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*Full Length Research Article*

# Ethnobotanical study of plants used for protection against insect bite and for the treatment of livestock health problems in rural areas of Akaki District, Eastern Shewa, Ethiopia

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## Abstract

**This paper presents the results of ethnobotanical field studies on traditional medicinal plants used by the local people in Akaki District of Eastern Shewa, Ethiopia. Ethnobotanical methods were applied and data collected in three kebeles (lowest administrative unit in Ethiopia) of Akaki District from January 2011 to April 2012. Semi-structured interview guide was used and data were collected by conducting individual interviews in areas where 27 traditional medicine practitioners gave information on the native plants used as insecticides, insect repellents and for various ethnoveterinary purposes. This study is primarily aimed at selecting and ranking the most important species. Healers identified plants with their local names and elaborated on the medicinal applications of 35 species distributed in 35 genera and 23 families. The predominant families were the *Asteraceae, Cucurbitaceae, Euphorbiaceae* and *Lamiaceae*. Among the species were *Oreosyce africana*, *Aloe pulcherrima*, *Agave sisalana* and *Canna indica,* these have not been previously reported for use as insecticides and for the control of ticks in Ethiopia. Though Akaki is not far from urban centers, many people still presently use traditional medicinal plants for public and livestock primary healthcare. The findings inspire in-depth phytochemical and pharmacological investigations.**

**Key words:** Insecticides, Insect repellents, Ethnovetrinary plants, Traditional healers

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## INTRODUCTION

Traditional medicine is defined by the World Health Organization as the sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and social imbalance, and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing (WHO, 2002). The same source further elaborates that even though indigenous knowledge systems are rapidly disappearing under the influence of Western culture, 80% of the world's population exclusively rely on traditional medicine; especially in developing countries, where they have the resources to sustain primary healthcare systems. The plant-based traditional medicine has been repeatedly verified by phytochemical, pharmacological and clinical tests motivating further studies on medicinal plants in different parts of the world.

Mosquitoes are responsible for transmitting the most important vector-borne diseases including malaria, lymphatic filariasis, Japanese encephalitis, dengue as well as yellow fever and other forms of encephalitis which causes illness and death in many developing countries (WHO, 2006). About 300–500 million malaria cases are annually reported by the WHO and 90% of this is from Africa. (Breman, 2001; Snow et al., 2005). Even though vector control strategy has been in Ethiopia for nearly five decades, malaria still ranks among the most important causes of mortality and morbidity in the country (Ministry of Health, 2004). The same source estimated that about 75% of the land inhabited by the people is vulnerable to malaria, yet 68% of the population lives in this area.

Global utilization of medicinal plants has increased enormously over the last three decades (Zewdu et al., 2001). The same source indicated that in the developing countries traditional medicine has remained the main alternative treatment due to shortage of pharmaceutical products and their unaffordable prices. However, an equally valid reason for the continued use of traditional medicinal plants is related to their efficacy and acceptability by the society. Traditional medicines also seen as alternative medicine as described by Abebe (2001) are sometimes the only source of therapeutics for nearly 80% of human population and 90% of livestock in Ethiopia. Meanwhile 95% of these alternative medicine are of plant origin (Abebe, 1986; Giday and Ameni, 2003). The majority of the population (90%) that lives in Ethiopia depend mainly on traditional medicines to meet their healthcare needs (WHO, 2002). The persistence of ethnoveterinary healthcare in Ethiopia is related to the high cost of treatment using modern veterinary drugs and the prohibitive distance of the veterinary stations from the rural areas (Sori et al., 2004). The emergence or re-emergence of certain diseases and drug resistance are also mentioned as additional problems. (Abebe, 2001).

The Akaki District health report of 2009/10 (unpublished) shows that 5,439 households in 2006/07, 9,772 in 2007/08 and 10,745 in 2008/09 were respectively sprayed with 964.07 kg, 2,190.1 kg and 2,546.6 kg of dichloro-diphenyl-trichloroethane (DDT) to control insects including mosquitoes. However, the extensive use of synthetic insecticides for major vector species during the last five decades has resulted in environmental toxicity and development of physiological resistance, in addition to the increased costs of insecticides (Abose et al., 1998; Abebe, 2001; Balkew et al., 2003; Yewhalaw et al., 2010; Abate and Hadis, 2011). Due to these factors the application of botanicals for the control of mosquitoes is recommended because they minimize the accumulation of harmful residues in the environment. (Alkofahi et al., 1989) Moreover, in contrast with synthetic repellents, natural products are usually simple, cost effective and accessible to communities with minimal expenditure (Seyoum et al., 2002). Plants have been used in various forms to repel or kill mosquitoes. For example, ancient people used smoke to repel biting insects from their caves or huts before sleeping. At present also in many parts of the world people are using plant materials to repel/kill mosquitoes and other insects (Seyoum et al., 2003).

Local plants with repellent or insecticidal action may play an important role in regions where mosquitoe bites are very common in the early evenings or in situations where there are no enough bed nets for prevention purposes. Burning plants to make smoke or hanging fresh plants to deter nuisance-biting insects entering or resting in houses is widespread in rural communities in Africa (Waka et al., 2004). It is reported that many plant species are traditionally used as repellents and insecticides in Ethiopia (Abebe et al., 2003; Berhanu et al., 2006). Furthermore, plant species including *Olea europaea* Ssp*. cuspidata*, *Otostegia integrifolia*, *Azadirachta indica*, *Silene macroserene* and *Echinops* spp. are shown to be the most commonly used traditional mosquito repellent plants in Addis Zemen Town, South Gonder, Ethiopia (Karunamoorthi et al., 2009).

