ Treat several diseases



(Fadeyi et al., 2017)

Amanita masasiensis (Yom)

- Stomach ulcer

Specific case from Benin (22/32)

Table 2: Edible species per Linguistic groups and biological groups

N°	Espèces de champignons				Groupes biologiques
	Noms scientifiques	Comestibilité selon l'ethnie			
		Bariba	Gando	Yom	
1	<i>Agaricus volvatulus</i> Heinem. & Goos.-Font.	+	+	-	Saprotrophe-humo-terricole
2	<i>Amanita aff. craseoderma</i> Bas	-	-	+	Ectomycorrhizien
3	<i>Amanita masasiensis</i> Härk. & Saarim.	+	+	+	Ectomycorrhizien
4	<i>Amanita cf. rubescens</i> Pers.	+	+	-	Ectomycorrhizien
5	<i>Amanita strobilaceovolvata</i> Beeli	-	+	+	Ectomycorrhizien
6	<i>Amanita subviscosa</i> Beeli	-	+	-	Ectomycorrhizien
7	<i>Amanita cf. xanthogala</i> Bas	-	-	-	Ectomycorrhizien
8	<i>Auricularia cornea</i> Ehrenb.	+	-	-	Saprotrophe lignicole
9	<i>Cantharellus addaiensis</i> Henn.	-	-	+	Ectomycorrhizien
10	<i>Cantharellus congolensis</i> Beeli	+	-	+	Ectomycorrhizien
11	<i>Cantharellus platyphyllus</i> Heinem.	+	-	+	Ectomycorrhizien
12	<i>Chlorophyllum aff. molybdites</i> (G.-Mey.) Masee	+	+	+	Saprotrophe humo-terricole
13	<i>Lactarius baliophaeus</i> Pegler	-	+	-	Ectomycorrhizien
14	<i>Lactarius denigricans</i> Verbeken & Karhula	+	+	-	Ectomycorrhizien
15	<i>Lactarius densifolius</i> Verbeken & Karnula	-	+	-	Ectomycorrhizien
16	<i>Lactarius saponaceus</i> Verbeken	-	+	-	Ectomycorrhizien
17	<i>Lactarius tenellus</i> Verbeken & Walley	+	+	+	Ectomycorrhizien
18	<i>Lactifluus edulis</i> (Verbeken & Buyck) Buyck	+	+	+	Ectomycorrhizien

N'Dali Région – (North of Benin)
(Boni and Yorou, 2015)

Table 3: Edible species, local name and preference level

N°	Scientific names	local name + appreciation			Signification		
		Nagot	Holli	Fon	Nagot	Holli	Fon
		1	<i>Volvariella volvacea</i> (Bull.) Sing.	Ohunto èkpè (1.5)	Ohunto èkpè (1)	Dékpohunto (1)	mushroom of palm tree
2	<i>Collybia</i> sp.	Okiki (1.5)	Okiki (1)	Okiki (1.5)	mushroom that comes out		
3	<i>Marasmius</i> sp.	Idjôdou (1)	Idjôdou (1)	Idjôdou (0.5)	-		
4	<i>Lentinus squarrosulus</i> Mont.	Oluawô (0.5)	Oluawô (0.5)	Ahô (0.5)	-		
5	mushroom sp1	Oludèrè (0.5)	Oludèrè (0.5)	-	-		
6	<i>Termitomyces letestui</i> (Pat.) Heim	OKo-adja (0.5)	-	-	-		
7	<i>Termitomyces schimperi</i> (Pat.) Heim	Oluènn (0.5)	Oluènn (0.5)	Oluènn or Lisso (0.5)	elephant mushroom		
8	<i>Marasmiellus inoderma</i> (Berk.) Singer	Eti-ologbo (0.5)	-	-	-		
9	mushroom sp2	Olubédjé (0.5)	Olubédjé (0.5)	-	-		
10	mushroom sp3	Oluébé (0.5)	-	-	-		
11	<i>Psathyrella tuberculata</i>	Oluehiki or	ehunto équi	Afikunto	Mushroom of tree		

Pobè Région – (South of Benin)
(Codjia and Yorou, 2014)

12

Specific case from Benin (23/32)

❖ Variability of knowledge across regions

Table 1: List of species of the genus *Amanita* and their uses according to ethnic groups

