

Traditional Use of Medicinal Plants Confirmed by the Baka in Southern and Eastern Cameroon

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Abstract

The limitations of biomedicine to provide effective solutions to certain pandemics has led many people to turn to alternative therapies. These palliative solutions, particularly phytomedicines, are much sought after for disease prevention and treatment. The Baka, a group of forest-dwelling people, hold knowledge on how wild plants can be effective in treating many illnesses. However, the greatest challenge for the identification of traditional medicines depends on the veracity of the information provided during ethnobotanical surveys by user populations. The present study describes forest plants used by the Baka and confirmed by them as being employed for traditional medicine. We carried out ethnobotanical surveys between 2019 and 2021 in 221 households within four districts of the Eastern and Southern Region of Cameroon. We used indices of significant use and performance applied to all mentioned species, alongside searches in the literature. The statistical tools used to distinguish the different groups/districts is Pearson's X^2 test. A total of 378 plant species were identified of 270 genera and 85 families. Ethnobotanical indices allowed to identify the most confirmed and efficient plants for several health problems. A pairwise comparison of these indices showed a significant corre-

lation with a p -value $< 2.2e-16$ and a dissimilarity distance less than 0.5. Some plants selected are widely cited in other regions and/or countries for the same health problems. The presence of active molecules responsible for their biological activity was also proven, justifying their use in traditional medicine. This paper examines the potential to enhance the value of Cameroon's pharmacopeia by integrating various ethnobotanical indices. It aims to discover new therapeutic molecules and develop improved traditional products from the diverse plant species documented. The findings indicate opportunities to advance both local and global healthcare solutions.

Keywords

Confirmed Plants, Import-Substitution, Improved Traditional Medicine (ITM), Sustainable Development Goals, Therapeutic Molecules

1. Introduction

Africa is home to a rich variety of plant species, many of which have important medicinal uses. These plants play a central role in the practices of folk pharmacopoeia [1]. Medicinal plants are highly valuable resources, both for local populations and for the pharmaceutical industry. They offer a significant alternative and complement to modern healthcare systems [2]. According to [3], modern medicine is currently lacking in new treatments. Furthermore, the process of developing a new drug can take many years, making it unable to provide effective solutions for certain diseases and increasing resistance to conventional medicines [4]-[6]. As a result, the pharmaceutical industry has shown a growing interest in ethnobotanical studies of plants, which continue to yield a range of promising molecules [7] [8]. Traditional medicine, therefore, appears to be the most suitable alternative for addressing gaps in healthcare needs [9].

Qualitative ethnobotanical surveys have proven to be one of the most reliable approaches to new drug discovery [10]. This is because, in addition to clearly identifying the plants cited, they aim to characterize the traditional uses or recipes made from these plants by local populations. Several research studies conducted in various parts of Africa have highlighted the potential of medicinal plants used by local peoples to ethnomedicine. These include a floristic and ethnobotanical study of medicinal plants used by Baka Pygmies on the periphery of the Ipassa Biosphere Reserve, Gabon [11], an ethnobotanical and floristic study of some medicinal plants marketed in Kinshasa in the Democratic Republic of Congo [12], on the ethnobotany and phytomedicine of medicinal plants in Douala [13] and on the ethnobotanical study of plants marketed in the city of Douala in Cameroon [14].

However, one of the fundamental problems that undermines the promotion of traditional medicine or the development of ITM based on traditional knowledge is the lack of veracity of the information provided by respondents. Often, much of this information is incorrect. The main answer therefore lies in the search for

analytical methods to highlight among the large mass of information collected, those that can be considered as confirmed for use for health problems. Several authors have contributed in this direction with the development of certain indices to determine the most significant and confirmed uses of plants for the health problems indicated. This is the case, for example [15]-[18] with the confirmation index (ICs or ICF) used to assess agreement between informants on plant use. Also [19] and [20] with the relative frequency of citation index (RFC) used to explore the significance or importance of species in an area; [21] with the fidelity level (FL) used to quantify the importance of the species for a given purpose. The combination of the different ethnobotanical parameters/indices can therefore be used to refine the list of plants confirmed for their traditional uses. This article aims to highlight among the plants used by Baka, those confirmed for their uses in traditional medicine. The specific objectives are to characterize the Baka flora and highlight significant uses.

2. Materials and Methods

2.1. Study Site

This work was carried out in fourteen (14) villages in two regions of Cameroon: East and South. The study villages are located in the districts of Mintom, Dimako, Lomié and Yokadouma. The climate is equatorial and humid. Rainfall averages between 1500 and 2000 mm per year, and some precipitation is common even during the dry seasons [22]. Mean annual temperature is between 23°C and 25°C, fluctuating slightly between seasons. There are four seasons: a major dry season, a minor rainy season, a minor dry season, and a major rainy season [23]-[25]. The major vegetation type is a mixture of evergreen and semi-deciduous forests [26]. These four districts/subdivisions are in the evergreen Cameroonian -Congolese forests, precisely in the Guineocongolese region.

2.2. Data Collection

Data collection started with an information and sensitization meeting of rural communities to obtain their consent. Before starting the survey in each village, we held meetings to inform the villagers of the objectives of our work and to set appointments. The informants were selected at random. Useful and original information on the popular use of medicinal plants was collected from anyone (Healer or not) who voluntarily agreed to receive us, regardless of gender. In each household surveyed, the various members were asked to provide information on any illnesses that they are often used to treat. Information related to medico-magical effects was not requested, to generate much more audience with informants. During the interview, we thought it best to start from the diseases to the plants, rather than going the other way around. By showing our interlocutor a sample of a plant and asking about its uses, we risked encouraging him to invent recipes [27]. Guides were engaged in each village to facilitate communication with the people surveyed. A semi-structured interview method based on a

questionnaire sheet was used [28]. Data concerning the details of the recipes were collected according to a standardized framework and inspired by the files proposed in the database of Traditional Medicine and Pharmacopoeia under the acronym Pharmel [29]. This sheet is composed of 5 parts, namely: 1) the identification of the informant, 2) the therapeutic indications, 3) the characteristics of the plant material used, 4) the methods of preparation and administration of the remedy, 5) and the comments. At least two plant samples were collected during the interviews in each zone. They are logged in the HNC in Yaoundé. A total of 221 informants, including both male and female, in 14 villages belonging to four subdivisions were interviewed. The distribution of these people by subdivision is such that: Dimako (33 informants), Lomié (39), Mintom (74) and Yokadouma (75). Respondents age is in the range [18 - 60] years.

2.3. Data Processing and Analysis

The sample is assumed to be random: the presence of information in the sample has no influence on the probability of the presence of other information. It is this hypothesis that seems possible to us on the collection of data and on the population studied (all plants used by Baka people in the Mintom subdivision). Therefore, non-parametric statistical techniques will be used [30].

2.3.1. Methodology for the Individualization of Groups

A plant or a recipe is considered to have a convergence of use when it is employed by at least two persons to treat the same disease/ailment. The data should be collected uniformly using a standard protocol across all households, irrespective of the varying roles of the respondents (healers, village chief). This consistent approach helps avoid biases that may arise from the specialization of certain individuals, such as healers. Comparisons are made for the same health issue, allowing for a reliable analysis of plant use patterns. The distinction between plant uses can be based on either the presence or absence of plants or the frequency of citations (number of times a plant is mentioned). The unit of analysis here is the village. Pearson's chi-squared test (χ^2) is employed to statistically differentiate between the groups [30].

The chi-square independence test (special case)

In this case, the groups studied must be compared in pairs [30]. The 2×2 contingency tables (chi-square test) will be used to see whether, for health problems, the two groups to be compared use the same plants or not. The chi-square independence test will thus be used in the same way as Sørensen's coefficient. It is used to see whether, for a given therapeutic indication, the citation weight (evaluated as the number or proportion of citations) of plant species varies or not with geographical zone. In other words, if the citation weight of a species is similar in all zones. The null hypothesis is $H_0: P_1 = P_2 = P_3 = \dots = P_n$. Where numbers a , b , c and d are defined in **Table 1**.

From the previous table, χ^2 observed is calculated by the following formula:

$$\chi^2_{obs.} = n(ad - bc)^2 / (a + b)(c + d)(a + c)(b + d)$$

Table 1. χ^2 contingency table 2×2 .

		Group I		Total
		Presence	Absence	
Group II	Presence	a	b	$a + b$
	Absence	c	d	$c + d$
	Total	$a + c$	$b + d$	$a + b + c + d$

a : number of species common to the 2 groups; b : number of species-specific to group II; c : number of species specific to group I; d : number of species absent in groups I and II.

If $\chi^2_{obs} > \chi^2$ theoretical, we reject the hypothesis of independence of the groups compared; in other words, there are similarities in the use of plants between the two groups. In this work, the threshold used is $\alpha = 5\%$; and therefore, $\chi^2(1 - \alpha)$ at the degree of freedom of 1, is equal to 3.84.

2.3.2. Search for the Most Significant Usages

Three different indices were used to highlight the most significant usages or plants: 1) the tradi-therapeutic interest index or TiI [27], 2) the Use Agreement Value Index or UAV [15] and 3) the performance index reference [31], the Spatial use convergency or SUC [27]. (Table A1)

The Traditherapeutic interest index (TiI)

The tradi-therapeutic interest index (TiI) assumes that “when two people or two groups of people do not significantly share the same plant species to treat a specific disease, the few species that are subject of a convergence of use in these two groups are of high tradi-therapeutic interest” [27]. The principle of the method consists of first identifying, through a test of χ^2 (special case), pairs of groups which do not use the same plants. All the species mentioned in each of these pairs are automatically qualified as interesting. For a species, this interest increases with the number of groups that share or use the indicated species. The Tradi-therapeutic interest index (TiI) is then determined for each species by calculating the average of the presence (value 1) of the species in all the groups surveyed. $TiIs = \sum_{i=1}^n \text{Pres-s} / Ng$, with TiIs; Index of tradi-therapeutic interest of the species s in the groups surveyed, Pres- s : presence of the species s in a group (Pres- $s = 1$), Ng: Number of groups surveyed. The value of TiI varies from 0 to 1 such that [0 - 0.25[: low; [0.25 - 0.5[: medium; [0.5 - 0.75[: high; [0.75 - 1]: very high.

