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# Ethnopharmacological survey of plants used for the treatment of female infertility in Baham, Cameroon

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ABSTRACT

*Ethnopharmacological relevance:* Infertility affects many women in Cameroon, with a rate of about 25%. This study aimed at collecting and documenting information on herbal remedies traditionally used for the treatment of women infertility in Baham subdivision (Western Region of Cameroon).
*Materials and methods:* Fieldwork was undertaken as an ethnopharmacological survey involving thirty-two traditional medicine practitioners interviewed in 8 villages of the Baham sub-division. Personal information on interviewees as well as issues related to medicinal use of plants were recorded using structured questionnaires. A literature investigation on the therapeutic or pharmacological properties of recorded medicinal plants was further undertaken.
*Results:* From this inventory, a total of 46 plant species belonging to 43 genera and 26 families have been registered. These plants are used in 32 recipes and prepared as maceration (43%) or decoction (40%) of only one plant (25%) or of the mixture of two (22%), three (28%), four (22%) or even seven (3%) medicinal plants. Globally, they are given orally during 30 days, at an average dosage of two glasses per day. The literature confirms the use of the majority of these plants for the treatment of the woman infertility and illnesses that are associated to it.
*Conclusion:* This research shows that traditional healers of the Baham subdivision use various recipes of medicinal plants for the treatment of female infertility. The valorization of this potential could be important for the conservation of these plants and the improvement of women reproductive health.


## 1. Introduction

Ethnopharmacological survey has been found to be one of the reliable approaches to natural and synthetic drug discovery and production (Fabricant and Farnsworth, 2001). These natural products and their derivatives represent worldwide, over 50% of all drugs in clinical use (Van Wyk et al., 2002). In African traditional societies, they are most often prepared as crude extract of medicinal plant organs (leaves, roots, flowers, bark, etc.) and used to fight many illnesses among which, infertility (Lux, 1976; Bussmann, 2006).

Infertility is a disease of the reproductive system which affects both men and women with almost equal frequency. It is a global phenomenon affecting an average of 10% of human reproductive-age population (Rowe et al., 1993). Many conditions can be associated to it among which non avoidable factors (anatomic, genetic, hormonal and immunological problems) and avoidable factors such as Sexually Transmitted Infections (STIs), infections after parturition or surgery, tuberculosis of the pelvis, and obesity (Daar and Merali, 2002; Larsen et al., 2007).

The majority of infertile people live in the developing world, especially in the "Infertility Belt" which stretches across central and southern Africa and has the world's highest rates of infertility (30%). In Cameroon, the rate of infertility for women aged between 22 and 44 years is 25% (Larsen, 2000). Infertlity almost always leads to decreased levels of personal well-being. By affecting the life of individuals, couples and families, it constitutes a serious burden for the socio-economical development of many African nations and as such has recently been considered as a public health concern (La Rochebrochard, 2004). Thus, urgent measures need to be taken in order to treat and/or prevent it.

A range of medical treatment options exist for infertility. They include the use of fertility drugs to stimulate "superovulation" which correspond to the development and release of more than one

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egg per ovulatory cycle; intrauterine insemination and "high-tech" treatments such as Assisted Reproductive Technologies (ARTs) (Breart and De Mouzon, 1995). However, these medical approaches are very expensive for people in developing countries and are neither always successful nor harmless. Furthermore, specialized medical centers able to offer such treatment are scarce and far distant from rural areas of those countries where the majority of infertile couples are found. They generally rely on traditional medicine for their reproductive health problems (Bussmann, 2006). Many studies have indeed indicated the implication of secondary metabolites from medicinal plants on the regulation of reproductive function (Moundipa et al., 1993; Telefo et al., 1998, 2004; Al-Quarawi et al., 2000; Jha et al., 2010).

In many African communities, the knowledge on medicinal plant usage is often transmitted from the older generation to the younger via word-of-mouth (orally) and most of this knowledge has not been documented (Sofowora, 1993; Asase et al., 2008, 2010). This situation is worsened by the general tendency of deforestation in some of these communities which would irremediably lead to the disappearance of valuable and rare medicinal plants. Moreover, with the increase of western lifestyle among these communities and the lack of interest of younger generation to carry on the tradition (Bussmann et al., 2006; Muthu et al., 2006; Focho et al., 2009a), we tend to believe that the number of traditional healers is gradually reducing there. Thus, there is an urgent need to record our ancestral knowledge on medicinal plants and to protect it from extinction (Mshana et al., 2001; Van Wyk et al., 2002; Van Wyk and Wink, 2004). The safeguard of these medicinal plant preparations could profuse sustainable data for producing good and accessible treatments against female infertility, principally for women in the "Infertility belt".

Accordingly, this paper aimed at collecting information on herbal remedies traditionally used by traditional healers for the treatment of female infertility in the Baham subdivision, Western region of Cameroon. For this purpose, questions on the local or common names of the medicinal plants recorded, the main part of the plants used, the number of plants used in different recipes as well as their mode of preparation and administration and finally the other therapeutic uses of the plants will be addressed to them.

