



Ethnobotanical Survey of Aromatic Plants of Masako Forest Reserve (Kisangani, DR CONGO)

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ABSTRACT

An ethnobotanical survey was conducted in Masako forest reserve, at Kisangani city located in the north-east of DR Congo in order to collect, identify and determine botanical parameters of aromatic plants. Forty three aromatic plants species corresponding to eleven families and twenty nine genera were identified. They are mainly woody plants and all of them are spontaneous. The majority of these plants are trees (77%) found in the forest. Meliaceae is the most represented family (35%). Mesophanerophytes (54%) is the principal biological type and the Centro Guinean species are the most represented (56%). Twenty two plants are used as medicines among which *Citrus medica*, *Afrostryrax kamerunensis*, *Scorodophloeus zenkeri*, *Hua gaboni*, *Afrostryrax lepidophyllum* are the most cited. Decoction is the most used mode in therapeutic and leaves are the most used part.

Keyword: Ethnobotanical survey, aromatic plants, Masako, DR Congo.

INTRODUCTION

Aromatic plants are known for their pleasant, characteristic fragrant smell. The fragrance of these plants is due to their content of essential oil. Essential oils (EO) are complex natural mixtures of volatile secondary metabolites mainly mono and sesquiterpenes including carbohydrates, phenols, alcohols, ethers, aldehydes and ketones. They are produced by aromatic plants for their own needs and are either considered as protectants or attractants. EO are not only responsible of the pleasant odor of aromatic plants but also of the biological activity of some aromatic and medicinal plants [1-6].

In fact, for centuries, essential oils are widely used for their antiparasitical, virucidal, bactericidal, fungicidal, insecticidal ... properties as medicinal and cosmetic applications. Due to these properties, spices and herbs have been added to food, not only as flavouring agents but also as preservatives. Nowadays, most of them are used as flavours in the food and beverage industry, as well as in perfumery. Several works demonstrate their pharmacological effects, such as antioxidant, antiinflammatory, cytotoxic and their biological effect against bacteria, fungi, viruses, protozoa, insects etc.[2,4, 5-9]. So they are intensively used in cosmetic, sanitary, pharmaceutical, agricultural and food industries as antimicrobial, analgesic, sedative, anti-inflammatory, spasmolytic, locally anesthetic remedies and for preservation of foods [4,5,7,10].

The many uses of aromatic plants justify their increasing demand in global markets. Since, the use of botanical raw material is in many cases much cheaper than using alternative

chemical substances and on about 800.000 known vegetable species, only 10 percent can synthesize EO [6,10,11-13]. So it is important to identify other sources of these important secondary metabolites.

This work is a first step in a large program of identification of new source of essential oil in Democratic Republic of the Congo (DRC). Indeed, DRC is reputed for the extraordinary richness of its biodiversity. In DRC, the forests cover approximately 62% of the national territory and this is the second largest block of tropical forest in the world. This country is located at the heart of Africa's forest massif and harbors approximately half of the continent's rainforests [13-23] and Masako is a protected forest area near the equator line [24,25].

MATERIALS AND METHODS

Study area

The ethnobotanical investigations were conducted in Masako forest reserve, 14 kilometers near Kisangani city, the main town of the Oriental province in the north-east of DRC. Kisangani is the most important town of DR Congo located near the equatorial line. Masako reserve lies at around 500 meters above sea level. It's located between 0° 1' 36" North and 25° 1' 13" East with an area of 2105 hectares (Fig.1). Masako biosphere reserve hosts a large variety of wildlife species and have a forest vegetation with a hot equatorial climate [24,25]. Swahili and lingala are spoken languages and the major ethnic group at Masako is Kumu.

