

Full Length Research Paper

An ethno-veterinary survey of medicinal plants in woredas of Tigray region, Northern Ethiopia

Gebremedhin Gebrezgabiher^{1,2*}, Shewit Kalayou^{2,3} and Samson Sahle²

¹Faculty of Veterinary Medicine, Semera University, Semera, Ethiopia.

²College of Veterinary Medicine, Mekelle University, Mekelle, Ethiopia.

³Department of Production Animal Clinical Sciences, Norwegian School of Veterinary Science, Oslo, Norway.

Accepted 29 January, 2013

For generations, the use of ethno-veterinary practices to treat and control livestock diseases is an old practice in a large part of the world, particularly developing countries where animal health services are still very poor. This study was undertaken to document the ethno-veterinary medicinal plant knowledge of 115 purposively selected local farmers in Tanqua-Abergele and Kolla-Tembien woredas of Tigray region using a semi-structured interview, observation and field guided walk from October 2008 to April 2009. Specimens of plants that were used for treatment of livestock ailments were collected, coded and transported for taxonomic identification at Mekelle University and Addis Ababa University National Herbarium. The survey led to documentation of 29 medicinal plant species belonging to 23 various families. *Achyranthes aspera* L. (10.4%) *Calpurinia aurea* (Ait) Benth (9.6%), *Nicotiana tabacum* (9.6%) and *Malva parviflora* L. (7%) were the most frequently reported plant species. Herbs were the most widely used for the treatment of various ailments constituting the largest percentage (60%) followed by trees and shrubs with 24.3 and 15.7%, respectively. The study reveals that the local farmers of the study areas were with a wealth of knowledge of medicinal plants used to manage livestock health problems by harvesting the ones found in their vicinity. Further ethno-veterinary botanical surveys in these areas and other unexplored part of the region as well as the other regions of the country is advocated before most times, tested indigenous knowledge of the traditional herbalists passes away.

Key words: Medicinal plants, livestock, ailments, Tanqua-Abergele, Kolla-Tembien, Ethiopia.

INTRODUCTION

In most developing African countries like Ethiopia, livestock production remains crucial and represents a major asset among resource-poor smallholder farmers by providing milk, meat, skin, manure and traction. However, the economic benefits of livestock populations remain marginal due to prevailing livestock diseases which are among the principal bottle necks of livestock performance and cause of high economic losses of the resource poor farmers (Mesfine and Lemma, 2001).

For generations, the use of ethno-veterinary practices to treat and control livestock diseases is an old practice in

a 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 (Kokwaro, 1976; McCorkle, 1995; Sinha et al., 2002). Still, those in close proximity to conventional drugs also use traditional medicinal drugs to treat their animals (Gemetchu et al., 1997) due to cultural acceptability, efficacy against certain diseases and economic affordability (Teklehaymanot and Giday, 2007).

A great variety of traditional materials are used to treat and prevent livestock health problems; medicinal plants (Bekele and Musa, 2009) which have been used both for prevention and cure of various diseases of humans and animals from time immemorial occupy the largest portion (Giday and Ameni, 2003).

Similar to other forms of traditional knowledge, ethno-

*Corresponding author. E-mail: gebruska2012@yahoo.com.
Tel: +251-913-532700. Fax: +251-336-660-621.

