

## Ethnobotanical, ecological and monographic study of four medicinal plants traditionally used in the treatment of sterility in Kenge City and its surroundings, Democratic Republic of the Congo

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### ABSTRACT

*Objective:* The objective of this study is the ethnobotanical and ecological characterization of the four aphrodisiac plant species used in Congolese traditional medicine, with the aim of their valorisation.

*Methodology and Results:* A survey was carried out in the town of Kenge and the surrounding area (Kwango Province). Sixty-four people or traditional practitioners were interviewed who in-depth knowledge of the medicinal plants had used in traditional medicine as aphrodisiacs. This enabled us to continue research based on the 8 species from the initial results. Four (4) species of different medicinal plants used effectively as aphrodisiacs in the treatment of male infertility. These species are distributed in 3 families: Phyllanthaceae (25 %), Apocynaceae (50 %) and Pentadiplandraceae (25 %). With regard to the level of knowledge of the uses of the plants listed as aphrodisiacs, *Landolphia lanceolata* or Mata (Kikongo) and *Mondia whitei* or la Racine (Français) represent (26.5%) the well-known species, *Pentadiplandra brazzeana* or l'Oubli (Français) (28.1%) the moderately well-known species and *Hymenocardia acida* or Coeur volants (Français) (17.2%) the little-known species. As for intensity of use, which expresses the degree to which it is used in recipes by traditional practitioners, 2 species, *Landolphia lanceolata* (1.88) and *Mondia whitei* (1.73) are widely used; *Pentadiplandra brazzeana* (1) is moderately used and *Hymenocardia acida* (0.5) is little used.

*Conclusion and Results and Applications:* This study classifies selected aphrodisiac plants traditionally used in the above mentioned city into three categories. First, *Landolphia lanceolata* and *Mondia whitei* are the most frequently cited and little used species, as it is found in almost all

grassy savannahs and which is justified by the fact that it is harvested and available a little late in the forest and is very expensive for farmers. Secondly, *Pentadiplandra brazzeana* is the species most frequently cited. Thirdly, *Hymenocardia acida* is the species that is rarely cited or used. Thus, it is desirable to conduct an in-depth study of these plant species using X-ray fluorescence and an *in vivo* study to determine which plant would be more active, and subsequently utilize it as a raw material for formulating an effective phytomedicine.

**Keywords:** Ethnobotany, Ecology, Monograph, Aphrodisiacs and sterility and Democratic Republic of Congo.

## INTRODUCTION

Many plant-based recipes are used in traditional African medicine to treat illnesses and diseases of various origins (Diallo, 2000; Diallo *l.*, 2004). For a long time, medicinal plants have been used to relieve a wide range of illnesses in the form of traditionally prepared dishes or in the form of pure active ingredients. Moreover, have been considered as a variety of plants used in traditional medicine in Cameroon as elsewhere for the treatment of infertility and/or sterility, anomalies of both the male and female reproductive system can persist from its embryonic stage and lead to diminished fertility (Ford WCL *et al.*, 2000). In today's world, when a couple is faced with a conception problem, they call on medical help. This call is justified by the concern of a married couple who are expecting offspring, but who have not yet conceived. In most cases, always the woman is to blame. Among couples who consult the health services for fertility problems, and who have an identifiable cause of infertility, 40% of the causes are linked to male factors, 40% to female factors, and 20% have combined male and female factors (WHO, 2001). Numerous studies on medicinal plants have been carried out in Africa. There are nearly 6,377 plant species in use, of which more than 400 are medicinal plants that account for 80-90% of medical treatment until 2004. It has also been estimated that nearly 75% of the African population still uses plants for food, clothing and healthcare (Arbonnier, 2000; Hmamouchi, 2001; Aké-Ass, 2002). Moreover, this type of treatment is often considered part of alternative or silent

medicine (Kar, 2017). According to the World Health Organisation, more than 80% of the population of Africa, in general, and the DRC in particular, are among the countries that attach great importance to the conservation, use and sustainable management of natural plant resources (Ngokaka *et al.*, 2010), with the majority of their populations resorting to traditional medicine to solve their primary health problems (WHO, 2002). The use of medicinal plants for various health problems is not only a choice, but is also linked to poverty and the high cost of modern medicines (Ngbolua *et al.* 2011a, b). On the other hand, the Democratic Republic of Congo, through almost all of its Provinces, in this case those of Central Kongo and Equateur, is still vast, rich and with varied flora. These entities, like all the others, still have some relatively intact ecosystems, and it is important to think about their protection and rational management, in order to resolve some of their health problems through the therapeutic exploration of their ethno-medical knowledge (Konda *et al.*, 2012). There are very few studies on savannah plant diversity in Kwango Province in general and in the Kenge hinterland town in particular (Mulwele *et al.*, 2016). Chemical studies carried out on aphrodisiac plants show that these plants have no side effects, thanks to their formulas, which are all natural. What's more, most of them contain different kinds of alkaloids and hormones similar to sex hormones, which can alter perception or, on the contrary, increase it and delay ejaculation (El Takir *et al.*, 1999); the same studies prove that many foods have aphrodisiac virtues that

