BirEx JOURNAL
Budapest International Research in Exact Sciences
Medical, Biological, Argiculture, Engineering
Science and other related areas
e-ISSN : 2655-7827
p-ISSN : 2655-7835
http://www.bircu-journal.com/index.php/birex

Ethnobotanical Value of Myrianthus arboreus Used in Traditional Medicine by the Ngbaka Tribe (South-Ubangi), Democratic Republic of the Congo

Pascal N. Bobuya[1], Jetron M. Ngbolondo[2], Jean Pierre K.A. Zwave[3], Colette Masengo Ashande[4], Muhammad Ridwan[5], Koto-Te-Nyiwa Ngbolua[6, *]

[1,2,3]*Institut Supérieur d'Etudes Agronomiques (ISEA) de Bokonzi, B.P. 67 Gemena, République Démocratique du Congo*

[4]*Département de l'Environnement, Faculté des Sciences, Université de Gbado-Lite, Gbado-Lite, République Démocratique du Congo*

[5]*Universitas Islam Negeri Sumatera Utara, Jalan HM. Said Gg. Wongso No 4 Medan, Indonesia*

[6]*Département de Biologie, Faculté des Sciences de l'Université de Kinshasa, République Démocratique du Congo*

jpngbolua@unikin.ac.cd, ngbolua@gmail.com

Abstract: *The aim of this study is to contribute to a better knowledge of the use of M. arboreus as a medicinal plant traditionally used in the treatment of common diseases by the Ngbaka people in the South Ubangi, Democratic Republic of the Congo. Based on free consent of the respondents, an ethnobotanical survey was carried out using a questionnaire among the Ngbaka healers. The aim of this study is to contribute to a better understanding of the use of M. arboreus as a medicinal plant traditionally used in the treatment of common diseases by the Ngbaka people in the South Ubangi. Based on consent of the respondents, an ethnobotanical survey was carried out using a questionnaire among the Ngbaka healers. The results obtained in this study allowed us to identify 23 diseases that are treated by Myrianthus arboreus. The organs of M. arboreus used for the treatment of diseases are mainly the leaf (96%), the bark of the stem (66%), the fruits and seeds (42%) and the roots (34%). The main methods of preparation of the organs were decoction (86%) and maceration (66%), while the administration of the recipes is predominantly via oral (86%) and cutaneous route (68%). The vast majority of respondents use M. arboreus organs for the treatment of abscesses (17 citations), sinusitis (15 citations) and tooth decay (15 citations), and wounds with 13 citations. This work provides a source of information that can be used as a basis for pharmacological studies to assess therapeutic effectiveness.*

Keywords: *medicinal plant; Myrianthus arboreus; Ubangi ecoregion; biodiversity conservation; Democratic Republic of the Congo*

I. Introduction

In developing countries, most rural and many urban populations rely primarily on food and medicinal plants for their primary health needs and nutrition (Kitadi et al 2020; Djolu et al 2021; Kitadi et al 2021; Kpula et al 2021; Magbukudua et al 2022). Medicinal plants are valuable resources for the vast majority of rural populations in Africa, where more than 80% of the population uses them for health care (Inkoto et al. 2018; Ipona et al. 2019). The exploitation and sustainable use of medicinal plants is particularly important not only for their medicinal value, but also because the majority of the population uses them for health care (Masengo et al 2021a, b; Masengo et al 2022). Since the beginning of the living world, the fate of humans has been associated with that of plants, so much so that one wonders what would happen to humanity without plant species. Medicinal plants still remain a source of medical care in developing countries in the absence of a modern medicinal system (Tabuti et al. 2003). Indeed, most plant species have therapeutic virtues, as they contain active principles that act directly on the body and are used in both conventional and traditional medicine. In addition, medicinal plants have advantages that synthetic drugs often lack.

The African continent is endowed with a rich plant biodiversity with a very high number of nutritional and therapeutic plants (Ngbolua et al 2019; Mawunu et al 2020; Ngbolua et al 2021). Many different natural substances have been isolated there and many of them are used in modern medicine for disease prophylaxis and treatment (UNEP-WCMC 2016). According to the World Health Organization (WHO), traditional medicine is the sum total of all knowledge, skills and practices based on the theories, beliefs and experiences of different cultures, whether explicable or not, which are used in the preservation of health, as well as in the prevention, diagnosis, amelioration or treatment of physical or mental illness. This knowledge and practice are based exclusively on lived experience, observation transmitted from generation to generation, orally or in writing (Kambu 1988).

