EJSIT
European Journal of Science, Innovation and Technology
ISSN: 2786-4936
www.ejsit-journal.com
Volume 5 | Number 4 | 2025

Vulnerability of Medicinal Plants Used in the Treatment of Sexual Weaknesses among the Ngengele of Tchambi, Maniema (DR Congo)

Hilaire USSENI NASIBU[1,2*], Dan KAPOLI OMBA[1], Augustin YAKAYENGO TOKO[1], Pierre YUMA MADJALIWA[1], Christophe LOMBA BOSOMBO[3] and Hippolyte NSHIMBA SEYA[3]

[1]Department of Renewable Natural Resources Management, Faculty of Agronomic Sciences, University of Kindu, BP 122/Kindu, DR Congo

[2]D.E.S Water and Forests Program, Faculty of Renewable Natural Resources Management, University of Kisangani, BP 2012/Kisangani, DR Congo

[3]Department of Plant Ecology, Faculty of Sciences, University of Kisangani, BP 2012/Kisangani, DR Congo

ABSTRACT

The use of medicinal plants to treat sexual weaknesses remains common among the Ngengele communities of Tchambi (Maniema Province, DR Congo). However, the intensive exploitation of roots, bark, and other organs threatens the survival of many species. This study aimed to inventory the locally used aphrodisiac plants and to assess their degree of vulnerability. Ethnobotanical surveys were conducted with 80 traditional healers (32 women and 48 men) across ten villages. A vulnerability index (IVi), based on nine ecological and ethnobotanical parameters, was calculated. A total of 26 species belonging to 15 families were recorded. Among them, 65% were classified as highly vulnerable, including *Millettia elskensii* (IVi = 2.9), and 35% as moderately vulnerable. The dominant use of bark and roots (59% of reported uses) places significant pressure on natural regeneration. These findings confirm that current management practices are unsustainable and highlight the urgent need for awareness raising, domestication, and participatory conservation strategies.

Keywords: ethnobotany, vulnerability, medicinal plants, aphrodisiacs, sustainable management

INTRODUCTION

Traditional medicine remains an essential health resource for many African communities, particularly in rural areas where access to modern healthcare is limited. It relies on a rich and diverse pharmacopoeia, transmitted from generation to generation, and plays a central role in the management of various diseases, including those related to sexual health (Diafouka, 1997).

However, the overexploitation of medicinal plants is raising growing concern. Excessive harvesting of vital organs such as roots, bark, or stems undermines natural regeneration and threatens the survival of many species (Akpagana, 1992; Akodéwou *et al*., 2019). In Central Africa, uncontrolled gathering has already led to the depletion, and in some cases the disappearance, of certain traditionally used plants (Betti, 2001). Rapid population growth has further increased human dependence on biodiversity (Amoussou *et al*., 2012). This pressure has caused alarming degradation of forest cover (Djègo & Oumorou, 2009), often putting the very existence of these resources at risk (Yessoufou, 2005).

Within this context, sexual weaknesses constitute a particularly sensitive health domain, mobilising a wide range of traditional remedies. Aphrodisiac plants occupy a prominent position, not only for their therapeutic value but also for their cultural and social importance.

* Corresponding Author: ussenihilaire@gmail.com

Nevertheless, the pressure exerted on these species remains poorly documented, and few studies have explicitly assessed their vulnerability (Ouattara *et al*., 2023).

The Bangengele Chiefdom, in Maniema Province (DR Congo), is home to remarkable floristic biodiversity as well as deeply rooted traditional practices. Among the Ngengele of Tchambi, the use of aphrodisiac plant species is both frequent and central to traditional medicine. Yet no systematic scientific evaluation has been undertaken to identify the species most threatened by this intensive use.

This study aims to fill this gap. Its objective is to identify the aphrodisiac plants used by the Ngengele communities of Tchambi and to evaluate their degree of vulnerability, with the ultimate goal of determining conservation priorities and proposing pathways for sustainable management.

MATERIAL AND METHODS

Study Area

The research was conducted in the Bangengele Chiefdom, located in Maniema Province (Democratic Republic of Congo). This territory covers approximately 7,136 km², with an average population density of 16 inhabitants/km² (N'Sanda *et al*., 2011). The climate is humid tropical (subequatorial), characterised by two main seasons: a rainy season (September to May) and a dry season (mid-May to mid-August). The vegetation is dominated by dense primary humid forests hosting species such as *Gilbertiodendron dewevrei*, *Milicia excelsa*, and *Entandrophragma angolense*, alongside fallow lands and shrub savannas (PDL, 2021).