were previously unsuspected, such as celery, asparagus and coriander. These foods are said to contain androsterone and alkaloids that stimulate the concentration of muscles in the perineum and the sexual organs, which is why they are recommended for consumption to increase libido. According to Boukef (1986), an aphrodisiac plant is any plant one part of which contains substances reputed to increase sexual desire, and according to Larousse (2009), an aphrodisiac is any substance, which excites sexual desire. To boost sexual performance, rediscover stronger sexual desires, cure sterility or infertility and have more satisfying sexual relations, many traditional practitioners and healers have strongly advised opting for natural products. With organic products, there is less risk of side effects. What's more, natural aphrodisiacs are cheaper and more practical. Plants play a very important role in the socio-economic balance of populations in developing countries, especially in rural areas (Guigma *et al.*, 2012). In Africa, as in the Democratic Republic of Congo, plants have been used for thousands of years for the many uses and services they provide. Plants are used as food (Ouattara *et al.*, 2016) and medicines (Béné *et al.*, 2016; Mulwele *et al.*, 2016). Finally, plants are used as ornaments (Amani *et al.*, 2019) and to control insects and ticks on animals and field crops (Azokou *et al.*, 2016), as poisons or ichthyological (Ngbolua *et al.*, 2019). Despite numerous ethnobotanical studies carried out in many regions or provinces of the DRC, there is little information on the plants used as aphrodisiacs that could contribute to the treatment of infertility in rural areas. Moreover, with the increase in prices and scarcity and/or unavailability of supply points

## MATERIALS AND METHODS

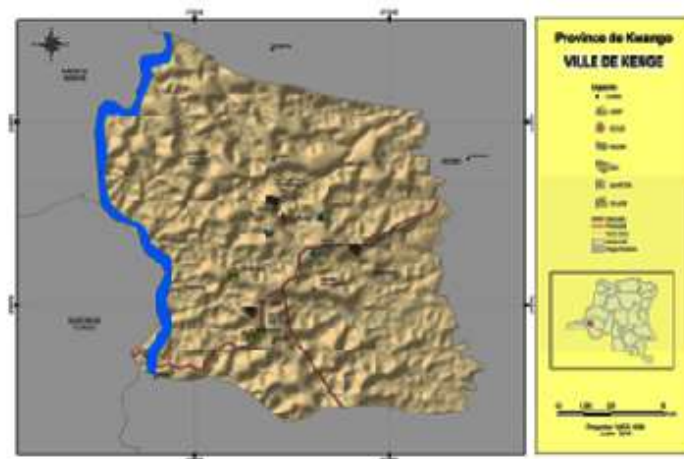
**Study area:** The study took place in the town of Kenge and 26 villages located on the outskirts (around 60 km from the town). The town of Kenge, the capital of Kwango Province, is located in the Kenge territory. It is

for some pharmaceutical products in several areas (Adjhonoum *et al.*, 1989), faced with this situation there is an urgent need to carry out a study on the medicinal aphrodisiac plants used in the treatment of infertility in the said province. So, in order to document this traditional knowledge and provide information on the medicinal species most commonly used, and also to make an inventory of the plants used as aphrodisiacs in the treatment of infertility by the people of the town of Kenge, a second study was added and carried out with a view to seeking out the plant species most commonly used and for which traditional practitioners prefer and recommend their use. Then their administration, which seems to have positive effects on male infertility. Four plant species among others with powerful aphrodisiac properties causing strong erections according to users were selected. According to many users, not having strong erections would also mean sexual impotence, which would lead to sterility or infertility. According to them, their use can remedy erectile insufficiency. These four species (*Hymenocardia acida*, *Landolphia lanceolata*, *Mondia whitei* and *Pentadiplandra brazzeana*) are listed with a view to studying their monographs and estimating their knowledge of uses and intensity of use in order to orient our study in a more precise area. The main objective of the study is to list and provide information on the medicinal plants used in the region and its surroundings. Specifically, the aims are to list the uses of plants used medicinally as aphrodisiacs, to identify all traditional practitioners, to evaluate the most commonly used species and identify their monographs and knowledge of use.

