



## **An Ethnobotanical and Floristical Study of Medicinal Plants Among the Baka Pygmies in the Periphery of the Ipassa- Biosphere Reserve, Gabon**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author JLB designed the study, assisted in data collection, performed the data analysis, wrote the protocol, managed the literature searches and wrote the first draft of the manuscript. Authors ODY, DOM, DMI and AN collected data and seized data in the excel database. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims:** This paper aims to describe the popular use of medicinal plants by the Baka Pygmies settled in the periphery of the Ipassa Reserve, analyses their relative importance and characterizes the medicinal flora.

**Study Design:** Gathering data on the popular use of medicinal plants in a given area.

**Place and Duration of Study:** Data obtained from direct interviews conducted in August 2011 in Mekob, a village settled at 10 km to the Makokou city in the North Gabon.

**Methodology:** The household was considered as the sample unit. For each health

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problem cited, the name of the plants, the plant parts, the modes of preparation, and the modes of administration of recipes were recorded. The plants were identified in the herbarium, Libreville. Plants were characterized by their phytogeographical distribution, their morphological types, their habitats, and their modes of scattering of seeds. The relative importance of the plants was established based on the number of citations "events" occurred in the recipes.

**Results:** Six Baka informants with an average age of 40 years old including three men and three women interviewed. A total of 136 citations composed of 71 plant species recorded in the treatment of 24 ailments. The examination of the curve showing the evolution of the number of plants with that of informants recommends enlarging the sample as to gather the maximum of plants used by the Baka pygmies. The typical Guinean species are most represented in terms of both number of plant species (72%) and citations (61.5%).

**Conclusion:** Some plant species cited at least twice for the same ailment are known in the literature to possess active compounds. Further studies should be undertaken to complete the sample and to investigate the affectivity of other plants that have not yet been studied for their chemical compounds and their pharmacological activity.

*Keywords: Ethnobotanical surveys; medicinal plants; ipassa-makokou biosphere reserve; Baka Pygmies.*

## 1. INTRODUCTION

Today, despite the many advances in modern medicine, there is a marked revival of interest with respect to medicine and traditional pharmacopoeia. Traditional medicinal plants have several advantages; they are affordable, easily accessible [1].

In central Africa, Pygmies are well known in literature as the great healers, who know much about forest products [2,3]. The use of plant medicines plays an important role in daily health care of the Baka pygmies. Local medicines are even preferred to modern medicines. They are of course less expensive, but they are often regarded as being more "effective". As in the case of the Aka pygmies of Congo [3], Baguyeli Pygmies of the south-Cameroon [4] or that of Baka pygmies of the Dja biosphere reserve in the East Cameroon [5], the large majority of medicines used by the Baka Pygmies of the Makokou region are of plant origins.

In the Makokou region, as in Congo-Brazzaville [6] and Cameroon [5], there exist two types of pharmacopoeia: the specialized pharmacopoeia which is practised by traditional healers for difficult problems, and the popular or general pharmacopoeia which is used by everyone and mostly for treating ordinary ailments such as fever, malaria and diarrhoea. Health problems are often self-treated first with the latter pharmacopoeia, called "self-aid" or "auto-medication".

The knowledge of the use of medicinal plants and the procedures applied to their preparation was transmitted from generation to generation, but this knowledge is in danger because transmission between older and younger generation is not always assured. It is essential to document the medicinal component of the flora of any country for conservation and sustainable use. This paper describes the popular use of medicinal plants among the Baka Pygmies settled in the periphery of the Ipassa- Biosphere Reserve, analyses their relative importance and characterizes the medicinal flora.

## 2. MATERIALS AND METHODS

### 2.1. Study Site

The Ipassa Biosphere Reserve is located in North East of Gabon, in the Ogooué Ivingo province, and at 620 km from Libreville and at about 12 km to Makokou city. Makokou itself (Fig. 1) is the regional capital of the Ogooué-Ivindo province, located at 0°34'51" latitude North and 12°50'22" longitude East.



**Fig. 1. location of Makokou city in the North Gabon [7]**

The Ipassa reserve was listed as a Biosphere reserve since 30 June 1983. And since there, it is the unique Biosphere Reserve in Gabon. The Ipassa Biosphere Reserve is composed of three main areas including: a central or core area of 10,000 hectare, a 2 km<sup>2</sup> buffer zone, and a 3.5 km<sup>2</sup> transition area. The average altitude is 520 m; the average temperature is 23.9°C while the annual rainfall varies between 1,600 and 1,800 mm.

Makokou belongs to the Guineo-congolian phytogeographical type [8]. Primary forests contain many plant species of Caesalpiniaceae, Burseraceae, and Euphorbiaceae family groups. Secondary forests contain high light demand plant species such as *Pycnanthus angolensis* and *Scyphocephalum ochococoa*. Species such as *Scorodophleus zenkeri*, *Santiria trimera*, *Coula edulis*, *Anonidium mannii*, *Afrostryax lepidophyllus*, known as non-timber forest products in Gabon [9] were listed among the most abundant tree species in the primary forests of the Ipassa Biosphere Reserve. The reserve hosts a large variety of Wildlife species including 129 mammals and 401 bird's species [10].

The major ethnic groups, the Bantus and the Baka Pygmies live side by side outside the reserve. The Bantus include the Fang, Kwélé, and Kota. Baka Pygmies live mostly scattered

in small settlements, mainly in the forest at some distance from the Bantu villages and roads. Bantus and Baka pygmies undertake many activities such as slash and burn agriculture type, hunting, fishing, gathering in the buffer and transition zones.

## 2.2 Ethnobotanical Survey

The method used in this study which we call the “method for the popular pharmacopoeia”, consists of gathering data on the popular use of medicinal plants in a given area (ex. village). Following this method, the data for this study were obtained from direct interviews with the local people conducted in August 2011 in Mekob, a village settled at 10 km in the north east of the Makokou city, at 0°40'60" latitude North and 12°55'0" longitude East.

A total of six Baka informants (Table 1) with an average age of 40 years old including three men and three women were interviewed in the Mekob village.

**Table 1. list of informants interviewed among the Baka pygmies group with their age and sex. F = female; M = male**

Code_informant	Age	Sex	Village
F1	23	F	Mekob
F2	59	F	Mekob
F3	22	F	Mekob
M1	35	M	Mekob
M2	60	M	Mekob
M3	42	M	Mekob

The survey aimed at identifying plants used in the popular pharmacopoeia among local people. The household was considered as the sample unit. For each health problem cited, the name of the plants, the plant parts, the modes of preparation (pharmaceutical forms), and the modes of administration of recipes used were carefully recorded. The vernacular names of the plants were recorded as much as possible, and we collected the plants mentioned by the informants. The plants were identified in the herbarium of the Institut de Pharmacopée et Médecine Traditionnelle (IPHAMETRA), in Libreville (Gabon). Voucher herbal specimens are kept in tree samples each at the Herbarium of IPHAMETRA. For each sample, we mentioned the names of the collectors followed by the order number of the list for the collector or the group of collectors. A total number of five persons collected the plant samples including: Afane Martin (Afane), Atouba Nzé (Atou), Betti (Bet), Yao Nicolas (Yao), Mussavou Guy (Mus). The therapeutic statements were made of a specific disease, a symptom or a physiological effect. Information on the diagnosis of ailments was provided through a semi-structured interview of nurses or local health officials.

## 2.3 Characterization of the Flora Used in Traditional Medicine by the Baka Pygmies

Medicinal plants used by the Baka pygmies are characterized in this document by their phytogeographical types, their morphological (or biological) types, their habitat preferences, and their modes of scattering of seeds.

### **2.2.1 Phytogeographical types**

The phytogeographical types of distribution presented here are defined in accordance with the chorological subdivisions agreed for the Central African region [8,11,12,13,14,15), These are:

- Plants largely distributed. They include: pan-tropical species or species found in tropical Africa, America and Asia; paleo-tropical or species found in tropical Africa and Asia and in Madagascar and Australia; Afro-Malagasy species or species which are common to the islands of Madagascar and continental Africa;
- Guinean and soudano-zambesian species (G-SZ) are species which are extended in two closed floristic regions without having any preference to a specific one;
- Guinean species: omni or sub-omni-Guinean-Congolese (GC) are species which are found in all the Guinean region; Centro-Guinean-Congolese (CG) are species for which the distribution map goes from Cameroon to the Democratic Republic of Congo; West Guinean (WG) are species for which the distribution map goes from west Africa to west Cameroon.

### **2.2.2 Morphological type**

The morphological types are defined according to Letouzey [16] and the "PHARMEL" database [17]. They include: trees, small trees, shrubs; annual herbs, perennial herbs; and lianas.

### **2.2.3 Habitat preferences**

Only the most characteristic habitat of each plant species is indicated. The types of habitats retained in this document are therefore: farms or crops which are cultivated species, swamp forests, primary or none disturbed forests, secondary forest, fallow, and village (or "ruderal plants") or plants found in the village.

### **2.2.4 Modes of scattering of seeds**

To group the plants according to their modes (means) of scattering of seeds, we referred to the classification proposed by Dansereau and Lems [18] and Evrard [19]. These are plants for which: seeds are scattered by the wind, seeds are scattered by the plant itself, and seeds are scattered by the man and/or animals.

