Short communication

Review of traditional plants from Toliara Province in southern Madagascar for the treatment of diabetes and cancer

ABSTRACT

In all countries, plants have always been and still are used for their health benefits as part of traditional medicine. The same is true of Madagascar, which also boasts considerable biodiversity, including plants that are totally endemic to the country.Our study aims to identify medicinal plants traditionally used to treat diabetes and cancer in the province of Toliarain Madagascar. At the end of the survey we carried out with the local population, using pre-established questionnaires, 34 plants were identified.Thus, among the species recorded, *Myrothamnus moschatus*, *Zanthoxylum* decaryi and *Calotropis procera* were targeted. These are multi-use species, they are used respectively to treat convulsion, hypertension and healing. Among the three species studied, two are endemic to Madagascar (*Myrothamnus moschatus* and *Zanthoxylum decaryi*), however the third is introduced. This study has enabled us to demonstrate the importance of ethnobotanical investigation in the field of research. The identification of these three species provides us with a basis for phytochemical development.

Key words: medicinal plants, *Myrothamnus moschatus*, *Zanthoxylum decaryi*, *Calotropis procera*, ethnobotany.

1. INTRODUCTION

Many of the bioactive molecules currently in use are derived from phytochemical studies. Indeed, nature provides a number of remedies for various pathologies.Today, many plant- and animal-derived medicines are widely prescribed, such as madeglucyl anti-diabetic(Puri et al., 2010) and taxol anti-cancer (Weaver 2014) drugs, and the search for new active ingredients of natural origin remains a hot topic.

According to a report by the World Health Organization (WHO), despite the development of conventional medicine, the majority of people in developing countries like Madagascar still rely on traditional healers and medicinal plants for their care (Albert Chominot, 2000; Xiaorui Zhang, 1998). The inaccessibility and high cost of conventional medicine, as well as the effectiveness of medicinal plants, are contributing to an increase in the number of people practicing traditional medicine. This increase also testifies to the preoccupation and importance of traditional medicine. The aim of this study is to inventory and identify medicinal plants used in the treatment of diabetes and cancer, with a view to creating a Traditionally Improved Medicine (TIM).

2. MATERIAL & METHODS

2.1. Presentation of the study area: The province of Toliara is one of the largest provinces of Madagascar (Figure 1) with an area of 161,405km^2 with an estimated population of 4,199,643 inhabitants including 2,054,286 men and 2,145,357 women (Madagascar-Instat-

RGPH3, 2018). This province is distinguished from other provinces of Madagascar by its semi-arid climate, predominated by the alternation of two seasons namely the dry season which lasts up to nine (09) months followed by a brief rainy season characterized by low annual rainfall less than 600mm. (Monograph AtsimoAndrefana Region, 2013).