Livestock are pivotal for several reasons in developing countries, the most obvious being for the provision of food products. Also, livestock are the major resources which make significant contribution to the national economy in Ethiopia (Mekonnen, 1994). In addition, as in other developing countries, Ethiopia relies on livestock production for its economy and sustained livelihood of the people (Mesfin and Lemma, 2001). Livestock farmers in

various under-developed regions of the world have long relied on and still use plants for treatment of livestock diseases. In the present study area, livestock serve as a source of food, income, and as beast of burden. The traditional practices can be used to provide economically affordable solutions to improve productivity of animals and bring about reduction in poverty of the farmers (Iqbal et al., 2005). On the other hand, ticks damage cows teats which become sealed, reducing milk yield (Mesfin and Shiferaw, 2009).

The objective of this study was to document the indigenous knowledge on medicinal plants and the ethnoveterinary practices in Akaki area and identify the plant species and their parts being employed in the traditional healthcare system including in the control of insects and tick and in the treatment of livestock diseases. The study is also aimed at ranking and prioritizing and to finally select candidate insecticidal plants for further studies.

## MATERIALS AND METHODS

### The study area and people

The study was conducted in three kebeles (Yerer Lencho, Gemeda and Boretaguji) of Akaki District, located at an average of 36 km away from Addis Ababa, the capital city of Ethiopia (Figure 1)**.** The District is geographically located between $8^0$33'-$8^0$57' N latitude and $38^0$43'-$38^0$50' E longitude in East Shewa Zone, Oromiya Region and bordering with Berhana Aletu to the North, Addis Ababa (Woreda 26) to the North West, Alem Gena to the West, Kersa Kondelt to the South, and Adaa Chukala to the East. According to Akaki District Socio-economic data (unpublished data of 2010/11), the land cover of the District is approximately 535.61 $km^2$ or 53,561 hectare (ha) and contains 28 kebeles. The District lies between the altitudinal ranges of 1500 and 2300m a.s.l. which fall in the two agroecological zones of *Weyna-dega* (mid-highlands) 98% and *Dega* (highlands) 2%. The average annual range of hot temperature lies between $15^o$c and $20^o$c, whereas, cold temperature lies between $10^o$c and $15^o$c. The average annual range of rainfall is from 800-1200 mm.

According to the socio-economic data of Akaki District compiled by Tamiru (unpublished data of 2010/11), the 2009 census revealed a total population of approximately 77,176 of whom 38,974 (50.5%) were males and 38,202(49.5%) females. The population density of the District is about 128 persons per $km^2$. The District is with steep rising hills reaching to an elevation of about 3,100m in the case of mount 'Yerer', 2,475m at mount 'Gujii', 2,380m at mount 'Bilibiloo', and 2,352m at mount 'Busho'. The topography of the District constitutes largely of plain that accounts for 60% followed by up and down and mountains contribute 32% and 8%, respectively. The District has four types of soils; black (74.11%), brown (15%), clay (5.89%), and red (5%). Of the total area of the land cover (53,561ha) in Akaki District, agriculture covers 37,532ha, pastureland (2,410.1ha), woodland (2,041ha), water body (756ha), annual crops (2,880.96ha), construction (3,208.1ha), investment (440ha), unused land (2,809.84ha), and unproductive land (1,483ha) ( unpublished data of 2010).

The Akaki District agricultural development office (unpublished data in 2010/11) shows the socio-economic activity of the local populationis depicted as relying mainly on mixed agropastoral system (91%), which involves both cultivation of crops and rearing of livestock. *Eragrostis tef* (Xafii in Afan Oromo), *Triticum turgidum* (Qamadii), *Cicer arietinum* (Shumbuura), *Lathyrus sativus* (Gayyoo), and *Zea mays* (Boqqolloo) are the commonly cultivated field crops. The report also shows that of all the domestic animals raised in the District, cattle population takes the first rank with 91,040, followed by 39,055 goats, 39,048 sheep, 22,676 donkeys, 6,136 horses, and 2,015 mules. Akaki District veterinary health office (unpublished report in 2010/11) showed the prevalence of many animal diseases, among which are included Anthrax (Abba sangaa in Afan Oromo), Black leg (Abba gorba), Pox (Finnoo), New Castile disease (Dhukkuba Lukkuu), Babesiosis (Maxxantuu qaama dhiiga keessa), Bloating (Bokoka), Mastitis (Jigoo), Rabies (Dhukkuba Saree), African horse sickness (Dhukkuba Fardaa), Fasicioliasis (Maxxantuu qaama keessa), and other internal and external parasites. However, to prevent these livestock diseases, only three veterinary clinics are available in the District. On the other hand, the rural communities highly depend on livestock not only for income generation but also for draught power and transportation; as a result they play a great role for the economic development of the area.

