




Ethnobotanical Study of the False Baobab (*Kigelia africana* Lam. Benth) in the Issaba District (Pobè Commune)

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Abstract

Kigelia africana is a species that is little known and studied, both by the populations of the Republic of Benin and by African researchers, even though it plays a vital role in traditional African medicine. The aim of this study, which was carried out in the Commune of Pobè, is to show the various traditional uses of *K. africana* with a view to its conservation to enhance the rich phyto-diversity of the Republic of Benin. To this end, an ethnobotanical survey was carried out with 71 people, including 31 women and 40 men. The interviews focused on an inventory of the different organs used and marketed, the different areas of use of the organs, and the endogenous strategies for conserving the species. The Rapid Vulnerability Assessment method was used. The data collected was processed using Excel 2010 and analyzed based on ethnobotanical indices. The results show that the local population uses the species in 5 categories, of which traditional medicine is the most cited, with thirty-one types of use. The most commonly used organs are the bark (32%) and the fruit (19%). Decoction and calcination are the most widely used pharmaceutical forms and are most commonly administered orally and dermally. *K. africana* is also abundant in the environment. Despite this abundance, studies show that human pressure on the species and its habitat is significant; hence, there is a need to define a short-term conservation strategy for the species to ensure its sustainability.

Keywords

Conservation, *Kigelia africana*, Ethnobotany, Republic of Benin, Plant Diversity

1. Introduction

In Africa, medicinal and aromatic plants are the main component of traditional medicine practice and have been used for centuries in traditional health culture (Kasilo et al., 2017: p. 2). For this reason, they are and remain the most widely used means of solving human and animal health problems, especially in rural areas (Alain et al., 2018: p. 441). Thus, about 80% of the population depends mainly on traditional medicines for their primary health care (Siddiqui et al., 2015: p. 35).

The lack of essential medicines, inadequate healthcare, the high cost of medicines in pharmacies, and people's socio-cultural habits explain the use of traditional practices based on medicinal plants. These plants contain a large number of metabolites with multiple uses in pharmacology, the food industry, and cosmetology (Alain et al., 2018: p. 442). The art of healing with plants has been known and practiced in Africa for a very long time, exploiting knowledge passed down orally from generation to generation to certain categories of initiated individuals who are health radiotherapists and herbalists (Sanogo, 2006: p. 5).

In the Republic of Benin, 5000 plant species have been inventoried in forest ecosystems (MEHU, 2002: p. 8). According to Codjia et al., quoted by Alain (2018: p. 9), 172 of these plants are consumed by local populations as food plants and 814 as medicinal plants. Indeed, several ethnobotanical studies have been carried out in Benin on these medicinal species (Adjanooun et al., 1989: p. 886). This is the case of *K. africana* (Lam.) Benth of the Bignoniaceae family is a medicinal plant that is used locally in many fields, ranging from traditional medicine to cosmetics and traditional rituals. Its organs are used locally to treat cancer, ulcers, gynaecological disorders, genital infections, skin diseases, diabetes, epilepsy, and bacterial and fungal infections, as well as for cosmetics (Atawodi & Olowoniyi, 2015: p. 3). Despite this enormous potential and prospects in traditional medicine and African pharmacopeia, the ethnobotanical knowledge of rural populations being rich, is poorly documented, which suggests a poverty of usable data (Djego et al., 2011: p. 6).

In the Commune of Pobè, *K. africana* contributes to local biodiversity by providing habitat and food for many species of birds, insects, and other animals. The roots of the tree help stabilize the soil, reducing erosion and loss of fertile soil in riparian areas, especially since the type of relief of the study area is a plateau. Thanks to its leaves and organic matter, this tree can enrich the soil and promote a beneficial microclimate for other plants. The large foliage provides shade, creating a favorable microclimate for other plants and human communities.

K. africana plays a socio-economic role in medicine, food, crafts, culture, and tourism. Although the fruit of *K. africana* is not consumed directly, it can be used for the preparation of certain dishes or drinks, thus contributing to food security. The wood of the species is durable and can be used to build houses, furniture, or other structures, thus playing a role in the local economy. As an emblematic spe-

cies, this tree can attract tourists, adding cultural and economic value to the region, especially in conservation and ecotourism initiatives. *K. africana* can serve as a focal point to raise awareness in communities about biodiversity conservation and the importance of local ecosystems.

The aim of this study, carried out in the Commune of Pobè, specifically in the Issaba Arrondissement, is to investigate the relationship between this plant and man, to gather as much information as possible on the endogenous knowledge linked to the therapeutic uses practised by the local population, with a view to defining approaches to solutions for the conservation and sustainable management of *K. africana*.

All studies conducted on the species in Benin have focused much more on botanical aspects. On the other hand, this one took into account the ecological and socio-economic aspects. But its particularity lies in the choice of the study area, which is the ecological zone of the species and the ethnobotanical knowledge of the species by a people (Hòlli) who have remained attached to their tradition despite the advances in traditional medicine. The study filled the selection bias of the study area and the choice of people in terms of knowledge of the species. It included quantitative data on the uses of plants, their availability especially, and their importance for the communities. The data collection method is reduced to collect reliable information.

