Traditional ethnoveterinary medicine in East Africa:

a manual on the use of medicinal plants

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The World Agroforestry Centre (ICRAF) is a non-profit research organisation whose vision is a rural transformation in the developing world resulting in a massive increase in the use of trees in rural landscapes by smallholder households for improved food security, nutrition, income, health, shelter, energy provision and environmental sustainability. ICRAF's mission is to generate science-based knowledge about the diverse roles that trees play in agricultural landscapes. ICRAF uses its research to advance the implementation of policies and practices that benefit the poor and the environment. We receive our funding from over 50 different investors, including governments, private foundations, international organisations and regional development banks. ICRAF is a CGIAR Consortium (www.cgiar.org/) Research Centre and is headquartered in Nairobi, Kenya.

REPUBLIC OF KENYA

MINISTRY OF LIVESTOCK & FISHERIES DEVELOPMENT

The goal of the Government of Kenya's Ministry of Livestock Development (MOLD) is to improve the livelihoods of Kenyans through sustainable livestock practices. Part of the department's mandate is the prevention and control of animal diseases to safeguard human health, improve animal welfare, increase livestock productivity and ensure livestock quality. The Government of Kenya seeks to increase livestock productivity through the provision of accessible inputs and services to farmers and pastoralists.

Citation: Dharani N, Yenesew A, Aynekulu E, Tuei B, Jamnadass R (2015) Traditional ethnoveterinary medicine in East Africa: a manual on the use of medicinal plants. Dawson IK ed. The World Agroforestry Centre (ICRAF), Nairobi, Kenya.

ISBN: 978-92-9059-335-5

Design and Layout: Martha Mwenda
Publisher: The World Agroforestry Centre

This manual is a collaborative work of the World Agroforestry Centre and the Kenyan Ministry of Livestock Development.

Disclaimer: This manual provides an overview of ethnoveterinary practices. Neither the authors nor the publisher are responsible for the consequences arising from the incorrect diagnosis or treatment of disease, or the misidentification of plants.

Acknowledgements

The production of this manual was only possible because of the willingness of rural communities, including farmers, traditional herbalists and village elders in Ethiopia, Kenya, Tanzania and Uganda, to share information on their ethnoveterinary practices. Our thanks are extended to all of them.

Ours thanks also to Nelly Mutio at the World Agroforestry Centre for facilitating the field work of Najma Dharani in compiling information from communities.

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b. Participants at a group meeting of Maasai women discuss the use of medicinal plants

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1.1. The importance of animal husbandry and ethnoveterinary practices in East Africa

In sub-Saharan Africa, tens of millions of pastoralists, agro-pastoralists and other farmers rely on livestock as important sources of food and income. Many pastoralists and agro-pastoralists live in marginal arid and semi-arid zones where livestock production contributes importantly to the resilience of communities, while most of the meat consumed in East Africa, and more than half of the milk, is estimated to come from pastoral herds. In Kenya, the livestock sector has been estimated to contribute 50% of agricultural production by value, in Tanzania approximately 30%, and in Ethiopia and Uganda around 19%. Some estimates of production and consumption of livestock in these countries are summarised in the table below.

Estimated production and consumption of animal products in four East African countries

Country	**Production** (2007, thousands of tonnes)			**Consumption** (2005, kg/ person/ yr)			**Calories** (2005)		**Protein intake** (2005)	
	Meat	Milk	Eggs	Meat	Milk	Eggs	From livestock products (kcal/ person/ day)	As share of total (%)	From livestock products (g/ person/ day)	As share of total (%)
Ethiopia	615	1816	38	8.3	22.4	0.4	80.6	4.4	5.6	10.7
Kenya	529	3672	53	15.4	75.8	1.4	216.6	10.4	13.0	22.6
Tanzania	365	955	37	9.5	24.3	0.8	91.0	4.5	6.1	12.6
Uganda	239	795	21	10.2	24.3	0.5	112.0	4.7	5.9	10.4

Data extracted from FAO (2009) (note that these figures are rough approximations).

Animal health is a major constrain to livestock production in East African countries, with a number of diseases (as detailed in Part 2 of this manual) causing major production losses and threats to human health. The impacts of animal diseases are particularly severe for poor communities that although relying heavily on livestock have limited access to modern veterinary services. Pastoralists, agro-pastoralists and other, small-scale, farmers in the East Africa region have engaged in a long tradition of ethnoveterinary practices to care for their animals, involving the use of many plants to prevent and treat different diseases and health conditions. These practices are still widely applied, often because of the lack of availability or the prohibitive costs of 'modern' veterinary medicines and approaches. Sometimes, 'modern' veterinary practices for particular contagious diseases and ethnoveterinary medicine for other conditions are employed in tandem by livestock holders, and this situation is likely to continue in the coming decades.

Hundreds of plant species have been identified by traditional practitioners for treating a wide range of livestock (and human) ailments, although the efficacy of plant treatments has often not been tested through formal trials, on which more work is required. Nevertheless, a large body of information on traditional use, over a number of centuries in many cases for indigenous plants, supports their utility for treatment and control.

1.2. The purpose and structure of this manual

The purpose of this manual is to help document ethnoveterinary practices in Ethiopia, Kenya, Tanzania and Uganda, both for the users of these practices and for others that are interested in understanding current practices better. The latter group includes scientists who are interested in undertaking research on ethnoveterinary medicine; for example, on the effectiveness and transferability of practices.

In Part 2 of this manual, animal conditions and practical information on ethnoveterinary treatments are compiled.

In Part 3, information on the plants involved in different treatments is given. Part 3 includes an introduction to the active compounds found in medicinal plants and particular information on 53 plant species.

For ease of reference, Appendix 1 provides an index to link the health conditions described in Part 2 with the plants listed in Part 3.

Further information on most of the plants listed in this manual can be found in the online Agroforestree Database (www.worldagroforestry.org/resources/databases/agroforestree). This includes data on where particular species are found growing in the East Africa region, information on their other uses and on how to manage them. Information on where to obtain seed of many of the plants listed in the manual, in order to plant them, can be found in the Tree Seed Suppliers Directory (www.worldagroforestry.org/our_products/databases/tssd).

The information provided in this manual was collected from a range of sources, including from existing written information and through meetings with the communities that are engaged in the practices described. The collection of information from communities involved extensive field work by one of the authors (Najma Dharani), who visited communities to document their practices. During these visits, support was given to communities to encourage them to cultivate important medicinal plants, with a view to maintaining these plants in the landscape. Information was also shared among communities on the different practices that different groups of people applied.

A selection of background references on livestock production in East Africa and the use of ethnoveterinary medicines

Dawson IK *et al*. (2014) Agroforestry, livestock, fodder production and climate change adaptation and mitigation in East Africa: issues and options. ICRAF Working Paper No. 178. The World Agroforestry Centre, Nairobi, Kenya.

FAO (2009) The state of food and agriculture: livestock in the balance. Food and Agriculture Organization of the United Nations, Rome, Italy.

Forse B (2004) Where there is no vet. Macmillan Education, Oxford, UK.

ITDG, IIRR (1996) Ethnoveterinary medicine in Kenya. A field manual of traditional animal health care practices. Intermediate Technology Development Group and International Institute of Rural Reconstruction, Nairobi, Kenya.

Jacob MO *et al*. (2004) Indigenous knowledge: the basis of the Maasai ethnoveterinary diagnostic skills. J. Hum. Ecol., 16, 43-48.

Katunguka-Rwakishaya E (2008) A guide to livestock health and management in Uganda. Fountain Publishers, Kampala, Uganda.

Mathias E (2001) Introducing ethnoveterinary medicine. Available at: www.ethnovetweb.com

Okitoi LO *et al*. (2007) Traditional herbal preparations for indigenous poultry health management in Western Kenya. Livestock Research for Rural Development, 19, article 72. Available at: www.lrrd.org/lrrd19/5/okit19072.htm

Ondwasy H *et al*. (2006) Indigenous chicken production manual. Technical Note Series No. 18. Kenya Agricultural Research Institute, Nairobi, Kenya.

Toyang NJ *et al*. (2007) Ethnoveterinary medicine: a practical approach to the treatment of cattle diseases in sub-Saharan Africa. Agrodok 44. Agromisa Foundation and CTA, Wageningen, The Netherlands.

Part 2


a


b


c


d

Animal conditions and ethnoveterinary treatments

a. Drenching a calf
b. Spraying an animal with a medicinal infusion
c. Washing an animal with a medicinal infusion
D. Applying a powdered medicine

2.1. Administering ethnoveterinary medicines

Common methods for administering ethnoveterinary medicines are described below.

Drenching: This involves the oral administration of a medicine in liquid form. After measuring the medicine it can be given to an animal using a plastic drink bottle, a bottle gourd or with a calabash spoon.

- Large animals should first be tied to a tree or pole, or sheep and goats can be restrained between the legs of the administrator. With cattle, placing fingers in the nostrils can help restrain the animal.
- Raise the animal's mouth upwards and hold the upper jaw with one hand to open its mouth. Insert the bottle, gourd or spoon sideways into the mouth with the other hand. Without removing the drenching instrument, gently pour the liquid into the mouth at intervals. Give the animal enough time to swallow to prevent the medicine from entering the lungs. Do not hold the animal's tongue.
- For camels, make the animal sit down and hobble it to prevent it from getting up. Hold the lower jaw and head and pour the liquid into the animal's mouth as above.

Adding medicine to feed and drinking water: Medicines can be added to the feed and water of sick animals that are kept isolated from other animals while they eat and drink. To ensure the full dose is taken, medicine may be mixed with or sprinkled on an initial portion of feed that is offered to the animal, which is then followed by the remainder of the feed. Similarly, liquid medicines may be mixed with an initial quantity of drinking water.

Fumigation: The use of smoke or fumes to drive away or kill insects and other pests is common. Powdered material or dried leaves, dung, bark, etc., are burnt in clay pots or on the open ground. The smoke engulfs the sick animal or the entire herd. Animal houses may also be fumigated.

Steam application: Medicinal plants can be added to boiling water and the animal exposed to the steam. Placing a hot rock into the water will keep it on the boil in order to maintain steam production.

Nasal and eye drops: Liquid medicines can be applied to eyes or nostrils with a dropper, straw or folded leaf.

