ETHNOBOTANICAL STUDY AND AVAILABILITY OF WILD FOOD PLANTS CONSUMED IN THE DEPARTMENT OF MAN

Abstract

Wild food plants are essential to human nutrition and significantly contribute to food security in developing countries. However, in this locality in Côte d'Ivoire, they remain understudied. This study aims to inventory the wild food species consumed in the Department of Man and assess their availability in the classified forests present. Semi-structured surveys conducted among 95 households in the sub-prefectures of Man and Sangouiné, followed by surface surveys along transects in the Mont Glas classified forest, enabled data collection. The investigations identified 23 wild species consumed by the populations, distributed among 15 families and 21 genera. The dominant morphological types were trees (39.13%), herbs (34.78%), and shrubs (13.04%). The most commonly used parts were leaves (48%), seeds (24%), and fruits (12%). The most frequently cited plants were *Elaeis guineénsis* with a citation frequency of 94.74%, *Beilschliedia mannii (*70.53 %), *Irvingia Gabonensis (*69.47%), *Ricinodendron heudelotii (*66.32%), *Solanum nigrum (*66.32%) et *Byttneria catalpifolia (*58.95%). The calculation of the rarity index (Ri) showed that all these species are rare in the Mont Glas classified forest. Domesticating these species and integrating them into agroforestry systems would ensure their sustainable management.

Keywords: Wild food plants, availability, classified forests, Department of Man, Côte d'Ivoire.

Introduction:-

Wild food plants have always been useful to humans. Although many countries have highly mechanized agriculture, they still rely on certain wild plants for food. In Côte d'Ivoire, wild food plants continue to play an important role in the daily lives of the Ivorian population (N'Dri and et al., 2008). They are still in demand and offer numerous economic, nutritional, social, and even therapeutic benefits (Piba et al., 2021; Kouamé et al., 2022). These wild plants are sources of essential micronutrients (Gautier-Béguin, 1992; Tchatchambé et al., 2017; Diarra et al., 2020), deficiencies of which are recurring public

health issues. In Côte d'Ivoire, many species serve both nutritional and pharmacological functions. They are used as food and in phytotherapy (Aké-Assi, 1984; N'Guéssan et al., 2010; Piba et al., 2010; Aké et al., 2013; Yao et al., 2024). Unfortunately, with the phenomenon of forest loss, various habitats and biodiversity refuges are being destroyed, and wild plants are becoming increasingly rare. The net loss of forest area in Côte d'Ivoire is estimated at 84% of the original area (Koné et al., 2015). From 16 million hectares at the end of the 19th century, the Ivorian forest area is currently estimated at 2.97 million hectares (Cuny et al., 2023). Many species that are sources of non-timber forest products (NTFPs) are seeing their availability severely compromised. This phenomenon of forest reduction and degradation widely affects the Department of Man. The extreme west of Côte d'Ivoire, which once had a significant area of primary forest, now resembles a wooded savanna (Sadia, 2021). Fortunately, the Department still hosts some classified forests. It is therefore necessary to conduct ethnobotanical studies to document the wild food plants consumed, in order to guide policymakers in developing appropriate conservation and restoration policies. This study aims to identify the wild plants consumed in the Department of Man and to determine their availability in the classified forests.

Material and methods:-

Study area

The Department of Man is located in western Côte d'Ivoire, in a mountainous area at 7° 24′ N, 7° 33′ W (Fig. 1). The vegetation belongs to the mountainous sector of the Guinean domain. According to Guillaumet and Adjanohoun (1971), the dominant vegetation was humid dense mountain forest, consisting at higher elevations of humid dense forest with *Parinari exalta* Sabine (Moraceae) and at lower altitudes of forest with *Memecylon fasciculare* (Planch. Ex Benth.) Naud (Melastomataceae) and *Eugenia leonensis* Engl. & v. Brehm. (Myrtaceae).

