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Marketing, Supply and consumption leaves *Cuervea isangiensis* traditional leafy vegetable in Africa-Congo Brazzaville

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Abstract
The aim of this work is to show the importance of traditional leafy vegetables, especially *Cuervea isangiensis* leaves, in the fight for food security and the alleviation of urban poverty in Congo Brazzaville compared to other market garden species. That the theoretical profitability makes more attractive.
Two investigations were made:
- One on the sale and supply of leaves of *Cuervea isangiensis.*
- Another, the household survey on the consumption of these leaves

From these results obtained, the marketing survey shows that the leaves of *Cuervea isangiensis* are sold in the markets of Brazzaville in piles, with a proportion of 54.0% and in packets (46%). In the week the respondents sell on average 10 packets of leaves of *Cuervea isangiensis* with a proportion of 20,0%, with P<0,001. This food (*Cuervea isangiensis* leaf) is transported to the markets of Brazzaville by truck from the villages. Suppliers of these leaves of *Cuervea isangiensis* make two trips a week (24%). The sale of *Cuervea isangiensis* leaves is breaking in markets during the dry season (74%.). These sheets are beneficial but the sale can not cover the needs of households (96%), sellers are interested in the sale of other foodstuffs for example the sale of bananas (24%.) And others (18%).The household survey shows that the leaves of *Cuervea isangiensis* are known (63% south of Brazzaville, 94% in other localities) and consumed by a part of the population (40% south of Brazzaville, 92% in other localities). The frequency of consumption of this vegetable is high in the southern part of Brazzaville, where 55% of the surveyed households consume twice a week, *Cuervea isangiensis*.
In conclusion, the leaf vegetable studied could constitute for the population an important food supplement, for the fight against protein-energy malnutrition (PRM) and the alleviation of poverty of urban populations.

Keywords: marketing, supply, eating habits, leafy vegetable

1. Introduction
In sub-Saharan Africa, the interest of wild plants in feeding rural populations is widely recognized [1]. Several dietary plant species have been identified and described in both West Africa [2] and Central Africa [3]. In fact, to cover their food needs, rural African populations resort to subsistence farming, supplemented by wild edible species including vegetables. Local leafy vegetables are cheap and easily accessible to many communities in rural, peri-urban and urban areas. These local vegetables are still of particular importance for sub-Saharan countries because cultivated vegetables often cost more on the market [4].
Congo is rich in edible non-wood forest products (NWFP) known and used by local people for several years for self-consumption and marketing. Thus, these resources play an important socio-economic role and contribute to food security and the income generation of the populations. In fact, Non-Timber Forest Products (NTFPs) contribute a good portion to the coverage of the needs expressed. Among Non-Timber Forest Products (NTFPs), *Cuervea isangiensis* play an important role in meeting food needs in the Republic of Congo.
On the other hand, leafy vegetables have rarely been taken into account by these policies despite their role in nutrition security and income generation for vulnerable urban populations [5, 6, 7].
It is in this context that this work aims to show, from this study, the importance of traditional leafy vegetables, particularly *Cuervea isangiensis* leaves, in the fight for food security and the alleviation of poverty among the population. in Congo Brazzaville, compared to other market gardening species, which theoretical profitability makes more attractive.

2. Material and Methods
2.1 Material
2.1.1 Target population
The choice of sellers and the household considered as a statistical unit, allowed to collect desired information (sales Information, sources of supply and consumption of leaves of *Cuervea isangiensis*).

2.1.2 Plant material
The working material consisted of leaves of *Cuervea isangiensis* traditional leafy vegetables consumed in Brazzaville and purchased in the markets of the place.

2.1.3 Teaching materials
The teaching material is summarized in a survey form in the form of questionnaires to the respondent whose answers are noted or checked on the form by the interviewer. This form is composed of open questions and closed questions. The main points of this sheet are: general information of the sellers, composition of the household, sale of the leaves of *Cuervea isangiensis*, preference of sale of the leaves of *Cuervea isangiensis*, means of transport, frequency and the profitability of sale, and some parameters of consumption.

