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PLANT USEFUL TO THE INDIGENOUS PEOPLES OF THE LIKOUALA DEPARTMENT, REPUBLIC OF CONGO

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ABSTRACT

Forests are ecosystems with a great diversity of habitats, niches and species. Man as a whole maintains perfect relations with the forest for his vital needs. Carried out in the Likouala forest on an area of 1 ha with the objective of improving knowledge of the plants most used by indigenous peoples, has demonstrated 289 trees with diameters ≥ cm to 130 cm from the ground, belonging to 61 species 55 genera and 31 m families. It reveals that the Sapotaceae and Myristicaceae families are the most used by the indigenous people as well as the species Staudtia kamerunens is. The values of the Shannon and Piélou Equitability indices indicate that the floristic diversity is maximal. The density per hectare is considerable. This study indicates, the natives use much more the parts of the trees as: the stem, the fruits, the bark, latex for their vital needs (construction, pharmacopoeia, food, diverse manufacture) of which the most used part is the bark. It is clearly indicated that the forest is still an essential environment for indigenous people because their lives depend on it.

Keywords: Aboriginal, Forest, Village, tree and diversity.

INTRODUCTION

Humans have various relationships with plants based on their uses (Kumar and Lalramnghinglova, 2011). These relationships may involve medicinal, edible, culturally significant, or artisanal and domestic plants (firewood, charcoal, and construction) (Mutamba, 2007; Ake-Assi et *al.,* 2010; Perumal, 2010). This finding is also very pronounced in Africa, where various ethno botanical studies have revealed that Several sociolinguistic groups have extensive knowledge of endogenous plant use (Dhiman, 1998). This is justified by the fact that due to their agro ecological functions, plants play a very important role in the conservation of water, soil and biodiversity (Boffa, 2000). Paradoxically, despite the importance of these trees, the degradation of ecosystems and species is increasingly noticeable (Assogbadjo et *al.,* 2010) and this, because of climate change, demographic pressure, and anthropic activities that contribute to the loss of these indigenous resources (Dadjo, 2011). This situation which mortgages the future of natural resources in general and those of forest resources in particular, it is urgent to make it a permanent concern because nowadays it constitutes a threat for the existence of species and by ricochet for sustainable development (Dah-Dovonon, 2002). From this gloomy picture, it is imperative to quantify the level of importance and use of local species by indigenous populations. The localized assessment at the scale of Northern Congo is interested in all the species that are part of the woody food species on which sustained attention and priority actions must be carried out on the basis of their socio-economic importance (Kantende et *al*., 1995).

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To achieve these objectives, it is necessary to conduct more ethno botanical studies in order to have a better knowledge of the floristic diversity of the Bangui-Motaba area. In order to achieve these objectives, the project will conduct surveys with local informants to find out which trees are useful to local people and what activities they carry out with the different trees they encounter in their village; reconcile the list of the most commonly used species with the list of species to be protected nationally and internationally (IUCN) in order to verify whether the needs of local people are in line with the various restrictions applied to endangered species. The general objective of this study is to improve knowledge of the plants most used by the indigenous peoples of the Likouala department in general and those of the Mbangui-Motaba village in particular. Specifically, it aims to: 1) determine the diversity of the trees most used by the indigenous people; 2) determine the parts of the trees used as well as their use and 3) evaluate the density per hectare as well as the diametric structure of these trees.

MATERIALS AND METHODS

Presentation of the study area

This study was conducted in the Department of Likouala, Dongou district, more precisely in the village of Bangui-Motaba (Figure 1). This Department occupies almost the entirethe Likouala Department is located in the northern part of the Republic of Congo and covers an area of approximately 64,044 km2 (PAM, 2009). Geographically, the Likouala Department is bordered to the north by the Central African Republic, to the south by the Cuvette Department, to the west by the Sangha Department and to the east by the Oubangui River, which separates it from the Democratic Republic of Congo (Figure 1). This Department occupies almost the northern part of the Republic of

Congo and covers an area of approximately 64,044 km□ (WFP, 2009). Geographically, the Likouala Department is bordered to the north by the Central African Republic, to the south by the Cuvette Department, to the west by the Sangha Department, and to the east by the Oubangui River, which separates it from the Democratic Republic of Congo (Figure 1).

