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An ethnobotanical study of medicinal plants used by the Zay people in Ethiopia

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An ethnobotanical survey was carried out to collect information on the use of medicinal plants by the Zay people of Ethiopia, who live on islands and along the shore of Lake Ziway in the Ethiopian Rift Valley. Vegetation surveys were also conducted to investigate the habitat and status of the reported medicinal plants in the area. A total of 33 species of medicinal plants were reported in the area. Leaf material forms the major component of plant parts collected. The majority of remedies are prepared in the form of a juice from freshly collected plant parts. Most of the remedies are prepared from a single species and are mainly taken orally. Most of the medicinal plants are harvested from the wild. Of the 33 medicinal plants, 10 were reportedly scarce locally. Environmental degradation and intense deforestation have been reported as the main causes for the depletion of medicinal plants in the area. As the Zay people are still partly dependent on medicinal plants, the loss of these medicinal plants and the associated knowledge will, to a certain extent, hamper the existing health care system in the area.

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Introduction

The Ethiopian flora is estimated to contain between 6500 and 7000 species of higher plants, of which about 12% are endemic (Tewolde B.G. Egziabher, 1991). The country is well known for its significant geographical diversity which has favoured the formation of different habitat and vegetation zones. Ethiopia is also a home to many languages, cultures and beliefs which have in turn contributed to the high diversity of traditional knowledge and practices of the people which, among others, includes the use of medicinal plants.

Plants have been used as a source of medicine in Ethiopia from time immemorial to treat different ailments. Due to its long history, traditional medicine has in fact become an integral part of the culture (Pankhurst, 1965). It is not unusual for people living in the countryside to treat some common ailments using plants available around them (e.g. *Hagenia abyssinica* (Bruce) J.F. Gmel. to expel tapeworm). Dawit Abebe and Ahadu Ayehu (1993) reported that 80% of the Ethiopian population depends on traditional medicine for their health care. More than 95% of traditional medical preparations are of plant origin (Dawit Abebe, 1986).

Despite its significant contribution to society, traditional medicine has experienced very little attention in modern research and development, and less effort has been made to upgrade the practice. It is only recently (Worku Abebe, 1984) that the Ethiopian health authorities have shown an interest in promoting and developing it. In 1979, a Co-ordinating Office for Traditional Medicine (recently promoted to the Drug Research Department) was established under the Ministry of Health (Dawit Abebe, 1996). The aims of the Office, among others, were to conduct chemical screening of medicinal plants, co-ordinate activities regarding traditional medicine and carry out a census of traditional medical practices, as well as to evaluate traditional medicine (Vecchiato, 1993; Meseret Shiferaw, 1996). Up until 1996, the Drug Research Department had collected and documented over 600 medicinal plants (Dawit Abebe, 1996).

Today, continued deforestation and environmental degradation of habitats in many parts of the country has brought about the depletion of medicinal plants and associated knowledge. Medicinal plants such as *Hagenia abyssinica* (Bruce) J.F. Gmel., *Securidaca longepedunculata* Freser., *Clerodendrum myricoides* (Hochst.) R.B. Br. ex Vatke, *Cucumis aculeatus* A. Rich. and *Warburgia ugandensis* Sprague, are among the threatened species in Ethiopia due to environmental degradation and overexploitation (Costentinos Berhe Tesfu et al., 1995; Fassil Kebebew and Getachew Addis, 1996). According to an FAO report (IUCN, 1996), the present rate of deforestation in Ethiopia is estimated at 2000 km^2/year. If the current trend is allowed to continue, the country will lose all its existing natural forests (which is now less than 2.7% of the total land area) within the coming 15 to 20 years (Kidane Mengistu, 1998). The actual part of the medicinal plants that is collected also poses a serious threat to the survival of the species. The species *Dracaena steudneri* Engler, *Hagenia abyssinica* and *Securidaca longepedunculata* are becoming scarce in the wild as a result of excessive harvesting of their roots, bark or whole parts (Costentinos Berhe Tesfu et al., 1995). Loss of the associated knowledge has been aggravated by the expansion of modern education, which has made the younger generation underestimate its traditional values. Migration from rural areas to towns and resettlement of people from drought-stricken regions to fertile areas have also resulted in the deterioration of traditional practices (Dawit Abebe, 1986). In countries like Ethiopia, where there are no adequate hospitals and formally trained doctors, a weakening of traditional medical practices will greatly affect the national primary health care system.

Recent works in the country have recorded medicinally important plants (e.g. Jansen, 1981; Mesfin Tadesse, 1986; Gelahun Abate, 1989; Dawit Abebe and Estifanos Hagos, 1991; Mesfin Tadesse and Sebsebe Demissew, 1992; Dawit Abebe and Ahadu Ayehu, 1993; Abbink, 1995; Tesfaye Awas and Zemede Asfaw, 1999). The Zay people are one of the minority nationalities

