

Revisión | Review

Ethnobotany of medicinal plants of northern Ethiopia

[Etnobotánica de plantas medicinales del norte de Etiopía]

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Abstract: An ethnobotanical survey based on semistructured questionnaires among 35 farmers was carried out in two regions in Tigray, northern Ethiopia. Ethiopia is one of the poorest countries in the world with low level of medical care; therefore indigenous knowledge of medicinal plants is highly priced information and can be a good source of income to family or community. In total, 58 plant species were detected, while 48 plants, and 44 genera, belonging to 27 families have been identified as medicinal. Vernacular, as well as scientific names, plant part used, way of use and modes of preparation and application are included. Majority of plants were used for various gastrointestinal disorders, sprains treatment or to heal bronchitis, however, interesting aspects are the uses of plants to cure bilirubinemia, prostate disorders, syphilis and milk ingest disorders.

Keywords: ethnomedicine, indigenous people, remedy, Ethiopia

Resumen: En dos regiones del Tigray (Tigré), en el norte de Etiopía se realizó un estudio etnobotánico, basado en un cuestionario semiestructurado, entre 35 agricultores. Etiopía es uno de los países más pobres del mundo con un bajo nivel de atención médica, por lo tanto, el conocimiento autóctono de las plantas medicinales es una información muy valiosa y puede ser una buena fuente de ingresos para la familia o comunidad. En total, se detectaron 85 especies de plantas, de las cuales fueron identificadas como plantas medicinales 48 especies y 44 géneros pertenecientes a 27 familias botánicas. En el estudio están incluidos los nombres vernaculares y científicos, como también parte de la planta utilizada y su forma de uso, modos de preparación y aplicación. La mayoría de las plantas se usan para el tratamiento de diversos trastornos gastrointestinales y esguinces o para curar la bronquitis; sin embargo, son interesantes los usos reportados para tratar la bilirrubinemia, dolencias de la próstata, sífilis y la intolerancia a la lactosa.

Palabras Clave: etnomedicina, pueblos originarios, remedio. Etiopía

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INTRODUCTION

Traditional botanical knowledge of indigenous communities relating to the uses and management of wild plant resources is extensive (Cotton, 1997). Study of Jin *et al.*, (1999) showed that documentation of indigenous knowledge through ethnobotanical studies is important for the conservation of biological and cultural diversities as well as sustainable utilization of resources. Due to these facts the need of conservation of the biological diversity and its indigenous knowledge has been emphasised in contemporary studies of ethnobotany and genetic diversity (Rossato *et al.*, 1999; Padula *et al.*, 2013; Fernandez *et al.*, 2013). However, this conservation can not be successful without indigenous people and application of their ethnobotanical knowledge.

Rural communities generally and indigenous people particularly depend on plant resources especially for food, forage, constructions, household supplements, beds and sleeping mattresses, firewood or as shade providing plants. Moreover, indigenous people all over the world are still using medicinal plants for treatment of various diseases and the practice of traditional medicine indicates to be continued in spite of advancement in allopathic system of medicine (Akram *et al.*, 2011, Ovesná *et al.*, 2011; Ovesná *et al.*, 2013). Ethnomedicine, a sub-field of ethnobotany dealing with the study of medicinal plants, might provide important information in development of new drugs. Ethiopia is one of the centers of origin (Harlan, 1975) and for most parts, the biological richness in diversity is still not adequately documented although there have been many attempts (Birhane *et al.*, 2011; Bussmann *et al.*, 2011; Giday *et al.*, 2009; Giday *et al.*, 2010; Parvez and Yadav, 2010; Seid and Tsegay, 2011; Teklehaymanot, 2009; Zerabruk and Yirga, 2012).

The aim of this paper is to document the traditional ethnobotanical knowledge of local medicinal plants which are used for the treatment of various human ailments by rural communities around Mekele city in northern Ethiopia. Moreover, specific information were obtained on plant parts used, how the plants are collected and processed to make remedies, and how the remedies are administered.