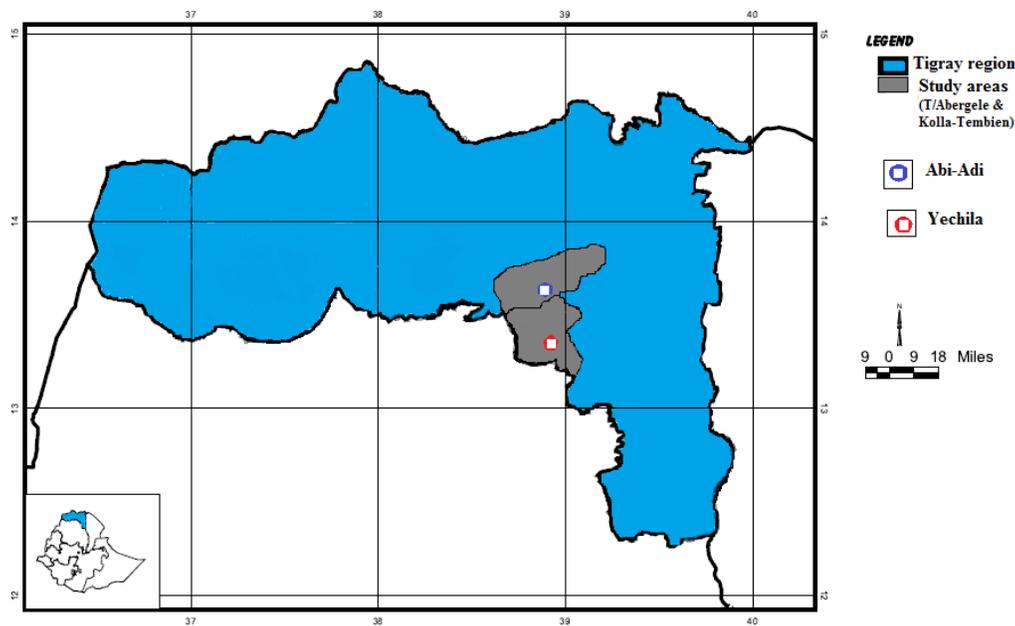


Figure 1. Map of the location of the study woredas (Tanqua-Abergele and Kolla-Tembien).

veterinary medicinal plant knowledge is not compiled (Fullas, 2010). It is simply transferred verbally from generation to generation and thus there is danger of extinction as older people die and younger generation is not interested in living the traditional way of life (Abebe and Ayehu, 1993). The situation is exacerbated by rapid socio economic, technological and environmental changes (Tabuti et al., 2003). Thus, unraveling the information and documentation of ethno-veterinary 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. To the best of our knowledge, this study is the first of its kind in this area. Therefore, this paper presents compiled ethno-veterinary medicinal plants used in the study districts, Tanqua-Abergele and Kolla-Tembien woredas of the Tigary region, northern Ethiopia.

MATERIALS AND METHODS

Study areas

The study was conducted from October 2008 to April 2009 in Kola Tembien and Tanqua Abergele districts of Tigray Region, Northern Ethiopia (Figure 1). Yechila (Tanqua Abergele) is located 110 km south west of Mekelle at 13.3° north latitude and 39° East longitude at an altitude of 1590 m.a.s.l. Average annual temperature ranges between 27 and 30°C, the vegetation of the area is dominated by xerophylic plants. Abi-Adi (Kola Tembien) is located 13° 33' 39 north latitude and 38° 58' 26 east longitude at an elevation of 1,693 m.a.s.l. bordered on the south by Tanqua-Abergele, on the west by the Tekezé River which separates it from the North Western Zone, on the north by the Wari River which separates it from Naeder

Adet and Werie Lehe, on the east by Eastern Zone, and on the southeast by Degua Tembien (Figure 1). Mixed crop and livestock farming system is the mode of agriculture in the districts with cattle and goats as the major livestock kept which are highly important for the livelihood of the local population in both woredas. Cattle and goat production particularly plays a central role in the farming system. There is no adequate veterinary man power and veterinary clinics, except two veterinary clinics located in the two towns of the woredas namely Yechila and Abi-Adi. Animal health professionals together with modern drugs, vaccines are mobilized to the rural areas and villages during disease out breaks and yearly vaccination campaigns.

Field survey

An ethno-veterinary botanical survey was conducted to gather information on the traditional usage of plants in livestock health care system using a semi-structured interview, observations and field guided walks (Martin, 1995) with the livestock owners, local and traditional healers who were willing to share their indigenous knowledge. A prior communication was done with the local administrative and agricultural developing agents for the objective of having affinity in the study area. A total of 115 individuals were purposively selected and interviewed based on their knowledge on traditional medicine.

Plant collection and identification

Specimens of plants that were mentioned by the traditional herbalists and farmers for treatment of livestock ailments were collected. Collection was based on the information provided by the herbalists during the survey. Plant specimen collection was done by including the vegetative part, leaves, and floral, fruiting and/or seed parts as it was appropriate for taxonomic identification. During collection information regarding habitat data, general description of the plant and geographical site of collection were recorded. The specimens were coded by their vernacular names and were trans-

ported by plastic bag to avoid drying. After collection and drying, voucher specimens were identified by botany specialists in Mekelle University and science faculty of Addis Ababa University National Herbarium for botanical identification and further storage as references.

Data analysis and interpretation

Proportions (percentiles) and tables were used to summarize the collected ethno-veterinary medicinal data.

RESULTS AND DISCUSSION

A total of 29 ethno-veterinary medicinal plant species belonging to various 23 families were documented with details on their local name, family, habit and their traditional preparation, mode of application (Table 1). *Achyranthes aspera* L. (10.4%) *Calpurinia aurea* (Ait) Benth (9.6%), *Nicotiana tabacum* (9.6%) and *Malva parviflora* L. (7%) were the most frequently used and reported plant species for ethno-veterinary practice. Table 2 shows the number of plant species belonging to the family. Table 3 shows the number of ethno-veterinary medicinal plant remedies used to treat livestock ailments. Figure 2 shows the proportion of habit of ethno-veterinary medicinal plant. Plant parts used and modes of remedy administration are listed in Figures 3 and 4, respectively.