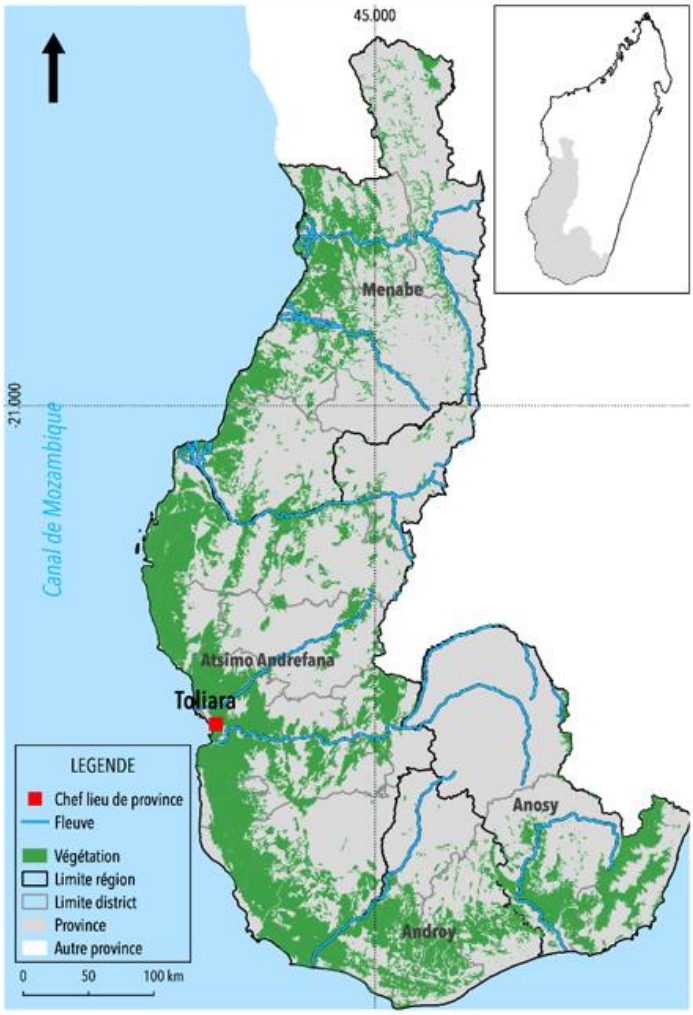

Figure 1. Study area

2.2. Ethno-botanical survey: Ethno-botanical surveys, based on direct questioning of anti-diabetic and anti-cancer medicinal plants, were carried out from June to July 2021 in the province of Toliara among healers, herbalists and, above all, villagers. The survey was carried out using a pre-established questionnaire form. The questions were asked in the local dialect, and varied according to the region where the survey was carried out. They covered socio-demographic data (age, sex, marital status, level of education), plants and organs used, as well as preparation and administration methods.

2.3. Sampling: According to the 2004 administrative division, the province of Toliara is made up of four regions. The sample was drawn up using a random sampling method, divided into two groups: group 1 (South West region, Menabe region), group 2 (Androy, Anosy). In order to ensure the objectivity of the data, 3-year students from the Chemistry Department,

the Institutd'Enseignement du Menabe and the Institutd'EnseignementSupérieur de Toliara were mobilized for practical and personal student work. They were divided into eight groups of five students. In each group, the presence of at least one student from one of the four regions is required.

2.4. Species selection: Two basic criteria were adopted in selecting the anti-diabetic and anti-cancer medicinal plants studied**.**

- The first criterion is based on the medicinal plants most frequently used in the treatment of the two diseases (i.e. the frequency of use to treat diabetes and cancer).
- The second is based on bioavailability in the region surveyed.

2.5. Data analysis: the citation frequency (Fc) of each plant surveyed is calculated using the formula in (Gbekley et al., 2017)

$$\mathbf{Fc} = \frac{\mathbf{n_c}}{\mathbf{N}} \times \mathbf{100}$$

With;

n_c = number of citations for the plant in question

N = number of people surveyed

3. RESULTS& DISCUSSION

3.1. Sociodemographic characteristics of the surveys (Table 1)

For this study, 108 people were surveyed, including 64.81% healers, 7.41% herbalists and 27.78% users. The majority of those surveyed were men (68.96%). Age ranged from under 30 to over 60, with the majority over 60 (50%). The majority of respondents came from the Androy region (49%) and the South-West region (38%). The highest percentages of respondents were healers (64.81%). With regard to educational level, the results show that 62.96% are illiterate, while university level is less represented (1.85%). In terms of marital status, the majority of respondents are married (72.22%).

Table 1: Socio-demographic characteristics of respondents (N=108).

Features	Frequency (%)
Gender	
Men	68.96
Women	37.04
Regional origin	
Anosy	4
Androy	49
Menabe	17
South-West	38
Age	
< 30	14.81

$30 \leq x \leq 60$	35.19
$x > 60$	50.00
Class	
Healers	64.81
Herbalists	7.41
Users	27.78
Level of education	
No schooling	62.96
Primary	25.93
Secondary	9.26
University	1.85
Marital status	
Single	2.78
Divorced	10.19
Married	72.22
Widowed	14.81

3.2. Plant parts used

The most commonly used plant parts are leaves (20.59%), leafy stems (20.59%), stems (2.94%), stem bark (29.41%) and root bark (26.47%). The results show that all four organ parts are similarly used in the preparation of anti-cancer and anti-diabetic recipes in the province of Toliara (Figure 2).

