

## Useful plants and tradition for pregnancy, child delivery and for post-partum care used by people living around Analavelona forest in South west Madagascar

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Free listing and semi-structured interviews were undertaken in order to get a list of plant used during pregnancy, child delivery and post-partum care in Sakaraha district, South-western Madagascar. Use of Anthropic and XLstat software were performed for plant lists analysis. One hundred twelve plant species belonging to 90 genera and 46 families are cited as useful for the care of women during pregnancy period, childbirth and post-partum. Those species are mentioned by 46% of the 259 informants interviewed. *Jatropha curcas* L., *Cedrelopsis grevei* Baill., *Ficus brachyclada* Baker, *Flacourtia ramontchi* L'Hér. and *Henonia scoparia* Moq are the most used plant species as they are cited by more than 30 informants. Women from our site study are entirely dependent on plants during pregnancy, child delivery and post-partum period. This study will contribute to preventing loss of traditional knowledge from the southern part of Madagascar.

**Keywords:** Women health, Pregnancy, Post-partum care, Useful plants, Analavelona forest, *Mikoboka*, *Mahaboboka*, *Amboronabo* tribes

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Worldwide, for the majority of people from different background, child always means wealth and survival of generations and the lineage. The birth of a child is always a cherished and happy event in any given family<sup>1,2</sup>. Despite the occurrence of discrimination and violence against women found in some Malagasy communities<sup>3,4,5,6,7,8</sup>, pregnancy period is always considered as a blessed period for mother and her family. In Malagasy society structure, pregnant women receive attentional care from their families by giving them special instructions, diets or restrictions following their belief<sup>9,10</sup>. Moreover, not only motherhood gives more consideration to women but also it gives prestige to their husband and to the whole family. In general, many societies think that during pregnancy period, women and fetus are susceptible by physical or clinical diseases<sup>11,12</sup>. Moreover, in such societies, including Malagasy society, pregnant women are viewed as more vulnerable to evil

thoughts and bad sorceries<sup>13,14,15</sup>. Thus future mothers need to pay more attention about their health as well the health of the baby they are carrying. However, in several African countries, including Madagascar, public and private health facilities for pregnancy and for child delivery care is very inadequate or even inexistent<sup>16,17</sup>. And, even if the healthcare facility or health base center (HBC) exists in their area, very often, poor rural people can't afford the cost of pregnancy control or the cost of drugs prescribed by doctors. Therefore, women living in rural areas and remote place rely on traditional medicine for their reproductive health, from pregnancy period to birth and the period after birth. Traditional cares are the only available treatment for them. Women of Sakaraha district in the South-western Madagascar are not exception to that pattern. Usually they give birth at home with traditional midwife and use plants to replace pharmaceutical medicines. By this context, our hypothesis is that a numerous plant species are

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used as care for women during pregnancy, child delivery and post-partum.

Traditional women’s reproductive health has been highly discussed in many part of the world<sup>18,19,20,21,22</sup>, however, only few study was documented in Madagascar about this topic. A Study undertaken in Southeastern part of Madagascar<sup>23</sup> highlighted that plants used for reproductive system are among the most cited plants by women. Our second hypothesis is that women from the Southwestern part of Madagascar have also more knowledge of useful plants for pregnancy, child delivery and post-partum care. This study is part of the ethno-botanical surveys on the knowledge of useful plants of people living in three communities of Sakaraha district in Southwestern Madagascar. The main objective is to inventory plants used by local people in three communities in Sakaraha, during their pregnancy, delivery period and post-partum care. Then to know variation of knowledge plants between gender and age and to transmit the most common useful plants for pregnancy, child delivery and post-partum to younger generation as to prevent loss of traditional knowledge.

**Methods**

**Study sites**

The study was conducted in 34 villages and hamlets surrounding the New Protected Area (NPA) of Analavelona (Fig. 1), located in the Southwestern Madagascar. These 34 villages and hamlets are circumscribed in seven Fokontany (Marotsiraka Betsileo, Soaserana, Manera, Soatanimbary, Besavoaha, Mitia, Fanjakà) within three rural communities (*Mikoboka, Mahaboboka, Amboronabo*) of Sakaraha district. These villages were chosen for the surveys because they are affected by the implementation process of Analavelona forest as a New Protected Area. The distance separating these villages from the only District Hospital Center (DHC) is between 40 and 100 km (100000 m). Furthermore, there are only five trained midwives available for the all Sakaraha district with a population (107,147) and an area of 8,837 sq km<sup>7,24</sup> and only 2 midwives work in Mahaboboka with 11,069 number of population (Personal Communication in 2012). In terms of social organization, the main tribe of Sakaraha region is called *Bara*, they own most of the land. However, other ethnic groups (*Antanosy, Antandroy, Masikoro, Vezo, Sakalava, Mahafaly, Betsileo* and *Antaisaka*) from different parts of Madagascar immigrated in this

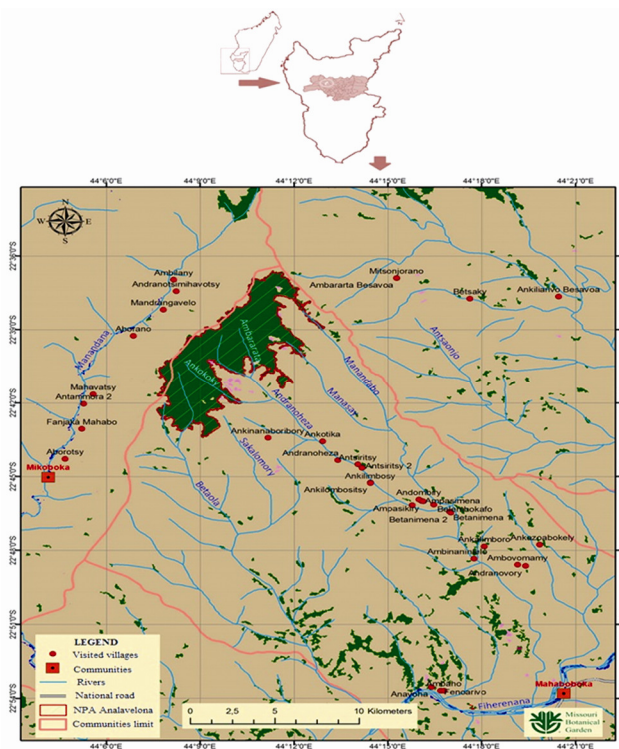


Fig. 1 — Location of site study

region in search of better place to live<sup>8,25</sup>. Consequently, Sakaraha district has (a mixing people having) different backgrounds and traditional knowledge’s, making it an interesting place to conduct ethno-botanical surveys. The two main activities in the area are livestock and agriculture farming<sup>25</sup>.