2.2 Methods
2.2.1 Survey in the markets
The survey was conducted in the districts of Brazzaville for this leaf vegetable in August of 2017 by students of Master1 of the Faculty of Science and Technology of the University Marien NGOUABI. This is a marketing survey of the leaves of *Cuervea isangiensis* on a population of 100 sellers in the markets of nine districts of Brazzaville. The survey is cross-sectional, with a three-stage survey for the enumeration of Counts of Enumeration. The investigation was conducted in such a way that an investigator was assigned to work with all the vendors of *Cuervea isangiensis* leaves within the geographic area of all Enumeration Areas. For each registered salesperson, the investigator had the task of evaluating the sale of these sheets.
The marketing questionnaires were submitted to people who usually sell *Cuervea isangiensis* leaves in local markets. The interviews were conducted possibly in the official language (French) or in national languages (Lingala and Kutuba)

2.2.2 Household survey
The household survey was conducted in the districts of Brazzaville and other localities (mouyondi, kayis) in the same period. This is a consumption survey of *Cuervea isangiensis* leaves on a population of 100 households.
For each household surveyed, the task of the enumerator was to evaluate the consumption of these sheets, only one consumer was questioned; the consumer questioned was designated by the person who usually takes care of the meals.

2.2.3 Sample size
The proportion of sellers and households not being known. The size of the sample was carried out by a two-stage draw, the first concerned the Enumeration Area and the second concerned the market and households. The sample provided a reasonable indication of the sale and consumption of leafy vegetables of *Cuervea isangiensis*. The number of sellers and households selected is based on the demographic weight of each Enumeration Area (EA). In practical terms, the daily capacity of a team was set at twenty vendors or households to accommodate the investigator's travel, capacity and workload. At the end of this process, the sample size was 100 (sellers as households).

2.2.4 Conduct of the investigation
The first task was to check the section maps containing the Enumeration Areas, as far as possible, in order to know the place of work. At the end of this review and verification, the survey was conducted in such a way that an investigator was assigned to work with all markets and households in the geographical area covering all Enumeration Areas.
For each household and for each identified market, the interviewer was tasked with assessing the household and market characteristics, the supply, storage or storage of *Cuervea isangiensis* leaves, as well as the sale and consumption of these leaves.

Statistical Analysis: it was done from Excel 2007 and Epi info 6. The student or comparison test was used. It makes it possible to decide whether the difference observed between the two movements is attributable to a systematic cause or whether it can be considered as the effect of a fluctuation due to chance.

3. Results
3.1 Commercialization of the leaves of *Cuervea isangiensis*
3.1.1 General Information.
Table 1, shows the results concerning the general information of the sellers of *Cuervea isangiensis* leaves. Three parameters are observed namely: marital status, the age of the sellers and the level of education. This table shows the following observations:
Regarding the marital status of the traders of *Cuervea isangiensis* leaves; single people (52.0%) dominate followed by married couples (32.0%). The age group most represented for the sellers of *Cuervea isangiensis* leaves is between 36 and 41 years old (22.0%); followed by that between 42 and 47 years (18.0%), with P <0.001. The most represented level of education for the sellers of these sheets is that of Secondary Cycle One (78.0%), followed by Primary (22.0%). The Student Test reveals a very significant difference. P <0.001.
The class of three people living in households dominates with a frequency of 24%, followed by that of five people in households (20.0%), and finally those of 2 persons and 6 persons in the household with frequencies 18.0 and 12.0% respectively. The other classes are poorly represented. The difference is very significant, P <0.001.

Table 1: General information of sellers

Parameter	Variable	Effective	Frequency (%)	significance, P
Marital status	Married	32	32,0	**p<0,001**
	free Union	4	4,0	
	Single	54	54,0	
	Divorced	4	4,0	
	Widower	8	8,0	
Age of sellers	18-23	2	2,0	**p<0,001**
	24-29	6	6,0	
	30-35	12	12,0	

	36-41	22	22,0	
	42-47	18	18,0	
	48-53	14	14,0	
	54-59	12	12,0	
	60-65	2	2,0	
	≥ 65	12	12,0	
Level of education of sellers	Primary	22	22,0	p<0,001
	Secondary 1st	78	78, 0	
	cycle	20	20	
	Second cycle	2	2,0	
	Superior			
How many people live in the household	2 persons	18	18,0	p<0,001
	3 people	24	24,0	
	4 people	14	14,0	
	5 people	20	20,0	
	6 persons	12	12,0	
	7personnes	4	4,0	
	> 7 people	8	8,0	

3.1.2 Preference and frequency of sale of *Cuervea isangiensis* leaves

Table 2, provides information on the choice of selling *Cuervea isangiensis* leaves in the city of Brazzaville.