Voucher number of the specimen	Scientific names	Edibility by ethnic group		
		Yom	Peuhls	Lokpa
FOG 0546	<i>Amanita crassiconus</i> Bas	-	-	-
FOG 0655	<i>Amanita afrospinosa</i> Pegler & Shah-Smith	-	-	-
FOG 0656	<i>Amanita cf. xanthogala</i> nom.prov.	-	-	-
FOG 0657	<i>Amanita cf. xanthogala</i> (witish form) nom.prov.	-	-	-
FOG 0163	<i>Amanita craseoderma</i> Bas	-	-	-
FOG 0658	<i>Amanita loosii</i> Beeli	+	+	-
FOG 0325	<i>Amanita masasiensis</i> Härk. & Saarim.	+	+	-
FOG 0659	<i>Amanita pulverulenta</i> Beeli	-	-	-
FOG 0660	<i>Amanita subviscosa</i> Beeli	+	+	+
FOG 0305	<i>Amanita virido-odorata</i> nom.prov.	-	-	-
FOG 0657				-

Monts Kouffè Région – (Center of Benin) (Fadeyi et al., 2019)

Legend: (+) Edible species

Table 2: Edible species per Linguistic groups and biological groups

		Bariba	Gando	Yom	
1	<i>Agaricus volvatulus</i> Heinem. & Goos.-Font.	+	+	-	Saprotrophe-humo-terricole
2	<i>Amanita aff. craseoderma</i> Bas	-	-	+	Ectomycorrhizien
3	<i>Amanita masasiensis</i> Härk. & Saarim.	+	+	+	Ectomycorrhizien
4	<i>Amanita cf. rubescens</i> Pers.	+	+	-	Ectomycorrhizien
5	<i>Amanita strobilaceovolvata</i> Beeli	-	+	+	Ectomycorrhizien
6	<i>Amanita subviscosa</i> Beeli	-	+	-	Ectomycorrhizien
7	<i>Amanita cf. xanthogala</i> Bas	-	-	-	Ectomycorrhizien
8	<i>Auricularia cornea</i> Ehrenb.	+	-	-	Saprotrophe lignicole
9	<i>Cantharellus addaiensis</i> Henn.	-	-	+	Ectomycorrhizien
10	<i>Cantharellus congolensis</i> Beeli	+	-	+	Ectomycorrhizien
11	<i>Cantharellus platyphyllus</i> Heinem.	+	-	+	Ectomycorrhizien
12	<i>Chlorophyllum aff. molybdites</i> (G.-Mey.) Masseur	+	+	+	Saprotrophe humo-terricole
13	<i>Lactarius baliophaeus</i> Pegler	-	+	-	Ectomycorrhizien
14	<i>Lactarius denigricans</i> Verbeken & Karhula	+	+	-	Ectomycorrhizien
15	<i>Lactarius densifolius</i> Verbeken & Karhula	-	+	-	Ectomycorrhizien
16	<i>Lactarius saponaceus</i> Verbeken	-	+	-	Ectomycorrhizien
17	<i>Lactarius tenellus</i> Verbeken & Walleyn	+	+	+	Ectomycorrhizien
18	<i>Lactifluus edulis</i> (Verbeken & Buyck) Buyck	+	+	+	Ectomycorrhizien
19	<i>Lactifluus flammans</i> (Verbeken) Verbeken	+	+	+	Ectomycorrhizien
20	<i>Lactifluus gym...</i> ken				

N'Dali Région – (North of Benin) (Boni and Yorou., 2015)

Ancestral knowledge which are transmitted from generation to generation

Specific case from Benin (24/32)

❖ High mycophagy (Nagot Sociolinguistic group)



<https://images.app.goo.gl/nDP1wmUE87e3JABA8>



<https://images.app.goo.gl/LhxnBd3PnC1UTn9aA>

Nagot from Nigeria (Yorou and De Kesel, 2002; De Kesel et al., 2002)

Specific case from Benin (25/32)

❖ High mycophagy (Nagot Sociolinguistic group)

About fifty macromycete species are consumed by Nagot people of central Benin

- *Amanita*
- *Auricularia*
- *Boletus*
- *Cantharellus*
- *Chlorophyllum*
- *Gymnopus*
- *Hebeloma*
- *Lactarius*
- *Lentinus*
- *Candolleomyces*
- *Russula*
- *Volvariella*
- *Termitomyces*

