

The Journal of Phytopharmacology

(Pharmacognosy and phytomedicine Research)

Research Article

ISSN 2320-480X

JPHYTO 2018; 7(6): 483-494

November- December

Received: 13-08-2018

Accepted: 17-11-2018

© 2018, All rights reserved

Andriamalala Rakotondrarfara

National Center for Applied
Pharmaceutical Research,
Ambodivoanjo. Rue Rahajarizafy A.P.,
BP. 702 Antananarivo (101), Madagascar

Roland Rakotondrajaona

National Center for Applied
Pharmaceutical Research,
Ambodivoanjo. Rue Rahajarizafy A.P.,
BP. 702 Antananarivo (101), Madagascar

Marrino Rakotoarisoa

National Center for Applied
Pharmaceutical Research,
Ambodivoanjo. Rue Rahajarizafy A.P.,
BP. 702 Antananarivo (101), Madagascar

Michel Ratsimbason

National Center for Applied
Pharmaceutical Research,
Ambodivoanjo. Rue Rahajarizafy A.P.,
BP. 702 Antananarivo (101), Madagascar

Vincent Emile Rasamison

National Center for Applied
Pharmaceutical Research,
Ambodivoanjo. Rue Rahajarizafy A.P.,
BP. 702 Antananarivo (101), Madagascar

Stephan Richard Rakotonandrasana

National Center for Applied
Pharmaceutical Research,
Ambodivoanjo. Rue Rahajarizafy A.P.,
BP. 702 Antananarivo (101), Madagascar

Correspondence:

Dr. **Stephan Richard**
Rakotonandrasana
National Center for Applied
Pharmaceutical Research,
Ambodivoanjo. Rue Rahajarizafy A.P.,
BP. 702 Antananarivo (101), Madagascar
Email: stephanandrasana@yahoo.fr

Ethnobotany of medicinal plants used by the Zafimaniry clan in Madagascar

Andriamalala Rakotondrarfara, Roland Rakotondrajaona, Marrino Rakotoarisoa, Michel Ratsimbason, Vincent Emile Rasamison, Stephan Richard Rakotonandrasana*

ABSTRACT

During an ethnobotanical survey conducted among the Zafimaniry clan in the Amoron'i Mania region of Madagascar, 164 medicinal plants species from 138 genera and 73 families are recorded to be used by local people to treat 65 different types of human diseases. The most prescribed species belong to Asteraceae (30 species), Fabaceae (8 species), Rubiaceae (7 species) Poaceae (6 species) and Solanaceae (7 species) botanical families. *Helichrysum* was the most cited genus with 6 species. The main pathologies treated with medicinal plants are abdominal colic (10.5%) using 25 species, cough (7.2%, 23 species), intestinal parasites (6.3%, 20 species) and diarrhea (5.8%, 25 species). The vernacular names and the recipes of used plants are also reported. Data are collected by interviewing 191 informants aged between 16 and 100 using standardized questionnaires. The present study shows that the Zafimaniry people use a large number of medicinal plants for their primary health care. Some of the recorded plants are new in the Malagasy ethnopharmacopoeia.

Keywords: Medicinal plants, Ethnomedicine, Zafimaniry clan, Madagascar.

INTRODUCTION

The use of traditional medicine dated back to ancient times in many parts of the world. The corresponding knowledge is inherited from ancestors and the methods of preparation of drugs are mainly transmitted orally from generation to generation. According to the World Health Organization, 80% of the world population depend on traditional medicine for their primary health care. In Madagascar, a large majority of Malagasy people have resort to traditional medicine due to the high cost of modern medicines and the lack of health facilities in remote regions of the country.

Madagascar is known as a country of biodiversity hotspot. The flora of Madagascar comprises 11 220 vascular plants, of which 84% are endemic.^[1] Nevertheless, due to anthropic pressures, the island is facing a severe degradation of its natural resources and ecosystems during these last decades, which would lead to a loss of knowledge related to traditional medicine. Consequently, ethnobotanical studies are needed to contribute to the preservation and the highlighting of this knowledge.

The population of Madagascar is composed of 18 ethnic groups which have their own manners and customs. However, only few works have been dedicated to the exploration of their ethnomedical practices. As far as we know, four ethnic groups have been the subject of ethnobotanical surveys so far: Sakalava and Antakarana in the north, Tanala and Antemoro in the south east of Madagascar.^[2-4]

We report herein the results of an ethnobotanical survey conducted among the Zafimaniry clan in the south eastern part of Madagascar. Zafimaniry people are included in the Betsileo ethnic group. Their origin is still unclear, being either descendants of the Merina and/or Betsileo^[5] or a clan of the Tanala race^[6]. To the best of our knowledge, there has been no previous inventory work on the medicinal plants used by the Zafimaniry people.

METHODOLOGY

The studied area is located in the south-eastern part of the Amoron'i Mania Region, district of Ambositra, about 300 km south of the capital of Madagascar (Figure 1). It extends between latitude 20°33'32.5" - 20°50'24.1" S and longitude 047°21'40.8" - 047°33'07.5" E. The ethnobotanical survey was carried out in 2015-2016 in six villages of the Zafimaniry clan as indicated in red points in Figure 1:

Fenomanta (Commune of Vohidahy), Ambohimanjaka and Ambohimitombo (Commune of Ambohimitombo I), Ambatokapaika and Ranomena (Commune of Ambohimitombo II), and Sakaivo Avaratra (Commune of Antoetra).

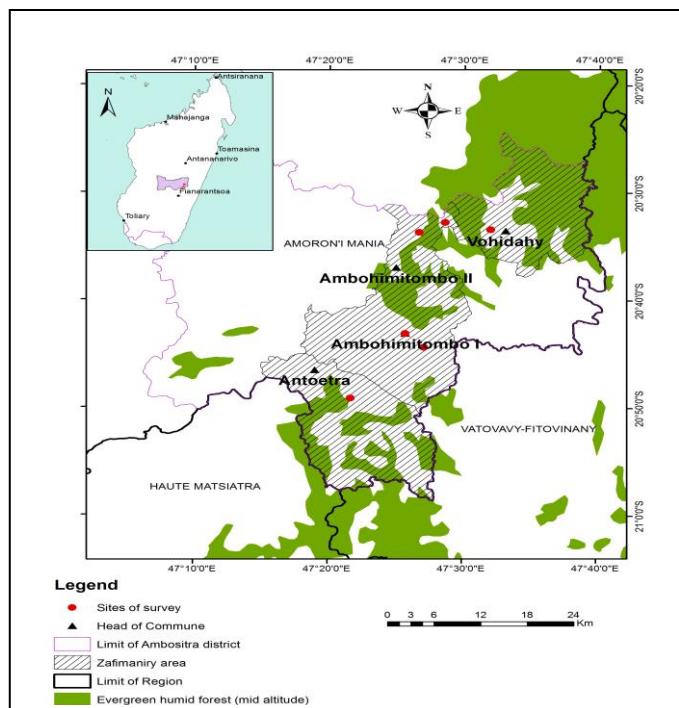


Figure 1: Map of localization

Vegetation in the study area is constituted by low altitude evergreen humid forests and evergreen forests of altitudes as well as its various

forms of degradation, grassland formations and reforestation mainly of *Eucalyptus* and the different crop areas. [7]

Informants consisted of 95 men and 96 women aged between 16 and 100 years. They are traditional midwives (06) and traditional healers (03), fathers and mothers of families (182).