The use of traditional practices based on medicinal plants and the pharmacopoeia could be explained by the poverty of the populations, the high cost of synthetic medicines, the lack of essential medicines for health care, the inadequacy or absence of infrastructure and socio-health personnel in modern medicine, especially in rural areas (Adjanohoun 1993). In traditional medicine, the ingredients prescribed are often of plant origin because plants provide the therapy with very original active molecules with highly varied structures (Penge 1991). In herbal medicine, or the art of healing with plants, the administration of care can be curative or preventive. In a well-organized society, the competence to provide health care is vested in experienced and certified persons. These are traditional practitioners and herbalists on the one hand, and modern medical personnel on the other. In the Democratic Republic of Congo (DRC), the Ethnobotany of medicinal plants treating various diseases has been the subject of several studies in the various provinces such as Konda et al. (2015); Lubini (1990); Fruth et al. (2011); Dhetchuvi and Lejoly (1990), among others. The present study focuses exclusively on knowledge of the organs or parts of M. arboreus used to treat diseases by the Ngbaka tribe in Mbari Sector, DRC. The aim of this research is to collect information and data on the parts used how the recipes are prepared and how they are administered to patients.

II. Research Methods

2.1 Study Area

This study was initiated in the Bokonwa groupement which is located in the Mbari Sector, South Ubangi Province, DRC. The Bokonwa groupement is an important economic Centre bordered to the north by the Nguya sector via the Foloza Dafa River; to the south by the Mbari River which separates it from the Botela groupement; to the east by the Boyambi groupement in the Banga-Kungu sector; and to the west by the Tamba River which borders the Bogbase groupement. The Bokonwa Groupement covers an area of 2,500 Km2 and has a population of over 108,112 (Annual Report 2016). The climate of Groupement Bokonwa is of the AW4 type, characterized by an alternation of two seasons, a long rainy season and a short dry season. The Bokonwa Group is characterized by savannah vegetation dominated by Chromolaena odorata. Its soil is of a reliable and fertile sandy-clay nature, endowed with an absorbent power (Annual report 2013).

2.2 Plant Material and Methodology

The plant material used in this study consists of the organs of M. arboreus, which are the fruits (Figure 1a), roots (Figure 1b), leaves and flowers (Figure 1c) and stem bark (Figure 1d).

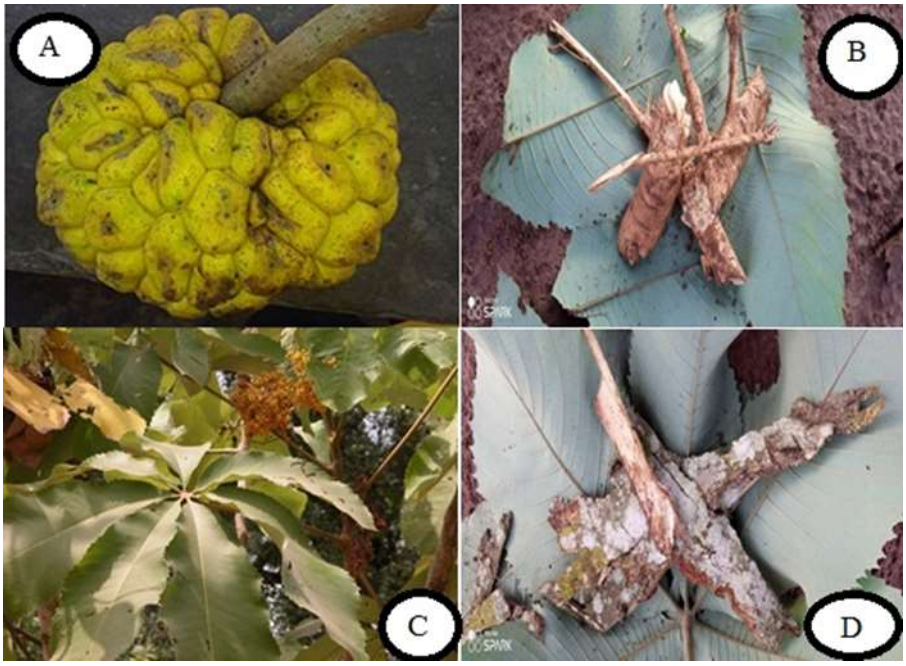

Figure 1. *Myrianthus arboreus (a) Fruits; (b) Roots on leaves; (c) Leaves and floweres; (d) Stem bark*

These organs were collected in the Bokonwa cluster in the province of South Ubangi, DRC. The plant sample was authenticated by Mr Nlandu of the Department of Biology, Faculty of Science, and University of Kinshasa.

A survey based on direct questions about the organs of M. arboreus used to treat diseases was carried out among the Ngbaka people using a questionnaire and free consent of the respondents. Before going to the field to conduct the study itself, the location of the different survey sites in the Ngbaka group was determined.

The survey was conducted during a period from June to September 2021. In this study, the identification of M. arboreus organs and diseases treated was determined by the respondents.

2.3 Data Analysis

All data collected in this research was placed in a database using Microsoft Excel 2016.

