Uses of Non-Timber Forest Products exploited by the populations of Dibombari and Pouma, two localities of the Littoral region (Cameroon)

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ABSTRACT
Objective: In Cameroon, Non-Timber Forest Products (NTFPs) play an important part in the life of local communities, providing them with food and subsistence income. The objective of this study was to determine the uses of NTFPs exploited by the populations in two peri-urban localities of the Littoral region. *Methodology and results*: The works consisted of ethnobotanical surveys of households in the localities of Dibombari and Pouma. The interviews were carried out with men and women, with a minimum age of 21 years old. The interviews were carried out with men and women, with a minimum age of 21 years old, and concerned the identification of NTFPs and their uses. At the end of these surveys, 96 species belonging to 87 genera and 44 families were identified, 70 species in Dibombari and 62 species in Pouma. *Gnetum africanum, Haumania danckelmaniana, Ageratum conyzoides,* were the commonest species in Dibombari, and *Ageratum conyzoides, Enantia chlorantha, and Spondias dulcis* in Pouma. Six types of uses were recorded, traditional medicine, food uses, Packaging, Artisanal, socio-cultural and firewoods. The parts of plant most cited were leaves (38.92%) and the whole plant (23.95%) in Dibombari, and fruits (27.41%) and leaves (24.78%) in Pouma.
Conclusions and application of findings: Types of uses of NTFPs providing species play an important rolein their avaibility. Thus, it would be judicious initially, to recommend eth popularization of the techniques of conservation of the plants with multiple uses to ensure the avaibility of these NTFPs in the study areas. Sustainable agriculture and effective conservation should be considered to promote and sustain the exploitation of NTFPs in both localities. In addition, the domestication and maintenance of some species on farms should be considered by the population.
Keywords: Conservation; Dibombari; Ethnobotanical survey; Pouma; Uses of plants.

INTRODUCTION

Tropical forests are natural resources abounding in a diversity of plant species that peoples use extensively for their daily needs for food, medicine, crafts, fodder, as well as for construction and energy (Traoré *et al.,* 2019). The Congo Basin is the second largest tropical forest ecosystem after the Amazon, relatively, preserved; it plays an important role in the regulation of the continental and global climate system (Baptiste Marquant *et al.,* 2015). Cameroonian forests, which are an integral part of this "hotspot", cover approximately 22.5 million hectares or 48% of the national territory (Fongnzossie *et al.,* 2014). They harbour a significant diversity of flora and fauna, which provide nearly eight million poor Cameroonians living in rural areas with important nutritional resources, traditional medicines, household energy and building materials (Kengne *et al.,* 2018). These forests also fulfil essential social and cultural functions for local and indigenous populations, thus contributing to their diet (Nasi *et al.,* 2011; De Wasseige *et al.,* 2014). The rural and urban populations of Cameroon are highly dependent on forest resources and particularly on Non-Timber Forest Products (NTFPs), as these contribute significantly to food security, nutritional balance and environmental objectives (conservation of biodiversity) (Melingui *et al.,* 2018). According to Nnanga *et al.* (2017), 80% of the population uses resources forests for health care and food. In addition, the development of NTFPs at the local level makes it possible to diversify the products from the surrounding forests, thus allowing the development of income-generating activities for the local population (CTFC, 2011). However, given the multiple importance of NTFPs, which place populations at the center of decisions in the development and conservation of plant resources, it is necessary to assess the knowledges of the populations. Indeed, according to (Vall and Diallo, 2009) local knowledge refers to the way a society thinks about and experiences its environment, how it practices its environment, its ecological space. In fact, according to (Vall and Diallo, 2009) local knowledge refers to the way a society thinks about and experiences its environment, how it practices its environment, its ecological space. Despite the growing interest of scientists in recent years on plant biodiversity, there is very little information on the inventories, uses and mode of exploitation of NTFPs of plant origin in peri-urban areas, real buffer zones between towns and rural areas. This study therefore aims to determine the uses of NTFPs in two peri-urban localities in the Littoral region.

