

Vol. 9(15), pp. 494-509, 17 April, 2015
DOI: 10.5897/JMPR2014.5681
Article Number: 8DFCBAC52764
ISSN 1996-0875
Copyright © 2015
Author(s) retain the copyright of this article
<http://www.academicjournals.org/JMPR>

Full Length Research Paper

Traditional medicinal plants used by Kunama ethnic group in Northern Ethiopia

Meaza Gidey^{1*}, Tadesse Beyene², Maria Adele Signorini³, Piero Bruschi⁴ and Gidey Yirga²

¹Department of Biology, Aksum University P.O. Box 287 Tigray, Ethiopia.

²Department of Biology, Mekelle University, PO Box 231 Tigray, Ethiopia.

³Department of Biology, University of Florence PO Box 100547, Florence, Italy.

⁴Department of Agriculture, Food and Environmental Science, sect. soil and Plant science, University of Florence, p.le Cascine 28 Firenze, Italy.

Received 7 November, 2014; Accepted 17 April, 2015

Utilization of medicinal plants is almost as old as the history of mankind. Semi-structured interview, guided field walk, group discussion and market survey were used to collect ethnobotanical data in Tahitay Adiyabo and Kafta Humera districts in northern Ethiopia. A total of 47 informants (30 males and 17 females) were selected purposefully from three sub-districts: Lemlem (n = 27), Adi-Goshu (n = 10) and Hilet-Coca (n = 10). A total of 115 species of medicinal plants were collected and identified for treating 59 humans and livestock ailments. The most commonly used plant parts for herbal preparations were roots (35.5%) and leaves (21.74%) and were administered through oral, dermal, ocular, nasal and vaginal routes in decreasing order. Oral application (58 preparations, 50.43%) was the highest and most commonly used route of application followed by dermal application (35 preparations, 30.43%). Kunama tribes are rich in medicinal plant species and the associated indigenous knowledge. Future studies should focus on phytochemical extraction of herbal drugs for their efficacy and possible toxicity.

Key words: Kunama, KaftaHumera, Tahitay Adiyabo, ethnobotany, traditional medicine.

INTRODUCTION

Utilization of medicinal plants is almost as old as the history of mankind. More than 80% of the world's population relies on traditional medicine to meet their daily health requirements (World Health Organization (WHO), 2001). This is partly due to accessibility, efficacy on treatment and affordable cost compared to Western medication (Cunningham, 1993; Konno, 2004). Medicinal plants were regularly used by people in prehistoric times

for biomedically curative and psychotherapeutic purposes (Barboza et al., 2009). Knowledge of medicinal plants has resulted from trial and error methods, and often based on speculation and superstition (Hamayun et al., 2006). Nearly 50,000 species of higher plants have been used for medicinal purposes, and are also used in food, cleaning, personal care and perfumery (Barboza et al., 2009). Traditional knowledge of medicinal plants is

*Corresponding author. E-mail: meazagideydesta@yahoo.com. Tel: +251-914-121064.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](http://creativecommons.org/licenses/by/4.0/)

important for modern medicine development (WHO, 2001; Luiz and Barbosa, 2012). Major pharmaceutical drugs have been derived from biological diversity (Bisset, 1994). For example, Aspirin was discovered independently by residents of both the New and Old worlds as a remedy for aches and fevers (Raskin et al., 2002).

Despite the wide utilization of medicinal plants for healthcare (Balick and Cox, 1996), medicinal plants across Africa are poorly documented. Plant remedies are the most important source of therapeutics for nearly 80% of the population in Ethiopia (Dawit, 2001; Awas, 2007) and most of the knowledge is still in the hands of traditional healers. Ethnobotanical research to document the knowledge and practices of traditional healers is invaluable. The present study reports ethnobotanical knowledge and practices by Kunama ethnic group (hereafter called Kunama) in northern Ethiopia where they are the smallest ethnic groups. Tigray National Regional State is one of the nine regions found in northern Ethiopia. It consists approximately 95% Tigrayans, 2.6% Amhara, 0.7% Erob and 0.05% Kunama (Fosse, 2006). The Kunama are a Nilotic people living in Ethiopia and Eritrea and about 100,000 (2% of the population of Eritrea) Kunama live in Eritrea near the border with Ethiopia between the Gash and Setit rivers (Refugees International, 2004).

In Tigray Kunama live in Kafta Humera and Tahitay Adiyabo districts near the border with Eritrea and the number of Kunama has dropped to 2,976 since the remaining 2,000 have migrated into the other Regions of Ethiopia (Community Supported Agriculture, 2008). They are known for treating human and livestock ailments using herbal medicine (COR, 2007) and live in remote and isolated areas both in Ethiopia and Eritrea. Access to the Kunama is difficult, and very little first-hand information is available in relation to their indigenous knowledge and practices (Refugees International, 2004). The present study attempts to document Kunama ethnobotanical knowledge and practices in northern Ethiopia.

Study area

The study was conducted in Tahitay Adiyabo and Kafta Humera districts in northern Ethiopia. Tahitay Adiyabo has an altitude ranging 900 to 1040 m above sea level. The mean annual rainfall and temperature of the district ranges from 400 to 500 mm and 28 to 40.5°C, respectively (Associação de Olivicultores de Trás-os-Montes e Alto Douro (AOTAD), 2013). Tahitay Adiyabo has a total surface area of 384,000 ha with a population of 98, 934, among these, 1,056 are Kunama found in one rural sub-district called Lemlem (PFOTAD, 2013). Kafta Humera has an altitude ranging 560 to 1820 m above sea level (Yosef, 2012). The mean annual rainfall and

temperature of the district ranges from 400 to 650 mm and 33 to 41.7°C, respectively (AOKHD, 2013). Kafta Humera district covers an area of 632, 877.75 ha with a population of 104,014, among these, 1,520 are Kunama found in two sub-district called Adi-Goshu (n = 610) and Hilet coca (n = 910) (PFOKHD, 2013). In both districts, the main crops cultivated are sesame (*Sesamum indicum*) sorghum (*Sorghum bicolor*), maize (*Zea mays*) and millet (*Eleusine coracana*). Malaria, acute respiratory infections, acute febrile diseases, diarrhea, helmenthiasis, infections of skin and subcutaneous tissue, pneumonia and dyspepsia are common disease in both districts (HOTAD, 2013; HOKHD, 2013). Both districts have no hospital. Tahitay Adiyabo and Kafta Humera have six and seven health centers, respectively (HOTAD, 2013; HOKHD, 2013).

METHODOLOGY

All locally available traditional healers (n = 30) and elders (n = 17) were selected for the study. A semi-structured interview, guided field walk and group discussion were used to collect ethnobotanical data. Medicinal plant specimens were collected, numbered and pressed at spot, and identified at National Herbarium, Addis Ababa University, Ethiopia. Preference ranking, direct matrix ranking, ranking of threats to medicinal plants, Informant consensus, Informant consensus factor (ICF) and Fidelity level were used to quantify ethnobotanical data (Martin, 1995).

Preference ranking was made following Martin (1995) for five most cited medicinal plants that were known for the treatment of snake bite. Seven randomly selected traditional healers were given the five most cited medicinal plants to rank based on their efficacy. Ranking was done by giving five to the most efficient plant and one to the least. Following Martin (1995) six traditional healers were selected for direct matrix ranking of five multi purpose (medicinal, firewood, food, charcoal, cash income, construction and shade) medicinal plants. Ranking was done by giving five to the most important plant and one to the least. Ranking of threats to medicinal plants was done by ranking five highly cited threats by taking six traditional healers randomly. The traditional healers valued five to the most destructive factor (threat) and one to the least. Finally ranking of threats was made by adding the value of each threat. In order to confirm the reliability of the ethnobotanical information traditional healers were visited three times (Informant consensus). Informant consensus factor (ICF) was calculated in order to identify the agreement of the informants on the reported ailments as follows: number of use citations in each category (nur) minus the number of species used (nt), divided by the number of use citations in each category minus one (Heinrich et al., 1998). The reported ailments were categorized and then the ICF were calculated using the formula;

$$ICF = \frac{n_{ur} - n_t}{n_{ur} - 1}$$

Fidelity level (FL) was calculated by taking five most cited medicinal plants in order to know the importance of the medicinal plants for a particular purpose; by dividing the number of informants who mentioned the medicinal plant for treating particular medicinal disease to the total number of informants who mentioned the plant for any use.

$$FL = \frac{Ip}{Iu}$$

Where Ip is the number of informants who mentioned the plant for particular purpose, and Iu is the total number of informants who mentioned the plant for any use. Market survey was conducted in the administrative center of Tahitay Adiyabo district called Shirarro and Kafta Humera district called Adi-Goshu and Adebay markets on three consecutive Saturdays, the market day of the local communities. It was carried out by interviewing individuals who sell and buy plants or plant products.