III. Discussion

3.1 Results

a. Socio-Demographic Characterization of the Informants

Table 1 shows the socio-demographic characteristics of the informants.

The majority (52%) of the informants are female, and only 48% are male. The data in Table 1 also shows that the majority (66.6%) of the men and 50.0% of the women are in the 36 to 50 age group. Furthermore, 20.8% of the men and 30.8% of the women were over 50 years of age. Also, 12.5% of the men and 19.2% of the women are between 18 and 35 years of age. In terms of education, 52.0% of women have secondary education compared to 28.0% of men; 24% of men have primary education compared to 20.0% of women; 28.0% of men are illiterate compared to 16.0% of women, and 20% of men are university graduates compared to 12.0% of women. Concerning the marital status of the respondents, the vast majority (90%) are married (88.5% men and 91.7% women), compared to 10% who are single (11.5% men and 8.3% women). In addition, concerning occupation, 61.5% of male respondents were

farmers, compared to 38.5% of teachers. Also, 81.2% of female respondents were teachers, compared to 18.8% who were farmers.

Table 1. Socio-Demographic Characteristics of Informants

Variables	**Gender of informants**			
	Parameters	Male	Female	Total
Age group	18-35 years	12.5	19.2	16.0
	36-50 years	66.7	50.0	58.3
	Over 50 years	20.8	30.8	26.0
Marital status	Single	11.5	8.3	10.0
	Married	88.5	91.7	90.0
Academic level	Illiterate,	28.0	16.0	22.0
	Primary	24.0	20.0	22.0
	Secondary	28.0	52.0	40.0
	University	20.0	12.0	16.0
Main occupation	Teacher	38.5	81.2	59.9
	Small farmer	61.5	18.8	40.1

b. Ethnomedicinal Information

Table 2 gives the scientific and vernacular names of the plant studied, the organs or parts used, the uses as well as the mode of administration in traditional medicine for the treatment of diseases by the Ngbaka people.

The organs of M. arboreus used in the traditional pharmacopoeia are respectively: leaf (34.8%), fruit (17.4%), Root (13.0%), Flower (8.7%) and leafy stem (4.3%).

Table 2. Ethnomedicinal Information on the Use of Myrianthus arboreus by the Ngbaka People

Treated diseases	Parts used	Preparation methods	Route used
Abscesses	Stem bark	Expression	Dermal
Sinusitis	Leafy stem	Maceration	Nasal
Hemorrhoid	Leaf	Expression	Anal
Anaemia	Leaf	Decoction	Oral
Dental caries	Fruit	Decoction	Oral
Headaches	Stem bark	Expression	Nasal
Wound	Stem bark	Expression	Dermal
Eyeaches	Fruit	Decoction	Ocular
Bronchitis	Flower	Maceration	Oral
Amoebic dysentery	Leaf	Mastication	Oral
Vomiting	Leaf	Mastication	Oral
Otitis	Root	Maceration	Auricular
Heart palpitations	Leaf	Mastication	Oral

Lower stomach	Leaf	Decoction	Oral
Macrocephalus	Stem bark	Expression	Dermal
Sickle Cell	Leaf	Maceration	Oral
Breastfeeding	Root	Infusion	Oral
Malaria	Fruit	Decoction	Oral
Back pain	Stem bark	Maceration	Oral
Hernia	Root	Maceration	Oral
Gastritis	Leaf	Mastication	Oral
Menstrual disorder	Flower	Decoction	Oral
Epilepsy	Fruit	Decoction	Oral

c. Diseases Treated

Figure 2 shows the different diseases treated by the Ngbaka people with the use of the medicinal plant *M. arboreus.*

