

Endogenous Knowledges and Diversity of Amaranths (*Amaranthus spp*) Grown in Burkina Faso

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Abstract

The present study is an ethnobotanical survey on *Amaranthus spp* coupled with accessions collection carried out in ten (10) provinces of Burkina Faso. It aims at contributing to a better knowledge of the extent of the culture and the agricultural management modes of the cultivated species of *Amaranthus spp*. Ninety-nine (99) accessions were collected. The ethnobotanical survey showed that the cultivation of amaranth is clearly increasing (67.57%). Agro-morphological and organoleptic characteristics are used by farmers for cultivars identification. Thus, three main morphotypes (dark-green, light-green and red) with several variants were identified. Among these morphotypes, the morphotype dark green was cited by respondents in the ten provinces surveyed. In this study, a greater number of morphotypes were recorded in three provinces (Houet, Ouhimbiri and Yatenga). Three (3) areas of use and fifteen (15) specific uses of the different organs of amaranth were reported by the 270 respondents. For 99.6% of the respondents, it is mainly used for human consumption (vegetable sauce, *baag-benda*, *gnougou* and couscous). Amaranth's leaves are sold at on-farm level or in markets and *yaar*. The price of these leaves packaged in bags of 50 kg bags, varies from 1,500 to 2,500 FCFA.

Keywords: Amaranth; Leafy vegetable; Market gardening; Ethnobotanical characterization; Burkina faso.

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1. Introduction

Amaranth is one of the most widely traded leafy vegetables in tropical markets. It is grown in large areas of vegetable gardens, although many people refer to it as a poor man's vegetable [1]. Amaranth can be grown anywhere on swampy lands and lowlands during water deficit periods, in vegetable gardens and around homes [2].

In Burkina Faso, amaranth is one of the most widely consumed leafy vegetables [3]. Formerly, it leaves were directly harvested from the wild type; however nowadays its cultivation is practiced in all climatic zones of the country especially in areas designed for marketing gardening and around huts [4]. Cultivated in both rainy and dry seasons, amaranth is more produced in urban and peri-urban areas than in rural areas [3]. Indeed, in 2018, in the capital city Ouagadougou only, production was estimated at 1140 tons on an area of 191 hectares for a national production of 1357 tons on an area of 246 hectares [5]. Such a practice exerts a selection pressure based on the consumers' preferential characteristics. It is therefore urgent that management strategies for this leafy vegetable be developed. This requires, first of all, an understanding of farmers' practices on its diversity management and local naming processes description [6]. Indeed, consumers' nutritional preferences, most often based on socio-cultural considerations, must be taken into account in the development of tools and methods to support the implementation and monitoring of diversity management and enhancement programs [7, 8]. Thus, the present study aims at taking stock of traditional knowledge and know-how on the management of amaranth species in Burkina Faso. Specifically, it aims to (i) identify local knowledges on the peasant management of species, (ii) identify consumers preferred traits on crop, and (iii) establish a collection of amaranths grown in Burkina Faso.

2. Material and Methods

2.1. Description of the Study Area

The sample collection survey followed by an ethnobotanical survey took place in 10 provinces distributed in the three climatic zones of Burkina Faso. The province of Bam, Yatenga and Séno are located in the Sahelian zone at northern Burkina Faso). In the Sudano-Sahelian zone, six provinces were surveyed: Kadiogo, Bazèga, Sanguié, Oubritenga, Kouritenga and Gourma. In the Sudanian zone (south), only one province, Houet, was surveyed.

2.1.1. Climate and Hydrography

The provinces of the Sahelian zone are characterized by a short rainy season (4 months at most), high inter-annual and spatio-temporal rainfall variability, high diurnal and annual thermal amplitudes, and consequently, very high potential evapotranspiration during the hot periods (March to June). As for the provinces of the Sudano-sahelian zone, they are characterized by a rainy season of about 5 months' duration, less significant diurnal and annual thermal amplitudes than in the northern part, with moderate potential evapotranspiration. The Houet province is characterized by a rainy season of nearly 6 months, diurnal and annual temperature amplitudes and low potential evapotranspiration [9].