### Study design

An ethnobotanical study was conducted with a sample of three kebeles in Akaki District from January 2011 to April 2012. The three kebeles are similar to the other kebeles in the District in agropastoral system; therefore, they are representative and manageable for this study. The study was initiated following an earlier investigation near the present study area by Woyessa et al. (2004) on malaria prevalence and mosquito density, which reported that among malaria positive cases, 69% were found to be *Plasmodium vivax* and 31% were *Plasmodium falciparum*. The study further showed that adult

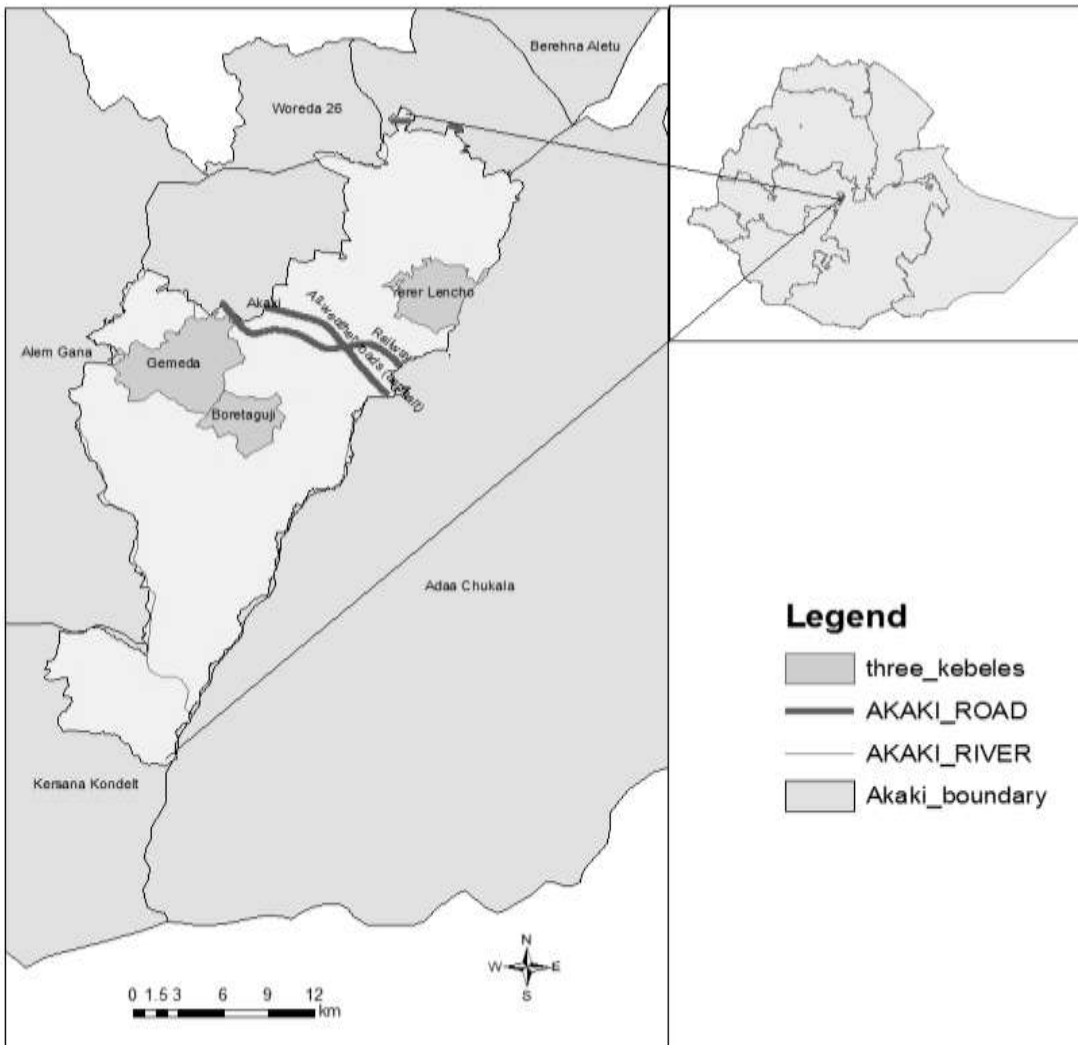


**Figure 1**. Sketch map of Ethiopia showing the three study kebeles (Yerer Lencho, Gemeda and Boretaguji) in Akaki District

anophelines were also collected among which *Anopheles christyi* and *Anopheles arabiensis* were the dominant species, the latter being the major vector for malaria transmission in the area.

On the other hand, the Oromiya Traditional Medicine Professionals Unity Association, which was initiated in 2006, is operating in the District. The District having two climatic zones is a potential area for diverse medicinal plants used by traditional healers for different human and animal diseases. Furthermore, people of Akaki District have similar socio-cultural practices with the people of Boosat District, where it is known that the people heavily rely on traditional medicinal plants as claimed by Hunde et al. (2004). In the present study, data were collected from the three kebeles (*Yerer Lencho*, *Gemeda*, and *Boretaguji*) selected on purpose from the 28 kebeles of Akaki District and the data from traditional healers on botanicals used for insecticides and repellents as well as for treatment of livestock ailments.

For collection of information on insecticide and repellents, and ethnoveterinary practices in the three kebeles, twenty seven key informants of whom 22 were males and five were females were contacted, their ages ranged from 30-40, 41-50, 51-60, and 61-70. The chair persons of each kebele were elders while local inhabitants were used to identify 11 traditional healers from Yerer Lencho, 9 from Gemeda and 7 from Boretaguji based on their willingness and being custodians of practical knowledge on medicinal plants and their applications. The informants were traditional healers themselves or practitioners of healing in their families and had knowledge of the plants and their

medicinal uses. They collaborated by showing the specific plants on site and telling their medical values and potency.

