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Ethnobotanical study of the coconut palm in the Coastal Zone of Benin

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The coconut palm (*Cocos nucifera* L.), also known as "tree of life", is widely distributed across the Coastal Zone in Benin, where its cultivation is most important. Using participatory research appraisal tools and techniques, a survey was conducted in this zone to assess the diversity of coconut ecotypes, associated endogenous knowledge and their utilization. Nineteen villages randomly selected, and comprising seven ethnic groups were surveyed. Ten different vernacular names were recorded across the study sites. The local diversity is very low. In particular, the number of ecotypes varied from 1 to 5. Moreover, recorded ecotypes were grouped in three categories including the *tall ecotype* known as endogenous ecotype, *dwarf ecotypes* known as introduced ecotypes and *medium-sized ecotypes* resulting from the crossing between the first two. The most important preference criteria used by producers were productivity (43%) followed by sweet taste (33%) and quantity of water (33%). Apart from being used for food, the species is also used for construction, traditional medicine, and traditional ceremonies. This study provides important information on the genetic resources of coconut palm while highlighting the socio-economic importance of the species in the Coastal Zone of Benin.

Key words: Endogenous knowledge, diversity, *Cocos nucifera*, palm uses, preference criteria, Benin.

INTRODUCTION

Coconut palm, *Cocos nucifera* L. (2n = 2X = 32), the sole species of the genus *Cocos*, is a diploid perennial oilseed plant, belonging to the Arecaceae family (Batugal et al. 2005). Coconut tree is the most widespread cultivated tree in the world and is found in all intertropical regions (Nayar, 2017; Sobral et al., 2018). Southeast Asia is

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reported to be its domestication center with the greatest genetic diversity (Perera et al., 2016). It was spread through human migration and travel, first in India, then in East and West Africa and then throughout the intertropical zone (Gunn et al., 2011; Ribeiro et al., 2013). The species is able to adapt to all types of soils. Coconut palm is easily grown on sandy soils in areas with low rainfall and tolerates high salinity compared to many other crops. It is a multi-purpose tree whose parts are used by humans for food, arts and crafts, housing, and traditional medicine (Ahuja et al., 2014). Although its importance in the global market is recent, the use of coconut palm by indigenous populations has a long history. Ten countries together account for 90% of global production (FAO, 2009), and the largest producing countries in Africa are Mozambique, Tanzania, Ghana and Ivory Coast. In addition to these, there are other small producer countries including Benin. Various products are obtained from the fruit. These are coconut water, coconut milk, coconut oil and fibers which are also used in the textile industry (Batugal et al., 2009). Coconut water obtained from immature nuts is a refreshing exotic drink consumed by many people. It also has dietary and medicinal properties that are undoubtedly linked to its biochemical composition making it a good rehydration drink (Prades, 2011). The main constituents are soluble sugars, proteins, minerals, salts, vitamin C and vitamins B. In Benin, coconuts are consumed fresh as coconut juice, fresh almonds, coconut milk and coconut cream. They are also exploited for the production of coconut oil. Cultivation of coconut palm provides through its sale significant income for producers and traders.

The cultivation of coconut palm in Benin dates back more than a century and has spread all over the coastal zone (Chaillard et al., 1983). However, there are concerns about the anarchic felling of coconut trees (Report of Council of Ministers (N°38/2018/PR/SGG/CM/OJ/ORD), which could reduce the species' diversity. In order to avoid disruption and loss of local diversity, Benin Government prohibited the slaughter of coconut palms without prior authorization (https://sgg.gouv.bj/cm/2018-12-12/). Till date little is known about the cultivated material and its state of local diversity remains unknown. Previous studies focused on agromorphological characterization of four ecotypes, and on the pest of coconut fruits (Negloh et al., 2011). While these studies have provided important information, they did not cover the whole Coastal Zone of Benin. In addition, we have little endogenous knowledge about the species cultivation, the production constraints, folk nomenclature, and gender role in the value chain of coconut. To fill this gap, the present study did a very large survey across areas of production of coconut. The study aims to document information related to producers, the level of diversity, the number of cultivated ecotypes, endogenous knowledge on cultivation, production constraints, folk nomenclature, traditional uses of coconut, and gender role in the value chain of coconut. Findings from this research are essential to assist the conservation strategy and promotion of coconut cultivation in Benin.

MATERIALS AND METHODS

Study area

The present study was carried out in the entire Coastal Zone of Benin (Figure 1). It is located between 1°35' and 7°30' East and between 6°20 and 7°30 North; it covers approximately 12,000 Km^2, that is, 10.5% of the total land surface of Benin (Teka et al., 2019). The Coastal Zone of Benin includes four administrative departments namely Ouémé, Littoral, Atlantique and Mono. The climate is of equatorial type with two rainy (from April to July, and from October to November) and two dry seasons (from August to September, and from December to March). The mean annual rainfall is 1200 mm (Zanvo et al., 2021). The main ethnic groups are Fon, Xwla, Pédah, Mina, Adja, Wémè, Yorouba (Teka et al. 2019).

Sampling and data collection

Prior to ethnobotanical survey, data on coconut cultivation and villages of production were gathered from the "Agence Territoriale de Développement Agricole" and through a preliminary survey of coconut sellers. A total of 19 villages where the species was cultivated were randomly selected and considered for the study in the districts of Sèmè-Podji, Ouidah, Abomey-Calavi, Cotonou, Comè, Bopa, and Grand-Popo. Figure 1 shows distribution of villages and area surveyed. The sample size of the study population was determined according to the binomial distribution formula (Dagnelie, 1998): $N= U^2_{1-\alpha/2} * p (1-p)/ d^2$. In this formula, N = sample size; is the value of the random normal variable; for a probability value of $\alpha = 0.05$; $U^2= 1.96$; p is the proportion of individuals who know and use coconut palm products and taken as p = 0.5; d is the marginal error set at 7%. As a result, a total of 173 persons were surveyed. In each village, the village chief / or the head of the producers' association was involved in the identification of persons having an activity related to the coconut palm such as producers, sellers, and craftsmen.

