Journal of Medicinal Plants Studies
www.PlantsJournal.com

ISSN (E): 2320-3862
ISSN (P): 2394-0530
NAAS Rating: 3.53
JMPS 2019; 7(4): 212-224

Received: 27-05-2019
Accepted: 29-06-2019

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An ethno botanical review on medicinal plants used for the management ectoparasitic skin diseases of ruminants

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Abstract
Ectoparasitic skin diseases of domestic ruminants caused by mange mites, lice, fleas, keds and ticks are among the serious diseases causing enormous economic losses to smallholder farmers, the tanning industry and the country as a whole. Infestation with ectoparasites is responsible for blood loss, irritation which results in downgrading and rejection of skins, poor growth, decreased production and reproduction and mortality. Even though ectoparasites of ruminants can be controlled by using synthetic commercial acaricides, their accessibility and affordability to the poor farmers, development of drug resistance and their profound impact on the environment makes them less preferable compared to other alternatives such as medicinal plants. Thus urgent action has to be designed to evaluate acaricidal efficacy of the traditionally used medicinal plants against ectoparasitic skin diseases of domestic ruminants in Ethiopia.

Keywords: Ectoparasite, medicinal plants, acaricides, efficacy, safety, phytochemicals

Introduction
Ethiopian livestock sector is the cornerstone for its economic development. Its livestock population is estimated to be 52.13 million cattle, 24.2 million sheep, 22.6 million goats, 44.89 million poultry, 8.73 million equines and 0.99 million camel populations (CSA 2012). Small ruminants constitute about 30% of the total livestock population of the country and provide 46% of the national meat production, 14% of milk consumption and 58% of the hide and skin production [1]. Thus, this cornerstone economic sector should be given great attention to get maximum benefit from the sector by controlling disease causing agents such as endoparasite and ectoparasites that has profound effect on the health of animal population.

Ectoparasites such as mange mites, lice, keds and ticks cause serious economic loss to smallholder farmers, the tanning industry and the country as a whole. They cause intense irritation leading to poor condition, weight loss, reduced milk yield or hide or fleece damage which can result in mortality. Besides this, they are responsible for transmission of disease to the animals themselves or are vectors of a number of diseases to humans [2-4]. Cattle ectoparasites induce skin irritation while sucking or feeding on epithelial debris and exudates. Scratching and rubbing destroyed their hair and damaged their skin besides reduce their feeding time. Sucking may make the animals anaemic and unthrifty. Particularly poorly nourished stock, young animals and calves suffer the most. Ectoparasite infestations mainly affected by the ruminant's skin and coat condition, skin surface temperature and light intensity. Heavy infestations of sucking ectoparasite result in lameness. Infestation by ectoparsite such as lice and sheep keds can cause damage in the cattle-hides and in sheep-skins resulting in defects to the leather [5].

To some extent the impact of ectoparasite of livestock and the disease they transmit has been underestimated historically compared to that of the major plagues such as rinderpest, even compared to that of endoparasite since this tend to be more economically important in temperate zone. This review of ectoparasite of animals and method of controlling them is thus timely and appropriate at a time where the livestock industry in the developing world playing an increasing important global role and yet is heavily handicapped by the disease resulting from ectoparasites attack. Couple this with our understanding awareness of the problem both in terms of environmental pollution and development of resistance of pathogens due to the

profligate use of chemicals for pest control and the urgency in assessing the situation is clear [6].

The use of synthetic insecticides in the management or treatment of ectoparasite becomes serious global problems due to their resistance development, nonspecific, residual products and environmental pollution. The ever increasing concern about environmental pollution attributed to several synthetic insecticides chemical wastes have paved the way for "green pharmaceutics". Researchers are now become more and more careful about the use of synthetic insecticides, and are putting significant effort in designing ecofriendly research protocols to develop safe drugs. Thus, effective control chemical agents that can be used safely for the treatment of both animals and human being are urgently needed. Herbal medicines have become more popular in the treatment of many diseases due to belief that green medicine is safe, easily available and with fewer side effects. Similar to other forms of traditional knowledge, ethno-veterinary medicinal plants knowledge is not compiled. 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. The situation is exacerbated by rapid socio economic, technological and environmental changes. 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.

Prevalence of Ectoparasite

Ectoparasites are organisms, which inhibit the skin or growth of the skin of the host for various periods. The association between arthropod ectoparasite and vertebrate hosts may take on variety of forms. In some cases the parasite may be totally dependent on the host, alternatively, the parasite may feed, or live only occasionally on the host, without being dependent on it [7]. The effect of skin parasitism usually depends on the size of invading population, on the manner on which the parasite ekes out its existence and the state of nutrition of the host animal when infected. The damage ectoparasites inflict may be mechanical, but the situation is complicated also by host reactions to the presence of the particular parasite, their secretion and excretion [8]. The prevalence of ectoparasites is variable depending on different factors. In Ethiopia there were reports that the prevalence of ectoparasites 13.8% - 68.69% in sheep and and 7.80% - 58% in goats [4, 9, 10]. The main variable factors that affect the distribution of extoparasites are agro-ecology, age, sex and management/handling of the livestock. High temperature, humidity and sun light favor the infestation of lice [11]. Poor management, nutrition and hygienic conditions, in addition less awareness of the owners on the effect of ectoparasites are believed to be contributed to wide spread occurrence of infestation. *Damalinia ovis* infestation in sheep is high in high lands, followed by midland and lest in low lands. When the temperature is cooler than optimum, egg do not develop while hotter temperature prevent egg lying and kill the lice [12].

Management of ectoparasitic skin disease of animals with conventional drugs

Animal ectoparasitic skin disease can be prevented and controlled by different synthetic antiectoparasites that affect parasites nervous system. Even though the currently available ectoparasiticide compounds are classified into different categories based on their chemical structure most of them have limitation as they target the nervous system. Thus it is important to find out for other drugs that have different mode of action. Besides this the conventional drugs on the market have suffered from a number of drawbacks, including the development of resistance and concerns over human and environmental safety. The aforementioned problems initiate rsearcher to search for the development safe alternative ectoparasiticide compounds with variable target of action [2]. Traditional medicine can be used as an alternative option to overcome this problem.

