



Ethnopharmacological spectrum of plants used in the traditional treatment of androgynecological pathologies

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Abstract

A study carried out in the ethnoecological zone of Garoua in northern Cameroon, with the aim of identifying, through ethnobotanical surveys and toxicopharmacological tests, the plants used in the traditional treatment of diseases and disorders of the male and female reproductive systems. A total of 182 medicinal species including 40 priority are used against 10 categories of pathologies divided into 82 androgynecological diseases specified. Most favorite parts used were leaves, barks, roots and fruits. The acute toxicity tests carried out showed a low toxicity of the 20 species most preferred by traditional healers. The phytochemical characterization tests led to the identification of three phytochemical groups divided into nine molecular families with varying degrees of reactions. It appears that there is a very abundant presence of sterols, polyterpenes, polyphenols and saponoids in the majority of the dosed extracts.

Keywords: ethnoecological area, ethnobotanical surveys, toxicopharmacological tests, phytochemical compounds.

1. Introduction

Nowadays, we observe an interest revival on medicinal plants and traditional medicine through the world (Dos Santos et Fleurentin, 1990; WHO, 2013; Balagizi, 2015). WHO(2013), estimated that at least 80% of the population in developing countries use exclusively medicinal plants to meet their primary health needs. Cameroon is one of the sub-saharan African countries with a rich flora and a secular ethno-phytotherapeutic know-how (Adjanohoun *et al.*,1996;

Betti, 1996; Sonke B., 1998; Betti, 2002; 2007). Traditional healers hold ethnotherapeutic knowledges of several medicinal plants and manage many types of diseases. Wide health issues including mental and physic disorders as diabetes, epilepsy, hypertension, cancers, malaria and male or female infertility are cured in traditional health system (Akaré Biyoghe, 2010; Hédon *et al.*, 2010 ; Lézier,2015).

In sub-Saharan Africa, 25 % of medical consultations concern health reproductive systems and 25-30% relative to infertility (Telefo. et al., 2011). In Cameroon, the infertility rate among couples aged 22 to 44 years is 21% to 30 % (Larsen, 2000). In the north region, this rate is estimated above of the national average (Mengue Me Ndongo, 2013). Infertility is the incapacity of a couple to have or to lead a pregnancy, after regular sexual intercourse without contraceptive method, during one year (Larsen, 2000). Male and female reproductive system diseases have several etiologies such as sexually transmitted infections like syphilis, gonorrhoea, chlamydia, genital herpes, Hiv/Aids and various hormonal or metabolic dysfunctions. These conditions can lead to serious consequences on reproductive health. Generally, for women, occurred symptoms are menstrual cycle troubles, ectopic pregnancies, abortions, uterine fibroids, ovarian cysts, tubal obstructions while in male, they can entail oligospermia, asthenospermia, azoospermia, varicocele and sexual weakness or impotence. The ultimate picture is infertility, which is a real reason for stigma, disharmony and divorce between sex partners. In the north ethnoecologic area, overall among rural populations, several medicinal plants are widely used for various androgenic and gynaecological problems. However, this ethnoflora has not yet been the subject of a serious ethnobotanical investigation so as to document his rich ethnomedical heritage, so far tillinorals tate (Tamze *et al.*, 1996;

Dibong *et al*, 2011; Telefo *and al.*, 2011; Mengue Me Ndongo, 2013). Indeed, this rich medical and cultural know-how is today threatened by numerous factors. This study was carried out to source for information from traditional medical practitioners on plant remedies used for the management and cure of male and female reproductive systems diseases in north Cameroon with a view to stimulating further chemical and toxicological screening of the priority plants for the eventual production of improved traditional drugs. In this context, it aims specifically to: (1)-List and describe the different folk medical practices used to cure female and male infertility causes; (2)-Inventory the plants widely used by traditional healers in androgynaecological pathologies cure and management; (3)-Evaluate the ethnotherapeutic spectrum of the medicinal plants species on reproductive troubles; (4)-Evaluate the acute toxicity and estimate chemical compounds of the species most used.

2. Materials and Methods

2.1. Study area

This study was conducted in the four departments of the North Region that lies between 8° and 10° Nord latitude Nord and 12° and 16° east longitude. It was carried out pinpointed in Garoua, Poli, Lagdo, Guider and Tcholliré subdivisions respectively situated in the north, west, east, north-east and south of the Region (Fig.1).

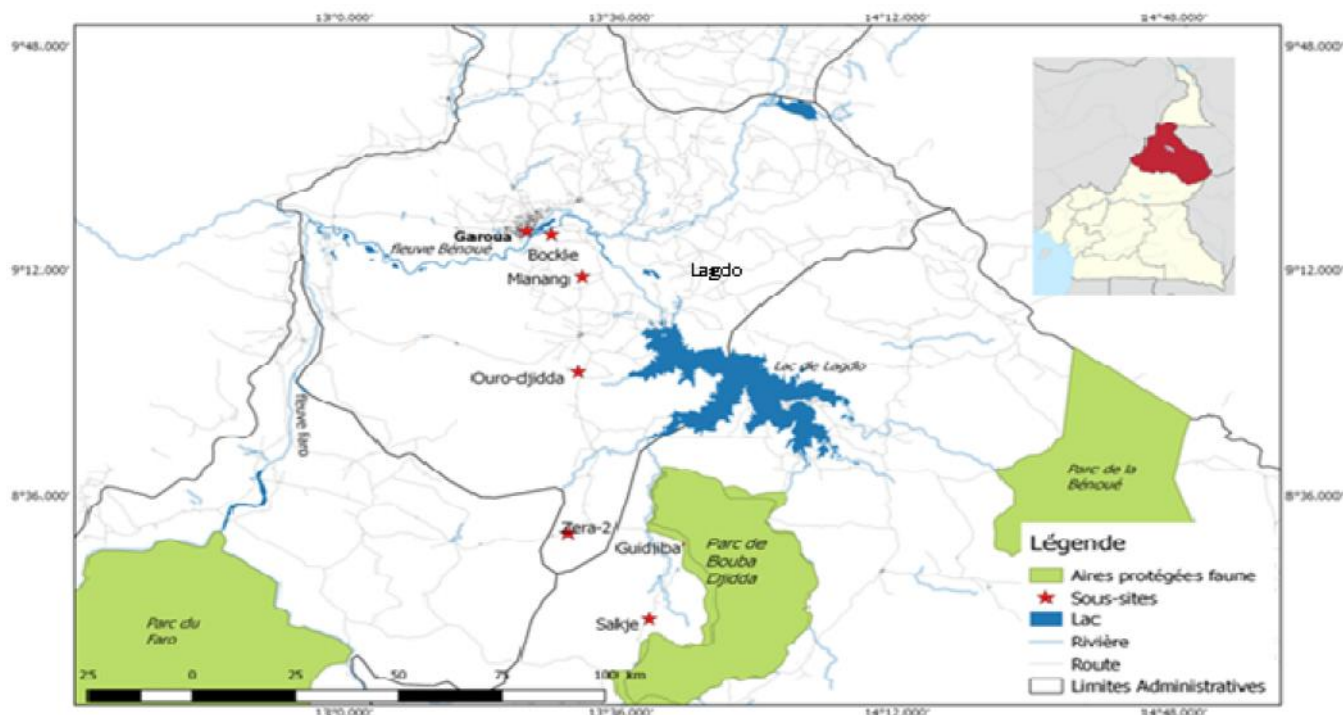


Figure 1. Ethnobotany survey area location map

The climate that reigns is the tropical type. Weather is hot with average annual temperatures ranged between 30 and 35 ° C. Precipitations vary with the seasons and the current average is 900 mm. The delimited area corresponds to the sudano-zambezi area of Letouzey (1968; 1985), dominated by three phytochories who, from north to south, are distinguished into three units: a transition area sudano-sahelian (peripheries of Garoua), combining a sudanian endemism (Faro department) and a sudano-guinean regional transition zone in the foothills of the cliff of the Adamawa. Population is estimated at approximately 1463 015 inhabitants spread over 5 229 km² with an average density of 35 inhabitants per km².

This zone is composed of several ethnic groups including Mafa, Fulani, Hausa, Doayos, Fali, Kapsiki, Dii, Namdji, autochthonous. The area is inflated by a stream of immigration established ethnic groups that are the Laka, Toupouri, Moundang, Mafa, Massa, Mousgoum and Ngambaye.

2.2. Target population, study design and data collection

To collect data related to the diseases of the male and female reproductive system, a sample of 630 people in four categories (218 traditional healers and herbalists, 230 patients, 146 practitioners of self-medication, 12 midwives, 20 nurses, 3 gynecologists and 1 urologist) has been pulled and questioned. Respondents derived from the main tribes living in the study area were interviewed individually and/or by group using semi-structured and structured questionnaire. Data obtained were collated and tabulated to give the socio-demographic characteristics, vernacular names of diseases and plants, as well as their folk use, method of preparation, application mode, dosage, duration of treatment and the plant parts used. Data were also collected on ethnoflora specifically at the area of harvest (ruderal, shrub savannah, wooded or treed savannah, forest gallery or fields and fallow land).

2.3. Sample size determination and statistical analysis

To estimate the importance of these medicinal plants in this ethnolinguistic group and to determine which diseases could be particularly controlled by the healers, RFC, *medUV*, *medIAR*, *medIF*, *medCpr* and *medIR* were calculated.

Relative frequency of citation (RFC) was obtained by dividing the frequency of citation (FC) (the number of informants reporting the use of species) by the total number of informants participating in the survey (N): $RFC = FC / N$

The technique of estimating the *Use Value* included in Phillips (1996) and later simplified by Thomas (2008) has been used. For each medicinal plant species, this value was calculated according to the following formula: $medsUV = \sum U_{is} / N_s$; where U_{is} is equal to the total number of responses to the medicinal uses of the s case mentioned by the informant i , and N_s is the total number of informants interviewers.

But, the *medsUV* does not so much reflect the consensus of the participants. For this, another parameter, the *medical Informant Agreement Ratio* (*medsIAR*), has been considered: $medsIAR = (\sum Sci - Nma) / (\sum Sci - 1)$.

Fidelity Index was used to indicate the plant species more ideal for the treatment of specific ailment (Friedman *et al.*, 1986). **FI** was calculated using following formula (Friedman *et al.*, 1986): $FI = (I_p / I_u) \times 100$ where; I_p shows the number of informants mentioning the use of plant species for a particular disease category and I_u shows the number of informants citing the usage of that plant species for any disease category.

The value of *medsRI* was calculated (Bennett and Prance, 2000) by using following formula: $medsRI = (PP + AC) \times 100 / 2$; where **PP** indicates the pharmacological properties which are calculated by dividing the number of U_r for plant species with the highest number of U_r , while **AC** indicates the diseases treated related to a particular body system. The value of **AC** is obtained by dividing the number of body systems treated using a particular plant species with the highest number of disease categories treated using a most extensively used species.

Medicinal Contribution Index to receipts (*Cpr*) (Marascuilo and Serlin, 1988) is used to evaluate a degree of intervention of each species in the preparation of remedies collected during survey. It was calculated: $medCpr = (Nr / Nt) \times 100$; where Nr is the number of remedies using a part a species and Nt total number of remedies prepared.

2.4. Descriptive statistics

For the statistical analysis, the data collected have, generally, been treated with software SPSS (Statistical Package for Social Sciences) version 20.0 and Excel. For the descriptive analysis of these data, the numbers and percentages were calculated. As for their analytical study, some tools were used depending on the case: the χ^2 test and the rate of Kendall.

