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Ethnobotanical survey in Canhane village, district of Massingir, Mozambique: medicinal plants and traditional knowledge

Ana Ribeiro^{1*}, Maria M Romeiras¹, João Tavares¹, Maria T Faria²

Abstract

Background: Medicinal plants are used by 80% of people from developing countries to fulfill their primary health needs, occupying a key position on plant research and medicine. Taking into account that, besides their pharmaceutical importance, these plants contribute greatly to ecosystems' stability, a continuous documentation and preservation of traditional knowledge is a priority. The objective of this study was to organize a database of medicinal plants including their applications and associated procedures in Canhane village, district of Massingir, province of Gaza, Mozambique.

Methods: In order to gather information about indigenous medicinal plants and to maximize the collection of local knowledge, eleven informants were selected taking into account the dimension of the site and the fact that the vegetation presents a great homogeneity. The data were collected through intensive structured and semi-structured interviews performed during field research. Taxonomical identification of plant species was based on field observations and herbarium collections.

Results: A total of 53 plant species have been reported, which were used to treat 50 different human health problems. More than half of the species were used for stomach and intestine related disturbances (including major diseases such as diarrhea and dysentery). Additionally, four species with therapeutic applications were reported for the first time, whose potential can further be exploited. The great majority of the identified species was also associated with beliefs and myths and/or used as food. In general, the community was conscientious and motivated about conservational issues and has adopted measures for the rational use of medicinal plants.

Conclusions: The ethnomedicinal use of plant species was documented in the Canhane village. The local community had a rich ethnobotanical knowledge and adopted sound management conservation practices. The data compiled in this study show the social importance of the surveyed plants being a contribution to the documentation of PGR at the national and regional level.

Background

In ancient times, medicinal plants have been used all over the world as unique sources of medicines and may constitute the most common human use of biodiversity [1,2]. According to the World Health Organization, 80% of people in developing countries still depend on local medicinal plants to fulfill their primary health needs [3]. Besides that, there is a global consensus on the benefits of phytopharmacy and at present medicinal plants

occupy a key position in plant research and medicine. These facts associated with the progressive loss of traditional knowledge, due to rural exodus, and with the threats to which Plant Genetic Resources (PGR) are exposed, make the efforts to study and preserve PGR relevant in every respect. In this context, several conservation studies have been performed [4-6].

Like most African countries, Mozambique is an important repository of biological diversity. This diversity is used by ca. 90% of the country's population to fulfill its housing, food, energy and health needs. According to [7], in Mozambique approximately 15% of the total PGR (ca. 5,500 plant species) is used by rural

* Correspondence: aribeiro@itqb.unl.pt

¹Tropical Research Institute, Rua da Junqueira 86, 1300-344, Lisbon, Portugal
Full list of author information is available at the end of the article

communities for medical purposes and plays a key role in basic health care. Despite a long history of medicinal plants use in Mozambique, research on this subject is still incipient [8-10] and poorly disseminated, focusing mainly on medicinal plant markets and trade issues from Maputo province [7]. The work presented in this article reports on the utilization of medicinal plants in the Canhane village, district of Massingir, Province of Gaza. The last survey in the region dates from 1960-70 [11,12].

Canhane village is located 32° 09' 30" E and 24° 4' 30" S (Figure 1). With an extension of 7,200 ha, the village has a flat landscape with slopes ranging from 0 to 2% and altitudes from 95 m N to 200 m S [13]. The climate is semi-arid with two seasons: (i) dry season (April/May to October/November), with temperatures varying from 14.5°C to 28.5°C and a maximum annual precipitation of 67.9 mm; and (ii) hot and rainy season (October/November to April/May), with temperatures ranging from 19.9°C to 32.8°C and a maximum annual precipitation of 370 mm [14]. The humidity index may vary between -50 and -70, the negative values indicating the dryness of the region [15]. The soils are essentially sandy with a low to moderate percentage of organic matter (0-3%) and thus poor for agriculture.

The village has 1357 inhabitants (51% women, 49% men) the great majority belonging to the Valoyi ("Witch doctor") family from the Changana ethnic group [16,17]. The community has poor access to water resources, health services (the closest health center is located in the Massingir village, seven Km away from Canhane), trading and communications, an obsolete energy system and an unsuccessful school system. Due to the lack of a

local health center, traditional medicine plays an important role in basic health care. The main activity is agriculture, followed by livestock and fisheries. Handicraft is a tertiary activity.

The major habitat types of Canhane are woodlands, savannah and grasslands [18,19]. Currently, the vegetation communities are at different levels of degradation mainly due to human practices (e.g. production of firewood, charcoal and grazing). The over-exploitation of resources and the limiting environmental conditions seem to be associated with the decay of the resilient capacity of the ecosystems as evidenced by the occurrence of great devastated areas [17].

With this study, we intended to contribute to the conservation and valorization of the local floristic and cultural heritage. It should be noted that the study area is of particular importance, since it is located in the heart of the Limpopo National Park, which together with Kruger National Park (South Africa) and Gonarezhou National Park (Zimbabwe) constitute the Great Limpopo Transfrontier Park and Conservation Area (GLTP). The study reports on 53 medicinal plant species and their traditional applications.

Methods

Ethnobotanical data collection

The work was initiated with a meeting between the researchers, the community leader and the Commission for Social Management from Canhane Village, in order to: i) explain the aim and importance of the work and its integration on the Community-based Development Program; ii) get cooperation and permission to use the cultural heritage; iii) collect information for structuring the interviews; iv) give orientations for the selection of informants by age and gender; and v) plan the field activities.

Eleven informants (six men and five women) were selected as the best traditional knowledge holders. The selection criteria were based on the size of the study site, the vegetation homogeneity and on the indications provided by the community.

Due to reasons related to beliefs and myths, it was not possible to get the information directly from Witch doctors. However, it should be highlighted that most of the Canhane inhabitants belong to the Valoyi ("Witch doctor") family. Using standard methods [20,21], the data was collected through intensive structured interviews and complemented with semi-structured interviews in local language (i.e. Changana). These included: common and local name of the plant, applications, parts of the plant used, methods of preparation and administration routes. Translation to Portuguese was validated by linguistic specialists.