This table shows that 72% of traders prefer to sell the leaves of *Cuervea isangiensis* because they yield profits, with a very significant difference, P < 0.001. For the sale of *Cuervea isangiensis* leaves, 34.0% of the traders invested a sum of 5000Fcfa. This sale of leaves is irregular in the week with a frequency of 52%. According to the sellers' opinions the last sale was yesterday with a proportion of 18, %. Most of the sellers of this leafy vegetable (74%) explain this irregularity by the dry season.

Table 2: Preference and frequency of sale of Cuervea *isangiensis* leaves

Parameter	Variable	Effective	Frequency (%)	significance, P
Why is your business focused on selling leaves rather than other things?	beneficial	72	72,0	p< 0,001
	harvester	22	22,0	
	Other	6	6,0	
How much money did you get the last time you sold the leaves of Cuervea isangiensis	beneficial	72	72,0	p< 0,001
	harvester	22	22,0	
	Other	6	6,0	
How much did you invest for this activity	3000fcfa	30	30,0	p< 0,001
	4000fcfa	28	28,0	
	5000fcfa	34	34,0	
	10000fcfa	2	2,0	
	Autres	6	6,0	
Why	Available	80	80,0	p< 0,001
	Accessible	20	20,0	
Frequency of sale of cuervea *isangiensis* leaves				
Do you usually sell Cuervea isangiensis leaves?	Yes	96	96,0	p<0,001
	No	4	4,0	
Did you sell Cuervea Isangiensis leaves this week	Yes	48	48,0	p<0,001
	No	52	52,0	
When did you make the last sale	Yesterday	18	18,0	p<0,001
	Yesterday	8	8,0	
	3 days	14	14,0	
	7 days	14	14,0	
	14 days	6	6,0	
	30 days	12	12,0	
	Other	28	28,0	
Does sales frequency remain nearly constant throughout the year	Yes	2	2,0	p<0,001
	No	96	96,0	
	Do not know	2	2,0	
If no, specify the period, causes and nature of variations	Do not know	2	2,0	p<0,001
	Dry season	74	74,0	
	Slaughter of forests	20	20,0	
	No truck	2	2,0	
	Other	2	2,0	

3.1.3 Modalities of sale and means of transport of leaves of *Cuervea isangiensis*

Table 3 provides information on the sales and transport modalities of *Cuervea isangiensis* leaves.

The results in this table show that the leaves of *Cuervea isangiensis* are sold in piles with a proportion of 54.0%. The sale of ten (10) average packets of *Cuervea isangiensis* leaves per week is reported by 20.0% of respondents, followed by 5 piles of *Cuervea isangiensis* leaves with a frequency of 16.0%. The Student Test reveals a very significant difference, P<0.001.

In terms of transport, 56% of respondents reported that *Cuervea isangiensis* leaves are trucked to urban centers and 36% of vendors use other means of transport. 24% of sellers make two trips a week to obtain *Cuervea isangiensis* leaves. 98% of the respondents say that these leaves come very often from the villages.

Table 3: Modalities of Sale and means of transport of leaves of Cuervea isangiensis

Parameter	Variable	Effective	Frequency (%)	significance, P
In what form are they sold?	heap	54	54,0	p<0,001
	Package	46	46,0	
How much leaves of Cuervea *isangiensis* do you sell on average each week	10tas	10	10,0	p<0,001
	5tas	16	16,0	
	5paquets	20	20,0	
	2paquets	8	8,0	
	3paquets	14	14,0	
	1paquet	6	6,0	
	6tas	10	10,0	
	10paquets	16	16,0	
Means of transport of cuervea isangiensis leaves				
Which means of transport do you use to sell your leaves of Cuervea *isangiensis* to Brazzaville?	Truck	56	56,0	p<0,001
	Canoe	2	2,0	
	Foot	6	6,0	
	Other	36	36,0	
What is the number of trips you make	Other	48	48,0	p<0,001
	1 trip per week	16	16,0	
	2 trips a week	24	24	
	2 trips per month	2	2,0	
	4 trips per month	6	6,0	
	Several trips a year	4	4,0	
Where did the leaves come from?	District	2	2,0	p<0,001
	Town	98	98,0	

3.1.4 Economic modality

Table 4 shows that all the respondents did not only sell *Cuervea isangiensis* leaves as the main activity (100%). the sale of the leaves is not sufficient to meet the needs with a frequency of 96% of which the difference is very significant, p<0.001. To cover household needs, sellers associate other foodstuffs with the sale of these leaves, such as bananas (24%) and other foods (18%).