located 275 km from the provincial city of Kinshasa, halfway along National Road No. 1 between the Congolese capital (Kinshasa) and the town of Kikwit, capital of Kwilu Province, 278 km away. Kenge's general climate is

tropical humid (Aw4) according to the Köppen classification, with an average monthly temperature of 24°C during the dry season and 30°C during the rainy season, with abundant rainfall (1500 mm per year). The town of Kenge is located at latitude 04°49'30" South, longitude 17°01'38" East, at an altitude of 558 m. It has an estimated population of 137,880, with a density of 62 inhabitants per km<sup>2</sup>, the majority of who belong to the Pelende, Yaka, Suku, Mbala, Lonzo, Yansi and Tshokwe tribes. It covers an area of 2,230 km<sup>2</sup>. The Kenge soil belongs to the Kalahari system. Its

transport, during the arid periods of the Quaternary, has allowed it to develop on plateaux and slopes (Mulwele *et al.*, 2016). This type of fragile soil, poor in organic matter, easily loses its aggregation and structure and thus remains highly vulnerable to the action of wind and rain erosion, poor texture and composition (Monographie de la Province de Bandundu, 2005). The rivers that drain the town of Kenge I belong to the hydro-geographical basin of the Wamba to the north-west and the Bakali to the east.



**Figure 1:** Geographical localization of survey sites

**Materials:** The material used in this study consisted of aphrodisiac plant species used by local people to treat infertility.

**Methodology:** After the 2015 survey, a second survey based on information gathering was held in the said town and in the twenty-six (26) villages. The ethnobotanical surveys made it possible to obtain information on the aphrodisiac plant species used by local people to treat infertility. In particular, a study on the parts or organs, vernacular names in 'Kikongo, Yaka (Pelende) and Yansi; the importance of use, the monograph (on morphological data, phytochemical, pharmacological and toxicological uses of the most selected species of each plant species used. These ethnobotanical surveys took place from January 2021 to June 2022. It was carried out

using a questionnaire drawn up in advance and aimed at traditional practitioners and/or healers, most of whom were elderly and had knowledge of the use of these medicinal plants in general and aphrodisiacs in particular. Two methods were used. The "door-to-door" method consisted of interviewing traditional healers from household to household, asking respondents to name the species they knew of that they used. This approach is particularly well suited to ethnobotanical studies using spontaneous responses (Thompson *et al.*, 2006). It is based on the principle that the most significant plants used are mentioned by several informants and thus rank highly (Malan, 2008). After the 'door-to-door' stage, the second method was to find out about the plants, their names in local languages, their

uses, the parts used and to carry out comparative studies (Thomas *et al.*, 2009).

**Plants Identification:** Professor B Yang Da Musa Masens of the Biology Department at the University of Kinshasa identified the plants.

**Data processing:** The ethnobotanical data collected was then supplemented with information on ecological types as follows: *Morphological type:* Tree (A), Shrub (Ar), Annual herb (Ha), Perennial herb (Hv), Liana (Li) and Rhizome (Rh);

*Biological type :* Bulbous geophyte (Gbu), Rhizomanteous geophyte (Grh), Tuberos geophyte (Gtu), Mesophanerophyte (Msph), Megaphanerophyte (Mgph), Microphanerophyte (Mcp), Nanophanerophyte (Nph), Lianessant phanerophyte (Phli), Erect therophyte (Thd), Prostrate therophyte;

*Leaf type:* Leptophyll (Lepto), Macrophyll (Macro), Mesophyll (Meso), Microphyll (Micro), Nanophyll (Nano);

*Diaspore type:* Ballochores (Ballo), Pterochores (Ptero), Sarcochores (Sarco), Sclerochores (Sclero);

*Phytogeographic distribution:* Afro-tropical (AT), Cosmopolitan (Cosmo), Guinéo-Congolese (GC), Palaeotropical (Paléo), Pantropical (Pan) and

*Biotope type:* Cultivated (Cult), Primary Forest (FP), Secondary Forest (FS), Savannah (Sa) or Ruderal (Rud).