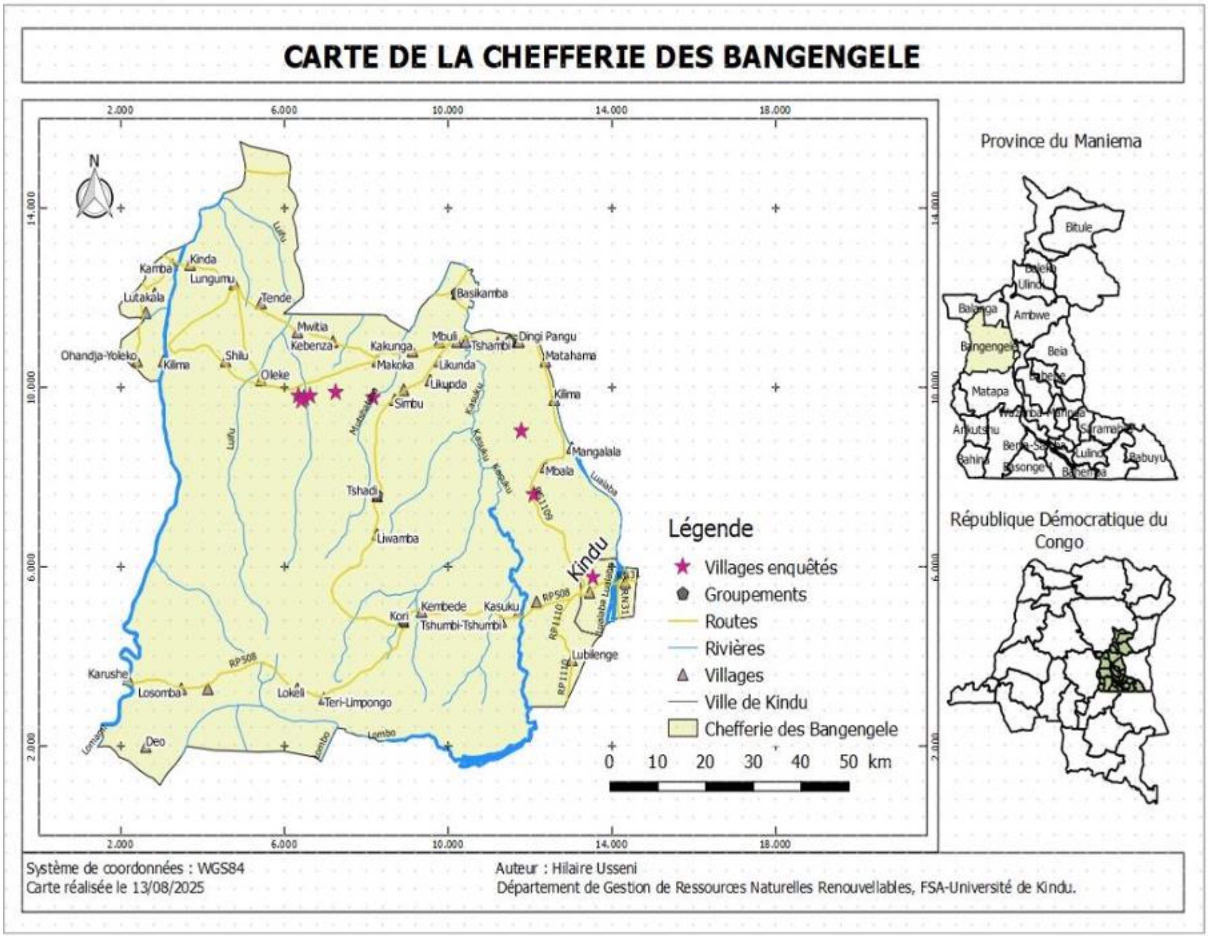

Figure 1: Localisation map of the study area

Methods

Sampling and data collection

Ethnobotanical surveys were carried out in ten villages of the Tchambi group (Kalemba I, Kalemba II, Myango, Dingi, Lomango, Kakungu, Makoka, Oleke, Tchombekilima, and Oluwo). Participants were selected using the "snowball" technique (Nzuki *et al*., 2013), whereby traditional healers are identified through successive recommendations.

A total of 80 individuals (32 women and 48 men), aged at least 20 years, were interviewed. The minimum age was set to ensure reliable testimony regarding changes in flora and traditional practices (Brossard, 2019). Semi-structured interviews addressed:

- the identification of plants used against sexual weakness;
- the plant organs harvested (roots, bark, leaves, etc.);
- modes of preparation (decoction, maceration, powder, etc.);
- routes of administration.