The Use Agreement Value Index (UAV)

The UAV allows a better interpretation of the medicinal cultural value of plants reference [32]. It combines the Use Value Index (UV) [33] and the Confirmation Index (CI) which allows to assess or express the agreement of informants on the plants used [15].

$$UAV = UV \times CIs \text{ with } CIs = Na/Nt \text{ and } UV = \sum_{i=1}^n Uis/ns$$

Uis indicates the number of uses of the species mentioned by the informant i

and n_s corresponds to the number of people who mentioned this species. The CIs range from 0 to 1, a value close to 0 indicates that informants disagree on the plants used, while a value close to 1 indicates a strong consensus around the use of the indicated plant. N_a is the number of people who mentioned the species “a” and N_t the total number of people surveyed.

The Spatial Use Convergence Index (SUC)

The Spatial Use Convergence Index (SUC) proposed by [27] is used to assess similarities in the use of plants for the same health problem. This index is based on the following hypothesis: “A plant is confirmed for its use in traditional medicine when it is cited by at least two people in the treatment of the same condition. This confirmation is even more important when these people are based in different regions [27]. SUC is therefore determined by an arbitrary scale ranging from 0 to 1 as follows: $SUC = 0$ when the plant species is cited by only one person, the importance of that plant is low; $SUC = 0.5$ when the plant is cited by at least two people in the same site, the importance is medium; $SUC = 0.75$ when the plant is cited in two different sites, the importance is high; and $SUC = 1$ when the plant is mentioned in all three sites, the importance of that plant is very high. So for example, if the ethnobotanical survey was carried out in five groups or 5 villages as in our case and the species *Carpolobia alba* was mentioned in 3 villages, $I_iTCarpolobia\ alba$ would be equal to $3/5$, or 0.6 .

Summary of significant uses with the UAV, SUC and TiI indices

The three indices were analyzed and compared to determine if they yield the same results. To facilitate comparison, the values of each index (UAV, SUC and TiI) for different plants were categorised into 4 levels 1: low, 2: medium, 3: high, and 4: very high. This classification allows for easier comparison and correspondence among the indices, facilitating the calculation of the degree of correlation or dissimilarity.

We used the Pearson correlation and Bray-Curtis dissimilarity tests to assess the degree of alignment among the indices in identifying plants of particular interest, or those confirmed for local use in treating health problems. Pearson’s value close to 1 or with p-value less than 0.05 reflects a strong correlation; while that of Bray and Curtis close to 0 shows a small distance of dissimilarity.

Performance Index Calculation and Analysis

The Performance Index was calculated according to the method described by [31]. For data analysis, we define “specific flora” as the list of plants used to treat a specific ailment, symptom, or physiological effect. In contrast, “global flora” refers to the total list of plants recorded for treating all types of ailments within a specific group, such as the Baka Pygmies.

To understand the relationship between “specific flora” and “global flora,” consider the following: if the use of a particular plant for a specific ailment is randomly selected, the proportion of citations for that plant relative to the total citations (P_1) should be similar to the proportion of specific flora to the global flora (P_2). To illustrate the selectivity of a plant for a specific ailment, we com-

pare the expected and observed values of the proportion of citations for a plant for a specific disease.

The difference (D) between the two proportions is used to define a performance index (PI), which ranges from 0 to 3 based on the following scale:

- **PI = 0 (Not significant):** If $P1 - P2 < 0$, indicating that the plant is rejected.
- **PI = 1 (Average performance):** If $0 < P1 - P2 \leq 1/3$.
- **PI = 2 (High performance):** If $1/3 < P1 - P2 \leq 2/3$.
- **PI = 3 (Very high performance):** If $P1 - P2 > 2/3$.

Example Calculation: *Alstonia boonei* for Malaria Treatment

To illustrate this, consider the performance index of the plant *Alstonia boonei*, used for treating malaria:

- **C1:** Number of citations of *Alstonia boonei* for treating malaria = 73.
- **C2:** Number of citations of *A. boonei* in the global list = 119.
- **C3:** Total number of citations for malaria = 305.
- **C4:** Total number of citations for all ailments = 1635.

The observed proportion (P1) and the theoretical proportion (P2) are calculated as follows:

- **P1 (observed):** $P1 = C1/C2 = 73/119 \approx 0.61$.
- **P2 (theoretical):** $P2 = C3/C4 = 305/1635 \approx 0.18$.

The difference (D) between P1 and P2 is:

$$D = P1 - P2 = 0.61 - 0.18 = 0.43$$

Since 0.43 falls between 1/3 and 2/3, the performance index (PI) for *Alstonia boonei* is calculated as:

$$PI = 2$$

This indicates a high performance for the use of *Alstonia boonei* in treating malaria.

Proportions and Ratios

The proportions used are derived from the ratios of the number of citations for diseases. The performance index thus provides a quantitative measure to assess the efficacy and significance of specific plants in traditional medicinal practices, ensuring a clear understanding of their role and importance within the local medicinal context.

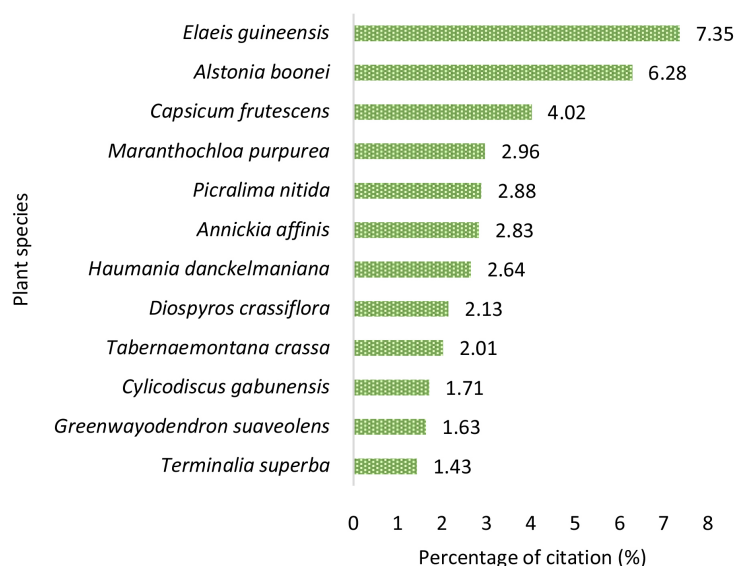
3. Results

3.1. Diversity of Medicinal Plants Used by Baka in Fourth Subdivisions

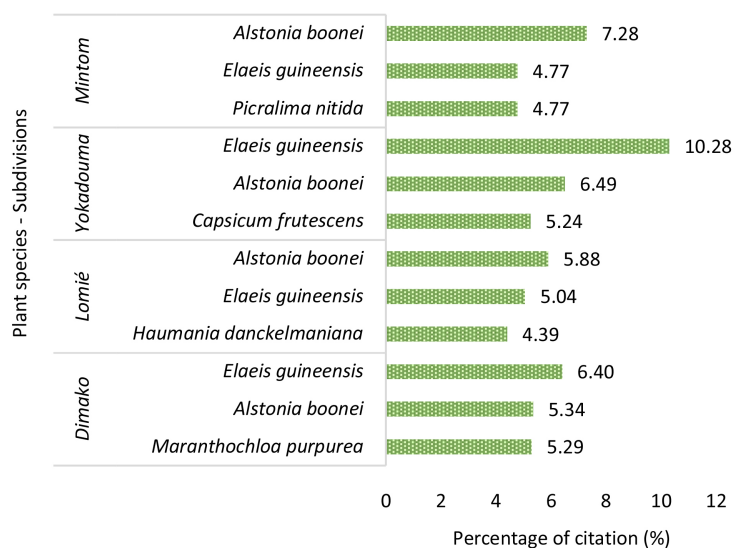
Three hundred and seventy-eight (378) plant species used in the Baka pharmacopoeia were identified. These species are distributed in 270 genera and 85 botanical families. The most diverse families are Fabaceae (35 species), Euphorbiaceae (34), Malvaceae (21), Apocynaceae (16) and Annonaceae (15). On the contrary, the most cited families are Apocynaceae (14.01% of citations), Fabaceae (8.52%), Arecaceae (7.73%), Marantaceae (6.94%) and Annonaceae (6.46%).

The twelve (12) most important plant species in terms of number of citations

are shown in **Figure 1(a)**. At all sites, *Elaeis guineensis* is the species most mentioned (7.35% of citations), followed by *Alstonia boonei* (6.28) and *Picralima nitida* (4.02%). **Figure 1(b)** shows the most frequently cited species at each site. Among these, *Alstonia boonei* and *Elaeis guineensis* appear in the top 3 of the plant species most mentioned by the population for health care.



(a)



(b)

Figure 1. (a) and (b) Relative importance of the most cited plants in the Baka pharmacopoeia.

3.2. Similarities in Use of the Medicinal Plants

The similar usage of the plants is highlighted because of the observed spatial use convergences and the relative performance of the plants used for health problems.