**Data collection**

**Trust building approach**

As traditional authorities are very powerful and respected in our site study, before conducting any study, they were the ones we approached first to explain the reason of our visit, the goal of our study and the timing of our activities during our stay in their village. To build a strong connection with the villagers, during the course of our fieldwork, we lived with them and followed the rhythm and custom of their everyday way of life. Actually, prior to conducting any interview, we created a bond with informants through simple conversations to make sure that interviews time is right, in order to put them at ease and comfortable. Because of the dialect barrier, we also hired a couple of local people to guide, to assist us and to translate local dialect in making sure that the data collected were correct.

### Data gathering

Data gathering refers to the process of recording traditional knowledge of the community and the activity of botanical collecting. Semi-structured method<sup>26,27</sup> was adopted during all interviews in villages/hamlets or while talking with informants (usually local healer or head of village) in the forest during voucher specimens collections. We also did a free listing<sup>28,29</sup> of plants used during pregnancy, during and after baby delivery.

### Voucher specimens

After the interview sessions, we went to the forest with the people who know vernacular names of the plants to make voucher specimens. The goal is to make scientific identification plants used by the locals and to correspond it with the local names. To help in the scientific plant identification, we made a lot of efforts to collect fertile plant materials<sup>30</sup>.

### Data analysis

Data containing list of plants used during pregnancy, child delivery and after birth were extracting from the list of all useful plants cited by informants. Data from free listing were treated with Anthropac 1.0 ®<sup>29</sup>. It gives the frequencies, average rank and salience Smith's index. XLSTAT software was used in order to test variation of informant's knowledge of useful plant for pregnancy, child delivery and post-partum. Non parametric Mann Whitney test was realized to know variation of informant's knowledge between genders. Non parametric Spreaman test was performed to know if there is a correlation between age of informants and their knowledge.

### Approval

Prior to our fieldwork, signed research authorization and collecting permit was obtained from the Malagasy Government. To fulfill what is stated in the seventh article of the Nagoya Protocol in 2012<sup>31</sup>, a verbal consent was obtained from traditional leaders. Then, we asked the elected head of Fokontany to sign a formal consent document allowing us to conduct our study in their village.

### Results

#### Demographic profile of informants

Among 119 informants who cited plants used for pregnancy, child delivery and post-partum care within them, 15 are composed of divine healer, head of village and traditional midwives, the rests are regular

community members. In terms of gender, informants are composed of 59 % of female and 41 % of male, aging from 12-81 yrs old. As for category by tribe, 72 % of informants are composed by Bara tribe and 28 % are from other tribes living around the forest. Most of informants are married (82 %) and a village household has at least 3 children (Table 1).

### Quantitative data

Examination of free-list revealed that each informant provides 1 to 29 useful plant names for pregnancy, child delivery and post-partum care. The average of plants cited by informants is about five plants. Female informants quoted more plants to the list than male informants because each female respondent mentioned five plant species on average versus four for the male respondent. However, the non-parametric, bilateral test of Mann Whitney with XLSTAT shows no significant difference between plants list of the two genders with p value equals to  $p=0.193$ . As for the Spreaman non parametric test, the p value equals to  $p=0.872$  indicated that there is no correlation between the class of age of informants

Table 1 — Profile of informants

Items	Number (percentage)
Gender	
Male	49 (41 %)
Female	70 (59 %)
Age	
<15	2 (2 %)
[15-30]	17(15 %)
[30-45]	59 (52 %)
[45-60]	28 (25 %)
[60-75]	6 (5 %)
≥75	1 (1 %)
Ethnic group	
<i>Antandroy</i>	3 (2 %)
<i>Antanosy</i>	21 (18 %)
<i>Bara</i>	86 (72 %)
<i>Mahafaly</i>	2 (2 %)
<i>Masikoro</i>	6 (5 %)
<i>Vezo</i>	1 (1 %)
Marital status	
Married	98 (82 %)
Single	18 (15 %)
Divorced	2 (2 %)
Widow (er)	1 (1 %)
Occupation	
Head of villages ( <i>Lonaky</i> )	7 (6 %) 8 (7 %)
Traditional healer	8 (7 %)
(divine healer and traditional midwives)	89 (80 %)
Public workers	
Farmers	

and the average number of plants used for pregnancy, child delivery and post-partum care given by each informant.

**Free-listing results**

From Anthropac ® analysis, the plant citation frequency is ranged from 0.9- 39.7%. Twenty-five species are cited by more than five informants with frequency value (F) > 5%. These 25 of free-listed

plants through the frequency and the Smith's index are indicated in Table 2. The top five of the most cited plants species include: *Jatropha curcas* L. (F = 39.7%), *Cedrelopsis grevei* Baill. (F = 29.3%), *Ficus brachyclada* Baker (F = 28.4%), *Flacourtia ramontchi* L'Hér. (F = 26.7%) and *Henonia scoparia* Moq. (F = 24.1%). They are cited by 30 informants at least. The Smith's index (S) vary from 0.004 to 0.258 and according to these values, 51 plant species have