## 2. Materials and methods

### 2.1. Study area

The sub-division of Baham is located in the mountainous part of the western region of Cameroon, along the fifth national road, between Douala the economical capital city of Cameroon (241 km) and Bafoussam (20 km) the third bigger town of the country. Baham is the Central sub-division of the upper plateau division of the western region of the Republic of Cameroon (Fig. 1) (Bomda, 2005). It lies between latitudes 5°15′N and 5°21′N to the North of the equator, and between longitudes 10°21′E and 10°27′E. Baham sub-division has a surface area of 82 km$^2$ and its average altitude is 1700 m above the sea level. The climate is subtropical with average annual temperature between 20 and 22 °C. It comprises two distinct seasons: a dry season from mid-November to mid-March and a rainy season which extends from mid-March to mid-November. The annual rainfall in the area is estimated at about 1600 mm with the highest occurring in September (339.3 mm per annum). Its predominant vegetation is the savannah which is constituted principally of grasslands and woodlands. Its soil is very diversified and fairly fertile for cultivation. It is a basaltic and lateritic soil with a very dark aspect, where the main cultures practiced are maize, beans and sweet potatoes. Baham is a highly touristic town. It possesses many sacred sites (e.g. Fovu Rocks) and many cultural and traditional festivals are yearly organized in the town (Bomda, 2005; Notué and Triaca, 2005).

The population in Baham is about 35,000 with a growth rate of 2.9% and a density of 300 inhabitants per km$^2$. The youth represents 60% of this population, and there are almost 52% of women against 48% of men (Bomda, 2005). Baham possesses one hospital and a few health care centers with a very low capacity. On the economic domain, the people rely mostly on agriculture for daily life (and as a source of income) and breeding; but there are also many commercial infrastructures such as hotels, bakeries or supermarkets. The people in Baham belong predominantly to the Bamileke ethnic group, and the main language spoken here is the 'ghomala' (Bomda, 2005). It is subdivided into 17 villages, but the traditional medicine practitioners were found in eight of them: Souo'o, Poumze, Demgo, Laagwe, Ghouom, Centre Urbain, Ngoungoua and Kaffo. Most of the forests in the region have been degraded and transformed to farmland and people trek long distances to collect medicinal plants. Some important medicinal plants are limited to sacred forests which are accessible only to a selected group of persons.

### 2.2. Data collection

Data were collected between October 2008 and August 2009, from thirty two interviewees who orally consented, without any financial compensation, to share their knowledge with us. Some traditional medicine practitioners declined to participate to this survey because this activity was their main source of income and by sharing this information with us they feared that we would become serious rivals. Most interviews were arranged by village leaders familiar with local conditions and who could communicate with indigenous communities, and by some persons who knew the traditional healers very well, facilitating the contact with them. The record questionnaires used (Appendix B) included information on the local use, the local name, the mode of preparation and forms of administration of the medicinal plants; the parts of the plants used during the preparation; the dosage and duration of the treatment. Data concerning the social profile of the persons interviewed, such as age, sex and profession were also recorded.

The respondents were local traditional medicine practitioners (who are able to treat culturally, specific illnesses such as infirmities, believed to be caused by the influence of the evil eye, contusions and sprains), herbalists (who treat their patients only with plant preparations) and villagers who had practical (or empirical) knowledge on medicinal plants used as herbal remedies. Informants were asked to collect plant specimens they knew and which are used in the treatment of infertility and related diseases in the area. They were able to recognize the important signs and symptoms of diseases which can lead to infertility (fibromas, STI, dysmenorrhoea, etc.). They accompanied the researchers to the field to identify the various plant species which were not growing or cultivated near their homes. In addition to infertility, other traditional usages of these plant species have also been recorded, as well as medicinal plants used in the management of the illnesses such as fibromas, microbial infections, amenorrhoea, or dysmenorrhoea, which can drive to infertility. In the process, plant specimens implicated were collected, and subsequently preserved and stored in the Department of Biochemistry of the Faculty of Science of the University of Dschang. They were identified at the National Herbarium of Cameroon and investigations were done about their therapeutic or pharmacological effects and their phytochemical composition in the literature.