The survey revealed that the major portion of the farmers in the villages relies on traditional veterinary knowledge, practices and locally available materials (Giday and Ameni, 2003) primarily medicinal plants to cure and prevent livestock health problems such as wound, local swellings, mastitis, ectoparasites, tape worm, anthrax, dermatophillosis, diarrhea, jaundice, ear infection (otitis), leach infestation, pastuerellosis, snake and scorpion bites, and bone fracture. Although, other local materials are used, the use of plants for the treatment of various ailments prevails.

In this study, herbaceous medicinal plants were the widely used for the treatment of various ailments constituting the largest percentage (60%) which agree with studies in other parts of Ethiopia (Tessema et al., 2001; Sori et al., 2004; Teklehmanot and Giday, 2007) followed by trees and shrubs with 24.3 and 15.7%, respectively. On the plant parts basis used for medicinal purposes, different plant parts like seeds, roots, latex, leaves, bark and flower were used for treatment. However, leaves were the predominantly (74.8%) used plant part for herbal preparation in the areas followed by latex (9.6%), bark (5.2%) by the ethno-veterinary practitioners. Numerous techniques of preparation were employed before administering the remedies. Some of the plants are fed directly to the affected animals to achieve desired effects, while the leaves of others are crushed and squeezed to get the plant juice needed for topical (66.1%), nasal drop (9.6%) and auricular application. In other cases, aqueous decoctions are

drenched. Some of the plant parts are processed with other ingredients like butter.

As with most local knowledge systems, information on ethno-veterinary medicinal plants in the study area is rarely codified in written form; they are accepted orally from their forefathers and transmitted similarly to their children, most often to the first-born from generation to generation. This was analogous with studies in other parts of Ethiopia (Giday et al., 2009), Pakistan (Farooq et al. 2008) and Brazil (Barboza et al., 2007; Monteiro et al., 2011). Moreover, the medicinal plants have been growing in natural habitats (wild) and are being exploited to cure ailments by collecting them from natural habitats (Sinha et al., 2002).

The bulk of plant matter that are used for medicinal purposes are collected from the natural vegetation stocks that shrink with majority of the claimed ethno-veterinary medicinal plants collected from natural habitat (wild) without cultivation. The fact that the remedies are found only in the wild possesses a big threat to their existence as long as the mass destruction of their habitats continues (Giday et al., 2003) and the mode of transfer of endogenous knowledge is verbal from generation to generation. There is also an increase threat to these medicinal plants due to continuous draught, agricultural expansions and cultivation of marginal lands. The stock of the vegetation of medicinal plants is shrinking and in a big threat due to the combined effects of these factors (Bekele, 2006).

The traditional medicinal use of some surveyed medicinal plants is recorded in other parts of the country. *Hagenia abyssinica* is used to treat Taneasis in human in Bale, Debark and Kofle rural communities of Ethiopia (Assefa et al., 2010). Similar, its use for treatment of livestock ailments have been also documented (Mesfin and Obsa, 1994; Abebe et al., 2000; Wondimu et al., 2007; Yineger et al., 2007). The therapeutic value of *Achyranthes aspera* is known for skin diseases (Goyal et al., 2007) and various gastrointestinal and respiratory problems (Bhandari, 1990). The medicinal use of *Azadirachta indica* to treat endoparasites and ectoparasites is also documented by Sori et al. (2004) in the Borena pastoralists, southern Ethiopia. Moreover, the efficacy of leaves of *A. indica* to reduce the parasitic load (Khan, 2009) and that of the Aloe species in treating *Trychostrongylus* in sheep (Ibrahim, 1986) has also been confirmed. It is also shown that *A. indica* contain chemicals that could help to control more than 200 pest species as well as antimalarial limonoids that showed good antimalarial action *in vitro* (Leeuwenberg, 1987; Lambert, 1997).

The people of Tanqua-Abergele and Kolla-Tembien were shown in this study to have a wealth of knowledge about traditional veterinary medicines for treating their livestock. For centuries, the local farmers have learnt a great deal about animal diseases and their way of management through indigenous knowledge to protect their health and

Table 1. List of ethno-veterinary medicinal plants for treatment of livestock ailments in Tanqua-Abergele and Kola Tembien woredas.