Skin application: Various methods are used. Techniques include the following:

- Poultices - a paste is made by grinding seed, fruit, leaves and/or roots, etc., and adding a small quantity of water. The paste is applied to the skin and sometimes covered by bandages or strips of banana leaf. Applications may be renewed at regular intervals.
- Compress - a piece of cloth impregnated with medicine is pressed to the skin. The cloth may contain a warm stone for 'warm' treatments.
- Powder - an animal may be dusted with a powdered medicine.
- Lotions and ointments - lotions and ointments may be massaged into the skin. Ointments are traditionally prepared by mixing plant materials with animal fat. However, vegetable oils, Vaseline and Lanoline can also be used.
- Bathing - animals may be washed with liquid medicines, either their whole bodies or just the affected areas.
- Spraying - animals can be sprayed with liquid medicines.

Anal application: To protect against infection, the administrator should wear plastic gloves or put clean plastic bags over their hands, having first washed their hands and clipped their nails (hands should be washed after administration also). Powdered medicine made into a small ball is carefully pushed into the animal's anus. If the ball is dry, it may be dipped in water or oil to ease entry. Today, young ethnoveterinary practitioners sometimes use needleless syringes to introduce liquid medicines into the anus.

Vaginal application: To protect against infection, the administrator should take the same measures as with anal application. Wash the animal's birth opening (vulva) with soap and warm water. Take the medicine in one hand and, cupping this hand into a cone shape, push it gently into the vagina. Leave the medicine in the vagina and slowly withdraw the hand.

A clean plastic bag placed over the hand protects against infection

Surgical gloves to protect against infection

2.2. Specific conditions and treatments in East Africa

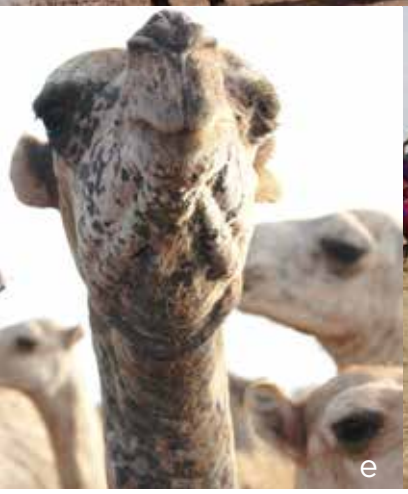
General animal health and diagnosis

General signs of a healthy animal include the following:

- Smooth, shiny skin.
- Moderate breathing (not too fast, slow or loud).
- Cold, moist muzzle and nostrils.
- Bright, clear eyes.
- Warm ears and feet.
- Good appetite.
- Good mobility, no limping or stiffness.
- For animals that ruminate, cud chewing when resting.
- Normal colour, consistency and amount of faeces and urine.
- Regular reproductive heat periods in mature, non-pregnant females.
- Normal production and colour of milk.

General signs of an unhealthy animal include the following:

- Dull, rough skin, standing hair.
- Persistent coughing, rapid, heavy and noisy breathing.
- Dry muzzle and nostrils.
- High or low body temperature.
- Lack of appetite.
- Reluctance to move, lameness, stiffness.
- No response to sounds.
- Hiccupping and shivering.
- Over-excitement.
- Bad smell, change in colour or consistency of faeces or urine, blood in faeces or urine.
- Low milk yield and abnormal colour or thickening of milk.



a. Healthy goats in Elangatawass market, Central Kenya
b. A healthy chicken with smooth, shiny feathers
c. A weak, sick camel
d. Healthy camels ruminating
e. Damaged skin on the face and neck of a camel
f. Healthy cattle in Elangatawass market, Central Kenya

2.2.1. Ectoparasites (external parasites)

Ectoparasites live on the outside of another animal. Many act as vectors of diseases. General signs of their presence include the following:

- Animals scratch, rub, bite or lick an affected area.
- Rough coat, skin rough and scaly.
- Hair loss, wounds, bruises in severe cases.
- Irritation, restlessness and discomfort, leading to weight loss and low milk production.

2.2.1.1. Ticks

Ticks are common on all livestock and can transfer to people that handle animals. Ticks attach themselves to the skin at various parts of the animal's body and suck blood. They can cause anaemia, weight loss and even death. Tick-borne diseases (such as East Coast fever, see 2.2.2.1) significantly limit animal production. Tick bites damage an animal's skin and make the hide less valuable for leather. The types and numbers of ticks on animals vary by season.

Local names: Kilmi (Afar); Umacheri (Ilchamus); Tilis/ Tlis (Pokot); Kerbes (Tugen); Silmii fi Diraandisa (Oromo); Olmasheri (Maasai, Kenya and Tanzania); Tsinamaara (Maragoli); Chillim/ Shilin/ Turdach (Rendille); Imansher/ Itunturi (Samburu); Shilin/ Yakhal (Somali); Kupe (Swahili); Ng'hundya (Sukuma); Ngimadang (Turkana); Apingac (Ngakarimojong).

Signs

- Ticks are found on the animal's skin, especially inside the ears, at the base of the tail and neck, and between the legs.
- Irritation, scratching and discomfort, weight loss, low milk production.
- Tick bites often become infected and turn into abscesses (see 2.2.9.2).
- Anaemia, with pale mucous membranes, especially the gums and under the tongue.
- Watery eyes when ticks are attached there.
- Sagging ears when many ticks attack an animal.
- Some ticks lead to paralysis.

a. Anus of a camel infested by ticks
b. Ticks attached to the anus of a goat
c. Dog ticks full of blood after they have been sucking for a few days, shown on the palm of a hand

Prevention and control

- Avoid tick-infested grazing areas.
- Grow repellent plants, e.g., *Azadirachta indica*, near animal houses and stalls.
- Remove weeds and bushes from around animal houses and stalls.
- Keep chickens in and around animal houses to eat ticks.
- Burn tick-infested manure.

Treatments

- Crush 1 handful of *Aloe secundiflora* leaves, mix with 1 l of water and rub or brush onto the parts of the animal's body where ticks are present. (Treatment for all animals.)
- Boil 1 kg of fresh *Ajuga remota* leaves in 2 l of water. Wash animals with the warm mixture. (Treatment for all animals.)
- Make a paste of green *Nicotiana tabacum* leaves and apply to the parts of the animal's body where ticks are present. (Treatment for all animals.)
- Boil 0.25 kg of *Nicotiana tabacum* leaves in 4 l of water, add 0.25 kg of soap. Wash or spray the affected animal. (Treatment for all animals.)
- Boil 1 kg of fresh or dry *Nicotiana tabacum* leaves in 10 l of water. Allow the liquid to cool and wash the animal's body. (Treatment for camels, cattle, donkeys, goats, horses and sheep.)
- Crush 0.5 kg *Adenium obesum* (any separate part of the plant or the whole plant), mix with 2 l of water and wash the affected animal (Treatment for all animals). **CAUTION: *Adenium obesum* is very poisonous and should be handled with care. Wear plastic bags over the hands or surgical gloves when handling and applying the liquid mixture. Keep out of the reach of children and prevent animals from licking the treated area.**
- Dissolve 0.2 kg of salt in 2 l of water and rub onto the animal's body. (Treatment for goats and dogs.)
- Pound 5 or 6 *Aloe secundiflora* leaves and mix with 0.3 l of paraffin oil and 2 handfuls of kitchen ash to make a paste. Apply onto the parts of the animal's body with ticks. (Treatment for camels, cattle, donkeys, goats, sheep, horses and dogs.)
- Boil 1 kg of *Commiphora africana* bark in 2 l of water, cool and wash the affected area. (Treatment for goat and sheep)
- Mix 1 l of camel urine with a handful of gum resin of *Commiphora erythraea*. Apply onto the parts of the animal's body with ticks. (Treatment for camels, cattle, donkeys, horses, goats and sheep.)
- Take 1 l of water, mix in a handful of gum resin of *Commiphora myrrha*, heat and stir until the gum dissolves. Apply warm to tick wounds. (Treatment for camels, goats, sheep, cattle and horses.)
- Rub old engine oil on affected areas. (Treatment for goats, cattle and sheep.)

2.2.1.2. Fleas

Fleas are small (1.5 to 3 mm), wingless insects that are able to leap long distances. Often found in animal hair, they bite through the skin to suck blood. Although not often a major problem for rangeland animals, they can be for dogs and poultry. Various types infest different species of livestock, domestic animals and humans. Dog fleas carry the larvae of tapeworms. Poultry fleas, also known as stick tight fleas due to their ability to attach themselves to a host and not let go, can be a danger to bird flocks as well as domestic pets. They attach themselves to the wattles, combs and around the eyes of chickens as well as around the eyes of dogs.

Local names: Taffii (Oromo); Ngikadesides (Ngakarimojong); Tuffi njirra (Gabbra); Virimboto/ vololo (Maragoli); Losusu (Samburu); Injit (Somali); Kiroboto (Swahili); Buda (Sukuma); Ng'ikorobotio (Turkana); Sosoyou (Pokot); Kimet (Tugen); Opindilai (Maasai-Kenya); Olosuisui (Maasai-Tanzania).

Signs

- Animal will scratch, rub and bite affected areas and roll on the ground.
- Weakness.
- Swelling at the site of bites.
- Fleas can look like black spots on the faces of birds.

Chicken and chicks scratch their feathers due to flea infestation

Fleas attached around the eye of a chicken

Close-up image of a poultry flea

Prevention and control

- Keep animals with fleas away from other animals.
- Keep animal houses clean by sweeping with a broom made of fresh branches (with leaves and flowers) of *Tagetes minuta* or of *Adenium obesum*.
- Burn 2 to 3 kg of dry leaves of *Tagetes minuta* in the boma.
- Burn the whole dry plant of *Ocimum kilimandscharicum* in and around animal houses.
- Crush Magadi soda and sprinkle inside the boma when fleas have been observed.

Treatments

- Take 1 to 2 kg of *Azadirachta indica* seed, pound and then cook until brown and sticky. Add 0.25 l of water to make a paste. Squeeze the paste to extract the oil. Rub the oil on animals. (Treatment for all animals.)
- Crush 0.5 kg of *Adenium obesum* root. Add 5 l of water and let stand for 10 to 12 hours. Morning and evening, wash the animal with this infusion. Repeat as needed until fleas disappear. (Treatment for all animals.) **CAUTION: *Adenium obesum* is very poisonous and should be handled with care. Wear plastic bags over the hands or surgical gloves when handling and applying the liquid mixture. Keep out of the reach of children and prevent animals from licking the treated area.**
- Crush 0.25 kg of *Aloe secundiflora* leaves. Add 2 to 3 l of water and let stand for 10 to 12 hours. Morning and evening, wash the animal with this infusion. Repeat as needed until fleas disappear. (Treatment for all animals.)