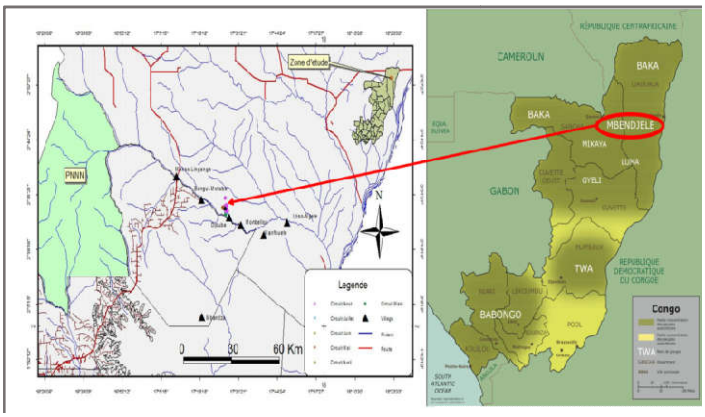

Figure 1: Geographic location of the study area

The climate in northern Congo is equatorial (Vennetier, 1966). The average annual rainfall in this department, whose meteorological station is located in Impfondo, is 1729 mm. The rainfall pattern is more regular and there are only two seasons: a rainy season from March to November and a relatively dry season from December to February.

Average monthly temperatures hover weakly around 25□ C, with a minimum in August and a maximum in March. The soils formed on land are ferralitic type and hydromorphic soils. The vegetation of Likouala precisely that of Bangui-Motaba presents a very classical aspect with a dominant stage made up of trees 40 to 60 m high such as Niove (Staudtia kamerunensis warb), Azobe (Lophira alata Banks ex C.F. Gaerth), Iroko (Milicia excelsa (welw.) C.C. Berg). The relief is relatively less rugged with altitudes not exceeding 500 meters. Gathering is an important activity for the populations of this department, especially for semi-nomadic women and men. Gathering products are of animal origin (insect larvae, snails, honey, etc.) or plant origin (fruits, leaves, stems, sap, mushrooms, etc.). They are used consistently by villagers and semi-nomads for food, medical care, construction, and the manufacture of various objects (CIB, 2010).

Plot installation and data collection method

In order to collect the data on the trees useful to the natives, the plots of 50 m x 50 m with an area of 2500 m2 or 0.25 ha each were set up following the orientations of the compass (North-South and East-West) in order to obtain the square plots by means of a double decameter. In total, four (4) plots were installed in this area with a surface of 10,000 m² or 1 ha sampled. All trees useful to indigenous people with a diameter ≥ 5 cm at 1.30 m from the ground were inventoried in each plot while indicating the different parts used (leaves, roots, sap, stems, fruits, seeds bark) as well as their uses for each species. The uses of the trees were grouped into 7 categories: food, medicine, construction, technology, firewood, magic-religious, and products for sale.

Data processing and analysis method

The collected data were entered and processed on the Excel 2016 spreadsheet with all the necessary parameters (vernacular names, scientific names, DBH, uses, part used and Family). The useful trees of Gabon (Meunier et *al*., 2015), the ecological phytogeographic and phytosociological study of the northern Congo (plateaus, basins, Likouala and Sangha (Moutsabomté, 2012) as well as various websites were consulted for the correction of scientific names and some families. To analyze our data, the following parameters were used (Pascal, 2003; Kitengé, 2011; Koubouana et *al.,* 2016).

- ✓ **Specific richness:** this is the total number of individuals counted on a given surface.
- ✓ **Crude and weighted spectra :** The gross and weighted spectra were calculated from the following formulas :
- ✓

raw spectrum = (Number of species per family)/(Total number of species in families)*100

weighted spectrum = (Number of individuals per family)/(Total number of individuals in families)*100

- ✓ **Relative frequency** (Fr) : allows to appreciate the heterogeneity of the composition of the species of a given zone.

