

Original Research Article

Ethnobotanical and socio-economics studies of *Dracaena camerooniana* Baker in Uíge Province, northern Angola

ABSTRACT

The tropical forest zones of Congolese guinea/Zambian located in Northern Angola, particularly in Uíge Province, is full of high value non-wood forest products (NWFPs) including *Dracaena camerooniana* Baker (locally called *Nzala bakala* or *Nsala bakala*), a wild vegetable essence appreciated by the local population and is also an additional source of financial income for subsistence farmers and Hunter-gatherers. Despite its importance in food security and socioeconomic terms in both rural and urban areas, few scientific researches have been fully interested in its valorization. The aim of this research consists of contributing to the inventory of ethnobotanical knowledge related to the use of *D. camerooniana* by the local communities bordering the tropical forests of Uíge. The study also shows that *D. camerooniana* is well known and used by the local communities of Uíge. Finally, the consumption and commercialization of NWFPs, such as the leaves of *D. camerooniana* contribute in strengthening nutrition, health, food diversity, income and livelihoods.

Key words: Ethnobotany; economic value; *Dracaena camerooniana*; Uíge Province; Northern Angola.

1. INTRODUCTION

Forests act as a source of food, medicine and fuel for more than a billion people. In addition to helping to respond to climate change and protect soils and water, forests hold more than three-quarters of the world's terrestrial biodiversity, provide many products and services that contribute to socio-economic development, and are particularly important for hundreds of millions of people in rural areas, including many of the world's poorest [1]. More than half of Africa's population depends on natural forest resources [2]. Regarding [3], therefore, non-timber forest products may offer sources of income and opportunities for poverty alleviation in both rural and urban areas. According to the FAO [4] NWFPs are a real treasure trove, both nutritionally (in terms of carbohydrate, protein, fat, vitamins and minerals) and medicinally. NWFPs help contributing to food self-sufficiency and food security [5; 6] but also to food diversity [7; 8]. In Angola, more precisely in the northern province of Uíge, NWFPs continue to ensure the survival of thousands of human beings living in poverty, especially those in the rural areas and also in peripheral-urban neighborhoods [7].

Forests of Uíge Province in northern Angola are full of high value NWFPs including *Dracaena camerooniana* Baker, a wild vegetable appreciated by the local population and an additional source of financial income for subsistence farmers and hunter-gatherers. Furthermore, they are constitute a reservoir of firewood for heating, handicrafts, building materials and furniture, instruments of music folkloric and religious; edible, medicinal plants, mushrooms and wild animals.

D. camerooniana is a monocotyledon belonging to the plant family *Asparagaceae* [9] and grows in African tropical forests [10]. As for its use, there are only two references for it in the literature. The leaves are used to cover ulcers in Liberia helping local people to heal [10]. According to Biloso and Lejoly [11], the leaves are edible and sold in the

DRC. As far as Angola is concerned, there are no ethno medicinal or socioeconomic studies based on this wild plant, yet it is one of the most valuable NWFPs for food use in the province of Uíge.

In addition, to value this phylogenetic resource of food and socio-economic interest, threatened with extinction due to uncontrollable exploitation by the local community and following the gradual disappearance of tropical forests due to largely subsistence agriculture, a research project has been carried out. The aim of this research consists of contributing to the inventory of ethnobotanical knowledge related to the use of *D. camerooniana* by the local communities in the tropical forests of Uíge. Whose specific objectives are: 1) Documenting the indigenous knowledge of the local population on the use of *D. camerooniana*: the harvest techniques, ways of preparation and preservation.; 2) Identifying the difference stakeholders of *D. camerooniana* (gatherer, vendor, consumer) chain in the research area; 3) Evaluating the socioeconomic importance of the harvest of the *D. camerooniana* in the life of subsistence farmers and hunter-gatherers.

2. MATERIALS AND METHODS

2.1. Study area

Uíge Province is located in Northern Angola has 16 municipalities with a population over 1.4 million of inhabitants, a surface of 58 698 Km² [12] and 11 ethnic Bakongo sub-groups are present: Bacongós, Gingas, N'golas, Muzombos, Muxicongos, Maiacas, Mahungos, Sossos, Massucos, Pombos and Punas [13]. According to the Köppen climate classification, the province has a tropical wet or dry or savannah climate Aw [8; 14]. This Guineo-Congolian rainforest climate is characterized by a rainy season which lasts more than six months, accompanied by relative humidity above 80% and dense fogs, locally called *Cacimbo* [15] or *Sivu* in Kikongo language [16] or *Mbangala* in Kikongo language. A precise description of the region was defined by White [17] who classified Angola's north, between the Guineo-Congolian and the Zambezian Regions, calling it the Guinea-Congolia/Zambezian regional transition zone. Barbosa [18] differentiated the area into six vegetation zones, shown in Figure 1. The surfaces and Populations of Uíge Province are equally distributed. Most of the population from this region is formed in great part with Bantus from Bakongo ethno-linguistics group [16] and they depend widely of shifting agriculture on slash-and-burn as the main source food, employment, and income, filling their daily needs. However, about 85 – 90% of the rural population in Angola depend entirely on subsistence farming, hunting and gathering of natural resources such as insects [19]. The opinion on the shifting agriculture has been supported by researches carried out by, [7; 16; 20-22] in this province during their relative researches related to medicinal and edible plants and NWFPs. The gathering was never the main source of food, employment and income of the rural households of Uíge, it is practiced occasionally. Uíge province benefits from edaphoclimatic (vast arable lands and excellent rainfall) and it has also a dense hydrographic network which waters the region.

