Ethnobotanical Study in and around Sirso Natural Forest of Melokoza District, Gamo Goffa Zone, Southern Ethiopia

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Research

Abstract

Background: Melokoza district has many ethnic groups and has a long tradition of using wild plants as a means of livelihood. However, communities' knowledge associated to plants is not fully studied. Hence, this study was conducted to document plant-based indigenous knowledge of the people in order to preserve the tapering off indigenous plant species and their associated traditional knowledge.

Methods: Ethnobotanical data were collected through semi-structured interviews, focus group discussion and guided field walk. A total of 72 informants were selected from four sampled Kebeles (the lowest administrative unit in Ethiopia) using stratified random sampling. Additional 24 key informants were selected purposively for exhaustive discussion. Preference ranking, paired comparison, direct matrix ranking, and informant consensus factor were calculated. Statistical tests were performed to compare the indigenous knowledge of the local communities on plants uses among different informant categories.

Results: A total of 135 plant species distributed in 116 genera and 52 families were recorded. Among flowering families Asteraceae was the most dominant family (15 species), followed by Lamiaceae (12 species). Of the total species, 92 plant species were recorded as medicinal to cure 39 human and livestock ailments. Fresh leaves were the most frequently reported plant parts (36), followed by roots (27). The highest ICF value (0.91) was computed for parasite infections disease categories. *Vepris dainellii* and *Embelia schimperi* were the most popular medicinal plants with high informant consensus cited by 51 (71%) and 48 (67%) informants respectively. *Cordia africana* and *Croton macrostachyus* were shown to be the top multipurpose and the most utilized plant species in the study area. Significant difference at (P =0.003) was observed on the mean number of plant species stated by groups of respondents compared within gender and age on traditional use of plant species for different purposes. Elder people and traditional healers of the area possess vast knowledge on plant use and ethnomedicinal practices in comparison with the young generation and have a positive correlation relationship (r=0.507) between the age and their traditional medicinal knowledge. Vast knowledge on traditional uses of plant species conveyed from one generation to the next one by the word of mouth and the knowledge transfer system is quite restricted within the family members.

Conclusions: The study revealed that Sirso natural forest of the district is a home for high diversity of plant species and associated indigenous knowledge. However, preservation efforts of the community are meager to assure survival of plant species and indigenous knowledge in the area. Thus, awareness creation to the youth and training

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to the healers is highly recommended to prevent the loss of plant species with their associated indigenous knowledge.

Keywords: Ethnobotany, Indigenous knowledge, medicinal plants, Sirso natural forest

Background

Ethnobotany is the study of how people of a particular culture and religion make use of indigenous plants. From the beginning of humanity, indigenous people have developed their own local specific knowledge on plant use, management, and conservation (Cotton1996). Ethnobotanical studies are useful in documenting, analyzing, and communicating knowledge and interaction between biodiversity and human society (Balick& Cox 1996). The study of ethnobotany plays a vital role because of the direct contact that can be established with the authentic information on the uses of plants both wild and cultivated. These plants are used for purposes of food, fodder, medicine, clothing, shelter, agricultural implements, hunting, narcotics, poison, gums, dyes, energy, fiber, profits generation and the demand of cultural and spiritual needs throughout the world (Asfaw 2013). Specifically, the life of indigenous peoples in developing countries is to date depends on plants (Balick& Cox 1996, Sophia 2005). In common with other developing countries, most indigenous people in Ethiopia are also depending on plants for their livelihood (Kassaye *et al.* 2006).

Ethiopia is endowed with a diversified topography and climate favorable for diversified vegetation types (Friis *et al.* 2010). The country is well known for its significant geographical diversity and ecological zones that favors the formation of different habitats. Apart from the plant diversity, Ethiopia is also home for many languages, cultures, and beliefs which in turn have contributed to the diversity of traditional knowledge and practices of the people (Limenih *et al.* 2015). Due to this, in Ethiopia there is a long history of using plants to treat different human and livestock ailments, construction materials and as wild food (Mesfin *et al.* 2014).

Although there are some ethnobotanical studies that have been conducted in different parts of Ethiopia, they are still not inclusive when compared with the existence of the multitude of different ethnic groups and their associated traditional knowledge on plants uses (Enyew *et al.* 2014). Despite the role the wild edible plants play in combating food insecurity, the ethnobotanical research conducted so far in Ethiopia addressed only 5% of the country (Lulekal *et al.* 2011) and these are also confined to central and highland regions of Ethiopia. Southern Ethiopia, particularly Melokoza District of Gamo Goffa zone has large ethnic and cultural diversities and the knowledge and use of plant species for different purposes is an integral part of that many ethnic rural cultures. Yet, there are research gaps on documentation of indigenous knowledge acquired by the local people and, their utilization in and around the natural forest. Besides, since Melokoza is one of the remote districts with infrastructure problem, it has been one of the least visited areas in the zone for scientific study (Denu and Desissa 2013). Thus, this study was initiated to fill the gap in the documentation of plant species which are used for different purpose associated with their indigenous knowledge in Melokoza District which situated in Gamo Goffa zone of Southwestern Ethiopia.

Materials and Method

Description of Study Area

The study was conducted in and around Sirso Forest, located in Melokoza District in the Gamo Goffa zone of Southern Nations Nationalities and Peoples Regional State (SNNPRs) (Figure 1). The study area falls within 6º 18' to 6º 42' North latitude and 36º 00' to 37º 00' East longitude. The elevation ranges from 700 m to 3200 meters above sea level. According to Denu & Desissa (2013), the area gets rain for nine months, with annual average of 1100 -1300 mm. The average annual temperature of the study area is 22^0C. The vegetation of the study area comprised of woodland mixed with highland bamboo and moist forest in the higher altitude. Sirso natural forest is the biggest one in area coverage (3501.49 ha) among other forest areas in the District. There exist eight (8) small administrative units, locally called Kebeles adjacent to Sirso natural forest namely Laha, Gergeda, Mashira, Dawla, Tafa, Pircha, Mayzelo and Tata. There are five ethnic groups in the study area: the Goffa (49.75%), the Melo (24.74%), the Basketo (21.9%), the Amhara (1.99%), and the Dime (0.75%); all other ethnic groups constitute 0.87% of the population.

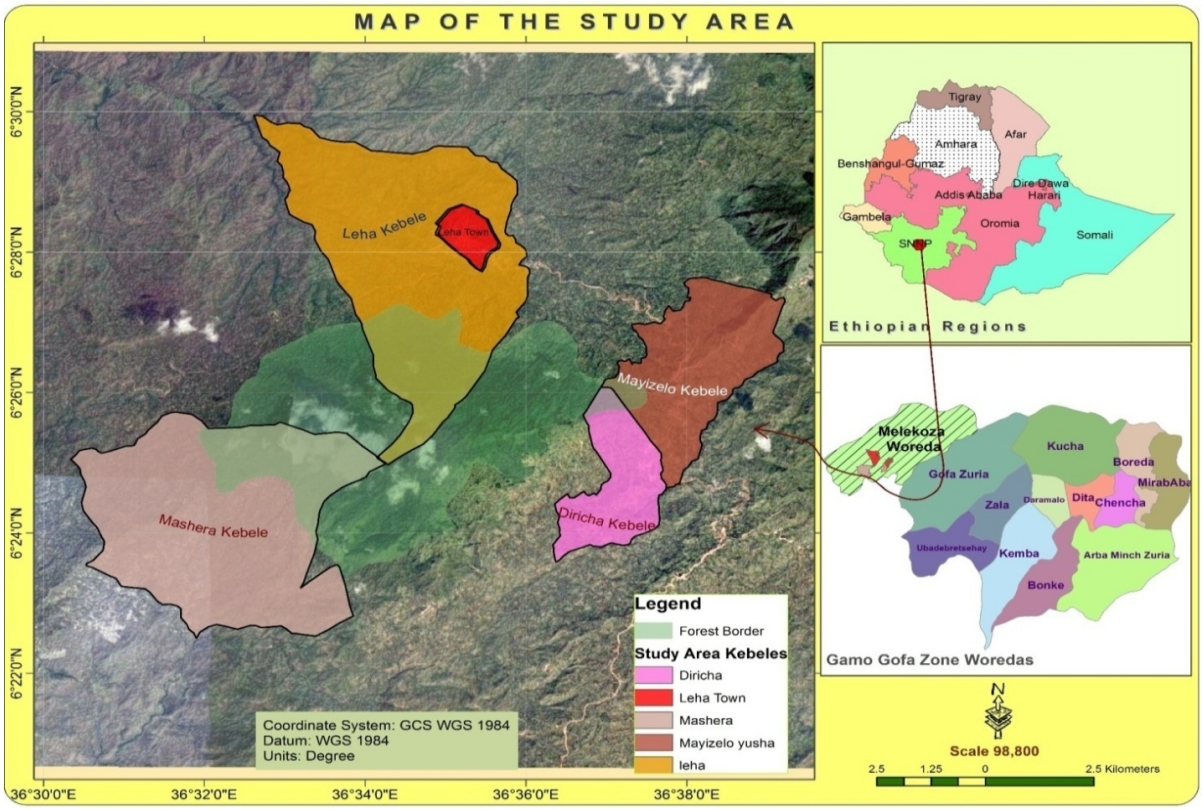

Figure 1. Map of the Study area showing with respect to Gamo Gofa Zone, SNNPR of Ethiopia

Site Selection

Among the five (5) demarcated natural forests in the Melokoza District, Sirso natural forest was selected purposively based on the total area coverage (which was the biggest one) and ease of accessibility. Then the eight (8) adjacent Kebeles were stratified in to three altitudinal zones based on relative altitudinal differences, in consultation with development agents (DAs) and district environmental protection experts. Accordingly, four representative Kebeles namely Mashira from the lower side of the forest, Laha and Pircha from middle range but opposite sides of the forest, and Mayzelo from the upper side of the forest were randomly selected from eight adjacent Kebeles.