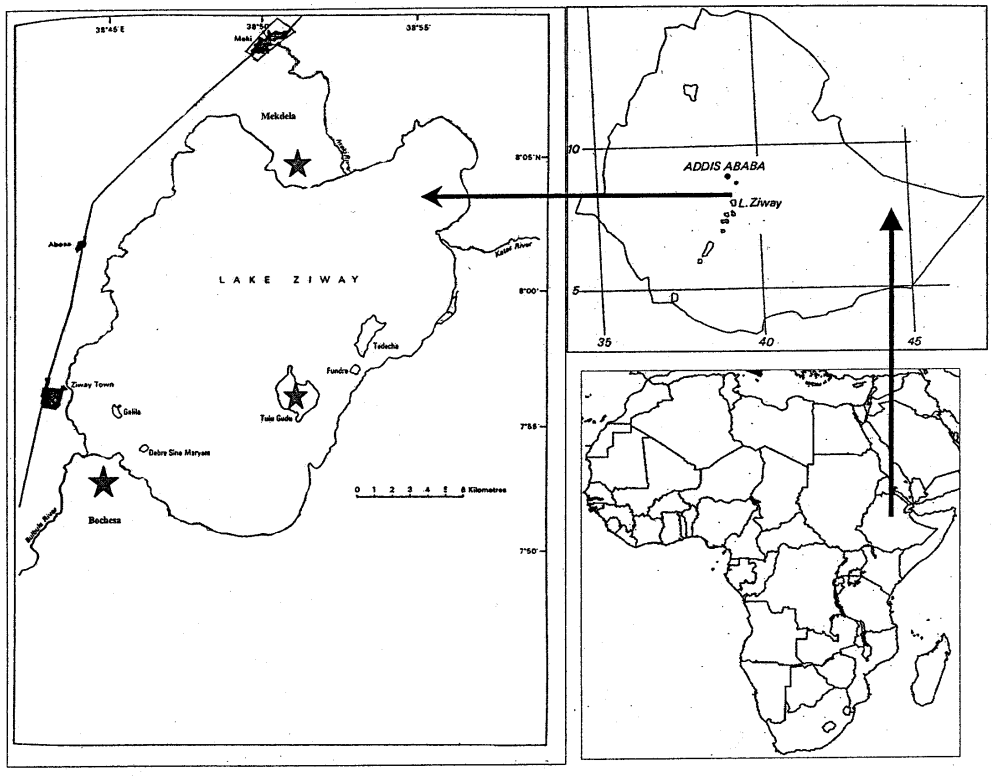

Figure 1. Map of the study area (modified from Makin et al., 1976).

in Ethiopia, with a population estimated to be around 5000 (Grimes, 1996). Zay, one of the Semitic languages which are mainly spoken in the north and partly in the central and eastern parts of the country, is the language of the Zay people.

According to local traditions, as compiled by Tuma Nadamo (1982), the Zay people are a result of a joining of three streams of people that crossed the water to the islands of Lake Ziway sometime between the early 14th and the middle of the 17th century for different reasons.

The economy of the Zay people is mainly based on subsistence agriculture and traditional fishing. Frequently cultivated crops in the area are maize, sorghum, finger millet, tef, pepper and barley. The Zay people also keep cattle, goats, sheep, donkeys and chicken, and use animal dung as their main source of fertilizer. Papyrus-made local boats are used as the main means of transport for the Zay people living on the islands, as donkeys and horses are for those residing on the shore. Fishing is widely practised in the area both for domestic use and trade.

According to informants and personal observations, the main health problems of the Zay people are malaria, schistosomiasis, diarrhoea and respiratory diseases. Black leg, anthrax, pasteurolosis and intestinal parasitic infections are some of the common livestock diseases in the area. Access to modern health services is very limited.

Like many other Ethiopians, the Zay people use medicinal plants for their primary health care. Ethnobotanically, these people have remained unexplored and no comprehensive account of their traditional practices (including ethnomedicine) is available. As is happening elsewhere in the country, both the traditional knowledge and the plants utilised by these people are under threat due to reasons mainly attributed to degradation, deforestation and cultural shifts.

In this study, we compiled the traditional

knowledge of the Zay people on medicinal plants, looked into factors affecting the practice of traditional medicine and assessed the current status/abundance of medicinal plants and their possible threats in the area.

Description of the study area

The Zay people live on two relatively large islands and two shore areas of Lake Ziway (7° 52' N, 38° 47' E), located about 160 km south of the Ethiopian capital, Addis Ababa, at an altitude of 1630 m a.s.l. With an area of 434 km^2, Lake Ziway is one of seven lakes situated along the Ethiopian Rift Valley. (Tesfaye Edetto, 1988).

There are five islands on Lake Ziway, namely Galila, Debre Sina, Tullu Guddo, Taddacha and Funduro. Galila and Debre Sina are found on the western side of the lake, whereas Tullu Guddo, Taddacha and Funduro are found on the eastern side (Tesfaye Edetto, 1988). Currently, the two larger islands, Tullu Guddo and Taddacha, are occupied by the Zay people, whereas the other three islands have been abandoned because of over-population and a shortage of agricultural land. The Zay people who moved out from these islands have mainly settled on two shore areas, locally known as Bochesa and Mekdela, found along the southeastern and northeastern sides of the lake respectively. Currently, about 2000 Zay people reside in Taddacha, 1500 in Tullu Guddo, 1000 in Bochesa and 500 in Mekdela. There is still a continuous influx of people from the occupied islands to the mainland in search of arable land.

The study area covered one island (Tullu Guddo) and two mainland villages (Bochesa and Mekdela), found at altitudes between 1700 and 1830 m a.s.l. (see Figure 1).

Climate

The area surrounding Lake Ziway, like other Rift Valley areas, has a wet season from July to September, the main rainy season, and a dry and windy season from October to January. There is also irregular, highly variable rainfall from February to June. Generally, the Lake Ziway basin is characterized by an arid climate, with a mean annual rainfall of around 600mm. The mean annual temperature is 19.3°C (Makin et al., 1976; EWNHS, 1996).

Flora and fauna

The Rift Valley is well known for its rich flora and fauna. The country's national parks, game reserves and sanctuaries are mainly concentrated in this area. Open *Acacia* woodland is characteristic of the Rift Valley area. Because of the increased need for farmland and cutting of trees for different purposes (e.g. charcoal making and construction of houses), the area around Lake Ziway, which used to be covered by a variety of woody plants (personal communication with local elders), has now been left with only remnant woodland and bushland patches dominated by *Acacia tortilis* (Forssk.) Hayne, *A. seyal* Del., *A. albida* Del. and *Balanites aegyptiaca* (L.) Del. (Makin et al., 1976).

Lake Ziway is also a refuge for many species of bird. Great white pelican, Marabou stork and Fulvous whistling duck are some of the most common species (EWNHS, 1996). Lake Ziway is also home for hippopotamus and some fish species such as *Tilapia nilotica* and several *Barbus* spp., of which *Barbus zwaicus* is probably endemic (Sayer et al., 1992). The shore areas are rich in *Paspalidium geminatum*, *Typha domingensis* Pers. (bulrush), *Cyperus papyrus* L. (papyrus), *Nymphaea nouchali* Burm. f. (blue water lily) and *Aeschynomene elaphroxylon* (Guill. & Perr.) Taub (ambatch). Bulrush is used for thatching houses, whereas ambatch and papyrus are used for construction of boats. The underground part of *Nymphaea nouchali* is edible, but is only eaten when there is a severe shortage of food.

Materials and Methods

Ethnobotanical information

Ethnobotanical data were collected between January and August 1999, based mainly on semi-structured interviews with selected knowledgeable elders (Martin, 1995; Cotton, 1996).