2.2.1.3. Lice

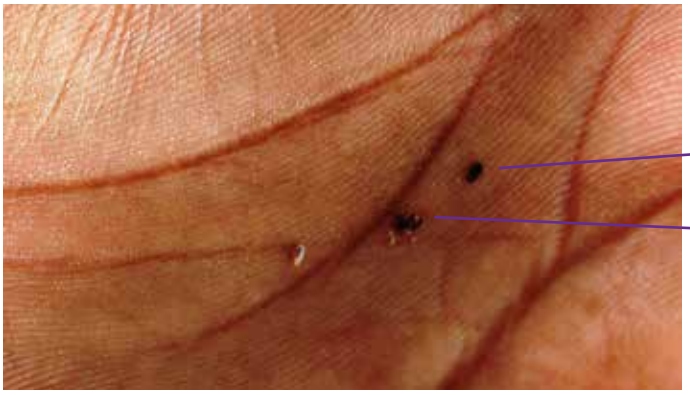
Biting and blood sucking lice are insects with no wings, 1 to 5 mm long, that live on the skin of animals, especially on young, weak and sick individuals. Poor sanitation/ hygiene can lead to infection; once an animal is infested, it will spread lice to other animals.

Local names: Intae (Afar); Hinjiraan (Oromo); Ilmasherr/ Elashei (Maasai-Kenya); Elasheyi (Maasai-Tanzania); Kisrel/ Serr (Pokot); Lachayo (Ilchamus); Kiser (Tugen); Ngilac (Ngakarimojong); Injirre (Gabbra); Tsinda (Maragoli); Lache (Samburu); Injir (Somali); Chawa (Swahili); Nda (Sukuma); Elachit/ Ng'ilach (Turkana); Ingir (Rendille).

Signs

- Lice or nits (small, white louse eggs) are found attached to hairs or feathers. In cattle, lice are found most commonly inside or around the ears, at the base of the tail and on the neck. In other animals such as goats and sheep, lice are commonly found all over the body.
- Local irritation, discomfort and restlessness lead to poor feeding, weakness, weight loss and low milk production; decreased egg production in poultry.
- Animals scratch using their feet or hooves and rub against posts and walls, causing skin wounds and bruises. In sheep, the wool may be damaged, while birds lose feathers.
- Animals may become anaemic (pale mucous membranes).

A Pokot farmer examines his lice-infested goat



Lice on the palm of a human hand

Close-up image of a head louse

Prevention and control

- Keep animals outside in sunlight as much as possible.
- Allow them to wallow in muddy rivers or ponds.
- In cattle, shave the base of the tail and other infested parts.
- Separate out animals infested with lice. In particular, keep newborns away from infested animals.
- To repel lice, spread branches of *Azadirachta indica* or *Eucalyptus citriodora* in animal pens.
- Keep the boma/pens clean by sweeping with a broom made of fresh branches (with leaves and flowers) of *Tagetes minuta*. Sweep dung out of the pen regularly in wet periods.

Treatments

- Soak 2 kg of wood ash in 3 l of water and stir thoroughly. Pound 5 kg of *Tephrosia vogelii* leaves and mix with the wood ash suspension. Filter and add 1 l of cow urine. Bathe or spray the affected animal with the mixture.
- Chop or crush 2 bulbs of *Allium sativum* and mix with 4 l of water. Wash the animal with the liquid once a day until it is free of lice.
- Rub the body of the affected animal with *Tagetes minuta* leaves and soft twigs. Burn an armful of fresh leaves and flowers of *Tagetes minuta* – either alone or mixed with dry cow dung – in the animal pen.
- Rub camel's urine on the infested animal's skin or mix camel's urine with salty soil to make a paste that is smeared over the animal's body. Make sure this mixture does not enter the animal's eyes.

2.2.1.4. Tsetse flies (glossina)

Tsetse flies are usually dark yellow/brown, 5 to 15 mm long, with crossed wings when the fly is still. Tsetse flies can represent a serious threat to animals. They cause painful bites that irritate, suck blood, prevent livestock from feeding and spread trypanosomosis (sleeping sickness). There are eight different species of tsetse fly in East Africa, mostly found in rangeland areas, especially along rivers, in thickets and in forests.

Local names: Dugga (Gabbra); Ligugu (Maragoli); Tolpupai (Samburu); Geudi (Somali); Mbung'o (Swahili); Sali (Sukuma); Lopodokong'or (Turkana); Nepadakah (Pokot); Lapupoi (Ilchamus); Sosoyou (Tugen); Olkimbai (Maasai, Kenya and Tanzania); Daker (Rendille).

Signs

- The bites of tsetse flies are painful and irritate animals.
- Animals are disturbed during grazing.
- Bites results in local swelling (chancre).
- Bites can cause decreased milk production and reduced weight.

A blood-fed female tsetse fly

An Ethiopian farmer pats his cow suffering from trypanosomosis (see 2.2.2.5), transmitted by tsetse flies

Prevention and control

- Graze animals away from bushes during and after wet periods.
- In fly-infested areas, move animals during the day.
- Water animals in the hot midday when flies are less active.
- Use fly traps.
- Burn dry cow dung near animals. (Fly repellent.)
- Take 1 to 2 kg of fresh seed of *Azadirachta indica*, remove the outer coat of seed and pound until the crushed kernels become brown and sticky. Add 0.25 l of water to make a paste. Squeeze the paste to extract the oil. Rub the oil on the animal's skin. (Fly repellent.)
- Take about 1 kg of fresh *Sesbania sesban* leaves, pound, add a little water and rub onto the animal's body. (Fly repellent.)

2.2.1.5. Mosquitoes

Mosquitoes are common during seasonal rains and in areas of standing water. They bite animals to suck blood and can spread various diseases.

Local names: Adayito (Afar); Binni (Gabbra); Bookee (Oromo); Tsisuna (Maragoli); Nkajing'ani (Samburu); Kanea (Somali); Mbu (Swahili); Mbo (Sukuma); Ng'isuru (Turkana); Rumbo (Pokot); Kipech (Tugen); Nkajongoni (Ilchamus); Ekasilei/ Ekahyani (Maasai, Kenya and Tanzania); Mune (Rendille).

Signs

- Painful and itchy bites.
- Animals become disturbed during grazing.

Mosquitoes bites can be painful and itchy

Prevention and control

- Avoid taking animals to grazing grounds where mosquitoes are common. Especially avoid wet, muddy locations with standing water, where mosquitoes breed.
- Move to windy areas where mosquitoes are blown away.
- Take the whole dry plant of *Ocimum kilimandscharicum* and burn it in and around animal pens. (Mosquito repellent.)
- Mix 0.5 kg of *Tagetes minuta* (the whole plant) with 2 kg of cow dung. Dry it in the sun and then burn in and around animal pens. (Mosquito repellent.)
- Burn dry *Eucalyptus citriodora* leaves in animal houses. (Mosquito repellent.)
- Burn the gum of *Commiphora erythraea* close to animals. (Mosquito repellent.)
- Take 1 to 2 kg of fresh seed of *Azadirachta indica*, remove the outer coat of seed and pound until the crushed kernels become brown and sticky. Add 0.25 l of water to make a paste. Squeeze the paste to extract the oil. Rub the oil on the animal's skin. (Mosquito repellent.)

2.2.1.6. Nasal bot (fly larvae)

Nasal bot flies affect mainly sheep, goats and camels. Flies lay eggs in the nostrils of the animal, which develop into larvae (1 cm long) that move inside the nose. The larvae are sneezed out of the nose and then develop further into new adult flies. The cycle occurs especially during seasonal rains. In sheep and goats the flies concerned are *Oestrus ovis,* in camels *Cephalopina titillator.*

Local names: Rammo (Gabbra); Kombiryet (Kipsigis); Kombiryet (Kipsigis); Jir (Luo); Raammoo furroo/ Sirriidoo (Oromo); Ormasinguan (Maasai-Kenya); Ormasinguan (Maasai-Tanzania); Tsing'ende (Maragoli); Surbub (Samburu); Sangal (Somali); Igino (Sukuma); Ewrutloekume (Turkana); Kamseun (Tugen); Ilmavsomwa (Ilchamus).

Signs

- White discharge from the nose.
- Rubbing of the nose on surfaces.
- Refusal to eat.
- Frequent shaking of the head and frequent sneezing.
- The agitated animal moves in circles.

White discharge from the nose of a goat

Prevention and control

- Keep animals away from bushes and thickets in the wet season.

Treatments

- Crush fresh *Solanum incanum* roots in a little water and pour a little of this solution into each of the animal's nostrils using a syringe and tube or similar. (Treatment for camels.)
- Take a yellow, ripe fruit of *Solanum incanum*, press it to mash the flesh but without puncturing the skin of the fruit. Lift the animal's head, puncture a small hole in the fruit and squeeze the juice into the nostril. The animal will start sneezing and the larvae will be ejected. (Treatment for sheep, goats and cattle.)
- Crush fresh *Acacia brevispica* roots and mix with a little water. Pour a little of the liquid into each nostril. (Treatment for camels, sheep and cattle.)

2.2.1.7. Biting flies

Types of biting flies include the following:

- **Tabanid flies** (horse flies) are usually large (about 2 cm long, larger than tsetse flies) and dark brown, although some are smaller and yellow/brown. They feed on the underside of the abdomen around the navel and on the legs and neck. They prefer large animals such as cattle and can transmit anthrax and trypanosomosis.
- **Haematobia flies** (horn flies) are yellow/brown or grey/black. They are about 5 mm long, occur in large numbers and stay close to animals, frequently biting and causing skin irritation and damage. The flies mainly feed around the horns, shoulders and from the belly of cattle and can transmit stephanofilariasis (hump sore).
- **Black flies** (buffalo flies) are small flies 1 to 5 mm long. They are active in the morning and evening, with several flies biting the animal at the same time to feed on blood. Large numbers may cause cattle to stampede. On cows, their bites can turn into small blisters on teats. Black flies are also associated with an acute disease involving bleeding from the skin, and swelling of the throat and abdomen.
- **Stable flies** are 5 to 10 mm long. They are grey with spots and have wings that stick out when still. They are very irritating flies of camels, horses, cattle, donkeys, dogs and birds. They can transmit trypanosomosis.

Local names: Tiitee hidditu (Oromo); Olkimbai (Maasai, Kenya and Tanzania); Mijirajiri/ Vuji (Maragoli); Lajing'a (Samburu); Sali (Sukuma); Ng'ichuchu (Turkana); Kaliang (Tugen); Koliong (Pokot); Iwang'ni (Luo); Dakar (Rendille).

Signs

- Animals are restless, disturbed during grazing.
- Itchy bites, small wounds, bleeding, skin inflammation, loss of hair and hide damage.
- Decreased milk production and reduced weight gain.