2. Materials and Method

2.1. Study Framework

Located in the Plateau Department between latitudes 7°2'30" and 7°8'35" north, and between longitudes 2°36'51" and 2°38'33" east. The Issaba Borough is bordered to the north by the Commune of *Kétou*, to the east by the Boroughs of *Towé* and *Igana*, to the south by the Borough of *Ahoyéyé*, and the west by the Commune of *Adja-Ouèrè*. The study area enjoys a tropical climate with a bimodal rainfall regime with two shades (of the middle Zou and south-eastern plateaux) with two rainy seasons and two dry seasons (Bani, 2006: p. 2). Average annual rainfall is around 1073 mm in 65 days (Bani, 2006: p. 2). The vegetation of Issaba is composed in places of forest gallery, open forest, wooded savannah, and shrub savannah, all of which are already under the influence of human activity. According to the results of the General Census of Population and Housing (RGPH4), the Issaba district had 28,223 inhabitants, including 14,546 women and 13,677 men. Issaba's local economy is based mainly on agriculture (INSAE, 2013). **Figure 1** shows the geographical location of the Issaba district.

2.2. Sampling

Several sampling methods were used: the purposive sampling method and stratified random sampling. This method divides the population into subgroups (strata) based on relevant criteria, such as the different villages in the Issaba district or age groups. This ensures that all segments of the population are represented. They use

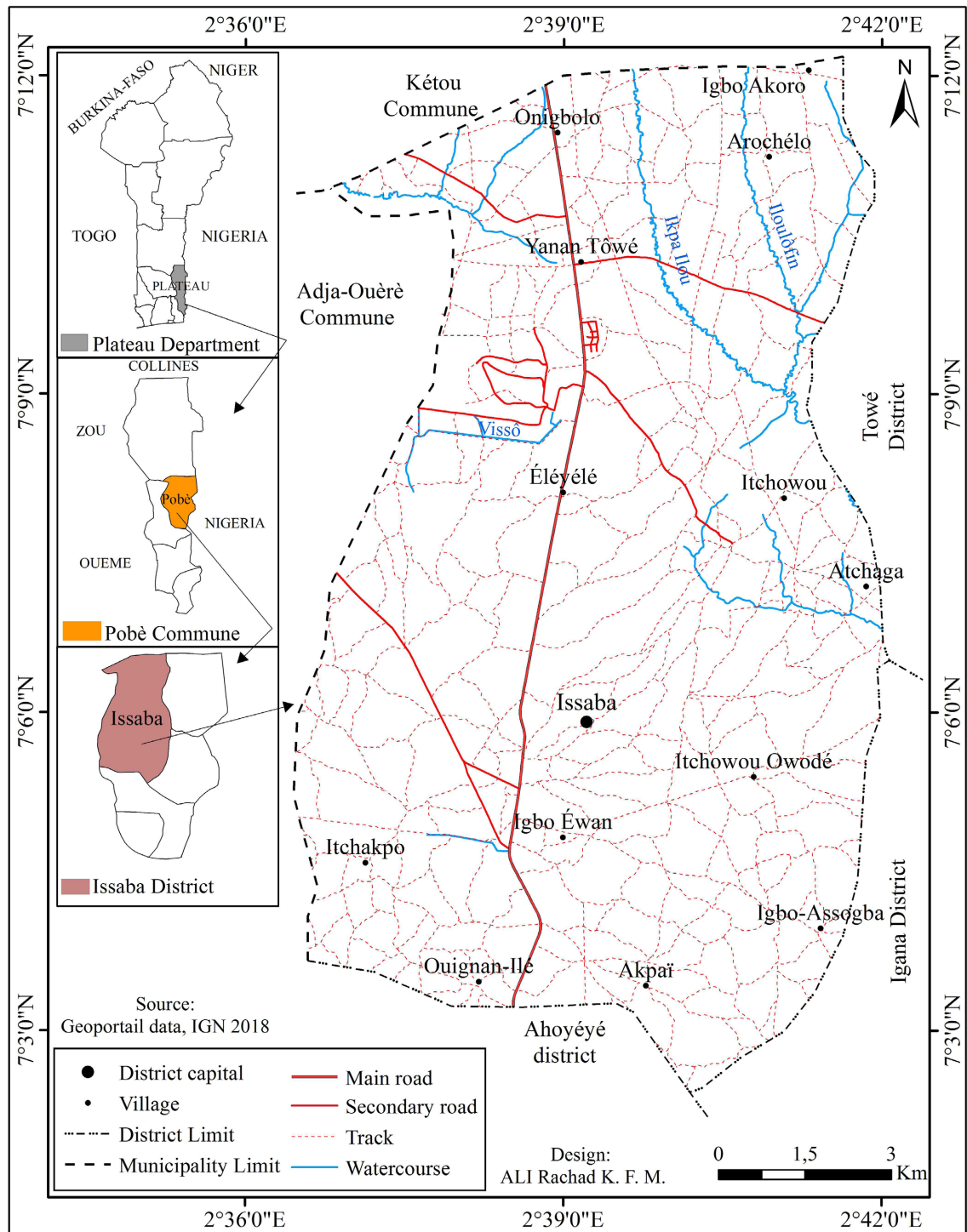


Figure 1. Geographical location of the study area.

several selection criteria:

- Know the species *K. africana*;
- Be a traditherapist, medicinal plant seller, artisan, or user of the *K. africana* species in the Issaba district;
- Endogenous knowledge of the species in traditional medicine;

- Have at least 3 years of professional experience (traditional therapists, medicinal plant sellers, and craftspeople);
- This belongs to one of the three age class categories used by (Assogbadjo et al., 2008), which are: young people < 30 years old; adults between 30 and 60 years old, and elderly people > 60 years old.