Rainfall in these different provinces varies according to their geographical position from north to south. For example, the Séno province is characterized by an annual rainfall varying between 400 and 600 mm, while the Bam and Yatenga provinces have annual rainfall ranging between 600 to 750 mm. As for in the Kadiogo and Sanguié provinces, the average annual rainfall is between 700 mm and 800 mm. The rainfall in the Oubritenga, Bazèga and Kouritenga provinces varies between 700 mm and 900 mm, while in the province of Gourma the mean rainfall ranges between 800 mm and 1000 mm depending on the year. As for the province of Houet, the annual rainfall varies between 800 and 1100 mm [10].

The hydrographic network that drains most of these provinces is fairly dense, but most of the rivers have temporary runoff and their flows show declining trends. The province of Yatenga has no permanent watercourses. Apart from a few low-lying areas located in the Nakambé riverbed, which can temporarily hold water, it is limited to dams and water reservoirs built by the State [11]. The fishery resources of the Sanguié province are essentially located on the Nazinon River and its tributaries, on certain dams and water reservoirs. The temporary nature of the rivers limits the development of fishery resources in these two provinces [12].

The Séno province is essentially drained by tributaries of the Niger River and the Nakanbé River, in addition to natural ponds and lowlands.

The hydrographic network of the provinces of Kadiogo, Oubritenga, Bazèga and Kouritenga is organized around two (2) main watersheds: The Nakanbé and Nazinon watershed in the West, the Sissili South-West and the Niger sub-watershed, consisting of the Sirba and the Faga in the East. The development of fisheries resources in these provinces is based on dams and numerous small reservoirs. As for the Gourma province, it is drained by a dense hydrographic network consisting essentially of rivers belonging to the Niger and Pendjari-Kompienga watersheds.

The Houet province has a particular topography and climate that makes it a real water tower, from there several rivers have their source.

2.1.2. Socio-Economic Activities

Economically, the main activities in these provinces are strongly dominated by the primary sector, namely livestock, forestry and agriculture [13]. Agriculture is dominated by cereal crops and market gardening is booming [9]. Market gardening in these different provinces is an important socio-economic activity for the population. Seven provinces (Kadiogo, Houet, Yatenga, Sanguié, Oubritenga, Bazèga and Bam) out of the ten are among the provinces with the largest areas of land under market gardening in the country [5]. The gardening activity in these provinces is seasonal (dry season), with the exception of Bazèga province, where it is practiced during both rainy and dry seasons. The main vegetable crops are: bulbous onion, leaf onion, tomato, cabbage, imported eggplant, local eggplant, green bean, chili pepper and okra [5]. In addition to these major crops, there are other emerging crops such as amaranth. In the province of Kadiogo, this vegetable crop is ranked fifth in terms of area cultivated (191 hectares) after bulb onions, leaf onions, tomatoes and cabbage, with a production of 1140 tons [5, 9].

2.2. Accessions Collection and Ethnobotanic Survey

Amaranth is well known in all the 45 provinces of Burkina Faso as it naturally exists at wild type. However, only 10 provinces were surveyed. The identification of these provinces was done with the support of the provincial directorates of agriculture (DPA) on the basis of the strong activity of market gardening and amaranth cultivation. This choice is also due to insufficient financial means to cover the whole country.

Accessions were collected from the surveyed producers in the form of panicles or seeds, either in the field, at the home, or in the garden. Each sample collected was labeled and stored in envelopes. Information's on the identity of the respondent, the geographical coordinates of his or her locality and ethnobotanical data were recorded by filling out a form pre-established. The information's collected from the producers included the origin, number and name of each local variety grown, the agricultural practices, the morphological characteristics preferred by producers and consumers, the method of seeds provision, the growing period, seeds conservation methods and the various uses. These information's were collected with each individual respondent in all the identified sites.

2.3. Treatments and Statistical Analysis of the Data

The Excel 2016 spreadsheet was used to construct histograms of the distribution of respondents according to gender, cropping periods, cropping systems, and seed acquisition methods. The Excel 2016 spreadsheet was also used to design graphs of grower and consumer preferences based on the different morphotypes.