However, the agriculture is still rudimentary and strongly tributary of rainfall. The subsistence farmers of Uíge Province generally practice a mixed agriculture and cultivate in forests so as in savannahs.

The main food crops and income of Mukongo subsistence farmers from Uíge are : *Manihot esculenta*, *Musa spp.*, *Ipomoea batatas*, *Arachis hypogaea*, *Phaseolus vulgaris*, *Persea americana*, *Dacryodes edulis*, *Saccharum officinarum* and *Citrus sinensis*. We can also find some other food crops such as *Colocasia esculenta*, *Dioscorea spp.*, *Zea mays* etc. the main vegetables, spices and fruiters cultivated are *Capiscum spp.*, *Allium cepa*, *Solanum cerasiforme*, *Abelmoschus esculentus*, *Amaranthus spp.*, *Carica papaya*, etc.

The basic food and main source of carbon hydrate among Bakongo of Uíge is the Manioc (Fufu, Cassava bread, etc.) frequently consumed with a diversity of wild or cultivated vegetables (*Pteridium aquilinum subsp.centraliafricanum*, *Amaranthus spp.*, *Phaseolus vulgaris*, *Gnetum africanum*, *Dracaena camerooniana*,

Mondia whetei, *Ipomoea batatas*, *Manihot esculenta*, *Salacia pynaertii*, *Hillieria latifolia*, *Pterocarpus angolensis*, etc.

The great part of leafy is cooked and seasoned with peanut butter, red palm oil, tomato, onion, etc. The use of smoked Caterpillar and meat, fresh or smoked fish depend on the financial capacity or physical accessibility of the households. Furthermore, the sea fishes (fresh, dried or smoked) constitute the main source of animal proteins consumed in the region due to its financial affordability.

The survey zone was chosen after a pre-survey that confirmed the existence of sheltering forest of *D. camerooniana* in wild state in this region. The figure 1 refers to the phytogeographic location which hosts *D. camerooniana* in the research area (Uíge province), which are the humid rain forests.

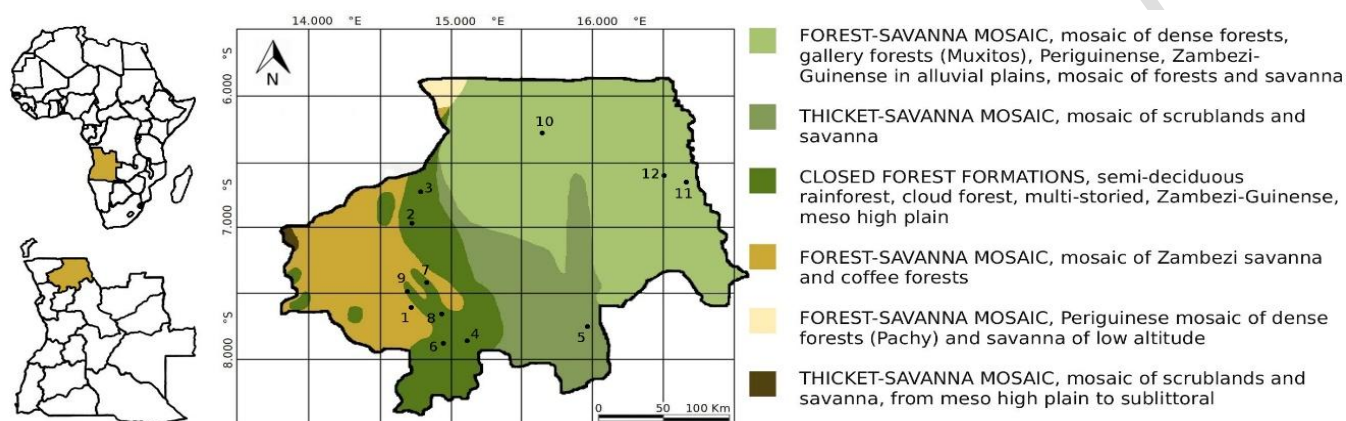


Fig. 1: Phytogeographic location map of the host forest of the *D. camerooniana* in Uíge province, which are the rainforests.

2.3. Plant Materials

The collection of the materials on the field was done through wildings of *D. camerooniana* (fig. 2a) commonly called in Kikongo language “*Nsala bakala*, *Nsala yakala*, *Nzala bakala*, *Nsala bayakala*, *Nsala batata*, *Nsala munsambu*, *Nkulala* or still *Nsala bakento*” collected in humid rain forests in the Guinea-congolia/Zambezi zone of Uíge province. The organs exploited from this plant for food purposes are the leaves (Fig. 2b), and the tuberous roots (Fig. 2c). The specimen was identified at the Institut für Botanik, Technische Universität Dresden, D-01062 Dresden, Germany, where a voucher specimen (No. 056361) of *D. camerooniana* was deposited.



(a) *D. camerooniana* plant



(b) Leaves of *D. camerooniana*



(c): Tuberous roots of *D. camerooniana*



(d) *D. camerooniana* fresh cut leaves

Fig. 2 (a-d). Photographs of *D. camerooniana*

2.4. Methods

The method opted is the ethnobotanical survey applied by [23-25]; it consists firstly, to write a questionnaire which allowed to understand the multiple usage of the *D. camerooniana* among the population of the study area. Data

collection was also done through direct observation Biloso and Lejoly [11] and interviewed was as well made through the use of Semi-structured questionnaires interviews [26; 27] to and individually or in focus group of people.