Local name	Scientific name	Family name	Habit	Plant parts used and preparation	Mode of application	Indication
Seraw	<i>Acacia etbaica</i>	<i>Fabaceae</i>	Tree	Inner part of the bark of the plant for tying tight legs that are fractured	Topical/externally tied	Bone fracture of limbs
Mechalo (melhas-bieray)	<i>Achyranthes aspera</i> L.	<i>Amaranthaceae</i>	Herb	The fresh root is chopped and bounded together with a leaf of <i>Commicarpus podunculosus</i> , mixed with water (masititis). The leaves are also crushed and mixed with water (for remedy of wound, diarrhea).	Topical and drenching	Mastitis, wound, diarrhea
Ere	<i>Aloe vera</i>	<i>Liliaceae</i>	Herb	The fresh leaf gel (latex)	Topical	Wound
	<i>Alternanthera pungens</i> Kunth	<i>Amaranthaceae</i>	Herb	Leaf is crushed and squeezed on wound using gauze or clean cloth	Topical	wound
Dandier	<i>Argemone mexicana</i>	<i>Papaveraceae</i>	Herb	Leaf is crushed and mixed with water	Topical	wound
Nim	<i>Azadirachta indica</i> A. Juss	<i>Meliaceae</i>	Tree	Leaf is crushed	Topical	Ectoparasites like lice
Shisha	<i>Boscia angustifolia</i> A. Rich.	<i>Capparaceae</i>	Tree	Bark is dried, powdered for treatment of wound and leaf are crushed and mixed with drops of water	Topical	Wound (animasl) and otitis (human)
Hitsawuts	<i>Calpurinia aurea</i> (Ait) Benth	<i>Fabaceae</i>	tree	Fresh leaves are grounded with small amount of water	Topical and Drenching	Mastitis, skin diseases like dermatophilosis and ectoparasites(lice, ticks)
Papaya	<i>Carica papaya</i>	<i>Caricaceae</i>	Shrub	Fresh leaf is crushed	Topical	Wound
Hamli kbao	<i>Chenopodium murale</i> L.	<i>Chenopodiaceae</i>	Herb	Leaf is crushed	Topical	Wound
Bunna	<i>Coffea arabica</i> L.	<i>Rubiaceae</i>	Shrub	Seed is roasted, pounded and mix with butter	Topical	Wound
Awhi	<i>Cordia Africana</i> Lam.	<i>Boraginaceae</i>	Tree	Leaf (fresh) is crushed and mixed water	Oral drenching	Snake and Scorpion bite
Acerkuka	<i>Cyphostemma adenocaula</i> Baker.	<i>Vitaceae</i>	Herb	Root is dried, chopped and crushed into powder	Topical	Wound
Etse Tekeze	<i>Dicliptera?Verticillata</i> (Ferssk.)C.Chr.	<i>Acanthaceae</i>	Shrub	Leaf is crushed	Topical	Wound
Tahsus	<i>Dodonaea angustifolia</i> .f.	<i>Sapindaceae</i>	Shrub	Leaf is dried and powdered by crushing and mixed with butter	Topical	Wound in animals and 'Almaz bale chira' (in human)
Tsaba dimu	<i>Euphorbia petitiiana</i>	<i>Eupherbeiaceae</i>	Herb	Latex is streaked on the infected part	Topical	Dermatophilosis
Habie	<i>Hagenia abyssinica</i> (Bruce) J. F. Gmel.	<i>Rosaceae</i>	Tree	Female flowers are dried and pounded and provided mixed with dog's food	Oral drenching	Habbei (tape worm) in dogs
Ange-ange	<i>Heliptropium cinerascens</i> DC	<i>Boraginaceae</i>	Herb	Fresh leaf is crushed	Topical	Wound

Table 1. Continued.

Smieja	<i>Justicia schimperiana</i> (Hochst ex. Nees) T. Andres.	<i>Acanthaceae</i>	Shrub	Leaf is crushed and mixed with water, squeezed	Drenching	Jaundice
Smieja	<i>Justicia schimperiana</i> (Hochst ex. Nees) T. Andres.	<i>Acanthaceae</i>	Shrub	Fresh Leaf is crushed and homogenized with pure water	Topical	Wound and jaundice
Enkftha	<i>Malva parviflora</i> L.	<i>Malvaceae</i>	Herb	Fresh leaves are squashed	Topical	wound
Enkftha	<i>Malva parviflora</i> L.	<i>Malvaceae</i>	Herb	Leaf is crushed and mixed with butter	drenching	Anthrax
Tambuk	<i>Nicotiana tabacum</i>	<i>Solanaceae</i>	Herb	Leaf is crushed with a small amount of water	Dropping infusions in nostrils	Leach
Hahot	<i>Rumex nervosus</i>	<i>Polygonaceae</i>	Herb	Root is dried, chopped and crushed into powder	Topical	camels wound
Angule	<i>Solanum incanum</i> L.	<i>Solanaceae</i>	Shrub	Leaf /root are crushed	Topical	wound
Adi-zana	<i>Stereospermum kunthianum</i> Cham	<i>Bignoniaceae</i>	Tree	Fresh leaf crushed	Topical	Fresh wound
	<i>Trichodesma trichodesmoides</i> (Bunge) Gurke	<i>Boraginaceae</i>	Herb	Fresh leaf is crushed homogenized with water	Topical	Wound
Amei'e	<i>Urtica simensis</i>	<i>Urticaceae</i>	Herb	Leaf is crushed and applied by straining/filtering with a gauze	Topical	For fresh bleeding wound
Tirnkhia	<i>Verbascum sinaiticum</i> Benth	<i>Scrophulariaceae</i>	Herb	Fresh leaf is crushed or leaf can be dried and powdered	Topical	Wound
Ater/alquay	<i>Vicia faba</i>	<i>Fabaceae</i>	Herb	Its seed is pounded and its paste is placed on wound for maturing the pus in closed type of wound	Topical	Local swelling and wound
Chobba	<i>Xanthium strumarium</i>	<i>Asteraceae</i>	Herb	The leaf of the plant is dried, pounded and then soaked in water for some time. It is filtered and the filtrate is taken orally	Drenching	Tegtegt/ Pasterelosis
Milola	<i>Ximenia caffra</i> sond.	<i>Olacaceae</i>	Tree	Bark is dried, chopped and powdered	Topical	wound (Saddle sore)