3. Results and Discussion

3.1. Results

3.1.1. Sociodemographic profiles and practices of local traditional medicine

A total of 364 herbalists from the four subdivisions were interviewed. Reports showed that 62.40 % of healers were men against 37.60 % women. There is a very low education level in both sexes, 48% not attending school against 35.50% acceded to the basic school. Healers interviewed were animists (43%), Muslims (32%) and Christians (15%). In the other hand, 56% of traditional healers said have acquired their know-how by a family heritage while 20.50% held it with training from another therapist. Thus, the study distinguished four categories of healers ($\chi^2 = 140.59$; $p < 0.0001$) including soothsayer-healers (28.80%), soothsayers (28.80%), herbal-healers (37 %) and midwives (7.40 %).

Three pathologies diagnosing methods are adopted by traditional healers recorded: divination (23 %), the combination of divination and classical consultation (39.60%) and classical consultation only (37.40%).

The main types of divination are stream of straw, cowrie shells, stones, animal sacrifice, the vision in a canaries filled with water, the egg manipulation, scarification or the bleeding ($\chi^2 = 43.32$; $p = 0.0018$). Otherwise, 59 % of practitioners agree that infertility can have a natural and supernatural origins ($\chi^2 = 1546.803$; $p = 0.0001$), such as social taboos (61.14 %) and itches attacks (24.84 %) were indicated like important causes infertility.

3.1.2. Androgynaecological pathologies categories managed by the traditional healers in the study area

A total of ten (10) androgynaecological pathologies categories treated by 364 ethnotherapists surveyed were recorded (Fig.2). The most controlled diseases categories in this traditional medicine are characterized by uppermost RFC and medIAR (Fig.1). The highest skill scores were obtained on infectious diseases (RFC = 17.29%; medIAR = 0.96), menstrual cycle disorders (RFC = 15.17%; medIAR = 0.93), uterine and cervical diseases (RFC = 11.26%; medIAR = 0.95) followed by male and female sexuality dysfunctions (RFC = 9.96%; medIAR = 0.97), supernatural infertility (RFC = 9.33%; medIAR = 0.97), gestational complications (RFC = 9.32%; medIAR = 0.95) and tubal and ovarian diseases (RFC = 9.12%; medIAR = 0.97). Gonadal and congenital troubles represent the least controlled cases about RFC (2.50 %) and medIAR (0.97).

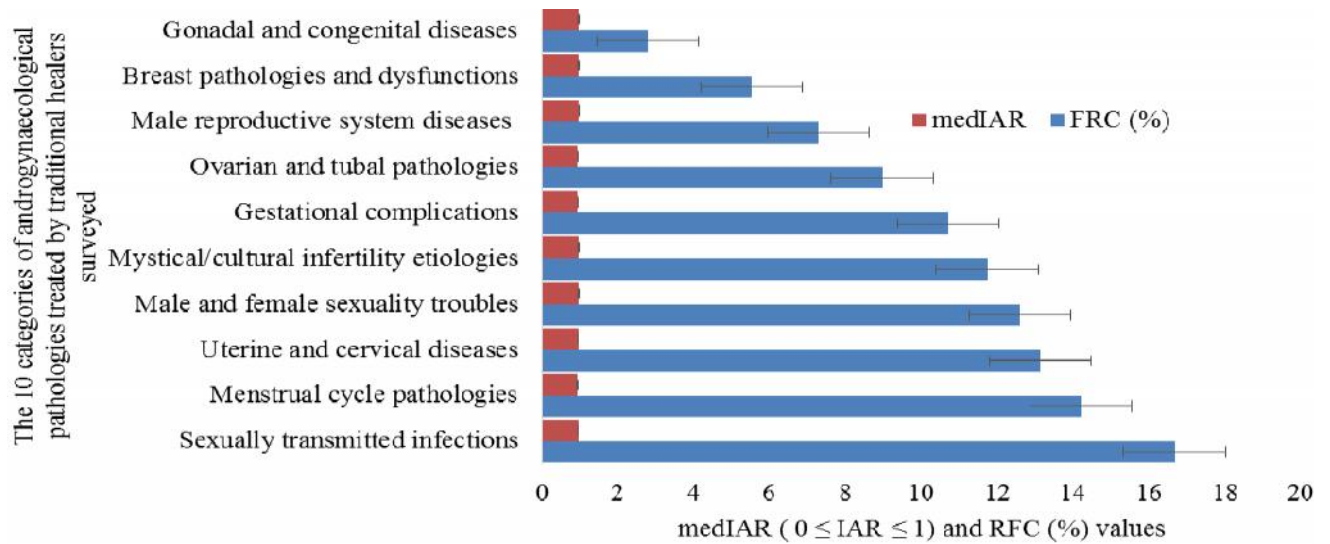


Figure 2. Relative frequencies citations (FRC) and Medicinal Informant Agreement Ratio (medIAR) about the 10 androgynaecological diseases categories managed by the traditional healers

3.1.3. Diversity of specified androgynaecological pathologies treated by traditional healers surveyed

Among a total of 71 androgynaecological pathologies recorded, 36 cases are best controlled in the therapeutic arsenal of traditional healers. The high RFC and medIAR values testify them (Fig.3). In fact, the majority of herbatalists better treat cases related to gonorrhoea and Staphylococcus (RFC =89.40%;

medIAR = 0.96), menstrual pains and dysmenorrhea (87.80 %; 0.97,) followed by sexual weakness and premature ejaculation(84.40 %; 0.98), uterine fibroids (67.80 %; 0.97), tubal obstruction and adhesion(65.80 %; 0.93), primary and secondary amenorrhoea(65.40 %; 0.94), oligospermia (65.20%;0.95),ovarian cysts (65.20%; 0.96), chlamydia and syphilis (62%; 0.98), Crossing a fetish (60.60%) and Jinns and ancestors angers (60.20%; 0.98).

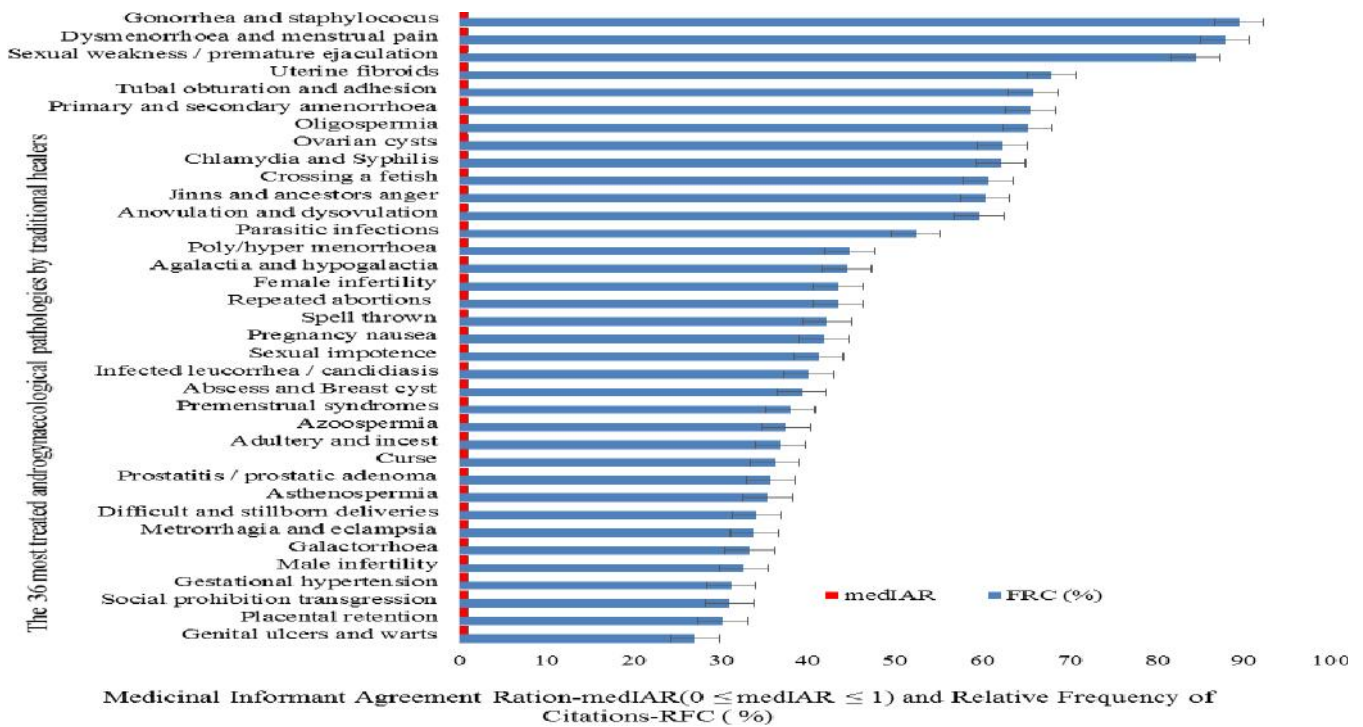


Figure 3. Global characteristics RFC (%) and medIAR (0 ≤ medIAR ≤ 1) variations values of specified androgynaecological pathologies the most treated by traditional healers surveyed

3.1.4. Diversity and importance of medicinal plants used in androgynaecological pathologies treatment

In short, 182 medicinal plant species were recorded in the local pharmacopoeia. Forty-four (44) of them had the support of the largest number of traditional healers (Tab.1). Their therapeutic importance is reflected by their different index values shown in table 1.

3.1.4.1. Relative Frequency Citations (RFC) of the most popular medicinal species

The relative frequency of citations attributed to a medicinal species reveals its importance in a given community. It has been evaluated for the 33 most exploited species in the traditional pharmacopoeia of the study area. The RFC highest values were observed in *Adansonia digitata* (11.2%), *Cassia sieberiana* (11.93%), *Pterocarpus erinaceus* (11.88 %), *Annona senegalensis* (11.79 %), *Cassia arereh* (11.68 %), *Eleutherine bulbosa* (11.27 %), *Kigelia africana* (11.21 %), *Detarium microcarpum* (11.07 %) followed by *Tribulus terrestris* (10.66 %), *Nauclea latifolia* (10.30 %), *Crinum jagus* (10.06 %), *Carissa edulis* (10.05 %) and *Crateva religiosa* (10.03 %).

3.1.4.2. MediAR and medUV of species with high and consensual ethnotherapeutic properties

Medicinal taxa with wide popularity and a high agreement consensus are marked by particularly high medUV (medUV 0.9) and mediAR (mediAR 0.9) values: *Annona senegalensis* (0.98; 0.99), *Crateva religiosa* (0.98; 0.98), *Detarium microcarpum* (0.98; 0.95), *Kigelia africana* (0.98;0.95), *Tribulus terrestris* (0.98; 0.96), *Pterocarpus erinaceus* (0.97;0.98), *Entada africana* (0.96;0.95), *Crinum jugas* (0.95; 0.97), *Cassia sieberiana* (0.95; 0.94) and *Hymenocardia acida* (0.95; 0.97).

3.1.4.3. Species contribution to the medicinal recipes preparation with high medCpr values

As for the values of the Cpr index which characterizes the species that have contributed the most to the recipes preparation (medCpr 10 %), the main species are *Cassia sieberiana* (25 %), *Eleutherine bulbosa* (17.95 %), *Adansonia digitata* (14.93 %), *Annona senegalensis* (13.47 %), *Detarium microcarpum* (13.46 %), *Crinum jagus* (13.01 %), *Parkia biglobosa* (11.03 %), *Nauclea latifolia* (10.62 %), *Panax lancifolia* (10.03 %) and *Burkea africana* (10.02 %).

