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Uses of lianas species according to the river communities of Azagny National Park (south of Côte d'Ivoire)

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***Abstract*—In Africa, lianas species are in great demand by human communities. The riparian communities of the Azagny National Park (ANP) use these species for various purposes. The objective of this study is to improve knowledge of the lianas species used by these communities. To better understand the interests of these riparian communities for lianas species, ethnobotanical surveys have been carried out. These surveys made it possible to interview 134 people, including 35 p.c. indigenous, 56 p.c. non-indigenous and 9 p.c. non-indigenous. These surveys show that 43 of lianas species are commonly used among natives and non-natives. Among these species, Piper guinense, Alchornea cordifolia, Caesalipinia bonduc and Tiliacora dinklagei are the most cited by the populations. Most of these populations obtain their supplies from the Azagny National Park. The machete is the most widely used harvesting tool. These populations use lianas for several uses but the most widespread are food and medicinal uses. The most used organs are fruits, Leaves and seeds. These surveys have shown that lianas occupy a significant place in the daily lives of communities bordering the ANP.**

***Keywords*—Uses, lianas, ethnobotanical surveys, Azagny National Park, Côte d'Ivoire.**

I. INTRODUCTION

For humans, plants are used as food, building materials, sources of energy and medicine [1]. In addition, plants include several morphological types: trees, shrubs, lianas, herbs. Depending on the morphological type, they each play a specific role in the peculiarities of tropical forests [2]. Among these morphological types, lianas constitute an important component [3]. Indeed, lianas play an important role in tropical forests [4]. In Africa, lianas are in great demand by rural populations for various uses. Indeed, several authors have revealed that

these groups of plants are useful plants [5], [6] and [7]. Whether woody or herbaceous, lianas occupy an important place because their different organs are used for different purposes. Their fruits and tubers are highly prized in food. Their stems and roots are also used in pharmacopoeia and crafts [8]. The organ products of many of them provide significant income for many households in the tropics [8]. Also, it is clear that lianas are an important economic resource for local communities, who use them in most cases for medicinal and food purposes [5] and [7].

However, the gradual disappearance of natural plant resources from village lands is pushing people to turn to protected areas which were, in the past, less in demand for their products. Indeed, located in the south of the Côte d'Ivoire, the Azagny National Park is home to a diversity of lianas species [9]. Thus, the riparian communities collect, in this park, the forest products necessary for the different areas of their life [10]. These are mainly non-timber forest products, among which the various lianas species occupy a prominent place. Among these lianas species, we can cite the example of *Piper guineense*. According to [10], this species constitutes an important source of food, medicinal and commercial resources which is reflected in the level of satisfaction of the riparian communities who exert strong pressure on the park. Unfortunately, the lianas species are, like all the other components of the forest flora, under the threat of anthropogenic pressure. In such a context, it is important to initiate ethnobotanical studies, in order to gain knowledge of these species. The purpose of this study is therefore to show the importance of creeping species for the communities bordering the PNA. Specifically, it will be a question to (1) draw up the profile of the populations living around the PNA, (2) evaluate the floristic richness of the lianas used by these populations, (3) determine the sources of supply, the tools used for harvests as well as the different uses of lianas by local populations.

Material and methods

Study site:

People living around the PNA were interviewed. This protected area is located in the south of the Côte d'Ivoire between northern latitudes 5 ° 09 "and 5 ° 16" and western longitudes 4 ° 48 "and 4 ° 58" (Figure 1). The localities surrounding the park have been visited. These are the villages of Toukouzou, N'guessandon, Braffedon, Nzida, Katchekpli and Djidjikro and the camps of Broukro, Ladjikro and Gboyo. These localities were selected on the basis of their direct proximity to the PNA. The soils in this zone are of the reworked ferralitic type. The vegetation in this area, which was of the evergreen dense forest type, is now experiencing a sharp increase in the areas of fallow-crop mosaics. The riparian population of the PNA is made up mainly of aboriginals represented by the Ahizi and the Avikam, of the aboriginals represented by the Baoulé, the Abbey and the Malinké and of the Allogene dominated by the Burkinabé. These non-native populations settled around the PNA irregularly depending on the availability of land and forest resources.