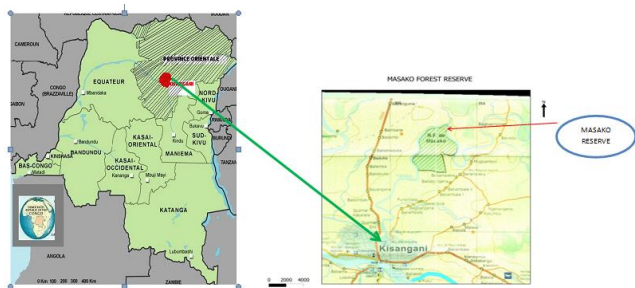


Fig. 1: Localization of Masako Forest reserve

Ethnobotanical survey.

An ethnobotanical survey was conducted for eight months from December 2012 to August 2013 in villages settled in the periphery of Masako reserve. The survey aimed to identify aromatic plants known by local people. The household was considered as the sample unit. Forty one households were identified and interviewed on a voluntary basis.

The data checklist for ethnobotanical field work focuses on the following elements:

The vernacular names for aromatic plants, frequency of citation, the possible use (medicinal, alimentary ...) and the used organ.

The identification of the collected plants was carried out by comparison with different vouchers referenced at the herbarium of the Faculty of Sciences (University of Kisangani). Vouchers specimens are on deposit at the same herbarium.

RESULTS AND DISCUSSION

The ethnobotanical survey led to the identification of 43 plant species representing 11 families and 29 genera which belong to the taxonomic group of Magnoliophyta.

These plants are arranged in alphabetical order of families and listed in table 1 and 2.

The following details were recorded [26-29]:

(a) The source of plant name in List of Plant site: WCSP (World Checklist of Selected Plant Families); Tropicos (TRO); The International Legume Database and Information Service (ILDIS); The iPlants project (iPlants).

b) The morphological types inventoried are Tree (T) and Shrub (Sh);

c) The following biological types have been recorded: Microphanerophytes (McpH) ; Nanophanerophytes (Nph); Mesophanerophytes (Msph) and Megaphanerophytes (MgpH)

d) Habitat types are distributed as following: Forest (Fo); Secondary forest (FoS); Ruderal(Rud) and Fallow (Fal)

e) Phytogeographic types have been recorded as following: Pantropical(Pantr); Afrotropical(Afro-t); Asia tropical (As-t); Guinean(Guin); Centroguinean(CG); Centroguinean Congolese(CGC); Afro American(A-m) and Congolese Forest (FC)

f) Vernacular name and the frequency of citation

g) The possible use: treated disease; used part; preparation mode.

Table 1. Ecological characteristics of aromatic plants in Masako reserve

Families	Plants species	Source	Morphological type	Biological type	Habitat type	Phytogeographic distribution
Annonaceae	Anonidium mannii (OLIVER) ENGLER & DIELS	WCSP	T	McpH	Fo	CGC
	Cananga odorata (LAM.)HOOKER f.& THOMS	WCSP	T	Msph	Rud	As-t
	Enantia lebrunii ROBYNS & GHESQ	WCSP	T	Msph	Fo	FC
	Hexalobus crispiflorus A. RICH	WCSP	T	MgpH	Fo	Guin
	Isolona congolona (DE WILD. &TH.DUR) ENGLER & DIELS	WCSP	T	Msph	Fo	CGC
	Monodora angolensis WELW.	WCSP	T	Msph	Fo	GC
	Xylopia aethiopica (DUNAL) A.RICH	WCSP	T	MgpH	FoS	Afro-t
Bignoniaceae	Fernandoa adolfi - friderici (GILG & MILDBR.) HEINE	TRO	T	Msph	Fo	CG
	Kigelia africana (LAM.) BENTHAM	iPlants	Sh	Msph	FoS	Afro-t
Burseraceae	Canarium schweinfurthii ENGLER	WCSP	T	MgpH	FoS	CG
	Santiria trimera (OLIV.) AUBREV.	WCSP	T	Msph	Fo	FC
Clusiaceae	Symphonia globulifera L. f.	WCSP	T	MgpH	Fal	A-m
Euphorbiaceae	Tetrorchidium didymostemon (BAILLON) PAX & HOFFM	WCSP	Sh	Msph	Fo	CG
Fabaceae	Erythrina stricta ROXB	ILDIS	Sh	McpH	Fal	CG
	Erythrina droogmasiana DE WILD. & TH. DUR	ILDIS	T	Msph	Fal	Afro-t