Fr=(Number of species) / (Total number of species)*100

- ✓ **Relative density :** Relative density =(Number of individuals by species or by family)/(Total number of individuals of species or family)* 100
- ✓ **Diversity index :** Shannon's diversity index measures the specific diversity of a stand by combining the relative abundance of species and species richness (Koubouana *et al.,* 2019). It is calculated by the following formula :

$$\mathbf{H' = \sum_{i=1}^{S} PilnPi}$$

With H'= Shannon index; S= Total number of species; P= ni /N with: ni: the number of individuals in a species; N: the total number of species.

According to Masharabu *et al.,* (2010), the Equitability (E), results from the ratio of the Shannon diversity index (H').

$$\frac{\mathbf{H'}}{\mathbf{H'max}}$$

With E = Piélou equitability, H 'max is ln of the total number of species (S) H 'max= lnS.

- ✓ **Density per hectare :** Density per hectare determines the number of stems per hectare and is evaluated according to the formula (Konan *et al.,* 2015).

$$\mathbf{D = \frac{n}{S}}$$

D= Density per hectare; n = is the total number of individuals surveyed in the biotope; S = the total area sampled in the environment.

- ✓ **Distribution by diameter classes of the groups**

It allows to appreciate the degree of disturbance or conservation of a biotope. The trees inventoried in each environment are grouped into diameter classes to produce the histogram of diameter structures. These classes are distributed as follows: [5-9.9 cm [, [10-19.9 cm [, [20-29.9 cm [, [30-39.9 cm [, [40-49.9 cm [and ∞ [(Konan *et al.,* 2015).

RESULTS

Floristic richness of species useful to natives

The floristic and structural inventory conducted in the area of Bangui-Motaba District of Dongou for trees useful to indigenous peoples has allowed to count 289 trees, belonging to 61 species 55 genera and 31 families.

The analysis of the raw and weighted spectrum of trees useful to indigenous peoples varies according to family (Figure 2).

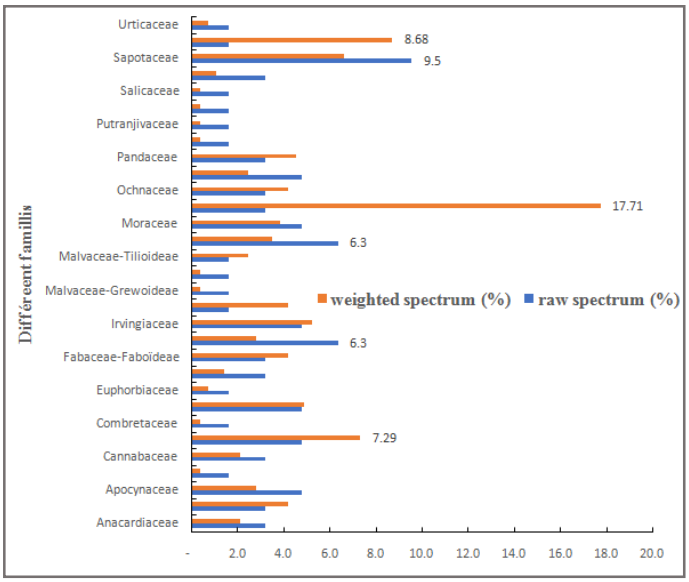

Figure 2 : Graphical representation of the raw and weighted spectrum.

For the raw spectrum, it appears from this figure that the Sapotaceae family is the most represented qualitatively with 9.5% (6 species) followed by Meliaceae and Fabaceae-Mimosoideae (6.3% or 4 species each). The others are less represented. On the other hand, the weighted spectrum shows that the Myristicaceae family is quantitatively better represented with 17.7% (51 individuals) followed by the Thomandersiaceae family (8.7% and 24 individuals) and the Clusiaceae family (7.3% and 21 individuals) and the Sapotaceae (6.60% and 21 individuals). The other families are poorly represented.

Relative density of species

Figure 3 presents the abundance of individuals by species. This relative density varies from one species to another.