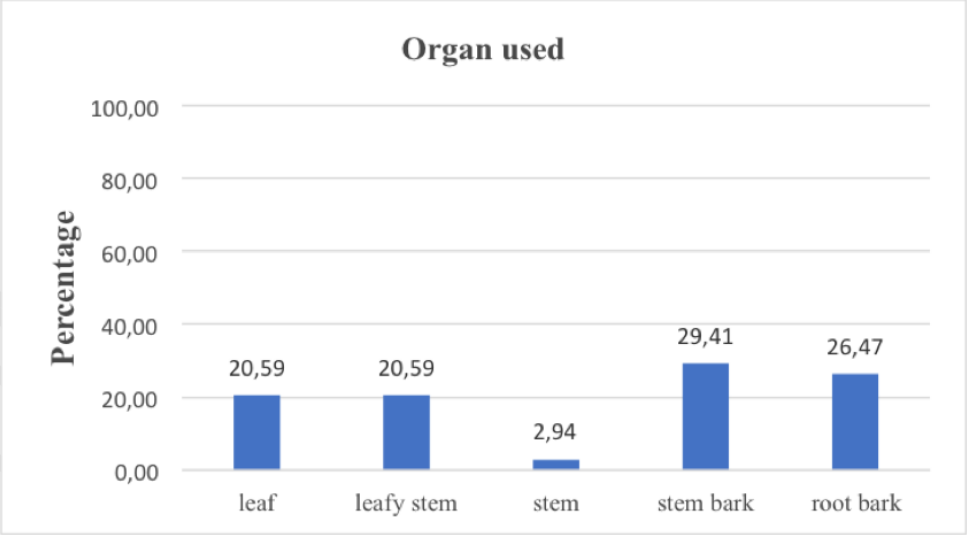

Figure 2. Histograms of the different parts used

3.3. Preparation techniques

According to the ethno-botanical survey, two techniques are used: decoction 67.65%, maceration 32.35% (Figure 3).

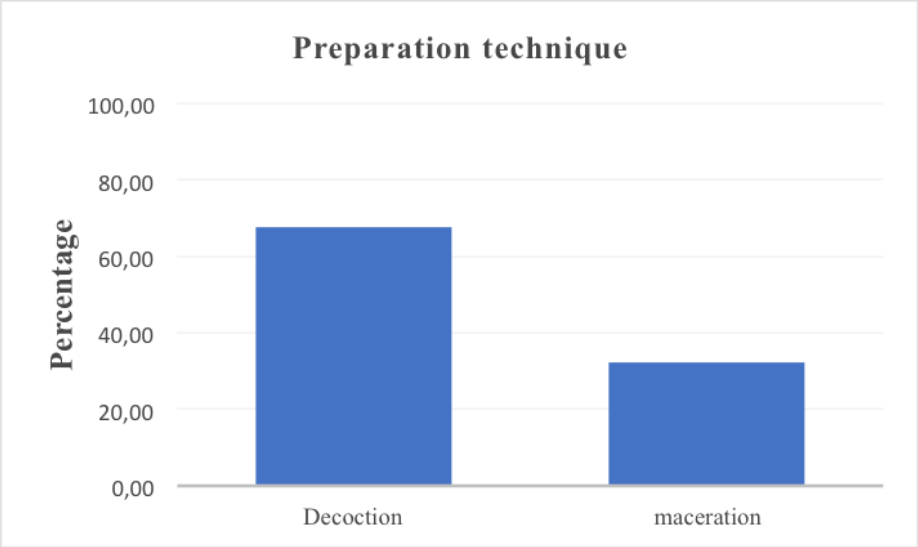

Figure 3.Histograms of preparation techniques

3.4. Route

Non-toxic plants are taken orally, while toxic plants are taken externally.A total of 34 anti-diabetic and anti-cancer plant species have been identified in Toliara Province (Table 2).

Table 2. Antidiabetic and anticancer medicinal plants in Toliara Province.

N°	Family	Scientific name	Vernacular name	Parts used	Preparation technique	Disease	Frequency of quotation (%)
1	Amaranthaceae	*Amaranthus spinosus*	*Tsirapahy*	Leafy stem	Decoction	Antidiabetic	1.85
2	Anacardiaceae	*Anacardium occidentale*	*Mahabibo*	Stem bark	Decoction	Anticancer	0.93
3	Anacardiaceae	*Sclerocaryabirrea*	*Sakoa*	Leaf	Decoction	Antidiabetic	2.78
4	Apocynaceae	*Calotropis procera*	*tapoky*	Leaf	Decoction	Anticancer / Antidiabetic	**37.04**
5	Apocynaceae	*RoupellinaboiviniM.Pichon*	*Lalondo*	Leaf, stem bark, root bark	Maceration	Anticancer	1.85
6	Aristolochiaceae	*Aristolochia albida Duch.*	*Totonga*	Leaf root bark	Decoction	Anticancer	0.93
7	Asclépiadaceae	*CryptostegiamadagascariensisBoj.*	*Lombiry*	root bark	Maceration	Anticancer	0.93
8	Astéraceae	*Dicomacarbonaria Baker*	*Peha*	Leaf	Maceration	Anticancer	1.85
9	Bignoniaceae	*Rhigozummadagascariense Drake*	*Hazontà*	Leaf, Stem bark	Decoction	Anticancer	2.78
10	Bignoniaceae	*Phyllarthronbernierianum Seem.*	*Toirave*	Stem bark	Maceration	Anticancer	4.63
11	Borraginaceae	*Ehretia sp.*	*Lamoty*	root bark	Decoction	Anticancer	7.41
12	Cannabaceae	*Trema orientalis*	*Tsivakimbaratra*	Stem bark	Decoction	Antidiabetic	9.26
13	Capparidaceae	*Boscia madagascariensis DC.*	*Pake*	Stem bark	Maceration	Anticancer	5.56
14	Ebénaceae	*Diospyros sp*	*vandamena*	root bark	Maceration	Anticancer	8.33
15	Ebénaceae	*Diospyros sp.*	*Hazomby*	Stem bark	Decoction	Anticancer	11.11
16	Euphorbiaceae	*Geloniumboivinianum Mull*	*Hazombalala*	Leafy stem	Decoction	Anticancer	7.41