Data were collected using participatory research appraisal tools and techniques such as group discussion, direct observation, individual interviews using a questionnaire and field visit (Adéoti et al., 2010). The questionnaire was edited using the KoBoCollect v1.30.1 collection tools. Data collected were the vernacular names of the ecotypes grown, ecotype diversity, uses (food, medicine, construction, cultural values, etc.), criteria for preference of a given ecotype, and constraints related to the species cultivation.

Statistical analysis method

All analyses and graphics were done in the R 3.5.1 software environment (R Core Team, 2018). Socio-demographic characteristics of the informants were described using descriptive statistics.

Socio-economic factors (sex, age category, instruction level, and ethnic group) determining the use of coconut were tested with a generalized linear models (GLM) of the Poisson family and extensions in the package MASS (Venables and Ripley, 2002). Barplots of means and standard errors were constructed in the package ggplot2 (Wickham, 2010). Simple correspondence analysis (CA) was used to describe the relationships between the preference criteria and ecotypes.

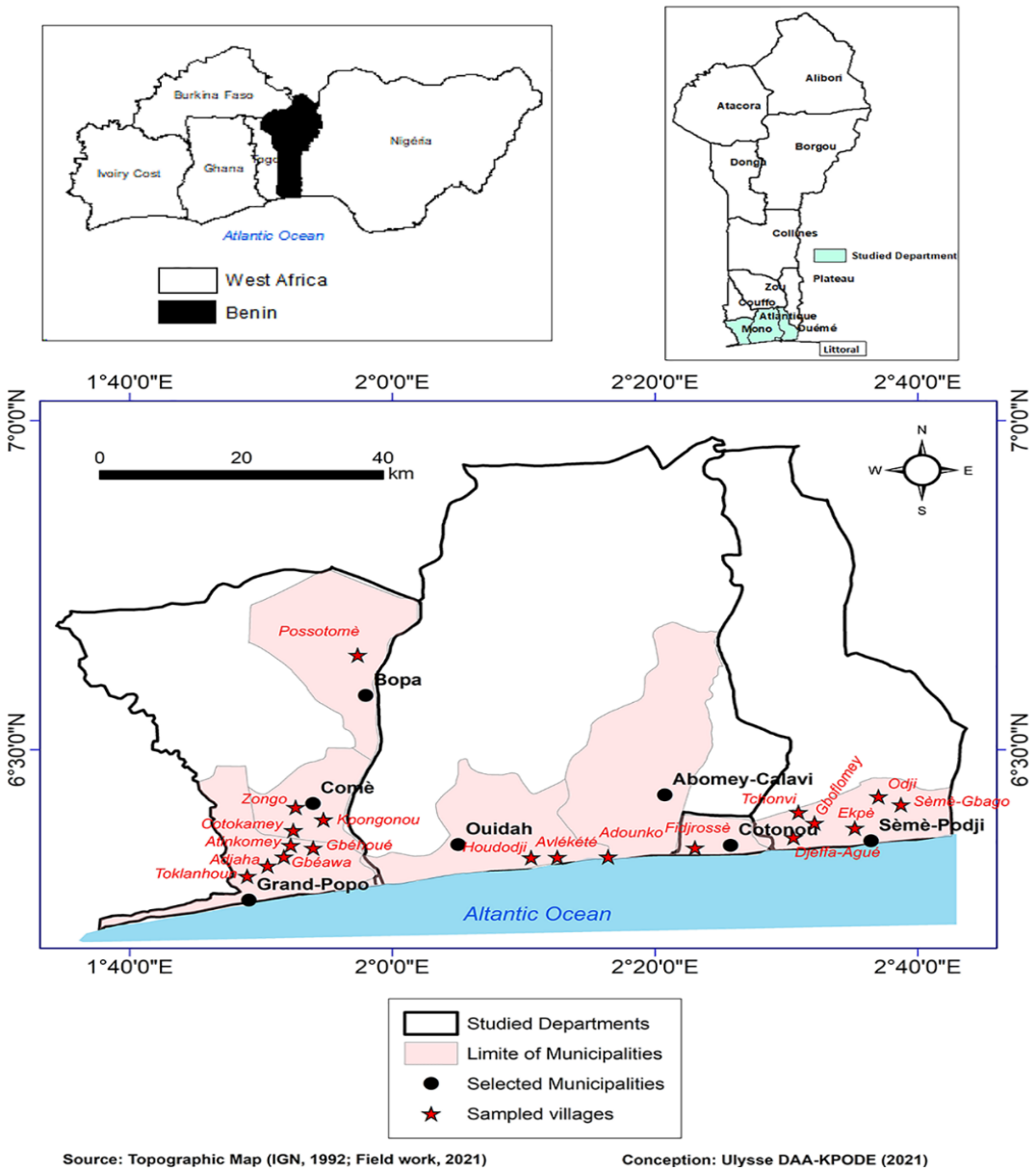

Figure 1. Graphical representation of study area.

