# International Journal of Botany

ISSN: 1811-9700

science alert

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OPEN ACCESS International Journal of Botany

ISSN 1811-9700
DOI: 10.3923/ijb.2020.45.57

Research Article

# Performance, Vulnerability and Importance of Medicinal Plants Used in the Treatment of Vaginitis in Four Cities of Cameroon

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## Abstract

**Background and Objective:** Recently, herbal medicine has gained interest and knows a boom in the treatment of various pathologies like vaginitis. Plants which are subjected to various additional demands and become more scarce in their initial biotope, thus having a significant impact on their availability. Therefore, the objectives of this study were to (1) Inventory the plants used in the treatment of vaginitis, (2) Determining the performance of the plants recorded and (3) Evaluating their vulnerability and importance. **Materials and Methods:** This study was divided into three sub-experiments. The first consisted of conducting ethnobotanical surveys in four cities of Cameroon, calculation of the performance index and assessment of the vulnerability of the studied plants and their importance. **Results:** Sixty-one plant species with a predominance of woody plants belonging to 43 plant families were cited. Nine families were the most represented, including Fabaceae (07 species). *Cylicodiscus gabunensis*, the most cited plant contributed 28.76% in the composition of recipes with high therapeutic use-value, 0.288. The performance indices revealed that plants with multiple uses had an average performance. Forty-two woody plants were selected for the assessment of their vulnerability index and importance. Thus three categories of importance are counted amount in which 14 plants were important. **Conclusion:** Therefore, the assessment of efficiency, vulnerability and importance taking into account anthropogenic factors, is a major asset for sustainable exploitation of biodiversity in the field of medicinal plants.

Key words: Woody plants, performance, vulnerability, importance, phytomedicine, vaginitis, biodiversity

Citation: Christelle, N.R., Z.Z. Leila, B.O. Parfait, N.B.J. Bruno, A. Mamat, K.M. Phalone, N.M. Ascension and D.S. Didier, 2020. Performance, vulnerability and importance of medicinal plants used in the treatment of vaginitis in four cities of Cameroon. Int. J. Bot., 16: 45-57.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

## INTRODUCTION

In the search for new therapeutic molecules, studies in ethnobotany are conducted not only in the world but also in Africa and particularly in Cameroon. These studies that tackle recurrent diseases such as infectious diseases often revolve around inventories and surveys of the uses of plants in the treatment of various diseases. As is the case in several African countries, some authors are increasingly using the same methodology to identify plants used in the treatment of specific diseases such as syphilis[1], hemorrhoidal diseases[2] and even vaginitis[3]. Obtaining ethnobotanical data requires a great deal of tact and subtlety in the investigator. Indeed, many studies mention the increasing reluctance of the holders of traditional medicine's knowledge, to reveal their secrets[2,4]. Plants are used in the treatment of the target pathology and are equally subjected to various uses both in the field of traditional medicine and in many others, adding a sizeable weight to their long-term availability[5,6]. Thus, it would be important to verify the theoretical performance of these species in the treatment of pathologies and the impact of this practice on the long-term availability of the requested species.

The objective of this study is to evaluate the performance and vulnerability of plants used in the treatment of vaginitis in four cities of Cameroon, particularly by (1) inventorying the plants used by the target populations in the treatment of vaginitis, (2) to evaluate their performance and (3) determining the vulnerability and importance of some inventoried plant species.

## MATERIALS AND METHODS

**Study site:** Douala, Edea, Mfou and Yaounde, respectively the economic capital, industrial capital, the small community of the Central region and political capital of Cameroon were chosen because of their representativeness, their cultural diversity and equality because these cities still have shreds of existing forest relics (Fig. 1). The study was carried out at the Laboratory of Biology and Physiology of Plant Organisms, Faculty of Science, University of Douala and Centre for Medicinal Plants Research and Traditional Medicine, Institute of Medical Research and Medicinal Plant Studies, Cameroon from March 2017 to June 2017.


Fig. 1: Map of Cameroon materializing the study sites[7]

## Methods

**Ethnobotanical survey:** Ethnobotanical surveys on the uses of plants mentioned in the traditional pharmacopeia against vaginal infections were conducted in the markets and neighborhoods of four Cameroonian cities (a metropolis and a small neighboring city in the central regions, Yaounde and Mfou) and Littoral (Douala and Edea). The choice of small towns was made based on proximity to metropolises and the presence of existing forest relics. The choice of markets is justified by the fact that the Mokolo Market and the Goat Market are the largest of the two metropolises in terms of the sale of medicinal plants; that of neighborhood villages, because they are indigenous villages still far from the city center where therapists enjoy an undeniable reputation[2,8]. These surveys were conducted in two phases, the first in the Littoral region in March 2017 and the second in the Central region in June of the same year.

The respondents' approach (sellers of medicinal plants from large cities or inhabitants of small towns, holders of knowledge in traditional medicine) on the dialogue in French and local languages to obtain a sample from at least 30 respondents. According to the questionnaire guidelines, the community-appointed herbalists, traditional healers and community-based knowledge holders underwent semi-structured interviews and gave all the information on medicinal plants used in the treatment of female gynecological diseases according to the methodology adopted by researchers[9].

**Counting of cards and calculation of ethnobotanical indices:** To identify the plants most involved in each gynecological use, the Cpr which is the contribution of each plant in the constitution of the recipes[10] was calculated by the formula:

$$Cpr = \frac{Nr}{NR} \times 100$$

where, Nr is the number of recipes soliciting the plant and NR is the total number of recipes.

The quotations frequencies of the various plants were determined according to the formula:

$$Fc = \frac{Nc}{N}$$

where, Nc is the number of citations of the plant and N the total number of citations of the plants listed.

The therapeutic use-value (TUV) of each species that significantly determines their use value in a given environment relative to other species was calculated using the following this formula[11]:

$$TUV = \frac{U}{Ninf}$$

where, U is the number of uses where the species is mentioned by each informant and Ninf the number of informants who mentioned the species.

**Coefficient of similarity of Sorensen:** A dendrogram showing the similarity in the use of anti-vaginitis plants by city and the respondent was derived from Sorensen's similarity coefficient. The calculation of this coefficient was based on the mere presence or absence of a species in a recipe cited by an informant of a given site. The formula used is as follows:

$$\beta = \frac{2c}{S1 \diagup S2}$$

where, c is number of common species between 2 sites, S1 is number of species-specific to the site 1 and S2 is number of species-specific to site 2.