The semi-structured interview was used during the survey. Information provided by informants was recorded as they said. [8,9] For each species, the places of harvest are geo-localized. Voucher specimens are deposited at the herbarium of medicinal plants at the National Center for Applied Pharmaceutical Research (CNARP), Antananarivo, Madagascar and the Botanical and Zoological Park of Tsimbazaza (TAN), Antananarivo, Madagascar.

Plants were identified at CNARP by the authors. The phylogeographic distribution is obtained by consulting the databases of the vascular plant catalog of Madagascar and the databases of the African plants.

The citation frequencies of all data obtained from this study was subjected to descriptive statistical analysis by calculating of frequency of plant citations, using the formula:

$$F (\%) = (\text{Number of people who cited the use of the species} / \text{Total number of persons interviewed}) \times 100.$$

RESULT

The one hundred and sixty-four medicinal plants recorded during the ethnobotanical survey among the Zafimaniry clan in Madagascar are listed in Table 1. The following ethnobotanical information are reported for each species: the scientific name, the family name (in parenthesis), the growth form, the geographical distribution, the vernacular name, the plant part used, the therapeutic uses and the voucher specimen number.

Table 1: Medicinal plants used by the Zafimaniry clan in Madagascar ([†]NE: Not endemic, INT: Introduced, E: Endemic; *Voucher Specimens: RLL: botanist collector who is Rakotondrafara Andriamalala), underlined species are new in Malagasy pharmacopoeia

Scientific names, Habit, Geographical Distribution [†]	Vernacular Names	Part used and Therapeutic uses	Voucher Specimens*
<i>Abrus precatorius</i> L. (FABACEAE), Liana, NE	Voamaintilany	Leaves : Syphilis	RLL 1175
<i>Acacia dealbata</i> Link (FABACEAE), Shrub, INT	Mimoza	Leaves : Syphilis	
<i>Achyranthes aspera</i> L. (AMARATHACEAE), Herb, INT	Tspotikamboa	Whole plant, Stomach aches ; Leaves: Diarrhoea, Abdominal colic, Intestinal parasites	RLL 1193
<i>Acmella caulirhiza</i> Delile, (ASTERACEAE), Herb, NE	Kimalahondrazana	Leaves : Cough, Emaciation	RLL 1093
<i>Ageratum conyzoides</i> L. (ASTERACEAE), Herb, INT	Ahimaimbo	Leaves : Abdominal colic, Wound	RLL 1162
<i>Albizia gummifera</i> (J.F. Gmel.) C.A. Sm. (FABACEAE), Tree, NE	Volomborona	Leaves : Asthma, Cough, Fatigue, Postpartum infections, <u>Side stitch</u>	RLL 1127
<i>Allium sativum</i> L. (LILIACEAE), Herb, INT	Tongolo gasy	Bulb : Intestinal parasites, Hypertension	
<i>Aloe conifera</i> H. Perrier (XANTHORRHOACEAE) , Herb, E	Vahona	Leaves : Emaciation, Dandruff, Diarrhoea, Intestinal parasites, Wound	RLL 1360
<i>Aloe macroclada</i> Baker (XANTHORRHOACEAE), Herb, E	Vahona	Leaves : Dandruff, <u>Sprain</u>	RLL 1191

<i>Ananas comosus</i> (L.) Merr. (BROMELIACEAE), Herb, INT	Mananasy	Leaves : Intestinal parasites, Asthma ; Fruit : <u>Dandruff</u>	RLL 1361
<i>Anthocleista amplexicaulis</i> Baker (GENTIANACEAE), Tree, E	Dindemy	Leaves : Malaria, Gastric ulcer, Stomach aches	RLL 1187
<i>Scientific Names, Habit, Geographical Distribution</i> ‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens*
<i>Anthocleista madagascariensis</i> Baker (GENTIANACEAE), Tree, E	Variha	Root : Abscess ; Stem : Toothache ; Leaves: Postpartum infections	RLL 1147
<i>Aphloia theiformis</i> (Vahl) Benn. (APHLOIACEAE), Tree, NE	Fandramanana	Leaves : Abscess, Convulsion, Eye Disease, Fatigue, Fever, Emaciation, Postpartum infections, Tooth ache, Wound	RLL 1076
<i>Arachis hypogaea</i> L. (FABACEAE), Herb, INT	Voanjompika	Seeds: Intestinal parasites ; Fruits : Anemia	
<i>Aristea humbertii</i> H. Perrier (IRIDACEAE), Herb, E	Kivazavazaha	Leaves : Syphilis	RLL 1269
<i>Asparagus simulans</i> Baker (ASPARAGACEAE), Liana, E	Odiota	Leaves : Boil, Pityriasis, Skin diseases	RLL 1173
<i>Bakerella clavata</i> (Desr.) Balle (LORANTHACEAE), Shrub, NE	Tongoalahy mena	Leaves : Abscess ; Postpartum infections	RLL 1315
<i>Bidens pilosa</i> L. (ASTERACEAE), Herb, INT	Anatraka	Leaves : Hypertension, Wound, Mounted milk	RLL 1103
<i>Blumea crispata</i> (Vahl) Merxm. (ASTERACEAE), Herb, INT	Ariandro	Leaves : Cough, Malaria, Side stitch	RLL 1176
<i>Brachylaena ramiflora</i> (DC.) Humbert (ASTERACEAE), Tree, NE	Merana	Leaves : Fatigue, Jaundice, Emaciation, Stomach aches	RLL 1090
<i>Bremeria vestita</i> (Baker) Razafim. & Alejandro (RUBIACEAE), Tree, E	Fatorialahy	Leaves : Constipation, Diarrhoea	RLL 1316
<i>Brugmansia candida</i> Pers. (SOLANACEAE), Shrub, INT	Detora	Leaves : Headache, Abscess, Epistaxis ; Flowers: Asthma, Tuberculosis, Cough	RLL 1256
<i>Buddleja madagascariensis</i> Lam. (SCROPHULARIACEAE) , Liana, E	Sevafotsy	Leaves : Vertigo, Epistaxis, Malaria, Emaciation, Wound	RLL 1089
<i>Burasaia madagascariensis</i> DC. (MENISPERMACEAE), Shrub, E	Tambarasaha	Leaves : Abdominal colic, Cough, Diarrhoea, Fatigue, Malaria, Stomach aches ; Stem: Fever	RLL 1116
<i>Scientific Names, Habit, Geographical Distribution</i> ‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Cannabis sativa</i> L. (CANNABACEAE), Shrub, INT	Rongony	Leaves: Emaciation	
<i>Canarium madagascariense</i> Engl. (BURSERACEAE), Tree, E	Ramy	Resin : Intestinal parasites	RLL 1276
<i>Capriola dactylon</i> (L.) Kuntze (POACEAE), Herb, NE	Kindresy	Leaves : Postpartum infections, Fractures; Whole plant: Jaundice ; Aerial part: Albumin; Stem: Ocytotic	RLL 1080
<i>Capsicum annuum</i> L. (SOLANACEAE), Suffrutescent, INT	Sakay pilokely	Fruit : Side stitch ; Headache ; Tooth ache; Eye Disease; Malaria	RLL 1217
<i>Carissa spinarum</i> L. (APOCYNACEAE), Tree, NE	Fantasy	Leaves : Syphilis, Tooth ache	RLL 1270