RESULTS

Socio-demographic characteristics of informants

About one third (34.68%) of the informants were women and 65.32% were men. Among these, 69.36% were young (aged from 18 to 29 years), 27.1% were adults (aged 30 to 59 years) and 3.47% were old persons (aged above 60 years). Most of the informants had low educational level; 24,28% have reached primary school, 38,15% secondary school and 19,65 % have never been to school. Among the ethnic groups investigated, the most representative is the “goun” ethnic group (40.46%), followed by “fon”(24.86%), Xwla (16.18%), “Adja” (9.83%), “Yoruba” (4.62%) and “Peda” (4.05%). Across all surveyed villages, production of coconut is combined with other activities like fishing. Farming is the main activity. During the first 5 years, coconut palm cultivation is associated with other crops such as market gardening, namely vegetables.

Diversity and origins of cultivated ecotypes

The number of cultivated ecotypes varies among villages. Indeed, the number of ecotypes per village varied from 1

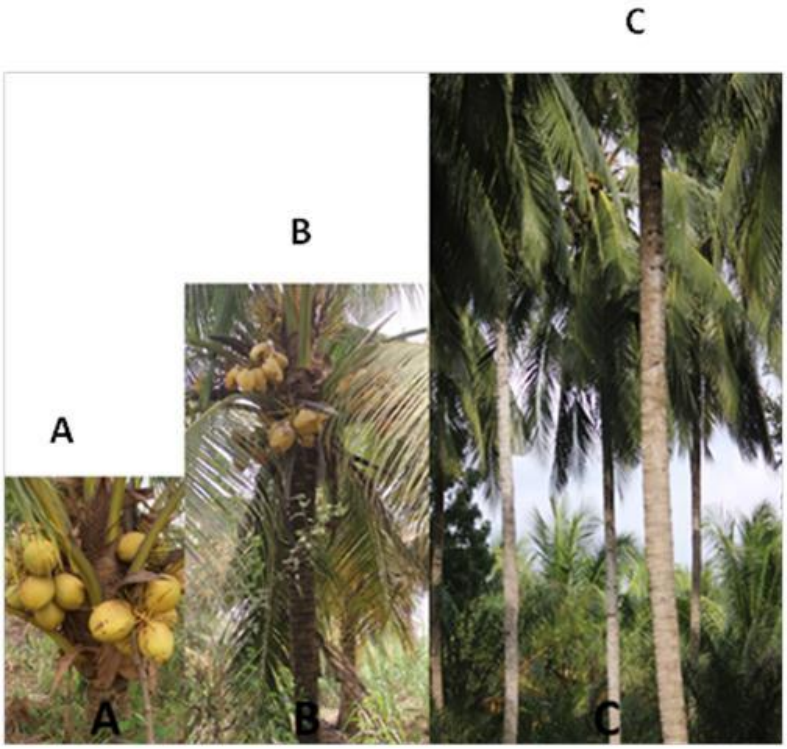

Figure 2: Ecotypes of coconut palm; (**A**) Dwarf ecotype; (**B**) Hybrid ecotype, medium size; (**C**) Tall ecotype.

to 5. The highest number of ecotypes (05) was observed at Fidjrossè in the municipality of Cotonou and the lowest number of ecotypes (01) was recorded at Kpongonou in the municipality of Comè. However, three main types of coconuts were observed and reported by producers. There are the dwarf ecotypes, the medium-sized ecotypes and the tall ecotypes (Figure 2). According to the producers, tall ecotypes are generally large and can reach 50 meters height. Tall ecotypes were considered by producers as indigenous across all villages. In addition, this coconut palm ecotype was found across all villages surveyed and was described as the first cultivated since more than a century and inherited from forefathers. The remaining ecotypes (medium-sized or dwarf ecotypes) were considered as introduced from other countries such as Ghana and Ivory Coast, or by researchers from the "Institut national de la recherche agronomique du Bénin (INRAB)" through the coconut program. These groups of coconuts were not found across all villages surveyed. There were mainly found in the district of Sèmè-Kpodji and differed from the ecotype so called endogenous by the fruit color and size, form of the fruit, shape of the trunk and the production cycle.

Folk taxonomy and vernacular names

According to the ethnic groups, there are diverse local names used to designate coconut. Producers and traders, use only one criterion for each ecotype to classify the existing diversity. Thus, generally, the selected criterion concerns the color of the fruit, the kernel, the water, the form of the fruit or the size of the fruit (large or small fruits) (Figure 3).

When no other trait could be associated with an ecotype, a generic local name was attributed to the coconut palm. Across the villages and ethnic groups surveyed, a total of ten (10) vernacular names were recorded. Coconut was designated by specific generic names which vary across ethnic groups. For example coconut palm is designated by "*Agon"* or "*Agounkè*" by Fon' ethnic group and ‘'*Agban"* or ‘'*Agbon*" by people belonging to Yoruba ethnic group. Moreover, the names ‘'*yovonain"*, ‘'*Gonnin"* are also used for coconut respectively by Adja and Xwla ethnic groups. Table 1 summarizes the local names recorded for different ecotypes and their meaning according to the ethnic group.

In general, a basic term "*Agon*" is found in most of the vernacular names recorded across ethnic groups. Very often, to name or describe such ecotype, people use different traits which refer to the origin or the main characteristics of the ecotype. Then, the generic name attributed by populations is mostly accompanied by a suffix to designate a distinctive aspect of plant or ecotype. For people belonging to Fon ethnic group, the

Figure 3. Varietal and morphological diversity of cultivated coconut.

Table 1. List of different vernacular names and their meaning.