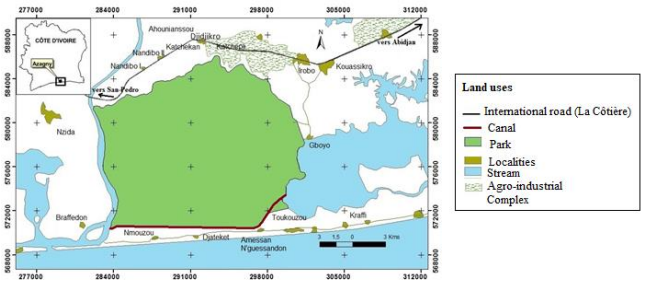

Figure 1: Location map of Azagny National Park [11]

Sampling methods

1.1. Collection of ethnobotanical data

Across all sites, 134 people were interviewed. The people interviewed were selected on the basis of their knowledge of the uses of lianas.

The methodology used in this study was based mainly on ethnobotanical surveys carried out among rural communities. These investigations took place in nine (09) villages and encampments adjacent to the PNA, including two in the South, one in the East, two in the North, two in the West, two in the North-East. Primary data were obtained through surveys of the population in households on the basis of previously established questionnaires. In addition to the inventory and uses of lianas species, the questionnaire concerned the profile (ethnicity and locality) of the people questioned. In addition, general knowledge about lianas was discussed. The areas of use of the lianas by the local population, the different parts used, the methods of preparation and the different sources of supply were noted. Subsequently, the data and information collected were reorganized according to indigenous, non-indigenous and non-indigenous communities.

To better understand the interests of riparian communities for lianas species, ethnobotanical surveys have been carried out. These surveys were initially carried out on the basis of a closed questionnaire submitted to each person, regardless of sex, age, ethnicity or religion. Subsequently, open discussion forums on the uses of plants were organized to supplement the information collected.

In the field, it is common for the same vernacular name to be attributed to several species. Thus, the census of lianas plants using only local names involves risks of error, as pointed out by [12]. These errors were minimized by collecting samples of leafy twigs and stems for presentation to interviewees.

Data analysis

Richness and floristic composition of the biotopes found in the Ecofarm

The floristic richness and the floristic composition were determined from the list of records. For each type of biotope, the number of species, genera and families was first determined, likewise the biological types and chorological affinity were determined. Likewise, species with special statuses were highlighted. These are the endemic species of Côte d'Ivoire (Gci), and the West African Forest Block (GCW), rare and endangered species of Ivorian flora, according to the lists of Aké-Assi (1998) and IUCN (2019).

Quantitative diversity of the flora of the Ecofarm

The quantitative floristic diversity was determined from the specific richness and the Diversity Indices which are: the Shannon Diversity Index (H '), the Pielou Equitability Index (E), the Diversity Index Simpson's (DS) and the Margalef Index (RMg). These indices were calculated according to the following mathematical formulas:

$$H' = -\Sigma [(ni / N) \times \ln (ni / N)].$$

In this formula, H 'is the Shannon index, nor the number of individuals of a species i and N the total number of individuals of all species:

$$E = H' / \ln S$$

where E denotes the Pielou index (1966), H 'denotes the Shannon index, S the total number of species in each biotope.

$$DS = 1 - \sum(\frac{Ni(Ni-1)}{N(N-1)})$$

In this formula, DS is the Simpson diversity index, Ni is the number of individuals of one species i, and N is the total number of individuals of all species.

$$R_{Mg} = \frac{S-1}{ln(N)}$$

The Margalef Diversity Index (RMg) measures the diversity of a site and is a correction for the sample size (Magurran, 2004).

III. RESULTS

3.1. Profile of respondents

The survey carried out among the populations living near the PNA allowed us to interview 134 people from nine villages. These are 32 people north of the park in the villages of Djidjikro and Katchekpli; 18 people in the south in the villages of N'Guessandon and Toukouzou; 25 people to the east in the village of Gboyo; 25 people to the west in the villages of Braffédon and N'Zida; and finally 34 people in the North-East in the villages of Broukro and Ladjikro.