Informant Sampling

The household respondents from each sampled kebeles were selected using stratified random sampling methods. Hence, ages and gender were important criteria in ethnobotanical knowledge difference by which informants were grouped, to evaluate their knowledge difference on plant utilization and capabilities in maintaining and transferring the knowledge to the young generations and, also to have a representative sample from the sampled kebeles. Thus, the household from each sampled kebeles were stratified in to male and female household. Similarly, based on the information from local elders and kebele administrator up on the criteria for age group categorization, the household of respondents from both gender groups were further stratified into three age classes: Youth (young aged (18-35)) years old, Adult (middle aged (36-60)) years old and elders (above 60 years old) using the lists of the inhabitants at each kebeles and by the help of Kebele administration. Then, 96 informants (69 males and 27 females) were selected from four sampled Kebeles using purposive and stratified random sampling methods. Among the 96 informants, 24 were key informants (KIs) selected purposively with the help of the Kebele administrators and DAs as recommended by Martin (1995). The remaining 72 informants (constituting 5% of the total population in the four studied Kebeles) were selected randomly from the four (4) Kebeles. Additionally, six to eight informants who were already taking part in the in-depth individual interviews selected/participated for focus group discussion (FGD) that was held in each Kebele.

Data Collection

Reconnaissance survey was conducted in December 2017 in the study area to get the general impression of the biophysical and accessibility of the natural forest of the study area, and on the traditional systems including the interaction of communities with the forest. Ethnobotanical data collection was conducted following the formal survey procedure as described in Cotton (1996) and Cunningham (2001). Accordingly, semi-structured interviews,

in-depth interviews with traditional healers, FGD and guided field walks were employed as the major sources of primary data. Four independent FGD were carried out from the four sample Kebeles to gain further information on plant use knowledge and to prove the reliability of the data collected through semi-structured interviews (Martin 1995). Guided field walk was done with one District biodiversity expert and two key informants who were volunteers to give more explanation about the plant species and their respective uses in the field.

Voucher specimens and necessary information were collected with the help of key informants and the district expert. The specimens were properly pressed, numbered, dried, identified, and labeled using plant press materials. Identification of specimen was performed with the help of a taxonomist at National Herbarium (ETH) of Addis Ababa University and the Ethiopian Biodiversity Institute (EBI)comparing them with already identified specimens, with the help of taxonomic experts, and using taxonomic keys; the volumes of the Flora of Ethiopia and Eritrea (FEE, 1989-2009). The specimens were deposited at both the herbaria of AAU and that of EBI.

Data Analysis

Ethnobotanical data were analyzed following survey and analytical tools for ethnobotanical methods as recommended by Martin (1995) and Cotton (1996) Values or scores given by key informants on use-preference and use-diversity of plant species were added and ranked using preference ranking and direct matrix ranking exercises, respectively. Paired comparison was performed to evaluate the levels of importance of certain selected plants following Nemarundwe and Richards (2002). The number of pairs to be compared was calculated by the formula, n (n-1)/2, where n is the number of items as described by Martin (1995). Informant consensus factor (ICF) was computed after the reported traditional remedies and corresponding diseases were grouped into 12 categories. ICF was calculated following Heinerich *et al.* (1998) as:

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

Where: n_{ur} is number of use citations in each disease category while n_t is the number of times a species used.

Traditional knowledge dynamics on use of plants by men and women, young (18-35) to middle-aged (35-60 years) and elderly (above 60 years) was compared using independent t-test and general linear model (GLM) at 95% confidence level between means of list of plant species., Pearson correlation model was also used to analyze the relationship of the number of plants mentioned as traditionally used with the age of informants. Descriptive statistics were also applied to identify the number and percentage of species, genera and families of medicinal plants used, their growth forms, proportions of parts harvested, modes of remedy preparation and routes of administration.

Results

Demographic Characteristics of the Informants

In this study, male respondents were dominant which accounted 69 (72%). With respect to age class distribution, the highest number of informants were in the age group of 36 - 60 years old 38 (40%), followed by above 60-year-old informants 35 (36 %). The least and highest age were 20 and 94 years respectively. Regarding to educational status, about 59 (61 %) were found to be unable to read and write, 14 (15%) can read and write whereas 23 (24%) had formal education (Table 1).

Diversity of Plant Species

In this study, 135 plant species that belong to 116 genera and 52 families were recorded from Sirso natural forest and its surroundings (Appendix 1). In terms of family distribution, Asteraceae stood first contributing with15 species, followed by Lamiaceae, which was represented by 12 species, and Fabaceae and Euphorbiaceae each, by 9 species. Considering the growth habit of plant species, shrubs were the most dominant (35.29%) followed by herbs (28.68%) and trees (27.21%). Climbers and Hemi parasites species were accounted the least number (7.35%) and (1.47%) respectively (Figure 2).

Use of Plants by the Local Community

Local people in the study area have diverse and huge knowledge on traditional uses of plants for their life system. Plant species that recorded in and around Sirso natural forest provides several services to the local communities including as a source medicine, spice, wild food and fodder, construction, furniture, firewood, charcoal and household utensils and also as a home for diverse wildlife.

Table 1. Demographic characteristics of informant in the study area

Variable	Category	Frequency	Percent (%)
Age	18-35	23	24
	36-60	38	40
	>60	35	36
Gender	Male	69	72
	Female	27	28
Educational level	Cannot read & write	59	61
	Can read & write	14	15
	Primary school	20	21
	Secondary school	3	3
Marital status	Married	75	78
	Single	7	7
	Widowed	11	11
	Divorced	3	3
Occupation	Farmer	70	73
	Housewife	18	19
	Students	6	6
	Joiner	1	1
	Military	1	1
Ethnic group	Goffa	65	68
	Basketo	19	20
	Melo	10	10
	Amhara	2	2

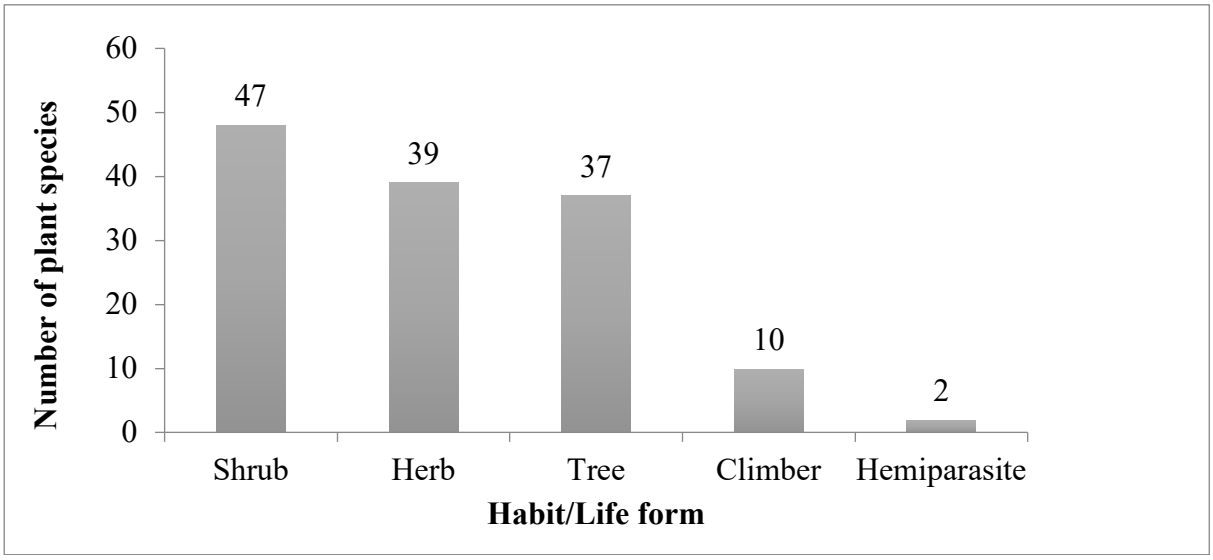

Figure 2. Distribution of recorded plant species by plant habits in the study area.

