12 Ethnoveterinary Plants Used in East Africa

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12.1 INTRODUCTION

Ethnoveterinary medicine has always been a part of traditional medical knowledge in many parts of Africa. East Africa covers Kenya, Uganda, Tanzania, Eritrea, Ethiopia, Somalia, and Djibouti. In this region, livestock farming is a central part of the farming activities. For instance, in Kenya, about 69% of the area can only be used for livestock farming rather than crop agriculture. The farming systems involve mainly pastoralisms but also include small holder farmers who keep a few animals. Due to limitation in resources, many of the farmers in these areas rely more or less on traditional medicine for treatment of their livestock.
For East Africa, several publications are available on anecdotal information on usage of medicinal plants to combat diseases of livestock. In addition, several monographs and studies in selected communities have been carried out to document the use of ethnoveterinary medicine. The publications in most cases highlight different conditions affecting livestock as well as symptoms associated with several disease conditions. The conditions that are covered range from abscesses to ectoparasites to treatment of conditions caused by protozoan parasites such as theileriosis (East Coast fever, ECF) and trypanosomosis. In some instances, symptoms such as diarrhea are treated but not the underlying condition that may cause the diarrhea. A number of databases and sources such as PRELUDE, ScienceDirect, and books were searched for information on ethnoveterinary plants used for different conditions in East Africa.

From the databases, 193 plants were documented. A total of 161 plants were recorded in Kenya, while 31 were from Uganda. These plants, their usage, and their mode of preparation are recorded in Table 12.1. This, however, does not mean that there was no information available from the other countries in East Africa. Nonetheless, we concentrated on these two countries where most of the information was readily available, and it is likely that the ethnoveterinary practices documented are similar throughout the subcontinent because of many shared traditions and customs.

Various conditions were noted with different treatment being offered. A minimum of 26 conditions have been reportedly treated with ethnoveterinary preparations. These conditions ranged from abscesses, wounds, and burns to specific treatments like that for brucellosis. The highest number of different plant treatments available for a single condition were 19 in Kenya for treatment of wounds, while only one different plant species was available for each of the following conditions: heartwater, bloat, ephemeral fever, anaplasmosis, mastitis, coccidiosis in chicken, burns, and brucellosis. Theileriosis and endoparasites had 12 and 13 different plant species used for their treatment, respectively.

The different treatments used a total of 64 families of plants. These treatments are addressed as endo- and ectoparasitic conditions, hemoparasitic conditions, and other diseases.

12.2 PARASITIC DISEASES

Parasitic diseases have been described to have the highest effect on productivity of livestock owned by the poor worldwide. These diseases are the major causes of low productivity of livestock in tropical and subtropical regions, including East Africa. Various plants are used to treat different hemoparasitic diseases in East Africa; some are discussed in depth next.

12.2.1 BABESIOSIS

Babesiosis is caused by intraerythrocytic protozoan parasites of the genus Babesia. The disease, which is transmitted by ticks, affects a wide range of domestic and wild animals and occasionally humans. While the major economic impact of
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Babesiosis is on the cattle industry, infections in other domestic animals, including horses, sheep, goats, pigs, and dogs, assume varying degrees of importance throughout the world. Two important species in cattle, *B. bigemina* and *B. bovis*, are widespread in tropical and subtropical areas worldwide. The main vectors of *B. bigemina* and *B. bovis* are one-host *Boophilus* spp. ticks, in which transmission occurs transovarially. The acute disease generally runs a course of about a week. Clinical signs include fever, inappetence, increased respiratory rate, muscle tremors, anemia, jaundice, weight loss, hemoglobinemia, and hemoglobinuria. Late-term pregnant cows may abort, and bulls may undergo temporary infertility due to transient fever.

