Ethnobotanical Survey Of Plant Species Used In Traditional Medicine In Bekaraoka Region, Northeastern Madagascar

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Abstract: Madagascar has one of the highest rates of biodiversity and endemism in the world, but the ethnobotanical reputation of Malagasy flora is still mediocrity investigation. This article presents a preliminary study on the use of plants carried out in the village of Bekaraoka located in the North East of Madagascar. With the help of standardized questionnaires, two traditional healers and 175 informants were interviewed on the medicinal use of local flora. 76 species turned out to be used as a medicine by residents the area. Fabaceae Family predominates in number of species. Leaves were most commonly used, with 30.1 % of the plants being used to treat gastrointestinal disorders (diarrhea, abdominal pain, stomach aches). This paper provides new information on medicinal plants from one area of North East Madagascar never investigated for ethnomedicine and may be used as data base and information source for researchers who follow the ethnopharmacology approach.

Keywords: Bekaraoka, Ethnobotany, Madagascar, Northeast

1 Introduction

Madagascar has been described as one of the most floristically unique places in the world [1]. Of 11,000 species belonging to 243 vascular plant families, 83 % are endemic to the Island [2]. The benefits provided by biodiversity in Madagascar are enormous. Most Malagasy still rely on medicinal plants for healing because of the lack of a doctor. In remote areas, drugs are expensive and access to a pharmacy is almost impossible. Some people simply do not trust modern medicine and prefer to heal in a traditional way. Even the population of big cities usually uses herbal medicine. According to the WHO, it would be about 70 % of the population. There are 2,300 plants used for medicinal purposes in the country, 90 % of which have not been commercialized. Traditional healers have never constituted a threat to the conservation of plant diversity. It is only once a certain species begins to be exploited commercially that the species begins to decline. The export of medicinal plants is based on 50 species, of which 33 are forest-based. Medicinal plants in Madagascar are a potential source of great income and scientific advancement (Convention on Biological Diversity – Madagascar country profile). Medicinal plants are collected either in the surroundings of the villages, or in the forest. Unfortunately, natural resources in Madagascar, including medicinal plants, are clearly affected by biodiversity loss, environmental degradation and a lack of sustainable harvesting practices [3]. These impacts are also exacerbated by climate change, and high levels of poverty [4]. Rapid deforestation and slash and burn cultivations (tavy) are threats that often affect medicinal plants in Madagascar which may affect people’s knowledge related to the use of medicinal plants [5]. Thus, in order to document, preserve, and sustain this traditional and valuable knowledge: several studies on the uses of traditional medicines in the country have been undertaken. The first chemical study of a Malagasy plant is that of Centella asiatica (L.) used locally for leprosy [6]. Later, ethnobotanical information specific to Madagascar was published [7], [8], [9], [10], [11]. More recently, studies have focused on particular regions or plants of Madagascar, and efforts to catalog and compile previously gathered ethnobotanical information have been made [12], [13], [14], [15], [16], [17]. Boiteau and Chanez in 1967 have worked extensively on medicinal plants in Madagascar with different healing properties. [18] Antimicrobial and antiplasmodial activities have been observed in some plants [19]. A non-
exhaustive census was suggested that 10 % of Malagasy species were detected as having no biological activity [20]. Despite these extensive studies, the medicinal plants in Bekaraoka region remain overlooked. Therefore, while the overall goal of this study is to enhance the role of plant species in traditional medicine, the specific objectives are (i) to determine the medicinal plants locally used in Bekaraoka, (ii) to assess the parts of plants used for the treatment of a particular disease, and (iii) to understand the preparation or administration forms of these plants.

2. Materials and methods

2.1. Study area
Bekaraoka forest is a part of Loky-Manambato protected area that covers about 70,837 ha and is limited by Loky River in the north and Manambato River in the South and Indian Ocean in the East. The area was officially protected in October 2008 and composed of four communes rural such as Daraina, Maromokotra, Ampisikinana and Nosibe. It has a unique concentration of representative areas of various habitats and species in the SAVA Region. Five types of forest types are present in Loky-Manambato: humid forests; dry deciduous forests, sclerophyll forests, coastal forests and mangroves. The current study was carried out in the villages surrounding the dry deciduous forests of Bekaraoka, Commune Rural of Daraina, District of Vohémar. Field work was carried out between October and December 2015.