Ecotype	Vernacular name	Ethnic group	Meaning	Main characteristics
Local (Tall coconut trees)	*Agon miton,*	Goun, Fon	Endogenous coconut	Local coconut ecotypes with large green fruit
	Agon vè,	Goun, Fon, Adja,	Red coconut	Orange-fruited local coconut ecotype before ripening
	Agon koun,	Goun, Fon, Adja,	Unknown	Local coconut ecotype with brown fruits before ripening
	Xwla gon	Xwla	Coconut palm cultivated by Xla ethnic group	Local coconut ecotypes with large green fruit
	Agban	Yorouba	Unknown	Local coconut ecotypes with large green fruit
Dwarf and Medium (Hybrids)	*Agon Hybridi,*	Goun, Fon	Hybrid coconut ecotype	Hybrid coconut tree with red fruits
	Agon Abidjanton,	Goun, Fon, Adja, Xwla	Coconut imported from Abidjan (Ivory Coast)	Hybrid coconut tree with large yellow fruits
	Sèmè gon	Goun, Fon	Coconut introduced by the INRAB under coconut program	Hybrid coconut tree with large green fruits
	Agon yovoton	Goun, Fon	White people coconut	Dwarf coconut palm
	Agon engraiton	Goun, Fon	Improved coconut	Hybrid coconut tree with large red fruits
	Coppa	Xwla, Pédah	Imported or improved coconut	Hybrid coconut tree with large green fruits and Dwarf coconut palm
	Agban ognibo	Yorouba	White people coconut	Hybrid coconut tree

Table 2. Names of the different parts of the coconut palm and derivatives according to ethnic groups.

Coconut palm and its derivatives	Goun	Fon	Yoruba	Cotafon	Adja	Pédah	Xwla
Coconut	*Agonkê, Agounkè*	*Agonkè, Agon*	*Agbon, Agban, Agboun*	*Agonkè, Agon*	*Yovonain*	*Agonkè, Agon*	*Gonnin*
Coconut palm	*Agonkêtin, Agounkètin*	*Agonketin, Agontin*	*Égui agbon, Igui Agban, Igui agboun*	*Agonketin, Agontin*	*Yovonaintchi,*	*Agonketin, Agontin*	*Gonnin Tin*
Coconut water	*Agonkêsin, Agounkèsin*	*Agonkesin, Agon sin*	*Omi agbon, Omi Agban, Omi agboun*	*Agonkesin, Agon sin*	*Yovonainchi*	*Agonkesin*	*Gonnin sin*
Coconut milk	-	*Agonkè si lè*	*Iyefou*		*Lait yovonintô*		
Coconut oil	*Agonkêmi, Agounkèmin*	*Agonkè mi, Agonmi*	*Épko agbon, Épko agboun*	*Agonkè mi, Agonmi*	*yovoninmi*	*Agonkè mi*	*Gonnin mi*

generic name "*Agon miton* "designates endogenous coconut. Similarly, "*Agon vè*" designates coconut with red or yellow fruits. Depending on the part of the plant, different vernacular names were also attributed. Sometimes, the same names "*Agontin*" or "*Agounkè tin*" designates coconut palm in Fon, Cotafon and Goun ethnic groups and illustrate the case of synonymy. In Adja and Xwla ethnic groups, coconut palm is called respectively "*Yovonaintchi*" and "*Gonnintin*". The common suffix "*tin*" and "*tchi*" used means tree. When considering coconut water, a prefix or suffix is often added to the basic term used according to the ethnic groups. For example, in Fon, Goun, Pédah and Cotafon a suffix "*sin*" is added to "Agon", and "*chi*" in Adja. A prefix "*omi*" is used in Yoruba and the coconut water is designated "*omi agbon*". Thus, to designate coconut water in Fon, Goun, Pédah and Cotafon, for example, one must add the suffix "*Sin"* which means water. Water is called "*Omi"* in Yoruba, and "*Chi"* in Adja. The different names are summarized in Table 2 according to each ethnic group. The names used to designate coconut milk in Yoruba, Fon and Adja are respectively "*Iyefou*", "*Agonkè si lè"*, and "*lè yovonintô"*.

Preference criteria

The preference criteria are essential in determining the choice and maintenance of ecotypes by producers. For coconut production and across the villages and ethnic groups surveyed, five preference criteria (productivity, that is, number of fruits per tree, quantity of water per coconut, availability, quality of the kernel, taste of the water and its aroma) were identified among which productivity ranks the first (43% of responds) followed by quantity of water (33%), taste (33%), availability of coconut (16%) and kernel (14%) (Figure 4).

A correspondence analysis (Figure 5) on the preference criteria and the ecotypes revealed three main groups. Group I is composed of Agon miton, Agon koun, Xla gon and Agban. Ecotypes of this group are mainly preferred for the quality of their kernel and the quantity of water of the coconut. Group II is composed of a single ecotype, named "Agon vè" and differed from the others and preferred for its aroma. The last group (Group III) is composed of dwarf and hybrid ecotypes which were preferred for their productivity, sweet taste and availability all the year.

Factors determining coconut uses

Table 3 summarizes the results of the GLM. Overall, coconut uses vary significantly according to ethnic group and age of people (Prob <0.05), Figure 6a and b). Indeed, the Fon ethnic group followed by Goun ethnic group had higher uses of coconut palm than Xla and Adja ethnic groups. Furthermore, elderly people have more knowledge about the uses of the coconut palm than younger people. Apart from firewood (Figure 6g) use, the other uses (construction, food, medicinal) varied significantly (Prob<0.05; Figure 6c, d, e, f and h) according to the ethnic groups. However, among the ethnic groups, Fon had higher knowledge on coconut uses than the other ethnic groups. In addition, age had significant effect (Prob < 0.05) on food and heat uses. Educational level (Figure 6i) also appears to influence medicinal and construction uses.