Three plant species are used for treatment of babesiosis in cattle: the stem bark of *Acacia exocephaleia*, Mimosaceae, roots of *Erythrina abyssinica* Lam. Fabaceae, and the bark of *Prunus africana* (Hook. f.) Kalkman, Rosaceae. They have been used for treatment of babesiosis in cattle,9 and the last species has also been used as a laxative in livestock.²

### 12.2.1.1 *Erythrina abyssinica*

*Erythrina abyssinica* is a tree, rarely a shrub, 3–10 m tall, with a rounded crown, and it is found throughout East Africa. This plant has been found to contain mainly flavonoids.18,19,97,98 The species was found to have antiprotozoal action and showed in vitro activity against plasmodium as well as against trypanosomosis. This antiprotozoal activity could explain its use in traditional treatment against babesiosis.

### 12.2.1.2 *Prunus africana*

*Prunus* (or *Pygeum*) *africana* is an endangered medicinal plant endemic to Africa. It is mainly found on higher-altitude areas, generally from 1,000 m above sea level. The African cherry [*Prunus africana* (Hook. f.) Kalm.] has been used in the treatment of benign prostatic hyperplasia and other disorders in men. The bark, from which the treatment is derived, is entirely wild collected. The major exporters of bark include Cameroon, Madagascar, Equatorial Guinea, and Kenya.84 The active constituents of *Pygeum* extract that is derived from this tree include phytosterols (e.g., beta-sitosterol), which exert anti-inflammatory effects by inhibiting production of proinflammatory prostaglandins in the prostate. *Pygeum* also contains pentacyclic triterpenes (ursolic and oleanolic acids)²⁶ that have antiedema properties and ferulic acid esters (n-docosanol and tetracosanol) that reduce prolactin levels and block the accumulation of cholesterol in the prostate.⁸,⁴⁰,⁴¹,⁶³,⁸⁰ In animals, chloroform and aqueous extracts were observed to manifest hepatotoxicity at dosages of above 3 g/kg body weight.³⁰,³¹

### 12.2.2 Trypanosomosis

Trypanosomosis is caused by protozoa of the genus *Trypanosoma* and affects all domestic animals. The major species are *T. congolense*, *T. vivax*, *T. brucei brucei*, and *T. simiae*. Cattle, sheep, and goats are infected, in order of importance, by *T. congolense*, *T. vivax*, and *T. brucei brucei*. In pigs, *T. simiae* is the most important. In dogs and cats, *T. brucei* is probably the most important. *Trypanosoma vivax*...
may occur outside tsetse-infested areas of sub-Saharan Africa. The trypanosomes that cause tsetse-transmitted trypanosomiasis (sleeping sickness) in humans, *T. brucei rhodesiense* and *T. brucei gambiense*, closely resemble *T. brucei brucei* from animals, and domestic animals act as reservoirs of human infections. Most tsetse transmission is cyclic and begins when blood from a trypanosome-infected animal is ingested by the fly. Tsetse flies (genus *Glossina*) are restricted to Africa from about latitude 15°N to 29°S. Mechanical transmission may also occur through tsetse or other biting flies. In the case of *T. vivax*, *Tabanus* spp. and other biting flies seem to be the primary mechanical vectors outside the tsetse areas, as in Central and South America. Mechanical transmission requires only that blood containing infectious trypanosomes be transferred from one animal to another. The clinical signs include intermittent fever, anemia, and weight loss, and in cattle the disease may have a chronic course with high mortality.