2.2. Sample collection
After being authorized by the appropriate local authority, an ethnobotanical survey was carried out in Bekaraoka to identify plants used to treat diseases in that area. During this survey direct interviews have been conducted among traditional healers, community elders and people having knowledge of traditional medicine. Different age classes and sex were interviewed to avoid bias in the interviewee’s response and to have more exhaustive results. Information on ethnobotanical reputation, parts of plants used as treatment of some disease and their preparation or forms of administration were recorded. Voucher specimens of used plant as medicine were collected, identified, dried and deposited in herbaria at the Parc Botanique and Zoologique of Tsimbazaza. Plant names were checked and updated with the online website (http://www.tropicos.org) of the Missouri Botanical Garden, accessed on 17 April 2016.

2.3. Results and Discussion

3.1. Diversity of medicinal plants and their application
A total of two traditional healers and 175 respondents aged from 16 to 76 were interviewed, of whom 52 % were male and 48 % were women. From this ethnobotanical interview in the village of Bekaraoka, 76 medicinal plants were recorded (Table 1). They belong to 39 families divided into 75 genera and 76 species. Twenty one percent of these species are endemic to Madagascar.

Table 1: Medicinal use of plant species from the Bekaraoka

<table>
<thead>
<tr>
<th>Scientific names</th>
<th>Disease treated</th>
<th>Part used</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANACARDIACEAE</strong></td>
<td></td>
<td></td>
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<tr>
<td>Mangifera indica L.</td>
<td>Fever</td>
<td>L</td>
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<tr>
<td>Poupardia caffra (Sond.) H. Perrier</td>
<td>Stomach pain</td>
<td>B</td>
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<tr>
<td></td>
<td>Diarrhea</td>
<td>B</td>
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<tr>
<td></td>
<td>Enterocolitis</td>
<td>B</td>
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<tr>
<td></td>
<td>Diarrhea</td>
<td>B</td>
</tr>
<tr>
<td><strong>ANNONACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annona muricata L.</td>
<td>Hypertension,</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>Gastralgia</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>Hypertension</td>
<td>L</td>
</tr>
<tr>
<td>Xylopia bixifolia Baillon</td>
<td>Icterus</td>
<td>L, S</td>
</tr>
<tr>
<td>Uvaria decaryana Cavaco &amp; Keraudren</td>
<td>Sexually transmitted disease</td>
<td>L</td>
</tr>
<tr>
<td><strong>APOCYNACEAE</strong></td>
<td></td>
<td></td>
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<tr>
<td>Mascarenhasia arborescens A. DC.</td>
<td>Stomach ache</td>
<td>L</td>
</tr>
<tr>
<td>Marsdenia truncata Jum &amp; H. Perrier</td>
<td>Tiredness,</td>
<td>L, S</td>
</tr>
<tr>
<td></td>
<td>Neuralgia</td>
<td>L, S</td>
</tr>
<tr>
<td>Lophia tenuis Jum</td>
<td>Tiredness,</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>Urinary retention</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>Paralysis</td>
<td>S</td>
</tr>
<tr>
<td>Leptadenia madagascariensis Decaisne</td>
<td>Sexually transmitted disease</td>
<td>S</td>
</tr>
<tr>
<td><strong>ASTERACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elephantopus scaber L.</td>
<td>Enterocolitis</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Diarrhea</td>
<td>E</td>
</tr>
<tr>
<td>Psiaia altissima (DC) Drake</td>
<td>Hair care</td>
<td>L</td>
</tr>
<tr>
<td>Emilia humifusa DC</td>
<td>Cough</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>Respiratory disease</td>
<td>L, S</td>
</tr>
<tr>
<td><strong>BIGNONIACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phyllartrhon megapeterum H. Perrier</td>
<td>Hypertension</td>
<td>L</td>
</tr>
<tr>
<td>Periciachema richardi Baill.</td>
<td>Hypocalemia</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>Wound</td>
<td>L, S</td>
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<tr>
<td></td>
<td>Gangrenous wound</td>
<td>L, S</td>
</tr>
<tr>
<td></td>
<td>Visceral wound</td>
<td>L, S</td>
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<tr>
<td></td>
<td>Tiredness</td>
<td>E</td>
</tr>
<tr>
<td><strong>CANNELACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cinammosa fragans Baill</td>
<td>Colic</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Diarrhea</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Headache</td>
<td>B</td>
</tr>
<tr>
<td><strong>CAPPARACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tylachium sumangui Bojer</td>
<td>Poisoning</td>
<td>R</td>
</tr>
<tr>
<td><strong>CARICACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carica papaya L.</td>
<td>Wound</td>
<td>Lx</td>
</tr>
<tr>
<td></td>
<td>Sexually transmitted disease</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>Constipation</td>
<td>Fr , Sd</td>
</tr>
<tr>
<td></td>
<td>Urinary retention</td>
<td>Fr , Sd</td>
</tr>
<tr>
<td><strong>COMBRETACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminalia sulcata Tul.</td>
<td>Infant digestive candidiasis</td>
<td>B</td>
</tr>
<tr>
<td><strong>CONVOLVULACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ipomoea batata (L.) Poir.</td>
<td>Anti-dandruff</td>
<td>L</td>
</tr>
<tr>
<td><strong>CRASSULACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kalanchea pinnata (Lam.) Pers.</td>
<td>Asthma</td>
<td>L</td>
</tr>
<tr>
<td><strong>CUCURBITACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagenaria sicerraria (Molina) St.jt.</td>
<td>Breast wound</td>
<td>L</td>
</tr>
<tr>
<td>Momordica charantia L.</td>
<td>Diarrhea</td>
<td>L</td>
</tr>
<tr>
<td>Cucurbita moschata Duchesne ex. Poir.</td>
<td>Hemorrhagic wound</td>
<td>L</td>
</tr>
</tbody>
</table>