It made it possible to quantify the degree of association of the species and the level of similarity amongst the recipes taking into account the plants that are used[12].

**Multiple Correspondence Analysis (MCA):** This analysis was done to describe and prioritize the statistical relationships existing between the different tribes and their uses of plants particularly by considering the parts used, the method of preparation and the route of administration.

**Calculation of the performance index:** The Performance Index (PI) described by Betti[13], represents the efficiency of a plant by pathology among all recorded pathologies that mention the plant in question. It is obtained after the interpretation of the following difference:

$$\frac{Nc}{N} - \frac{Ncm}{Nt}$$

where, Nc is the number of citations of a plant in the treatment of a disease, N is the total number of citations of all plants used in the treatment of this disease, Ncm is the number of citations of the plant for all diseases and Nt is the total number of citations.

- PI = 0 if (Nc/N) - (Ncm/Nt) <0 for zero performance
- PI = 1 if 0 <(Nc/N) - (Ncm/Nt) $\leq$1/3 for average performance
- PI = 2 if 1/3 <(Nc/N) - (Ncm/Nt) $\leq$2/3 for a good performance

- PI = 3 if (Nc/N)-(Ncm/Nt)>2/3 for excellent performance

**Assessment of the vulnerability and importance of the studied plants**

**Vulnerability index:** The calculation of the vulnerability index of species (Iv) has been adapted[5,6]. The vulnerability scale proposed[5] has three levels (from 1 to 3) and has been used to calculate the risk of the vulnerability of species used in the treatment of vaginitis. A value of 1 indicates a species with low vulnerability for the indicated parameters, a value of 2 represents a vulnerable species and a value of 3 characterizes a highly vulnerable species. The vulnerability indices were calculated from the following parameters :

**Morphological types (A):** Depending on the morphological type and life cycle of the plant, the risk of vulnerability is higher or lower. Virtually none at herbaceous and creepers, whose life cycle is annual and generation, spontaneous, is average in sub-shrubs, medium in shrubs and high in trees. Herbs and creepers were thus excluded in this study on the risk of vulnerability.

**The organs used (B):** The vulnerability of a plant increases depending on whether the plant organ removed easily regenerates or not. For example, harvesting bark, stem tissue and roots almost always kill trees[5], while leaves do not necessarily kill mature trees. The sporadic harvest of some fruits will have less effect on the long-term stability of the populations of exploited woods, whereas an intensive harvest of fruits and seeds may lead to a gradual reduction of the woody species that produce them.

**The number of quotations (C):** It was considered low when less than 5 citations, average when between 5 and 10 and high when greater than or equal to 10.

**The frequency of citations of species (D):** The frequency of citations of a species is given by the ratio Nc/N, where Nc is the number of citations of the plant and N the total number of citations of the plants listed.

When it is less than 25% it is said to be weak, between 25 and 50%, it is average and beyond 50% it is said to be high.

Thus the calculation of the vulnerability index of the species x (Ivx) is obtained according to the formula:

$$Ivx = \frac{N}{4}$$

with N = A+B+C+D If Ivx <2 the plant is not very vulnerable, if 2<Ivx<2.5, the plant is said to be vulnerable and if Ivx$\geq$2.5 the plant is said to be very vulnerable.

**Importance index:** The importance index developed in this study takes into account the performance and vulnerability of the plants developed[5,12]. For the calculation of the importance index for any plant, the highest value of the performance index obtained for any symptom or vaginal pathology was used. It is obtained from the following formula:

$$Iimp = \frac{Ip}{Iv}$$

where, limp is the importance index; Ip: Performance index; Iv: vulnerability index:

- limp = 1 if Ip/Iv <1 for zero importance
- limp = 2 if Ip/Iv =1 for average importance
- limp = 1 if Ip/Iv >1 for excellent importance

**Data analysis:** Graphs were obtained using the Microsoft Excel 2013 Spreadsheet. A dendrogram showing the similarity of the use of anti-vaginitis plants by city and respondent was derived from the Sorensen similarity coefficient using R software. The Multiple Component Analysis (MCA) was done on XLSTAT 2019 version 1.2 to prioritize the different patterns of plant use by the respondents.

## RESULTS

**Ethnobotanical survey:** A total of 73 recipes were recorded; which correspond to the number of respondents, each giving a particular recipe. Thus, 61 plant species belonging to 43 plant families have been cited in the treatment of diseases related to the female genital tract with a score of 194 citations. The main species mentioned are *Cylicodiscus gabunensis* Harms (21 citations), *Mammea africana* (Sabine) (15), *Antrocaryon klaineanum* Pierre (12), *Aloe vera* Linn. (10), *Guibourtia tessmannii* (Harms) J. Leonard (8), *Piptadeniastrum africanum* (Hook.f.) Brenan (6), *Alchornea cordifolia* (Sch. and Thonn.) Müll. Arg. (5), *Hylodendron gabunensis* Tab. and *Citrus limon* L. (5 citations each). All the species mentioned have been characterized and their number of citations, citation frequencies, contributions in the recipes and values of therapeutic use recorded in Table 1.