Diversity of uses of the coconut palm

The coconut palm is a tree whose parts can be used for various purposes, notably food, construction, traditional medicine, and during traditional ceremonies (Figure 7). Table 4 summarizes the various uses of the coconut palm. The first and most important use is the fruit consumption and its by-products obtained from its processing. The food uses of coconut are numerous and similar across ethnic groups. Coconut's consumption

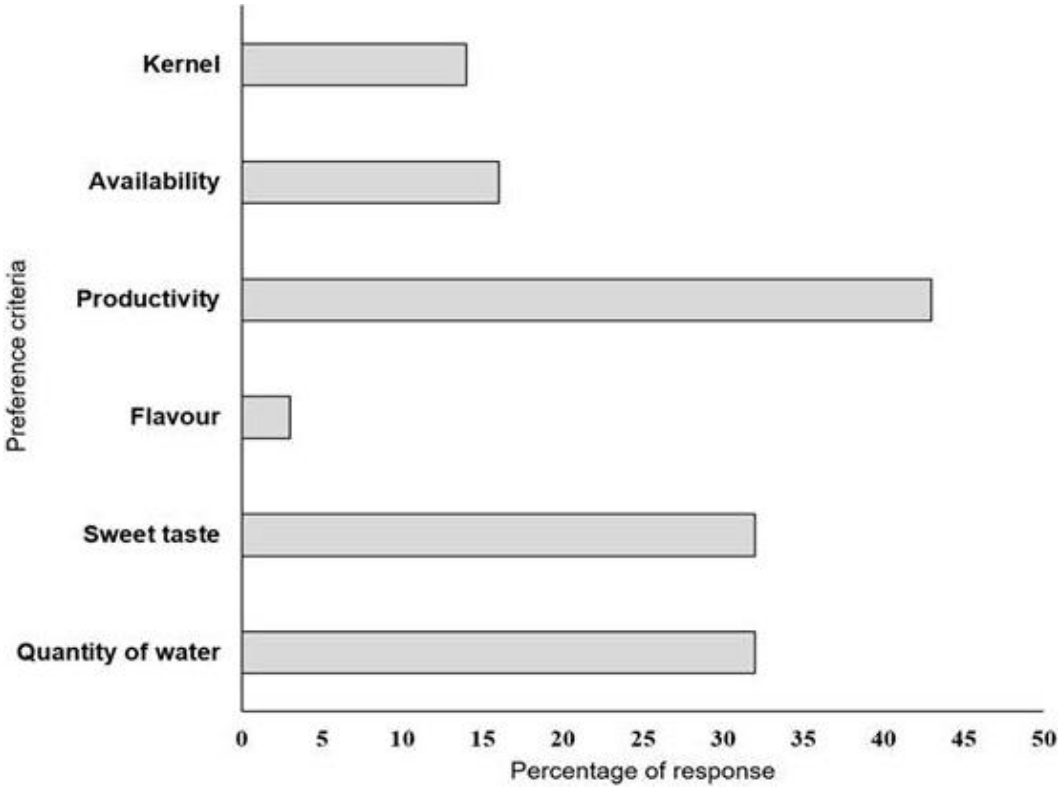

Figure 4. Relative frequency of citation of preference criteria.

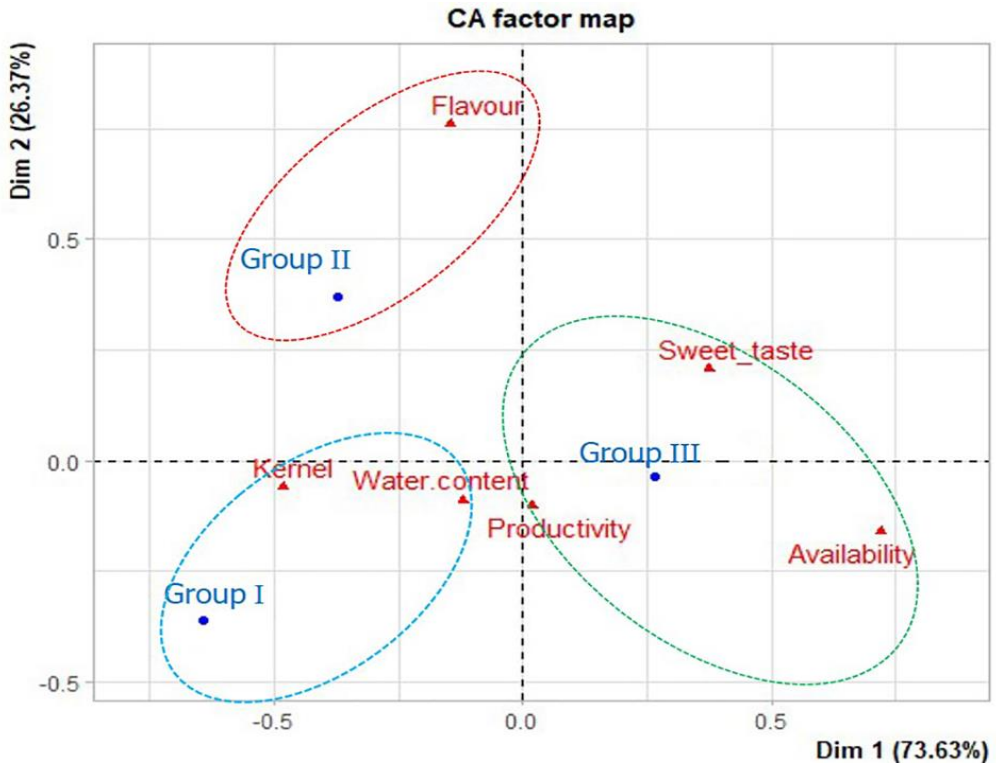

Figure 5. Correspondence factor analysis showing the relationship between coconut ecotype and preference criteria.