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**CYCADACEAE**

- *Cycas thouarsii* Gandich. | Discomfort | L

**ERYTHROXYLACEAE**

- *Erythroxylum platyclados* Bojer | Wound | L

**EUPHORBIACEAE**

- *Tragia sp.* | Itching | E
  - *Tragia farrialis* Bojer ex Prain | Pruritus | E
  - *Croton barorum* Le.,ri | Cancer | S, R
  - *Manihot esculenta* Crantz | Colic | L
  - *Euphorbia thyrsifolia* L. | Diarrhea | L
  - *Jatropha curcas* L. | Wound | Lx

**FABACEAE**

- *Caesalpinia bonduc* (L.) Roxb. | Enuresis | Fr, Sd
  - * Cajanus cajan* (L.) Druce | Infant digestive candidiasis | L
  - *Senna occidentalis* (L.) Link. | Enterocolitis | L, R
  - *Vigna unguiculata* L. | Abscess | S, R
  - *Tamarindus indica* L. | Icterus | L, S
  - *Acacia pervillei* Benth. | Epistaxis | L
  - *Albizia gummi-fera* (J. F. Gmel.) C.A. Sm. | Cough | B
    - *Mucuna gigantea* (Wild.) DC. | Chronic cough | B
  - *Abrus precatorius* L. | Fever | E
  - *Pithecellobium dulce* (Roxb.) (Benth.) | Diarrhea | B
  - *Mimosa pudica* L. | Dysentery | B
  - *Acacia senegal* Lam. | Infantile diarrhea | L
  - *Acacia tortilis* Lam. | Hematuria | E

**LAURACEAE**

- *Cassia tingitana* L. | Tiredness | E

**LOGANIACEAE**

- *Strychnos spinosa* Lam. | Anti stains, Ex
  - Against the eye | Ex
  - Hair falling | L
  - Enterocolic | R
  - Anti-diarrhea | L
  - Cough | Fr