Tabanid flies feed on a camel

A dog's head and neck covered by stable flies, showing ear damage

Prevention and control

- Keep animals away from places with many flies.
- Burn cow dung. (Fly repellent.)
- Position the animal house where the wind blows, to blow flies away.
- Move animals to watering places during the middle of the day when fewer flies are active.
- Make sure animal houses are clean and dry. Clean away faeces and rotten food.
- Try to avoid wet, muddy places where many flies breed.
- Treat wounds quickly before they become infected.

Treatments

- Take 1 to 2 kg of fresh seed of *Azadirachta indica*, remove the outer coat and pound until the crushed kernels become brown and sticky. Add 0.25 l of water to make a paste. Squeeze the paste to extract the oil. Rub the oil on the animal's skin. (Treatment for cows, goats, sheep, donkeys, camels.)
- Crush 0.5 kg of *Adenium obesum* tuber or stem bark and mix with 1 l of water. Apply to the animal's body. **CAUTION: *Adenium obesum* is very poisonous and should be handled with care. Wear plastic bags over the hands or surgical gloves when handling and applying the liquid mixture. Keep out of the reach of children and prevent animals from licking the treated area.**

2.2.1.8. Mites

Mites, which burrow under the skin and cause severe itching, cause mange (scabies), which affects all livestock species, but is most common in sheep and goats. Animals scratch infested areas, resulting in wounds that leave animals more susceptible to other diseases. Scabies spreads by direct contact between infected animals.

In poultry, red mites spread fowl pox and other diseases. Also, scaly leg mites dig into the skin on birds legs, resulting in thick scaly legs and often the inability to walk properly. Feather mites live at the base of feathers, causing irritation and resulting in birds pulling their feathers out.

Local names: Chito (Gabbra); Osursur (Luo); Ipepedo (Samburu); Cada (Somali); Ekoikoi/ Ekoto (Turkana); Emitina (Ngakarimojong [in camels, cattle, sheep, goats]); Apingac (Ngakarimojong [in chicken]); Kiborom (Tugen); Ipepedo (Ilchamus); Elpepedo/ Musaduku (Maasai, Kenya and Tanzania); Ngamunyani (Rendille); Agara (Afar); Cittoo (Oromo); Buchele (Sukuma).

Signs

- Severe scratching. Affected animals scratch against trees, walls and other objects.
- Inflamed swelling and thickening of the skin.
- Skin infections result in discoloured, loose or matted hair and loss of hair/wool/feathers.
- Loss of appetite causing weakness.
- Drops in milk and meat production; reduced egg production in chickens.
- Scaly legs on poultry.
- The presence of tiny red mites on the feathers of chicken.
- The death of young poultry.

Wound due to mite attack and itching

Camels can contract severe mange

Prevention and control

- Affected animals should be isolated from healthy animals.
- Avoid using animals that have mange for breeding purposes.
- Treat those animals that are affected quickly and all at the same time (to prevent reinfestation).

Treatments

- Crush 20 leaves of *Aloe secundiflora*, mix with 1 l of water, and brush on to infested parts of the animal's body. (Treatment for sheep, goats, camels and cattle.)
- Mix 1 l of camel urine with a handful of gum resin of *Commiphora erythraea*. Heat and stir to make a paste. Apply on affected skin. (Treatment for all animals.)
- Take 0.5 kg of fresh *Juniperus procera* fruit, crush and add 1l warm water. Wash the animal with this solution. Repeat daily until the animal recovers.
- Burn the leaves, bark and branches of *Salvadora persica* to form charcoal. Powder the charcoal and mix with 1 l of ghee to form a paste. Apply onto affected areas. (Treatment for camels, cattle, donkeys, goats and sheep.)
- Apply used motor oil to the infested area. Note that the use of too much oil may burn the skin. (Treatment for all animals.)

CAUTION: To prevent human infection, wear hand protection (plastic bags over the hands or surgical gloves) when applying treatments. Wash hands thoroughly with soap and water afterwards.

2.2.2. Diseases caused by ticks and biting flies

Ticks and biting flies (see the previous section) can carry various serious diseases. East Coast fever, anaplasmosis, babesiosis and heartwater are carried by various types of tick, while trypanosamosis is transmitted by tsetse flies. These diseases are related in this section.

2.2.2.1. East Coast fever

East Coast fever is a killer disease of cattle transmitted by the brown ear tick found under wet, cool conditions. The ticks attach themselves around the animal's ears. The disease is more severe in young animals than in adults. Animal become sick ten to 20 days after they have been bitten by host ticks. East Coast fever is caused by a protozoan, *Theileria parva,* which multiplies in the animal's lymph nodes, making them swell. Hybrid animals are more prone to this disease than local breeds.

Local names: Shimli dimtu (Gabbra); Sosoito (Kipsigis); Olitikana (Maasai, Kenya and Tanzania); Evivitu (Maragoli); Lipis (Samburu); Lokit (Turkana); Lokit (Ngakarimojong); Madundo (Sukuma); Biirtee (Oromo).

Signs

- Loss of appetite, weakness and decreased milk production.
- Rapid breathing and high fever.
- Coughing and discharge from the nostrils.
- Swollen lymph nodes, especially under the ear, in front of the shoulder and at the knee.
- Some animals have diarrhoea with blood spots or mucus in the faeces.
- Occasionally small red spots on the gums, eyelids and at the base of the tongue.
- Cattle walk in circles, their back legs may become paralysed.

Cattle contract East Coast fever in higher altitude, cool areas during the rainy season

A young animal suffering from East Coast fever, with loss of appetite and weakness

Prevention and control

- See methods to control ticks (2.2.1.1).

Treatments

- Take 1 kg of fresh *Adansonia digitata* leaves and cut into small pieces. Take a few fruit from the same species, crush and mix with the leaves. Add a little saltlick and allow infected animal to eat the mixture freely.
- Take 0.5 kg of fresh leaves and roots of *Vernonia amygdalina* or *Vernonia auriculifera* and of *Sesbania sesban*. Crush the leaves and mix with 1 l of water. Add a teaspoon of salt and boil for 20 minutes. Drench the sick animal.
- Take 0.5 kg of fresh bark of *Warburgia ugandensis* and a few fruit of *Solanum incanum*, mix with crushed limestone (calcium carbonate) and a little clean water to make a paste. Apply where ticks have bitten the skin.
- Add 0.5 kg of fresh stem bark of *Warburgia ugandensis* to 1 l of water, drench cattle with 0.3 l per day for 2 to 3 days.

2.2.2.2. Heartwater (cowdriosis)

Heartwater is a common and serious disease of cattle, goats and sheep, especially during the wet season. Camels rarely contract it. Animals are infected by ticks carrying the disease from other animals. The disease can be severe in young animals as they have no immunity. They become sick one to four weeks after they have been bitten by infected ticks; many may die. Conditions that have some of the features of heartwater include anthrax, East Coast fever, poisoning, rabies and tetanus. The disease is caused by a rickettsia *(Cowdria ruminantium).*

Local names: Qanno ree (Gabbra); Chepkiyait (Kipsigis); Hawirawira (Luo); Olmilo (Maasai, Kenya and Tanzania); Amili (Turkana); Lokou (Ngakarimojong); Tummaa (Oromo); Busatu bo kuharisha ne kushetangamin (Sukuma).

Signs

- Animals quite suddenly have high fever and lack of appetite.
- Animal are nervous and uncoordinated, lifting their legs very high when walking and going round in circles.
- Constant chewing movements.
- Occasional diarrhoea with blood in faeces.
- Swollen lymph nodes.

- The animal constantly blinks and presses it head against objects.
- Animals collapse, have convulsions and die in one to seven days.
- In a dead infected animal, a sac around the heart is full of fluid. Cattle have less fluid here than sheep or goats. Watery fluid in the chest and abdomen can be seen.

A weak, nervous goat, with a high fever, suffering from heartwater

During the wet season, cattle suffer from heartwater

Prevention and control

- See methods to control ticks (2.2.1.1).

Treatments

- Boil a handful of roots and a handful of bark of *Warburgia ugandensis* in 1 l of water. Drench the adult animal (0.3 l per day for cattle, 75 ml per day for sheep) for 2 to 3 days. (Treatment for cattle and sheep.)
- Take a few fresh fruit of *Capsicum frutescens* and a few fruit of *Solanum incanum,* pound them together and mix with crushed limestone (calcium carbonate) and a little clean water to make a paste. Apply where ticks have bitten the skin. (Treatment for cattle, sheep and goats.)
- Take 0.5 kg of fresh bark of *Strychnos henningsii,* crush it and boil for 20 minutes in 1 l of water. Cool, strain the mixture and give 0.2 l of the solution to cattle twice a day for 3 days. Use half the dose for sheep and goats. (Treatment for cattle, sheep and goats.)

2.2.2.3. Anaplasmosis

Cattle contract anaplamosis most often, but it also affects camels, sheep and goats. Animals become sick 20 to 28 days after infection. Other conditions with some similar features include babesiosis, trypanosomosis and liver fluke disease. The disease is caused by a rickettsia (*Anaplasma* species). Animals that recover from anaplasmosis may remain weak for a long period and are susceptible to other diseases. They still carry the infection and if stressed may become sick again.

Local names: Asdaho (Afar); Birra (Gabbra); Endigama/ Lipis (Maasai, Kenya and Tanzania); Cheptikonit (Kipsigis); Ndiss (Samburu); Busatu bo wjan (Sukuma); Lonyang' (Turkana); Lopid (Ngakarimojong).

Signs

- The animal refuses to eat, becomes weak, feverish, unsteady, tired and thin.
- The animal is depressed, docile and looks for shade.
- Milk production drops.
- Anaemia, jaundice and mucous membranes look yellow; yellow eyes.
- Little, yellowish urine; constipation and very hard dung.
- Hair stands on end.
- The abdomen is swollen.
- Pregnant cows abort.
- The flesh of a dead infected animal is pale yellow, the blood thin and watery. The gall bladder is large and full, the spleen large and dark.

An unconscious cow suffering from anaplasmosis

Several ticks are attached to the animal's body

Prevention and control

- See methods to control ticks (2.2.1.1).