MATERIAL AND METHODS

Study Areas description: Dibombari (Latitude, 4°10'43'' N ; Longitude, 9°39'21''E ; altitude, 57m) has a dry and humid equatorial type climate with two seasons, namely a dry season from mid-november to the end of March and a rainy season from the end of March to mid-November. The temperature generally ranges from 23°C to 33°C. The average annual rainfall amounts to 2402.8 mm. The population is approximately 4810 people. Pouma (Latitude, 3°51'0"N ; Longitude, 10°31'0"E ; Altitude, 157m) has a Guinean-type equatorial climate with four seasons: a long dry season from December to mid-march with high temperatures in march and April of 27° C on average; a short rainy season from mid-march to mid-June with rainy but often hot days; a small dry season which runs from mid-June to mid-September. The average annual temperature is between 22 and 26°C and the average annual rainfall is 2500 mm. The population is approximately 13475 people.

Methodology: The study was conducted in the period from June to December 2019. The "snowball" type surveys were carried out with

actors in the NTFP sector. Data collection was done using the semi-structured individual survey method, using an open and closed questionnaire (Kouakou, 2019). Questionnaires were administered to the people, of all sexes, and aged at least 21 years. A total of 126 people were interviewed, 77 in Dibombari and 49 in Pouma. Information about the plants species, their uses, the parts of the plant used and the harvesting methods were collected. Botanical specimens were collected directly in the field with local guides. The identification of the specimens was done « in situ », based on the works of Ladoh-Yemeda *et al*. (2016) and continued at the National Herbarium of Cameroon. Data were recorded on a spreadsheet and analysed using GraphPad Prism 8.0.1 and Xlstat 2022.1.2.1236 software.

RESULTS

Socio-demographic characteristics of respondents: Figure 1 shows the proportions of respondents among the 126 people of both arrondissements. In Dibombari, women were majority (62%), against 38% of men. In Pouma on the other side, a dominance of men (51%) was observed, compared to women (49%). The age group [21-40] was the most represented (51%) followed by [41-60] (42%) at Dibombari. People aged over 60 were the least represented (7 %). 41-60 years recorded 53 % of the followed by [21-40] with 45 %, and over 60 years were 2 % of the Pouma's population.
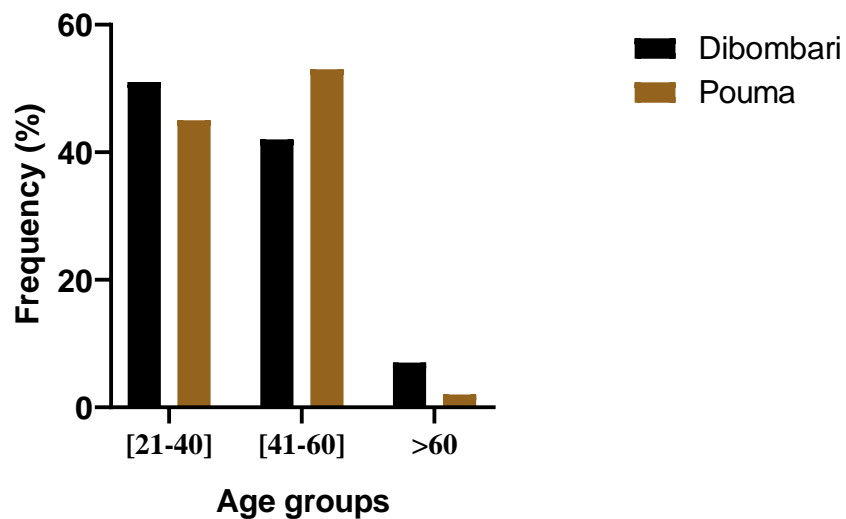


Figure 1: Age groups of respondents.

In Dibombari, 4 ethnic groups were interviewed: Sawa'a was the most dominant group (75%), followed by Bamileke (12%), Bamenda (5 %) and Bassa (4 %). Pouma was more represented by Bassa group (88%), followed by Bamenda and Bamileke (4% respectively). The least represented are Bafia and Sawa (2%).