Medicinal uses

Among 135 plant species recorded in the current study, 92 (68%) of them were mentioned as traditional medicine plants used for treatment of different human and livestock aliments. Majority of these medicinal plants (88%) identified in the study area are wild while 11.96% of the species are cultivated in home garden, farmland and as life fence. The growth form analysis of medicinal plants in this study also showed that shrubs made up the highest proportion (40.22%) followed by herbs (35.87%).

In the study area 39 traditionally known human (25) and livestock (14) ailments were mentioned being treated through traditional medicine prepared from plant species identified in the study area. Sixty-two medicinal plants were traditionally used to treat only human ailments, 17 were used to treat only livestock ailments, and 13 were used to treat both human and livestock ailments.

Plant Parts Uses

Leave (36%) were the most widely reported plant part followed by roots (27%). The mixture of leaves and roots constitutes 7% (Figure 3). About 66.67% of medicinal plant parts were mentioned being prepared in freshly

harvested whereas 22.62% were prepared using both fresh and dry parts. Only 10.71% of the medicinal plants were stated to be prepared in dry form.

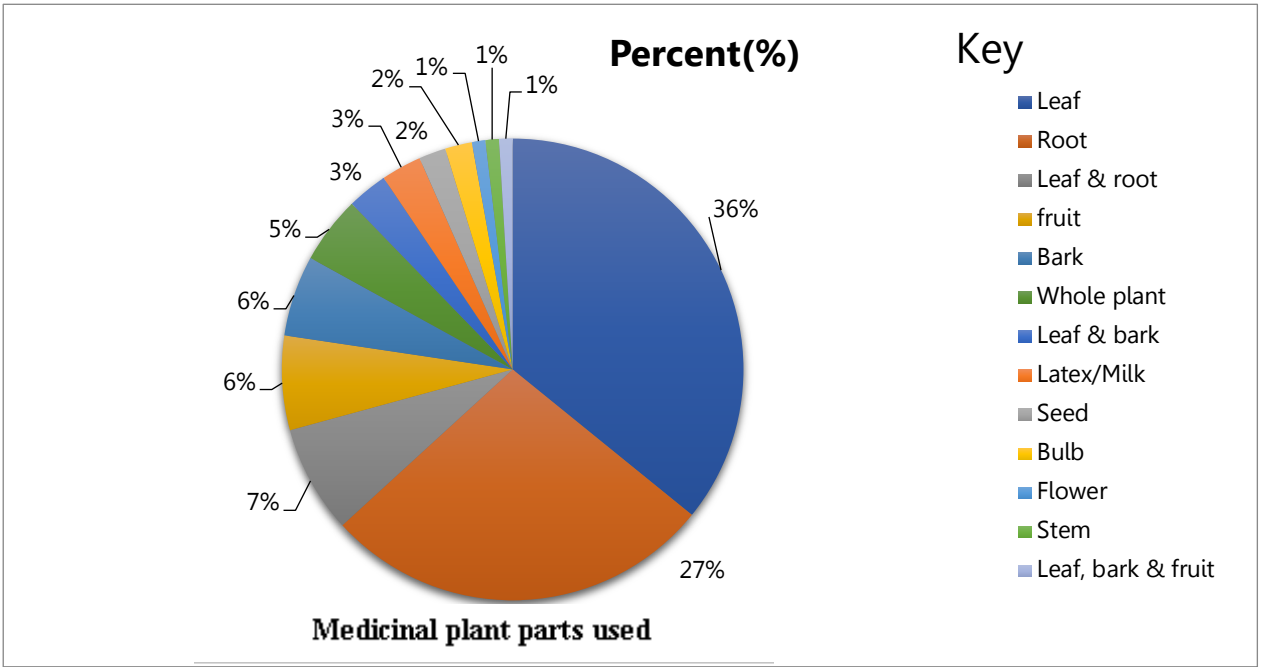

Figure 3. Proportion of plant parts used for preparation of traditional medicine

Mode of preparation and application of prepared remedies

The local community for different types of ailments reported various methods of preparation of traditional medicine. According to their explanation, the variation depends on the type of disease to be treated and the mode of application. Accordingly, the most frequently reported preparation method was pounding (25%) followed by crushing (20.48%) and squeezing (13.25%). As indicted in Table 2, the dominant route of administration was oral (49.13%) followed by dermal (21.97%).

Table 2. Route of administration of traditional medicine in the study area

Route Administration	Frequency	Percentage (%)	Type of application	Frequency	Percentage (%)
Oral	85	49.13	Drinking	60	34.68
			Eating	9	5.20
			Swallow	9	5.20
			Dropping	5	2.89
			Chewing & holding	2	1.16
Dermal	38	21.97	Creamed /Ointments	23	13.29
			Washing/ Bathing	6	3.47
			Brushing	4	2.31
			Spraying	3	1.73
			Putting on & tied	2	1.16
Oral & Nasal	16	9.25	_	16	9.25
Oral & Dermal	13	7.51	_	13	7.51
Nasal	11	6.36	Dropping	5	2.89
			Smoking	4	2.31
			Sniffing	2	1.16
Nasal & Dermal	7	4.05	_	7	4.05
Others	3	1.73	Fumigating of house	3	1.73

Dosage of the remedy to be administered varied based on the diseases to be treated, age of the patients and the practitioners who treated the disease. There was also variation on duration, and time at which remedies to be taken and prescribed by healers for the same kind of health problems. Local people reported different materials in determining the dosage that adopt in the study area such as a coffee cup, a teacup, a glass and a halo/ shorika which is a traditional coffee drinking material made from small gourd fruit (*Lagenaria ciseraria* (Molina) Standl.). In addition, the size, number of plant parts and droplets of medicine were measured using finger to determine the dosage of prepared medicine. Until recovery from the disease, disappearance of the symptoms of the diseases, vanishing out of the disease sign and judgment of the healer to stop the treatment were some of the criteria used in determining duration in the administration of the dosage.

Efficacy of medicinal plants

The informant consensus factor (ICF) of medicinal plant usage per illness category was calculated. The result showed that parasite infections (helminthes diseases) scored the highest (0.91) followed by dermatological problems and febrile illness each having score an ICF of 0.86 (Table 3).

Table 3. Informant consensus factor by categories of diseases in the study area

Disease category	No of plant species	Number of use citations (N_{ur})	ICF
Gastrointestinal disorder (Abdominal pain, internal swelling, stomachache, diarrhea, vomiting, "**Maresha**")	31	124	0.76
Parasitic infection/ helminthes (tapeworm, ascariasis and hook worm)	8	76	0.91
Dermatological problems (Itching, wound, wart)	7	43	0.86
Febrile illness (Headache, Malaria)	14	97	0.86
Rheumatism and stabbing pain,	10	41	0.78
Evil eye and evil spirit,	13	38	0.68
Snake bite	8	22	0.67
Throat and respiratory diseases (Tonsillitis and common cold)	4	10	0.75
Organ diseases (such as teeth, ear, blood stream of child "**Ado**"	9	36	0.77
Genitourinary problems (gonorrhea)	2	7	0.625
Placental retention	2	9	0.78
Body swelling "kuriba", Abscess	3	11	0.80

Non-medicinal use of plants in the study area

Local people in the study area have listed different types of plant species for different types of non-medicinal uses. Accordingly, 14 plant species was reported as wild food, 28 as fodder plants,23 for construction purpose (house construction, making a beehive, garner, house utensil and agricultural materials), 12 plant species to make furniture, and 8 for charcoal production. Most of these species (49), except herbs, are also used as a source of fuel wood as well. Because of making the fire overnight (*Maesa lanceolata* Forssk.) was the most preferred and frequently used plant for firewood; and (*Terminalia laxiflora* Engl. &Diels) was the most preferred one for charcoal production. As reported by the local peoples (*Pterolobium stellatum* (Forssk.) Brenan.) and, (*Oplismenus hirtellus* (L.) P. Beauv.) were most preferred plants species as animal feed particularly for cows to gain good quality and quantity of milk products.

Ranking and scoring on different uses of plant species

Preference ranking

A total of three-preference rankings were computed. Preference rankings were excised with ten KIs on medicinal plants that were reported to be treated against rheumatism disease; plants having good taste quality as wild food, and plant species, which are durable for house construction in the study area. For treating rheumatism diseases, the result of the present study showed that *Echinops Kebericho* ranked first (50) followed by *Securidaca longepedunculata* with the total score of 46 (Table 4).

