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PHYTOCHEMICAL AND ETHNO BOTANICAL STUDY OF MEDICINAL PLANTS USED TO TREAT ECTOPARASITES IN RUMINANT ANIMALS IN EASTERN TIGRAY, NORTHERN ETHIOPIA

Hailegrebreal Tesfaye, Mabratu Hishe and Shilashi Badasa *

College of Natural and Computational Science, Adigrat University, P.O. Box 50, Adigrat, Ethiopia.

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Correspondence to Author: Shilashi Badasa

College of Natural and
Computational Science,
Adigrat University, P.O.
Box 50, Adigrat, Ethiopia.


E-mail: shibobix@gmail.com

ABSTRACT: The use of ethnobotany practices to treat and control ruminant livestock diseases is old practices in large part of the world. To investigate Traditional medicinal plants used to treat ectoparasites in ruminant animals' Semi-structured interview, observation and field guided walks were used with ruminant livestock owner, local and traditional healers who had willing to share their indigenous knowledge. The outcome of this study indicates that *Phytolacca dodecandra*, *Calpurnia subdecandra*, and *Nicotiana glauca* Graham are the dominant plants used by local people to treat ectoparasites in ruminant animals in the study area. These three plants were extracted by methanol for chemical information and accepted laboratory techniques were used for phytochemical determinations. Phytochemical analysis of methanol extract showed the presence of bioactive molecules.

INTRODUCTION: In most developing African countries like Ethiopia, ruminant livestock production remains crucial and represents a major asset among resource-poor smallholder farmers by providing milk, meat, skin, and manure. However, the economic benefits of ruminant populations remain marginal due to prevailing ruminant livestock diseases which are among the principal bottlenecks of livestock performance and cause of high economic losses of the resource-poor farmers¹. For generations, the use of ethnobotany practices to treat and control ruminant livestock diseases is old practices in large part of the world, particularly developing countries where animal health services are still very poor or/and are found scarcely located at urban areas^{2, 3, 4}.

Still, those near conventional drugs also use traditional medicinal drugs to treat their animals due to cultural acceptability, efficacy against certain diseases and economic affordability⁵. A great variety of traditional materials are used to treat and prevent ruminant livestock health problems; medicinal plants which have been used both for prevention and cure of various diseases of humans and animals from time immemorial occupy the largest portion^{6, 7}.

Herbal medicine has become more popular in the treatment of many diseases due to the belief that green medicine is safe, easily available and with fewer side effects⁸. Similar to other forms of traditional knowledge, ethnoveterinary medicinal plants knowledge is not compiled⁹. It is simply transferred verbally from generation to generation and thus there is a danger of extinction as older people die and the younger generation is not interested in living the traditional way of life¹⁰. The situation is exacerbated by rapid socio-economic, technological and environmental changes¹¹. Thus, unraveling the information and

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documentation of ethnoveterinary medicinal plants is urgent so that the medicinal plant knowledge can be available and conserved from deterioration and loss for the sustainable control of livestock diseases. Additional to investigating the information and documentation of ethnoveterinary medicinal plants, bioactive compounds were characterized from three dominant plants (*Phytolacca dodecandra*, *Calpurnia subdecandra*, *Nicotiana glauca* Graham) and results were recorded as indicated in **Table 5**.

The result obtained from the study revealed that there are many ethnoveterinary medicinal plants which have good potential for treatment of ectoparasites in livestock animals. Many bioactive compounds were disclosed by this study from the three selected plants. Therefore, this paper presented accumulated ethnoveterinary medicinal plants used in the study area, Eastern Tigray, Northern Ethiopia.

General Objective: This study aimed to investigate the ethnobotanical and chemical composition of medicinal plants used to treat ectoparasites in ruminant animals.

Specific Objectives:

- ✓ To identify the traditional medicinal plants in treating ectoparasites in ruminant animals.
- ✓ To document and transfer the identified plants for the next generation.
- ✓ To document plant parts used for medicinal purposes and methods of preparation.
- ✓ To determine the presence of bioactive compounds in traditional medicinal plants.
- ✓ To assess the threat of medicinal plants.