In the case of the semi-structured interviews in a group were applied following the method described by Wentholt *et al.* [28] which consists of questioning men and women separately. The questionnaire was based on the knowledge and use of *D. camerooniana* by the local community. The questionnaires was administered to submitted orally to 285 respondents speakers, where 175 were consumers, and 75 gatherers and 35 sellers, they are all residents living in the study research area. A total of 12 sampling sites (Fig. 1), was used and 110 *D. camerooniana* plants was evaluated. where In total, have been visited 12 sampling sites (Fig. 1), and analyzed 110 *D. camerooniana* plants.

Through this research, The local names, it was revealed vernacular names, methods and collection techniques of the respondents stakeholders of *D. camerooniana* chain, parts of the plants that are used in human food, consumption and preparation mode, consumption preference, mode and place of selling were accessed and documented.

The field survey was done from April 2016 to March 2018, period which covers the dry and rainy season. The interview were conducted in Kikongo language and in Portuguese according to the language mastered by the people surveyed. On the other hand, the choice of the surveyed people was based on the Adult people with the ages between among 20 to 65 years old who know and or use this plant in daily live and are available at the moment of the survey. The collected data was and analyzed with SPSS Software (Statistical Package for Social Sciences) 19.0. and Microsoft Excel 2013.

4. RESULTS AND DISCUSSION

4.1. Profile of the respondents stakeholders of *D. camerooniana* chain in Uíge

The NWFP chain in Uíge province is consists of three mains types of stakeholders (gatherer, seller, and consumer). The latter ones are part of all the social strata of the local community. According to the collected results, the age of *D. camerooniana* chain stakeholders, it can be seen that in average the ages of the respondents as gatherers age is higher (47 years old) than of all the other stakeholders, which ranges between respectively 41 and 38 years old for sellers and consumers respectively.

In traditional societies like Bantu in Northern Angola; Monizi *et al.* [16], the sexo-specific norms dictate sometimes the roles of men and women and their opportunities in which concerns the types of work to do, in urban so as in rural zones.

The table 1 summarizes the data about the typology of the stakeholders of *D. camerooniana* chain in Uíge province, located in Northern Angola.

Table1: List of the Profile of the respondents stakeholders of *D. camerooniana* chain in Uíge province

	Parameters (%)	Gatherers (n=75)	Sellers (n=35)	Consumers (n=175)
Gender	Male	87	13	53
	Female	13	87	47
Academic level	Literate	66	72	89
	Illiterate	44	18	11
Main activities	Civil service	1	0	43
	Agriculture	16	48	31

	Hunting	80	12	16
	Others	4	37	7
Area of Residence	Urbain and Nearby	14	68	49
	Rural	86	32	51

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The analysis of the results in table 1 shows that in Uíge province, men and women are actively involved in gathering NWFPs, including *D. camerooniana* leaves. But it happens that in this activity, men are the greatest craftsmen (87%) than women (fig. 3b), who occupy less than ¼ in the joint of gatherers, that is 13 percent. This can be explained to the fact that the majority of men who practice the gathering of *D. camerooniana* are hunters (Fig. 3c). This later often conduct the gathering alone, during the hunting with guns or when checking out animal traps. On the other hand, women very seldom do their gathering in accompaniment of their husbands, they would have gone with a relative or acquaintance for safety, because forests are isolated places and dangerous due to the presence of wild animals.

Moreover, the results of the table 1 shows that the gathering; the commerce, and consumption of the NWFPs whose *D. camerooniana* leaves attract the attract the educated as well as those who have never attended any school with respectively 75.67 and 24.33%. These results are in accordance with the those by Monizi *et al.* [16], which showed that the great part (95 percent) of NWFPs stakeholders whose chain *Raphia* wine in Northern Angola is integrated by literate people.

In Northern Angola, particularly in Uíge Province, the commerce empire of the NWFPs, is won over by women. The commercialization of the NWFPs is assured by the family members of the exploiters who are in general their spouses or sons.

Moreover, the commercialization of NWFPs which are destined for food whose *D. camerooniana* is in majority won over by women with 92 percent. Men only occupy less than one-tenth of the total worforce, that is 8 percent. These remarks are closer to the ones by Monizi *et al.* [16] in Uíge province in Northern Angola, that 83 percent of NWFPs sellers especially *Raphia* wine are women. Whereas in Congo Brazzaville, Loubelo [6], showed that NWFP sellers are in majority women. While in Cameroon, N'doye *et al.* [29], showed that 94 percent of the people who work in commercial sector of NWFPs are feminine gender. Still in Cameroon, Tchatat et Ndoeye [30]; Betti *et al.* [31] attest

that the commercialization of NWFP is an activity in majority practiced by women. finally, these remarks are in agreement with those reported by FAO [4], that in Central Africa the commercial sector of NWFP is dominated over 80 percent by women.

It was also revealed that We could see that, the commercialization of *D. camerooniana* leaves is done in short and long marketing network. In relation with the consumption of wild NWFPs destined for food, the *D. camerooniana* leaves are enjoyed by the all social strata of the local population of Uíge; we can mention, from villagers or city-dwellers, to from the odd-job man, to the public servant, from young to the oldman, from women to the men, from illiterate to the literate and , briefly all the social strata.