METHODOLOGY

Study area

Ethiopia belongs to one of the poorest countries in the world (UNDP, 2011). The country is divided into 13 administrative districts while the landscape contains

scale of vegetation resources, varying from tropical rain and cloud forests in the southwest to the desert scrubs in the east and northeast and parkland agroforestry on the central plateau. Both study sites, Atsbi and Adi Keyih villages (Figure 1), are located in arid and semi-arid zones with cool, tropical climate. The mean annual temperature is 18 °C, while the average daily temperature is fairly constant throughout the year. Annual rainfall in both sites is about 700 mm per year. Farmers can only grow one rain-fed crop a year, while the growing period lasts between 45 to 120 days (Corbeels *et al.*, 2000).

Main cultivated crops are *Avena abyssinica* Hochst., *Catha edulis* Forssk., *Coffea arabica* L., *Eleusine africana* Kenn.-O'Byrne, *Ensete ventricosum* (Welw.) Cheesman, *Eragrostis tef* (Zuccagni) Trotter and *Guizotia abyssinica* (L. f.) Cass. (Cowan and Watson, 2006).

The soils are predominantly sandy and stony with low organic matter content. Highlands of Tigray, northern Ethiopia, are facing the problems with land degradation, i.e. erosion and soil nutrient depletion. Farmers in Tigray enrich their soils by uprooting and burning weeds (Mengesha, 1996). Average farm size is less than 0.5 ha, of which less than 0.3 ha is cultivated. The non-cultivated area is left fallow or is unsuitable for arable cropping (Hengsdijk *et al.*, 2005).

Data collection

The ethnobotanical research was conducted near two villages (Atsbi and Adi Keyih), located 48 km (Lat: 13° 52' 0.0006" Long: 39° 43' 59.9988") to the north and 68 km (Lat: 12° 59' 9.312" Long: 39° 40' 40.3392") to the south from Mekele city, respectively, the capital of Tigray Regional State located in northern Ethiopia. The data were obtained in November 2010 from 35 farmers (9 women, 26 men) with an average age of 49 years, who spent most of their lives in studied area and who were willing to participate in the survey. Prior to research, the permission to carry out the interviews with local people about the use of medicinal plants was obtained from representatives of the villages, moreover, the local authorities recommended key respondents for research and give us general information about the tradition of the indigenous people. Semi-structured questionnaires were used to collect information and respondents were queried for the type of herbal cure used for treating various diseases. Obtained data were recorded in Ahmaric language and subsequently translated into English. Botanical identification was done with the

help of group of taxonomists from Research Institute at Mekele and verified in the Czech University of Life Sciences Prague by Assoc. Prof. Vaclav Zeleny. Due to absence of generative organs, flowers or fruits, the identification of ten plant species was impossible.

Ethnomedicinal uses were categorized according to Economic Botany Data Collection Standard and the Fidelity level index was estimated $P < 0.05$ (Cook, 1995; Friedman et al., 1986).

Figure 1
Location of two study areas in northern Ethiopia.



RESULTS

In total, 58 medical species were encountered of which 48 species, and 44 genera, belonging to 27 families have been identified within this ethnomedicinal survey. The most representative families were *Fabaceae* and *Solanaceae* comprising 9 and 6 species, respectively, followed by *Asteraceae* and *Boraginaceae* (3 species each) and *Acanthaceae*, *Cucurbitaceae*, *Malvaceae* and *Polygonaceae* (each comprised 2 species). The most frequently used species were *Achyranthes aspera* L. reported by 12 respondents, *Heliotropium steudneri* Vlatke, *Solanum incanum* L., and *Withania somnifera* (L.) Dunal prefaced consistently by 7 respondents and *Carissa edulis* (Forssk.) Vahl, and *Maytenus arbutifolia* R. Wilczek were reported by 6 and 5 respondents, respectively. Table 1 shows the list of medicinal plants used for human treatment by rural communities around study sites, of which all are used curatively

except the species *Olea europae* L., which is used both preventively and curatively.