	<i>Millettia dubia</i> DE WILD	ILDIS	Sh	Msph	FoS	FC
	<i>Millettia versicolor</i> WELW. Ex BAKER	ILDIS	T	Msph	FoS	CG
	<i>Millettia drastica</i> WELW. Ex BAKER	ILDIS	Sh	Msph	FoS	CG
	<i>Pericopsis elata</i> (HARMS) VAN MEEUWEN	ILDIS	T	Mgph	Fo	FC
	<i>Scorodophloeus zenkeri</i> HARMS	ILDIS	T	Mgph	Fo	CG
Huaceae	<i>Afrostryax kamerunensis</i> PERKINS & GILG	WCSP	T	Msph	Fo	CG
	<i>Afrostryax lepidophyllum</i> MILDBR	WCSP	T	Msph	Fo	CG
	<i>Hua gaboni</i> PIERRE ex DE WILD	WCSP	Sh	Msph	Fo	CG
Irvingiaceae	<i>Irvingia smithii</i> HOOKER f.	WCSP	T	Mgph	Fo	CG
	<i>Irvingia wombulu</i> VERMOESEN	WCSP	T	Mgph	Fo	CG
Meliaceae	<i>Guarea glomerulata</i> HARMS	WCSP	T	Mgph	Fo	CG
	<i>Guarea thompsonii</i> SPRAGUE & HUTCH	WCSP	T	Mgph	Fo	Guin
	<i>Guarea cedrata</i> (A. CHEV.) PELLEGR	WCSP	T	Mgph	Fo	Guin
	<i>Guarea laurentii</i> DE WILD	WCSP	T	Mgph	Fo	CG
	<i>Heckeldora staudtii</i> (HARMS) STANER	WCSP	Sh	Mcph	Fo	CG
	<i>Lovoa trichilioides</i> HARMS	WCSP	T	Mgph	Fo	CG
	<i>Trichilia retusa</i> OLIVER	WCSP	Sh	Msph	Fo	CG
	<i>Trichilia gilgiana</i> HARMS	TRO	T	Msph	FoS	CG
	<i>Trichilia gillettii</i> DE WILD	WCSP	T	Msph	FoS	CG
	<i>Trichilia priureana</i> JUSS.	TRO	T	Msph	Fo	CG
	<i>Trichilia rubescens</i> OLIVER	WCSP	T	Msph	Fo	CG
	<i>Trichilia tessmannii</i> HARMS	WCSP	T	Msph	FoS	Guin
	<i>Trichilia wewitschii</i> C. DC.	WCSP	T	Msph	FoS	CG
	<i>Turraea laurentii</i> DE WILD	WCSP	T	Msph	Fo	CG
	<i>Turraeanthus africanus</i> (WELW.) PELLEGER	TRO	T	Mcph	Fo	Guin
Rutaceae	<i>Citropsis gabunensis</i> (ENGLER) SWINGLE & KELLERMAN	WCSP	Sh	Mcph	FoS	CG
	<i>Citrus medica</i> L.	WCSP	T	Mcph	Rud	Pantr
Verbenaceae	<i>Lantana camara</i> L.	WCSP	Sh	Nph	Fal	Pantr

WCSP: World Checklist of Selected Plant Families. TRO: Tropicos. ILDIS: The International Legume Database and Information Service iPlants : The iPlants project. T: Tree ; Sh: Shrub ; Rud: Ruderal ; Fo : Forest ; FoS: Secondary forest ; Fal: Fallow Mcph: Microphanerophytes ;Nph : Nanophanerophytes ; Msph : Mesophanerophytes ; Mgph: Megaphanerophytes Pantr: Panropical ; Afro-t : Afrotropical; As-t : Tropical Asia; Guin : Guinean ; CG: Centroguinean ; CGC: Centroguinean Congolese; A-m: Afro American; FC: Congolese Forest