In Uíge, the gathering activity was never the main source of income, employment and livelihoods of the rural households because the gathering activity is practiced occasionally. On the other hand; the main activity of the gatherers is the shifting agriculture on slash and burn. This last one assures the food self-sufficiency, food security and diversity, and generate employments and income from the sells of the excedent crop products on the rural, suburbs and urban markets. These facts are in accordance with the ones by FAO [4], that in Central Africa the agriculture is in geral of livelihoods destined to self-consumption and the selling of the excedents in rural, semi-rural and urban markets. According to Mawunu *et al.* [7] the agriculture constitutes the main source of income (95%) of the rural population of Ambuila Municipality in Northern Angola and the other sources of income are hunting and commerce which supplies respectively 4 and 1 percent. Following the same line of ideas, Kuedikuenda and Miguel [32], showed that in Angola the shifting agriculture is the main source of income and food in the rural communities. According to INE [12], showed that agriculture and fishing are the economic representative activities in Angola.

The results of our survey have equally showed that a part from agriculture, other activities are practiced by the local communities of Uíge as a source of income and employment not only for rural households, suburbs and urban vulnerable.

4.3. Transfers of knowledge and Know-how

According to the collected The results also revealed, the knowledge and the indigenous know-how on *D. camerooniana*. are transmited orally. Our results are in Accordance with the works of ones Monizi *et al.* [16], which showed that in Northern Angola, in particular in Uíge province, the knowledge and techniques on the use of NWFPs are transmitted orally from mouth to the ear. In Cameroon, Kahane *et al.* [33], showed that the knowledge and traditional know-how “connected to food in tropical countries” are transmitted from generation to generation without written trace. In DRC, Liengola [34], reported relates that knowledge on the wild plants was slowly developed and accumulated, later kept and delivered from one generation to another, therefore the knowledge is it is permanently at risk to disappearance because since it is mainly transmitted orally.

4.4. *D. camerooniana* collection techniques

In Uíge province, the leaves of *D. camerooniana* are exploited by the population who live near larger forest areas. The gathering of *D. camerooniana* leaves is done using uncovered hands, following two different ways:

The first technique consists of collecting only the large leaves of the stem and the smaller ones are left on the plant whereas the second technique consists of cutting the plants followed by leaf gathering. Scientifically, Unless, this second technique is not sustainable and can contribute to the dead of the plant. However, the collectors are preferring it inorder to gain time. According to Mawunu *et al.* [7], the local population of the municipality of Ambuila (Northern Angola) uses various techniques for gathering wild plant products: from picking only selected plant parts, through to pulling off the whole plant, peeling off the bark or felling trees. Some of these techniques as the felling

and pull off plants are not sustainable and can cause a growing pressure on the remaining individuals, genetic erosion, and a decline of income.

In which concerns the keen interest of the local population on wild leafy vegetables as *D. camerooniana*, makes that in certain localities in Uíge province to collect a great quantity of leaves for sale, the gatherers spend many hours and walk long distances in the forests.

According to the people surveyed, the collected quantity of leaves varies from one gatherer to another, as well as from dry to rainy season, and it also depends on the quantity of plant individuals found.

D. camerooniana leaves are used for self-consumption as well as for sale. Our results are closer, self-consumption (67%) and sales (33%) to those presented in Togo by Adjatan [35], that nearly 90% of the production or gathering is destined to self-consumption and the remaining are sold not only in rural but also urban markets.

According to the data of our surveys, the quantity of bundles of *D. camerooniana* leaves gathering in Uíge province varies from one to several tens. When farmers or hunter-gatherers collected one or two bundles, this quantity is reserve for self-consumption. In addition, beyond the two, the harvested products are destined for marketing. A bundle contains is on average 150 leaves and weighs an average of 1596 grams. Strong attraction due to Market value of *D. camerooniana* leaves in the region, the gatherers start cutting the plants, some do this unconsciously, whereas the others do this for greed because one wants to collect great quantity of leaves in short time and make lots of Money. If collectors do not change their gathering techniques plant will disappear, the income will disappear. Official collection restrictions and limitations are needed. According to Loubelo [6], the intensity of the exploitation is a function of the domestic demand and commercial value of the product.

4.5. Means of transportation of *D. camerooniana* leaves

The gatherers of *D. camerooniana* leaves in Uíge province used many transportation means to carry their products. The vehicles as medium of transportation with the mean value of 71%, is the main mean (71%) *D. camerooniana*, then comes motorbike taxi 17 percent and carrying on heads (12%). These results are in accordance with of Mawunu *et al.* [7] and Monizi *et al.* [16] who worked in the same region (Northern Angola) and showed that the transportation of NWFP is assured by many different transportation means. The vehicle is predominant, followed respectively by motorbike taxi, head and bicycle.

4.6. Ethno-nutritional value of *D. camerooniana*

The data of our survey revele that, the food use of *D. camerooniana* in Uíge province goes back to the 1950s period corresponding to the recruitment and training of the first anti-colonialist troops for the liberation of the country. During this war of independence the soldiers used many wild NWFPs for their shelter, medication and food. The succulent tuberous roots of *D. camerooniana*, formerly called *Madioko ma mfinda* (Kikongo language), were consumed raw; at that time, the leaves of this plant were not yet used for human food. However, the food use of *D. camerooniana* leaves as leafy vegetable goes back to the 1960s.

