RESEARCH ARTICLE

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Ethnobotanical study of medicinal plants of Mirab-Badwacho district, Ethiopia

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ABSTRACT
Ethnobotanical investigation on medicinal plants was conducted in Mirab-Badwacho district of Ethiopia. Sixty traditional healers participated in the study. Data were collected using semi-structured interviews, guided field walks and key informant interviews. Voucher specimens of the medicinal plants were collected during guided field walks. Ethnobotanical techniques such as informant consensus factor (ICF) and preference ranking were used to analyse the data. A total of 57 medicinal plants belonging to 40 families were recorded. The most commonly used plant families include Euphorbiaceae, Solanaceae, Asteraceae, Cucurbitaceae, Lamiaceae, Rosaceae and Brassicaceae. Medicinal plants were mostly collected from the wild habitats. Herbs accounted for the lion's share of the medicinal plants. The medicinal plants of the study site were used to treat 31 ailments. About 42% of the plants were used to treat stomach ache, diarrhea and intestinal worms. Leaves (41%) and roots (20.3%) were the most frequently used medicinal plant parts. Flowers were least used plant parts for medicinal purpose. Routes of administration of the traditional remedies were mouth, skin, nose and eye. The study area has considerable diversity of medicinal plants. However, expansion of agricultural land, over grazing and deforestation are major threats to the medicinal plants. Hence, proper conservation measures need to be practiced for sustainability of the medicinal plants.

Key words: ethnobotany, informant consensus factor, preference ranking, ailments, sustainability

Introduction

Indigenous people around the world have unique knowledge of plant resources on which they depend for food, medicine and other uses (Martin, 1995). Plants have been vital sources of both preventive and curative traditional medicine for man and livestock (Dery et al., 1991). It was estimated that 25 000 to 75 000 species of higher plants have been used in traditional medicine worldwide (Farnsworth, 1985). Medicinal plants still play considerable role in the health care system of the developing world.

As a result of its wide range of altitude and great geographical diversity, Ethiopia is an important regional centre for biological diversity (Kelbessa et al., 1992; Friis et al., 2011). There are about 6500-7000 vascular plants in Ethiopia, nearly 12% of which are endemic (Teweldebirhan, 1991). In Ethiopia, plants are used as a source of traditional medicine from antiquity to solve different health problems and human ailments (Asfaw et al., 1999). Nearly 80% of the population in Ethiopia use plant-based traditional medicine as their primary health care system which could partly be attributed to the fact that it makes use of locally available plant resources (Dawit & Ahadu, 1993; Dawit, 2001).

Herbal medicine in Ethiopia, as it is the case in other parts of Africa, is facing with problems of continuity and sustainability (Kelbessa et al., 1992). It is therefore very important to investigate the ethnobotanical knowledge of the various socio-cultural groups in Ethiopia. Such studies are useful not only for documenting, analyzing and disseminating indigenous knowledge of local people but also to indicate interaction between biodiversity and human society (Martin, 1995).

Thus far, various ethnobotanical studies were conducted in Ethiopia (Getahun, 1976; Dawit, 1986; Taddesse, 1986; Giday, 1999; Deribe et al., 2006; Teklehaymanot et al., 2007; Teklehaymanot & Giday, 2007; Wondimu et al., 2007). However, much remains to be studied given the enormous ecological and cultural diversity in Ethiopia. For instance, no ethnobotanical study was conducted in Mirab-Badwacho district of Ethiopia. Hence, the present study was conceived to explore medicinal plants and the associated indigenous knowledge on use of the plants in Mirab-Badwacho district of Ethiopia.

Materials and Methods

Mirab Badwacho district is found in Hadiya Zone which is part of the Southern Nations, Nationalities and Peoples Regional State of Ethiopia. It is located approximately in 07°69′00″N to 07°91′91″N latitude and 37°95′00″E to 38°10′00″E longitude (Figure 1). It is 355 km away from Addis Ababa, the capital of Ethiopia. The study area has temperature and rainfall range of 12°C to 28°C and 200 mm to 400 mm, respectively.