All sixteen villages in the Issaba district were visited. An exploratory survey of 30 individuals representative of the population was conducted in these villages. During this survey, respondents were asked a single question (Do you know the false baobab?) to determine the proportion (P) of the population familiar with *Kigelia africana*.

The size of the sample (N) of people surveyed in each village according to the binomial sampling law is expressed as follows:

$$N = \frac{U_{1-\alpha}^2 / 2 \times P(1-P)}{d^2}$$

Knowing that:

N is the size of the study sample;

$U_{1-\alpha}^2 / 2$ is the normal distribution value for a value of 1.96;

D is the margin of error, $d = 5\%$;

P is the proportion of people with knowledge of the use of *K. africana* in the locality and its value obtained after the exploratory survey of 30 people taken at random in the district, $P = 0.9$.

$$N = \frac{1.96 \times 0.9(1-0.9)}{0.0025} = \frac{0.1764}{0.0025} = 70.56 \approx 71$$

2.3. Data Collection Techniques

Several techniques were used to collect the data. The semi-structured interview is a technique based on the use of a grid of themes. This type of interview was used mainly during the exploratory phase, with the help of an interview guide to facilitate direct communication with resource persons, especially in the local language (Holli), concerning the distribution of the species in the study area. Direct observation is a technique for studying social actors and their interaction in their real context by a researcher who is integrated into an environment. This technique enabled the researcher to be integrated into the environment, to locate the plants of the species found in the environment to take their geographical coordinates, and, above all, to evaluate the use score (high, medium, low) of the organs of the species to analyze the various pressures on the species in the study environment. The observation grid is the tool used. The different techniques used allowed us to collect in-depth qualitative data on traditional knowledge and uses of *K. africana*. Open-ended questions encourage informants to share personal and practical experiences. Participant observation helps to understand the cultural context of the use of the plant.

2.4. Data Processing

This phase enabled the data collected to be processed and discussed. The survey

forms were analyzed manually and coded in a database before being processed by computer. The data collected was grouped by the center of interest, which made it possible to use appropriate processing software. The basic data (tables, figures, etc.) were processed using Excel 2010 and Microsoft Office Word 2013. The processed data was analyzed and commented on. The frequencies of responses obtained for the socio-cultural parameters considered were calculated as percentages.

Various parameters such as the respondent diversity index (ID) and the equitability index (EI) were assessed using socio-cultural parameters.

- **Respondent diversity index (Adomou et al., 2012):** This index is calculated by the following formula:

$$ID = U_x/U_t$$

U_x : Number of uses cited by a respondent;

U_t : Total number of uses;

$ID \in [0, m]$; where m = number of respondents using this method.

It measures how many respondents use a given species and how this knowledge is distributed among respondents. When $ID \leq 0.5$ then many people know and use this species; when $ID > 0.5$ then few people know and use this species.

- **Equitability index of respondents (Byg & Baslev, 2001):**

This was determined by the formula below:

$$IE = ID/ID_{max}$$

ID: Diversity value;

ID_{max} : Maximum diversity value index;

$IE \in [0, m]$. The equitability index measures the degree of homogeneity of knowledge among respondents. When $IE \leq 0.5$ knowledge is held by a small number of individuals within the respondents; $IE > 0.5$ knowledge is more or less evenly distributed within the respondents. This value measures the importance of each category of use and how it contributes to the total value of use.

3. Results

3.1. Distribution of *K. africana* (Lam.) Benth in the Issaba District

In the Republic of Benin in general, and the study area in particular, *K. africana* is used for health, crafts, culture, and worship. In terms of health, the organs of the species are used in the composition of various phytomedicines for traditional treatments. It is used in crafts to make masks, art objects, and, above all, charcoal. In some villages in the district, it is regarded as a cultural divinity, representing a traditional dance venue known as “*Ibidjo oyichanagbo*”. According to these people, the species acts as a traditional amplifier (funnel). In other words, it carries the singers’ voices far. It is also a place for offerings and spiritual rituals, known as “*Igui èbo*” or “*Ita èbo*” by others. Given its abundance in the area, *K. africana* does not have a considerable commercial value for local people, which is justified by their insensitivity to fruit rot (Plate 1).



Shooting: Ali (June 2024).

Plate 1. *K. africana* fruit rot at Illekpa (a) and *K. africana* fruit used to protect a field at Itchaagba (b).

Photo 1(b) shows that the fruits of *K. africana* (Lam.) Benth is also used spiritually to protect fields against crop theft. In the study area, the species has become naturalized around the villages of the Issaba district. **Figure 2** provides information on its distribution.

An analysis of **Figure 2** shows that the species is abundant in the Issaba district. *K. africana* (Lam.) Benth is found in almost all the villages in the study area.

3.2. Endogenous Knowledge and Uses of the Species in Issaba

In the study area, the species is used in several ways by local people.

3.2.1. Parataxonomy of the Species

- **Local names of *K. africana* in the Issaba district**

K. africana is known by eight vernacular names in the Issaba district, including three by the *Hollis*, who represent the majority sociolinguistic group in the area, two by the *Mahi*, one by the *Nagot*, one by the *Yoruba*, and finally one by the *Fon* and the *Goun*. **Table 1** below summarises all the local names inventoried by ethnic group.