Table 3. Effect of socioeconomic factors on coconut use value.

Use value	Socio-demographic characteristic	Df	Deviance	Prob
Total	Sex	1	0.05	0.526
	Age category	2	1.04	0.028
	Instruction level	4	1.15	0.096
	Ethnic group	3	1.95	0.004
Construction	Sex	1	0.01	0.892
	Age category	2	0.13	0.217
	Instruction level	4	0.55	0.012
	Ethnic group	3	0.34	0.046
Food	Sex	1	0.16	0.127
	Age category	2	1.39	<0.001
	Instruction level	4	0.11	0.817
	Ethnic group	3	0.78	0.013
Heating	Sex	1	0.05	0.470
	Age category	2	1.01	0.006
	Instruction level	4	0.26	0.631
	Ethnic group	3	0.40	0.261
Medecinal	Sex	1	0.01	0.960
	Age category	2	0.13	0.797
	Instruction level	4	4.69	0.002
	Ethnic group	3	3.65	0.005

Df : degree of freedom ; Pr: Probability.

begins from the first stage of fruit development to the final stage of maturity resulting in the formation of copra. Indeed, coconut water is consumed as refreshing drink.

The terminal bud called “palm heart” is edible and consumed raw, and the extracted sap is used to make wine palm mainly by the Xla ethnic group. For the ethnic groups Fon and Goun, the extracted kernel (Figure 8) is consumed fresh, with bread, gari (cassava flakes) or with hypocotyls obtained from seed germination of African fan palm (*Borassus aethiopum* Mart). Moreover, milk is also extracted from the kernel and consumed by people. The oil extracted from copra is used to cook foods and the obtained cakes are used to produce new food products. For the medicinal uses (Figure 9), coconut water is consumed to improve sexual performance (40,46 %), and mixed with lemon to treat malaria disease (69 %). Additionally, the stipe is used for frame construction due to its resistance and the leaves for building house fence and crafts.

Coconut palm production constraints

Many constraints related to coconut palm production have been reported by informants. These constraints differ between men and women. Both men and women are involved in the nurseries and seedlings’ production activities. However, the harvest is exclusively done by men who are more skilled to climb the tree. According to producers, the major constraints are productivity and plant height. Improved ecotypes are most productive than the endogenous ecotypes. Endogenous ecotypes are more appreciated due to their organoleptic characteristics. However, from a certain number of years, the tree size of endogenous ecotype becomes so high that it is difficult to climb and harvest the coconuts. So, to circumvent this difficulty, producers opt more for improved and dwarf ecotypes.

Women are mainly involved in activities related to collection and selling. They represent at least 70% of coconut water and copra traders. Another important constraint is which related to biotic stress. Three (03) main diseases were reported across area across the study villages. The first one is the dry rot of the coconut heart, which most often attacks young plants. The two others are the leaf dieback disease and yellowing leaf disease which attack adult coconut palms.