Table 4: Profitability of the sale of Cuervea *isangiensis* leaves

Parameter	Variable	Effective	Frequency (%)	significance, P
Is the sale of Cuervea *isangiensis* leaves your main source of income?	No	100	100,0	P<0,001
Do you think that the sale of Cuervea isangiensis leaves is sufficient to meet your household expenses?	Yes	4	4,0	p<0,001
	No	96	96,0	
If no, how do you cover your household expenses?	Sale of bread	2	2,0	p<0,001
	Banana sale	24	24,0	
	Sale of tubers	8	8,0	
	Cassava sales	18	18.0	
	Fish sale	12	12,0	
	Sale orange	18	18,0	
	Other	18	18,0	

3.1.5 Consumption Survey

The results of the consumption survey of *Cuervea isangiensis* leaves are presented in Tables V, VI, VII.

The results of Tables V and VI show that *Cuervea isangiensis* (De Wild) N. Hallé is known south and north of Brazzaville with 63.0% and 69% respectively.

40% of households surveyed south of Brazzaville consume this leaf vegetable with a highly significant difference, P<0.001. The inhabitants of the boroughs of northern Brazzaville, although the plant is known, consumption remains low, 16%.

In households where *Cuervea isangiensis* (De Wild.) N. Hallé is consumed, 67% of people south of Brazzaville prefer this leaf vegetable compared to Gnetum africanum. In Brazzaville

this leaf vegetable is prepared in 96% broth sauce in the south and 91% in the north of Brazzaville.

The frequency of consumption is slightly above average in the southern part (55%) and remains low in the north, where 92% of surveyed households rarely consume this vegetable.

In other localities such as mouyondi and kayis (Table 3), the population is aware of this leafy vegetable (94%): *Cuervea isangiensis* (De Wild) N. Hallé, of which 87% of the surveyed population consume it often with peanut paste. In these localities, the frequency of consumption is somewhat considerable, where 35% of surveyed households consume *Cuervea isangiensis* once a week (De Wild.) N. Hallé and 34% of households consume them often, with a highly significant difference P < 0,001.

Table 5: Knowledge, consumption, choice of vegetables and frequency of weekly consumption of cuervea *isangiensis* south of Brazzaville

Parameter	Variable	Effective	Frequency (%)	significance, P
Knowledge of the plant	Yes	63	63,0	p<0,001
	No	37	37,0	
Consumption of leaves	Yes	40	40	p<0,001
	No	60	60	
Method of preparation	Peanut paste	4	4	
	Broth	96	96	p<0,001
	Palm juice		0	
Choice of Vegetable	Cuervea *isangiensis*	33	33	p<0,001
	Gnetum *africanum*	67	67	
Frequency of Consumption	Once a week	2	2	p<0,001
	Twice / week	55	55	
	Often	0	0	
	Rarely	43	43	

Table 6: knowledge, consumption, choice of vegetables and frequency of weekly consumption of cuervea isangiensis north of Brazzaville

Parameter	Variable	Effective	Frequency	significance, P
Knowledge of leaves	Yes	68	68	p<0,001
	No	32	32	
Consumption of leaves	Yes	16	16	p<0,001
	No	84	84	
Method of Preparation	Peanut paste	7	7	p<0,001
	Broth	91	91	
	Palm juice	2	2	
Choice of Vegetable	Cuervea isangiensis	10	10	p<0,001
	Gnetum africanum	90	90	
Frequency of Consumption	Once a week	1	1	p<0,001
	Twice / week	7	7	
	Often	0	O	
	Rarely	92	92	

Table 7: Knowledge, consumption, choice of vegetables and frequency of weekly consumption of cuervea *isangiensis* in other localities of Congo

