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Ethnobotanical survey, mineral and phytochemical composition of *Byttneria catalpifolia* and *Sida urens*: Two spontaneous plants consumed in households in the city of Man

SORO Lêniféré Chantal [1,*], MONYN Ebalah Delphine [1], KOUADIO Kouakou Kouassi Armand [1], BOUH Ange Meka Hanielle [1] and ANIN-ATCHIBRI Anin Louise [2]

[1] *UFR - Forestry and Environmental Agronomic Engineering (UFR IAFE), University of Man, BP 20 Man, Ivory Coast.*
[2] *UFR Food Science and Technology (UFR, STA), Nangui Abrogoua University, 02 BP 801 Abidjan 02, Ivory Coast.*

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Abstract

This study aims to promote the wild food plants consumed in households in the city of Man. To achieve this objective, an ethnobotanical survey was conducted in 90 households distributed in three districts of the city of Man, in order to inventory the wild plants that are consumed there. The survey was completed by the mineral and phytochemical analysis of two plants selected following the survey carried out in the city. The results obtained make it possible to identify 34 plant species, 27 of which have been identified, divided into 21 botanical families. The majority of the plants mentioned are consumed for their taste (87%) and as a sauce (90%). The mineral and phytochemical analysis of the plants studied *Byttneria catalpifolia* and *Sida urens* showed High levels of polyphenol (23.37± 0.82 mg EAG/gp), calcium (80.9%) in the plant *Byttneria catalpifolia* while the potassium (11.4%) was moderate and that copper, chlorine of flavonoid (1.77 ± 0.28 mg EQ/gp) was low. The results also revealed the presence of compounds such as terpenes, saponins, coumarins, proteins in the plant *Byttneria catalpifolia* The plant *Sida urens* showed a low content of copper (0.05%), chlorine (0.2%) and flavonoid (1.17± 0.03 mg EQ/gp) On the other hand, the moisture content (10%), ash (18%), calcium (62%), iron (14.9%), potassium (14.7%), polyphenol (29.16± 0.042 mg EAG /gp) were high. Let us remember from this study that the city of Man contains a variety of wild food plants and most of these plants contain appreciable amounts of nutrients.

Keywords: Ethnobotanical survey; Spontaneous plants; Mineral and phytochemical composition; *Byttneria catalpifolia*; *Sida urens*

1. Introduction

Plants have occupied a prominent place and have been for man, a privileged point of contact with nature and health. Herbal remedies are increasingly popular and used based on sound values. They have been tested by our ancestors, of whose virtues confer a significant place in traditional therapy [28].

African populations have always used medicinal plants and cultivated or spontaneous food species to cover their health and nutritional needs [12]. Wild food plants play a very important role in the socio-economic balance of developing populations. This flora serves as food [29], sanitary products [33], household tools, energy sources [15] and contributes to diversifying sources of income [16]. They are important sources of vitamins (A, B and C), trace elements, proteins, fibre, and carbohydrates and thus contribute to improving the nutritional status of populations [22]. They are also an effective resource in managing the double nutritional burden that many countries in sub-Saharan Africa are suffering

* Corresponding author: SORO Lêniféré Chantal
UFR - Forestry and Environmental Agronomic Engineering (UFR IAFE), University of Man, BP 20 Man, Ivory Coast.

from, marked by the rapid advance of malnutrition and metabolic diseases. These less cultivated wild plants are threatened with rarefaction or disappearance due to food depreciation or anthropogenic actions (logging, agricultural expansion, urbanization). Forests in general, and even sacred forests, are subject to rapid and massive degradation, resulting in a reduction of their area or even their complete disappearance [17]. In such a context, it is important to initiate ethnobotanical, phytochemical and biochemical studies in order to lead to the knowledge, conservation and valorization of these species. This work was therefore undertaken in order to contribute to the exploitation of endogenous knowledge relating to the use of food plants of the flora of the West of Côte d'Ivoire, more precisely wild plants consumed in households of the city of Man.

2. Material and methods

2.1. Plant material

The material consisted mainly of leaves of the *Sida urens* plant and stem of *Byttnéria catalpifolia*. The choice of the species *Byttnéria calapifolia* was based on the fact that it is widely known and consumed by the indigenous peoples of the region (Yacouba). As far as *Sida urens* is concerned, it was chosen because it is known only by the peoples from the city of Man, and is also endangered.