Table 4. Preference ranking of medicinal plant to treat Rheumatism disease (R stands for respondents / informants; 6= most preferred, 1= least preferred)

Plant species	RESPONDENT S											
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Total	Rank
Echinops kebericho Mesfin,	6	5	4	6	5	6	4	5	5	4	50	1st
Moringa stenopetala (Bak. f) Cuf.	4	6	6	1	3	4	5	3	3	5	40	3rd
Vepris dainellii (Pichi-Serm.) Kokwaro	2	1	2	5	4	2	2	4	4	1	27	5th
Dicrocephala integrifolia (L.f) Kuntze.	5	4	3	3	1	3	3	6	1	2	31	4th
Securidaca longepedunculata Fresen.	3	3	5	4	6	5	6	2	6	6	46	2nd
Ranunculus multifidus Forssk.	1	2	1	2	2	1	1	1	2	3	16	6th

Regarding with wild food, *Syzygium guineense* and *Rubus apetalus* were mentioned as the most preferable wild food plant species with a score of 55 and 48, respectively (Table 5). For house construction *Bridelia micrantha* stood first (64), followed by *Bridelia scleroneura* with score of 59 (Table 6). On the other hand, *Arundinaria alpina* and *Oxythenatera abyssinica* were most preferable for beehive and garner construction.

Table 5. Preference ranking on six most popular wild food plant species based on taste quality as perceived by respondents in the study area (Note: 6= most preferred, 1= least preferred)

Plant species	R	E	S	P	O	N	D	E	N	T	S	
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Total	Rank
Syzygium guineense (Willd.) DC.	6	5	6	6	4	6	5	6	5	6	55	1st
Carissa spinarium L.	2	4	3	5	2	4	1	2	3	2	28	4th
Vitex doniana Sweet	5	3	2	4	5	2	2	3	1	3	30	3rd
Garcinia livingstonei T Anders.	1	1	4	1	3	1	4	4	2	1	22	6th
Rubus apetalus Poir.	4	6	5	3	6	5	3	5	6	5	48	2nd
Physalis peruviana L.	3	2	1	2	1	3	6	1	4	4	27	5th

Table 6. Preference ranking on seven plant species used for house construction in the study area.

Plant species	R	E	S	P	O	N	D	E	N	T	S	
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Score	Rank
Bridelia micrantha (Hochst.) Baill	7	6	7	5	7	7	6	5	7	7	64	1st
*Oxytenanthera abyssinica (*A. Rich.)	3	4	4	2	3	1	2	3	1	2	25	6th
Terminalia laxiflora Engl. & Diels	4	7	6	7	4	2	5	6	5	4	50	3rd
Bridelia scleroneura Muell. *Arg.*	6	5	5	6	5	6	7	7	6	6	59	2nd
Pouteria altissima (A. Chev.)	5	1	2	3	1	3	2	4	4	1	26	5th
Psydrax schimperiana (A. Rich.) Bridson	1	2	1	1	2	4	1	2	2	2	18	7th
Terminalia schimperiana Hochst.	2	3	3	4	6	5	3	1	3	3	33	4th

Paired Comparison

Pair comparison of medicinal plants for treating ascariasis, the most frequently reported disease, and for making furniture were calculated and presented in Table 7 and 8. Accordingly, for treating ascariasis, paired comparison result for *Cylosia trigyna* was found to be 18, followed by *Euphorbia amplyphylla* with a score of 16 (Table 7). On the other hand, for making furniture, paired comparison result for *Cordia africana* was found to be 1st (24) followed by *Hagenia abyssinica* with a score of 16 (Table 8).

Table 7. Paired comparison of medicinal plants used to treat Ascariasis

Plant species	RSPONDENTS								
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	Total	Rank
Celosia trigyna L.	4	3	1	3	3	0	4	18	1st
Embelia schimperi Vatke,	1	0	3	1	2	4	1	12	4th
Euphorbia ampliphylla Pax	3	2	2	0	4	3	2	16	2nd
Indigofera stenophylla Guill. & Perr.	2	4	4	2	0	1	0	13	3rd
Tamarindus indica L.	0	1	0	4	1	2	3	11	5th

Table 8. Paired comparison on five plant species used for furniture in the study area.

Plant species	Respondents								
	R1	R2	R3	R4	R5	R6	R7	Score	Rank
Cordia africana Lam.	4	4	3	2	3	4	4	24	1st
Hagenia abyssinica (Bruce) L.F. Gmel.	2	3	4	0	4	2	1	16	2nd
Croton macrostachyus Del.	3	3	2	4	1	1	0	14	3rd
Ficus sycomorus L.	1	2	1	3	0	0	3	10	4th
Euphorbia ampliphylla Pax	0	1	0	1	2	3	2	9	5th

Informant consensus

Informant consensus analysis showed that some medicinal plants were more popular than others. Accordingly, *Vepris dainellii* was the most stated medicinal plants 51 (70.83%) followed by *Embelia schimperi* 48 (66.67%) in the study area (Table 9).

Table 9. Informant consensus analysis of 15 most frequently stated medicinal plants

Plant species	Local name	Most known disease treated	Number of informants cited	% of Informants
Vepris dainellii (Pichi-Serm.) Kokwaro	**Chawula**	Headache	51	70.83
Embelia schimperi Vatke,	**Wenkoko**	Tapeworm	48	66.67
Croton macrostachyus Del	**Beta/ Anika**	Wound	42	58.33
Echinops amplexicaulis oliv	**Burisa**	Expel retained placenta	38	52.78
Hagenia abyssinica (Broce) I.F. Gmel	**Koso**	Tapeworm	37	51.39
Echinops kebericho Mesfin,	**Dechimerach**	Stabbing pain	37	51.39
Moringa stenopetala (Bak. f) Cuf,	**Haleko**	Stomachache	34	47.22
Celosia trigyna L.	**Majimala**	Ascariasis	29	40.28
Clerodendrum alatum Gurke.	**Alga**	Evil eye	29	40.28
Euphorbia ampliphylla Pax	**Arigide**	Ascariasis	26	36.11
Clorodundrum myricoides (Hochst.). Vatke	**Boymecha**	Snake bite	25	34.72
Ocimum urticifolium Roth	**Ancha/Gulo**	Itching & acute febrile illness	22	30.56
Vernonia amygdalina Del.	**Gera**	Abdominal pain	22	30.56
Securidaca longepedunculata Fresen.	**Sangano**	Rheumatism & Evil eye	22	30.56
Staphena abyssinica (Dillon et A. Rick) Walp.	**Turturo**	Snake bite	21	29.17

Use diversity ranking of plants species

In the study area, many medicinal plants were reported to be used for many purposes other than medicinal value. Some of the major uses mentioned by the respondents include food, firewood, charcoal, forage/fodder, construction, and furniture (Table 10). In the present study, *Cordia africana* ranked first and hence it is the most preferred plant by local people for various uses, while *Terminalia schimperiana* and *Croton macrostachyus* were ranked second and third, respectively.

Table 10. Results of direct matrix ranking on six multi-purpose plant species based on 5 key informants. (Use values given: 5 = Excellent, 4 = Very good, 3 = Good, 2 = Less, 1 = least &0= No use)

Species	Medicine	Construction	Food	Firewood	Fodder	Furniture	Charcoal	Score	Rank
Croton macrostachyus Del	5	4	0	5	2	4	3	23	3rd
Hagenia abyssinica (Broce) L.F. Gmel	5	3	0	4	2	5	1	20	4th
Carissa spinarium L.	2	1	5	5	3	0	0	16	6th
Albizia gummifera (L. F. Gmel.) C.A. Sm.	4	2	0	3	5	2	2	18	5th
Cordia africana Lam.	2	5	3	4	4	5	3	26	1st
Terminalia schimperiana Hochst.	4	5	0	5	2	3	5	24	2nd

Variation of indigenous knowledge on the uses of plants according to gender and age

Men listed a greater number of plants species (74.63%) than women (25.37%). The independent t-test statistical analysis showed a significant knowledge difference between the two gender groups on traditional use of plant species for different purposes (at d_f= 1, p= 0.003). However, there was no significant knowledge difference between the respondents of both gender groups on medicinal plants use knowledge (at d_f= 1, p= 0.703) (Table 11).

Table 11. Statistical test of significance, t-test, on average number of reported general and medicinal plant species between the two gender groups of the informants

	Level of Knowledge		
	Number of plant species reported/sex of the respondents		
		For general knowledge	For only medicinal plant knowledge
Gender group	N	Mean ± SD	Mean ± SD
Male	69	26.93± 11.77 [b]	8.27±3.84 [a]
Female	27	19.52± 58.16 [a]	7.79±2.57 [a]

Respondents aged 36-60 and above 60 years reported the maximum number of plant species, which accounted 40.08% and 38.26% respectively, while respondents age 18-35 years reported the least number of plant species (21.67%). Regarding use of medicinal plants, there was a great variation in knowledge among the three-age classes. The maximum number of plant species (41.24%) was reported by the aged group of above 60 years followed by the group from 36-60 years old (39.60%). Moreover, the result of multiple comparison test analysis showed that the level of knowledge is significantly different for the respondent in young-aged and middle-aged groups in both cases. Similarly, there was a significant difference with young-aged group and elders, but no significant difference was found between middle-aged and elderly (Table 12). Furthermore, there was a positive relationship (*r=0.507*) between the age of informants and their traditional knowledge on use of plants in the study area and the older people have more knowledge than the younger ones (Figure. 4).