The population questioned on the outskirts of the Azagny National Park is divided into three distinct groups, dominated by non-natives (Figure 2). The natives (35 p.c.) consist of Ahizi and Avikam. The non-natives (56 p. c.) Are represented by the Baoulé, Abbey, Sénoufo and Malinké. The foreigners (9 p. c.) are all of Burkinabé origin. This distribution of origins varies according to the geographic location of the people interviewed. In the northern and north-eastern parts of the PNA, there is a dominance of non-natives and an absence of natives. The South and West are represented only by the natives. The East zone brings together all the identified ethnic groups (Figure 2).

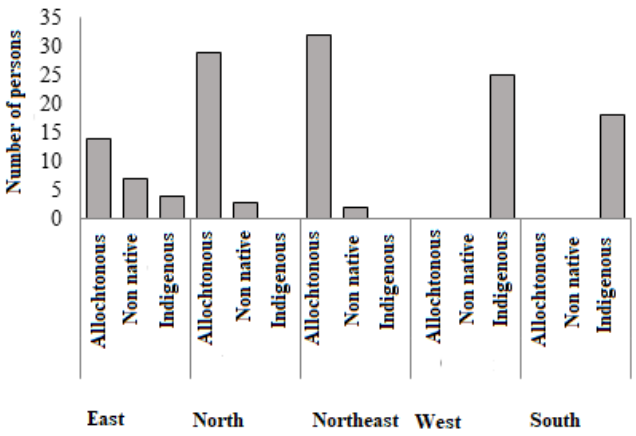

Figure 2: Distribution of respondents according to geographic location

3.2. Floristic richness of the lianas used by the riparian populations of the PNA

Surveys carried out among neighboring populations made it possible to identify 43 species of lianas commonly used (Table 1). They are divided into 33 genera and are classified in 20 families dominated by Dioscoreaceae (7 species), Cucurbitaceae (6 species), Apocynaceae (6 species) and Passifloraceae (3 species).

Ten (10) species including *Piper guinense, Alchornea cordifolia, Caesalipinia bonduc* and *Tiliacora dinklagei* are the most cited by populations (Figure 3). Of the respondents, 93.7 p.c. cited *Piper guinense* and 51.9 p.c. cited *Alchornea cordifolia*. As for *Caesalipinia bonduc* and *Tiliacora dinklagei*, they were cited respectively by 41.8 p.c. and 29.1 p.c. of the people questioned.

3.3. Sources of supply

Four (04) sources of supply were cited by interviewees. The Azagny National Park remains the main source of supply for the local population with lianas species (Figure 4). Plantations and fallows are represented by percentages of around 21 p.c. and 14 p.c. respectively. Markets are the minority supply sources (4 p.c.).