3.1.4.4. Relative Importance (medIR) of the most versatile species

The medicinal significance index (medsIR) which shows the plants medicinal spectrum ranges from 18.02 % to 50.33 %. The most versatile (medIR > 30 %) are *Annona senegalensis*(50.33 %), *Detarium microcarpum* (46.93 %), *Eleutherine bulbosa* (46.65%), *Ganoderma lucidum* (42.91 %), *Azelia africana* (39.73 %), *Daniella oliveri* (39.62 %) and *Boscia salicifolia* (39.40 %) followed by *Nauclea latifolia*(36.16 %), *Cochlospermum tinctorium* (35.94 %), *Cissus quadrangularis* (35.88 %), *Tribulus terrestris* (35.83 %), *Opilia celtidifolia* (32.53 %), *Adansonia digitata* (32.48 %), *Burkea africana* (32.42 %), *Grewia bicolor* (32.42 %), *Kigelia africana* (32.42 %) and *Pterocarpus erinaceus* (32.42 %).

3.1.4.5. Therapeutic fidelity levels variations (medFI) of priority species recorded

The results had shown higher fidelity levels (medFI 10 %) for *Eleutherine bulbosa* (25 %), *Detarium microcarpum* (21.43 %) followed by *Cadaba farinosa*, *Cassia sieberiana*, *Entada africana*, *Hymenocardia acida* and *Opilia celtidifolia*, 20 % respectively. They are followed by *Crinum jagus* (16.67 %), *Crateva religiosa* (14.29 %), *Ficus polita* (14.29 %), *Vitex doniana* (14.29 %), *Vitellaria paradoxa* (12.5 %), *Kigelia africana* (11.11 %), *Pterocarpus erinaceus* (11.11 %), *Panax lancifolia* (11.03 %), *Adansonia digitata* (10.92 %), *Carissa edulis* (10.33 %), *Cissus quadrangularis* (10 %) and *Cochlospermum tinctorium*, *Nauclea latifolia*, *Tribulus terrestris*, 10 % respectively.

Table 1. Popularity, homogeneity, fidelity and versality levels variations of the forty-four (44) priority medicinal plants cited by traditional healers interviewed in the whole study area

Scientific names	Families	RFC	medIAR	medUV	medCpr	medIR	medFI
<i>Abrus precatorius</i> L.	Fabaceae	9,79	0,89	0,88	9,11	27,01	19,74
<i>Adansonia digitata</i> L.	Malvaceae	11,20	0,93	0,9	14,93	32,48	10,92
<i>Afzelia africana</i> Smith.	Fabaceae	9,93	0,91	0,83	7,69	39,73	9,09
<i>Annona senegalensis</i> Pers.	Annonaceae	11,79	0,98	0,99	13,47	50,33	7,14
<i>Biophytum umbraculum</i> Welw.	Oxalidaceae	9,01	0,95	0,97	3,85	21,6	20
<i>Boscia salicifolia</i> Oliv.	Capparaceae	9,74	0,91	0,91	5,77	39,4	9,09
<i>Burkea africana</i> Hook.	Caesalpiniaceae	9,55	0,88	0,92	10,02	32,42	7,96
<i>Carissa edulis</i> (Forssk.) Vahl.	Apocynaceae	10,05	0,93	0,94	9,78	21,76	10,33
<i>Cassia arereh</i> Delile	Caesalpiniaceae	11,68	0,94	0,92	9,62	28,74	20
<i>Cassia sieberiana</i> L.	Caesalpiniaceae	11,93	0,95	0,95	25	25,28	20
<i>Cissus quadrangularis</i> L.	Vitaceae	9,08	0,91	0,81	3,85	35,88	10
<i>Citrus aurantiifolia</i> (Christm.) Swingle	Rutaceae	6,78	0,84	0,86	5,55	21,12	10,76
<i>Cochlospermum tinctorium</i> Perr. ex A. Rich.	Cochlospermaceae	9,43	0,92	0,92	3,85	35,94	10
<i>Crateva religiosa</i> G. Forst.	Capparaceae	10,03	0,98	0,95	5,77	25,11	14,29
<i>Crinum jagus</i> .aut.	Amaryllidaceae	10,06	0,95	0,94	13,01	21,6	16,67
<i>Daniella oliveri</i> Harms.	Caesalpiniaceae	9,77	0,91	0,84	5,77	39,62	9,09
<i>Desmodium adscendens</i> (Sw.) DC.	Fabaceae	11,89	0,94	0,89	11,70	27,98	14,18
<i>Detarium microcarpum</i> Gmel.	Caesalpiniaceae	11,07	0,98	0,95	13,46	46,93	21,43
<i>Dioscorea macroura</i> Harms	Dioscoreaceae	8,98	0,91	0,86	7,61	21,39	11,76
<i>Euphorbia hirta</i> L.	Euphorbiaceae	10,58	0,94	0,88	10,17	21,01	12,52
<i>Eleutherine bulbosa</i> (Mill.) Urb.	Iridaceae	11,27	0,91	0,82	17,95	46,65	7,69
<i>Entada africana</i> Guill. & Perr.	Mimosaceae	9,23	0,96	0,95	5,77	18,02	20
<i>Ficus polita</i> Vahl subsp. <i>polita</i>	Moraceae	8,56	0,94	0,81	3,85	25,11	14,29
<i>Ganoderma lucidum</i> P.Karst.	Ganodermaceae	9,54	0,92	0,93	5,77	42,91	8,33
<i>Grewia bicolor</i> Juss.	Tiliaceae	8,88	0,91	0,89	6,78	32,42	9,9
<i>Hibiscus sabdariffa</i> L.	Malvaceae	11,76	0,92	0,85	9,77	20,73	19,55
<i>Hymenocardia acida</i> Tul.	Euphorbiaceae	9,01	0,95	0,97	3,85	21,6	20
<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	11,21	0,98	0,94	5,77	32,42	11,11
<i>Lawsonia inermis</i> L.	Lythraceae	9,23	0,96	0,95	5,77	18,02	20
<i>Momordica charantia</i> L.	Cucurbitaceae	9,95	0,91	0,84	11,03	25,28	25
<i>Nauclea latifolia</i> Sm.	Rubiaceae	10,30	0,91	0,83	10,62	36,16	10
<i>Opilia celtidifolia</i> Endl.	Opiliaceae	8,78	0,89	0,87	0,92	32,53	20
<i>Panax lancifolia</i> Darke.	Araliaceae	9,54	0,78	0,78	10,03	28,85	11,03
<i>Parkia biglobosa</i> (Jacq.) R. Br.	Mimosaceae	9,95	0,91	0,84	11,03	25,28	25
<i>Pergularia daemia</i> Chiov	Asclepiadaceae	11,21	0,98	0,94	5,77	32,42	11,11
<i>Pennisetum glaucum</i> L.	Poaceae	10,29	0,89	0,94	8,89	23,87	17,20
<i>Piliostigma thonningii</i> L.	Caesalpiniaceae	9,24	0,85	0,88	7,95	18,19	19,08
<i>Prosopis africana</i> Taub.	Caesalpinaceae	11,87	0,91	0,86	7,61	21,39	11,76
<i>Pterocarpus erinaceus</i> Poir.	Fabaceae	11,88	0,97	0,98	9,62	32,42	11,11
<i>Securidaca longipedunculata</i> Fresen.	Polygalaceae	11,27	0,91	0,82	17,95	46,65	7,69
<i>Tapinanthus bangwensis</i> Danser.	Loranthaceae	10,17	0,93	0,83	3,85	25,11	14,29
<i>Tribulus terrestris</i> L.	Zygophylliaceae	10,66	0,98	0,98	3,85	35,83	10
<i>Vitellaria paradoxa</i> C. F. Gaertn.	Sapotaceae	9,42	0,94	0,93	5,77	28,74	12,5
<i>Vitex doniana</i> Sweet.	Verbenaceae	9,07	0,94	0,83	3,85	25,11	14,29

3.1.5. Ethnotherapeutic indications of medicinal plants on the 10 pathologies categories identified

This section assesses the degree of contribution of the priority species in the treatment of the 10 categories of diseases identified. The medicinal contribution (medCpr) and performancy (medIp) indices make it possible to assess the reliability of the information that attributes to a plant a given category of diseases (Tab.2).

Thus, sexually transmitted infections are better treated with *Detarium microcarpum* (medCpr = 10.89 %; medIp = 66.97%), *Grewia bicolor* (10.51 %; 57.30%), *Burkea africana* (9.65 %; 56.51%), *Carissa edulis* (7.89 %; 56.51%) and *Opilia celtidifolia* (7.75 %; 54.35%) while menstrual cycle pathologies are better controlled using *Cassia arereh* (11.87 %; 74.85%), *Kigelia africana* (10.86 %; 59.25%), *Dioscorea macroura* (10.22%; 41.11 %), *Pterocarpus serinaceus* (10.10 %; 67.54%) and *Daniella oliveri* (9.09%; 48.51%).

In addition, against traditional uterine and cervical affections, traditional healers prefer *Cassia arereh* (11.43 %, 44.60%), *Opilia celtidifolia* (11.24%; 39.87%), *Kigelia africana* (11%; 25%), *Detarium microcarpum* (9.33%; 34.44%) and *Carissa edulis* (9.33%; 33.49%).

In addition, opinions are convergent on the indications of *Pergularia daemia* (12.23%; 44.60%), *Cassia arereh* (11.61%;

42.38%), *Parkia globosa* (10.02 %; 35.87 %), *Kigelia africana* (9.82 %; 30.37%) and *Dioscorea macroura* (9.82 %; 27.30 %) against gestational difficulties.

Against suspected infertility of supernatural origin, traditional healers prescribe recipes based on *Biophytum umbraculum* (11.8 %; 47.50 %), *Cissus quadrangularis* (10.80 %; 47.10 %), *Cassia sieberiana* (8.68 %; 23 %) and *Tapinanthus bangwensis* (8.68 %; 28.60%).

To treat ovarian and tubal dystrophies, the most indicated species are *Opilia celtidifolia* (12.88 %;

44.92 %), *Securidaca longipedunculata* (12.52 %; 54.13 %), *Pergularia daemia* (11.88 %; 35.40 %), *Crateva religiosa* (11.07 %; 45.71 %), *Kigelia africana* (10.88 %; 36.98 %) and *Cassia arereh* (10.88 %; 33.49 %).

The main and most consensual recipes in male and female reproductive system diseases treatment are *Boscia salicifolia* (13.42 %; 69.37 %), *Annona senegalensis* (12.77 %; 64.76 %), *Cassia sieberiana* (11.77 %; 41.59 %), *Tribulus terrestris* (11.54 %; 61.59 %), *Kigelia africana* (11.19 %; 43.49 %), *Nauclea latifolia* (11.19 %; 43.49 %), *Hymenocardia acida* (10.42 %; 47.30 %), *Crinum jagus* (10.31 %; 40.16 %) and *Panax lancifolia* (10.19%; 46.03%).

The recipes intended to regulate male sexual dysfunction are concocted mainly from *Tribulus terrestris* (13.17 %; 51.90 %), *Annona senegalensis* (12.17 %; 46.83 %), *Crinum jagus* (12.03 %; 44.13 %), *Boscia salicifolia* (11.17 %; 37.65 %), *Nauclea latifolia* (11.03 %; 33.97 %), *Abrus precatorius* (10.17 %; 37.46 %) and *Kigelia africana* (10.17 %; 35.43 %).

In addition, opinions converge on the indications for *Pergularia daemia* (12.23%; 44.60%), *Cassia arereh* (11.61%; 42.38%), *Parkia biglobosa* (10.02%; 35.87 %), *Kigelia africana* (9.82%; 30.37%) and *Dioscorea macroura* (9.82%; 27.30%) against gestational difficulties.