3.2.1. Convergence of Spatial Uses

The convergence of spatial uses allows highlighting the most significant plants confirmed for their use in the traditional pharmacopoeia. This is done through three indices including UAV, SUC and TiI.

The plant species with the highest use agreement indices are in order of importance: *Elaeis guineensis* (2.49), *Alstonia boonei* (2.13), *Capsicum frutescens* (1.36), *Maranthochloa purpurea* (1), *Picalima nitida* (0.98), *Annickia affinis* (0.96) and *Haumania danckelmaniana* (0.9).

The highest values in spatial use convergence are found for the following species. Eighty-one (81) species are cited in all four districts (SUC = 1). The most cited are: *Alstonia boonei*, *Capsicum frutescens*, *Picalima nitida*, *Annickia affinis*, *Baillonella toxisperma*, *Diospyros crassiflora*, *Tabernaemontana crassa* and *Cylicodiscus gabunensis*. Sixty-two (62) in three districts (SUC = 0.75): *Ceiba pentandra*, *Bidens pilosa*, *Chrysophyllum lacourtianum*, *Celtis adolfi-friderici* et *Ficus mucoso*. Sixty-seven (67) in two districts (SUC = 0.5): *Combretum mucronatum*, *Mitragyna stipulosa*, *Trichoscypha acuminata*, *Jateorhiza macrantha*, *Scorodophloeus zenkeri*, *Poga oleosa*, *Aframomum melegueta*, *Beilschmiedia gaboonensis* and *Cola gigantea*. The remaining one hundred and sixty-nine (169) are cited by at least two people in the same village (SUC = 0.25). Among them: *Allanblackia floribunda*, *Senna hirsuta*, *Landolphia owariensis* and *Eriobroma oblongum*.

The analysis of the convergences of use based on the Chi-square test showed two significant divergences on the six combinations of districts done for the determination of the traditherapeutic interest index of the plants for a specific disease. Ninety-three (93) species obtained a value of $TiI1 > 0$. The more this value tends towards 1, the greater its importance. These species are automatically qualified as interesting in the treatment of diseases. *Aframomum danielli*, *Afrostryax lepidobotrys* and *Greenwayodendron suaveolens* possess a medium value of traditherapeutic interest index ($TiI = 0.33$) for headache treatment. In the case of diarrhoea, *Xylopiya hypolampira*, *Tabernaemontana crassa* and *Manniophyton fulvum* are most indicated ($TiI = 0.33$). For malaria, species such *Alstonia boonei*, *Annickia affinis* and *Chromoleana odorata* present medium value of traditherapeutic interest index ($TiI = 0.33$). Concerning Cough, *Pycnanthus angolensis*, *Hylodendron gabunense* and *Bridelia micrantha* are also interesting for treatment ($TiI = 0.33$).

3.2.2. Relative Performance of Some Plants

Plants are sometimes used in association or not, for a multi-target therapy. The performance index is therefore useful to determine the performance or effectiveness of a plant for a particular disease. All species with an index greater than or equal to 1 are considered high performing. For malaria cases for example, 41 species performed well ($PI \geq 1$) including *Alstonia boonei* ($PI = 2$), *Annickia affinis*, *Capsicum frutescens*, *Harungana madagascariensis*, *Ocimum gratissimum*, *Picalima nitida*, *Rauvolfia macrophylla*, *Tabernaemontana crassa* and *Lepidobotrys*

staudtii (PI = 1). Regarding diarrhoea, 35 species were found to perform well with an PI varying between 1 and 2. *Manihot esculenta* is reported to be more effective (PI = 2) in the treatment of diarrhea. As for cough, many species are performed. Among these: *Trichoscypha acuminata*, *Hyiodendron gabunense* (PI = 3), *Eribroma oblongum* (PI = 2), *Chrysophyllum lacourtianum*, *Desbordesia glauscescens* and *Bridelia micrantha* (PI = 1). Several species are used for headache treatment. Species with very high performance (PI = 3) include *Amaranthus hybridus*, *Drypetes gilgiana*, *Solanum lycopersicum*. While *Baphia leptobotrys*, *Tabernaemontana pendutiflora*, *Raphia regalis*, *Millettia senegana* and *Streblus usamberensis* have a high performance (PI = 2) for the same disease.

Some of the species listed have multiple uses. Among the most significant plants according to their use, *Alstonia boonei*, *Picralima nitida* and *Elaies guineensis* possesses a performance index of 1 respectively for 12, 6 and 23 ailments. For example, *Alchornea floribunda* is listed as a high performer for the treatment of diarrhoea. While it performs moderately well for stomachache (1) and easy childbirth (1). *Afzelia bipidensis*, for its part, is mentioned in the treatment of hernia, rata, cough and sexual weakness, for which it registers an average performance (1). Other plants, such as *Mondia whitei*, are mainly cited for the treatment of diseases linked to the digestive system, such as worms (PI = 1), diarrhea (1) and colic (1). On the other hand, some species have no performance for one illness: but are very effective for other health problems. This is the case of *Calpocalyx dinklagei* has a PI = 2 for menstrual periods but low performance for headaches.

3.2.3. Summary of Significant Uses

The various significant uses indices compared two by two revealed a p-value < 2.2e-16 for the Pearson correlation test and a value of less than 0.5 (the reference value) for Bray and Curtis dissimilarity distance. These results indicate a positive correlation between UAV, SUC and TiI indices. They confirm that the three indices are evolving in the same direction for determine plants confirmed for their usage in traditional medicine.

4. Discussion

4.1. Floristic Composition in Fourth Subdivisions Investigated

A total of 378 plant species recorded are distributed in 270 genera and 85 botanical families. Three hundred and seventy-eight (378) plant species used in the *Baka pharmacopoeia* were identified. These species are distributed in 270 genera and 85 botanical families. The most diverse families are Fabaceae (35 species), Euphorbiaceae (34), Malvaceae (21), Apocynaceae (16) and Annonaceae (15). The preponderance of the first two families is linked to the presence of flavonoids, terpenes and alkaloids [17] [34] [35]. The use of these botanical families for traditional medical practices is explained by their ability to satisfy the needs of populations in different health problems, through their richness in secondary

metabolites. [35] showed a correlation between the known biological activities of the isolated compounds and the ethnobotanical uses of the plants containing them. The same author reveals that Apocynaceae, Euphorbiaceae, Sapotaceae, Meliaceae, Moraceae and Fabaceae are rich in alkaloids, terpenoids and flavonoids. These bioactive metabolites are responsible for antimalarial, hepatoprotective, vasorelaxant, anticancer, antimicrobial, antioxidant, estrogenic, antifungal and antisalmonella activities [35]. In medicine, alkaloids alone are used as major analgesics (morphine), antimalarials (quinine), to combat excess uric acid (colchicine), as paralytic substances (curare, caffeine), narcotics (cocaine, mescaline), cholinergics (pilocarpine) or anticancer agents (vinblastine, vincristine) [36]. In terms of medicinal plants used in Kinshasa, the Leguminosae and Rubiaceae families are the richest [12]. The study's findings contradict those of [37], who found Lamiaceae (20 species), Asteraceae (11), Apiaceae (8), Fabaceae (7), Rosaceae (6), and Poaceae (5) to be the richest families; of [38] in the Daloa region, where Asteraceae, Euphorbiaceae and Rubiaceae are also cited as the most dominant families; and [39] in the village of Ngadisari in Indonesia, where Poaceae and Zingiberaceae (4) and Apiaceae (3) are reported to be the most diverse. And in the mountainous region of Kahuzi-Biega, where Asteraceae (5), Euphorbiaceae (4), Fabaceae and Rubiaceae (3) are the most diverse [40].

The relative importance of medicinal plants based on the weight of citations highlights *Elaies guineensis* (7.35%), *Alstonia boonei* (6.28%), *Capsicum frutescens* (4.02%), *Maranthochloa purpurea* (2.96%) and *Picralima nitida* (2.88%) as the species most in demand for health care in all 4 subdivisions. This result can be explained by the fact that some of these species are used either as inputs or recipes in ethnomedical practices to either facilitate absorption of the medicine or amplify its action. Certain organs, especially fruits and seeds, are used as auxiliary or adjuvant ingredients, to reinforce the therapeutic action of the main components of the recipes and also to treat the secondary symptoms of the disease [41]. This is the case with *Elaies guineensis*, whose nut oil is mixed with leaves, for example, to be applied as a suppository in the case of hemorrhoids [4]. Or because they contain bioactive principles responsible for their biological activity in phytotherapy. Indeed, alkaloids, phenolic compounds (flavonoids, tannins, quinones, coumarins) and terpene compounds (triterpenes, steroids, saponosides) confer remarkable properties on chillies, which could justify their antimicrobial and antifungal activities [42] [43]. While [44] show that capsaicin present in *Capsicum frutescens* possesses an anti-inflammatory effect comparable to the inhibition of inflammation produced by diclofenac. *A. boonei* extracts contain alkaloids, flavonoids, phenolic compounds, tannins, saponins, anthraquinones and terpenoids [45]. They are also known for their antioxidant, antimalarial, antimicrobial, anticancer and anti-inflammatory properties [46] [47]. *Picralima nitida* is also recognized for its therapeutic properties. Its fruit extracts are rich in alkaloids, sterols, polyphenols, saponosides and flavonoids, giving it

antioxidant properties; used in the treatment of malaria and diabetes [48]. In addition to similar constituents, [49] found tannins and phytophenols, cardiac glycosides and anthraquinones in the seeds of this species. The assortment of secondary metabolites would be responsible for the high demand for these species in traditional medicine. The unanimous use of most of these plants for illnesses on the scale of their distribution and through the multiplicity of peoples with diverse and varied customs can be considered indisputable proof of their therapeutic virtues or potential.