Looking at the table, the Nagot, Yoruba, Fon, and Gouns have a single local name for the species, whereas the Holli and Mahi have several different names. These local names have meanings only for the Holli, Nagot, Yoruba, and some of the Mahi.

- **Characteristics of the morphotypes of *Kigelia africana* (Lam.) Benth**

For 65% of respondents, *K. africana* is a uni-morphotype. Some respondents (35%) noted that the species has two morphotypes (male and female), each with specific characteristics. These people can recognize the different morphotypes of the species based on visual and sometimes tasty criteria. After analysis, we can see that knowledge or lack of knowledge of recognition criteria is not linked to any of the sociolinguistic categories surveyed. According to 30% of people who know the morphotypes, the female *K. africana* has longer fruits than the male; 20% think that the female has enough fruits, whereas the male has few or none; for 18%, the trunk of the female is larger than that of the male. In terms of reproduction, 7% of respondents said that the female reproduced faster than the male. As

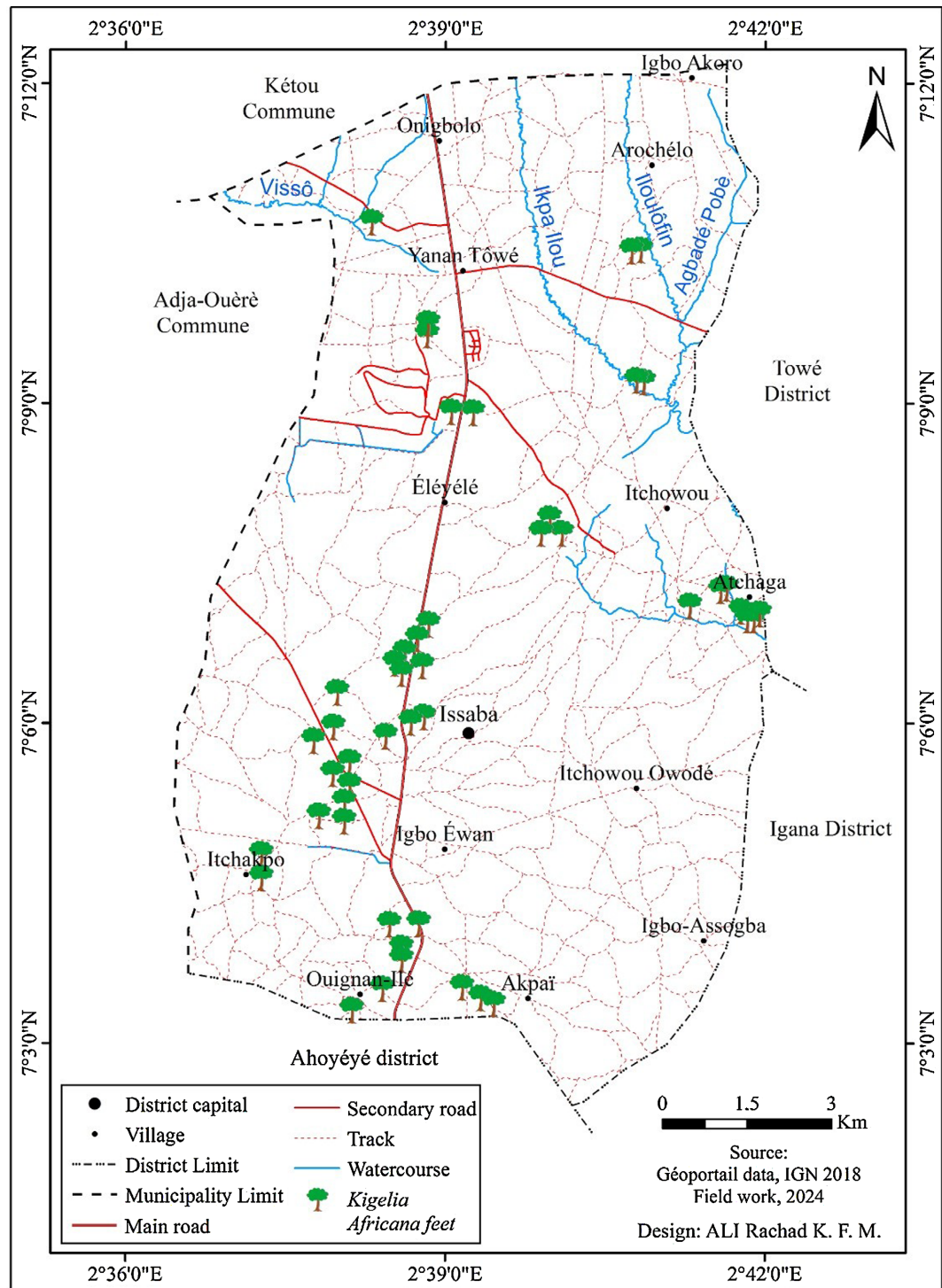


Figure 2. Spatial distribution of *K. africana* plants in Issaba.