RESULTS

A total of 115 medicinal plant species belonging to 97 genera and 47 families were used to treat 59 human and livestock ailments (Table 1). The family Fabaceae had the highest number of genera (13%; n = 13) followed by Solanaceae (6%, n = 6) and Lamiaceae (5%, n = 5). Similarly the family Fabaceae had the highest number of medicinal plant species (17%, n = 20) followed by Solanaceae (6.96%, n = 8) and Lamiaceae (4.35%, n = 5). The genera *Acacia* had the highest number of medicinal plants (4%, n = 5) followed by *Ficus* (3.48%, n = 4) and *Senna* (2.61%, n = 3). Most (68%, n = 78) of the traditional medicinal plants were collected from the wild and in some cases small herbs and algae were also collected from caves and lakes, respectively. Roots (35.5%, n = 41) were the most frequently used parts followed by leaves (21.74%, n = 25). Most (43%, n = 48) of the medicinal plants identified were trees followed by herbs (37%, n = 46) (Figures 1 and 2).

The traditional healers also collected medicinal plant parts (*Zingiber officinale*, *Trigonella foenum-graecum*, *Allium sativum*, *Trachyspermum ammi*, *Nigella sativa*, *Lepidium sativum* and *Rhamnus prinoides*) from the market since they were not commonly grown in the study area. Fresh was the dominant condition of medicinal preparation (44.35%, n = 51) followed by dry (28.7%, n = 33) and fresh or dry (26%, n = 31). Pounding/crushing, decoction, smoking and unprocessed were common methods of remedy preparation. Most (62.61%, n = 72) remedy were prepared through pounding/crushing followed by smoking (10.43%, n = 12). Most remedies (57.39%, n = 66) had no specific dosage. Coffee cup (30.43%, n = 35) and bottle cup (5.22%, n = 6) were used to determine dose of remedy for patients. Oral application was the highest (50.43%, n = 58) followed by dermal (30.43%, n = 35) (Figure 3). Most (75.65%, n = 87) of the medicinal plant species were also used for other purposes such as fodder, food, fire wood, construction, shade and for making furniture. *Ipomoea kituiensis*, *Withania somnifera* and *Calotropis procera* were effective against snake bite in decreasing order (Table 2). *Acacia oerfota*, *Ziziphus spina-christi*, *Balanites aegyptiaca*, *Acacia tortilis* and *Tamarindus indica* were the most cited multipurpose plants and ranked 1st, 2nd, 3rd, 4th and 5th, respectively. *Ipomoea cicatricosa* and *Tecomaria*

capensis were cited by 26 and 10 traditional healers, respectively (Table 3). Informant Consensus Factor percentage of epidermal infection was the highest (71%) followed by evil eye (57%) (Table 4). *Acacia oerfota*, *Securidace longepedunculata* and *Tecomaria capensis* with fidelity level 100% each were the most useful plants followed by *Diospyros mespiliformis* (83%), *Balanites aegyptiaca* and *Withania somnifera* (80% each), respectively (Table 5). Deforestation, soil erosion, agricultural expansion and drought were major threats of medicinal plants in decreasing order.

DISCUSSION

A Total of 115 medicinal plant species belonging to 97 genera and 47 families were used to treat 59 human and livestock ailments by Kunama in the study area. Since ancient times Kunama have used biological resources as a source of medicine for the control of various ailments affecting humans and their livestock. This demonstrates that Kunama are remarkable in utilizing different species of medicinal plants for treating various human and livestock disease. However, such remarkable knowledge is currently being threatened elsewhere in Ethiopia due to environmental degradation and deforestation (Yirga, 2010a, b, c; Zenebe et al., 2012).

Deforestation, soil erosion, agricultural expansion and drought are threatening the medicinal plants of the study area and the associated knowledge. Documentation of traditional medical knowledge in Ethiopia still remains at minimum level (Teklay et al., 2013) suggesting urgent ethno botanical studies and subsequent conservation measures to conserve resources from further loss (Giday et al., 2003). The indigenous knowledge and the associated plants in Ethiopia are being depleted mainly due to deforestation and environmental degradation which results in loss of some important medicinal plants (Desissa and Binggeli, 2000; Ragunathan and Abay, 2009). Farmers in the study area also use medicinal plants for treating livestock diseases.

This might be due to lack of access to modern veterinarians, price of modern medicines and ethno veterinary traditional medicinal plants are believed to be more efficacious for treatment of livestock ailments than modern medicines (Harun-or-Rashid et al., 2010). Ethno veterinary medicines are also easy to prepare and with very little or no cost to farmers (Jabber et al., 2005).

The majority of medicinal plants were collected from the wild which is consistent with many studies across Ethiopia (Cotton, 1996; Giday, 2001; Giday and Ameni, 2003; Yineger et al., 2008; Bekalo et al., 2009; Yirga, 2010b, c). Medicinal plants were also collected from caves and lakes mainly herbs and algae. This indicates that medicinal plants are collected from different habitats that might be linked with the substrate and mineral composition of the area. The natural forest resource base of Tigray region is over exploited due to human economic

Table 1. List of medicinal plant species used by Kunama (n=47) to treat 59 human and livestock ailments in northern Ethiopia in 2013.

Scientific name	Family	Local name	Habit	Preparation, application and dosage	No of Infor.	Pp	type D.	Cp	Disease treated	Other uses
<i>Acacia abyssinica</i>	Fabaceae	Etera (Ku), Chaae (Tig)	T	The dried or fresh latex of the plant was consumed	3	Lax	Hu	D/F	Constipation	Firewood, Fodder, Fence
<i>Acacia etbaica</i>	Fabaceae	Yorra (Ku), Seraw (Tig)	T	The gum was chewed taking the fluid part every morning until treated	3	Lax	Hu	F/D	Constipation	Fodder, Firewood, Construction
<i>Acacia oerfota</i>	Fabaceae	Gumamma (Ku), Tenkeleba(Tig)	Sh	Crushing, powder was added in to boiled water which contain green stone collected from algae rich lakes and expose the infected eye to the smoke to fumigate	4	B	Hu	D	Eye disease & Saitan	Fence, Firewood, Construction, Charcoal, Fodder
<i>Acacia robusta</i>	Fabaceae	Gujja (Ku)	T	Tiding the fresh or dried root on the neck when symptoms are seen.	3	R	Hu	D/F	Saitan	Firewood, Fodder
<i>Acacia tortilis</i>	Fabaceae	Gegeja (Ku), Gumret(Tig)	Sh	Pounding and drink a cup of the juice. The leaf is pounded and then cover the infected area with it	3	R&L	Hu	F	Snake bite	Fence, Firewood, Charcoal, Construction, Fodder
<i>Acalypha fruticosa</i>	Euphorbiaceae	Timigidda (Ku)	T	Add the leaf in to fire and expose the vagina to the smoke	3	L	Hu	F	Excess menstruation	Fodder
<i>Acokanthera schimperi</i>	Apocynaceae	Mebtie (Tig)	T	Pounding leaf together with dried leaf of <i>Croron macrostachyous</i> and <i>Rumex nevosus</i> and cover the wound area with the thick juice for seven consecutive days.	2	L	Hu&Li	F	Skin wound	Shade, Fodder
<i>Agave sisalana</i>	Agavaceae	Angolaga (Ku), Eka (Tig)	Sh	Chewing the internal (white) part of the root and swallow the solution.	3	R	Hu	F	Diarrhea	Fodder
<i>Ageratum conyzoides</i>	Asteraceae	Gugisha (Ku)	H	Pounding the root, homogenize with water and then wash the vagina thoroughly	3	R	Hu	F	Pain during delivery	Fodder
<i>Allium sativum</i>	Alliaceae	Tsaida shingurti (Tig)	H	Frequent eating of the fresh bulb with injera.	2	Bul.	Hu&Li	F/D	Blood pressure	Food
<i>Amaranthus caudatus</i>	Combretaceae	Akuba shukfa (Ku), Eshok mergem	T	Pounding, homogenize the powder with water and wash the vagina thoroughly or apply a half cup of the solution nasally	3	R	Hu	D	Problem on delivery	-
<i>Anogeissus leiocarpa</i>	Amaranthaceae	Bella (Ku), Hanse (Tig)	H	The root bark is pounding and mix with water and drink 3-cups (<i>One shekina</i>) of the solution	3	R&B	Li	D/F	Antrax	Fodder, firewood, furniture
<i>Asparagus africanus</i>	Asparagaceae	Bechega (ku), Birik (Tig)	Sh	By eating the fresh fruit when it ripens	3	Fr	Hu	F	Heart disease	Food, Fodder
<i>Azandricta indica</i>	Meliaceae	Mimmo (Ku), Nim Humera	T	Crushing, a bottle cup of the solution will be drunked	3	L	Li	F	Diarrhea in hen	Shade