To treat ovarian and tubal dystrophies, the most indicated species are *Opilia celtidifolia* (12.88%; 44.92%), *Securidaca longipedunculata* (12.52%; 54.13%), *Pergularia daemia* (11.88%; 35.40%) *Crateva religiosa* (11.07%; 45.71%), *Kigelia africana* (10.88%; 36.98 %) and *Cassia arereh* (10.88%; 33.49%).

Gonadal troubles and congenital malformations in both sexes are cured with *Tribulus terrestris* (12.12 %; 39.3 %), *Tapinanthus bangwensis* (9.09 %; 29.37 %), *Kigelia africana* (9.09%; 23.10%), *Boscia salicifolia* (6.06 %; 21.11 %), *Vitellaria aradoxa* (6.06 %; 15.56 %), *Nauclea latifolia* (6.06 %; 10.48 %) and *Eleutherine bulbosa* (5.45 %, 6.78 %).

Table 2. Ethnotherapeutic contribution of medicinal plants on the 10 pathologies categories identified

Sexually transmitted infections($\chi^2 = 78,69$; $P < 0,0018$)			Menstrual cycle troubles diseases($\chi^2 = 94,73$; $P < 0,0001$)		
Medicinal plants cited	medC pr	medI F	Medicinal plants cited	medC pr	medIF
<i>Grewia bicolor</i> Juss.	10,51	57,30	<i>Vitex doniana</i> Sweet.	5,22	44,29
<i>Burkea africana</i> Hook.	9,65	56,51	<i>Detarium microcarpum</i> Gmel.	6,09	66,27
<i>Carissa edulis</i> (Forssk.)Vahl	7,89	56,51	<i>Dioscorea macroua</i> Harms	10,22	41,11
<i>Detarium microcarpum</i> Gmel.	10,89	66,97	<i>Cochlospermum tinctorium</i> Perr. ex A. Rich.	6,76	38,57
<i>Entada africana</i> Guill.	6,14	53,33	<i>Adansonia digitata</i> L.	6,97	49,58
<i>Cassia arereh</i> Delile	5,26	51,75	<i>Ganoderma lucidum</i> L.	6,58	44,73
<i>Cissus quadrangularis</i> L.	6,14	49,21	<i>Cassia arereh</i> Delile	11,87	74,85
<i>Opilia celtidifolia</i> Endl	7,75	54,35	<i>Pterocarpus erinaceus</i> Poir.	10,1	67,54
<i>Pergularia daemia</i> Chiov	5,26	43,81	<i>Kigelia africana</i> Benth.	10,86	59,25
<i>Kigelia africana</i> Benth.	6,75	40,63	<i>Daniella oliveri</i> Harms	9,09	48,51
Uterine and cervical pathologies($\chi^2 = 22,69$; $P < 0,0001$)			Gestational pathologies($\chi^2 = 43,97$; $P < 0,0001$)		
Medicinal plants cited	medC pr	medI F	Medicinal plants cited	medC pr	medIF
<i>Carissa edulis</i> (Forssk.)Vahl	9,33	33,49	<i>Parkia biglobosa</i> Benth.	10,02	35,87
<i>Hibiscus sabdariffa</i> L.	6,67	30,00	<i>Carissa edulis</i> Vahl	8,41	27,62
<i>Kigelia africana</i> Benth.	11,00	38,25	<i>Pergularia daemia</i> Chiov	12,23	44,60
<i>Cassia arereh</i> Delile	11,43	44,60	<i>Kigelia africana</i> Benth.	9,82	30,37
<i>Detarium microcarpum</i> Gmel.	9,33	34,44	<i>Pterocarpus erinaceus</i> Poir.	7,64	22,70
<i>Momordica charantia</i> L.	4,00	22,86	<i>Detarium microcarpum</i> Gmel.	8,43	19,52
<i>Citrus aurantiifolia</i> (Christm.) Swingle	8,00	19,37	<i>Daniella oliveri</i> Harms	7,23	17,62
<i>Lawsonia inermis</i> L.	5,33	8,73	<i>Dioscorea macroua</i> Harms	9,82	27,30
<i>Opilia celtidifolia</i> Endl	11,24	39,87	<i>Cassia arereh</i> Delile	11,61	42,38
<i>Abrus precatorius</i> L.	6,33	0,48	<i>Ganoderma lucidum</i> .L.	8,61	22,38
Unearthly causes of infertility ($\chi^2 = 32,97$; $P < 0,0001$)			Ovarian dystrophies and tubal obstructions($\chi^2 = 78,23$; $P < 0,0013$)		
Medicinal plants cited	medC pr	medI F	Medicinal plants cited	medC pr	medIF
<i>Crinum jagus</i> Bury	13	45,7	<i>Opilia celtidifolia</i> Endl	12,88	44,92
<i>Biophytum umbraculum</i> Welw.	11,8	47,5	<i>Securidaca longipedunculata</i> Fresen.	12,52	54,13
<i>Cissus quadrangularis</i> L.	10,8	47,1	<i>Pergularia daemia</i> Chiov	11,88	35,40
<i>Cassia sieberiana</i> L.	8,68	23	<i>Crateva religiosa</i> G. Forst.	11,07	45,71
<i>Tapinanthus bangwensis</i> Danser.	8,68	28,6	<i>Kigelia africana</i> Benth.	10,88	36,98
<i>Pterocarpus erinaceus</i> Poir.	7,55	16	<i>Cassia arereh</i> Delile	10,88	33,49

<i>Ficus polita</i> Vahl	7,14	6,83	<i>Dioscorea macroura</i> Harms	9,69	33,17
<i>Kigelia africana</i> Benth.	6,82	55,9	<i>Crinum jagus</i> Bury	7,88	33,17
<i>Adansonia digitata</i> L.	6,82	26,4	<i>Daniella oliveri</i> Harms	7,07	17,62
<i>Abrus precatorius</i> L.	6,27	3,33	<i>Ficus polita</i> Vahl	6,88	33,49
Male and female sexual reproductive system pathologies ($\chi^2 = 57,88$; P < 0,0001)			Breast diseases and galactic disorders ($\chi^2 = 81,21$; P < 0,0001)		
Medicinal plants cited	medC	medIF	Medicinal plants cited	medC	medIF
	pr	F		pr	
<i>Boscia salicifolia</i> Oliv.	13,42	69,37	<i>Adansonia digitata</i> L.	12,22	47,30
<i>Annona senegalensis</i> Pers.	12,77	64,76	<i>Pennisetum glaucum</i> L.	11,22	47,46
<i>Cassia sieberiana</i> L.	11,77	41,59	<i>Euphorbia hirta</i> L.	11,22	45,71
<i>Tribulus terrestris</i> L.	11,54	61,59	<i>Ganoderma lucidum</i> L.	10,74	40,32
<i>Kigelia africana</i> Benth.	11,19	43,49	<i>Pergularia daemia</i> Chiov	9,74	6,98
<i>Nauclea latifolia</i> Sm.	10,89	45,87	<i>Dioscorea macroura</i> Harms	9,48	39,21
<i>Hymenocardia acida</i> Tul.	10,42	47,30	<i>Kigelia africana</i> Benth.	8,67	36,70
<i>Crinum jagus</i> Bury	10,31	40,16	<i>Ficus polita</i> Vahl	8,22	37,46
<i>Panax lancifolia</i> Darke	10,19	46,03	<i>Cassia Arereh</i> Delile	8,11	35,56
<i>Ereuthrine bulbosa</i> (Mill.) Urb.	9,42	35,08	<i>Opilia celtidifolia</i> Endl	7,85	27,98
<i>Prosopis africana</i> Taub.	7,19	40,63	<i>Cassia sieberiana</i> L.	6,85	27,62
Dysfunction of the man reproductive system ($\chi^2 = 49,81$; P < 0,0001)			Gonadal dystrophies and congenital malformations ($\chi^2 = 33,21$; P < 0,0051)		
Medicinal plants cited	medC	medIF	Medicinal plants cited	medC	medIF
	pr	F		pr	
<i>Tribulus terrestris</i> L.	13,17	51,90	<i>Tribulus terrestris</i> L.	12,12	39,30
<i>Annona senegalensis</i> Pers.	12,17	46,83	<i>Tapinanthus bangwensis</i> Danser.	9,09	29,37
<i>Crinum jagus</i> Bury	12,03	44,13	<i>Kigelia africana</i> Benth.	9,09	23,10
<i>Boscia salicifolia</i> Oliv.	11,17	37,65	<i>Boscia salicifolia</i> Oliv.	6,06	21,11
<i>Nauclea latifolia</i> Sm.	11,03	33,97	<i>Vitellaria paradoxa</i> C. F. Gaertn.	6,06	15,56
<i>Abrus precatorius</i> L.	10,17	37,46	<i>Nauclea latifolia</i> Sm.	6,06	10,48
<i>Kigelia africana</i> Benth.	10,17	35,43	<i>Eleuthrine bulbosa</i> (Mill.) Urb.	5,45	6,78
<i>Hymenocardia acida</i> Tul.	9,31	29,84	<i>Carissa edulis</i> Vahl	3,03	13,97
<i>Panax ginseng</i> C.A. Meyer	9,03	27,78	<i>Dioscorea macroura</i> Harms	3,03	5,87
<i>Euphorbia hirta</i> L.	8,17	30,63	<i>Crinum jagus</i> Bury	3,03	3,49
<i>Pennisetum glaucum</i> L.	7,31	22,71	<i>Adansonia digitata</i> L.	3,03	3,33

3.1.6. Ethnotherapeutic indications of the priority medicinal plants in the management of specified androgynaecological pathologies

Among 182 medicinal species listed throughout the site and commonly used to treat 82 pathologies affecting the male and female reproductive system, 37 species were found to be the most preferred by the traditional healers surveyed (Tab.3). Thus, to treat *Chlamydia*, *Staphylococcus aureus*, *Neissera gonorrhoea* and *Candidiasis*, the most preferred medicinal plants are: *Grewia bicolor*, *Burkea africana*, *Carissa edulis*, *Detarium microcarpum* and *Entada africana* while *Carissa edulis*, *Cassia arereh*, *Opilia celtidifolia*, *Kigelia africana* are used to treat genital *Herpes* and viral hepatitis infections. Regarding disorders related to the menstrual cycle as painful periods, dysmenorrhea, primary and secondary amenorrhea are treated mainly with *Pterocarpus erinaceus*, *Cochlospermum tinctorium*, *Cassia arereh*, *Kigelia africana* and *Vitex doniana* while eclampsia, metrorrhagia and other hemorrhages are controlled using extracts from *Dioscorea macroura*, *Detarium microcarpum*, *Ganoderma lucidum* and *Adansonia digitata*.

In the other hand, *Cassia arereh* is widely indicated against tubal obstructions and *Opilia celtidifolia* and *Kigelia africana* are used against uterine fibroids, polyps while *Detarium microcarpum* and *Carissa edulis* are indicated against tumors of the cervix and endometriosis.

To treat pathologies and gestational disorders, *Parkia biglobosa*, *Caarissa edulis*, *Pergularia daemea* are indicated against abortion threats while *Ganoderma lucidum* and *Cassia arereh* are successfully used to facilitate difficult deliveries.

Traditional healers use *Crinum jugas*, *Biophytum umbraculum* and *Tapinanthus* to bathe infertile couples under the influence of djins or wizards.

In addition, ovarian cysts, dysovulations and annovulations are mainly managed by *Pergularia daemea*, *Opilia celtidifolia*, *Securidaca longipedunculata*, *Crateva religiosa*, *Kigelia africana* and *Daniella oliveri*.

Tubal obstructions are better treated by *Cassia arereh*, *Ficus polita*, *Opilia celtidifolia* and *Pergularia daemea*.