Floristic richness, composition and diversity were subsequently determined. The diversity of morphotypes was evaluated through indices such as

- Shannon [14] diversity index (H'); it combines the number and evenness of the considered species or morphotypes,

$$H' = -\sum (N_i/N) \cdot \ln (N_i/N) \text{ where } N_i \text{ is the number of species } i \text{ and } N \text{ the total number of morphotypes}$$

- Pielou [15] equitability index (E),

$$E = H' / \ln S \text{ where } E \text{ is Pielou equitability index and } S \text{ is the total number of morphotypes in a biotope.}$$

- Simpson's diversity index basically measures the probability that two individuals randomly selected from a sample belong to the same species or cultivar [16] and, therefore, if D increases, diversity decreases. The index was therefore transformed as $1-D$ so that greater diversity corresponds to higher values. $IS=1-D$ or $D=\sum p_i^2$ and $P_i= n_i/N$

- The degree of similarity between the different climatic zones was evaluated, taking into account the morphotypes of the amaranth species they contain using Sorensen similarity coefficient. $P = (2C/(A + B)) \cdot 100$

Where P is the similarity coefficient and expresses the percentage of morphotypes common to two climatic zones compared, A the total number of morphotypes from climatic zone 1, B the total number of morphotypes from climatic zone 2 and C the total number of morphotypes common to both climatic zones.

Ethnobotany indices [17, 18] were calculated using R statistical software with the *ethnobotanyR* Package version 3.6.3 [19].

- Relative citation frequency (RCF) was calculated to express the response rate by type of use [18].
- The number of uses (NU), which is the number of specific uses for each use category of the species;
- The cultural importance index (CI). It is used to assess the importance of a plant in a given use category;
- The use value index (UV) of the species. UV represents the average number of uses reported by informant i and calculated by use category.

Also, a pie chart linking specific uses to the different domains of use of the species using the *ethnobotanyR* package. This diagram allows a better visualization of the frequency of citation of each specific use for the different use categories.

3. Results

3.1. Location of Cultivation Sites and Number of Accessions Collected in the Ten Provinces Surveyed

The provinces and study sites are shown in Figure 1. In the Sahelian zone, 24 accessions were collected in three provinces. In the province of Bam, the surveys followed by the collection of accessions were conducted in the market garden sites of the Kongoussi town and in the villages of Guibaré (rural commune) and Koulniéré. In Yatenga province, the market garden sites of Goïnré located in the city of Ouahigouya were covered by the study. In the Séno province, the market garden sites located in the different sectors of the city of Dori were covered.

In the Sudano-Sahelian zone, 65 accessions were collected. The sites surveyed in the province of Kadiogo were the vegetable farms located downstream of the Boulmiougou and Tanghin dams in the city of Ouagadougou and in four rural communes located in its vicinity (Tintilou, Komki-ipala, Komsilga and Koubri). Two villages (Gonsé and Kognoudou) and one rural commune (Toécin) located in the vicinity of the commune of Kombissiri were surveyed in Bazèga province. In the Sanguié province, sites are located in the communes of Réo and Kyon and in the villages of Ekoukcola and Bonyolo. In the provinces of Oubritenga, Kouritenga and Gourma, the market garden sites in Sector 2 of the town of Ziniaré, and in the communes of Koupéla and Fada NGouma were surveyed respectively. In Houet province, in the Sudanian zone, 10 amaranth accessions were collected from cultivation sites in sectors 6, 12 and 13 of the town of Bobo Dioulasso.

3.2. Socio-Demographic Profile of Respondents

A total of 270 producers, whose 74.07% of men and 25.93% of women, were surveyed in the areas of study. However, in the provinces of Gourma (58%), Bazèga (55%), Oubritenga (70%) and Séno (60%), women predominate in the activity (Table 1). More than half of the respondents are indigenous, with occupations varying from one province to another. In the provinces of Bazèga (85%), Houet (86.67%), and Kadiogo (61.90%), the majority of respondents are market gardeners. On the other hand, in the provinces of Bam (100%), Oubritenga (70%) and Sanguié (76.92%), the surveyed people are mostly farmers and housewives.

The average age of these producers is between 15 and 75 years. In all the provinces surveyed, young people are strongly represented. For example, in Bam (100%), Yatenga (70%), and Bazèga (65%) provinces, more than half of the surveyed amaranth growers are young people between 15 and 35 years old. More than half (55.28%) of surveyed producers have less than five years' experience in amaranth production.

3.3. Local Nomenclature of Amaranth in the 10 Provinces of Burkina Faso

Thirteen (13) vernacular names were identified within the nine ethnic groups encountered during the ethnobotanical surveys (Table 2). The names varied from one ethnic group to another and within the same ethnic

group, with more diversity of names within the *Mossi* ethnic group than in the other ethnic groups (25 names, 8 of which were retained). These names are either specific to each ethnic group or common to 2 or 3 ethnic groups.