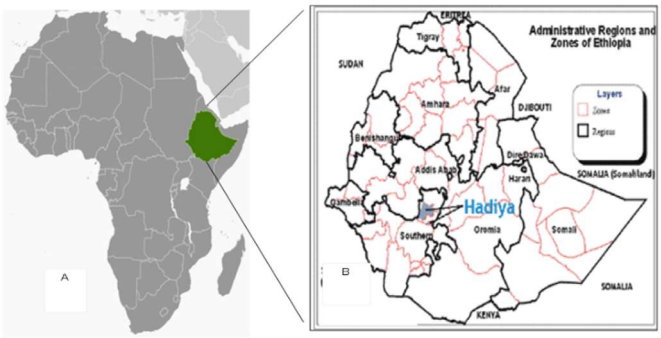

Figure 1. *Map of the study area. 'A' shows location of Ethiopia in Africa. 'B' shows the location of Hadiya Zone (which includes Mirab Badwacho district) in the map of Ethiopia.*

For purpose of this study, five peasant associations named Garbo, Wobara, Danama Gaberemehiber, Ilifeta and Danema, which were considered to have relatively better plant diversity, were selected from Mirab Badwacho district of Hadiya Zone. Data were collected through semi-structured interviews, guided field walks, observation and group discussions with the informants. A total of 60 (40 males and 20 females) traditional healers having age range of 25 to75 years were interviewed. Eight key informants were asked to rank medicinal plants in terms of their potency for selected ailment.

The interview questions focused on local names of medicinal plants, parts of used, diseases treated, mode of preparation and administration of the traditional remedies. The interviews and discussions were carried out in the local language (Hadiyigna). Voucher specimens of the medicinal plants were collected during guided field walks. The specimens were identified at National Herbarium (ETH) and the nomenclature of the plants was based on Flora of Ethiopia and Eritrea (Hedberg & Edwards, 1995; Edwards et al.,1995, 1997, 2000; Hedberg et al., 2003, 2004, 2006).

Preference ranking was computed to rank the plants in terms of the preference of respondents (Alexiades, 1996; Cotton, 1996). To estimate user variability of medicinal plants, Informant Consensus Factor (ICF) was calculated. ICF values range from 0.00 to 1.00. High ICF values are obtained when only one or a few plant species are reported to be used by a high proportion of informants to treat a particular ailment. Low ICF values indicate that informants disagree over which plant to use. High ICF values can thus be used to find particularly important species for the search of bioactive compounds (Canales et al., 2005).

Results and Discussion

Diversity, habits and habitats of medicinal plants

A total of 56 species of medicinal plants belonging to 40 families were recorded in the study area (see Annex 1). Euphorbiaceae and Solanaceae account for the high proportion of medicinal plants recorded in the study site, followed by Asteraceae, Cucurbitaceae, Lamiaceae, Rosaceae and Brassicaceae (Figure 2). The remaining families account for 58% of the medicinal plants.

The importance of these families in the medicinal flora of Ethiopia is also reported by other researchers (Teklehaymanot et al., 2007; Giday et al., 2009). Herbs account for most of the medicinal plants, followed by shrubs, trees and climbers, respectively (Figure 3).

Similarly, previous ethnobotanical studies in Ethiopia and elsewhere showed that herbs account for considerable proportion medicinal plants (Giday et al., 2003;

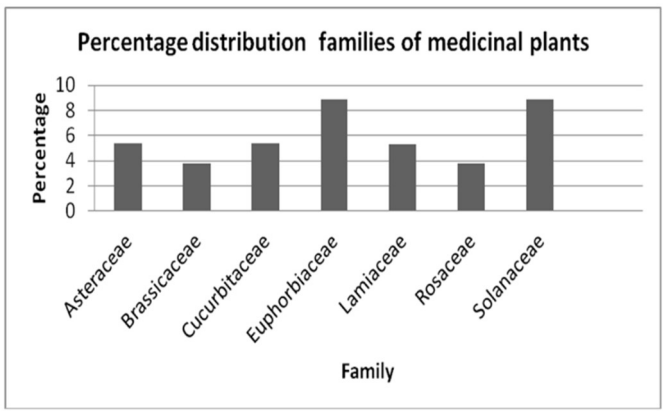

Figure 2. *Percentage distribution of medicinal plant families in the study area.*