Treatments

- Take a handful of fresh bark of *Croton megalocarpus*, add to 0.5 l of water and boil for 10 to 15 minutes. Cool, sieve and drench the sick animal with the solution. (Treatment for goats, sheep and cattle.)
- Take 0.5 kg of fresh leaves of *Capsicum frutescens* and add half a teaspoon of crushed limestone (calcium carbonate). Crush the leaves and boil in 0.5 l of water. Cool, sieve and drench the sick animal with the solution. (Treatment for cattle, goats and sheep.)
- Take a handful of roots and fruit of *Aspilia mossambicensis* and 4 fruit of *Solanum nigrum*. Crush and boil in 1 l of water. Drench the sick animal. (Treatment for cattle.)
- Take 4 fresh fruit of *Solanum nigrum*, 0.25 kg of fresh bark of *Warburgia ugandensis* and half a teaspoon of limestone (calcium carbonate) and place in warm water. Leave for 15 to 20 minutes. Mix thoroughly and sieve. Drench the sick animal with the solution. (Treatment for all animals.)
- Collect 1 kg of fresh bark of *Acacia oerfota* and soak in 10 l of water for 2 days. On the third day, stir the mixture and then drench the animal with the solution. Repeat once a day for 5 days. For cattle use a dosage of 2 l, for goats and sheep use half this.

2.2.2.4. Babesiosis (redwater fever)

Babesiosis causes very high fever and infected animals often die. Cattle and dogs most often contract babesiosis, but donkeys, sheep and goats are occasionally infected. In cattle, sheep and goats the disease is often known as redwater fever, while in donkeys it is referred to as biliary fever. Animals become sick one to four weeks after they are bitten by the tick host. Adult animals are more susceptible to infection than young ones. Animals that recover from babesiosis still carry the infection and can relapse if they are stressed. The disease is caused by protozoa (*Babesa bigemina* and others).

Local names: Andera (Afar); Aremo (Luo); Enadonkulak (Maasai, Kenya and Tanzania); Ngula (Samburu); Eyiala (Turkana); Iyalaara (Ngakarimojong); Biirtee (Oromo); Busatu bo kutundaga mininga (Sukuma).

Signs

- Animals scratch, bite or lick the tick-infested area.
- Animals have very high fever with red urine.
- Animals are weak, nervous and tired and do not move about or eat much.
- The mucous membrane is yellow or pale in colour.
- Distressed and fast breathing, fast heart rate.
- Some animals die 2 to 4 days after symptoms appear, if no treatment is given.
- In infected dead animals the meat is yellow and the blood is thin and watery. The liver and lymph nodes are larger than normal.

Redwater fever is contracted through tick bites

Prevention and control

- See methods to control ticks (2.2.1.1).

Treatments

- Boil 0.5 kg of fresh stem bark of *Warburgia ugandensis* in 1 l of water. Cool and drench the animal with 0.3 l (cattle dosage, reduce for smaller animals) of the liquid per day for 2 to 3 days. (Treatment for cattle, goats and sheep.)
- Add 2 full tablespoons of dry, powdered *Prunus africana* bark to 1 l of water. Leave for 2 hours, stir and drench the infected animal with the infusion once a day for 2 days. (Treatment for cattle.)
- Take 0.5 kg of fresh bark of *Acacia oerfota* or *Acacia dolichocephala*. Soak in 1.5 l of water for 12 hours. Drench the sick animal using 1 l of the liquid for cattle, 0.5 l for goats and sheep. Repeat the next day if the animal has not recovered. (Treatment for cattle, goats and sheep.)

2.2.2.5. Trypanosomosis/trypanosomiasis (sleeping sickness, surra)

All animals, including cattle, camels, sheep, goats, pigs and donkeys, can contract trypanosomosis (also known as trypanosomiasis or sleeping sickness). It is caused by being bitten by tsetse flies infected with trypanosomes (*Trypanosoma brucei, T. congolense, T. simiae, T.suis, T. vivax*). Tsetse flies are infected by trypanosomes when they bite wild animals. People can also contract trypanosomosis when they are bitten by tsetse flies. Animals become sick with trypanosomosis one to three weeks after they have been bitten by infected flies.

Biting flies such as tabanids and stable flies transmit surra, also known as camel trypanosomosis, which can also affect cattle, donkeys and dogs (people do not contract surra). Animals contract surra when bitten by biting flies that carry the disease from already infected animals. Animals become sick with surra seven to ten days after being bitten by infected flies. In camels, it can become a very severe disease. Surra is caused by *Trypanosoma evansi*.

A weak, thin camel suffering from trypanosomosis

A dog's neck covered by biting flies, which can cause surra

Local names: Wosswoss/ Geramole (Afar); Ghandi (Gabbra); Kayangat (Kipsigis); Dorobo (Maasai, Kenya and Tanzania); Itikana (Samburu); Dukan (Somali, Ethiopia and Kenya); Dorobo/ Malale (Swahili); Lotorobwo (Turkana); Ediit (Ngakarimojong); Bumbulu (Sukuma); Umar (Rendlle); Dhukkaana (Oromo [in camels]); Gandii (Oromo [in cattle]).

Signs

- Loss of appetite, discomfort and deterioration of body condition; very weak, thin animals.
- Rough, dull hair and skin, which may become scaly.
- Reduced milk production in females.
- Abortion in pregnant animals.
- Watery discharge from the eyes, cloudy eyes and frequent blinking.
- Swollen lymph nodes.
- Intermittent fever over several weeks.
- Paleness of gums, under the tongue and inner surface of the eyelid.
- In camels, mild cases may recover slowly, but in severe cases the hump becomes smaller and hair falls out, especially from the tail. Animals become very sick and collapse, leading to death within two weeks.
- Pigs in severe cases breathe very fast, stop eating, have a high fever, and collapse and die in one or two days.

Inform the officer in charge in the Government Veterinary Department if you suspect an animal has trypanosomosis.

Prevention and control

- See methods to control biting flies and tsetse flies (2.2.1.4, 2.2.1.7).
- In addition, burn branches of *Azadirachta indica* or *Tagetes minuta* near animals.

Treatments

- Boil 0.5 kg of stem bark of *Warburgia ugandensis* in 1 l of water. Strain and drench with the warm liquid once a day for 2 to 3 days, using 1 l of drench for camels, cattle and donkeys, 0.5 l for other animals. (Treatment for camels, cattle, goats, pigs, sheep and donkeys.)
- Boil 0.5 kg of *Salvadora persica* bark in 1 l of water. Drench with the warm liquid, using 1 l of drench for camels, cattle and donkeys, 0.5 l for other animals. (Treatment for camels, cattle, goats, pigs, sheep and donkeys.)
- Take 1 kg of fresh roots and bark of *Acacia reficiens*, crush and soak overnight in 5 l of water. Sieve and drench with about 3 l of the mixture. (Treatment for camels.)

2.2.3. Skin diseases

2.2.3.1. Dermatophilosis (streptothricosis, lumpy wool)

This is a serious skin disease of cattle, especially of young animals. Severity also depends on sex and breed. In goats and sheep it is called lumpy wool disease. Animals usually contract dermatophilosis under hot and wet weather conditions. When conditions become drier, animals can recovers spontaneously, before the disease reappears at the next rainy season. Skin damage due to tick bites, biting flies and thorns encourages the disease, which is carried between animals by direct contact, insects, birds and other means. Other diseases with some similar characteristics include ringworm and contagious skin necrosis. Dermatophilosis is caused by the bacteria *Dermatophilus congolensis*.

Local names: Upele kwa ngosi (Swahili); Qarfat (Gabbra); Immonkoi (Samburu); Ankaala (Turkana); Lonaru/ Abus (Ngakarimojong); Harar/ Giss (Rendille); Galidelila (Afar); Luqqa'uugoaa (Oromo); Kiproom/ Kiborom (Tugen); Ipepedo (Ilchamus); Ekimeeto (Maasai-Kenya); Egimeeto (Maasai-Tanzania); Buchele (Sukuma).

Signs

- Skin lesions, mainly on the shoulders, back and hindquarters, around the ears and between the legs.
- Papules that leak serum appear and form crusts, which bleed.
- A seriously-diseased animal is emaciated and weak, with loss of appetite.
- Loss of hair. In sheep the disease causes large, hard, thickly-matted lumps of wool.

An animal suffering from dermatophilosis, with open wounds

Prevention and control

- Move animals away from areas where there are many ticks and biting flies that cause skin damage (see methods to control ticks and biting flies, 2.2.1.1, 2.2.1.7).
- Make a shelter to protect animals from the rain.
- Isolate diseased animals from healthy ones.
- Slaughter animals with severe disease to help prevent spread.

Treatments

- Take a few fruit of *Solanum aculeastrum*, roast on charcoal and slice the fruit into halves. Tether the infected animal and remove disease crusts. Rub affected skin areas every day for 3 days with halved fruit. (Treatment for cattle, goats and sheep.) **CAUTION: Wear hand protection (plastic bags over the hands or surgical gloves) when applying this treatment, and wash hands thoroughly with soap and water afterwards, because *Solanum aculeastrum* fruit are poisonous.**
- Take 1 kg of *Azadirachta indica* bark, 1 kg of *Khaya anthotheca* bark and 0.5 kg of roasted *Ricinus communis* seed. Grind these together into a powder. Add a handful of crushed limestone (calcium carbonate) and 2 kg of butter. Mix to make a paste. Tether the infected animal and remove disease crusts. Apply the paste to the affected skin areas daily for 3 to 6 days, until the infection disappears. (Treatment for cattle.)

New crusts may appear during treatment, but will fall off. New hair should grow on the treated areas in 2 to 3 weeks.

2.2.3.2. Contagious skin necrosis

This disease only affects camels and is caused by several bacteria together (*Streptothrix* with *Actinomyces*/*Corynebacteria*/*Staphylococci*/*Streptococci*). Infection is through small skin injuries. The disease is associated with a lack of salt in animal feed and is spread through animal contact.

Local names: Galidelila (Afar); Qarfat (Gabbra); Imonkoi (Samburu); Maca (Somali); Ng'abusion (Turkana); Giss (Rendille); Luqqa'uugoaa (Oromo); Abus/ Ajome (Ngakarimojong); Ekimeeto (Maasai-Kenya); Egimeeto (Maasai-Tanzania); Upele kwa ngosi (Swahili); Buchele (Sukuma).

Signs

- One or several swellings on the skin that can burst after 5 to10 days to form large wounds.
- Wounds are common on the neck, shoulders, flanks and hind legs.
- Pus can be discharged from wounds over a period of several months.
- Loss of appetite and reduced milk production.

Camel suffering from contagious skin necrosis

Swellings can burst and form large wounds with blood and pus

Prevention and control

- Keep infected animals away from the rest of the herd.
- Give adequate salt to the affected animals, with their feed.
- Avoid hitting the affected animals on swellings or wounds.