Male sexual disorders are corrected by the use of *Boscia salicifolia*, *Prosopis africana*, *Annona senegalensis*, *Cassia sieberiana*, *Hymenocardia acida* while those related to women are cured by species including *Kigelia africana*, *Eleutherine bulbosa* and *Panax lanciofolia*.

Some of these species have mixed properties, so they can be used both for sexual disorders in men and in women. These are mainly *Tribulus terrestris*, *Kigelia africana*, *Panax lanciofolia* and *Crinum jugas*.

Breast cysts and breast congestion are best treated with *Kigelia africana*, *Adansonia digitata*, *Pennisetum glaucum* and *Pergularia daemea* extracts while hypogalactia, agalactia and galactorrhea are regularized using *Euphorbia hirta*, *Pennisetum glaucum*, *Adansonia digitata*, *Ficus polita* and *Pergularia daemea*.

Table 3. Medicinal plants the most used in management of male and female reproduction dysfunctions

Scientific names	Verna names	Families	Diseases treated	PU	PhF	AR	RFC	medI AR	med UV	med Cpr	medI R	medIF
<i>Abrus precatorius</i> L.	Welel-Mbandu	Fabaceae	Oligospermia/Asthenospermia (1) Sexual weakness and impotence (2)	1. Ro 2. Lea	1.Po 2.De	1.Or 2.Or	5,78	0,93	0,88	12,76	0,79	17,04
<i>Adansonia digitata</i> L.	Bohi/Kalkouk	Malvaceae	Dysmenorrhea(1)/Amenorrhoea(2) Ovarian cystis (3)/Infantile anemia (4)/ Unearly nferility (5)	1 Ro (1) (2) 2 Ba (1) (2) (3) (4) 3 Mis (1) (2) (3) (5)	1 Po 2 De 3 Am	1 Or 2 Or 3 Por	3,51	0,91	0,91	14,93	0,62	19,05
<i>Annona senegalensis</i> Pers.	Dukuhi laddé	Annonaceae	Oligospermia/Azoospermia(1) Sexual weakness and impotence (2) Dysmenorrhea (3)/Uterian fibroids (4)	1 Ba (1) (2) 2 Ro (4) 3 Lea (1) (2) (3)	1 Po 2 In 3 De	1 Or 2 Or 3 Or	4,17	0,91	0,94	13,47	0,68	8,62
<i>Biophytum umbraculum</i> Welw.	Woinsooree	Oxalidaceae	Unexplained infertility/Sexual rape (1) Amenorrhoea/Menstrual pains (2)	1 Lea (1) (2) (3)	1 In 2 De	1 Vba 2 Or	2,72	0,93	0,81	4,08	0,25	13,33
<i>Boscia salicifolia</i> Oliv.	Salee-tii	Capparaceae	Sexual weakness and impotence (1) Premature ejaculation (2) Oligospermia/Azoospermia(3)	1 Lea (1) (2) 2 Ro (2) (3) 3 Ba (3)	1 Po 2 De 3 De	1 Or 2 Or 3 Or	3,54	0,91	0,91	5,77	0,43	14,29
<i>Burkea africana</i> Hook.	Kokkobi/Kapi	Caesalpiniaceae	Menstrual pains (1)/Dysmenorrhea(2) Gonorrhea/ Syphilis (3)	1 Ba s(1) (2) 2 Ro (3)	1 Poe 2 De	1 Or 2 Or	5,45	0,94	0,81	3,76	0,79	9,09
<i>Carissa edulis</i> (Forssk.)Vahl	Paah-may	Apocynaceae	Chlamydia/Gonorrhea(1) Breast tumors / cervix(2) Dysmenorrhea / Menstrual pains (3)	1 Ba (1) (2) 1 Ro (1) (2) 2 Mis (3)	1 Po 2 De 3 Ca	1 Or 2 Or 3 Un	6,17	0,96	0,91	3,76	0,84	20,00
<i>Cassia arereh</i> Delile.	Bing-lay	Caesalpiniaceae	Amenorrhea/ Menstrual pains (1) Tubal obturations/Salpingitis (2) Anovulation/ovarian cysts (3) Underminated bacterial infections (4)	1 Ba (1) (2) (3) (4) 2 Ro (2) (4) 3 Mis (2) 4 Lea (1)	1 Po 2 De 3 De 3 Po	1 Or 2 Or 3 Or 4 Or	4,27	0,92	0,95	11,35	0,73	11,11
<i>Cassia sieberiana</i> L.	Serrehi/Malgahi	Caesalpiniaceae	Menstrual pains (1)/ Chlamydia (2) Aids/Herps/Hepatitis(3)	1 Ba (1) (2) (3) 2 Ro (4)	1 Po 1 Ma	1 Or 2 Or	4,04	0,94	0,91	18,08	0,85	20,00
<i>Cissus quadrangularis</i> L.	Gweeree	Vitaceae	Unearly infertility//Witchcraft curse(1) Abortions and abortions threat (2)	1 Wp (1) 2 Lea (2) (3)	1 Po 1 De	1 Or 1 Wb	3,48	0,90	0,89	4,32	0,47	7,69
<i>Piliostigma thonningii</i> L.	Buuri	Caesalpiniaceae	Dysmenorrhea/ Menstrual pains (1) Amenorrhoea/leucorrhoea(2) Frigidity and anorgasmia (3)	1 Ro (1) (2) 2 Ba (1) (3) 3 Lea (3)	1 De 2 Po 3 In	1 Or 2 Or 3Wb	2,72	0,93	0,81	6,12	0,25	9,20
<i>Cochlospermum tinctorium</i> Perr. ex A. Rich.	Debel-yeon	Cochlospermaceae	Dysmenorrhoea/Menstrual pains (1) Chlamydia/Gonorrhoea (2) Candida/Leucorrhoea (3)	1 Ro (1) (2) (3) 2 Lea (1)	1 Po 1 De 1 In	1 Or 2 Or	3,54	0,93	0,90	4,36	0,42	14,29
<i>Crateva religiosa</i> G. Forst.	Tiama nakehi	Capparaceae	Dysmenorrhoea.Menstrual pains (1) Dysovolution/Ovarian/Breasts cysts(2)	1 Ba (1) (2) 2 Ro (2) (1)	1 Po 2 De	1 Or 2 Or	4,04	0,95	0,90	4,97	0,35	13,85
<i>Crinum jagus</i> (L.f.ex Ait)Bury	Gaadal Teeme	Amarylidaceae	Sexual weakness and impotence (1) Varicocele/ Epididymitis (2) Oligospermia/Qstnenospermia (3)	1 Ro (1) (2) (3)	1 Po 2 De	1 Or 2 Or	3,38	0,90	0,87	13,01	0,60	14,21
<i>Daniella oliveri</i> (Harms)Rolfe	Kayerlahi Mboasse	Caesalpiniaceae	Metrorrhagia/Eclampsia(1) Anovulation/Fibroids (2) Witchcrafts:Menstrual pains (4)	1 Ba (1) (2) (3) 2 Mis (3) (4)	1 Po 2 De 2 Fu	1 Or 2 Or 3 Fu	3,58	0,91	0,91	8,01	0,77	9,51
<i>Detarium microcarpum</i> Gmel.	Konkehi Tignoree	Caesalpiniaceae	Menstrual pains/Dysmenorrhea(1)(2) Candida/Chlamydia/Gonorrhoea (3) Uterine fibroids/ Ovarian cysts (4)	1 Lea (1) (2) 2 Ro s(2) (3) (4) 3 Ba (3) (1)(2) (4)	1 Po 2 De 3 De	1 Or 2 Or 3 Or	3,58	0,96	0,88	8,99	0,82	9,20
<i>Dioscorea macroura</i> (Kunth) Pax	Wulderehi Sorbohohm	Dioscoreaceae	Anovulation/Dysovolutions (1) Breast hypotrophisis and congestion (2) Women nferility and abortions (3)	1 Ro 1) (2) (3)	1 Ma 1Po	1 Or 1 Or	0,33	0,95	0,07	0,74	0,41	0,04
<i>Eleutherine bulbosa</i> (P.Mill.)Urb.	Madalaygn	Iridaceae	Sexual weakness and impotence(1) Anaphrodisia/Frigidity/Menopause(2) Oligospermia/ Azoospermia(3)	1 Ra (1) (2) (3)	1 Ma 1 Po 1 De	1 Or 1 Or 1 Or	3,67	0,90	0,11	1,10	0,57	0,45
<i>Euphorbia hirta</i> L.	Barday	Euphorbiaceae	Menstrual pains/Dysmenorrhea (1) Agalactia/Hypogalactia (2) Oligospermia/ Sexual weakness (3)	1 Wp (1) (2) (3)	1 Po 2 De	1 Or 1 Or	2,92	0,92	0,81	7,05	0,44	20,00