2.2. Methods

2.2.1. Choice of survey sites

The surveys were conducted in the city of Man. For this study, three neighbourhoods were selected. This is Domoraud, Camp séa, Campus 1, these neighbourhoods have been selected in relation to the standard of living (low or high) of their population. For each neighbourhood, households were randomly selected.

The sampling unit is the household. The number of households was calculated using the method described by Magnani [20].

$$n = \frac{t^2 Xp(1-p)}{m^2} \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

n = number of households, t = 1.96 at a confidence level of 95%, m= margin of error at 2.792%.

In this work, a value of p = 50% was chosen in order to obtain a maximum sample [9], the number of persons per household being undetermined. A sample of 90 households to be surveyed was obtained and distributed in each of the three selected neighbourhoods (30 households per neighbourhood). The household size ranged from one to ten (10) individuals, corresponding to members of the same family.

2.2.2. Ethnobotanical survey

The method used was ethnobotanical surveys [21]. This involves writing a questionnaire to understand the multiple uses of plants among the population. To conduct this survey, we used semi-structured interviews [23]. The investigation consisted of questioning the mistress or the man of the house. For species identification, plant samples were collected with the help of informants and identified. These plant samples were determined using the Aké-Assi method [4] [5], then updated with APG IV using the online database of the Conservatoire du Jardin Botanique of the city of Geneva. Those that could not be correctly identified were kept, transported to the National Floristic Centre (CNF) of the University Félix Houphouët Boigny de Cocody for identification or confirmation.

To determine the level of knowledge and consumption of plant species, the criteria for knowledge and for actual consumption of food plants have been combined, according to Ambé [7]. Thus, food plants have been classified into known, medium-known and little-known species. The level of relative population knowledge (Prc) for each species was estimated by the ratio of the number (n) of people familiar with the species to the total number (N) of people interviewed using the following formula:

$$\mathrm{Prc} = (\mathrm{n}/\mathrm{N}) \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Plant species, with a relative level of knowledge (Prc.) between 50 and 100 p.c., are the best known. With a Prc of 25 to 50 p.c., the species are said to be medium known. For a Prc.from 0 to 25 p.c., the species are said to be little known [32].

2.2.3. Phytochemical analysis

These are tests performed to collect data on the composition of the studied plants (in powder form). Most are based on colorimetric assays and also precipitation, using various reagents. The methods used for the characterization of the chemical groups present in each plant follow the protocols described by Abdelhamed et al. [1]; Abdul et al. [2]; Ahmed et al. [3]; Krishnaiah et al. [19]; Rahman et al. [26] and Živić et al. [34].

2.2.4. Minerals analysis

The analysis of the minerals was carried out by X-ray fluorescence spectrometry according to Valérie [31] method.

2.3. Statistical analysis

Data were entered using Excel software and then exported to Statistical Package for the Social Sciences software [27].

3. Results

3.1. Ethnobotanical data of listed plants

There are 34 species of wild food plants inventoried in households in the city of Man. Of these plants, seven (7) were not botanically identified, while 27 were well identified. These wild species belong to 21 families. The Malvaceae family contains the most plant species with six (6) species. It is followed by Solanaceae with four (4) species, then Piperaceae with two (2) species. The family Cucurbitaceae, Anacardiaceae, Caricaceae, Lamiaceae, Basellaceae, Talinaceae, Urticaceae, Amaranthaceae, Fabaceae, Dioscoraceae, Araceae, Tiliaceae, Pedaliceae, Solanaceae, Malvaceae, Euphorbiaceae, Irvingiaceae, Lauraceae, Arecaceae have only one species each (Figure 1).