Vulnerability Assessment

The vulnerability of the recorded species was measured using the Vulnerability Index (IVi), adapted from Badjare *et al*. (2021). Nine parameters were taken into account: relative frequency of use, number of uses, plant organs harvested, harvesting method, morphological type, preparation method, habitat type, diaspore type, and biogeographical distribution.

Each parameter was scored on a scale from 1 (low vulnerability) to 3 (high vulnerability). The vulnerability index of a given species (*IVi*) corresponds to the average of the values obtained, according to the following formula:

$$\mathbf{IVi} = \sum \frac{\mathbf{Ni}}{\mathbf{9}} \quad (1)$$

where: IVi = Vulnerability Index of species *I*; Ni = Vulnerability values for each parameter.

Three classes were defined: Low vulnerability: Ivi < 2; Moderate vulnerability: 2 ≤ Ivi < 2.5; High vulnerability: Ivi ≥ 2.5.

The table below presents the vulnerability scale for the different parameters considered.

Table 1: Key parameters used to calculate the Vulnerability Index (Ivi)

Parameters	Low (scale = 1)	Moderate (scale = 2)	High (scale = 3)
P1: Relative frequency	Fu < 20%	20% ≤ Fu ≤ 60%	Fu ≥ 60%
P2: Number of uses	Nu < 2	2 ≤ Nu ≤ 4	Nu ≥ 5
P3: Plant organ used	Leaf, latex, resin, or sap	Fruits, branches	Root, tuber, seed, bark, flower, wood
P4: Harvesting method	Gathering	Leaf collection	Tree felling, uprooting, fruit harvesting, debarking, branch cutting
P5: Morphological types	Annual herbs, Ferns	Perennial herbs, Small shrubs	Lianas, Shrubs, Trees
P6: Preparation method of plant remedies	Ash, powder, ointment, dried organ	Herbal tea	Maceration, infusion, decoction, fresh, paste, fumigation, steam
P7: Habitat types	Savannah	Fallow, Secondary forest, Aquatic	Primary forest
P8: Diaspore types	Autochorous plants	Ballochores, Barochores	Anemochores, Pterochorous, Pogonochores, Sclerochores, Pleichorous

P9: Biogeographical types	Widely distributed species, Cosmopolitan	Transitional species: Pantropical, Afro-American, Palaeotropical, Afro-Malagasy, Afrotropical	Endemic species: Sudanian–Zambezian, Guineo-Congolian, Omniguineo-Congolian (OGC), Lower-Guineo-Congolian (BGC), Congolese–Central Forest (CFC), Centro-Guinean, Other endemic species

Knowledge similarity analysis

To compare the distribution of knowledge across villages, genders, and age groups, the Sorensen similarity index (IS) was calculated (Atakpama *et al.*, 2021). This index ranges from 0 (no similarity) to 1 (identical knowledge), according to the following formula:

$$\mathbf{IS} = \frac{2C}{(S1+S2)} \quad (2)$$

where C = number of species common to both groups, $S1$ = number of species in group 1, and $S2$ = number of species in group 2.

RESULTS

Species Inventory

Interviews with 80 traditional healers (32 women and 48 men) across ten villages recorded 26 plant species used for treating male sexual weakness among the Ngengele of Tchambi. These 26 species belong to 24 genera and 15 families. The most represented families are: Fabaceae (29% of species), Euphorbiaceae (11.5%), Phyllanthaceae, Sapotaceae and Rubiaceae (8% each), while other families account for 3.8% each.