MATERIALS AND METHODS:

Description of the Study Area: The study was conducted in Eastern Tigray, North Ethiopia. Eastern Tigray is found in Northern part of Ethiopia, which is about 818 km far from Addis Ababa and about 35 km from Mekelle town, the capital city of Tigray regional state. It is located at altitudinal ranges from 2000-3000 m.a.s.l and geographically located 14°16'34' N latitude and 39°27 '52' E longitudes. It has a unimodal rainfall distribution with the highest rain falling from June

to early September. The annual average rainfall of this zone ranges from 450 mm-600 mm, and the minimum and maximum temperature are 6 and 21°C respectively.

Field Survey and Ethno-botanical Data

Collection: An ethno-veterinary botanical survey was conducted to gather information on the traditional usage of plants in ruminant livestock health care system using a semi-structured interview, observation and field guided walk¹² with ruminant livestock owner, local and traditional healers who had willing to share their indigenous knowledge. A prior communication was done with the local administrative and agricultural developing agents for the objective of having an affinity in the study area. Purposive sampling was undertaken and was interviewed based on their knowledge of traditional medicine. Among the seven woreda three were selected randomly. Those Woredas are Wukura, Gulomekeda and Atsbi. During collection of information regarding habitat data, part of the plant used, effective of the plant relative to the other, traditional preparation and its application were recorded.

Plant Sample Collection: Based on the information provided by the herbalists during the survey, plants were collected for chemical information. The fresh leaves and healthy part of these plants were collected locally from the selected woreda. After collection samples were transported to the chemistry department of Adigrat University. The leaves of the sample were washed with water and dried under shaded area at room temperature.

Extraction of Organic Compounds: The dried leaves of each plant were ground by mortar and pistol, weighed and stored at room temperature. The Soxhlet extraction method was used for this extraction. 40 gm plant materials were extracted in a Soxhlet apparatus, using methanol for 3:30 h for each plant. The same method was repeated until enough crude residues were collected. The solvent was evaporated to dryness. The remaining extract was dried in vacuum oven at 40 °C for two hrs to remove any residual solvent. The crude residues were then weighed for estimating their percentages yield and kept in a refrigerator (-4 °C) until phytochemical test was done.

Phytochemical Analysis of Methanol Extract:

The study for phytochemical constituents was performed using generally accepted laboratory technique for qualitative determinations. The screening was carried out for crude extract to identify the active chemical constituents. The tests were done for glycosides, terpenoids, steroids flavonoids, anthraquinone, saponins, phenolics, tannin, carotenoids, and carbohydrate.

Test for Flavonoids: 1 gm of each crude extract was mixed with 2 ml of 2% solution of NaOH in separate test tubes. An intense yellow color was formed for all the three samples which turned colorless on the addition of 3 drops of dilute HCl which indicated the presence of flavonoids.

Test for Glycosides: 2 ml of concentrated H₂SO₄ was added carefully to 1 gm of each crude extract in the test tube and shaken gently. A reddish brown color was observed for all extracts. This indicated the presence of aglycone portion of the glycoside.

Test for Phenols: 1 gm of each Crude extract was mixed with 2 ml of 2% solution of FeCl₃ in a separate test tube. A bluish-black was observed for each extract.

Test for Saponins: 1 gm of each crude extract was mixed with 5 ml distilled water in a test tube, and it was shaken vigorously. The stable foam was formed for all the extracts. This taken as an indication for the presence of saponins.

Carbohydrates:

Iodine Test: 2 ml of each extract was treated with 5 drops of Iodine solution. The blue color was observed for both *Phytolacca dodecandra* and *Calpurnia subdecandra*, but brown color was observed for methanol extract of *Nicotiana glauca* Graham.

Test for Steroids: 1 gm each crude extract was mixed with 2 ml of chloroform and concentrated H₂SO₄ was added sidewise. A red color was produced in the lower chloroform layer. This result was indicating the presence of steroid.

Test for Tannins: 1 gm each crude extract was boiled in 10 ml of water in a test tube and then filtered. 3 drops of 0.2% ferric chloride were added, and a blue-green was observed.

Test for Terpenoids: 1gm of each crude extract was dissolved in 2ml of chloroform and evaporated to dryness. To each 2ml of concentrated H₂SO₄ was added and heated for 2 min. A reddish-brown color was observed.

Data Analysis: Percent and tables were used to summarize the ethnoveterinary medicinal data. The analysis of the percent of yield and phytochemical analysis were done in triplicate.