Diversity of NTFPs exploited : A total of 96 species of NTFPs in 846 citations were identified after investigations, belonging to 87 genera and 44 families. Asteraceae was the family with the higher number of species (s = 10 species), followed by Euphorbiaceae and Lamiaceae with 6 species. Dibombari recorded a higher number of species (s = 70 species) than Pouma, with 62 species (Figure 2). The families who occurred in Dibombari were Asteraceae (8 species), *Fabaceae* (5 species) and *Lamiaceae* (4 species). In Pouma,

Asteraceae (6 species) were the most diverse, followed by *Lamiaceae* and *Zingiberaceae* with four species (Figure 2). The most cited species in Dibombrai were *Gnetum africanum* (10.9%), *Haumania danckelmaniana* (8.2%) and *Ageratum conyzoides* (7.8%). *Ageratum conyzoides* (6.4%), *Enantia chlorantha* (5.4%) and *Spondias dulcis* (4.8%) were the most cited species in Pouma. (Table 1)
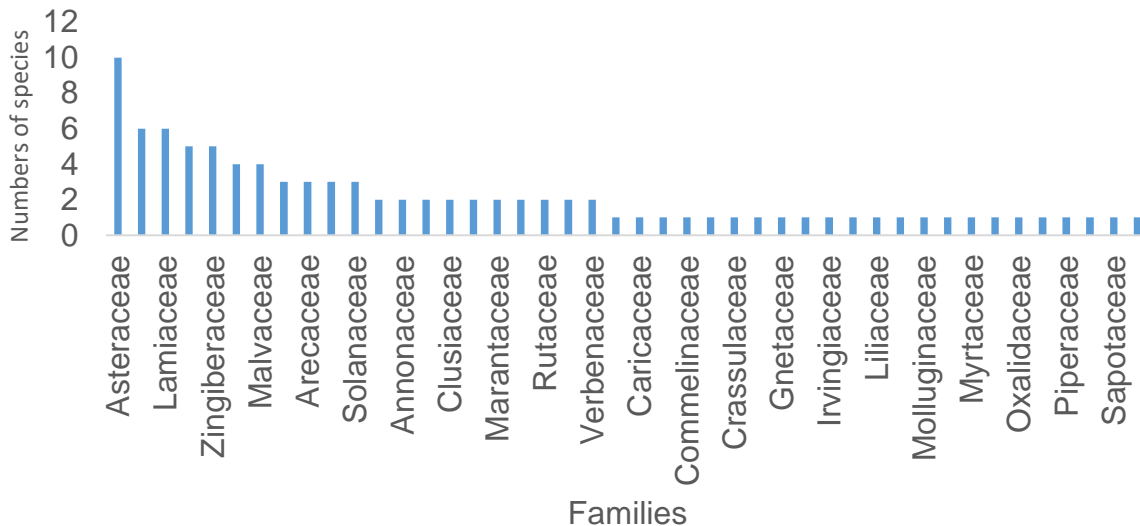
Figure 2: Specific richness of the families

Table1: Plant species use in the studies areas

Species	Common/Local Names	Families	Frequency of citation in Dibombari	Frequency of citation in Pouma
Abelmoschus esculentus	Okra	*Malvaceae*	0.21	-
Acmella caulirhiza	Chickens eyes	*Asteraceae*	0.62	-
Aframomum citratum	Mbongo (Bassa'a), Mbongolo (Duala)	*Zingiberaceae*	-	1.69
Aframomum meleguetta	Ndong (Ewondo)	*Zingiberaceae*	0.21	1.69
Aframomum sp.	Ndong bahon (Bassa)	*Zingiberaceae*	-	1.01
Afrostyrax lepidophyllus	Dom (Bassa'a)	*Huaceae*	-	0.34
Afzelia bipindensis	Night poison	*Fabaceae*	0.62	
Ageratum conyzoides	King of herbs, katoro (Bassa'a)	*Asteraceae*	7.88	6.42
Alafia multiflora	Nyamamoto (Duala)	*Apocynaceae*	0.62	-
Alchornea cordifolia	Dibobondji (Duala)	*Euphorbiaceae*	1.87	-
Aloes vera	Aloes vera	*Aloecaceae*	0.41	-
Alstonia boonei	Emien, Kokmol (BAssa'a)	*Apocynaceae*	-	1.69
Ananas bracteatus	Wild pineapple	*Bromeliaceae*	0.41	-
Annona muricata	Soursop	*Annonaceae*	0.41	-
Anthocleista schweinfurthii	Bopolopolo (Duala)	*Loganiaceae*	2.70	1.01
Asystasia gangetica	Chenise violet	*Acanthaceae*	-	0.68