Thus, specifically, 5 names have been identified among the *Mossi*. The name *Boulouboula* has the highest frequency of citation (11.48%). Among the *Gourounsi* ethnic group, the two names identified are specific to the group, namely "*Ejangio*" and "*Jublé*", with a higher frequency of citation (18.15%) for the name "*Ejangio*". Among the *Bôbô* ethnic group, three names were cited, with a higher frequency of citation (26.67%) for the name *Mouna*. Among the *Turka* and *Toussain*, only one name, "*Bolombourou*", was noted.

On the other hand, the name "*barambourou*", with a frequency of 22.22%, is observed among both the *Mossi* and the *Bôbô*. The name "*Balamboule*" or "*balboule*" that is common to the *Mossi*, *Gourmantches* and *Peuhl* ethnic groups, recorded a very low frequency of citation of 1.48%.

3.4. Naming Criteria and Variability of Cultivated Amaranth

Morphological (colour and productivity of the plant), organoleptic (taste and odor after cooking), and status of the plant (wild or cultivated) were the criteria used by the respondents to describe the existing variability (Table 3). On the basis of these criteria, the number of morphotypes varied from 2 to 3. Thus, with reference to leaf and stem colour, three morphotypes were identified: they are: "*bouroumbouri miougou*" in *Mooré* and "*ejangio nachion*" in *Gourounsi* meaning red amaranth, "*bouroumbouri sablga*" in *Mooré* and "*ejangio nabiou*" in *Gourounsi* meaning dark-green amaranth, and "*bouroumbouri peeel*" in *Mooré* and "*ejangio napoan*" in *Gourounsi* meaning white or light-green amaranth. In terms of productivity, 46% of respondents observed two morphotypes, the large, broad-leaved morphotype and the small, thin-leaved morphotype called "*bouroumbouri yanga*" and "*bouroumbouri raogo*" in the local *Mooré* language, meaning "female amaranth" and "male amaranth" respectively. On the basis of organoleptic characteristics, two morphotypes have been identified, namely amaranth with a "sickening" odor and amaranth with a "pungency". These morphotypes are called "*ejangio ouolo*" and "*ejangio ndè*" in the local language *Gurunsi*. According to the status, two morphotypes have also been identified, the wild morphotype called in *Gurunsi* language, *nlou-ejangio* or "*go-ejangio too*" and the cultivated morphotype called "*nasar-ejangio*" by the *Gourounsi* and *bouroumbourou nassara* in *Mooré* which means white pigweed.

3.5. Richness and Quantitative Diversity of Morphotypes in the Ten Provinces

In all the surveyed provinces, the number of morphotypes cited varied from 2 to 3. The greatest number of morphotypes was registered with the producers in the provinces of Bam, Houet and Sanguié. The values of the diversity and equitability indices calculated for each province show a good conservation and a great regularity of morphotypes of amaranth species cultivated in Burkina Faso (Table 4). Indeed, the most diverse provinces in terms of number of morphotypes are Houet, Oubritenga and Yatenga. The greatest regularity of amaranth morphotypes was observed in Gourma ($E = 0.97$), Oubritenga ($E = 0.99$), Yatenga ($E = 0.99$), Houet ($E = 0.88$) and Séno ($E = 0.88$) provinces.

The values of Sorensen coefficients of similarity calculated, also showed a similarity between the climatic zones in Burkina Faso. The coefficient of similarity was higher between the Sahelian and Sudano-Sahelian zones ($P = 83.33\%$). The lowest degree of similarity was recorded between the Sahelian zone and the Sudanian zone ($P = 54.45\%$).

3.6. Knowledges' Diversity on the Uses of Amaranth

Table 5 shows the diversity of uses of amaranth in the 10 provinces covered by the survey. Fifteen (15) specific uses of the different plant organs were cited by the 270 respondents (Figure 2). These different specific uses are divided into three areas of use. Traditional medicine (NUs = 7) is the use category the most specificized, followed by the use as food (NUs = 5). However, in the cultural domain, few uses were reported (NUs = 3). For more than ninety-nine percent (99.6%) of the respondents, amaranth is mainly used for human consumption (vegetable sauce, *baag-benda*, *gnougou* and couscous), while only 9.67% reported the use of the plant as fodder in animals feeding. The use of amaranth in the traditional medicine for diseases cure was mentioned by 20% of the respondents. Cultural uses of amaranth were the least mentioned. For this last category of use, amaranth is most used in funeral rites with a level of loyalty of 81.82%.