Table 2 Ethnobotanical data on aromatic plants of Masako reserve

Families	Plant species	Vernacular name (language)	Use	Treated diseases	Used part	Preparation mode	Frequency
Annonaceae	<i>Anonidium mannii</i> (OLIVER) ENGLER & DIELS	mbombi (kikumu, kirega)	A / T	dermatosis	bark	infusion	50a 15b
	<i>Cananga odorata</i> (LAM.)HOOKER f.& THOMS	ilangi langi (lingala)	L	-			65a 85 b
	<i>Enantia lebrunii</i> ROBYNS & GHESQ	mayojaune (lingala)	L	-			12a 5 b
	<i>Hexalobus crispiflorus</i> A. RICH	mbulandombe (kikumu)	T	anemia	leaves	decoction	35a 12 b
	<i>Isolona congolona</i> (DE WILD. &TH.DUR) ENGLER & DIELS	isolona,eka (kibali)	T	anemia	fruits	decoction	10a 45 b
	<i>Monodora angolensis</i> WELW.	wingo,mbeya (kikumu)	T	rheumatism	leaves	decoction	48a 60 b
	<i>Xylopia aethiopica</i> (DUNAL) A.RICH	bosange,ndunga (kikumu ,mongo)	T	fever	leaves	Infusion bath	22a 3 b
Bignoniaceae	<i>Fernandoa adolfi - friderici</i> (GILG & MILDBR.) HEINE	lototo (kikumu)	L	-			6a 25 b
	<i>Kigelia africana</i> (LAM.) BENTHAM	mabele ma nzombo (lingala)	L	-			5a 20 b
Bursaceae	<i>Canarium schweinfurthii</i> ENGLER	kassuku ,mbindi (kiswahili, kikumu)	L / T	Skin infection	paste	massage	45a 50 b
	<i>Santiria trimera</i> (OLIV.) AUBREV.	engungu (turumbu)	T	hypertension	root	crushing	20a 10 b
Clusiaceae	<i>Symphonia globulifera</i> L. f.	ossolo (mituku)	T	hemoroides	bark	decoction	10a 5 b
Euphorbiaceae	<i>Tetrorchidium didymostemon</i> (BAILLON) PAX & HOFFM	bosefo, didi (kilulua)	T	diabetes	leaves	decoction	41a 60 b
Fabaceae	<i>Erythrina stricta</i> ROXB	kifitifiti, karabumba (kibemba, kinyanga)	L	-			48a 6 b
	<i>Erythrina droogmasiana</i> DE WILD. & TH. DUR	kolomasumbu (tshiluba)	A	-			45a 12 b
	<i>Millettia dubia</i> DE WILD	bonkelele (lingala)	L / T	Sexual weaknees	root	crushing	42a 7 b
	<i>Millettia versicolor</i> WELW. Ex BAKER	bosoko, hoto (lingala, kiswahili)	T	Influenza	leaves	Bath infusion	49a 12 b
	<i>Millettia drastica</i> WELW. Ex BAKER	inkene, bussembo, djembi (mongando, kingombe)	-	-	-	-	71a 15 b
	<i>Pericopsis elata</i> (HARMS) VAN MEEUWEN	mogoya (lokele)	L	-	-	--	68a 50 b
	<i>Scorodophloeus zenkeri</i> HARMS	bofili (topoke)	A / T	Amaebiasis	leaves	decoction	94a 75 b
Huaceae	<i>Afrostryax kamerunensis</i> PERKINS & GILG	bofili (kikumu)	A / T	Stomac ake	leaves	decoction	95a 58 b
	<i>Afrostryax lepidophyllum</i> MILDBR	bofili (kikumu)	A / T	Hypertension, Stomac ake	Leaves,b ark	decoction	92a 60 b
	<i>Hua gaboni</i> PIERRE ex DE WILD	lofiongI (turumbu)	T	asthma	root	infusion	93a 70 b
Irvingiaceae	<i>Irvingia smithii</i> HOOKER f.	-	-	-	-	-	ND a 15 b
	<i>Irvingia wombulu</i> VERMOESEN	-	-	-	-	-	ND a 7 b
Meliaceae	<i>Guarea glomerulata</i> HARMS	-	T	anemia	leaves	Infusion bath	48 a 3 b