## **2.3 Relative Importance of Medicinal Plants**

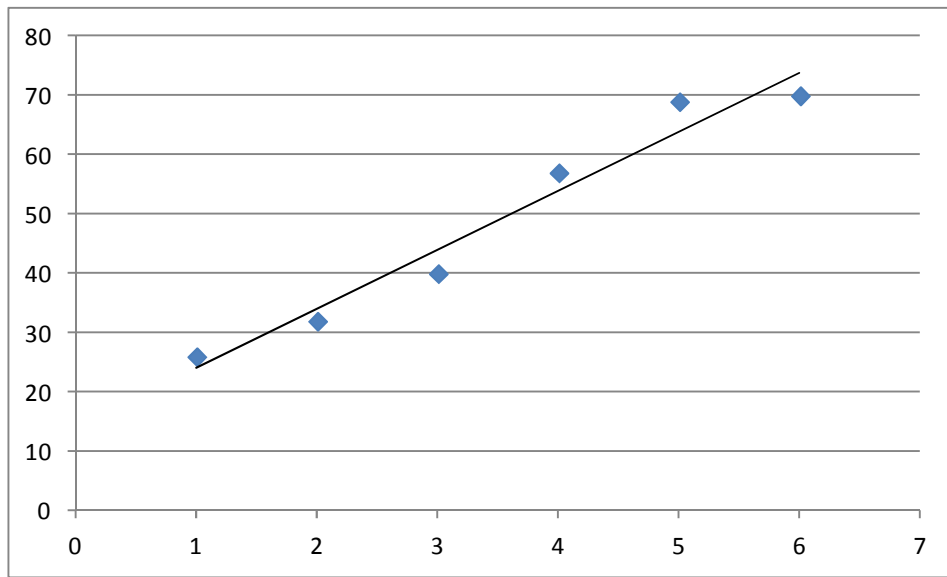
Gathering quantitative ethnobotanical data is a useful tool to identify the most promising pharmacological plants. It has been stated that such semi-quantitative information increases the likelihood of finding promising ethnopharmacological leads [20]. The relative importance of the plants cited by the Baka pygmies is established here based on the number of citations "events" occurred in the recipes. A given plant species will be considered as important when it is cited at least twice for treating the same ailment. The more the number of citation of a plant is high for a given ailment, the more the plant is confirmed for its use in traditional medicine of the Baka pygmies for treating that ailment. The number of citations for each recorded plant species used for a specific ailment is shown in Appendix 2.

### 3. RESULTS

#### 3.1 List of Medicinal Plants

A total of 136 citations composed of 71 plant species were recorded in the treatment of 24 ailments. Appendix 1 presents details for each citation (one line or one registration) including the code of informant, the ailment cited, the plant species indicated, and the characteristics of recipes.

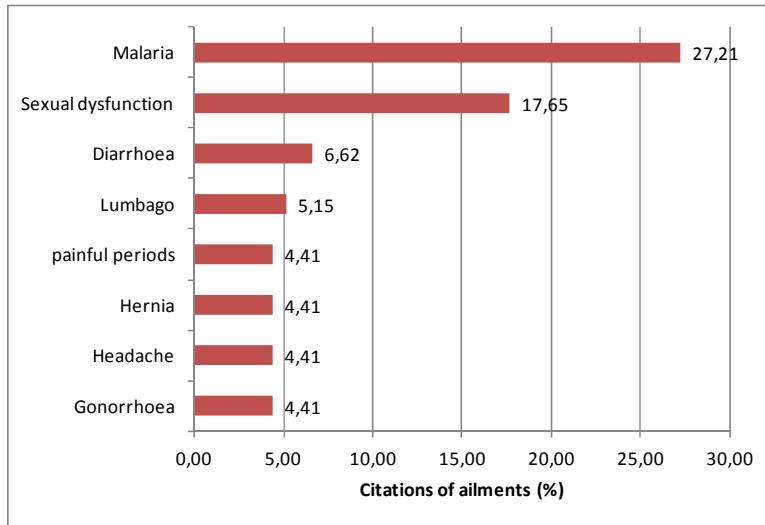
To investigate if the collected plants were representative of the plants used in the general pharmacopoeia of the Baka pygmies living in the periphery of the Ipassa Biosphere Reserve, we counted the cumulative number of plants cited by additional number of informants. The informants were chosen randomly without replacement, one after one. The change in the number of plant species to that of informants is illustrated in Fig. 2. The curve can best be approximated equation:  $Y = 9.9429X + 14.2$ ; Y is the number of plant species; X is the number of informants. The examination of the figure shows that an increasing number of informants contribute to increasing the number of medicinal plants used by the Baka pygmies.



**Fig. 2. Cumulative number of medicinal plants to the number of informants interviewed**

#### 3.2 Relative Importance of Ailments Cited

Fig. 3 illustrates the relative importance of ailments cited based on their number or percentage of citations recorded. Only the most cited ailments are represented. Malaria (27.21% of citations), sexual dysfunction (17.65%) and diarrhoea (6.62%) appear in this order as the most cited ailments by the Baka pygmies.

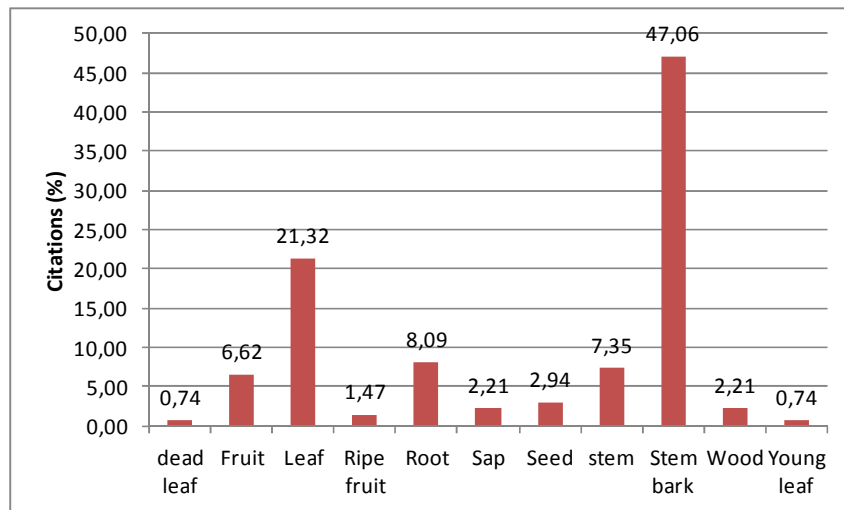


**Fig. 3. Relative importance of ailments treated with medicinal plants among the Baka pygmies in the Makokou region, Gabon**

### 3.3 Characteristics of Recipes of Medicinal Plants

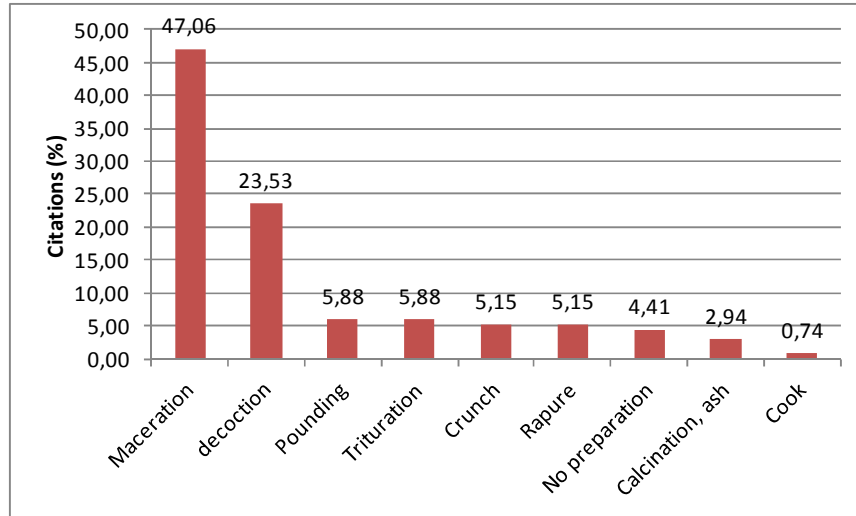
Recipes used by the Baka pygmies are characterized in this paper by the relative importance of plant parts, modes of preparation and voices of administration used.

A total of eight plant parts were cited in the pharmacopoeia used by the Baka pygmies in the Makokou region including: leaves, fruits, roots, sap, seeds, stems, stem barks and wood. Stem barks (47.06% of citations) and leaves (22.8%) are the plant parts that were mostly cited (Fig. 4).



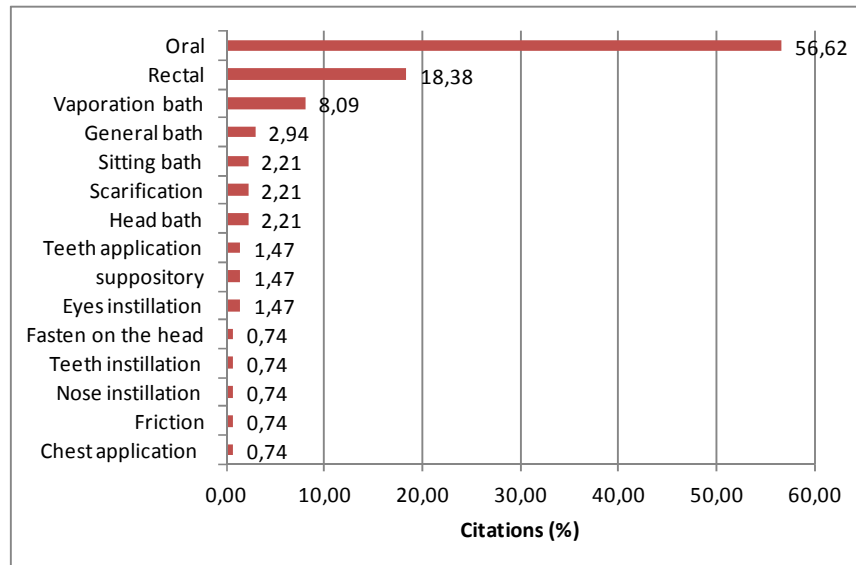
**Fig. 4. Plant parts cited in the general pharmacopoeia of the Baka Pygmies in the Makokou region**

Baka pygmies cited a total of nine modes of preparations of recipes. Fig. 5 illustrates their relative importance. Maceration (47.06%) and decoction (23.53%) are the two most important modes of preparation of recipes among the Baka pygmies.



**Fig. 5. Mode of preparation of recipes cited in the general pharmacopoeia of the Baka Pygmies in the Makokou region**

A total of fifteen different ways of administration of recipes were cited by the Baka pygmies (Fig. 6). The recipes are mostly administered through oral voice (56.62%), followed by the rectal voice (18.38%) and the vaporation bath (8.09%).