The predominant life forms of plants were herbs (59 %) followed by shrubs (21 %), while trees were represented by 14 %. Approximately 96 % of farmers collect medicinal plants from wild, mainly from natural forest, and 74 % cultivate them in homegardens. Most of reported plant parts used in preparation of remedies were roots (65 %) and leaves (38 %). Given popularity of roots might be due to easy way of their use, as they are mainly chewed or put on fire and inhaled. Gessler et al. (1995) reported that roots can be also dried and powdered or homogenized with water (Ojewole, 2002) and this mixture can be kept for longer time. The high percentage of (semi-)domesticated encountered species showed the potential propagation of medicinal plants as some of them were already cultivated in homegardens, however, the extensive root excavation can be

devastating and can lead to a threat of the species survival or extinction (Amri & Kisangau, 2012).

Given the frequency of medicinal plants, 12 species were used for treatment of stomach problems (22%) followed by sprains 11 plant species (20%), 7 plant species (12%) were used to treat bronchitis, 6

(10%) were used for swelling and 5 (8%) of mentioned plants were used as antidepressant and to cure wounds. The use of medicinal plants for gastrointestinal disorders was also reported as the most important category in other tropical regions (Begossi et al., 2002; Heinrich et al., 1998; Macía et al., 2005).

Table 1
Medicinal plants used for human treatment by rural communities around Mekele city, Tigray region, Ethiopia

Botanical name and voucher specimen	Family	Vernacular name	Plant part used	Use	Mode of preparation	Mode of application	<i>n</i>
<i>Acacia</i> sp. MOR020	<i>Leguminosae</i>	Kentefefe	Root	Swelling	Paste is mixed with honey from <i>Apis mellifera</i>	Poultice	1
<i>Acacia etbaica</i> Schweinf. MOR039	<i>Leguminosae</i>	Seraw	Root	Bronchitis	Roasted	Smoke inhalation	1
<i>Achyranthes aspera</i> Duss. MOR028	<i>Amaranthaceae</i>	Michelle	Leaf, root	Stomach ulcer, eye ache, scorpio bite, wound, cold, sprain	Juice; infusion; dried; fresh	Drink, eye drops, chewing, poultice, inhalation	12
<i>Aloe</i> sp. MOR031	<i>Asphodelaceae</i>	Re	Root	Sprain	Roasted	Smoke Inhalation	1
<i>Argemone mexicana</i> L. MOR019	<i>Papaveraceae</i>	Medafe	Stem	Wound	Macerate in water	Drops, poultice	1
<i>Asparagus africanus</i> Lam. MOR033	<i>Asparagaceae</i>	Kesta nito	Root	Sprain	Decoction	Inhalation	1
<i>Astragalus atropilosus</i> Hochst. MOR018	<i>Leguminosae</i>	Teten agazen	Leaf	Tooth pain	Fresh	Chewing, poultice	1
<i>Asystasia gangetica</i> (L.) T. Anderson MOR021	<i>Acanthaceae</i>	Girbia	Leaf, root	Stomach ache, stomach ulcer	Juice	Drink, chewing	3
<i>Buddleja polystachya</i> Fresen. MOR041	<i>Buddlejaceae</i>	Metere	Leaf	Tonsil inflammation	Fresh	Poultice	1
<i>Cadia purpurea</i> Ait. MOR013	<i>Leguminosae</i>	Shilean	Leaf	Fire burn	Powder is mixed with coffee	Scarification	1
<i>Calpurnia aurea</i> Baker MOR038	<i>Leguminosae</i>	Hitswits	Bark, root	Bronchitis	Roasted	Smoke inhalation	1
<i>Caralluma fimbriata</i> Wall. MOR048	<i>Asclepiadaceae</i>	Hamashiro	Stem	Heartburn	Fresh	Chewing	1
<i>Carissa edulis</i> Vahl. MOR026	<i>Apocynaceae</i>	Igam	Root	Antidepressant, sprain	Combination of more plants*, **	Smoke inhalation	6
<i>Clerodendrum myricoides</i> Gürke MOR007	<i>Lamiaceae</i>	Shewah, Tsaeda kotsli ^a	Root	Snake bite	Paste is mixed with water	Drink	2
<i>Coffea arabica</i> Benth. MOR049	<i>Rubiaceae</i>	Buna	Fruit	Antidepressant	Roasted and mixed with hot water	Drink	1
<i>Cordia africana</i> Lam. MOR006	<i>Boraginaceae</i>	Awhi	Leaf	Stomach ache	Paste is mixed with hot water and sugar	Drink	1