Table 2 — Frequency and Smith index of the top 25 useful species

Family	Scientific name	Local name	F (%)	Rank	S	Voucher
Euphorbiaceae (EUPH)	<i>Jatropha curcas</i> L.	<i>Savoa</i>	39,7	4,15	0,258	PBP1725
Flacourtiaceae (FLACOURT)	<i>Flacourtia ramontchi</i> L'Hér	<i>Lamoty</i>	26,7	3,29	0,178	Hong-Wa176, MNH198
Moraceae (MOR)	<i>Ficus brachyclada</i> Baker	<i>Adabo</i>	28,4	4,76	0,17	TAB358
Amaranthaceae (AMARANTH)	<i>Henonia scoparia</i> Moq.	<i>Kifafa</i>	24,1	3,71	0,162	TAB203
Rutaceae (RUT)	<i>Cedrelopsis grevei</i> Baill.	<i>Katrafay</i>	29,3	5,24	0,144	TAB225
Anacardiaceae (ANACARD)	<i>Sclerocarya birrea</i> subsp. <i>caffra</i> (sond.) Kokwaro	<i>Sakoa</i> <i>Sakoalahy</i>	18,1	3,57	0,115	RKN425
Phyllanthaceae (PHYLL)	<i>Margaritaria</i> L. f.	<i>Kotika</i>	14,7	2,71	0,104	TAB524
Lamiaceae (LAM)	<i>Ocimum gratissimum</i> L.	<i>Rombabe</i>	16,4	4,84	0,093	TAB262
Oleaceae (OLEA)	<i>Noronhia buxifolia</i> H. Perrier	<i>Tsilaitsy</i>	13,8	4,63	0,086	ATH 1488, RKN395
Olacaceae (OLAC)	<i>Anacolosa pervilleana</i> Baill.	<i>Tanjaky</i>	12,9	4	0,077	ATH538, TAB298
Malvaceae (MALV)	<i>Sida</i> aff. <i>cordifolia</i>	<i>Mandravasarotsy</i>	9,5	3,09	0,077	TAB532
Phyllanthaceae (PHYLL)	<i>Phyllanthus casticum</i> Willemet	<i>Sanira</i>	10,3	3,25	0,074	ATH1464, TAB354
Lauraceae (LAUR)	<i>Ocotea trichantha</i> Baker	<i>Manojeja-Maroanaky</i>	10,3	3,5	0,069	ATH1508, TAB339
Phyllanthaceae (PHYLL)	<i>Antidesma madagascariense</i> Lam.	<i>Voafona</i>	7,8	3,56	0,056	RKN428, TAB212
Poaceae (POA)	<i>Echinochloa colona</i> (L.) Link	<i>Akatafoty</i>	9,5	5,45	0,054	MNV551
Euphorbiaceae (EUPH)	<i>Suregada eucleoides</i> Radcl. -Sm.	<i>Kalavelo</i>	8,6	5,1	0,051	TAB422
Cannabaceae (CANN)	<i>Trema orientalis</i> (L.) Blume	<i>Andrarezo</i>	10,3	7,42	0,05	ATH914, RKN406
Buddlejaceae (BUDDL)	<i>Buddleja madagascariensis</i> Lam.	<i>Seva</i>	8,6	4	0,046	Josso 39
Apocynaceae (APO)	<i>Cynanchum luteifluens</i> var. <i>longicoronae</i> Liede	<i>Trivony</i>	7,8	4,56	0,041	TAB547
Salvadoraceae (SALV)	<i>Salvadora angustifolia</i> Turrill	<i>Sasavy</i>	6,9	3,63	0,039	RFM35
Fabaceae (FAB)	<i>Entada chrysostachys</i> (Benth.) Drake	<i>Fany</i>	7,8	5	0,038	TAB522
Convolvulaceae (CONV)	<i>Metaporana parvifolia</i> var. <i>obtusata</i> Verdc.	<i>Kililo</i>	7,8	5,67	0,036	
Rubiaceae (RUB)	<i>Coffea perrieri</i> Drake ex Jum. & H. Perrier	<i>Hazombalala</i>	4,3	3,6	0,033	TAB211
Malvaceae (MALV)	<i>Grewia lavanalensis</i> Baill.	<i>Sely</i>	4,3	4,2	0,032	TAB266, RKN 437
Fabaceae (FAB)	<i>Crotalaria retusa</i> L.	<i>Katsakatsa</i>	4,3	3,6	0,032	SFR 146

TAB : Randrianarivony, RFM: Randriatsivory, RBU: Bussmann, RKN: Rakotoarivelo, RZA: Razanatsima, ATH : Andriamihajarivo, SFR : Andrianarivelo, PBP : Peter B. Phillipson

salience value from 0.01 to 0.258 and they are divided in three classes:

The first class groups the most important plant species with S value  $> 0.09$  and includes species such as: *Jatropha curcas* L. (S = 0.258), *Flacourtia ramontchi* L'Hér (S = 0.178), *Ficus brachyclada* Baker (S = 0.170), *Henonia scoparia* Moq. (S = 0.162), *Cedrelopsis grevei* Baill. (S = 0.144), *Sclerocarya birrea* subsp. *caffra* (Sond.) Kokwaro (S = 0.115) and *Ocimum gratissimum* L. (S = 0.093).

The second class contains plant species with S value between 0.05 and 0.08 ( $0.05 < S < 0.08$ ) and includes the following species: *Noronhia buxifolia* H. Perrier (S = 0.086), *Anacolosia pervilleana* Baill. (S = 0.077), *Sida* aff. *cordifolia* L. (S = 0.077), *Phyllanthus casticum* P. Willemet (S = 0.74), *Ocotea trichantha* Baker (S = 0.069), *Antidesma madagascariense* Lam. (S = 0.056), *Echinochloa colona* (L.) Link (S = 0.054), *Trema orientalis* (L.) Blume (S = 0.05).

The third class includes 34 less known useful plant species with S value between 0.01 and 0.05 ( $0.01 < S < 0.05$ ).

### Useful plants

Villagers in our site study use about 112 plant species for women during the pregnancy period, child delivery and for post-partum care. These plant species are grouped under 90 genera and 46 families. Apocynaceae (9 spp), Fabaceae (9 spp), Poaceae (8 spp) and Rubiaceae (8 spp) are the richest families for species number (Fig. 2). In terms of life form, tree species are dominant (45 %) followed by herbaceous species (28 %) (Fig. 3). Leaves, roots and branches of plants are the major parts used (Fig. 4). Decoction of leaves and stem powder are the main preparation of plants. Taking account to the distribution of useful

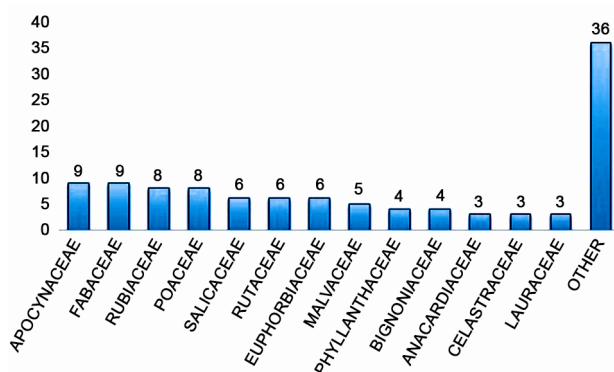


Fig. 2 — Importance of plant families in number of useful species

plants species, 59% are endemic and native to Madagascar and the rest are introduced from other location or naturalized (Fig. 5). These 112 species include plants used for treating pain during menstrual period and infertility, or used as contraceptive and pregnancy protection, as cure for dizziness, headache and nausea during pregnancy, mother prenatal care, strengthening the mother and post-partum recovery (Fig. 6). About a dozen plant species (12) are cited uniquely for both prenatal and post-partum care, it includes species like: *Buddleja madagascariensis* Lam., *Echinochloa colona* (L.) Link, *Ficus brachyclada* Baker, *Flacoutia ramontchi* L'Hér., *Henonia scoparia* Moq, *Leptadenia madagascariensis* Decne, *Marsdenia verrucosa* Decne., *Noronhia buxifolia* H. Perrier, *Phyllanthus casticum* P. Willemet, *Ocimum gratissimum* L., *Salvadora angustifolia* Turrill, *Sclerocarya birrea* subsp. *Caffra* (Sond.) Kokwaro.