**Fig. 6. Relative importance of voices of administration of recipes cited in the general pharmacopoeia of the Baka Pygmies in the Makokou region**



### 3.4 Relative Importance of Medicinal Plants Cited in the General Pharmacopoeia of the Baka Pygmies

Appendix 2 shows all the plants collected with their number of citations for specific ailment. We can see for example, *Alchornea floribunda*, *Alstonia boonei*, *Capsicum frutescens*, *Carica papaya*, *Ceiba pentandra*, *Gambeya lacourtiana*, *Ipomoea involucreta*, and *Picralima nitida* are cited at least twice for treating malaria. Same observation can be made for *Carpolobia alba*, *Annickia chlorantha*, *Garcinia punctata*, *Megaphrynium gabonense*, *Nauclea diderrichii*, *Saccharum officinarum*, *Schumaniophyton magnificum*, *Tetrapleura tetraptera*, in treatment of the male sexual dysfunction.

### 3.5 Characteristics of the Medicinal Flora Used by the Baka Pygmies

Appendix 3 presents for each plant species cited by the Baka pygmies interviewed, its family, its vernacular or Baka name, its Voucher sample number as mentioned in the Herbarium of IPHAMETRA at Libreville (Gabon), its phytogeographical distribution, its morphological/biological type, its habitat preference, its mode or mean of scattering of seeds, and its number of citations.

The 71 plant species cited are distributed in 69 genera and 38 families. The most represented families are Annonaceae and Apocynaceae (5 plant species each), Euphorbiaceae, Sapotaceae and Zingiberaceae [4], Anacardiaceae, Caesalpiniaceae, Fabaceae, Maranthaceae, Mimosaceae, and Rubiaceae [3].

The relative importance of the phytogeographical distribution of plants cited is illustrated in Fig. 7. The typical Guinean species composed of Guinean-congolese and central African species are most represented in terms of both number of plant species (72%) and citations (61.5%). This group is followed by the large distribution species, composed mainly of pantropical species (18.75 % of species and 26.23% of citations).

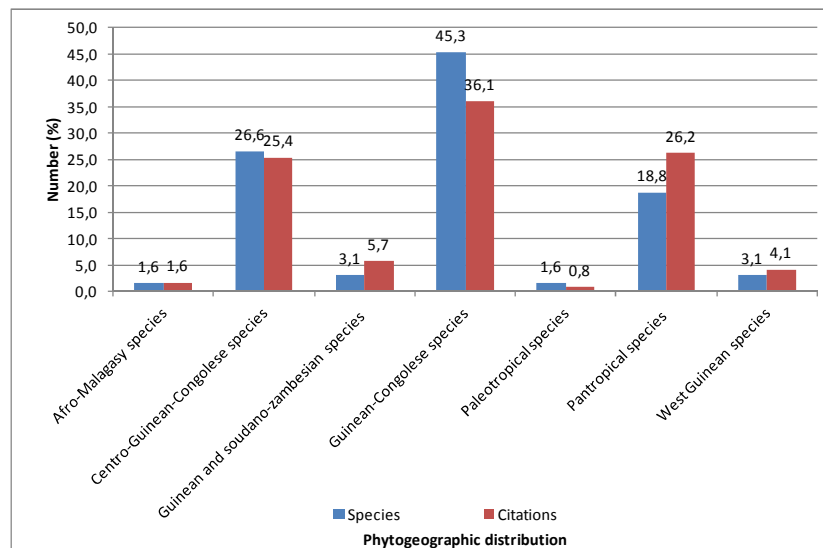
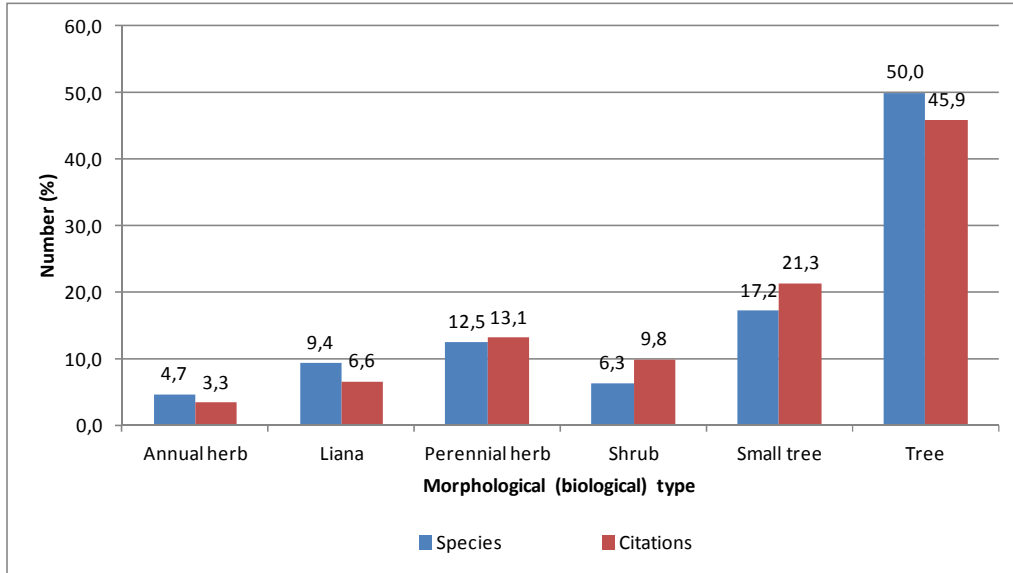


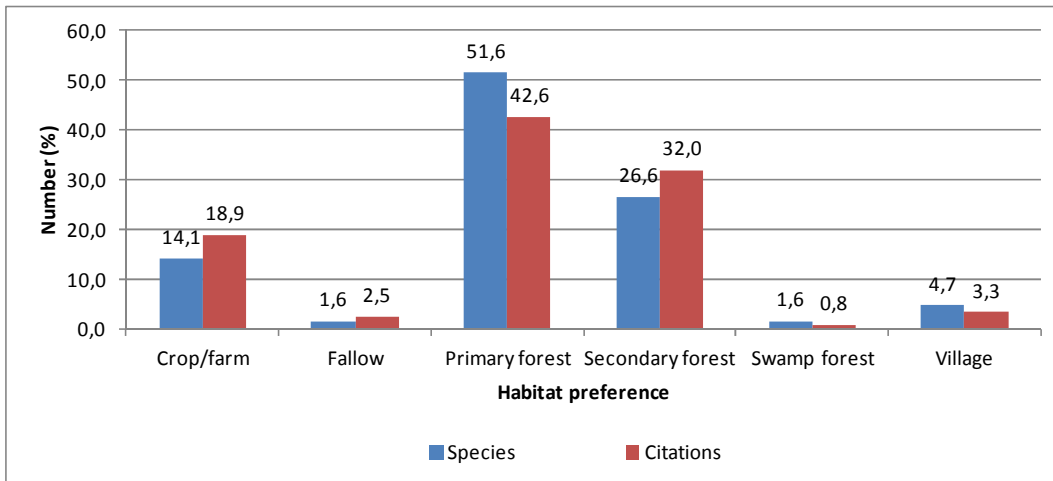
Fig. 7. Relative importance of phytogeographical distributions of medicinal plants cited by the Baka Pygmies in the Makokou region

Fig. 8 shows the relative importance of morphological or biological types of medicinal plants cited by the Baka pygmies. Trees including high and small individuals are the most cited, representing 67.2% of all plant species and citations.



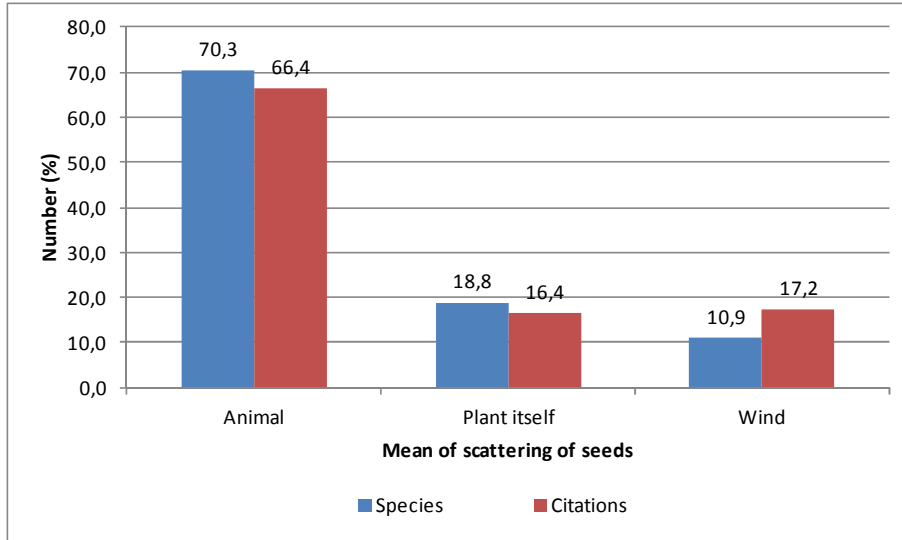
**Fig. 8. Relative importance of morphological types of medicinal plants used by the Baka pygmies, in the Makokou region**

The relative importance of habitat preferences of medicinal plants cited by the Baka pygmies is illustrated in Fig. 9. Forest plants including primary and secondary forests abound both in terms of number of species (78.2%) and citations (74.6%).



**Fig. 9. Relative importance of habitat preferences of medicinal plants used by the Baka pygmies in Makokou, Gabon**

Fig. 10 illustrates the relative importance of modes of scattering of seeds of medicinal plants cited by the Baka pygmies. We can see, the high important role of animals who scatter 70.3% of medicinal plants cited.