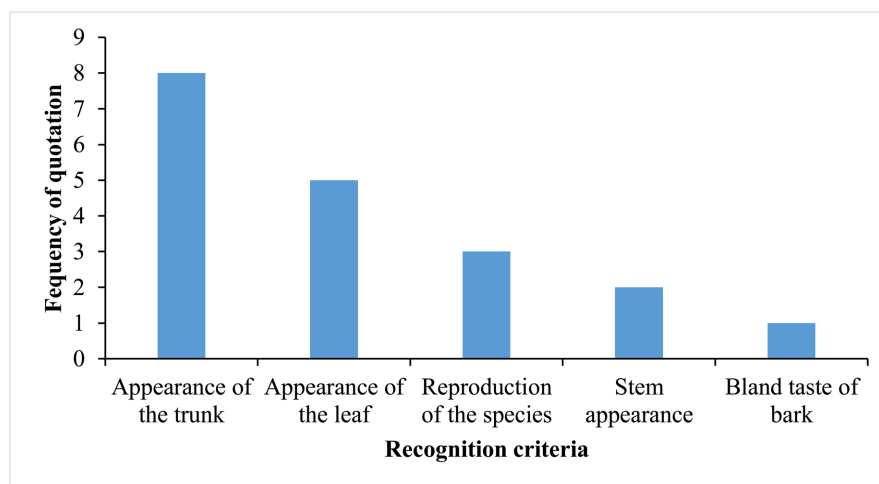
for the appearance of the leaves, fruit, and trunk, 5% said that the female leaves were less green and wider, while the males were greener and narrower. 3% said that the female's fruit and trunk were smoother than the male's, its stems were more flexible and had more leaves than the male's, and its charred bark was less fermented than the charred bark of the male. In conclusion, the criteria for recognizing the

morphotypes of the species used in the Issaba district relate to the appearance of the leaf (15.63%), the fermented taste of the bark after calcination (3.12%), the appearance of the fruit (40.63%), the appearance of the stems (6.25%), the appearance of the trunk (25%) and the reproduction of the species (9.38%). **Figure 3** shows the parataxonomic Knowledge of each respondent.

Table 1. Local names of *K. africana* (Lam.) Benth in the Issaba district.

Ethnic groups	Percentages surveyed (%)	Local names	Meaning
	82	<i>Iyankpan</i>	Magical healing power
<i>Hollis</i>	11	<i>Oguiyan</i>	Allow me to heal with your organs
	7	<i>Adèrè</i>	Refers to the long shape of the fruit of the species
<i>Mahi</i>	20	<i>Oyanssisin</i>	-
	80	<i>Yanblikpé</i>	Magical healing power
<i>Nagot</i>	21	<i>Kpahoudoror</i>	Refers to the long shape of the fruit of the species
<i>Yoruba</i>	5	<i>Omonyán</i>	The child survived
<i>Fon</i>	4	<i>Yanblikpo</i>	-
<i>Goun</i>	1	<i>Yanblikpo</i>	-

Source: Field surveys (June 2024).



Source: Field surveys (June 2024).

Figure 3. Parataxonomic knowledge by respondent.

According to the figure, the recognition criteria vary according to the frequency of quotation. Consequently, parataxonomic knowledge of the species varies from one respondent to another.

3.2.2. Local People's Perception of the Environment

The ecological perception of the local population focused on the habitat, availability, phenology, and status of *K. africana*.

- **Habitat of the species**

Kigelia africana is very common in more humid environments, more specifically in low-lying areas, and is also more common on clay soils than sandy soils. *K. africana* is a forest species.

- **Availability of *K. africana* (Lam.) Benth at Issaba**

About the availability of the species, 68% of the sample surveyed considered that *K. africana* is not a rare species. Among this percentage of people surveyed, some (77.08%) found that *K. africana* is often found in fields, forests, and fallow land. For some (22.92%) the species is also found in habitats. According to the respondents, *K. africana* is not a ruderal species (around houses). However, most respondents avoid domesticating the species just to spare small children and adolescents who are unaware of the various negative effects of touching the fruits of the species. For 32% of the total population, this plant is not widely available in the study area. According to these people, this low availability is explained by the abusive use of the species' organs for various purposes (medicinal use, craft use, cultural ceremonies, and the effect of urbanization).

According to 38.03% of the population surveyed, the presence of *K. africana* in a particular place depends on certain valid reasons. Of this small proportion of people who answered this question, 44.44% said that the species does not depend on a particular type of soil for its growth, but for others (22.22%), the species needs certain types of soil for good growth (preferably clay soils). From the point of view of some people (33.34%), the presence of *K. africana* in certain unexpected places (not cultivated by human hands) depends on the distribution of its seeds as a result of erosion or the use of its fruits for medicinal or other purposes. However, a relatively large proportion of respondents (61.97%) were silent on this question. In terms of food, according to almost all respondents (100%), *K. africana* fruit is not edible. Only 2.82% of respondents eat its leaves as a vegetable (young shoots). The remaining 97.18% had no idea of eating the leaves of the species. For them, the fruits and leaves of *K. africana* can only be consumed as phytomedicines.

- **Phenology of the species according to local populations**

The local population's knowledge of the phenology of the species is not, however, precise. Nevertheless, a large proportion (60.57%) of the total population surveyed had an idea of the flowering period, fruiting period, and annual yield of *K. africana*; a small proportion of people (8.45%) gave their views only about the flowering and fruiting periods. Some people (14.08%) gave their knowledge of the fruiting and annual yield of the species, while the remaining 16.90% did not know the phenology of the species during the year.