Baillonela toxisperma	Moabi	*Sapotaceae*	-	0.68
Bidens pilosa		*Asteraceae*	0.41	0.68
Bryophyllum pinnatum	Edibedibe	*Crassulaceae*	1.04	-
Canarium schweinfurthii	Aielé, african elemia	*Burseraceae*	0.62	1.01
Capsicum frutescens	Loba massi(Duala)	*Solanaceae*	0.41	1.69
Carica papaya	Papaya	*Caricaceae*	0.41	1.35
Ceiba pentandra	Djom (Bassa'a), Cheese maker	*Bombacaceae*	0.41	3.38
Chromolaena odorata	Mbimba (Bassa'a), Kondengui (Duala)	*Asteraceae*	1.66	2.36
Citrus lemon	Lemon	*Rutaceae*	-	1.69
Cocos nucifera	Mbondo (Bassa'a), coconut tree	*Arecaceae*	-	0.34
Cola nitida	Cola	*Sterculiaceae*	0.62	0.34
Cola pachycarpa	Mokey's cola	*Sterculiaceae*	1.66	-
Commelina benghalensis	Musa loba (Duala)	*Commelinaceae*	0.62	-
Corchorus olitorius	Kelenkelen (Duala)	*Malvaceae*	0.41	-
Costus afer	Costus	*Costaceae*	-	1.35
Coula edulis	Noisette	*Olacaceae*	0.83	1.35
Cymbopogon citratus	Makaï (Bassa'a)	*Poaceae*	-	1.35
Dacryodes edulis	Sa'a (Bassa'a),	*Burseraceae*	1.24	2.70
Diospyros crassiflora	Ebene	*Ebenaceae*	0.21	-
Dissotis rotundifolia	Dissotis	*Melostomataceae*	0.21	0.34
Elaeis guineensis	Lihend (Bassa'a); Nut palm	*Arecaceae*	5.19	3.72
Emilia coccinea	Wô go lomg (Bassa'a); Toy lambo (Duala)	*Asteraceae*	1.45	1.01
Enantia chlorantha	Moambé jaune	*Annonaceae*	0.62	5.41
Eremomastax speciosa		*Acanthaceae*	1.86	1.35
Erigeron floribundus	Sida bâ kouri (Bassa'a)	*Asteraceae*	-	1.01
Euphorbia sp.	Euphorbe	*Euphorbiaceae*	0.41	-
Fagara heitzii	Olon (Bassa'	*Rutaceae*	-	0.34
Garcinia kola	Onié; bitter cola	*Clusiaceae*	2.97	2.03
Garcinia lucida	Essok (Ewondo)	*Clusiaceae*	-	0.34
Gnetum africanum	Okok	*Gnetaceae*	10.99	4.39
Guibourtia tessmannii	Bubinga	*Fabaceae*	-	1.69
Haumania danckelmaniana	Mbendoban (Duala)	*Maranthaceae*	8.30	1.01
Ipomea sp.	Ipomea	*Convolvulaceae*	0.41	-
Irvingia gabonensis	Andok (Ewondo); Doga (Basa'a)	*Irvingiaceae*	6.22	4.39
Justica secunda		*Acanthaceae*	1.24	0.34
Lantana camara	Mbodja satan (Duala)	*Verbenaceae*	0.62	-
Laportea ovalifolia	Tolabandji (Duala)	*Urticaceae*	0.62	-
Lippia sp.	Ebandadjéka(Duala)	*Verbenaceae*	-	2.03
Macaranga spinosa	Boboya (Bassa'a)	*Euphorbiaceae*	-	1.01