### Methods of data collection

Informants responded to questions on the use of locally grown plants as insecticides, repellents, anti-insects, anti-ticks and for treatment of livestock ailments as well as the local names of the plants, mode of preparation and administration. Semi-structured interview guide prepared before hand were applied in the three kebeles using the local language (Afan Oromo), which was spoken by all members of the community. Semi-structured interviews and observations were used based on methods described by Martin (1995). In addition, guided field walk was employed whereby informants guided the researchers for touring in their agricultural fields, backyard gardens and into the forest to show the plants. Species mentioned by informants were collected, botanical determinations made and deposited at the National Herbarium.

### Ethical consideration

Before conducting the survey, written permission from the office of the Akaki District Agriculture and Rural Development and verbal permission from each kebele chief concerned was obtained. Ahead of data collection, clear explanation was given for each informant about the objectives of the study and its benefits, and requested for verbal consent to participate in the study. They were told that the results will be used for academic purposes and ultimately for the wellbeing of the plants and the community.

### Data analyses

Data collected through semi-structured interviews were presented using tables, graphs and charts. Moreover, preference-ranking technique as described by Martin (1995) was employed to reflect participants' perceptions of the plant's significance, or the effectiveness of plants against insects/mosquitoes. Each rank was given a numerical value (1, 2, 3, 4, 5, 6 and 7) with the most preferred being assigned the highest value '7' and '1' for the least important. Preference ranking data was obtained by asking the informants to consider value as an insecticide/insect repellent. Then, the scores were summed for all informants and an overall rank of the species was obtained.

The collected ethnobotanical data in regard to plant uses for insecticides and protection from tick infestation were analysed following the method of Friedman et al. (1986) that expresses its botanical efficacy and fidelity level (FL). The fidelity level was employed for determining the most important plant species used for treating a particular disease by the local herbal practitioner(s) and knowledgeable elder(s). The authors described the fidelity level (FL) of each plant using the relation: FL (%) = ($I_p/I_u$) x 100, where $I_p$ is the number of informants who independently suggested the use of a species for a particular purpose; and $I_u$ is the total number of informants who mentioned the plant for any use. This was employed in the present study.

## RESULTS

### Medicinal plants used by healers to control insects and treat livestock ailments

The results showed that healers use 35 plant species belonging to 35 genera and 23 families to control insects including mosquitoes and to treat various diseases of livestock (Tables 1 and 2). Among the plant families, the predominant ones were the *Asteraceae, Cucurbitaceae, Euphorbiaceae and Lamiaceae*, which have three species each, followed by *Fabaceae, Rutaceae, Solanaceae* and *Brassicaceae* (two species each). The remaining families have one species each. Most of these plant species were collected from wild habitats. In the study area, visual observation showed that the dominant natural plants consisted of *Acacia seyal*, *Agave sisalana*, *Croton macrostachyus, Calpurnia aurea*, *Euphorbia tirucalli*, *Ocimum lamiifolium,* and *Oreosyce africana.*

### Growth habits of plants

The most dominant growth forms were herbs which accounted for 39%. Proportions of these and other growth forms are given in Figure 2.

### Plant parts used as traditional medicine in the study area

The different parts of plants used in preparing the traditional insecticides, insect repellents, and to treat livestock diseases are illustrated in Figure 3. Leaves are the most commonly used parts, followed by fruit and whole plant and the rest constituted lower proportions.

### Application methods of botanicals against insects including mosquitoes

Most of the plants used in vector control were

**Table 1**. List of plant species claimed to have insecticidal and repellent properties with local names, habits, parts used and methods of applications

| S. No. | Scientific name (Voucher No.) | Family name | Local names | Habit | Parts used and methods of applications | Claimed medicinal use |
|---|---|---|---|---|---|---|
| 1 | *Agave sisalana* Perrine. Ex-Engel (DB.26) | Agavaceae | Qaca | Herb | Leaves juice sprayed in the house | Insecticide |
| 2 | *Ageratum conyzoides* L. (DB.24) | Asteraceae | Tufo | Herb | Whole plant juice sprayed in the house | Insecticide |
| 3 | *Ajuga integrifolia* Ham-Buch Ex D.Don (DB.25) | Lamiaceae | Harmagusa | Herb | Whole plant juice sprayed in the house | insecticide |
| 4 | *Aloe pulcherrima* Gilbert and Sebsebe (ined.) (DB.29) | Aloaceae | Hargessa dhala | Herb | Leaves juice sprayed in the house and leaves smoking | Mosquitocide and insect repellent |
| 5 | *Brassica nigra* L. Koch (DB.27) | Brassicaceae | Sanafica | Herb | Seed crushed and its juice rubbed on the body | insecticide |
| 6 | *Calpurnia aurea* (Ait.) Benth. (DB.23) | Fabaceae | Ceka | shrub | Leaves crushed and its juice sprayed in the house | Insecticide |
| 7 | *Canna indica* L. (DB.19) | Cannaceae | Cale | Shrub | Rhizome juice sprayed in the house | Insecticide |
| 8 | *Lepidium sativum* L. (DB.30) | Brassicaceae | Fexo | Herb | Seed crushed and its juice sprayed in the house | Insecticide |
| 9 | *Lippia javanica* (Burn.f.) Spreng (DB.32) | Verbenaceae | Kusaye | Shrub | Shoot smoking in the house | Insect repellent |
| 10 | *Maesa lanceolata* Forssk. (DB.34) | Myrsinaceae | Abayi | Tree | Fruit juice sprayed in the house | insecticide |
| 11 | *Momordica foetida* Schumach (DB.28) | Cucurbitaceae | Laqana Qura | Herb | Whole plant juice sprayed in the house | Insecticide/mosquito-ide |
| 12 | *Ocimum lamiifolium* Hochst. Ex.Benth (DB.21) | Lamiaceae | Qoricha Michi | Shrub | Growing plant nearby houses, rubbing its juice on the body and whole plant smoking | Mosquito repellent |
| 13 | *Oreosyce africana* Hook.f. (DB.18) | Cucurbitaceae | Manabasi | Liana | Leaf juice sprayed in the house | Insecticide/mosquitocide |
| 14 | *Premna schimperi* Engl. (DB.33) | Lamiaceae | Urgessa | Shrub | Shoot smoking in the house | Insecticide |
| 15 | *Ricinus communis* L.(DB.31) | Euphorbiaceae | Qobo | Shrub | Seed crushed and its juice rubbed on the skin | Insecticide |
| 16 | *Ruta chalepensis* L. (DB.35) | Rutaceae | Ciladama | Herb | Fruit smoking in the house | Insect repellent |
| 17 | *Solanum macrocarpon* L. (DB.20) | Solanaceae | Hidi Warabesa | Shrub | Fruit juice sprayed in the house | Insecticide |
| 18 | *Tagetis minuta* L. (DB.36) | Asteraceae | Hada | Herb | Whole plant smoking | Insect repellent |