Most of the interviews and discussions were conducted in Amharic, the official language of the country, and a few in the Oromo language with the help of a translator. On each day, the time allotted for interview with one informant was about three hours. Interviews were conducted in a place where the informants were most comfortable. Information regarding the gathering, preparation, use, status/abundance, trends and cultivation practices of medicinal plants and their marketability was also collected. Additional discussions were conducted with the informants in order to understand the traditional health system of the people and its organization. At the end of each interview, specimens of plants mentioned for their medicinal uses were collected and identified. Voucher specimens for most of these medicinal plants are stored at the National Herbarium, Addis Ababa University.

In this ethnobotanical study, 17 knowledgeable elders (16 men and one woman), between the ages of 41 and 77, were involved from the three study areas (three from Tullu Guddo, four from Mekdela and the remaining 10 from Bochesa) and served as key informants. These elders knowledgeable on medicinal plants were chosen from the different sites with the assistance of local administrators and community elders. During the course of the study, each informant was visited three times in order to verify the reliability of data obtained. If what was said during the first visit concerning the use of a particular medicinal plant by an informant did not agree with what was said during the second or third visit, the information was considered unreliable and was rejected. Repeated visits also helped to gather additional information that was not mentioned during earlier interviews.

The relative popularity of each medicinal plant species was evaluated based on the proportion of informants who independently reported its medicinal use (informant consensus) in the area. For each species, the proportion of informants who independently reported its use against a particular disease/disease category was also assessed following approaches used by Adu-Tulu et al. (1979) and Trotter and Logan (1986).

Additional interviews were also conducted with two groups of different age classes. The first group comprised 20 people aged between 18 and 40, and the second group of 20 people above the age of 40. All the participants in these interviews were randomly picked from the residents of Bochesa village. The aim of the interviews was to compare knowledge of medicinal plants (its depth and breadth) between the two age groups. Every member of the two groups was interviewed separately for about 20 minutes. According to the local elders, parents start passing on their knowledge about medicinal plants to their children at the age of 10, and this continues up to the age of 18. Commencing at the age of 18, children are expected to know what their fathers or mothers know, unless they are not willing to learn or are denied the chance (privilege) by their parents.

A preference ranking technique was employed to rank some selected medicinal plants according to their degree of scarcity. Preference ranking, according to Martin (1995), is one of the simplest analytical tools, which involves asking people to think of five to seven items and then arrange those items according to a given criterion (in this case, medicinal plants were ranked according to their degree of scarcity). Each rank is given an integer value (1, 2, 3 and so on) with the most important item (the most scarce medicinal plant in this case) given the highest value, while the least important is assigned a value of 1. These numbers are summed for all respondents, giving an overall ranking for the objects by the selected group of respondents. For this purpose, 10 individuals were randomly selected from the people that had already served as key informants. Each one of the informants was provided with fresh specimens of six scarce medicinal plants and asked to rank them according to their degree of scarcity. The six plants were selected from a list of medicinal plants that were already reported as scarce by most of the key informants, based on information obtained from key informants, vegetation studies and observation.

Interview responses were recorded in a notebook and sometimes a tape recorder was used.

Some photos were also taken when considered necessary.

Vegetation sampling

In order to classify and describe the existing plant communities and assess the abundance and distribution of the reported medicinal plants in the area, a vegetation survey was carried out between 21st and 27th of March 1999. A total of 30, 20x20 m sample plots were established in all three study sites (11 in Mekdela, nine in Tullu Guddo and 10 in Bochesa), at altitudes between 1700 and 1830 m, following a sampling approach as described by Muller-Dombois and Ellenberg (1974). The sample plots were established systematically in order to cover all habitat types and plant communities occurring in the area (agrib cultural plots, hilltops, grazing areas, wet and dry areas etc.). The homogeneity of each tree stand was checked through observation before laying down a sample plot. For each tree species, individuals encountered within each relevé were counted and percentage cover estimated. For those plants which were not trees (shrubs, herbs, vines, trailing species etc.), only percentage cover was estimated. Herbarium specimens were collected for those plants that were not identified to species level at the time, for later determination at the National Herbarium, Addis Ababa University.

Data analysis

A descriptive statistical method was employed to analyse and summarise the ethnobotanical data on the reported medicinal plants. The programme SYN-TAX, ver. 5 (Podani, 1994), was used to analyse and classify the vegetation data obtained from the relevés. Using classification, similar individual sample stands are grouped into categories which are as homogenous as possible (Greig-Smith, 1980). The percentage cover values, estimated while recording the species in the field, were converted into cover-abundance values according to a 1-9 modified Braun-Blanquet scale (van der Maarel, 1979) (see Table 1).

Table 1. Modified Braun-Blanquet scale for cover-abundance values (van der Maarel 1979).

Scale	Cover/abundance
1	rare
2	occasional
3	abundant
4	very abundant
5	cover 5–12.5%
6	cover 12.5–25%
7	cover 25–50%
8	cover 50–75%
9	cover > 75%

Results

The plants and their application

During the present ethnobotanical survey, 33 plant species were reported by the informants for their medicinal uses (see Tables 2 and 3), representing 32 genera and 23 families. Four species belonged to the family *Boraginaceae* and three to the family *Fabaceae*. The families *Apocynaceae*, *Cucurbitaceae*, *Euphorbiaceae*, *Solanaceae* and *Poaceae* were represented by two species each, whereas the other 16 families were represented by a single species each. Eighty-eight percent of the medicinal plants were reported with their local names and most of them were known only by their Oromo or Amharic names. Four of the plants (12%) have names in the Zay language. Analysis of the data based on their habits shows that 18 species (55%) are herbs, 11 species (33%) are trees and shrubs and four species (12%) are climbers.

Of the 33 reported medicinal plants, 28 species were used against human ailments and 11 species were used against cattle and equine diseases. Some of the medicinal plants were used for both human and veterinary purposes (see Tables 2 and 3). Efforts have been made to find equivalent medical terms in English for each of the local disease names. For such purposes, some medical and veterinary doctors were consulted, although for some local terms, corresponding English names could not be found. Local diseases names are given in small caps.

For human use – Eight species are used as

remedies against gastrointestinal problems, seven species against MICH (febrile illness), four species against skin diseases and three species each against chest pain and snakebites. One to two species each were reported as being used for a number of different ailments such as tonsillitis, toothache and haemorrhoids (see Table 2).

For veterinary use – Ten species are used as remedies against four kinds of cattle diseases, of which four species are used to treat skin problems and three species against anthrax (ABA SENGA). One species is used as a treatment against the only reported equine (donkeys and horses) disease, locally called GEREGELCHA (see Table 3).