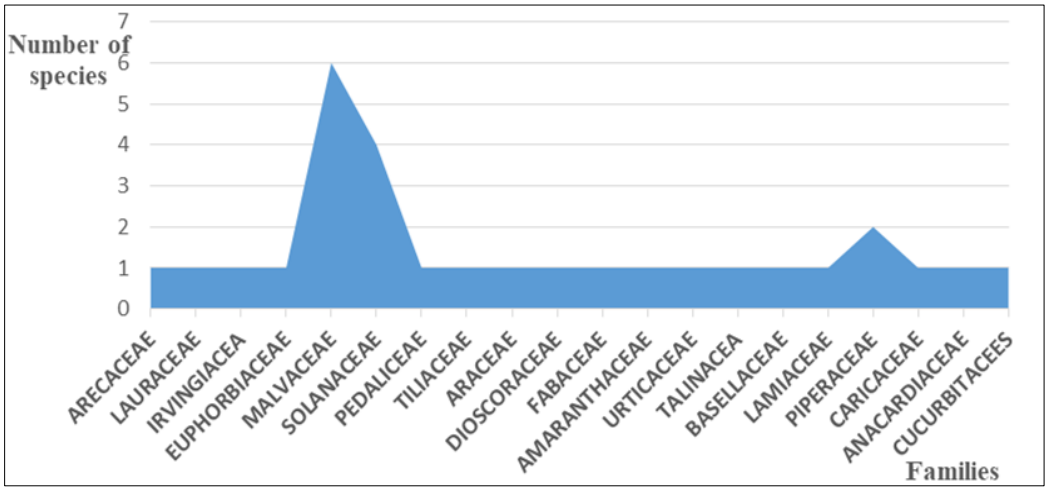


Figure 1 Number of species according to families

3.2. Level of knowledge of plants by respondents

By level of knowledge and use, the wild food plants encountered are divided into three (3) groups, the most well-known plants (Figure 2), the medium-known plants (Figure 3), the little-known plants (Figure 4). The best known wild food plants in the city of Man are four (04). Their level of knowledge ranges from 50% to 63.33%. They are*: Irvingia gabonensis, Byttnéria catlapifolia, Ricinodendron heudelotii, Elaeis guineensis*. These species were cited and consumed by the majority of respondents. The most popular plant in the city of Man is *Elaeis guineensis.* There are seven (7) of the medium-known plants. These are: *Capscicum annum, Basella Alba, Sesanum radiatum, Solanum nigrum, Solanum torvum, Corchorus alitorius, Beilschliedia mannii.* The number of times they have been cited ranges from 25.55% (*Capscicum annum*) to 47.77% (*Beilschliedia mannii*). There are 16 little-known plants in the city of Man. They have a level of knowledge ranging from 1.11% (*Cucumus melon*) to 22.22% (*Amarantus cruentus*).

