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Ethnobotanical Survey of Two Medicinal Plants (*Heliotropium indicum* L., *Abrus precatorius* L.) Used in Traditional Medicine in West Africa

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ABSTRACT

Since the time of our ancestors, natural products issued from plant play a therapeutic crucial role. About 25-30% of all medicines (drugs) available for the treatment of diseases are derived from natural products (from plants, animals, bacteria and fungi) or are derivatives of natural products. The aim of this research was to scientifically identify and supply tangible documentation on these two plants employed in the traditional medicine. From November 2020 to February 2021, an ethnobotanical survey was conducted within four markets at the south of Benin, employing a semi-structured questionnaire. Two hundred respondents including 80% of females and 20% of males were interviewed. The 2 studied plants are mainly used for different types of sickness related to infections. Females' herbalists are the most represented. From this research, it appears that the 2 plants are widely used for the treatment of severe infections. On the market, 95% of the leafy steam are sold against 5% of the roots for both plants. The main preparation way is decoction. Oral use is reported to be common in all region. The value of samples sold varies from 200F CFA (Financial Cooperation of Africa) to 1000F CFA. The decoctions are usually obtained through one of a mix of different types of plants. Traditional knowledge is transmitted from one generation to another by oral education. Till today there was no record found. During our study, we did no record prohibition or side effect related to these plants' use. These medicinal plants occupy a crucial place within the therapeutic arsenal of west Africa. Our results constitute a vital tool to determine the true potentials of these plants. These results could lead to new improved traditional medicine.

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1. Introduction

Since the time of our ancestors, vegetable resources have always been considered vital to humankind. Nowadays, about 25-30% of all drugs available for the treatment of diseases are derived from or are derivatives of plants, animals, bacteria and fungi ^[1]. Despite this, in recent decades, mainly because of the advance of synthetic chemistry, natural market research within the pharmaceutical industry has been in slow decline. However, evidence from the pharmaceutical industry shows that, for a few complex diseases, natural products still represent a particularly valuable source for the assembly of latest chemical entities. As they represent preferred structures selected by evolutionary mechanisms over a period of innumerable years ^[2]. Plants, as vital elements of biological diversity, serve essentially for human well-being ^[3]. After a protracted struggle with traditional medicine, doctors and health organizations are now more fascinated by the values and effectiveness of plant treatments. Medicinal plants have always had a crucial place within the therapeutic arsenal of humanity. Numerous scientific studies are undertaken to check the botanical and therapeutic aspects of plants and to integrate their medicinal properties into a contemporary health system by exploiting their active ingredients ^[4]. Approximately 80% of the world's population and over 90% of the population in developing countries depend on them for basic health care ^[5-9]. Urgent attention must be paid to many species as possible on earth that haven't yet been studied scientifically. This is to determine their phytochemical and pharmacological properties, and also assess their qualities, safety and efficacy. This green heritage thus represents an infinite reservoir of compounds waiting to be discovered ^[10]. Ethnobotanical surveys are proving to be one in all the foremost reliable approaches for the invention of the latest drugs ^[11]. Today, numerous studies distributed within the field of ethnopharmacology show us that the plants employed in traditional medicine and which are tested are often effective plants in pharmacological models. On the opposite hand, they would be practically nontoxic ^[12]. The rummage around for new medicinal molecules of natural origin is predicated on the distribution of medicinal plants and on ethnobotanical studies. These studies allow inventories of plants in a locality or country to be made, followed by photochemical and pharmacological studies. As a result, the valorization of natural resources is becoming an increasingly important concern in many countries.

We therefore propose during this present work; to hold out an ethnobotanical study within the communes of Abomey-Calavi, Cotonou, Porto-Novo and Pobe ; to spot

the various usages of Two medicinal plants (*Heliotropium indicum* L., *Abrus precatorius* L.) utilized in traditional medicine in this geographical region.

2. Material and Methods

2.1 Material

The Benin's analytical flora ^[13] served as a base to identify and confirm the studied plants. An audio recorder has been used for the interviews, a camera for the pictures and some nylon bags for the collections of the samples.