Mangifera indica	Djandolo (Bassa'a), Mango (Duala)	*Anacardiaceae*	1.45	2.03
Manihot esculenta	Cassavas	*Euphorbiaceae*	0.41	-
Megaphrynium macrostachyum	Biogland (Duala); Okié (Ewondo)	*Marantaceae*	2.70	1.35
Mimosa pudica	Mukoyo musadi (Duala)	*Mimosaceae*	0.41	-
Mollugo nudicaulis	Water leaf	*Molluginaceae*	1.66	1.35
Monodora myristica	Pèbè (Duala); Nding (Ewondo)	*Annonaceae*	0.62	0.34
Musanga cecropioides	Parassolier	*Cecropiaceae*	0.41	0.34
ocimum canum	Kotimadjo (Bassa'a)	*Lamiaceae*	-	1.01
Ocimum gratissimum	Macepo	*Lamiaceae*	-	3.04
ocimum sp.	Email (Duala)	*Lamiaceae*	1.04	-
Ocimun basilic	Basilic	*Lamiaceae*	4.56	-
Oxalis barreleris	Oxalis	*Oxalidaceae*	-	1.01
Passiflora foetida	Nyangala (Duala)	*Passifloraceae*	0.62	0.66
Persea americana	Piya	*Lauraceae*	0.41	1.01
Picralima nitida	Kinkeliba	*Apocynaceae*	0.83	1.35
Piper nigrum	Poivre	*Piperaceae*	-	1.35
Piptadeniastrum africanum	Bokombolo (Duala)	*Mimosaceae*	0.21	-
Platostoma africanum	Ewouda beer (Duala)	*Lamiaceae*	1.24	-
Poa annua	Gazon	*Poaceae*	0.41	-
Portulaca oleracea	Nyukutu (Duala)	*Portulaceae*	0.21	-
Psidium goyava	Guava	*Myrtaceae*	1.24	0.68
Pterocarpus soyauxii	Padouk	*Fabaceae*	0.21	-
Pycnanthus angolensis	Bokonda (Duala)	*Myristicaceae*	0.21	-
Raphia hookeri	Mbaï (Duala); Raphia	*Arecaceae*	3.53	2.36
Ricinodendron heudelotii	Djansang	*Fabaceae*	1.45	3.04
Scoparia dulcis	Scoparia	*Plantaginacea*	-	0.66
Scorodophloeus zenkeri	Ohmi (Bassa'a)	*Caesalpiniaceae*	-	1.35
Senna alata	Longkanä (Bassa'a);	*Caesalpiniaceae*	2.49	2.36
Solanum macrocarpon	Nkeya	*Solanaceae*	0.41	0.34
Solenostemon monostachyus	Dimayn (Duala); mbonyo'o (Bassa'a)	*Lamiaceae*	0.21	2.03
Spondias dulcis	Cassimango	*Anacardiaceae*	0.83	4.73
Stachytarpheta urticifolia		*Verbenaceae*	0.21	-
Stevia rebaudiana		*Asteraceae*	0.62	-
Terminalia catappa	Banga dibango	*Combretaceae*	0.41	-
Tetrapleura tetraptera	Essèssè	*Fabaceae*	1.45	-
Vernonia amygdalena	Ndolet	*Asteraceae*	2.07	0.68
Vernonia stellulifera	Muwiso musadi (Duala)	*Asteraceae*	0.41	-
Voacanga africana	Itoué (Bassa'a)	*Apocynaceae*	-	0.34
Zingiber officinalis	Djindja	*Zingiberaceae*	-	1.35

Types of NTFP uses: A total of six main plant uses were identified by the respondents. In Dibombari, Traditional medicine was recorded 48% of the citations, Food uses 36 %, packaging 10 %, artisanal and socio-cultural were recorded 3% respectively . Regarding Pouma, Medicinal use was the most cited (55%), followed by Food use 36%. The less cited were artisanal, socio-cultural, packaging and firewood with respectively 4%, 3%, 2% and 1%. (Figure 3).
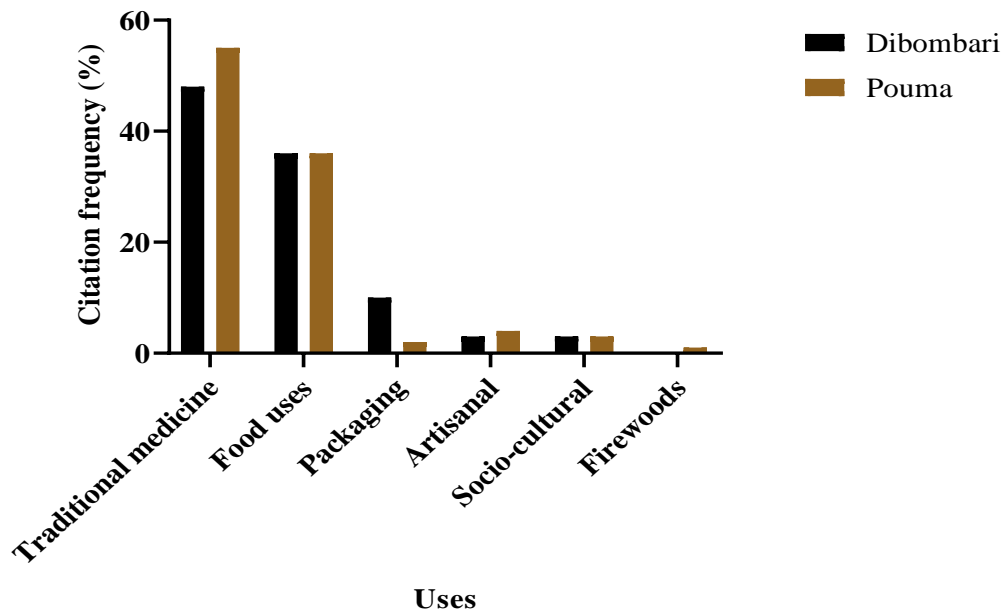