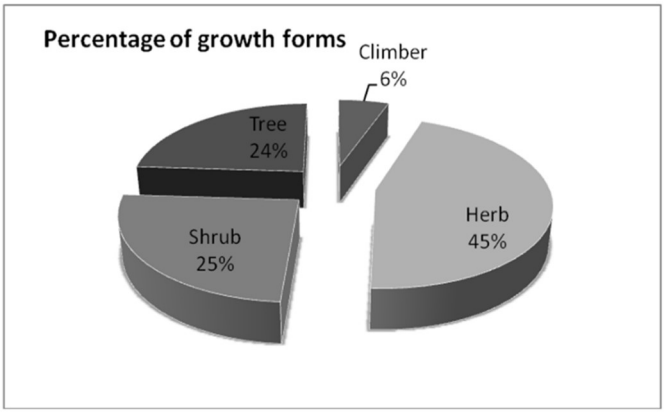

Figure 3. *Percentage distribution of habits of medicinal plants.*

Teklehaymanot & Giday, 2007; Teklehaymanot et al., 2007; Wondimu et al., 2007; Yineger et al., 2008; Simbo, 2010). The popularity of herbs in traditional medicine is associated with their higher likelihood of containing pharmacologically active compounds compared to woody plant forms (Thomas et al., 2009). With regard to distribution, the majority of medicinal plants were recorded in the wild as shown in Table 1.

Table 1. *The habitats of medicinal plants in the study area. Habitat in this case stands for the places where medicinal plants were usually collected by the traditional healers.*

Habitat	Number of plants	Percentage
Wild (bush lands, forests)	37	65
Homegarden	15	26.3
Both wild and homegarden	5	8.7

Other studies also showed that reported that most of the plants used for medicinal purpose in Ethiopia are collected from wild habitats which may worsen the rate of loss of medicinal plants (Giday,1999). This fining is also concurrent with findings of in other African countries which reported that medicinal plants mostly occur in the wild (Simbo, 2009; Amri & Kisangau, 2012). About two-thirds medicinal plants in use worldwide are harvested from the natural habitat and about one fifth of them are in danger of extinction (Edwards, 2004). Thus, the high dependence on medicinal plants harvested from the wild habitats has a considerable impact on the availability of these resources and is likely to account for their vulnerability to being overexploited.

The low occurrence of medicinal plants in home gardens may be due to disturbance caused by agricultural practices. It also indicates that transplantation and cultivation medicinal plants is not as such a common practice in the study area. Hence, appropriate conservation measures need to be practiced in the wild habitats housing the medicinal plants. Furthermore, transplanting of wildings should be promoted to ensure the sustainable use of medicinal plants.

Ailments treated, informant consensus factor & preference ranking

The medicinal plants of the study area were used to treat a total of 31 ailments (Table 2). About 42% of the plants were used to treat stomach ache, diarrhea and intestinal worms. Hence, the most frequently cited indications in the study area were digestive system disorders which may be due lack of access to clean drinking water and sanitary problems. Ailments such as tooth ache, fever, tonsillitis, wound, venereal diseases, ear infection, hepatitis, malaria, rabies, etc. are also treated using the medicinal plants. The indigenous use of medicinal plants for treatment of some of the aforementioned ailments was also reported by different researchers (Teklehaymanot et al., 2007; Wondimu et al., 2007; Yineger et al., 2008; Giday et al., 2009; Teklehaymanot, 2009; Musa et al., 2011).

For most of the ailments, the level of informant consensus was high (ICF≥0.7). Total consensus (ICF=1.00) noted for eleven ailments. Hepatitis, shoulder & joint pains and asthma showed relatively low levels of consensus (ICF≤0.50). High ICF values show that the species traditionally used to treat these ailments are worth searching for bioactive compounds (Canales et al., 2005).