**LYTHRACEAE**

- *Woodfordia fruticosa* (L.) Kurz | Tiredness | L, S
  - *Lawsonia inermis* L. | Neuralgia | R
  - Sexually transmitted disease | L

**MALVACEAE**

- *Ceiba pentandra* (L.) Gaertn. | Diarrhea | B
  - *Gossypium herbaceum* L. | Oral candidiasis | L
  - *Grewia triflora* Bojer | Child candidiasis | L
  - *Malva neglecta* L. | Diarrhea | L, B
  - *Datura stramonium* L. | Enterocolic | L, S
  - *Datura inoxia* L. | Diarrhea | L, S

**MELIACEAE**

- *Malleastrum rakotozalii* Cheek. | Fever | L, B

**MENISPERMACEAE**

- *Burasata madagascariensis* DC. | Facial care | B

**MORACEAE**

- *Artocarpus altis var.serriferi* (Duss) Fournet | Jaundice | L
  - *Bleekrodea madagascariensis* Blume | Facial care | B
  - *Ficus polio* Vahl | Sterility | R

**MUSACEAE**

- *Musa sp.* | Metrorrhagia | S

**MYRISTICACEAE**

- *Mauloutchia parvifolia* (H Perr) RC | Infant oral candidiasis | Lx
  - *Eucalyptus citriodora* Hook. | Wound | Sd
  - *Uapaca thouarsii* Baill. | Infectious oral candidiasis | B

**MYRTACEAE**

- *Psidium guajava* L. | Abdominal pain | L
  - *Euphorbia cyparissias* L. | Enterocolitis | L
  - *Hyalanthus natalensis* L. | Diarrhea | L
  - *Eucalyptus citriodora* Hook. | Fever | L, S

**OPILIACEAE**

- *Antidesma petiolare* Tul. | Against the ghost | L, S

**PHYLLANTHACEAE**

- *Uapaca thouarsii* Baill. | Tiredness | R
  - *Euphorbia cyparissias* L. | Neuralgia | R
  - *Scheelea oppositifolia* Blume | Insomnia | R

**PIPERACEAE**

- *Piper sp.* | Pelvic pain | E
  - *Piper nigrum* L. | Induced abortion | E

**POACEAE**

- *Saccarum officinarum* L. | Jaundice | S
  - *Euryale myrtifolia* (L.) | Sprain | E
  - *Dislocate* | E
  - *Dislocate* | E
  - *Dislocate* | E
  - *Dislocate* | E
  - *Dislocate* | E

**RHAMNACEAE**

- *Gonemia mauritiana Lam.* | Used as gel | L

**RUBIACEAE**

- *Coffea robusta* L. (Linden) | Urinary retention | Ex
  - *Paederia sp.* | Gastralgia | L
  - *Piper nigrum* L. | Detoxifying | L

**RUTACEAE**

- *Uapaca thouarsii* Baill. | Headache | L
  - *Citrus aurantiifolia* (Christm.) Swingle | Flu | L
  - *Citrus aurantiifolia* (Christm.) Swingle | Cold | L

**SALICACEAE**

- *Bivinia jalberti* Tul. | Jaundice | L
  - *Flacourtia ramontchi* L’Hér. | Enterocolitis | L, S
  - *Barringtonia edulis* L. | Diarrhea | L, S
  - *Barringtonia edulis* L. | Abdominal pain | L, S

**SAPINDACEAE**

- *Eucalyptus citriodora* Hook. | Jaundice | L
  - *Litchi chinensis* Sonn. | Enterocolitis | L
  - *Diospyros kaki* L. | Diarrhea | L