<i>Coreopsis</i> sp. MOR003	<i>Asteraceae</i>	Imbaboadey	Root	Wound	Powder is mixed with water	Ointment	1
<i>Cucumis propheratum</i> L. MOR001	<i>Cucurbitaceae</i>	Korarmbe	Root	Snakebite	Fresh	Chewing	1
<i>Cynoglossum lanceolatum</i> Forssk. MOR004	<i>Boraginaceae</i>	Teneg	Leaf	Swelling	Fresh	Scarification	1
<i>Dodonea angustifolia</i> L.f. MOR012	<i>Sapindaceae</i>	Tehases	Leaf, bark, root	Bronchitis, wound	Roasted, paste	Smoke inhalation, dressing	2
<i>Echinops maracandicus</i> Bunge MOR053	<i>Asteraceae</i>	Dender	Root	Headache	Decoction	Inhalation	1
<i>Eucalyptus globulus</i> Labill. MOR057	<i>Myrtaceae</i>	Tsaed bahrizaf	Leaf	Sprain	Infusion	Inhalation	1
<i>Euclea racemosa</i> Murr. MOR002	<i>Ebenaceae</i>	Killaw	Bark, root	Bilirubinemia, bronchitis	Roasted; decoction	Smoke inhalation, drink	3
<i>Heliotropium steudneri</i> Vatke MOR009	<i>Boraginaceae</i>	Amamgimel	Leaf	Broken bone, swelling, wound	Paste	Poultice, scarification, dressing	7
<i>Juniperus procera</i> Hochst. ex Endl. MOR029	<i>Cupressaceae</i>	Sareda	Root	Sprain	Roasted combination of more plants**	Smoke inhalation	1
<i>Justicia schimperiana</i> T.Anderson MOR036	<i>Acanthaceae</i>	Shimega	Leaf	Bilirubinemia	Juice	Drink	2
<i>Maytenus arbutifolia</i> R.Wilczek MOR023	<i>Celastraceae</i>	Atat	Bark, root	Bronchitis, sprain	Combination of more plants**; fresh	Inhalation	5
<i>Momordica foetida</i> Schumach. MOR044	<i>Cucurbitaceae</i>	Rambo rambo	Root	Stomach ache	Fresh	Chewing	2
<i>Olea europaea</i> Thunb. MOR032	<i>Oleaceae</i>	Awlie	Bark, root, leaf, stem	Bronchitis, toothache	Roasted, fresh	Smoke inhalation, chewing	3
<i>Rosa abyssinica</i> R.Br. MOR024	<i>Rosaceae</i>	Kaga, Kaka ^a	Root	Sprain	Combination of more plants	Inhalation	2
<i>Rumex abyssinicus</i> Jacq. MOR016	<i>Polygonaceae</i>	Mekmoko	Root	Bone tuberculosis	Paste is mixed with cow butter	Ointment	1
<i>Rumex obtusifolius</i> Auct. Ex Meisn. MOR058	<i>Polygonaceae</i>	Dengele	Root	Headache	Decoction	Inhalation	1
<i>Sida schimperiana</i> Hochst. ex A.Rich. MOR030	<i>Malvaceae</i>	Tifrarria	Root	Sprain	Roasted	Smoke inhalation	2
<i>Solanum incanum</i> L. MOR011	<i>Solanaceae</i>	Ngule	Root, leaf	Stomach ache, peptic ulcer	Paste, juice; fresh	Chewing, drink	7
<i>Solanum</i> sp. MOR046	<i>Solanaceae</i>	Alamogella	Leaf	Stomach ache	Paste	Poultice	1
<i>Tarchonanthus camphoratus</i> Houtt.ex DC. MOR040	<i>Asteraceae</i>	Ibuk	Root	Bronchitis	Roasted	Smoke inhalation	1
<i>Trifolium campestre</i> C.C.Gmel. MOR055	<i>Leguminosae</i>	Hazo	Leaf	Swelling	Mixed with onion	Poultice	1