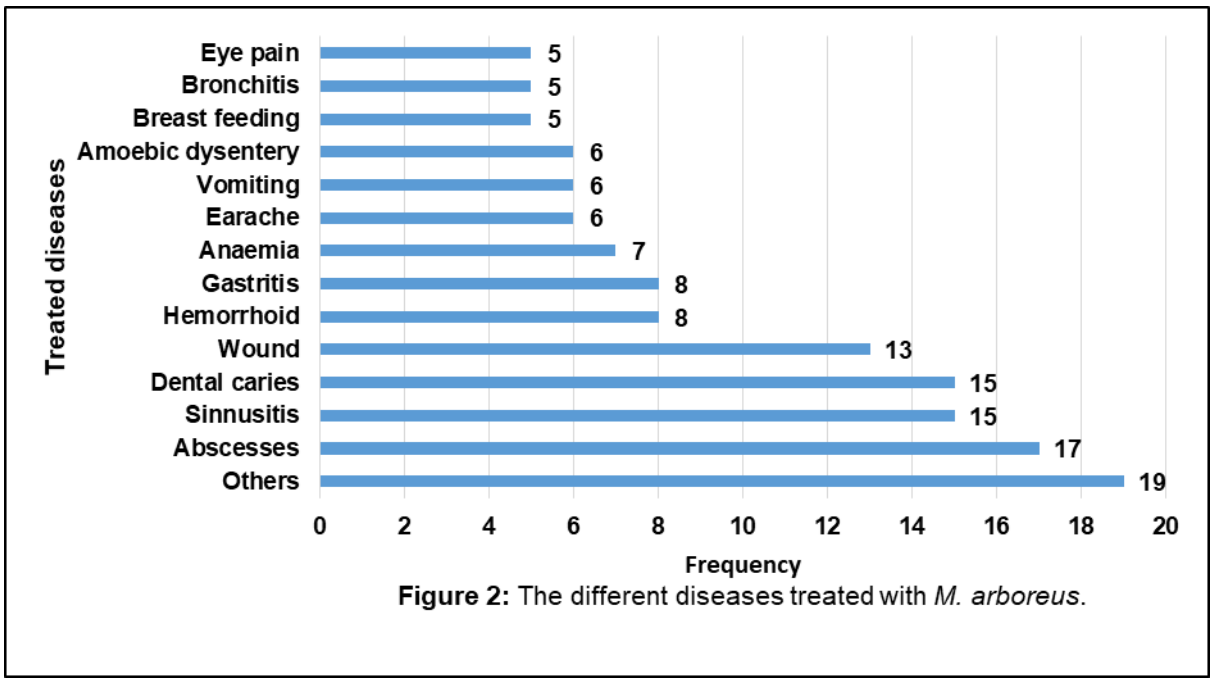

Figure 2: The different diseases treated with *M. arboreus*.

Analysis of Figure 2 reveals that out of a total of 23 illnesses treated by the Ngbaka with the use of *M. arboreus*, abscesses are the most cited (17 citations), followed by sinusitis (15 citations) and tooth decay (15 citations), and wounds with 13 citations. In addition, the other diseases accounting for less than ten citations are: gastritis and haemorrhoids, anaemia, amoebic dysentery, vomiting and earache, eye ache, bronchitis and lactation, lower back pain, headache, macrocephaly, sickle cell anaemia and malaria, lower abdomen, heart palpitations and epilepsy and lastly, hernia and menstrual disorder.

d. Organs Parts Used of Myrianthus arboreus

Figure 3 shows the different organs of *M. arboreus* used in the traditional pharmacopoeia of the Ngbaka people.

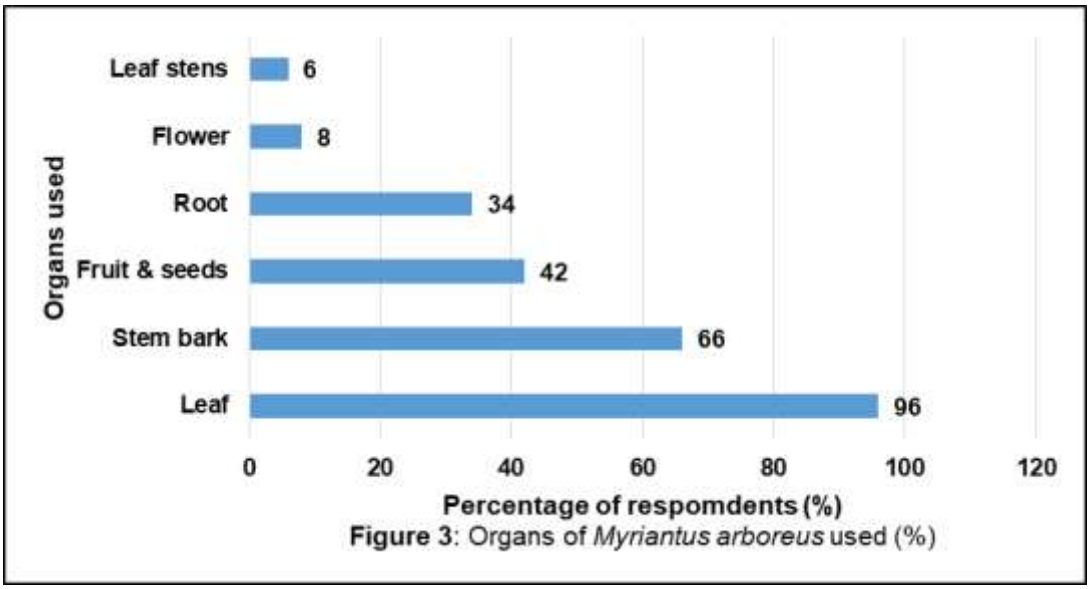

Figure 3: Organs of *Myriantus arboreus* used (%)

Figure 3 shows in descending order the seven organs of *M. arboreus* used as drugs by the Ngbaka people: leaf (96%), stem bark (66%), fruit (seed) (42%), root (34%), flower (8%), leafy stem (6%) and sap (4%).

e. Methods of Preparation

Figure 4 shows the different ways in which the Ngbaka people prepare medicinal recipes using *M. arboreus* organs.