Table 1. cont'd

<i>Balanites aegyptiaca</i>	Zygophyllaceae	Shingella (Ku), Mekie (Tig)	T	Pounding the dried root and apply a finger tip of the powder nasally. Pounding the fresh root, take the juice by filtrating with nylon and drink cup of it in the morning for a week	4	R	Hu	DF	Head ache. Abdominal pain	Food, fire wood , furniture shade, construction
<i>Borassus aethiopum</i>	Arecaceae	Kassikafita (Ku), Laka (Tig)	T	The dried leaf is Pounded together with root of <i>clematis simensis</i> and <i>Sesamum orientale</i> L. and then cream the epidermal part of the skin thoroughly	3	L	Hu	D	Children become too thin, Skin becomes inelastic ("Wealth")	Furniture
<i>Boswellia papyrifera</i>	Capparaceae	Emilla (Ku), Meker (Tig)	T	Add to fire and expose the goat to the smoke. Pounding the root together with <i>Calotropis procera</i> and keep the powder of the mixture in the home.	3	Lax, R	Hu & Li	DD	Goat dizziness. Snake repelling	Firewood
<i>Boscia angustifolia</i>	Capparidaceae	Vinna (Ku), Kermed (Tig)	T	Chewing and taking the liquid part. By tiding the fresh root to back bone part for 7 consecutive days	3	R	Hu	F/D	Diarrhea. Dislocated bone	Fodder, firewood
<i>Boscia mossambicensis</i>	Burseraceae	Jinna (Ku)	T	Pounding, mixed with better and cover the infected area	3	R	Hu	F	External swell of Skin	Fodder, firewood, construction
<i>Brassica rapa</i>	Brassicaceae	Ejella (ku), Hamli adri (Tig)	H	Crushing the dried seed, the fine powder is homogenized with water and drink a cup of this solution.	3	L	Hu	D	Abdominal cramp and Taniea Saginata	Food
<i>Buddleja polystachya</i>	Scrophulariaceae]	Metere(Tig)	T	Add to fire and expose to the smoke	3	AG	Hu	D	Saitan	Fire wood, fodder
<i>Calotropis procera</i>	Apocynaceae	Taffa (Ku), Gindae(Tig)	T	Pounding, juice of the fresh root will be mixed with boiled water, decant and drink 3-cups of the decant for 3 consecutive days. Crushing, and cover the bitten area	3	RL	Hu	F	Consuming of toxic substances. Snake bite	-
<i>Capparis tomentosa</i>	Capparaceae	Wella (Ku), Andel (Tig)	T	Crushing and take the juke and drop it nasally in the morning and evening for two days	3	R	Hu	F	Head ache	Fodder, firewood
<i>Capsicum annuum</i>	Solanaceae	Franga (Ku), Shirba berbere (Tig)	H	Eating the fresh fruit with injera or crush the dried fruit then a powder of this is added with milk and drink	3	F	Hu	D/F	Abdominal, parasite	Food
<i>Carica papaya</i>	Caricaceae	Papaya (Ku,Tig)	T	Firstly, wash the wound by water and soup, crushing the leaf and cover the wound part by that fine powder	2	L	Li	D	wound of Donkey and Camel	Food
<i>Carissa edulis</i>	Apocynaceae	Agam (Tig)	T	Crushing, add the fine powder with appropriate amount of water and give a cup of the solution in the morning	3	F	Hu	D	Constipation	Food, fodder, firewood
<i>Casimiroa edulis</i>	Rutaceae	Assa (ku), Dimma (Tig)	T	Attaching and tiding the root on the back bone part. Cooking the leaf and eat like other edible vegetables	3	RL	Hu	D/F	Back bone pain. Abdominal pain	Food, Fodder, Shade, Furniture

Table 1. cont'd

<i>Chenopodium murale</i>	Ulmaceae	Hamli kebioo (Tig)	T	Pounding the leaf and cover the wound area	3	L	Hu	F	Swelled wound on skin	-
<i>Cissus petiolata</i>	Chenopodiaceae	Ashuga (Ku), Alke (Tig)	H	By tiding the fresh or dry stem on the neck	3	St	Hu & Li	F/D	Saitan	-
<i>Citrus limon</i>	Rutaceae	Lemon (Ku, Tig)	T	Boiling the leaf with water, half cup of the decoction is taken orally in the morning in empty stomach	3	L	Hu	F	Amoebic. Dysentery	Food
<i>Celtis Africana</i>	Vitaceae	Aga (Ku)	C	Crushing together with bark of <i>Boscia angustifolia</i> homogenize with water and drink a bottle cup of the solution for 7 consecutive days in the morning	2	R	Hu	D	Lung disease	Fodder
<i>Clematis hirsute</i>	Ranunculaceae	Koba (Ku)	C	Pounding, drink a cup of the thick solution during bite	3	R	Hu	F	Snake bite	Fodder
<i>Clematis simensis</i>	Ranunculaceae	Tauta (ku)	C	Grinding and giving a finger tip of this nasally	3	R	Hu	F	Malaria	-
<i>Combretum molle</i>	Combretaceae	Semikebeda (ku)	T	Pounding when it is moist, drying, and crushing to make fine powder, then by washing with water and soap cover the wound area with that powder.	3	RB	Li	F	Epidermal, wounds	Fodder, firewood
<i>Corrigiola capensis subsp. Africana</i>	Combretaceae	Dakagella (ku)	T	Crushing the leaf, and drink a cup of the juice for three consecutive days	2	L	Li	F	Lung disease of cattle	Fodder
<i>Combretum collinum</i>	Nyctaginaceae	Babella (Ku) Bissina (Tig)	H	Pounding, the fine powder is baked or cooked with powder of teff " taffa Kitta" or "Kallafa" teff respectively and then eat or drink in the morning in empty stomach	2	B	Hu	D	Tape worm	Firewood
<i>Commicarpus pedunculatus</i>	Boraginaceae	Ezini anchiwa (Tig)	T	By crushing the root and drink a cup (Chilfa) of the juice	2	H	Hu	F/D	Abdominal pain ("Mengena")	-
<i>Cordia Africana</i>	Boraginaceae	Kunjigsha (Ku), Awehi (Tig)	T	By eating the fresh fruit and swallow the seed	3	Fr	Hu	F	Constipation & <i>Taniae saginata</i>	Food, Furniture, construction, firewood
<i>Croton macrostachyus</i>	Euphorbiaceae	Tambok (Tig)	T	Put a piece of the stem in to hot metal, add butter and cream in to the swelled part	3	St	Hu & Li	D	Dermal swelling of cattle and human	Fire wood,
<i>Crotalaria pycnostachya</i>	Solanaceae	Yeman Gedenna (Ku)	H	Crushing the parts, add small amount of water and take the juice and mix with better and cover the wound part	3	AG	Hu	F/D	Danduruf	-
<i>Cucumis dipsaceus</i>	Cucurbitaceae	Sandewo (ku), Hafafilo (Tig)	H	Pounding the root and drink a cup(Chilfa) of the juice. Crushing the root or leaf and apply the powder in the vagina or pens	3	RL	Hu	F	Snake bite Gonorrhoea	Fodder