Table 12. Statistical analysis on ethnobotanical knowledge variation under the three age classes of the respondents

		Level of Knowledge	
		Number of species reported by respondents from the three age classes	
		For general plant use knowledge	For only medicinal plant use knowledge
Age classes	N	Mean± SE	Mean ± SE
Young (18-35)	23	16.29±2.37 [a]	5.79±0.754 [a]
Middle (36-60)	38	24.85±1.71 [b]	8.86±0.543 [b]
Elderly (61-94)	35	26.32±2.01 [b]	9.46±0.639 [b]

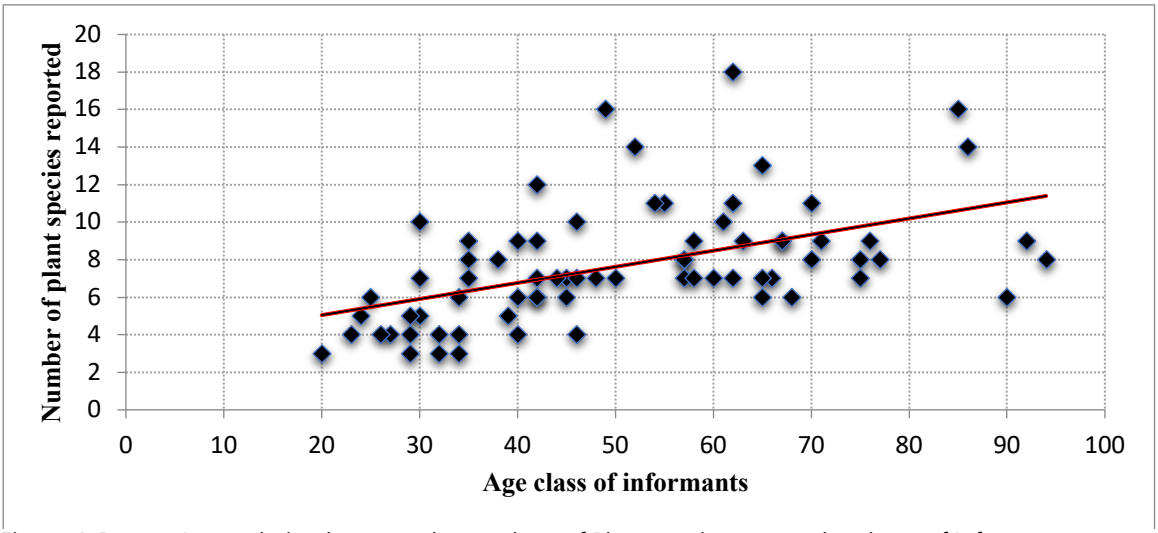

Figure 4. Pearson's correlation between the numbers of Plant species reported and age of Informants

Knowledge transferring on traditional medicinal plants

Most of the traditional healers in the Melokoza District transfer their indigenous knowledge on the types of medicinal plants, traditional concepts of illness and methods of treats to their family members by word of mouth, especially of an elder son 32.14% and trusted and wise son/daughter 21.43% (Table 13). It was also found that there is maximum secrecy in passing the knowledge the family circle.

Table 13. Traditional medicinal plant knowledge transfer of healers

To whom transferred	Number of healers	Percent (%)
Elder son	9	32.14
Trusted and wise son/daughter	6	21.43
Elder daughter	4	14.29
All children	3	10.71
Not transferred	3	10.71
Wife	2	7.14
Sister	1	3.57

Discussion

The result of this study showed that Sirso natural forest is a crucial resource to the local community in terms of usage. This is indicated by the study, which identifies 135 species named by the local community for their different daily usages. Most of the 135 species identified in the present study belongs to the family Asteraceae, Lamiaceae and Fabaceae. This might be due to the weedy nature of the family Asteraceae and the adaptation potential of the species in the family in a wide range of altitudes in the study area. Lulekal *et al.* (2013) indicated that the plant families that contributed to the considerably higher number of medicinal plant species were due to their wider distribution and abundance in the flora area as well as the presence of bioactive ingredients

Although herbs have found everywhere than other plant growth forms, the present study identifies shrubs as the most harvested and used plant form for medicinal and other uses. This finding is in line with some of previously reported studies (Hunde *et al.*2004, Balemie *et al.*2004, Lulekal *et al.*2008, Mesfin *et al.* 2009). As explained by Lulekal *et al.* (2008), the dominance of shrubs in the present study could be associated to their abundance and year-round availability compared to herbs where most of the time their existence was seasonal and water source based. In contrast with the current finding, herbs were reported as dominant medicinal plants in the general pattern seen in most medicinal inventories in Ethiopia (Yineger *et al.* 2008, Awas & Demissew 2009, Giday *et al.* 2010, Lulekal *et al.* 2013), and in other countries (Tabuti *et al.* 2003).

Sirso natural forest and its surroundings are a particular wild habitat of medicinal plants. This is reflected in the result of the present study where about 88% of the reported medicinal plants are wild and yet not cultivated. This may be due to the availability of medicinal plants still in abundant in the natural forest and absence of scarcity of them in the study area. According to Awas and Demissew (2009) medicinal plants are among the diverse categories of useful plants obtained from the wild. This finding also agrees with the general pattern seen in many investigations in Ethiopia in which more medicinal plants are collected from the wild (Tolosa 2007, Yineger *et al.* 2008, Etana 2010) than an effort to cultivate them.

Higher preference of leaf parts for most medicinal plant preparations (36%) over other plant parts could be due to ease of preparation and the best concentration of active ingredients in leaves. Like the current finding, leaves were reported as most preferred plant parts to be used to prepare traditional medicine (Amenu 2007, Tolosa 2007, Chekole *et al.* 2015). In comparison with harvesting of other plant parts such as roots, bulbs, stems, and whole plant harvesting leaf parts for traditional medicine use have minimal effect on the long - term survival of the plant and this reduces the risk of threat on the traditional medicinal plants. Easy accessibility and availability of medicinal plants in the current study area makes fresh preparation the most preference method (66.67%) as compared to dried plant biomass. Moreover, most practitioners of traditional medicine in the study area believed that using active ingredients of fresh plant parts attaining high efficacy which they thought could be lost on drying and due to improper storage. This finding is consistent with other findings (Amenu 2007, Lulekal *et al.* 2008, Chekole *et al.* 2015).

A total of 39 most frequently occurred and traditionally known human (25) and livestock (14) ailments were described being treated through traditional medicine in the study area. This is a small number in comparing with other studies (Getaneh & Girma 2014). From twelve disease categories of the current study, parasite infections or helminths diseases scored the highest ICF of 0.91. This finding is analogous with result reported by Gebrehiwot (2010) who conducted similar study in Seru district in Arsi zone of Oromia Region. This could be due to most frequent occurrence of parasitic disease in the study area due to poor sanitation, and the emergence of only few effective medicinal plants through long time traditional practice. On the other hand, according to Gazzaneo (2005), higher ICF for parasitic infection may imply the existence of information exchange between informants. In addition, the less ICF values (values between 0 and 0.65) might indicate the minimal networking of indigenous people in sharing of their knowledge on medicinal practices, which is usually the case with traditional healers. This is mainly because of the interest of each healer to keep his knowledge secretly from other healers for fear of piracy (Chekole 2017).

In the present study, it has been observed that there is a lack of agreement among the informants on doses of certain remedies prescribed for treating the same type of health problem and lack of precision on the dose. Many authors have also mentioned that one of the constraints of traditional medicinal plants is a lack of appropriate doses for a given ailment. Moreover, the dose differs according to different cultures (Balemie *et al.*2004). The toxicity of some medicinal plants and their potential to do harm is a common complaint among those who would like traditional medicine to be standardized. It is commonly believed that traditional practitioners either do not know the strength of their own medicines or do not bother to fit doses to the size or body weight of the patients (Hillenbrand 2006). However, in the present study it had been observed that some traditional healers do give different dosages and frequency of applications depending on age, sex and other conditions or vary the medicine itself on such differences.

The informant consensus analysis of medicinal plants estimated in the present study for frequently reported diseases revealing a range of values. The variation in values obtained from the informant consensus analysis of medicinal plants was related to their frequent application for different disease control. The fidelity level of *Vepris dainellii* for headaches and *Embelia schimperi* for tapeworm were calculated at 71% and 67% respectively. Whereas

the lowest fidelity level was calculated at 30.56% and 29.17% for *Securidaca longepedunculata* in treating Rheumatism and *Stephania abyssinica* in treating snake bite respectively. Higher values identified from informant consensus analysis for these species could be an indication of the potential of these plants for treatment of the respective disease.