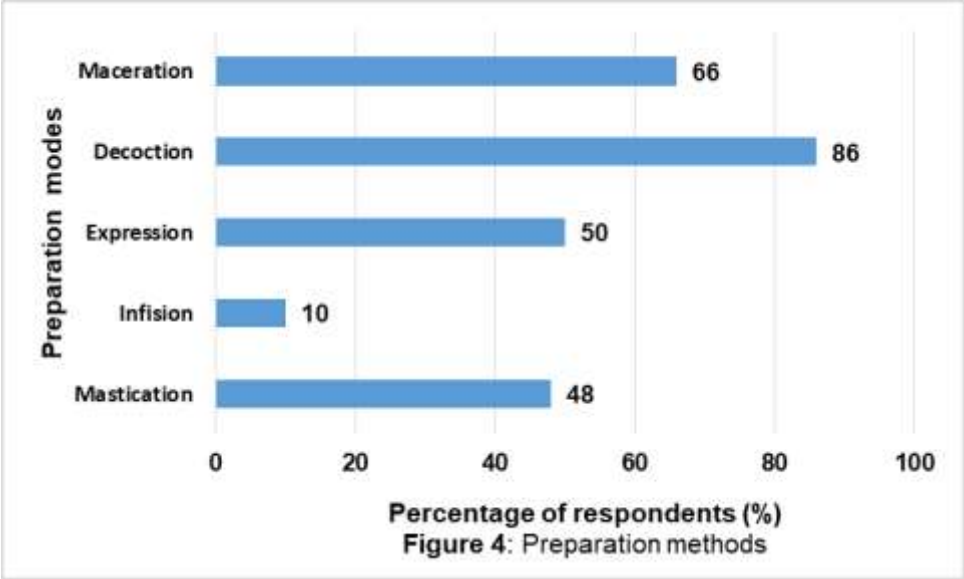

Figure 4: Preparation methods

Figure 4 shows that the Ngbaka people use several modes of administration of *M. arboreus* preventive drugs, which are decoction (86%), maceration (66%), expression (50%), mastication (48%), and infusion (10%). This percentage shows that the maceration and decoction are the most common processes.

f. Modes of Administration

Figure 5 shows the different routes of drug administration from *M. arboreus*.

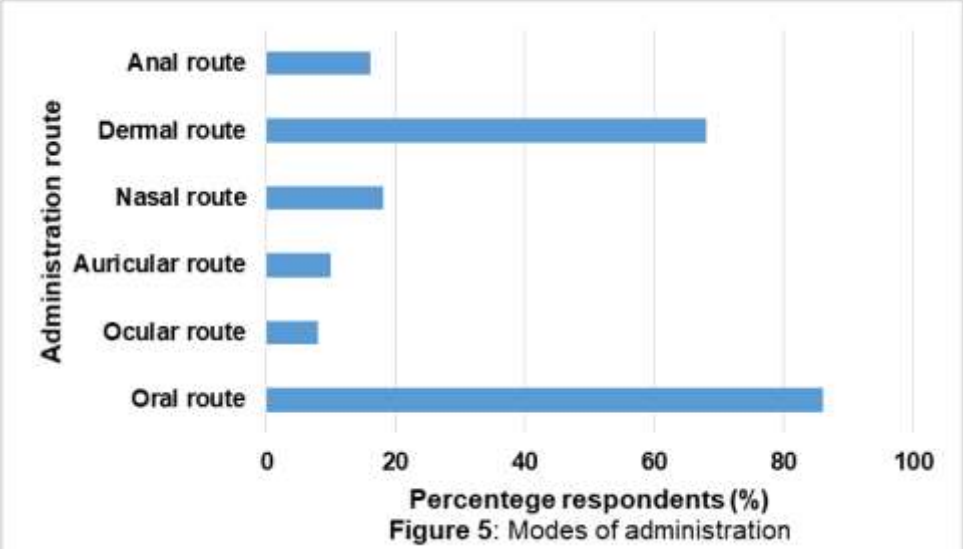

Figure 5: Modes of administration

Figure 5 shows that oral route (86%) is the most used in the administration of phytomedicine by Ngbaka group, followed respectively by the cutaneous route (68%), nasal route (18%), anal route (16%), auricular route (10%) and ocular route (8%).