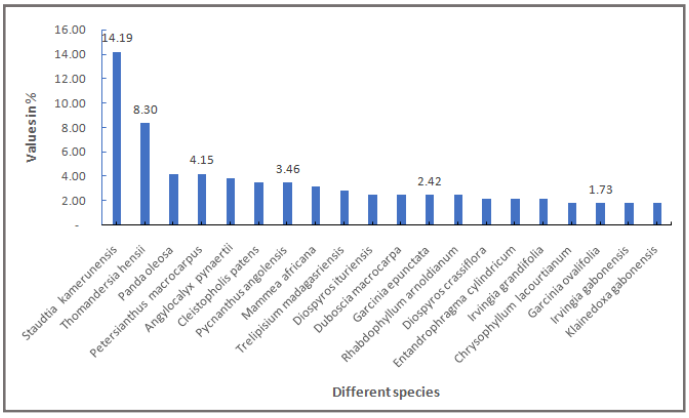

Figure 3 : Relative density of species

This figure shows us that the species most used by the natives is *Staudtia kamerunensis* warb. With a 14 .19%, followed by *Thomandersia hensii* De Wild. (8,30%) and the other species are weakly represented.

Shannon and Equitability indices of piélou

The values of the diversity indix vary according to the plots studied. They vary from 2.44 to 3.22 for Shanonn and from 0.88 to 0.95 for Piélou Equitability (figure 4).

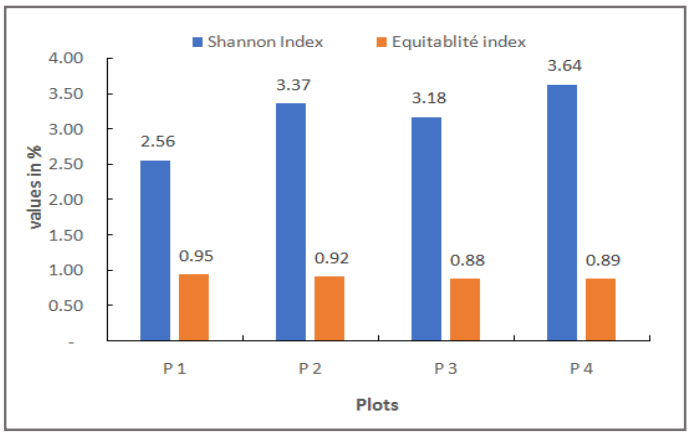

Figure 4 : Values of the Shannon Index and Piélou Equitability Index

It can be seen from this figure that the value of the Shannon index is highest in plot 4 (3.22) followed by plot 2 (3.09). The lowest value is obtained in plot 1 (2.44). On the other hand, the highest value of Piélou's Equitability Index was obtained in plot 1 with 0.95 followed by plot 2 (0.92), plot 4 (0.89). The lowest value was observed in plot 3 with 0.88.

Relative frequency

This study demonstrates that the representation of species useful to indigenous people depends on the species. These results indicate that *Angylocalyx pynaertii* De Wild, *Panda oleosa* Pierre and *Sterculia tragacantha* Lind are the most represented species (100%) followed by *Celtis adolfi*-friderichi Eng, *Cleistopholis patens* (Benth.) Engl. & Diels, *Petersianthus macrocarpus* (P. Beauv.) Liben, *Trichoscypha acuminata* Eng, *Tetrapleura tetraptera* (Schumach. & Thonn.) Taub, *Pycnanthus angolensis* (Welw.) warb (75% each). The others are poorly represented.

Density per hectare

The density of species useful to indigenous peoples has an overall average of 289 stems/ha.

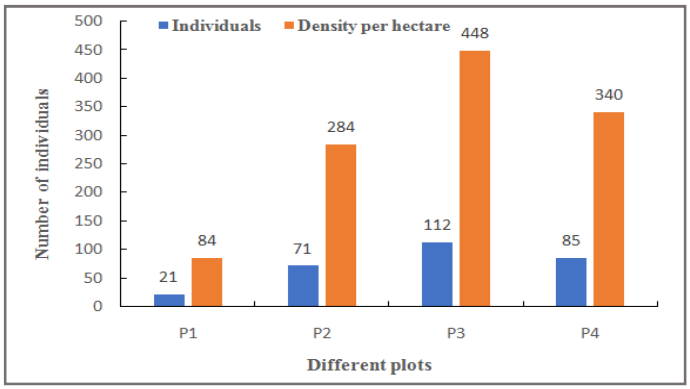

Figure 5: Density per hectare of species

The analysis of this figure shows that the highest number of individuals and density per hectare are obtained in plot 3 with 112 and 448 stems/ha respectively; followed by plot 4 with 85 and 340 stems/ha and plot 2 with 71 and 284 stems/ha. Finally, plot 1 is the least represented with 21 and 84 stems/ha.