Several plant species have been used to treat trypanosomosis in East Africa. These include *Acacia reficiens*, *Adenia volkensii*, *Fagara chalybea*, *Salvadora persica*, and *Terminalia brownie*, which are used in Kenya. In Uganda, in vitro studies have been carried out to evaluate the antitrypanosomal activity of *Albizia gummifera*, *Ehretia amoena*, *Entada abyssinica*, *Securinega virosa*, and *Vernonia subuligera*. In Tanzania, of 37 extracts derived from 15 plant species tested for antitrypanosomal activity, the chloroform extract of the root bark of *Asteranthe asterias* and the ethanol extract of the root bark of *Annickia kummeriae* showed the highest activity, with IC₅₀ values of 0.8 and 0.7 µg/mL, respectively. Ten extracts exhibited antitrypanosomal activity, with IC₅₀ values between 1 and 5 µg/mL. Among them are the extracts of *Asteranthe asterias*, *Commiphora emenii*, *Diospyros verrucosa*, *Enantia kummeriae*, *Hymenocardia ulmoides*, and *Zanthoxylum chalybeum*. Six extracts showed IC₅₀ values between 5.1 and 20 µg/mL. All other extracts had less or no activity.

Some of these species are discussed briefly next.

### 12.2.2.1 Adenia volkensii Harms, Passifloraceae (Kiliambiti)

*Adenia volkensii* Harms, Passifloraceae (Kiliambiti) is a woody shrub or herb that grows up to 1.5 m and arises from a tuberous rootstock or a succulent stem and is without tendrils. Roots are used in Kenya to treat trypanosomosis, pneumonia, and bronchitis in livestock. This plant is known for the extreme toxicity of the sap. It has cyanogenic glycosides and lectins (ribosome-inactivating proteins) that destroy ribosomes and hence prevent protein synthesis.

### 12.2.2.2 Fagara chalybea [Engl.] Engl. Rutaceae

(= *Zanthoxylum chalybeum*) Engl.

*Fagara chalybea* [Engl.] Engl. Rutaceae (= *Zanthoxylum chalybeum*) Engl. is a deciduous shrub or small tree up to 6 m tall found in eastern and southern Africa. Apart from the use of stem bark, fruit, and seeds in the treatment of trypanosomosis, it has ethnoveterinary use as an antifebrile agent and for other livestock conditions, such as conjunctivitis, diarrhea, pneumonia, respiratory disease, and lymph node disease, which is the usual layperson’s term used to describe theileriosis. Alkaloids isolated from this plant were found to have mitochondrial inhibitory effects. The quinolone alkaloids isolated from this species have been shown to have biocidal
activity and are described as general growth inhibitors; that is, they can act as anti-
feedants, phytotoxics, and antifungals. The quaternary benzophenanthridine alka-
loids (e.g., sanguinarine, chelerythrine, and nitidine) have potent antiplasmodial and
antitopomerase activities.

12.2.2.3 *Salvadora persica* L., Salvadoraceae

The toothbrush tree *Salvadora persica* (synonym *Galenia asiatica*, *Salvadora indica*) is a small tree or shrub with a crooked trunk. Its roots and bark are used to
treat livestock of trypanosomosis and abscesses, mange, and retained afterbirth. It is
also used for the treatment of anthrax.

Various constituents isolated from different parts of *Salvadora* species have been
described. These include alkaloids, steroids, terpenoids, flavonoids, and lignins. Some useful activities reported from various parts of the plant and from the iso-
lated chemicals are antiulcer, hypolipidemic, hypoglycemic, and anticonvulsant
activities. Due to the presence of benzyl isothiocyanate (BIT), it is widely used for
oral hygiene (so-called chewing sticks) in different parts of the world. A phytochemical investigation of stems from *Salvadora persica* demonstrated the
novel presence of natural benzylamides. The addition of *Salvadora persica* to the
growing and mature BB male rabbit diets was demonstrated to improve growth and
reproductive capabilities by raising plasma testosterone levels. In Kenya, the leaves
of the plant are a preferred camel diet.