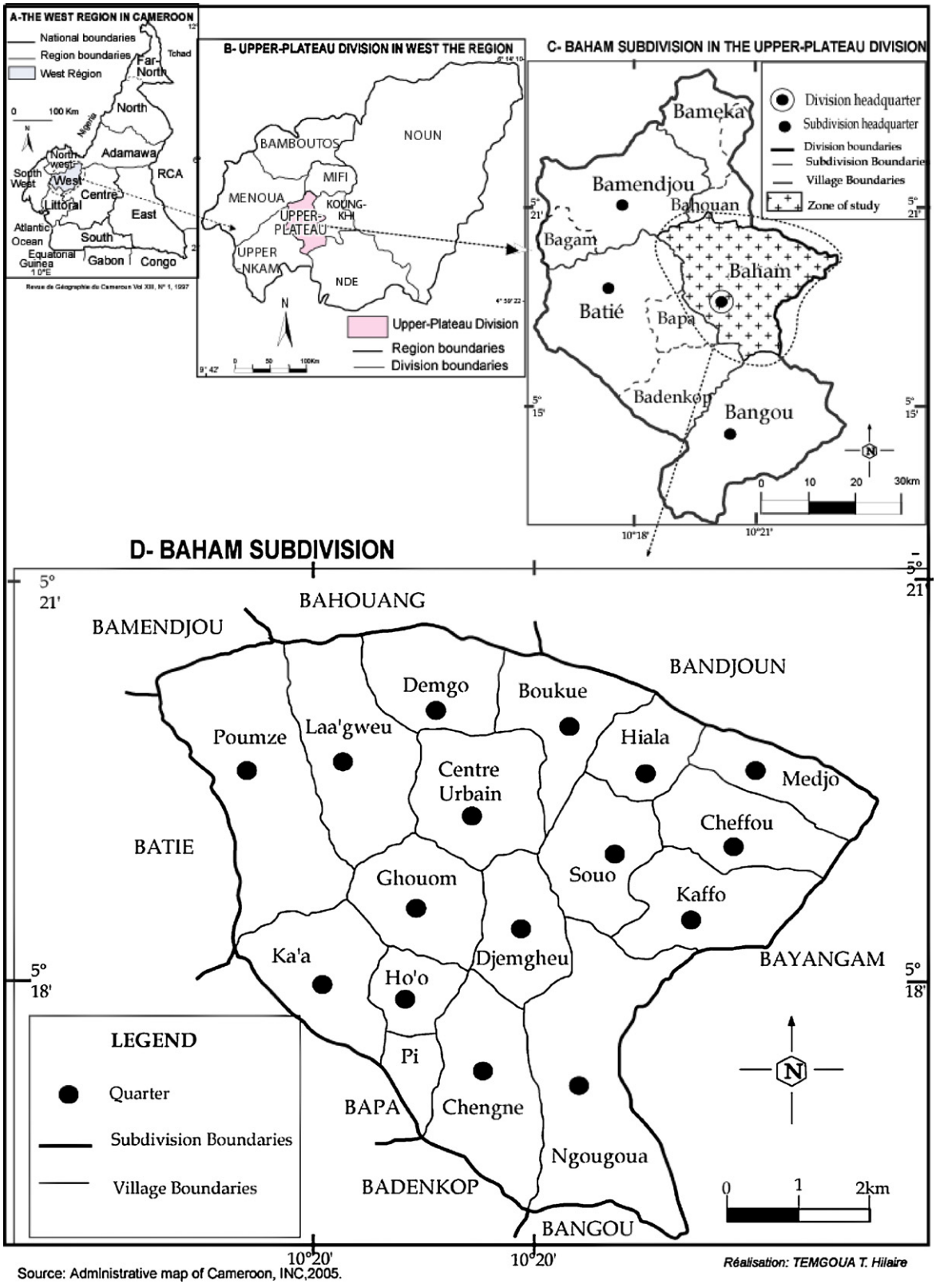


**Fig. 1.** Baham in the upper plateau of western region of Cameroon.

### 2.3. Data analysis

Descriptive statistics was principally used in this study. Initially, the information about the popular uses of the species collected, along with botanical information, was compiled into a database. The species were listed in alphabetical order by family, scientific name, popular name in the region (vernacular name), voucher number and frequency of use. The frequencies of observations of plants were calculated as the sum of their utilizations among the questionnaires given to healers. The frequency of citation (FC) of

**Table 1**
Identification and vernacular name of the plants counted according to their frequency of use.

| Families | Scientific names | Voucher number | Vernacular names (ghomala'a)* | FC (%) |
|---|---|---|---|---|
| Acanthaceae | *Eremomastax speciosa* Hochst. | 23604/SRF/Cam | pinkuidjum | 8.70 |
| | *Justicia insularis* T. Anders | 24150/SRF/Cam | kwe mchie | 4.35 |
| | *Declipta obanensis* S. Moore | 41850/HNC | vee gne | 1.09 |
| | *Brillantaisia lancifolia* L. | 60385/HNC | feng gne | 3.26 |
| Amaryllidaceae | *Crinum distichum* Herb. | 736/SRF/Cam | Lin pedui | 1.09 |
| Apiaceae | *Centella asiatica* L. | 7042/SRF/Cam | Lin wou wou | 4.35 |
| | *Eryngium foetidium* L. | 11741/HNC | Lin tie tie | 1.09 |
| Araliaceae | *Polyscias fulva* (Hiern) Harms | 321958/HNC | Pangwi | 1.09 |
| Asteraceae | *Ageratum conyzoides* L. | 6575/SRFK | Mré guefah | 5.43 |
| | *Aspilia Africana* (Pers.) C.D. Adams | 6555/SRF/Cam | Sia msou | 1.09 |
| | *Bidens pilosa* L. | 9507/SRF/Cam | Kin gne | 1.09 |
| | *Senecio biafrae* (Oliv. & Hiern) J. M. | 32999/SRF/Cam | Doua | 9.78 |
| | *Senecio mannii* Hook. | 7623/HNC | Makoh | 1.09 |
| | *Emilia coccinea* (Sims) G. Don | 20079/HNC | Mré lapin | 3.26 |
| | *Erigeron floribunduus* (Kunth) H.B. | 5619SRF/Cam | Mré gam | 1.09 |
| | *Spilanthes filicaulis* (Schum. &Thonn) C.D. Adams | 22027/SRF/Cam | Pin twe | 1.09 |
| Balsaminaceae | *Impatiens burtonii* (G.M. Schulze) Hook F. | 22788/SRF/Cam | Ma pe pie kouop | 2.17 |
| Bignoniaceae | *Kigelia africana* (Lam.) Benth | 1979/SRF/Cam | Lin ghobe | 1.09 |
| Caryophylaceae | *Drymaria cordata* (L.) Willd | 20550/SRF/Cam | Mto kia | 1.09 |
| Chenopodiaceae | *Chenopodium ambrosioides* L. | 33300/HNC | | 1.09 |
| Commelinaceae | *Commelina benghalensis* L. | 33333/HNC | Wou wou | 2.17 |
| Cucurbitacea | *Coccinia barteri* (Hook F.) Keay | 5643/SRF/Cam | Boutah | 1.09 |
| | *Zehneria scabra* (L.f.) Sonder | 19668/SRF/Cam | Lelomkan | 1.09 |
| Crassulaceae | *Bryophyllum pinnatum* (Lam) Oken. | 33394/HNC | Fam | 1.09 |
| Dracaenaceae | *Dracaena deisteliana* Engl. | 27673/HNC | Fre kan | 1.09 |
| Euphorbiaceae | *Elaephorbia grandifolia* (Haw.) Croizat | 23349/SRF/Cam | Mamcreh | 1.09 |
| | *Euphorbia tirucalli* L. | 26549/SRF/Cam | Lin kesuh | 1.09 |
| | *Jatropha curcas* L. | 33592/HNC | Cottonier | 1.09 |
| Lamiaceae | *Plectranthus glandulosus* | 7656/SRF/Cam | Dedam sii | 1.09 |
| Liliacea | *Aloe buettneri* A. Berger | 59062/HNC | Aloe vera | 4.35 |
| | *Allium cepa* L. | | Anoussi | 1.09 |
| Malvaceae | *Hibiscus noldeae* Baker F. | 23814/SRF/Cam | Ki ki | 3.26 |
| Moraceae | *Ficus capreaefolia* Del. | 17381/SRF/Cam | Yam | 2.17 |
| | *Ficus glumosa* (Miq.) Del. | 46260/HNC | Gah | 2.17 |
| | *Ficus sycomorus* L. | 27006/HNC | Gah douh | 1.09 |
| Musaceae | *Musa sapientium* L. | | Vuh kedé | 1.09 |
| Pentadiplandraceae | *Pentadiplandra brazzeana* Baillon | 42918/HNC | Allium | 1.09 |
| Piperaceae | *Piperonia pelucida* L. | | piperonia | 1.09 |
| Rubiaceae | *Spermacoce princeae* K. Schum | 60795/HNC | Kom teu | 1.09 |
| Sapindaceae | *Paullinia pinnata* L. | 34685/HNC | Dzuh kelong | 1.09 |
| Smilacaceae | *Smilax anceps* L. | 30357/HNC | Khap kape | 1.09 |
| Solanaceae | *Nicotiana tabacum* L. | 18637/SRF/Cam | Depah | 1.09 |
| | *Solanum torvum* Sw. | 10742/SRF/Cam | Su su dem | 1.09 |
| Vitaceae | *Ampelocissus pentaphylla* Gild & Brandt | 7747/SRF/Cam | Boutoh | 1.09 |
| | *Cissus quadrangularis* L. | 7739/SRF/Cam | 4 cotés | 3.26 |
| Zingiberaceae | *Aframomum letestuanum* | 43133/HNC | Du dum | 7.16 |