Currently, the local population of Uíge knows and consumes more the leaves than the roots of *D. camerooniana*.

The results of our ethno-botanical survey shows that only less than 1% percent among the surveyed people know the existence and the usage of *D. camerooniana* roots. They are only consumed raw by men in form of snack after peeling, very often in forests to alleviate hunger and thirst. The roots are also consumed due to its presumed aphrodisiac virtue, which originated the name *Nsala bakala*, literally translated “Masculine work” that means strengthening the masculine sexual activity. *Nzala bakala* can also mean literally translated “They were hungry”, so due to the lack of foods they had to eat this wild leafy vegetable.

The leaves of *D. camerooniana* are cooked in water an average time of 30 to 45 minutes. They are very appreciated by the local population of Uíge due to its organoleptic characteristics (taste, texture, digestibility etc). When compared to the cooked *Mfumbwa* (*Gnetum africanum*) leaves, the leaves of *D. camerooniana* are softer, more digestible and more appetizing. Our results also show that the use of wild food plants in daily life are part of socio-cultural patrimony of the Bakongo group of Uíge province. According to Bonnehin [36], the local forest plants are still used in Africa. Numerous quantitative and qualitative assessments on the use of these plants have been addressed to demonstrate their importance in the lives of rural populations [7; 16; 22; 37; 38].

We noted that in Uíge province, sometimes in the preparation (cooking) of *G. africanum* leaves, some housewives voluntarily mix the *D. camerooniana* leaves with *G. africanum* leaves in order to soften this latter mentioned. In contrast, some ill intentioned retailers mix the leaves of *G. africanum* with some leaves of *D. camerooniana* with the purpose of increasing the quantity of *G. africanum* heaps seeing that *D. camerooniana* leaves are cheaper than *G. africanum* ones.

4.7. Place and selling modes of *D. camerooniana* leaves

The commerce of NWFPs like *D. camerooniana* leaves takes place in rural peri-urban (Fig. 3c) and urban markets, at the roadsides, or even at home of the gatherers. The leaves are sold in bundles of 150 leaves on average or heap cut into small pieces, ready for further preparation steps (Fig. 3a).

The leaves destined for sale are basins or plastic sacks stretched out on the land. Concerning the volume and number of leaves on the bundle vary from one bundle to another, and from one gatherer to another but also from the seasonality, it means that the volume of bundle and therefore the number leaves decrease in the dry season but increase in rainy season. This can be explained by the fact that during the rainy season, plants easily grow and leaves are well developed, reason why the bundles are of a bigger volume than in the dry season.

4.8. Economic value of *D. camerooniana* leaves

The commercialization of NWFPs destined for human food, medicine, crafts, for house construction etc in Uíge province constitutes a lucrative activity in that part of the country.

In this study, it was observed that our case, one bundle of *D. camerooniana* leaves costs on average 175 AOA (USD 1.06) in urban zones and 80 AOA (USD 0.49) in rural zones. The average monthly income per gatherer is USD 24.50, whereas the urban sellers' income is three times higher (USD 65.20). The exchange rate was calculated based on AOA 165.097 being equivalent to USD 1. Our results are lower than those of Biloso and Lejoly [11], who showed that the monthly receipts of the *D. camerooniana* exploiters in Kinshasa (DRC) are around USD 75.55.

The big difference observed between Kinshasa and Uíge city can be related firstly to the methods used to calculate the prices based on surveys at the market of the selling price of wild food plants in both studies. The prices of the wild food plants will certainly vary according to their availability, which is linked to seasonality and sustainable use of these natural resources.

The difference in selling prices can also be explained by the development level of the two cities. Kinshasa is the political and economic capital of DRC. Uíge is the capital city of Uíge province (Angola). Uíge is less developed and has a relatively low cost of living compared to Kinshasa.

The other explanation is in relation to the geographic location of these two cities. In RDC, Mutambwe [39] explains that the price of the NWFPs depends on the supply and demand, which in turn is influenced by the seasonality of the products. In addition, Mutambwe [39], also mentions that the price of the NWFPs depends on its quality (deteriorating conditions), the dimension or size of the products as well the cost of transportation and the place

where the product is sold. These observations agree with Betti *et al.* [31] in Cameroon that, the price of NWFPs will certainly vary according to their availability, which is also linked to the season.



(a) Selling modes of *D. camerooniana* leaves



(b) Peri urban Market of food products in Uíge



(c) Hunter-gatherers of *D. camerooniana*



(d) Sun – dried cut leaves of *D. camerooniana*

Fig. 3 (a-d). Photographs showing different activities with *D. camerooniana*

4.9. Income generation from the exploitation of *D. camerooniana* leaves for Allocation of the income and the socioeconomics of *D. camerooniana* leaves

The commercialization of *D. camerooniana* leaves is an additional income generating activity for subsistence farmers and hunter-gatherers. Fig. 4 shows the allocation percentage of the income from the sales of *D. camerooniana* leaves according to the gender of exploiters in Uíge province.