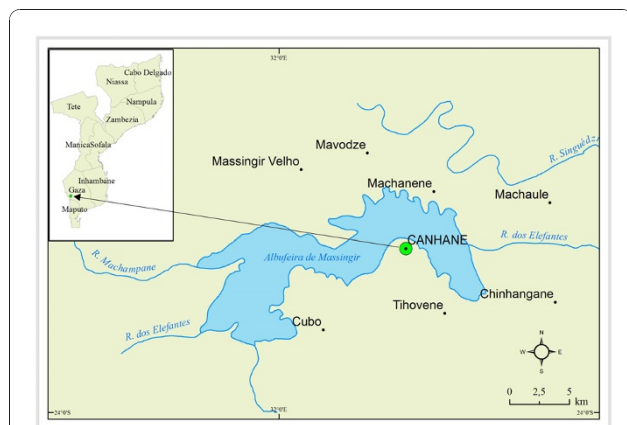


Figure 1 Geographical location of the study site. Left: Map of Mozambique illustrating the geographical position of the Province of Gaza and the District of Massingir. Right: Geographical position of Canhane within the District of Massingir.

Taxonomic identification

The medicinal plants reported by the informants were collected during three field surveys (in October of 2007 and in March and November of 2008). The team was accompanied by two local guides with a deep knowledge of local flora. Species identification was done during the field visits and by comparing voucher specimens with specimens deposited at the Herbarium of the Faculty of Sciences, Universidade Eduardo Mondlane (LMU, Maputo, Mozambique). The scientific names were confirmed through specialized bibliography [22-25] as well as the African Plant Database [26], Tropicos database [27] and the International Plant Names Index [28]. Additional information was gathered from the study of numerous herbarium specimens, mainly from the Tropical Research Institute Herbarium (LISC, Lisbon, Portugal).

Results and Discussion

Medicinal Plants' Survey

A total of 53 plant species distributed over 47 genera and 31 families were reported by the 11 informants (Table 1). All the reported species grew naturally in the area, reflecting the social importance of the local floristic resources. Most of the identified plants were shrubs or trees (15 spp. or 28.3%), herbs and trees (11 spp. for each category or 20.8%), and shrubs (nine species or 17.0%). The best represented families were Fabaceae (six species), Euphorbiaceae (four species) and Tiliaceae (three species). Altogether the 53 species were used to treat 50 different human health problems (Table 1), the great majority of which (75.5%) having more than one medical application. The most cited species were *Euclea racemosa* (ca. 82%), *Colophospermum mopane*, *Cucumis* sp. and *Elephantorrhiza elephantina* (ca. 73% each species), *Cassia abbreviata* and *Cissus quadrangularis* (ca. 64% each species), *Aloe marlothii*, *Maerua edulis*, *Secamone parvifolia* and *Terminalia sericea* (ca. 55% each species) and *Boscia albitrunca*, *Gossypium herbaceum* and *Gymnosporia heterophylla* (ca. 46% each species) (data not shown). The number of medicinal plants and their potential applications reflect the rich ethnomedicinal knowledge in the Canhane community. Similar potentialities were found in other African countries like Cameroon [29] and Ethiopia [30-32] as well as in non-African countries [33-35]. Certainly, there is a lot more knowledge to exploit on the topic in Mozambique.

More than half of the reported species (54.7%) were used for stomach and intestine related disturbances (Table 2). Of these, almost 38% were used to treat diarrhea and dysentery, a major concern in the region. In fact, in Mozambique diarrhea has for a long time been associated with a complex array of illnesses. Amongst them, dysentery and cholera usually have a high

mortality rate if not treated promptly [10]. The use of traditional medicinal plants seems to play a major role in controlling diarrhea-associated diseases.

Around 23% of the surveyed species were used as analgesic, anti-inflammatory or anti-pyretic and for wound treatment, 15% for dentistry and 11% for gynecology-related problems. Approximately 9% of the reported species were used to treat ear diseases and hemorrhoids, 8% for burns, cough, debility and malnutrition, epilepsy, eye diseases and malaria, and 6% for heart problems. Only one species, *Ximenia americana* (ca. 2%) was used against HIV-AIDS. Thus, looking at the three major national health concerns, namely diarrhea and dysentery, malaria and HIV-AIDS a considerable number of potentialities are available for the first group (11 species), while moderate (four species) and low (one species) alternatives can be exploited for malaria and HIV-AIDS. In fact, several pharmacological studies of these three groups of human ailments are available for most of the species reported in the present survey [36-42].

With the exception of six species (*Blepharis diversispina*, *Grewia flavescens*, *Guibourtia conjugata*, *Hermania micropetala*, *Loeseneriella crenata*, *Zanthoxylum humile*), all species under study have been reported as medicinal plants in other African countries [11,43-46]. While the use of *G. flavescens* and *Z. humile* by traditional healers has been reported in India and Mozambique, respectively [7,47], as far as our literature review goes, four species (i.e. *B. diversispina*, *G. conjugata*, *H. micropetala*, and *L. crenata*) were reported here for the first time. Of these, only two genera have been associated with ethnomedicine: the genus *Blepharis* [48] and the genus *Loeseneriella* (*L. obtusifolia*). Thus, these species constitute new potential sources of natural medicines.

From the 53 species, nine were reported previously by [10] and 3 by [7] in studies conducted in the province of Maputo. Besides that, several other species belonging to 11 genera (*Aloe*, *Asparagus*, *Boscia*, *Cissus*, *Crinum*, *Cucumis*, *Ficus*, *Grewia*, *Maerua*, *Secamone*, *Strychnos*) were also reported as medicinal species [7]. The potential medicinal plant markets from the southern provinces of Maputo and Gaza seem to be different. This may reflect the rich ethnomedicinal potential which exists in the entire country.

A comparative analysis with local specific ethnobotanical literature [11,12,46] and complementary information gathered from the LISC Herbarium plant collections, identified 25 different plant species used for medicinal purposes (Table 3) of which only two, *Combretum imberbe* and *Lannea schweinfurthii*, are common to those reported in this study. Regarding their applications, similarities were found for *C. imberbe* (stomach

Table 1 Medicinal plants (53 spp.) used in the Canhane village (2007- 2008)