**Fig. 10. Relative importance of modes or means of scattering of seeds of medicinal plants used by the Baka pygmies in the Makokou region, Gabon**

#### 4. DISCUSSION AND CONCLUSIONS

To examine the validity of the study, we examined the representativeness of the samples through a regression curve of the number of plant species by number of informants. Fig. 2 shows that the plants samples recorded in this study are not representative of all that are used by the Baka pygmies living in the periphery of the Ipassa- Biosphere Reserve as medicinal plants. Further investigations are needed to complete the list of medicinal plants used by the Baka people of the Makokou region. This result is explained by the low number of informants interviewed, only six.

A total of 24 ailments were cited in the traditional medicine of the Baka pygmies, from which malaria, sexual dysfunction, and diarrhoea are the most cited. In the Dja biosphere reserve in the East Cameroon, 37 Baka pygmies cited a total of 102 plant species in the treatment of 22 ailments from which cough, lactation failure, malaria and wounds were listed as the most important based on their number of citations [5]. The high number of citation of the sexual dysfunction (17.65%) characterizes the pharmacopoeia of the Baka pygmies of the Makokou region, compared to that of Baka pygmies living in the periphery of the Dja reserve (0.8%). Whatever be the country, malaria appears as one of the most important ailments treated in the general pharmacopoeia. This may be due to the fact that, Gabon as far as Cameroon are both located in the high risk zone of malaria, zone C [21].

Several methods have been used by different authors to select the most important plants used in traditional medicine including the factor of informant consensus, the fidelity level, Use-Values, disease-consensus index, simple percentage, relative Importance Index,.... [20]. But whatever be the approach used, the most important and first step to follow is to

make sure that plants cited by informants are really those that they use in their daily pharmacopoeia. In the Dja biosphere reserve in Cameroon, it has been shown that, plants cited at least twice (with at least two citations or by at least two different informants) against the same ailment (spatial common usage), or those cited by the same informant in two different dates (interval of five years = temporal common usage) were often recognized in the literature to possess effective chemical compounds for the ailments indicated [22,23,24]. In this paper, we follow this scheme, but for the beginning, we base the selection of plants on their spatial common usage (at least two citations).

There are some similarities in the use of medicinal plants by the Baka pygmies of the Makokou and those settled in the periphery of the Dja biosphere reserve in Cameroon (5). Hence, both groups use largely (with at least two citations) *Alstonia boonei* and *Picralima nitida* in the treatment of malaria. The two groups also use *Carpolobia alba* as aphrodisiac or against male sexual dysfunction. There are also much dissimilarity in the use of medicinal plants between the Baka pygmies of the Makokou and those of the Dja reserve. For example, *Vernonia amygdalina* which is largely used for treating malaria in the Dja biosphere reserve is not cited for the same ailment by the Baka pygmies of the Ipassa Makokou biosphere reserve. In the other hand, *Gambeya lacourtiana* or *Ceiba pentandra* which are more frequently used by the Baka pygmies of the Ipassa makokou biosphere reserve against malaria are not cited by pygmies living in the periphery of the Dja biosphere reserve in Cameroon. Some plant species frequently used for a specific ailment (cited at least twice) by the Baka pygmies of Makokou region are known in the literature to possess active compounds. The following are four of such plants in the treatment of malaria: *Alstonia boonei* [25,26], *Carica papaya* [27], *Citrus limon* [28], and *Picralima nitida* [29,30,31]. These examples show that the plants cited by many persons may have effective chemical substances. Selection of those plants can be a good step in the way of discovering new drugs from medicinal plants, which illustrates the importance of conducting ethnobotanical surveys.

As mentioned above, the medicinal flora of the Baka pygmies living in the periphery of the Ipassa-Makokou biosphere Reserve is characterized in this document through its phytogeographical distribution, morphological or biological type, habitat preferences, and modes of scattering of seeds. Guinean species composed mostly of Guinean-congolese and central African species are most represented (72% of species). in the Congo Brazzaville's medicinal flora, the Guinean species represent 43.1-54.8% and in the Democratic republic of Congo (DRC), they represent between 28.3 and 40.3% of species. The importance of guinean species confirms the position of the Ipassa – Makokou biosphere Reserve in the Guinean phytogeographical area. The importance of pantropical species (18.7%) is due to the presence of banal plants including ruderal and cultivated species in the medicinal flora. Forest plants species abound (78.2%) in the medicinal flora of the Baka pygmies of makokou region. This finding meets the tendency observed in many areas in the Congo basin, where cultivated plants are less represented in the recipes. The proportion of forest plants ranges from 52.6% in the Dja biosphere reserve in Cameroon [22] to 87.7% in the Odzala national park in the north Congo [6]. It is stated that traditional healers including Baka pygmies, prefer using wild plant species, since they are viewed as more effective than cultivated plants [22]. About 70.3% of the plants cited in recipes are scattered by animal (or man). This finding is closed to that observed in the Dja biosphere reserve in Cameroon, where 71.23% of medicinal plants cited were scattered by animals or men [22].

## CONSENT

Not applicable.

## ETHICAL APPROVAL

Not applicable.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Al-Adhroey AH, Nor ZM, Al-Mekhlafi HM, Mahmud R. Ethnobotanical study on some Malaysian anti-malarial plants: A community based survey. *J. Ethnopharmacol.* 2010;132:362-364.
2. Bouquet A. Féticheurs et médecines traditionnelles du Congo-Brazzaville. Mémoire ORSTOM, Paris; 1969. French.
3. Motte F. Les plantes chez les pygmées Aka et les Mozombo de la Lobaye (Centrafrique). *Soc. Et. Ling. et Anthropol. de France, Etudes pygmées V*; 1980. French.
4. Dijk JFW. Non-timber forest products in the Bipindi-Akom II region, Cameroon. A socio-economic and ecological assessment. The Tropenbos-Cameroon programme; 1999.
5. Betti JL. An ethnobotanical study of medicinal plants among the Baka Pygmies in the Dja Biosphere Reserve, Cameroon. *African Study Monographs.* 2004;25(1):1-27.
6. Diafouka A. Analyse des usages des plantes médicinales dans quatre régions du Congo – Brazzaville. Thèse de Doctorat Université Libre de Bruxelles; 1997. French.
7. Available:<http://fr.getamap.net/cartes/gabon/ogoooue-ivindo>.
8. White F. The vegetation of Africa. A descriptive memoir to accompany the UNESCO/AETFAT/UNSO/Vegetation map of Africa. UNESCO, Paris 1; 1983.
9. Raponda-Walker RA, Sillans S. Les plantes utiles du Gabon. IRA, Paris;1961. French.
10. Dupuy E. Etude floristique et structurale des forêts de la réserve de biosphère d'Ipassa-Makokou (Gabon). Rapport de stage long à l'étranger. ENGREF, Herbarium National du Gabon, IRET; 2008. French.
11. Mullenders W. La végétation de Kaniama (entre Lubish et Lubilash, Congo belge). *Publ. INEAC, Sér. Scient.* 61; 1954. French.
12. Aubréville A. Position chorologique du Gabon. *Flore du Gabon* 3 : 3-11. *Museum Hist. Nat., Paris*; 1962. French.
13. Denys E. A tentative phytogeographical division of tropical Africa based on mathematical analysis of distribution maps. *Bull. Jard. Bot. Nat. Bel.* 1980;50:465-504.

14. Lejoly J, Mandango A. L'association arbustive ripicole à *Alchornea cordifolia* dans le Haut-Zaïre. Royal Botanical Society of Belgium Brussels. 1982;257-265. French.
15. White F. The Guineo-Congolian region and its relationships to the other phytochoria. Bull. Jard. Bot. Nat. Belg. 1979;49:11-55.
16. Letouzey R. Etude phytogéographique du Cameroun : 511 p. Paris, Editions P. Lechevalier; 1968. French.
17. Adjanohoun E, Cusset G, Issa Lo, Keita A, Lebras M, Lejoly J. Banque de données de médecine traditionnelle et de pharmacopée (Pharmel). Notice pour la collecte et l'entrée des données, seconde édition. A.C.C.T., Paris; 1994. French.
18. Danserau P, Lems K The grading of dispersal types in communities and their significance. Montréal, Contr. Inst. Bot. 1957;71.
19. Evrard C. Recherches écologiques sur le peuplement forestier des sols hydromorphes de la cuvette congolaise. Publ. I.N.E.A.C., sér. scient. 1968;110. French.
20. Andrade-Cetto A, Heinrich M. From the field into the lab: useful approaches to selecting species based on local knowledge. Front. Pharmacol. 2011;2:20.
21. Betti JL. Medicinal plants sold in Yaoundé markets, Cameroon. African Study Monographs. 2002;23(2):47-64.
22. Betti JL. Usages traditionnels et vulnérabilité des plantes médicinales dans la réserve du Dja et dans les marchés de Yaoundé, Cameroun. Thèse de Doctorat, Université Libre de Bruxelles; 2001. French.
23. Betti JL. Plants used for treating malaria in the Dja Reserve, Cameroon. Revue de Médecines et Pharmacopées Africaines. 2003;17:121-130.
24. Betti JL, Lejoly J. Contribution to the knowledge of medicinal plants in the Dja Biosphere Reserve, Cameroon: plants used for treating jaundice. Journal of Medicinal Plants Research. 2009;3(12):1056-1065.
25. Zihiri Guede, N. Recensement des plantes médicinales antipaludiques du Département d'Issia (Côte d'Ivoire) et étude descriptive de celles ayant une très bonne activité antiplasmodiale. Revue de Médecines et Pharmacopées Africaines. 2004;18:99-103. French.
26. Olajide OA, Awe SO, Makinde JM, Ekhelar AI, Olusola A, Morebise O, et al. Studies on the anti-inflammatory, antipyretic and analgesic properties of *Alstonia boonei* stem bark. Journal of Ethnopharmacology. 2000;71(1-2):179-186.
27. Idowu OA, Soniran OT, Ajana O, Aworinde DO. Ethnobotanical survey of antimalarial plants used in Ogun State, Southwest Nigeria. African Journal of Pharmacy and Pharmacology. 2010;4(2):055-060.
28. Titanji VPK, Zofou D, Ngemeneya MN. The Antimalarial potential of medicinal plants used for the treatment of malaria in Cameroonian Folk Medicine. Afr. J. Trad. CAM. 2008;5(3):302-321.
29. Iwu MM. African medicinal plant in the search for new drugs based on ethnobotanical leads. In: Chadwick DJ & Marsh J (eds) Ethnobotany and the Search for New Drugs (Ciba Foundation Symposium No. 185). Wiley, Chichester; 1994.
30. Iwu MM, Klayman DL. Evaluation of the in vitro antimalarial activity of *Picralima* extracts. Journal of Ethnopharmacology. 1992;36(2):133-135.
31. Ezeamuzie IC, Ojinnaka MC, Uzogara EO, Oji SE. Anti-inflammatory, antipyretic and anti-malarial activities of a West African medicinal plant—*Picralima nitida*. Afr. J. Med. Med. Sci., 1994;23(1):85-90.