boost productivity. Such remedies reflect centuries of experiences, trial and errors and well adapted to the local culture and environmental condition which have stood the test of time (Sofowora, 1982; ITDG/IIRR, 1996; Bekele and Musa, 2009). Medicinal plants that are found in

the vicinity are harvested and used for the treatment of sick animals. Recognizing the value of this indigenous knowledge empowers livestock owners to attempt to solve their animal health problems in an accessible way and economic affordability (Abebe et al., 2003).

Herbal preparations are crude and could potentially be toxic. Research is therefore needed to determine safety, toxicity optimal dose and concentrations of preparations and to identify the side effect of the remedies. In general, documentation of more ethno-veterinary botanical

Table 2. Plant families frequently used among traditional herbalists and livestock owners in Tanqua-Abergele and Kolla-Tembien woredas.

Plant family name	Number of ethno-veterinary medicinal plant species	Proportion (%)
<i>Rubiaceae</i>	1	4.34
<i>Acanthaceae</i>	7	30.43
<i>Amaranthaceae</i>	13	56.52
<i>Asteraceae</i>	3	13.04
<i>Bignoniaceae</i>	1	4.34
<i>Boraginaceae</i>	4	17.39
<i>Capparaceae</i>	2	8.69
<i>Caricaceae</i>	4	17.39
<i>Chenopodiaceae</i>	2	8.69
<i>Eupherbeiaceae</i>	4	17.39
<i>Fabaceae</i>	16	69.56
<i>Liliaceae</i>	7	30.43
<i>Malvaceae</i>	8	34.78
<i>Meliaceae</i>	4	17.39
<i>Olacaceae</i>	4	17.39
<i>Papaveraceae</i>	3	13.04
<i>Polygonaceae</i>	1	4.34
<i>Rosaceae</i>	4	17.39
<i>Sapindaceae</i>	2	8.69
<i>Scrophulariaceae</i>	7	30.43
<i>Solanaceae</i>	15	65.21
<i>Urticaceae</i>	2	8.69
<i>Vitaceae</i>	1	4.34

Table 3. The number of ethno-veterinary medicinal plant remedies used to treat livestock ailments in Tanqua-abergele and Kolla-Tembien woredas.

Ailments/conditions treated	Number of ethno-veterinary medicinal plant remedies used
Anthrax	4
Bone fracture (limbs)	1
Dermatophillosis	7
Ectoparasites	6
Leach infestation	11
Local swelling	4
Mastitis	9
Otitis	1
Pastuerelosis	2
Snake and scorpion bite	1
Tape worm	4
Wound	57

surveys in these areas and other unexplored areas of the region as well as the other regions of the country need to be conducted before most of the time tested indigenous knowledge of the traditional herbalists passes away.

ACKNOWLEDGEMENTS

This investigation partly received financial support from Ethiopian Ministry of Science and Technology research