3.7. Economic Importance of Amaranth in Burkina Faso

Used as a vegetable, the sale of fresh amaranth leaves and seeds is an important source of income for various stakeholders. The leaves are sold at the production sites or in markets and *yaar*. On the production sites, women buy whole planks at prices ranging from 5,000 to 15,000 CFAF, depending on the availability and the timing. Once harvested, the leaves are packaged in bags of 50 kg and sold at 1500 to 2500 FCFA. In the markets, the leaves are sold in piles at prices ranging from 100 to 300 FCFA (Figure 3). In addition to the sale of leaves, the sale of *baag-benda* and *Gnougou* is a source of income for women (Figure 4). As for seeds, they are sold in bags at 100 FCFA each one or in 0.5-, 1- and 1.5-liter cans at a price of 1,500 to 3,500 FCFA, depending on the period and the morphotype. These activities allow many women to meet family needs such as health care, children's schooling and even the purchase of food (rice, millet, corn).

4. Discussion

Amaranth is well known and cultivated by several actors (especially market gardeners) and the main ethnic groups in the different provinces covered by the survey. Indeed, the diversity of vernacular names testifies to the knowledge of producers in the management and conservation of this genetic resource, but also to the existence of a genetic diversity. According to Adoukonou-Sagbadja, *et al.* [20] and Barry, *et al.* [21], the diversity of names of varieties is the basic unit that producers use in the management and selection of genetic resources. However, this nomenclature remains confused and imprecised because it is characterized by synonymy, probably due to the subdivision of certain ethnic groups into several dialects on the one hand, and on the other hand, to the distortion of the original name of the plant due to the adoption of this name by several ethnic groups. Indeed, the names "*Broum-broum*, *Balamboulé*, *Barambourou*, *Bolombourou*, *Boutboura*, *Boulouboula*" come from the original (popular) name "*baram-bourou* or *borom-brom*" which means "*baram*" leaf in the Malinké language (Dioula). The same nomenclature "*borom-brom*" is also used by ethnic groups in the Republic of Côte d'Ivoire [22]. Furthermore, the naming criteria based on morphological and organoleptic characters reflect the existence of morphological variability within cultivated amaranth.

The study also found that amaranth is well exploited for several uses, the most common of which is food use. It is used in all the provinces surveyed as a leafy vegetable by local people. Indeed, the diversity of dishes (sauces) prepared from the leaves especially during socio-cultural events (baptisms, weddings ...) indicate an integration of this plant in the dietary habits of the population in all surveyed provinces. According to Kamga, *et al.* [23] and Hama-Ba, *et al.* [3], socio-cultural origin and dietary habits are the main factors influencing vegetable consumption in households. Indeed, the high production of this vegetable in urban and peri-urban areas than in rural areas would be related to the evolution of food habits, which tend to value certain local dishes in these environments. In fact, *Baag-benda*, once considered as a food for the hungry or "poor" people, is now a popular dish in urban centers and is generally eaten during ceremonies [24]. This suggests that the maintenance and valorisation of local dishes could constitute a source of income for the local population, on the one hand, and, on the other hand, contribute to the valorisation of other so-called minor plants. Moreover, Baskar [25] and Kahane, *et al.* [26] have also pointed out that the maintenance of traditional cuisine and socio-cultural beliefs represent a socio-economic issue, but also a strategic and ecological issue in the maintenance of diversity.

In the past, amaranth was grown as a proticulture and was mainly used at the family's scale. This study shows that amaranth cultivation is clearly on the rise, as it is now a significant source of income for producers. Indeed, amaranth is mainly grown on market gardening sites for marketing. Similarly, the high proportion of men and youth in amaranth cultivation is also due to its high commercial value. Indeed, the latter are more interested in crops that are a source of income. Dansi, *et al.* [27], Kiébré [8] and Kaboré [28] have also reported that the production of African vegetables, especially when it comes to those intended primarily for family consumption, is largely carried out by women. Its economic contribution through the sale of its leaves generates employment and income. It could contribute to solving huge unemployment problems faced by young people. However, the high production of the green morphotype reflects a selection oriented towards this morphotype by producers who justify their choice by the availability of seeds, the large size of the plant, the high leaf biomass, the organoleptic qualities and the high demand by consumers for this morphotype. The preference of a morphotype over another could lead to selection towards the preferred morphotype and the abandonment of other morphotypes, which could lead to a loss of diversity. Indeed, according to [29], selection methods generally based on organoleptic, agronomic and market value traits contribute to an organization of genetic diversity.