4.2. Significant Uses, Biological Activity and Ethnogeographical Convergence in the Uses of Some Medicinal Plants

The potency of medicinal plants depends solely on their active phytochemical components, which produces a definite physiological action on the human body and are responsible for their numerous bioactivities [6]. Some plants retained in this work have already been recognized as having biological activities against several diseases due to their richness in active molecules. In medicine, alkaloids are used for their many therapeutic properties. a summary of ethnobotany, ethnogeographical convergence and biological properties of some plants confirmed is presented.

Alstonia boonei De Wild. is a widely cited species. It has the highest values in spatial convergence indices (UAV = 2.13; TiI = 1 and SUC = 0.33), and a good performance for malaria (PI = 2), jaundice, intestinal worms, common cold and galactogen (PI = 1). A usage against malaria was found by [50] with also an PI = 2. The bark of *Alstonia boonei*, contains indole alkaloids, hence their interest in malaria control [36]. [6] noted that leaves extract of *A. boonei* showed high parasitaemia suppression; this could be due to the presence of phytochemical compounds such as terpenoids, alkaloids, phenols and flavonoids which are thought to be responsible for antiparasmodial activity and justifying its usage in the management of malaria in Nigeria. Similar uses are observed by [50]-[56]. The hydroethanolic extracts of *Alstonia boonei* contain alkaloids, flavonoids, phenolics, tannins, saponins, anthraquinones, and terpenoids [45]. Alkaloids, flavonoids, and tannins are known for their antioxidant, antimalarial, antimicrobial, anti-cancer, and anti-inflammatory activities [46] [47].

Annickia affinis Versteegh & Sosef, closely related to *Annickia chlorantha* Setten & P. J. Maas (both species also referred to as *Enantia chlorantha* Oliv.) [57]. *A. affinis* possesses respectively values of 0.96; 1 and 0.33. This specie has a medium-performing plant (PI = 1) for typhoid fever, aches and pains, influenza, jaundice, chest pain, malaria and intestinal worms. In Yaoundé markets, the plant is used to treat typhoid fever, jaundice and malaria, with a performance index equal to 1 [58]. A few similar uses have been identified outside our study sites. It is reported to be active against *Plasmodium* spp [59]. *A. affinis* leaves and bark have been shown to be active against *Plasmodium falciparum* [60]. Convergences in use are also reported by [38] [53]-[55] [59] [61] [62] and. In

Dja, this specie performs well against jaundice and malaria as in our study; but also against conjunctivitis, wasting disease, measles and syphilis [27]. Uses against jaundice are reported in Cameroon, Congo-Brazzaville, Central Africa and West Africa [63]. Uses against malaria/fever are indicated in Cameroon, Equatorial Guinea and Congo-Brazzaville. The popularity of *Annickia affinis* against jaundice in Cameroon may be linked to the yellow color of the stem bark. Their chemical composition is dominated particularly by various isoquinoline alkaloids, as well as by acetogenins and sesquiterpenes, which have been isolated from the bark and leaves. All three of these classes of compounds have been reported to exhibit noteworthy biological activity [57]. The chemical investigation of the stem bark of *A. chlorantha* led to the isolation of ten known secondary metabolites classified into seven alkaloids, one triterpene, and two steroids [64].

Capsicum frutescens L. also has respectively values of 1.36; 1 and 0.33. It also has a medium performance for chest pain, malaria, back ache, diarrhoea, jaundice and cough. *Capsicum frutescens* is prescribed for lower back pain contains capsaicin, which [65] reported to have anti-rheumatic properties. [44] shows in their study that capsaicin possesses an anti-inflammatory effect, which is comparable to inhibition of inflammation produced by diclofenac. In contrast, [66] showed that *C. frutescens* exhibited inhibitory activities against some pathogenic bacteria such as *E. coli*, *Vibrio cholerae*, *Staphylococcus aureus* and *Pseudomonas aeruginosa*. [67] found the presence of steroids, terpenes, flavonoids, polyphenols and quinones in the extracts of the same species. Alkaloids, phenolic compounds (flavonoids, tanins, quinones, coumarins) and terpene compounds (triterpenes, steroids, saponosides) confer remarkable properties to peppers, which could justify their antimicrobial and antifongic activities [42] [43]. Another genus of capsicum (*Capsicum annuum*) regularly also prescribed against intestinal worms contain respectively tropanic alkaloids and capsaicin. These alkaloids used against stomachache are said to have effects against gastrointestinal spasms and laxative effects. They increase intestinal peristalsis [65]. [68] reveals that alcohol extracts of *C. annuum* is used for the treatment of rheumatoid arthritis in southern Ukraine. [69] report that the species possesses antioxidant and anti-inflammatory properties and is rich in phenolic compounds and capsaicin.

Elaeis guineensis (Arecaceae) has values of 2.49; 1 and 0.33. Oil palm has many uses. It is used in medicinal recipes for more than 15 diseases, with average performance (PI = 1). In the Dja pharmacopoeia, it is also used to treat 19 health problems, while in the Yaoundé markets, it is used to treat 4 diseases or physiological effects [58]. The African pharmacopoeia [70] notes its usefulness for the following purposes: wounds, burns, skin infections. Palm and palm kernel oils are also used as decongestants. No toxicity has been reported for palm and palm kernel oils, which are edible. Mucilage is found in vegetative organs such as the male inflorescence of *Elaeis guineensis*. They are soluble fibers with

several medicinal properties. The phytochemical constituents of this species produce anti-cholesterol, anti-constipation, healing, anti-diabetic, anti-cancer, anti-microbial and antioxidant effects [71]-[73]. These authors also found that *E. guineensis* is rich in phenolic compounds, tannins, flavonoids, alkaloids, saponins, steroids and vitamin E isomers. Work has also shown the rich secondary metabolites (tannins, flavonoids, polyphenols and saponosides) of *Elaies guineensis* were richly responsible for their therapeutic efficacy [74].

Picralima nitida (Apocynaceae) obtained values of 0.98; 1 and 0.33. This specie treats malaria, jaundice, intestinal worms, hernia, ache, diabete and hemmorrhage with an average performance. Apart from Cameroon, this specie is found in Nigeria, Congo, Ivory coast, Ghana, Ouganda and RDC where its various organs are used for therapeutic purposes [75]. *P. nitida* is also used to treat malaria and typhoid fever [13] [76], diabete [77] [78]. Its bark is used in combination to treat COVID-19 [79]. These plant parts are used in 21 treatments in South of Benin. Among them: Malaria, diabete, intestinal worms and colic [80]. *Picralima nitida* seeds have a potential palliative effect on dyslipidemia, hyperglycemia, oxidative stress and insulin resistance [81]. Other properties have been reported for this specie: Anthelmintic [49], antioxidant [48] [78], antimicrobial [82], antitrypanosomal [83], antitussive [84], antifungal [85]. *P. nitida* contains secondary metabolites including polyphenols, alkaloids, sterols, saponosides, tannins and flavonoids [48] [86] [87].

4.3. Contribution for Suistainable Development

The list of plants confirmed for their uses in traditional medicine constitutes a basis for the development of improved traditional medicines, that will help to promote, maintain and restore the health of the population. These phytomedicines will be accessible to everyone in traditional health centers set up in areas where access to health services is difficult. All the information resulting from this work contributes to raising the standard of living of the most disfavored populations through the creation of jobs, promoting good health and ensuring the well-being of all at any age, and increase national economy. Thus, contributing to the achievement of the objectives 1, 3 and 8 of sustainable development.

5. Conclusion

Traditional medicine is expanding considerably with the introduction of pandemics, emerging diseases and the resistance of certain germs to conventional medicines. As a result, the exploitation of plant resources to overcome various health problems is a palliative. This is also because of their accessibility, but also and above all because of the inexhaustible and renewable active ingredients contained in these plants. The present study has highlighted the plants confirmed for their uses in traditional medicine both within and outside the study area. Spatial use convergences and the performance index highlighted the significant uses (or plants confirmed for their use in local traditional medicine) for the

treatment of several diseases. The presence of secondary metabolites, bioactive molecules, is responsible for the pharmacological activity (anticancer, neurological, antimicrobial, anti-inflammatory, antioxidant, antibacterial, antifungal, antispasmodic, antidiarrheal, antiulcer, antihemorrhagic, anti-inflammatory, cicatrifiant...) of several plants identified in the study. The therapeutic properties conferred by these biomolecules would therefore justify and reinforce the use of the plant species identified in the Baka pharmacopoeia. The presence of several metabolites in these species also confirms their use to treat several diseases. This research can also be used as an avenue to explore for further work on the little known or not yet explored plant species mentioned, with a view to confirming the effective presence of potential therapeutic substances. Overall, the information obtained from this work represents different therapeutic options that can be used by pharmaceutical industries with the formulation of medicines and other improved traditional medicine or improved traditional products (ITM, ITP). In addition, it permits to envisage the possibilities for developing tradi-medical tourism based on medicinal plants derived products for specific health cases.

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Conflicts of Interest

The authors declared no conflicting interests.

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Appendix

Table A1. Values of UAV, TiI and SUC indices of plants used in traditional medicine.