Scientific name*	Local and Common name	Habit	Part used	Main Diseases	Administration Route	Method of preparation
Acanthaceae						
<i>Blepharis diversispina</i> (Nees) C.B. Clarke	Nchachacha wa mananga Velvet bushwillow	Sub-shrub or Herb	Fruits	Hemorrhoids	Topic	Burning and grinding
				Cough	Oral	Grinding and maceration
			Roots	Hemorrhoids	Topic	Burning and grinding
			Seeds	Wounds	Topic	Burning and grinding
				Fontanel hardening	Topic	Burning and grinding
Aloaceae						
<i>Aloe marlothii</i> A. Berger	Mhanga Flat-flowered aloe, Mountain aloe	Herb	Leaves (sap)	Biliary disorder; Malaria	Oral	Direct
				Wounds	Topic	Direct
			Roots; Leaves	Toothache	Oral	Direct; Decoction
				Liver disorder	Oral	Decoction
<i>Aloe zebrina</i> Baker	Ximhangani Small maculate aloe	Herb	Leaves (sap)	Eye treatments	Eyewash	Direct; Maceration
				Wounds	Topic	Direct
			Roots	Liver disorder	Oral	Decoction
Amaryllidaceae						
<i>Crinum stuhlmannii</i> Baker	Khonwua Candy-striped crinum	Herb	Stem	Swellings	Topic	Decoction
Anacardiaceae						
<i>Lannea schweinfurthii</i> (Engl.) Engl.	Xivombo nkanyi, xihumbunkany, munganikomo False marula	Tree	Bark	Anemia; Diarrhea; Stomach disorders	Oral	Decoction
			Stem	Malaria	Oral	Decoction
<i>Sclerocarya birrea</i> (A. Rich.) Hochst.	Nkanyi Marula	Tree	Bark	Anemia	Oral	Infusion
				Diarrhea; Stomach disorders	Oral	Scraping and decoction
				Hemorrhoids	Topic	Decoction and vapors; Scraping
		Stem	Anemia	Oral	Maceration	
Apocynaceae						
<i>Sarcostemma viminale</i> (L.) R. Br.	Neta, netha Caustic vine	Herb (succulent)	Root	Stomach ache	Oral	Decoction
			Sap	Eye treatments	Eyewash	Direct
<i>Secamone parvifolia</i> (Oliv.) Bullock	Nyokani, nyoka ya yitsongo Milimili	Shrub	Roots	Deworming; Rheumatism	Oral	Decoction
				Epilepsy	Oral	Decoction; Heating; Grinding and water
				Stomach ache	Oral	Crushing and water; Decoction
			Stem; Roots	Varicose veins	Topic	Decoction

Table 1: Medicinal plants (53 spp.) used in the Canhane village (2007- 2008) (Continued)

Asparagaceae							
<i>Asparagus africanus</i> Lam.	Kwangwa la tilo Bush asparagus	Shrub	Roots	Stomach disorders	Oral	Decoction	
			Whole plant	Stomach disorders	Oral	Grinding and maceration	
Balanitaceae							
<i>Balanites maughamii</i> Sprague	Nulu, nulo Green thorn, Y-thorned	Tree	Roots	Malaria	Oral	Scraping and infusion	
Bombacaceae							
<i>Adansonia digitata</i> L.	Ximuwa, ximuhu, ximuvo Baobab	Tree	Bark	Debility	Bath	Maceration	
			Roots	Diarrhea	Oral	Maceration	
Capparaceae							
<i>Boscia albitrunca</i> (Burch.) Gilg & Gilg-Ben.	Nxunkutso, xikutse, xikutso, xikutsu, xukutsi Shepherd's tree	Shrub or tree	Leaves	Diarrhea; Hemorrhoids	Topic	Crushing and infusion	
<i>Boscia foetida</i> Schinz subsp. <i>filipes</i> (Gilg) Lötter	Xicutso Bushveld shepherds tree, sandveld shepherds, tree smelly shepherds tree	Shrub	Roots	Stomach and kidney purification	Oral	Infusion	
<i>Maerua edulis</i> (Gilg & Gilg-Ben.) De Wolf	Xikolwa, xikolwe Blue-leaved bush cherry	Suffrutex or Shrub	Roots	Women fertility,	Oral	Decoction; Infusion	
				Stomach ache	Oral	Decoction	
<i>Maerua parvifolia</i> Pax	Nongonoko Dwarf bush-cherry, small-leaved maerua	Shrub	Roots	Diarrhea; Stomach ache and purification	Oral	Decoction	
Celastraceae							
<i>Loeseneriella crenata</i> (Klotzsch) Wilczek ex N.Hallé	Lorho, nhlohlo Valley paddle-pod	Climbing shrub	Roots	Epilepsy; Stomach ache	Oral	Decoction	
				Malnutrition	Oral; Vaccine	Burning and decoction; Grinding; Scraping and burning	
				Stem	Antiallergic	Necklace	Direct
<i>Gymnosporia heterophylla</i> (Eckl. & Zeyh.) Loes.	Xivambulani, xichangwa, libatzondze Angular-stemmed spikethorn, common spikethorn	Shrub or Small tree	Leaves	Swellings	Oral	Decoction	
			Roots	Internal clots	Oral	Decoction	
				Stabbing heart	Oral; Topic	Burning and grinding; Decoction; Scraping	
Combretaceae							
<i>Combretum imberbe</i> Wawra	Mondzo Leadwood	Shrub or tree	Bark	Toothache	Oral	Decoction	
			NA	Stomach ache	Oral	Burning and watering	
<i>Terminalia sericea</i> Burch. ex DC.	Nsunsu, nkonola, kondla, mogonono Silver cluster-leaf, silver terminalia	Tree	Branches (bark)	Burns; Wounds	Topic	Drying and grinding	
			Leaves	Stomach ache	Oral	Decoction	
			Roots	Diarrhea	Oral	Decoction	

Table 1: Medicinal plants (53 spp.) used in the Canhane village (2007- 2008) (Continued)

				Burns; Wounds	Topic	Drying and grinding; Scraping	
Cucurbitaceae							
<i>Cucumis metuliferus</i> E.Mey. ex Naudin	Dema	Herb	Roots	Appendicitis; Stomach ache	Oral	Decoction	
<i>Cucumis zeyheri</i> Sond.	Xiyakayani, xihakahani, chihacaiane Wild cucumber	Herb	Fruits	Stomach disorders	Oral	Drying and grinding	
				Laxative	Enema	Decanting and filtration; Grinding; Maceration	
				Leaves	Dysentery; Laxative	Oral	Decoction; Maceration
Dracaenaceae							
<i>Sansevieria hyacinthoides</i> (L.) Druce	Xikwenga xa kwhati Mother-in-law tongue	Herb	Leaves	Contusions; Hemorrhoids; Rheumatism; Swellings;	Topic	Decoction and vapors; Heating	
			Roots	Women fertility	Oral	Crushing and water	
				Epilepsy	Oral	Decoction	
Ebenaceae							
<i>Euclea racemosa</i> Murr.	Mulala, nhlangulo Bush guarri, glossy guarri river guarri	Shrub	Roots	Caries; Toothache	Oral	Direct (chewing)	
				Wounds	Topic	Peeling and grinding	
				Stem	Wounds	Bath	Cutting and water
Euphorbiaceae							
<i>Acalypha indica</i> L.	Ntlambissana Copperleaf, indian nettle	Herb	Leaves	Hemorrhoids	Oral; Topic	Crushing; Decoction	
				Intestinal lavage	Enema	Grinding and decoction; Maceration	
				Laxative	Oral; Topic	Crushing; Infusion	
				Roots	Laxative	Oral	Decoction; Infusion
				Stem	Hemorrhoids	Oral	Decoction
<i>Androstachys johnsonii</i> Prain	Cimbiri Lebombo-ironwood, simbi tree	Tree	NA	NA	NA	Kept in secret by Hitch doctors	
<i>Flueggea virosa</i> (Roxb. ex Willd.) Voigt	Nsangasi, sangasi Snowberry tree, whiteberry bush	Shrub	Branches	Abscesses	Topic	Heating (with castor oil on top)	
<i>Spirostachys africana</i> Sond.	Xilangamahlo, dzanvori African Sandal, tamboti	Tree	Bark	Debility (HIV-AIDS)	Oral	Decoction (in milk)	
			Sap	Ear and eye treatments	Topic	Direct	
			Stem	Burns, Wounds	Topic	Burning; Grinding; Scraping	
Fabaceae							
<i>Cassia abbreviata</i> Oliv.	Lumanyama Longtail cassia, sjambok pod	Tree	Fruits	Eye treatments	Eyewash	Heating and grinding	
			Leaves, roots and stems (mix)	Stomach ache	Oral	Infusion	
			Roots (bark)	Diarrhea	Oral	Decoction	
			Stem	Malaria; Stomach ache	Oral	Decoction	