Int. J. Adv. Res. Biol. Sci. (2020). 7(3): 168-192

<i>Ficus polita</i> Vahlsubsp. <i>polita</i>	Litahi Hoo-Menee	Moraceae	Ovarian and breast cysts(1) Anovulation/Dysoovulation (2) Agalactia/Hypogalactia (3)	1 Ba (1) 2 Fr (2) 3 Mis (3)	1 De 2 In 3 Am	1 Or 2 Or 3 Por	3,15	0,94	0,81	3,85	0,34	0,13
<i>Ganoderma lucidum</i> P.Karst.	Hebbee	Ganodermaceae	Unexplained infertility(1) Amenorrhoea/Menstrual pains (2) Hypermenorrhoea(3)/Menorrhagia(4)	Wp (1) (2) (3) (4)	1 De	1 Or	3,05	0,90	0,87	4,99	0,34	14,29
<i>Grewia bicolor</i> Juss.	Botoki Mbiriwel	Tiliaceae	IST and Menstrual pains(1) Anovulation/Dysoovulation (2)	1 Ro (1) (2) (3)	1 Po 1 De	1 Or 1 Or	5,81	0,94	0,86	6,02	0,90	9,14
<i>Hibiscus sabdariffa</i> L.		Malvaceae	Infected leucorrhoea (1) Abortions/Abortions threat (2) Intimate hygiene/Vaginal prolaps (3) Anaphrodisia/FrigidityAnorgasmia(4)	1 Sd (1) (4) 2 Lea (2) (3) 3 Fl (3) (1) (4)	1 Ma 2 Po 3 De 4 In	1 Vba 2 Or 3 Vba 4 Pur	0,56	0,97	0,10	0,37	0,29	0,05
<i>Hymenocardia acida</i> Tul.	Samatahi Gebelee	Euphorbiaceae	Sexual weakness and impotence (1) Varicocele and epididymitis (2) Oligospermia and asthenospermia (3)	1 Ba (1) (2) 2 Ro s(2) (1) 3 Mis (3)	1 Po 2 De 3 Po	1 Or 2. Or 3. Or	3,54	0,96	0,87	4,79	0,32	8,33
<i>Kigelia africana</i> (Lam.) Benth.	Yirlahi/Maka Tomoree	Bignoniaceae	Syphilis/Chlamydia/Herpes (1) Dysmenorrhoea/Menstrual pains (2) Hypotrophic breasts/Agalactia (3) Cryptorchidism/Varices (4) Testicular hypotrophy(5) Dysoovulation/Anovulation (6) Sexual weakness and impotence(7) Oligospermia/Hypotrophic penis (8)	1 Ba (1) (2) 2 Mis (1) (2) (3) (4) (8) 3 Fr(3) (5) (6) (7) (8)	1 Po 2 De 3 Ca 3 Oi 3 Tr	1 Or 2 Or 3 Mas 3 Mas 3 Patc	3,41	0,93	0,88	11,25	0,62	20,56
<i>Momordica charantia</i> L.	Habirou Nee-twee	Cucurbitaceae	Menstrual pains/ Amenorrhoea (1) Genital candida/ yeasts(2) Gonorrhoea and syphilis(3)	1 Wp (1) (2) (3) 2 Fr (1) (3)	1 Po 2 De	1 Or 2 Vba	3,05	0,97	0,92	17,95	0,27	11,11
<i>Nauclea latifolia</i> Sm.	Bakurehi Kumkuma	Rubiaceae	Menstrual pains and dysmenorrhoea(1) Uterine fibroids and endometriosis(2) Oligospermia and azoospermia (3) Sexual weakness and impotence(4) Precocious ejaculation (5)	1 Ro (1) (2) (3) (4) (5)	1 Po 1 De 1 Ma 1 In	1 Or 1 Or 1 Or 1 Or	4,40	0,93	0,83	9,69	0,72	12,70
<i>Opilia celtidifolia</i> (Guill. Perr)Endl	Danda	Opiliaceae	Chlamydia/Herpes/ Aids/Hepatitis(1) Gonorrhoea and candida(2) Ovarian and breasts cysts (3)	1 Ba (1) (2) (3) 2 Ro (1) (2) (3) 3 Lea (2)	1 Ma 2 Po 3 De	1 Or 2 Or 3 Or	5,45	0,97	0,88	3,30	0,29	10,00
<i>Panax ginseng</i> C.A. Meyer	Hum-Craa	Araliaceae	Oligospermia/Azoospermia(1) Male and female sexual troubles (2) Precocious ejaculation (3) Gestational hypertension (4)	1 Ro (1) (2) (3) (4)	1 De 1 In	1 Or 2 Or	6,17	0,94	0,92	5,49	0,84	20,00
<i>Parkia biglobosa</i> (Jacq.) Benth.	Narehi/zien Liw	Mimosaceae	Dysmenorrhoea/Menstrual pains (1) Secondary and primary Amenorrhoea(2) Frigidity/anaphrodisia/Anosg (3) Undeveloped sexual organs(4) Ovarian and cervix tumors(5)	1 Ro (1) (2) (3) (4) (5) 2 Ba (1) (4) 3 Lea (3)	1 De 2 Po 3 In	1 Or 2 Or 3 Vba	4,27	0,94	0,97	6,10	0,80	11,11
<i>Vitex doniana</i> Sweet.	Galbihi Ga'ahree	Verbenaceae	Dysmenorrhoea/Amenorrhoea(1) Hormonal troubles (2) Eclampsia/Metrorragia(3)	1 Ro (1) (2) 2 Ba (1) (3)	1 De 2 Po 3 In	1 Or 2 Or 3 Vba	5,45	0,94	0,85	3,43	0,42	10,80
<i>Pergularia daemia</i> Forsk.	Yam-miguiri	Asclepiadaceae	Candida/Chlamydia (1) Foul-smelling leucorrhoea (2) Genital ulcerations(3)	1 Ro (1) (2) (3)	1 De 2 Po 3 Ma	1 Or 2 Or 3 Or	3,48	0,96	0,85	3,21	0,38	11,11
<i>Pterocarpus erinaceus</i> Poir.	Yiyamhi Koo-chii	Fabaceae	Menstrual pains (1) Secondary and primary amenorrhoea(2) Galactorrhea/Agalactia (3) Metrorragia/endometriosis(4)	1 Ba (1) (2) (3) (4) (5) 2 Ro (4) 3 Mis (5)	1 Po 2 De 3 De	1 Or 2 Or	2,72	0,93	0,98	8,86	0,69	16,98

			Woman unexplained infertility (5)									
<i>Securidaca longipedunculata</i> <i>Frensen.</i>	Alali/Homo Swerga	Polygalaceae	Dysmenorrhea/Menstrual pains (1) Ovarians and breasts cysts (2) Uterine fibroids(3) Chlamydia/Syphilis (4)	1 Ro (4) (3) (2) (1)	1 In 1 De 1 Po	1 Or 1 Or 1 Or	3,54	0,89	0,91	5,49	0,53	9,47
<i>Tamarindus indica</i> Linn.	Djabbi Baaree	Caesalpiniaceae	Dysmenorrhea/ Menstrual pains(1) Ovarians and breasts cysts(2) Supranatural infertility/ Djins (3)	1 Ba (1) (2) 2 Mis (1) (2) (3)	1 De 1 In 2 Oil	1 Or 1 Or 2 Or	4,04	0,95	0,04	1,10	0,25	0,02
<i>Tapinanthus bangwensis</i> Danser.	Yewteere Fegeng	Loranthaceae	Chlamydia/Gonocorrhea(1) Dysménorrhea/Menstrual pains (2) Supranatural infertility/Djinns (3)	1 Ba (1) (2) (3) 2 Lea (2) (3)	1 Po 2 In 2 Am	1 Or 2 Wba 2. Por	3,38	0,94	0,91	7,69	0,59	7,42
<i>Tribulus terrestris</i> L.	Tupppere Nguergeche	Zygophylliaceae	Sexual weakness and impotence (1) Oligospermia/Azoospermia (2) Evil spirits and witchcrafts (3) Anaphrodisia/Frigidity (4)	1 Wp (1) (2) (3) (4) 2 Sd (1) (2) (3) (4)	1 Po 1 De 2 Po 2 De	1 Or 1 Or 2 Or 2 Or	3,58	0,93	0,92	3,91	0,34	10,00

Legend: les chiffres entre parenthèses (n) désignent les numeros d'ordre par ligne des maladies traitées par une plante donnée tandis que ceux non entre parenthèses désignent les numeros de correspondances entre partie utilisée, la forme du remède et sa voie d'administration. Exemple illustratif: *Abrus precatorius*; 1&ère ligne, traite 2 maladies don't l'oligospermie et azoospermie(1) en première intention et la faiblesse sexuelle et l'impuissance(2) en deuxième intention. 1Ro signifie que la maladie de première intention (1) est traitée par les racines (Ro) et 2.Lea cad que la seconde maladie par les feuilles (Lea).

3.1.7. Results of a sample of patients treated by herbalists and monitoring by gynecologists

The purpose of this section was to follow a sample of patient volunteers under treatment with traditional healers and with medical records accompanied by the diagnosed pathologies. Out of a sample of 228 patients, 166 (72.81%) partially or completely recovered their health after treatment. A total of 20 medicinal plants have been tested for this purpose.

The results show that for 10 cases of tubal obstructions, 11 cases of Chlamydia infections and 9 of Staphylococcus aureus subjected to the treatment based on *Cassia arereh*, the respective success rates are 7/10 (70%), 7 / 11 (63.64%), 6/9 (66.67%) and 3/5(60%) of cases cured. Against oligospermia, seven(7)plants showed their effectiveness, that is to say respectively 6 cases out of 7 of standardized spermograms (85.71%) with *Boscia salicifolia* (13/17; 86 %), *Crinum jugas* (7/7; 100%), *Annona senegalensis* (5/5; 100%), *Tribulus terrestris* (3/5; 60%), *Nauclea latifolia* (3/4; 75%), *Eleuthrine bulbosa* (7/9; 77.78%) and *Hymenocardia acida* (3/5; 60%).

Out of 24 patients suffering from sexual weakness, 18 cases (75%) were successfully treated, with rates of 7/10 respectively with *Boscia salicifolia* (70%), *Cassia sieberiana* (3/5; 60%) and *Hymenocardia acida* (6/7; 85.71%).

In addition, out of 8 women with uterine fibroids, 3 out of 5 cases were treated with *Kigelia africana* (60%) and 2 out of 3 with the use of *Dioscorea macroura*(66.67 %).

Two plants including *Crinum jugas* and *Kigelia africana* have been tested on sexual impotence with respective success, with the rates of 4/5 (80%) and 6/9 (66.67%) respectively.

The performance of these medicinal plants is shown in the table 4, by the values of the medIp and medIF index. The listed medicinal plants are categorized into tree: "very efficient" (medIp = 3), "efficient" (medIp = 2) and those "moderately efficient" (medIp < 2) medicinal species. Thus very effective medicinal plants are, among others, *Adansonia digitata* against dysmenorrhea and tubal obstructions (D = 0.74; medIp = 3; medIF = 61.53%), *Annona senegalensis* used against oligospermia and impotence (D = 0.91; medIp = 3; medIF = 89.82%) and *Pterocarpus erinaceus* to treat amenorrhea and dysmenorrhea (D = 0.89; medIp = 3; medIF = 81.08%).

To manage oligospermia and sexual weakness, traditional healers prefer *Tribulus terrestris* (D = 0.88; medIp = 3; medIF = 85.67%), *Boscia salicifolia* (D = 0.86; medIp = 3; medIF = 79.01%) and *Nauclea latifolia* (D = 0.85; medIp = 3; medIF = 71.06%) against. Furthermore, the best performing species against tubal obstructions is *Cassia arereh* (D = 0.86; medIp = 3; medIF = 71.06%).

Table 4. Evolution of the results of the most effective herbal treatments on a sample of 146 volunteer patients under clinical monitoring

Scientific names	Pathologies treated	PU	FPh	Dose and duration of treatment	NP	NPC	CR(%)	$D = \frac{P_1 - P_2}{P_2}$	medIp	medIF	Indicators
	Tubal obstructions	Ba/Ro	Dec	250 ml X 2/d X 3w	10	7	70	0,92	3	92	Gr/Echographies
	<i>Chlamydia trachomatis</i>	Ba/Ro	Dec	250 ml X 2/d X 2w	11	7	63,64	0,91	3	91	Negative serlogy
	<i>Staphylococcus aureus</i>	Ba/Ro	Dec	250 ml X 2/d X 2w	9	6	66,67	0,89	3	89	ECBU negative
	Mycoplasma/Chlamydia	Ba/Ro	Dec	250 ml X 2/d X 2w	5	3	60	0,88	3	88	Negat serology
<i>Boscia salicifolia</i>	Oligospermia	Ba/Ro	Dec	1 C à C X 2/d X 4w	7	6	85,71	0,86	3	86	Spermogram
	Sexual weakness	Ba/Ro	Pow	2 C à C X 2/d X 4w	10	7	70	0,86	3	86	Verbal testimony
<i>Pergularia daemea</i>	Anovulation	Ro	Pow	3 C à C X 2/d X 6w	6	3	50	0,85	3	85	Pregnancies
<i>Cassia sieberiana</i>	Sexual weakness	Ro	Pow	4 C à C X 2/d X 1w	5	3	60	0,79	3	79	Verbal testimony
<i>Detarium microcarpum</i>	Candida albicans	Ba/Ro	Dec	250 ml X 2/d X 3w	8	7	87,5	0,77	3	77	CBEU
	Mycoplasma/Chlamydia	Ba/Ro	Dec	250 ml X 2/d X 4w	5	5	100	0,77	3	77	CBEU/Elisa
<i>Kigelia africana</i>	Anovulation/Dysovulation	Ba	Dec	200 ml X 2/d X 3w	12	8	66,67	0,73	3	73	Hormonal
	Sexual weakness/ impoten	Ba	Dec	200 ml X 2/d X 6w	9	6	66,67	0,72	3	72	Verbal testimony
	Breast cysts/congestion	Fr	Dec	200 ml X 2/d X 4w	7	7	100	0,69	3	69	Echography
	Ovarian cysts	Fr	Dec	200 ml X 2/d X 4w	10	6	60	0,69	3	69	Echography
	Fibroids/Tubal obturation	Fr	CaFr	200 ml X 2/d	5	3	60	0,68	3	68	Echography
	Cervical tumor	Fr/Ba	CaFr	X 5w	5	4	80	0,74	3	74	PCV