Plant species	Family	UAV	SUC	TiI	Plant species	Family	UAV	SUC	TiI
<i>Acacia pennata</i> (L.) Willd.	Fabaceae	0	0.25	0	<i>Hypselodelphys scandens</i> Louis & Mullend.	Marantaceae	0.01	0.25	0
<i>Acmella caulirhiza</i> Delile	Asteraceae	0.08	1	0.33	<i>Hypselodelphys sp.</i>	Marantaceae	0.01	0.25	0
<i>Adenia cissampeloides</i> (Planch. ex Hook.) Harms	Passifloraceae	0	0.25	0	<i>Imperata cylindrica</i> (L.) Rauecsh.	Poaceae	0	0.25	0
<i>Adenia lobata</i> (Jacq.) Engl.	Passifloraceae	0	0.25	0	<i>Ipomoea batatas</i> (L.) Lam.	Convolvulaceae	0	0.25	0
<i>Aframomum daniellii</i> (Hook. f.) K. Schum.	Zingiberaceae	0.33	1	0.33	<i>Ipomoea involucrata</i> Beauv.	Convolvulaceae	0.01	0.5	0.17
<i>Aframomum melegueta</i> K. Schum.	Zingiberaceae	0.03	0.5	0.17	<i>Irvingia excels</i> Mildbr.	Irvingiaceae	0.11	1	0.33
<i>Aframomum sp.</i>	Zingiberaceae	0	0.25	0	<i>Irvingia gabonensis</i> (Aubry-Lecomte ex O'Rorke) Baill.	Irvingiaceae	0.22	1	0.33
<i>Afrostryax lepidophyllus</i> Mildbr.	Huaceae	0.19	1	0.33	<i>Irvingia grandifolia</i> (Engl.) Engl.	Irvingiaceae	0.10	1	0.33
<i>Afzelia bipindensis</i> Harms	Fabaceae	0.09	0.75	0.17	<i>Jateorhiza macrantha</i> (Hook. fil.) Exell & Mendonça	Mennispermaceae	0.05	0.5	0.17
<i>Agelaea pentagyna</i> (Lam.) Baill.	Connaraceae	0.01	0.5	0.17	<i>Jatropha curcas</i> L.	Euphorbiaceae	0.01	0.25	0
<i>Agelanthus brunneus</i> (Engl.) Balle & N. Hallé	Loranthaceae	0.01	0.25	0	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	0.03	0.25	0
<i>Ageratum conyzoides</i> L.	Asteraceae	0.08	0.75	0	<i>Khaya sp.</i>	Meliaceae	0.01	0.25	0
<i>Alafia sp.</i>	Apocynaceae	0.20	0.75	0.17	<i>Klainedoxa gabonensis</i> Pierre ex Engl.	Irvingiaceae	0.28	1	0.33
<i>Albizia ferruginea</i> (Guill. & Perr.) Benth.	Fabaceae	0	0.25	0	<i>Klainedoxa trillesii</i> Pierre ex Tiegh.	Irvingiaceae	0.04	0.5	0.17
<i>Albizia zygia</i> (DC.) J. F. Macbr.	Fabaceae	0.05	0.5	0	<i>Laccosperma secundiflorum</i> (P. Beauv.) Kuntze	Arecaceae	0.03	0.75	0.17
<i>Alchornea cordifolia</i> (Schuman. & Thonn.) Müll. Arg.	Euphorbiaceae	0.04	1	0.33	<i>Landolphia congolensis</i> (Stapf) Pichon	Apocynaceae	0	0.25	0
<i>Alchornea floribunda</i> Müll. Arg.	Euphorbiaceae	0.21	1	0.33	<i>Landolphia maxima</i> (K. Schum. ex Hallier fil.) Pichon	Apocynaceae	0	0.25	0

Continued

<i>Alchornea laxiflora</i> (Benth.) Pax & K. Hoffm.	Euphorbiaceae	0	0.25	0	<i>Landolphia owariensis</i> P. Beauv.	Apocynaceae	0.01	0.25	0
<i>Allanblackia floribunda</i> Oliv.	Clusiaceae	0.02	0.25	0	<i>Landolphia sp.</i>	Apocynaceae	0	0.25	0
<i>Allium cepa</i> L.	Alliaceae	0.03	0.25	0	<i>Lannea welwitschii</i> (Hiern) Engl.	Anacardiaceae	0	0.25	0
<i>Allium sativum</i> L.	Alliaceae	0.01	0.25	0	<i>Lantanna sp.</i>	Verbenaceae	0	0.25	0
<i>Allophylus bullatus</i> Radlk.	Sapindaceae	0.01	0.25	0	<i>Lasiodiscus mildbraedii</i> Engl.	Rhamnaceae	0	0.25	0
<i>Aloe sp.</i>	Zingiberaceae	0.01	0.25	0	<i>Lepidobotrys staudtii</i> Engl.	Lepidobotryaceae	0.11	0.75	0.33
<i>Alstonia boonei</i> De Wild.	Apocynaceae	2.13	1	0.33	<i>Leplaea cedrata</i> (A. Chev.) E. J. M. Koenen & J. J. de Wilde	Meliaceae	0.05	0.75	0.33
<i>Amaranthus hybridus</i> L.	Amaranthaceae	0	0.25	0	<i>Leplaea thompsonii</i> (Sprague & Hutch.) E. J. M. Koenen & J. J. de Wilde	Meliaceae	0.21	1	0.33
<i>Amaranthus viridus</i> L.	Amaranthaceae	0.02	0.25	0	<i>Leptaspis cochleata</i> Thwaites	Poaceae	0.03	0.5	0.17
<i>Amphimas pterocarpoides</i> Harms	Fabaceae	0.10	0.75	0.17	<i>Lipotriche scandens</i> (Schumach. & Thonn.) Orchard	Asteraceae	0.01	0.25	0
<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	0.01	0.75	0.33	<i>Lomariopsis guineensis</i> (Underw.) Alston	Lomariopsidaceae	0.02	0.5	0.17
<i>Aneilema beniniense</i> (P. Beauv.) Kunth	Commelinaceae	0	0.25	0	<i>Lovoa trichilioides</i> Harms	Meliaceae	0	0.25	0
<i>Angylocalyx vermeulenii</i> De Wild.	Fabaceae	0.01	0.25	0	<i>Macaranga monandra</i> Müll. Arg.	Euphorbiaceae	0	0.25	0
<i>Annickia affinis</i> (Exell) Versteegh & Sosef	Annonaceae	0.96	1	0.33	<i>Macaranga sp. 1</i>	Euphorbiaceae	0.03	0.5	0.17
<i>Annona muricata</i> L.	Annonaceae	0	0.25	0	<i>Macaranga sp. 2</i>	Euphorbiaceae	0.01	0.25	0
<i>Anonidium mannii</i> (Oliv.) Engl. & Diels	Annonaceae	0.32	1	0.33	<i>Maesobotrya barteri</i> (Baill.) Hutch.	Euphorbiaceae	0	0.25	0
<i>Anopyxis klaineana</i> (Pierre) Engl.	Rhizophoraceae	0.03	0.5	0.17	<i>Maesopsis eminii</i> Engl.	Rhamnaceae	0.04	0.75	0.33
<i>Anthocleista schweinfurthii</i> Gilg	Loganiaceae	0.01	0.25	0	<i>Mallotus oppositifolius</i> (Geisel.) Mull.	Euphorbiaceae	0	0.25	0
<i>Anthocleista vogelii</i> Planch.	Loganiaceae	0	0.25	0	<i>Mammea africana</i> Sabine	Clusiaceae	0.04	0.5	0
<i>Anthonothea lamprophylla</i> (Harms) J. Leonard	Fabaceae	0.02	0.25	0	<i>Mangifera indica</i> L.	Anacardiaceae	0.21	1	0.33

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<i>Antrocaryon klaineum</i> Pierre	Anacardiaceae	0.06	1	0.33	<i>Manihot esculenta</i> Crantz	Euphorbiaceae	0.12	1	0.33
<i>Aorantho cladantha</i> (K. Schum.) Somers	Rubiaceae	0.01	0.25	0	<i>Manniophyton fulvum</i> Mull. Arg.	Euphorbiaceae	0.22	1	0.33
<i>Arachis hypogaea</i> L.	Fabaceae	0.02	1	0.33	<i>Manotes griffoniana</i> Baill.	Connaraceae	0.02	0.5	0.17
<i>Asplenium currori</i> Hooker	Aspleniaceae	0	0.25	0	<i>Mansonia altissima</i> (A. Chev.) A. Chev.	Malvaceae	0.04	0.5	0.17
<i>Asystasia leptostachya</i> Lindau	Acanthaceae	0	0.25	0	<i>Maranthes glabra</i> (Oliv.) Prance	Chrysobalanaceae	0	0.25	0
<i>Autranella congolensis</i> (De Wild.) A. Chev.	Sapotaceae	0	0.25	0	<i>Maranthochloa purpurea</i> (Ridl.) Milne-Redh.	Marantaceae	1.00	0.5	0.17
<i>Baillonella toxisperma</i> Pierre	Sapotaceae	0.24	1	0.33	<i>Marantochloa cordifolia</i> (K. Schum.) Koechlin	Marantaceae	0.16	0.75	0
<i>Baphia leptobotrys</i> Harms	Fabaceae	0.01	0.5	0.17	<i>Marantochloa sp.</i>	Marantaceae	0	0.25	0
<i>Baphia sp.</i>	Fabaceae	0	0.25	0	<i>Margaritaria discoidea</i> (Baill.) Webster	Euphorbiaceae	0.04	0.75	0.17
<i>Barteria fistulosa</i> Mast.	Flacourtiaceae	0.13	1	0.33	<i>Markhamia tomentosa</i> (Benth.) K. Schum. ex Engl.	Bignoniaceae	0	0.25	0
<i>Beilschmiedia</i> <i>gaboonensis</i> (Meisn.) Benth. & Hook. f.	Lauraceae	0.01	0.5	0	<i>Massularia acuminata</i> (G. Don) Bullock ex Hoyle	Rubiaceae	0.38	1	0.33
<i>Beilschmiedia mannii</i> (Meisn.) Robyns & R. Wilczek	Lauraceae	0	0.25	0	<i>Megaphrynium</i> <i>macrostachyum</i> (Benth.) Milne-Redh.	Marantaceae	0.24	1	0.33
<i>Bidens pilosa</i> L.	Asteraceae	0.11	0.75	0.17	<i>Meiocarpidium</i> <i>lepidotum</i> (Oliv.) Engl. & Diels	Annonaceae	0.03	0.25	0
<i>Blighia welwitschii</i> (Hiern) Radlk.	Sapindaceae	0.03	0.25	0	<i>Microdesmis puberula</i> Hook. f. ex. Planch.	Pandaceae	0.33	1	0.33
<i>Brenania brieyi</i> (De Wild.) E. M. A. Petit	Rubiaceae	0.04	0.25	0	<i>Milicia excelsa</i> (Welw.) Berg	Moraceae	0.24	1	0.33
<i>Bridelia atroviridis</i> Müll. Arg.	Euphorbiaceae	0	0.25	0	<i>Millettia duchesnei</i> De Wild.	Fabaceae	0.06	0.25	0
<i>Bridelia micrantha</i> (Hochst.) Baill.	Euphorbiaceae	0.07	1	0.33	<i>Millettia sanagana</i> Harms	Fabaceae	0.05	0.25	0
<i>Calpocalyx dinklagei</i> Harms	Fabaceae	0.01	0.5	0.17	<i>Millettia sp.</i>	Fabaceae	0	0.25	0
<i>Campylospermum</i> <i>elongatum</i> (Oliv.) Tiegh.	Ochnaceae	0.07	0.75	0.33	<i>Mimosa pigra</i> L.	Fabaceae	0.02	0.5	0.17
<i>Canarium schweinfurthii</i> Engl.	Burseraceae	0.03	0.5	0	<i>Mimosa pudica</i> L.	Fabaceae	0.03	0.5	0.17