About house construction, *Bridelia micrantha* stood first. This species was preferred by most of informants, and this could be due to its durability and resistance against termites (Schmidt&Mwaura2010). Although *Cordia africana* was found to be the first preferred plants for various uses in this study, it was also mentioned as the most threatened plant species in the area. This might be due to over utilization of the species for different purposes particularly for timber production. Similarly, other studies had reported *C. africana* as first use rank (Gebeyehu 2014, Etana 2010, Chekole *et al.* 2015); hence, it is the most preferred plant by local people for various uses and is the most threatened species.

In the present study, the number of informants in terms of gender is not proportional and, men were found to be more knowledgeable than women were. This might be due to males were more volunteer those that answered the questionnaire and most of the time male were more exposed to the external environments as well as have more social contact than females. According to Voeks (2007) community members who have greater contact with medicinal plants are more knowledgeable about therapeutic uses of the plants than those with intermittent contact. Chekole (2017) mentioned that males could have chances to learn the useful values of plant species from their daily interactions. Moreover, healers preferred males to transfer their indigenous medicinal plant knowledge because of their expectations that a male alone could take the plant species in far sites and forests. However, no statistically significant difference was found between respondents of both gender groups on medicinal plants use knowledge while male informants reported more medicinal plants than women did. This result indicated that both men and women are knowledgeable on use of traditional medicinal plants despite the relative dominance of traditional flow of information regarding medicinal plants along the male line in Ethiopia (Teklehaymanot 2009) and elsewhere (Collins S. 2006). This finding was also in line with Lulekal *et al.* (2013) who reported male informants were listed more medicinal plants than women though the difference was not statistically significant.

The significant difference on the average number of medicinal plants reported by different age groups compared in this investigation showed that indigenous knowledge on use of medicinal plants is still strong with elderly people and middle than in the younger generation. This could be attributed to the very poor system of sharing indigenous knowledge on traditional medicinal uses of plants to the younger generation. According to Awas and Demissew (2009), the old person knows more medicinal plants than youngsters dis and ethnobotanical knowledge of medicinal plants is transferred from the older people to younger generations at household level, like any other traditional societies in Africa. Indigenous knowledge differences between the young and old aged informants reported from other ethnobotanical studies are agreed with current result (Chekole *et al.* 2015, Hunde 2004). Silva *et al.* (2011) explained that greater knowledge of older people on medicinal plants is the result of high degree of opportunity for more cultural contact and experience with plants and associated traditional uses during their past lifetime than that of younger people. On the other hand, the younger generation is more exposed to modern education, and hence not disposed in learning and practicing IK from their parents. Absence of continuous cultural interaction with plants was also reported as one factor for the loss of traditional knowledge down generations (Winter &McClatchy 2008).

Most of the traditional healers in the present study area transferred their knowledge to their elder son and trusted son/daughter. This agreed with other ethnobotanical studies (Gebrehiwot 2010, Abebe 2011, Lulekal *et al.* 2013). Traditional healers explained that the IK is transferred from generation to generation through word of mouth, with maximum secrecy and only along family lines with giving advice and command ones to care the knowledge from transferring to others or out of the family members. While few healers transfer their knowledge with both word of mouth and written documents. The indigenous societies living in the Melokoza district transfer their indigenous knowledge to the younger one by telling practicing traditional medicine is one of source of income to preserve the indigenous knowledge associated with plant uses.

Conclusion

The present study showed as Sirso natural forest is a home for high diversity of plant species with several traditionally and economically important plant species used as traditional medicine and other purposes. Asteraceae is the dominant family found in the study area. Majority reported plant species were Shrubs. The majority of mentioned medicinal and other multipurpose plants were wild and some of them were reported to be rare. Leaf is

the most commonly harvested plant part, and this is an opportunity for the plants as leaf has less effect on the mother plants survival compared with root/bulb. Medicinal plants such as *Vepris dainellii* for and *Embelia schimperi* were the most preferred and highest informant consensus, an indication of their high healing potential. In the study area human diseases are more common than livestock diseases as most of the medicinal plants documented are used for the treatment of human ailments. In the current study parasite infections or helminthes diseases scored the highest ICF value from twelve disease categories. The traditional knowledge varies among various social groups. The number of traditional female practitioners are limited in number, which is probably because most traditional healers, transfer their knowledge to their sons than to their daughters. Among the three age classes, the older people have more accumulated knowledge on medicinal plant uses than the younger ones. However, the indigenous knowledge of using and preserving these plant species is still being transferred from generation to generation.

The major challenges to erode indigenous knowledge associated with plant uses for different purpose particularly for medicinal come from secrecy, oral based knowledge transfer, religious factors, spiritual and culture beliefs, refusal of young next generation to gain the indigenous knowledge, and lack of awareness. This situation calls for an effort to close the observed generation gap through continuous professional support and training of local communities with an objective of preserving their indigenous knowledge and practices through systematic documentation. Hence, awareness creation is timely needed to improve the local community's knowledge on the importance and management of plants to avoid the erosion of associated indigenous knowledge and to ensure its sustainable uses. Besides, further study is recommended on the reported medicinal plants in the present study in order to confirm them scientifically and use them in modern drug development.

Declarations

List of abbreviations: AAU - Addis Ababa University; DAs - Developmental Agents; EBI - Ethiopian Biodiversity Institute; ETH - National Herbarium of Addis Ababa University; IK - Indigenous Knowledge; ICF - Informant Consensus Factor; KIs - Key Informants; SNNPRs - Southern Nations Nationalities and Peoples Regional State; TMPs - Traditional Medicinal Plants

Ethics approval and consent to participate: Letters of consent were taken from Hawassa University, Melokoza District Administration offices, and each sampled study site Kebele office prior to the data collections. Oral consents were also obtained from the informants by performed group discussions about the objectives of the study prior to the interviews, and all data were collected through their oral consents. Finally, Hawassa University certified the research finding after it was presented.

Consent for publication: Not applicable

Availability of data and materials: The datasets used and/or analyzed during the current study are available in the "Appendix" as a supplementary information file and from the corresponding author on a reasonable request.

Competing interests: The authors declare that there is no competing interest regarding the publication of this article

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Authors' contributions: Efrata Mekebib and Tesfaye Awas performed Reconnaissance survey for study site selection and herbarium specimen identification. Efrata Mekebib conducted all interviews in field data collection, analyzed the data and wrote the manuscript. Tesfaye Awas made advice in the study.

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Appendix 1. List of plants species recorded from the study area and their respective uses (Scientific Name, Family, and Local Name, Growth form, Use value and Voucher no. of each traditional important plants species in study area)
Key:LN= Local name, **Ha**= Habit (**Cl**= Climber, **H**= Herb, **Sh**= Shrub and **T**= Tree), **PU** = Parts Used (**B**. = Bark, **F** = Fruit, **FL** = Flower, **L**= Leaf , **LA** = Latex , **R** = Root, **S** = Seed , **ST** = Stem and **WP** = Whole plant)

Scientific name	Family	LN	Ha	PU	Use Value	Voucher No
Achyranthes aspera L.	Amaranthaceae	**Telenj**	H	L	Medicinal	EM-069
Achyrospermum schimperi (Hochst. ex Briq.)	Lamiaceae	_	Sh	L	Medicinal	EM-057
Acmella caulirhiza Del.	Asteraceae	**Balbashe**	H	F	Medicinal	EM-067
Aframomum corrorima (Braun) Jansen	Zingibiraceae	**Korerima**	H	S	Medicinal & spice	EM-068
Agaristasa licifolia (Comm. ex Lam.) Hook. f,	Ericaceae	**Gasgaso**	Sh	L	Medicinal	EM-084
Albizia gummifera (I. F. Gmel.) C.A. Sm.	Fabaceae	**Sisa**	T	B	Medicinal, Fodder & firewood	EM-014
Alchemilla kiwuensis Engl.	Rosaceae	_	H	L	Medicinal	EM-053
Antiaris toxicaria Lesch	Moraceae	**Dube**	T	B & ST	Construction & bark for cloth	EM-094
Artemisia abyssinica Sch. Bip. ex A. Rich.	Asteraceae	**Natro/ chikugn**	H	L	Medicinal	EM-075
Arundinaria alpina K. Schum.	Poaceae	**Kerikeha**	Sh	ST	Construction, Fence	EM- 104
Aspilia africana (Pers) Adams	Asteraceae	**Kishikisha**	Sh	L	Medicinal	EM-127
Asystasia gangetica (L.) T. Anders.	Achanthaceae	**Marena**	H	R	Medicinal	EM-025
Becium grandiflorum (Lam.) Pic.Serm.	Lamiaceae	**Pitisa**	H	L & R	Medicinal	EM-016
Bersama abyssinica Fresen.	Melianthaceae	**Zage**	T	ST	Construction, Firewood	EM- 123
Bridelia micrantha (Hochst.) Baill.	Euphorbiaceae	**Gerchi**	T	ST	Construction, firewood	EM-039
Bridelia scleroneura Muell.Arg.	Euphorbiaceae	**Zuzie**	T	ST	Construction	EM-112
Brucea antidysenterica J.F. Mill.	Simaroubaceae	**Shrushika**	T	L	Medicinal	EM-070
Buddleja polystachya Fresen.	Loganiaceae	**Muzinga**	T	L &WP	Fodder, firewood	EM-132
Carissa spinarium L.	Apocynaceae	**Leda**	Sh	R	Medicinal, food & firewood	EM-013
Celosia trigyna L.	Amaranthaceae	**Majimala**	H	L & R	Medicinal	EM-004
*Celtis africana*Burm. f.	Ulmacfae	**Shoa**	Sh	ST	Construction & firewood	EM-135