The role of herbal medicine in management of ectoparasitic skin disease of animals

Traditional medicine have been used in the management various disease of livestock worldwide particularly in the under developing countries. The uses of herbal medicines by tradomedical practitioner in developing countries have been increased. The developed countries have also shown an increased interest and use of herbal drugs due to public dissatisfaction with the cost of prescription drugs and interest in returning in to natural remedies. Besides, in Africa access to acaricides is curtailed by uncertain economic conditions, resulting in escalating prices of imported goods. Furthermore, incorrect administration of acaricides by untrained or unauthorised persons enhances development of resistance [13]. If only synthetic acaricides are used, there is a risk that traditional knowledge of the use of indigenous plants could be lost. Reassessment of traditional knowledge of ethno veterinary medicine is therefore justified [14].

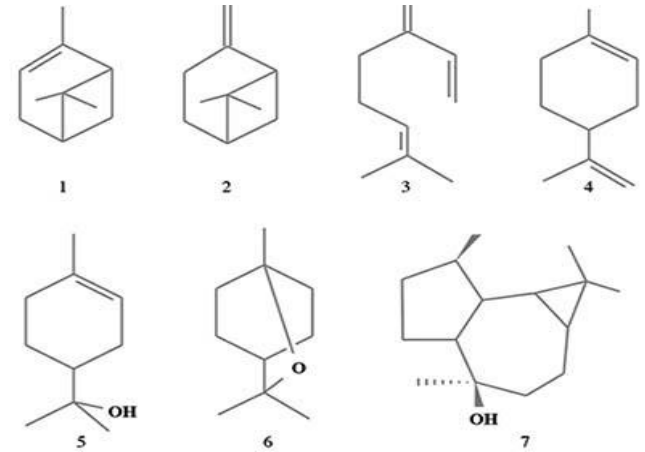
Even though several experimental trials involving both *in vitro* and *in vivo* studies have been documented on the importance of herbal medicaments that used to treat ectoparasic skin disease of animals this reviews summaries only the common one used by herbalists.

Eucalyptus globulus Labill: Family: Myrtaceae, local name: Nachi bahir zaf

Parts used Leaf

Phytochemistry

Hydrodistillation of the *E. globulus* leaves yielded 1.8% of essential oil (w/w, based on the fresh weight of the mature leaves) with a spicy aromatic odour. The major component was 1, 8-cineole (85.8%), while α-pinene (7.2%) and β-myrcene (1.5%) were minor main components. Other compounds identified in the oil obtained were β-pinene, limonene, α-phellandrene, γ-terpinene, linalool, pinocarveol, terpinen-4-ol, α-terpineol and globulol. The eucalyptus oil consisted mostly of oxygenated monoterpenes (87.32%) and monoterpene hydrocarbons (12.45%), 1, 8-cineole determines the commercial value of the oil and its importance as a raw material for different industries. The biological activity of *E. globulus* essential oil is due to the presence of a mixture of monoterpenes and oxygenated monoterpenes (most of the antimicrobial activity in the oils has been attributed to the oxygenated monoterpenes), [15].



1: α-pinene, 2: β-pinene, 3: β-myrcene, 4: limonene, 5: α-terpineol, 6: 1, 8-cineole, 7: globulol

Fig 1: Terpene components in *E. globulus* essential oil

Pharmacological properties, ectoparasiticides

The medicinal parts of the plant are the leaves. Eucalyptus leaf extracts have been used to treat influenza, chest rub, and skin rashes while the vapor is inhaled to fight inflammation [16]. *Eucalyptus* oil is also used in food flavoring, confectionery, detergent, aerosol, soap, nasal and cough drops, inhalant, hand cleaner, perfume and as a solvent [17]. *Eucalyptus* oil can also directly act as a natural insect repellent to provide protection against mosquitoes and other harmful arthropods. The quantity of essential oil in the leaves of *E. globulus* ranges from less than 1.5 to over 3.5%. Essential oils intended for medicinal use should contain about 70 to 85 % cineol or eucalyptol and obtained mainly from *E. globulus* [18]. The use of leaves of *E. globulus* as traditional medicine has been a long custom especially in the rural parts of Ethiopia to refresh the air, and as insect repellents.

Gemeda [19] has reported that *E. globulus* essential oil has pronounced insecticidal activity against sheep ked using *in vitro* adult immersion test at 12.7 μL/mL dose. On other study conducted on lice similar insecticidal activity has been observed by essential oil of *E. globulus* using the same techniques. An unpublished study conducted by Ahmed and coworker done in Ethiopia on ectoparasiticides *E. globulus* leaves essential oil in experimental sheep and goats at pilot level has revealed that the essential oil significantly has insecticidal activity against mange mites in a dose-dependent manner. From the above researcher investigations it is possible to conclude that essential oil from *E. globulus* leaf can be the promising candidate ectoparasiticidal medicament.

Safety and toxicity

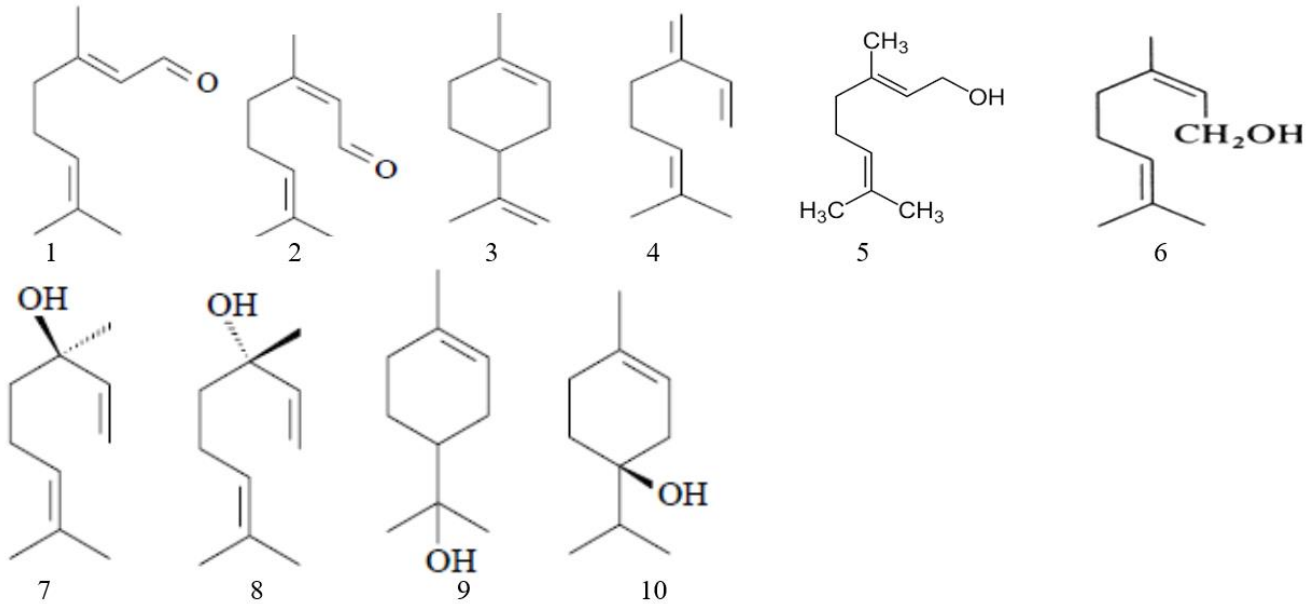
According to the classification system that allows a prediction of systemic toxicity *in vivo* from the cell culture data the expected systemic toxicity of eucalyptus essential oils can be rated as very little toxic. Clinical studies about the topical use of eucalyptus essential oil demonstrate that it is tolerated well both when inhaled and when applied onto the skin in topical formulations [20]. However, the ingestion of a few milliliters of essential oils may cause severe symptoms of intoxication like vomiting, respiration failure, and unconsciousness and may lead to death, especially when infants are concerned [21].