				200 ml X 2/d X 5w								
<i>Securidaca longiped.</i>	Ovarian cysts	Ro	Pow	1 C à C X 2/d X 4w	6	2	33,33	0,67	3	67	Echography	
<i>Annona senegalensis</i>	Oligospermia	Le	Pow	1 C à C X 2/d X 4w	5	5	100	0,61	3	61	Spermogram	
<i>Adansonia digitata</i>	Menstrual pains	Le/Ba/Ro	Dec	200 ml X 2/d	9	7	77,78	0,61	3	61	Verbal testimony	
	Hypogalactia	Fr	Inf	X 1w	8	8	100	0,75	3	75	Verbal testimony	
<i>Crateva religiosa</i>	Ovarian cysts	Ba/Ro	Dec	200 ml X 2/d	6	5	83,33	0,59	2	59	Echography	
	Anovulation	Ro	Pow	X 3w	5	4	80,00	0,66	3	64	H. balance	
<i>Pterocarpus erinaceus</i>	Amenorrhoea	Ba	Dec	1 C à C X 2/d X 4w	3	3	100	0,58	2	58	Verbal testimony	
	Eclampsia	Ba	Dec	200 ml X 2/d	5	3	60	0,27	1	47	Verbal testimony	
	Abortion threat	Ba	Dec	X 1w	11	11	100	0,88	3	75	Normal pregnancy	
	Menstrual pain	Ba	Dec	200 ml X 2/d X 1w	13	13	100	0,89	3	79	Verbal tetimony	
<i>Opilia celtidifolia</i>	Ovarian cysts	Ba	Dec	250 ml X 2/d X 3w	10	7	70	0,23	1	43	Echography	
<i>Dioscorea sp</i>	Fibroids	Tu	Dec	250 ml X 2/d X 3w	3	2	66,67	0,92	3	62	Echography	
<i>Daniellia oliveri</i>	Menstrual pains	Ba/Ro	Dec	200 ml X 2/d X 1w	3	3	100	0,91	3	61	Verbal testimony	
<i>Tribulus terrestris</i>	Oligospermia	Wp	Pow	250 ml X 2/d X 3w	5	3	60	0,89	3	79	Spermogram	
<i>Nauclea latifolia</i>	Oligospermia	Ro	Dec	250 ml X 2/d X 4w	4	3	75	0,88	3	68	Spermogram	
<i>Ficus polita</i>	Dysovulation	Fr	Pow	1 C à C X 2/d X 4w	6	4	66,67	0,86	3	66	Echography	
<i>Carissa edulis</i>	Cervical tumors	Ro	Pow	1 C à C X 2/d X 4w	5	3	60	0,86	3	56	Pcv	

<i>Eleuthrine bulbosa</i>	Oligospermia	Bu	Inf	250 ml X 2/d X 5w	9	7	77,78	0,85	3	55	Spermogram
<i>Piliostigma thonningii</i>	Oligospermia	Fr	Pow	1 C à Cx2 d x	6	5	66,67	0,92	3	62	Spermogram
	Sexually infections	Ro	Dec	3 w 200 ml X 2/d X 1w	7	7	100	0,88	3	59	Verbal testimony
<i>Hymenocardia acida</i>	Oligospermia	Mi	Pow	1 C à C X 2/d X 4w	5	3	60	0,67	3	61	Spermogram
	Sexual weakness	Mi	Pow	1 C à C X 2/d X 4w	7	6	85,71	0,78	3	73	Verbal testimony
<i>Prosopis africana</i>	Oligospermia	Mi	Pow	1 C à C X 2/d X 4w	3	2	66,67	0,69	3	44	Spermogram
	Sexual weakness	Mi	Dec	250 ml X 2/d X 2w	2	2	100	0,54	2	39	Verbal testimony
<i>Crinum jugas</i>	Oligospermia	Bu	Dec	250 ml X 2/d X 3w	7	7	100	0,78	3	78	Spermogram
	Sexual impotence	Bu	Tri	1Bu X 1 X 1d	5	4	80	0,83	3	86	Verbal testimony
<i>Parkia biglobosa</i>	Ovarian cysts	Fr	Pow	1 C à C X 2/d X 3w	5	3	60	0,49	2	54	Echography
<i>Panax lancifolia</i> L.	Oligospermia	Tu	Pow	1 C à C X 2/d X 4w	3	3	100	0,47	2	51	Spermogram

Legend: PU: parts used; PhF: Pharmaceutic form; NP: Number of patients; NPC: Number of patients cured; CR: Cure rate; Ba: Bark; Ro: Root; Fr: Fruit; Le: Leaf; Tu: Tuber; Bu: Bulb; Mi: Mistletoe; Dec: Decoction; Inf: Infusion; Pow: Powder; Tri: Trituration; d: Day; W: Week

3.1.8. Characteristics of medicinal plant parts used, pharmaceutical forms, recipes categories and administration routes

Overall eight types of plants organs were variously used as raw material having medicinal proprieties. Most favorite parts were leaves (34.26 %) followed by barks, roots and fruits mentioned in the respective proportions of 25.77 %; 20.68 % and 12.39 %.

The most frequent drug configurations were decoctions (26,58%), powders (20.50%), macerated (11.89%) and amulets (11.41%).

The different ethnopharmaceutical formulations can be classified in three categories: category 1(49.26%), category 2 (39.26%) and category 3(11.03%) according to the degree of care provided in their packaging.

Oral (31.98 %) and dermal (23.84%) routes are the most commonly used followed by anal (17.74%) and vaginal (14.60%).

3.1.9.2. Increase in the overall mortality rate per batch according to plants

The count of deaths among 972 treated mice including 108 controls and 864 subjected to 18 extracts from 18 species, showed heterogeneous mortality rates according to the doses and the species of plants tested.

At the dose of 500 mg / kg of the various extracts administered to the first series of batches of mice for the 18 species tested, no case of death was observed for all the batches.

The first animal deaths, i.e. 6/108 mice, were recorded at a dose of 1000 mg / kg in the second series of 18 batches of mice with extracts of *Opilia celtidifolia* (2 deaths at the dose of 1000mg / kg) and *Pergularia daemea* (2 deaths at a dose of 1000mg / kg) followed by *Kigelia africana* and *Tribulus terrestris* respectively 1 death at 1000mg/kg.

At the dose of 2000 mg / kg, the number of deaths was 18/108 mice in total in the third series of 18 batches of mice treated with extracts of 18 plants. Here, the highest mortality rates were observed with extracts of

Opilia celtidifolia and *Pergularia daemea*, 2 deaths respectively.

At a dose of 3000 mg / kg, the extracts resulted in the death of 38 mice in this four series of 18 lots. The highest mortality rates were recorded with the extracts of *Kigelia africana*, *Tribulus terrestris*, *Pergularia daemea* and *Opilia celtidifolia*, with 3 deaths respectively.

On the other hand, at the dose of 4000 mg / kg, 46 deaths were counted in the treated batches, including 4 deaths caused by the respective extracts of *Nauclea latifolia*, *Carissa edulis*, *Kigelia africana*, *Tribulus terrestris*, *Pergularia daemea* and *Opilia celtidifolia*. Treatment with a dose of 5000 mg / kg caused the death of 64/108 mice of this fifth series. The extract of *Opilia celtidifolia* was lethal for the 6 animals in the batch concerned, while 4 deaths were recorded with the extracts *Carissa edulis*, *Kigelia africana*, *Tribulus terrestris*, *Pergularia daemea* and *Nauclea latifolia*. In addition, the last two doses, 6000mg / kg and 7000mg / kg, were lethal for the majority of treated batches. However, a certain number of animals survived the dose of 6000 mg / kg of extracts from *Adansonia digitata* (3/6 dead mice), *Cassia arereh*, *Boscia salicifolia*, *Annona senegalensis*, *Parkia biglobosa*, ie 4 deaths respectively.

3.1.9.3. Overall mortality according to time slots for animal observations

Among all the mice treated with the different extracts, the first animals that succumbed were observed 1 hour after the administration of the different drugs, ie 4 mice in total, respectively one death in the series of Lot 2, Lot 3, Lot 4 and Lot 8 (Fig.4). The numbers of deaths become massive during the fourth (4H), sixth (6H), eighth (8H) and tenth (10H) hourly recording phases, with respectively 179 dead, 232, 299 and 124 dead counted.

The extracts thus globally manifested their lethal activities between 6 hours and 10 hours after their administration in different doses, hence the appearance in bells of the 8 plotted mortality curves illustrated in figure 4. The last mice succumbed at the fourteenth hour of observation, i.e. 23 dead mice.

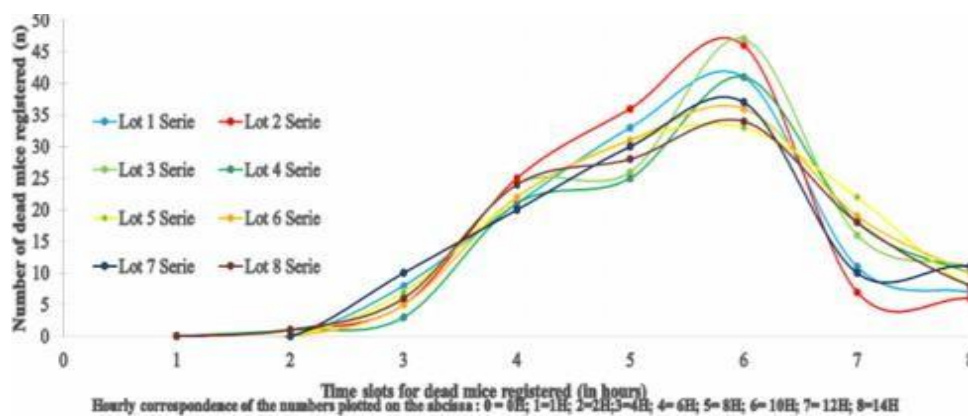


Figure 4. Evolution of the numbers of dead mice treated according to the recording time slots

3.1.9.4. Evolution of acute toxicity and LD₅₀ values

The graphical projections on the Trevan curve show that, for the 18 species tested, the lethal dose which kills half of the mice in a batch (LD₅₀), is on average at 4105.26 ± 0.773 mg / kg body weight. Since the average daily dose traditionally fixed by late practitioners for the 18 plants mentioned above for a patient with an average body weight of 70 kg corresponds to 132 g for a week of taking, or 18.85 g / day. Thus, to have a lethal effect on humans, it is necessary to absorb 287368.2 mg (287.368 g) in one take, or 15.24 times the lethal dose (LD₅₀). The species can thus be classified according to their decreasing safety: *Parkia biglobosa* (5500.34 mg / kg), *Hymenocardia acida* (5470.57 mg / kg), *Detarium microcarpum* (5353.54 mg / kg), *Cassia arereh* (4050, 67 mg / kg), *Pterocarpus erinaceus* (4050 mg / kg), *Boscia salicifolia* (4050 mg /kg).

Regarding the minimum dose which kills 16% of mice in a batch (Dm₁₆%), the required doses are 4000 mg / kg for the extract of *Parkia biglobosa*, 3000 mg / kg for *Hymenocardia acida* and *Detarium microcarpum* and 3000 mg / kg respectively for the majority of the species tested.

The lethal doses at 100% of deaths (D_{max}100%) are located at 7000 mg / kg for four species including *Adansonia digitata*, *Boscia salicifolia*, *Cassia arereh* and *Pterocarpus erinaceus* while they are fixed at 6000 mg / kg for the extracts otherspecies.

The effective safe non-toxic dose is 3000 mg / kg for *Parkia biglobosa* extract and 2000 mg / kg for *Detarium microcarpum* and *Hymenocardia acida*.