DISCUSSION

Diversity and conservation status are important aspects

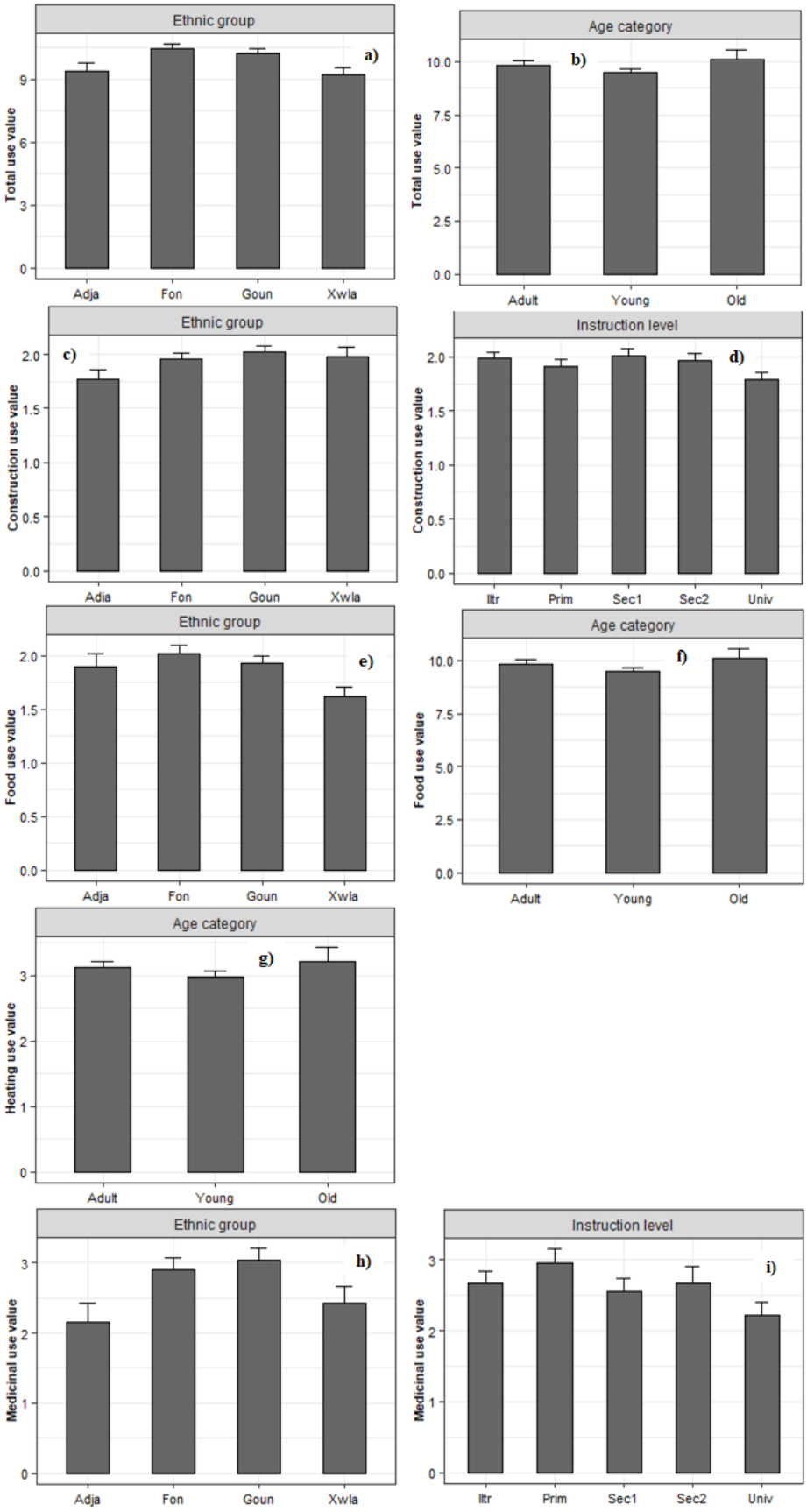

Figure 6. Variation of coconut use values in relationships to socioeconomic factors.

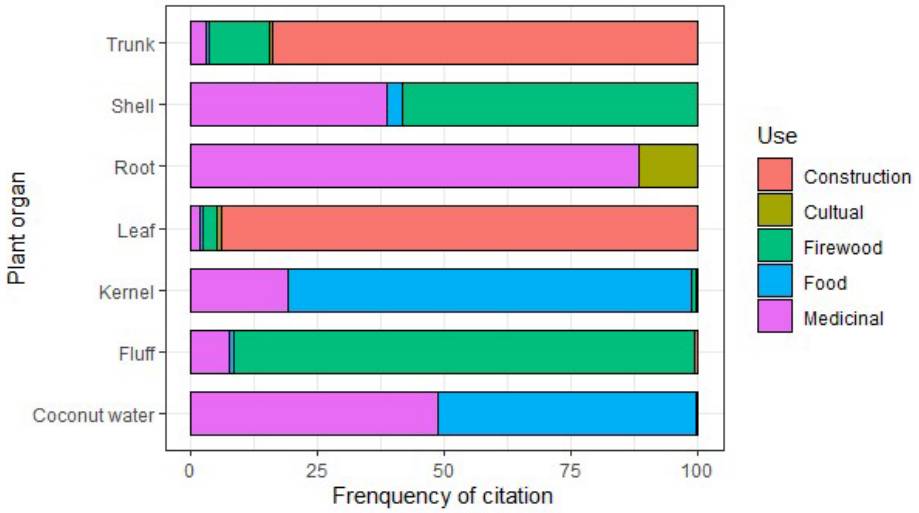

Figure 7. Uses of the coconut tree.

Table 4. Uses of the different parts of the coconut palm tree in the study area.

Parts of the plant	Medicinal recipe	Food recipe	Construction	Cultural recipes	Other uses
Leaf	Unknown	Unknown	Roof, fence	Unknown	Ropes, garden boards, broom, hat
Trunk	Anemia, painful menstruation	Unknown	Carpentry, fences	Unknown	firewood
Root	Anemia, malaria, infection, icterus, mouth sores, general fatigue, stomach ache, calcium deficiency, aphrodisiac, sexual weakness, newborn tea, sperm purification, hemorrhoids, newborn head deformity	Unknown	Unknown	power of luck	Unknown
Fibre	Anemia	Unknown	Unknown	Unknown	Cooking fire, textiles
Hull	Anemia, malaria, newborn head deformity	Unknown	Unknown	Unknown	Cooking fire
Kernel	Oligospermia, Aphrodisiac, calcium deficiency, virility, typhoid fever, malaria, general fatigue	Milk, coconut oil, snacks, dried grated coconut, copra,	Unknown	Unknown	Ebauty cream,
Water	Serum, malaria, sexual weakness, premature ejaculation, fertility, ulcers, general fatigue, infection, hypertension, cleansing of the body, white loss, fibroids, cysts, strengthening the immune system	Refreshing drink	Unknown	Power of luck	Infusion

to be elucidated to guide development of strategies for sustainable plant genetic resources conservation and management. This study focused on the case study of coconut tree in Benin. The number of local names recorded for all ecotypes, subject to synonymy, was low compared to other crops species. This low diversity could be related to the ethnic groups living in the area of study. Indeed, the ethnic groups located in the coastal area could be qualified as derived mostly from Fon ethnic group with which they share a lot of linguistic expression. Contrary to the 10 vernacular names recorded in our study, 38 local names were enumerated in the Vêtuboso' village on the island of Vanua Lava (Caillon, 2011) with an area of only 314 Km^2. In addition, the system of designation of coconut ecotypes in Benin coastal zone is very similar to the ones described by Caillon (2011) on