## APPENDIX 1

## Citations of medicinal plants among the Baka pygmies, in the Makokou region, Gabon

Code of informant: F = female; M = male

One citation = One line = one registration in this table

Code_informant	Ailment	Latin name	Associated plant	Plant part	Mode of preparation	Mode of administration
F1	Abdominal pain	<i>Gouania longipetala</i>		Leaf	Maceration	Oral
F1	Abdominal pain	<i>Schumanniohyton magnificum</i>		Stem bark	Maceration	Oral
F1	Aneamia	<i>Gilletiodendron pierreanum</i>		Stem bark	Maceration	Oral
F1	Aneamia	<i>Lophira alata</i>		Sap	Maceration	General bath
F1	Flu	<i>Capsicum frutescens</i>	Associated with Piptadeniastrum africanum	Fruit	decoction	Oral
F1	Flu	<i>Piptadeniastrum africanum</i>	Capsicum frutescens	Stem bark	decoction	Oral
F1	Flu	<i>Polyalthia suaveolens</i>		Leaf	Trituration	Nose instillation
F1	Gonorrhoea	<i>Annonidium mannii</i>	Associated with Carica papaya	Stem bark	decoction	Oral
F1	Gonorrhoea	<i>Ataenidia conferta</i>		Leaf	Maceration	Oral
F1	Gonorrhoea	<i>Carica papaya</i>	Annonidium mannii + Citrus limonosum	Stem bark	decoction	Oral
F1	Gonorrhoea	<i>Ceiba pentandra</i>		Fruit	decoction	Rectal
F1	Gonorrhoea	<i>Citrus limon</i>	Associated with Carica papaya	Fruit	decoction	Oral
F1	Gonorrhoea	<i>Pterocarpus soyauxii</i>		Stem bark	Maceration	Oral
F1	Headache	<i>Cnestis ferruginea</i>	Uapaca paludosa	Leaf	Maceration	Head bath
F1	Headache	<i>Uapaca paludosa</i>	Associated with Manniophyton fulvum	Stem bark	Maceration	Head bath
F1	Malaria/fever	<i>Alchornea florinbunda</i>	Associated with Microdesmis puberula	Leaf	decoction	Vaporation bath

Code_informant	Ailment	Latin name	Associated plant	Plant part	Mode of preparation	Mode of administration
F1	Malaria/fever	<i>Alstonia boonei</i>		Stem bark	Maceration	Rectal
F1	Malaria/fever	<i>Alstonia boonei</i>		Stem bark	Maceration	Oral
F1	Malaria/fever	<i>Baillonella toxisperma</i>	Associated with <i>Harungana madagascariensis</i>	Stem bark	Maceration	Rectal
F1	Malaria/fever	<i>Capsicum frutescens</i>	Associated with <i>Harungana madagascariensis</i>	Fruit	Maceration	Rectal
F1	Malaria/fever	<i>Gambeya lacourtiana</i>	Associated with <i>Harungana madagascariensis</i>	Stem bark	Maceration	Rectal
F1	Malaria/fever	<i>Gambeya lacourtiana</i>		Stem bark	Maceration	Rectal
F1	Malaria/fever	<i>Harungana madagascariensis</i>	<i>Baillonella toxisperma</i> + <i>Gambeya lacourtiana</i> + <i>Capsicum frutescens</i>	Stem bark	Maceration	Rectal
F1	Malaria/fever	<i>Haumania danckelmaniana</i>	Associated with <i>Microdesmis puberula</i>	Leaf	decoction	Vaporation bath
F1	Malaria/fever	<i>Microdesmis puberula</i>	<i>Alchornea floribunda</i> + <i>Haumania danckelmaniana</i>	Leaf	decoction	Vaporation bath
F1	Malaria/fever	<i>Pachypodanthium confine</i>		Stem bark	Rapure	suppository
F1	Stomach pain	<i>Aframomum sulcathum</i>		stem	Maceration	Oral
F1	Tiredness	<i>Gilbertiodendron dewevrei</i>	<i>Microdesmis puberula</i>	Stem bark	Maceration	General bath
F1	Tiredness	<i>Microdesmis puberula</i>	Associated with <i>Gilbertiodendron</i>	Stem bark	Maceration	General bath
F2	Blood pressure	<i>Barteria nigritiana</i>		Stem bark	Rapure	Chest application
F2	Blood pressure	<i>Dialium pachyphyllum</i>		Leaf	Maceration	Oral
F2	Diarrhoea	<i>Pycnobotria nitida</i>		Leaf	Cook	Oral
F2	Diarrhoea	<i>Schumaniophyton magnificum</i>		Stem bark	decoction	Rectal
F2	Diarrhoea	<i>Xylopi hypolampra</i>		Stem bark	Maceration	Oral



Code_informant	Ailment	Latin name	Associated plant	Plant part	Mode of preparation	Mode of administration
F2	Jaundice	<i>Acmella uliginosa</i>		Leaf	Maceration	Oral
F2	Jaundice	<i>Nauclea didderichii</i>		Wood	decoction	Oral
F2	Jaundice	<i>Nauclea didderichii</i>		Wood	decoction	Rectal
F2	Lactation failure	<i>Pycnobotria nitida</i>		Sap		Oral
F2	Pain after delivery	<i>Tabernaemontana crassa</i>		Stem bark	decoction	Oral
F3	Diarrhoea	<i>Aframomum melegueta</i>		Seed	Pounding	suppository
F3	Diarrhoea	<i>Capsicum frutescens</i>	Associated with <i>Occimum gratissimum</i>	Fruit	Maceration	Rectal
F3	Diarrhoea	<i>ocimum gratissimum</i>	<i>Capsicum frutescens</i>	Leaf	Maceration	Rectal
F3	Headache	<i>Ageratum conyzoides</i>		Leaf	Trituration	Eyes instillation
F3	Headache	<i>Ipomoea involucrata</i>		Stem		Fasten on the head
F3	Headache	<i>Sida acuta</i>		Leaf	decoction	Head bath
F3	Malaria/fever	<i>Aframomum melegueta</i>		Seed	Maceration	Rectal
F3	Malaria/fever	<i>Aframomum pruinosum</i>	Associated with <i>Ceiba pentandra</i>	Leaf	decoction	Vaporation bath
F3	Malaria/fever	<i>Ceiba pentandra</i>	<i>Ipomoea involucrata</i>	Stem bark	decoction	Sitting bath
F3	Malaria/fever	<i>Ceiba pentandra</i>		Stem bark	Maceration	Oral
F3	Malaria/fever	<i>Ceiba pentandra</i>		Stem bark	Maceration	Rectal
F3	Malaria/fever	<i>Ceiba pentandra</i>	<i>Aframomum pruinosum</i> + <i>Ipomoea involucrata</i> + <i>Musa paradisiaca</i>	Stem bark	decoction	Vaporation bath
F3	Malaria/fever	<i>Ipomoea involucrata</i>	Associated with <i>Ceiba pentandra</i>	Leaf	decoction	Sitting bath
F3	Malaria/fever	<i>Ipomoea involucrata</i>	Associated with <i>Ceiba pentandra</i>	Stem	decoction	Vaporation bath
F3	Malaria/fever	<i>Musa paradisiacal</i>	Associated with <i>Ceiba pentandra</i>	dead leaf	decoction	Vaporation bath
F3	Toothache	<i>Acmella uliginosa</i>		Leaf	Pounding	Teeth application
F3	Toothache	<i>Capsicum frutescens</i>		Leaf	Trituration	Teeth instillation

Code_ informant	Ailment	Latin name	Associated plant	Plant part	Mode of preparation	Mode of administration
M1	Amoebic dysentery	<i>Gillettiodendron pierreanum</i>		Stem bark	Rapure	Oral
M1	Amoebic dysentery	<i>Pentaclethra macrophylla</i>		Stem bark	Maceration	Oral
M1	Diarrhoea	<i>Gilbertiodendron dewevrei</i>	Associated with <i>Xylopia hypolampra</i>	Stem bark	Maceration	Oral
M1	Diarrhoea	<i>Nauclea didderichii</i>		Stem bark	Maceration	Oral
M1	Diarrhoea	<i>Xylopia hypolampra</i>	<i>Gilbertiodendron dewevei</i>	Stem bark	Maceration	Oral
M1	Hernia	<i>Angylocalyx pynaertii</i>		Stem bark	Maceration	Oral
M1	Hernia	<i>Angylocalyx pynaertii</i>	<i>Massularia acuminata</i>	Stem bark	Maceration	Oral
M1	Hernia	<i>Massularia acuminata</i>		Stem bark	Maceration	Oral
M1	Hernia	<i>Massularia acuminata</i>	Associated with <i>Angilocalyx pynaertii</i>	Stem bark	Maceration	Oral
M1	Hernia	<i>Picalima nitida</i>		Stem bark	Maceration	Oral
M1	Hernia	<i>Picalima nitida</i>		Stem bark	Crunch	Oral
M1	Lumbago	<i>Alchornea florinbunda</i>		Root	Crunch	Oral
M1	Lumbago	<i>Carpolobia alba</i>		Root	Crunch	Oral
M1	Lumbago	<i>Annickia chlorantha</i>		Root	Crunch	Oral
M1	Lumbago	<i>Erythrophleum ivorence</i>		Stem bark	Calcination, ash	Scarification
M1	Lumbago	<i>Mangifera indica</i>		Stem bark	decoction	Sitting bath
M1	Lumbago	<i>Panda oleosa</i>		Stem bark	Calcination, ash	Scarification
M1	Lumbago	<i>Picalima nitida</i>		Stem bark	Maceration	Oral
M1	Malaria/fever	<i>Aframomum sulcathum</i>	Associated with <i>Carica</i>	Leaf	decoction	Vaporation bath