* Ghomala'a is the traditional language spoken in the region.

the species of plants being utilised was evaluated using the formula: (number of times a particular species was mentioned/total number of times that all species were mentioned) × 100.

## 3. Results

### 3.1. Informants and medicinal species

Among the thirty two interviewees, there were a high percentage of Traditional medicinal healers (59%). They were followed by villagers (22%) and herbalists (19%). Women and men were interviewed equally and the majority of interviewees encountered (66%) were at least 50 years old (data not shown).

The medicinal plants recorded during this study are presented in Table 1. Altogether 46 plant species belonging to 26 families and 43 genera were reported from the study area. The largest number of species was noted from the family Asteraceae (8 species), followed by Acanthaceae (4 species). The Asteraceae family contains the plant *Senecio biafrae* which obtained the highest FC. Many other plants such as *Eremomastax speciosa*, *Aframomum letestuanum*, *Ageratum conyzoides*, *Justicia insularis* or *Aloe buettneri* also presented high FC.

### 3.2. Parts of the plants used, mode of preparation and administration

This study found that many different parts of the medicinal plant species are used as medicine (namely: leaves, root, stem, whole plant, fruits, seeds, bark, and latex); but the most commonly used plant parts were the leaves (43%) (Fig. 2).

The medicines were prescribed in different forms including paste, decoction, infusion and maceration (Table 3 ). They were prepared mainly by three means: maceration (43%), decoction (40%) and infusion (14%) in water or palm juice (Fig. 2). The length of the treatment was highly variable and starts from one day to six months. The most often utilized mode of remedy administration was oral ingestion (Fig. 2). The plants used in the treatments by these traditional healers were sometimes used alone (25%), but most often in combination of two (22%), three (28%), four (22%), or seven (3%) medicinal plants (Table 2).