Table 1: Morphological and phenological characterization of the listed species

| Families | Scientific names | Morphological type | Phytogeographic distribution | Types of Biotopes | Organes Utilisés | Nc | Nr = U | Fc | Cpr | TUV |
|---|---|---|---|---|---|---|---|---|---|---|
| Aloeaceae | *Aloe vera* (L.) Burn.f./ Aloe vera (french) | Perennial herb | WG | Savannah | Leaves | 10 | 10 | 5.076 | 13.699 | 0.137 |
| Amaryllidaceae | *Allium* sp/ lilang (bassa) | Annual herb | Cos | Fields | Bulb | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Anacardiaceae | *Annickia chlorantha* (Oliv.) Setten and Maas/écorce jaune (french) | Tree | Tropical Africa, Cameroon and Nigeria | Primary forest | Bark | 3 | 3 | 1.523 | 4.11 | 0.041 |
| Anacardiaceae | *Antrocaryon klaineanum* Pierre / Agongui (ewondo) | Tree | At and West Africa | Primary forest | Bark | 12 | 12 | 6.091 | 16.438 | 0.164 |
| Anacardiaceae | *Mangifera indica* L./ djangolo (bassa) | Tree | Pant | Fields | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Annonaceae | *Monodora myristica* (Gaertn.) Dunal/ pèbè (bassa) | Tree | G-Sz | Primary forest | Bark | 3 | 3 | 1.523 | 4.11 | 0.041 |
| Annonaceae | *Anonidium mannii* (Oliv.) Engl. and Diels | Tree | At, Ghana, Gabon, et DRC | Savannah, Tropical forest | Bark | 3 | 3 | 1.523 | 4.11 | 0.041 |
| Apocynaceae | *Alstonia boonei* De Wild./Ekouk (ewondo) | Tree | Tropical Africa, Ethiopia and Tanzania | Secondary forest | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Araceae | *Xanthosoma* sp./macabo sauvage (french) | Perennial herb | Pant, Asia and South America | Fields | Leaves | 4 | 4 | 2.03 | 5.479 | 0.055 |
| Araliaceae | *Panax ginseng C.A.Meyer* | Perennial herb | Asia | Mountain forest | Roots | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Arecaceae | *Elaeis guineensis* Jacq./ tong (bassa) | Tree | GC | Fields | Seeds | 4 | 4 | 2.03 | 5.479 | 0.055 |
| Asteraceae | *Vernonia amygdalina* Delile/ ndolè (duala, bassa) | Shrub | At | Fields | Leaves | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Asteraceae | *Ageratum conyzoides* L./katoro (bassa) | Annual herb | Pan | Commonplace | Whole plant | 6 | 6 | 3.046 | 8.219 | 0.082 |
| Asteraceae | *Emilia coccinea* G.Don./ oreille de chien (french) | Annual herb | DRC, Angola et Zambia | Forest edge | Leaves | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Bignoniaceae | *Spathodea campanulata* P. Beauv. | Tree | GC | Secondary forest | Bark | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Bombacaceae | *Ceiba pentandra* (L.) Gaertn./ djom (bassa) | Tree | SZ | Primary forest | Bark | 4 | 4 | 2.03 | 5.479 | 0.055 |
| Caricaceae | *Carica papaya* L./ pawpaw (bassa) | Stipe | Mexico | Fields | Leaves | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Cecropiaceae | *Musanga cecropioides* R. Br./ parassolier (french) | Tree | G | Secondary forest | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Clusiaceae | *Mammea africana* Sabine/ abotzock (ewondo) | Tree | GC | Hydromorphic forest | Bark | 15 | 15 | 7.614 | 20.548 | 0.205 |
| Commelinaceae | *Commelina benghalensis* L./ lawouwout (bagangté) | Perennial herb | Tropical Asia and Africa | Commonplace | Leaves | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Convolvulaceae | *Ipomea* sp./ patate sauvage (french) | Annual herb | - | Commonplace | Leaves | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Costaceae | *Costus afer* Ker Gawl./ canne des jumeaux (french) | Perennial herb | GC | Forest edge | Stalk | 4 | 4 | 2.03 | 5.479 | 0.055 |
| Euphorbiaceae | *Alchornea cordifolia* (Schumach. and Thon.) Müll.Arg./Aboe (ewondo) | Tree | Tropical Africa | Secondary forest | Leaves | 5 | 5 | 2.538 | 6.849 | 0.068 |
| Euphorbiaceae | *Ricinodendron heudoleutii* (Baill.) Pierre ex Heckel/ djassang (bassa) | Tree | GC | Secondary forest | Bark | 3 | 3 | 1.523 | 4.11 | 0.041 |
| Euphorbiaceae | *Croton oligandrus* Pierre ex Hutch. | Tree | GC | Secondary forest | Bark | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Fabaceae | *Cylicodiscus gabunensis* Harms/ adoum (ewondo) | Tree | Equatorial Africa | Primary forest | Bark | 21 | 21 | 10.66 | 28.767 | 0.288 |
| Fabaceae | *Piptadeniastrum africanum* (Hook.f.) Brenan | Tree | At | Primary forest | Bark | 6 | 6 | 3.046 | 8.219 | 0.082 |
| Fabaceae | *Guibourtia tessmannii* (Harms) J.Léonard/ Bubinga (ewondo) | Tree | GC | Primary forest | Bark | 8 | 8 | 4.061 | 10.959 | 0.11 |
| Fabaceae | *Erythrophleum suaveolens* (Guill. and Pierr.) Bren. | Tree | G-SZ | Primary forest | Bark | 7 | 7 | 3.553 | 9.589 | 0.096 |
| Fabaceae | *Hylodendron gabunense* Taubert | Tree | WG | Primary forest | Bark | 5 | 5 | 2.538 | 6.849 | 0.068 |
| Fabaceae | *Senna alata* (L.) Roxb/ longkana (bassa) | Under shrub | South America | Fields | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Fabaceae | *Tetrapleura tetraptera* (Schum. et Thonn.) Taub./ sèsè (malimba) | Shrub | GC | Fallow | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Irvingiaceae | *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill./Ando'o (ewondo) | Tree | GC | Primary forest | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |

Table 1: Continue

| Families | Scientific names | Morphological type | Types of distribution | Organes Biotopes | Utilisés | Nc | Nr = U | Fc | Cpr | TUV |
|---|---|---|---|---|---|---|---|---|---|---|
| Lamiaceae | *Ocimum basilicum* L./ massep (ewondo) | Perennial herb | Paleo | Fields | Leaves | 3 | 3 | 1.523 | 4.11 | 0.041 |
| Lauraceae | *Persea americana* Mill./ Sa'a (bassa) | Tree | Mexico and Central America | Fields | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Lecythidaceae | *Petersianthus macrocarpus* (P.Beauv.) | Tree | GC | Secondary forest | Bark | 3 | 3 | 1.523 | 4.11 | 0.041 |
| Loganiaceae | *Anthocleista vogelii* Planchon/ bopolopolo (Duala) | Shrub | Sierra Leone, Kenya, Zambia et Angola | Secondary forest | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Malvaceae | *Sida rhombifolia* L./ sida (français) | Under shrub | Pan | Commonplace | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Malvaceae | *Sida cordifolia* L./ sida (french) | Under shrub | Pan | Commonplace | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Malvaceae | *Triumfetta pentandra* A.Rich. | Tree | At | Secondary forest | Bark | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Melastomataceae | *Dissotis rotundifolia* (Sm.)Triana/ salé (français) | Annual herb | At | Fallow | Whole plant | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Meliaceae | *Entandrophragma cylindricum* (Sprague)/ koundjock (bassa) | Tree | GC | Primary forest | Bark | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Moringaceae | *Moringa oleifera* Lam./ moringa (french) | Tree | India | Fields | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Ochnaceae | *Lophira alata* C.F.Gaertn./ Mangosi (bassa, ewondo) | Tree | GC | Primary forest | Bark | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Passifloraceae | *Passiflora foetida* (L.)/ bonbon serpent (french) | Herbaceous liana | AA | Fallow | Whole plant | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Phyllanthaceae | *Bridelia micrantha* (Hochst.) Baill. | Tree | Paleo | Secondary forest | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Poaceae | *Cymbopogon citratus* (DC.) Stapf/ citronnelle (french) | Perennial herb | Pan | Fields | Leaves | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Portulacaceae | *Portulaca oleracera* L. | Annual herb | Pan | Savannah | Leaves | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Rosaceae | *Prunus africana* (Hook.f.)/ | Tree | Central and Southern Africa, Madagascar | Secondary forest | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Rubiaceae | *Morinda lucida* Benth./ akeng (ewondo) | Tree | At | Secondary forest | Bark | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Rutaceae | *Citrus medica* L./ citron (french) | Shrub | Pan | Fields | Fruit | 4 | 4 | 2.03 | 5.479 | 0.055 |
| Rutaceae | *Citrus limon* L./ lemon (french) | Shrub | Pan | Fields | Fruit | 5 | 5 | 2.538 | 6.849 | 0.068 |
| Sapotaceae | *Baillonella toxisperma* Pierre/ moabi (french) | Tree | GC | Primary forest | Bark | 4 | 4 | 2.03 | 5.479 | 0.055 |
| Solanaceae | *Nicotiana tabacum* L./ siba (bassa) | Annual herb | Pan | Fields | Leaves | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Solanaceae | *Solanum melongena* L./ aubergine sauvage (french) | Annual herb | Asia | Fields | Fruit | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Sterculiaceae | *Cola acuminata* (P.Beauv), Schott et Endl./ cola rouge (french) | Shrub | At | Fields | Bark | 2 | 2 | 1.015 | 2.74 | 0.027 |
| Theaceae | *Camellia sinensis* (L.) Kuntze/ thé (french) | Shrub | Asia | Fields | Leaves | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Urticaceae | *Myrianthus arboreus* Beauv./ ananas du singe (french) | Tree | At | Secondary forest | Bark | 3 | 3 | 1.523 | 4.11 | 0.041 |
| Verbenaceae | *Lantana camara* L./ bondjasatan (duala) | Shrub | West Indies | Fields | Leaves | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Zingiberaceae | *Zingiber officinale* Roscoe/ djindjer (bassa, duala, ewondo) | Perennial herb | India | Fields | Rhizome | 1 | 1 | 0.508 | 1.37 | 0.014 |
| Zingiberaceae | *Aframomum melegueta* K. Schum./ ndong (bassa, ewondo) | Perennial herb | GC | Hydromorphic forest | Fruit | 3 | 3 | 1.523 | 4.11 | 0.041 |

At: Afrotropical, CG: Guinean-Congolese Center, GC: Guineas congolese, G: Guinean, Paleo: Tropical paleo, Pan: Pantropical, Cos: Cosmopolitan, SZ: Sudano-Zambezian, G-SZ: Guinean-Sudano-Zambezian, WG: Western Guinean, AA: African American, Nc: Number of quotes, Nr: Number of recipes, U: Number of uses, Fc: Frequency of quotations, Crp: Contribution in the recipes, TUV: Therapeutic use value

It is apparent from this table that the species *Cylicodiscus gabunensis* is the one with the highest therapeutic value for use in vaginal infections; it is closely followed by *Mammea africana* and *Aloe vera*.

**The similarity of respondents' knowledge:** A dendrogram revealed whether the respondents' knowledge converges (Fig. 2).

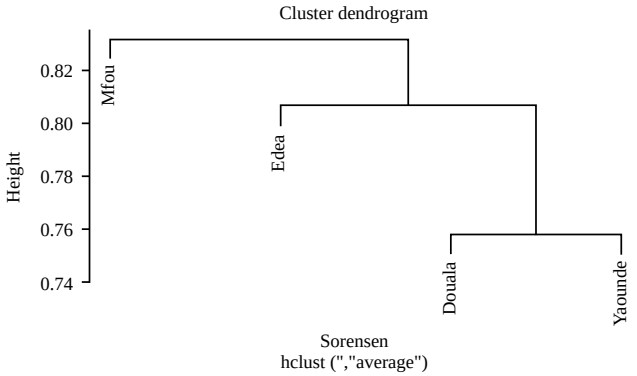


Fig. 2: Dendrogram of similarity of the knowledge of the respondents of the four cities

Figure 2 highlights the degree of similarity between the knowledge of four cities visited.

The analysis of this dendrogram reveals the degree of similarity between the knowledge of the respondents of the two big cities (Douala and Yaoundé), although the plants used at Edea are closer to those of these metropolises, unlike those used at Mfou; Douala and Yaoundé as well as Edea. It appears that practitioners of traditional medicine in metropolitan areas such as Douala and Yaoundé have the same habits in the use of plants for the treatment of vaginitis.

Multiple correspondence analysis was done to highlight the main uses of medicinal plants by different ethnic groups in the treatment of infections and other pathologies of the vaginal route (Fig. 3).

From Fig. 3, the main observation emerges: the respondents belong to two major ethnic groups (the Bamileke and the other ethnic groups).

Bamilekes are characterized by the use of shrubs and bushes. The most used parts by this ethnic group are the leaves, seeds, stems and roots and the methods of preparation are infusion, grinding and crushing. The routes of administration of the drug are the oral and vaginal routes.