About the flowering of *K. africana*, 84.51% of the total proportion of respondents had a precise idea, while the remaining 15.49% had no opinion. Of those who gave their knowledge of the flowering period, 43.33% thought that it took place during the short and long rainy seasons (June to September; March to May), 36.67% said that flowering took place throughout the year, and only 20% thought that the species flowered between May and August.

Regarding fruiting, 87.32% of the population surveyed gave their opinion on this question. Of this group of people, some (53.22%) thought that fruiting took place between 4 and 6 years of age, meaning that the species grew moderately fast, while others (25.81%) said that the species began to bear its first fruit between 6 and 8 years of age, meaning that it grew slowly. Only 20.97% find that *K. africana* produces for the first time after several years (8 to 12 years): its growth is very slow. The other remaining respondents (12.68%) were all unaware of the species' fruiting period.

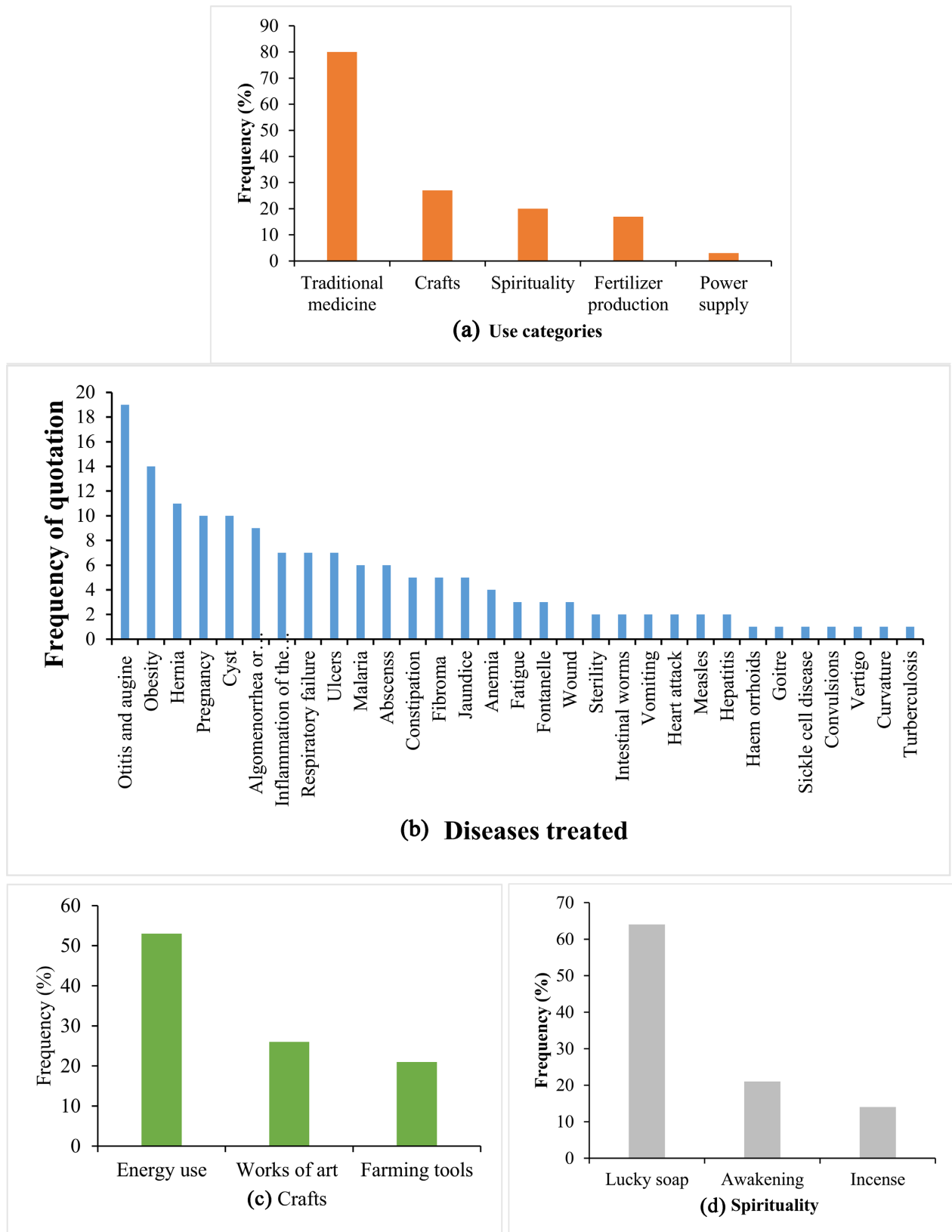
Most of the people surveyed (91.55%) had a precise idea of the annual yield. A small proportion (1.54%) thought that the species reproduced only once a year. For the majority (72.31%), *K. africana* reproduces two to three times a year; for others (26.15%) it is capable of reproducing several times a year. The few remaining people (8.45%) remained silent on this question.

A large number of the sample (92.96%) gave their knowledge of the species' reproduction. The majority of these people (89.39%) thought that the species reproduces by seed as a result of its fruit rotting, while others (10.61%) thought that it can also reproduce by planting its soft branches (preferably during the rainy seasons). According to the few remaining people (7.04%), *K. africana* is a forest species; consequently, they are all unaware of its reproduction mechanism.

According to the respondents, flowering, fruiting, annual yield, and even growth of *K. africana* sometimes depend on its morphotype and habitat.