<i>Cassinopsis madagascariensis</i> Baill. (ICACINACEAE), Tree, E	Hazomafaitra	Leaves : Cough , Fatigue, Fatigue for pregnant, Syphilis	RLL 1148
<i>Centella asiatica</i> (L.) Urb. (APIACEAE), Herb, INT	Talapetraka	Leaves : Dysentery, Abdominal colic	RLL 1242
<i>Chassalia ternifolia</i> (RUBIACEAE), Shrub, E	Tsifady	Leaves : Emaciation	RLL 1334
<i>Chenopodium ambrosioides</i> L. (CHENOPODIACEAE), Suffrutescent, INT	Taimborotsiloza	Leaves : Intestinal parasites, Headache, Fear of heights	RLL 1126
<i>Cinnamomum camphora</i> (L.) J. Presl (CANELLACEAE), Tree, INT	Ravintsara	Leaves : Fatigue, Postpartum infections	RLL 1293
<i>Cinnamosma madagascariensis</i> Danguy (CANELLACEAE), Tree, E	Kisenasena	Bark: Vertigo, Stomach aches, Intestinal parasites; Leaves : Abscess, Eye Diseases, Emaciation; Stem: Dysentery	RLL 1153
<i>Cissus floribunda</i> (Baker) Planch. (VITACEAE), Liana, E	Vahiràna	Leaves : Eye Diseases	RLL 1188
<i>Clidemia hirta</i> (L.) D. Don (MELASTOMATACEAE), Herb, NE	Sompatra	Leaves : Abdominal colic, Diarrhoea, Dysentery, Gastric ulcer, Wound	RLL 1110
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Coffea canephora</i> Pierre ex A. Froehner (RUBIACEAE), Shrub, INT	Kafe	Leaves : Abdominal colic, Diarrhea, Malaria ; Fruit : Fatigue	RLL 1158
<i>Colocasia esculenta</i> (L.) Schott (ARACEAE), Herb, INT	Saonjo	Leaves : Mounted milk, Partum infections; Tuber: Abscess; Petiole: Wound	RLL 1278
<i>Commelina africana</i> var. <i>mannii</i> (C.B. Clarke) Brenan (COMMELINACEAE), Herb, NE	Tsimativonoina	Leaves : Fever of children, Emaciation, Side stitch, Convulsion, Vomiting	RLL 1101
<i>Conyza bonariensis</i> (L.) Cronquist (ASTERACEAE), Herb, INT	Ahibahiny	Leaves : Headache, Tooth ache, Vomiting	RLL 1132
<i>Crassocephalum rubens</i> var. <i>sarcobasis</i> (DC.) C. Jeffrey et Beentje (ASTERACEAE), Herb, NE	Anandrambo	Leaves : Dysentery, Stomach aches, Wound	RLL 1104
<i>Cymbopogon citratus</i> (DC.) Stapf (POACEAE), Herb, INT	Veromanitra	Leaves : Soporific	
<i>Cyperus latifolius</i> Poir. (CYPERACEAE), Herb, NE	Herana	Leaves : Stomach aches, Syphilis	RLL 1273
<i>Danais cernua</i> Baker (RUBIACEAE), L	Tamboriharina	Leaves : Muscle Cramp	RLL 1314
<i>Desmodium hirtum</i> Guill. et Perr. (FABACEAE), Herb, NE	Mandalodiaraitra	Leaves : Fever	RLL 1263
<i>Desmodium ramosissimum</i> G. Don (FABACEAE), Herb, NE	Tadindambo	Leaves : Emaciation, Stomach aches	RLL 1255
<i>Dianella ensifolia</i> (L.) DC. (XANTHORRHOACEAE), Herb, NE	Voamasotaitso	Whole plant : Purgative, Stomach aches; Leaves : Vertigo, Fever, Scabies, Skin illness	RLL 1117
<i>Dichaetanthera cordifolia</i> Baker (MELASTOMATACEAE), Herb, E	Tsingotitra	Leaves : Metrorrhagia, Wound	RLL 1272
<i>Dichrocephala latifolia</i> DC. (ASTERACEAE), Herb, E	Ahidrindrina	Leaves : Cough, Fever, Hepatic Pain, Emaciation, Purgative, Side stitch, Stomach aches, Wound	RLL 1100
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens

<i>Dicranopteris linearis</i> (Burm. f.) Underw. (GLEICHENIACEAE), Herb, NE	Ampangavy	Leaves : Gastric ulcer	RLL 1208 bis
<i>Diodella sarmentosa</i> (Sw.) Bacigalupo & E.L. Gabral (RUBIACEAE), Herb, E	Lelamenarana	Aerial part : Wound ; Leaves : Metrorrhagia, Abdominal colic	RLL 1252
<i>Dioscorea bulbifera</i> L. (DIOSCOREACEAE), Liana, NE	Hofika	Fruit : Abscess	
<i>Distephanus garnierianus</i> (Klatt) H. Rob. et B. Kahn (ASTERACEAE), Tree, E	Hazomavo	Leaves : Fever, Hepatic Pain, Stomach aches	RLL 1086
<i>Doellia cafra</i> (DC.) Anderb., (ASTERACEAE) Herb, INT	Miandramiondrika	Leaves : Eye Disease	RLL 1337
<i>Drosera madagascariensis</i> DC. (DROSERACEAE), Herb, NE	Mahatanando	Whole plant : Dysentery, Fever	RLL 1200
<i>Drymaria cordata</i> (L.) Willd. ex Roem. et Schult. (CARYOPHYLLACEAE), Herb, NE	Anantarika	Leaves : Ocytotic, Vomiting, Wound	RLL 1280
<i>Elephantopus scaber</i> L. (ASTERACEAE), Herb, INT	Tambakombako	Leaves : Diarrhoea, Abdominal colic, Cough, Intestinal parasites	RLL 1260
<i>Emilia citrina</i> DC. (ASTERACEAE), Herb, E	Kitsionsiona	Leaves : Cough, Hepatic Pain, Scabies	RLL 1218
<i>Equisetum ramosissimum</i> Desf. (EQUISETACEAE), Herb, INT	Kitohitohy	Stem : Stunting	RLL 1295
<i>Eriobotrya japonica</i> (Thunb.) Lindl. (ROSACEAE), Shrub, INT	Kobasy	Stem : Stomach aches	RLL 1284
<i>Erythroxylum ferrugineum</i> Cav. (ERYTHROXYLACEAE), Tree, E	Malambovony	Stem : Burn	RLL 1283
<i>Eucalyptus robusta</i> Sm. (MYRTACEAE), Tree, INT	Kininina	Exudate : Malaria	RLL 1111
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Faucherea parvifolia</i> Lecomte (SAPOTACEAE), Tree, E	Nanto	Bark : Abdominal colic, Diarrhea	RLL 1321
<i>Ficus pachyclada</i> Baker (MORACEAE), Tree, E	Voara	Leaves : Asthma, Ocytotic	RLL 1122
<i>Ficus politoria</i> Lam. (MORACEAE), Tree, E	Nonoka	Leaves : Constipation, Fatigue ; Root : Fractures	RLL 1180
<i>Ficus pyrifolia</i> Burm. f. (MORACEAE), Tree, E	Nonoka madinidravina	Leaves : Fever, Gastric ulcer, Stomach aches, Wound	RLL 1363
<i>Gerbera petasitifolia</i> Humbert (ASTERACEAE), Herb, NE	Fotsiavadika	Leaves : Asthma, Intestinal parasites	RLL 1159
<i>Gomphocarpus fruticosus</i> (L.) R. Br. (APOCYNACEAE), Shrub, INT	Fanoro, Fanory, Kifanory	Latex : Tooth ache; Leaves: Abdominal colic	RLL 1206
<i>Halleria ligustrifolia</i> Baker (STILBACEAE), Shrub, E	Somotsohy	Leaves : Emaciation, Syphilis	RLL 1108
<i>Harungana madagascariensis</i> Lam. ex Poir. (HYPERICACEAE), Tree, NE	Harongana	Leaves : Abdominal colic, Diarrhoea, Dysentery, Fever , Malaria, Metrorrhagia, Postpartum infections ; Terminal bud : Vertigo, Jaundice, Stomach aches ; exudates : Eye Disease	RLL 1079
<i>Hedychium coronarium</i> J. König (ZINGIBERACEAE), Herb, NE	Gilingiza	Leaves : Cough, Jaundice	RLL 1185

<i>Helichrysum aff. bakeri</i> Humbert (ASTERACEAE), Herb, E	Mavoantoerana	Leaves : Gastric ulcer, Stomach aches	RLL 1210
<i>Helichrysum bracteiferum</i> (DC.) Humbert (ASTERACEAE), Shrub, E	Rambazana	Leaves : Fatigue, Gastric ulcer, Tooth ache	RLL 1194
<i>Helichrysum cordifolium</i> DC. (ASTERACEAE), Herb, E	Tsimanandrana	Leaves : Albumin, Cough, Otitis, Postpartum infections, Stomach aches, Syphilis	RLL 1135
<i>Helichrysum faradifani</i> Scott-Elliot (ASTERACEAE), Herb, E	Ahibalala	Leaves : Asthma, Cough, Syphilis	
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Helichrysum fulvescens</i> DC. (ASTERACEAE), Herb, E	Ahipotsy	Leaves : Vertigo, Fever, Wound	RLL 1209
<i>Helichrysum mutisiaefolium</i> Less. (ASTERACEAE), Liana , E	Kelimileladrà	Leaves : Wound	RLL 1083
<i>Hubertia faujasioides</i> (Baker) C. Jeffrey (ASTERACEAE), Liana, E	Kiboiboy	Leaves : Otitis, Scabies ; Aerial part : Syphilis	RLL 1078
<i>Ilex mitis</i> (L.) Radlk. (AQUIFOLIACEAE), Tree, NE	Hazondrano	Leaves : Burn, Fever	RLL 1118
<i>Imperata cylindrica</i> (L.) Raeusch. (POACEAE), Herb, NE	Tenina	Leaves : Postpartum infections	RLL 1123
<i>Inula speciosa</i> (DC.) O. Hoffm. (ASTERACEAE), Herb, E	Lelanaomby	Leaves : Aphrodisiac	RLL 1239
<i>Ipomoea batatas</i> (L.) Lam. (CONVOLVULACEAE), Herb, INT	Vomanga	Leaves : Dandruff, Abdominal colic, Diarrhea, Wound; Tuber: Scabies	
<i>Jussiaea stolonifera</i> Guill. & Perr. (ONAGRACEAE), Herb, NE	Kitondratondra	Leaves : Postpartum infections	RLL 1248
<i>Kalanchoe peltata</i> (Baker) Baill. (CRASSULACEAE), Herb, E	Kidisadisa	Leaves : Cough, Syphilis	RLL 1130
<i>Lantana camara</i> L. (VERBENACEAE), Shrub, INT	Radriaka	Leaves : Wound, Hypertension, Hypertension, Malaria, Diarrhea, Dysentery	RLL 1095
<i>Lindsaia subtilis</i> K. U. Kramer(LINDSACEAE), Herb, E	Ampangamena	Leaves : Fatigue, Jaundice, Gastric ulcer	RLL 1338
<i>Litchi chinensis</i> Sonn. (SAPINDACEAE), Tree, INT	Letisia	Leaves : Dysentery, Diarrhea	RLL 1257
<i>Ludwigia octovalis</i> (Jacq.) P. H. Raven (ONAGRACEAE), Herb, NE	Lefavoana	Leaves : Purgative, Stomach aches, Wound	RLL 1251
<i>Lycopodiella cernua</i> (L.) Pic. Serm. (LYCOPODIACEAE), Herb, NE	Ampangafotsy	Leaves : Fever, Malaria, Gastric ulcer	RLL 1091
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Lygodium lanceolatum</i> Desv. (LYGODIACEAE), Herb, NE	Pitry	Leaves : Eye Disease, Fatigue, Malaria	RLL 1335
<i>Macaranga myriolepida</i> Baker (EUPHORBIACEAE), Tree, E	Karambita	Leaves : Burn	RLL 1333