When different species are prescribed for treatment of the same health problem, preference ranking helps rank the plants in terms of the preference of respondents. In this study, stomach ache was the most widely cited ailment in the study area. As shown in Table 2, twenty-one percent of the medicinal plants recorded in the study area were used to treat stomach ache. Eight key informants were asked to rank the potency of each of these medicinal plants using a one to five scale. The top five medicinal plants used for treatment of stomach ache are outlined in Table 3. *Rumex nepalensis* was the most preferred for its potency against stomach ache, followed by *Ruta chalepensis, Clausena anisata, Nicotiana tabacum* and *Zingiber officinale,* respectively.

Parts used, condition of use and route of administration

In about 41% of medicinal plants of the study area, leaves were the most commonly used plant parts, followed by roots (13%). In addition, seed, bark, stem, bulb, fruit, latex and flower were used for medicinal purpose (Figure 4). In some cases, different parts of the same plant are used for treatment of different ailments. There are also cases where more than one plant is used to treat a particular ailment.

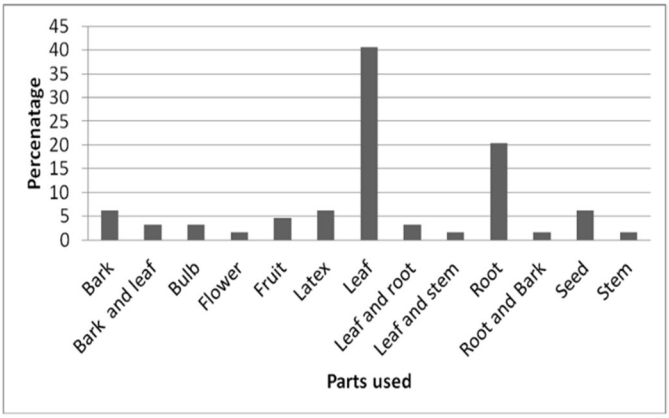

Figure 4. *Percentage distribution of plant parts used for medicinal purposes.*

Similarly, earlier ethnobotanical studies in Ethiopia and elsewhere showed that leaves are the most frequently used parts in the preparation of traditional remedies (Tabuti et al.,

2003; Wassihun et al., 2003; Asase et al., 2005; Tadesse et al., 2005; Muthu et al., 2006; Giday et al., 2007; Teklehaymanot et al., 2007; Pradhan & Badola, 2008; Yineger et al., 2008; Focho et al., 2009; Signorini et al., 2009). One of the possible reasons for wide use of leaves for medicinal purposes is that leaf harvesting is relatively a sustainable practice compared to utilization of other plant parts (Ayyanar & Ignacimuthu, 2005). The second reason for wide use of leaves could be due to the fact that leaves accumulate inulins, tannins and other alkaloids, which may be account for their medicinal properties (Okoegwale & Omefezi, 2001). Harvesting medicinal plants through uprooting and bark striping can jeopardize survival of the plant (Cunningham, 2001; Kamatenesi, et al., 2011).

Most of the plants (72%) are used for preparation of remedies soon after harvest. Twenty-six percent of the plants need to be dried before used for preparation remedies. The remaining 2% could use either in fresh or dried form. Other

Table 2. *ICF values of ailments treated using the medicinal plants of the study area. ICF=Nur-Nt /(Nur-1). Where Nur is the number of plant use reports for a particular aliment and Nt is the total number of plants used by all informants for this ailment.*