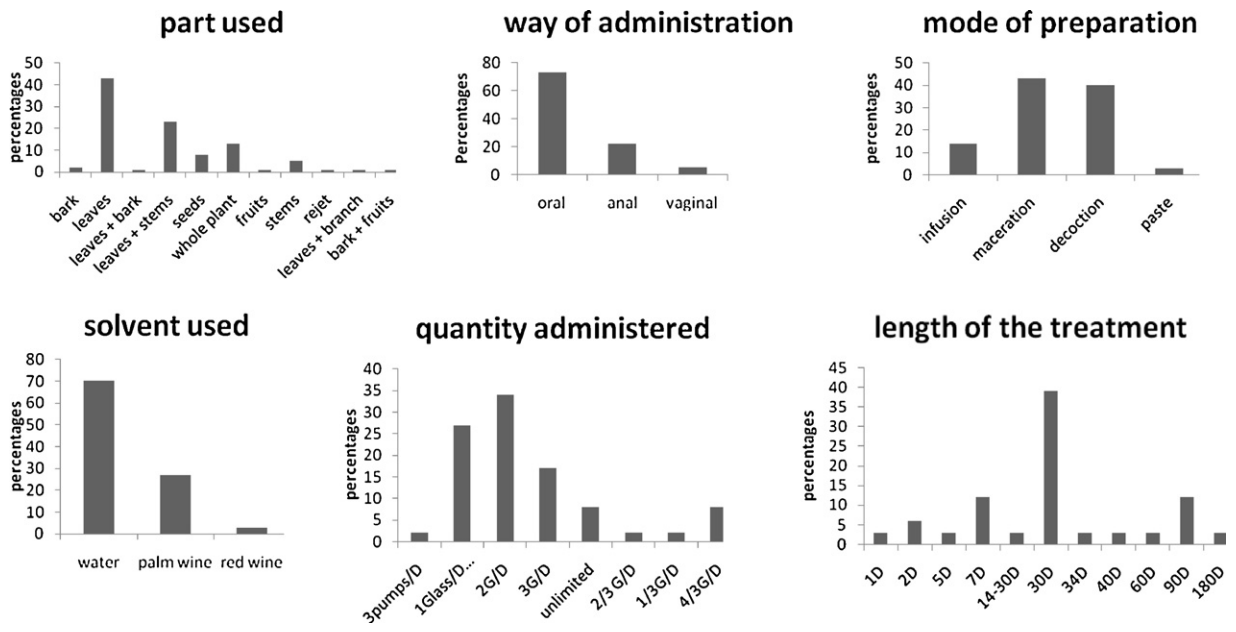


**Fig. 2.** Mode of preparation, ways of administration, used parts, ways of administration of different recipes.

**Table 2**
List of the species according to the different recipes, mode of preparation, used parts and mode of administration.

| Type of recipe[a] (%) | Specie | Organ | Route of administration | Solvents | Mode of preparation | Quantities administered | Length of the treatment | Others diseases treated |
|---|---|---|---|---|---|---|---|---|
| 1 (25) | *Eremomastax speciosa* | L | O | Water | M | Unlimited | 30D | |
| | *Spermacoce princeae* | L + S | O | Water | M | 3G/D | 30D | |
| | *Justicia insularis* | L + S | O | Water | d | 3 G/D | 30D | |
| | *Ficus glumosa*[b] | B + Fr | O | Palm wine | d | 2 G/D | 5D | Horns gulps, hemorrhoids, rheumatism, colic, |
| | *Ficus capreaefolia*[b] | L + B | O | Water | d | 2 G/D | 30D | Fibromas, convulsions, syphilis, |
| | *Ficus sycomorus* | L + R | O | Water | d | 2 G/D | 40D | Sexual weakness, dysentery, gonorrhea |
| | *Senecio biafrae* | L + S | O | Water | M | 2 G/D | 30D | |
| | *Impatiens burtonii* | L | O | Water | I | 2 G/D | 30D | |
| 2(22) | *Senecio biafrae*<br>*Ageratum conyzoides* | L + S<br>F | O | Palm wine | M | 2 G/D | 7D | |
| | *Musa sapientium*<br>*Eryngium foetidum* | Reject<br>L | O | Palm wine | d | 2G/D | 7D | |
| | *Senecio biafrae* | L + S | O | Water | M | 3G/D | 30D | Stomach ache |
| | *Dracaena deistetiana* | L | A | | | 1G/D | | |
| | *Senecio biafrae*<br>*Eremomastax speciosa* | L + S<br>L | O | Palm wine | M | 2G/D | 2D | |

| Type of recipe[a] (%) | Specie | Organs | Route of administration | Solvents | Mode of preparation | Quantities administered | Length of treatment | Others illnesses treated |
|---|---|---|---|---|---|---|---|---|
| 2 (22) | *Cissus quadrangularis* | S | O | Water | d | 1G/D | 90D | Horns gulps, gonorrhea, Chlamydia |
| | *Aloe buettneri*[b] | L | A | | | 2G/D | | |
| | *Ageratum conyzoides* | F | V | Water | d | 2/3G/D | 30D | |
| | *Aframomum letestuanum* | Gr | | | | | | |
| | *Senecio mannii* | L | A | | Paste | 3 pumps/D | 30D | |
| | *Aframomum letestuanum* | Se | | | | | | |

Table 2 (*Continued*)