Table 2: Plants used as aphrodisiacs in Tchambi

N°	Species	Family	Organs	PM	RA	MT	BT	IVs
1	*Aidia micrantha* (K. Schum.) F. White	Rubiaceae	Roots, bark	Decoction	Anal	Shrub	McPh	2.7
2	*Arachis hypogaea* L.	Fabaceae	Seeds	Roasted	Oral	Annual herb	Th	2.0
3	*Autranella congolensis* (De Wild.)	Sapotaceae	Bark	Decoction	Anal	Tree	MgPh	2.8
4	*Carpolobia alba* G. Don	Polygalaceae	Bark	Decoction	Oral	Shrub	McPh	2.7
5	*Chrysophyllum lacourtianum* Aubrev. & Pellegr.	Sapotaceae	Roots	Raw	Oral	Tree	MgPh	2.6
6	*Cola acuminata* (P. Beauv.) Schott & Endl.	Sterculiaceae	Seeds, roots	Raw, Decoction	Oral, Anal	Tree	McPh	2.7
7	*Croton mubango* Müll. Arg.	Euphorbiaceae	Bark	Decoction	Anal, Oral	Shrub	McPh	2.4
8	*Cymbopogon citratus* (DC.) Stapf	Poaceae	Roots, leaves	Decoction, Infusion	Oral	Perenni al herb	HcPh	2.1
9	*Euphorbia hirta* L.	Euphorbiaceae	Whole plant	Maceration, Infusion	Oral	Annual herb	Th	2.4
10	*Gilbertiodendron dewevrei* (De Wild.) J. Léonard	Fabaceae	Bark, roots, leaves	Decoction, Herbal tea	Oral	Tree	MgPh	2.7
11	*Jatropha curcas* L.	Euphorbiaceae	Seeds	Drying	Oral	Shrub	McPh	2.2
12	*Mangifera indica* L.	Anacardiaceae	Bark, leaves	Maceration	Oral, Anal	Tree	MgPh	2.4
13	*Millettia versicolor* Welw. ex Baker	Fabaceae	Bark	Decoction	Oral	Tree	MsPh	2.6

14	*Millettia elskensii* De Wild.	Fabaceae	Stems	Decoction	Anal	Liana	PhGr	2.9
15	*Morinda morindoides*	Rubiaceae	Stems, leaves	Decoction	Oral, Anal	Tree	MsPh	2.8
16	*Ocimum gratissimum* L.	Lamiaceae	Stems and leaves	Maceration, Decoction	Anal	Shrub	ChPh	2.7
17	*Pentaclethra macrophylla* Benth.	Fabaceae	Roots, leaves	Fresh (raw) + alcohol, Ash, Powder	Oral, Local	Tree	MsPh	2.7
18	*Pentadiplandra brazzeana* Baill.	Capparaceae	Roots	Raw, Powder	Oral	Liana	PhGr	2.6
19	*Piper nigrum* L.	Piperaceae	Grains	Powder, Raw	Oral	Liana	PhGr	2.7
20	*Piptadeniastrum africanum* (Hook.f.) Brenan	Fabaceae (Mimosaceae)	Bark	Maceration with lemon juice	Anal	Tree	MgPh	2.4
21	*Rauvolfia vomitoria* Afzel.	Apocynaceae	Roots	Decoction	Anal	Tree	McPh	2.8
22	*Senna spectabilis* (DC.) Irwin & Barneby	Fabaceae	Bark	Decoction	Anal	Tree	MsPh	2.3
23	*Uapaca guineensis* Müll. Arg.	Phyllanthaceae	Bark	Maceration, Powder	Oral	Tree	MsPh	2.7
24	*Uapaca heudelotii* Baill.	Phyllanthaceae	Roots	Powder, Paste	Oral	Tree	MsPh	2.8
25	*Zanthoxylum gilletii* (De Wild.)	Rutaceae	Bark, roots, leaves	Decoction, Maceration	Oral, Anal	Tree	MsPh	2.8
26	*Zingiber officinale* Roscoe	Zingiberaceae	Rhizome	Infusion, Maceration, Powder	Oral	Perennial herb	GPh r	2.4

Legend: MP: Preparation Method; RA: Route of administration; MT: Morphological type; BT: Biological type; IVs: Species Vulnerability Index; Herbe ann.: Annual herb; Herbe viv.: Perennial herb; MsPh: Mesophanerophytes; McPh: Microphanerophytes; MgPh: Megaphanerophytes; NPh: Nanophanerophytes; GPh r: Rhizomatous geophytes; PhGr: Climbing phanerophytes; Th: Therophytes; HcPh: Hemicryptophytes.

Plant parts used

The most frequently harvested plant organs are: Bark: 31% of recorded uses, Roots: 28%, Leaves: 19%, Seeds: 11%, Stems: 8%, Whole plant: 3%.

The predominance of bark and root harvesting indicates high pressure on vital organs, severely limiting the natural regeneration of species.

Modes of preparation and administration

Preparation: Decoction is the most common method (35%), followed by maceration (17.5%) and powder (15%).

Administration: The oral route predominates (59%), followed by anal administration (38%) and local application (3%).

Morphological and biological types

Morphological types: Trees are the most represented (50%), followed by shrubs (23%), lianas (11.5%), and herbs (7.7% annual, 7.7% perennial).

Biological types: Mesophanerophytes dominate (34%), followed by microphanerophytes (23%) and megaphanerophytes (19%). Hemicryptophytes, chamaephytes, nanophanerophytes, and rhizomatous geophytes are less represented (4% each).