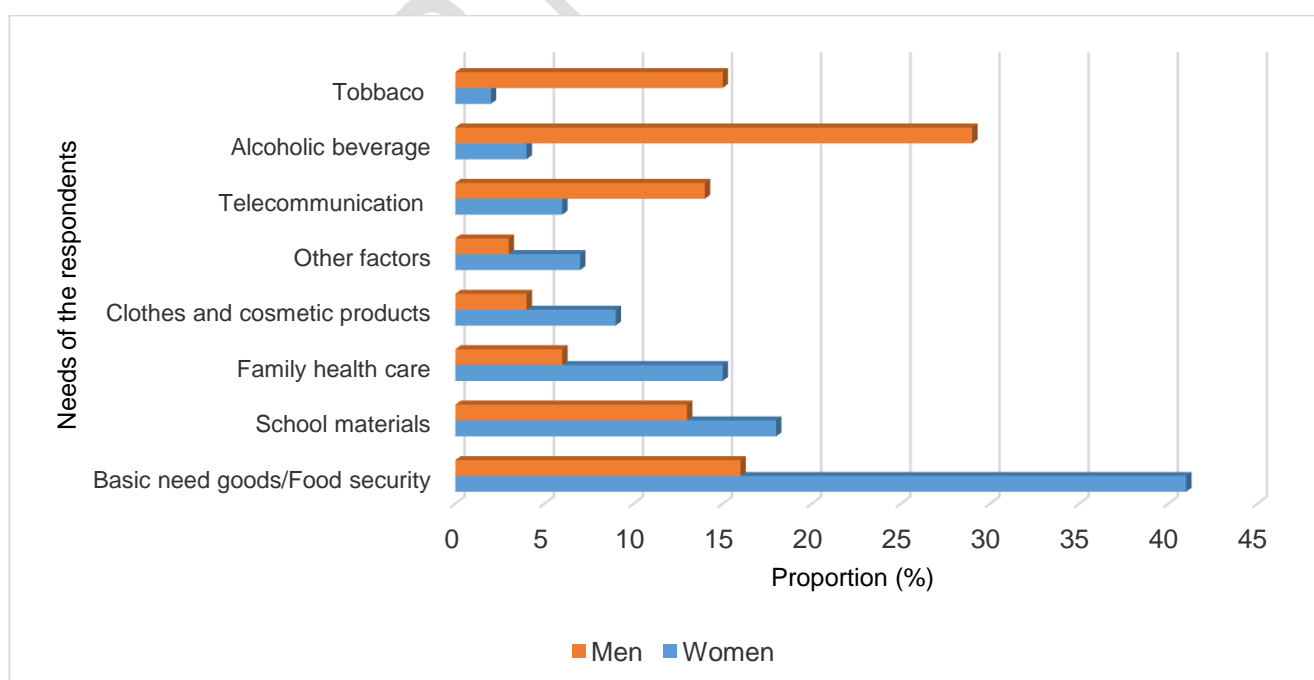


Figure 4: Income generation from the exploitation of *D. camerooniana* leaves Allocation of income from the sales of *D. camerooniana* leaves according to the gender of exploiters (%)

In regard to the data in (4), it can be seen that money received from the sales of NWFPs, including *D. camerooniana*, contributes in part to the basic need for products or food security, buying school materials, clothes and cosmetic products, health care, telecommunication and other items. However, the allocation of the income differs according to the gender of the exploiter. The money used to solve the immediate needs of the household is by far the largest volume (in total 74 %): 41 % is saved to buy the most needed products or to reinforce the basic goods needed, food, soap, kerosene lamp oil, batteries for flashlights etc.; 18% are allocated for children's schooling and 15% for family health care. Furthermore, 9% are allocated for clothes and cosmetic products, 12% for personal needs: telecommunication (6%), alcoholic beverage (4%), and tobacco (2%). In relation to the other aspects, they occupy 7% of money received by women (for help to relatives and friends, for funerals, marriages, donations for church, savings etc. According to Armand Asseng [40], in Cameroon, NWFPs collected by men are firstly sold for tobacco or alcohol. In Uíge province, men use the majority (58%) of the income firstly for personal needs (hobbies and passions): 29% for buying manufactured or traditional alcoholic beverages; 15% for tobacco and *Cannabis sativa*, 14% for telecommunications). The household benefits only 39% from money where 16% are allocated to food security; 13% for school; 6% family health care, and 4% for clothes and cosmetic products; and other aspects (shot for hunting, agricultural materials, helping parents) only benefit of 3%.

The difference observed between the two genders which concerns the allocation of income from the sale of *D. camerooniana* leaves seems to be attributable to the fact that among Bakongo people of Uíge, women are the guardians of the households and they worry much more about the wellbeing of their family. In other words, in Angola particularly in Uíge province women play the role of guardians of the households, which is the reason why they spend a great part of their income for the well-being of their households. According to [41-46] women have a greater tendency than men to care about the health, education, food and a general interest in the well-being of the households.

From the above it can be seen that the sales of NWFPs such as the *D. camerooniana* leaves generates income, which contributes to the reinforcement of food security, school, clothes, cosmetic products, health care, telecommunication etc. Our results are in partial or total accordance with various authors. For example, according to FAO [4] in Central Africa, the commercialization of NWFPs gives opportunity to many households to earn money, which allows the diversification of income and acquisition of goods and vital services. The NWFPs represent an important source of income and a network of food security in Central Africa. According to Loubelo [6], in Congo Brazzaville, the commercialization of NWFPs provide food, health, employment and generate income to the stakeholders involved in its exploitation and commercialization. In Cameroon, IITA [47] and Batchep [48], showed that the income generated from the sale of vegetables contributes to the food security and access to family health care. In DRC, Biloso and Lejoly [11], showed that the population fully exploit the NWFPs for their vital needs and to cope with problems of everyday life.