### Pregnancy

During the pregnancy period, *Bara* people believed that mother and the fetus are preferred prey of evil spirits. They call pregnant women sick (Magneolognelo, Siloky, Marary) during the first trimester of pregnancy. They used specific plant species to protect pregnant women and her baby against evil. They categorized these plants as magical

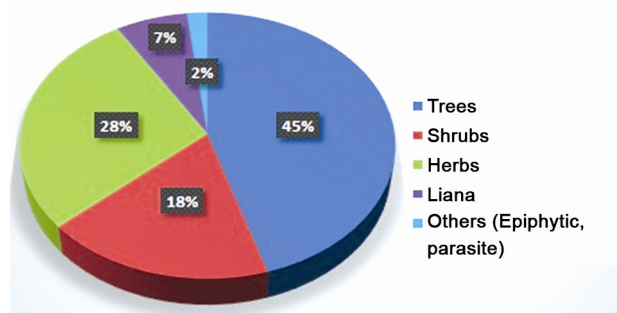


Fig. 3 —Life form of useful plant species for pregnancy, child delivery and post-partum recovery

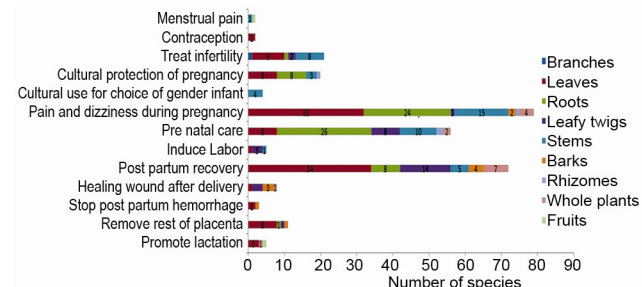


Fig. 4 — Parts used of useful plant species for treatment of pregnancy, child delivery and post-partum recovery



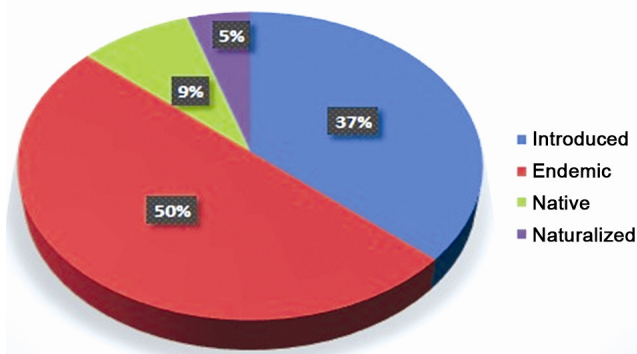


Fig. 5 — Distribution of useful plant species for pregnancy, child delivery and post-partum recovery

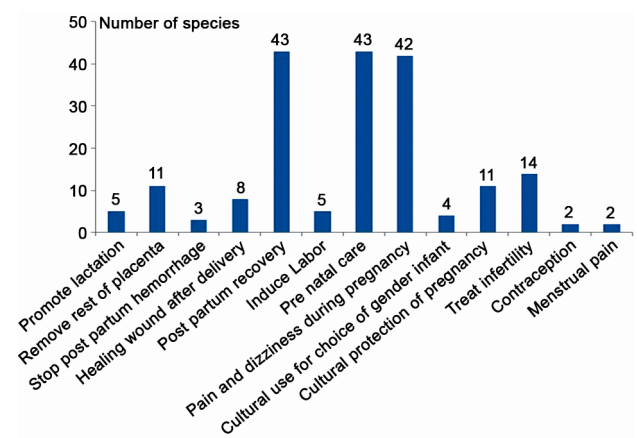


Fig. 6 — Number of species in different treatment for pregnancy, child delivery and post-partum recovery

plants then use them as remedy of evil sickness during pregnancy and they call them locally *Aoly Besaro*.

Most of the time, pregnancy are hidden to other people during the first trimester. When the pregnancy is known, a ritual ceremony called *Fandroa troky* is offered to the spirit to announce the pregnancy. They have several interdictions for pregnant women. They are not allowed to use mirrors during their pregnancy and it is forbidden for them to touch blood. In parallel, they use commonly magical and medicinal plants for pregnant women.

About 36 % (49 species) of the total species mentioned are used to protect women during pregnancy. These plants are used to minimize the morning sickness like dizziness, migraines and pain during pregnancy. Among these 49 species, 27 plant species are quoted by more than three informants. Six species such as: *Henonia scoparia* Moq, *Phyllanthus casticum* P. Willemet, *Flacourtia ramontchi* L’Hér., *Sclerocarya birrea* subsp *caffra* (Sond.) Kokwaro,

*Noronhia buxifolia* H. Perrier and *Suregada eucleoides* Radcl.-Sm. are the most important useful plant species during pregnancy period. Leaves, leafy twigs and roots of these species are collected for the pregnancy cases (Table 3).

Mixture of three to ten plants such as: *Sida cordifolia* L., *Henonia scoparia* Moq., *Phyllanthus casticum* Willemet, *Flacourtia ramontchi* L’Hér., *Grewia* aff. *lavanalensis* Baill., *Entada chrysostachys* (Benth.) Drake, *Marsdenia verrucosa* Decne., *Zingiber officinale* Rosc, *Desmodium salicifolium* (Poir.) DC, *Alchornea perrieri* Leandri, *Anacolosia pervilleana* Baill. and *Toddalia asiatica* (L.) Lams are prepared by divine healer (*Ombiasy*) to protect the mother and her baby against evil spirit. These species can be prepared alone or accompanied with divination sands called *Sikily*. Roots and leaves are the most (69%) parts used during pregnancy. They are mainly used as decoction and powder. The powders of some parts of plants (branch, stem, twigs, roots, leaves) are placed in a red or black small tissue bag wear by the women like a necklace (*voa*) (Fig. 7).