**Level of knowledge of plant uses:** The level of knowledge of plant uses is reflected in the frequency with which each plant species is cited (Ilumbe *et al.*, 2014; Malan, 2008). This citation frequency is the number of times a plant is cited by a respondent. It is an index based on the consensual use of plants, which makes it possible to estimate the credibility of the information received (Schrauf & Sanchez, 2008). The frequency with which a species is cited (FC) is calculated using the formula of Grangé & Lebar (1993):

$$FC = n / N \times 100$$

Where n is the number of respondents who cited the plant; N is the total number of

respondents interviewed during the survey in a given area. The species are then divided into the following classes (Kouamé *et al.*, 2008):

- The species is said to be well known if the level of knowledge is between 50 and 100%;

- The species is said to be moderately well known if its level of knowledge is between 25% and 50%;

- The species is said to be little known if its level of knowledge is between 0 and 25%.

**Plant usage intensity:** The ethnobotanical use value of a species represents the intensity of use of that species by communities (Tiétiambou *et al.*, 2016). The ethnobotanical use value (EUV<sub>i</sub>) of a species within a use category is represented by its average use score within the use category (Martin, 1995). The application of ethnobotanical methods makes it possible to identify the importance attached to plants by local populations. Their interest lies in the fact that they enable us to determine in a significant way, which species are of great importance to the population. Use values are proving to be a basic tool for selecting species of socio-economic and cultural interest that are subject to strong anthropogenic pressure (Dossou *et al.*, 2012). The ethnobotanical unit use value (VU) was calculated for all plant species and in all categories using the calculation method used by Belem *et al.* (2008). The use value of a given species (k) within a given use category is represented by its average use score within that category. It is calculated by the following formula used by Philips & Gentry (1993):

$$VU(k) = \sum_i S_j / N$$

Where VU (k) is the ethnobotanical use value of species k within a given use category; S<sub>j</sub> is the use score assigned by respondent j; N is the number of respondents for a given use category, so species are divided into three groups:

- A species is said to be very widely used when its use value is between 1.2 and 2;



- A species is said to be moderately used when its use value is between 0.66 and 1.2;

- The species is said to be little used when its usage value is between 0 and 0.66.

**RESULTS**

**Sociodemographic data:** The ethnobotanical survey was carried out among 64 traditional healers, including 30 women (46.87%) and 34 men (53.13%). Of all the people who took part in the survey, 24 (37.50%) are recognised by

the Kwango Provincial Division (DPS/WHO/Kwango, 2017) as using plant-based treatments in the town of Kenge. Table 1 gives the results of the ethnobotanical use values of the eight plants.

**Table 1:** Level of knowledge (FC) and for intensity of use VU (k) values of selected plants

Species	N	N	FC	Sj	N	VU(k)
<i>Canarium Schweinfurthui</i> Engl	64	0	0	0	0	0
<i>Hymenocardia acida</i> Till	64	11	17.2	1	2	0.5
<i>Jatropha curcas</i> L	64	0	0	0	0	0
<i>Landolphia lanceolata</i> K	64	17	26.5	34	18	1.88
<i>Mondia whitei</i> (Hook F)	64	17	26.5	26	15	1.72
<i>Pentadiplandra brazzeana</i> Baill	64	18	28.1	3	3	1
<i>Quassia africana</i> Baill	64	0	0	0	0	0
<i>Zingiber officinale</i> Rose	64	1	1.6	0	0	0

On the basis of ethnobotanical use value, four plants were selected, namely *Hymenocardia acida* Tul, *Landolphia lanceolata* K Schun Pichon, *Mondia whitei* (Hook f) Skeels and *Pentadiplandra brazzeana* Baill.

plants or species listed is based on their systematic classifications, identifications, vernacular names (in Kikongo, Yaka (Pelende) and Yansi), families, parts used; use (ecological character, chemical composition, traditional use and their toxicity).