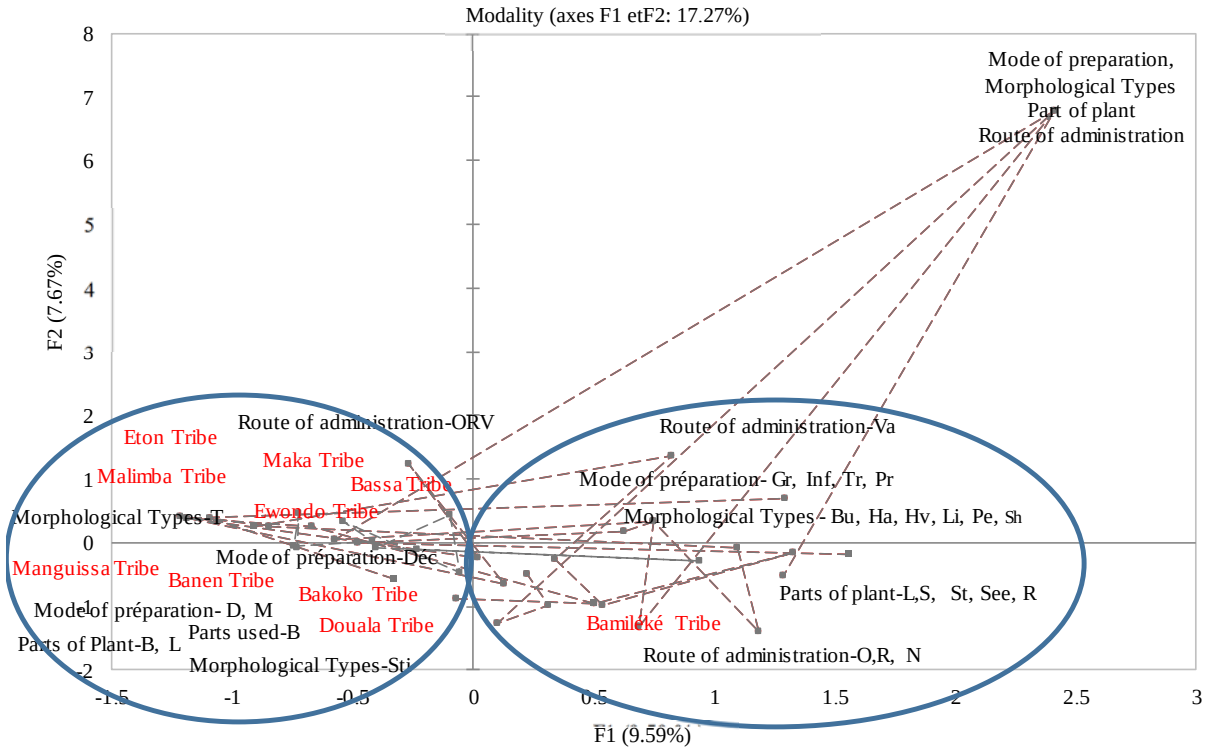


Fig. 3: Multiple Component Analysis

Morphological types: Bu: Bushes, Li: Liana, Sh: Shrub, Sti: Stipe, T: Tree; Parts of plant: B: Bark, L: Leaves, Pe: Petiole, R: Roots, S: Sap, See: Seeds, St: Stem; Mode of preparation: D: Decoction, Gr: Grinding, Inf: Infusion, M: Maceration, Pr: Pressing, Tr: Trituration; Route of administration: N: Nasal, O: Oral, R: Rectal, V: Vaginal

Table 2: Plant performance index used in the treatment of symptomatic/diseases/gynecological uses

| Diseases/Symptomatic/Used species | Vag.I | Vag.Itc. | V.Toi. | Chla. | Syp. | Gon. | P.P. | W.D. | Vag.Ca. | W.W. | Fac.C. | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Aframomum melegueta* K. Schum. | - | 1 | - | 1 | - | - | - | - | - | - | - | - |
| *Ageratum conyzoides* L. | 2 | - | - | - | - | - | - | - | - | 1 | - | - |
| *Alchornea cordifolia* (Schumach. and Thonn.) Müll.Arg. | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - |
| *Allium* sp. | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Aloe vera* (L.) Burn.f. | 2 | - | - | - | 1 | - | - | 1 | - | - | - | - |
| *Alstonia boonei* De Wild. | - | 3 | - | - | - | - | - | - | - | - | - | - |
| *Annickia chlorantha* (Oliv.) Setten and Maas | - | 1 | - | 1 | 1 | - | - | - | - | - | - | - |
| *Anonidium mannii* (Oliv.) Engl. and Diels | - | 2 | - | - | - | - | - | - | - | - | - | - |
| *Anthocleista vogelii* Planchon | - | 3 | - | - | - | - | - | - | - | - | - | - |
| *Antrocaryon klaineanum* Pierre | - | 1 | 1 | - | 1 | 1 | - | - | 1 | - | - | - |
| *Baillonella toxisperma* Pierre | - | 1 | - | - | - | - | - | - | 1 | - | - | - |
| *Bridelia micrantha* (Hochst.) Baill. | - | - | - | 3 | - | - | - | - | - | - | - | - |
| *Camellia sinensis* (L.) Kuntze | - | - | - | - | - | 3 | - | - | - | - | - | - |
| *Carica papaya* L. | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Ceiba pentandra* (L.) Gaertn. | - | - | - | - | 2 | 1 | - | - | - | - | - | - |
| *Citrus medica* L. | 1 | - | - | - | - | - | - | 1 | - | - | - | - |
| *Citrus limon* L. | 1 | - | 1 | - | - | - | - | - | 1 | - | - | - |
| *Cola acuminata* (P.Beauv), Schott et Endl. | 1 | - | - | 2 | - | - | - | - | - | - | - | - |
| *Commelina benghalensis* L. | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Costus afer* Ker.Gawl. | 1 | - | - | - | - | 1 | - | - | - | - | - | - |
| *Croton oligandrus* Pierre ex Hutch. | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Cylicodiscus gabunensis* Harms | - | 1 | 1 | - | 1 | 1 | - | 1 | - | - | - | - |
| *Cymbopogon citratus* (DC.) Stapf | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Dissotis rotundifolia* (Sm.)Triana | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Elaeis guineensis* Jacq. | - | - | - | - | - | 1 | - | - | - | - | 1 | - |
| *Emilia coccinea* G.Don. | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Entandrophragma cylindricum* (Sprague) | - | 3 | - | - | - | - | - | - | - | - | - | - |
| *Erythrophleum suaveolens* (Guill. and Pierr.) Bren. | - | 1 | - | 1 | - | - | - | - | - | - | - | - |
| *Guibourtia tessmannii* (Harms) J.Léonard | - | 1 | - | 1 | 1 | 1 | - | - | - | - | - | - |
| *Hylodendron gabunense* Taubert | - | 2 | - | - | - | - | - | - | - | - | - | - |
| *Ipomea* sp. | - | 1 | - | - | - | - | - | - | 2 | - | - | - |
| *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill. | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Lantana camara* L. | - | - | - | 3 | - | - | - | - | - | - | - | - |
| *Lophira alata* C.F.Gaertn. | 1 | - | 1 | - | - | - | - | - | - | - | - | - |
| *Mammea africana* Sabine | - | 1 | - | - | - | 1 | - | - | 1 | - | - | - |
| *Mangifera indica* L. | - | - | - | - | - | 3 | - | - | - | - | - | - |
| *Monodora myristica* (Gaertn.) Dunal | 1 | - | 1 | - | - | - | - | - | - | - | - | - |
| *Morinda lucida* Benth. | - | 3 | - | - | - | - | - | - | - | - | - | - |
| *Moringa oleifera* Lam. | - | - | - | - | 3 | - | - | - | - | - | - | - |
| *Musanga cecropioides* R. Br. | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Myrianthus arboreus* Beauv. | - | - | - | - | - | - | - | - | 1 | - | - | - |
| *Nicotiana tabacum* L. | - | - | - | - | - | - | - | 3 | - | - | - | - |
| *Ocimum basilicum* L. | 1 | - | - | - | - | - | 1 | - | - | - | - | - |
| *Panax ginseng* C.A. Meyer | 1 | - | - | - | - | - | - | 2 | - | - | - | - |
| *Passiflora foetida* L. | - | - | 1 | - | - | - | 1 | - | - | - | - | - |
| *Persea americana* Mill. | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Petersianthus macrocarpus* (P.Beauv.) | - | 2 | - | - | - | - | - | - | 1 | - | - | - |
| *Piptadeniastrum africanum* (Hook.f.) Brenan | - | 1 | - | 1 | 1 | - | - | - | - | - | - | - |
| *Portulaca oleracera* L. | - | - | - | - | - | - | - | - | - | - | 3 | - |
| *Prunus africana* (Hook.f.) | - | - | - | - | 3 | - | - | - | - | - | - | - |
| *Ricinodendron heudoleutii* (Baill.) Pierre ex Heckel | - | 1 | - | - | - | - | - | - | 1 | - | - | - |
| *Senna alata* (L.) Roxb | - | - | - | 3 | - | - | - | - | - | - | - | - |
| *Sida cordifolia* L. | - | 3 | - | - | - | - | - | - | - | - | - | - |
| *Sida rhombifolia* L. | - | 3 | - | - | - | - | - | - | - | - | - | - |
| *Solanum melongena* L. | - | - | 1 | - | - | - | 1 | - | - | - | - | - |
| *Spathodea campanulata* P. Beauv. | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| *Tetrapleura tetraptera* (Schum. et Thonn.) Taub | - | - | - | - | 3 | - | - | - | - | - | - | - |
| *Triumfetta pentandra* A.Rich. | - | - | - | 2 | - | - | 1 | - | - | - | - | - |
| *Vernonia amygdalina* Delile | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Xanthosoma* sp. | 1 | - | - | - | - | - | - | - | 1 | - | - | - |
| *Zingiber officinale* Roscoe | - | 3 | - | - | - | - | - | - | - | - | - | - |