<i>Macaranga sphaerophylla</i> Baker (EUPHORBIACEAE), Tree, E	Telefoitra	Leaves : Male sexual incompetence	RLL 1317
<i>Maesa lanceolata</i> Forssk. (PRIMULACEAE), Shrub, NE	Voarafy	Leaves : Albumin, Abdominal colic, Eye Disease, Fever, Emaciation, Ocytotic, Postpartum infections ; Terminal bud : Diarrhea, Fear of heights ; Root: Gastric ulcer	RLL 1125
<i>Mangifera indica</i> L. (ANACARDIACEAE), Tree, INT	Manga	Leaves : Diarrhea, Abdominal colic, Dysentery	
<i>Manihot esculenta</i> Crantz (EUPHORBIACEAE), Shrub, INT	Kajaha	Stem : Wound ; Malaria	RLL 1204
<i>Mikania microptera</i> DC. (ASTERACEAE), Liana, INT	Vahia	Leaves : Cough, metrorrhagia	RLL 1202
<i>Morus alba</i> L. (ROSACEAE), Shrub, INT	Voaroihazo	Leaves : Fatigue	RLL 1392
<i>Nicotiana tabacum</i> L. (SOLANACEAE), Shrub, INT	Paraky	Leaves : Tooth ache, Intestinal parasites, Abdominal colic, Sore throat, Wound, Eye Disease, Epistaxis	
<i>Nuxia capitata</i> Baker (STILBACEAE), Tree, E	Lambinana	Leaves : Fever, Leaves	RLL 1085
<i>Nuxia involucrata</i> Aug. DC. (STILBACEAE), Tree, E	Lambinana	Leaves : Fatigue, Fever, Stomach aches	RLL 1393
<i>Nuxia sphaerocephala</i> (Baker) Baker (STILBACEAE), Tree, E	Lambinambavy	Leaves : Fatigue	RLL 1302
<i>Ocimum gratissimum</i> L. (LAMIACEAE), Shrub, INT	Romba	Leaves : Postpartum infections, Malaria	RLL 1294
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Obetia radula</i> (Baker) ex B.D. Jacks. (URTICACEAE), Shrub, NE	Mihena	Leaves : Cough	RLL 1196
<i>Oryza sativa</i> L. (POACEAE), Herb, INT	Vary	Seeds : Mounted milk, Wound, Syphilis	
<i>Carica papaya</i> L. (CARICACEAE), Tree, INT	Mapaza	Leaves : Headache, Yellow fever, Aperitif ; Root: Malaria,	RLL 1182
<i>Passiflora edulis</i> Sims (PASSIFLORACEAE), Liana, INT	Garanadrelina	Leaves : Burn, Diarrhea, Intestinal parasites, Wound, hypertension, Abdominal colic	RLL 1082
<i>Pauridiantha paucinervis</i> (Hiern) Bremek. (RUBIACEAE), Shrub, E	Marootody	Leaves : Anorexia, Abdominal colic, Dysentery, Gastric ulcer	RLL 1077
<i>Pellaea viridis</i> (Forssk.) Prantl (PTERIDACEAE), Shrub, E	Ampangamena	Leaves : Syphilis	RLL 1267
<i>Phaseolus vulgaris</i> L. (FABACEAE), Herb, INT	Tsaramaso	Fruits : Diabetes	
<i>Phyllarthron bojeranum</i> DC. (BIGNONIACEAE) Tree, E	Zahandilana	Leaves : Cough , Fatigue, Fever, Headache, Malaria, Emaciation, Male sexual incompetence	RLL 1138
<i>Physalis peruviana</i> L. (SOLANACEAE), Liana, INT	Voanatsindrana	Leaves : Intestinal parasites, Scabies ; Terminal bud : Diarrhoea	RLL 1174
<i>Phellolophium madagascariense</i> Baker APIACEAE), Herb, E	Tsileondraohao	Leaves : Cough of children, Diarrhea, Emaciation, Scabies, Skin diseases, Gastric ulcer, Syphilis, Tooth ache	RLL 1165

<i>Piper borbonense</i> (Miq.) C. DC (PIPERACEAE), Herb, NE	Sakaiala	Leaves : Asthma, Cough ; Fruit : Fever, Postpartum infections ; Aerial part : Syphilis	RLL 1115
<i>Plectranthus bojeri</i> (Berth) Hedge (LAMIACEAE), Herb, E	Voanjomanga	Leaves : Dysentery	RLL 1389
<i>Plectranthus gibbosus</i> Hedge (LAMIACEAE), Herb, E	Lelamboasira	Leaves : Haemostatic, Wound	RLL 1380
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Prunus persica</i> (L.) Batsch (ROSACEAE), Shrub, INT	Paiso gasy	Leaves : Abdominal colic, Diarrhea, Intestinal parasites, Malaria, Abdominal colic, Diarrhoea, Fever, Headache, Haemostatic, Malaria, Postpartum infections, Rheumatism, Scabies, Stomach aches, Syphilis, Intestinal parasites ; Bark : Purgative	RLL 1105
<i>Psidium altissima</i> (DC.) Drake (ASTERACEAE), Shrub, E	Kidingadingana	Bark : Purgative ; Leaves : Abdominal colic, Diarrhoea, Fever, Headache, Haemostatic, Malaria, Postpartum infections, Rheumatism, Scabies, Stomach aches, Syphilis, Intestinal parasites	RLL 1081
<i>Psidium salviaefolia</i> Baker (ASTERACEAE), Shrub, E	Kizitina	Leaves : Diarrhoea, Scabies, Stomach aches, Intestinal parasites	RLL 1198
<i>Psidium cattleianum</i> Sabine (MYRTACEAE), Shrub, INT	Gavotsinahy	Leaves : Dysentery, Abdominal colic, Diarrhoea	RLL 1109
<i>Psorospermum fanerana</i> Baker (HYPERICACEAE), Tree, E	Tsifadimbohitra	Leaves : Emaciation	RLL 1199
<i>Psorospermum ferrovestitum</i> Baker (HYPERICACEAE), Shrub, E	Fotsiavadika	Leaves : Postpartum infections	RLL 1350
<i>Pteridium aquilinum</i> (L.) Khun (DENNSTAEDTIACEAE), Herb, NE	Ampanga	Leaves : Postpartum infections	RLL 1124
<i>Ranunculus multifidus</i> Forssk. (RANUNCULACEAE), Herb, NE	Afoantany	Leaves : Tooth ache	RLL 1150
<i>Ravenala madagascariensis</i> Sonn. (STRELITZIACEAE), Tree, E	Fontsy	Leaves : Asthma ; Stem : Hypertension	RLL 1121
<i>Raphia farinifera</i> (Gaertn.) Hyl. (ARECACEAE), Tree, INT	Rofia	Petiole : Dysentery	
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Ricinus communis</i> L. (EUPHORBIACEAE), Shrub, INT	Kinàna	Leaves : Surdity, Malaria	RLL 1096
<i>Rorippa insularis</i> Jonsell, (BRASSICACEAE) Herb, NE	Anandrano	Leaves : Syphilis	RLL 1141
<i>Rorippa madagascariensis</i> (DC.) Hara (BRASSICACEAE), Herb, NE	Anandranombohitra	Leaves : Pityriasis	RLL 1383
<i>Rorippa nasturtium-aquaticum</i> (L.) Hayek (BRASSICACEAE), Herb, INT	Anandrano	Aerial part : Emaciation	
<i>Rubus rosifolius</i> Sm. (ROSACEAE), Liana, INT	Voaroimainty	Leaves : Abdominal colic, Diarrhea ; Terminal bud: Side stitch	RLL 1195