Table 1. cont'd

<i>Cucumis pustulatus</i>	Cucurbitaceae	Lemin bayta (Tig)	H	Pounding the root, fire through nylon, a cup of the filtered juice is drinking during cramp	3	R	Hu	F	Abdominal cramp	Fodder
<i>Cucurbita pepo</i>	Cucurbitaceae	Jamba (Ku), Duba (Tig)	H	Seed and fruit is added with feces of donkeys, add to fire and expose to the smoke	3	S&Fr	Hu	D	Evil eye	Furniture
<i>Cynoglossum lanceolatum</i>	Boraginaceae	Afeninaa(Ku), Dekik teneg (Tig)	H	Crushing, the fine powder is added in to burned area after washing with water and soap	2	R	Hu	D/F	Fire burn skin	Cultural value (Meskel celebration)
<i>Datura innoxia</i>	Solnaceae	Shartut (Ku), Abisho (Tig)	H	Pounding together with salt and then apply this powder to the pain full area	3	S	Hu	D	Cheek disease	-
<i>Datura stramonium</i>	Solnaceae	Mezerbi(Ku), Mezerbaie (Tig)	H	The seed is put into boiled water stay for awhile and expose the infected cheek to the vapor	2	S	Hu	D	Check disease	-
<i>Dichrostachys cinerea</i>	Ranunculaceae	Sussa(Ku), Gonok (Tig)	H	The latex is added in to fire and expose to the smoke in the morning and evening	2	Lax	Hu	D/F	Saitan	Fodder, firewood
<i>Delphinium dasycaulon</i>	Fabaceae	Merbba (Ku)	H	The root and leaf are pounding together and drink a bottle cup of this juice in the morning.	2	R&L	Hu	F	Diarrhea	-
<i>Desmodium barbatum</i>	Fabaceae	Balengua bereka (Tig, Ku)	T	Crushing and cover the wound area	3	L	Hu	F	Skin wounds	Fodder
<i>Diospyros mespilliformis</i>	Ebenaceae	Fawwa (Ku), Aye (Tig)	T	By eating the fruit	3	F	Hu	D	Constipation	Food, fodder, firewood, construction
<i>Dombeya torrida</i>	Sterculiaceae	Biwak (Tig)	T	Crushed, the fine powder will be applied to the wound area by washing	2	R	Hu	D	Skin Wound	Furniture, construction
<i>Dregea schimperi</i>	Asclepiadaceae	Keleb Gimel (Tig)	C	Crushing, the fine powder is mixed with cooked powder of teff, drink a cup of this in the morning, until he/she recovers	3	R	Hu	D	Internal body swell	Fodder
<i>Echinops Kebericho</i>	Asteraceae	Dendere (Tig)	Sh	Feces of donkey are added with it and add in to fire then expose to the smoke.	2	AG		F/D	Evil eye	Firewood, Fodder
<i>Entada abyssinica</i>	Fabaceae	Sesenaffa (ku)	T	Pounding the root and drink a bottle cup of the juice in the morning	3	R	Hu	F/D	Diarrhea in children	Fodder
<i>Euphorbia tirucalli</i>	Euphorbiaceae	Kenchib (Tig)	T	The fresh latex is mixed with butter and stained the whole part of the penis and heated it for about 5 minutes for 3 days	3	Lax	Hu & Li	F	Male impotency	Fence
<i>Ficus ovate</i>	Fabaceae	Tekili Humera(Tig)	T	Pounding the leaf, adding with root and leaf of <i>Cabotropis procera</i> and cover the infected area	3	L	Hu	F	Snake bite	Shade
<i>Ficus sycomorus</i>	Moraceae	Challa (Ku), Tsekente (Tig)	T	Add stem of <i>Securidaca longipedunculata</i> With its bark, add to fire expose the patient to the smoke in the evening.	3	B	Hu	D	Saitan	Shade, firewood

Table 1. cont'd

<i>Ficus sur</i>	Moraceae	Segella (Ku), sagella (Tig), Sagella (Tig)	T	A ripened fruit fluid is mixed with butter and creamed over the body	3	Fr	Hu	F	Itching	Shade, food
<i>Ficus vasta</i>	Moraceae	Kallecahlla (Ku), Daero (Tig)	T	Crushing the root, add small amount of water and drink a bottle cup in the morning for 7days	3	R	Hu	F/D	Internal swell of abdomen	Food, shade (local meeting)
<i>Indigofera spicata</i>	Fabaceae	Daddata (Ku), Shahshahita (Tig)	H	Crushing the root, the separated juice will be added with better and cream the epidermis in the morning by exposing to the sun	2	R	Hu	F	Dyspesia	-
<i>Ipomoea cicutrice a</i>	Convolvulaceae	Dakabibi	C	Crushing or pounding, mix the fine powder or juice with 3 cup of milk and drink	26	R	Hu	D/F	Teder effect	Fodder
<i>Ipomoea kituensis</i>	Convolvulaceae	Eu-gagagassa kassifilla (Ku)	H	The powder or juice will be homogenized with water and decant then drink a cup of it for 7 days during pain	10	R	Hu	D/F	Internal body swell & snake bite	Fodder
<i>Jacaranda mimosifolia</i>	Bignoniaceae	Chegenne (Ku) chigone (Tig)	T	The root and bark is crushed, apply the fine powder nasally	3	R&B	Hu & Li	D/F	Evil eye	Fire wood, fodder
<i>Jasminum abyssinicum</i>	Oleaceae	Degollo (Ku) Shafferro (Tig.)	T	Cooking the fresh leaf with boiled water followed by eating	3	L	Hu	F	Abominal parasites	Food, fodder, firewood shade
<i>Lactuca sativa</i>	Asteraceae	Seletafa (Ku), Selata (Tig)	H	Add the leaf in to boiled water, wait for awhile and expose the eye to the vapor during sleeping	2	L	Hu	F	Night blindness	Food, Fodder
<i>Lepidium sativum</i>	Brassicaceae	Shinfae (Tig)	H	Grinding the seed, mix the fine powder with honey and eating in the empty stomach	2	S	Hu	D	Diarrhea	-
<i>Leucas martinicensis</i>	Lamiaceae	Shinshino (Ku), Teketater (Tig)	Sh	Fresh leaf is added to boiled water, wait for some time in the fire, then expose the infected eye to the vapor	3	L	Hu	F	Eye disease	-
<i>Lycopersicon esculentum</i>	Solanaceae	Komidera (Ku), Tsebihi Abun (Tig)	H	Crushing the leaf, take the thick juice and drink 4-cups (or a shirffa) of that thick solution	3	L	Li	F	Cattle drinks worm from lakes (Alekiti)	Food, fodder
<i>Malva parviflora</i>	Malvaceae	Shigshiga (Ku), Eshok begie (Tig)	H	Seed and root is mixed with the internal white part of fruit <i>Cucurbita pepo</i> , add to fire and expose the cheek to the smoke until some insects are move out	3	S&R	Hu	D	Cheek infection	Fodder
<i>Maytenus senegalensis</i>	Celastraceae	Argudi (Tig)	T	Pounding the dried root, the fine powder is homogenized with water and drink a cup of the solution.	3	R	Hu	D	Excess menstruation	Firewood
<i>Melia azedaracha</i>	Meliaceae	Mimmo (Ku), Nim (Tig)	T	Pounding and covering of the infected area by the grinded product	3	L	Hu	F	Cheek disease	Shade