Analysis of the data revealed that *Solanum incanum* and *Withania somnifera* are applied to a wide range of ailments. *Solanum incanum* is used against six different ailments (stomach problems, snakebites, chest pain, tonsillitis, MICH and skin wounds of cattle) and *Withania somnifera* is a used for five types of diseases (chest pain, MICH, anthrax, typhoid and evil eye). The other reported medicinal plants (31 species) have one or two uses each.

Plant parts used and method of preparation

Leaves are the most widely used plant parts, accounting for 48% of the reported medicinal plants uses, followed by roots (33%), flowers (9%), fruits and seeds (9%), above ground parts (9%) and the whole plant (9%).

A majority of remedies are prepared in the form of a juice from freshly collected plant parts. The juice is usually prepared by pounding or crushing the plant parts in a wooden or stone mortar and pestle. Water is mostly used to dilute the juice. Few remedies are prepared from dried, and subsequently ground plant parts. Usually, the Zay people do not store remedies for a prolonged period of time. When the need comes, they go out and collect the plant, prepare the remedy and apply it to the animal or person who needs the treatment. Most of the remedies were reportedly prepared from a single species. Detail information on how to prepare each remedy is available from the first author.

Route of administartion and dosage

Most remedies are taken orally, accounting for 79% of medicinal plant use, followed by external application (applied topically on skin) (36%) and nasal application (9%). One species (*Calotropis procera*) is given anally to treat haemorrhoids. The mode of applications of two remedies, *Senna occidentalis* and *Withania somnifera* (used for repelling snakes and in preventing the spread of typhoid respectively), do not fit into either of the above categories since they are meant for prevention rather than treatment. Dried leaves of *Withania somnifera*, for example, are fumigated in the house of the sick person in order to minimize the transmission of the disease to others, while fresh or dried *Senna occidentalis* leaves are kept in a pocket to prevent snakes.

To improve the acceptability of certain oral remedies, additives are frequently used. The juice prepared from the crushed leaves of *Cynoglossum lanceolatum*, for instance, is usually taken with coffee to reduce its bitterness. The remedy prepared with female *Hagenia abyssinica* flowers is mixed with a jelly scraped from a freshly debarked stem of a plant locally called 'deqono', so that the preparation can be swallowed without much difficulty.

Some of the informants reported that restrictions are imposed when certain types of remedies are taken by patients. For example, a patient who takes a remedy against snakebites prepared from the root of *Solanum incanum*, should not sleep the first night after treatment. It is believed that sleeping reduces the efficacy of the remedy. Food is not given to a patient who takes a remedy against tapeworm (prepared from *Hagenia abyssinica*) until the proglottids are expelled from the intestine. The drug is thought to be more effective when the proglottids are made to starve.

For most of the remedies, a full dose is taken at once. The dose given to the patient depends on age, physical and health conditions. Lack of agreement among the informants on doses of certain remedies prescribed was sometimes noted. For example, three crushed leaves of *Cordia monoica* mixed in a cup of water was

Table 2. List of medicinal plants used against human ailments, alphabetically arranged by scientific names (please note that Amh. stands for Amharic and Or. for Oromo).

Scientific name	Family	Zay name	Amharic or Oromo name used by Zay people	Habit	Application	Plant part used	Route of administration
Achyranthes aspera L.	Amaranthaceae	ambulale	dergu arba (Or.)	climber	skin wounds	leaves	skin
Acokanthera schimperi (A. DC.) Schweinf.	Apocynaceae		qereru (Or.)	tree	tonsillitis	leaves	oral
Allium sativum L.	Alliaceae		nech shinkurt (Amh.)	herb	influenza	bulb	oral
					headache	bulb	oral
					chest pain	bulb	oral
Asparagus africanus Lam.	Asparagaceae		seriti (Or.)	climber	skin lesions	cladodes	skin
Calotropis procera (Ait.) Ait. f.	Asclepiadaceae		tobiaw (Amh.)	shrub	haemorrhoids	stem (latex)	anal
Carissa edulis (Forssk.) Vahl	Apocynaceae		agamsa (Or.)	shrub	rheumatism	root	oral
Cordia monoica Roxb.	Boraginaceae	ira	menchera (Or.)	tree	MICH*	leaves	oral and nasaloral
					eye diseases	leaves	
Croton macrostachyus Del.	Euphorbiaceae		bekanisa (Or.)	tree	retained placenta	leaves	oral
					MICH*	root	oral
Cucumis ficifolius A. Rich.	Cucurbitaaceae		holoto (Or.)	trailer	chest pain	root	oral
Cynoglossum lanceolatum Forssk.	Boraginaceae		yemich kitel (Amh.)	herb	MICH *	leaves	oral and nasal
Dyschoriste radicans Nees	Acanthaceae	–	–	trailer	toothache	whole plant	oral
Eleusine coracana (L.) Gaertn.	Poaceae		dagusa (Amh.)	herb	diarrhoea	seeds	oral
Euclea schimperi (DC.) Dandy	Ebenaceae		miessa (Or.)	shrub	MICH*	root	oral
Euphorbia crotonoides Boiss.	Euphorbiaceae		guri (Or.)	herb	stomach problems	root	oral
Hagenia abyssinica (Bruce) J.F. Gmel.	Rosaceae		kosso (Amh.)	tree	tapeworm	flowers (female)	oral
Heliotropium aegyptiacum Lehm.	Boraginaceae	ambachirara		herb	dandruff	leaves	skin
Heliotropium pterocarpum DC.	Boraginaceae		yeamara yemich kitel (Amh.)	herb	MICH*	leaves	oral
Indigofera spicata Forssk.	Fabaceae	–	–	trailer	stomach problems	root	oral
Kedrostis foetidissima (Jacq.) Cogn.	Cucurbitaceae		holobido (Or.) yetirign kitel (Amh.)	climber	chest pain	whole plant	oral
Linum usitatissimum L.	Linaceae		telba (Amh.)	herb	retained placenta	seeds	oral
Ocimum urticifolium Roth.	Lamiaceae		chebicha, wehale (Or.)	herb	MICH*	leaves and skin	oral
Pavetta gardeniifolia (Hiern) Verdc.	Rubiaceae		galo ajeftu (Or.)	shrub	snakebites	leaves	oral
Ruta chalepensis L.	Rutaceae		tena adam (Amh.)	herb	stomach problems	leaves	oral
Senna occidentalis (L.) Link	Fabaceae	–	–	herb	to repel snakes	leaves	–

*MICH – It is a febrile disease. The main symptoms, according to the local elders, are fever, headache and sweating.