Cympobogon citratus: Family: Lamiaceae, common name: lemongrass

Parts used leaf

Phytochemistry

Although the chemical composition of the essential oil of *cymbopogon* species varies according to several factors, such as local, climatic, seasonal and experimental conditions [22, 23, 24], geranial, neral, geraniol, nerol, limonene and β-myrcene have been constantly registered as the major compounds (figure 1). Citral, which is a natural mixture of two isomeric acyclic monoterpene aldehydes [geranial (*trans* citral, citral A) and neral (*cis*-citral, citral B)] is the main chemical component of lemongrass oil [25, 26]. However, analysis of the chemical constituents of essential oil of lemongrass from Ethiopian highlands indicated that geraniol and not citral as a major component [27]. Citral is an important raw material used in the pharmaceutical, perfumery and cosmetic industries, especially for the synthesis of Vitamin A and ionone [28].



1: Geranial, 2: Neral 3: Limonene 4: β-myrcene, 5: Geraniol, 6: Nerol, 7: (-)-Linalool, 8: (+)-Linalool, 9: α-Trepineol, 10: Terpinen-4-ol

Fig 2: Some of the chemical constituents of cympobogon citratus

Pharmacological properties, ectoparasiticides

In tropical and subtropical countries, *Cymbopogon citratus* produces a pleasant aroma in herbal teas [29]. Lemongrass is widely used in ameliorating nervous and gastrointestinal abnormalities [30]. The essential oil obtained from this plant has antibacterial and antifungal activities [31, 32]. Its sedative and anticonvulsant properties as well as its use as an anxiolytic agent has been documented [33]. In Trinidad and Tobago, it is used to combat diabetes. In Surinam's traditional medicine lemongrass is used against coughing, cuts, asthma, bladder disorders and as a diaphoretic and to relieve headaches [34]. In USA, hot water extract of entire plant is used externally by Laotian Hmong in Minnesota for healing wounds and bone fractures. Hot water extract of dried leaves is taken orally as a hypotensive, for catarrh and rheumatism in Cuba and as a renal antispasmodic and diuretic in Egypt [35].

Besides the medicinal use, the lemongrass essential oil is also used in food flavoring, perfume and cosmetics industries [36]. Generally, the "tea" or "infusion" prepared with fresh or dry leaves of lemongrass is popular medicine in almost all the continents and it comprises a wide range of uses [37].

Negassa *et al*., [38] has reported that at both 0.3125% and 0.15615% concentration of *Cymbopogon citractus* essential oil has showed good efficacy aganist *Sarcoptes scabiei var caprea* mange mites on naturally infested goats as compared to the positive reference drugs (diazinon). This aligns with Gemeda *et al*., [19] studies that *C. citratus* essential oil has shown higher insecticidal activity against sheep ked than the positive control (Diazinone). Even though there is very little previous study so far conducted on the acaricidal activity of this oil, several earlier studies reported antimicrobial activities by *Cymbopogon citratus* essential oil [39, 40, 41]. The oil exhibited broad spectrum of antifungal toxicity [42]. *Cymbopogon citratus* essential oil inhibited microrganism examined at < 2% v/v [43]. Other plant materials like linolool also showed acaricidal activity against *psoroptes* mite in, *in vivo* on rabbits and goats [44]. In a recent study [45] Linalool and cinnamyl acetate showed insecticidal activity against *pediculus humanus capitis.* Medicinal plants with acaricidal properties have additional merits including low environmental toxicity never induce resistance readily in insects and relatively non-toxic to mammals [46, 47, 48]. These results consolidate the belief that the use of herbal acaricides may provide a better alternative of combating options against mange in domestic animal and they can be used more safely and effectively.