Distribution of tree parts used

Figure 6 shows the different parts of the trees used by the natives.

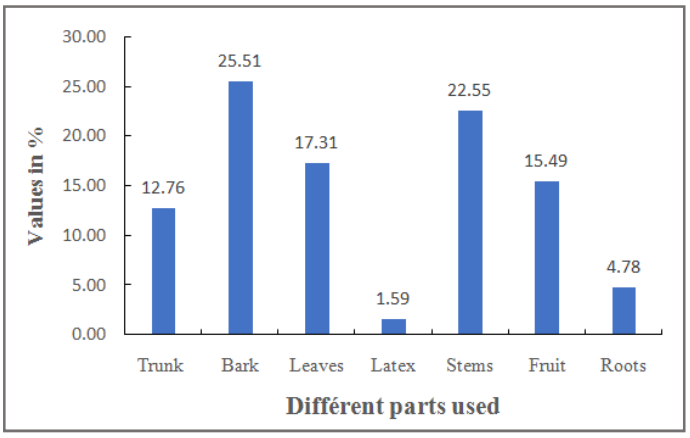

Figure 6 : Different parts of trees useful to indigenous people

This figure shows that bark is the most used part with 25.51%, followed by stems (22.55%), leaves (17.31%), fruits (15.55%).On the other hand, latex and roots are the least used parts.

Different parts of trees used and their use by species

Table I shows the different parts of some tree species and their uses by the natives. These various parts are often used by the latter for their vital needs. These different parts are: stem, bark, fruit, etc. and these uses are among others the handle of the Machetes, pharmacopoeia, food etc.

Table I: Different parts of the trees used and their uses.

Scientific names	Parts used	Use
Angylocalyx pynaertii De Wild	Stem	Machetes/Construction Channel
Anonidium mannii (Oliv.) Engl. & Diels	Fruit	Edible
Autranella congolensis (De Wild.) A. chev.	Bark	Medicinal
Carapa procera DC.	Fruit and Bark	Pharmacopoeia
Celtis adolfi- friderichi Engl	Stem	Construction
Celtis tessmanii Rendle	Stem	Construction
Chrysophyllum lacourtianum De Wild.	Fruit	Edible
Chrysophyllum beguei Aubrev	Fruit	Edible
Chytranthus atroviolaceum	Fruit	Construction
Cleistanthus mildbraedrü Jabl	Bark	Medicinal
Cleistopholis patens (Benth.) Engl. & Diels	Bark	Medicinal
Copaifera salikounda. Auct	Bark and et latex	Manufacturing/ Baskets
Cylicodiscus gabunensis Harms	Stem/fruit	Medicinal bark and latex fire starte
Dichostemma glaucescens Pierre	Stem	Construction/poison of fish
Staudtia kamerunensis warb.	Trunk/bark/leaf	Pirogues and pharmacopoeia
Sterculia tragacantha Lindl.	Leaf	Caterpillar production
Strombosia grandifolia hoof. F.	Stem	Construction
Strombosia pustulata Oliv.	Stem/bark	Construction/ Medicinal
Strombosiopsis tetrandra Engl.	Stem	Construction
Synsepalum brevipes (Baker) T.D. Penn.	Fruit	Face ornament for women
Synsepalum dulcificum (Schumach & Thonn.) Daniell	Fruit	Edible/used as bait when fishing
Pycnanthus angolensis (Welw.) warb.	Stem	Construction
Rhabdophyllum arnoldianum (DeWild. & Th. Dur.) Van Tiegh.	Stem	Construction
Ricinodendron heudelotii (Baill.) pierre ex Heckel	Trunk	Pirogues and tam-tam

DISCUSSION

The floristic study carried out in the Bangui-Motaba area over a total area of 10,000 m2 or 1 ha revealed the presence of 289 individuals, 61 species, 55 genera, and 31 families used by the indigenous people for their nutritional, pharmaceutical, religious, cultural and construction needs. This study indicates that the Likouala forest in general and the Bangui-Motaba forest in particular has a very high floristic richness of trees useful to indigenous people.