### Child delivery

During giving birth, mother with the new born baby should stay in a small closed room which is warmed with fire wood in order to avoid cold that may affect the new mother’s health. She must be well covered and not allowed to use cold water even doing housework.

During child delivery several plant species are used to help the process. From our study, we know that five plant species are given to the mother. Leaves decoction of *Breonadia salicina* (Vahl) Hepper & J.R.I. Wood, *Cassytha filiformis* L. or *Tarenna grevei* (Drake) Homolle are given to the pregnant mother three days before the time of child delivery in order to induce labor.

### Post-partum care

In the surroundings of Analavelona forest, post-partum period begins immediately after the child delivery and goes about four weeks to three months. During this period, the mother and the new born baby are still kept in the small room to protect them against danger (evil that hunt the new born baby). The males in her family should consult the head of village or the divine healer (*Ombiasy*) to determine the day when the mother could start going outside of the house where she did stay during post-partum period. From the child’s birth, the mother is treated

Table 3 — Use of frequently used species during pregnancy, child delivery and post-partum care

Family	Scientific name (Local name, voucher)	Parts use	Preparation	Administration	Use indication
SAP	<i>Cardiospermum halicacabum</i> L. (Voafaria, TAB569)	L	Decoction	Drink	Contraceptive. Use in mixture
CANN	<i>Trema orientalis</i> (L.) Blume				
EUPH	<i>Excoecaria madagascariensis</i> (Baill.) Müll. Arg. (Tsimarefy,	St	Powder	Mask, in necklace	Fertility. Use in mixture
LAUR	<i>Ocotea trichantha</i> Baker				
EUPH	<i>Suregada eucleoides</i> Radcl. -Sm.				
POA	<i>Oryza sativa</i> L. (Vary, common species)	Lem	Decoction	Drink	Use for painful menstruation
APT	<i>Anacolosa pervilleana</i> Baill.	L	Decoction	Drink	Pre natal care
PHYLL	<i>Antidesma madagascariense</i> Lam	R, St	Powder	Mask	Dizziness during pregnancy. Used with other species <sup>1,2</sup>
BUDDL	<i>Buddleja madagascariensis</i> Lam.				
FLAC	<i>Flacourtia ramontchi</i> L'Hér				
AMAR	<i>Henonia scoparia</i> Moq.				
ANA	<i>Sclerocarya birrea</i> subsp. <i>caffra</i> (sond.)				
PHYLL	Kokwaro <i>Phyllanthus casticum</i> Willemet				
FAB	<i>Entada chrysostachys</i> (Benth.) Drake	Se	Powder	Mask, in necklace	Protection of mother during pregnancy. Used with other species <sup>1,2</sup>
ZING	<i>Zingiber officinale</i> Rosc.	Rhi			
OLEA	<i>Noronhia buxifolia</i> H. Perrier	L R, St	Decoction	Drink	Dizziness during pregnancy, protection of mother during pregnancy.
PHYLL	<i>Phyllanthus casticum</i> Willemet Used with other species <sup>1,2</sup>		Powder	Mask	
MAL	<i>Sida</i> aff. <i>cordifolia</i> L. Used with other species <sup>1,2</sup>	LR, St	Decoction Powder	Drink, inhalationMask	Induce labor, Dizziness during pregnancy. Protection of mother during pregnancy.
RUB	<i>Bretonia salicina</i> (Vahl) Hepper & J.R.I. Wood, (Soaravy, RIR498)	L	Decoction	Drink	Induce labor
RUB	<i>Tarenna grevei</i> (Drake) Homolle (Matsakiambanikily, TAB469)				
LAU	<i>Cassytha filiformis</i> L (Hazotsitafotsy, MNH298)				
EUP	<i>Jatropha curcas</i> L.	L, LTW	Decoction	Drink just after delivery during 3 to 6 days	Post-partum recovery Remove rest of placenta in mother's womb
LAM	<i>Ocimum gratissimum</i> L.				
MOR	<i>Ficus brachyclada</i> Baker	L, LTW	Decoction	Drink during 1 to 2 months	Post-partum recovery Restore uterus
APO	<i>Cynanchum luteifluens</i> var. <i>longicorona</i> Liede(Trivony, TAB547)	L, LTW, Whpl	Decoction	Drink	Post-partum recovery. Heal uterus
POA	<i>Echinochloa colona</i> (L.) Link	L, Whpl	Decoction	Drink	Post-partum recovery
POA	<i>Echinochloa colona</i> (L.) Link		Decoction	Drink	Restore uterus, induce lactation
APO	<i>Leptadenia madagascariensis</i> Decne.	L, LTW	Decoction	Drink	Post-partum recovery
CON	<i>Metaporana parvifolia</i> var. <i>obtus</i> Verdc <i>Panicum maximum</i> Jacq				
POA RUT	<i>Zanthoxylum tsihanimposa</i> H. Perrier (Monongo, TAB 408, RZA 1120)				
RUT	<i>Cedrelopsis grevei</i> Baill.	B	Decoction, Maceration	Drink	Poste partum recovery. Drink prior to mother go out of her house and do daily activities
ANA	<i>Operculicarya decaryi</i> H. Perrier (Jabihy, RFM 256)				

L: Leaves, St: Stems, Rh: Rhizome, R: Roots, Lem: Lemna, B: Bark, LTW: Leafy twigs, Whpl: Whole plant.

<sup>1</sup>*Henonia scoparia* Moq. + *Marsdenia verrucosa* Decne. + *Zingiber officinale* Rosc. + *Entada chrysostachys* (Benth.) Drake + *Ocimum gratissimum* L.+ *Salvadora angustifolia* Turrill + *Desmodium salicifolium* (Poir.) DC.