| Type of recipe[a] | (%) | Specie | Organs | Route of administration | Solvents | Mode of preparation | Quantities administered | Length of treatment | Others illnesses treated |
|---|---|---|---|---|---|---|---|---|---|
| 3 (28) | | *Senecio biafrae* | L + S | O | Water | d | Unlimited | 30D | |
| | | *Ageratum conyzoides* | L | | | | | | |
| | | *Commelina benghalensis* | L | | | | | | |
| | | *Drymaria cordata* | WP | O | Water | I | 1G/D | 30D | |
| | | *Spilenthes filicaulis* | WP | | | | | | |
| | | *Bidens pilosa* | WP | A | | | 1/3G/D | | |
| | | *Cissus quadrangularis* | S | O | Water | d | 3G/D | 90D | Gonorrhea, drepanocytosis, boils, malaria, syphilis |
| | | *Euphorbia tirucalli* | S | | | | | | |
| | | *Smilax anceps* | L | | | | | | |
| | | *Senecio biafrae* | L + S | O | Water + Palm wine | M | 1G/D | 180D | |
| | | *Eremomastax speciosa* | L | | | | | | |
| | | *Ageratum conyzoides* | L | A | | | 1G/D | | |
| | | *Justicia insularis* | L | O | Water | I | 2G/D | 90D | |
| | | *Zehnaria scabra* | L + S | | | | | | |
| | | *Eremomastax speciosa* | L | | | | | | |
| | | *Polyscias fulva* | L | O | Water | M | 1G/D | 2D | |
| | | *Senecio biafrae* | L + S | | | | | | |
| | | *Nicotiana tabacum* | L | | | | 3G/D | Indeterminate | |
| | | *Brillantaisia lancifolia* | L + S | O | Water | M | 4/3G/D | 7D | |
| | | *Aframomum letestuanum* | Se | | | | | | |
| | | *Hibiscus noldeae* | L | A | | | 1G/D | | |
| | | *Justicia insularis* | L | O | Water | I | 2G/D | 30D | |
| | | *Coccinia barteri* | L + S | | | | | | |
| | | *Paulinia pinnata* L. | L | | | | | | |
| | | *Solanum torvum* | Fr | O | Palm wine | M | 4/3G/D | 1D | Horns gulps |
| | | *Centella asiatica* | WP | | | | | | |
| | | *Aframomum letestuanum* | Se | A | | | 1G/D | | |
| 4 (22) | | *Cissus quadrangularis* | S | O | Water | M | 1G/D | 60D | |
| | | *Hibiscus noldeae* | L | | | | | | |
| | | *Eremomastax speciosa* | L | | | | | | |
| | | *Brillantaisia lancifolia* | L + S | | | | | | |
| | | *Justicia insularis* | L | O | Water | I, M | 3G/D | 14-30D | |
| | | *Emilia coccinia*[b] | WP | | | | | | |
| | | *Declipta obanensis* | WP | | | | | | |
| | | *Plectranthus glandulosis* | L | | | | | | |
| | | *Erigeron floribondus* | WP | O | Water | M | 4/3G/D | 7D | |
| | | *Aframomum letestuanum* | Se | | | | | | |
| | | *Bryophyllum pinnatum* | L | A | | | 1G/D | | |
| | | *Crinum distichum* | WP | | | | | | |
| | | *Pepperonia* sp. | B | O | Red wine | d | 3G/D | 90D | Horns gulps, painful menstruations, sexually transmitted infections |
| | | *Alium cepa* | R | | + | | | | |
| | | *Pentadiplandra brazzeana* | R | | water | | 1G/D | | |
| | | *Chenopodium ombrosoides* | L | | | | | | |
| | | *Senecio biafrae* | L + S | O | Palm wine | d, M | Unlimited | 30D | Painful menstruations, horns gulps |
| | | *Eremomastax speciosa* | L | | | | | | |
| | | *Aframomum letestuanum* | Se | V | | | | | |
| | | *Emilia coccinea* | WP | | | | | | |

Table 2 (*Continued*)

| Type of recipe[a] (%) | Specie | Organs | Route of administration | Solvents | Mode of preparation | Quantities administered | Length of treatment | Others illnesses treated |
|---|---|---|---|---|---|---|---|---|
| | *Senecio biafrae* | L + S | O | Palm wine | d | 2G/D | 34D | |
| | *Eremomastax speciosa* | L | | | | | | |
| | *Commelina benghalensis* | L + S | | | | | | |
| | *Brillantaisia lancifolia* | L + S | | | | | | |
| | *Aloe buettneri* | L | O | Palm wine | d | 2G/D | 34D | |
| | *Jatropha curcas* | L + S | | | | | | |
| | *Centella asiatica*[b] | WP | | | | | | |
| | *Ampelocissus pentaphylla* | L | | | | | | |
| 7 (3) | *Kigelia africana* | B | O | Water | d, M | 2G/D | 34D | |
| | *Aframomum letestuanum* | Se | | | | | | |
| | *Eremomastax speciosa* | L | A | | | | | |
| | *Impatiens burtonii* | WP | | | | | | |
| | *Commelina benghalensis* | L | | | | | | |
| | *Ageratum conyzoides* | L | | | | | | |
| | *Hibiscus noldeae* | L | | | | | | |

L, leaves; WP, whole plant; Fr, fruit; B, bark; Se, seed; S, stem; O, oral; A, anal; V, vaginal; G/D, glass per day; D, day; I, infusion; d, decoction; M, maceration.

[a] The number of plants used in the preparation.

[b] Plants used in the treatment of illnesses capable to drag the infertility and whose recipes are not presented in the table that is also the case of *Aspilia africana* and *Elaephorbia grandifolia*, that is why their apparitions in the table do not correspond to their frequencies of use.

### 3.3. Pharmacological or therapeutic effects and phytochemical compositions of plants as reported in the literature

The recorded plants are used in various parts of the world to treat a very large spectrum of illnesses. Most of them are then used to treat infertility and health conditions associated to it, or which can lead to it. These plants are very diversified in biochemical compound families (Table 3). Many works have already been undertaken, principally on the most cited plants while no report was obtained from the others.