Ailments	Number of plants used for treatment of the ailment (NT)	Percentage of medicinal plants used	Number of use reports (NUR)	ICF value
Stomach ache	12	21	51	0.78
Intestinal worms	7	12.3	53	0.88
Diarrhea	5	8.7	58	0.93
Tooth ache	5	8.7	15	0.71
Fever & head ache	4	7	12	0.72
Tonsillitis	4	7	32	0.90
Wound	4	7	9	0.62
Ear infection	3	5.3	17	0.87
Venereal diseases & hemorrhage	3	5.3	5	0.50
Hepatitis	3	5.3	4	0.33
Malaria	3	5.3	7	0.66
Rabies	3	5.3	9	0.75
Asthma	2	3.5	3	0.50
Constipation	2	3.5	2	0.00
Dandruffs	2	3.5	8	0.86
Hypertension	2	3.5	2	0.00
Joints & shoulder pains	2	3.5	3	0.50
Snake bite	2	3.5	6	0.80
Swelling	2	3.5	2	0.00
Bleeding	1	1.75	2	1.00
Bone fracture	1	1.75	44	1.00
Chigger	1	1.75	3	1.00
Delayed placenta	1	1.75	21	1.00
Diabetes	1	1.75	5	1.00
Evil eye	1	1.75	46	1.00
Eye infection	1	1.75	5	1.00
Gland TB	1	1.75	2	1.00
Herpes zoster	1	1.75	12	1.00
Loss of appetite	1	1.75	12	1.00
Meningitis	1	1.75	5	1.00
Sexual impotency	1	1.75	6	1.00

Table 3. *Preference ranking for five selected medicinal plants based on their potency for treating stomach ache as perceived by key informants. The scores were in 1-5 scale and 'I' stands for the key informants.*

Medicinal Plant	Scores by the informants								Total	Rank
	I1	I2	I3	I4	I5	I6	I7	I8		
Nicotiana tabacum L.	3	4	5	5	4	3	4	5	33	4th
Rumex nepalensis Spreng.	5	5	4	5	5	5	5	5	39	1st
Ruta chalepensis L.	5	4	5	4	5	4	5	5	37	2nd
Clausena anisata (Willd.) Benth.	3	5	3	5	5	5	3	5	34	3rd
Zingiber officinale Roscoe.	3	4	3	4	3	3	4	3	27	5th

studies also reported that the freshly harvested plants are widely used for preparation of remedies (Giday et al., 2003; Yineger et al., 2008). The wide use of freshly harvested materials could be an attempt not to lose volatile oils, the concentration of which could decline on drying (Giday et al., 2009).

The routes of administration of traditional remedies in the study site are oral, dermal, nasal, auricular and optical (Figure 5). Most of the traditional remedies are taken orally. This is because of the fact that most of the medicinal plants recorded in the study area are used to treat stomach ache, diarrhea and intestinal worms as shown in Table 2. Other ethnobotanical studies also indicated that traditional remedies are mostly administered orally (Dawit & Ahadu, 1993; Teklehaymanot & Giday, 2007; Addisie et al., 2012; Amri & Kisangau, 2012).

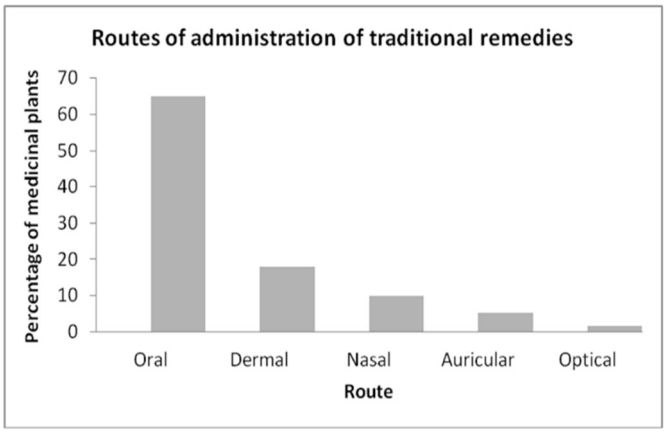

Figure 5. *Routes of administration and percentage of medicinal plants.*

Conclusion

The study revealed that there are considerable number of medicinal plants in Misrak Badewacho district which are used to treat ailments which are common in the district. Hence, medicinal plants still play considerable role in the health care of system of the district. The lion's share of medicinal plants in the study area were found to be herbs. Most of the medicinal plants were harvested from the wild. Transplantation of the medicinal plants to homegardens is strongly recommended to ensure the sustainability of the plants. Plants with high preference ranking scores such as *Rumex nepalensis*, *Ruta chalepensis, Clausena anisata, Nicotiana tabacum* and *Zingiber officinale* need to tested for their efficacy. Natural habitats need to be managed properly to minimize threats on the medicinal plants.