Diaspore dissemination modes

Zoochory is the most common mode of dispersal (46% of species), followed by barochory (35%), ballochory (11%), and anemochory (8%).

Species Vulnerability

Data related to the vulnerability of plant species are mentioned in the figure below.

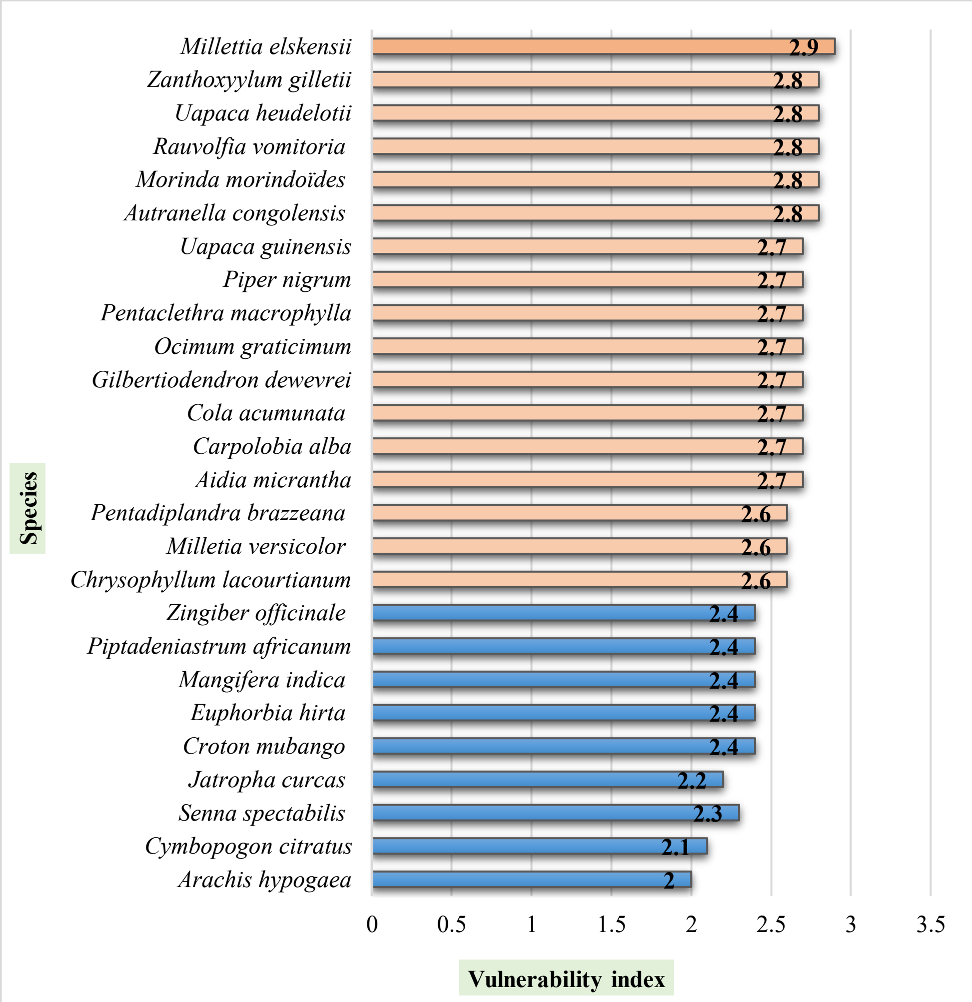

Figure 3: Species vulnerability index

The vulnerability analysis shows that: 65% of species are highly vulnerable (IVi ≥ 2.5); 35% are moderately vulnerable (2 ≤ IVi < 2.5); none are classified as low vulnerability.

The most threatened species are: *Millettia elskensii* (IVi = 2.9); *Autranella congolensis* (IVi = 2.8); *Morinda morindoides* (IVi = 2.8); *Rauvolfia vomitoria* (IVi = 2.8); *Zanthoxylum gilletii* (IVi = 2.8).

Similarity of Species Knowledge by Villages

Data related to knowledge similarities are shown in the figure below.