<i>Verbascum sinaiticum</i> Benth. MOR050	<i>Scrophulariaceae</i>	Efshwea	Root	Bilirubinemia	Powder is mixed with water	Drink	1
<i>Verbena officinalis</i> L. MOR037	<i>Verbenaceae</i>	Atush	Root	Tonsil inflammation, toothache	Fresh	Chewing	3
<i>Withania somnifera</i> (L.) Dunal MOR022	<i>Solanaceae</i>	Agol	Root	Antidepressant, sprain	Infusion; combination of more plants***	Drink, inhalation	7
Unknown sp. 1 MOR035	<i>Leguminosae</i>	No local name	Root	Stomach ache	Fresh	Chewing	1
Unknown sp. 2 MOR056	<i>Leguminosae</i>	Naykurtset	Root	Stomach disorder	Fresh	Chewing	1
Unknown sp. 3 MOR027	<i>Leguminosae</i>	Quequeta	Root, leaf	Sprain, milk ingest disorders	Mix of more plants; dried and powdered**	Inhalation, drink	4
Unknown sp. 4 MOR034	<i>Malvaceae</i>	Tsere dimu	Leaf	Stomach ulcer	Paste is mixed with honey from <i>Apis mellifera</i>	Oral ingestion	1
Unknown sp. 5 MOR007	<i>Solanaceae</i>	Alamo	Root	Syphilis	Fresh	Chewing	1
Unknown sp. 6 MOR052	<i>Solanaceae</i>	Gullehe tsenie	Root	Sexual disease	Dried and powdered	Drink	1
Unknown sp. 7 MOR051	<i>Solanaceae</i>	Alamohegora	Leaf	Stomach disorder	Paste	Poultice	1
Unknown sp. 8 MOR010	<i>Verbenaceae</i>	Bierir	Stem	Antidepressant	Fresh	Inhalation	1
Unknown sp. 9 MOR005	Unknown	Dorora	Leaf	Weapon wound	Paste is mixed with water	Body wash	1
Unknown sp. 10 MOR014	Unknown	Keyh fire	Leaf	Pulling out of spike	Fresh	Poultice	1
Unknown sp. 11 MOR015	Unknown	Mecheru	Root	Head tuberculosis, snake bite	Fresh	Chewing	2
Unknown sp. 12 MOR017	Unknown	Ezni anchewa	Leaf	Swelling	Paste is mixed with honey from <i>Apis mellifera</i> ; paste	Drink, poultice	2
Unknown sp. 13 MOR025	Unknown	Tish bealhito	Root	Sprain	Combination of more plants**	Inhalation, smoke inhalation	3
Unknown sp. 14 MOR042	Unknown	Tsifiriri	Root	Prostate disorder	Paste	Poultice	1
Unknown sp. 15 MOR043	Unknown	Seseg	Leaf	Swelling	Paste	Poultice	1
Unknown sp. 16 MOR045	Unknown	Shewa kerni	Root	Antidepressant	Roasted combination of more plants *	Smoke inhalation	1
Unknown sp. 17 MOR047	Unknown	Tiemti	Root	Snake bite	Infusion	Drink	1
Unknown sp. 18 MOR054	Unknown	Keyhembeba	Root	Stomach disorder	Fresh	Chewing	1

^aVarious names in study areas; n: number of reports; (*, **, ***) plant mixed together