Table 1. cont'd

<i>Nicotiana tabacum</i>	Solanaceae	Tinbako (Tig)	H	Pounding the leaf and drink half cup of this thick juice	5	L	Hu	F	Worm drinking with water ("Alekti")	-
<i>Nigella sativa</i>	Ranunculaceae	Tselim Aweseda (Tig)	H	Adding the seed into boiled water, add small amount of sugar to the decoction, cool and drink a tea spoon of the solution during pain	3	S	Hu	D	Children abdominal pain	Food
<i>Ocimum lamifolium</i>	Lamiaceae	Euna-abissa (Ku)	T	Pounding, mix the fine powder with dried meat of hyrax and allow eating	3	R	Hu	F/D	Saitan	-
<i>Otostegia int egrifolia</i>	Lamiaceae	Chiendog (Tig)	Sh	Burning the above ground part by mixing with feces of donkeys and then expose the patient to the smoke	3	AG	Hu & Li	F/D	Evil eye	Fodder, firewood
<i>Parkinsonia aculeate</i>	Fabaceae	Shewit Hagay (Tig)	T	By eating the fresh leaf	3	L	Li	F	Goat disease (locally called "Selim")	Fodder, firewood
<i>Pennisetum villosum</i>	Scrophulariaceae	Ekuna Abissa (Ku) Chera kurkur (Tig)	H	Add the root in to boiled water and expose the infected eye to the vapor	3	R	Hu	F	Eye disease	Fodder
<i>Pentatropis nivalis</i>	Asclepiadace	Amemmeka(ku)	H	Pounding the root drink a tea spoon of the juice in the morning	3	R	Hu	F	Loss of appetite in Children	-
<i>Premna oligotricha</i>	Plumbaginaceae	Sasa (Ku)	C	Pounding, filter the juice through nylon and give a cup of the thick juice nasally for four days and benig in shaded area.	3	L	Li	F	Cattle disease (locally called "Tirfaia")	Fodder, Firewood
<i>Pterolobium stellatum</i>	Fabaceae	kuka (Ku)	Sh	Pounding the root, mix with water and drink a bottle cup of it in the morning.	3	R	Hu	F	To remove retained placenta during delivery	Fodder
<i>Plumbago zeylanica</i>	Lamiaceae	Aftuh (Tig)	Sh	Insert the above ground part to water wait for two days and drink a cup of the concoction.	5	AG	Hu	F/D	Irritative swell in the skin	Fodder
<i>Rhamnus prinoides</i>	Rhamnaceae]	Gesho (Tig)	T	Adding the leaf in to water, stay for awhile and give the drop of this Concoction to the child.	3	L	Hu	D/F	Fever in children	Local alcohol making
<i>Ricinus communis</i>	Polygonaceae	Entura (Ku), Gulei (Tig)	H	Pounding and cover the hairy and skin part of the head with it.	2	S	Hu	F	Dandruf	Injera baking
<i>Rumex abyssinicus</i>	Polygonaceae	Moqmoqo (Tig)	Sh	By adding the root in to boiled water and drink acup of the decoction	3	R	Hu	D/F	TB	Food
<i>Rumex nervosus</i>	Euphorbiaceae	Hehot (Tig)	T	Pounding the apex part of the leaf, mix the fine powder with powder of teff, baked it and eaten	3	L	Li	D/F	Cattle disease locally called "Halafein" in cattle	-Food, Fodder

Table 1. cont'd

<i>Ruta chalepensis</i>	Rutaceae	Chena adam(Tig)	Sh	Pounding the leaf together with <i>Allium sativum</i> followed by smelling	3	L	Hu	F/D	Evil eye	Food
<i>Salvia nilotica</i>	Lamiaceae	Nagesadda (Ku), Cheguri habesha(Tig)	H	Crushing, homogenize with water and drink a cup of the solution	2	R	Hu	D/F	Snake bite	-
<i>Securidaca longepedunculata</i>	Polygalaceae	Tittirra (Ku), Shitora (Tig)	T	Add to fire and expose to the smoke during sleeping	5	R	Hu	F/D	Saitan	-
<i>Senna holosericea</i>	Fabaceae	Betuma kura (Ku)	Sh	By crushing or the root, add small amount of water and drink a cup of this solution in the morning	2	R	Hu	F/D	Lack of blood	-
<i>Senna italic</i>	Fabaceae	Derra (Ku)	Sh	Crushing the dried root and apply a finger tip of the fine powder nasally	3	R	Hu	D	Saitan	Firewood, fodder
<i>Sesamum indicum</i>	Fabaceae	Eshkulubia (Ku)	Sh	Pounding the fresh root, mixed with boiled milk and drink a half cup of it in the morning and afternoon	3	R	Hu	F	Malaria and snake bite	
<i>Sesamum orientale</i>	Pedeliaceae	Akotta (Ku), Selit (Tig)	H	Crushing, mixed with water and cream the skin thoroughly	3	S	Hu	D	Skin allergy	Food, cash crop
<i>Sesbania quadrata</i>	Pedaliaceae	Spania (Tig)	H	Pounding the leaf, drink 5-cups of the juice in the morning. Or By eating the fresh leaf in the morning.	3	L	Li	F	Catte disease locally called "Selim"	Fodder
<i>Sida ovate</i>	Fabaceae	Deki daero (Ku)	H	Crushing the root, the fine powder is mixed with sulfur and bark of <i>Securidaca longipedunculata</i> add to fire and expose to the smoke	3	R	Hu & Li	D	Saitan	Fodder
<i>Senna singueana</i>	Malvaceae	Hambahambo (Tig)	H	Pounding the fresh leaf, drink a 2 cup of the thick juice	2	L	Li	F	Abdominal cramp in Cattle	-
<i>Solanum incanum</i>	Solanaceae	Tauga (Ku), Engulae (Tig)	Sh	Pounding and homogenize with pure water and then drink a cup (Chilfa) of the solution during pain	3	R	Hu	F	Abdominal pain (locally called "Mengena")	-
<i>Solanum tuberosum</i>	Solanaceae	Dorefoger (Ku), Echemaer (Tig)	H	Both the root and leaf are pounded together followed by drinking.	3	R&L	Li	D	Hen disease (Dizziness)	Fodder
<i>Spermacoce sphaerostigma</i>	Rubiaceae	Tinigita (Tig)	H	Pounding the above ground part, homogenize with water the juice and apply it to the bed where he/she sleeps.	3	AG	Hu	F	Saitan	-
<i>Sterculia setigera</i>	Sterculiaceae	Bibilla (Ku), Mesequa (Tig)	T	Pounding, taking the juice and drink one cup of it in each morning for 8 days. Pounding the fresh leaf and cream the infected part	3	RL	Hu	F F	Abdominal discomfort snake bite	Fodder, firewood