## 4. Discussion

The main objective of the present ethnopharmacological survey was to collect information on herbal remedies used traditionally at Baham subdivision, Cameroon, for the treatment of female infertility. A total of 46 medicinal plants belonging to 26 families were recorded. Broad literature review of these medicinal plants shows that they are used in many countries of sub-Saharan Africa, and principally in Cameroon, either for the treatment of infertility or that of illnesses which can drive to it (Igoli et al., 2005; Jiofack et al., 2008, 2010; Focho et al., 2009a,b, 2010). Indeed, two ethnopharmacological surveys conducted in other villages of the western region of Cameroon, on medicinal plants used for the treatment of female infertility, reported the presence of some medicinal plants recorded during this study. For example, fourteen medicinal plants listed in Table 1 were recorded during the survey undertaken by Lemfack (2007) in two villages of the Menoua division (western region of Cameroon). Twenty of them were also recorded in a sub-division of the Northwest region of Cameroon by Focho et al. (2009b). These observations prove the reliability of information gathered during this survey. Moreover, many clinical and pharmacological studies attest the efficiency of some of these plants in the treatment of female infertility. The estrogenic effect of *Senecio biafrae* and its inductive potential on the onset of puberty was demonstrated on immature female rats (Lienou et al., 2010). The FSH-like and anti-estrogenic effects of *Eremomastax speciosa*, its inductive effect on ovulation as well as its regularizing effect on the estrous cycle of female rats were proven (Lemfack, 2007; Ngoufack, 2009). A clinical study on the effects of compounds from *Aloe buettneri* has shown in 250 cases of sterility, improved fertility and a decrease in menstrual disorders in 85% and 44.6% of cases respectively (Bhaduri et al., 1968; Garg et al., 1970; Gupta, 1972). *Justicia insularis* have been shown to increase folliculogenesis in female rats (Tagne, 2009). Studies on the aqueous extract of the leaf mixture of four medicinal plants including *Aloe buettneri* and *Justicia insularis* have proven its estrogenecity and inducing effect on female rat folliculogenesis and steroidogenesis (Telefo et al., 1998, 2002, 2004).

The medicinal plants belonging to the Asteraceae family were the most recorded during this survey. The same rank was also obtained by Lemfack (2007) and Focho et al. (2009a) who undertook their surveys in geographic and ecological areas closer and similar to that of Baham. This predominance of plants from the Asteraceae family for the treatment of infertility could be a reflection of the world wide high number of species (19,085) found in this family (Voeks, 1996). These plants are herbaceous species that most often occur as weeds and their high frequency of use in this study may be related not only to their availability and abundance in this geographical area but also to the similarities of traditional knowledge of people of this area on female infertility treatment with medicinal plants.

The number of male healers consulted was the same as that of female healers; but the four plants most cited (*Senecio biafrae*, *Eremomastax speciosa*, *Aframomum letestuanum* and *Ageratum conyzoides*) were principally recorded from women. This is justified by the fact that women are more aware of this illness, notably in African society where infertility is sometimes wrongly attributed to woman and not to man.

The leaves were the main plant parts used in remedy preparation. They are their main photosynthetic organs and also act as their reservoirs for photosynthates or exudates; some of which protect the plants against devourers or are of medicinal values to the human body (Balick and Cox, 1996). Other medicinal plant parts (roots, barks, fruits, and seeds) were cited during this survey; but the high frequency of utilization of leaves may be advantageous