2.2 Method

2.2.1 Study Area

Fours communes at the south of Benin has been investigated during this study see Figure 1.

Theses communes have the particularity to concentrate various tribal groups originated from different parts of the world. The marketing of traditional medicine is considered to be an identity business hand over by ancestors. The study area is located at the level of Guinea Gulf, between 110° 0' and 140° 0' W, 60°0 'S and 80°0'N with two seasons of rainfall per year (April to June and September to November). The annual average is 1200 mm. All over the year, the temperature varies between 25 °C and 29 °C with a ratio between 69% and 97% ^[14]. In the study area, agricultural practices impacted heavily the forest coverage area ^[15].

- Four departments are involved in our study. It is the:
- **Atlantic department** with equatorial climate marked by two rainy seasons and two dry seasons. One type of soil is observed in the south; it is the ferrallitic soil.
 - **Coastal department** extended over a length of 121 km. The width varies from 3 km to 10 km (West to East) with 50 metres altitudes ^[13]. Along the oceans, different types of barriers could be observed separated by lagoons and fluvial-lacustrine complex ^[13].
 - **OUEME department** marked by ferruginous soil of red colour; forest relics formed by clay, grass and others. We also noticed the presence of mangroves and raphia ^[13].
 - **Plateau department** is characterized by sudano-guinean climate with a shrubby savannah vegetation. A presence of the relic's forests is also noted followed by the dominance of *Daniellia oliveri* ^[16].

2.2.2 Exploratory Investigation

After the paperwork's step, the geographic distribution of the plants was established in prelude followed by prospective research. The main idea was to get in touch

with referenced people, capable to feed us with tangible information in traditional medicine. That permits us to strengthen our questionnaires in order to obtain convincing results after our survey.

Ethno-ecological approach was employed. In each department, three markets were surveyed.

2.2.3 Ethnobotanical Survey

Three markets per communes were surveyed using the methodology of structured interview ^[9,17] see Table 1.

Table 1. Departments, communes and markets selected for the study.

Departments	Communes	Markets
Atlantic	Abomey-Calavi	- Akassato
		- Glo
		- Calavi-kpota
Coastline	Cotonou	- Gbgamey
		- Vedoko
		- Dantokpa
Plateau	Porto-Novo	- Agbokou
		- Adjara
		- Ouando
Oueme	Pobe	- Odja Obada
		- Odja Ogori
		- Odja Igana

To gain real and tangible information from the herbalist, a previous discussion has been made with them to explain the importance of this study for humankind. This was followed by the registration of herbalists which were ready to share their knowledge with us. The richness of the shop influenced our choice.

Four local languages were used for the interview:

- **Fon** for the herbalist living in Abomey-Calavi (Benin)
- **Mina** for the herbalist coming from Togo and Ghana
- **Goun** for the herbalist living in Porto-Novo (Benin)
- **Yoruba** for the herbalist selling in Pobe and the ones coming from Nigeria.

The survey took into account the age, the sex, and the level of alphabetization.

The local name, the preparation and administration mode, prohibitions, side effects, and other necessary information were collected during the survey.

2.2.4 Socio-economic Survey

The methodology of structured interview described by ^[9,17] was used to conduct the survey. The sales' prices and the storage's condition were registered.

2.2.5 Data Processing

The collected data were coded and inserted in excel 2020 databases then analysed by the software Minitab