Safety and toxicity

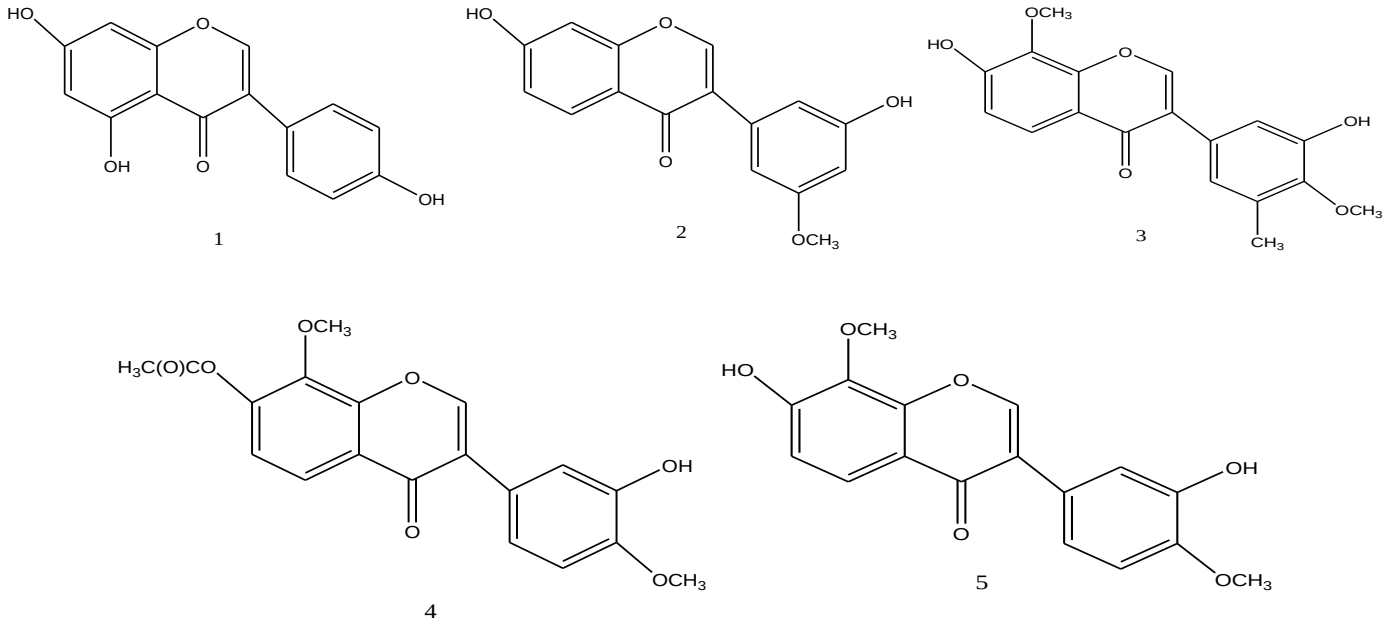
Studies on the lemon grass oil toxicity in mammals demonstrated that this natural oil is innocuous [49]. Repeated administration of lemongrass stem infusion to rats did not produce any significant change in their blood lipid profiles, liver function parameters, renal function parameters, and did not show hepatotoxic and nephrotoxic signs [50].

Other toxicity studies indicated that citral, which is a major constituent of *Cymbopogon citratus*, is devoid of major toxicity and carcinogenic potential in both mice and rats [51, 52]. According to [53], the extract administered to rat did not present adverse effects, considering that morphometric and histological alterations were not observed in vital organs, or biochemical alterations in the blood and urine. An infusion of lemongrass given orally to male and pregnant female rats for two months in doses up to 20 times the corresponding human dose did not induce any toxic effects and no external malformations were noted in the offspring [54].

Calpurea aurea: Family: Fabeaceae, Local name: Digta or chekata

Phytochemistry

The isoflavones, 4′, 5, 7-trihydroxyisoflavone (1), 7, 3′-dihydroxy-5′-methoxyisoflavone (2), 7-hydroxy-4′, 8-dimethoxyisoflavone (3), 7-acetoxy-4′, 8-dimethoxyisoflavone (4) and 3', 7-dihydroxy-4′, 8-dimethoxyisoflavone (5), a pterocarpan (3-acetoxy-9-methoxypterocarpan) and a quinolizidine alkaloid (Calpurnine) were isolated from the stem and bark of *Calpurnia aurea*. The tetra substituted isoflavone (5) was found to be the most active in the three cell lines amongst all the compounds tested. This was followed by trisubstituted isoflavone [55].



1: 4′, 5, 7-trihydroxyisoflavone, 2: 7, 3′-dihydroxy-5′-methoxyisoflavone, 3: 7-hydroxy-4′, 8-dimethoxyisoflavone, 4: 7-acetoxy-4′, 8-dimethoxyisoflavone 5: 3', 7-dihydroxy-4′, 8-dimethoxyisoflavone

Fig 3: Isoflavone components of *Calpuria aurea*

Pharmacological properties, Ectoparasiticides

In Ethiopia, traditionally, the leave of *C. aurea* is used for the treatment of syphilis, malaria, rabies, diabetes, hypertension, diarrhoea, leishmaniasis, trachoma, elephantiasis, fungal diseases and different swellings, stomach-ache, bowel, and bladder disorders [56]. Plant products have been part of phytomedicines since time immemorial. These can be derived from any part of the plant like bark, leaves, flowers, seeds, etc. i.e., any part of the plant may contain active components. Extracts of *C. aurea* have been used in South Africa to treat maggot-infested wounds and in Ethiopia to treat scabies. In western Ethiopia, the juice of crushed leaves and bark is used for tick control [57]. The Borana people of northern Kenya and southern Ethiopia soak leaves of *C. aurea* in cold water to treat louse infestations in humans and calves [58] and to control ticks on cattle.