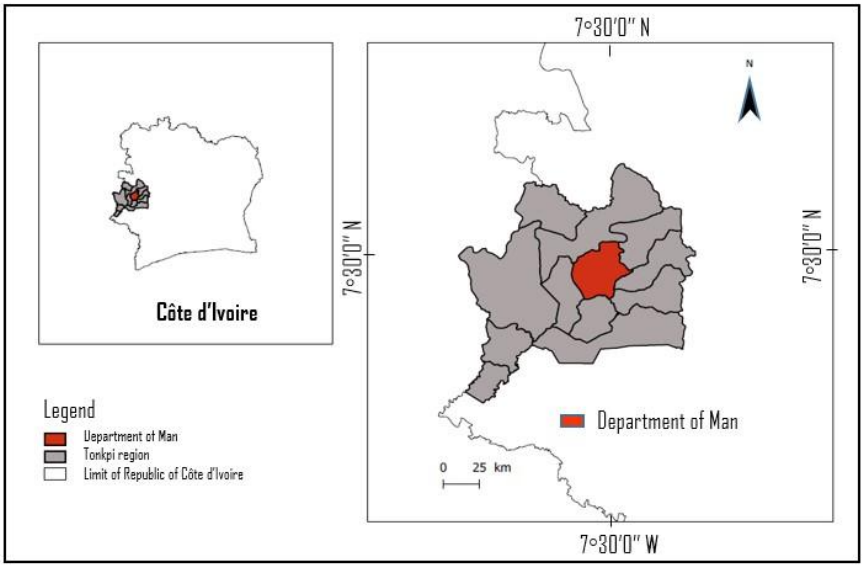

Figure 1:- Geographical location of the Study Area

Data Collection

Ethnobotanical Surveys

Surveys were conducted among households from December 2021 to January 2022 in the sub-prefectures of Man (7°24'18.047" N and 7°33'18.389" W) and Sangouiné (7°15'6.00" N and 7°46'59.99" W). These localities are the most densely populated in the Department of Man, with 182,871 and 36,832 inhabitants, respectively (RGPH, 2014). A total of 95 households, 60 in Man and 35 in Sangouiné, were randomly selected and interviewed using a semi-structured questionnaire. Interviews were conducted in rural areas, in the evening, prioritizing parents (father and mother) and other family representatives if parents were unavailable. The questionnaire included vernacular names of consumed wild food plants, parts consumed, and preparation or consumption methods. Plant samples were collected during the investigations for botanical identification at the University of Man.

Floristic Inventories

Surface surveys along transects were used to assess the availability of wild food plants (WFPs) in the forest landscape of the Department of Man. The chosen site was the Mont Glas classified forest (7°24'39.8" N and 7°35'33.2" W), located on the outskirts of Man and representing the largest protected forest massif in the Department. Surface surveys, used by several authors (Mbarga, 1998; Piba, 2018), were conducted in 13 transects of 100 m × 10 m (1,000 m² or 0.1 ha) randomly placed in the forest. These surveys recorded the presence,

absence, and number of individuals of the target species. Only the availability of priority species, most cited by the populations during the ethnobotanical surveys, was evaluated.

Botanical identification

The plant species recorded were identified by comparison with the herbarium specimens from the National Floristic Centre (CNF) of Félix Houphouët-Boigny University. The identified specimens were preserved at the University of Man. The Global Biodiversity Information Facility (GBIF, https://www.gbif.org/) online database was also used for the botanical identification of plant species. The family nomenclature was updated according to the APG IV system (APG 2016).

Data Processing Methodology

Citation Frequency

The ethnobotanical data collected from the populations were used to calculate citation frequencies (FC) and assess the level of plant knowledge among the population. The formula is (1):

$$\mathbf{FC = (ni/N) \times 100 \ (1)}$$

Where ni is the number of citations for a plant, and N is the total number of households interviewed. Priority species were those with the highest citation frequencies. The most consumed species had FC > 50%, moderately consumed species had FC between 25% and 50%, and less consumed species had FC < 25%.

Density

This parameter indicates species availability in a given area (Roselt and Oss, 2004) and is expressed as the number of individuals per hectare (2):

$$\mathbf{D = ni/S \ (2)}$$

Where ni is the number of individuals counted, and S is the surveyed area in hectares.

Rarefaction Index

The rarefaction index (Ri) is an ethnobotanical index regularly used (Vroh *et al.*, 2014) to determine the abundance and rarity of a plant species in a given area (Géhu and Géhu, 1980), (3):

$$\mathbf{Ri = (1 - (nT/NT)) \times 100 \ (3)}$$

Where Ri is the rarity index of species i, nT is the number of transects where species i was found, and NT is the total number of transects. This index was used to determine the status

(Table 1) of the priority species.