<i>Termitomyces clypeatus</i> Heim	ADK1947, ADG114	soisoi soisoi = après, à fructification tardive
	ADK2193	itikpajè itik = pied, ajè = oiseau
<i>Termitomyces fuliginosus</i> Heim	ADK2237, Y82	osusu akété akété = termite
<i>Termitomyces letestui</i> (Pat.) Heim	ADK2053	okoadja queue (= oko) du chien (= adja)
<i>Termitomyces medius</i> Heim & Grassé	ADK2136	loo loo = vaste, poussant sur de grandes étendues
	ADK2807	osusu fée
<i>Termitomyces microcarpus</i> (Berk. & Broome) Heim	ADK2278	wiliwili wili = beaucoup
<i>Termitomyces schimperi</i> (Pat.) Heim	Y118	inku aginaku inku = genou (l'os), aginaku = éléphant
<i>Termitomyces striatus</i> (Beeli) Heim s.l.	ADK2830	osusu émé émé (emi) = <i>Vitellaria paradoxa</i> (karité)
<i>Volvariella earlei</i> (Murr.) Shaffer	ADK1948, ADK3102, Y100	gnomé, guémo gnomé = billon, dans les champs à billons
	ADK2352	osusu gèmo/kpaké kpaké = manioc, dans les champs de manioc
<i>Volvariella volvacea</i> (Bull. ex Fr.) Singer	ADK2687	osusu féré ?

(Yorou and De Kesel, 2002)

Specific case from Benin (26/32)

❖ Collection of mushrooms is only a secondary activity

corresponds with the period of preparation of the crop fields.



<https://images.app.goo.gl/xH4Bcj5ka9EemZJr7>

Zea mays



<https://images.app.goo.gl/YJwLYm2WNRNPKF2T8>

Oryza sativa



<https://images.app.goo.gl/RwAFguCtzkoFWbZPA>

Dioscorea alata

(Yorou and De Kesel., 2002)

Specific case from Benin (27/32)



<https://images.app.goo.gl/iDc3eqoPUhmL1BdTA>

Collecting firewood

<https://images.app.goo.gl/tDCkrT7b9E3TBqS8A>

(Yorou and De Kesel, 2002; De Kesel et al., 2002; Codjia and Yorou, 2014 ; Boni and Yorou, 2015; Fadeyi et al., 2017; Fadeyi et al., 2019).

Specific case from Benin (28/32)

❖ Men
(hunters)



<https://images.app.goo.gl/5NdUPyhNqmCvDCq28>

Rich knowledge in folk medicine

(Yorou and De Kesel, 2002; De Kesel et al., 2002;
Codjia and Yorou, 2014 ; Boni and Yorou, 2015;
Fadeyi et al., 2017; Fadeyi et al., 2019)⁴⁶

Specific case from Benin (29/32)