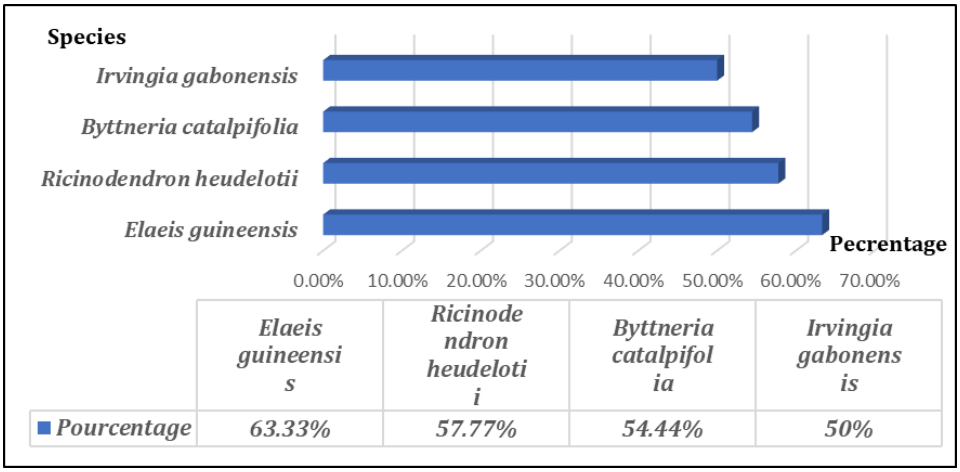


Figure 2 The most famous plant

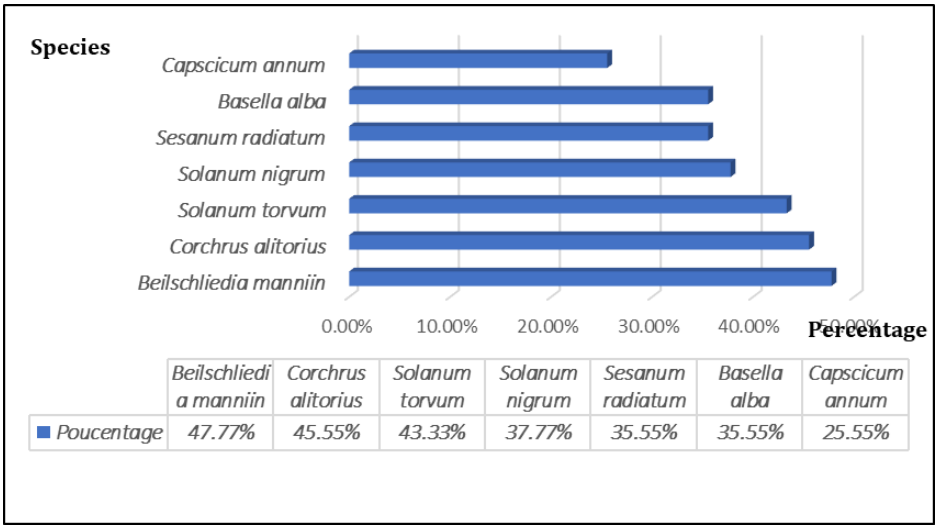


Figure 3 Medium-known plants

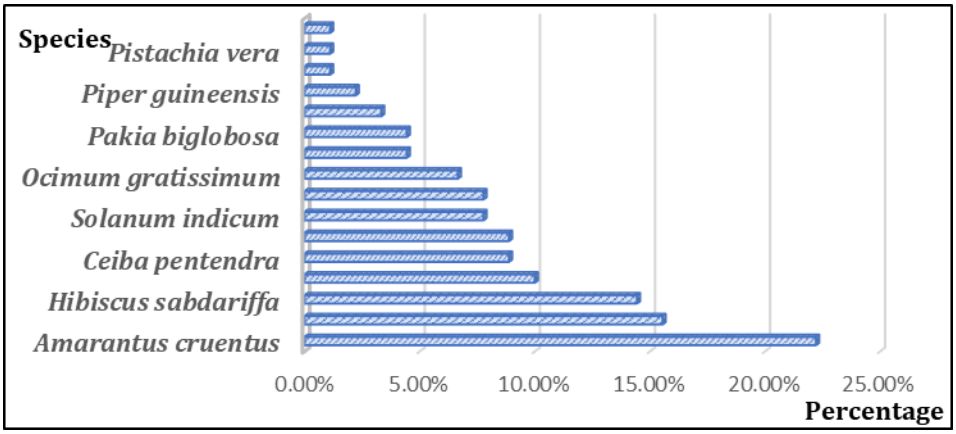


Figure 4 Little-known plants

3.3. Parts consumed, Mode of consumption and reason for consumption

Leaves are the most consumed parts (44%), followed by fruits (24%), seeds (22%), stems (9%) and tubers (1%) respectively (Figure 5). The pattern of consumption of spontaneous plants in the study area is shown in Figure 6. Wild

plants were much more consumed after cooking with a proportion (92%), while only 8% of plants were consumed as spices.