Vag.I: Vaginal infections, Vag.It: Vaginal itching, V.Toi.: Vaginal toilet, Chla.: Chlamydia, Syp. : Syphilis, Gon. Gonorrhea, P.P.: Painful periods, W.D.: Abundant white losses, Vag.Ca.: vaginal candidiasis, W.W.: Women's worm, Fac.C.: Facilitates childbirth, Ant.: Antibiotic

Table 3: Vulnerability and Importance of woody plants used in the treatment of vaginitis

| Scientific names | TM (A) | O (B) | Nc (C) | Fc (D) | Average (C+D+E+F)/4 | Vulnerability | Ip/Iv | Iimp |
|---|---|---|---|---|---|---|---|---|
| *Alchornea cordifolia* (Schumach. and Thon.) Müll.Arg. | 3 | 1 | 2 | 1 | 1.75 | Little vulnerable | 1/1 | Medium importance |
| *Alstonia boonei* De Wild. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 3/2 | Important |
| *Annickia chlorantha* (Oliv.) Setten and Maas | 3 | 3 | 1 | 1 | 2 | Vulnerable | 1 /2 | Not important |
| *Anonidium mannii* (Oliv.) Engl. and Diels | 3 | 3 | 1 | 1 | 2 | Vulnerable | 2/2 | Medium importance |
| *Anthocleista vogelii* Planchon | 2 | 3 | 1 | 1 | 1.75 | Little vulnerable | 3/1 | Important |
| *Antrocaryon klaineanum* Pierre | 3 | 3 | 3 | 1 | 2.5 | Very vulnerable | 1/3 | Not important |
| *Baillonella toxisperma* Pierre | 3 | 3 | 1 | 1 | 2 | Vulnerable | 1/2 | Not important |
| *Bridelia micrantha* (Hochst.) Baill. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 3/2 | Important |
| *Camellia sinensis* (L.) Kuntze | 2 | 1 | 1 | 1 | 1.25 | Little vulnerable | 3/1 | Important |
| *Carica papaya* L. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 2/2 | Medium importance |
| *Ceiba pentandra* (L.) Gaertn. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 2/2 | Medium importance |
| *Citrus limon* L. | 2 | 3 | 2 | 1 | 2 | Vulnerable | 1/2 | Not important |
| *Citrus medica* L. | 2 | 3 | 1 | 1 | 1.75 | Little vulnerable | 1/1 | Medium importance |
| *Cola acuminata* (P.Beauv), Schott et Endl. | 2 | 3 | 1 | 1 | 1.75 | Little vulnerable | 2/2 | Medium importance |
| *Croton oligandrus* Pierre ex Hutch. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 2/3 | Not important |
| *Cylicodiscus gabunensis* Harms | 3 | 3 | 3 | 1 | 2.5 | Very vulnerable | 1/3 | Not important |
| *Elaeis guineensis* Jacq. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 1/2 | Not important |
| *Entandrophragma cylindricum* (Sprague) | 3 | 3 | 1 | 1 | 2 | Vulnerable | 3/2 | Important |
| *Erythrophleum suaveolens* (Guill. and Pierr.) Bren. | 3 | 3 | 2 | 1 | 2.25 | Vulnerable | 1/2 | Not important |
| *Guibourtia tessmannii* (Harms) J.Léonard | 3 | 3 | 2 | 1 | 2.25 | Vulnerable | 1/2 | Not important |
| *Hylodendron gabunense* Taubert | 3 | 3 | 2 | 1 | 2.25 | Vulnerable | 2/2 | Medium important |
| *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 2/2 | Medium important |
| *Lantana camara* L. | 2 | 1 | 1 | 1 | 1.25 | Little vulnerable | 3/1 | Important |
| *Lophira alata* C.F.Gaertn. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 1/2 | Not important |
| *Mammea africana* Sabine | 3 | 3 | 3 | 1 | 2.5 | Very vulnerable | 1/3 | Not important |
| *Mangifera indica* L. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 3/2 | Important |
| *Monodora myristica* (Gaertn.) Dunal | 3 | 3 | 1 | 1 | 2 | Vulnerable | 1/2 | Not important |
| *Morinda lucida* Benth. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 3/2 | Important |
| *Moringa oleifera* Lam. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 3/2 | Important |
| *Musanga cecropioides* R. Br. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 2/2 | Medium importance |
| *Myrianthus arboreus* Beauv. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 1/2 | Not important |
| *Persea americana* Mill. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 2/2 | Medium importance |
| *Petersianthus macrocarpus* (P.Beauv.) | 3 | 3 | 1 | 1 | 2 | Vulnerable | 2/2 | Medium importance |
| *Piptadeniastrum africanum* (Hook.f.) | 3 | 3 | 2 | 1 | 2.25 | Vulnerable | 1/2 | Not important |
| *Prunus africana* (Hook.f.) | 3 | 3 | 1 | 1 | 2 | Vulnerable | 3/2 | Important |
| *Ricinodendron heudoleutii* (Baill.) Pierre | 3 | 3 | 1 | 1 | 2 | Vulnerable | 1/2 | Not important |
| *Sida cordifolia* L. | 1 | 1 | 1 | 1 | 1 | Little vulnerable | 3/1 | Important |
| *Sida rhombifolia* L. | 1 | 1 | 1 | 1 | 1 | Little vulnerable | 3/1 | Important |
| *Spathodea campanulata* P. Beauv. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 1/2 | Not important |
| *Tetrapleura tetraptera* (Schum. et Thonn.) | 2 | 3 | 1 | 1 | 1.75 | Little vulnerable | 3/1 | Important |
| *Triumfetta pentandra* A.Rich. | 3 | 3 | 1 | 1 | 2 | Vulnerable | 2/2 | Medium importance |
| *Vernonia amygdalina* Delile | 2 | 1 | 1 | 1 | 1.25 | Little vulnerable | 2/1 | Important |