Treatments

- Take a few fruit of *Solanum aculeastrum*, crush and squeeze out the juice. Apply the juice to the wounds for a week or more until the pus dries up and wounds start to heal. **CAUTION: Wear hand protection (plastic bags over the hands or surgical gloves) when applying this treatment, and wash hands thoroughly with soap and water afterwards, because *Solanum aculeastrum* fruit are poisonous.**
- Cut some fresh branches or bark of *Euphorbia robecchii.* Collect the white sap that exudes. Using a brush made from small branches, cover affected areas with sap.

2.2.3.3. Ringworm

Ringworm is a fungal disease (*Micosporum* and *Trichophyton* fungi; it is not caused by a worm) that can be contracted by all animals. It manifests itself especially in calves and domestic animals. The disease can be spread by contact with infected animals, by flies and sometimes by birds. Animals are more likely to contract ringworm when it is hot and wet. Humans can be infected by the disease too.

Local names: Robi (Gabbra); Sidhay (Luo); Ekamunyani/ Ekerikos (Maasai); Ekimeeto (Maasai-Kenya); Kekombamori (Maragoli); Nkamunyani (Samburu); Anbaar (Somali-Ethiopia); Anfar (Somali-Kenya); Mashilingi/ Uba (Swahili); Kishe (Sukuma); Akiserit (Turkana); Akesit (Ngakarimojong); Kallangal (Tugen); Deya (Rendille); Robbii (Oromo); Kisrel/ Serr (Pokot); Lachayo (Ilchamus).

Signs

- Animals have circular scabs on the skin, about 3 cm in diameter.
- Scabs usually appear first around the nose, above the eyes, on the ears or under the tail. The head, neck and hindquarters of the animal are especially affected.
- The skin under the dry scab is wet.
- Scabs sometimes break open, become infected by bacteria, and may become filled with pus.
- The animal is restless and scratches against trees, and does not feed well.

Dry scab on a cow's skin

A goat's skin with fungal infection

Prevention and control

- Isolate infected animals from the rest of the herd.
- Keep animals in sunlight as much as possible.

Treatments

Before applying any of the following treatments, shave the hair away from around the ringworm. Then burn the removed hair to prevent infection. Scrape scabs off gently.

- Crush a handful of *Tagetes minuta* stem, leaves and/or flowers. Collect the juice and rub onto affected areas once a day for 3 days. (Treatment for all animals.)
- Take a few seed of *Azadirachta indica* and crush them to form a paste. Apply the paste onto affected areas until they clear. (Treatment for all animals.)
- Cut a bulb of *Allium sativum* and rub the cut surface on the affected areas. Repeat daily until the ringworm clears. (Treatment for cattle, donkeys, goats, sheep and dogs.)
- Crush gum from *Commiphora erythraea* in a cup of water to make a paste. Apply to the affected areas. (Treatment for all animals.)
- Mix together 0.5 kg of *Carissa spinarum* leaves and 0.1 kg of *Carissa spinarum* roots. Place a handful of the mixture in a pot with 2 l of water and boil until it turns blackish. Depending on the size of the sick animal, drench with between 0.25 l and 0.5 l twice a day until the fungus clears. (Treatment for camels, sheep, goats, donkeys and cattle.)
- Collect a few leaves of *Datura stramonium* while the plant is flowering or during the dry season. Crush the leaves and rub the juice onto affected areas. After application, rub a little cooking fat onto the affected areas. Repeat the treatment every 2 to 3 days until the affected areas clear. (Treatment for cattle, goats and sheep.) **CAUTION: *Datura stramonium* is very poisonous and should be handled with care. Prevent animals from licking treated areas (e.g., tie animals and cover treated areas with plastic and adhesive tape). Wear hand protection and wash hands after application (see also comment below).**

CAUTION: To prevent human infection with ringworm, wear hand protection (plastic bags over the hands or surgical gloves) when applying treatments. Wash hands thoroughly with soap and water afterwards.

2.2.3.4. Lumpy skin disease

This is a severe disease only in cattle, causing swollen lymph nodes and large lumps on the skin. It is caused by *Capripox* viruses. Cattle contract the disease when they are bitten by blood-sucking insects such as mosquitoes which carry the virus from infected animals. The disease spreads at the start of seasonal rains when there are many insects. Cattle become sick 10 to 20 days after infection. Imported cattle breeds are more susceptible than local ones.

Local names: Galidelila (Afar); Chesiru nebo makatet (Kipsigis); Bur (Luo); Tsisundu (Maragoli); Nkeya eltonna (Samburu); Furuq (Somali); Ede-lemeri (Turkana); Lonaru (Ngakarimojong); Upele kwa ngosi (Swahili); Ryoho (Sukuma); Harar (Rendille); Suukii (Oromo); Ekimeeto (Maasai-Kenya); Eririy (Maasai-Tanzania); Kiproom/ Kiborom (Tugen); Ipepedo (Ilchamus).

Signs

- Swollen lymph nodes cover the skin of the animal.
- Many lumps on the skin turn into sores that become infected and result in deep wounds that damage the hide of the animal.
- Body temperature is very high, legs are swollen.
- Drooling, clear discharge from the eyes and nose. Later, discharge from the nose becomes grey/white.
- The animal stops eating, is tired and weak.
- In females, abortion and reduced milk production.

A cow covered by swollen lymph nodes

Inform the officer in charge in the Government Veterinary Department if you suspect lumpy skin disease (animals can be vaccinated).

Prevention and control

- Keep sick animals separate from healthy animals.
- See point above on vaccination.

Treatments

- Crush 2 kg of fresh seed of *Solanum incanum* and mix with 2 l of water. Rub the animal's body with this mixture and then rub with *Ricinus communis* oil (castor oil) or animal fat.
- Crush a handful of fresh leaves of *Harrisonia abyssinica* and 1 fresh leaf of *Aloe secundiflora*. Collect the juice and apply to sores.
- Take a handful of fresh leaves and a handful of roots of *Harrisonia abyssinica* and pound into a paste. Apply to sores.
- Smear used engine oil over the animal's entire body.
- Wash the animal with warm salty water. Mix ash with a little water to make a paste and rub the animal's body. Repeat every day until the animal recovers.

CAUTION: Wear hand protection (plastic bags over the hands or surgical gloves) when applying treatments. Wash hands thoroughly with soap and water afterwards to prevent human infection from infected sores and wounds.

2.2.3.5. Pox

Pox affects all livestock including camels, cattle, goats, sheep, poultry and donkeys. Camels with camel pox become sick 5 to 15 days after infection, cattle with cattle pox 5 to 10 days after infection. In poultry, fowl pox is also known as avian pox, is a chronic disease in adult birds, but acute and fatal among chicks. In sheep and goats it is the very young that are most severely affected (e.g., very young sheep may die before they show signs of the disease). Pox is spread through animal-animal contact, especially in wet periods. Many animals are infected via people that have touched infected animals. Birds can contract fowl pox from insect bites as well as by contact with infected animals. All pox diseases are caused by viruses: *Capripox* viruses for sheep and goats, *Orthopox* viruses for camels, *Parapox* viruses for cattle. Other diseases with some characteristics of pox include orf, foot-and-mouth disease and mange.

Local names: Korbor (Afar); Abdara (Gabbra); Aput/ Aluny (Luo); Inyundu (Maragoli); Afturro (Rendille); Abturo (Samburu); Utubali/ Farug (Somali-Ethiopia); Furruk/ Afur (Somali-Kenya); Upele wa mnyama (Swahili); Ndubi (Sukuma); Etune (Turkana); Etom (Ngakarimojong [goats, sheep]); Longolesike (Ngakarimojong [poultry]); Mavondo (Maragoli); Kihundu (Luhya [poultry]); Bagaa/ Finnoo (Oromo); Olorobi (Maasai, Kenya and Tanzania).

Signs

In cattle, donkeys, sheep and goats (the disease is more common and more severe in the last two):

- Small red patches on the skin, usually around the mouth, on the head, under the tail and between the legs.
- The patches become swellings under the skin that turn into blisters that break and become open sores which soon develop scabs.
- Animals often have distressed breathing due to blisters inside the lungs.
- Most animals have a lack of appetite, become thin and weak, with high fever and shivering.
- Watery discharge from the nose and eyes, drooling.
- Pregnant animals often abort.

In camels:

- Swellings around the lips, blisters filled with pus in the mouth and around the lips. It is very painful for animal to eat.
- Hair loss and scab formation.
- Young animals with severe disease have high fever, diarrhoea and dehydration.
- In young animals, blisters around the lips and eyes spread over the head and possibly over the whole body. Some blisters break and become bleeding sores.
- In young animals, watery discharge from the eyes may prevent animals from seeing properly.
- Most young animals recover from infection, but some may die, with swollen heads and breathlessness.

In poultry:

- Lesions and blisters around the head, especially on wattles and comb, around the eyes, nose, inside the beak and eyelids.
- Blisters under feathers and on the feet.
- Blisters soon break and become scabs.
- Watery discharge from the eyes.

- Difficulty in breathing, wheezing.
- Loss of appetite.
- Mortality low in adult birds, but high in chicks.
- Drop in egg production in laying birds.

Pox blisters and sores on a goat's lips, nose and legs

A hen with severe fowl pox lesions on its comb and on the rest of the head

Prevention and control

- Separate infected animals from healthy animals.

Treatments

- Mix half a cup of salt with 1 l of warm water. Wash infected areas daily until they clear.
- Add a handful of fresh pounded roots of *Microglossa pyrifolia* and a few fresh ground leaves of *Agave sisalana* and *Aloe secundiflora* to 2 l of water. Boil for 30 minutes, cool and sieve. Drench with 1 l of liquid twice a day. (Treatment for donkeys, goats and sheep.). Give the same mixture to infected chickens instead of drinking water (not as a drench).
- Take a few seed of *Azadirachta indica* and crush to form a paste. Apply the paste to affected areas until they clear. (Treatment for all animals.)
- Pound fresh bark of *Azadirachta indica* with a little water and apply the juice to sores. (Treatment for all animals.)
- Pound 0.5 kg of dried leaves of *Acalypha fruticosa* to a powder. Mix with 0.5 kg of butterfat or ghee to form a paste and apply once to affected areas. (Treatment for all animals.)

CAUTION: Wear hand protection (plastic bags over the hands or surgical gloves) when applying treatments. Wash hands thoroughly with soap and water afterwards.

2.2.3.6. Orf (contagious pustular dermatitis, contagious ecthyma)

Orf affects mainly young sheep, goats and camels. The disease is transmitted through animal-animal contact. Infection occurs through small injuries in the skin. Dogs can be infected through eating the meat of infected animals. Baby goats and sheep obtain the disease from their mothers. People can also contract orf. Orf is a viral infection caused by *Parapox* viruses. Other diseases with some of the same characteristics as orf are foot-and-mouth disease and pox.