**Monographic data (ethnobotanical and ecological):** The monograph on these four

**Table 2:** Classification of four species

Species	<i>Hymenocardia acida</i> Tul	<i>Landolphia lanceolata</i> K Schun Pichon	<i>Mondia whitei</i> (Hook f) Skeels	<i>Pentadiplandra brazzeana</i> Baill
<b>Clade</b>	Angiosperms	Angiosperms	Angiosperms	Angiosperms
<b>Clade</b>	Dicots	Dicots	Dicots	Dicots
<b>Clade</b>	Core of Dicotyledons	Core of various dicotyledons	Core of various dicotyledons	Core of various dicotyledons
<b>Clade</b>	Superrosidae	Superasteridae	Superasteridae	Superrosidae
<b>Clade</b>	Rosidae	Asteridae	Asteridae	Superosidae/Malvideae
<b>Ordre</b>	Malpighiales	Gentianales	Gentianales	Brassicales
<b>Family</b>	Phyllanthaceae (Hymenocardia ceae)	Apocynaceae (Konda et al., 2015)	Apocynaceae	Pentadiplandraceae
<b>Gender</b>	<i>Hymenocardia</i>	<i>Landolphia</i>	<i>Mondia</i>	<i>Pentadiplandra</i>
<b>Species :</b>	<i>Hymenocardia acida</i> Tull.	<i>Landolphia lanceolata</i>	<i>Mondia whitei</i> (Hook.f.) Skeels	<i>Pentadiplandra brazzeana</i>

		(K. Schum.) Pichon.		Baill
<b>Vernacular names</b>	Lepiere (Kiyansi), n'heti ou muheti (yaka and Pelende, Mvete, Luhete or mpeti peti (Kikongo), and Mveti (Mbala)	Litonge (Lingala), mata (Kisuku), dundu (Kimbala), Dimbulu or tsetye (Kiyaka), dimbula or mata (Kikongo), mayar (Kiyanzi)	Kimbiolongo or ntubungu (Kikongo) (Kikongo)	Nkengikiasa (Kikongo), Musumi (Kimbala), Nkengekiasi (Kiyanzi)
<b>Distribution ou origin</b>	Tropical Africa Guinea, Mozambique, Senegal, Ethiopia, South Africa, Mozambique	Madagascar, Central Africa	Tropical and sub-tropical Africa (Guinea, Cameroon and South Africa)	Nigeria to the Central African Republic and as far south as the DRC and Angola, tropical Africa, Cameroon).

Source: Michel Botineau, 2010, APG IV (2016).

## Identification or systematics of the species listed

### 1 *Hymenocardia acida*

#### *Ecological characteristics*

- Morphological: Pyrophytic shrub
- Biological type (TB): Mesophanerophyte
- Leaf type (TF): Nanophyll
- Dissemination type (TD): Pterochores
- Chorology or phytogeographic distribution: Afro-tropical (At).
- Biotope: Savannah

Shrub that can reach 2 to 4 m in height. Rhytidome exfoliates into thin lamellae covering a red pulverulent tissue, leaves pedicellate (young shoots and underside of leaves (when very young) punctuated with numerous coloured glandular discs.

- Fruits: very strongly compressed (obcordate and glabrous); indehiscent mono rigid and winged around the edges.
- Leaves: male and female with imbricate pre-flowering (often open), usually apetalous. Elliptical, rounded at both ends, usually pubescent and membranous, with leathery adults becoming hairless and used as goat

food. They are thick, leathery, elliptical-oblong, up to 8.75 cm long and 3.75 cm wide.

- Bark: thick and smooth or flaky, covered with a pink-brown dust when fresh but later turning pale brown or grey.

- Station: Savannah woodland species (Konda *et al.*, 2012; Makumbelo *et al.*, 2018).

**Chemical composition:** Presence of saponins, (hymenocardine), cyclo peptides (root bark), tannins (all parts, but largely in the stem bark), amphiphilic triterpenoids of the lupane type (bark), quinones and reducing sugars. Steroids, flavonoids, pro anthocyanidins, coumarins, triterpenoids (Diallo, 2004), One alkaloid in particular (hymenocardine peptide). They contain neither alkaloids nor heteroids and their latex is used in the manufacture of glue and rubber; presence of alkaloids, flavonoids, saponins, steroids, tannins but absence of anthraquinone and resins (Sofowora, 1993; Evans, 2002; Chibuzo C *et al.*, 2018).

**Biological activity:** The aqueous extracts have shown a number of activities, including antifungal, antimicrobial (antibacterial, anti-amoebic), against *Staphylococcus aureus* and *Bacillus cereus*, parasitic activity and anti-

fertility. These aqueous extracts also have anti-inflammatory and anti-complement properties. In Gabon, biological studies have highlighted its antibacterial and antifungal, antiplasmodial and trypanocidal, and sickle cell anaemia properties (Akendengué *et al.*, 2018; Mpiana *et al.*, 2007). Phytochemical analyses of aqueous extracts of bark and stems in rats have shown levels of parasitaemia, extended lifespan and trypanocidal activity (Arbonnier, 2000).