RESULTS:

Traditional Remedies against Ectoparasites: During the survey, 12 traditional plants remedies were mentioned by the respondents in the control of ectoparasite in livestock. **Table 1** presents an overview of these remedies, with their respective families and methods of preparation according to the respondents. According to informants, all the remedies are used in new forms (Leaves, latex, roots) grounded with water or urine of animals or ash and applied to the skin of the animals. In application no mixing of the different plant was reported by the informants, it is based on the preparation of a single plant. Although, a remedy prepared by mixing of varying plant increases the efficiency for treatment of these various ectoparasites of livestock due to the synergetic effect, it has a toxic effect on the animals.

TABLE 1: PLANTS IDENTIFIED AS ETHNO VETERINARY MEDICINAL PLANTS USED TO TREAT ECTOPARASITES IN LIVESTOCK, PART OF THE PLANT USED AND METHOD OF PREPARATION FROM EASTERN TIGRAY, NORTHERN ETHIOPIA

Botanical name	Local name (Tigrigna)	Family name	Habit	Part used	Method of preparation and application
<i>Piliostigma thonningii</i> (Schumacher)	Amamgimel (T)	Boraginaceae	Herb	Leaf	Fresh leaves are pounded and applied to the skin where affected by ectoparasites
<i>Phytolacca dodecandra</i> . L	Shibti (T)	Phytolacaceae	Climber	Leaf	Fresh leaves are grounded with little water and applied to the place where affected by ectoparasites

<i>Nicotiana glauca</i> Graham	Tegegne (T)	Solanaceae	Shrub	Leaf	Leaf is grounded with water and applied to treat ectoparasites, avoid skin diseases. Used to treat leech. After application, the plant must be washed from the animal in one day because it has side effect on the animal
<i>Aloe megalacantha</i>	Ere (T)	Aloeceae	Shrub	Latex	Cut leaf and apply latex on skin.
<i>Croton macrostachyus</i> Hochst.	Tunbako (T)	Euphorbiaceae	tree	Root	Root chopped and mixed with water and dressed to the tick-infested area on cow and calf
<i>Otostegla integrifolia</i> Benth	Chiendog (T)	Lamiaceae	Shrub	Leaf	The leaves are pounded with little water and carefully applied to skin
<i>Calpurnia decandra</i>	Hatsawts (T)	Fabaceae	Tree	Leaf	The leaf of the plant is grounded with water and applied to the skin of animals affected by parasites. Mainly used to against ticks
<i>Datura innoxia</i> Mill	Mestenagir (T)	Solanaceae	Herb	Leaf	The leaf is grounded and applied to the skin position affected by parasites
<i>Laggera tomentosa</i>	Kasho kasho (T)	Asteraceae	Herb	Leaf or root	The leaf is grounded and placed on the wound by parasites
<i>Premna oligotricha</i>	Sesha dama (T)	Lamiaceae	Shrub	Leaf	Place on fire for fumigation
<i>Ricinus communis</i> .L.	Gulei (T)	Euphorbiaceae	shrub	Leaf	The leaf is grounded and placed on the wound by parasites
<i>Euphorbia petitiiana</i>	Tsaba dimu (T)	<i>Euphorbiaceae</i>	herb	Latex	Latex is streaked on the infected part against Dermatophilosis

The Diversity of Medicinal Plants: The present study reported total of 12 traditional plant remedies used by the traditional healers. These traditional plant remedies belong to 8 families with Euphorbiaceae represented by (3 species), Solanaceae and Lamiaceae (2 species each) and Boraginaceae, Pytolacaceae, Aloeceae, Fabaceae and Asteraceae (1 species each) **Table 2**.

Habitat, Growth Forms, and Plant Parts Used, Threats of Medicinal Plants:

Habitat: In the study areas, the majority of the medicinal plants (66.67%) were reported to be collected from the wild and search of these medicinal plants takes long time and distance, however some of the plants such as *Heliotropium cineastes*, *Phytolacca dodecandra* L., *Aloe megalacantha* and *Calpurnia decandra* are found nearby home gardens. The plant *Nicotiana glauca* *Graham* is mostly found in near agricultural field and roadside along highly disturbed areas. In the study areas, leaves represented the most common part used for treatment of ectoparasites (66.67%) than the roots (16.67%) and latex/ clado (16,67%) **Table 3**. Regarding to the growth forms the

study indicates that the shrubs were the widely used for the treatment of ectoparasites with largest percentage (41.66%) followed by herb (33.3%), tree (16.67%) and climber (8.34%).