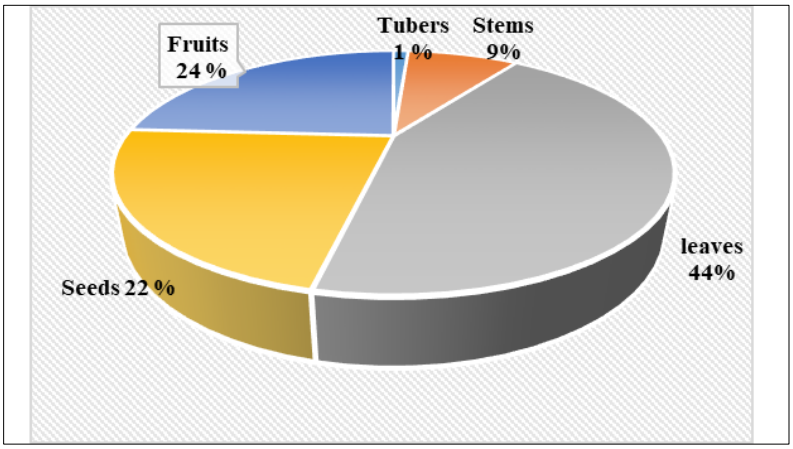


Figure 5 Parts consumed from wild food plants

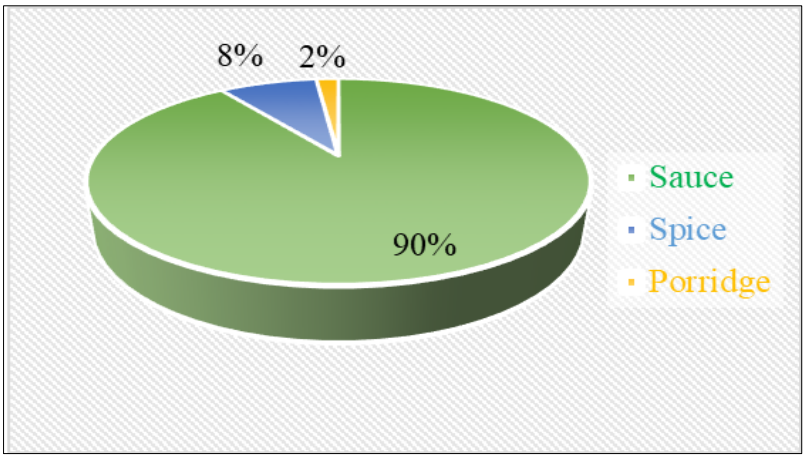
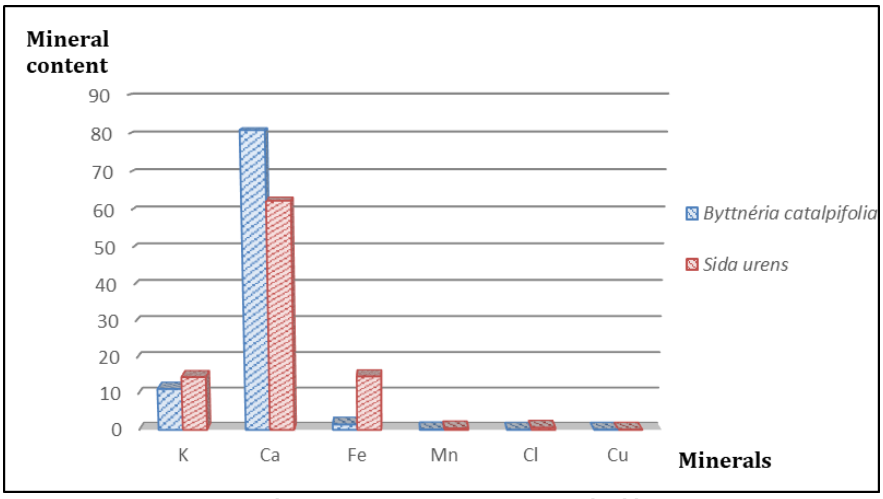


Figure 6 Mode of consumption of wild food plants

3.4. Mineral content



K= Potassium, Ca= Calcium, Fe= Iron, Mn= Manganese, Cl= chlorine, Cu= Copper

Figure 7 Percentage of minerals contained in *Byttnéria catalpifolia* and *Sida urens*

The percentages of essential nutrients contained in the plants *Byttneria catalpifolia* and *Sida urens* are shown in Figure 7. The figure shows that the plants studied contain several minerals of food interest in different proportions. They are very rich in calcium, 80% for *Byttneria catalpifolia* and 62% for *Sida urens*. The percentage of potassium, iron and chlorine is higher in *Sida urens* plant than *Byttneria catalpifolia*, respectively (14.75%, 14.91%, and 1.2%) against (11.36%, 1.49%, and 0.027%).

3.5. Phytochemical analysis

The results of phytochemical screening by colour reactions of phytochemical compound are presented in Table II. These results show that the plants studied contain a range of active products, based on the testing of numerous interactions with qualitative reagents, resulting in color changes or precipitation. The two plants studied contain all, flavonoids and reducing sugars but, they do not contain compounds such as: Alkaloids, anthraquinones, quinones and phlobatanins. The results of the tri-phytochemicals also reveal the presence of terpenes, saponosides, coumarin, proteins and glycoside in the extracts of *Byttnéria catalpifolia* and their absence in the plant *Sida urens*. The sterol test was positive in *Sida urens* and negative in *Byttnéria catalpifolia*. Table 3 shows that the total polyphenols content of the different plants varies between 23.37 and 29.16 mgEAG/gp. The highest polyphenols concentration is observed in *Sida urens* (29.16 0.42 mgEAG/gp) and the lowest in *Byttnéria catalpifolia* (23.37 0.82 mg EAG/gp). The flavonoid content of *Byttnéria catalpifolia* 1.77 0.28 (mg EQ/gp) is higher than that of *Sida urens* 1.17 0.03 (mg EQ/gp).

Table 1 Triphytochimic by colour reaction of the studied plants

	sterols	**terpenes**	**saponoside**	**flavonoide**	**coumarine**	**alkaloid**
Byttneria catalpifolia	-	+	+	+	+	-
Sida urens	+	-	-	+	-	-

Legend: +: presence - : Absence

Table 2 Results of the determination of polyphenols and flavonoids

Plant material	**Polyphenols (mgEAG/100gp)**	**Flavonoids (mgEQ/100gp)**
Byttneria catalpifolia	23,37±0,82a	1,77±0,28b
Sida urens	29,16±0,042b	1,17±0,03a

4. Discussion

This study identified thirty-four (34) wild food species consumed in households in the city of Man. Twenty-seven (27) of these species were identified and divided into 21 families. The most cited families were the Malvaceae, Solanaceae and Piperaceae. In the households of the city of Man, leaves are the most consumed organs 44%, these leaves are consumed there as sauce. Indeed, the leaves are permanent organs on the plant, so they are available almost all year round. They are also more accessible and do not significantly affect the plant, which is essential for its survival and for the sustainable management of our floristic heritage. Practices harmful to the survival of many species include root bark removal and systematic removal of species [25].