Table 1: Medicinal plants (53 spp.) used in the Canhane village (2007- 2008) (Continued)

<i>Colophospermum mopane</i> (Benth.) Léonard	Gungwa, nxfanati, nxfanatsi, mesanya Mopane	Shrub or Tree	Bark	Bleeding; Dysentery; Stomach ache	Oral	Decoction
			Leaves	Stomach ache	Oral	Crushing; Direct (chewing); Infusion
				Dysentery	Oral	Grinding and water
			Roots	Stomach ache	Oral	Decoction
			Stem; Stem and leaves (mix)	Stomach ache; Diarrhea	Oral	Decoction; Infusion
<i>Dalbergia melanoxylon</i> Guill. & Perr.	Xipaladze, xiphalanzi African blackwood	Shrub or Tree	Roots	Toothache	Oral	Decoction
<i>Dichrostachys cinerea</i> (L.) Wight & Arn	Ndzenga, ntsenga, ndzhenga Small-leaved sickle bush	Shrub or Small tree	Roots	Skeletal disorders	Topic; Vaccine	Burning and grinding; Scraping
			Roots (sap)	Laxative	Oral	Direct
<i>Elephantorrhiza elephantina</i> (Burch.) Skeels	Xivurayi Dwarf elephant's root	Shrub or Sub-shrub	Roots	Anemia	Oral	Cutting and maceration; Decoction and grinding
				Pain killer, Fever	Oral	Decoction
<i>Guibourtia conjugata</i> (Bolle) J. Léonard	Ntsotso Small copalwood, small false mopane	Tree	Leaves	Stomach disorders	Oral	Crushing and water
			Roots	Intense cough	Oral	Decoction
Malvaceae						
<i>Gossypium herbaceum</i> L.	Thonji ra khwati, thondji la khwati, nuba Wild cotton	Sub-shrub	Fruits	Ear treatment	Topic	Direct
			Roots	Vomits control	Oral	Decoction
				Tonic	Oral	Decoction
<i>Hibiscus meyeri</i> Harv.	Muxaxayevu, kongowa, kloklonya, muchachanyevo Dainty white wild hibiscus, lebombo hibiscus	Herb	Roots	Tonic, Stabbing heart	Oral	Decoction
Meliaceae						
<i>Trichilia emetica</i> Vahl subsp. <i>emetica</i>	Nkuhlu Natal-mahogany	Tree	Branches (sap)	Stomach ache	Oral	Direct (chewing)
			Roots	Contraceptive	Oral	Infusion
Menispermaceae						
<i>Tinospora caffra</i> (Miers) Troupin	Nyokani ya yikulo, nyoka ya yikulo Orange grape creeper	Creeper	Leaves	Paralysis and Children diseases	Oral	Decoction
			Roots	Epilepsy; Pain killer;; Paralysis and Children diseases; Stomach ache	Oral	Decoction; Infusion
			Stem	Epilepsy	Oral	Decoction
Moraceae						
<i>Ficus sycomorus</i> L.	Nkuwa Common cluster fig, sycamore fig	Tree	Sap	Ringworm	Topic	Direct
Oliaceae						
<i>Olax dissitiflora</i> Oliv.	Nkondzomhuntana, ximanimurhi, nondzomuntana Small sourplum, small-fruit olax	Shrub or Tree	Leaves	Wounds	Topic	Grinding

Table 1: Medicinal plants (53 spp.) used in the Canhane village (2007- 2008) (Continued)

<i>Ximenia americana</i> L.	Ntsengele, matsengele, tsingela Blue sourplum, small sourplum	Shrub or Tree	Roots	Antiabortifacients, HIV-AIDS, Menstrual cycle, Stabbing heart, Stomach ache, Women fertility,	Oral	Decoction
				Wounds	Topic	Drying and grinding
Orchidaceae						
<i>Ansellia africana</i> Lindl.	Phakama Leopard orchid, monkey sugarcane, mopane orchid, tree orchid	Herb (Epiphyte)	Fruits	Cough, Rheumatism	Necklace, Bath	Direct; Heating and grinding
			Fruits and stem (mix)	Cough	Oral	Decoction
Poaceae						
<i>Cynodon dactylon</i> (L.) Pers.	Rintlhang, nulangi-rithangi Bermuda grass	Herb	Leaves	Antiabortifacients	Oral	Grinding and water
Ptaeroxylaceae						
<i>Ptaeroxylon obliquum</i> Radlk.	Ndzharhi Sneezewood	Shrub or Tree	Sap	Stomach ache	Oral	Direct
Rubiaceae						
<i>Gardenia volkensii</i> K. Schum.	Xitsalala Bushveld, savanna or woodland gardenia, transvaal gardenia	Shrub or Tree	Leaves	Stomach ache	Oral	Grinding and water
Rutaceae						
<i>Zanthoxylum humile</i> (E.A. Bruce) P. G. Waterman	Manungwani, manongwane, manungwame Hairy knobwood	Shrub	Roots	Mouth anesthetic; Toothache	Oral; Topic	Decoction; Peeling, grinding, drying, and grinding
				Wounds and Burns	Topic	Peeling, grinding, drying, and grinding
			Stem	Pain killer	Vaccine	Burning
Sapotaceae						
<i>Manilkara mochisia</i> (Baker) Dubard	N'whamba, wambo, n'wambu Lowveld milkberry	Shrub or tree	Roots	Toothache	Oral; Topic	Decoction; Maceration and scrapping
				Ear treatments	Topic	Direct
Strychnaceae						
<i>Strychnos madagascariensis</i> Spreng. ex Baker	Nkwankwa Black monkey-orange, hairy-leaved monkey-orange	Shrub or Tree	Roots	Fever	Oral	Peeling and decoction
Sterculiaceae						
<i>Hermannia micropetala</i> Harv. & Sond.	Sindzambita, xisindzambita Cactus wine, wild grape	Shrub or Sub-shrub	Fruits	Laxative	Topic	Juice
			Leaves	Laxative	Topic	Juice
			Roots	Fontanel hardening	Topic	Burning and oil
Tiliaceae						
<i>Grewia flavescens</i> Juss. var. <i>flavescens</i>	Nsihana, nsiphane, dzuwa wa mananga Donkeyberry, Sandpaper raisin, Rough-leaved raisin	Climbing shrub	Leaves	Stomach disorders	NA	NA
<i>Grewia hexamita</i> Burret	Nsihana, nsihani, nsihane, nsiphane Giant grewia, Giant raisin	Shrub or Tree	Roots	Menstrual cycle, Women Fertility	Oral	Infusion
			Sap	Post-delivery cleaning	Oral	Direct