Code_informant	Ailment	Latin name	Associated plant	Plant part	Mode of preparation	Mode of administration
M1	Malaria/fever	<i>Alchornea floribunda</i>	<i>papaya</i> Associated with <i>Carica papaya</i>	Leaf	decoction	Vaporation bath
M1	Malaria/fever	<i>Alstonia boonei</i>		Stem bark	Maceration	Oral
M1	Malaria/fever	<i>Alstonia boonei</i>	<i>Capsicum frutescens</i>	Stem bark	Maceration	Rectal
M1	Malaria/fever	<i>Capsicum frutescens</i>	Associated with <i>Alstonia boonei</i>	Fruit	Maceration	Rectal
M1	Malaria/fever	<i>Carica papaya</i>	<i>Aframomum sulcathum</i> + <i>Alchornea floribunda</i> + <i>Citrus limonosum</i>	Leaf	decoction	Vaporation bath
M1	Malaria/fever	<i>Carica papaya</i>		Young leaf	Maceration	Rectal
M1	Malaria/fever	<i>Citrus limon</i>	Associated with <i>Carica papaya</i>	Fruit	decoction	Vaporation bath
M1	Malaria/fever	<i>Picralima nitida</i>		Stem bark	Maceration	Oral
M1	Malaria/fever	<i>Picralima nitida</i>		Stem bark	Rapure	Oral
M1	Malaria/fever	<i>Strophanthus glauca</i>		Leaf	Maceration	Rectal
M1	painful periods	<i>Antrocaryon klaineanum</i>	Associated with <i>Harungana madagascariensis</i>	Stem bark	Maceration	Rectal
M1	painful periods	<i>Chrytranthus talboti</i>		Leaf	Maceration	Oral
M1	painful periods	<i>Chrytranthus talboti</i>		Leaf	Maceration	Rectal
M1	painful periods	<i>Harungana madagascariensis</i>	<i>Saccharum officinarum</i> + <i>Antrocaryon klaineanum</i>	Stem bark	Maceration	Rectal
M1	painful periods	<i>Saccharum officinarum</i>	Associated with <i>Harungana madagascariensis</i>	Stem	Maceration	Rectal
M1	painful periods	<i>Schumanniophyton magnificum</i>		Stem bark	Maceration	Oral
M1	Sexual dysfunction	<i>Arachis hypogeal</i>		Seed		Oral
M1	Sexual	<i>Carpolobia alba</i>	Associated with <i>Picralima</i>	Root	Maceration	Oral

Code_informant	Ailment	Latin name	Associated plant	Plant part	Mode of preparation	Mode of administration
M1	dysfunction Sexual dysfunction	<i>Coula edulis</i>	<i>nitida</i>	Seed		Oral
M1	dysfunction Sexual dysfunction	<i>Annickia chlorantha</i>	Associated with <i>Picralima nitida</i>	Root	Maceration	Oral
M1	dysfunction Sexual dysfunction	<i>Garcinia punctata</i>		Fruit	Crunch	Oral
M1	dysfunction Sexual dysfunction	<i>Garcinia punctata</i>	Associated with <i>Tetrapleura</i>	Stem bark	Maceration	Rectal
M1	dysfunction Sexual dysfunction	<i>Megaphrynium gabonense</i>	Associated with <i>Saccharum officinarum</i>	Leaf	Pounding	Oral
M1	dysfunction Sexual dysfunction	<i>Megaphrynium gabonense</i>	Associated with <i>Saccharum officinarum</i>	Leaf	Trituration, rub on the sugar canne	Oral
M1	dysfunction Sexual dysfunction	<i>Nauclea didderichii</i>	Associated with <i>Saccharum officinarum</i>	Leaf	Pounding	Oral
M1	dysfunction Sexual dysfunction	<i>Nauclea didderichii</i>	Associated with <i>Saccharum officinarum</i>	Leaf	Trituration, rub on the sugar canne	Oral
M1	dysfunction Sexual dysfunction	<i>Picralima nitida</i>	<i>Enanthia chlorantha</i> + <i>Tetrapleura tetraptera</i> + <i>Carpolobia alba</i>	Stem bark	Maceration	Oral
M1	dysfunction Sexual dysfunction	<i>Saccharum officinarum</i>	<i>Megaphrynium gabonense</i>	Stem	Pounding	Oral
M1	dysfunction Sexual dysfunction	<i>Saccharum officinarum</i>	<i>Megaphrynium gabonense</i>	Stem	Trituration, rub on the sugar canne	Oral
M1	dysfunction Sexual dysfunction	<i>Saccharum officinarum</i>	<i>Nauclea didderichii</i>	Stem	Pounding	Oral
M1	dysfunction Sexual dysfunction	<i>Saccharum officinarum</i>	<i>Nauclea didderichii</i>	Stem	Trituration, rub on the sugar canne	Oral
M1	dysfunction Sexual dysfunction	<i>Scyphocephalum ochocoa</i>		Root	Crunch	Oral
M1	dysfunction Sexual dysfunction	<i>Tetrapleura tetraptera</i>	Associated with <i>Picralima nitida</i>	Root	Maceration	Oral
M1	dysfunction Sexual dysfunction	<i>Tetrapleura tetraptera</i>	<i>Garcinia punctata</i>	Stem bark	Maceration	Rectal

Code_ informant	Ailment	Latin name	Associated plant	Plant part	Mode of preparation	Mode of administration
M2	Aneamia	<i>Croton oligandrum</i>		Stem bark	decoction	Oral
M2	Aneamia	<i>Pterocarpus soyauxii</i>		Wood	decoction	Oral
M2	Aneamia	<i>Pycnanthus angolensis</i>		Stem bark	decoction	Oral
M2	Cough	<i>Garcinia punctata</i>		Stem bark		Oral
M2	Cough	<i>Petersianthus macrocarpus</i>		Stem bark	Maceration	Oral
M2	Cough	<i>Tetracera alnifolia</i>		Sap		Oral
M2	Headache	<i>Maesopsis eminii</i>		Root	Rapure	Eyes instillation
M2	Intestinal helminthiasis	<i>Beilschmiedia fulva</i>		Stem bark	Maceration	Oral
M2	Malaria/fever	<i>Alstonia boonei</i>		Stem bark	Maceration	Oral
M2	Malaria/fever	<i>Alstonia boonei</i>		Stem bark	Maceration	Rectal
M2	Scabies	<i>Baillonella toxisperma</i>		Stem bark	Trituration	Friction
M2	Sexual dysfunction	<i>Carpolobia alba</i>		Stem bark	Pounding	Oral
M2	Sexual dysfunction	<i>Annickia chlorantha</i>	<i>Schumanniphyton magnificum</i>	Root	decoction	Oral
M2	Sexual dysfunction	<i>Milicia excelsa</i>		Stem bark	Pounding	Oral
M2	Sexual dysfunction	<i>Omphalocarpum elatum</i>		Fruit	decoction	Rectal
M2	Sexual dysfunction	<i>Schumanniphyton magnificum</i>		Root	Maceration	Oral
M2	Sexual dysfunction	<i>Schumanniphyton magnificum</i>	Associated with <i>Enanthia chlorantha</i>	Root	decoction	Oral
M2	Snake bite	<i>Diospyros hoyleana</i>		Leaf	Crunch	Oral
M2	Throat infection	<i>Capsicum frutescens</i>	associated with <i>Manniophytum fulvum</i>	Ripe fruit	Calcination, ash	Oral

Code_ informant	Ailment	Latin name	Associated plant	Plant part	Mode of preparation	Mode of administration
M2	Throat infection	<i>Capsicum frutescens</i>	Associated with <i>Costus lucanusianus</i>	Ripe fruit	Maceration	Oral
M2	Throat infection	<i>Costus lucanusianus</i>	<i>Capsicum frutescens</i>	Stem	Maceration	Oral
M2	Throat infection	<i>Manniophyton fulvum</i>	<i>Capsicum frutescens</i>	Stem	Calcination, ash	Oral
M2	Toothache	<i>Zanthoxylum heitzii</i>		Stem bark	Rapure	Teeth application
M3	Malaria/fever	<i>Ataenidia conferta</i>		Leaf	Maceration	Oral
M3	Intestinal helminthiasis	<i>Beilschmiedia fulva</i>		Stem bark	Maceration	Oral
M3	Malaria/fever	<i>Petersianthus macrocarpus</i>		Stem bark	Maceration	Oral
M3	Malaria/fever	<i>Tricoscypha acuminata</i>		Stem bark	Rapure	Scarification

**APPENDIX 2**

**Number of citations of medicinal plants used by the Baka pygmies in each ailment in the periphery of the Ipassa Biosphere Reserve, Gabon**

	Abdominal pain	Amoebic dysenthery	Aneamia	Blood pressure	Cough	Diarrhoea	Flu	Gonorrhoea	Headache	Hernia	Intestinal helminthiasis	Jaundice	Lactation failure	Lumbago	Malaria	Pain after delivery	painful periods	Scabies	Sexual dysfunction	Snake bite	Stomach pain	Throat infection	Tiredness	Toothache	Total	
<i>Acmella uliginosa</i>												1												1	2	
<i>Aframomum melegueta</i>						1									1											2
<i>Aframomum pruinosum</i>															1											1
<i>Aframomum sulcathum</i>															1						1					2
<i>Ageratum conyzoides</i>									1																	1
<i>Alchornea floribunda</i>														1	2											3
<i>Alstonia boonei</i>															6											6
<i>Angylocalyx pynaertii</i>										2																2
<i>Annonidium mannii</i>								1																		1
<i>Antrocaryon klaineanum</i>																	1									1
<i>Arachis hypogeal</i>																			1							1
<i>Ataenidia conferta</i>								1							1											2
<i>Baillonella toxisperma</i>															1			1								2
<i>Barteria nigritiana</i>				1																						1
<i>Beilschmeidia sp</i>											2															2