17	Fabaceae	*Chadsiagrevei Drake*	*Remote*	root bark	Maceration	Anticancer	5.56
18	Fabaceae	*Indigofera tinctoria L*	*Netse*	Leaf	Decoction	Anticancer	6.48
19	Hypéricaceae	*Psorospermumsp*	*Hazompanihy*	Stem bark	Maceration	Anticancer	8.33
20	Labiatae	*Capitanopsis angustifolia*	*Reringitse*	Leafy stem	Decoction	Antidiabetic	9.26
21	Lamiaceae	*Portulaca oleracea*	*Kalabotretraka*	Leafy stem	Decoction	Antidiabetic	12.96
22	Lauraceae	*Ranveseraaromaticagmelin*	*Ravintsara*	Leafy stem	Decoction	Antidiabetic	1.85
23	Loganiaceae	*Strychnossp*	*Mandakolahy*	root bark	Maceration	Anticancer	0.93
24	Loganiaceae	*Strychnossp*	*Hazomby*	root bark	Decoction	Anticancer	0.93
25	Meliaceae	*Cedrelopsisgrevei*	*Katrafay, katsafa, katrafa*	Stem bark	Maceration	Anticancer	1.85
26	Musaceae	*Musa paradisiaca*	*Kida*	Ripe banana peel	Decoction	Antidiabetic	4.63
27	Myrothamnaceae	*Myrothamnusmoschatus*	*Maharoaky,Somorombato*	Leafy stem	Decoction	Anticancer/ Antidiabetic	**31.48**
28	Myrtaceae	Psidium guajava	*Goavy*	Leaf andfruit	Decoction	Antidiabetic	8.33
29	Nymphaeaceae	*Nymphea stellata willd*	*Bekapaike*	Leafy stem	Decoction	Antidiabetic	3.70
30	Olacaceae	*Olax sp.*	*Ambihotse*	Stem	Decoction	Anticancer	7.41
31	Papilionaceae	*Cajanus indicus spreng*	*Ambatry*	Root bark	Decoction	Antidiabetic	2.78
32	Rhamnaceae	*Ziziphus mauritiana*	*Tsinefo*	Leaf	Decoction	Antidiabetic	0.93
33	Rubiaceae	*Paederiamajungensis*	*Lengobe*	Dry root	Decoction	Antidiabetic	4.63
34	Rutaceae	*Zanthoxylum decaryi*	*Monongo*	Stem bark	Decoction	Antidiabetic / Anticancer	**25.00**

3.5. Plant selection criteria

Based on the predefined criteria above, three medicinal plants were selected. These are:*Calotropis procera* (37.04%), *Myrothamnusmoschatus* (31.48%), *Zanthoxylumdecaryi* (25.00%).

3.6. Monograph for each plant selected according to pre-established criteria

a) *Myrothamnusmoschatus*(Myrothamnaceae)(Millogo-Rasolodimby, 1991).

It's a dioecious shrub that only grows on bare, sunny rocks, hence the name "lithophyte plant". The flowering season is divided into two main parts: for the male, January to March and July to December; for the female, January to February and October to December. This plant is characterized by its ability to adapt to long periods of drought, and as soon as it rains, the leaves change color. This ability gives it the name "resurrection plant".