Table 1: Medicinal plants (53 spp.) used in the Canhane village (2007- 2008) (Continued)

<i>Grewia monticola</i> Sond.	Nsihana, nsihani, nsiphane Grey grewia, Grey raisin, Silver raisin	Shrub or Tree	Fruits	Ear treatments	Topic	Heating and grinding
			Fruits; Seeds	Wounds	Topic	Heating and grinding
			Roots	Diarrhea	Oral	Decoction
			Stem	Swellings	Topic	Heating
Vitaceae						
<i>Cissus cornifolia</i> (Bak.) Planch.	Mphesani, mphesana Ivy-grape	Shrub or Tree	Roots	Burns; Wounds	Topic	Crushing
<i>Cissus quadangularis</i> L.	Covoloti, Covoluti Cactus vine, wild grape	Creeper (succulent)	Roots	Ear treatments	Topic	Warming and squeezing
			Sap	Ear treatments; Wounds	Topic	Direct
			Seeds	Antidote; Wounds	Topic	Grinding
			Stem	Sprains; Swellings	Topic	Heating
				Cough	Oral	Cutting and decoction
Antidote; Wounds	Topic	Crushing and water				

Family, scientific, local and common names, growth habit, parts used, main diseases, administration route and method of preparation.

*Scientific names are according to [22-28].

NA = Not Available.

disorders) and *L. schweinfurthii* (diarrhea and stomach disorders). According to the available data, *C. imberbe* was also used to treat schistosomiasis and *L. schweinfurthii* to treat tuberculosis, while in our survey they were additionally indicated for the treatment of toothache (*C. imberbe*), anemia and malaria (*L. schweinfurthii*). Because the older surveys did not specifically target medicinal plants, we believe that our data are more accurate in what concerns the applications of these two species. This fact may also explain why the great majority of the species reported 40 years ago (23 out of 25 or 92%) does not overlap with those identified in this survey. However, the possibility of loss of genetic resources and/or traditional knowledge should also be considered.

The great majority of the identified species (46 spp. or 86.8%) were also used for other purposes than medicine (Table 4; Figure 2). The major groups of applications were associated with beliefs and myths (26 spp. or ca. 49%) or used as food (24 spp. or ca. 45%). Wood production, handicraft and veterinary were the third major class of application, with 10 (ca. 19%), 9 (ca. 17%) and 8 (ca. 15%) species, respectively. This reinforces the socio-economic importance of the reported species, placing them in a privileged position for conservational aspects and income-generating purposes.

Plant parts used, methods of preparation and administration routes

Several plant parts were used (Table 1), the most frequent being roots (38.8%), followed by leaves (17.5%),

stems (13.6%), fruits (8.8%), bark (5.8%), sap (5.8%), combinations of plant organs (3.9%), branches (2.9%) and seeds (2.9%). Regarding the methods of preparation (Figure 3), in many cases (38%) a combination of methods was used. The most common method was decoction (25%), followed by direct consumption (10%), infusion (6%), crushing (5%), grinding (5%), maceration (4%), scraping (2%), heating (2%), burning (1%), cutting (1%) and juice (1%). Fifty nine percent of the medicines were administered orally, 31% topically and only 10% through vaccine, bath, enema, eyewash and necklace (ca. 2% for each mode) (Figure 4). In general, the results seem to follow the pattern of medicinal plant uses in Africa [26,28,49] except that in Canhane, instead of leaves, roots occupy the top position which is concordant with the results from [7]. Consistent with the findings of [28,49] in Kenya and Ethiopia respectively, is the lack of standardized dosage and quality control.

Conservational aspects

In general, the community was conscientious and motivated regarding conservational issues and had adopted sound measures for the rational use of medicinal plants. Conservation in farms or home gardens was performed for the most commonly used plants, namely *Aloe marlothii*, *A. zebrina*, *B. albitrunca*, *C. mopane*, *C. zeyheri*, *E. racemosa*, *Ficus sycomorus*, *Flueggea virosa*, *Grewia hexamita*, *G. monticola*, *H. micropetala*, *Sclerocarya birrea* and *T. sericea*. Additionally, the intensity and frequency of exploitation was controlled and there were