3.2 Discussion

Myrianthus arboreus is a dioecious tree reaching 15 m in height. Its leaves are composed digitate, with 5 to 7 leaflets. It is a secondary forest species, located in waterholes. It is widespread from Sierra Leone to Angola. In the west of the DRC, this plant species has several medical uses. Indeed, the decoction of the fruits is used as a gargle against tooth decay; the decoction of the trunk bark is used in a steam bath to treat paralysis. The leaf decoction is used as a steam bath to treat epilepsy, while the leaf macerate combined with ember treats gastritis (Konda et al. 2015). The results of the present survey indicated that only tooth decay is cited by our respondents. *M. arboreus* is rich in secondary metabolites. Indeed, Awodi et al. (2017) reported that, the leaf extract contain various phytochemicals like saponins (2.05±0.02mg/g), flavonoids (0.33 ± 0.02mg/g), alkaloids (0.02±0.00mg/g), tannins (5.32 ± 0.01mg/g), total phenol (11.02 ± 1.00mg/g) and glycosides (0.48 ± 0.00mg/g).

As a member of the family Cecropiaceae, *M. arboreus* contain oleanane- and ursane-type pentacyclic triterpenes including myriaboric acid, ursolic acid, euscaphic acid, tormentic acid, myrianthic acid, myrianthic acid, myrianthinic acid, arjulonic acid, arboreic acid, and their derivatives notably in the leaves, stem bark, and trunk wood. Also, peptide alkaloids such as myrianthines A, B, and C and phytosterols such as β-sitosterol and β-sitosterol-3-O-β-D -glucopyranoside are present in the leaves (Kasangana et al. 2018). The richness of this plant in various chemical compounds justifies its use in Traditional Medicine. According to the used parts, the results of the present research corroborate those of Tahri et al. (2012) who reported that leafy branches are the most used parts in the preparation of recipes. The large-scale use of roots is a practice that could contribute to the erosion of these plant genetic resources. The tropical plant *Myrianthus arboreus* constitute a bio-resource for the management of common diseases for future generations. To this end, he needs to be integrated into sustainable management to validate and improve the quality and efficacy of its pharmacological properties (Masengo et al 2021a, b; Masengo et al 2022). It has been reported by several authors that the local population considers decoction to be an adequate

mode for warming the body and disinfecting the plant (Ngbolua et al. 2016; Mongeke et al 2018). Also, the decoction allows collecting the most active principles and attenuates or even cancels the toxic effect of certain recipes (Salhi et al., 2010). The results of this study corroborate the research conducted by Gnagne et al. (2017). In contrast to the results obtained in this work, Lautenschläger et *al.* (2018) in their study on first large-scale ethnobotanical survey in the province of Uíge, northern Angola reported that *M. arboreus* leaves are used in the treatment of yellow fever. In Nord Ubangi eco-region, this plant species is used to treat monkeypox virus disease (Djolu et. 2021).

IV. Conclusion

The aim of the present study was to conduct an ethnobotanical survey on M. arboreus, a plant used in Traditional Medicine by the Ngbaka tribe.

The results obtained in this study show that:

- The leaf is the most used part (96.0%) followed respectively by the bark (66%), the fruit (seed) (42%), the root (34%), the flower (8%) and the leafy stem (6%).
- Decoction is predominant (86%) among the five methods of preparation used and the oral route (86%) is the most widely used for drug administration.
- 23 diseases were recorded among the Ngbaka of South Ubangi using M. arboreus as a medicinal plant;
- Among the diseases listed, abscess is the most cited, followed by sinusitis and tooth decay respectively.

A subsequent pharmacological study will assess the therapeutic efficacy and safety of this plant in the management of common diseases in order to formulate improved traditional medicines.

The present study has shown that, in the absence of modern pharmaceuticals which are often very expensive, less affluent people can obtain inexpensive medicines from the wild. Nevertheless, excessive exploitation of plant parts such as leaves and root or stem barks could threaten the rapid extinction of this species, which may become very rare in the wild. Participatory domestication of the commonly used medicinal species in home gardens and rational exploitation of natural resources are indispensable. To this end, a good policy to promote the safe and effective use of traditional medicine should include regulation, research, education and the integration of traditional knowledge into modern health care systems.

References

Adjanohoun, E. (1993). Tropical forests and African pharmacopoeia, Forêt Trop. Afr., pp. 331–342.

Annual Report (2013). Southern District-Ubangi, Democratic Republic of Congo.

Annual Report (2016). Civil Registry of the Mbari Sector, Democratic Republic of Congo.

Awodi, P.I.o, Abbah, C.O., Ejembi, D.O. (2017). Phytochemical Constituents and Antioxidant Properties of Aqueous Leaf Extract of Myrianthus arboreus. International Journal of Biomedical Science and Engineering 5(1), 9-13. doi: https://doi.org/10.1021/acs.jnatprod.8b00079.

Dhetchuvi, J., Lejoly, M.M. (1990). Contribution to the knowledge of medicinal plants of Northeastern Zaïre. Inst. Allg. Bot., Hambg. 23b, 991–1006.