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Annex 1. *The list of medicinal plants recorded in the study area and the ailments treated.*

№	Scientific name	Habit	Family	Local name	Parts used	Ailments treated
1	*Acanthospermum hispidum* DC.	H	Asteraceae	Halliutta	Leaf	Joint and shoulder pain
2	*Achyranthes aspera* L.	H	Amaranthaceae	-	Leaf	Bleeding, herpes zoster
3	*Allium sativum* L.	H	Alliaceae	Kashari shunkurutta	Bulb	Common cold, other infections in upper respiratory tract, fever, cough, asthma, malaria, hypertension
4	*Aloe monticola* Reynolds	H	Aloaceae	Genenno	Latex of the leave	Liver disease
5	*Asparagus africanus* L.	C	Asparagaceae	Serette'e	Leaf	Sexual impotency
6	*Brassica carinata* A. Br.	H	Brassicaceae	Shanna	Leaf	Constipation
7	*Brucea antidysentrica* J.F. Mill.	T	Simaroubaceae	Chirontta	Bark and leaves	Eczema, dysentery
8	*Carica papaya* L.	T	Caricaceae	Papaya	Leaf	Malaria
9	*Carissa spinarum* L.	S	Apocynaceae	Goqaa	Root	Cold
10	*Centelia asiatica* L.	H	Apiaceae	Kallalla	Leaf	Meningitis
11	*Clausena anisata* (Willd.) Benth.	T	Rutaceae	Xogganne	Leaf and root	Stomach ache, ear infection
12	*Clematis hirsuta* Perr. & Guill.	C	Ranunculaceae	Morikarra	Leaf	Gland TB
13	*Clutia lanceolata* Forssk.	H	Euphorbiaceae	-	Root	Hepatitis
14	*Commelina spp.*	H	Commelinaceae	Luxun ixxa	Leaf	Skin infections such as dandruff
15	*Colocasia esculenta* (L.) Schott.	H	Araceae	Boinna	Root	Stomach ache
16	*Croton macrostachyus* Del.	T	Euphorbiaceae	Massana	Bark, Leaf	Stomach ache, dysentery
17	*Cucurbita moschata*	H	Cucurbitaceae	Dabaqula	Root	Delayed placenta (for expulsion of the placenta)
18	*Cucurbita pepo* L.	H	Curcurbitaceae	Qooma	Seeds	Tape worm
19	*Datura stramonium* L.	H	Solanaceae	Machara	Leaves	Toothache, dandruffs
20	*Ensete ventricosum* (Welw.) Cheesman	T	Musaceae	Hywona	Bulb	Bone fracture
21	*Eucalyptus globulus* Labill	T	Myrtaceae	Qadalli barizaffa	Leaf	Cough, breathing difficulties, Stomach ache, rabies
22	*Euclea divinorum* Hiern	S	Ebenaceae	Gunnaa	Leaf	Toothache, cold
23	*Euphorbia candelabrum* Kostshy	S	Euphorbiaceae	Addamaa	Latex	Venereal disease, ring worm
24	*Euphorbia tirucalli* L.	S	Euphorbiaceae	Maxxoo	Latex	Haemorrhage /Wart
25	*Ficus thorningii* Bluma.	T	Moraceae	Shankkaa	Root, Bark	Stomach-ache, tapeworm
26	*Flacourtia indica* (Burm.f.) Merr.	S	Flacourtiaceae	Hagala	Bark	Cold
27	*Gnidia involucarta Stend.ex* A.Rich	H	Thymelaeaceae	Worraa	Root	Ascaris, Gonorrhea
28	*Gossypium arboretum* L.	S	Malvaceae	-	Root	Snake bite
29	*Hagenia abyssinica* (Bruce) J. F. Gmel	T	Rosaseae	Suxxoo	Flower Seed	Tapeworm
30	*Hymenodictyon floribundum* (Hochst.&Steud.) Robinson	S	Rubiaceae	Omorro'o	Leaf	Eye infection
31	*Ipomoea batatas* (L.) Lam.	H	Convolvulaceae	Shukare'e	Leaf	Boil
32	*Justicia schimperiana* (Hochst).ex A.Nees) T.Anders	S	Acanthaceae	Tumunigga	Leaf	Hepatitis
33	*Kalanchoe petitana* A.Rich.	H	Crassulaceae	Doxxi hanchurraa	Leaf	Rheumatic pain/Swelling
34	*Lepidium sativum* L.	H	Brassicaceae	Shumiffaa	Seed	Stomach ache
35	*Mangifera indica* L.	T	Anacardiaceae	Mango	Leaf Bark Root	Diarrhea, hypertension, asthma, cough
36	*Millettia ferruginea* (Hochst.) Back	T	Fabaceae	Hanggada	Leaf	Chigger
37	*Momoridica foetida* Schumach	H	Cucurbitaceae	Achcha	Leaf	Malaria, headache