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<i>Cannabis sativa</i> L.	Cannabaceae	0.01	0.25	0	<i>Mitragyna ledermannii</i> (K. Krause) Ridsdale	Rubiaceae	0.01	0.5	0.00
<i>Capsicum annuum</i> L.	Solanaceae	0.04	0.75	0.33	<i>Mitragyna stipulosa</i> (DC.) Kuntze	Rubiaceae	0.10	0.5	0.17
<i>Capsicum frutescens</i> L.	Solanaceae	1.36	1	0.33	<i>Momordica cissoides</i> Planch. ex Benth.	Cucurbitaceae	0.04	0.25	0.00
<i>Carica papaya</i> L.	Caricaceae	0.31	1	0.33	<i>Mondia whitei</i> (Hook. fil.) Skeels	Apocynaceae	0.10	0.25	0.00
<i>Carpoloba alba</i> G. Don	Polygalaceae	0.01	0.75	0.17	<i>Monodora crispata</i> Engl.	Annonaceae	0.01	0.5	0.17
<i>Carpolobia lutea</i> G. Don	Polygalaceae	0.01	0.25	0	<i>Morinda lucida</i> Benth.	Rubiaceae	0.01	0.25	0.00
<i>Ceiba pentandra</i> (L.) Gaertn.	Malvaceae	0.18	0.75	0.33	<i>Motandra guineensis</i> (Thonn.) A. D. C.	Apocynaceae	0.01	0.5	0.17
<i>Celtis adolfi-friderici</i> Engl.	Cannabaceae	0.10	0.75	0.17	<i>Musa xparadisica</i> L.	Musaceae	0.21	1	0.33
<i>Celtis mildbraedii</i> Engl.	Cannabaceae	0.08	0.75	0.33	<i>Musanga cecropioides</i> R. Br. ex Tedlie	Moraceae	0.24	1	0.33
<i>Celtis philippensis</i> Blanco	Cannabaceae	0.03	0.5	0.17	<i>Myrianthus arboreus</i> P. Beauv.	Moraceae	0.29	1	0.33
<i>Celtis tessmannii</i> Rendle	Cannabaceae	0.03	0.25	0	<i>Nauclea diderrichii</i> (De Wild.) Merr.	Rubiaceae	0.03	0.75	0.33
<i>Cercestis mirabilis</i> (N. E. Br.) Bogner	Araceae	0.02	0.75	0.33	<i>Neoboutonia mannii</i> Benth.	Euphorbiaceae	0.01	0.5	0.00
<i>Chasmanthera welwitschii</i> Troupin	Mennispermaceae	0.03	0.5	0.17	<i>Nephrolepis biserrata</i> (SW.) Schott	Dryopteridaceae	0.00	0.25	0.00
<i>Chenopodium ambrosioides</i> L.	Amaranthaceae	0.01	0.5	0	<i>Nesogordonia papaverifera</i> (A. Chev.) Capuron	Malvaceae	0.00	0.25	0.00
<i>Christella dentata</i> (Forssk.) Brownsey & Jermy	Thelypteridaceae	0.01	0.25	0	<i>Nicotiana tabacum</i> L.	Solanaceae	0.08	1	0.33
<i>Chromolaena odorata</i> (L.) R. M. King & H. Rob.	Asteraceae	0.15	1	0.33	<i>Ocimum gratissimum</i> L.	Lamiaceae	0.21	1	0.33
<i>Chrysophyllum africanum</i> A. DC.	Sapotaceae	0	0.25	0	<i>Octolobus spectabilis</i> Welw.	Malvaceae	0.01	0.25	0.00
<i>Chrysophyllum boukokoense</i> (Aubrév. & Pellegr.) L. Gaut.	Sapotaceae	0.01	0.25	0	<i>Olax latifolia</i> Engl.	Olcaceae	0.00	0.25	0.00
<i>Chrysophyllum lacourtianum</i> De Wild.	Sapotaceae	0.11	0.75	0.17	<i>Oldfieldia africana</i> Benth. & Hook. f.	Euphorbiaceae	0.04	0.5	0.00
<i>Chrysophyllum</i> sp.	Sapotaceae	0.01	0.5	0.17	<i>Olyra latifolia</i> L.	Poaceae	0.02	0.5	0.17
<i>Cinnamomum</i> sp.	Lauraceae	0	0.25	0	<i>Omphalocarpum elatum</i> Miers	Sapotaceae	0.16	1	0.33

Continued

<i>Cissus glaucophylla</i> Hook. f.	Vitaceae	0.02	0.75	0.17	<i>Oncoba mannii</i> Oliv.	Flacourtiaceae	0	0.25	0
<i>Cissus quadrangularis</i> L.	Vitaceae	0.02	0.25	0	<i>Oncoba</i> sp. 1	Flacourtiaceae	0	0.25	0
<i>Citrus medica</i> L.	Rutaceae	0.15	0.75	0.33	<i>Oxalis barrelieri</i> L.	Oxalidaceae	0	0.25	0
<i>Citrus x aurantium</i> L.	Rutaceae	0	0.25	0	<i>Palisota bracteosa</i> CB Clarke	Commelinaceae	0.18	1	0.33
<i>Cleistopholis glauca</i> Pierre ex Engl. & Diels	Annonaceae	0.06	0.75	0.33	<i>Panda oleosa</i> Pierre	Pandaceae	0.15	1	0.33
<i>Clerodendrum</i> sp. 2	Lamiaceae	0	0.25	0	<i>Parinari excelsa</i> Sabine	Chrysobalanaceae	0.02	0.5	0.17
<i>Clerodendrum</i> sp. 4	Lamiaceae	0.02	0.5	0.17	<i>Paspalum paniculatum</i> L.	Poaceae	0	0.25	0
<i>Clerodendrum</i> sp. 5	Lamiaceae	0.03	0.25	0	<i>Passiflora foetida</i> L.	Passifloraceae	0.04	0.5	0
<i>Clerodendrum splendens</i> G. Don	Lamiaceae	0.01	0.5	0	<i>Paullinia pinnata</i> L.	Sapindaceae	0.01	0.25	0
<i>Clerodendrum</i> <i>umbellatum</i> Poir	Lamiaceae	0.03	0.25	0	<i>Penianthus longifolius</i> Miers	Mennispermaceae	0	0.25	0
<i>Cnetis</i> sp.	Connaraceae	0.02	0.25	0	<i>Pentaclethra</i> <i>macrophylla</i> Benth.	Fabaceae	0.46	1	0.33
<i>Coelocaryon preussii</i> Warb.	Myristicaceae	0	0.25	0	<i>Pentadiplandra</i> <i>brazzeana</i> Baill.	Pentadiplandraceae	0	0.25	0
<i>Coffea canephora</i> Pierre ex A. Froehner	Rubiaceae	0.05	0.5	0	<i>Pericopsis elata</i> (Harms) Meeuwen	Fabaceae	0.05	0.25	0
<i>Cola acuminata</i> (P. Beauv.) Schott & Endl.	Malvaceae	0.07	0.75	0.17	<i>Persea americana</i> Mill.	Lauraceae	0.08	1	0.33
<i>Cola altissima</i> Engl.	Malvaceae	0.01	0.25	0	<i>Petersianthus</i> <i>macrocarpus</i> (P. Beauv.) Liben	Lecythidaceae	0.23	1	0.33
<i>Cola gigantea</i> A. Chev.	Malvaceae	0.01	0.5	0.17	<i>Phyllocosmus africanus</i> (Hook. fil.) Klotzch	Ixonanthaceae	0.04	0.5	0.17
<i>Cola lateritia</i> K. Schum.	Malvaceae	0.01	0.25	0	<i>Physalis angulata</i> L.	Solanaceae	0.01	0.25	0
<i>Cola millenii</i> K. Schum.	Malvaceae	0.02	0.25	0	<i>Picralima nitida</i> (Stapf) T. Durand & H. Durand	Apocynaceae	0.98	1	0.33
<i>Cola rostrata</i> K. Schum.	Malvaceae	0.02	0.25	0	<i>Piper guineense</i> Schumach & Thonn.	Piperaceae	0.01	0.25	0
<i>Combretum molle</i> R. Br. Ex. G. Don	Combretaceae	0	0.25	0	<i>Piper umbellatum</i> L.	Piperaceae	0.14	1	0.33
<i>Combretum mucronatum</i> Schum. & Thonn.	Combretaceae	0.15	0.5	0	<i>Piptadeniastrum</i> <i>africanum</i> (Hook. f.) Brenan	Fabaceae	0.18	1	0.33
<i>Combretum Platypterum</i> (Welw.) Hutch. & Daziel	Combretaceae	0.04	0.5	0	<i>Plagiostyles africana</i> (Müll. Arg.) Prain	Euphorbiaceae	0.02	0.25	0