	<i>Guarea thompsonii</i> SPRAGUE & HUTCH	-	T	cough	bark	decoction	30a 9 b
	<i>Guarea cedrata</i> (A. CHEV.) PELLEGR	-	-	-	-	-	45a 12 b
	<i>Guarea laurentii</i> DE WILD	diambi (kisonge)	L	-	-	-	40a 6 b
	<i>Heckeldora staudtii</i> (HARMS) STANER	-	-	-	-	-	15a 54 b
	<i>Lovoa trichilioides</i> HARMS	dibetu (tshiluba)	L	-	-	-	35a 10 b
	<i>Trichilia retusa</i> OLIVER	-	-	-	-	-	45a 8 b
	<i>Trichilia gilgiana</i> HARMS	-	-	-	-	-	40a 12 b
	<i>Trichilia gilletii</i> DE WILD	-	-	-	-	-	55a 40 b
	<i>Trichilia prieureana</i> JUSS.	bokoko (lokele)	A / T	Urogenital infections	Roots	Infusion bath	50a 25 b
	<i>Trichilia rubescens</i> OLIVER	-	-	-	-	-	40a 50 b
	<i>Trichilia tessmannii</i> HARMS	-	-	-	-	-	40a 68 b
	<i>Trichilia wewitschii</i> C. DC.	soko blanc (swahili)	T	Intestinal worms	Stem bark	decoction	60a 65 b
	<i>Turraea laurentii</i> DE WILD	-	-	-	-	-	54a 23 b
	<i>Turraeanthus africanus</i> (WELW.) PELLEGER	avodire (turumbu)	T	Anaemia	leaves	decoction	14a 35 b
Rutaceae	<i>Citropsis gabunensis</i> (ENGLER) SWINGLE & KELLERMAN	-	A / T	Intestinal worms	Whole plant	decoction	35a 60 b
	<i>Citrus medica</i> L.	ndimu (lingala)	A / T	malaria	leaves	Infusion bath	97a 75 b
Verbenaceae	<i>Lantana camara</i> L.	-	L	-	-	-	35a 15 b

a Frequency of citation by local people

b Frequency of citation in the literature.

A alimentary use

L lidic use

T therapeutic use

Morphological types

Figure 2 shows the weighted morphological types of aromatic plants identified at Masako

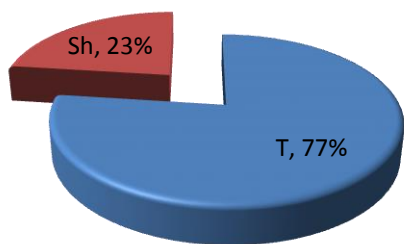


Fig. 2: Weighted morphological types identified. It can be noticed from this figure that trees represent about 77% of species while Shrub represent 23% .

That can be justified by the fact Masako reserve is located in the forest in equatorial line.

Biological types

The analysis of the biological types of the inventoried aromatic plants of Masako reserve (Fig. 3) indicates the predominance of Mesophanerophytes(54%) followed by Megaphanerophytes (30%). Nanophanerophytes are the less represented biological types with only 2% of identified plants.

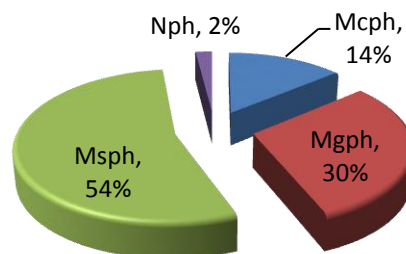


Fig. 3: The morphological types identified

Habitat preference

Figure 4 presents percentage of different habitat types of aromatic plants from Masako forest reserve.