Table 1: Species status based on the rarity index

Ri (%)	Statut
Ri = 100	Absent (not found anywhere)
Ri > 80	Rare
80 > Ri > 50	Abundant et preféerential
Ri < 50	Very abundant and very preferential

Results:-

Sociodemographic characteristics of respondents

The sociodemographic characteristics of the respondents are presented in Table 2. Households were primarily composed of women (74.74%). Men, often absent, represented 25.26% of respondents. The majority were homemakers, while farmers accounted for 13.68% of respondents. The Yacouba ethnic group was the most represented (55.79%), followed by the Baoulé (12.63%) and Wobé (11.58%). Other ethnic groups (Malinké, Mahoka, Toura, Guéré, Gnamboa, and Kôyaga) represented 20% of respondents. In total, 11 ethnic groups were interviewed.

Table 2:- Sociodemographic characteristics of respondents

	Caractéristiques	Proportion (%)
Gender	Femmes	74.74
	Garçons	25.26
Occupation	Homemakers	63.16
	Farmers	13.68
	Others	23.16
Ethnic Group	Yacouba	55.79
	Wobé	11.58
	Baoulé	12.66
	Autres	20

Knowledge of WFPs used in the Department of Man

Floristic composition and importance of cited plants

The ethnobotanical surveys identified 23 wild plant species distributed among 21 genera and 15 botanical families (Table 3). The dominant morphological types were trees (39.13%), herbs (34.78%), shrubs (13.04%), and lianas (13.04%). The most cited species in Man were *Elaeis guineensis* Jacq. (95%), *Beilschliedia mannii* (Meisnn) Benth. & Hook (73.33%), *Corchorus alitorius* L. (68.33%) *Ricinodendron heudelotii* (Baill.) Pierre ex Heckel (65%), *Irvingia gabonensis* (O'Rorke) Baill. (63.33%). In Sangouiné, the most cited species were *E. guineensis* (94.29%), *I. gabonensis* (80%), *Solanum nigrum* L. (71.43%), *R. heudelotii* (68.57%) et *Byttneria catalpifolia* Jacq. (65.71%). Overall, *E. guineensis* (94.74%), *B. mannii* (70.53 %), *I. Gabonensis* (69.47%), *R. heudelotii (*66.32%), *S. nigrum (*66.32%) and *B. catalpifolia (*58.95%) were the most cited WFPs in the Department of Man (Table 3) and represent priority species for the populations. The most cited species were common to both sub-prefectures. In total, the most known and consumed species represented 25.8% of all plants, moderately consumed species represented 9.68%, and less known and consumed species represented 64.52%.

Diversity of consumed parts and consumption methods

The results showed that seven types of plant parts are consumed (Fig. 2), seeds (Fig. 3 and 4), fruits, leaves (Fig. 5), sap, flowers, stems (Fig. 6), and tubers. Leaves (48%), seeds (24%), and fruits (12%) were the most cited (Table 3). The number of edible parts per species ranged from 1 to 3. The palm tree, *E. guineensis*, was the only taxon providing three edible products: sap, seeds, and fruits. Consumption after cooking (94%) was the most common method, compared to 3% for beverages made from sap and 3% for raw consumption. Except for *E. guineensis*, whose sap is consumed, all other plants are consumed after cooking.