<i>Sabicea diversifolia</i> Pers. (RUBIACEAE), Shrub, E	Sevatrandraka	Leaves : Fever, Hepatic Pain	RLL 1271
<i>Saccharum officinarum</i> (L.) C. Shih (POACEAE), Shrub, INT	Fary	Leaves : Emaciation, Malaria ; Stem : Diarrhea	RLL 1120
<i>Senna septemtrionalis</i> (Viv.) H.S. Irwin et Barneby (FABACEAE), Shrub, INT	Anjananjana	Leaves : Intestinal parasites	RLL 1075
<i>Senecio andinus</i> H. Buek (ASTERACEAE), Shrub, E	Menavitrana	Leaves : Otitis	RLL 1213
<i>Sida rhombifolia</i> L. (MALVACEAE), Herb, NE	Sindahory	Leaves : Abscess, Convulsion, Fever, fractures, Emaciation, Tooth ache	RLL 1094
<i>Sigesbeckia orientalis</i> L. (ASTERACEAE), Herb, INT	Satrikoazamaratra	Leaves : Wound, Diarrhea	RLL 1265
<i>Sloanea rhodantha</i> (Baker) Capuron (ELAEOCARPACEAE), Tree, E	Vanana	Fruit : Sore throat	RLL 1371
<i>Solanum rudepannum</i> Dunal (SOLANACEAE), Shrub, NE	Roingivy	Stem : Gonorrhoea ; Leaves : Side stitch, Emaciation, Ocytotic, Postpartum infections,	RLL 1164
<i>Lycopersicon esculentum</i> Mill. (SOLANACEAE), Herb, INT	Voatabia	Leaves : hypertension, Wound, Dysentery	RLL 1292
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Solanum tuberosum</i> L. (SOLANACEAE), Herb, INT	Ovy	Tuber : Abscess, Burn ; Leaves: Dandruff	
<i>Symphytum officinale</i> L. (BORAGINACEAE), Herb, INT	Aikisoda	Leaves : Stomach aches	RLL 1099
<i>Syzygium cumini</i> L. Sleels (MYRTACEAE), Shrub, INT	Voarotra	Leaves : Dysentery	RLL 1258
<i>Syzygium emimense</i> (Baker) Labat et G. E. Schatz (MYRTACEAE), Tree, E	Rotra	Stem : Emaciation	RLL 1354
<i>Syzygium phillyreifolium</i> (Baker) Labat et G. E. Schatz (MYRTACEAE), Tree, E	Voaroibary	Leaves : Wound	RLL 1309
<i>Tabernaemontana coffeoides</i> Bojer ex A. DC. (APOCYNACEAE), Tree, NE	Kotolahy	Bark : Gastric ulcer, Abdominal colic ; Leaves : Malaria	RLL 1282
<i>Tambourissa parvifolia</i> Baker (MONIMIACEAE), Tree, E	Ambora madinidravina	Leaves : Emaciation	RLL 1243
<i>Tambourissa religiosa</i> (Tul.) A. DC. (MONIMIACEAE), Tree, E	Vilanimbàrika	Bark : Rheumatism ; Stem: Tooth ache	RLL 1308
<i>Taraxacum officinale</i> F. H. Wigg. (ASTERACEAE), Herb, INT	Talapetraka	Leaves : Diabetes, Emaciation	RLL 1377
<i>Tetradenia clementiana</i> Phillipson (LAMIACEAE), Shrub, E	Borona	Leaves : Abscess, Fatigue	RLL 1305
<i>Toddalia asiatica</i> (L.) Lam. (RUTACEAE), Liana, NE	Kasimba	Aerial part : Wound ; Leaves : Diabetes, Scabies, Syphilis	RLL 1168
<i>Trema orientalis</i> (L.) Blume (CANNABACEAE), Tree, NE	Tsivakimbaratra	Bark : Wound ; Leaves : Asthma	RLL 1250
<i>Tristemma mauritianum</i> J.F. Gmel. (MELASTOMATAACEAE), Herb, NE	Voatrotroka	Leaves : Stomach aches	RLL 1151

<i>Typha angustifolia</i> L. (TYPHACEAE), Herb, NE	Vondrona	Leaves : Emaciation ; Postpartum infections	RLL 1145
Scientific Names, Habit, Geographical Distribution‡	Vernacular Names	Part used , Therapeutic uses	Voucher Specimens
<i>Uapaca bojeri</i> Baill. (EUPHORBIACEAE), Tree, E	Tapia	Leaves : Cough	RLL 1215
<i>Urena sinuata</i> L. (MALVACEAE), Herb, INT	Papana	Leaves : Intestinal parasites, Gastric ulcer	RLL 1301
<i>Vandenboschia gigantea</i> (Bory ex Willd.) Pic. Serm. (HYMENOPHYLLACEAE), Herb, NE	Ampangamena	Leaves : Gastric ulcer	RLL 1211
<i>Vernonia appendiculata</i> (Less.) H. Rob. (ASTERACEAE), Shrub, E	Ombiaty	Terminal bud : Intestinal bloating, Wound	RLL 1131
<i>Vernonia pectoralis</i> Baker (ASTERACEAE), Shrub, E	Sakatavilotra	Leaves : Cough, Diarrhoea, Dysentery, Fever, Intestinal parasites	RLL 1384
<i>Zanthoxylum thouvenotii</i> H. Perrier (RUTACEAE), Tree, E	Tsitongambarika	Root : Tooth ache; Bark : Cough, Emaciation; Leaves : Abdominal colic, Gastric ulcer	RLL 1142
<i>Zea mays</i> L. (POACEAE), Herb, INT	Tsakomanta	Leaves : Dysentery, Wound ; Flowers : Yellow fever; Diabetes	RLL 1207

During our ethnobotanical survey, a total of 164 plant species having medicinal uses among the Zafimaniry clan were recorded. They belong to 138 genera and 73 botanical families. The most represented families are: Asteraceae (30 species, 18.2%), Fabaceae (8 species, 4.8%), Rubiaceae (7 species, 4.2%), Solanaceae (7 species, 4.2%) and Poaceae (6 species, 3.6%). At the genus level, *Helichrysum* predominates with 6 species, followed by *Ficus*, *Nuxia*, *Psiadia*, *Rorripa*, *Solanum* and *Syzygium* with 3 species each.

On the other hand, the endemic plants (39.0 %) prevail over the introduced (33.5%) and non-endemic indigenous (27.4%) ones (Figure 2). Among the most frequently cited species *Burasaia madagascariensis* (14.4%), *Dichrocephala latifolia* (13.29%), *Psiadia altissima* (12.1%), *Kalanchoe prolifera* (10.8%) are endemic. *Harungana madagascariensis* (15.6%), *Maesa lanceolata* (15.1 %) and *Sida rhombifolia* (13.8%) are native species whereas *Zingiber officinale* (16.7%), *Psidium littorale* var. *longipes* (15.1%) and *Solanum mauritianum* (14.4%) are introduced and cultivated species.