Continued

<i>Combretum sp. 1</i>	Combretaceae	0	0.25	0	<i>Poa annua</i> L.	Poaceae	0.01	0.25	0
<i>Combretum sp. 2</i>	Combretaceae	0.01	0.25	0	<i>Poga oleosa</i> Pierre	Anisophylleaceae	0.03	0.5	0.17
<i>Combretum sp. 3</i>	Combretaceae	0.08	0.25	0	<i>Pouteria aningeri</i> Baehni	Sapotaceae	0.02	0.25	0
<i>Copaifera mildbraedii</i> Harms	Fabaceae	0.05	0.25	0	<i>Psidium guajava</i> L.	Myrtaceae	0.13	1	0.33
<i>Cordia platythyrsa</i> Baker	Boraginaceae	0.10	0.5	0	<i>Pteleopsis hylodendron</i> Mildbr.	Combretaceae	0.05	0.75	0.17
<i>Corynanthe johimbe</i> K. Schum.	Rubiaceae	0.19	1	0.33	<i>Pteridium aquilinum</i> (L.) Kuhn	Dennstaedtiaceae	0.04	0.5	0
<i>Corynanthe pachyceras</i> K. Schum.	Rubiaceae	0.08	0.75	0.33	<i>Pteris acanthoneura</i> Alston	Adiantaceae	0	0.25	0
<i>Costus afer</i> Ker Gawl	Costaceae	0.04	0.75	0.17	<i>Pterocarpus soyauxii</i> Taub.	Fabaceae	0.26	1	0.33
<i>Costus sp.</i>	Costaceae	0.01	0.25	0	<i>Pterygota macrocarpa</i> K. Schum.	Malvaceae	0.01	0.5	0.17
<i>Crema spora thomsonii</i> Hiern	Rubiaceae	0	0.25	0	<i>Pycnanthus angolensis</i> (Welw.) Warb.	Myristicaceae	0.40	1	0.33
<i>Croton oligandrus</i> Pierre ex Hutch.	Euphorbiaceae	0.10	0.25	0	<i>Pyrenacantha sylvestris</i> S. Moore	Iacaceae	0	0.25	0
<i>Ctenitis lanigera</i> (Kuhn.) Tardieu	Dryopteridaceae	0.03	0.5	0.17	<i>Raphia regalis</i> Becc.	Arecaceae	0.08	1	0.33
<i>Cucurbita pepo</i> L.	Cucurbitaceae	0.02	0.75	0.17	<i>Raphia sp. 1</i>	Arecaceae	0	0.25	0
<i>Cyathillium stelluliferum</i> (Benth.) H. Rob.	Asteraceae	0	0.25	0	<i>Raphia sp. 2</i>	Arecaceae	0	0.25	0
<i>Cyathula prostrata</i> (L.) Blume	Amaranthaceae	0.03	0.75	0.17	<i>Raphia sp. 3</i>	Arecaceae	0	0.25	0
<i>Cylicodiscus gabunensis</i> Harms	Fabaceae	0.58	1	0.33	<i>Rauvolfia macrophylla</i> Stapf	Apocynaceae	0.25	0.75	0.33
<i>Cymbopogon citratus</i> (DC.) Stapf	Zingiberaceae	0.04	1	0.33	<i>Rauvolfia vomitoria</i> Afzel.	Apocynaceae	0.05	1	0.33
<i>Cyphostemma</i> <i>adenopodum</i> (Sprague) Desc.	Vitaceae	0	0.25	0	<i>Renealmia sp.</i>	Zingiberaceae	0	0.25	0
<i>Dacryodes edulis</i> (G. Don) H. J. Lam	Burseraceae	0.02	0.75	0	<i>Ricinodendron</i> <i>heudelotii</i> (Baill.) Pierre ex Heckel	Euphorbiaceae	0.30	1	0.33
<i>Dalbergia hostilis</i> Benth.	Fabaceae	0.03	0.75	0.17	<i>Ricinus communis</i> L.	Euphorbiaceae	0.01	0.25	0
<i>Desbordesia glaucescens</i> (Engl.) Tiegh.	Irvingiaceae	0.13	0.75	0.17	<i>Rinorea dentate</i> (P. Beauv.) Kuntze	Violaceae	0.02	0.75	0.33
<i>Desmodium adscendens</i> (Sw.) DC.	Fabaceae	0.01	0.5	0	<i>Rinorea keayi</i> Brenan	Violaceae	0.02	0.5	0.17

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<i>Detarium macrocarpum</i> Harms	Fabaceae	0.03	0.25	0	<i>Rourea obliquifoliolata</i> Gilg.	Connaraceae	0.19	1	0.33
<i>Dewevrea bilabiata</i> Micheli	Fabaceae	0.01	0.25	0	<i>Saccharum officinarum</i> L.	Poaceae	0.03	0.75	0.17
<i>Dichostemma glaucescens</i> Pierre	Euphorbiaceae	0.01	0.25	0	<i>Santiria trimera</i> (Oliv.) Aubrév.	Burseraceae	0.21	1	0.33
<i>Dicranolepis buchholzii</i> Engl. & Gilg	Thymeleaceae	0	0.25	0	<i>Sarcophrynium</i> <i>prionogonium</i> (K. Schum.) K. Schum.	Marantaceae	0	0.25	0
<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	0.05	1	0.33	<i>Scepcarpus trinervis</i> (Hochst.) T. Wells & A. K. Monro	Urticaceae	0.01	0.25	0
<i>Dioscorea burkilhana</i> Miège	Dioscoreaceae	0.01	0.5	0	<i>Schumanniohyton</i> <i>magnificum</i> (K. Schum.) Harms	Rubiaceae	0.12	1	0.33
<i>Dioscorea cayenensis</i> subsp. Rotundata (poir.) J. Miège	Dioscoreaceae	0.02	0.75	0.17	<i>Scleria secans</i> (L.) Urb.	Cyperaceae	0.05	1	0.33
<i>Dioscorea minutiflora</i> Engl.	Dioscoreaceae	0.01	0.25	0	<i>Scorodophloeus</i> <i>zenkeri</i> Harms	Fabaceae	0.04	0.5	0.17
<i>Dioscorea sp. 1</i>	Dioscoreaceae	0	0.25	0	<i>Senna alata</i> (L.) Roxb.	Fabaceae	0.01	0.25	0
<i>Dioscorea sp. 2</i>	Dioscoreaceae	0.01	0.25	0	<i>Senna hirsuta</i> (L.) HS Irwin & Bameby	Fabaceae	0.02	0.25	0
<i>Dioscorea sp. 3</i>	Dioscoreaceae	0.01	0.25	0	<i>Setaria barbata</i> (Lam.) kunth	Poaceae	0	0.25	0
<i>Diospyros canaliculata</i> De Wild.	Ebenaceae	0.01	0.5	0.17	<i>Setaria megaphylla</i> (Steud.) T. Durand & Schinz	Poaceae	0.02	0.5	0
<i>Diospyros crassiflora</i> Hiern	Ebenaceae	0.72	1	0.33	<i>Shirakiopsis elliptica</i> (Hochst.) Esser	Euphorbiaceae	0	0.25	0
<i>Diospyros Gracilescens</i> Gürke	Ebenaceae	0.01	0.25	0	<i>Sida rhombifolia</i> L.	Malvaceae	0.20	1	0.33
<i>Diospyros suaveolens</i> Gürke	Ebenaceae	0.05	0.5	0.17	<i>Sloetiopsis usambarensis</i> Engl.	Moraceae	0.19	1	0.33
<i>Discoglyprena</i> <i>caloneura</i> (Pax) Prain	Euphorbiaceae	0.01	0.5	0	<i>Smilax anceps</i> Willd.	Smilacaceae	0.03	1	0.33
<i>Dracaena arborea</i> (Willd.) Link	Draceanaceae	0.03	0.75	0.33	<i>Solanum anguivi</i> Lam.	Solanaceae	0.21	1	0.33
<i>Drypetes capillipes</i> (Pax) Pax & K. Hoffm.	Euphorbiaceae	0.01	0.5	0.17	<i>Solanum lycopersicum</i> L.	Solanaceae	0.14	0.75	0.17
<i>Drypetes gilgiana</i> (Pax) Pax & K. Hoffm.	Euphorbiaceae	0.02	0.25	0	<i>Solanum sp.</i>	Solanaceae	0.01	0.25	0