Local names: Sanderra/ Ameraro/ Annaso (Afar); Abdara gala (Gabbra); Umburuura (Oromo); Abturo (Samburu); Afdhalow (Somali-Ethiopia); Afturro (Rendille); Etune (Turkana); Ejota (Ngakarimojong); Ooyyalee (Oromo); Olorobi (Maasai-Kenya); Eririy (Maasai-Tanzania); Ngremen (Pokot); Kamuren (Tugen); Upele wa mnyama (Swahili); Ndubi (Sukuma).

Signs

- Swollen lips and swollen head; swollen lymph nodes on the head (camels).
- Small pimples, swellings and lesions around the mouth; small raised sores on the skin.
- Suckling young have sores around the lips and eyes; they stop suckling due to internal mouth sores.
- Older animals usually have sores on legs and feet.
- Mothers have sores on their teats and udder.
- Several small sores often join together and have thick scabs over them; some scabs break off and bleed.
- Animals feverish.

Inform the officer in charge in the Government Veterinary Department if you suspect orf.

Suckling baby goats with sores and lesions around the mouth and nose

Prevention and control

- Isolate infected animals from the healthy herd.

Treatments

- Mix a quarter of a cup of salt with 2 l of warm water. Wash affected areas once a day until they clear. (Treatment for all animals.)
- Crush 0.5 kg of *Acacia nilotica* pods and mix with 2 l of water. Leave for 30 minutes. Strain the mixture and wash the affected areas with the liquid once a day until the animal recovers. (Treatment for camels.)

2.2.4. Eye diseases and problems

2.2.4.1. Pink-eye (kerato-conjunctivitis)

All animals and humans can contract conjunctivitis, of which pink-eye is a severe form seen in cattle, sheep, goats, camels and chicken. Animals contract the disease by contact with infected animals. Flies can also spread infection, while damage to the eye caused by thorns, tick bites, etc., increases the chances of infection. Pink-eye is caused by a range of bacteria (e.g., *Moraxella*, *Mycoplasma*, *Listeria*, *Chlamydia*).

Local names: Jicho jekundu/ Ugonjwa wa macho (Swahili); Aribo akongu (Ngakarimojong); Moyian yoonkonyek (Samburu); Itwaren (Somali); Edeke ankonyen (Turkana); Hiitaailaa (Oromo); Chirsot konyen (Pokot); Nkonyek na nyokie (Ilchamus); Enkongu nado (Maasai, Kenya and Tanzania); Jess (Rendille).

Signs

- Discharge from one or both eyes; the discharge may be clear, white or yellowish.
- The mucous membrane under the eyelid becomes red and swells; the eye may bulge out and be injured; partial or complete closure of the eye.
- The animal avoids strong sunlight and blinks frequently.
- In severe cases, the eye can be lost.

Eyelid and eye redness in a goat due to pink-eye

This chicken has lost its eye due to pink-eye

Prevention and control

- Separate infected animals from healthy animals.
- Wash the eye with clean warm water and salt.
- Manually remove ticks from eyelids.
- Grow fly-repellent trees and shrubs such as *Azadirachta indica* and *Ocimum kilimandscharicum* where animals are kept.

Treatments

- Burn leaves and stems of *Combretum molle* and crush the ash to a fine powder. Apply the powder directly to infected eyes. (Treatment for cattle, goats and sheep.)
- Burn a few pieces of *Euphorbia candelabrum* stem and crush the ash to a fine powder. Apply the powder directly to infected eyes. (Treatment for cattle, goats, camels and sheep.)
- Dissolve 2 tablespoons of salt in a cup of fresh milk. Using a clean syringe (without the needle) or a straw, wash infected eyes with this solution twice a day until the animal recovers. (Treatment for all animals.)

CAUTION: Wash hands thoroughly with soap and water after applying treatments, to prevent cross-infection (including of self). Be careful not to cross-contaminate the non-infected eye of an animal that has only one infected eye.

2.2.4.2. Eyeworms (thelaziosis)

Most animals can be infected by eyeworms, which are *Thelazia* parasites carried by flies and ticks from infected animals.

Local names: Minyoo kwa jicho (Swahili); Aribo akongu (Ngakarimojong); Moyian yoonkonyek (Samburu); Itwaren (Somali, Kenya and Ethiopia); Edeke ankonyen (Turkana); Harroit (Rendille); Olkuto tenkongu (Maasai-Kenya); Elasheyi (Maasai-Tanzania); Makarkarekob konyek (Tugen); Ilnkuru lo nkonyuk (Ilchamus); Chirsot konyen (Pokot); Raammooilaa (Oromo).

Signs

- A clear discharge may come from one or both eyes. Occasionally the discharge becomes white, grey or yellow.
- Thin, white worms (about 2 cm long) can be seen on the surface of the eye.
- Infected animals avoid bright light.

Prevention and control

- See methods to control ticks (2.2.1.1).

Treatments

- Pound or chew fresh fibrous bark of *Piliostigma thonningii*. Squeeze out the juice and apply it directly to the infected eye, daily for 3 to 7 days. (Treatment for all animals.)
- Squeeze out the juice from 3 or 4 fresh *Nicotiana tabacum* leaves. Apply 3 drops of juice into the infected eye, daily for 3 days. Apply 1 drop a day for chickens. (Treatment for cattle, goats, camels, sheep, chicken.)

2.2.4.3. Poison-in-the-eye

Caused by irritating sap from plants such as *Calotropis procera* and *Euphorbia candelabrum*, and by snake venom.

Local names: Sumu kwa jicho (Swahili); Aribo akongu (Ngakarimojong); Moyian yoonkonyek (Samburu); Itwaren (Somali); Edeke ankonyen (Turkana); Koroitap konyenk (Tugen); Sayet/ Nkonyek na nyokie (Ilchamus); Oenkongu nado (Maasai, Kenya and Tanzania); Jess (Rendille); Hadhaailaakeessa (Oromo).

Signs

- Tears from the eye, which may be slimy or pus-like.
- Swollen red eye.
- Partially or completely closed eye.
- A thick-whitish film that may develop later and cover the eye.
- The animal is restless and shakes its head frequently.

Partially closed eye due to poison-in-the-eye

Prevention and control

- If possible, do not graze animals where there are plants with irritating sap.
- Avoid plants with irritating sap for animal pen construction.

Treatment

- Put 3 to 5 drops of fresh milk into the affected eye. Repeat a few hours later and continue treatment at further intervals if symptoms persist. (Treatment for donkeys, cattle, goats, camels and sheep.)

Eye diseases and problems, general treatments

- Crush 1 leaf of *Aloe secundiflora* and collect the juice. Put 5 drops daily into an affected eye until the animal recovers. (Treatment for cattle, goats, camels and sheep.)
- Grind dry seed of *Boscia coriacea* to a fine powder. Put a pinch of powder directly into the eye twice a day until it heals. (Treatment for donkeys, cattle, goats, camels and sheep.)
- Grind *Acacia mellifera* leaves to a fine powder. Clean the eye with warm water. Apply a pinch of powder into the affected eye. (Treatment for donkeys, cattle, goats, camels and sheep.)
- Grind a handful of dried *Balanites aegyptiaca* leaves to a powder. Put a teaspoonful of powder in hot water, stir, strain the mixture and apply the solution to the affected eye twice daily until it heals. (Treatment for donkeys, cattle, goats, camels and sheep.)
- Crush 10 g of chewing tobacco (from *Nicotiana tabacum*), add 2 tablespoons of water, mix thoroughly and strain the mixture. Put several drops into the affected eye. Apply to only one eye at a time, as the treatment may cause temporary blindness. Repeat if necessary. (Treatment for donkeys, cattle, goats, camels and sheep.)

2.2.5. Endoparasites (internal parasites)

2.2.5.1. Stomach and intestinal worms

Roundworms can infect most animals, especially during wet periods. Infection often occurs from pasture contaminated with worm eggs or larvae. Young animals often suffer worst. Birds contract roundworms when kept together in close confinement.

Hookworms, a type of roundworm, infect cattle, sheep, goats and dogs, especially when many animals are crowded together. Infection usually occurs in wet locations contaminated with the faeces of animals with hookworms. Animals become infected by larvae that dig through the skin or by eating contaminated food. Hookworms are usually 2 to 3 cm long, live in the small intestine and suck blood.

Lungworms (ascaris worms) are a type of roundworm that infects camels, cattle, sheep, goats, donkeys and dogs. Young animals suffer the most. Humans can be infected by lungworms from animals, especially from dogs. Animal infection often occurs from pasture contaminated with worm eggs by the faeces of animals with lungworms. Eggs once ingested develop into larvae in the animal's intestine, which dig through the intestine wall and enter the liver and lungs. They develop in the lungs and proceed up the trachea into the animal's mouth, where they are swallowed and develop into adults in the intestine, where they produce eggs that are expelled in the faeces about two months after the animal was infected. In cattle, infection is caused by *Toxocara vitulorum*, in donkeys by *Parascaris equorum* and in dogs by *Toxocara canis*.

(Additional information on lungworms is given in 2.2.5.2.)

Local names: Beni-segara (Gabbra); Ntumuai (Samburu); Goryan (Somali-Ethiopia); Ng'ilomum (Turkana); Ngikur (Ngakarimojong); Tymbo muhoo (Pokot); Minyoo (Swahili); Minyoo (Sukuma); Tzinzoka (Maragoli); Echoka/ Olbuduki (Maasai-Kenya); Orupuduki (Maasai-Tanzania); Malahh (Rendille); Raammoogaraacha fi mardhimaanii (Oromo).

Signs

General signs:

- The animal often stops eating and becomes skinny, weak and tired.
- Some animals feed well but grow slowly.
- Rough coat.
- Enlarged belly and swelling at the throat (sometimes known as bottle jaw).
- With severe disease due to lungworms, animals cough and have distressed breathing.

- Diarrhoea and dehydration; faeces sometimes contain blood and mucus.
- Pale mucous membranes.
- Sometimes animal has severe abdominal pain.
- In dead animals it is sometimes possible to see larger worms, but others are too small to see easily.
- Animals do not have a fever.

In birds:

- Feathers appear rough and some fall out.
- Reduction in egg laying.
- Some young birds may die.

Animals stop eating, become thin and tire easily

A goat with bottle jaw

Prevention and control

- Rotate pasture.
- After deworming animals, move immediately to clean pasture.
- Keep the animal house/pen and its surrounding clean.