Table 2. Continued...

Scientific name	Family	Zay name	Amharic or Oromo name used by Zay people	Habit	Application	Plant part used	Route of administration
HelSolanum incanum L.	Solanaceae		hidi (Or.)	herb	stomach problems	root	
					snakebites	root	oral
					chest pain	root, root bark	oral and skin
					tonsillitis	flowers, fruits	oral
					MICH*	leaves	oral
Sorghum bicolor (L.) Moench	Poaceae		zengada (Amh.)	herb	diarrhoea	seeds	oral
Vernonia amygdalina Del.	Asteraceae	iIbicha		tree	skin wounds	leaves	oral
Withania somnifera L.	Solanaceae		kumo (Or)	herb	chest pain	root	oral
					MICH*	leaves	oral and skin
					typhoid	root	–
					evil eye	root	nasal

*MICH – It is a febrile disease. The main symptoms, according to the local elders, are fever, headache and sweating.

Table 3. List of medicinal plants used in traditional veterinary medicine, alphabetically arranged by scientific names.

Scientific name	Family	Zay name	Amharic or Oromo name used by Zay people	Habit	Application	Plant part used	Route of administration
Acacia sieberiana DC.	Fabaceae		lafto (Or.)	tree	skin diseases	flowers	skin
Agave sisalana Perrine ex Engel.	Agavaceae		alge (Or.)qacha (Amh.)	herb	blackleg	root	oral
Aloe trichosantha Berger	Aloaceae		hargisu (Or.)	herb	anthrax		
Asparagus africanus Lam.	Asparagaceae	seriti (Or.)		climber	GEREGELCHA[1]	root and cladodes	oral
Calotropis procera (Ait.) Ait. f.	Asclepiadaceae		tobiaw (Amh.)	shrub	blackleg	stem (latex)	skin
Capparis tomentosa Lam.	Capparidaceae		gora (Or.)	shrub	skin diseases	leaves	skin
Commicarpus plumbagineus (Cav.) Standley	Nyctaginaceae		gale, qoricha simbira (Or.)	climber	skin diseases	above ground	skin
Kedrostis foetidissima (Jacq.) Cogn.	Cucurbitaceae		holobido (Or.) yetirign kitel (Amh.)	climber	ALOYE[2]	leaves	oral
Senna occidentalis (L.) Link	Fabaceae		-	herb	anthrax	leaves	oral
Solanum incanum L.	Solanaceae		hidi (Or.)	herb	skin wounds	leaves	skin
Withania somnifera L.	Solanacaeae		kumo (Or.)	herb	anthrax	root	oral

[1]GEREGELCHA - an equine disease where mucous continuously comes out of the nose of the sick animal.
[2]ALOYE - a cattle disease. The main symptoms are loss of hair, skin lesions, constipation, failure to urinate and swelling of the body.

cited as a full dose against a disease called MICH by one informant, whereas another informant reported that a handful of leaves of the species should be taken as a full dose to treat the same ailment. Besides, the units (e.g. handful of leaves, some leaves) employed to measure the amount of the plant or plant parts used in the preparation of most of the remedies are rough and therefore lack precision.

No side effects were reported by the informants as a result of the use of the different remedies, except for three species (*Hagenia abyssinica*, *Kedrostis foetidissima* and *Vernonia amygdalina*) that cause vomiting and diarrhoea. Two species (*Solanum incanum* for its fruit used in treating tonsillitis and *Calotropis procera* for its white latex used in treating haemorrhoids) were reported as poisonous to humans if not handled with proper care.

Informants consensus

The results of the study show that some medicinal plants are more popular than others. Accordingly, *Solanum incanum* is the most popular, cited by 10 informants (59%) for its medicinal value, followed by *Withania somnifera* and *Cordia monoica* mentioned by nine (53%) and eight (47%) informants respectively. Each one of the other reported medicinal plants was mentioned by one or two informants.

Similarly, some remedies are more familiar to the informants than others for use against a particular ailment or health problem. Informant consensus for those remedies that were mentioned by two or more informants as being used for the same purpose is given in Table 4. *Cordia monoica* was the most frequently cited remedy, where eight out of the 17 key informants (47%) independently reported its use against MICH, whereas each one of the other reported remedies was only cited by three or less informants.

Comparison of knowledge of medicinal plants between age groups

Knowledge of medicinal plants between two age groups (18 to 40 years and above 40 years) was compared. The sample size for each age group was 20 people. The results revealed that members of the age group above 40 mentioned more medicinal plants than the other group. Eighteen of the interviewees (90%) from this age group cited at least one medicinal plant each (two on average). A total of 10 medicinal plant species were mentioned by this group. Every member of this group who reported to have knowledge of medicinal plants knew the identity of each plant species that they cited, the location where it is collected, its preparation and route of administration.

Nine of the interviewees (45%) from the other group, between the ages of 18 and 40, cited at least one medicinal plant each (one on av-

Table 4. List of medicinal plants confirmed by two or more informants as being used for a particular ailment

Scientific name	Ailment	No. of informants
Cordia monoica	MICH	8 (47%)
Solanum incanum	chest pain	3 (18%)
	tonsillitis	2 (12%)
	stomach problems	2 (20%)
Withania somnifera	evil eye	3 (18%)
	chest pain	2 (12%)
	MICH	2 (12%)
	anthrax*	2 (12%)
Capparis tomentosa	skin disease*	2 (12%)
Commicarpus plumbagineus	skin disease*	2 (12%)
Ocimum urticifolium	MICH	2 (12%)
Hagenia abyssinica	tapeworm infection	2 (12%)
Cynoglossum lanceolatum	MICH	2 (12%)

*cattle diseases

Table 5. Three categories of medicinal plants based on their degree of abundance, as reported by informants.