<sup>2</sup>*Henonia scoparia* Moq + *Sida* aff. *cordifolia* L. + *Grewia lavanalensis* Baill.+ *Antidesma madagascariense* Lam. + *Margaritaria* L.f. + *Noronhia buxifolia* H. Perrier + *Flacourtia ramontchi* L'Hér + *Sclerocarya birrea* subsp. *caffra* (sond.) Kokwaro + *Brexiella longipes* H. Perrier + *Coffea perrieri* Drake ex Jum. & H. Perrier



Fig. 7 — Necklace with tissue containing plants, wear by Bara pregnant woman

with 49 species of plants. These species are used in order to avoid post-partum hemorrhage, to remove placental remnants and to clean uterus, to ensure uterus recovery and to strengthen physically the mother. Decoction of leaves is the main preparation of 78% of plant species. However, for some, e.g, *Cedrelopsis grevei* Baill., *Operculicarya decaryi* H. Perrier and *Neobegonia mahafaliensis* J.-F. Leroy, bark of stems is the parts used instead of leaves. Leaves, leafy twigs of plants or the whole plants are transformed into drink and served as everyday drink for the mother during the post-partum period. Just right after child delivery, leaves or leafy twigs decoction of *Jatropha curcas* L., *Ficus sycomorus* Baker, *Marsdenia verrucosa* Decne, *Ocimum gratissimum* L., *Trema orientalis* (L.) Blume are given to the child mother as her beverage from three days to one week for cleaning out the rest of placenta in her uterus. Then, she is given drinks from leaves or leafy twigs decoction of *Salvadora angustifolia* Turrill, *Abrahamia grandidieri* (Engl.) Randrian. & Lowry, *Metaporana parvifolia* var. *obtusata* Verdc. or *Panicum maximum* Jacq., *Echinochloa colona* (L.) Link, *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult, *Zanthoxylum tsihanimposa* H. Perrier. for two to four weeks to restore and heal her uterus. For a period of eight weeks, various decoctions of plants such as: *Cynanchum luteifluens* var. *longicorona* Liede, *Plectanania stenophylla* Jum., *Trema orientalis* (L.) Blume and *Crotalaria coursii* M. Peltier are given to the child mother in order to physically make her strong so she prepares to assume her responsibilities in the household as a mother or wife. Finally, before she can get out for the first time, the

mother is treated with maceration or decoction of the bark of *Cedrelopsis grevei* Baill, *Operculicarya decaryi* H. Perrier or *Neobegonia mahafaliensis* J.-F. Leroy, which are administered as drink and bath during two days. Fruits of *Carica papaya* L. are given to the mother in her diet to induce lactation.

## Discussion

Based on the findings that we gathered during our fieldtrips and the literature review we did, the outcome of this study is far more than interesting. All pregnant women in our site study use plants during pregnancy, child birth and especially for post-partum care so it is a well-established practice. Results of our investigation show that plants are the only affordable and accessible care to the communities of *Mahaboboka*, *Amboronabo* and *Mikoboka*, which is similar to results from other African countries like Nigeria, Côte d'Ivoire, Malawi, Mali and South Africa<sup>18,22,32,33,34</sup>. In this study like in other studies in Honduras<sup>21</sup> and in Côte d'Ivoire<sup>18</sup>, the most frequently plants cited for pregnancy and child delivery and post-partum care are widespread and easy to find. In addition to the fact that 50 % the useful species for pregnancy, child delivery and post-partum care are non- endemic species, in our site study, they are largely distributed in savannah and in remaining dry forest. They are also collected likely near villages so these plants are part of weeds. It suggests important use of weeds for medicinal purpose especially for pregnancy, and post-partum care. However, it should be noted that 11 species, such as: *Alchornea perrieri* Leandri, *Brexiella longipes* H. Perrier, *Zanthoxylum tsihanimposa* H. Perrier, *Drynaria willdenowii* (Bory) T. Moore, *Strychnos henningsii* Gilg, *Tannodia cordifolia* Baill., *Toddalia asiatica* (L.) Lam., *Vepris boiviniana* (Baill.) M., *Vepris unifoliolata* (Baill.) Labat, *Wielandia elegans* Baill. and *Suregada eucleoides* Radcl.-Sm. are collected only from the NPA of Analavelona forest, which highlight importance of Analavelona forest.

Throughout the study, we know that there no correlation between age and knowledge of useful plants for pregnancy, child delivery and child birth and there is no significant difference of number of plants cited by male and female informants. So our second hypothesis is rejected because all villagers' male and female, young and adults showed interests to the plants used during pregnancy period, child delivery and post-partum care. It can be explained that



each member of the community is concerned about the procreation and plants knowledge are orally transmitted to younger generation. Nevertheless, importance of this study is to dispatch frequently useful plants to the community and sensitize villagers about potential toxicity of the most useful plants. For example, it was reported that by Jean-Pierre (2012) that internal use of *Jatropha curcas* can cause death, villagers should be aware of the toxicity of this species<sup>35</sup>. About tradition related to pregnancy, some interdiction if hiding pregnancy during the first trimester is related to the protection of the mother and the fetus against evil forces. This tradition is very common to other part of the world<sup>4</sup> and in Madagascar<sup>9,10</sup>. However, apart from use of medicinal plants, there is no special food diet proscription or prescription for women in our site study not like for women from Kry ethnic group in Lao PDR<sup>36</sup>.

In some ethnobotanical studies undertaken in Madagascar, plants treating women during pregnancy, child delivery and post-partum care are not among the list of the more knowledgeable plants<sup>37,38,39,40,41,42,43,44,45,46,47</sup>. Less than 20 species are including in the list of useful plants cited in these studies. Only Razafindraibe *et al.* (2013) cited 46 species used by women in Mahabo, Farafangana, eastern part of Madagascar for pregnancy and post-partum case<sup>23</sup>. As we have found 112 plant species cited by informants for this study, it confirms our first hypothesis that numerous plants are used by villagers for their reproductive health. Compare to study performed by Sussman (1995), 11 species used for the treatment of pregnancy, neonates and post-partum care in Mahafaly ethnic group<sup>15</sup>, southern Madagascar are cited in this study. However, only three species, cited in this study, are used by women from the eastern part of Madagascar<sup>23</sup>. It appears that plants species used by people living around Analavelona forest use for medicines for women during their pregnancy period, child delivery and post-partum care are quite similar to what people use in some southern parts of Madagascar.