5. Conclusion

Amaranth, a vegetable crop, is well known (99 accessions have been collected) and increasingly cultivated in Burkina Faso, especially by men, because of its high economic value. It is nowadays considered as a very productive vegetable crop on small areas, in gardens, around water points and dams. Amaranth is most often grown (with a predominance of the green morphotype) in association with other vegetables without a technical production itinerary. This study revealed a diversity of names and "varieties", identified by the surveys, based on phenotypic and organoleptic characteristics, which could be associated with the existence of a significant diversity of this species. The amaranth has several assets because of these uses (food, medicinal and cultural). The importance of the food use of the leaves and tender stems indicates the potential of the plant in strategies for improving nutritional status based on local resources. Similarly, cultural and medicinal uses are strategies for maintaining diversity. The agromorphological characterization of the accessions collected during this activity will allow to establish the level and structuring of its diversity in the study area.

Figures and Tables

Figure-1. Location map of amaranth accessions collection sites

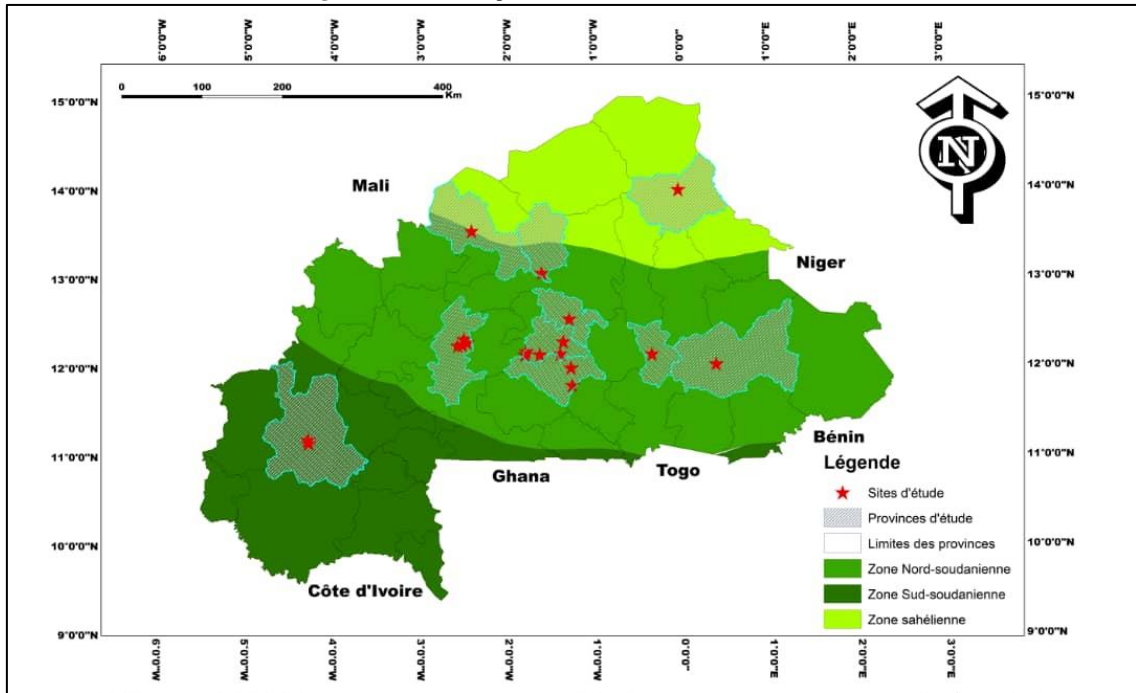


Figure-2. Diagram linking specific uses to different areas of amaranth use

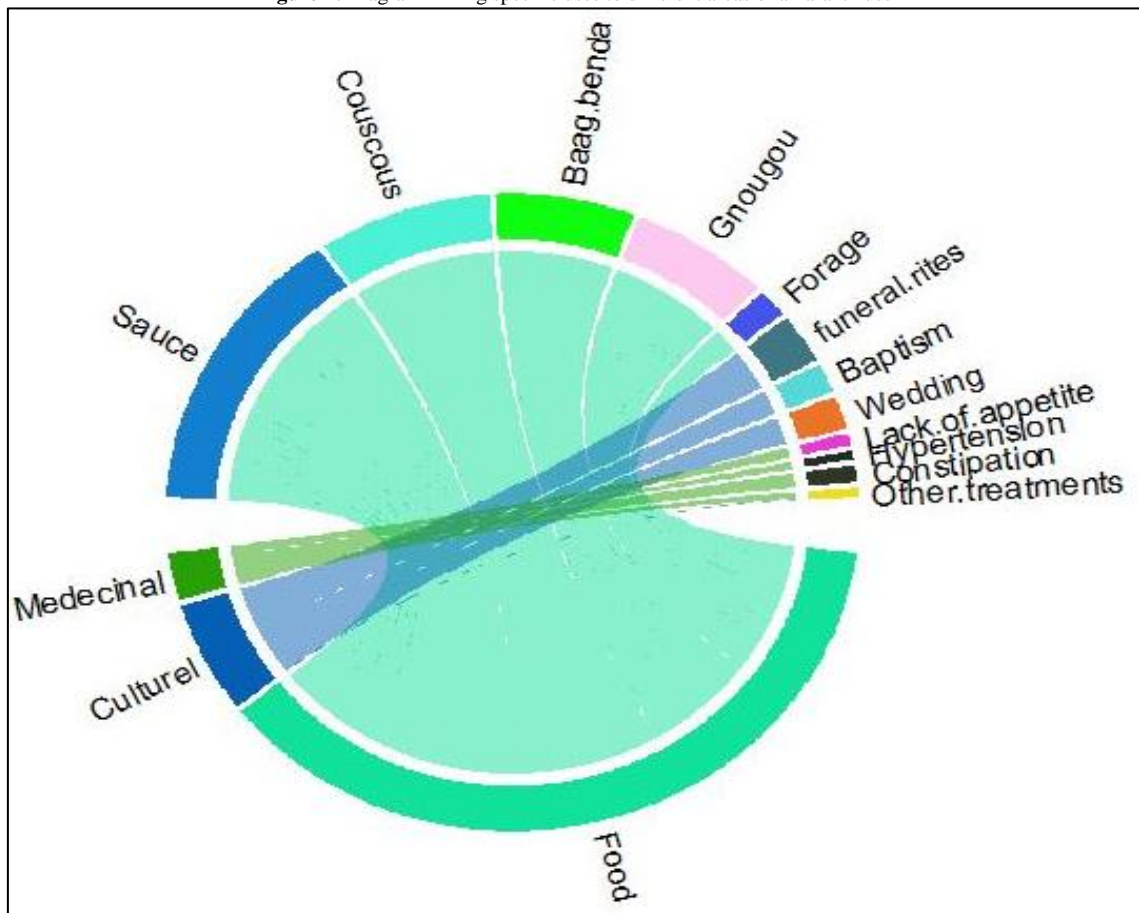


Figure-3 Amaranth leaves sold in Ouagadougou markets.
a: heap of leaves sold at 100 FCFA per heap, b: dish sold at 250 FCFA

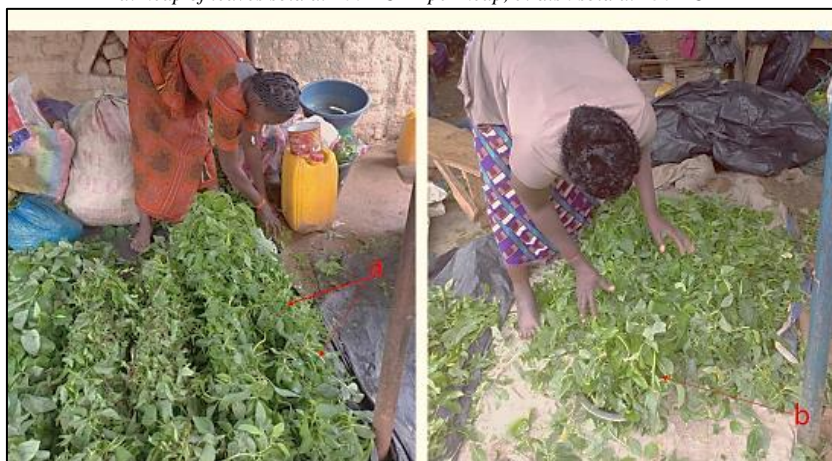


Figure-4. Baag-benda sold in the neighborhoods of Ouagadougou
a : baag-benda sold in the Bedego neighborhood, b: baag-benda sold in the Dassasgho neighborhood