The twenty-seven (27) identified plant species can be divided into three groups. The most known and consumed with a frequency varying from 50 to 100%, the average consumed with a frequency varying between 25 and 50%, and finally the least known and consumed with a frequency less than 25% which are the most represented of the plants mentioned. The best known species are *Elaeis guineensis*, *Ricinodendron heudelotii*, *Irvingia gabonensis*. This classification of spontaneous plants into three groups has already been done by Kouamé et al. [18] who also reported most of these species in their work. This finding corroborates that of Vroh et al. [32], which showed that there are various species of spontaneous plants of food interest however, very few are known. This could also be explained by the galloping destruction of forests to the detriment of cash crops such as cocoa, whose region remains a major producer, and finally, by propagating food crops to the detriment of spontaneous plants, without forgetting the rapid urbanization of rural areas [25].

In addition, some spontaneous plants used for food purposes by the surveyed population are also used for other uses such as traditional medicine. These are known to treat various diseases such as malaria, intestinal parasites, infections,

etc [6]. The plants listed in the households of Man are trees, shrubs of herbs and lianas growing in the forests, they are therefore known because many are widespread in the region of Man which is a forest area.

Some biochemical and phytochemical parameters were sought in *Byttnéria catalpifolia* and *Sida urens*, plants selected after surveys. Mineral research in the extracts of *B. catalpifolia* and *S. urens* revealed their rich calcium and potassium content of 80.9%; 11.4% for *B. catalpifolia* and 62.4%; 14.7% for *S.urens*. Our results corroborate with the results of Tokpa et al. [30] in a study of the red variety *Byttnéria catalpifolia* in the same area (Man) which also found that extracts of *B. catalpifolia* were rich in calcium and potassium. Other essential minerals have also been found in these two (2) plants. These are iron, manganese, and chlorine, copper. The latter must be brought in very small proportions to the organism but are nevertheless essential for the proper functioning of the latter which does not synthesize them. They act in most enzyme systems, metabolisms and cell construction [10].

Triphytochimic has shown that extracts of *Byttnéria catalpifolia* and *Sida urens* contain a large number of secondary metabolites. Terpenes, flavonoids, coumarines, saponosides, polyphenols were found in *B. catalpifolia*; sterols, polyphenols and flavonoids in *S. urens*. The determination of polyphenols and flavonoids indicates that *S. urens* has the highest polyphenols content 29.16 (mgEAG/gp), its flavonoid content is 1.17 (mgEQ/gp). As for *B. catalpifolia*, its polyphenols content is 23.27 (mgEAG/gp) and 1.77 (mgEQ/gp) for flavonoids. All of these identified compound have various pharmacological properties [24]. All of these compound could explain traditional use in the treatment of diseases cited by interviewees and/or identified in the literature [11]. Flavonoids are veinotonic, antispasmodic, antibacterial, etc., terpenes are antiinflammatory, analgesic, and antifungal [8]; saponosides also cause red blood cell lysis [14].

5. Conclusion

The present study is a contribution to the valorization of wild plants in human food of the flora of Man. To do this, the work was devoted to an ethnobotanical survey, to the biochemical and phytochemical study of extracts of *Byttnéria catalpifolia* and *Sida urens* on the basis of their use only by the indigenous peoples of the area. Surveys of 90 households revealed a high proportion of women and the age group between 30 and 50 years with a high number of allogeneic. Leaves are the organs most consumed in sauces and are prized for their taste. The diversity of the plants identified and their level of consumption depend on cultural groups and certain socio-economic factors. Biochemical analysis showed the presence of essential minerals, namely calcium, manganese, iron, chlorine, copper in the aqueous extracts of *B. catalpifolia* and *S. urens*. These two (2) species also contain polyphenols, terpenes, flavonoids, coumarines, saponosides, and sterols. All these compound present in *B. catalpifolia* and *S. urens* have great importance in nutrition and in the medicinal field.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors have not reported any conflicts of interest.

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