- ❖ Most wild edible mushrooms are ectomycorrhizal fungi

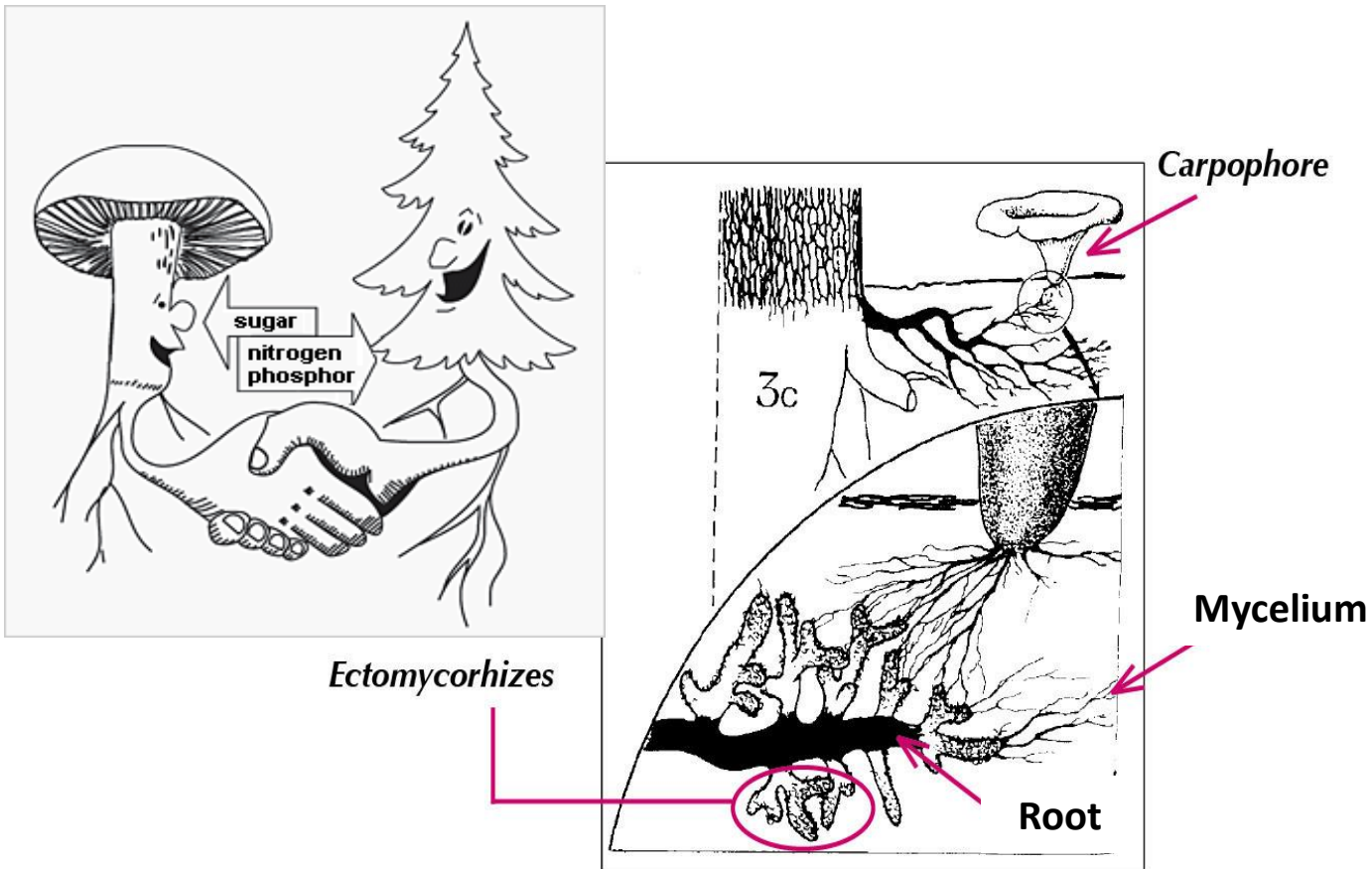


Fig. Ectomycorrhizal symbiosis

<https://images.app.goo.gl/7Nf2s8woqyxfYAos8>

Specific case from Benin (30/32)

❖ Ectomycorrhizal families



Caesalpiaceae



Phyllantaceae



Caesalpiaceae

(De Kesel et *al.*, 2002 ; Yorou et *al.*, 2002 a,b, c)

Specific case from Benin (31/32)

❖ Ectomycorrhizal families



(De Kesel et *al.*, 2002 ; Yorou et *al.*, 2002 a,b, c)

Dipterocarpaceae (*Monotes kerstingii* Gilg).

<https://images.app.goo.gl/oWThgM5pY3QxKtXTA>

Specific case from Benin (31/32)

❖ Several identification criteria of edible and non-edible mushrooms

“All the ethnic groups are found around of two major senses: the taste and the visual (Heim, 1977)”

- Odour

- Taste

- Colour

- Proximity to trees whose fruits are edible

- Form

(Yorou and De Kesel, 2002; De Kesel et al., 2002; Codjia and Yorou, 2014 ; Boni and Yorou, 2015; Fadeyi et al., 2017; Fadeyi et al., 2019).

Specific case from Benin (32/32)

❖ Traditional nomenclature

Lactarius saponaceus : Nagot "osusu wawo" which mainly grows under the tree *Uapaca togoensis* (Euphorbiaceae). (Boni et Yorou, 2014)



Uapaca togoensis (Euphorbiaceae)

<https://images.app.goo.gl/1YUCXwQevp9yq7RG9>



Ploceus cucullatus

<https://images.app.goo.gl/5QZuCDmbQjcJkZKfA>

CONCLUSION (1/2)

- The local populations have very rich and diverse knowledge on the uses of mushrooms
- We know a lot about the influence of ethny, age, sexe on ethnomycological knowldeg.
- What remains to document is among other how demographic/migratory traits affect present ethnomycological knowledge of the ethnic groups.

CONCLUSION (2/2)

Questions to reply

- Does the origin of the respondent (or his ethnic group) affect his present ethnomycological knowledge?
- Is there a link between level of knowledge and period of installment?
- Question to reply to: Is there a link between knowledge depreciation with generations?
- Question: Does linguistically close ethnic group hold similar approach to naming taxa?



- Fungal Diversity of tropical Africa: Edible mushrooms of Benin - FunTrAf; Federal Ministry of Education and Research (BMBF, Germany)
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