TABLE 2: PLANT FAMILIES FREQUENTLY USED AMONG TRADITIONAL HERBALISTS AND LIVE-STOCK OWNERS IN ATSBI, WUKRO AND GULEMEKEDA WOREDAS

S. no.	Family	Number of species	Proportion
1.	Lamiaceae	2	16.67
2	Solanaceae	2	16.67
3	Euphorbiaceae	3	25
4	Oleaceae	1	8.3
5	Phytolacaceae	1	8.3
6	Asteraceae	1	8.3
7	Boraginaceae	1	8.3
8	Fabaceae	1	8.3

In the study areas various human-induced and natural factors which threaten the survival of medicinal plants were reported by the informants. Although, ranking of threatening factors was not made, agricultural expansion, drought incidence, firewood extraction, overgrazing, and construction

major threats of these plants. Since, the indigenous knowledge of these medicinal plants is in the hands of few peoples most of the people considered the service the medicinal plants the rendered as free of service. The informants feared unless conservation measured is made the will be the loss of the plant role over time.

TABLE 3: PARTS OF ETHNO-VETERINARY MEDICINAL PLANTS USED AS REMEDY FOR LIVESTOCK IN THE STUDY AREAS

Part used	Percentage
Leaves	66.67
Roots	16.67
Latex/Clado	16.67

TABLE 5: PHYTOCHEMICAL ANALYSIS OF METHANOL EXTRACT OF *PHYTOLACCA DODECANDRA*, *CALPURNIA SUBDECANDRA*, *NICOTIANA GLAUCA GRAHAM*

Constituents	<i>Phytolacca dodecandra</i>	Evidence	<i>Calpurnia subdecandra</i>	Evidence	<i>Nicotiana glauca Graham</i>	Evidence
Alkaloid	+	Brown-reddish precipitate	+	Brown-reddish precipitate	+	Brown-reddish precipitate
Flavonoids	+	Yellow color	+	Yellow color	+	Yellow color
Glycosides	+	A reddish brown color	+	A reddish brown color	-	Black
Carbohydrates	+	blue colour	+	blue colour	-	Brown
Tannin	+	Blue-Green color	-	Red	+	Blue-Green color
Saponin	+	Formation of foam	+	Formation of foam	+	Formation of foam
Terpenoids	+	A reddish brown color	+	A reddish brown color	+	A reddish brown color
Steroids	+	A red color	+	A red color	+	A red color
Phenol	+	A bluish-black	+	A bluish-black	+	A bluish-black

DISCUSSION: Indigenous people of different localities have their specific knowledge on plant use, management and conservation¹³. Medicinal plants represent a significant contribution to human and livestock health, and it has been suggested that their use is one of the most significant ways in which humans directly reap the benefits provided from biodiversity^{14, 15}. The people of Kilde-Awulalo have a long history of using medicinal plant for treatment of different animal and human parasites and diseases¹⁶. The present study reports a total of 12 traditional remedies are reported by informants in the three.

Study areas of eastern zone of Tigray. This finding similar to¹⁷ reported the use of *Nicotiana tobacum* for treatment of ectoparasites such as ticks, fleas, and lice in three ethnic societies in the South Omo zone of the Southern Nations, Nationalities and Peoples Region (SNNPR) of Ethiopia. A similar

Phytochemical Analysis of Methanol Extract of *Phytolacca dodecandra*, *Calpurnia subdecandra*, and *Nicotiana glauca Graham*: Phytochemical screening of selected three top plants shows the presence of active ingredients.

TABLE 4: THE YIELD OF METHANOL EXTRACTS OF *PHYTOLACCA DODECANDRA*, *CALPURNIA SUBDECANDRA* AND *NICOTIANA GLAUCA GRAHAM*

S. no.	Plants	The yield of the extract
1	<i>Phytolacca dodecandra</i>	20.6
2	<i>Calpurnia subdecandra</i>	23.85
3	<i>Nicotiana glauca Graham</i>	27.4

study by Gebremedhin *et al.*, 2013 reported traditional healers in Tamaqua-Abergele and Kolla-Tembien depends of medicinal plants of *Calpurnia decandra* and *Euphorbia petitiiana* for treatment of ectoparasites of skin. In another study *Aloe megalacantha*, *Premna oligotricha* and *Otostegla integrifolia* are used for the treatment of ectoparasites by peoples of Kilde-Awulalo as reported by Abrha *et al.*, 2013.¹⁶

Nearly, 41.67% of the medicinal plants used by the local peoples for treatment of ectoparasites are a shrub. This may indicate that their relatively better abundance as compared to another life form. High usage of herbs as a means of medicinal plants for treatment of various diseases and parasites especially occurs in areas receiving year-round rainfall. Medicinal plants are harvests for their roots, rhizomes, barks, stems and whole parts as described by^{10, 18}.