**Table 2.** List of plants of ethnoveterinary importance with their local names, plant habit, parts used and methods of application, ailment treated, and animal treated in the study area

| S. No. | Scientific name (Voucher No.) | Family name | Local name | Plant habit | Parts used and methods of applications | Ailment treated | Animal treated |
|---|---|---|---|---|---|---|---|
| 1 | *Acacia seyal* Var. Seyal (DB.10) | Fabaceae | Waqodimo | Tree | Bark infusion is applied topically | Eye disease | Cattle |
| 2 | *Achyranthes aspera* L. (DB.2) | Amaranthaceae | Sariti | Herb | Root concoction is drunk | Anthrax and Blackleg | Cattle and Sheep |
| 3 | *Citrus aurantifolia* (Christm.) (DB.15) | Rutaceae | Lommi | Tree | Fruit paste is applied to the affected area | Tick infestation | Cattle |
| 4 | *Croton macrostachyus* Del (Db.1) | Euphorbiaceae | Bakanissa | Tree | Leaf paste applied topically | Skin lesion and abscesses | Cattle |
| 5 | *Cucumis ficifolius* A. Rich (DB.4) | Cucurbitaceae | Hidi Holoto | Liana | Root concoction is drunk | Anthrax | Cattle and Horse |
| 6 | *Dodonaea angustifolia* L.F. (DB.16) | Sapindaceae | Itacha | Shrub | leaves juice sprayed to the affected area | Ectoparasites (ticks, fleas, lice) | Horse |
| 7 | *Euphorbia tirucalli* L. (DB.11) | Euphorbiaceae | Ano | Shrub | Milky sap from shoot spread on wound | Skin lesion | Cattle |
| 8 | *Ferula communis* L. (DB.6) | Apiaceae | Kamona | Herb | Root concoction is applied nasally | Bloat | Cattle and Horse |
| 9 | *Justicia schimperiana* T. Andris (DB.7) | Acanthaceae | Dhumuga | Shrub | Leaf infusion is drunk | Blackleg | Cattle |
| 10 | *Kalanchoe marmorata* Bak (DB.5) | Crassulaceae | Ancura | Herb | Whole plant is buried under skin | Glandular swelling | Cattle |
| 11 | *Maytenus senegalensis (Lam.) Exell (DB.14)* | Celastraceae | Kombolcha | Tree | Leaf and bark juice applied topically | Eye inflammation | Cattle |
| 12 | *Nicotiana tobacum* L. (DB.9) | Solanaceae | Tambo | Herb | Pounded leaves applied topically | Tick and leech infestation | Cattle |
| 13 | *Olea europaea* L.Ssp. cuspidate (DB.13) | Oleaceae | Ejerisa | Tree | Crushed leaf applied topically | Eye inflammation | Cattle |
| 14 | *Phytolacca dodecandra L.* (DB.3) | Phytolaccaceae | Handode | Shrub | Leaf concoction is drunk | Rabies and anthrax | Cattle and Horse |
| 15 | *Rhamnus prinoides* L'Herit (DB.8) | Rhamnaceae | Geshe | Tree | Pounded leaves applied nassaly | Leech infestation | Cattle |

**Table 2. Contd.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 16 | *Rubia cordifolia* L. (DB.12) | Rubiaceae | Incibiri | Herb | Whole plant concoction is drunk | Coughing | Cattle |
| 17 | *Vernonia amygdalina* Del. (DB.17) | Asteraceae | Ebicha | Shrub | Pounded leaf is drunk | Coughing | Cattle |

insecticides prepared in the form of juice for spraying in the house. Others were applied as insect repellents by smoking and rubbing and by growing the plants around houses (Figure 4).

**Preferences for the medicinal plants**

Ten healers were asked to rank eight selected medicinal plant species used against insects including mosquitoes. The results showed that *Oreosyce africana* was the most preferred followed by *Aloe pulcherrima* and *Agave sisalana* (Table 3).

**Efficacy of the medicinal plants**

The nine species indicated in Table 4 were reported to be useful for the control of insects and ticks. These species were arranged in accordance with the percentage of informants suggesting the same protection use for a given species as compared with the total number of informants reporting any sort of use for that plant. *Oreosyce africana* and *Aloe pulcherrima* turned out 100% fidelity level and others had lower proportions.