**Table 3**
Activity and major phytochemical compounds of the plants in literature.

| Species | Major phytochemical compounds | Therapeutic utilization | Frequency in the survey |
|---|---|---|---|
| *Eremomastax speciosa* | Flavonoids, alkaloids, saponins, and tannins (Oben et al., 2006) | Infertility, urinary infections (Adjanohoun et al., 1996; Tacham, 2000; Priso et al., 2006) | 8 |
| *Justicia insularis* | Flavonoids, alkaloids, and glycosides (Telefo et al., 2004) | Infertility, pains of childbirth, menstruation unrest (Adjanohoun et al., 1996; Telefo et al., 1998) | 4 |
| *Crinum distichum* | No report | Infertility, amenorrhea (Priso et al., 2006) | 1 |
| *Ageratum conyzoides* | Flavonoids, alkaloids, benzofuranes, and terpenes (Adewole, 2002) | Infertility, microbial infections, infections of the genital device (Bouquet, 1969; Burkill, 1985; Adjanohoun et al., 1988; Iwu, 1993; Noumi and Dibakto, 2000; Igoli et al., 2005; Jantet, 2006) | 5 |
| *Bidens pilosa* | Acetylenic compounds, flavonoids, glycosides, clalcones terpenes, and essential oils (Amvam Zollo et al., 1995; Brandao et al., 1997) | Difficult childbirth (Bouquet, 1969; Kerharo and Gadam, 1973; Adjanohoun et al., 1988) | 1 |
| *Senecio biafrae* | Dihydroisocoumarins, terpenoids, sesquiterpens, amino acids, and mineral salts (Adebooye, 2004; Dairo and Adanlawo, 2007; Tabopda et al., 2009) | Infertility, microbial infections (Tacham, 2000; Ngo et al., 2007) | 9 |
| *Emilia coccinia* | No report | Dysmenorrhea, microbial infections (Adjanohoun et al., 1996; Priso et al., 2006) | 3 |
| *Erigeron floribunduus* | Flavonoids, alkaloids, saponins, phenols, and tannins (Asongalem et al., 2004) | Genital infections (Lejoly et al., 1993) | 1 |
| *Spilanthes filicaulis* | No report | Genital infections (Adjanohoun et al., 1996; Afegenui, 2007) | 1 |
| *Polyscias fulva* | No report | Obesity (Jeruto et al., 2008) | 1 |
| *Kigelia africana* | No report | Barrenness, feminine infertility, syphilis, breast inflammation (Adjanohoun et al., 1988; Arbonnier, 2002) | 1 |
| *Zehnaria scabra* | No report | Infertility, dysmenorrhea, genital infections, hemorrhoids (Adjanohoun et al., 1996) | 1 |
| *Euphorbia tirucalli* | No report | Hemorrhoids, gonorrhea (Arbonnier, 2002; Jain et al., 2008) | 1 |
| *Jatropha curcas* | No report | Infertility (Kerharo and Gadam, 1973; Burkill, 1985; Igoli et al., 2002, 2005; Jain et al., 2008) | 1 |
| *Plectranthus glandulosus* | No report | Microbial infections (Egwaikhide and Gimba, 2007) | 1 |
| *Bryuphyllum pinnatum* | Alkaloids, flavonoids, saponins, phenols, and tannins (Okwu and Josiah, 2006) | No report | 1 |
| *Aloe buettneri* | Glycosides, quinines, coumarins, and anthraquinonic derivatives (Telefo et al., 2004) | Infertility, painful menstruations, dysmenorrhoea (Gupta, 1972; ACCT, 1989; Schaffner, 1992; Penelope, 1994; Adjanohoun et al., 1996; Telefo et al., 1998; Tacham, 2000; Priso et al., 2006) | 4 |
| *Hibiscus noldeae* | No report | Abortion (Chifundera, 1998; Adjanohoun et al., 1996) | 3 |
| *Ficus capreaefolia* | No report | Syphilis (Arbonnier, 2002) | 2 |
| *Ficus glumosa* | No report | Feminine sterility, childbirth (Arbonnier, 2002) | 2 |
| *Ficus sycomorus* | Galinic tannins, saponins, reducing sugars, alkaloids, and aglycon flavons (Sandabe et al., 2006) | Bareness (Arbonnier, 2002) | 1 |
| *Plectranthus glandulosus* | Alkaloids, tannins, anthraquinones, glycosides reducing sugars, saponins, flavonoids, phlobatannins, terpenoids, and steroids (Egwaikhide and Gimba, 2007) | No report | 1 |
| *Musa sapientium* | No report | Barrenness, irregular menstrual cycle, milky insufficiency (Chifundera, 1998) | 1 |
| *Paulinia pinnata* | No report | Feminine barrenness, amenorrhea, gonorrhea (Arbonnier, 2002) | 1 |
| *Smilax anceps* | Alkaloids, saponins (Adebayo-Tayo and Adegoke, 2008) | Syphilis (Arbonnier, 2002) | 1 |
| *Solanum torvum* | Flavonoids, alkaloids, saponins, glycosides, and tannins (Chah et al., 2000; Lu et al., 2008) | Infertility, microbial infections, genital infections (Iwu, 1993; Adjanohoun et al., 1996; Tacham, 2000; Chah et al., 2000) | 1 |
| *Ampelocissus pentaphylla* | No report | Infertility (Tacham, 2000) | 1 |
| *Cissus quadrangularis* | No report | Gonorrhea, syphilis, milky insufficiency (Chifundera, 1998; Arbonnier, 2002) | 3 |

for the conservation and sustainable utilization of the medicinal plants. Indeed, improper collection of roots of a plant may lead to its definite destruction (Poffenberger et al., 1992; Abebe and Ayehu, 1993; Zheng and Xing, 2009). The length of thirty days of treatment certainly matches with the length of the menstrual cycle of the woman and corresponds to the period during which the efficacy of the treatment should be proven.

The remedies using more than one plant were in high proportion (75%) in this study. This can be explained by the fact that these traditional healers are most often interested in the treatment of

the conditions associated to the illness. That is why they use many plants in their recipes. They claimed that in their remedy, each plant chosen is generally virtually oriented by the symptom encountered. Because of their limited tool of diagnosis, they have little information about the real origin of the ailment. Their treatments are thus oriented most often against the sexually transmitted infections or affections of the women genital tract, and conditions due to hormonal defects, which are the main causes of infertility in our area. For example, the association of *Senecio biafrae*, *Eremomastax speciosa* and *Ageratum conyzoides* as they claimed is employed in women with menstrual disorders. In the mixture, *Solanecio biafrae* and *Eremomastax speciosa* could specifically act on the normalization of the menstrual cycle through the induction of ovarian folliculogenesis (Ngoufack, 2009; Lienou et al., 2010) and the great anti-microbial action of *Ageratum conyzoides* could help to fight any infection of the reproductive system. It is through this procedure that they may sometimes defeat the ailment.

Due to the high diversity of the compounds in the recorded medicinal plants, no real evidence can show the correlation between the presence of a group of phytochemical compounds and the efficacy of the plant. The main reason is the high variability of the causes of infertility and thus, of their treatment. Also, the use of some of the recorded medicinal plants for the treatment of other illnesses not related to infertility may be linked to their high variability in phytochemical compounds. The synergistic effect between these compounds can explain the high spectrum of action of some recorded medicinal plants in the treatment of various diseases (Stepp and Moerman, 2001).

## 5. Conclusion

The results of this study provide valuable information on medicinal plants used by traditional healers of Baham sub-division in Cameroon to treat female infertility. Although, preliminary studies undertaken on some of these medicinal plants have confirmed their therapeutic effect; further pharmacological, phytochemical and toxicological investigations need to be conducted on the extracts of most of them. This will help in the development of new plant based female infertility drugs.

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## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jep.2011.04.036.

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