Figure 3: Non-Timber Forest Products listed according to the main types of use in the study

NTFPs management

Parts of the plant used : In Dibombari, the most cited part of plant was Leaves (38.92 %), Whole plant (23.95%), and Fruits (16.17%). Other parts such as Barks, Kernels, Seeds, fibres, Exudate and root had a little number of citations. In Pouma, Fruit was the most cited part (27.41%) followed by Leaves (24.78%) and Bark (16.91%) of citations. Whole plant, Kernel, Fibres and Seeds, Exudate, Stem, Rhizome and Root has the less number of citations (Figure 4).
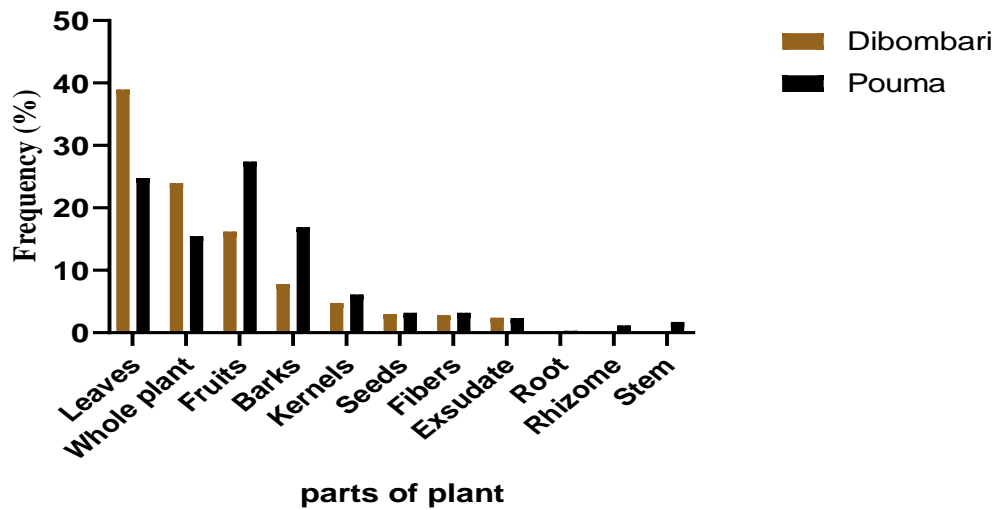
Figure.4: Proportion of plant organs removed by the population of Dibombari and Pouma

Harvesting methods of NTFPs: Four main methods of harvesting the NTFP resourced have been identified in the two study areas. In Dibombari, Sectioning (47.51%) was the most cited method, followed by Uprooting (24.25%), Pick-up (20.28%) and Debarking (7.95%). In Pouma, the main modes of organ removal were Sectioning (45.48%), Gathering (20.70%), Debarking (17.20%) and Uprooting (16.62%) (Figure 5).
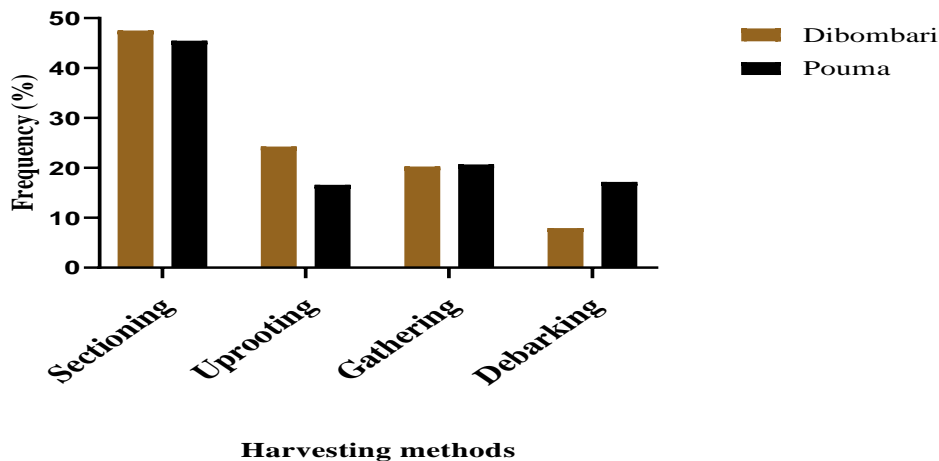
Figure 5: Method of harvesting plant organs in the study areas