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<i>Drypetes gossweileri</i> S. Moore	Euphorbiaceae	0.33	1	0.33	<i>Solanum torvum</i> Sw.	Solanaceae	0.10	0.75	0.17
<i>Drypetes sp. 3</i>	Euphorbiaceae	0	0.25	0	<i>Spathodea campanulata</i> P. Beauv.	Bignoniaceae	0.04	0.5	0
<i>Duboscia macrocarpa</i> Bocq.	Malvaceae	0.02	0.25	0	<i>Spermacoe intricans</i> (Hepper) Burkill	Rubiaceae	0.02	0.25	0
<i>Duboscia viridiflora</i> (K. Schum.) Mildbr.	Malvaceae	0.07	0.75	0.33	<i>Spondias dulcis</i> Parkinson	Anacardiaceae	0.01	0.25	0
<i>Duguetia barteri</i> (Benth.) Chatrou	Annonaceae	0.09	0.25	0	<i>Stachytarpheta</i> <i>cayennensis</i> (Rich.) Vahl	Verbenaceae	0.01	0.25	0
<i>Duguetia confinis</i> (Engl. & Diels) Chatrou	Annonaceae	0.02	0.25	0	<i>Staudtia kamerunensis</i> Warb.	Myristicaceae	0.04	0.75	0
<i>Duguetia staudtii</i> (Engl. & Diels) Chatrou	Annonaceae	0.04	0.25	0	<i>Sterculia oblonga</i> Mast.	Malvaceae	0.01	0.25	0
<i>Elaeis guineensis</i> Jacq.	Arecaceae	2.49	1	0.33	<i>Strombosia grandifolia</i> Hook. f.	Olacaceae	0.06	0.75	0.33
<i>Elaeophorbium drupifera</i> (Thonn.) Stapf	Euphorbiaceae	0.08	0.75	0.17	<i>Strombosia pustulata</i> Oliv.	Olacaceae	0.05	0.5	0.17
<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	0	0.25	0	<i>Strombosiosopsis tetrandra</i> Engl.	Olacaceae	0.02	0.5	0
<i>Emilia coccinea</i> (Sims) G. Don	Asteraceae	0.04	0.25	0	<i>Strychnos aculeata</i> Soler.	Loganiaceae	0	0.25	0
<i>Entandrophragma</i> <i>candollei</i> Harms	Meliaceae	0	0.25	0	<i>Strychnos boonei</i> De Wild.	Loganiaceae	0	0.25	0
<i>Entandrophragma</i> <i>cylindricum</i> (Sprague) Sprague	Meliaceae	0.28	1	0.33	<i>Strychnos campicola</i> Gilg ex Leeuwenb.	Loganiaceae	0.07	0.5	0.17
<i>Entandrophragma utile</i> (Dawe & Sprague) Sprague	Meliaceae	0.01	0.25	0	<i>Strychnos camptoneura</i> Gilg & Busse	Loganiaceae	0.05	1	0.33
<i>Eremomastax speciosa</i> (Hochst.) Cufod.	Acanthaceae	0.02	0.5	0	<i>Tabernaemontana</i> <i>crassa</i> Benth.	Apocynaceae	0.68	1	0.33
<i>Erythrophleum ivorense</i> A. Chev.	Fabaceae	0.18	1	0.33	<i>Tabernaemontana</i> <i>pachysiphon</i> Stapf	Apocynaceae	0.02	0.25	0
<i>Euphorbia heterophylla</i> L.	Euphorbiaceae	0	0.25	0	<i>Tabernaemontana</i> <i>penduliflora</i> K. Schum.	Apocynaceae	0.10	0.5	0.17
<i>Euphorbia hirta</i> L.	Euphorbiaceae	0	0.25	0	<i>Telfairia sp.</i>	Cucurbitaceae	0.01	0.25	0
<i>Euphorbia thymifolia</i> L.	Euphorbiaceae	0	0.25	0	<i>Terminalia superba</i> Engl. & Diels	Combretaceae	0.48	1	0.33
<i>Ficus asperifolia</i> Miq.	Moraceae	0.01	0.25	0	<i>Tessmannia africana</i> Harms	Fabaceae	0.05	1	0.33

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<i>Ficus bubu</i> Warb.	Moraceae	0.02	0.25	0	<i>Tetracera eriantha</i> Oliv. Hutch.	Dilleniaceae	0.03	0.75	0.17
<i>Ficus exasperata</i> Vahl	Moraceae	0.07	1	0.33	<i>Tetrapleura tetraptera</i> (Schum. & Thonn.) Taub.	Fabaceae	0.14	1	0.33
<i>Ficus mucoso</i> Welw. ex Ficalho	Moraceae	0.04	0.75	0	<i>Theobroma cacao</i> L.	Malvaceae	0.09	1	0.33
<i>Ficus pseudomangifera</i> Hutch.	Moraceae	0.05	0.75	0.17	<i>Thomandersia hensii</i> De Wild. & T. Durand	Acanthaceae	0.07	0.25	0
<i>Ficus trichopoda</i> Baker	Moraceae	0.03	0.5	0.17	<i>Thonningia sanguinea</i> Vahl	Balanophoraceae	0.01	0.25	0
<i>Funtumia elastica</i> (P. Preuss) Stapf	Apocynaceae	0.17	1	0.33	<i>Tithonia diversifolia</i> (Hemsl.) A. Gray	Asteraceae	0.16	1	0.33
<i>Garcinia afzelii</i> Engl.	Clusiaceae	0	0.25	0	<i>Tragia benthamii</i> Baker	Euphorbiaceae	0.01	0.25	0
<i>Garcinia kola</i> Heckel	Clusiaceae	0.01	0.25	0	<i>Treculia africana</i> Decne.	Moraceae	0.05	0.75	0.17
<i>Gilbertiodendron dewevrei</i> (De Wild.) J. Léonard	Fabaceae	0.08	0.75	0.17	<i>Trema orientale</i> (L.) Blume	Cannabaceae	0	0.25	0
<i>Glyphaea brevis</i> (Spreng.) Monach.	Malvaceae	0.01	0.5	0	<i>Trichilia rubescens</i> Oliv.	Meliaceae	0.06	0.75	0.33
<i>Gossypium barbadense</i> L.	Malvaceae	0.03	0.75	0.33	<i>Trichoscypha acuminata</i> Engl.	Anacardiaceae	0.10	0.5	0
<i>Gouania longipetala</i> Hemsl.	Rhamnaceae	0.16	1	0.33	<i>Trichoscypha oddonii</i> De Wild.	Anacardiaceae	0.20	0.75	0.17
<i>Graptophyllum glandulosum</i> Turill	Acanthaceae	0.06	0.75	0.17	<i>Trilepisium madagascariense</i> DC.	Moraceae	0.05	0.5	0
<i>Greenwayodendron suaveolens</i> (Engl. & Diels) Verdc.	Annonaceae	0.55	1	0.33	<i>Triplochiton scleroxylon</i> K. Schum.	Malvaceae	0.08	0.5	0.17
<i>Grewia coriaca</i> Mast.	Malvaceae	0	0.25	0	<i>Triumphetta cordifolia</i> A. Rich.	Malvaceae	0.01	0.25	0
<i>Guibourtia tessmannii</i> (Harms) J. Léonard	Fabaceae	0.01	0.25	0	<i>Turraeanthus africanus</i> (Welw. ex. C. DC.) Pellegr.	Meliaceae	0.01	0.25	0
<i>Gymnanthemum amygdalinum</i> (Delile) Sch. Bip. ex Walp.	Asteraceae	0.03	0.75	0	<i>Uapaca guineensis</i> Müll. Arg.	Euphorbiaceae	0.05	1	0.33
<i>Harungana madagascariensis</i> Lam. ex Poir.	Hypericaceae	0.03	0.75	0.33	<i>Urera cordifolia</i> Engl.	Urticaceae	0.07	0.75	0
<i>Haumania dankelmaniana</i> (J. Braun & K. Schum.) Milne-Redh.	Marantaceae	0.90	1	0.33	<i>Urera repens</i> (Wedd.) Rendle	Urticaceae	0.10	0.75	0.33

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<i>Heisteria zimmereri</i> Engl.	Olacaceae	0.04	0.75	0.17	<i>Uvariopsis congolana</i> (De Wild.) R. E. Fr.	Annonaceae	0.01	0.25	0
<i>Hexalobus crispiflorus</i> A. Rich.	Annonaceae	0.02	0.75	0.33	<i>Vernonia doniana</i> DC.	Asteraceae	0.01	0.5	0
<i>Hillieria latifolia</i> (Lam.) H. Walt.	Phytolaccaceae	0.04	0.5	0.17	<i>Vitex thyrsoflora</i> Baker	Lamiaceae	0.02	0.25	0
<i>Holoptelea grandis</i> (Hutch.) Mildbr.	Ulmaceae	0.05	0.75	0.33	<i>Xanthosoma malfaffa</i> schott	Araceae	0.07	0.75	0.33
<i>Homalium sp.</i>	Salicaceae	0.02	0.25	0	<i>Xylopia quintasii</i> Engl. & Diels	Annonaceae	0.01	0.25	0
<i>Hunteria umbellate</i> (K. Schum.) Hallier f.	Apocynaceae	0.01	0.25	0	<i>Xylopia hypolampra</i> Mildbr. & Diels	Annonaceae	0.06	1	0.33
<i>Hylodendron gabunense</i> Taub.	Fabaceae	0.26	1	0.33	<i>Zanthoxylum gilleti</i> (De Wild.) P. G. Watterman	Rutaceae	0.12	1	0.33
<i>Hymenocardia ulmoides</i> Oliv.	Euphorbiaceae	0	0.25	0	<i>Zea mays</i> L.	Poaceae	0.11	0.75	0.33
<i>Hypselodelphys poggeana</i> (K. Schum.) Milne-Redh.	Marantaceae	0.01	0.25	0	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	0.06	0.25	0