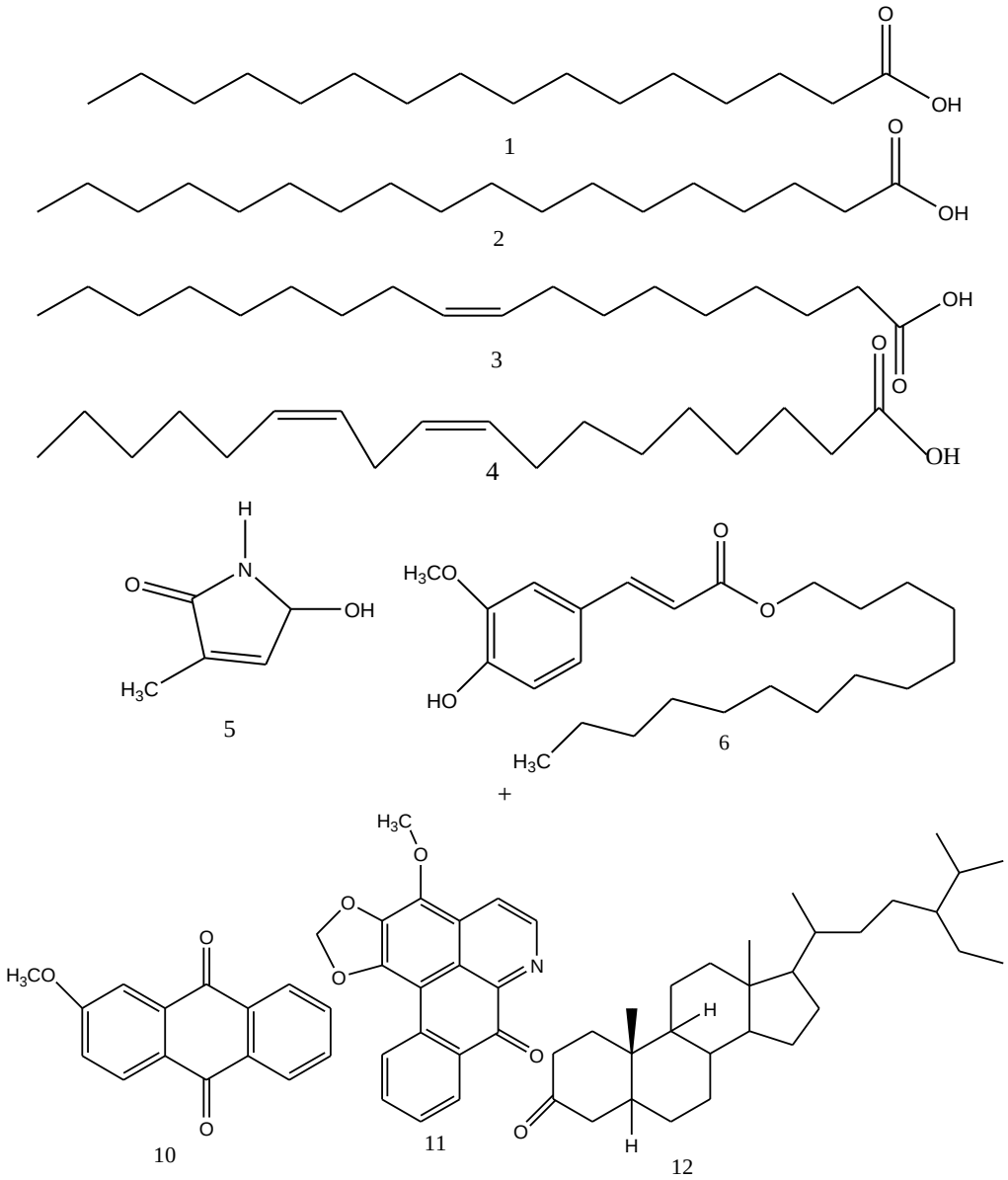
Jatropha curcas: Family: Euphorbiaceae, local name: Ayderke

Parts used: Different parts

Phytochemistry

Phytochemical investigations on different species of *Jatropha* resulted in the isolation of fatty acids, essential oil, sugars. Among other compounds alkaloids, flavonoids and steroids are most considerable components. The latex of *Jatropha* contains an alkaloid known as Jatrophine which is believed to be anticarcinogenic. The juice of the leaf possesses both procoagulant and anticoagulant activities.

A number of compounds have been isolated from this plant such as tetradecyl-(E)-ferulate, palmitic acids (C16:0), stearic acids (C18:0), oleic acids (C18:1), linoleic acid (C18:2), steroid stigmasterol, atherospermidine, heudelotinone, epi-isojatrogrossidione, 2-alpha-hydroxy-epiisojatrogrossidione, and 2-methyl anthraquinone [59, 60].



1: Palmitic acid, 2: stearic acid, 3: oleic acid 4: Linoleic acid, 5: Jatrophine, 6: tetradecyl-(E)-ferulate, 7: Heudelotinone, 8: epi-isojatrogrossidione, 9: 2-hydroxyl-epi-isojatrogrossidione, 10: 2-methoyl anthraquinone, 11: Atherospermidine, 12: Steroid Stigmasterol.

Fig 4: Some of compounds isolated from Jatropha curcas

Pharmacological properties, ectoparasiticides

Different parts of the plant had been used as ethno medicine in different countries for centuries [61]. Many studies demonstrated the efficacy of *Jatropha curcas* against a wide array of bacteria and fungi [62, 63, 64]. Results of several studies also revealed that Jatropha has anticancer and antitumor properties [65, 66, 67]. It is also used in the treatment of various disorders in man and animals, including goats and sheep, and

is also ingested by grazing animals particularly at times of drought. This align with Grainge and Ahmed [68] reports that shows extracts from all parts of the physic nut has insecticidal properties particularly the seed oil extracts and phorbol esters from the oil which used to control various pests. In addition to being a source of oil, Jatropha also provides meal that serves as a highly nutritious and economic protein supplement in animal feed, if the toxins are removed [69]. The plant can be used to prevent soil erosion, to reclaim land, grown as a live fence and also is planted as a commercial crop [70].

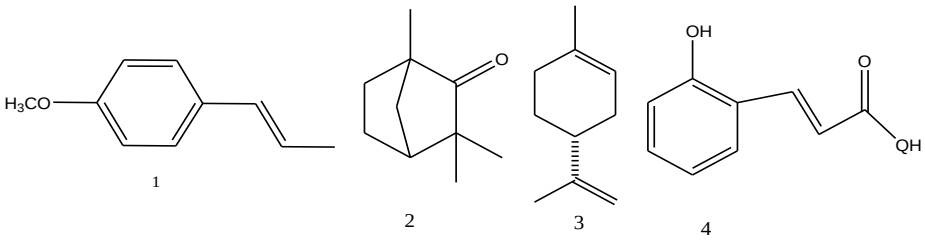
Safety and toxicity

The seeds of *Jatropha curcas* are generally toxic to humans and animals. Several cases of Jatropha nut poisoning in humans after accidental consumption of the seeds have been reported with symptoms of giddiness, vomiting and diarrhea and in the extreme condition even death has been recorded [69]. The high concentration of phorbol esters present in Jatropha seed has been identified as the main toxic ingredient responsible for Jatropha toxicity [71, 72]. Curcin, a toxic protein isolated from the seeds of Jatropha, was found to inhibit protein synthesis in *in vitro* studies. A crucial obstacle in the establishment of this plant as a commercial crop would be overcome by detoxifying the seeds or seed oil [73].