Table 1. cont'd

<i>Stereospermum kunthianum</i>	Bignoniaceae	Edidura (Ku), Adigizana (Tig)	T	The breaked area is tiding with the fresh bark for 3 days	3	B	Hu	F	Dislocated back bone	Shade
<i>Striga hermonthica</i>	Scrophulariaceae	Jimmata (Ku) Adiri bereka(Tig)	H	Crushing the leaf, homogenized with water and apply a drop of it nasally for three consecutive days	3	L	Hu	F	Pneumonia	-
<i>Tamarindus indica</i>	Fabaceae	Eilla (Ku) Hummer (Tig)	T	Pounding the fresh seed and mix with appropriate amount of salt and water and drink a cup of it for 7 consecutive days	3	S	Hu	F	Dermal infection (locally called Hamot)	Food, fodder shade
<i>Tecomaria capensis</i>	Bignoniaceae	Gemerro (Ku), Kenteb (Tig)	T	Pounding the fresh root by adding small amount of water, decant and a half cup of the juice will be applied either orally or nasaly	10	R	Hu & Li	F	To remove retained placenta during delivery and snake bite	Fence, fire wood, fodder
<i>Tephrosia bracteolate</i>	Fabaceae		H	Add to boiled water and expose the infected eye to the vapour	3	AG	Hu	F/D	Eye disease	-
<i>Tephrosia gracilipes</i>	Fabaceae	Atotoka (ku)	H	Crushing the dried root, homogenize with water and drink a bottle cup of it in the morning in empty stomach	3	R	Hu	D	Malaria ("Goka")	-
<i>Terminalia brownie</i>	Combretaceae	Merassa (Ku), Sebaea (Tig)	T	Pounding, homogenize with water and decant; drink a bottle cup of the decant in the morning in empty stomach for 4 days	3	B	Hu	F	Malaria	Fodder, firewood, furniture
<i>Thespesia populnea</i>	Malvaceae	Tsenquya (Tig)	T	Wash the head by the internal part of the bark	3	B	Hu	F	Dandruf	Fodder, firewood construction
<i>Trachyspermum ammi</i>	Apiaceae	Azemut (Tig)	H	Seed is mix with <i>Zingiber officinale</i> add to boiled water take a cup of the decoction to drink in the morning and evening	3	S	Hu	D	Loss of appetite	Food
<i>Trichodesma zeylanicum</i>	Fabaceae	Wulad Tauta (Ku)	H	The fresh leaf will be inserted in to boiled water and expose to the smoke in the evening	2	L	Hu	F	Eye disease	-
<i>Trigonella foenum-graecum</i>	Boraginaceae	Abeake (Tig)	H	Add the seed in to boiled water which contain <i>Zingiber officinale</i> , allow to boil for awhile and then drink a cup of the decoction in the morning in empty stomach	2	S	Hu	D	Diarrhea	Food
<i>Verbascum sinaiticum</i>	Scrophulariaceae	Luta (Tig)	H	Adding the fresh or dried leaf in to boiled water and expose the infected eye in to the vapor	2	L	Hu	F/D	eye disease	-
<i>Wissadula rostrata</i>	Malvaceae	E-dadda (Ku)	H	Crushing, drink a cup of the thick solution in the morning in empty stomach	2	R	Hu	F	Stomach ache	-
<i>Withania somnifera</i>	Solanaceae	Sona (Ku), Agol (Tig)	Sh	Crushing, mix the fine powder with pure water and drink a cup of it in the morning and afternoon for four days	5	R	Hu & Li	D	Snake bite	Fodder

Table 1. cont'd

<i>Zingiber officinale</i>	Zingiberaceae	Jinjibile (Tig)	H	chewing the rizome and swallow the liquid part	2	Rh	Hu	D	Abdominal cramp	Food
<i>Ziziphus spina-christi</i>	Rhamnaceae	Asseba (Gaba)	T	Mixed with <i>Acacia oerfota</i> root or bark, pounded together to make powder and mix the fine powder with water and then drink acup of it in the morning in empty stomach	3	R	Hu	D	Abdominal pain	Food, fodder, fence, firewood, construction

*Plant part used (Pp), Condition of the plant (Cp), Disease treated, and preparation and application are listed. Common abbreviations Plant part (Pp; R=root, L=leaf, B=bark, AG=above ground, S=Seed, Fr=fruit, Lax=Latex, Bul. =Bulb, St=Stem, Rh=Rhizome, RB=Root bark), Condition of the plant (Cp; D=Dried, F=Fresh, D/F=Dried or Fresh) and Ailment type (Hu=Human, Li=Livestock). *Type D.= Type of disease. *Ku= Kunama language (Plants not known in Tigrigna language in the area). Tig= plants known in Tigrigna language.

Table 2. Preference ranking of plants used for treating snake bite, by taking seven healers to rank five potential medicinal plants by Kunama ethnic group, Northern Ethiopia in 2013

Scientific name	Respondents (key informants) (R1-R7)							Total	Rank
	R1	R2	R3	R4	R5	R6	R7		
<i>Ipomoea kituiensis</i>	5	5	5	4	5	4	4	32	1st
<i>Withania somnifera</i>	5	2	5	2	4	4	5	27	2nd
<i>Calotropis procera</i>	3	5	4	2	2	4	5	25	3rd
<i>Clematis hirsute</i>	4	2	3	4	4	3	4	24	4th
<i>Sesamum indicum</i>	1	3	4	3	2	4	1	18	5th

Table 3. Informant consensus of medicinal plants by Kunama ethnic group, Northern Ethiopia in 2013 (Plants mentioned by more than 3 informants).

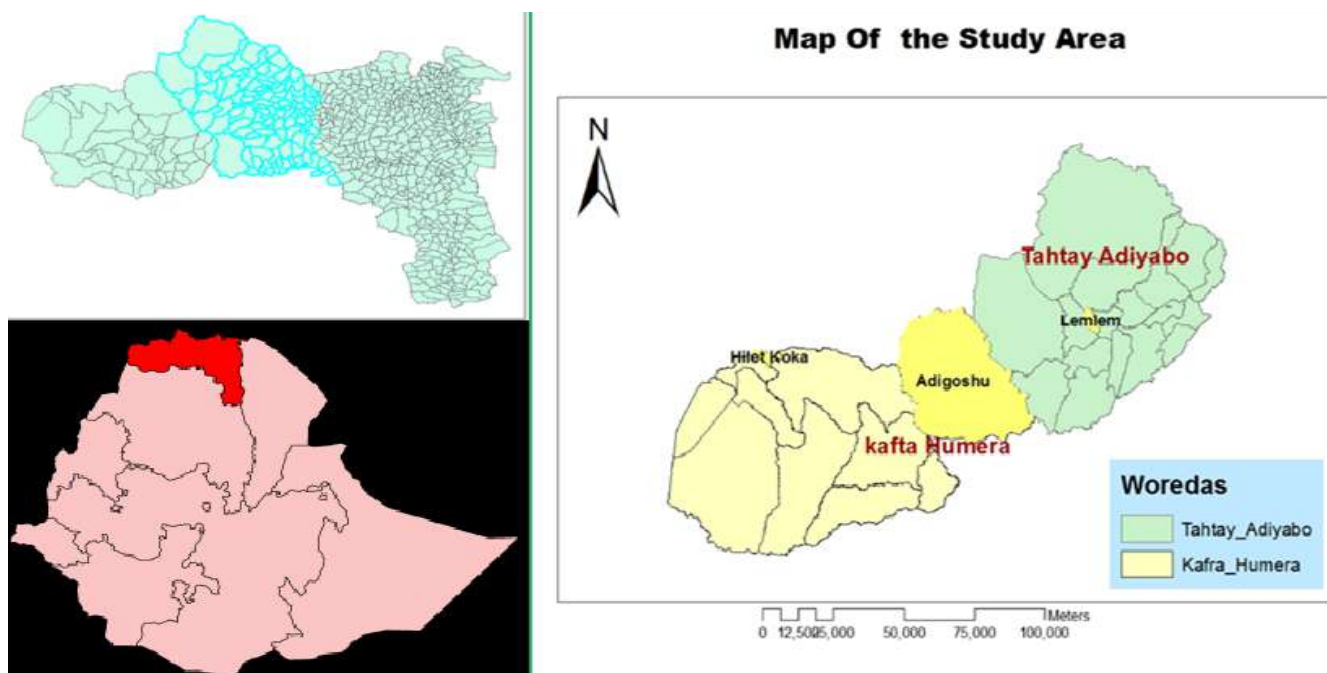
Scientific name	No. of informants	%	Rank
<i>Ipomoea cicatricsa</i>	26	55.32	1st
<i>Tecomaria capensis</i>	10	21.28	2nd
<i>Withania sominifera</i>	5	10.64	3rd
<i>Nicotiana tabacum</i>	5	10.64	3rd
<i>Plumbago zeylanica</i>	5	10.64	3rd
<i>Securidace longepedunculata</i>	5	10.64	3rd
<i>Acacia oerfota</i>	4	8.51	7th
<i>Balanites aegyptiaca</i>	4	8.51	7th

Table 4. Informant consensus factor of most cited disease by Kunama ethnic group, Northern Ethiopia in 2013

Disease type	No of species (nt)	(%) all species	No of informants (nur)	%	ICF	%	Rank
Epidermal infection	11	9.56	36	76.5	0.71	71	1
Evil eye	4	3.48	8	17.02	0.57	57	2
Eye disease	6	5.22	10	21.28	0.44	44	3
Malaria	3	2.61	4	8.51	0.33	33	4
Abdominal disorder	26	22.61	30	0.32	0.14	14	6
Snake bite	6	5.22	8	17.02	0.28	28	5
Saitan	10	8.69	11	0.23	0.1	10	7

Table 5. Fidelity level of medicinal plants in Kunama ethnic group, Northern Ethiopia in 2013

Medicinal plant	Alignment category	lp	lu	FL	%	Rank
<i>Acacia oerfota</i>	Saitan	6	6	1.00	100	1st
<i>Balanites aegyptiaca</i>	Digestive system	4	5	0.80	80	3rd
<i>Diospyros mespiliformis</i>	Digestive system	5	6	0.83	83	2nd
<i>Plumbago zeylanica</i>	Epidermal infection	3	4	0.75	75	4th
<i>Securidace longepedunculata</i>	Saitan	5	5	1.00	100	1st
<i>Tecomaria capensis</i>	Delivery problems	10	10	1.00	100	1st
<i>Withania somnifera</i>	Snake bite	4	5	0.80	80	3rd
<i>Calotropis procera</i>	Snake bite	3	4	0.75	75	4th

**Figure 1.** Map of Ethiopia showing the location of Tigray and map of Tigray showing the location of the study sites.

activities and population pressure (Nyssen et al., 2004) and covers about 0.2% of the total area (Tesfay, 2006). Anthropogenic and natural factors such as drought cause many of the medicinal plants to be rarely encountered.