## DISCUSSION

Herbal remedy is a subject that everyone is interested in, since each person is interested in his or her health. Although modern medicine has most of the answers to health problems, it is not always available or affordable to many. As a result, like in all other places, the local people in Akaki District make use of herbal medicine in public and livestock healthcare, mostly provided by traditional healers. The distribution of informants indicated that, of the 27 traditional medicine practitioners interviewed, majority were in the range of 41-50 years of age. Further analysis showed that 93% were over 40 years old, and 7% between 30 and 40 years. Majority of informants accounting for 81% were males, and the remaining 19% were females. This work indicated that among the informants, nearly 93% healers were elders. The proportion of plant parts used in the present study is in agreement with the study by Jain et al. (2009). Leaves have been used as a remedy more than other parts since leaves seem to contain more active chemicals.

Blood feeding arthropods (insects and arachnids) can carry and transmit various pathogens, which lead to diseases causing serious health problems to humans and livestock. Usually, these pathogens complete a portion of their life cycle within the arthropod vector before they infect humans and such diseases are transmitted through the bites of arthropod vectors. In the present study area there are various big, medium and small bodies of water and suitable temperature that would favor breeding for mosquitoes. Woyessa et al. (2004) showed that about 42.6% of the *Anopheles christyi* larvae were collected from the edges of streams, rain pools, swamps and excavation ditches near the present study area. The same source reported that *Anopheles arabiensis* larvae were abundant more in excavation ditches followed by rain pools and canals. *Anopheles arabiensis, Anopheles chriysti* and *Anopheles pharoensis* were the three important anthropophilic species in Akaki (Woyessa et al., 2004). In developing countries the use of synthetic insecticides is becoming a problem due to prohibitive costs and development of resistance by mosquitoes towards chemical insecticides. These are some of the conditions that initiated search for alternative control measures (Abebe et al., 2003).

Insecticidal and repellent plants are being used to protect not only from mosquito bites but also from malaria and other vector borne diseases. For example, in India, the smoke produced by burning dried leaves of *Azadirachta indica* has been used since ancient times (Mittal and Subbarao, 2003). Also, a work conducted in Guinea Bissau revealed that traditional natural products against mosquitoes were commonly used by 55% of the surveyed population (Pålsson and Jaenson, 1999).