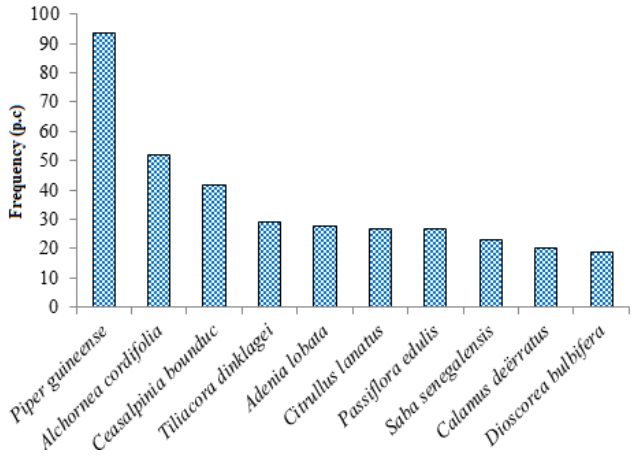

Figure 3: Histogram of the species most cited by the populations

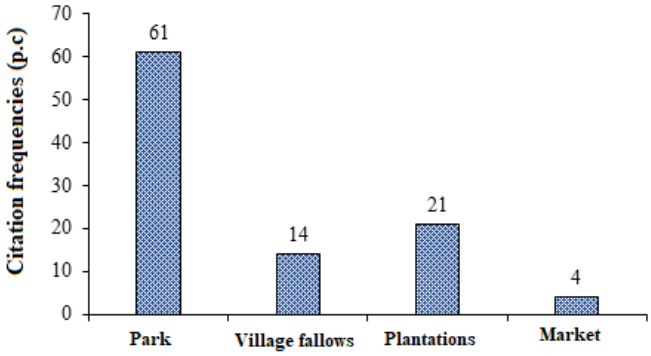

Figure 4: Source of supply for creeping species

3.4. Organ harvesting tools used

Respondents use different types of tools to harvest the different organs of the lianas species used (Figure 5). The most popular tool is the machete. It is mainly used to cut stems and roots. The second most used tool is the knife. This is used to cut herbaceous lianas as well as leafy branches accessible by hand. As for the ax, it is used to cut down some guardians of lianas. This is the case at *Piper guineense*, where the guardian is shot to gain access to the fruit above it. Sickles are the least used tools. They are used to cut the organs (fruits, leafy branches) located high up.

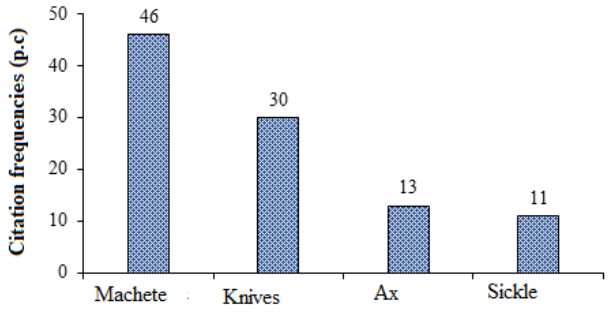

Figure 5: Tools used for harvesting the different organs

3.5. Types of use of lianas by populations

Populations use creepers in seven categories of uses. These are food, crafts, traditional medicine, hunting, fishing, cosmetics and pharmaco-magic. Food, traditional medicine and crafts are the main uses made by populations of lianas. Then come hunting, cosmetics, fishing and pharmaco-magic.

The frequencies of citations of the main uses vary according to the different ethnic groups (Figure 6). Food use was most cited among non-native and non-native northerners, with values of around 62 p.c. and 55 p.c. respectively, while medicinal use was most cited among native and non-Akan natives. The quotation frequencies vary from 43 p.c. among the natives to 49 p.c. among the Akan non-natives. The other uses of fishing, hunting, cosmetics and pharmaco-magic were only mentioned among the natives (3 p.c.) and Akan non-natives (4 p.c.). A list of lianas species with their uses has been recorded in Table 1.

Table 1: List of lianas species cited by riparian communities with their uses

Species	Parts used	Uses
Abrus precatorius	Leaves	Medicinal
	Seeds	Artisanal
Adenia lobata	Leaves	Medicinal
	Sap	Medicinal
	Stem	Artisanal
		Medicinal
Alafia barteri	Leaves	Medicinal
Alchornea cordifolia	Leaves	Oral hygiene
	Stem	Medicinal
		Oral hygiene
Calamus deërratus	Stem	Artisanal
Ceasalpinia bounduc	Fruit	Food
	Seeds	Artisanal
	Stem	Artisanal
Cercestis afzelii	Leave	Medicinal
	Fruit	Medicinal
	Stem	Artisanal
		Fishing
Citrullus lanatus	Seeds	Food
Cnestis ferruginea	Stem	Aphrodisiac
		Hunting
		Oral hygiene
Cucumeropsis mannii	Seeds	Food
Dioscorea bulbifera	Bark	Artisanal
	Tuber	Food
Dioscorea burkilliana	Tuber	Food
Dioscorea cayenensis	Tuber	Food
Dioscorea hirtiflora	Tuber	Food
Dioscorea mangenotiana	Tuber	Food
Dioscorea minutiflora	Tuber	Food
Dioscorea odoratissima	Tuber	Food
Griffonia simplicifolia	Leave	Medicinal
	Stem	Hunting
		Oral hygiene
Icacina mannii	Tuber	Cosmétic
Iodes liberica	Stem	Artisanal
Ipomoea mauritiana	Leave	Food
Lagenaria siceraria	Fruit	Artisanal
Landolphia hirsuta	Fruit	Food
Landolphia membranacea	Leave	Medicinal
Landolphia owariensis	Fruit	Food
Luffa aegyptiaca	Fruit	Artisanal
Momordica charantia	Leave/Stems	Medicinal
Morinda morindoides	Leave	Medicinal
Nauclea latifolia	Leave/Bark	Medicinal
	Leave/Bark	Medicinal
Parquetina nigrescens	Leave/Stems	Medicinal
	Stem	Medicinal
Passiflora edulis	Fruit	Food
Passiflora foetida	Leave	Medicinal
	Fruit	Food
Paullinia pinnata	Leave	Medicinal
	Fruit	Food
Piper guineense	Leave	Medicinal
		Pharmaco-magic
	Fruit	Food
		Medicinal
	Seeds	Medicinal
Saba senegalensis	Bark	Medicinal
	Fruit	Food
	Sap	Hunting
	Stem	Medicinal
Salacia nitida	Sap	Artisanal
Smilax anceps	Stem	Artisanal
Spinacea oleracea	Leaves	Food
Strophanthus gratus	Bark	Medicinal
Telfairia occidentalis	Seeds	Food
Tetracera alnifolia	Sap	Artisanal
Tiliacora dinklagei	Bark	Medicinal
	Root	Medicinal
	Stem	Aphrodisiac
		Hunting
		Oral hygiene
		Medicinal
Triclisia patens	Stem	Hunting