12.2.3 East Coast Fever (Theileriosis)

East Coast fever is an acute disease of cattle characterized usually by high fever, swell-
ing of the lymph nodes, dyspnea, and high mortality. It is caused by *Theileria parva*
and is a serious problem in east and central Africa. The disease is transmitted by
the brown ear tick *Rhipicephalus appendiculatus* during feeding. Clinical signs vary
according to the level of challenge and range from inapparent or mild to severe and
fatal. Typically, fever occurs 7–10 days after parasites are introduced by feeding ticks,
continues throughout the course of infection, and may be 42°C. Lymph node swell-
ing becomes pronounced and generalized. Anorexia develops, and the animal rapidly
loses condition; lacrimation and nasal discharge may occur. Terminally, dyspnea is
common. Just before death, a sharp fall in body temperature is usual, and pulmonary
exudate pours from the nostrils. Death usually occurs 18–24 days after infection. The
plant species discussed next have been cited for use in ECF in East Africa.

12.2.3.1 *Adansonia digitata* L., Bombacaceae

Leaves and fruits are used to treat ECF in Kenya. *Adansonia digitata* (baobab tree)
main stem may reach enormous proportions, up to 28 m in girth, although baobab
trees seldom exceed a height of 25 m. The species is also used for treatment of try-
panosomosis in West Africa. It has been identified as possessing gastroprotec-
tive properties, probably due to astringent flavonoids and antioxidant properties, in
rats and mice that have been artificially induced to develop ulcers. Phytochemical
screening of the fruit pulp indicated the presence of sterols or triterpenes, saponins,
tannins, carbohydrates, and glycosides.
12.2.3.2 *Aerva javanica* [Burm. f.] Juss. ex J.A. Schultes, Amaranthaceae

Flowers of *Aerva javanica* [Burm. f.] Juss. ex J.A. Schultes, Amaranthaceae are used in Kenya to treat theileriosis in cattle. This is an erect, much-branched perennial herb, 0.4–1.6 m high, that grows on sandy soils along drainage lines. It was found to stimulate mice in a hypnotic study. Carbohydrates or glycosides, tannins, saponins, alkaloids, unsaturated sterols, triterpenes, and flavonoids have been demonstrated to be present in this species. Aqueous extracts of the species exhibited dose-dependent smooth muscle relaxant effects and significant antispasmodic activity.

12.2.3.3 Euphorbiaceae Species

Several Euphorbiaceae species have been cited for use in treating theileriosis in East Africa. These include the bark of *Croton megalocarpus*, the whole plant of *Euphorbia triaculeata*, and a decoction of the leaves and bark of *Synadenium compactum*.1,2,13,32,67–69

Euphorbiaceae consists of about 322 genera and 8,900 species around the world in both arid and humid tropics, and the plants are found as herbs, shrubs, stunted succulents, and tall canopy trees.100 The Euphorbiaceae have been shown to possess flavonoids, saponins, diterpenes, phorbol esters, lectins, and triterpenoids.104 Clerodane-type diterpenes have been isolated from *Croton megalocarpus*.4 Euphorbiaceae are well known for skin-irritating and tumor-promoting diterpenoids (e.g., daphnane diterpenoids).23 However, numerous macrocyclic diterpenes (e.g., jatrophane, ingol, and myrsinane) from this taxon have also shown good biological activity (i.e., anticancer, analgesic and antifeedant, among others).66,91 In addition to the alkaloids, the Euphorbiaceae also contain phenolics, triterpenoids, and steroids.43 *Synadenium* spp. have shown immunoregulatory, fibrinolytic, and antitumoral activity.72

*Euphorbia candelabrum* Trémaux ex Kotschy, Euphorbiaceae, latex and stem are also used to treat lymph node enlargement and for wounds, abscesses, and conjunctivitis in livestock.38 In Uganda, it is used to treat ECF.21,65

12.2.3.4 Other Species

Leaves and juice extracted from leaves of *Agave americana* L., Agavaceae, are also used in treatment of theileriosis wounds and act as a coagulant and an insect repellent.1 Steroidal sapogenins with anti-inflammatory activity and in vitro antileukemic activity have been characterized from this species. Antibacterial and molluscidal constituents have also been isolated and characterized.69,79,86 Agave is a source of fiber and produces steroidal sapogenins and saponins.105