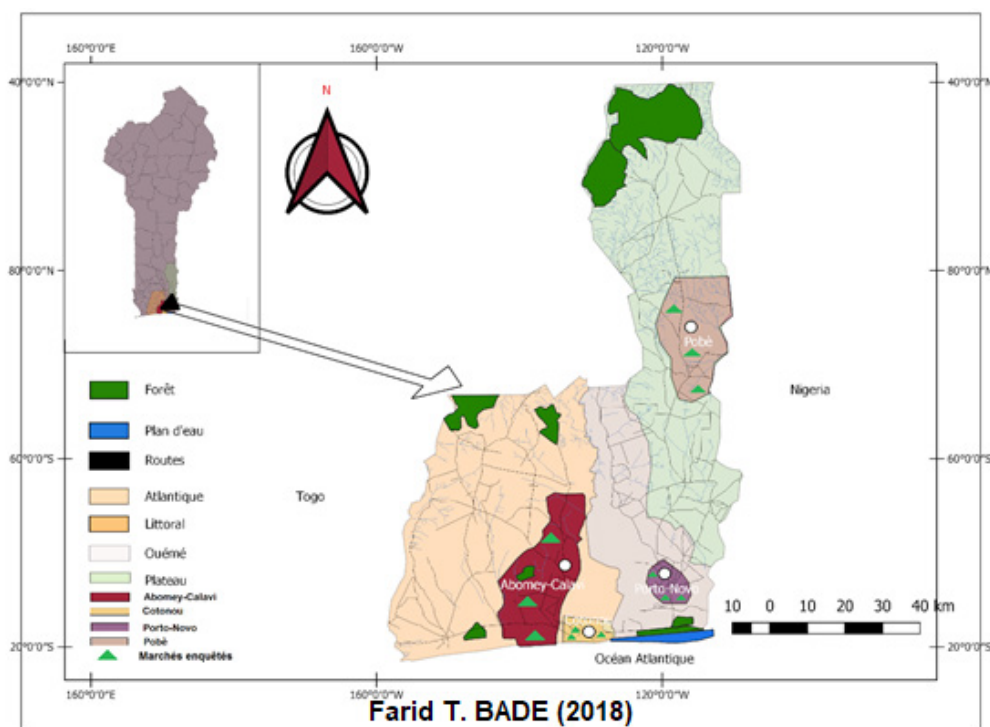


Figure 1. Map showing the study area's departments and their respective communes involved in the survey (Source: Farid T. BADE 2018)

17.0 and Graph pad 2019.

The frequency of citation (Fc) of every plant was resolute by the formula:

$$Fc = \frac{\text{number of citation of the plant}}{\text{Number of citation of all plante}} \times 100$$

3. Results and Discussion

3.1 Strengths and Weaknesses of the Survey Method Used in This Study

The method used in this research was retrospective. It was based on the capacity of the herbalist to remember their ancestral knowledge [18]. This could lead to biases due to their personal emotions. So, the value attributed to these plants depends on the individual's appreciations, taking into account their experience.

In spite of this, the retrospective method is widely used by many authors [19-21] and, has the privilege of giving convincing results, when the people involved are highly implicated in traditional treatments.

3.2 Sociodemographic Characteristics of the Respondents

The results concerning the age, the sex, and the level of alphabetization are displayed in table 2. The analyse of this table showed that 80% of herbalists present in the study area are female against 20% of males. The identical observation had been made by [22] and [23] who realized that during their different study, females' herbalists are more dominants. This could be due to the fact that nowadays,

in west Africa's market, women prefer soft works, like selling in the market while men preferred hard works. The herbalist interviewed were aged from 30 to 95 years. The subjects of 60 years old and more are more dominants, followed by the ones in the range of 50 to 60 years old. These results could be explained by the fact that in Africa, young people prefer activities with fast and important revenue instead of these kinds of activities with low incomes. It could also be due to the new generation youths that are not patient enough to receive the precious ancestral knowledge from the elders. Analphabets were more represented in our survey results. This data is closed the national data of PNUD BENIN who stipulated that the use and the commercialization of traditional medicine is the privilege of the poor and illiterate.

Forty percent of the herbalists are Gouns while 8 % are Minas. The majority of Goun obtained could be justified by the location of the study area. It appears from our survey that the Goun are the most represented tribe in the south. They are also present in Nigeria and are involved in all types of business. In contrary the Minas were in minority, because these activities are not seen as an important source of revenue for them, they prefer importing commodities from Togo and Ghana to Benin, in order to make better profit.