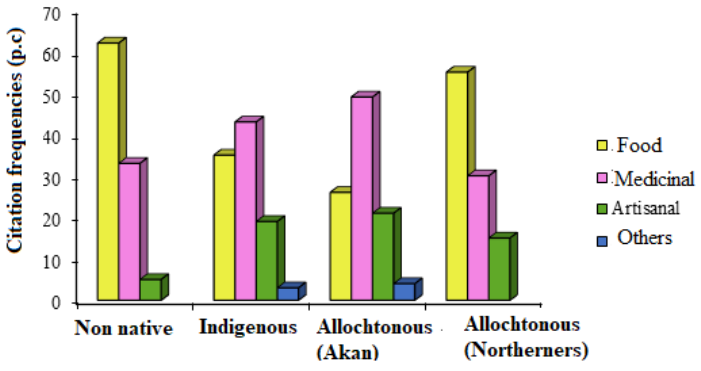

Figure 6: Frequency of citation by ethnic group

3.6. Organs used from harvested lianas

Eight (08) types of organs and parts of organs of lianas are taken by the populations (Figure 7). The fruits are the most cited (26.6 p.c.) by the population. They are taken from 11 species, the most frequent of which are: *Luffa aegyptiaca* whose dried fruits are used as a vegetable sponge, *Passiflora edulis* whose fruits are edible and *Piper guineense* for which the fruits are edible and have medicinal properties. The leaves (20 p.c.) are the second type of organ most used by populations. They are taken from 13 species, the most cited of which are *Alchornea cordifolia*, *Spinacea oleracea* and *Abrus precatorius*. They are sometimes used in combination with the bark of *Nauclea latifolia* and the stems of *Momordica charantia* and *Parquetina nigrescens* to treat malaria. The seeds are used in six (06) species. The seeds of *Abrus precatorius* are dried and used to make prayer beads for ritual purposes. The seeds of *Caesalpinia bonduc* are used in the African sowing game popularly known as *Awalé* by local people and *Abrus precatorius* are used in crafts. The seeds of *Citrullus lanatus*, *Cucumeropsis mannii* and *Telfairia occidentalis* are edible.

Stems are taken from 13 species. They are used in traditional medicine for their aphrodisiac properties. This is the case with *Cnestis ferruginea* and *Tiliacora dinklagei*. The stems of *Griffonia simplicifolia* and *Triclisia patens* are used for hunting and the stems of *Cercestis afzelii* are used for fishing. The stems of *Smilax anceps* and *Adenia lobata* are used to attach various objects. The tubers are taken from eight (08) species of which seven (07) belong to the genus *Dioscorea* and one (01) to the genus *Icacina*. The barks are used in four (04) species which are *Tiliacora dinklagei*, *Saba senegalensis, Dioscorea bulbifera* and *Strophanthus gratus.* The sap is used as a glue in two (02) species which are *Saba senegalensis, Salacia nitida*. The sap of *Adenia lobata* is instilled into the eyes to treat eye inflammation. *Tiliacora dinklagei* roots are chewed to cure male sexual weakness.