Cissampelos mucronata A. Rich.	Menispermaceae	**Turtura**	Cl	L & R	Medicinal	EM-001
Citrus aurantifolia (Christm.) Swingle	Rutaceae	**Lomia**	Sh	F	Medicinal & food	EM- 102
Clausena anisata (Willd.) Benth.,	Rutaceae	**Eshima**	Sh	L	Medicinal	EM-093
*Clematis hirsuta*Perro&Guill	Ranculanceae	**Soge**	Cl	WP	Medicinal & Fodder	EM-085
Clerodendrum alatum Gurke.	Lamiaceae	**Alga**	Sh	L	Medicinal	EM-095
Clorodundrum myricoides (Hochst.). Vatke	Lamiaceae	**Boymecha**	Sh	R	Medicinal	EM-006
Coffea arebica L.	Rubiaceae	**Buna**	Sh	L & S	Medicinal & drink	EM-096
Colocasia esculenta (L.) Schott	Araceae	**Godere**	H	B	Medicinal, fodder	EM-115
Terminalia laxiflora Fresen	Combertaceae	**Digiso**	T	ST	Charcoal & construction firewood	EM-103
Combretum molle R.B`r. ex G. Don.	Combertaceae	**Sobo**	T	ST	Construction & charcoal	EM-023
Commelina benghalensis L.	Commelinaceae	**Diliesha/Ertsirist**	Gr	R	Medicinal & fodder	EM-079
Conyza bonariensis (L.) Cronq.	Asteraceae	**Boshe**	Sh	L & R	Medicinal, Fodder	EM-090
Cordia africana Lam.	Boraginaceae	**Moha**	T	ST	Furniture, Construction, Medicinal & food	EM-097
Crassocephalum macropappurn (Sch. Bip.) ex A.	Asteraceae	**Yegisha dele**	H	L	Medicinal	EM-060
Croton macrostachyus Del.	Euphorbiaceae	**Beta**	T	B, L & La	Medicinal, Firewood	EM-002
Cynodon dactylon (L.) Pers.	Poaceae	**Dilima**	Gr	WP	Fodder	EM-061
Cynoglossum coeruleum Hochst. ex A.DC.	Boraginaceae	**Kachinsa**	H	L	Medicinal	EM-050
Cyperus spp.	Cyperesaceae	**Bidir**	Gr	R	Medicinal	EM- 100
Cyphostemma adenocaule (Steud. ex A. Rich.)	Vitaceae	**Jeljelo**	Cl	L	Medicinal	EM-077
Cyratia gracilis (Guill. & Pem)	Fabaceae	**Alfatel**	Cl	L	Medicinal	EM-082
Datura stramonium L.	Solanaceae	**Ateefaris**	H	S	Medicinal	EM-098
Dicrocephala integrifolia (L. f) Kuntze	Asteraceae	_	H	L	Medicinal	EM-052
Dombeya torrida (L.F. *Gmel.*) P. Bamps,	Stericuliaceae	**Lolashe**	T	B & ST	Construction & firewood	EM- 124
Dracaena fragrans (L.) Ker Gawl.	Dracaenaceae	**Washe**	Sh	L & WP	Fodder & fence	EM-020
Dracaena steudneri Engl.	Dracaenaceae	**Elale**	Sh	L&ST	Fence	EM-129

Drynaria volkensii Hieron.	Polypodiaceae	**Kakiye**	Pa	L	Medicinal	EM-047
Echinops amplexicaulis Oliv	Asteraceae	**Buris**	Sh	R	Medicinal & fodder	Em-021
Echinops kebericho Mesfin.	Asteraceae	**Dechimerechi**	H	B & R	Medicinal	EM-026
Ehretia cymosa Thonn.	Boraginaceae	**Etiwarji**	Sh	L	Medicinal firewood	EM-063
Embelia schimperi Vatke,	Myrsinaceae	**Wenkoko**	Sh	F	Medicinal	EM-065
Erythrina brucei Schweinf.	Fabaceae	**Bortua**	T	B	Medicinal	EM - 029
Euphorbia ampliphylla Pax	Euphoribiaceae	**Argide**	Sh	M/ La	Medicinal & fodder	EM-042
Euphorbia schimperiana Scheele	Euphorbiaceae	_	H	WP	Medicinal	EM-038
Ficus exasperata Vahl	Moraceae	**Akimits**	T	L & ST	Construction, washing materials	EM-018
Ficus sur Forssk.	Moraceae	**Ase**	T	F & ST	Construction, food & furniture	EM-113
Ficus sycomorus L.	Moraceae	**Maro**	T	ST	Furniture, construction & firewood	EM-015
Ficus vasta Forssk.	Moraceae	**Wela**	T	ST	Construction, furniture	EM-111
Flueggea virosa (Willd.) Voigt.	Euphorbiaceae	**Tate**	Sh	L	Medicinal	EM-059
Galineria saxifraga L.	Rubiaceae	**Buringo**	Sh	L	Medicinal Fodder	EM-116
Garcinia livingstonei T Anders.	Hypericaceae	**Lomak**	Sh	F & ST	Food & firewood	EM-081
Gnidia stenophylla Gilg	Thymelaceae	**Tumeno**	H	R	Medicinal	EM-028
Hagenia abyssinica (Broce) I.F. Gmel.	Rosaceae	**Koso**	T	Fl	Medicinal & Furniture	EM-033
Hippocratea africana (Willd) Loes.	Celastraceae	**Daniko**	Cl	WP	Fodder, fence	EM-134
Indigofera stenophylla Guill. &Perr.	Fabaceae	**Wusis**	Sh	R	Medicinal & fodder	EM-046
Ipomoea alba L.	Convolvulaceae	_	Cl	L	Medicinal	EM-055
Justicia heterocarpa T. Anders.	Acanthaceae	_	H	L	Medicinal	EM-058
Justicia schimperi (Hochst.) Dandy,	Acanthaceae	**Algi**	Sh	L & R	Medicinal Fodder	EM-088
Kalanchoe petitlana A. Rich	Crasulaceae	**Korde**	H	L	Medicinal	EM-040
Lagenaria sicenria (Molina) Standi	Cucurbitaceae	**Anda/ Halo**	C	L	Medicinal	EM - 030
Lantana trifolia L.	Verbenaceae	**Mirimich**	Sh	L & F	Medicinal, food & fodder	EM-005

Leonotis ocymifolia (Burm. f) Lwarsson	Lamiaceae	**Katilush**	H	L	Medicinal	EM-062
Leptadenia bastata (Pers.) Decne	Asclepidiaceae	**Bosatura**	H	L & R	Medicinal	EM-076
Leucas deflexa Hook. f.	Lamiaceae	**Bubuho**	H	L	Medicinal	EM-051
Lippiaa doensis Hochst. ex Walp.	Verbenaceae	**Shasha/Kese**	Sh	L	Medicinal & wash milk storage matrerial	EM-044
Macarangaca pensis (Baill.) Sim	Euphorbiaceae	**Belea**	T	S	Construction, furniture	EM-105
Maesa lanceolata Forssk.,	Myrsinaceae	**Terika**	T	WP	Firewood	EM- 101
Marantochloaleucantha (K. Schum.) Milne-Redh.	Marantaceae	**qarewesha**	Gr	L & WP	Fodder, construction	EM-092
Millettia ferruginea (Hochst.) Bak.	Fabaceae	**Zagie**	T	S	Construction, firewood	EM-108
Momordica foetida Schumach.	Cucurbitaceae	**Ache**	Cl	R	Medicinal	EM-086
Moringa stenopetala (Bak. f.) Cuf.	Moringaceae	**Haleko**	T	B, L &R	Medicinal, firewood	EM-008
Morus alba L.	Rosaceae	**Enjori**	Sh	F	Food	EM-054
Mussaenda arcuata Poir.	Rubiaceae	**Munimuno**	T	F & S	Food, firewood	EM-118
Nicotina tobacum L.	Solanaceae	**Timba/timbaho**	H	L	Medicinal	EM-074
Ocimum urticifolium Roth	Lamiaceae	**Anchaf**	Sh	L	Medicinal & fodder	EM-010
Oplismenus hirtellus (L.) P. Beauv.	Poaceae	**Sutsunto**	Gr	WP	Fodder	EM-064
Oxyanthus speciosus DC.	Rubiaceae	**Gorpie**	T	S	Construction, Fence	EM-119
Oxytenantben abyssinica (A. Rich.) Munro	Poaceae	**Wusinsa**	Sh	S	Construction, fodder & fence	EM-080
Passiflora sp.	Passifloraceae.	**Tinchro**	H	L	Medicinal	EM-027
Pentas schimperiana (A. Rich.) Vatke	Rubiaceae	**Darense**	Sh	L	Fodder	EM-120
Pentatropis nivalis (J.F. Gmel.) D. V. Field	Asclepidiaceae	**Marena**	H	L	Medicinal	EM-128
Phragmanthera regularis (Sprague)	Lorantaceae	**Tsensa**	Pa	L	Medicinal	EM-122
Physalis peruviana L.	Solanaceae	**Birike**	H	F	Medicinal & food	EM-072
Phytolocca dodecandra L'Herit.	Phytolacaceae	**Anchicho**	Sh	L & R	Medicinal	Em-024
Polyscias fulva (Hiern) Harms	Araliaceae	**Karasho**	T	S	Furniture, held hive	EM-110
Pouteria altissima (A. Chev.) Baehni	Sapotaceae	**Matseta**	T	S	Construction	EM-083