*Cissus quadrangularis*, Vitaceae L., seeds, stem, and roots are used to treat theileriosis as well as diarrhea, external parasitism, foot rot, and pneumonia.9,32,39,49,62,65,67,90 *Cissus quadrangularis* is a source of stilbenes, including resveratrol, flavonoids, and triterpenoids.5,13,35,57 Extracts of the plant have shown a bone fracture healing property and antosteoporotic effect as well as antibacterial and antioxidant activities.64

*Clerodendrum myricoides* (Verbenaceae) root is also used in Kenya to treat theileriosis, diarrhea, and fever in livestock.95 Spermidine alkaloids have been isolated
from this species.\textsuperscript{106} It is traditionally used to treat malaria in Kenya, and methanol extracts have shown significant suppression of plasmodial parasitemia.\textsuperscript{107}

The leaves of the cucurbit, \textit{Gerrardanthus lobatus} and the root of \textit{Iboza multiflora} are used to treat theileriosis in cattle in Kenya,\textsuperscript{9} while the leaves of the latter are used for ectoparasites.\textsuperscript{59,67}

\textit{Plectranthus barbatus} leaves are also used to treat ECF fever in Kenya.\textsuperscript{67} Monoterpenoids, sesquiterpenoids, diterpenoids, and phenolics have been reported in species of \textit{Plectranthus}.\textsuperscript{107} \textit{Plectranthus barbatus} is used in French Guyana for malaria.\textsuperscript{109} \textit{Albizia coriaria} and \textit{Albizia zygia}, both Mimosaceae, root infusions are used in Uganda to treat ECF.\textsuperscript{87,21} The related species \textit{A. gummifera} is used traditionally to treat malaria and has spermine alkaloids that exhibited moderate activity against the malaria parasite in vitro.\textsuperscript{110}

Other ethnoveterinary medicines reported for ECF in East Africa are leaf infusions of \textit{Ananas comosus} (Bromeliaceae), \textit{Aristolochia elegans} (Aristolochiaceae), \textit{Asparagus racemosus} (Asparagaceae), \textit{Boerhavia diffusa} (Nyctaginaceae), and \textit{Clerodendrum myricoides} (Verbenaceae) and root infusions of \textit{Harrisonia abyssinica} (Simaroubaceae), \textit{Maytenus senegalensis} (Celastraceae), and \textit{Milicia excelsa} (Moraceae).\textsuperscript{88}

There appears to be a striking correlation between plants that are used to treat malaria in humans and the use of the plants in ECF. This may be a useful bio-prospecting angle indicating that plant metabolites may have generalized antihemoparasitic activity.

12.2.4 Heartwater

Heartwater is an infectious, noncontagious, rickettsial disease of ruminants in areas infested by ticks of the genus \textit{Amblyomma}. These include regions of Africa south of the Sahara and the islands of the Comores, Zanzibar, Madagascar, Sao Tomé, Réunion, and Mauritius. Heartwater and its vector are also endemic on the islands of Guadeloupe and Antigua. Many ruminants, including some antelope species, are susceptible. Some animals may become subclinically infected and act as reservoirs. Indigenous African cattle breeds (\textit{Bos indicus}) appear more resistant than \textit{B. taurus} breeds. The causative organism is an obligate intracellular parasite, previously known as \textit{Ehrlichia ruminantium}. Clinical signs are dramatic in the peracute and acute forms. In peracute cases, animals develop fever, followed rapidly by hyperesthesia, lacrimation, and convulsions. In the acute form, animals show anorexia and nervous signs such as depression, a high-stepping stiff gait, exaggerated blinking of eyes, and chewing movements. Both forms terminate in prostration and convulsions. Diarrhea is occasionally seen. In subacute cases, the signs are less marked, and central nervous system involvement is inconsistent.