#### **Use in traditional treatments**

- Part used: leaves, roots, bark and leafy stems  
- Preparation: decoction (Fernandes *et al.*, 1985; ICIPE Annual Regassaa, 2000; Schmidt, 2003b), maceration and infusion.

**Uses:** Anaemia or sickle cell anaemia in Benin and Congo (Adjanohoun *et al.*, 1989; Mpiana *et al.*, 2007) analgesic, febrifuge, antimalarial, anti-infectious (Hoet *et al.*, 2004), digestive diseases (Obame *et al.*, 2007), dysentery and diarrhoea, polymenorrhoea, hepatitis, heart palpitation, smallpox, trypanosomiasis, cough, abdominal pain, epilepsy (Diallo, 2000), haemorrhoids and fever and/or malaria (Vontron-Senecheau *et al.*, 2003), aphrodisiac.

**Toxicological:** The LD50 of aqueous leaf extracts (w/w) in mice showed no clinical signs of toxicity after treatment (Lamidi *et al.*, 2005).

**Other observations:** Leaf juice is used to treat otitis, ophthalmia, headaches (as an ear, eye or nasal instillation), feverish aches and rheumatic pains (as a rub). The plant is also used as a galactogen, aphrodisiac and anti-dysenteric, Burkill (1985-2000).

## **2 Landolphia lanceolata K Schun Pichon**

### **Ecological characteristics**

- Morphological: Shrub  
- Biological type (TB): Therophyte  
- Foliar type (TF): Microphytic  
- Dissemination type (TD): Ballochores

- Chorology or phytogeographic distribution: Pantropical.

- Biotope: Savannah.

Shrubs reaching 25 to 50 cm in height. Their latex is abundant and the single fruits are often edible berries.

- Fruits: bacciform.

- Stems and branches glabrescent.

- Leaves usually opposite or whorled in threes.

- Flowers; yellowish.

- Site: savannah.

**Chemical composition:** Presence of alkaloids, saponins, phenols, triterpenes, flavoid tannins and Vit C, B1 and B2, ferric ions, hydrogen peroxide scavenging activity, It contains neither alkaloids nor heterosides and their latex is used in the manufacture of glue and rubber (Bouquet *et al.*, 1974); presence of alkaloids, flavonoids, saponins, steroids, tannins but absence of reducing sugars, anthraquinones, terpenoids and resins (Sofowora, 1993; Evans, 2002).

### **Use in traditional treatments**

- Parts used: leaves and fruit, and to a lesser extent, fresh roots and bark.

- Stem bark: by calcination of the grating to be used by local application.

- Preparation: chew roots, spray stem bark (Makumbelo *et al.*, 2008; Kone, 2004).

**Uses:** rheumatism, female sterility, diabetes (*Carpodinus lanceolata* in symbiosis with *landolphia lanceolata*). Some species are used as rubber plants in Madagascar (Hseini, 2007).

- The fruits of this species in association with *Anisophyllea quangensis*, *Dracaena nitens* and *Aframomum alboviolaceum* are often used to prepare jams and syrups of good quality (Proceedings of the symposium "management of plant genetic resources in savannah Africa" Bamako, 1997).

**Toxicological:** Used for the accumulation of metals, more specifically aluminium, in the soil (Mawunu *et al.*, 2020; Christin *et al.*, 2022). This species is used as an antivenom and has an ichthyotoxic impact on biodiversity (Koto-te-Nyiwa, 2018).



**Other observations:** The genus *Landolphia*, with 20 species, is a liana of large forests or forest galleries, often very long, with young twisted branches, small whitish or yellowish flowers and fleshy, globular fruits of varying size. This plant is ichthyotoxic (Koto-Te-Nyiwa, 2018), and the trunk bark is used for snake bites (Koto-te-Nyiwa *et al.*, 2021).

### 3 *Mondia whitei* (Hook f) Skeels

#### **Ecological characteristics**

Morphological: Liana

- Biological type (TB): Phanerophyte lianessant

- Leaf type: Macrophyllleophylle

- Type of spread: Ballochores

- Chorology or phytogeographical distribution: Species of the Guineo-Congolese region

- Biotope: Secondary forest

Climbing or creeping species, with thin, hairy stems 3 to 6 m long or a climbing liana.

- Fruits: woody follicles; lanciform.

- Stems: puberulent or glabrescent.

- Leaves: large alternate leaves. Opposite and entire, oblong leaves eaten as heart-shaped vegetables and covered with fine hairs.

- Roots: develop just below the ground and can cover large areas; they are yellow and very fragrant. Brownish, thick and aromatic. Commonly used to treat urinary tract infections.