In Angola, Monizi *et al.* [16] and Monizi *et al.* [22], noted that income from sales of NWFPs serves in the acquisition of basic needs, school materials, health care, clothes, etc. Finally, the data of our study also show that part of the income from the sales of *D. camerooniana* leaves are saved. This kind of *tontine*, locally called *Dikelemba*, in Kikongo language and *Quixikila* in Angolan Portuguese. It is "a kind of capital investment and informal agreement or association of individuals contributing to a fund, the amount of money allocated is given in turn to each of them according to a plan previously established by mutual agreement". The sellers of *D. camerooniana* leaves do not like to keep their money in the banks because they find it takes a long time to take their money out and sometimes

when they need it, there are no funds available. The other reason is that the income from NWFP is often not enough to deposit, so they prefer saving their money at home.

4.10. Mode of consumption and conservation

D. camerooniana leaves are consumed chopped and cooked in water before consumed, after being finely chopped, for an average time of 30 to 45 minutes. The leaves are first picked or bought, washed and cut into small strips. Cooking the *D. camerooniana* leaves as a traditional dish depending on the culinary art of the housewife and the ingredients used. Once gathered or purchased at the market the fresh leaves are divided into heaps (Fig. 3b), after they are cut or chopped into small slices with a sharp knife. Next, the slices are washed and put into a pot to boiling along with the ingredients (butter of peanuts "*Mwamba nguba*, in *Kikongo language*" as the main ingredient, red palm oil, tomato and onion, etc. The addition of ingredients such as smoked meat, fresh or smoked fish, and smoked caterpillars depends on the financial ability or the physical availability of the households. The contribution of protein from animals and the other ingredients makes this *D. camerooniana* traditional dish a complete meal. Our results regarding the preparation mode and consumption of this wild African leaves are closer to those of Itoua Okouango *et al.* [49], who showed that in Brazzaville, *Phytolacca dodencadra* (wild spinach), is consumed cooked and, the preparation of this vegetable is garnished either with meat and fresh or smoked fish, or dried caterpillars. The consumption of these foods is influenced by the financial factor. Concerning the mode of preparation, our results are in accordance with those of Manirakiza *et al.* [50], in Congo-Kinshasa, who showed that the preparation of leafy vegetables such as *Gnetum spp.*, with peanuts and red palm oil occupy over half of the ingredients used. Van der Hoeven [51], in South Africa, showed that the ingredients used in preparation of vegetable dishes may vary and include oil, peanut butter, coconut, sodium bicarbonate, tomato and onion. Finally, Manduna & Vibrans [52], in Zimbabwe, the wild vegetables were cooked as spinach and served as a relish with the main staple, sadza. Tomatoes, onions, and peanut butter would be added to make a sauce.

About the preparation of chopped and dry leaves of *D. camerooniana*, these are washed and then boiled. Once boiled, the leaves are drained and then added to the ingredients mentioned above. Finally, the sauce is made with clean water.

For conservation of *D. camerooniana* chopped leaves, women in rural and peri-urban areas have developed a traditional conservation technique, which consists of drying chopped leaves (Fig. 3d) under the sun and then keeping them in preferably cotton sacks for many months.

4.11. Classification of the preference factors of *D. camerooniana* consumption

Many factors can influence food in a community such as food habits, social and cultural customs, environment and economy. The consumers of *D. camerooniana* leaves in Uíge province do not escape to this rule. As it can be observed, when people emigrate from the villages to the cities, they usually take their lifestyles with them, including their food and sociocultural habits, which can be considered a kind of "*ruralization of cities*". It was observed in this study that, city dwellers who consume *D. camerooniana* leaves are mostly former villagers or their descendants. This can be explained by the fact that, many times, the lifestyle, food and sociocultural habits of families or communities are transmitted from parents to children. Graph 2 shows the main factors, which motivate the consumption of *D. camerooniana* leaves by the local population of Uíge.

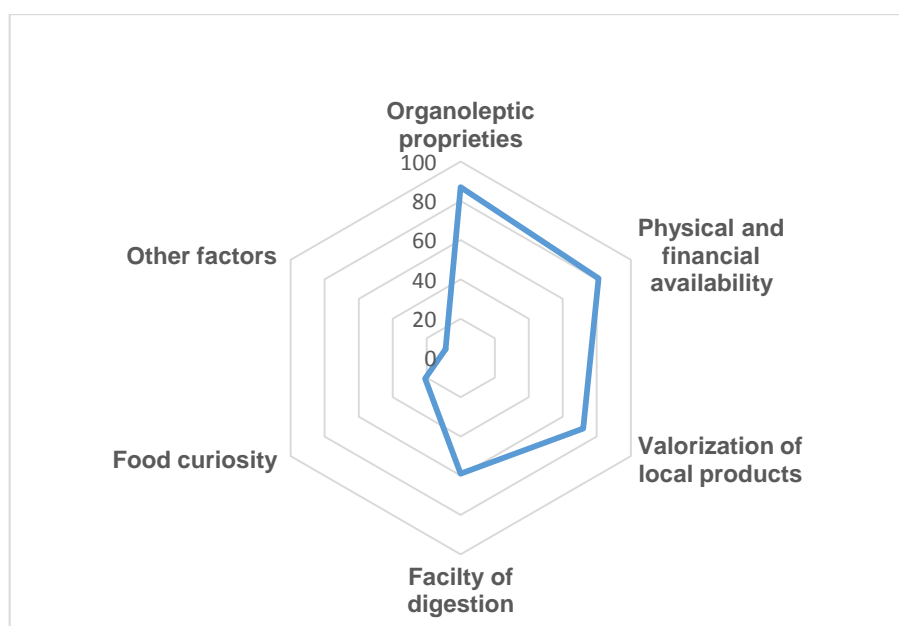


Figure 5: Motivating factors in the consumption of *D. camerooniana* leaves in Uíge province