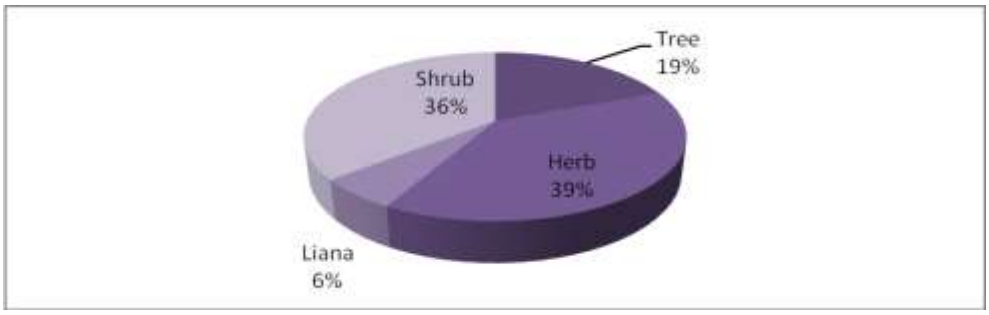


**Figure 2**. Pie chart showing different plant growth habits

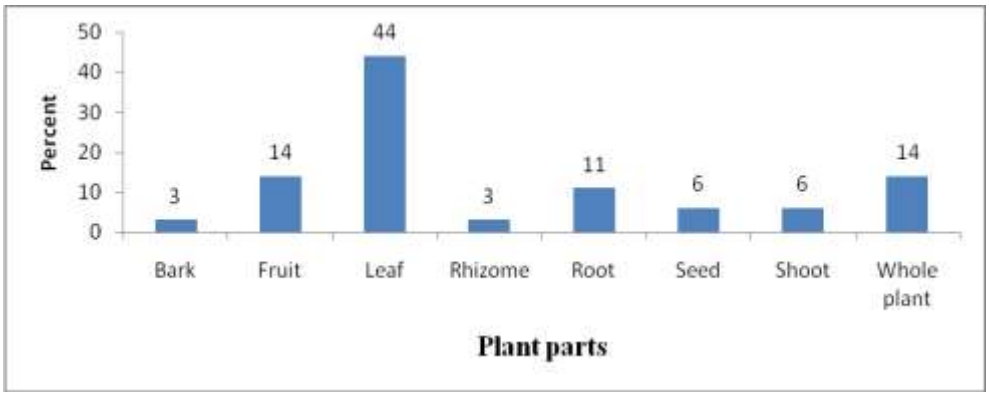


**Figure 3.** Parts of plants used as local insecticides, insect repellents and for the treatment of livestock diseases

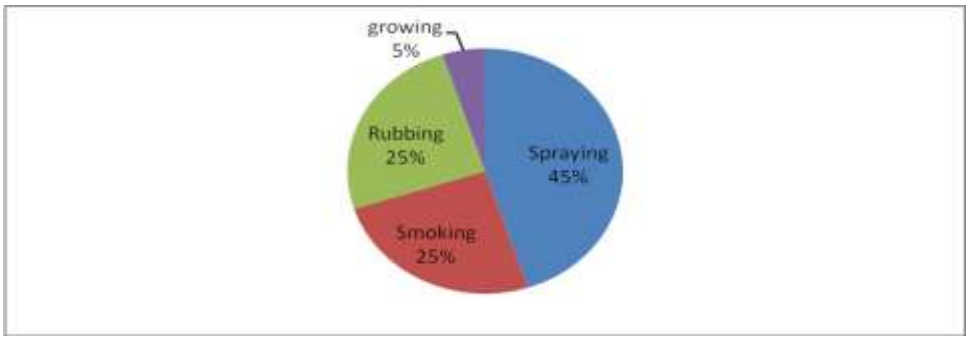


**Figure 4.** Pie chart showing different modes of application of various personal protection methods in the study area

Against mosquitoes, the most commonly stated plants in the study area used for insect bite prevention was *Oreosyce africana* followed by *Aloe pulcherrima, which* scored 61(22.2%) and 45(16.4%), respectively (Table 3). Another study by Yineger and Yewhalaw (2007) showed that the roots of *Oreosyce africana* were used to treat gonorrhea in western Ethiopia. Results of the preference ranking (Table 3) have been used to prioritize plants and this could guide further studies on these species.

The majority of traditionally used mode of application of protection method from insect bite that accounted for 45% was by spraying infusions on the walls and around entry sites like eaves and windows with four widely used plants *Oreosyce africana*, *Aloe pulcherrima*, *Agave sisalana* and *Brassica nigra* to kill any surviving insects in the room (Figure 4). The infusion prepared from *Oreosyce africana* and *Aloe pulcherrima* is sprayed in human dwellings so as to kill insects. (Table 1)

**Table 3**. Priority ranking of plants used as insecticides and insect/mosquito repellents in Akaki District (**Key** – scores in the table indicate ranks given to medicinal plants based on their uses as insecticides and insect/mosquito repellents. Highest number (7) for the plant which informants ($R_1$-$R_{10}$) considered the best and the lowest (1) for the least effective).

| | Scores given by informants ($R_1$-$R_{10}$) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plant species** | **R1** | **R2** | **R3** | **R4** | **R5** | **R6** | **R7** | **R8** | **R9** | **R10** | **Total** | **Percent** | **Rank** |
| *Agave sisalana* | 5 | 5 | 7 | 2 | 3 | 4 | 3 | 5 | 4 | 3 | 41 | 14.9 | 3 |
| *Aloe pulcherrima* | 4 | 3 | 5 | 3 | 5 | 5 | 6 | 4 | 5 | 5 | 45 | 16.4 | 2 |
| *Brassica nigra* | 3 | 3 | 2 | 4 | 5 | 1 | 6 | 6 | 2 | 4 | 36 | 13.1 | 4 |
| *Calpurnia aurea* | 3 | 4 | 5 | 1 | 1 | 2 | 3 | 2 | 2 | 1 | 24 | 8.7 | 6 |
| *Canna indica* | 2 | 1 | 2 | 2 | 3 | 4 | 1 | 2 | 1 | 2 | 20 | 7.3 | 8 |
| *Lepidium sativum* | 3 | 3 | 6 | 4 | 1 | 1 | 2 | 1 | 3 | 2 | 26 | 9.4 | 5 |
| *Ocimum lamiifolium* | 2 | 1 | 2 | 3 | 5 | 1 | 2 | 2 | 3 | 1 | 22 | 8.0 | 7 |
| *Oreosyce africana* | 7 | 5 | 6 | 6 | 7 | 6 | 5 | 7 | 6 | 6 | 61 | 22.2 | 1 |

**Table 4.** Major uses of plants reported as protection from insect bite and tick infestation by more than three informants with their fidelity level (FL) in Akaki District (**Key** –$I_u$ is the total number of informants who mentioned the plant for any use $I_p$ is the number of informants who independently suggested the use of plant species for anti-insect and anti-tick, and FL is fidelity level)

| **Plant species** | **Family** | **Uses of plant in protection from insect bite and tick infestation** | $I_u$ | $I_p$ | **FL (%)** |
|---|---|---|---|---|---|
| *Oreosyce africana* | Cucurbitaceae | Mosquito bite and tick infestation | 26 | 26 | 100 |
| *Aloe pulcherrima* | Aloaceae | Insect bite and tick infestation | 23 | 23 | 100 |
| *Agave sisalana* | Agavaceae | Insect bite and manage mite | 21 | 19 | 90 |
| *Lepidium sativum* | Brassicaceae | Insect bite and tick infestation | 18 | 15 | 83 |
| *Brassica nigra* | Brassicaceae | Insect bite and tick infestation | 17 | 12 | 71 |
| *Momordica foetida* | Cucurbitaceae | Insect bite and tick infestation | 15 | 10 | 66 |
| *Calpurnia aurea* | Fabaceae | Insect bite and tick infestation | 13 | 7 | 54 |
| *Ocimum lamiifolium* | Lamiaceae | Mosquito bite and manage mite | 11 | 5 | 45 |
| *Canna indica* | Cannaceae | Insect bite and tick infestation | 10 | 4 | 40 |

*Agave sisalana* leaves were pounded and the powder is mixed with water to make paste and is sprayed on the wall and bed to kill mosquitoes, bedbugs, and fleas (Table 1). Moreover, *Agave sisalana* is a multipurpose specie as it has strong fibers and used to make rope for house construction, restraining animals, whips for ploughing oxen and also used for fodder. Also an informant healer stated that *Calpurnia aurea* has multipurpose uses such as for tick control, insecticides, fences, and making different furniture that help for ploughing in agriculture. The above mentioned plant specie come close to the species identified by Ahmed et al. (1984).