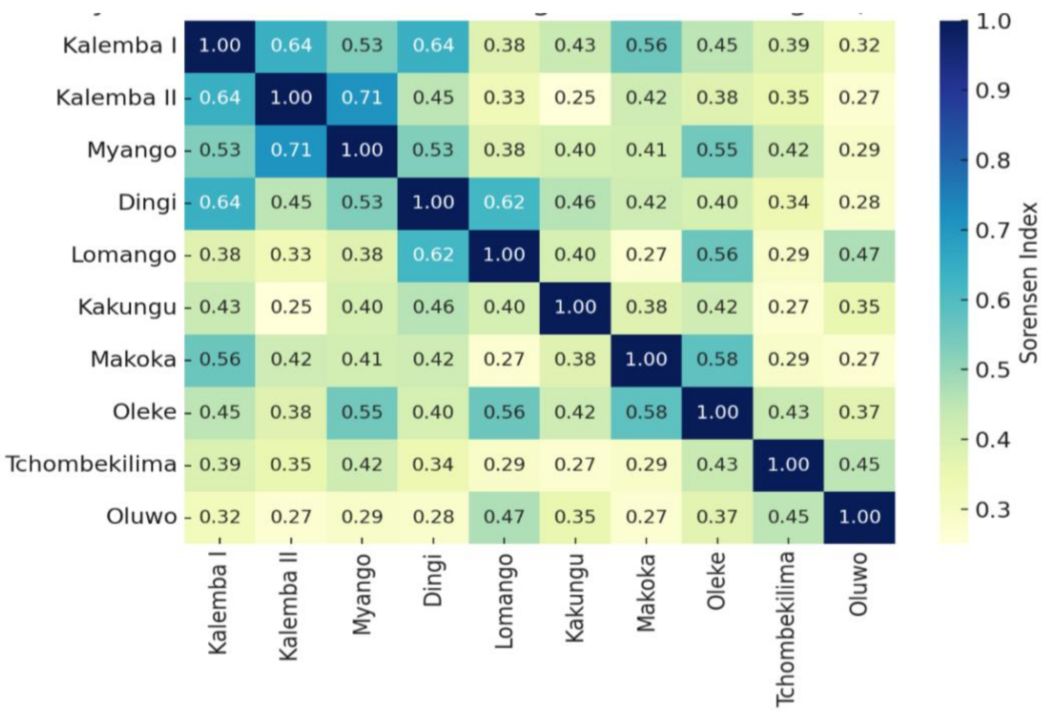

Figure 3: Similarities of Knowledge between Villages (Sorensen Index)

The Sorensen similarity index (IS) ranges between 0.27 and 0.71 across villages.

- The highest similarities are observed between Myango and Kalemba II (IS = 0.71) and Lomango and Dingi (IS = 0.62).
- Geographically close villages tend to share more homogeneous knowledge.

DISCUSSIONS

This study highlights both the importance and the vulnerability of aphrodisiac plants used by the Ngengele communities of Tchambi. Of the 26 species recorded, nearly two-thirds were classified as highly vulnerable, which represents a particularly high proportion compared to other regions of Central Africa.

Our findings differ from those of Betti (2001) in Cameroon, where only 17% of plants studied were considered highly vulnerable. Similarly, Gadikou *et al*. (2022) in Togo identified a comparable diversity of botanical families but a smaller proportion of species under severe threat. These differences may be explained by: the strong dependence of the Ngengele on aphrodisiac plants, considered essential in social and family life; the type of organs harvested, mainly roots and bark, which directly compromise plant survival; the absence of sustainable local management measures. Sexual weaknesses represent a major concern within communities, which explains the importance given to aphrodisiac plants. Their use responds not only to a therapeutic need, but also to social expectations linked to virility and reproduction. Thus, the disappearance of these species could impoverish the local therapeutic capital and weaken traditional care practices, still widely used in this region where modern health services are limited. Many studies have highlighted that several species are in danger of extinction in Africa, being sought for their roots (Mccartan, 1998; Raimondo *et al*., 2009). In these studies, researchers mainly report the overexploitation of aphrodisiacs.

Ouattara *et al*. (2023) reported 25 medicinal species in the Sahelian zone of Burkina Faso, distributed across 25 genera and 18 families, with Fabaceae again dominant. The repeated presence of Fabaceae in ethnobotanical studies across West and Central Africa (Zerbo *et al*., 2005; Asse *et al*., 2011) confirms the pharmacological potential of this family, rich in tannins, alkaloids, and isoflavonoids with known oestrogenic properties.

The predominance of bark and root harvesting (59% of uses) is the principal factor contributing to species vulnerability. Unlike leaves or fruits, removing bark and roots often leads to plant death, reducing the chances of natural regeneration and gradually degrading forest ecosystems. This dynamic of overexploitation has also been noted by Nga *et al*. (2016) and Ngbolua *et al*. (2022) in other regions of Central Africa.