Parameter	Variable	Effective	Frequency	significance, P
Knowledge of leaves	Yes	94	94	p<0,001
	No	6	6	
Consumption of leaves	Yes	92	92	p<0,001
	No	8	8	
Method of Preparation	Peanut paste	87	87	p<0,001
	Broth	12	12	
	Palm juice	1	1	
Choice of Vegetable	Cuervea *isangiensis*	51	51	p<0,001
	Gnetum *africanum*	49	49	
Frequency of Consumption	Once a week	35	35	p<0,001
	Twice / week	17	17	
	Often	34	34	
	Rarely	17	17	

4. Discussion

Numerous ethnobotanical studies in tropical Africa have shown the importance of wild edible plants (vegetables and fruit) in the diet of rural populations [8, 9]. During events of joy, the vegetable is much solicited by the organizers in order to respect the mores. Congo is a country with fertile soil, which facilitates the germination and growth of its shrubs and herbs that the Congolese likes to consume. In the basket of the

housewife vegetables are not lacking whatever its form and its use in the kitchen (food preparation). Thus, the results of this evaluation highlight the following elements:

The marketing of leafy vegetables is exclusively reserved for women, but the income from their sale is intended for the needs of the whole family [10].

The trade in *Cuervea isangiensis* leaves is more exercised by educated singles whose age is between 36-41 years and managing a household of at least 04 people. The sale of *Cuervea isangiensis* leaves is not a lucrative main activity, the women next to these leaves of *Cuervea isangiensis* sell banana (24%), and other commodities (18%). These women associate their sale with the leaves of *Cuervea isangiensis* in order to answer to the small conjugal need, at the expense of the ticket of the city hall. This argument was supported by: Batawila *et al* [11], according to which "local leafy vegetables are more of a particular source of income for Sub-Saharan countries because they often cost more on the market". The sale of *Cuervea isangiensis* leaves is beneficial (72.0%). Thus, "in addition to their nutritional importance, leafy vegetables have a significant economic and social value because of their relatively low cost and the speed with which they are prepared," Gupta and Wagle said [12].

The season and the means of transport define the availability of leaves of *Cuervea isangiensis* in the markets, the quantities of the leaves produced do not answer to the demand of the sellers. This information received during the surveys is supported by Assogbakomlan *et al*. [13] who report that in sub-Saharan Africa, these plants feed local but also regional markets.

Eating habits differ by household, ethnicity, and social category. The results of this study highlight the following: *Cuervea isangiensis* (De Wild.) N. Hallé is known and more consumed in other localities than in Brazzaville. In Brazzaville, the lack of knowledge of this plant in the northern part could be explained by the eating habits of these areas, which are generally based on meat and fish than other cities or savanna regions.

The population of Brazzaville uses as a method of preparation of this vegetable the "broth" than the peanut paste mode preferred in other localities. According to Bettencourt and Konopka [14], many species of leafy vegetables traditionally consumed are still under exploited. The International Plant Gentic Resources Institute (IPGRI) is trying to safeguard this diversity in Africa by promoting the use of these species. This is why the maintenance of traditional cuisine represents an economic but also strategic and ecological means [15].

The consumption of leaves of Gnetum africanum in comparison with those of *Cuervea isangiensis* by the population of Brazzaville is a preference that emanates from their eating habit with respect to Gnetum africanum, a leafy vegetable that is widely consumed in Congo [16].

The frequency of consumption of *Cuervea isangiensis* is high, with 55% of households south of Brazzaville consuming twice the week of *Cuervea isangiensis* leaves compared with 35% of households surveyed in other localities consuming it once. This statement is encouraged by some authors: Tirilly *et al*. [17] and FAO [18] suggest that "leafy vegetables, whether wild or cultivated, from lianas, tubers or trees, also provide populations that have very little meat or fish, essential proteins, especially for pregnant or breastfeeding women, and for young children or during growth.

The low frequency of consumption observed in southern Brazzaville is linked to the scarcity of this vegetable during the dry season, during which this survey took place.

5. Conclusion

The leaves of *Cuervea isangiensis* is a green leafy vegetable, sold in the Brazzaville markets in heaps and packets, could constitute for the population an important food supplement, for the alleviation of the poverty of the urban populations. Consumed in some households, these leaves are a good food for the fight against protein-energy malnutrition (PM). However, this leafy vegetable is not yet widely known by the population with regard to Gnetum africanun.

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