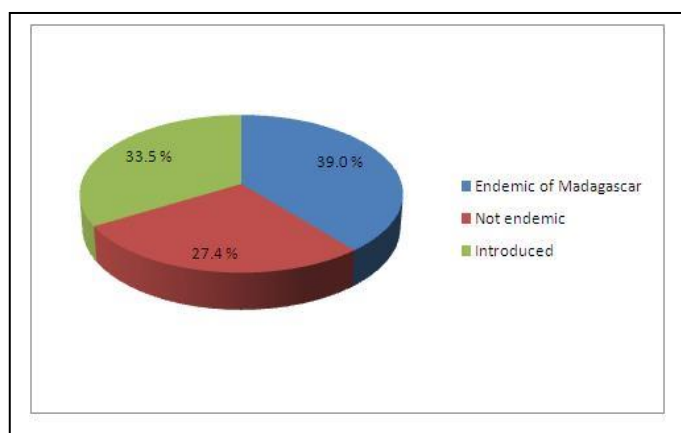


Figure 2: Diagram of the biogeographic affinity of the encountered medicinal species

Out of the total quoted medicinal plants, herbaceous plants are the most widely used with 71 species (43.3%) followed by trees with 45 species (27.4%). Shrubs and climbers are represented by 34 (20.7%) and 14

(8.5%) species, respectively. The recorded medicinal plants are used to treat 65 types of human ailments. The top thirty most cited diseases are shown in figure 3. The prevalent ailment is digestive tract affections related to abdominal colic (10.5%) which are cared for with 28 species. This disease is followed by cough (7.2%, 23 species), intestinal parasites (6.3%, 20 species) and diarrhea (5.8%, 25 species). Wound is treated with the highest number of species (28 species).

Different plant organs are used for the preparation of drugs in the Zafimaniry traditional medicine. Leaves are the most frequently employed (81.1%) followed by barks (3.0%), fruits (2.4%), stems (2.2%) and other parts (1.7 to 0.2% each).

Regarding the preparations, in 68.1% of cases, a single plant is generally prescribed for a given therapeutic indication and decoction is the most recommended mode of uses (54.8%). Nevertheless, some species are crushed to obtain juice (21.1%) or are used as a poultice (8.5%). The medication is taken by oral route, inhalation or fumigation. Ailments needing the application of a cataplasm concern wounds, burns and sprains.

DISCUSSION

As inferred from the above data, the plants identified as medicinal in the studied area are characterized by a high diversity at the species, genus and family levels. Asteraceae, Fabaceae, Rubiaceae and Poaceae are the botanical families which encompass the highest number of medicinal plants used by the Zafimaniry clan. They are also large plant families encountered in Madagascar [1, 10]. Solanaceae is among the top ten families of the medicinal flora of Madagascar [11, 12, 13]. Generally, the number of medicinal plant species in a given family is positively related to the number of species in this family [14, 15]. One key result of this study is that twenty-three species belonging to twenty-three genera and seventeen families are new in the Malagasy ethnopharmacopoeia.

When compared with results reported from others regions of Madagascar, the data presented herein are richer and more diverse than those carried out in the Zahamena National Park and in the new protected area of Agnalazaha where 104 and 152 species have been inventoried, respectively [13, 16]. On the contrary, the number of medicinal plants in our study is less than those from the rural

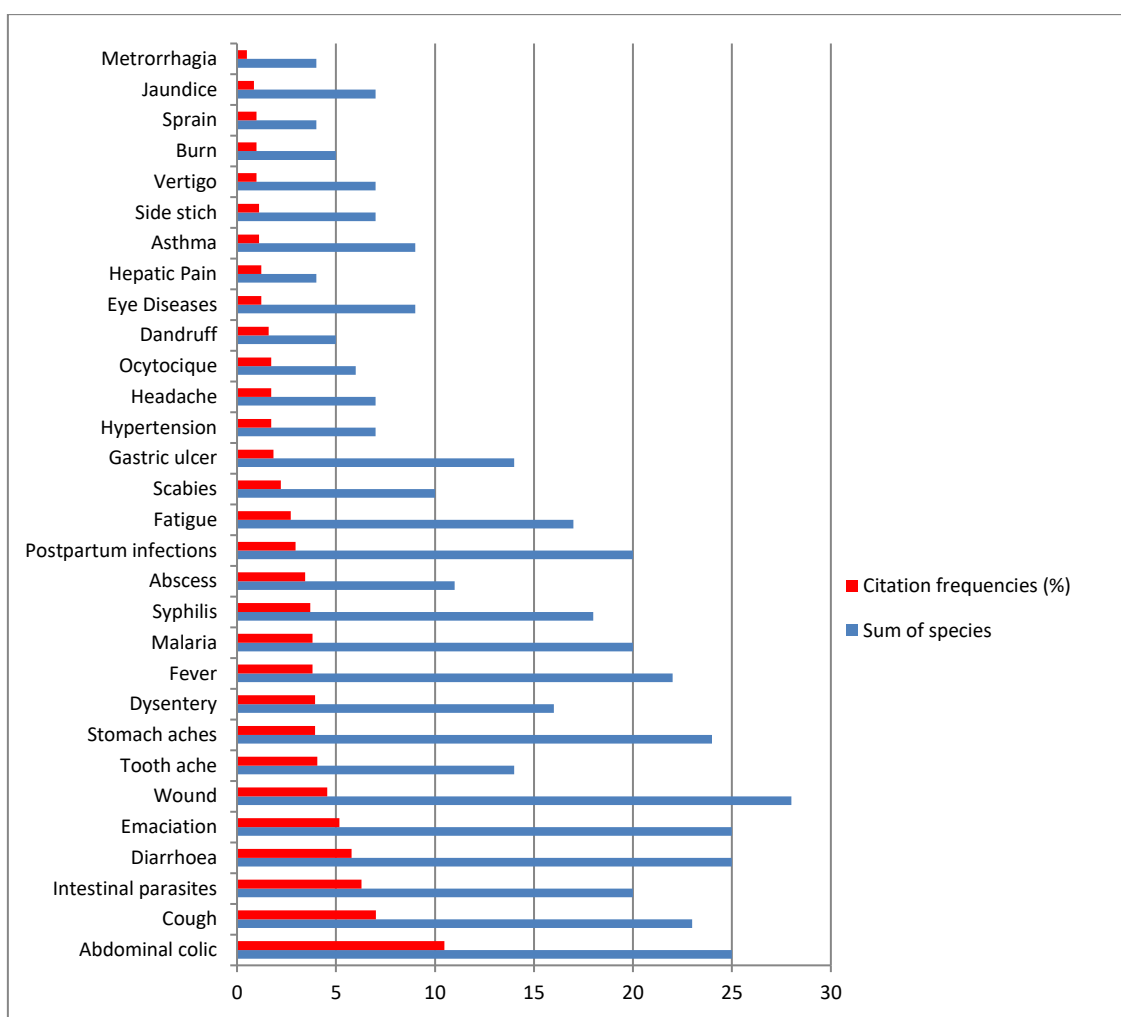


Figure 3: Top thirty diseases with related species number

communities of Ambalabe where 209 species have been documented [16]. These three sites are located in the eastern part of Madagascar.

Generally, the number of medicinal plant species in a given family is positively related to the number of species in this family [14, 15]. One key result of this study is that twenty-three species belonging to twenty-three genera and seventeen families are new in the Malagasy ethnopharmacopoeia.