**THYMELAEACEAE**

- *Gnidia linearis* (L.ex.) Z.S. Rogers | Wound | B

**VERBENACEAE**

- *Lantana camara* L. | Fever | L
  - *Lantana camara* L. | Fever | L, S
  - *Postpartum* | L, S
The diversity of medicinal plants in botanical groups shows that dicotyledons have a very high percentage of utilization (98.7 %), where as monocotyledons are only 1.3 %. The most important families are FABACEAE (11 species), followed by EUPHORBIACEAE (6 species) and APOCYNACEAE (4 species). The families ASTERACEAE, ANNONACEAE, CUCURBITACEAE, MALVACEAE and MORACEAE contain 3 species each. RUBIACEAE, BIGNONIACEAE, LYTHRACEAE, PHYLLANTHACEAE, POACEAE, SALICACEAE, ANACARDIACEAE, RUTACEAE and MYRTACEAE have only 2 species each (Table 1). Comparing with the ethnobotany survey carried out by the team of the Garden of the world in the district of Antsiranana II [21]. In this study, 156 species were listed. It was found that families containing many species are almost the same. These are the families of ASTERACEAE FABACEAE, APOCYNACEAE and EUPHORBIACEAE. For the two studies carried out, the family FABACEAE is the richest in species (17 species for the district of Antsiranana II, 11 species for Bekaraoka). This one is followed by ASTERACEAE (12 species) and APOCYNACEAE (8 species) for the survey minnow in the north-west of Madagascar. On the other hand, for Bekaraoka (Northeastern Madagascar), the second and third are respectively the family EUPHORBIACEAE (6 species), APOCYNACEAE (4 species). FABACEAE are containing alkaloids, amines, non-protein amino acids (NPAA), cyanogenic glucosides, peptides, phenolics, polyketides and terpenoids [22]; [23]. Family APOCYNACEAE is rich in many secondary metabolites with important biological and economic values, viz., triterpenes, cardenolides, sterols, saponins, and alkaloid [24], [25], [26], [27], [28]. For the ASTERACEAE family, terpenoids, phenolic compounds were the most representative classes of compounds [29], [30], [31], [32], [33]. All these compounds are well known for their activities. For example, alkaloids have a wide range of pharmacological activities including antimalarial, antiasthma, cholinoimmetic, vasodilatory, anticancer, antiarrhythmic, analgesic, antibacterial and antihyperglycemic activities [34], [35], [36], [37], [38]. Flavonoids (Phenolic compound) have favourable antioxidant, anti-inflammatory, anti-mutagenic and anti-carcinogenic properties [39], [40], [41], [42].

3.2. Type of part of the plant used for disease treatment
In Bekaraoka area, leaves, stem, root, seed, flowers and fruits are used for healing. If we consider the use of a single vegetative organ, the leaves have the highest percentage of use (31.5 %), followed by the bark (15.4 %), the root (5.4 %), the rest has a percentage of less than 3.5 %. In some cases, users use whole plants or two different organs to treat a disease, in which case the use of blends of leaves and stems at a percentage of 14 % and that of whole plants is 11.2 % (Figure 1).

3.3. Modes of recipes preparation
For the preparation, six methods such as decoction, poultice, maceration, infusion, inhalation and oil extraction were used by the traditional healers, among them, the decoction is the most used with a percentage of 74.1 % followed by poultice 14.7 %. The infusion represents only 3.5 % (Figure 2).

3.4. Treated diseases for the inventoried medicinal plant species
In general, decoctions and infusions need to be taken on or two times / day. For the poultice, the plant materials are crushed or scraped and applied on skin or on wound if it is a wound. The decoction was the most used method of preparation in traditional medicine. Indeed, it allows extraction complete active ingredients of plant organs during boiling of the vegetable solvent mixture [47], [48]. The preference of this mode of preparation is reported by many authors [49], [50].
With regard to the type of disease, about one-third (30.1%) of the plants are used for the treatment of gastrointestinal disorders (diarrhea, abdominal pain, stomach pain, etc.), 13.3% are used to treat skin diseases and inflammations, 11.2% for the nervous system, 10.5% for the uro-genital system and 7.7% for fever. The plants used to treat the hair are 4.9%. The treatment for respiratory system and Icterus are 4.2% of each. The percentage of plants to treat the circulatory system is only 3.5% (Figure 3).

Figure 3: Treated diseases for the inventoried medicinal plant species.