Rarely encountered (30% of the total)	Occasionally encountered (27% of the total)	Commonly encountered (39% of the total)
Acacia sieberiana	*Achyranthes aspera*	*Agave sisalana*
Acokanthera schimperi	*Aloe trichosantha*	*Allium sativum*
Asparagus africanus	*Calotropis procera*	*Cucumis ficifolius*
Carissa edulis	*Capparis tomentosa*	*Cynoglossum lanceolatum*
Cordia monoica	*Commicarpus plumbagineus*	*Eleusine coracana*
Croton macrostachyus	*Dyschoriste radicans*	*Heliotropium aegyptiacum*
Euclea schimperi	*Euphorbia crotonoides*	*Heliotropium pterocarpum*
Kedrostis foetidissima	*Indigofera spicata*	*Linum usitatissimum*
Pavetta gardeniifolia	*Ruta chalepensis*	*Ocimum urticifolium*
Vernonia amygdalina		*Senna occidentalis*
		Solanum incanum
		Sorghum bicolor
		Withania somnifera

erage), although some were not sure about the plant part used or modes of preparation and application. A total of six medicinal plants were reported by the group. The rest of the interviewees from this group (55%) responded that they did not have any knowledge of medicinal plants and hence could not mention any species.

Habitat, current status and trend of the medicinal plants

Results of this study show that there is little practice of cultivating medicinal plants in the area. Most of the medicinal plants (82%) are, therefore, harvested from the wild. It was noted that only six medicinal plants (*Agave sisalana*, *Allium sativum*, *Linum usitatissimum*, *Ocimum urticifolium*, *Ruta chalepensis* and *Sorghum bicolor*) are under cultivation in the area, either in home gardens or farming plots, of which only one species (*Ocimum urticifolium*) is cultivated primarily for its medicinal use. The medicinal plants *Cordia monoica* and *Acokanthera schimperi* were seen in one or two home gardens, grown from seedlings brought from the wild, mainly for other purposes.

Most of the medicinal plants collected from the wild are available in areas not very far from the Zay villages. There is one highland species (*Hagenia abyssinica*) that is not naturally occurring in the area, but utilized by the people as a vermifuge against tapeworm. When the need arises, the remedy is purchased from the nearby towns.

Thirty percent of Zay medicinal plants which formerly were forest-inhabiting species are now only rarely encountered in the area as remnants on farm plots, edges of farm plots and other disturbed areas (see Table 5). Their quantity was reported to have been decreasing from time to time. Sixty-six percent of the noted medicinal plants are commonly or occasionally found in the area. Most of them are wild herbs that grow in disturbed areas such as fallow lands, roadsides and around home gardens. Favoured by the ever-increasing habitat disturbance, the abundance of these plants in the area was reported to have been increasing during the past years.

Preference ranking values, obtained from the overall ranking for the six medicinal plants (*Acacia sieberiana*, *Acokanthera schimperi*, *Asparagus africanus*, *Carissa edulis*, *Cordia monoica* and *Euclea schimperi*) by the selected respondents (10 informants), showed that *Acokanthera schimperi*, *Cordia monoica* and *Carissa edulis* are the most scarce species in the area (see Table 6). The six plants were selected from a list of medicinal plants that were already reported as scarce by the key informants.

Marketability of the Zay medicinal plants

Ninety seven percent of the Zay medicinal plants are used locally within the community. They were

Table 6. Preference ranking values (based on their degree of scarcity) of the six selected medicinal plants in the study area.

List of medicinal plants	Key informants (coded A to J)										Total score	Ranking
	A	B	C	D	E	F	G	H	I	J		
Acacia sieberiana	3	3	2	2	2	2	1	2	2	4	23	5th
Acokanthera schimperi	5	4	6	6	5	5	6	6	5	5	53	1st
Asparagus africanus	1	1	3	3	1	6	2	5	3	2	27	4th
Carissa edulis	4	6	4	5	4	3	3	3	4	1	37	3rd
Cordia monoica	6	5	5	4	6	4	5	4	6	6	51	2nd
Euclea schimperi	2	2	1	1	3	1	4	1	1	3	19	6th

reported as not being sold in markets, close or distant, by the Zay people, and it is only one species (*Hagenia abyssinica*) that is purchased from markets, since it is does not grow in the area.

Vegetation classification and distribution of medicinal plants

A total of 96 plant species were recorded from the 30 sample plots. Based on the composition and cover-abundance data of the species, the sample plots were classified into five recognized vegetation or community types, 1–5.

1. *Aeschynomene–Typha–Agrostis* community: *Aeschynomene elaphroxylon*, *Typha domingensis* and *Agrostis lachnanta* Nees are the characteristic species of this community. This type of community was found in two of the three study sites; a mainland shore area at Mekdela and a shore area of Tullu Guddo. These are very marshy areas, to the extent that plants growing in these areas are partly covered by water. This plant community is found at an altitude of 1700 m. There were no medicinal plants recorded from this community.
2. *Cynodon–Nymphaea* community: *Cynodon dactylon* (L.) Pers. and *Nymphaea nauchali* are the characteristic species of this community. This type of community occurred in all the three study sites (Tullu Guddo, Bochesa and Mekdela). These are mainly wet grazing areas, bordered by shores of the lake and farming lands. This community occurs at an altitude of 1700 m. Two medicinal plants, *Withania somnifera* and *Heliotropium aegyptiacum*, were recorded from this community. The species are considered rare because of their low mean cover-abundance values.
3. *Cynodon–Cyperus* community: *Cynodon dactylon* and *Cyperus rigidifolius* Steud. are the characteristic species of this community. *Acacia albida* is also abundant. This type of community occurs in the two Zay villages (Bochesa and Mekdela) found on the mainland shore areas of Lake Ziway. It is a community utilised as both grazing areas and farming plots. This community occurs at altitudes between 1700 and 1730m. The medicinal plants *Solanum incanum, Senna occidentalis*, *Achyranthes aspera* and *Ocimum urticifolium* were recorded from this community. *Solanum incanum* was found in abundance.
4. *Acacia–Hypoestes* community: *Acacia tortilis* and *Hypoestes forsskoli* are the characteristic species of this community. This type of community occurred in two of the three study sites (Tullu Guddo and Bochesa). It covers hilly areas with estimated slopes between 30º and 40º, though the stony slopes are still being used as farming plots due to the critical shortage of farming land in the area. This community occurs at altitudes between 1700 and 1830m. The medicinal plants *Heliotropium aegyptiacum* and *Solanum incanum* are rarely encountered in this type of community.
5. *Heliotropium* community: This is a farming plot found in Tullu Guddo where the medicinal plant *Heliotropium aegyptiacum* is

the characteristic species, with a very high mean cover-abundance value (7.000). This community occurs at an altitude of 1700 m.