Species used the study area

Two major plants were identified. There were:

Heliotropium indicum L., and *Abrus precatorius L.* (Table 3). These species are the most sold for the treatments of severe infections and other complications. The citation of each species varies according to the department

Table 2. Sociodemographic characteristics of herbalists

Characteristics	Modality	Herbalist %				
		ATLANTIC	COASTLINE	OUEME	PLATEAU	Mean
Sex	Male	20	10	30	20	20
	Female	80	90	70	80	80
Age	[30-40]	30	18	15,50	22,22	21,43
	[40-50]	10	15	3	10,08	9,52
	[50-60]	40	25	30	38,2	33,30
	[60-95]	20	42	51,5	29,5	35,75
Level of alphabetization	Analphabet	92	84	92	100	92
	Primary	8	16	8	0	8
	Secondary	0	0	0	0	0
Religion	Animist	72	40	88	80	70
	Christian	16	48	6	10	20
	Muslim	12	12	6	10	10
Tribal group	Fon	45	25	10	0	20
	Mina	15	17	0	0	8
	Yoruba	20	18	30	60	32
	Goun	20	40	60	40	40

surveyed. Nevertheless, there is no significant difference between the citations of the species. Other authors like ^[22] noticed that *Heliotropium indicum L.*, was more present in the commune of Abomey-Calavi during a census of medicinal plants used in the treatment of gestational diabetes. These observations show that *Heliotropium indicum L.*, could be the most dominant and the one with the high frequency of use compared to the other. On the other hands *Abrus precatorius L.* was more cited in Pobe. This could be probably due to soil and other traditional interest. According to ^[13], *Abrus precatorius L.* grows easily in savannah forest and sandy area. The presence of forest in this community could justify the high frequency of citation.

The co-dominance of *Abrus precatorius L.*, and *Heliotropium indicum L.* could be justified by their importance in traditional medicine. While *Abrus precatorius L.*, is used to relieve pains, fever and caught, *Heliotropium indicum L.*, is generally used in the treatment of severe infections.

Table 3. Citation frequency of *Abrus precatorius L.*, and *Heliotropium indicum L.* In the study area.

Commune	Citation frequency (%)	
	<i>Abrus precatorius L.</i>	<i>Heliotropium indicum L.</i>
Abomey - Calavi	60	40
Porto-Novo	50	50
Cotonou	60	40
Pobe	51	49
Local name	<i>Viviman</i>	<i>koklossou dinkpadja</i>

Different uses of *Abrus precatorius L.*, and *Heliotropium indicum L.*

The phytochemical analysis of the leaves of *abrus precatorius L.* ^[24] showed a heterogeneity of the following chemical groups: alkaloids, tannins, flavones, coumarin, saponins, sterols, triterpenes and reducing compounds, responsible for its attributed therapeutic properties. *Abrus precatorius L.* roots contain sterol and terpenes. *Abrus precatorius L.* helps to treat fever, dysentery, stomach disorders, abdominal colic in new-borns with the fresh plant (leaves, stems, roots together without seeds) or dried plant ^[25]. The decoction of the leaves helps in the treatment of diabetes.

Abrus precatorius L., has been classified as an anti-tussive plant and expectorant for centuries ^[26], so it is not surprising that people in places like Madagascar and Senegal are interested in using it to treat childhood coughs, coughs, asthma and bronchitis ^[25,27]. It is also an anti-inflammatory.

Abrus precatorius L. is a galactogenic or galactagogue food that promotes, the production of breast milk. This

plant is administered orally with an extract of its leaves diluted with palm wine (1 glass/day) or the ash of the vine is used as a local application after scarification on the chest ^[28]. Alternatively, the leaves are used in a drink for the treatment of gynaeco-obstetric disorders. In case of asthenia (weakening of the organism, physical fatigue, low libido) it is recommended to decoct it with water, or mixing the powder of its leaves with honey ^[3]. ^[29] publication stated that in Uganda the powdered leaves/roots of *Abrus precatorius L.* or the decoction is taken orally to treat cases of premature ejaculation.