Table-1. Characteristics of respondents by province

Provinces	Gender		Socio-professional group		
	Male (%)	Female (%)	Market garden (%)	farmer and housewife (%)	Informal sector (%)
Bam	65	35	00	100	00
Bazèga	45	55	85	10	5
Houet	100	00	86.67	13.33	00
Gourma	42	58	00	100	00
Kadiogo	54.76	45.24	61.90	14.29	23.81
Kouritenga	53	47	8	92	00
Oubritenga	30	70	15	70	15
Sanguié	69.23	30.77	13.46	76.92	9.62
Seno	40	60	18	82	00
Yatenga	100	0	30	25	45

Table-2. Some names for amaranth in local languages and their frequency of use

N°	Ethnics groups	Vernacular name	RCF (%)
1	Mossi	<i>Broum-broum</i>	3.70
2	Mossi	<i>Zilibé ou zimini</i>	5.93
3	Mossi	<i>Boulouboula</i>	11.48
4	Mossi	<i>Boutboura</i>	2.96
5	Mossi	<i>Lisambo</i>	1.48
6	Mossi, peuhl, Gourmantché	<i>Balamboulé</i>	1.48
7	Mossi, Bôbô	<i>Barambourou</i>	22.22
8	Bôbô	<i>Mouna</i>	26.67
9	Bôbô	<i>Mana</i>	0.7
10	Gourounsi	<i>Ejangio</i>	18.15
11	Gourounsi	<i>Jublé</i>	1.85
12	Dafin, Turka	<i>Bolombourou</i>	3.33

Table-3. Names, ethnic groups and meanings of vernacular names of morphotypes

Denomination Criteria	Ethnic groups	Denomination	Signification
Colour of the plant	Mossi	<i>bouroumbouri miougou</i>	Red amaranth
	Mossi	<i>bouroumbouri sablga</i>	Dark green amaranth
	Mossi	<i>bouroumbouri peepe</i>	White amaranth
	Gourounsi	<i>ejangio nachion</i>	Red amaranth
	Gourounsi	<i>ejangio nabiou</i>	Dark green amaranth
	Gourounsi	<i>ejangio napoan</i>	White amaranth
Productivity	Mossi	<i>Bououmbouri yanga</i>	Female amaranth
	Mossi	<i>bouroumbouri raoogo</i>	male amaranth
Status	Gourounsi	<i>Gô-ejangio</i>	Wild amaranth
	Gourounsi	<i>nasar-ejangio</i>	amaranth of the white
	Mossi	<i>bouroubourou raaga</i>	Wild amaranth
	Mossi	<i>bouroubourou nassara</i>	amaranth of the white
Organoleptic	Gourounsi	<i>ejangio ouolo</i>	Amaranth with disgusting smell
	Gourounsi	<i>ejangio ndè</i>	Spicy amaranth

Table-4. Diversity and equitability of amaranth morphotypes identified

Provinces	1-D	H	E	Morphotype number
Bam	0.41	0.71	0.64	Dark green, Light green and Red
Bazèga	0.23	0.39	0.56	Dark green and Light green
Houet	0.59	0.96	0.88	Dark green, Light green and Red
Gourman	0.48	0.67	0.97	Dark green and Light green
Kadiogo	0.46	0.71	0.64	Dark green and Light green
Kouritenga	0.440	0.60	0.51	Dark green and Light green
Oubritenga	0.50	0.69	0.99	Dark green and Light green
Sanguié	0.28	0.50	0.46	Dark green, Light green and Red
Seno	0.42	0.61	0.88	Dark green and Light green
Yatenga	0.50	0.69	0.99	Dark green and Light green

Table-5. The different indices calculated for the amaranth use categories

Use categories	NUs	FCs	FRC %	CI	UV
Food	5	269	99,6	2.507	2.519
Medecinal	7	55	20,00	0.378	0.367
Cultural	3	20	7,40	0.119	0.119

Legend: NUs: Number of uses of the species, FCs: Frequency of citation, FRC: Relative frequency of citation, CI: Cultural index of importance, UV: Use value

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