Table 2 Distribution by category of disease

Analgesic, anti-inflammatory and antipyretic	<i>Adansonia digitata</i> , <i>Cissus quadrangularis</i> , <i>Crinum stuhlmannii</i> , <i>Dichrostachys cinerea</i> , <i>Elephantorrhiza elephantina</i> , <i>Grewia monticola</i> , <i>Gymnosporia heterophylla</i> , <i>Sansevieria hyacinthoides</i> , <i>Strychnos madagascariensis</i> , <i>Tinospora caffra</i> , <i>Zanthoxylum humile</i>
Anemia	<i>Elephantorrhiza elephantina</i> , <i>Lannea schweinfurthii</i> , <i>Sclerocarya birrea</i>
Antiallergic	<i>Loeseneriella crenata</i>
Antidote	<i>Cissus quadrangularis</i>
Appendicitis	<i>Cucumis metuliferus</i>
Bleeding	<i>Colophospermum mopane</i>
Burns	<i>Cissus cornifolia</i> , <i>Spirostachys africana</i> , <i>Terminalia sericea</i> , <i>Zanthoxylum humile</i>
Cough	<i>Ansellia africana</i> , <i>Blepharis diversispina</i> , <i>Cissus quadrangularis</i> , <i>Guibourtia conjugata</i>
Debility and malnutrition	<i>Gossypium herbaceum</i> , <i>Hibiscus meyeri</i> , <i>Loeseneriella crenata</i> , <i>Spirostachys africana</i>
Dentistry	<i>Aloe marlothii</i> , <i>Boscia albitrunca</i> , <i>Combretum imberbe</i> , <i>Dalbergia melanoxylon</i> , <i>Euclea racemosa</i> , <i>Flueggea virosa</i> , <i>Manilkara mochisia</i> , <i>Zanthoxylum humile</i>
Deworming	<i>Secamone parvifolia</i>
Ear diseases	<i>Cissus quadrangularis</i> , <i>Gossypium herbaceum</i> , <i>Grewia monticola</i> , <i>Manilkara mochisia</i> , <i>Spirostachys africana</i>
Epilepsy	<i>Loeseneriella crenata</i> , <i>Sansevieria hyacinthoides</i> , <i>Secamone parvifolia</i> , <i>Tinospora caffra</i>
Eye diseases	<i>Aloe zebrina</i> , <i>Cassia abbreviata</i> , <i>Sarcostemma viminalis</i> , <i>Spirostachys africana</i>
Gynecology	<i>Cynodon dactylon</i> , <i>Grewia hexamita</i> , <i>Maerua edulis</i> , <i>Sansevieria hyacinthoides</i> , <i>Trichillia emetica</i> , <i>Ximenia americana</i>
Heart	<i>Gymnosporia heterophylla</i> , <i>Hibiscus meyeri</i> , <i>Ximenia americana</i>
Hemorrhoids	<i>Acalypha indica</i> , <i>Blepharis diversispina</i> , <i>Boscia albitrunca</i> , <i>Sansevieria hyacinthoides</i> , <i>Sclerocarya birrea</i>
HIV-SIDA	<i>Ximenia americana</i>
Internal clots	<i>Gymnosporia heterophylla</i>
Kidney disorders	<i>Boscia foetida</i>
Liver disorders	<i>Aloe marlothii</i> , <i>Aloe zebrina</i>
Malaria	<i>Aloe marlothii</i> , <i>Balanites maughamii</i> , <i>Cassia abbreviata</i> , <i>Lannea schweinfurthii</i>
Non-identified diseases	<i>Androstachys johnsonii</i>
Paralysis and other children diseases	<i>Tinospora caffra</i>
Ringworm	<i>Ficus sycomorus</i>
Skeletal structure	<i>Dichrostachys cinerea</i>
Stomach and intestine disorders	<i>Acalypha indica</i> , <i>Adansonia digitata</i> , <i>Asparagus africanus</i> , <i>Boscia albitrunca</i> , <i>Boscia foetida</i> , <i>Cassia abbreviata</i> , <i>Colophospermum mopane</i> , <i>Combretum imberbe</i> , <i>Cucumis metuliferus</i> , <i>Cucumis zeyheri</i> , <i>Dichrostachys cinerea</i> , <i>Hermannia micropetala</i> , <i>Gardenia volkensii</i> , <i>Grewia flavescens</i> , <i>Grewia monticola</i> , <i>Guibourtia conjugata</i> , <i>Gossypium herbaceum</i> , <i>Lannea schweinfurthii</i> , <i>Loeseneriella crenata</i> , <i>Maerua edulis</i> , <i>Maerua parvifolia</i> , <i>Ptaeroxylon obliquum</i> , <i>Sarcostemma viminalis</i> , <i>Secamone parvifolia</i> , <i>Sclerocarya birrea</i> , <i>Terminalia sericea</i> , <i>Tinospora caffra</i> , <i>Trichillia emetica</i> , <i>Ximenia americana</i>
Varicose veins	<i>Secamone parvifolia</i>
Wounds	<i>Aloe marlothii</i> , <i>Aloe zebrina</i> , <i>Blepharis diversispina</i> , <i>Cissus cornifolia</i> , <i>Cissus quadrangularis</i> , <i>Euclea racemosa</i> , <i>Grewia monticola</i> , <i>Olox dissitiflora</i> , <i>Spirostachys africana</i> , <i>Terminalia sericea</i> , <i>Ximenia americana</i> , <i>Zanthoxylum humile</i>

Distribution of the 53 medicinal plant species within different disease categories (Canhane, 2007-2008).

local rules to protect native plant species, particularly *Adansonia digitata*, *B. discolor*, *Cissus cornifolia*, *C. mopane*, *E. elephantina*, *F. sycomorus*, *F. virosa*, *G. monticola*, *G. conjugata*, *Manilkara mochisia*, *S. birrea*, and *Strychnos madagascariensis*. Other conservation measures included community guards in protected places to control fires and logging, mostly due to South African migrants. On the other hand, trading was controlled and confined to the village.

Conclusions

This study shows the social importance of the floristic richness in the Canhane village, particularly regarding the significance of medicinal plants in primary health-care. This is reflected in the great diversity of plants used for medical purposes as well as in the wide range of their applications and associated procedures. The data compiled in this study are a contribution to the documentation of PGR at the national and regional level

Table 3 List of medicinal plants (25 spp.) surveyed in the district of Massingir in 1960-70