In terms of qualitative dominance (gross spectrum), the Sapotaceae family (9.5%) is the most used by the indigenous people. The dominance of this family indicates that, the species (*Chrysophyllum lacourtianum, Autranella congolensis, Chrysophyllum beguei*, Emphalocarpum elatum, Synsepalum brevipes, Synsepalum dulcificum) belonging to this family produce important elements such as (bark, fruit, trunk and stems) for the survival of the natives. Kandza (2021) states that the Bayaka natives of the area use species belonging to this family for their fruits. Indeed, the food value of the *Chrysophyllum lacourtianum* species, for example, has already been allocated by Edem *et al.,* (1984) who showed that the pulp of the fruit contains 8.8% protein; 15.1% lipid; 68.7% carbohydrate; 3.4% ash; and 4.0% crude fiber. This high dietary value may justify the relative importance of the fruit's consumption by local populations and therefore its presence in the area. Quantitatively (weighted spectrum), the Myristicaceae family (17.7%) is the most exploited by the indigenous people. The dominance of this family can be explained by species such as: *Staudtia kamerunensis and Pycnanthus angolensis* that provide important elements for therapeutic and construction needs.

The species: *Angylocalyx pynaertii,Panda oleosa* and *Sterculia tragacantha* are the most distributed species in this area (100% relative frequency). The good distribution of these three species can be explained by the nature of the soil in the Likouala department. Thus, it is important to say that this type of soil favors a diversity of plant species that are beneficial to indigenous peoples.

Analysis of the diversity of these plants useful to the natives

The values of the diversity indexes indicate that no species takes the upper hand over the others, that is, the distribution is equitable. According to the results, these values therefore indicate a diversity of knowledge of the populations on the uses of the species in all domains. They present a socio-cultural value of its communities and highlight their ethno-anthropological knowledge on the importance

and exploitation of trees. These results are similar to those obtained by Lougbegnon et *al.,* (2015) in the quantitative ethno botanical study of the use of *Chrysophyllum albidum* G. Don by local populations in Benin.

Analysis of the parts used as well as their uses

The natives have specific parts on trees that they use according to their needs. These different parts are: the stem, the bark, the fruit, the latex, the trunk and the root. These various parts are often used a lot by the latter for their vital needs. And these uses are among others the manufacture of dugouts, the pharmacopoeia, the food ornament and the culture. This result corresponds with those found by Kandza in 2021 in the same department on the feeding behavior of indigenous children. The diversity of organs used by indigenous people shows a strong representation of bark and stems. The dominance of these organs is certainly due to their therapeutic virtues, construction, the manufacture of dugout canoes, tom-toms, traps, machete handles and also the manufacture of baskets and wooden houses. Although fruits with 15.55% remain the least represented part, this element remains important by the natives.

CONCLUSION

The floristic study carried out in the Bangui-Motaba area over a total area of 10,000 m2 (1 ha) allowed us to count 289 individuals, 61 species, 55 genera and 31 families of trees useful to the indigenous people. For this study, the Sapotaceae family with 9.5% is the most used qualitatively and quantitatively, the Myristicacaea family (17.71%).This study shows that indigenous people use species such as: *Staudtia kamerunensis* and *Thomandersia hensii* for their needs. In terms of relative frequency*, Angylocalyx pynaertii*, *Panda oleosa* and *Sterculia tragacantha* are the best represented species. Analysis of the biodiversity indices shows that the diversity of indigenous useful trees is maximum. The average density per hectare is 289 stems/ha. The parts of these trees used by the indigenous people for their vital, cultural, construction, pharmacopoeia and building needs are: roots, stems, bark, leaves, trunks, latex and fruits. But, among these, the most used is the bark. In short, this study confirms that trees are multiple-use species among the Aboriginal people. The different parts are widely consumed and used in traditional medicine to treat several diseases and symptoms. These species contribute to improved health, nutrition, food security and income for local communities.

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Conflict of Interest

The authors declare that they have no competing interests.

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