Only nine (all herbs except one) out of the 33 reported medicinal plants were encountered in the 30 sample plots. Their mean cover-abundance values (also indicative of their frequency) were very low, except for *Heliotropium aegyptiacum* and *Solanum incanum* (see Table 7). Out of the nine medicinal plants, eight were recorded from three communities (community number 3, 4 and 5) that were predominantly agricultural areas. There was no medicinal plant recorded from community 1. As a result of their rare occurrence during the time when the vegetation survey was carried out, the rest of the cited medicinal plants were not encountered in the sample plots.

Discussion

Medicinal plants and associated knowledge

The reported number of medicinal plants (33 species) being used by the Zay people is not small, taking into account the small population size and the extent of deforestation and degradation, and acculturization that has occurred in the area through the years. In a similar study (Abbink, 1993) that was carried out on people called Me'en, whose population size was estimated to be 51,000 and inhabited an area with relatively better vegetation cover in the southwestern part of the country, 52 species of medicinal plants were reported. Tesfaye Awas and Zemede Asfaw (1999) also conducted a similar study on the Berta people of the Benishangul Gumuz Region in Western Ethiopia and their preliminary results showed 24 medicinal plants.

All the informants agreed that more medicinal plants were in use in the past than those reported now. This has happened as a result of continued deforestation, degradation and acculturization that has taken place in the area over several years. This situation gave way to the local loss of some medicinal plants and the associated knowledge. The shore areas of Lake Ziway that are currently inhabited by the Zay people were reported to have been covered by many tree species such as *Acacia tortilis, Acacia albida*, *Acacia tebaica*, *Balanites aegyptiaca*, *Ficus* spp., *Rhus glutinosa* and *Maytenus senegalensis*. Most of these trees have been destroyed, mainly due to the expansion of agriculture and widely practised charcoal making. Few of them are now found scattered on farmlands as remnants. One informant reported that a medicinal plant (local name not given), which was used as remedy against rabies, was lost as a result of the continued deforestation in the area. The informant was not sure whether the plant could be found in some other places in the country or not.

A rich knowledge of medicinal plants has also disappeared, because this knowledge was not properly passed down to the next generation by specialized healers of that time. These healers had a strong tendency of keeping their knowledge secret. Five informants, for instance, reported that the identity of one medicinal plant, which was used as a remedy against snakebites, was lost because holders of the knowledge kept it secret and died without releasing the information to anybody.

Today, there are no professional Zay healers in the area that regularly serve the community. Most of the knowledge is held by elders (picked up from their fathers and grandfathers), who mainly use it to keep the well being of their respective families. Occasionally, they offer help to other people within the community when a request comes. Most of these knowledgeable elders are men. Costentinos Berhe Tesfu et al. (1995) reported that the practice of traditional medicine in Ethiopia is dominated by men. According to Zemede Asfaw (personal communication), however, there are many female healers taking care of family level treatments even though the high level professional healing is mainly practised by men.

Result of interviews conducted on two groups of different age classes showed that older people are more knowledgeable on medicinal plants than the younger ones. The younger generation is more exposed to modernisation

Table 7. Mean cover-abundance values of recorded medicinal plants in the five clusters (community types).

Species name	Mean cover-abundance value in each of the five communities				
	1	2	3	4	5
Withania somnifera	0	0.28571	0	0	0
Heliotropium aegyptiacum	0	0.28571	0	0.18182	7
Solanum incanum	0	0	2.5556	0.90909	0
Senna occidentalis	0	0	0.66667	0	0
Achyranthes aspera	0	0	0.22222	0	0
Ocimum urticifolium	0	0	0.22222	0	0
Pavetta gardeniifolia	0	0	0	0.63636	0
Agave sisalana	0	0	0	0.36364	0
Indigofera spicata	0	0	0	0.18182	0

(e.g. modern education) and is therefore not interested in learning and practicing traditional medicine. Similar situations have been observed elsewhere. In Nepal, for example, the impact of modernization has been so widespread that only older people have a knowledge of traditional medicine (Manandhar, 1995).

The fact that most of the medicinal plants are known by either their Amharic or Oromo names gives us room to suspect that the major source of knowledge of the medicinal plants of the Zay people are both the peoples of Amhara (northern part of the country) and the Oromo (central part of the country). This might have occurred as a result of their long-standing historical relationship with the Amharic speaking people in the earlier times (Tuma Nadamo, 1982), and later on the close interaction they had with the neighbouring Oromo people. The younger generation of Zay community inhabiting the shore areas of Lake Ziway use Oromo language more frequently than their own (Zay language) in their day-to-day communication. This shows the strong relationship they have established with the Oromo people. This does not mean that the Zay people are using these medicinal plants exactly the same way they have been used by the peoples of Amhara and Oromo. Some modifications are expected to have happened in the process as traditional knowledge itself is dynamic and, in fact, we observed some changes in the way some medicinal plants are used in the area. In the treatment of haemorrhoids, for instance, the Zay people use the white latex of *Calotropis procera* (a recently introduced weed to the area), whereas the Amhara people use powdered seeds of *Calotropis procera* as a remedy against the same ailment.

Thirty-nine percent of the reported medicinal plants are used for the treatment of gastrointestinal problems and MICH. Gastrointestinal disorders and MICH are among the most highly prevalent diseases in the study area. According to Dawit Abebe and Ahadu Ayehu (1993), a certain complaint with several alternative drugs might indicate a preponderance of that particular health problem.

Solanum incanum and *Withania somnifera* are the two most frequently used species as remedies against a variety of complaints in the area. The high diversity of use of these two species could be attributed to their relative abundance in the area. The high consensus of the key informants on the medicinal use of the species *Solanum incanum*, *Withania somnifera* and *Cordia monoica* shows the importance of these plants to the Zay people. The high salience or familiarity of *Cordia monoica* (cited by 47% of the key informants) for use as a remedy against a particular ailment, MICH, might indicate its efficacy. According to Trotter and Logan (1986), pharmacologically effective remedies are expected to have greater informant consensus. According to Johns et al. (1990), however, confirmation is not a single true measure of the potential efficacy of any remedy. There is a great probability of a common plant, reported to treat a common disease, to be cited more frequently than a rare plant that is

used to treat a disease of limited occurrence.