	Abdominal pain	Amoebic dysenthery	Aneamia	Blood pressure	Cough	Diarrhoea	Flu	Gonorrhoea	Headache	Hernia	Intestinal helminthiasis	Jaundice	Lactation failure	Lumbago	Malaria	Pain after delivery	painful periods	Scabies	Sexual dysfunction	Snake bite	Stomach pain	Throat infection	Tiredness	Toothache	Total
<i>Capsicum frutescens</i>						1	1								2							2		1	7
<i>Carica papaya</i>								1							2										3
<i>Carpolobia alba</i>														1					2						3
<i>Ceiba pentandra</i>								1							4										5
<i>Chrysanthus talboti</i>																	2								2
<i>Citrus limon</i>								1							1										2
<i>Cnestis ferruginea</i>									1																1
<i>Costus lucanusianus</i>																						1			1
<i>Coula edulis</i>																			1						1
<i>Croton oligandrum</i>			1																						1
<i>Dialium pachyphyllum</i>				1																					1
<i>Diospyros hoyleana</i>																				1					1
<i>Annickia chlorantha</i>														1					2						3
<i>Erythrophleum ivorence</i>														1											1
<i>Gambeya lacourtiana</i>															2										2
<i>Garcinia punctata</i>					1														2						3
<i>Gilbertiodendron dewevrei</i>						1																	1		2
<i>Gilletiodendron pierreanum</i>		1	1																						2
<i>Gouania longipetala</i>	1																								1
<i>Harungana madagascariensis</i>															1		1								2



	Abdominal pain	Amoebic dysenthery	Aneamia	Blood pressure	Cough	Diarrhoea	Flu	Gonorrhoea	Headache	Hernia	Intestinal helminthiasis	Jaundice	Lactation failure	Lumbago	Malaria	Pain after delivery	painful periods	Scabies	Sexual dysfunction	Snake bite	Stomach pain	Throat infection	Tiredness	Toothache	Total	
<i>Haumania dancklemaniana</i>															1										1	
<i>Ipomoea involucrata</i>									1						2											3
<i>Leptonichra echinocarpa</i>															1											1
<i>Lophira alata</i>			1																							1
<i>Maesopsis eminii</i>									1																	1
<i>Mangifera indica</i>														1												1
<i>Manniophyton fulvum</i>																						1				1
<i>Massularia acuminata</i>										2																2
<i>Megaphrynium gabonense</i>																			2							2
<i>Microdesmis puberula</i>															1								1			2
<i>Milicia excelsa</i>																			1							1
<i>Musa paradisiaca</i>															1											1
<i>Nauclea didderichii</i>																			2							2
<i>Nauclea didderichii</i>						1						2														3
<i>ocimum gratissimum</i>						1																				1
<i>Omphalocarpum elatum</i>																			1							1
<i>Pachypodanthium confine</i>															1											1
<i>Panda oleosa</i>														1												1
<i>Pentaclethra macrophylla</i>		1																								1
<i>Petersianthus macrocarpus</i>					1										1											2

	Abdominal pain	Amoebic dysentery	Anemia	Blood pressure	Cough	Diarrhoea	Flu	Gonorrhoea	Headache	Hernia	Intestinal helminthiasis	Jaundice	Lactation failure	Lumbago	Malaria	Pain after delivery	painful periods	Scabies	Sexual dysfunction	Snake bite	Stomach pain	Throat infection	Tiredness	Toothache	Total	
<i>Picralima nitida</i>										2				1	2				1						6	
<i>Piptadeniastrum africanum</i>							1																		1	
<i>Polyalthia suaveolens</i>							1																		1	
<i>Pterocarpus soyauxii</i>			1					1																	2	
<i>Pycnanthus angolensis</i>			1																						1	
<i>Pycnobotria nitida</i>						1							1												2	
<i>Saccharum officinarum</i>																	1		4						5	
<i>Schumanniohyton magnificum</i>	1					1											1		2						5	
<i>Scyphocephalum ochocoa</i>																			1						1	
<i>Sida acuta</i>									1																1	
<i>Strophanthus glauca</i>															1										1	
<i>Tabernaemontana crassa</i>																1									1	
<i>Tetracera alnifolia</i>					1																				1	
<i>Tetrapleura tetraptera</i>																			2						2	
<i>Tricoscypha acuminata</i>															1										1	
<i>Uapaca paludosa</i>									1																1	
<i>Xylopi hypolampra</i>						2																			2	
<i>Zanthoxylum heitzii</i>																								1	1	
<b>Total</b>	2	2	5	2	3	9	3	6	6	6	2	3	1	7	37	1	6	1	24	1	1	1	4	2	3	136

## APPENDIX 3

## Floristical characteristics of medicinal plants used by the Baka pygmies in the Makokou region, Gabon

**Voucher sample number:** for each sample, we mentioned the names of the collectors followed by the order number of the list for the collector or the group of collectors: Afane Martin (Afane), Atouba Nzé (Atou), Betti (Bet), Yao Nicolas (Yao), Mussavou Guy (Mus).

Latin name	Family	Vernacular (Baka) name	Voucher sample number in the Herbarium of IPHAMETRA, Libreville, Gabon	Phytogeographic distribution	Morphological (biological) type	Habitat preferences	Mean of scattering	Number of citations
<i>Acmella uliginosa</i> (Sw.) Cass	Asteraceae	Ndonsi	Yao 60; 65	Pantropical species	Annual herb	Village	Wind	2
<i>Aframomum melegueta</i> K. Schum.	Zingiberaceae	Ndong	Yao 15; 54	Guinean-Congolese species	Perennial herb	Crop	Animal	2
<i>Aframomum pruinatum</i> Gagnep.	Zingiberaceae	Etsia	Bet_Yao 11	Guinean-Congolese species	Perennial herb	Primary forest	Animal	1
<i>Aframomum sulcatum</i> (Oliv. & Hanb. ex Bak.) K. Schum.	Zingiberaceae	Ndiyi	Yao 19	Guinean-Congolese species	Perennial herb	Primary forest	Animal	2
<i>Ageratum conyzoides</i> L.	Asteraceae	Nalobebi	Yao 22; 29	Pantropical species	Annual herb	Village	Wind	1
<i>Alchornea floribunda</i> Mull. Arg.	Euphorbiaceae	Yando	Yao_Mus_Afane 8; 17; 32	Guinean-Congolese species	Shrub	Primary forest	Plant itself	3
<i>Alstonia boonei</i> De Wild.	Apocynaceae	Gouga	Yao_Mus 5; 25; 37; 59	Guinean-Congolese species	Tree	Secondary forest	Wind	6
<i>Angylocalyx pynaertii</i> De Wild.	Fabaceae	Boeni	Yao 45	Centro-Guinean-Congolese species	Small tree	Primary forest	Animal	2
<i>Annickia chlorantha</i> (Oliv.) Setten & Maas	Annonaceae	Epoué	Yao_Mus 19; 53	Centro-Guinean-Congolese species	Tree	Primary forest	Animal	3
<i>Anonidium mannii</i> (Oliv.) Engl. & Diels	Annonaceae	Mgbé	Yao_Mus 76	Centro-Guinean-Congolese species	Tree	Primary forest	Animal	1

Latin name	Family	Vernacular (Baka) name	Voucher sample number in the Herbarium of IPHAMETRA, Libreville, Gabon	Phytogeographic distribution	Morphological (biological) type	Habitat preferences	Mean of scattering	Number of citations
<i>Antaenidia conferta</i> (Benth.) K. Schum.	Maranthaceae	boboko	Yao 57; Yao_Mus 10	Guinean-Congolese species	Perennial herb	Primary forest	Animal	2
<i>Antrocaryon klaineanum</i> Pierre	Anacardiaceae	Ngongou	Yao_Mus 27; 55	Centro-Guinean-Congolese species	Tree	Primary forest	Animal	1
<i>Arachis hypogaea</i> L.	Fabaceae			Pantropical species	Annual herb	Crop	Animal	1
<i>Baillonella toxisperma</i> Pierre	Sapotaceae	Mabé	Yao 2, Yao_Mu 20; 46	Centro-Guinean-Congolese species	Tree	Primary forest	Animal	2
<i>Barteria nigritiana</i> Hook. f. subsp. fistulosa (Mast.) Sleumer	Flacourtiaceae	Pambo	Yao 12; Yao_Mus 13; 16	Guinean-Congolese species	Tree	Secondary forest	Animal	1
<i>Beilschmiedia fulva</i> Robyns & R.Wilczek	Lauraceae	Zingo	Yao_Mus 50					2
<i>Capsicum frutescens</i> L.	Solanaceae	Alamba	Yao_Mus 14	Pantropical species	Shrub	Crop	Animal	7
<i>Carica papaya</i> L.	Caricaceae	Makoua	Yao_Mus 6	Pantropical species	Small tree	Crop	Animal	3
<i>Carpolobia alba</i> G. Don	Logoniaceae	Monono	Yao_Mus 36	Centro-Guinean-Congolese species	Small tree	Secondary forest	Animal	3
<i>Ceiba pentandra</i> (L.) Gaertn.	Bombaceae	Koulo	Yao_Mus 32	Pantropical species	Tree	Secondary forest	Wind	5
<i>Chytrantus talbotii</i> Baker f. (Keay).	Sapindaceae	Lékanguesoua	Yao_Mus_Afane 57					2
<i>Citrus limon</i> (L.) Burm. f.	Rutaceae	Malala	Yao_Mus_Afane 21	Pantropical species	Small tree	Crop	Animal	2
<i>Cnestis ferruginea</i> Vahl ex DC.	Connaraceae	Toukoussa	Yao_Mus 18	Guinean-Congolese species	Liana	Primary forest	Animal	1
<i>Costus lucanusianus</i> J. Braun ou C, afer Ker Gawl	Costaceae	Nganguélangué	Yao 40	Guinean-Congolese species	Perennial herb	Secondary forest	Animal	1