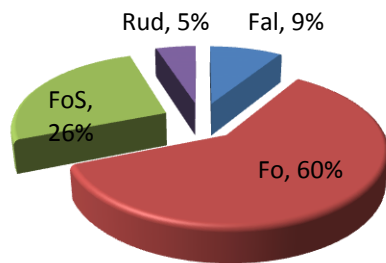


Fig. 4: Habitat types identified

This figure indicates that the most characteristic habitat for identified species is the primary forest (60%) and the secondary forest (26%). Ruderal plants represent only 5% of plants

Phytogeographic Distribution

From phytogeographic distribution of aromatic plant of Masako reserve (Fig. 5), the Centro guinean species are the most represented (56%) followed by the Guinean species (12%). Other species are not largely represented.

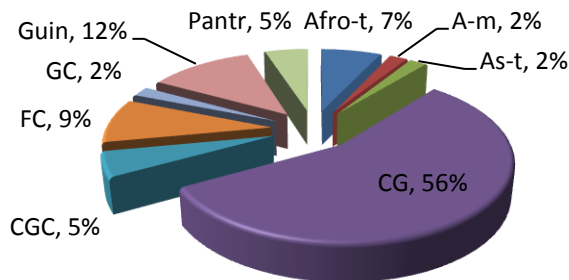


Fig. 5: Weighed phytogeographic distribution identified

Taking into account these ethnobotanical data of plant species, the protection of the habitat as a natural reservoir of aromatic plants should be a common effort at national, sub-regional and regional levels. Indeed, inventoried plant species have large spectrum of distribution in Africa.

Botanical Families Involved in the Study

Forty-three species of plants belonging to eleven different families were collected. Meliaceae family is the most represented with fifteen plant species (35%) followed by Annonaceae and Fabaceae with seven species each (16%); Huaceae have three species (7%); Bignoniaceae, Burseraceae and Irvingiaceae possess two plant species each and the others families are represented by one plant species each (Fig.6).

Floristic analysis and others considerations

From a biological point of view, the 43 collected species are woody plants (phanerophytes), and all of them are spontaneous. The majority of these plants are Trees (77%) found in the forest. That can be explained by

the fact that the vegetation of Masako reserve is consisted of Forest.

On 43 collected aromatic plants, 22 species are used as medicines and others have alimentary or lidic use. Five most cited plants for both therapeutic and alimentary use are: *Citrus medica*, *Afrostryax kamerunensis*, *Scorodophloeus zenkeri*, *Hua gaboni*, *Afrostryax lepidophyllum*.

In fact, the frequency of citation by both traditional healers and literature is an indication that the plant is well known and have a possible therapeutic effect [26-28].

Decoction is the most used mode in therapeutic and leaves are the most used part, this confirms our previous observation for some other plants used in Congolese traditional medicine [26-31].

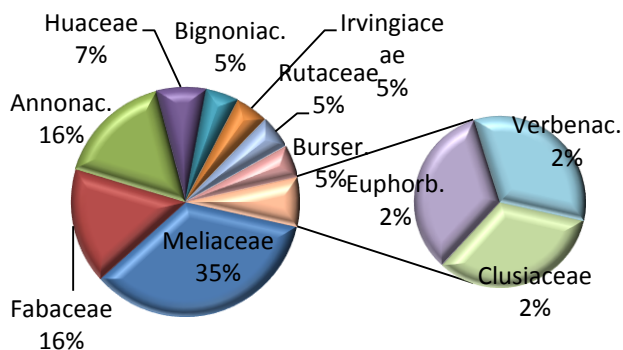


Fig.6 : Distribution of species according to their botanical families.

CONCLUSION

This study lists some aromatic plants found in MASAKO reserve in Kisangani, in North-eastern part of DR Congo. Several of these plants are also used against many diseases by local people and need to be screened in order to identify their physico-chemical and biological properties. So investigations of some of them are in progress and might lead to extraction of essential oil with high biological activity .

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