About 19 % of the useful plants reported in this study can be found in Scientific literature from different part of the world and in Madagascar. Among them, 13 % are cited by people for same uses. For example, the use of *Ocimum gratissimum* L. for post-partum recovery can be supported by its use as contraceptive in Peru<sup>19</sup> (and its use to induce labor in Nigeria<sup>35</sup>). Uses of *Ocimum gratissimum* L. for post-

partum recovery is also reported in Côte d'Ivoire<sup>18</sup> and in other part of Madagascar<sup>37,38</sup>. For the same indication, use of *Operculicarya decaryi* H. Perrier, *Panicum maximum* Jacq., *Rhigozum madagascariense* Drake, *Metaporana parvifolia* (K.Afzel.), *Metaporana parvifolia* var. *obtusum* Verdc by Mahafaly ethnic group is reported by Sussman, (1995)<sup>15</sup>. Common use of *Neobegonia mahafaliensis* J.-F. Leroy to strengthen mother after child delivery is reported by Stiles, (1998) for Mikea ethnic group in the southwestern part of Madagascar<sup>45</sup>. Similar use of *Cedrelopsis grevei* Baill was also reported by Rakotondrafara, (2010)<sup>48</sup>. Yet post-partum recovery use of *Leptadenia madagascariensis* Decne is reported also in the work of Radaniel, (2011) in Mahajanga, Madagascar<sup>49</sup>. Use of *Salvadora angustifolia* Turill to reduce post-partum hemorrhage is reported also by Norodiny, (2011) for her study in the southwestern part of Madagascar<sup>43</sup>. Use of *Jatropha curcas* L. for post-partum recovery is reported in some literatures<sup>15,19,23,50</sup>. Moreover, based on pharmacological test of this species, presence of alkaloid known as Jatrophine<sup>15</sup> in *Jatropha curcas* L. (Sussman 1995) confirm its use reported from this study which remove rest of placenta in the mother's uterus after child delivery. Use of *Tamarindus indica* L. for pregnancy is also reported by Razafindraibe *et al.* (2013)<sup>23</sup>.

Use of ginger (*Zingiber officinale* Rosc) during pregnancy, reported in this study and by Lamxay (2011) is supported by the anti-nausea effects of the species<sup>36,51</sup>.

However, several plant species cited in literatures have different use from what we have found for this study. For example: *Zea mays* L. and *Zingiber officinale* Rosc. are used for mother's care during pregnancy but in Razafindraibe *et al.* (2013), those plants were cited for post-partum recovery<sup>23</sup>. Likewise, *Secamone capitata* Klack, *Cynodon dactylon* (L.) Pers. and *Zea mays* L. were reported by Bussman & Glenn (2010) and Sussman (1995) for uterus treatment and post-partum recovery but they are cited for pregnancy treatment in this study<sup>15,19</sup>.

## Conclusion

Plants used by *Bara* people for pregnancy, child birth and post-partum care are important for communities in Mahaboboka, Amboronabo and Mikoboka. 112 plant species are cited by 119 informants. Different plants are used during the three stages (pregnancy, child birth and post-partum care).

Savannah, secondary forest and remnants of forest are important for the habitat of those plants in our site study. Species only collected from Analavelona forest are mainly used for protection of mother during pregnancy. Useful plants for pregnancy, child delivery and post-partum care are known and used by all villagers.

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### References

- Newman B & Newman P, *Development through life: a psychosocial approach*, (Wadsworth, Cengage Learning, US, 11E), 2011.
- Lefeber Y & Voorhoeve HWA, *Indigenous customs in childbirth and child care*, (Assen, The Netherlands, Pays Bas: Van Gorcum), 1998.
- Chemonis International, *Women's legal rights initiative of the women in development, Madagascar*, (Assessment and analysis reports, U S Agency for International Development, Pennsylvania, Washington, DC, US), 2014.
- Williamson N, *Motherhood in childhood facing the challenge of adolescent pregnancy*, (State of the World population, Adviser: Blum W. R., United Nations Population Fund), 2013.
- Ricaldi Coquelin NM, *Visages d'exclusion dans la société Malgache contemporaine*, (L'Harmattan), 2010, 315.
- Randriamamonjy M, *Intégrer les questions de genre dans le secteur forestier en Afrique, Madagascar*, (Organisation des Nations Unies pour l'alimentation et l'agriculture), 2007.
- Haingotiana FL, *Etude de la prévalence de la syphilis pendant la grossesse*, Thèse de Doctorat, (Faculté de Médecine, Université d'Antananarivo, Antananarivo, Madagascar), 2005.
- Elli L, *Les Bara de Madagascar, une civilisation du bœuf, difficultés et perspectives d'une évangélisation* (Université d'Amboizantany, Fianarantsoa, Madagascar), 1993.
- Morris JL, Short S, Robson L & Andriatsihosena MS Maternal health practices, beliefs and traditions in southeast Madagascar, *African J Repr Health*, 18 (3) (2014) 101-117.
- Decary R, Quelques pratiques malgaches relatives aux accouchements, *Bulletin et Mémoires de la Société d'anthropologie de Paris*, 1 (1-1-3) (1930) 3-7.
- Jamieson DJ, Theiler RN & Rasmussen SA, Emerging infections and pregnancy, *Emerging Infectious Diseases*, 12 (11) (2006) 1638-1643.
- Sappenfield E, Jamieson DJ & Kourtis AP, Pregnancy and susceptibility to infectious diseases, *Infectious Diseases in Obstetrics and Gynecology* (2013). <http://dx.doi.org/10.1155/2013/752852>
- Bo Nielsen K & Waldrop A, *Women, gender and everyday social transformation in India*, (Anthem press, London, UK/New York, US), 2014.
- Helman CG, *Culture, health and illness*, 5<sup>th</sup> edn, (Hodden Arnold, London, UK/Oxford university press, U.S), 2007.
- Sussman LK, Routine herbal treatment for pregnant women, neonates and post-partum care among the Mahafaly of southwest Madagascar, *Women and International Development Working paper 251* (Michigan State University, Board of trustees, US), 1995.
- UNFPA, La pratique de la sagefemme dans le monde en 2011, In : *Madagascar 2011*, Partie 4, profil de pays, 2011, 92-93.
- Ministère de la santé Madagascar, UNFPA & Vice Primature chargée de la santé publique, *Evaluation des besoins en matière de soins obstétricaux et néonatales d'urgence à Madagascar*, (Rapport final UNICEF, OMS, AMDD, MSIS), 2010, 220.
- Malan DF & Neuba DFR, Traditional practice and Medicinal plants used during pregnancy by Anyi-Ndenye Women (Eastern Côte d'Ivoire), *African J Repr Health*, 15 (1) (2011) 85-94.
- Bussmann RW & Glenn A, Medicinal plants used in Northern Peru for reproductive problems and female health, *J Ethnobiol Ethnomed*, 6 (2010) 30.
- Adams JD & Garciz C, Women's health among the Chumash, *Evidence-Based Comple Altern Med*, 3 (1) (2006) 125-131.
- Tickin T & Dalle SP, Medicinal plant use in the practice of midwifery in rural Honduras, *J Ethnopharmacol*, 96 (2005) 233-248.
- Steenkamp V, Traditional herbal remedies used by South African women for gynaecological complaints, *J Ethnopharmacol*, 86 (2003) 97-108.
- Razafindraibe M., Kuhlman AR, Rabarison H, Rakotoarimanana V, Rajeriarison C, *et al.*, Medicinal plants used by women from Agnalazaha littoral forest (Southeastern Madagascar), *J Ethnobiol Ethnomed*, 9 (2013) 73.
- MAEP (Ministère de l'Agriculture, de l'Élevage et de la Pêche), *Monographie de la Région du Sud-ouest, Madagascar*, 2003.
- Horning NR, *The limits of rules: when rules promote forest conservation and when they do not-Insights from Bara country, Madagascar*, PhD thesis, (Cornell University, New York, US), 2004.
- Debourdeau A, *Enquête de terrain et l'entretien*, (Cours controverses), 2008, 10.
- Alexiades MN, Collecting ethno-botanical data: an introduction to basic concepts and techniques, In: *Selected Guidelines for Ethnobotanical Research: a Field Manual*, edited by Alexiades MN, (The New York Botanical Garden, U.S), 1996, 53-94.
- Quinlan M, Consideration for collecting freelists in the field: examples from ethnobotany, *Field Method*, 17 (3) (2005) 1-16.
- Borgatti SP, *Anthropac 4.0 @, methods guide*, (Natick, MA: Analytic Technologies), 1996, 45.
- Dold A, Phillipson P, Liesner R, Lowry II P & White L, Collecte d'échantillons botaniques, In: *Conservation en forêt pluviale africaine : méthodes de recherche*, edited by White L & Edwards A (Wildlife Conservation Society, New York, US), 2000.
- Conservation on Biological Diversity (CDB), *The Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets*, (Secretariat of the CDB, Montréal, Canada), 2010.