Foeniculum vulgare: family: Apiaceae, common name: fennel

Phytochemistry

Foeniculum vulgare fruit extraction results in 4% palmitic acid, 22% oleic acid, 14% linoleic acid and 6% petrocylic acid. It is also reported that more than 30 types of terpene compounds in the essential oil of fennel, of which the most important are 50 to 80% trans-anethole, 8% fenchone and limonene 5%. Phenolic compounds such as hydroxycinnamic acids, 4-O-Caffeoyl quinic acid, 5-O-Caffeoyl quinic acid, 1,3-O-Di-Caffeoyl quinic acid, 1,4-O-di-Caffeoyl quinic acid,1,5-O-di-Caffeoyl quinic acid, Eriodictyol-7-rutinoside, quercetin-3-O-galactoside, quercetin-3-glucuronide, kaempferol-3-glucoronide, quercetin -3-O-rutinoside, kaempferol -3-O-rutinoside, rosmarinic acid are some constituents that are identified [74, 75, 76].



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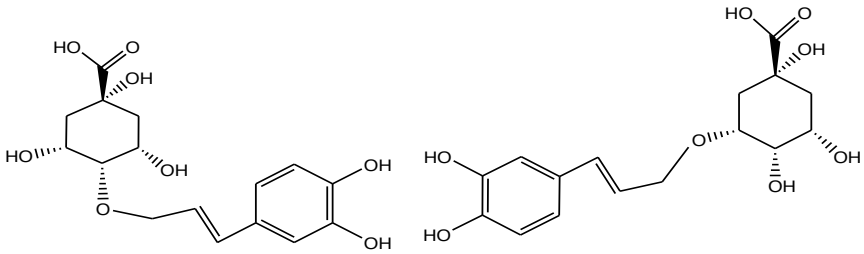

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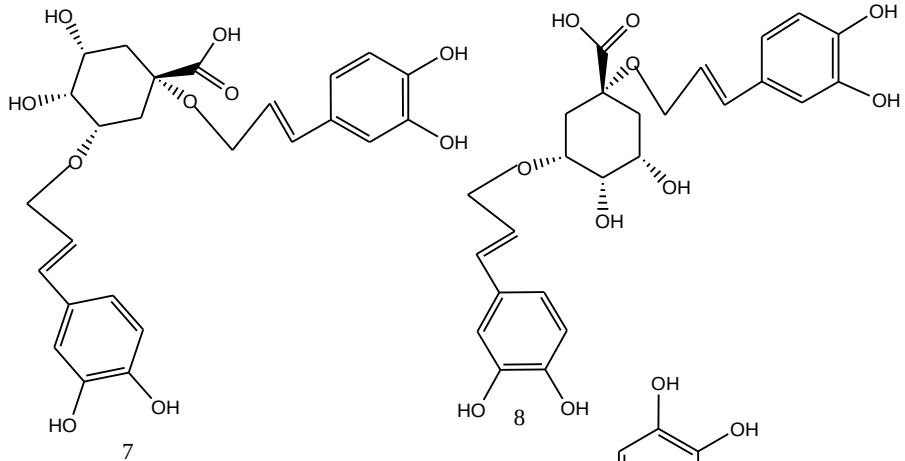

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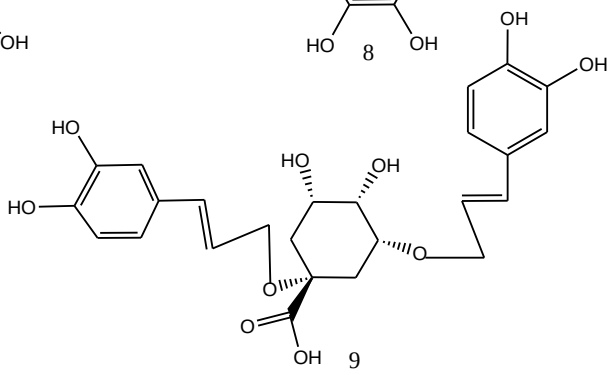

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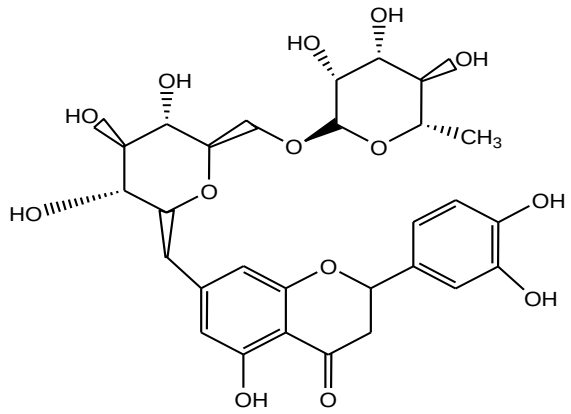

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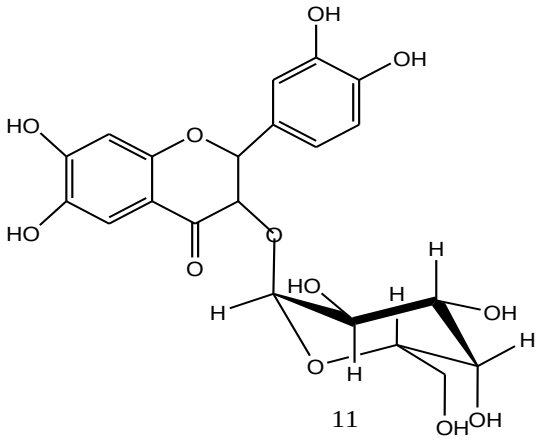

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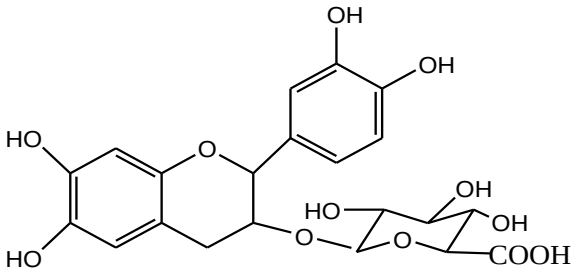

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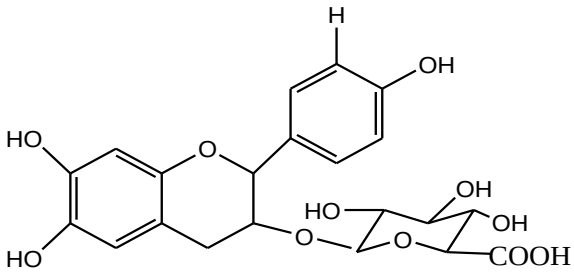