Scientific name*	Local name	Diseases- Gaza district
Alismataceae		
<i>Limnophyton obtusifolium</i> (L.) Miq.	NA	Ear diseases
Amaranthaceae		
<i>Chenopodium ambrosioides</i> L.	Kanunka uncono	Intestinal ulcers; Stomach-aches
<i>Hernbstaedia odorata</i> (Burch.) T. Cooke	Chomeli	Diuretics; Stomach wash
Anacardiaceae		
<i>Lannea schweinfurthii</i> (Engl.) Engl.	chiumbocanha, chebombocanho, munganicomo	Abdominal pain; Choleric diarrhea; Cough; Tuberculosis
<i>Ozoroa obovata</i> (Oliv.) R.Fern. & A. Fern.	xinungu, chimungumango, chinungo, chinungumafe, chinungumafi	Diarrhea; Laxative; Pain
<i>Sclerocarya birrea</i> Sond.	canhi (tree and fruit), tsula (tree), ditsula (fruit)	Diarrhea; dysentery
Apocynaceae		
<i>Adenium multiflorum</i> Klotzsch	chimua	Male sterility; Sexual performance
<i>Pergularia daemia</i> (Forssk.) Chiov.	furana	Antiemetic; Cough
Araceae		
<i>Stylochiton natalensis</i> Schott	NA	Ear diseases; Respiratory diseases; Tranquilizing
Asteraceae		
<i>Ageratum conyzoides</i> L.	NA	Abdominal disorders; Laxative
Burseraceae		
<i>Commiphora africana</i> (A. Rich.) Engl.	NA	Abdominal disorders; Asthma; Head ache; Stomach ache
Capparaceae		
<i>Boscia mossambicensis</i> Klotzsch	Chimapamapane, chicutlu	Eye disinfectant
<i>Cadaba natalensis</i> Sond.	tssatsassana, mejacocone	Tuberculosis
<i>Capparis tomentosa</i> Lam.	caua, cahu	Respiratory diseases; Tuberculosis
<i>Cladostemon kirkii</i> (Oliv.) Pax & Gilg	tumangoma, mahuco, maúco, buguane, tambocolata	Abdominal disorders; Colds; Sexual performance; Venereal diseases
<i>Thilachium africanum</i> Lour.	compfa, compha	Asthma; Diarrhoea; Edema; General pain; Vomiting
Celastraceae		
<i>Elaeodendron schlechteranum</i> (Loes.) Loes.	chigugutzo; chigugusse	Aphrodisiac; Deworming.
<i>Maytenus senegalensis</i> (Lam.) Exell	Chixangua, Chichangua; chilhangua	Bilharziosis; Bronchitis and tuberculosis; Convulsions; Diarrhoea and dysentery; Male and female sterility
Combretaceae		
<i>Combretum apiculatum</i> Sond.	Chivonzôane, samabulile	Abdominal pain; Conjunctivitis
<i>Combretum imberbe</i> Wawra	Monzou; mondzo	Bilharziosis; Stomach-aches
<i>Combretum microphyllum</i> Klotzsch	Funté, mumbambanguene pfunte	Abdominal pain; Bilharziosis; Diarrhoea; Female sterility
<i>Combretum molle</i> R.Br ex G. Don	Chicucudze, xicucutce	Abortifacients, Dysentery
<i>Combretum mossambicense</i> (Klotzsch) Engl.	Futé, funté, fute	Diarrhoea; Laxative
<i>Combretum zeyheri</i> Sond.	NA	Eye cleaning
<i>Pteleopsis myrtifolia</i> (M.A. Lawson) Engl. & Diels	Ludzane	Fever; Madness Male and female sterility

NA = Not Available

The table provides the family, scientific and local names, habit and diseases of 25 spp. surveyed in the district of Massingir mainly during the 60-70 s. *[11,12,43]

Table 4 Other applications of the surveyed plant species from Canhane village (2007- 2008)

Scientific name	Other Applications
Acanthaceae	
<i>Blepharis diversispina</i> (Nees) C.B. Clarke	Beliefs and myths
Aloaceae	
<i>Aloe marlothii</i> A. Berger	Beliefs and myths; Food (nectar); Veterinary (cattle diseases)
<i>Aloe zebrina</i> Baker	Food (leaves); Veterinary (cattle, chicken and lamb's diseases)
Anacardiaceae	
<i>Lannea schweinfurthii</i> (Engl.) Engl.	Beliefs and myths; Food (fruits); Handicraft, Ornamental
<i>Sclerocarya birrea</i> Hochst.	Beliefs and myths; Food (fruits); Handicraft; Ornamental; Wood
Apocynaceae	
<i>Sarcostemma viminale</i> (L.) R.Br.	Food (fruits); Forage
Asparagaceae	
<i>Asparagus africanus</i> Lam.	Beliefs and myths
Balanitaceae	
<i>Balanites maughamii</i> Sprague	Beliefs and myths; Forage; Ornamental; Wood
Bombacaceae	
<i>Adansonia digitata</i> L.	Food (fruits); Paper
Capparaceae	
<i>Boscia albitrunca</i> (Burch.) Gilg & Gilg-Ben.	Food (fruits); Firewood; Handicraft; Wood
<i>Maerua edulis</i> (Gilg & Gilg-Ben.) DeWolf	Food (Fruits)
<i>Maerua parvifolia</i> Pax	Beliefs and myths; Fishery; Food (Fruits)
Celastraceae	
<i>Loeseneriella crenata</i> (Klotzsch) Wilczek ex N. Hallé	Beliefs and myths; Carts and animal traction; Textile
Combretaceae	
<i>Combretum imberbe</i> Wawra	Charcoal; Firewood; Kitchen handicraft; Wood
<i>Terminalia sericea</i> Burch. ex DC.	Beliefs and myths; Fiber; Firewood; Handicraft; Ornamental; Wood
Cucurbitaceae	
<i>Cucumis zeyheri</i> Sond.	Beliefs and myths; Food (leaves); Veterinary (Cattle and lambs wounds)
<i>Cucumis metuliferus</i> E.Mey. ex Naudin	Veterinary (Goat diseases, Newcastle disease)
Dracaenaceae	
<i>Sansevieria hyacinthoides</i> (L.) Druce	Beliefs and myths; Textile
Ebenaceae	
<i>Euclea racemosa</i> Murr.	Cosmetics; Food (fruits)
Euphorbiaceae	
<i>Androstachys johnsonii</i> Prain	Wood
<i>Flueggea virosa</i> (Roxb. ex Willd.) Voigt	Beliefs and myths; Food (fruits)
<i>Spirostachys africana</i> Sond.	Veterinary (cattle eye diseases); Wood
Fabaceae	
<i>Cassia abbreviata</i> Oliv.	Beliefs and myths; Ornamental; Wood
<i>Colophospermum mopane</i> (Benth.) Léonard	Charcoal; Firewood; Handicraft; Wood
<i>Dalbergia melanoxydon</i> Guill. & Perr	Handicraft; Musical instruments
<i>Dichrostachys cinerea</i> (L.) Wight & Arn	Beliefs and myths; Farm fencing; Forage
<i>Elephantorrhiza elephantina</i> (Burch.) Skeels	Beliefs and myths
<i>Guibourtia conjugata</i> (Bolle) J.Léonard	Beliefs and myths; Firewood; Glue; Handicraft; Ornamental
Malvaceae	
<i>Gossypium herbaceum</i> L.	Food (Leaves); Textile
<i>Hibiscus meyeri</i> Harv.	Aphrodisiac; Broom

Table 4: Other applications of the surveyed plant species from Canhane village (2007- 2008) (Continued)