4. Discussion

Folk medicine represents an important tool to spot plants of pharmacological interest, since it can predict sources of bioactive compounds [51]. In fact, at least five species used in Bekaraoka are mentioned in the phytochemical literature. In Bekaraoka, the species Tamarindus indica L. is traditionally used against jaundice. In contrast, according to the literature, in Africa, this species is widely used in traditional medicine for the treatment of many diseases such as fever, dysentery, jaundice and gastrointestinal disorders [52],[53]. According to the survey conducted in Bekaraoka, Carica papaya is used to treat wounds, sexually transmitted diseases, constipation and urinary retention. Scientific literature has shown that papaya bark and seeds have shown antioxidant potential and that the antioxidant potential of peel and papaya seeds may contribute to production of functional foods and nutraceuticals by using these papaya wastes [54], [55]. Annona muricata is traditionally used against hypertension, and to treat the stomach. According to Coria-Téllez et al., 2018, A. muricata is known to traditionally treat diverse diseases ranging from fever to diabetes and cancer [56]. More than 200 chemical compounds have been identified and isolated from this plant, the most important being alkaloids, phenols and acetogenins. Its extracts and phytochemicals have been characterized as antioxidant, anti-microbial, anti-inflammatory, insecticidal, larvicidal, and cytotoxic to cancer cells. In vivo studies have revealed anxiolytic, immunomodulatory, anti-stress, anti-inflammatory, antimalarial, antidepressant, gastro protective, wound healing, hepatoprotective, hypoglycemic, anticancer and anti-tumoral activities [56]. In Bekaraoka, the genus Ipomoea batata (L.) is a well-known antidiarrheal. According to the scientific literature, the sweet potato leaves (Ipomoea batatas L.) are vegetables with abundant polyphenols and have an antioxidant activity. This species is also used as a functional food to combat the symptoms of metabolic disorders, such as type II diabetes mellitus in many countries [57],[58]. Aqueous extracts of Litchi chinensis seeds have been found to have a very potent antibacterial activity [59]. This activity proves its traditional use (treatment of Enterocolitis and diarrhea) (Table 1). This discussion has shown that traditional medicine has led to some of our most important modern drugs. Ethnobotany, that is, the scientific study of the use of plants by native cultures, has contributed significantly to the practice of medicine to day. Plant constitutes a very high place on folk medicines, but their use and exploitation need a good management to assure their sustainability not only for species conservation but their pharmacological value which need more and deep research to valorize Malagasy flora. Utilization of leaves does not constitute an alarming threat for the plant even if it presents a highest percentage of use (31.5%). But it is not valid for bark, root and stems especially by uproot pathway even if it has a lower rate of use successively 15.4%, 5.6% and 3.5%. Bark is an essential organ to protect plant on external aggression and roots hold up plant. These organs present an important function on the plant serenity increase actively its pressure which may lead to its extinction. Collecting mode and harmful utilization may contribute to the biodiversity destruction. However, this floristic list has more endemics species (21%) with 5 of them are already included on red list assessment of vascular plant of Madagascar made by GSPM on 2011 and the tropicos database. Terminalia sulcata endangered, Xylopia buxifolia (ANNONACEAE) and Acacia pervillei (FABACEAE) are classified as Vulnerable, Cycas thouarsii (CYCADACEAE) and Leea cuspidifera (VITACEAE) on Least concern category. In this sense, this floristic list may help Protected Area Manager to take decision on sustainable harvesting and exploration of the species.

5 Conclusion

The aim of this ethno-botanical study was to determine plant species used in traditional medicine in the village of Bekaraoka in the SAVA Region. Results from this study have shown that plant species in the Fabaceae family predominate in number of species. Leaves were the most used plant parts and digestive system and the skin were the most commonly treated diseases. This report may be used as data base and information source for researchers who follow the ethnopharmacology approach for their investigation of natural sources for bioactive secondary metabolites. Within this context, it is recommended that detailed phytochemical and pharmacological studies be performed on the most interesting species determined by the present study as these could lead to the development of active substances against the mentioned diseases.

6 References