The present study reported leaves were the most harvested plant part of remedy preparation in the study areas. This is due to their easy availability and easy to collect them. Studies show that removal of up to 50% of tree leaves does not significantly affect plant growth¹⁹. Collecting leaves do not cause great danger to the continuity of an individual plant compared to the collection of roots, bark, stem or whole plant. The present study shows, nearly around 66.67% of the medicinal plants are collected from wild when they needed. The search for these plants takes a long time and long distance that wild habitats are the major pool of medicinal plant resources for the local community. Gidey (2001)²⁰ reported that there is little practice of domesticating medicinal plants and medicinal plants found in the wild also poses a threat to their existence if habitats are destroyed.

The phytochemical screening done for selected medicinal plants (*P. dodecandra*, *Calpurnia subdecandra*, *Nicotiana glauca* Graham) shows that the presence of different active compounds (Glycosides, terpenoids, steroids flavonoids, anthraquinone, saponins, phenolics, tannin, carotenoids, and carbohydrate). Determination of yield of methanol extract shows that *Nicotiana glauca* Graham gave a high yield with methanol extract. Further, validation through *in-vitro* and *in-vivo* assessment of their anti-parasitic properties is required to better inform their use by traditional healers. Furthermore, bioactivity evaluation of these plant species also will help to isolate and purify the active principles by bio-assay guided fractionation for new drug development.

The finding shows that most of the medicinal plants in the study area have no protection since they are harvested from the wild with no evident conservation practices. Agricultural expansion, drought incidence, firewood extraction, over-grazing, and construction are major threats of survival of these plants. Pressures from agricultural expansion, widespread cutting for fuel wood combined with seasonal drought have been reported by Balemie et al., (2004)²¹, Mesfin et al., (2009)²² and Lulekal et al., (2008)²³ as main factors for environmental degradation as well as the depletion of medicinal plants. For example, the plants such as *Calpurnia decandra* (Hutsawutse) which domesticated in agricultural are used for the

construction of farming materials. The most dominant plant *Nicotiana glauca* Graham (Tegegne) which growth on near agricultural fields completely is removed from the field for agricultural expansion. Abrha et al., (2013)¹⁶, reported that the knowledge of medicinal plants is in the hands of few traditional healers associated with this the knowledge of knowing medicinal plants is declining to the failure of transferring from elderly to young generation due to the fading interest of the young generation. Unless effective conservation and documentation of these medicinal plants are made, there is a potential of loss of the role of the plant over time.

CONCLUSION: Loss of knowledge and habitat of traditional medicinal plants is threatening the future of vital resources and diversity of herbal medicine. The observation and finding bring further evidence that local people and traditional healers in the study area have enough knowledge on the use of medicinal plants. The study will facilitate the researcher who has volunteer around this work for further investigation of plants with the relatively high level of potency to against ectoparasites for ruminant animals in eastern Tigray, Ethiopia.

RECOMMENDATION: Depending on the result of our study the following recommendations were given.

- To save the next generation and solve the present problem we should concern with natural products which are available around us
- The observation and finding bring enough evidence that old people have an excellent background about traditional medicinal plants than this generation. So documentation of these plants should be continued to save indigenous knowledge and transfer to the next generation.
- The present finding brings clue that the extract from the three plants is becoming powerful and saves alternative means of ectoparasites control instead of synthetic drugs that may have the side effect.
- This study is not finalized; in further work validation through *in vitro* and *in vivo* assessment of their anti-parasitic properties is required to better inform their use by traditional healers.