Most of the reported Zay medicinal plants (70%) are also used elsewhere in Ethiopia for their medicinal value, of which six species (*Allium sativum*, *Calotropis procera*, *Eleusine coracana*, *Hagenia abyssinica*, *Solanum incanum* and *Withania somnifera*) are in many instances used in the same way as they are used by the Zay people. The fact that some medicinal plants are used for the same purpose by more than one community (we may call it 'community consensus') might indicate the pharmacological effectiveness of these remedies. Thirty-seven percent of the plant remedies that were cited during the course of this study were also reported to have been used medicinally by authors in other parts of the world (Lal and Yadav, 1983; Johns et al., 1990; Ghazanfar and Al-Sabahi, 1993; Sequeira, 1994; Barrett and Kiefer, 1996; Karehed and Odhult, 1997; Weimann and Heinrich, 1997; Ballero and Pole, 1998). The active substances of some of the Zay medicinal plants are already known from other studies carried out elsewhere (Dawit Abebe and Estifanos Hagos, 1991).

Preparation, dosage and route of administration

Most of the reported preparations in the area are drawn from a single plant; mixtures are used rarely. In other parts of the country, the use of mixtures of plant species in treating a particular ailment is fairly common (Dawit Abebe, 1986). Synergic interaction or potentiating effect of one plant on the other, when in prescription of multiple sources, is well-recognized in Ethiopian traditional medical practice (Dawit Abebe and Ahadu Ayehu, 1993).

Lack of precision in the determination of doses has been noted in the area. According to Dawit Abebe and Ahadu Ayehu (1993), the major drawbacks in traditional medicine stem mostly from a lack of precision in dosage.

The majority of the remedies are taken orally. This agrees with the results of a study carried out by Dawit Abebe and Ahadu Ayehu (1993). They found that the main administration route of all the reported remedies used in Northern Ethiopia is an oral route, accounting for 42%.

Habit of the medicinal plants used

More than half of the Zay plant remedies were reported to have been obtained from herbs. This might indicate that the people have come to rely on herbs because they are relatively common in the area as compared to tree species. It takes much more time and effort to harvest medicinal trees. Dawit Abebe and Estifanos Hagos (1991) compiled a list of 51 medicinal plants used in the traditional health practices of Ethiopia, of which 30 species (56%) were herbs.

The most widely sought after plant part in the preparation of remedies in the area is the leaf. Collecting leaves does not pose a great danger to the existence of an individual plant when compared with the collection of an underground part, stem or whole plant. Studies have shown that removal of up to 50% of tree leaves does not significantly affect the growth of the species studied (Poffenberger et al., 1992). However, the popularity of roots including bulbs and rhizomes, barks and stems has grave consequences from both an ecological point of view and for the survival of the species (Dawit Abebe and Ahadu Ayehu, 1993). Costontinos Berhe Tesfu et al. (1995) reported that some plant species, such as *Dracaena steudneri*, *Hagenia abyssinica* and *Securidaca longepedunculata*, that are harvested for their roots, bark or whole part in many parts of the country have become scarce and thus difficult to find.

Habitat and status of the medicinal plants

Most of the medicinal plants utilized by the Zay people are harvested from the wild. This is also true in many other parts of the country. Tesfaye Awas and Zemede Asfaw (1999) reported that 71% of the medicinal plants of the Berta people in western Ethiopia were obtained from the wild. Zemede Asfaw (1998) reported that only six percent of plants maintained in home gardens in Ethiopia are primarily cultivated for their medicinal value, even though many other plants grown mainly for non-medicinal uses turn out to be

important medicines when health problems are encountered. The fact that most of the remedies are only found in the wild poses a significant threat to their existence if the mass destruction of their habitats continues. The continued cutting of plants for different reasons has resulted in a scarcity of some medicinal plants in the study area (e.g. *Acokanthera schimperi* and *Cordia monoica*). Even those species that seem relatively common (those that favour disturbed areas) may soon be endangered. An increasing need to use more herbicides (especially on the mainland shore areas) and the continued use of farming plots for cultivation without leaving land fallow (as there is a shortage of farming plots in the area as a result of over-population) could also be potential threats to the existence of the Zay medicinal plants normally growing in agricultural fields in the area.

Analysis of the vegetation data collected from the relevés showed that almost all of the medicinal plants reported from the study area are rarely encountered. As most of the medicinal plants reported from the area are seasonal herbs, with the timing of the data collection being in the dry season, many of the were dry and, therefore, had low a probability of being encountered in the relevés. They are abundant towards the end of the long rainy season (August and September). Much time and effort is needed to harvest medicinal plants during the dry season. We were told that some medicinal plants only grow immediately after the rainy season, but these were not included in our survey because their identity was not known.

Medicinal plants and trade

There is no threat to Zay medicinal plants arising from trade, as they are only harvested for local use. But, the same medicinal plants could be available in markets elsewhere in the country. There are a number of Ethiopian medicinal plants (e.g. *Hagenia abyssinica*, *Embelia schimperi* and *Glinus lotoides*) that are widely traded for their domestic use (Kloos, 1976; Kloos et al., 1978). The only significant recorded medicinal plant export from Ethiopia is khat (*Catha edulis*), but it is traded primarily for its properties as a stimulant (TRAFFIC International, 1998).

Conclusion

The Zay people are partly dependent on medicinal plants to fulfil their day-to-day health care needs. A loss of medicinal plants and associated knowledge will, to a certain extent, hamper the existing health care system in the area, as there is no adequate modern health care programme that can fully shoulder this responsibility.

However, the knowledge of medicinal plants is declining in its depth and breadth and less and less medicinal plants are being utilized as generation goes by. The introduction of modern education to the area has partially contributed in making the younger generation undermine traditional medicinal knowledge and practices because such practices have been considered backward.

The environmental degradation and intense deforestation that have continued for a century, as a result of increased needs for farming lands, fuel wood and construction materials in the area, have been the main causes for the reduction in quantity (depletion) of medicinal plants. As a result, there has been a major shift in the type of medicinal plants used in the area, from forest-derived species to those growing in disturbed habitats (mostly herbs), such as roadsides and fallow land.

As environmental degradation and deforestation continue, there is a high probability of losing some of the rarely encountered medicinal plants from the area (e.g. *Acokanthera schimperi* and *Cordia monoica*). In the area, there is little practice of bringing medicinal plants under cultivation.

There is no real threat to the medicinal plants in the area as a result of over-harvesting for their medical purposes. They are only used locally and therefore harvested in small quantities. Furthermore, since most of the Zay remedies are obtained from leaves, the probability of survival of individual plants after harvest is expected to be high.

Most of the Zay medicinal plants are also widely used elsewhere in the country for their medicinal value (some of them even for the same medicinal use). The wide use of these medicinal plants could be attributed to their effective medicinal properties.

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