\textit{Abrus precatorius} (jequirity bean) is used in combination with \textit{Carissa edulis} to treat heartwater.\textsuperscript{9} Several toxic lectins have been isolated from the seeds of \textit{A. precatorius},\textsuperscript{37} and isoflavonquinones isolated from the roots were found to have potent anti-inflammatory, antiplatelet, and antiallergic actions.\textsuperscript{51}
Leaves and roots of *Carissa edulis* are used for heartwater, as a laxative and purgative, and for treatment of internal parasitism, colitis, gastritis, and peritonitis. Lignans and sesquiterpenes have been isolated from this species.

### 12.2.5 Anaplasmosis

Anaplasmosis is a vector-borne, infectious, hemolytic, rickettsial disease of cattle, sheep, goats, and other wild ruminants. In cattle, the most common etiological agent is *Anaplasma marginale*; cattle also are affected with *Anaplasma centrale*, generally resulting in mild disease. Anemia results from extravascular hemolysis when parasitized red blood cell (RBC) membranes are altered and recognized by the reticuloendothelial system. These RBCs are removed and finally destroyed. Accordingly, antibodies that develop against the altered cell membrane can cause destruction of uninfected erythrocytes. The severity of anaplasmosis depends on the species involved and age of the animal. Young calves seem to have an innate resistance to the disease, while the acute form generally occurs in cattle from 1 to 3 years. In cattle over 3 years, the peracute or most severe form, with rapid onset and death, predominates. Animals that survive anaplasmosis can become carriers for life and act as a reservoir of infection for susceptible animals. Economic losses from anaplasmosis include abortions, death, weight and gain losses, decreased milk production, bull infertility, and treatment expenses.

Roots, leaves, and bark of *Ficus sycomorus* L., Moraceae, are used to treat anaplasmosis and other conditions, including colitis, gastritis, and peritonitis and flushing of uterus after abortion in animals. *Ficus sycomorus* is native to Africa south of the Sahel and north of the Tropic of Capricorn, also excluding the central-west rain forest areas. In Burkina Faso, it has been cited for use in malaria, but in vitro studies have not shown good activity against *Plasmodium falciparum*. Phytochemical analysis carried out on *Ficus sycomorus* demonstrated the presence of steroids, condensed tannins, flavone aglycones, and saponins. Extracts of *F. sycomorus* have not shown good antibacterial or antifungal activity. However, the *Ficus* genus is a popular herbal remedy that has been used to treat tumors (internal and external) as well as mastitis, bronchitis, tuberculosis, and diarrhea. Phanenstroindolizidine alkaloids, coumarins, stilbenes, flavonoids, and triterpenoids have been isolated from this taxon.

### 12.3 Ectoparasites

A total of 25 plants have been documented to have activity against ectoparasites. Leaves are commonly used as insect repellant and for external parasites. Of the 25 species reported to be used for treatment of ectoparasites, 12 utilized leaves. These included *Acalypha fruticosa* (Euphorbiaceae), which is also used to treat wounds, abscesses, foot rot, burns, and pox as well. This species was also found to attract ticks due to its odor. It is also an important folk medicine in Saudi Arabia and India. *Adenia veneta* Forssk. Passifloraceae leaves are used for treatment of external parasites and mange and as an antifungal. Leaves of *Adenia multiflorum* Klotzsch Apocynaceae have been used as an insecticide and acaricide. *Adenia* spp. possess entomotoxic lectins, which may explain their activity.
12.4 CONCLUSION

Many plants have been identified for use for treatment of parasitic diseases in East Africa. For many of them, phytochemical analysis is yet to be done. However, there is a sufficient body of literature for many plants whose phytochemistry has been done. Most of the plants identified were for treatment of diseases in ruminants; in a few exceptions, plants were used to treat conditions in camels and poultry. Leaf and bark were the most commonly used plant parts. In some instances, whole plants were used, and a mixture of two or more plants has also been widely reported.

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