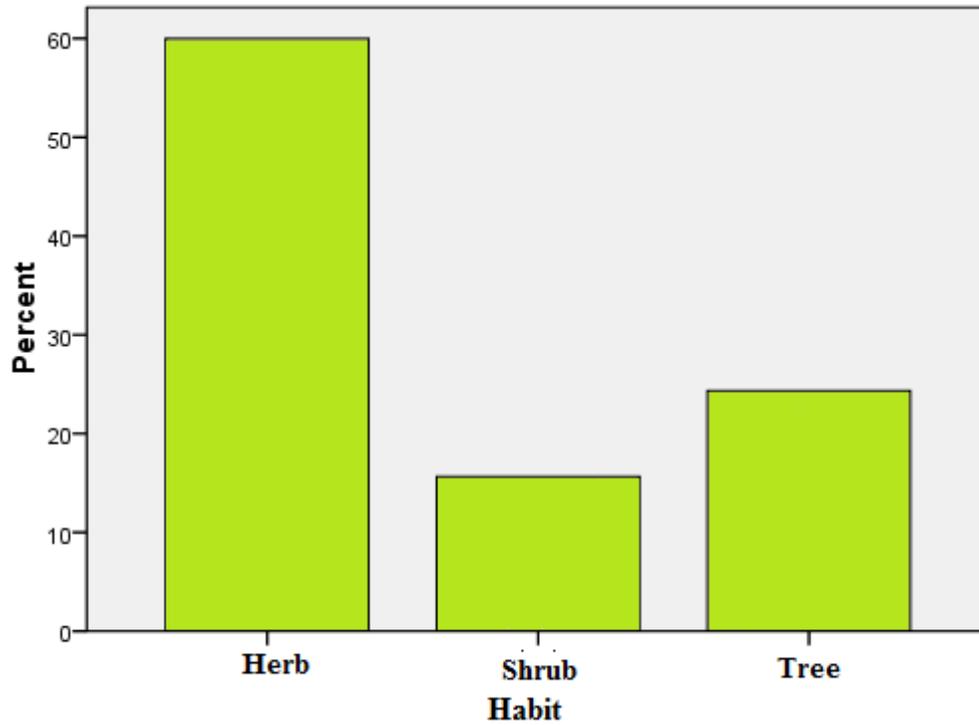


Figure 2. Percentage of habits of ethnoveterinary medicinal plants used for the treatment of livestock by the farmers of the study areas

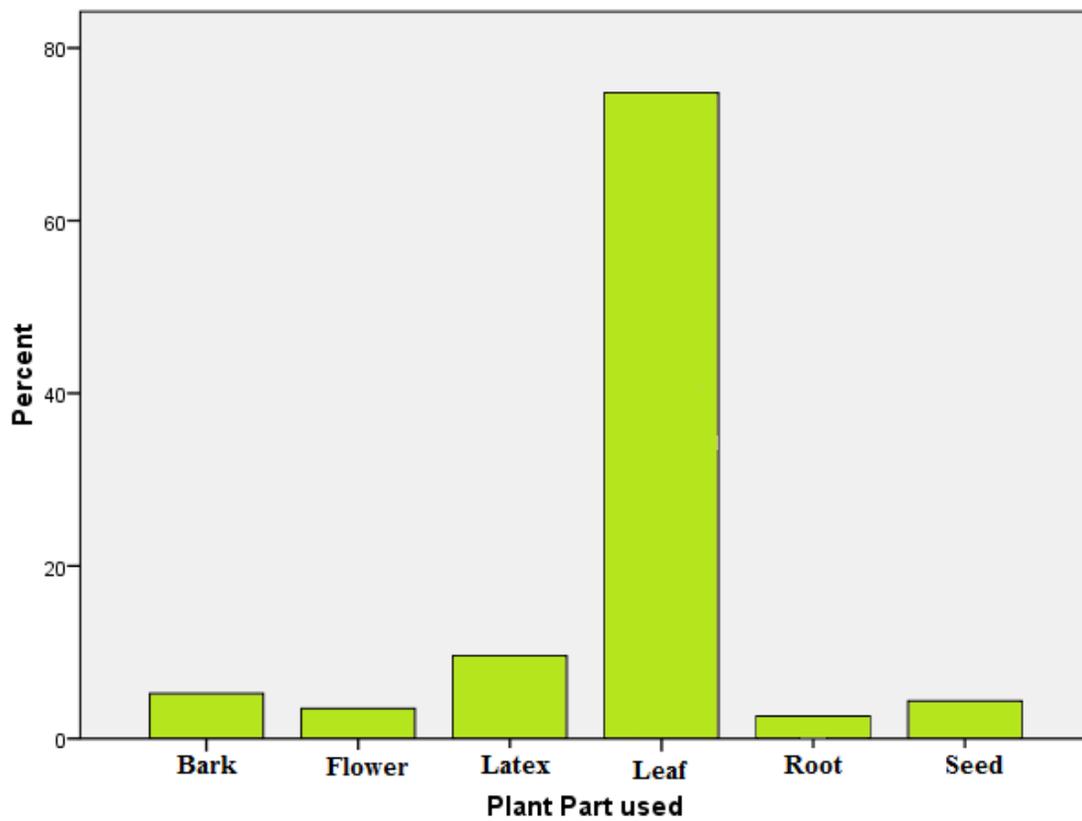


Figure 3. Parts of ethno-veterinary medicinal plants used as remedy for livestock in the study areas.