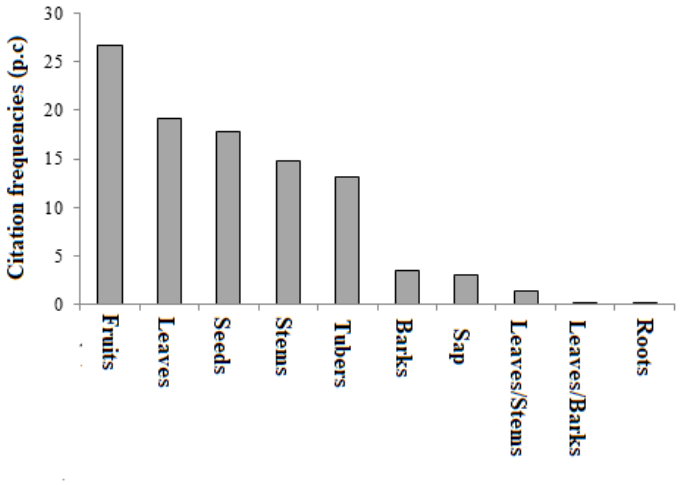

Figure 7: Evolution of the proportions of the different organs used

IV. DISCUSSION

During our work, 43 lianas species were recorded as utility plants by the communities bordering the Azagny National Park for various reasons. Unlike the present study, [7] identified 114 lianas species used by the riparian populations of the classified forests of Scio and Haut-Sassandra in the west of the Côte d'Ivoire. The low diversity of lianas species observed in the present study could be explained by a certain ignorance of these plants by local populations as demonstrated by [8] in Togo.

Food, traditional medicine and crafts are the main uses made by the populations, as is the case in several forests. [6] reported that climbing plants are mainly used as medicinal plants, then as building materials and, finally, as food, by people living around the Budongo reserve in Uganda.

Among the lianas species recorded, *Piper guineense* was the most cited. Its use is wider around the Azagny National Park. It is collected by natives, non-natives as well as non-natives. This plant is also well known to the scientific world by researchers such as [12], [13], [14]; [10]. For the populations encountered around the park, *Piper guineense* is a medicinal, food and pharmaco-magic plant. The pathologies treated by these local populations with

Piper guineense are often identical. These include malaria, stomach wounds and sinusitis, among others. The nutritional value of this plant is mainly observed in Senoufo, Avikam and allogeneic populations. The fruits of this plant are used as a spice for seasoning foods. This species, widely known as a food and medicinal plant, also has cultural value and is marketed through a sub-regional channel [10]. *Alchornea cordifolia* was the second most cited species. Surveys have shown two uses of this species by the communities bordering the Azagny National Park. This species is used in traditional medicine and oral hygiene. These two uses were also identified by [15] in the Democratic Republic of Congo. According to these authors, the stems of this species are used as toothpicks. A decoction of the leaves is given to drink to cure anemia and finally, the stem pith is chewed to stop the cough. The populations living near the PNA use a decoction of the Leaves as a mouthwash, for private toilets, to treat athlete's feet and stomach ulcers. The leaves are also used as a blood cleanser, tonic, and to treat anemia and epilepsy in Nigeria [16]. Fresh crushed Leaves or dry powdered leaves are applied as a poultice as a healing remedy to wounds and fractures to hasten healing [17]. In addition to uses in medicine and oral hygiene, [7] showed that *Alchornea cordifolia* is used in the field of handicrafts in the west of Côte d'Ivoire. Indeed, the stem of this species is used in the manufacture of dabas and the Leaves, as a coloring in dyeing.