Annex 1. *Continued.*

	Scientific name	Habit	Family	Local name	Parts used	Ailments treated
38	*Moringa stenopetala* (Bak. f.) Cuf.	T	Moringaceae	Moringa	Leave Bark Seeds Root	Diabetes, headache, inflammation
39	*Nicotiana tabacum* L.	H	Solanaceae	Tambbaa	Leaf	Stomach ache, toothache, leech
40	*Ocimum basilicum* L.	H	Lamiaceae	Gimanja	Leaf	Loss of appetite
41	*Ocimum lamiifolium* Hochst ex. Benth.	H	Lamiaceae	Damakasse	Leaf	Common cold, wound
42	*Pavetta oliveriana* Hiern	S	Rubiaceae	Shisho'o	Leaf	Gonorrhoea, urine retention
43	*Persea americana* Mill.	T	Lauraceae	Abokado'o	Fruit	Constipation, dysentery
44	*Phytolacca dodecandra* L.	S	Phytolaceae	Hanjjaa	Leaf and root	Intestinal worms, rabies
45	*Podocarpus falcatus* (Thumb.) Mirb.	T	Podocarpaceae	Diggibaa	Leaves Waxy substance from stem	Wart, diarrhea, fever and joint pain
46	*Prunus africana* (Hook. f.) Kalkm.	T	Rosaceae	Kossaratt	Bark	ear infection, stomach ache
47	*Ricinus communis* L.	H	Euphorbiaceae	Qobbo'o	Root Leaf	Toothache, rabies, wound
48	*Ruta chalepensis* L.	H	Rutaceae	Qachabbaa	Root Leaf	Stomach ache Cold
49	*Rumex nepalensis* Spreng.	H	Polygonaceae	Anggammibisha	Root	Tonsillitis, stomach ache
50	*Solanum incanum* L.	S	Solanaceae	Qadalli loro'o	Fruit	Tonsillitis and tooth ache
51	*Solanum marginatum* L.f.	S	Solanaceae	Widlorroo	Root	Swelling, eczema
52	*Verbena officialis* L.	H	Verbenaceae	-	Fruit Root	Ear infection, stomach-ache
53	*Vernonia amygdalina* Del.	T	Asteraceae	Hebbaa	Leaf	Tonsillitis, evil eye
54	*Zehneria scabra* (Linn.f.) Sond.	C	Asteraceae	Mich qarare'e	Leaf and stem	Fever, wound
55	*Zingiber officinale* Roscoe.	H	Zingiberaceae	Janjibella	Root	Stomach ache, tonsillitis, cough, cold, fever
56	*Ziziphus mucronata* Willd.	S	Rhamnaceae	-	Leaf	Wound