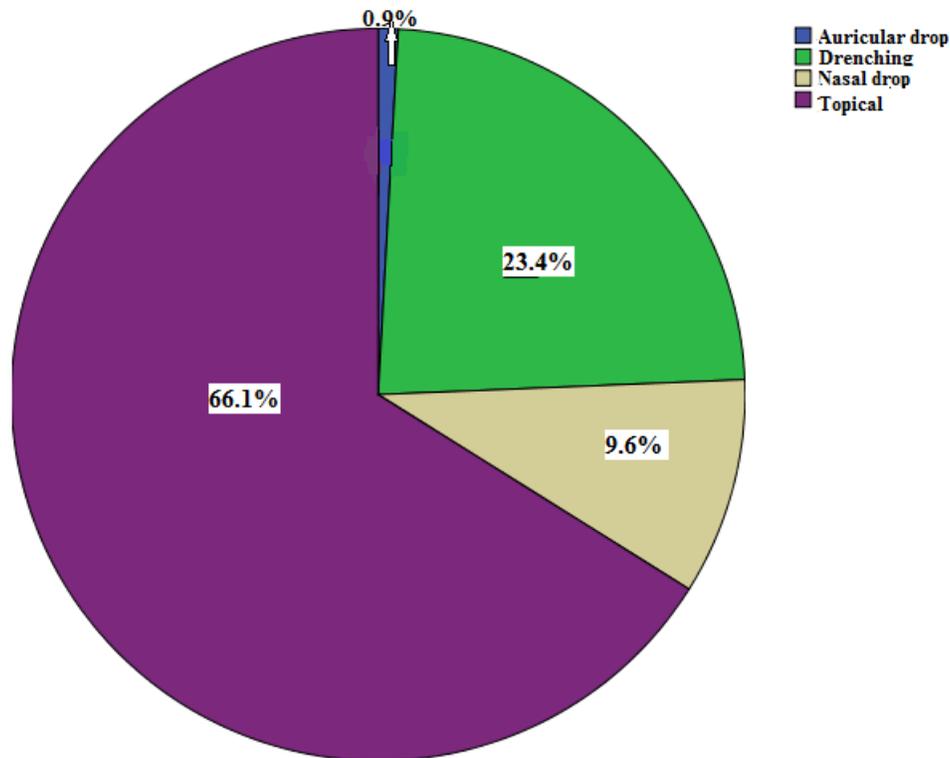


Figure 4. Administration routes of ethno-veterinary medicinal plant remedies in the study areas in Tanqua-abergele and Kolla-Tembien woredas.

and development grant (project number-FVS/11/2008). We are grateful to the local healers, farmers and religious leaders in the study areas who were willing to share their indispensable ethno-veterinary medicinal knowledge.