- 32 Nordeng H, Al-Zayad W, Diallo D, Ballo N & Paulsen BS, Traditional medicine practitioners' knowledge and views on treatment of pregnant women in three regions of Mali, *J Ethnobiol Ethnomed*, 9 (2013) 67.
- 33 Attah AF, O'Brien M, Koehbach J, Sonibare MA, Moody JO, et al. Uterine contractility of plants used to facilitate childbirth in Nigerian ethnomedicine, *J Ethnopharmacol*, 143 (1) (2012) 377-382.
- 34 Maliwichi-Nyirenda CP & Maliwichi LL, Medicinal plants used for contraception and pregnancy related cases in Malawi: A case study of Mulanje District, *J Med Plants Res*, 4 (20) (2010) 3024-3030.
- 35 Jean-Pierre N, *Plantes médicinales du Nord de Madagascar : ethnobotanique Antakarana et informations scientifiques*, (Jardin du Monde Brasparts), 2012.
- 36 Lamxay V, de Boer H J & Björk L, Traditions and plant use during pregnancy, childbirth and post-partum recovery by the Kry ethnic group in Lao PDR, *J Ethnobiol Ethnomed*, 7 (2011) 14.
- 37 Haingotiana SMH, *Influence des facteurs démographiques et écologiques sur la qualité des récoltes de plantes médicinales*, (Ms thesis, Université d'Antananarivo, Antananarivo, Madagascar), 2013.
- 38 Razafindrazaka RM, *Les plantes sauvages les plus utilisées dans la région Analamanga : Inventaires ethnobotaniques dans les Communes Rurales d'Ankadinandriana, d'ambohitrandriamanitra et de Miadanandriana*, (Ms Thesis, Université d'Antananarivo, Antananarivo, Madagascar), 2012.
- 39 Miarisoa R, *Inventaire des plantes médicinales des forets aux alentours des zones de conservation du projet Ambatovy en vue de leurs valorisations*, (Ms thesis, Université d'Antananarivo, Antananarivo, Madagascar), 2012.
- 40 Rabearivony DA, *Etude ethnobotanique des espèces médicinales à Ambalabe - Vatomandry et évaluation de leur statut écologique*, (MS Thesis, Université d'Antananarivo, Antananarivo, Madagascar), 2010.
- 41 Lehman AD, *Assessing ethno-botanical knowledge and resources to develop a sustainable management plan for the Lokaro Reserve in the Southeast, Madagascar* (Ms Thesis, University of Montana, Missoula, and US), 2009.
- 42 Mirhani N, *Essai d'analyse éco-géographique de la végétation sectorielle du Fiherenana*, (Ms Thesis. Université de Toliara, Toliara, Madagascar), 2007.
- 43 Norodiny, *Valorisation des filières potentielles en matière de biodiversité : les plantes médicinales dans l'Aire Protégée communautaire "Tsinjoriake", Sud-ouest de Madagascar*, (MS Thesis, Université de Toliara, Toliara, Madagascar), 2011.
- 44 Faranirina L, *Etudes ethnobotaniques, biologiques et écologiques des plantes utiles dans la forêt d'Antsahabe Est (Anjozorobe)*, (Ms Thesis, Université d'Antananarivo, Antananarivo, Madagascar), 2003.
- 45 Stiles D, The Mikea hunter – gatherers of southwest Madagascar : Ecology and socioeconomics, *African Study Monographs*, 19 (3) (1998) 127-148.
- 46 Nat Quansah, Ethnomedicine in the Maroantsetra Region of Madagascar, *Econ Bot*, 42 (3) (1988) 370-375.
- 47 Pernet R & Meyer G, *Pharmacopée de Madagascar*, (Publications de L'institut de recherche scientifique, Tsimbazaza, Tananarive), 1957.
- 48 Rakotondrafara A, *Études écologique, ethnobotanique et évaluation des statuts UICN des huit espèces du genre Cedrelopsis endémique de Madagascar (Rutaceae)*, (Ms Thesis, Université d'Antananarivo, Antananarivo, Madagascar), 2010.
- 49 Radaniel JF, *Synthèse des valeurs de Leptadenia Madagascariensis Decne ou «Dokterahely» (Asclepidaceae)*, (Ms thesis, Université de Mahajanga, Mahajanga, Madagascar), 2011.
- 50 Diame GLA, *Ethnobotany and ecological studies of plants used for reproductive health: a case study at Bia biosphere reserve in the western region of Ghana*, (Final report submitted to the division of ecological sciences UNESCO (MAB) Young Scientist Research Award Scheme Paris Cedex 15 France UNESCO, accra office), 2010.
- 51 Thomson M, Corbin R & Leung L, Effect of ginger for nausea and vomiting in early pregnancy, a meta-analysis, *J Am Board Fam Med*, 27 (1) (2014) 115-122.