When compared with results reported from others regions of Madagascar, the data presented herein are richer and more diverse than those carried out in the Zahamena National Park and in the new protected area of Agnalazaha where 104 and 152 species have been inventoried, respectively [13, 16]. On the contrary, the number of medicinal plants in our study is less than those from the rural communities of Ambalabe where 209 species have been documented [16]. These three sites are located in the eastern part of Madagascar.

The proportions of biological forms of medicinal plants reflect the vegetation of the study area where grass formations occupy the largest extent. Local population chiefly uses plants growing nearby their houses as a source of materials for the preparation of herbal medicines. Several authors have already indicated the importance of plant resources found close to habitations for health care [16-22]. The large use of leaves is understandable for the facts that this plant part offers a relatively good availability and its collection has no destructive effects on individual plants.

The main diseases treated are related to digestive disorders, traumatic injuries, respiratory tract diseases and stomatological illnesses. They are also the most frequently occurring ailments in other regions of Madagascar [16, 17].

CONCLUSION

In light of the above data, it appears that Zafimaniry people have a great knowledge on the uses of medicinal plants for their health care. These plant species, most of which are endemic should be valorized to improve rural incomes and human health. In particular, the results obtained during the present ethnobotanical survey can help scientists to select plants in their research work which aims at discovering secondary metabolites of biological significance. Conservation and management measures of these species are of high importance to protect the vegetation types in the study area.

ACKNOWLEDGEMENTS

Financial support from the National Center for Applied Pharmaceutical Research is gratefully acknowledged. We also thank the Ecology, Forest and Environment Ministry of Madagascar for providing research permit. The authors are thankful to all the informants for sharing their traditional botanical knowledge.

REFERENCES

1. Callmänder MW, Phillipson PB, Schatz GE, Andriambololonera S, Rabarimanarivo M, Rakotonirina N et al. The endemic and non-endemic vascular flora of Madagascar updated. *Plant Ecology and Evolution*. 2011; 144 (2): 121-125.
2. Rakotobe EA, Rasolomanana CJC, Randrianasolo SS. Pharmacopée de l'Ambongo et du Boïna. CIDST : Antananarivo, 1993.
3. Beaujard P. Plantes et médecine traditionnelle dans le Sud-Est de Madagascar. *Journal of ethnopharmacology*. 1988 ; 23 :165-265.
4. Nicolas J.-P. Plantes médicinales du Nord de Madagascar Ethnobotanique Antakarana et informations scientifiques. Ed. Jardin du monde : France, 2012.

5. Rafotsy V. Projet de création d'une unité de bungalow dans le site touristique Zafimaniry. MSc thesis, Université d'Antananarivo : Antananarivo, 2010.
6. Mattei M. Etude ethnographique sur les Zafimaniry. Bulletin de l'Académie Malgache, Imprimerie G. Pittot et Cie : Antananarivo, 1930.
7. Moat J, Smith P. Atlas of the vegetation of Madagascar. Kew Publishing, RBG: Kew, 2007.
8. Rao RR, Hajra PK. Methods of research. In: Jain SK, editor. A manual of ethnobotany Ethnobotany. India : Scientific Publishers Jodhpur; 1987.
9. Cunningham AB. Applied ethnobotany. People, wild plant use and conservation, Earthscan: London, 2001.
10. Gautier L, Goodman S. Introduction to the flora of Madagascar. In: Goodman, SM, Benstead JP, editors. The Natural History of Madagascar. Chicago and London: The University of Chicago Press; 2003.
11. Rabesa ZA, Rabenoro C, Andriantsiferana R, Rakotobe EA. Notes on Malagasy plants used in the traditional pharmacopoeia, First International congress on Ethnopharmacology, Strasbourg, 1991.
12. Rabesa ZA, Randrianasolo SS, Rasolomanana CJC, Randriamizana JP 1986. Pharmacopée de l'Alaotra. Edition Fanantenana: Antananarivo, 1986.
13. Rakotonandrasana SR. Les plantes médicinales de l'aire protégée de Zahamena (Madagascar) et de ses environs : richesse floristique et endémicité. *Scripta botanica Belgica*. 2013 ; 50 : 356-362.
14. Stepp JR, Moerman DE. The importance of weeds in ethnopharmacology. *Journal of Ethnopharmacology*. 2001; 75: 19-23.
15. Moerman DE, Estabrook GF. Native Americans' choice of species for medicinal use is dependent on plant family: Confirmation with meta-significance analysis. *Journal of Ethnopharmacology*. 2003; 87: 51-59.
16. Razafindraibe M, Kuhlman AR, Rabarison H, Rakotoarimanana V, Rajeriarison C, Rakotoarivelo N et al. Medicinal plants used by women from Agnalazaha littoral forest (Southeastern Madagascar). *Journal of Ethnobiology and Ethnomedicine*. 2013.doi:10.1186/1746-4269-9-73.
17. Rakotoarivelo NH, Rakotoarivony F, Ramarosandratana AV, Jeannoda V, Kuhlman AR, Randrianasolo et al. Medicinal plants used to treat the most frequent diseases encountered in Ambalabe rural community, Eastern Madagascar. *Journal of Ethnobiology and Ethnomedicine*. 2015. DOI 10.1186/s13002-015-0050-2.
18. Rakotonandrasana SR, Rakotondrafara A, Rakotondrajaona R, Rasamison V, Ratsimbason M. Plantes médicinales des formations végétales de la baie de Rigny- Antsiranana à Madagascar. *Bois et Forêts des Tropiques*. 2017; 331 (1) : 55-65.
19. Zerbo P, Millogo-Rasolodimby J, Nacoulma-Ouedraogo OG, Van Damme P. Plantes médicinales et pratiques médicales au Burkina Faso : cas des Sanan. *Bois et Forêts des Tropiques*. 2011; 307(1) : 41-53.
20. Catarino L, Indjai B, Mourao D. Agents and plants used in traditional medicine in the Orango Island (Guinea-Bissau). *Scripta botanica Belgica*. 2013; 50: 381 - 390.
21. Huang J, Shengji JP, Chunlin L. An ethnobotanical study of medicinal plants used by the Lisu people in Nujiang, Northwest Yunnan, China, *Economic Botany*. 2004; 58 (supplement): 53-264.
22. Randrianarivony T, Randrianasolo A, Andriamihajarivo T, Ramarosandratana AV, Jeannoda VH, Rakotoarivony F et al. Useful plants and tradition for pregnancy, child delivery and for post-partum care used by people living around Analavelona forest in South west Madagascar. *Indian Journal of Traditional Knowledge*. 2016; 15(1), 68-78.
23. Faranirina L. Etudes ethnobotaniques, biologiques et écologiques des plantes utiles dans la forêt d'Antsahabe (Anjozorobe). MSc thesis, Université d'Antananarivo: Antananarivo. 2003.

HOW TO CITE THIS ARTICLE

Rakotondrafara A, Rakotondrajaona R, Rakotoarisoa M, Ratsimbason M, asamison VE, Rakotonandrasana SR. Ethnobotany of medicinal plants used by the Zafimaniry clan in Madagascar. *J Phytopharmacol* 2018; 7(6):483-494.