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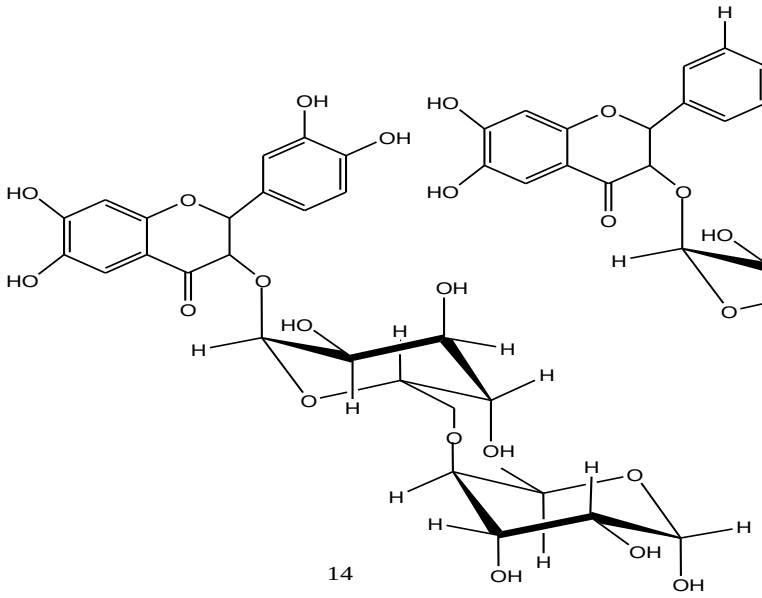

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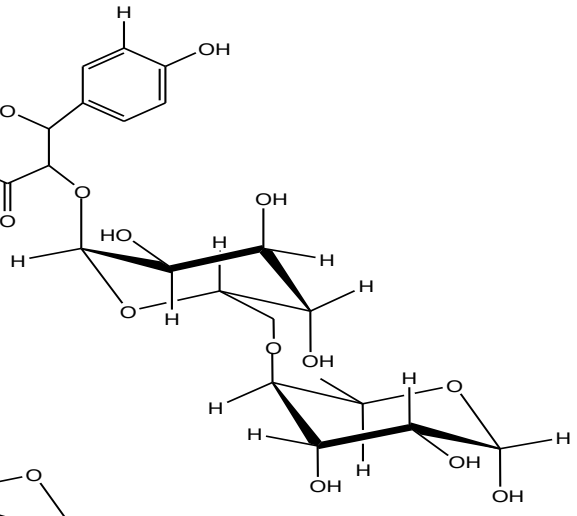

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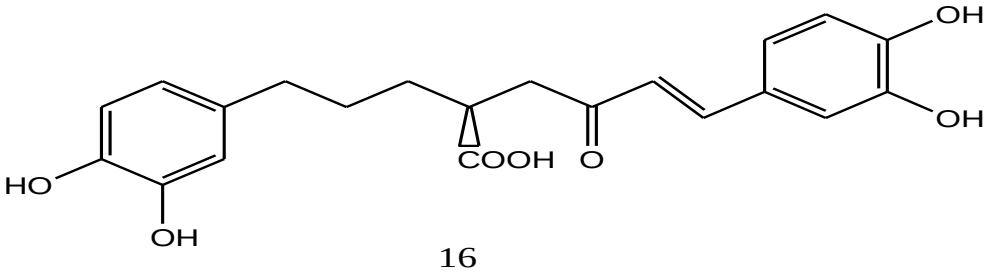

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1: trans-Anethole, 2: Fenchone, 3: Limonene, 4: Hydroxycinnamic acid, 5: 4-O-Caffeoyl quinic acid, 6: 5-O-Caffeoyl quinic acid, 7: 1,3-O-Di-Caffeoyl quinic acid, 8: 1,4-O-di-Caffeoyl quinic acid, 9: 1,5-O-di-Caffeoyl quinic acid, 10: Eriodictyol-7-rutinoside, 11: quercetin-3-O-galactoside, 12: quercetin-3-glucuronide, 13: kaempferol-3-glucoronide, 14: quercetin -3-O-rutinoside, 15: kaempferol -3-O-rutinoside, 16: Rosmarinic acid.

Fig 5: Some compounds isolated from *Foeniculum vulgare*

Pharmacological properties, ectoparasiticides

From immemorial time different part and extract of *Foeniculum vulgare* Mill has been used to treat various ailments and disorders in different part of the world [74].

Fennel has been used in traditional medicine to treat various diseases for thousands of years in parts of the world. Nowadays, the different parts of the plant are used in treatment of many diseases, particularly pain in the digestive system and liver. Also it is very useful in the treatment of diabetes, bronchitis, chronic cough and kidney stones [75]. Fennel seeds are used as a flavoring in cooking meat and fish, prepare ice cream and cream. It has also been reported that essential oils from leave of *F. vulgare* have ectoparasiticidal activity against *Melophagus ovinus*. Fennel is also used to treat many bacterial, fungal, viral, and mycobacterial infectious diseases [75, 76].

Safety and toxicity

Shah *et al* [77] reported that oral administration of an ethanolic extract of *Foeniculum Vulgare* fruit to mice at 0.5, 1 and 3 g/kg b.w. caused no mortality and no significant difference in body and vital organ weights or in external morphological, haematological or spermatogenic parameters in comparison with the control group.

Methodology

Various types of documents such as books, published research articles and theses were thoroughly explored to collect valuable information regarding the medicinal plants used for the treatment of ectoparasites. The references of identified articles and hand searched journals on ethno botany, herbal medicine such as the journal of ethnoveternary were also searched. Various web sites including Google scholar and pub med have also been searched for the collection of data using important related key words such as Ethno botanical survey, Ethiopian herbal medicine, antiectoparasite plants, etc. Using the sources and tools, the scientific, family and local names of each plant species together with the parts used and method of preparation were clearly described and presented in a table 1.