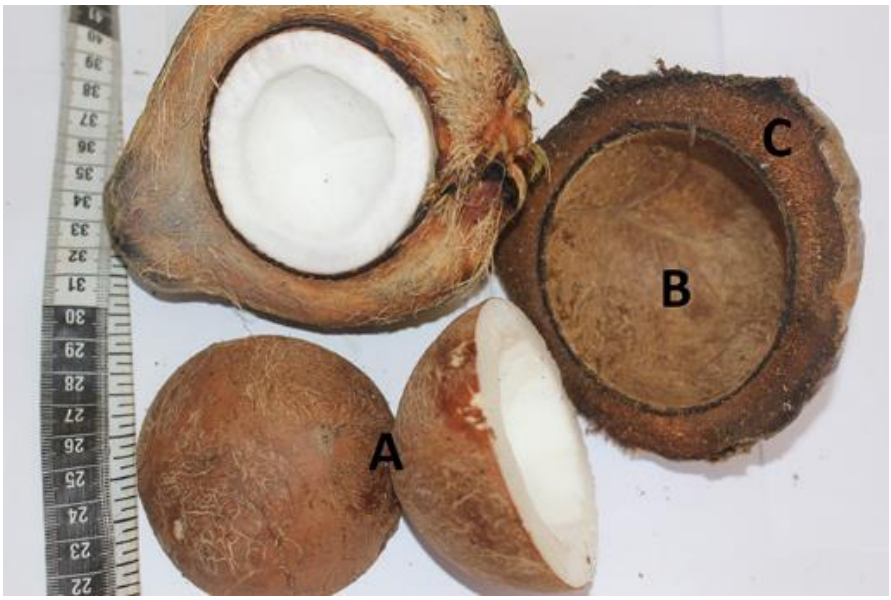

Figure 8. Cross section of a coconut; **A**) kernel; **B**) Shell; **C**) Fluff.

Figure 9. Coconut water for medical use; Lemon is added for malaria treatment, milk to improve sexual performance.

the island of Vanua Lava. Almost all of the names listed by local populations are made of two names where the first designates the “coconut” and the second often related to a morphological characteristic of the fruit or tree.

Determining preference criteria is very important for promotion and maintenance of ecotypes by producers. For coconut palm, productivity and organoleptic characteristics are the priority criteria used by producers. Indeed a good productivity means higher yield, and hence more money. Productivity had been reported as the first criterion of preference for many crops (Weltzien et al., 2020; Marimo et al., 2020). For coconut, this criterion is followed by organoleptic characteristics that meet the needs of consumers. In general, palms were reported to be a multi-purpose species whose part can be

used by human for food, construction, medicine, cultural ceremonies and other uses (Araújo Neto et al., 2016; Zon et al., 2021). Different uses were recorded for coconut palm. As most of edible palm species, coconut is primarily used for food. Fruit is the main part of coconut palm consumed for human food. Coconut water is used for refreshing when immature; the kernel is consumed raw; and mature oil is extracted from kernel for cooking or for other uses. The apical meristem of coconut is also consumed like palm heart. Many authors also reported the same and various uses of coconut in human food (Ahuja et al., 2014; Lima et al., 2015; Erawan et al., 2018; Moreno et al., 2020). In Benin coastal zone, coconut uses have significant relationship with informant age category; older people use the species more than younger informants probably because older are more knowledgeable about coconut uses. In addition, knowledge on medicinal uses is mainly held by people with very low educational level.

A recent study by Gruca et al. (2015) underlined palms as prominent elements in African traditional medicines. Concerning medicinal purposes, apart from the leaves, all other parts of coconut palm are used alone or in combination with other ingredients to treat different pathologies and vary among ethnic groups. Indeed, several studies had reported various medicinal properties of coconut (Lima et al., 2015). At least ten medicinal uses such as malaria treatment, stomach pain medication, improving sexual performance and sexual pathologies treatment, menstrual cramps, anemia, calcium deficiency and others were reported by respondents. Most of the medicinal uses reported in our study had been also listed in Indonesia by Erawan et al. (2018). Several studies reported on the role and importance of palm species included coconut palm in meeting the health needs of indigenous people. Besides the different uses described and discussed above, another aspect listed by local people is the magical use of coconut palm to attract good luck. Indeed, traditional medicine is also in close association with endogenous spirituality or belief which makes difficult certain explanations. Gruca et al. (2015) reported that ritual use of palms is an inextricable part of African medicinal and spiritual systems. Coconut palm in the ritual uses has been already among certain ethnic groups in Kenya, Madagascar and Nigeria (Nagata et al., 2011). Many authors had reported the socio-economic importance of palm species especially for making handicrafts, objects for domestic uses and others (Zon et al., 2021). Here coconut palm leaves were used by local people to make hat, ropes, garden boards and sometimes to make fire for cooking. This same coconut utilization were also reported in Tanzania by Muyengi et al. (2015). Our results showed the importance of coconut palm in the lives of people across the coastal zone. In view of the diversity of products obtained from the exploitation of the coconut palm, it appears important to evaluate its contribution to the local economic chain and especially in household income.

Conclusion

This study provides useful information on genetic resources of the coconut palm cultivated in the coastal zone of Benin. Currently, there is a low diversity of coconut cultivated across the area of study. Three main types of coconut were distinguished: local and tall ecotype, improved dwarf ecotypes, and the medium size (height). These results can serve as guidelines for the implementation of conservation strategies of the species across the zone. Up to now, the management of coconut plantations remains family-owned and this production is essentially for domestic market. Increasing production requires highly productive ecotypes, and resolving constraints of coconut production such as training farmers on farm and soils management, insect and pests' management, etc. Additionally, molecular genetic diversity study will contribute to clearly identify the cultivated ecotypes. It is also important to assess physico-chemical composition of coconut products from cultivated ecotypes in order to identify the best ecotypes that can be candidates in the development and/or genetic improvement program. Assistance from the authorities to producers and development of technologies for enhancing productivity and the income of coconut farmers are important to boost the value chain of coconut palm.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

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