It is evident in (fig. 5) that, the main factors which motivate the consumption of *D. camerooniana* leaves as a wild leafy vegetable within rural and urban areas in Uíge province are in decreasing order: organoleptic proprieties (87%), physical and financial availability (81%), valorization of local products (72%), ease of digestion (59%), food curiosity (21%), and other factors (food diversity, food habit, the choice of husband, and the medicinal role) only occupy 9%. Our results are closer in part with those presented by FAO [53] and Rubaihayo [54], which showed that the local leafy vegetables are cheap and easily accessible to numerous communities in rural, peri-urban and urban zones. According to Gupta and Wagle [55], leafy vegetables present an economic and social interest not negligible due to their relatively low cost.

4.12. Opportunities and constraints related to the access, gathering and commercialization

The results of our survey of the population of the study area show that the gathering of wild leafy vegetable such as *D. camerooniana*, is done freely in the forest, that is to say, it is not subject to prior authorization of the owner of the forest. These facts agreed with the study done in Central Africa by FAO [4], which showed that the access to the forest resources is free, as in case of *Gnetum spp* in DRC and in Cameroon.

Nowadays, there is a rise in anthropogenic activities in tropical rainforests of Uíge province, the natural habitats of *D. camerooniana*. These activities are responsible for dwindling forests in that part of the country. There are multiple factors responsible for the massive loss of tropical forests in Uíge province. Shifting agriculture or slash and burning is the main cause of deforestation resulting in natural habitat destruction, loss of vegetation cover, reduction of vegetal biodiversity and, also of many other species of vital interest in this part of the country. Other causes of deforestation are extraction of firewood, construction of roads, urbanization and construction materials, mechanized agriculture, felling wood for furniture, etc.). This study also shows that many constraints influence the access to the exploitation of NWFPs including seasonality, bad condition of secondary and tertiary roads and the distance to the gathering zone. Finally, there is no farmer organization in the region, which works in defence, either to teach or legislate to control the exploitation of NWFPs.

A. 5. CONCLUSION AND RECOMENDATIONS PERSPECTIVES

The study contributes to the traditional knowledge, the importance and the socioeconomic value of *D. camerooniana* by the population of local communities in Uíge province. *D. camerooniana* is however, threatened by

many factors such as poor harvesting techniques due to greed, anthropic pressures caused by shifting agriculture in tropical rainforests. Domestication of the plant should be carried out to ensure its preservation both in *situ* and *ex situ*. Also, methods of collections should improve and the exploitation of the roots and stem bark of the plant should not be involved as it is detrimental to the sustainance of the plant. Also, the Phytochemical studies should be carried out to discover the nutritional, toxic, and medicinal proprieties of this plant. This should be done with the support of local peasants because they know the techniques in this field. Finally, conservation should also be carried out to conserve the tissue strains of this wild forest leafy vegetable. This should tart with *in vitro* micro propagation as long as the genetic diversity that it represents is still available in its natural habitat.

The aim of this study was to contribute to the survey of traditional knowledge related to the use and the socioeconomic value of *D. camerooniana* by the population of local communities in Uíge province.

The results obtained in this study show that:

- *D. camerooniana* is a wild, perennial and spontaneous plant of the humid rainforests of Uíge province ;
- The leaves are whole, perennial and evergreen;
- *D. camerooniana* is a monocotyledon with tuberous and succulent roots. Its roots are consumed raw by humans in order to alleviate hunger and thirst in forests or as an aphrodisiac;
- The natural habitats of *D. camerooniana* in northern Angola are better known by hunter-gatherers than by farmers;
- The harvesting of *D. camerooniana* leaves is done freely without prior authorization from the forest owner;
- The leaves of *D. camerooniana* are consumed cooked and are used more for home-consumption than for sale;
- *D. camerooniana* leaves can be stored for months, once cut and dried in the sun; The number of seeds in the fruits of *D. camerooniana* varies from one to three seeds;

Several factors encourage the local population to consume *D. camerooniana* leaves as leafy vegetables, most important are: organoleptic properties, financial and physical accessibility and valuation of local products. The study has also shown that many factors threaten the disappearance of this plant in the region. First, poor harvesting techniques due to greed. Second, the anthropic pressures caused by shifting agriculture in tropical rainforests. These are the main causes of deforestation and the disappearance of this plant in northern Angola. If collectors do not change their gathering techniques plants will disappear and the income will also disappear. Official collection restrictions or limitations are needed.

Phytochemical studies should be carried out to discover the nutritional, toxic, and medicinal proprieties of this plant. Experiments to domesticate the plant should be also carried out to ensure its preservation both in *situ* and *ex situ*. This should be done with the support of local peasants because they know the techniques in this field. Finally, conservation should also be carried out to conserve the tissue strains of this wild forest leafy vegetable. This should tart with *in vitro* micro propagation as long as the genetic diversity that it represents is still available in its natural habitat.

Conflict of interest.

The authors declare that they have no competing interest.

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