Table 1: List of medicinal plants used for the treatment of ectoparasite

Scientific name	Family name	Part used	Preparation methods	Target parasites	Availability status	Comments & precautions	
Aloe excelsa A. Berger.	Aloaceae	Stem, leaves	Crush leaves, mix with water for 24 h & spray	Fleas, ticks	Seasonal	Safe to use	[19]
Eucalyptus globulus	Myrtaceace	leaf	Aqueous Extract	external parasite	always	Very effective	[19]
Syzygium unineense	Myrtaceae	leaf	aqueous extract	sheep ked	always		[19]
Croton acrotaschyus	Euphorbiaceae	leaf	aqueous extract	External arasite	Always	Safe to use	[19, 15]
Bersama abyssinica Fresen.	Melianthacee	leaves	Leaf aqueous extract	Sheep ked		Safe to use	[19]
Vernonia auriculifera Hiern.	Asteraceae	leaves	Leaf aqueous extract	Sheep ked	always	Safe to use	[19]
Capsicum annuum L.	Solanaceae	Fruits	Crush the fruits and mix with soot in water and spray	Ticks	Always	Causes eye irritation	[78, 79]
Nicotiana tabacum L.	Solanaceae	leave	Break and mix with water	Ticks	Always	Safe to use	[19, 80, 81, 82]
Cadaba rotundifolia Forssk		Root	aqueous extract	External parasite.			[83]
Solanum incanum L.	Solanaceae	Fruits	Crush fruits and mix with water	Ticks	Seasonal	Handle with care	[78]
vernonia amygdalina	Asteraceae	leave	powder paint	Ticks	Always	Safe to use	[78]
Azadirachta indica A. Juss	Meliaceae	leaf	powder on topical	Ticks	Always		[84, 82]
Citrus aurantifolia (Christm)	Rutaceae	Fruit	Fruit paste is applied to the affected area		Seasonal	Safe to use	[85]
Aloe megalacantha	Aloaceae	leaf	latex	Ticks and lice	always		[86]
Melia azedarach L.	Meliaceae	Leaf and fruit	Aqueous and organic extract	Ticks and lice	always		[87]
Otostegia integrifolia Benth.	Lamiaceae	Whole plants	Fumigate the plant in the house where the animals are kept	Ticks and lice	always		[86, 87, 89, 90]
Guizotia scabra	Asteraceae	leaves	Leaves of *Guizotia scabra* and Leaves of *Calpurnia aurea* crushed and rubbed	Ticks and lice	seasonal		[91]
Dodonaea angustifolia L.F. (DB.16)	Sapindaceae	leaves	leaves juice sprayed to the affected area	ectoparasite	always	Safe to use	[85]
Calpurinia aurea (Ait) Benth Fabaceae tree Fresh leaves are grounded with small amount of water Topical and Drenching Mastitis, skin diseases like dermatophilosis and ectoparasites (lice, ticks)	Solanaceae	leaves	Leaf aqueous extract	ectoparasite	always	Safe to use	[85, 81, 92]
Premna schimperi Engl.	Lamiaceae	root	root hot aqueous extract	Tick and mite infestations		Safe to use	[81]
Cassia nigicans	Caeasalpiniaceae	leaves s and stems	Aqueous extract	Ticks and lice			[82]
Euphorbia obovalifolia	Euphorbiaceae	leaves	Latex	ticks	always	Handle with care	[82]
Ficus brachypoda	Moraceae	leaves	Latex	ticks	always	Handle with care	[82]
Acokanthera schimperi (A. DC.) Benth	Apocynaceae	leaves		Insecticide			[95]
Cissus petiolata Hook. f	Vitaceae	leave		Mange mites			[95]
Cucumis dipsaceus Ehrenb	Cucurbitaceae	root		insecticide			[95]
Datura stramonium L.	Solanaceae	Leaves and fruit		Mange mites			[95]
Xeminia Americana L.	Oleaceae	seeds	Roasted& crushed seed mixed with butter	ectoparasite			[96]
Euphorbia abssinica	Euphorbiaceace	leaves	Latex	ectoparasite			[94]
Acacia melanoxylon R.Br	Fabaceae	leaves	Crushed leaf mixed with water	Mange mites			[92]
Rhus ruspolii Engl	Anacardaceae	leaves	Aqueous leaf extract	ectoparasite			[91]
Helinus mystacinus (Ait.) E. Mey. ex Steud	Euphorbiaceae	leaves	crushed and smashed leaves	ectoparasite			[91]
Verbascum sinaiticum Benth	Scrophulariaceae	leaves	Aquoeous leaf extact	ectoparasite			[91]
Cucurbita pepo L	Cucurbitaceae	seeds	Fruit cooked and rubbed	ectoparasite			[91]
Maesa lanceolata Forssk.	Myrsinaceae	leaves	aqueous	ectoparasite			[91]
Clausena anisata (Willd.)	Rutaceae	leaves		ectoparasite			[93]
Opuntia ficus-indica (L.) Miller	Cactaceae	leaves	Aqueous leaf exract	ectoparasite			[86]
Nicotiana glauca Graham	Solanaceae	leaves	Aqueous leaf exract	ectoparasite			[86, 89, 90]
Phytolacca dodecandra. L	Phytolacaceae	Leaves	Aqueous leaf exract	ectoparasite			[90]
Calpurnia decandra	Fabacaea	leaves	Aqueous leaf exract	ectoparasite			[90]
Datura innoxia Mill	Fabacaea	leaves	Pounded leaves	Ectoparasite			[90]
Piliostigma thonningii (schumach) Amamgimel (T) Boraginaceae Herb Leaf- Fresh leaves are pounded and applied to the skin where affected by ectoparasites.	Boraginaceae	leaves	Fresh pounded leaves	ectoparasite			[90]
Commiphora erythraea (Ehrenb.) Engl.	Bruseraceae		latex	ticks			[97].

Conclusion

The prevalence of animal ectoparastic skin disease and the use of herbal medicines have been shown to increase all over the world, particularly across the developing countries. More than 80% of people who live in the developing countries rely on herbal medicines for their health and their animal's health care needs. The medicinal plants reported in this study are ectoparasiticides herbal agents that have been studied scientifically as well as used in Ethiopian traditional medicine. In the present review, a total of forty four medicinal plants have been identified and recorded for their use in management of animal ectoparastic skin disease. Though most of these medicinal plants are widely utilized in different parts of the country, only safety and efficacy information of some of them such as *Eucalyptus globulus*, *Cympobogon citratus*, *Jatropha curcus*, *Calpurea aurea*, and Foeniculum *vulgare* were scientifically tested in animals. Thus, it is relevant for recent and future researchers in the field to conduct the safety and efficacy study of the remaining traditional claimed medicinal plants and generate the information to protect the veterinary.

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