Heliotropium indicum L. has multiple therapeutic uses due to its natural composition of active's elements on human biology. This plant with its slightly bitter taste is rich in polyphenols, saponosides, flavonoids, gall tannins, catechics, quinones, adrenomimetic substances and alkaloids. The aqueous extract of *Heliotropium indicum L.* has multiple biological properties including the following potentials: gastro-protective against gastric ulcerations for example ^[30], antihypertensive, anti-inflammatory, antimicrobial, vasorelaxant and immunostimulant.

Indeed, with its chemical composition, *Heliotropium indicum L.* leaves can treat several types of eczema, burns, wounds, boils, impetigo in children and even sexually transmitted diseases such as herpes. In Africa, it is also traditionally used in the pharmacopoeia to help treat diarrhoea, constipation and cardiovascular diseases due to the presence of alkaloids that reduce high blood pressure. To treat cases of hypertension in Nigeria, the whole plant of *Heliotropium indicum L.* together with that of *afromomum melegueta*, are roasted and then powdered and administered with hot porridge twice daily in the morning and evening for a week ^[31].

The fresh crushed leaves are applied as a rub and used as an anti-venom for scorpion stings ^[32]. The plant is also used for a number of unspecified eye diseases, but by instillation. For pregnant women, a decoction of *Heliotropium indicum L.* leaves in the form of a bath can reduce swelling of the face, such as pregnancy masks ^[33]. In addition, the decoction of *Heliotropium indicum L.* leaves, is used in various malaria treatments in Nigeria, and the juice of *Heliotropium indicum L.* leaves applied topically is used to treat canker sores in Benin. However, other uses continue to be reported for this incredible plant for amenorrhoea, vomiting and various spiritual treatments.

Decoction is the main way of preparation. Since no intoxication has been reported, the medicine is taking orally.

The preparation is consisted of single plant (30%) or a combination of several plants (70%). The parts of the plant mostly used are the leaves and the leafy stem (Figure 2).

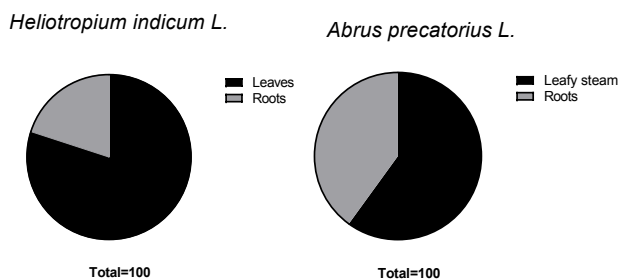


Figure 2. part of the plant used for decoction

Socio-economic values

The species sold within the market are available as leafy stems and roots. For *Heliotropium indicum L.* the massive sales of the leafy stem are up to 80% while for the other the massive sales are up to 40%. The difference obtained is justified by the used of each plant. In the case *Abrus precatorius L.* the roots are regularly used to lower fever and relieve pains.

The supply of plants materials has significantly decreased over the years. This is due to the fast demographic advance. This is confirmed by more than 87% of our respondents. But the availability of species varies according to people preference and the species. In fact, in some area, people consider *Heliotropium indicum L.* as bad bush and easily get rid of it. This observation is thanks to fast urbanization of the study area. The common purchase and selling prices of every plant recorded during the study period still low. The gains varied significantly according to the actors of the sectors. In general, the gains range from 3000 F CFA to 4000 F CFA per bag of 50 kg. The producers get more benefits than others. Their benefits range for 1000f to 3000f daily. For others (wholesalers, semi-wholesalers and retailers) involved well selling, prices vary between 100f and 200f. They get a much bigger profit when selling in detail. This business represents an important source on incomes for actors involve.

4. Conclusions

The vital role of herbalists in the treatments of different type sickness has been highlighted in this study. The 2 plants play a significant role in West Africa traditional medicine. Frequently cited diseases have been: dysentery, stomach disorders, abdominal colic, eczema, burns, wounds, boils, impetigo in children and even sexually transmitted diseases such as herpes. These results require deep laboratory research to determine and isolate the bio-active compounds presents in the plants. A new generation of improved traditional medicine could appear with a significant beneficial effect for humankind.

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