This study highlighted three (03) main uses made by populations of lianas. These are food, traditional medicine and crafts. Regarding medicinal use, this study showed that lianas are used to treat several ailments. Most of the diseases identified in the study area are linked to the working conditions of the populations (general fatigue, malaria, hemorrhoid), to hygienic conditions (urinary tract infections, oral infection, inflammation of the eyes, wound, diarrhea, cough and tuberculosis) and female health problems. Indeed, all parts of lianas plants for medicinal use are used. The most important parts are the Leaves and stems. The bark is used in individuals of large diameter [7].

The work of [18] report that *Cercestis afzelii* is used as a medicinal plant in Côte d'Ivoire, and that this species has therapeutic properties. Likewise, in the present study, the populations of Azagny National Park used *Cercestis afzelii* as a medicine in the treatment of cough or tuberculosis. Various studies carried out outside the Côte d'Ivoire present results similar to our work. Indeed, in the Ozoro populations of Nigeria, *Cercestis afzelii* is used to treat fractures of the hand and leg [19]. In addition, the artisanal use of *Cercestis afzelii* mentioned in this study was also reported by [11]. The runners of *Cercestis afzelii* are used in making baskets and as a building material, as it is used as rope for making fences and for building houses.

In general, the families of the creeping species tend to be useful against a specific group of conditions. This is the case for the Rubiaceae family (*Morinda Morindoides, Nauclea latifolia*). The species of this family show great efficacy against malaria. According to [7], species of the Euphorbiaceae family (*Alchornea cordifolia, Phyllanthus muellerianus*) are effective in oral hygiene care. The creepers used in food, crafts, hunting and fishing generally remain the same from one locality to another. This is not the case in traditional medicine, where the species are varied and their uses are diverse. In addition, the recipes are administered through different routes, which are oral (drink or food), anal (purge) or external (bath, massage, and tourniquet).

Lianas also participate through their production in feeding populations. Fruits and leaves are the most commonly used organs for food. Indeed, the leaves are used as a vegetable for making and seasoning sauces. In addition, the leaves are also used for the fermentation of certain drinks such as palm wine. This is the case with *Griffonia simplicifolia* and *Momordia charantia*. These two species have been reported for the same uses by [7]. Most of the fruits are eaten raw

at the point of harvest ([8], sold in local markets [10] or used for condiments [12]. Generally speaking, most of these lianas species have organs that are harvested or collected for individual food as a snack and / or during periods of lean or scarcity.

Many lianas in the forests are regularly used in crafts. In this group, rattan palms (*Calamus deerratus, Laccosperma secundiflorum*) are the most mentioned. These rattan palms are used in the manufacture of furniture. According to [20], rattan palms are used by the populations living around the classified forest of Haute-Dodo, in the making of furniture and various art objects. Also, they are consumed and used in traditional African medicines. In addition, the heart and terminal buds of *Calamus deerratus* and *Laccosperma secundiflorum* are eaten and traded on a small scale in local markets in the center-west of Côte d'Ivoire [12] [20]. Besides the rattan palms used in handicrafts, species such as *Caesalpinia bonduc* and *Iodes liberica* are used for handicrafts. Indeed, the seeds of *Caesalpinia bonduc* are used in the game of *awalé* and the stem of *Iodes liberica* is used for the manufacture of traditional sponges. The uses made of these species by the riparian populations of the PNA are identical to those of the riparian populations of the classified forests of Scio and Haut-Sassandra, as demonstrated by [7]. As for hunting and fishing, *Tiliacora dinklagei* and *Triclisia patens* are prized because of the flexibility of their stems.

Indeed, many scientific works [5] [6] [7] [21] [12] [8] [11] report that lianas species are plants widely known and used in their areas of distribution by local populations. Also, it is clear that lianas are an important resource for local communities, especially for medicinal reasons.

V. CONCLUSION

At the end of this study, it emerges that the lianas species are commonly used by the communities bordering the National Park of Azagny (PNA). They infiltrate the Park with the help of various for the collection of creepers. Food, traditional medicine and crafts are the main uses. Different parts of lianas are used for different purposes. Thus, lianas play an important role in the care of populations in forest areas and their use in traditional medicine is varied and diversified. They continue to cover a not insignificant part of the essential needs of populations deprived of monetary resources or far from urban centers.

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