Table 3:- List of wild plants consumed in the Department of Man

Vernacular Name	Scientific Name	Botanical Family	Citation (%)	Consumed Parts	Morphological Type
Palmier	*Elaeis guineensis* Jacq.	Arecaceae	94.74	Fruit, Seed, Sap	Tree
Slan	*Beilschmiedia mannii* (Meisnn) Benth. & Hook	Lauraceae	70.53	Seed	Shrub
Kplé	*Irvingia gabonensis* (O'Rorke) Baill.	Irvingiaceae	69.47	Seed	Tree
Apki	*Ricinodendron heudelotii* (Baill.) Pierre ex Heckel	Euphorbiaceae	66.32	Seed	Tree
Morelle noire	*Solanum nigrum* L.	Solanaceae	66.32	Leaves	Herb
Zan	*Byttneria catalpifolia* Jacq.	Malvaceae	58.95	Stem	Liana
Kouala	*Corchorus olitorus* L.	Malvaceae	57.89	Leaves	Herb
Guiley	*Sesanum radiatum* Schumach. & Thonn.	Pedaliaceae	51.58	Leaves	Herb
Igname sauvage	*Dioscorea odoratissima* Pax	Dioscoreaceae	24.21	Tuber	Liana
Fromager	*Ceiba pentandra* (L.) Gaertn.	Malvaceae	22.11	Young leaves	Tree
Brombrou	*Amaranthus cruentus* L.	Amaranthaceae	20	Leaves	Herb
Néré	*Parkia biglobosa* (Jacq.) Benth.	Fabaceae	14.74	Seed	Tree
Piment sauvage	*Capsicum annuum* L.	Solanaceae	14.74	Fruit	Herb
Poivre	*Piper guineense* Schum. & Thonn.	Piperaceae	14.74	Seed	Tree
Aubergine sauvage	*Solanum indicum* auct.	Solanaceae	10.53	Fruit	Herb
Samba	*Triplochiton scleroxylon* Schumann	Malvaceae	8.42	Young leaves	Tree
Baobab	*Adansonia digitata* L.	Malvaceae	8.42	Young leaves	Tree
Wou ticliti	*Myrianthus arboreus* P. Beauv.	Cecropiaceae	6.32	Young leaves	Shrub
Tigabougouni	*Talinum triangulare* (Jacq.) Willd.	Portulacaceae	6.32	Leaves	Herb
Toupie	*Bombax buonopozense* P. Beauv.	Malvaceae	5.26	Flowers	Tree
Kui akplô	*Basella alba* L.	Basellaceae	5.26	Leaves	Liana
Basilic africaine	*Ocimum gratissimum* L.	Lamiaceae	5.26	Leaves	Herb
Koingnon (Wobé)	*Myrianthus libericus* Rendle	Cecropiaceae	2.11	Young leaves	Shrub

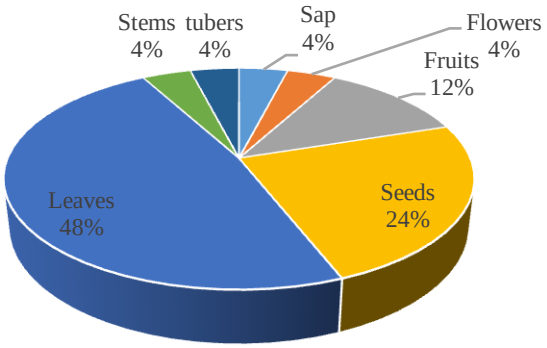

Figure 2:- Consumed plant parts

Figure 3:- Seeds of *Irvingia gabonensis*

Figure 4:- Seeds of *Beilschliedia mannii*

Figure 5:- Leaves of *Solanum nigrum*

Figure 6:- Stem piece of *Byttneria catalpifolia*

The surface surveys identified a total of 19 individuals of five species sought in the Mont Glas classified forest. Specifically, one of *I. gabonensis* (Fig. 7), two individuals of *B. mannii* (Fig. 8), 14 of *B. catalpifolia* (Fig. 9), two of *S. nigrum* (Fig.10) and none of *R. heudelotii*. Le availability of *E. guineensis* not to been sought because of its cultivation. The two individuals of *B. mannii* were found in two different transects, while those of *S. nigrum* were in the same transect. For *B. catalpifolia*, 12 individuals were found in one transect and the remaining two in another. With a density of 10.77 individuals/ha, *B. catalpifolia* was the most abundant of the four studied species, followed by *B. mannii*, *S. nigrum* (1.54 ind./ha each), and *I. gabonensis* (0.77 ind./ha). The density of these species was relatively low. The rarity index calculation showed that all four species are rare in the Mont Glas classified forest (Fig. 11). The indices were 85% for *B. catalpifolia* and *B. mannii*, and 93% for *I. gabonensis* and *S. nigrum*. With a density of 0.0 ind./ha and a rarity index of 100%, *R. heudelotii* was the rarest of the studied species.