Decoction is the most preferred method of preparation (35%), followed respectively by maceration, powder, fresh and infusion, or respectively 17.5%, 15%; 12.5% and 7.5%. These results are consistent with those of Nga *et al*. (2016), where the most used method of preparation for recipes of plant species from Douala is decoction (27.46%), followed by maceration (23.94%) and friction (19.01%). Banyanga (2014) also found that decoction is the most used method of preparation, (36.53%). Betti (2001) found the same trends where decoctions (39%) and macerations (36%) are the most used forms.

Oral route is the most preferred for the administration of recipes (59%) followed by anal route (38%), finally local application, or 3%. For Ouattara *et al*., (2023) also, revenue administration is mainly done orally through drinking (46%). This practice could be explained by the simplicity of this method. In addition, for Moyabi *et al*., (2021), the disease being located in internal organs, the compound must pass through the digestive system to reach them and facilitate assimilation and action.

The most represented biological types are Mesophanerophytes (34%), followed by Microphanerophytes (23%), Megaphanerophytes (19%). The least represented are Hemichryptophytes, Chamephytes, Nanophanerophytes and Rhizomatous Geophytes, representing 4% each. The intermediates are climbing Phanerophytes and Therophytes, respectively (11.5% and 7.7%). These results are similar to those of Ouattara *et al*. (2023) for whom Phanerophytes represented (80%), including 76% for simple phanerophytes and 4% for climbing phanerophytes, and Therophytes (12%). Geophytes and chamephytes are represented with lower frequencies of 4% each. This predominance of phanerophytes would reflect the state of vegetation in tropical and equatorial regions (Ngbolua, *et al*., 2022).

For the type of diaspores, Zoochores are the most represented in number of species (46%), followed by Barochores (35%), Ballochores (11%). Finally, Anemochores 8%. These results contradict those of Betti (2001) for whom Sarcochores are the most represented in number of species (65%) and in number of citations (66%). Ballochores represent only 4% of species and 1% of citations.

The high Sorensen index values (up to IS = 0.71 between neighbouring villages) indicate active transmission of ethnobotanical knowledge. However, this also suggests homogenisation of practices, which concentrates harvesting pressure on a limited number of species, further exacerbating their vulnerability. These results corroborate those of Gadikou *et al*. (2022) for whom the upper Sorenson index is (IS = 0.7) showing that almost three-quarters of the reported species are common to both sexes.

The study also highlights the lack of legal or customary frameworks to regulate the exploitation of medicinal plants. This regulatory vacuum encourages uncontrolled harvesting and unsustainable practices. By contrast, initiatives in other regions, such as the domestication of medicinal species in Burkina Faso (Ouattara *et al*., 2023), provide models that could inspire similar actions in Tchambi.

CONCLUSION

This study documented 26 plant species used by the Ngengele communities of Tchambi to treat sexual weakness, the majority of which were found to be highly vulnerable. Fabaceae dominate the local pharmacopoeia, while the preferential exploitation of roots and bark increases the risk of resource depletion. *Millettia elskensii* (IVi = 2.9) emerged as the most threatened species and should be prioritised for conservation measures.

The findings demonstrate that current management practices are unsustainable and that the homogenised transmission of knowledge intensifies pressure on a small number of key species. Without appropriate interventions, the disappearance of these plants would jeopardise both local biodiversity and traditional medicine.

Efforts to raise community awareness, domesticate wild specimens (case of *Millettia elskensii*), strengthen local regulations and carry out additional research on the most vulnerable species therefore remain a priority.

ACKNOWLEDGEMENTS

We extend our sincere thanks to all the traditional healers who generously shared their knowledge. Special thanks go to Engineer ONYUMBE INVULA Robert, whose support in the field was instrumental in facilitating contact with practitioners. We are also grateful to all those who provided assistance and encouragement throughout this study.

REFERENCES

Akodéwou, 2020. Land Use and Land Cover Dynamics Analysis of the Togodo Protected Area and Its Surroundings in Southeastern Togo, West Africa. Sustainability, 12(9): 1–23.

Akpagana, K. (1992). Some rare or endangered species of Togo. I – The coastal strip. *Annales de l'Université du Bénin*, 10: 33–36.

Amoussou, E., Camberlin, P., Mahé, G. (2012). Impact of climate variability and the Nangbéto dam on the hydrology of the Mono-Couffo system (West Africa). *Hydrological Sciences Journal*, 57(2): 1–13.

Asse, A., Otenge-Yeboah, A., Odamtten, G., & Simmonds, S. (2005). Ethnobotanical study of some Ghanaian anti-malarial plants. *Journal of Ethnopharmacology*, 99(2): 273–279.

Atakpama, W. (2021). Plants and the management of maternal health in the Maritime Region of Togo. *African Annals of Medicine*, 14(3): e4196–e4206.