All parts produce a white latex that treats diarrhoea; some men eat the root bark and drink the liquid extract; (Lampiao, 2008).

Also used as an aphrodisiac with 3 modes of action (increasing libido or sexual desire, potency or effectiveness of erection and sexual pleasure).

- Location: pre-forest areas, fallow land and secondary forests.

**Chemical composition:** Essential oil, glucose, sucrose, proteins, lipids, fibre, copper, phosphorus, sodium, iron, zinc and calcium.

**Biological activity:** Anti-fertility, anti-haemorrhoidal, anti-parasitic, anti-

inflammatory and anti-cancer. The fruit has antioxidant activity.

#### **Use in traditional medicine**

- Part used: roots, leaves are eaten as vegetables, the fleshy bark of the roots is eaten raw or sometimes dried to refresh the mouth as an aphrodisiac and as an aperitif (Mawunu *et al.*, 2022; Mawunu *et al.*, 2020; Konda *et al.*, 2012).

- Preparation: decoction, infusion.

**Uses:** treatment of coughs, sexual asthenia, invigorating, antitoxic, stomach aches, haemorrhoids and constipation. A phytomedicine based on the root in association with kola nut has already been developed in the DRC. In association with several other plants, it has a number of uses: anaemia, gonorrhoea, coughs, dermatitis, vermifuge, epilepsy, rheumatism, hernia, sexual weakness, stomach, haemorrhoids, skin rashes, dermatitis, rheumatism, joint pain, sexual weakness, etc. (Watcho *et al.*, 2004). The leaves and roots are said to have the following properties: Aromatic, bechic and also as an aphrodisiac.

**Other observations:** According to Watcho, P *et al.*, 2001 and Lampiao *et al.*, 2008, the plant is said to have the following properties: sexual stimulant from the roots and the bark of the trunk, pieces of root 5 to 10 cm long are sold in markets which are effective on male sterility but not on erection of the male penis. This plant has not yet been the subject of in-depth scientific investigation.

### 4 *Pentadiplandra brazzeana* Baill

#### **Ecological characteristics**

- Morphological: Shrub

- Biological type (TB): Nanophanerophyte

- Leaf type (TF): Mesophyllophyllous

- Dissemination type (TD): Ballochores

- Chorology or phytogeographic distribution: species of the Guinean-Congolese region

- Biotope: Secondary forest

Monoecious shrub and hairless liana 5 to 20 m high

- Fruits: globose berries that are not edible

- Leaves: alternate simple whole and elliptical, obovate

- Site: Forest galleries and secondary forests.

**Chemical composition:** In the 1990s, a purified protein was isolated, brazein, which is 5 rt 2000 times sweeter than sucrose. From the roots, urea derivatives were isolated, in the presence of carbamates.

**Biological activity:** Anti-bacterial, antifungal, antispasmodic and anti-plasmodium activity. Aqueous extract increases the weight of rat testicles and their testosterone levels.

#### **Used in traditional treatments**

- Parts used: leaves, flowers, seeds, roots and root bark.

- Preparation: decoction of roots, infusion and maceration.

**Uses:** rheumatism, urogenital infections, aphrodisiacs, coughs, diarrhoea, haemorrhoids, malaria, sexual asthenia,

## **DISCUSSION**

The monograph also states that the species listed belong to 3 families (Hymenocardiaceae, Apocynaceae and Pentadiplandraceae) and 4 genera. All the species are aphrodisiacs, but according to the administration the most commonly used is classified in the following order: *Mondia whitei*, *Landolphia lanceolata*, *Pentadiplandra brazzeana* (75%) and *Hymenocardia acida* (25%). The ecological characteristics show that the 4 species of aphrodisiac plants inventoried are of 2 morphological types, the shrub type being the most represented (75.00%) and a single type of liana (25.00%). The biological types of these plants, show 4 different types chacones 25.00% namely: Microphanerophyte, Phéropfiyte, Phanerophytes lianessant and Nanophanerophyte; 2 types of diaspores distributed as follows: ballochiores (75%), and a single pterochores or 25 %. The ecological data reveal 3 types of phytogeographical distribution, of which 50% are Congolese Guinea, and 25% each for Afro-tropical and Pantropical. These results corroborate those of

dysmenorrhoea, mycosis or dermatitis The roots have a distinctive flavour and are used throughout Central Africa for problems such as childbirth and hernia. Infusion of the roots: toothache, rheumatism, haemorrhoids, various skin infections (Kamtchouning *et al.*, 2002). In the DRC, macerated roots are used to treat malaria, while in Cameroon a decoction of the bark is used as an aphrodisiac; the roots also have laxative properties. The fruit is used as a peach poison.