REFERENCES

- Abebe D, Ayehu A (1993). Medicinal Plants and Enigmatic Health Practices of Northern Ethiopia. B.S.P.E, Addis Ababa, Ethiopia. pp. 419-431.
- Abebe D, Debella A, Urge K (2003). Medicinal plants and other useful plants of Ethiopia. EHNRI, camerapix publishers international, Nairobi. pp. 25-43.
- Abebe G, Dawson LJ, Detweiler G, Gipson TA, Sahlu T (2000). *Hagenia abyssinica* (Kosso) for internal parasite control in goats. In The opportunities and challenges of enhancing goat production in East Africa. (Eds: R. C. Merkel, G. Abebe and A. L. Goetsch) E (Kika) de la Garza Institute for Goat research, Langston University, Langston OK, Debub University, Awassa, Ethiopia, 10-12 November. pp. 190- 195.
- Assefa B, Glatzel G, Buchmann C (2010). Ethnomedicinal uses of *Hagenia abyssinica* (Bruce) J.F. Gmel. among rural communities of Ethiopia. J. Ethnobiol. Ethnomed. 6:20.
- Barboza RRD, Souto WMS, Mourão JS (2007). The use of zootherapeutics in folk veterinary medicine in the district of Cubati, Paraíba State, Brazil. J. Ethnobiol. Ethnomed. 3:1-14.
- Bekele A, Musa A (2009). Ethnoveterinary practice in Chiro District, western Hararge, Ethiopia. Pharmacologyonline.1:128-139.
- Bekele E (2006): A study on actual situation of medicinal plants in Ethiopia. <http://www.endashaw.prepared by JAICAF>
- Bhandari MM (1990). Flora of the Indian desert, MPS Repros, Jodhpur, India. pp. 287-288.
- Farooq Z, Iqbal Z, Mushtaq S, Muhammad G, Zafar M, Iqbal AM (2008). Ethnoveterinary practices for the treatment of parasitic diseases in livestock in Cholistan desert (Pakistan). J. Ethnopharmacol. 118:213-219.
- Fullas F (2010). Ethiopian Medicinal Plants in Veterinary Healthcare: A Mini-Review. Ee-JRIF. 2(1):48-58.
- Gemechu W, Girma A, Temesgen S, Ensermu K (1997). 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.
- Giday M, Ameni G (2003). An Ethnobotanical Survey on Plants of Veterinary Importance in Two Woredas of Southern Tigray, Northern Ethiopia. SINET: Ethiop. J. Sci. 26 (2):123-136.
- Giday M, Asfaw Z, Woldu Z (2009). Medicinal plants of the Meinit ethnic group of Ethiopia: An ethnobotanical study. J. Ethnopharmacol. 124:513-521.
- Giday M, Asfaw Z, Woldu Z, Elmquist T (2003). An Ethnobotanical study of medicinal plants by the Zay people in Ethiopia. J. Ethnopharmacol. 85:43-52.
- Goyal BR, Goyal RK, Metha AA (2007). Phyto-pharmacology of *Achyranthes aspera* : A review. Plant Rev. 1:143-150.
- Ibrahim MA (1986). Veterinary traditional practices in Nigeria: livestock systems research in Nigeria's sub-humid zone. Proc 2nd Intern Livestock Center Africa Symp.
- ITDG/IIRR (1996). Ethnoveterinary Medicine in Kenya. A Field Manual of Traditional Animal Health Care Practices. ITDG/IIRR, Nairobi.
- Khan F M (2009). Ethno-veterinary medicinal usage of flora of greater Cholistan desert (Pakistan). Pak. Vet. J. 29(2):75-80.
- Kokwaro JO (1976). Medicinal Plants of East Africa. East African Literature Bureau, Nairobi. pp. 292-294.
- Lambert J (1997). Medicinal plants: Rescuing a global heritage. World Bank Technical. p. 355. Washington DC.
- Leeuwenberg AJM (1987). Medicinal and Poisonous Plants of the Tropics. Proceedings of the Symposium of the 14th International Botanical Congress, Berlin.
- Martin GJ (1995). Ethno botany . A conservation Manual. Chapman and

- Hall, London.
- McCorkle CM (1995). Back to the future lessons from ethnoveterinary research, development extension for studying and applying knowledge. *J. Agric. Food Human Values Society* 22(2):52-80.
- Mesfin T, Obsa T (1994). Ethiopian traditional veterinary practices and their possible contribution to animal production and management. *Rev. Sci. Technol.* 13:417-424
- Mesfine T, Lemma M (2001). 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. pp. 22-28.
- Monteiro MV, Bevilacqua CML, Palha MDC, Braga RR, Schwanke K, Rodrigues ST, Lameira OA (2011). Ethnoveterinary knowledge of the inhabitants of Marajó Island, Eastern Amazonia, Brazil. *Acta Amazonica* 41(2):233-242.
- Sinha P, Govil NJ, Singh VK (2002). Diseases and their management, recent progress in medicinal plants, *Sci. Tech, Pub LLC, USA*. pp. 1-105.
- Sofowora A (1982). *Medicinal plants and Traditional medicine in Africa*. John Wiley and Sons, New York. pp. 255-256.
- Sori T, Bekana M, Adunga G, Kelbessa E (2004). Medicinal plants in Ethnoveterinary practices of Borana pastoralists, Southern Ethiopia. *Int. J. Appl. Res. Vet. Med.* 2: 220-225.
- Tabuti JRS, Dhillon SS, Lye K (2003). A Ethnoveterinary medicines for cattle (*Bos indicus*) in Bulamogi county, Uganda: plant species and mode of use. *J. Ethnopharmacol.* 88:279-286.
- Teklehaymanot T, Giday M (2007). Ethno botanical study of medicinal plants used by people in Zegie peninsula, north western Ethiopia. *J. Ethnobiol. Ethnomed.* 3:12.
- Tessema T, Giday M, Akiilu N (2001). Stacking and information on the medicinal plants of Ethiopia. In *National Biodiversity strategy and action plan project Medicinal plant Team*, Addis Ababa: IBDA.
- Wondimu T, Asfaw Z, Kelbessa E (2007). Ethnobotanical study of medicinal plants around 'Dheeraa' town, Arsi Zone, Ethiop. *J. Ethnopharmacol.* 112(1):152-161.
- Yineger H, Kelbessa E, Bekele T, Lulekal, E (2007). Ethnoveterinary medicinal plants at Bale Mountains National Park, Ethiop. *J. Ethnopharmacol.* 112(3):55-70.