The practice of cultivating medicinal plants is quite limited in the area and across Ethiopia (Giday, 2001; Yiniger et al., 2008; Abdurhman, 2010). Measuring units such as coffee cup, bottle cup, tea spoon, drops and fingers were

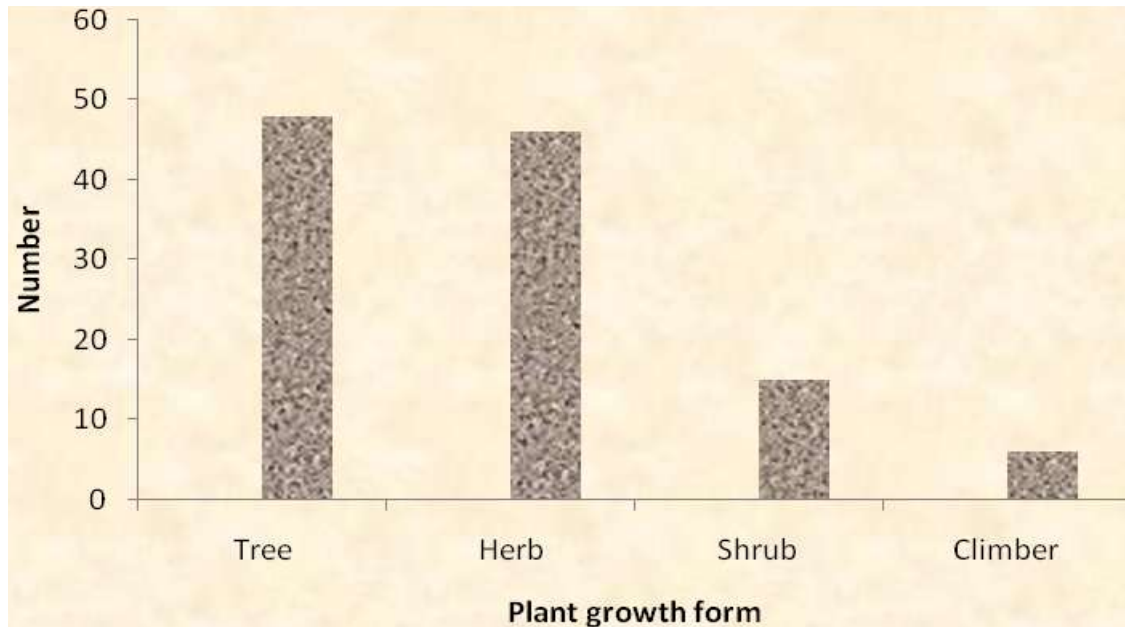


Figure 2. Growth forms of medicinal plants (n=115) used by Kunama ethnic group, Northern Ethiopia in 2013

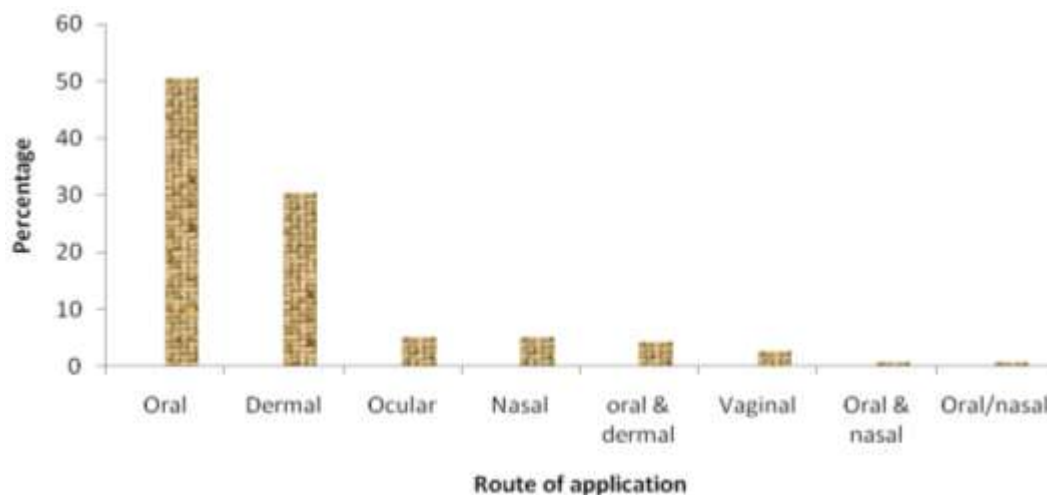


Figure 3. Route of remedy application by Kunama ethnic group, Northern Ethiopia in 2013

used for dose determination. Lack of standardization and precision of preparations are drawbacks of traditional health care system elsewhere (Getahun, 1976). Root was the most used plant part in the preparation of remedies in the area compared to other parts and this is consistent with many studies in the country (Lulekal et al., 2008; Mesfin et al., 2009; Birhane et al., 2011). In contrast to this other studies conducted elsewhere in Ethiopia reported the dominance of leaves in the preparation of remedies (Giday and Ameni, 2003; Bekalo et al., 2009; Yirga, 2010b; Abebe and Hagos, 1991). Frequently harvesting of roots causes death of the medicinal plant.

Fresh was the dominant condition of medicinal preparation in the study area. The frequent use of fresh materials might be important to reduce loss of volatile oils, the concentration of which could deteriorate on drying (Giday et al., 2009). *A. oerfota*, *S. longepedunculata* and *T. capensis* had highest fidelity level values suggesting good healing potential of the plants. Plants that are used in a repetitive fashion are more likely to be biologically active (Trotter and Logan, 1986). Kunama are rich in medicinal plant species and the associated indigenous knowledge. Future studies should focus on phytochemical extraction of herbal drugs

for their efficacy and possible toxicity.

ACKNOWLEDGMENTS

We greatly acknowledge Mekelle University for financial support and the National Herbarium at Addis Ababa University for plant specimen identification. We thank Mr. Solomon Walu, Mr. Teklay Gebrekidan, Mr. Nigusse Gebre and Mr. Bahire Jaifar for field assistant. We acknowledge the informants, administrative, health, agriculture, plan and finance offices of the study area.

Conflict of interest

Authors have none to declare.