3.1.9.5. Classification of 18 medicinal plants according to pharmacovigilance standards

The figure 5 summarizing the evolution of the toxicity and safety of the extracts of the 18 medicinal plants tested shows a large safe therapeutic area spread between 0 and 2.7 probits (from 500 mg / kg to 1300 mg / kg of weight bodily). For all the extracts, above 1300 mg / kg, the extracts begin to show their toxicity on the animals tested to take lethal values at 50% around 4000 mg / kg. From 6000 mg / kg of body weight, the extracts are 100% lethal for the batches of mice thus treated.



Figure 5. Evolution of the safety and toxicity margin of the extracts from the 18 medicinal plants

3.1.9.6. Phytochemical screening of the different extracts from the 20 medicinal species

The phytochemical characterization tests led to the identification of three phytochemical groups divided into nine molecular families with varying degrees of reactions (Tab. 5). It appears that there is a very abundant presence of sterols and polyterpenes, polyphenols and saponoids in the majority of the dosed extracts. Specifically, it is observed that *Detarium microcarpum*, *Cassia arereh*, *Kigelia africana* and *Pergularia daemea* represent the most

prolific and diverse essences in chemical substances potentially in active ingredients.

The highest concentrations of flavonoids have only been revealed in *Pergularia daemea*, *Securidaca longipedunculata* and *Carissa edulis*.

The sterols have had very positive reactions with *Kigelia africana*, *Nauclea latifolia*, *Securidaca longipedunculata* and *Dioscorea macrourea* extracts.

Table 5. Different types of molecular compounds identified in the 18 extracts from the plants tested

Medicinal plants selected	Phytochemical groups in reactions									
	Sterols and polyterpenes			Nitrogen compound	Phenolic compound					
	Sterols	Polyterpenes	Saponins		Alkaloids	Anthracene derivatives	Tannins	Polyphenols	Flavonoids	Free flavonoids
					Anthocyanins	Catechic	Gallics	Leucoanthocyanins		
<i>Pergularia daemea</i>	-	+	++	+++	+	+	+	+	-	+++
<i>Cassia arereh</i>	++	++	++	+++	-	-	++	+	+++	+
<i>Kigelia africana</i>	+++	-	++	+	-	-	++	+	+	-
<i>Pterocarpus erinaceus</i>	+	++	-	+	-	-	+	-	+	-
<i>Tribulus terrestris</i>	+++	+	+	-	-	-	+	+	-	+++
<i>Boscia salicifolia</i>	+	++	-	+++	-	-	-	-	+	-
<i>Adansonia digitata</i>	++	-	-	+	+	+	-	-	+	+
<i>Dioscorea macrourea</i>	+++	++	+	++	+	-	+	-	-	-
<i>Detarium microcarpum</i>	++	++	+	+++	-	-	++	+	+	+
<i>Annona senegalensis</i>	-	++	+	+	-	-	-	-	+++	+++
<i>Crinum jugas</i>	-	-	++	-	-	-	-	+	+	++
<i>Nauclea latifolia</i>	+++	+	-	-	-	-	+	+	-	-
<i>Securidaca longipedunculata</i>	-	+	-	++	+	-	-	-	+	+++
<i>Carissa edulis</i>	+	++	+	+++	-	-	-	-	+	+++
<i>Opilia celtidifolia</i>	+	-	+	-	-	-	+	+	+++	+
<i>Diospyros mespiliformis</i>	+	+	-	++	-	+	-	-	+++	++
<i>Prosopis africana</i>	+	-	+	++	+	-	+	+	-	-
<i>Hymenocardia acida</i>	++	-	+	+	+	+	+	+	-	+
<i>Parkia biglobosa</i>	+	+	-	-	-	-	++	+	-	++
<i>Daniella oliveri</i>	+	++	-	+	-	-	+	+	-	++

Legend: -: absence of positive reaction; +: weak reaction; ++: strong reaction; +++: Very strong reaction

The strong positive reactions marking the presence of the alkaloids were revealed with *Pergularia daemea*, *Cassia arereh*, *Boscia salicifolia*, *Detarium microcarpum* and *Carissa edulis* extracts.

The most significant sources of terpenes come from extracts of *Cassia arereh*, *Annona senegalensis*, *Opilia celtidifolia* and *Diospyros mespiliformis*.

The sterols have had very positive reactions with *Kigelia africana*, *Nauclea latifolia*, *Securidaca longipedunculata* and *Dioscorea macroura* extracts. The strong positive reactions marking the presence of the alkaloids were revealed with *Pergularia daemea*, *Cassia arereh*, *Boscia salicifolia*, *Detarium microcarpum* and *Carissa edulis* extracts.

The most significant sources of terpenes come from extracts of *Cassia arereh*, *Annona senegalensis*, *Opilia celtidifolia*.

3.2. Discussion

The socio-demographic profiles of the respondents revealed a predominance of male traditional healers (62.40%) compared to women (37.60%). Betti and Lejoly (1999) and Sangaré (2011), made similar observations in Cameroon and concluded that one of the reasons for this male supremacy is that the profession of therapist has given him fame in African societies. The analysis revealed a very low level of education for both sexes, 45% illiterate compared to 43.80% having gone to basic school. This situation, testified in several research works, would be general for all traditional healers in the world. The results corroborate those of Addis *et al.* (2002) and Sangaré (2011) who found in their studies that illiterate healers constituted the majority of respondents. The acquisition of this ethnotherapeutic knowledge is done mainly by hereditary transfer, as an extension of a family tradition or by the support of ancestors or a deity manifested by inspirations, dreams, visions or revelations (Pelt, 1993).

Traditional healers treat ten categories of specified diseases in 82 identified pathologies. The most recurrent categories of diseases cited in their management are sexually transmitted infections, menstrual cycle disorders, uterine and cervical damage. These revelations had already been reported in a number of works including those of Delcroix (1994) and Deleke-Koko (2005), which also projected that sexually transmitted infections and menstrual

cycle disorders would become a formidable public health problem. Similarly, Dianzinga (2009) found that sexually transmitted diseases and menstrual cycle disorders accounted for 82% of the causes of infertility in central Africa.

To cope with these pathologies, traditional healers recommend as a priority: *Cassia arereh*, *Annona senegalensis*, *Cassia sieberiana*, *Pterocarpus erinaceus*, *Detarium microcarpum*, *Tapinanthus bangwensis*, *Tribulus terrestris*, *Kigelia africana*, *Cissus quadrangularis*, *Adansonia digitata*, *Piliostigma thonningii*, *Nauclea latifolia*, *Daniellia oliveri*, *Eleutherine bulbosa*, *Prosopis africana*, *Parkia biglobosa* and *Dioscorea macroura*.

Number of phytochemical analyzes including those of De N. *et al.* (2009) highlighted in *Cassia arereh*, several families of substances including phenols, tannins, glycosides, phlobatanines and anthraquinones.

Annona senegalensis is cited in several studies for its antibacterial and viral properties. This plant is widely used against menstrual cycle pathologies, tubal and cervical damage, oligospermia and prostatitis. This species contains mainly diterpenes, rutin, quercetin, acetogenins (annosenegaline and annogalene) that Eshiet *et al.* (1971) and Sahpaz *et al.* (1996) have isolated from its leaves, barks and roots.

Cassia sieberiana is one of the most preferred species of traditional healers for its aphrodisiac and oligospermia therapeutic properties. These activities would be linked, as highlighted in the work of De N. *et al.* (2009), with the high concentrations of mucilages, sterols, oxymethylantraquinones and saponins highlighted in its roots and barks.

Pterocarpus erinaceus was widely indicated by the healers against painful periods, dysmenorrhea, primary and secondary amenorrhea and uterine fibroids. Nguessan *et al.* (2006) obtained the same reports of its empirical virtues from traditional healers interviewed in Togo. The presence of alkaloids, flavonoids, tannins, saponins and anthracenes has been reported by Tittikpina *et al.* (2006).

Detarium microcarpum also obtained strong support from informants for its therapeutic properties against bacterial and fungal infections and tubal obstruction and ovarian dystrophies. Similar data are reported by Adjahoun *et al.* (1996) and De N. *et al.* (2009) in Benin and Burundi respectively. The authors noted the presence in its bark and roots of sterols, triterpenes,

coumarins, anthracenosides and polyphenols known for their very broad therapeutic actionspectra.

Tapinanthus bangwensis finds its reputation among healers by its medico-magic uses widespread in the African tradition. Recipes based on *Tapinanthus bangwensis* take several forms (decocted, macerated, amulet or incense) and are undoubtedly the most sought after of all the products available from healers and on the various markets for medicinal plants prospected. These remedies are prescribed to solve various mystical problems related to sexuality, spells cast, infertility of mystical origin, as a love potion, to protect the fetus from witch attacks or to conceal a litigious or involuntary pregnancy etc. Betti (2002) and Sangaré (2011) have successively pointed out the mystical properties of African mistletoe in their respective works.

Tribulus terrestris has been used for thousands of years by traditional Chinese and Indian medicine to treat sexual impotence, premature ejaculation, male and female fertility disorders, frigidity and dysmenorrhea. Its use is widely known in the sports community to increase their testosterone levels, which promote endurance and physical and mental vitality. This Zygophyllaceae contains, according to De N. *et al.* (2009), active compounds such as steroidal saponins such as diosgenin, diogenizes as well as protodioscin, amino acids, nitrates and potassiumchloride.

Traditional healers surveyed see *Kigelia africana* as the number one remedy for infertility. They recognize the properties of toning the breasts, stimulating lactation in lactating women and preventing breast cancer. In humans, its use would help to get rid of the troubles related to sexuality including premature ejaculation, azoospermia, erectile dysfunctions, and micropenis (it would have the particularity of increasing the size of sex in men). The same uses are recognized for the plant by Pelt (1993) who gives it the name of "village pharmacy". Would these virtues be due to the estrogenic substances that Azu *et al.* (2011) found in abundance in all of its parts?

As for *Cissus quadrangularis*, its reputation as a medicinal plant is due to its multiple medico-magical indications recognized in traditional African medicine. Chevalier (1937) had already pointed out it as a magic plant cultivated by the Blacks of Africa like fetish with multiple uses.

Adansonia digitata is the best used plant to treat fibroids, dysmenorrhea and anovulations. According to local perceptions, it represents the very symbol of

fertility. It is reported, and it is the shared opinion of many traditional healers, that two feet of baobab side by side is an indicator of a gemstone birth in this locality. This assertion is repeated in many ethnobotanical works in West Africa including those of Adjanohoun *et al.* (1996).

Conclusion and Perspectives

The study identified a total of 182 medicinal plants used in the traditional treatment of the 10 categories of pathologies of the male and female reproductive systems, 40 of which are more preferred by local traditional healers. The species have shown very low acute toxicity and contain potentially active chemical compounds. Thus, they can be used with a good margin of safety, the LD50 (3200ml / kg of body weight) for all the species being largely above the effective doses prescribed by traditional healers. Thus, depending on the indices of appreciation of their importance, *Pterocarpus erinaceus*, *Detarium microcarpum*, *Cochlospermum tinctorium* and *Dioscorea macroura* could be validated for the treatment of menstrual cycle disorders, *Cassia arereh*, *Detarium microcarpum* against tubal obstructions and sexually transmitted infections. We can also recommend, *Kigelia africana* and *Pergularia daemea*, *Adansonia digitata*, *Crateva religiosa*, *Securidaca longipeduncula* and *Carissa edulis* respectively against uterine fibroids, ovarian cysts and tumors of the uterus while *Nauclea latifolia*, *Annona senegalensis*, *Tribulus terrestris* and *Boscia salicifolia* would be better indicated against sexual weakness and oligospermia. In perspective, analyzes of subchronic and chronic toxicity must be carried out on the 18 most used species.

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