Latin name	Family	Vernacular (Baka) name	Voucher sample number in the Herbarium of IPHAMETRA, Libreville, Gabon	Phytogeographic distribution	Morphological (biological) type	Habitat preferences	Mean of scattering	Number of citations
<i>Coula edulis</i> Baill.	Olacaceae	Mégombé	Yao 16; Yao_Mus 40; 56; 67	Guinean-Congolese species	Tree	Primary forest	Animal	1
<i>Croton oligandrus</i> Pierre ex Hutch.	Euphorbiaceae	Ndéngo	Yao_Mus 22; 26	Centro-Guinean-Congolese species	Small tree	Secondary forest	Animal	1
<i>Dialium pachyphyllum</i> Harms	Caesalpiniaceae	Mbéléngui	Yao_Mus 41					1
<i>Diospyros hoyleana</i> F. White	Ebenaceae	Gbokèmbè	Yao_Mus 48	Centro-Guinean-Congolese species	Small tree	Primary forest	Animal	1
<i>Erythrophleum ivorence</i> A. Chev.	Caesalpiniaceae	Ngbanda	Yao_Mus 37	Guinean and soudano-zambesian species	Tree	Primary forest	Plant itself	1
<i>Gambeya lacourtiana</i> (De Wild.) Aubr.	Sapotaceae	Bambou	Yao_Mus 7	West Guinean species	Tree	Primary forest	Animal	2
<i>Garcinia punctata</i> Oliv.	Clusiaceae	kpom	Yao_Mus 2	West Guinean species	Small tree	Primary forest	Animal	3
<i>Gilbertiodendron dewevrei</i> (De Wild.) Léon.	Caesalpiniaceae	Bemba	Yao_Mus 39	Guinean-Congolese species	Tree	Primary forest	Plant itself	2
<i>Gilletiodendron pierreanum</i> (Harms) J.Léonard	Leguminosae	Mbayé	Yao_Mus 35					2
<i>Gouania longipetala</i> Hemsl.	Rhamnaceae		Yao_Mus 45	Guinean-Congolese species	Liana	Secondary forest	Wind	1
<i>Harungana madagascariensis</i> Lam. ex Poir.	Hypericaceae	Ndjéné	Yao_Mus 25	Afro-Malagasy species	Small tree	Secondary forest	Animal	2
<i>Haumania danckelmaniana</i> (Braun & K. Schum.) Milne-Redh.	Maranthaceae	Kpa sèlè	Yao 86; Yao_Mus 31	Centro-Guinean-Congolese species	Liana	Primary forest	Animal	1
<i>Ipomoea involuocrata</i> Beauv.	Convolvulaceae	Poulou	Yao 17; Yao_Mus 33	Pantropical species	Liana	Fallow	Plant itself	3

Latin name	Family	Vernacular (Baka) name	Voucher sample number in the Herbarium of IPHAMETRA, Libreville, Gabon	Phytogeographic distribution	Morphological (biological) type	Habitat preferences	Mean of scattering	Number of citations
<i>Lophira alata</i> Banks ex Gaertn.	Ochnaceae	Ngokélé	Yao 4; Yao_Mus 49	Guinean-Congolese species	Tree	Primary forest	Plant itself	1
<i>Maesopsis eminii</i> Engl.	Rhamnaceae			Guinean-Congolese species	Tree	Secondary forest	Animal	1
<i>Mangifera indica</i> L.	Anacardiaceae			Pantropical species	Tree	Crop	Animal	1
<i>Manniophyton fulvum</i> Mull. Arg.	Euphorbiaceae	Koussa	Yao 14; Yao_Mus 14	Guinean-Congolese species	Liana	Secondary forest	Plant itself	1
<i>Massularia acuminata</i> (G. Don) Bullock ex Hoyle	Rubiaceae	Mindo	Bet_Yao_49	Guinean-Congolese species	Small tree	Primary forest	Animal	2
<i>Megaphrynium gabonense</i> Koechlin	Maranthaceae	Ngouassa		Guinean-Congolese species	Perennial herb	Primary forest	Animal	2
<i>Microdesmis puberula</i> Hook. f. ex Planch.	Pandaceae	Piipi	Yao_Mus 44	Centro-Guinean-Congolese species	Small tree	Primary forest	Animal	2
<i>Milicia excelsa</i> (Welw.) Berg	Moraceae	Bangui		Guinean-Congolese species	Tree	Secondary forest	Animal	1
<i>Musa paradisiaca</i> L.	Musaceae			Pantropical species	Shrub	Crop	Animal	1
<i>Nauclea diderrichii</i> (De Wild.) Merrill	Rubiaceae	Noko akondom	Yao_Mus 3; 34	Guinean-Congolese species	Tree	Primary forest	Animal	2
<i>Ocimum gratissimum</i> L.	Lamiaceae		Bet_Yao 31; Yao_Mus 30	Paleotropical species	Shrub	Crop	Wind	1
<i>Omphalocarpum elatum</i> Miers	Sapotaceae	Mbaté	Yao_Mus 57; Yao_Mus_Atou 1	Centro-Guinean-Congolese species	Tree	Primary forest	Animal	1
<i>Pachypodanthium confine</i> Engl. and Diels	Annonaceae	Molombo	Yao_Mus 52	Guinean-Congolese species	Tree	Primary forest	Animal	1
<i>Panda oleosa</i> Pierre	Pandaceae	Kana	Yao 11; Yao_Mus 46	Guinean-Congolese species	Tree	Primary forest	Animal	1

Latin name	Family	Vernacular (Baka) name	Voucher sample number in the Herbarium of IPHAMETRA, Libreville, Gabon	Phytogeographic distribution	Morphological (biological) type	Habitat preferences	Mean of scattering	Number of citations
<i>Pentaclethra macrophylla</i> Benth.	Mimosaceae	Mbalaka	Yao_Mus 29	Guinean-Congolese species	Tree	Secondary forest	Plant itself	1
<i>Petersianthus macrocarpus</i> (P. Beauv.) Liben.	Lecythidaceae	Mbosso	Yao 70; Yao_Mus 8	Centro-Guinean-Congolese species	Tree	Secondary forest	Plant itself	2
<i>Picralima nitida</i> (Stapf) Th & H. Dur.	Apocynaceae	Motokotoko	Yao_Mus 63	Guinean and soudano-zambesian species	Tree	Secondary forest	Animal	6
<i>Piptadeniastrum africanum</i> (Hook. f.) Bren.	Mimosaceae	Koungou	Yao 48; Yao_Mus 9; 19	Guinean-Congolese species	Tree	Primary forest	Plant itself	1
<i>Polyalthia suaveolens</i> Engl. & Diels	Annonaceae	Botunga	Yao_Mus 12	Centro-Guinean-Congolese species	Tree	Primary forest	Animal	1
<i>Pterocarpus soyauxii</i> Taub.	Fabaceae	Nguèlè	Yao 53; yao_Mus 38	Centro-Guinean-Congolese species	Tree	Primary forest	Plant itself	2
<i>Pycnanthus angolensis</i> (Welw.) Excell	Myristicaceae	Etengué	Yao_Mus 11	Guinean-Congolese species	Tree	Secondary forest	Animal	1
<i>Pycnobotria nitida</i> Benth	Apocynaceae	Korsok	Yao_Mus_Afane 41					2
<i>Saccharum officinarum</i> L.	Poaceae			Pantropical species	Perennial herb	Crop	Wind	5
<i>Schumanniophyton magnificum</i> (R. Good). N. Hallé	Rubiaceae	Gogologo	Yao_Mus_Afane 55	Centro-Guinean-Congolese species	Small tree	Secondary forest	Animal	5
<i>Scyphocephalum ochocoa</i> Warb.	Myristicaceae	Massoko	Yao 3; yao_Mus 42					1
<i>Sida acuta</i> Burm.	Malvaceae		Yao 18; Yao_Mus 15	Pantropical species	Perennial herb	Village	Plant itself	1
<i>Strophanthus hispidus</i> DC.	Apocynaceae							1

Latin name	Family	Vernacular (Baka) name	Voucher sample number in the Herbarium of IPHAMETRA, Libreville, Gabon	Phytogeographic distribution	Morphological (biological) type	Habitat preferences	Mean of scattering	Number of citations
<i>Tabernaemontana crassa</i> Benth.	Apocynaceae	Pando	Yao 43; Yao_Mus_Atou 60	Guinean- Congolese species	Tree	Secondary forest	Animal	1
<i>Tetracera alnifolia</i> Willd.	Dilleniaceae	Nkpwo ngo	Yao 37; Yao_Mus_Afane 43	Guinean- Congolese species	Liana	Primary forest	Animal	1
<i>Tetrapleura tetraptera</i> (Schum. & Thonn.) Taub.	Mimosaceae	Adiaga	Yao_Mus_Afane 1	Guinean- Congolese species	Tree	Primary forest	Plant itself	2
<i>Trichoscypha acuminata</i> Engl.	Anacardiaceae	Ngoyo	Bei_Yao 15; Yao_Mus 39	Guinean- Congolese species	Tree	Primary forest	Animal	1
<i>Uapaca paludosa</i> Aubrév. & Léandri	Euphorbiaceae	Séngui	Yao_Mus_Afan 23	Guinean- Congolese species	Tree	Swamp forest	Animal	1
<i>Xylopia hypolampra</i> Mildbr.	Annonaceae	Mondiyè	Yao_Mus_Afan 58	Centro-Guinean- Congolese species	Tree	Primary forest	Animal	2
<i>Zanthoxylum heitzii</i> (Aubr. et Pell.) Waterman	Rutaceae	Blongo	Yao_Mus 38; Yao_Mus_Afane 28	Centro-Guinean- Congolese species	Tree	Primary forest	Animal	1

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