The second traditionally used mode of application of protection method against insect/mosquito bite in the present study area was plant smoking by burning as indicated in Figure 4. The plant material of *Ocimum lamiifolium*, *Lippia javanica, Ruta chalepensis,* and *Tagetus minuta* are placed on the indoor cooking fires each evening to reduce/prevent mosquitoes from entering the houses (Table 1). Another specie, *Lepidium sativum* as indicated in Table 4 is used for protection from insect bite and tick infestation and has a fidelity level accounted for 83%. Similarly, Berhanu et al. (2006) reported that the use of the same species as insecticides and insect repellent measured 65.7%.

The results of this study have shown that burning the head containing fruits of *Ocimum lamiifolium* by placing on fire within the house can fumigate the room so as to get rid of mosquitoes, and smeared/rubbed paste made from its leaves on the bare skin can also repel mosquitoes. The results of this study are consistent with those of a study conducted in a rural community of Cameroon. (Ntonifor et al., 2006) in the said study, the method of application of *Ocimum basilicum* was by rubbing its juice on skin and direct burning to repel mosquitoes. The same authors reported that *Ocimum basilicum* has significant repellent effects against mosquito/insect bites compared to diethyltoluamide (*p*-value = 0.001). Similarly, spp *Ocimum americanum* have shown to be effective mosquito repellents (Seyoum et al., 2002). Another study by Waka et al. (2004) showed that the effect of fresh leaves and shoots of *Ocimum forskolei* hanging on walls at the head and foot of beds was tested in Eritrea against *Anopheles arabiensis* and was found to have 53% reduction in mean number of mosquitoes per

house. On the other hand, ectoparasite infections on livestock can cause intense irritation to the skin and can lead to poor condition and weight loss or, in the worst cases, to the death of the infested animals. Economic losses like reduced milk yield are a common consequence of such infestations. Due to their effects, the control of livestock ectoparasites/ticks is therefore of great importance from the animal health and the economic point of view. As indicated in Table 4, the indigenous plants used for protection from insects in humans are also applied in ethnoveterinary practice. In view of this, the protection efficacy of each plant is expressible by its FL or rank order priority and is given for the nine species in Table 4. *Aloe pulcherrima* is used in the study area to treat animals infested with ticks and insecticides in the home which turned out a fidelity level of 100%, and *Oreosyce africana* has also fidelity level of 100%. In line with this study, the *Aloe* species have long been shown for use in the treatment of wounds, ticks and in managing mites in other places (Mesfin and Shiferaw, 2009).

Friedman et al. (1986) stated that agreements regarding the use of a medicinal plant in a community as well as the scientific validation of their therapeutic action may explain the fact that some species are always among the most cited in ethnobotanical studies. Therefore, preserving this knowledge offers a way of registering the informal learning that contributes to the promotion of popular medicine, besides generating information about the health of local communities. Accordingly, the data showed that the plant *Oreosyce africana* was found to be highest among the insecticides and tick control. The next is *Aloe pulcherrima*, *Agave sisalana*, *Lepidum sativum* and then *Brassica nigra* (Table 4), Accordingly, these plant species mentioned above may contain some active ingredients that validates their use, though further investigation is recommended.

In the present work, major plants utilized in indigenous veterinary healthcare in Akaki district are highlighted in Table 2. Despite the existence of indigenous knowledge in the area, as in other communities, the knowledge is passed verbally from one generation to the next (Mesfin and Obsa, 1994). Traditional animal health care practice has remained popular because it is readily available and a low-cost alternative to the relatively costly inputs driven by modern veterinary services in the rural communities of Akaki District. On the other hand, in many places where veterinary health services exist, indigenous knowledge and practice is already undermined, and the people who have such experience are becoming lesser in the community (Mesfin and Obsa, 1994).

According to McCorkle (1986), local practices could be environmentally friendly than imported ones. The same author mentioned that local tick control methods, for example, are commonly less harmful to the environment than dipping with commercial chemicals. The ethnoveterinary characteristics of some of the plants from different regions in Ethiopia against common infections have been studied while the majorities have not received much scientific attention. (Mesfin and Obsa, 1994; Regassa, 2000; Mesfin and Lemma, 2001; Giday and Ameni, 2003; Hunde et al., 2004; Sori et al., 2004; Yineger et al., 2007; Mesfin and Shiferaw, 2009). Therefore, the plants that appear as insecticides and tick infestation control agents in particular warrant intensive chemical and toxicological studies.

## Conclusion

The present study shows that the people of Akaki District use plant materials to protect themselves against mosquitoes and other insect bites and also to treat livestock ailments. Plant materials were commonly used because they are simple, cost-effective and accessible to communities with minimal external input. Plant insecticides and repellents are highly effective against many insect enemies that are not successfully controlled by synthetic insecticides.

On the other hand, useful information on traditional use of animal healthcare practices remains uninvestigated in a sizable proportion of livestock-raising communities in the Akaki District. There is therefore the need to investigate and integrate these results into primary human and livestock healthcare delivery systems in the District. The wealth of traditional knowledge on use of plants among the people of this District will provide the basis for further studies in developing new, effective and safe insecticides or repellents to fight against vector-borne diseases and other new uses. Therefore, it is recommend that screening of those plants that scored relatively higher preference ranking and fidelity level should be carried out in order to justify the local traditional uses and check their side effects.

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