TM: Morphological type, O: organ used, Nc: Number of quotes, Fc: Frequency of quotes, Imp: Importance index

The other ethnic groups (Bakoko, Banen, Bassa, Douala, Eton, Ewondo, Maka, Malimba and Manguissa) use the trees and stipes much more and the parts used are the bulbs, barks and leaves. Given the contributions and the cosine squares of the different variables, the differences mainly oppose the Bamilekes to Bakoko, Bassa, Eton, Ewondo, Maka, Malimba and Manguissa; At the morphological types, the perennial herb is more associated with the Bamileke and the tree is more associated with the other above-mentioned. On the other hand, the tree is opposable to Bamilékés, so less used by them while the herbaceous perennial is less used by other ethnic groups.

**Plant performance:** The performance index, whose role would be to guide the investigators in the choice of plants to be studied for a specific pathology, among all the listed vaginal disorders are recorded in the following Table 2.

It can be seen from Table 2 that only the plants mentioned once have very good performance compared to those with multiple uses.

**The vulnerability of the most used woody species:** The listed woody species were selected for the calculation of their vulnerability risk; the results obtained are recorded in the Table 3.

Table 3 presents the vulnerability and importance indices of the 42 woody species obtained in this study.

In total, among the 61 species identified 42 woody plants were selected for the evaluation of their vulnerability index. Thus three categories are counted: the less vulnerable species (10), the vulnerable species (29) and the highly vulnerable species (03). The five most common local plants in the treatment of vaginal infections are particularly highly susceptible to *Antrocaryon klaineanum* Stone, *Cylicodiscus gabunensis* Harms and *Mammea africana* Sabine; vulnerable (*Myrianthus arboreus* Beauv.) and not very vulnerable (*Alchornea cordifolia* (Schumach. and Thon.) Müll.Arg). Thus, depending on the organs used and the solicited plant, the therapeutic potential varies.

**Plant importance:** The importance index, whose role would be to guide the choice of plants whose performance will be more important than vulnerability.

On the 42 woody species used in the estimation of their vulnerability index, three categories of plants are observed: 14 important plants, 12 moderately important plants and 16 non-important plants.

## DISCUSSION

The analysis of the dendrogram obtained from the similarity of Sorensen reveals the relationship between the knowledge of the respondents of the two big cities (Douala and Yaounde), although the plants used at Edea are closer to those of these metropolises contrary to those used in Mfou; Douala and Yaounde as well as Edea and Yaounde. The dendrogram obtained from the index of similarity of knowledge of the respondents revealed that the information differed from one respondent to another; the dissimilar nature of plant knowledge is also exposed in this study, as is in the case for hemorrhoids in southern Cameroon[2]. Furthermore, the analysis in multiple components reveals that the Bamileke has a singular way of using the plants for the treatment of vaginal infections, unlike other ethnic groups whose uses are as close by the organs used, the parts used as by preparation methods and routes of administration. The respondents gave information on 61 plant species and 73 recipes which correspond to the number of respondents, each giving a particular recipe. These recipes differed as much in the floristic characteristics of the plants used, as in the different methods used to obtain and administer the drug obtained[14]. This means that each practitioner brings his personal touch in the preparation of his medicine and this then reveals the great difficulty in the transmission of knowledge. Sixty one plant species belonging to 43 plant families were cited in the treatment of diseases related to the female genitalia with a score of 194 citations. Nine families are the most represented including Fabaceae (07 species) Anacardiaceae, Asteraceae, Euphorbiaceae, Malvaceae (03 species each), Annonaceae, Rutaceae, Solanaceae and Zingiberaceae (02 species each). In Burundi, Asteraceae and Fabaceae are also the most represented families in an ethnobotanical study on infectious diseases. These families are also the most represented in the treatment of helminthiases in Gabon by Bajin Ba Ndob and collaborators; they represent the most important and well-controlled African populations in the treatment of these infections that are then endemic to developing countries[14,15]. Hence, these populations found themselves exploiting the multitude of plants that surrounded them to find solutions to these recurring health problems, as is the case for the use of Asteraceae against diabetes in Morocco[16].