**Toxicological:** Depending on the studies, pharmacological properties need to be explored (Tsompo *et al.*, 1999).

**Other observations:** In central Kongo, this plant is not used for aphrodisiac or sterility studies. There is a phytomedicine based on the roots in symbiosis with the kola nut used as a fortifier and aphrodisiac (Makingangolo in the DRC) (Ministry of Health, 2009).

Mulwele *et al.* (2016), Lubini, (2001), Ngbolua *et al.* (2019). From the point of view of the biotope of the species inventoried, they are classified into 2 types: savannah and secondary forest species (50.00% each). In terms of traditional use, these plants are used to treat a variety of ailments, including headaches, haemorrhoids, stomach upsets, anaemia, malaria, aphrodisiacs, rheumatism and sexual impotence. As for their pharmacological data, our monograph shows that these plant species may be of interest in the treatment of sterility. These results corroborate those of other researchers (Kamtchouning *et al.*, 2002; Guohua, 2009; Hsenie *et al.*, 2007; Kabena *et al.*, 2014). Given that in many cases the uses of medicinal plants have been confirmed by pharmaceutical studies, the screening of these plants cited in the monograph of the species studied, such as: (Lampioa, 2008), states that there is sufficient scientific information to support the use of *Mondia whitei* as an aphrodisiac, and these data indicate that it is capable of increasing

libido by stimulating testosterone and increasing sexual potency, and can also be used as an alternative in vivo drug in the treatment of men affected by asthenosphere. Adakole (1997), shows that the administration of oral extracts of *Hymenocardia acida* did not sufficiently affect the sex cells but did reduce the level of parasitaemia and prolong the life span of the rats, could lead to a better evaluation of the latter and will make it possible to popularise those that are really very useful in the treatment of infertility. With regard to the level of knowledge of the uses of the plants or species identified as aphrodisiacs, of the species identified *Landolphia lanceolata* and *Mondia whitei* represent (52%) the best-known species, *Pentadiplandra brazzeana* (28.1%) the medium-known species and *Hymenocardia acida* (17.2%) the little-known

species. These results are also consistent with those of Makumbelo *et al.* (2008) and Hsenie *et al.* (2007). As for intensity of use, which expresses the degree to which it is used in recipes by traditional healers, it was found that 2 species, namely: *Landolphia lanceolata* (1.88) and *Mondia whitei* (1.73)), are used a lot; *Pentadiplandra brazzeana* (1) is the species used moderately and *Hymenocardia acida* (0.5) is the species used little. This grouping into categories of their monograph, level of knowledge and uses and intensity of use indicate that plants are chosen and used according to the roles each plays, availability, radius or corner of the village (Personal communication, 2022). These results also corroborate those observed in Cameroon (Gormo *et al.*, 2013), Burkina Faso (Boyd *et al.*, 2014), and Côte d'Ivoire (Yao *et al.*, 2020).

## CONCLUSION AND APPLICATION OF RESULTS

This study on ethnobotanical and ecological data, the monograph, the level of knowledge of use and the intensity of use of the plants, is part of the fundamental research into aphrodisiac plants used in the treatment of sterility, with the aim of gaining a better understanding of the Congolese pharmacopoeia (from Kwango Province) and developing and exploiting it sustainably and effectively. It will also show how often people in developing countries such as the DRC and the town of Kenge resort to traditional medicine. In addition, the data from our surveys enabled us to corroborate the results from the literature, as well as the information from traditional practitioners, with a view to orienting the more widely used and less studied species. With regard to the level of knowledge of the uses and intensity of use of the plants, it should be noted that these plants

are represented in 3 categories. Firstly, *Landolphia lanceolata* and *Mondia whitei* are the most frequently cited and little used species, as it is found in almost all grassy savannahs and which is justified by the fact that it is harvested and available a little late in the forest and is very expensive for farmers. Secondly, *Pentadiplandra brazzeana* is the species most frequently cited. Thirdly, *Hymenocardia acida* is the species that is rarely cited or used. The result applications of this study are numerous, including the subsequent formulation of an effective and safe phytomedicine for the management of male infertility; the sustainable management of these genetic resources and the effective implementation of the Convention on Biological Diversity, particularly the ABS (Access and Benefit Sharing) component.

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