Prunus africana (Hook. f.) Kalkm	Rosaceae	**Okanse**	T	S & WP	Construction, Furniture, firewood	EM-114
Psydrax schimperiana (A. Rich.) Bridson	Rubiaceae	**Gila**	T	R & S	Medicinal & construction	EM-019
Pterolobium stellatum (Forssk.] Brenan	Fabaceae	**Pinduki**	Sh	L & F	Medicinal & fodder	EM-034
Pycnostachys abyssinica Fresen.	Lamiaceae	**Shona**	Sh	L & S	Fodder	EM-131
Ranunculus multifidus Forssk.	Ranunculaceae	**Jamer**	H	R	Medicinal	EM-035
Rhamnus prinoides L'Herit	Rhamnaceae	**Gesha/Gesho**	Sh	L	Medicinal, Making tea	EM-078
Rhus glutinosa A. Rich	Anacardiaceae	**Zalle**	Sh	S	Construction firewood	EM-130
Rhus ruspolii Engl.	Anacardiaceae	**Maldaye**	Sh	R	Medicinal, firewood	EM-106
Rubus apetalus Poir.	Rosaceae	**Goram**	Sh	F &WP	Food, firewood	EM-109
*Rumex nepalensi s*Spreng.	Polygonaceae	**Zakila**	H	R	Medicinal	EM-048
Ruta chalepensis L.	Rutaceae	**Tselote**	Sh	L	Medicinal	EM-017
Salvia nilotica Jacq.	Lamiaceae	**Gasindo**	H	L &Sh	Medicinal	EM-031
Sapium ellipticum (Krauss) Pax	Euphorbiaceae	**Wuzingie**	T	S	Construction, firewood	EM-117
Satureja punctata (Benth.) Briq.	Lamiaceae	**-**	H	L	Medicinal	EM-073
Schefflera abyssinica (Hochst. ex A. Rich.) Harms	Araliaceae	**Koyira**	T	S	Construction of music instrument	EM- 126
*Securidaca longepedunculata*Fresen.	Polygalaceae	**Sangano**	Sh	R	Medicinal	EM- 099
Senecio myriocephalus Sch. Bip. ex A. Rich.	Asteraceae	**Unkown**	H	WP	Fodder	EM-066
Senna obtusifolia (L.) Irwin & Bameby	Fabaceae	**Shoshainxersa**	Cl	L	Medicinal	EM-071
Sida ovata Forssk.	Malvaceae	**Chursa**	Sh	WP	Medicinal & fodder	EM-036
Sida schimperiana Hochst. ex A. Rich.	Malvaceae	**Chifirig**	Sh	R	Medicinal & fodder	EM-043
Solanum incanum L.	Solanaceae	**Bulbulo**	Sh	F & R	Medicinal	EM-012
*Solanum macracanthum*A. Rich	Solanaceae	**Unkowm**	Sh	L	Medicinal	EM-032
Staphena abyssinica (Dillon et A. Rick) Walp.	Fabaceae	**Gestano**	Cl	L	Medicinal	EM-022
Syzygium guineense (Willd.) DC.	Myrtaceae	**Oche**	T	F & S	Food, firewood, charcoal, construction.	EM-003

Tamarindus indica L.	Fabaceae	**Kore**	T	F	Medicinal Fodder & firewood	EM-087
Terminalia brownii Fresen.	Combertaceae	**Gelalio**	T	S	Construction, firewood charcoal	EM-107
Terminalia laxiflora Fresen	Combertaceae	**Digiso**	T	ST	Charcoal & construction firewood	EM-103
Terminalia schimperiana Hochst.	Combretaceae	**Ambe**	T	B & S	Medicinal, Construction & firewood	EM-011
Trichilia dregeana Sond	Meliaceae	**Dima**	T	S	Construction, firewood	EM-125
Tephrosia uniflora Pers	Fabaceae	**Charenda**	Sh	R & WP	Fodder & medicinal	EM-121
Urena lobata L.	Malvaceae	**Lage**	Sh	S & WP	Construction, fodder	EM-091
Vepris dainellii (Pichi-Serm.) Kokwaro	Rutaceae	**Chawula**	T	F & R	Medicinal, fodder & firewood	EM-041
Vernonia adoensis Sch. Bip. ex Walp.	Asteraceae	**Buzo**	Sh	L	Medicinal	EM-045
Vernonia amygdalina Del.	Asteraceae	**Gara/ Grawa**	Sh	L	Medicinal & fodder, firewood	EM-037
Vernonia hochstetteri Sch. Bip. ex Walp.	Asteraceae	**Mono**	Sh	L	Medicinal	EM-007
Vernonia ischnophylla Muschl.	Asteraceae	**Bosha**	Sh	L	Medicinal	EM-089
Vernonia cinerascens Sch. Bip.	Asteraceae	**Gingina**	Sh	L	Medicinal & fodder	EM-049
Vitex doniana Sweet	Verbenaceae	**Gorens**	T	F & S	Food, construction& firewood	EM-009
Withania somnifera (L.) Dunal,	Solanaceae	**Gezawa**	Sh	L & R	Medicinal	EM-056

Appendix 2. Checklist of semi-structured questions used for interview and discussion for the collection of ethnobotanical data

I. General information on the respondents

1. Name _____ Age _____

2. Sex: I. Male II. Female

3. Marital status: I. single II. Married III. Widowed IV. Divorced

4. Educational status:

I. cannot read and write II. Read and write III. Elementary school (1-8th)

IV. Secondary school (9-12th) V. College graduate or diploma

5. Religion _____ Ethnicity_____ Occupation _____

6. Respondent position in the household

no	Position in the household	Mark
1	Household head	
2	Spouse of head	
4	Son	
5	Daughter	
6	Others specify	

II. Ethnobotanical Information

1. How is the relationship of the communities and plants in and around Sirso natural forest looks like? What is your trends using forest products for different day to day activities? ----------
2. Listplant species that you use for different purpose which found in and around the natural forest including local (vernacular) names. domestic, are these cultivated in gardens or farm areaor only harvesting form the wild?).----
3. For what purpose you use those plant speciesin your village? Mention (for food, fodder, medicine, construction, firewood, and other cultural practices…..)
4. What part of the plant (the seed/ fruit/leaf/ stem/ root/bark…) is important? --------
5. If you use for medicine, for which one human or livestock ailments and mention the mode of preparation and route of application/ administration? ----------
6. Which types of human or livestock disease are frequently occurring in your area?

7. Which age classes and social group of people collect and use these wild plants (children/ adult/ elder/ women/ shepherds/ farmers), mention! ----------
8. What are the local names of multipurpose plants you collect form the forest? Mention it with its use -----
9. Which plant species have more preference for food, furniture, construction, firewood, medicine..... mention your preference for each purpose? For medicinal purpose mention your answer depending on each disease categories?
10. Please mention plant species which treat more than one disease type from you lists as medicinal plants?
11. Do you know any plant of special importance; mention their local names with their importance?
12. Are there locally scarce plant species that used for different purpose in the area?
13. If say yes, list the species and mention the causes of scarcity for each species.----------
14. Howplants species you use different purposeare conserved through indigenous knowledge in your village? ----------
15. How is the knowledge of traditional plants use maintained and transferred from generation to generation in the community? Means how is it conserve in younger generation? ----------
16. Are there taboos, myths, or rituals and other concepts linked to plant use? Mention----------