Djolu, R. D., Ashande, C. M., Ngbolua, K.N., Monizi, M., Bekomo, J. I., Tshibangu, D. S.-T., Tshilanda, D. D., Mpiana, P. T., & Virima, M. (2021). Ethnobotanical Study and Vulnerability of Uvariodendron molundense (Annonaceae) in Gbado-Lite City (Ubangi

Eco-region), Democratic Republic of the Congo. Journal of Botanical Research, 3(3). https://doi.org/10.30564/jbr.v3i3.3387.

Djolu , R.D., Ngbolua , K.N. , Masengo , C.A. , Falanga , C.M. , Kumbali , G.N. , Nagahuedi, J.M.S. Survey on Monkeypox virus circulation at the wild animal-human interface in Ubangi Ecoregion (Democratic Republic of the Congo) : The case study of Businga Territory. In : Research Trend in Virology, Vol I (SLDV Ramana Murty Kadali Ed.), Akinik Publication, New Delhi, pp : 83-95, 2021. ISBN: 9789391538156. Book DOI: https://doi.org/ed.book.1324.

Fruth, B., Mato, B., Lukoki, F., Lejoly, J., Muganza, M. (2011). Care for Health and Body: An Ethnobotanical Approach to Nkundo Plant Use (Cuvette Centrale, DRC) with focus on the Significance of Indigenous Knowledge for the Human Skin. Curare 34, 4, 263–284.

Gnagne, S.T., Camara, D., N'Guessan, B-Y.F., Bene, K., Zirihi, N.G. (2017). Ethnobotanical study of medicinal plants used in the treatment of diabetes in the Department of Zouénoula (Côte d'Ivoire). Journal of Applied Biosciences 113, 11257-11266.

Inkoto, L.C, Bongo, N.G., Kapepula, M.P., Masengo, A.C., Gbolo, ZB, Tshiama, C. et al. 2018. Microscopic features and chromatographic fingerprints of selected Congolese medicinal plants: Aframomum alboviolaceum (Ridley) K. Schum, Annona senegalensis Pers. and Mondia whitei (Hook.f.) Skeels. Emergent Life Sciences Research; 4 (1), 1-10.

Ipona, E.N., Inkoto, CL., Bongo, G.N., Mulenga, C.M., Ilinga, BL., Shetonde, OS. et al. 2019. Ethno-Botanical Survey and Ecological Study of Medicinal Plants Traditionally Used Against Erectile Dysfunction in Democratic Republic of the Congo; Bioscience and Bioengineering; 4(4), 85-91.

Kambu, K. (1988). African Traditional Medicine, CRP, Kinshasa, 105p.

Kasangana, P.B., Haddad, P.S., Hoda, M. E., Abir, N., Tatjana, S. (2018). Bioactive Pentacyclic Triterpenes from the Root Bark Extract of Myrianthus arboreus, a Species Used Traditionally to Treat Type-2 Diabetes. Natural Products 81(10), 2169–2176. Doi: https://doi.org/10.1021/acs.jnatprod.8b00079.

Kitadi, J. M., Inkoto, C. L., Lengbiye, E. M., Tshibangu, D. S. T., Tshilanda, D. D., Ngbolua, K.N., Taba, M., Mbala, B. M., Schmitz, B., Burubu, J. L., & Mpiana, P. T. (2021). Mineral Composition of Medicinal Plants Traditionally Used in the Management of Sickle Cell Disease in the Kwilu Province (Congo-Kinshasa). Sumerianz Journal of Biotechnology, 41. https://doi.org/10.47752/sjb.41.16.21.

Kitadi, J. M., Mazasa, P. P., Tshibangu, D. S. T., Kasali, F. M., Tshilanda, D. D., Ngbolua, K.N., & Mpiana, P. T. (2020). Ethnopharmacological survey and antisickling activity of plants used in the management of sickle cell disease in Kikwit City, DR Congo. Evidence-Based Complementary and Alternative Medicine, 2020. https://doi.org/10.1155/2020/1346493.

Konda, K., Bavukinina, N. M., Mbembe, B. R., Dumu, L., Mandanga, K. K., Kelela B., Itufa Y., (2015). Traditional Medicinal Plants of the Democratic Republic of Congo - Preliminary Data, IRSS: Kinshasa.

Kpula, N. M., Ngbolua, K.N., Assi, R. L., Nzamonga, A. G., Andia, P. L., & Masengo, C. A. (2021). Pratique de l'agriculture traditionnelle sur brûlis dans la commune de Molegbe en République Démocratique du Congo. www.agrimaroc.org.

Lautenschläger, T., Monizi, M., Pedro, M., Mandombe, J. L., Futuro Bránquima, M., Heinze,C., Neinhuis, C. (2018). First large-scale ethnobotanical survey in the province of Uíge, northern Angola. Journal of Ethnobiology and Ethnomedicine. Journal of Ethnobiology Ethnomedicine 14, 51.