DISCUSSION

Diversity of NTFPs exploited in the study areas: Non Timber Forest Products are an important source of supply for the populations of Dibombari and Pouma. Ethnobotanical surveys revealed that among the respondents from Dibombari, women overpassed men, and in Pouma, proportions of both sexes were closed. This means a better knowledge of the people of Pouma of the uses of plants. Kouakou (2019) pointed out that men are more willing to provide information on the use of NTFP source species than women. The high proportion of women corroborates the work of Nnanga *et al.* (2017) who pointed out that

women and children are the most involved in the collection of NTFPs because their exploitation is informal. A total of 96 plant species of NTFPs were identified during this study. Kouakou *et al.* (2017) and Tiébré *et al.* (2016) worked respectively in the Centre-West and Korhogo in Côte-d'Ivoire found 134 and 127 species exploited by the populations.

Types of NTFP uses: Many plants uses were found in the localities after the investigations. They reflect the level of knowledge of these plant resources and their importance. Six categories of uses of NTFPs were identified after the study, traditional medicine, food uses , packaging, artisanal, socio-cultural and firewood and. Nnanga *et al.* (2017) found four categories (Food, Traditional medicine, Traditional rites and Firewood) in of Yabassi and Mouanko localities. The populations of Dibombari and Pouma use NTFPs mainly for medicinal purposes. The work of Hadonou-Yovo *et al.* (2019) have also been pointed out that the populations of the Mono Biosphere Reserve (Benin) exploit NTFPs for the treatment of pathologies (malaria, anaemia, cough, jaundice, cardiovascular diseases). On

the other hand, Nnanga *et al.* (2017) have shown that it is food use that is valued by populations. According to Kouadio *et al.* 2020), medicinal plants represent a precious wealth for the vast majority of rural populations in Africa, where more than 80% of the population uses them to guarantee health care.

Methods of harvesting NTFPs: The harvesting method used by the population of Dibombari was mainly Uprooting, while in the locality of Pouma. Sectionning was the method of harvesting most cited by the populations. Monizi *et al.,* 2016 found Uprooting as the second harvesting method besides Gathering in the locality of Ambuila (DRC). In a logic of sustainability, local actors with power and potential can fundamentally contribute to the rational use of ecosystem goods and services of woody species Badjaré *et al.* (2018). It is therefore necessary to raise public awareness of rational techniques for harvesting plant organs in order to ensure sustainable management of these resources that provide NTFPs.

CONCLUSION AND APPLICATION OF RESULTS

The study carried out in the localities of Dibombari and Pouma aimed to identify the different uses of NTFPs exploited by the populations of these two localities. It emerges from this that: Of the 70 species listed in Dibombari*, Gnetum africanum, Haumania danckelmaniana, Ageratum conyzoides* are the most exploited. In Pouma, of the 62 species mentioned, *Ageratum conyzoides, Enantia chlorantha, Spondias dulcis* were the most used. These species are used in traditional medicine, human food and as service products

(artisanal, socio-cultural, packaging and firewood). In both localities, the plants are most exploited for medicinal purposes. Leaves, fruits, and bark are the most consumed organs by the populations of Dibombari and Pouma. The exploitation of NTFPs source species contributes to the well-being of the populations of the study sites. Given the important role that NTFPs play in the daily lives of these populations, programs must be defined for better management and sustainable exploitation.

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