REFERENCES

- Abebe D, Hagos E (1991). Plants as a primary source of drugs in the traditional health practices of Ethiopia. In *Plant Genetic resources of Ethiopia*. Edited by Engles JMM, Hawkes JG, Worede M. Cambridge University Press, Cambridge pp. 101-113.
- Abdurhman N (2010). Ethnobotanical study of medicinal plants used by local people in Ofra Wereda, Southern Zone of Tigray Region. Ethiopia. M.Sc. Thesis. Addis Ababa University, Addis Ababa, Ethiopia.
- Awas T (2007). Plant diversity in Western Ethiopia: Ecology, Ethnobotany and Conservation. Department of biology, Faculty of Mathematics and Natural Sciences, University of Oslo, Norway.
- Balick MJ, Cox PA (1996). *Plants People and Culture. The science of ethnobotany*. Scientific American Library, New York, USA.
- Barboza GE, Cantero JJ, Núñez C, Pacciaroni A, Espinar LA (2009). Medicinal plants: A general review and a phytochemical and ethnopharmacological screening of the native Argentine Flora. *Kurtziana* 34:1-2.
- Bekalo HT, Demissew S, Asfaw Z (2009). An ethnobotanical study of medicinal plants used by local people in the lowlands of Konta Special Wereda, Southern Nations, Nationalities and Peoples Regional State, Ethiopia. *J. Ethnobiol. Ethnomed.* 5:26.
- Birhane E, Aynekulu E, Mekuria W, Endale D (2011). Management, use and ecology of medicinal plants in the degraded dry lands of Tigray, Northern Ethiopia. *J. Med. Plants Res.* 5:309-318.
- Bisset N (1994). *Herbal drugs and phytopharmaceuticals. A handbook for practice on a scientific basis* Ed. Medpharm. Sc. Publishers, Stuttgarts-CRC Press, Boca Raton.
- Cotton CM (1996). *Ethnobotany: Principles and Applications*. Chichester, England: John Wiley and Sons Ltd.
- Cultural Orientation Resource center (COR) (2007). *The Kunama. Center refugee backgrounder*.
- Cunningham A (1993). African medicinal plants: setting priorities at the interface between conservation and primary health care. *People and Plants working paper 1*, Paris: UNESCO.
- Dawit A (2001). The Role of Medicinal Plants in Healthcare Coverage of Ethiopia, the possible integration. In: Medhin Zewdu and Abebe Demise, (eds.). *Proceeding of the National workshop on Biodiversity Conservation and Sustainable Use of Medicinal Plants in Ethiopia*, 28 April- 1 May 1999. IBCR, Addis Ababa pp. 6-21.
- Desissa D, Binggeli P (2000). Uses and conservation status of medicinal plants used by the Shinasha people.
- Fosse T (2006). *Migration and Livelihoods - The Voluntary Resettlement Program in Ethiopia*. Msc. thesis, Norwegin.
- Getahun A (1976). Some common medicinal and poisonous plants used in Ethiopian folk medicine.
- Giday M, Asfaw Z, Elmquist T, Woldu Z (2003). An ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. *J Ethnopharmacol.* 85(1):43-52.
- Giday M, Ameni G (2003). An Ethnobotanical Survey on plants of veterinary importance in two weredas of Southern Tigray, Northern Ethiopia. *SINET: Ethiop. J. Sci.* 26:123-136.
- Giday M, Asfaw Z, Woldu Z, Teklehaymanot T (2009). Medicinal plant knowledge of the Bench ethnic group of Ethiopia: an ethnobotanical investigation. *J. Ethnobiol. Ethnomed.* 5:34.
- Hamayun MS, Khan A, Kim HY, Leechae IJ (2006). Traditional knowledge and *ex-situ* conservation of some threatened medicinal Plants of Swat Kohistan. *Pak. J. Bot.* 38:205-209.
- Harun-or-Rashid MD, Tanzin R, Ghosh KC, Jahan R, Khatun A, Rahmatullah M (2010). An ethnoveterinary survey of medicinal plants used to treat cattle diseases in Birishiri area, Netrakona District, Bangladesh. *Adv. Natl. Appl. Sci.* 4:10-13.
- Health Office of Kafta Humera District (HOKHD) (2013). Humera, Tigray National Regional State, Ethiopia.
- Health Office of Tahitay Adiyabo. HOTAD. (2013). Shiraro, Tigray National Regional State, Ethiopia.
- Heinrich M, Ankli A, Frei B, Weimann C, Sticher O (1998). Medicinal plants in Mexico: Healer's Consensus and Cultural Importance. *Soc. Sci. Med.* 47:1863-1875.
- Jabber A, Akhtar MS, Muhammad G, Lateef M (2005). Possible role of ethnoveterinary medicine in poverty reduction in Pakistan: Use of botanical Anthelmintics as an example. *J. Agric. Soc. Sci.* 1:187-195.
- Konno B (2004). Integration of traditional medicine with modern medicine. EHNRI, Addis Ababa, Ethiopia pp. 3-9.
- Luiz W, Barbosa R (2012). *Selecting Medicinal Plants for Development of Phytomedicine and Use in Primary Health Care* pp. 1-72.
- Lulekal E, Kelbessa E, Bekele T, Yineger H (2008). An ethnobotanical study of medicinal plants in Mana Angetu District, south-eastern Ethiopia. *J. Ethnobiol. Ethnomed.* 4:10.
- Martin G (1995). *Ethnobotany: A Method Manual*. Chapman and Hall, London pp. 1-251.
- Mesfin F, Demissew S, Teklehaymanot T (2009). An ethnobotanical study of medicinal plants in Wonago Woreda, SNNPR, Ethiopia. *J. Ethnobiol. Ethnomed.* 5:28.
- Nyssen J, Poesen J, Moeyersons J, Deckers J, Mitiku H, Lang A (2004). Human impact on the environment in the Ethiopian and Eritrean highlands –a state of the art. *Earth Sin. Rev.* 64:273-320.
- Plan and finance office of Kafta Humera District (PFOKHD) (2013). Humera, Tigray National Regional State.
- Plan and finance office of Tahitay Adiyabo District (PFOTAD) (2013). Shiraro, Tigray National Regional State.
- Ragunathan M, Abay SM (2009). Ethnomedicinal survey of folk drugs used in Bahirdar Zuria District, Northwestern Ethiopia. *Indian J. Tradit. Knowl.* 8:281-284.
- Raskin I, Ribnick DM, Komarnytsky S, Ilic N, Poulev A, Borisjuk N, Brinker A, Moreno DA, Ripoll C, Yakoby N, O'neal JM, Cornwell T, Pastor I, Fridlender B (2002). Plants and human health in the twenty-first century. *Trends Biotechnol.* 20:522-531.
- Refugees International (2004). *Forgotten People: The Kunama of Eritrea and Ethiopia*. Available at: <http://reliefweb.int/report/eritrea/forgotten-people-kunama-eritrea-and-ethiopia>
- Teklay A, Abera B, Giday M (2013). An ethnobotanical study of medicinal plants used in Kiile Awulaelo District, Tigray Region of Ethiopia. *J. Ethnobiol. Ethnomed.* 9:65.
- Tesfay G (2006). *Agricultural resources management and institutions: A social economic analysis of households in Tigray, Ethiopia*. Tropical resource management. Papers No 88. Wageningen University and Research, The Netherlands.
- Trotter RT, Logan MH (1986). Informants consensus: a new approach for identifying potentially effective medicinal plants. In: *Plants in Indigenous Medicine and Diet*. Edited by Etkin NL. New York: Redgrave Publishing Company, Bedford Hill pp. 91-112.
- World Health Organization (WHO) (2001). *Legal Status of Traditional Medicine and Complementary/Alternative Medicine: A World Wide Review*, Geneva.
- Yineger H, Yewhalaw D, Teketay D (2008). Ethnomedicinal plant knowledge and practice of the Oromo ethnic group in south-western Ethiopia. *J. Ethnobiol. Ethnomed.* 4:10.

- Yirga G (2010a). Ethnobotanical study of medicinal plants in and around Alamata, Southern Tigray, Northern Ethiopia. *Curr. Res. J. Biol. Sci* 5:338-344.
- Yirga G (2010b). Assessment of indigenous knowledge of medicinal plants in Central Zone of Tigray, Northern Ethiopia. *Afr. J. Plant Sci.* 4:6-11.
- Yirga G (2010c). Assessment of traditional medicinal plants in Endrta District, South-eastern Tigray, Northern Ethiopia. *Afr. J. Plant Sci.* 4:255-260.
- Yosef AB (2012). Carbon Stock Potentials of woodlands and land use and land Cover changes in north western lowlands of Ethiopia. Msc Thesis. Hawassa University, Wondo Genet College of Forestry and Natural Resources, Wondo Genet, Ethiopia.
- Zenebe G, Zerihun M, Solomon Z (2012). An Ethnobotanical study of medicinal plants in Asgede Tsimbila District, Northwestern Tigray, Northern Ethiopia. *Ethnobot. Res. Appl.* 10:305-320.