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CONFLICT OF INTEREST: Nil

REFERENCES:

- Mesfine TM and Lemma: The role of traditional veterinary herbal medicine and its constraints in the animal health care system in Ethiopia. In: Conservation and Sustainable Use of Medicinal Plants in Ethiopia. Medhin Zewdu and Abebe Demissie (Eds); Institute of Biodiversity Conservation and Research, Addis Ababa, Ethiopia 2001: 22-28
- Kokwaro O: Medicinal Plants of East Africa. East African Literature Bureau, Nairobi 1976; 292-294.
- McCorkle CM: Back to the future lessons from ethnoveterinary research, development extension for studying and applying knowledge. J Agric Food Human Values Society 1995; 22(2): 52-80.
- Sinha P, Govil J and Singh K: Diseases and their management, recent progress in medicinal plants. Sci Tech, Pub LLC, USA, 2002: 1-105.
- Gemechu W, Girma A, Temesgen S and Ensermu K: Aspects of farmers' knowledge, attitudes and practices (KAP) of animal health problems in the central highlands of Ethiopia. Presented at Intern Conf Ethnovet Med, Pune, India, 1997.
- Bekele A and Musa A: Ethnoveterinary practice in Chiro District, western Hararge, Ethiopia. Pharmacologyonline 2009; 128-139
- Giday M and Ameni G: An Ethnobotanical Survey on Plants of Veterinary Importance in Two Woredas of Southern Tigray, Northern Ethiopia. SINET: Ethiop J 2003; 123-136.
- Prakash C: Biological and pharmacological properties of *Terminalia chebula* retz. (haritaki)-An overview. Int J of Pharmacy and Pharmaceutical Sciences 2012; 62-68.
- Fullas F: Ethiopian Medicinal Plants in Veterinary Healthcare: A Mini-Review. Ee-JRIF 2001; 48-58.
- Abebe D and Ayehu A: Medicinal Plants and Enigmatic Health Practice of North Ethiopia. Berhanina Selam Printing Enterprise, Addis Ababa, 1993.
- Tabuti J, Dhillion S and Lye K: Ethnoveterinary medicine for cattle (*Bos indicus*) in Bulamogi country, Uganda: plant species and mode of use. J Ethnopharmacol 2003.
- Martin G: Ethnobotany: A method Manual. Chapman and Hall. London, 1995.
- Cotton M: Ethnobotany: Principles and Applications. New York, USA: John Wiley and Sons, 1996.
- Fransworth N and Soejarto D: Global importance of medicinal plants. In The Conservation of medicinal plants. Edited by Akerele O, Heywood V, and Synge H, Cambridge, UK: Cambridge University press; 1991: 25-51.
- Bannister K and Prophet R: Ethnobotany: A report on traditional plant knowledge and contemporary concerns of the Prophet River First Nation. Northeastern British Columbia; Prophet River First Nation and Prophet River Contracting Ltd; 2006: 1-53.
- Abraha T, Braha T and Mirutse G: An ethnobotanical study of medicinal plants used in Kilte Awulaelo District, Tigray Region of Ethiopia. Journal of Ethnobiology and Ethnomedicine 2013; 9: 65
- Ketema T, Etana D, Spiridoula A, Adugna T, Gebeyehu G and Jos G: Ethnomedicinal study of plants used for the treatment of human and livestock ailments by traditional healers in South Omo, Southern Ethiopia. Journal of Ethnobiology and Ethnomedicine 2013; 9: 32
- Hunde D, Asfaw Z and Kelbessa E: Use of traditional medicinal plants by people of 'Boosat' subdistrict, Central-Eastern Ethiopia. Ethiopian Journal of Health Science 2006; 141-155.
- Poffenberger, McGean MB, Ravindranath NH and Gadgil M: Editors of Field Methods Manual Volume 1: Diagnostic tools for supporting joint forest management systems. Society for Promotion of Wastelands Development, New Delhi, India, 1992.
- Gidey M: An ethnobotanical study on medicinal plants used by the Zay people in Ethiopia. Centrum för Biologisk Mångfald Skriftserie 2001; 81-99.
- Balemie, Kelbessa K and Asfaw Z: Indigenous medicinal utilization, management and threats in Fentale Area, Eastern Shewa, Ethiopia. Ethiopian Journal of Biological Science 2004; 1-7.
- Mesfin, Demissew FS and Teklehaymanot T: An ethnobotanical study of medicinal plants in Wonago Woreda, SNNPR, Ethiopia. Journal of Ethnobiology and Ethnomedicine 2009; 5: 28
- Lulekal E, Kelbessa E, Bekele T and Yiniger H: An ethnobotanical study of medicinal plants in Mana Angetu District, south-eastern Ethiopia. J Ethnobiol Ethnomed 2008; 4: 10.

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