DISCUSSION

The results obtained may indicate that the incidence of diseases as stomach problems, sprains, bronchitis and swelling was relatively high in the study area, while common African diseases, like malaria and dengue, were limited by environmental conditions (i.e. high elevation). Almost all remedies were based on the preparation of a single plant, notable exceptions were species used to cure sprain (*Carissa edulis*, *Maytenus arbutifolia*, *Rosa abyssinica* R. Br., *Withania somnifera* and two unidentified species), bronchitis (*Maytenus arbutifolia*) and depression (*Carissa edulis* and *Withania somnifera*). Interestingly, the species known as *Alamo* in Ahmaric belonging to family *Solanaceae* was used to treat syphilis, *Tsifriri* was used to cure prostate disorders, while the species *Quequeta* from family *Leguminosae* was used for milk ingest disorders.

Furthermore, most of the medicinal plant species had high Fidelity level (Friedman *et al.*, 1986) which indicates that the species were used by the respondent to treat only one or two illnesses. The low fidelity level was recorded only on *Achyranthes aspera*, which was used for treatment of stomach ulcer, Scorpio's bite, wound, cold, sprain and eye ache. Antioxidant activity and wound healing effect at this species were reported by Edwin *et al.*, (2008) and Barua *et al.*, (2006); while Subbarayan *et al.*, (2010) reported anti-cancer activity in India.

Storing of remedies at studied households was not recorded, the only exception mentioned by informants was *Rumex abyssinicus* Jacq. root, which was stored in cool place to prevent the material going rot or dry up. All other remedies were prepared mainly from fresh plant material which was collected in the nearest forest or around the place of living. We assume that this is influenced by the fact that there are more plant species curing the same disease, such as *Momordica foetida* and *Solanum incanum*, which are both used for stomach ache, thus there is always fresh plant material available for given remedy.

According to Bradacs (2008), the discussion with the local authorities underlined that in this area the knowledge is usually inherited from generation to generation, given from mother to daughter and father to son and most likely staying in one family (sometimes, these rules can be changed and knowledge can be passed on inter-sexually from father to daughter or mother to son or even to third parties). This logically imply that elderly people should have better knowledge of medicinal plants, however, our

results show that local knowledge of medicinal plants do not increase with age of the farmer, and younger individuals had often greater knowledge and used more medicinal plant species. We asses that the natural progress was probably interrupted by sequence of major events, such war with Eritrea, epidemic, big age difference between father and son or simply by the fact, that younger generation obtained the knowledge by their own experience. Contrary to our assumptions, Estomba *et al.*, (2006) reported that medicinal plant knowledge and use increase with age, when community suffers an important erosion of ethnomedicinal plant knowledge, probably because the ethnic group studied was different and it be the cause of the observed differences.

The respondents reported that they have obtained their knowledge from the books or any other accessible literature, while illiterate farmers had to rely on knowledge of their fathers and their own experimental treatment methods. Our findings are in agreement with the study of Awad *et al.*, (2006) who reported that respondents with education acquired knowledge about common diseases and medicines for self-treatment more easily.

CONCLUSION

The present research have shown that the traditional medicine in study area is still playing a significant role in meeting the basic healthcare needs, and medicinal plants are widely used by local people. In this study 58 plants belonging to 27 families were recorded to be used as remedies, while most of the species were collected in the nearest surrounding of the farms. *Fabaceae* and *Solanaceae* were the most frequent botanical families, while the predominantly quoted species were *Achyranthes aspera*, *Heliotropium steudneri*, *Solanum incanum*, *Withania somnifera*, *Carissa edulis* and *Maytenus arbutifolia*. In terms of frequency of utilized plant parts, the most popular were roots (65%) followed by leaves (38%) used mostly (> 50%) to cure stomach problems, sprain and bronchitis.

Based on the findings of this study, it has been suggested that additional studies may be carried out, as the documentation of traditional knowledge of medicinal flora is very important to the context of maintaining linkage between local culture and its ecosystem, which is of utmost concern for the conservation of local biodiversity. Moreover, the surveyed area indicates a high diversity of medicinal plants and it is believed that further studies may

contribute to research for sourcing of raw materials for the development of commercial pharmaceuticals.

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