Meliaceae	
<i>Trichilia emetica</i> Vahl subsp. <i>emetica</i>	Cosmetics; Food (fruits, seeds)
Moraceae	
<i>Ficus sycomorus</i> L.	Beliefs and myths; Food (fruits); Forage
Oleaceae	
<i>Olax dissitiflora</i> Oliv.	Beliefs and myths; Food (fruits); Forage; Wood
<i>Ximenia americana</i> L.	Beliefs and myths; Cosmetics; Farm fencing; Food (fruits, seeds); Veterinary (cattle wounds)
Orchidaceae	
<i>Ansellia africana</i> Lindl.	Beliefs and myths
Poaceae	
<i>Cynodon dactylon</i> (L.) Pers.	Forage
Rubiaceae	
<i>Gardenia volkensii</i> K. Schum.	Beliefs and myths; Food (fruits); Textile
Rutaceae	
<i>Zanthoxylum humile</i> (E.A. Bruce) P.G. Waterman	Beliefs and myths; Snake repellent
Sapotaceae	
<i>Manilkara mochisia</i> (Baker) Dubard	Food (fruits)
Strychnaceae	
<i>Strychnos madagascariensis</i> Spreng. ex Baker	Beliefs and myths; Food (fruits); Handicrafts; Musical instruments
Sterculiaceae	
<i>Hermannia micropetala</i> Harv. & Sond.	Beliefs and myths
Tiliaceae	
<i>Grewia flavescens</i> Juss. var. <i>flavescens</i>	Beliefs and myths; Food (fruits)
<i>Grewia hexamita</i> Burret	Food (fruits); Handicraft
<i>Grewia monticola</i> Sond.	Food (fruits); Ornamental; Veterinary (relieves cow's pain during calf-birth)
Vitaceae	
<i>Cissus cornifolia</i> (Bak.) Planch.	Food (fruits); Repellent; Veterinary (cattle wounds)
<i>Cissus quadrangularis</i> L.	Beliefs and myths; Repellent; Veterinary (cattle Newcastle disease, wounds)

The table presents a list of 46 spp. which, besides their medicinal use, are used for non-medical purposes (e.g. applications related to beliefs and myths, food, handicraft, animal diseases, ornamental).

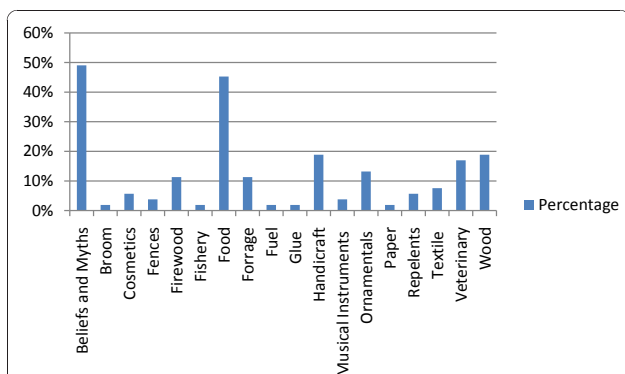


Figure 2 Non-medical applications. Non-medical applications of the 53 medicinal plant species (Canhane, 2007- 2008).

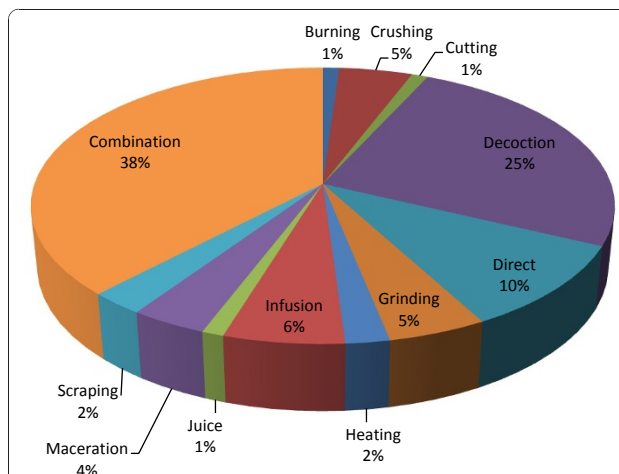
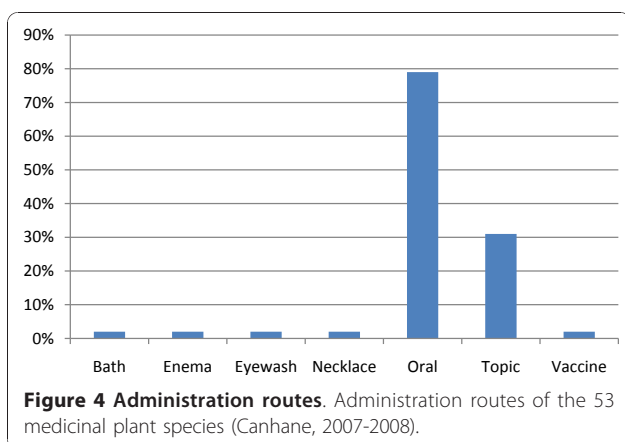


Figure 3 Methods of preparation. Methods of the 53 medicinal plant species (Canhane, 2007-2008).



and can serve as a basis to develop larger and interdisciplinary studies.

List of abbreviations

GLTP: Great Limpopo Transfrontier Park and Conservation Area; PGR: Plant Genetic Resources.

Acknowledgements

The authors would like to express their gratitude to the Canhane community, particularly the 11 informants for their unreserved efforts in transmitting traditional local knowledge, the Canhane Community Lodge for coordinating the work with the community and for the logistics, the direction of Paulo Samuel Kankhomba Primary school for selecting the students and Non-Governmental Organization LUPA. Acknowledgments are also due to botanical collectors, António Zacarias and Ernesto Macamo, and translators, Arminda Mfumo, dr. David Langa and dr. Orlando Bahule. Thanks to Dr. José Manuel Mota Cardoso (Veterinary Hospital, Eduardo Mondlane University, Mozambique) for medical terminology and language revision, Dr. Katharina Pawlowski (Stockholm University) for the language revision, Dr. Cristina Duarte (Tropical Research Institute, Portugal) for the taxonomic revision, and Ezequiel Correia for preparing the distribution map of the study area. This work was supported by a grant from Fundo Aberto - Universidade Eduardo Mondlane and the Swedish International Development Agency (Research Funding).

Author details

¹Tropical Research Institute, Rua da Junqueira 86, 1300-344, Lisbon, Portugal.
²Faculdade de Agronomia e Engenharia Florestal, Universidade Eduardo Mondlane, CP 257, Maputo, Mozambique.

Authors' contributions

The design, planning, field survey and taxonomic analysis was coordinated and conducted by TF. AR and TF performed the data processing and analysis. The taxonomic revision was done by MMR and JT. Data from other geographical regions and from 1960-70 was retrieved by MMR, JT and TF. Literature retrieval was done by AR and MMR. AR wrote the manuscript, which was revised by MMR and TF. All authors read and approved the manuscript.

Competing interests

The authors declare that they have no competing interests.

Received: 18 June 2010 Accepted: 3 December 2010

Published: 3 December 2010

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doi:10.1186/1746-4269-6-33

Cite this article as: Ribeiro *et al.*: Ethnobotanical survey in Canhane village, district of Massingir, Mozambique: medicinal plants and traditional knowledge. *Journal of Ethnobiology and Ethnomedicine* 2010 **6**:33.

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