3.2.3. Uses of *K. africana* (Lam.) Benth at Issaba

Five categories of use of *K. africana* are identified by the local populations of Issaba: traditional medicine (80.28%); handicrafts (26.76%); spirituality (19.72%); the manufacture of chemical fertilizers (16.90%); and food (2.82%). Thirty-seven types of use are made of *K. africana* by local people in the three categories mentioned most often. Traditional medicine is the most diverse category, with thirty-one types of use. It is followed by the crafts and spirituality categories, each with three types of use. Taking into account the frequency with which types of use are cited, *K. africana* is cited by 26.76% for its use in the manufacture of hunting bows, masks or other art objects, agricultural tools (hoe handles, etc.) and above all charcoal manufacture and heating; and by 19.72% for its use in the manufacture of incense, the composition of soaps for good luck and also for casting out spells. In the category of traditional medicine, for the thirty-one types of use, *K. africana* is cited by 30.92% of respondents for its use in the treatment of diseases related to human reproduction; 28.95% for the treatment of diseases related to general medicine; 15.13% for the usefulness of the species in the treatment of ENT (ear, nose and throat); by 11.18% of respondents for the use of *K. africana* in the treatment of diseases of the digestive tract. On the other hand, only 7.24% of people cited *K. africana* as an important species in the treatment of dermatological diseases and others (6.58%) in the cure or alleviation of various respiratory ailments. **Figure 4** below shows the frequency of citing the types of use of *K. africana* in each category of use.



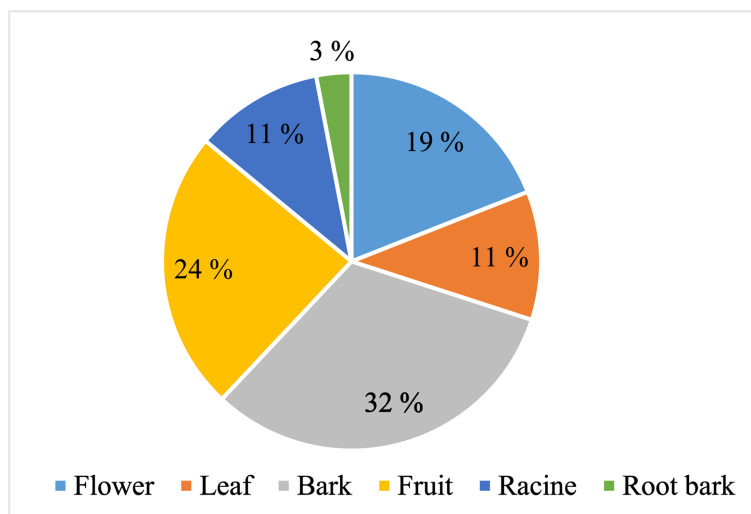
Source: Field surveys (June 2024).

Figure 4. Frequency with which types of use are cited at use category level.

According to the figure, the frequency of citations varies according to the type of use in each category.

3.2.4. Bodies Used and Methods of Acquisition

The organs used and how they are acquired vary according to the category of use. The most commonly used organs are the bark, the fruit, and the flower. **Figure 5** shows the frequency of organs used and how they are acquired.



Source: Field surveys (June 2024).

Figure 5. Frequently used organs.

Analysis of **Figure 5** shows that the bark, fruit, and root of *K. africana* are the most frequently cited organs. Field surveys show that these organs are used to cure several diseases.

In terms of modes of acquisition, the results revealed two methods: harvesting and purchase. Harvesting is the most common method, accounting for 92% of purchases. According to local people, this high proportion is due to the abundance of the species in the district. In addition, some of the medicinal plant vendors surveyed do not sell *K. africana* organs. The remaining 8% are mainly made up of people from more or less urbanized areas of the district (Onigbolo, Gbanago, etc.) and those from less humid soils (Igbo-éwé, Illoulofin, etc.).

4. Discussion

To identify the various uses of *K. africana* in southern Benin, more specifically in the Issaba district, a survey was carried out in the villages in this part of the country. During this survey, almost all the results obtained confirmed the work carried out on the species in Africa in general and in Benin in particular. In the field, some traditional health practitioners were skeptical and reluctant to share their knowledge. As in the work of Kipre et al. (2017: p. 10871) during an ethnopharmacological survey of antimalarial plants in the department of Agboville, south-east Ivory Coast, this finding is justified by three reasons:

- Researchers would use their knowledge to manufacture modern medicines with the sole aim of making money without the associates;
- Researchers never come back to give the results of their work;
- Researchers are often mistaken for usurpers in search of secrets and/or traditional medicines to use for their ends.

The results showed that around 68% of those surveyed were illiterate, most of them adults ($30 \leq \text{aged} < 60$). According to Benin's fourth national report on biological diversity, rural populations, who are predominantly illiterate, are the holders of medicinal plant knowledge (UNDP-Bénin, 2009). The results are similar to the national data and show that the sale and knowledge of the virtues of medicinal plants are still mostly the preserve of poor, illiterate people. All the herbalists surveyed were male, and only a few were female. This is because, in Benin, the sale of plant organs at the market is usually reserved for women. It is widely accepted in Africa that it is the wise, the elderly, who have the traditional knowledge of how to treat illnesses. Moreover, the medicinal properties of plants are ancestral knowledge that is passed down from generation to generation (Dassou et al., 2014: p. 201).