Lubini, A. (1990). Plants used in traditional medicine by the Yansi of Kwilu-Kamtsha (Zaire). Mitt. Inst. Allg. Bot., Hambg. 23b, 1007–1020.

Magbukudua, J. P. M., Masengo, C. A., Djoza, R. D., Ndaba, M. M., Elumba, K., & Ngbolua, K. N. (2022). Impact de revenu agricole sur le développement de l'agriculture paysanne dans le Secteur de Bosobolo (Nord-Ubangi) en RDC. In Rev. Mar. Sci. Agron. Vét (Vol. 10, Issue 1). www.agrimaroc.org.

Masengo, C. A., Djolu, R. D., Ngbolua, K. N., Nagahuedi, J. M. S., Ilumbe, B. I., & Mpiana, P. T. (2022). Étude ethnobotanique et vulnérabilité de Vitex doniana Sweet (Lamiaceae) dans la forêt péri-urbaine de Gbado-Lite, RDC. In Rev. Mar. Sci. Agron. Vét (Vol. 10, Issue 1). www.agrimaroc.org.

Masengo, C.A., Bongo, G. N., Robijaona, B., Ilumbe, G. B., Ngbolua, K.N., & Mpiana, P. T. (2021a). Étude ethnobotanique quantitative et valeur socioculturelle de Lippia multiflora Moldenke (Verbenaceae) à Kinshasa, République Démocratique du Congo. In Rev. Mar. Sci. Agron. Vét (Vol. 9, Issue 1). www.agrimaroc.org.

Masengo, C.A., Inkoto, C. L., Munsebi, J. M., Mandjo, B. L., Mpiana, P. T., & Ngbolua, K. N. (2021b). Connaissance et usages de Quassia africana (Simaroubaceae) par les peuples Mongo, Yaka et Yombe de Kinshasa en République Démocratique du Congo. In Rev. Mar. Sci. Agron. Vét (Vol. 9, Issue 4). www.agrimaroc.org.

Mawunu, M., Makuntima, P., Masidivinga, L., Lautenschläger, T., Luyindula, N., Ngbolua, K. N., & Lukoki, L. (2020). First Survey on the Edible Non-Wood Forest Products Sold in Uíge Province, Northern Angola. European Journal of Agriculture and Food Sciences, 2(6). https://doi.org/10.24018/ejfood.2020.2.6.135.

Mongeke, M.M, Ngbolua, K.N., Bakola, R.D., Inkoto, C.L., Elikandani, P.N., Mowuli, C.Y. (2018). Enquête sur les plantes utilisées en Médicine Traditionnelle par les Bambenga: Pygmées du Secteur de Dongo (Territoire de Kungu, Province du Sud-Ubangi) en République démocratique du Congo. Revue Marocaine des Sciences Agronomiques et Vétérinaires 6(4), 469-475.

Ngbolua, K. N., Molongo, M. M., Libwa, M. T. B., Amogu, J. J. D., Kutshi, N. N., & Masengo, C. A. (2021). Enquête ethnobotanique sur les plantes sauvages alimentaires dans le Territoire de Mobayi-Mbongo (Nord-Ubangi) en République Démocratique du Congo. In Rev. Mar. Sci. Agron. Vét (Vol. 9, Issue 2). www.agrimaroc.org.

Ngbolua, K.N, Inkoto, C., Mongo, N., Ashande, M. C., Masens, Y., & Mpiana, P. T. (2019). Étude ethnobotanique et floristique de quelques plantes médicinales commercialisées à Kinshasa, République Démocratique du Congo. Revue Marocaine Des Sciences Agronomiques et Vétérinaires, 7(1).

Ngbolua, K.N., Mandjo, B.L., Munsebi, J.M., Masengo, C.A., Lengbiye, E.M., Asamboa, L.S. et al., 2016. Ethnobotanical and ecological studies of plants used in traditional medicine in the Lukunga District of Kinshasa (DR Congo). International Journal of Innovation and Scientific Research 26, 612-633.

Penge, O. (1991). Role and importance of African rainforest conservation. UNESCO, p. 8.

Salhi, S., Fadli, M., Zidane, L., Douira, A. (2010). Floristic and ethnobotanical studies of the medicinal plants of the city of Kenitra (Morocco). Lazaroa 31, 133-146.

Tabuti, J.R.S., Lye, K.A. & Dhillion, S.S. (2003). Traditional herbal drugs of Bulamogi, Uganda: plants, use and administration. J. Ethnopharmacology 88, 19-44.

Tahri, N., El Basti, A., Zidane, L., Rochdi, A., Douira, A. (2012). Ethnobotanical Study of Medicinal Plants in the Province of Settat (Morocco). Journal of Forestry Faculty 12(2), 192-208.

UNEP-WCMC (2016). The State of Biodiversity in Africa: A mid-term review of progress towards the Aichi Targets. UNEP-WCMC, Cambridge, UK. 112p.