Badjare, B., Woegan, Y.A., Folega, F., Atakpama, W., Wala, K., & Akpagana, K. (2021). Vulnerability of woody resources in relation to different forms of use in Togo: the case of the Doungh-fossé aux lions protected landscape (Savanes Region). *Agrobiologia Review*, 11(2): 2552–2565.

Banyanga, (2014). Indigenous knowledge on ethnobotanical plants of Kavrepalanchowk District. *Journal of Science, Engineering and Technology*, 5: 96–109.

Betti, J. (2001). Vulnerability of plants used as antimalarials in the Mintom district, south of the Dja Biosphere Reserve (Cameroon). Laboratory of Systematic Botany and Phytosociology, Université Libre de Bruxelles, Belgium & Ministry of Environment and Forests, Yaoundé, Cameroon.

Brossard, B. (2019). Considering age in qualitative methods: an attempt at clarification. *SociologieS* [Online], Research experiments: Rethinking social age relations between respondents and researchers, 1–11.

Diafouka, A. (1997). *Analysis of the uses of medicinal plants in four regions of Congo-Brazzaville*. PhD Thesis, Université Libre de Bruxelles, 434 pp.

Djègo, J., & Oumorou, M. (2009). Understorey phytosociology and the impact of forest plantations on floristic diversity in the Lama Forest Reserve. *Annales des Sciences Agronomiques*, 12(1). https://doi.org/10.4314/asab.v12i1.53834

Gadikou, J., Atakpama, W., Egbelou, H., Kombate, B., Batawila, K., & Akpagana, K. (2022). Use-value of vulnerable medicinal plants in the Maritime Region of Togo. *Revue Agrobiologia*, 12(2): 3009–3023.

McCartan, S.A., & Crouch, N.R. (1998). In vitro culture of *Mondia whitei* (Periplocaceae), a threatened Zululand medicinal plant. *South African Journal of Botany*, 64: 313–314.

Moyabi, A.G.A., Coulibaly, F.A., Konan, Y.A.O., Kouakou, D.K.R., & Koné, M.W. (2021). Medicinal plants used in the treatment of couple infertility in the Oumé Department, Central-West Côte d'Ivoire. *Afrique Science*, 19(6): 133–145.

N'Sanda, L., Vivi, K., Akilimali, C., Kabala, K., Tabu, O., Omasombo, J., & M'pene, Z. (2011). *Maniema: Space and Lives*. Brussels: Le Cri Éditions. ISBN 978-2-8710-6562-3, pp. 136–137.

Nga, E., Kidik Pouka, C., Ngo Boumsong, P.C., Dibong, S.D., & Mpondo, E. (2016). Inventory and characterisation of medicinal plants used in therapeutics in the Sanaga Maritime Department: Ndom, Ngambe and Pouma. *Journal of Applied Biosciences*, 106(1): 10333–10352.

Ngbolua, K.N., Mihigo, S.O., Liyongo, C.I., Ashande, M.C., Tshibangu, D.S.T., Zoawe, B.G., Baholy, R., Fatiany, P.R., & Mpiana, P.T. (2022). Ethnobotanical survey of plant species used in traditional medicine in Kinshasa city (Democratic Republic of the Congo). *Tropical Plant Research*, 3(2): 413–427.

Nzuki, F., Termote, C., Kibungu Kembelo, A., & Van Damme, P. (2013). Identification and local importance of medicinal plants used in the Mbanza-Ngungu area, DR Congo. *Bois et Forêts des Tropiques*, 316: 63–77.

Ouattara, R., Zerbo, P., Ouattara, A., Sourabie, S., & Boussim, J. (2023). Indigenous knowledge of plants used in the management of reproductive disorders in the Sudanian zone of Burkina Faso. *Journal of Animal & Plant Sciences*, 56(3): 10364–10377.

PDL, 2021. *Local Development Plan of the Bangengele Chiefdom 2021–2025*.

Raimondo, D., Von Staden, L., & Foden, W. (Eds.) (2009). *Red List of South African Plants*. Strelitzia 25. Pretoria: SANBI.

Yessoufou, K. (2005). Ethnobotanical and ecological research on two fruit species in the Plateau Department, southern Benin: *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill. and *Blighia sapida* K. König. MSc Thesis, AGRN FSA UAC, Benin, 67 pp.

Zerbo, P., Millogo, J., Odille, G., Nacoulma-Ouedraogo, O., & Van Damme, P. (2011). Medicinal plants and medical practices in Burkina Faso: the case of the Sanan. *Bois et Forêts des Tropiques*, 307(1): 41–53.