With regards to the contribution of the recipes and the value of the therapeutic use of the different plant species mentioned, these two results depend closely on the frequency of quotation. Indeed, the more a plant is mentioned, the more it contributes to the composition of the recipes and the higher its value of therapeutic use is high. This is the case of *Cylicodiscus gabunensis*, the most quoted plant (21 citations) whose contribution for recipes is 28.76 and its therapeutic use-value for vaginal affections is the highest 0.288. It is followed closely by *Aloe vera* and *Mammea africana*. The latter is also known for its use in ethnobotany in the treatment of sexually transmitted diseases[17].

The performance index whose role is to guide the investigators in the choice of plants to be studied for a specific pathology among all the listed diseases reveals that only the plants mentioned once have very good performance compared to those whose uses are multiple who get average performance. The calculation of the performance index is therefore limited and should apply only to plants that have been mentioned several times and whose medicinal uses are varied[13]. Of the 28 types of a phytogeographic distribution represented, the Guineo-Congolese type (14 citations) is the majority, followed closely by the Pantropical (09) and Afrotropical (07) types. This result is the same as that of plants with essential oils, alkaloids, flavonoids and also that of the ethnobotanical study of anti-hemorrhoidal plants of the peoples of southern Cameroon[2,4]. The majority of these types would be due to the geographical location of the study area. The populations would best control the plants whose natural environment is the one in which they live. This could be

justified by an abundance of these species for centuries and a familiarization of the populations which rub them[18]. Crops (19 citations), secondary forests (14) and primary forests (13) are the most represented biotopes. Since the study area is mainly forest and belongs to the Guineo-Congolese forest, of which South Cameroon is one, secondary forests are then the preferred mode of supply of the plants used in the treatment of hemorrhoids in South Cameroon[2]. Populations that solicit plants in their environment (primary and secondary forests) seem to be aware of the danger of extinction on the biodiversity that is the source of so much well-being. These populations would then have begun to cultivate and sustain useful plants as recommended by several authors[4]; which would justify the crops being the most represented biotope. The main species mentioned were *Cylicodiscus gabunensis* Harms (21 citations), *Mammea africana* Sabine (15), *Antrocaryon klaineanum* Pierre (12), all ligneous. These endemic plants are used in the treatment of various diseases and would be overexploited. The ligneous is very exploited in Central Africa for various diseases such as hemorrhoids in Cameroon[2]. The use of forest trees species depends on their geographical area and their importance value explains the vulnerability of these species[18]. *Cylicodiscus gabunensis* is also the most widely used plant in the treatment of helminthiases in Gabon[15], infectious diseases[14] and many others. *Antrokaryon klaineanum* and *Cylicodiscus gabunensis* also return most in an ethnomedical study of plants used to treat diabetes in Cameroon[19]. Given that Central Africa is an endemic zone of infectious diseases on the one hand and that it enjoys a rich but over-exploited plant biodiversity and that the populations living there still depend on almost 70% of plants for their primary health[20] care on the other hand, it would be important to carry out investigations on the therapeutic power of these plants to regulate their exploitation while considering preventive measures against the loss of this plant biodiversity.

One of the major challenges is how to ensure the sustainability of vulnerable forest species like those used in the treatment of recurrent diseases. In this study of plants used against vaginal infections, 42 woody species were inventoried and their vulnerability assessed. Among them, 29 were vulnerable, 03 very vulnerable and ten more vulnerable. The use of leaves locally will probably have no impact on its disappearance but for sustainable exploitation and on an industrial scale, it could be threatened with extinction.

Besides, the most cited woody species were also not only the most vulnerable but not the most curative in this study. These species whose barks are harvested during the year for purposes not necessarily useful are then endangered. Besides, traditional medicine uses for bark and root collection add a significant footprint to biodiversity[21]. Several other activities have a greater impact on tree viability including deforestation for firewood and timber[5,6]. To name only the last two that threaten forest ecosystems, traditional healers who exert less pressure on biodiversity should join those who carry out forest activities to collect the bark they will need. Thus, to reduce the impact of the use of plants for health purposes on the one hand and to prevent the disappearance of woody species of great importance, on the other hand, the scientific community and the structures in charge of plant protection should identify the major health problems of rural populations, evaluate the therapeutic potential of the plants requested to identify those that are useful and finally make sensitization of the local populations concerned on the importance of species useful in the treatment of endemic diseases. On the 42 woody species used in the estimation of their vulnerability index, three categories of plants are observed: 14 important plants, 12 moderately important plants and 16 non-important plants. The new calculation of the importance index has led to the following conclusion that: a plant will be considered important when its importance index is greater than or equal to 1. For this, its performance must always be greater than or equal to its vulnerability. It would also be wise to identify areas of abundance that can serve as *in situ* conservation areas for species[22]. The introduction of these species into botanic gardens would also be an asset for their protection[6]. From the literature, a distinction emerges between uses that alter ecosystems, for example by modifying their diversity and those which generate benefits without harming them[23]. For sustainable use, the development of the culture of medicinal plants for the production of phytomedicines could serve as a source of much more foliar organs for vulnerable woody species. The calculation of the importance index may be applicable to the use and conservation of the plant species. The fields of application can be ethnopharmacology, farms gardens, conservation gardens, research in botany and not only. This study only took into account the use relating to ethnopharmacology. It could also apply to plants used for various uses such as food, industry, urbanization and so on. The significance index could be a tool for preserving endangered species.

## CONCLUSION

This study that was carried out identified 61 antivaginitis plants from which the vulnerability and performance indices

were calculated. The assessment of vulnerability and performance is a major asset in the use of plants. These indices made it possible to obtain the importance index. The latter can guide the choice of plants to be used. To deepen this research, it would be important to take into account make the management of inventoried woody medicinal plants and develop the these plants for the production of phytomedicines for their eco-management.

## SIGNIFICANCE STATEMENT

This study discovers the importance index of medicinal plants that can be beneficial for users, traditional healers, researchers and the environment. This study will help the researcher to uncover the critical areas of conservation and plant biodiversity that many researchers were not able to explore. Thus a new theory on ethnopharmacology which is the importance index may be arrived at.

## ACKNOWLEDGMENT

We thank the Ph.D. students of the Laboratory of Biology and Physiology of Plant Organisms of the University of Douala and the traditional healers of the cities visited, whose active participation allowed us to achieve this ethnobotanical study.

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