The plant is known by several vernacular names, which vary according to ethnic group:

- Maimbelona:mérina
- Fanalahy : betsileo
- Maharoaka et somoro: bara
- Tsangatsanga : tsimihety
- Maharoaky:antandroy

Geographical distribution: Southern part of Madagascar

Traditional uses:

- Asthma: dried leaves are smoked like tobacco
- Cough: decoction of the whole plant
- External use: to heal wounds and facilitate wound healing

Pharmacological action tested from essential oil(Rasoanaivo et al., 2012)

- Antimicrobial activity
- *In vitro:*cytotoxic

Use of essential oil in agriculture (Pavela et al., 2022)

- Effective against crop arthropods and of medical interest

Use as phytomedicines (Rasoanaivo et al., 2012)

- Essential oil: to prevent and treat convulsions and migraines

Dry season plant

Wet season plant

Phytomedicine

Figure 4. *Myrothamnusmoschatus*

b)*Zanthoxylum decaryi* ,Rutaceae(Perrier De La Bathie, 1950)

A small tree, 5 to 8 cm high, very thorny when young, becoming almost ineradicable with age, with thick, scarred final branches. The hairless leaves measure from 15 to 25 cm and are grouped in a maximum of 12 terminal clusters. Male flowers are pubescent thyrses, tetramerous with stamens leading the carpels astray. Female inflorescences are clustered and very similar to the male flowers.

The plant is known by several Malagasy vernacular names, including monongo, monongovola and monongovola.

Geographical distribution: Southern part of Madagascar

Traditional uses:Antidiabetic, hypertension, malaria: bark decoction

Figure 5. *Zanthoxylum decaryi*

c)*Calotropis procera*,Apocynaceae

A 5-metre-high latex shrub with large, glaucous leaves. Its purplish flowers are grouped together. Its fruits resemble small oval apples in the form of testicles.
The plant is known by several Malagasy vernacular names: tapoky, tsipopoky.

Geographical distribution: Southern Madagascar, Eastern India, Arabia, Africa

Traditional uses:

- Decoction for external use to disinfect wounds (leaves)
- Latex accelerates healing
- Antidiabetic: decoction of leaves (take care to respect the dose)

Pharmacological action tested:

- Effects on biochemical markers of organic functions in OFA rats (LohouesEssiset al., 2006)
- Phytochemical properties and antioxidant activity of *Calotropisprocera* (Ait.) R. Br. (Kumar et al., 2013)
- Coagulant properties of *Calotropisprocera* and its potential use in the food industry (Baba-Moussa et al., 2007)
- Acute toxicological properties of *Calotropisprocera* latex in rats (Lohoues et al., 2006)
- *Coagulant properties of Calotropis*procera and its potential use in the food industry (Farid et al., 2007)
- *In vitro* cytotoxicity against different human cancer cell lines of laticifer proteins of Calotropis procera (Ait.) R. Br (Soares de Oliveira et al., 2007)
- *Calotropis procera* (Aiton) Dryand (Apocynaceae) as an anti-cancer agent against canine mammary tumor and osteosarcoma cells (Rabelo et al., 2021)

flower

shrub

fruit

Figure 6. ***Calotropis procera***

3.7. Discussion

The ethno-botanical surveys carried out in the province of Toliara questioned 108 people of different classes, the majority of whom were men (68.96%). When age is taken into account, the result is that they are over 60 (50%), which explains why the practice of traditional medicine is the prerogative of older men. These results are in line with the work carried out by (Gbekley et al., 2015), which also revealed the importance of ancestral knowledge. It emerges from this study that the majority of people surveyed are married (72.22%), illiterate (62.96%) and these results are corroborated with national data (Madagascar-INSTAT-RGPH3, 2018). The present study strictly concerns plants used against cancer and diabetes, among the species listed: *Calotropis procera*, *Myrothamnusmoschatus* and *Zanthoxylumdecaryi* particularly caught our attention due to the fact that they are the most solicited in the province of Toliara whose citation frequencies are 37.04%; 31.48% and 25% respectively. Moreover, the frequency of use testifies to the abundance of chemical groups that could have effects on people suffering from diabetes and/or cancer, but they need to undergo scientific validation to justify their use. In traditional medicine, most recipes are prepared by decoction. This explains why the action of decocting recipes.

4. PROSPECTS AND CONCLUSIONS

The ethnobotanical survey carried out in the province of Toliara identified 34 medicinal plants used in the treatment of diabetes and cancer. From this list, *Calotropis procera*, *Myrothamnusmoschatus* and *Zanthoxylum decaryi* are the most cited. To scientifically prove the therapeutic efficacy and safety of these three plants, a study is currently underway in partnership with the Institut Malgache de RecherchesAppliquées (IMRA) and the Unité Transformations &Agroressources of the Université d'Artois in France. The use of these three medicinal plants to treat diabetes and cancer is another step in the valorization of these plants. It also enables us to contribute further knowledge on the progress of our research in terms of biological activity and the chemistry of natural products.

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