Figure 7:- Individuals of *Irvingia gabonensis*

Figure 8:- Individuals of *Beilschliedia mannii*

Figure 9:- Colony of *Byttneria catalpifolia*

Figure 10:- Individuals of *Solanum nigrum*

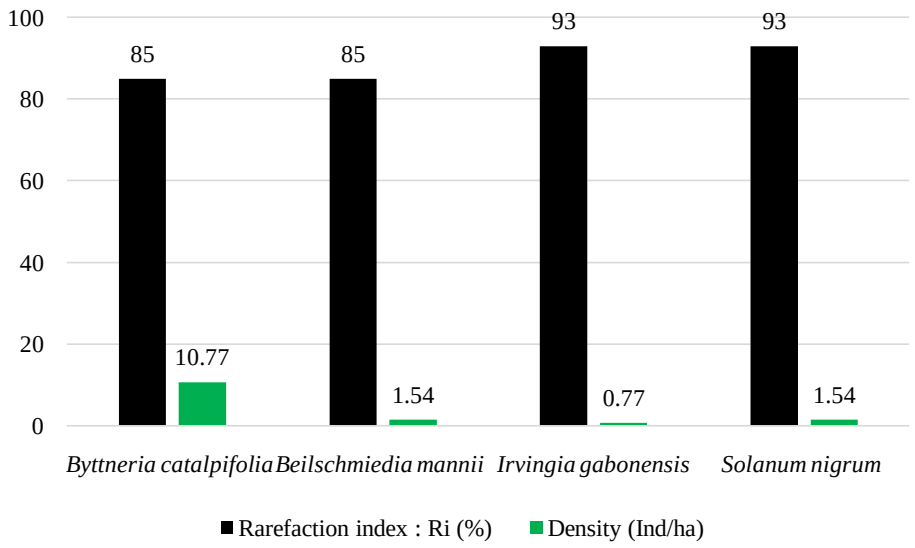

Figure 11:- Density and rarity index of the different species

Discussion:-

This study aimed to document the wild food plants consumed in the Department of Man, identify the most cited species, and assess their availability. A total of 95 households from 11 ethnic groups were interviewed. The results revealed a diversity of wild plants used for food by the local population. Twenty-three (23) wild plant species from 21 genera and 15 families were recorded, representing 0.61% of the national flora, estimated at approximately 3,800

species (Aké Assi, 1984). Several studies have documented wild plants in Côte d'Ivoire (Kouamé et al., 2008; Ouattara et al., 2016; Denisi et al., 2018; Vanié et al., 2021), reporting 50 species in Gagnoa, 81 in Bondoukou, 96 in Agboville, and 76 in Zuénoula. These discrepancies may stem from regional dietary habits or the inclusion of exotic fruit species in some studies. Differences were also noted in the parts consumed. Leaves were predominant in this study, while fruits were more common in other studies (Denisi et al., 2018; Vanié et al., 2021). The priority species *E. guineensis*, *B. mannii*, *I. gabonensis*, *R heudelotii*, *S. nigrum*, and *B. catalpifolia* are widely consumed in Côte d'Ivoire (Asare, 2006 ; Piba *et al*. (2010) and the Guinea-Congolian zone (Betti et al. 2016). This study complements existing research on wild food plants in Côte d'Ivoire.

The low availability of priority WFPs in the Mont Glas classified forest, the largest peri-urban forest in Man, underscores the need for domestication. The results showed that these species are rare in the forest, with only 19 individuals of the five priority species recorded outside *E. guineensis*. Rarity indices ranged from 85% to 100%, indicating that all studied WFPs are rare in the Mont Glas forest. This rarity may result from forest degradation, agricultural expansion, urbanization, and overexploitation (Piba et al., 2016). Growth and reproduction modes also influence species abundance. For example, *B. catalpifolia*, which grows in colonies and reproduces vegetatively, was more abundant than *S. nigrum*, *I. gabonensis*, and *B. mannii*, which lack this ability. Domestication and integration into forest management policies are essential for the sustainable conservation of these species (Piba et al., 2018).

Conclusion:-

The search for wild food plants for valorization led to an ethnobotanical study in the Department of Man. This study revealed a significant diversity of wild plants used for food in this region. A total of 23 wild plant species were recorded, with leaves being the most harvested parts. Cooking was the most common preparation method. These plants play a crucial role in local diets and offer valuable nutritional benefits. However, the assessment of their availability in the Mont Glas classified forest was concerning, showing that the studied species are rare. Domestication and reforestation efforts incorporating these wild food plants are recommended to ensure their sustainable use and conservation.

Conflict of interest:-

None declared.

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