Data collected from market herbalists showed that *K. africana* organs are not sold, given its abundance in the area. During field surveys, we found that the species is much more dominant in baffoons and wetlands (clay soils). The results are consistent with the work of Grace and Davis (2002: p. 35), on the plant resources of tropical Africa, who found that *K. africana* is present along watercourses, in river fringes, in alluvial and open forests, savannah with high rainfall, bush, and rainforests. The species is found on red silty-clay soils, sometimes rocky damp, or peaty. On the other hand, the species is more common in the driest regions than other species (Flore de la Réunion, 2019).

According to the respondents, *K. africana* reproduces by seed and sometimes by cuttings. These results are similar to those obtained by Grace and Davis (2002: p. 36), who agree from their surveys that the species is easily propagated by seed; vegetative propagation by cuttings is possible, but recovery rates are generally low.

For this study, the organs of *K. africana* are used for many purposes. Mainly in traditional medicine, various parts of the plant are used locally to treat otitis and angina, sterility, fatigue, fontanelle, cyst, respiratory failure, obesity, hepatitis, vomiting, sickle cell anemia, constipation, ulcers, convulsions, vertigo, wounds, fibroids, hernias, algomenorrhoea or dysmenorrhoea, anemia, intestinal worms, aches and pains, heart attacks, malaria, abscesses, spleen inflammation, goiter, measles, hemorrhoids, tuberculosis, pregnancy, and jaundice. Our results are probably similar to those of Atawodi and Olowoniyi (2015: p. 11); Costa et al. (2017: p. 8), in their respective research on "Annual Research Report and Review in Biology" and "Development, Environment, and Health: role of medicinal plants in traditional medicine". These findings state that the species plays an essential role in maintaining the livelihoods of mainly rural communities.

To facilitate the administration of phytomedicines, several preparation methods are used by local populations. A total of seven preparation methods were identified during the ethnobotanical surveys, including decoction, calcination, trituration, maceration, pounding, sprinkling, and poultice. Of these methods, decoction is the most cited with a total of 79.63%. Corroborating the work of Adomou et al. (2017: p. 15) on plant resources in southern Benin, decoction yields the most active ingredients and attenuates or cancels out the toxic effect of certain recipes. For Houmenou et al. (2017: p. 18), in addition to decoction, maceration is also a more important preparation method in the traditional pharmacopeia. This variation in opinion may be linked to the socio-cultural groups interviewed and the dietary habits of each region.

The methods of administration are derived from the methods used to prepare the recipes. In this study, three methods of administration were identified: oral, dermal, and scarification. According to the results, medicinal extracts used to treat various illnesses are mainly administered orally. These results are exactly those found by Guinnin et al. (2015: p. 1374), during an ethnobotanical study of medicinal plants used in the traditional treatment of viral hepatitis B and C in several departments in Benin.

The results of this study reveal that plant drugs are routinely prescribed without any scientific knowledge of their biological activities (pharmacokinetics and pharmacodynamics) and, above all, of the toxicity and possible interaction of the species and its various components. It is therefore important to carry out a phytochemical, toxicological, and pharmacological study of *K. africana*, especially as the public has placed much greater emphasis on the effectiveness of this species in the treatment of diabetes. They admit to having used it for the traditional treatment of this disease. This statement corroborates with that of Lawin et al. (2016), in their study on the vulnerability and endogenous conservation strategies for plants used to treat diabetes in the Communes of Glazoué and Savè in Centre-Bénin, that *K. africana* is the most threatened species with a score of 16 points, and also with the work of Adomou (2005), who indicated that *K. africana* is one of the 280 threatened plant species in Benin, and Dassou et al. (2014), who reported the same species among the 31 vulnerable plants for veterinary use in North Benin. This work has the merit of having identified the different categories of use of the species in a region where endogenous knowledge is still embedded in the daily lives of local populations, in other words, an endogenous environment. This study dealt with the ethnobotanical knowledge of the species and its importance to the local population. On the other hand, we envisage future research and a multidisciplinary approach to be interested in the pharmacological properties of *K. africana* extracts to develop potential treatments against specific diseases (infections, inflammations), explore the use of the extract in cosmetic formulations, because of its potentially beneficial properties for the skin, evaluate the safety and nutritional benefits of *K. africana* fruits to develop healthy food products, organize training sessions for communities on the cultivation and use of *K. africana*, with emphasis on the economic

and health potential, raise awareness among the younger generations on the importance of biodiversity and the conservation of medicinal plants, set up monitoring programs to evaluate the impact of conservation initiatives on local biodiversity and *K. africana* populations.

5. Conclusion

Medicinal plants remain and will remain for a long time to come, a reliable source of active ingredients known for their therapeutic properties. An ethnobotanical study of the false baobab (*K. africana*) carried out in the Issaba district identified the *K. africana* trees available and the different uses made of the species by local people, as well as the human threats to the species in the area and the approaches to finding appropriate solutions. It will be necessary to establish collaborations with local communities, NGOs, and academic institutions for a better understanding of traditional practices, that is to say, to create databases that list the medical and culinary uses of *K. africana* by local populations, to set up protected areas for the conservation of *K. African*, by integrating sustainable management practices, to promote the cultivation of the tree in community gardens to ensure its sustainability and to raise awareness among the population of its importance.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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