Treatments

- Take 0.5 kg of *Carissa spinarum* roots and 1.5 kg of *Cucurbita maxima* leaves. Boil in 3 to 4 l of water for 45 minutes. Filter off the liquid, cool and use as a drench, twice in 1 day. Repeat after 1 month. (Treatment for cattle, goats and sheep.)
- Crush 2 kg of fresh roots of *Rhus vulgaris* and leave in 1 l water overnight. Sieve and drench cattle with 0.5 l of the liquid once a day for a week (half this dose for sheep, goats and calves). Give to animals only after they have been fed. (Treatment for cattle, goats and sheep.)
- Crush 0.25 kg of *Myrsine africana* leaves, add to 0.5 l water and stir. Filter off the liquid and drench cattle, camels and donkeys with the full volume, once daily for 2 days (half this dose for sheep, goats and calves). (Treatment for camels, cattle, goats, sheep and donkeys.)
- Chop or crush 2 bulbs of *Allium sativum* and mix with 4 l of water. Drench with 0.25 l to 0.5 l of the liquid twice a day for 2 days. (Treatment for cattle, goats and sheep.)
- Take 2 or 3 fresh fruit of *Hagenia abyssinica*, crush and add 0.5 l of water. Drench cattle with the full volume of the liquid once daily for 2 days (half this dose for sheep and goats). (Treatment for cattle, goats and sheep.)
- Take a small piece of *Zingiber officinale* root (rhizome) and 2 fruit of *Capsicum frutescens*, crush and mix with 1 l of water. Give as drinking water to chickens. If birds will not drink the mixture, drench them with it (2 teaspoonfuls for chicks, 2 tablespoonfuls for adult birds). (Treatment for chickens.)

2.2.5.2. Lungworms (ascaris worms)

(See also 2.2.5.1.)

Local names: Silayitu (Afar); Minyoo ya mapafu (Swahili); Aniambo (Luo); Minyoo ya matupu (Sukuma); Irikipeu/ Iripeu (Maasai-Tanzania).

Signs

- Coughing and distressed breathing.
- Stunted growth.
- On examining dead animals, worms can be found in the windpipe and lungs.

Prevention and control

- Rotate pasture.
- After deworming animals, move immediately to clean pasture.
- Avoid overcrowding.

Treatments

- Grind *Lantana trifolia* fruit and mix a handful with 1 l of water. Drench the animal with this mixture. Use 1 l for adult cattle and 0.25 l for calves, sheep and goats. (Treatment for cattle, sheep and goats.)
- Take 0.25 kg of fresh bark of *Trichilia emetica* and soak in 2 l of water for 6 hours. Sieve and use the liquid to drench the sick animal. Use 2 l for large animals and 0.5 l for small animals. (Treatment for camels, cattle, dogs, sheep and goats.)
- Crush 0.5 kg of *Albizia anthelmintica* bark and add to 2 l of water. Allow to stand for 6 hours. Sieve and use the liquid to drench the sick animal. (Treatment for camels, cattle, dogs, sheep and goats.)
- Pound 0.5 kg of *Albizia anthelmintica* roots and boil in 1 l of water. Sieve and use the liquid as a drench. Administer 1 l for cattle, 0.25 l for calves, sheep and goats. (Treatment for cattle, sheep and goats.)
- Pound 0.5 kg of fresh *Albizia coriaria* bark and add to the drinking water of sick animals. (Treatment for cattle, sheep and goats.)

2.2.5.3. Liver fluke disease (fasciolosis)

Liver fluke are flat worms (*Fasciola hepatica*, *Fasciola gigantic*) that live in the liver. Liver fluke disease is contracted by most livestock, including cattle, camels, donkeys, sheep and goats. People are sometimes also infected. Acute (severe) liver fluke disease can be contracted especially by young sheep and goats. The disease is contracted in areas where the snails within which the liver fluke larvae develop are found. The larvae stick to pasture and are ingested by animals while grazing. The chances of infection are highest during seasonal rains and near stagnant, dirty water.

Local names: Beni-segara (Gabbra); Ochwe (Luo); Ovoveyi (Maragoli); Ikurui/ Lemonyua (Samburu); Faraqle (Somali-Ethiopia); Sogul (Somali-Kenya); Minyoo ya itema (Sukuma); Malahh (Rendille); Raammoogaraacha fi mardhimaanii (Oromo); Ngikur (Ngakarimojong); Tymbo muhoo (Pokot); Echoka/ Olbuduki (Maasai-Kenya); Orukuru (Maasai-Tanzania).

Signs

- The animal is thin and weak, tires easily and stops eating.
- Rough coat and pale mucous membrane.
- The animal often has diarrhoea; the faeces contain some blood.
- Coughing, especially at night.
- Enlarged belly and swelling at the throat (bottle jaw).
- Loss of milk production.
- Some animals die before they have any signs of the disease; usually, animals are very sick for a few days and then partially recover.
- Animals do not usually have fever.
- In dead animals with acute disease, the liver is large and dark, there is much red/brown liquid in the abdomen (especially in sheep and goats) and the flesh is often pale coloured. The bile ducts in the liver may be thicker than normal; when cut, the worms can be seen.

In animals with acute liver fluke disease, the liver is large and dark, and the gall bladder larger than normal

The intestine turns whitish in acute liver fluke disease

Prevention and control

- Avoid wet, swampy areas.
- After deworming animals, move immediately to clean pasture.

Treatments

- Take 2 fruit of Solanum incanum and a little crushed limestone (calcium carbonate) and boil in 1 l of water. Drench the animal with the liquid. (Treatment for cattle.)
- See treatments for lungworms (2.2.5.1, 2.2.5.2).

2.2.6. Digestive diseases and abdominal problems

These are common in all animals and have multiple causes, including diet, inadvertent intake of poisonous plants, and stomach and intestinal worms (see 2.2.5.1).

2.2.6.1. Bloat (tympany)

Bloat is when an animal has too much gas in its stomach (rumen) due to eating too much fresh pasture or too much of certain dry feeds. It is a life-threatening condition that can cause the animal to suffocate due to the pressure placed on the chest. Goats, sheep and cattle suffer from bloat, camels occasionally.

Local names: Derma (Afar); Furfur (Gabbra); Kowiren (Kipsigis); Ich-Kuot (Luo); Epokit/ Empongit (Maasai, Kenya and Tanzania); Kuriuma munda (Maragoli); Kuhaata (Luhya); Mpwna (Meru); Lesana (Pokot); Mberini (Samburu); Bakhakh/ Dunbudhyo/ Balao (Somali-Ethiopia); Dhibir / Dibiryio/ Boallallo (Somali-Kenya); Kubimbelwa (Sukuma); Lotebwo/ Akitebukin (Turkana); Kuvimba Kwa tumbo (Swahili); Ekitubon (Ngakarimojong); Bokokaa (Oromo); Ngov (Rendille).

Signs

- The abdomen is large on the left side.
- Distressed breathing and protrusion of the tongue.
- The animal stops eating and has a little diarrhoea.
- The animal tries to urinate and defecate frequently.
- Sometimes green froth comes out of the nose and mouth.
- The animal may collapse and die quickly.

When an animal feeds on too much fresh, lush grass it can become bloated

Animals stop eating, have diarrhoea and may refuse to move

Prevention and control

- Ration feeds that can cause bloat.
- Before grazing animals on wet green pasture, feed them with dry grass.
- Do not give water to animals just before releasing them into wet pasture.
- Do not let animals feed on wet grass very early in the morning; wait until the sun has dried the pasture.
- Introduce any changes in animal diet gradually.
- Remove food from an animal with a bloated stomach.

Treatments

- Mix 0.5 kg of Magadi soda with 1 l of water and drench adult cattle with the mixture. For calves, goats and sheep, drench with 0.5 l. Use 2 l for adult camels. (Treatment for cattle, camels, goats and sheep.)
- Drench adult cattle with 4 l of fresh milk. For calves, goats and sheep, drench with 2 l. Animals will recover within 1 to 3 hours. (Treatment for all animals.)
- Keep the bloated animal running until it passes gas. (Treatment for goats and sheep.)
- Mix 0.5 l of edible oil with 0.5 kg of fresh crushed leaves of *Vernonia amygdalina* and 2 teaspoons of salt. Drench adult cattle and camels with the full volume of this mixture. For calves, goats and sheep, drench with 0.25 l. (Treatment for all animals.)
- If an animal is suffering from 'sudden bloat' (i.e., the left side of the abdomen is very swollen, the animal can hardly breath, the animal lies on the ground, and the legs are stiff and spread when standing), puncture the swollen part of the stomach (e.g., with the reverse end of a spear, knife or large needle). After the gas has been released, smear animal fat or butter on the wound. (Treatment for cattle and camels).

2.2.6.2. Diarrhoea

Diarrhoea is a common condition in all livestock, particularly in new born animals. It can be a symptom of many diseases and of poisoning, and may result from changes in diet. It can affect whole herds or flocks.

Local names: Uruguta (Afar); Halabati (Gabbra); Koburketan (Kipsigis); Diewo (Luo); Enkorotik/ Olodo kurum (Masaai, Kenya and Tanzania); Kunyalala munda (Maragoli); Ngorotit (Samburu); Har/ Har dig (Somali); Eremonu (Turkana); Kuharisha/ Harisho (Swahili); Kupanza (Sukuma); Akiurut (Ngakarimojong); Kipseret (Pokot); Kipkaiwat (Tugen); Nkiriaroto (Ilchamus); Harr (Rendille); Albaatii/ Albaatii dhiigaa/ Albaatii bishaanii (Oromo).

Signs

- Frequent, loose stool.
- Faeces may contain blood or mucus, smell strangely and have an unusual colour.
- The animal is weak, has no appetite, stops ruminating and loses weight.
- The animal becomes dehydrated if diarrhoea continues for long; as a result, the coat becomes dry and rough, the eyes are sunken and the animal urinates less than normal.

Sick animal with diarrhoea

Prevention and control

- Keep the animal house/enclosure clean by removing faeces regularly.
- Avoid the overcrowding of animals.
- Control for worms.
- It is important that a newborn animal drinks its mother's colostrum. If a newborn animal is too weak to suck from its mother, then express the colostrum and feed it from a bottle.

Treatments

- Crush 0.5 kg of fresh *Acacia seyal* bark and boil in 0.5 l of water for 10 minutes. Cool, sieve off the liquid and drench cattle and camels with the full volume. Use 0.3 l of the liquid for calves, goats and sheep. (Treatment for camels, cattle, sheep and goats.)
- Place 0.5 kg of fresh bark from the roots of *Acacia oerfota* in 1 l of hot water and leave standings for 20 to 30 minutes. Sieve and use the liquid to drench the affected animal once a day for 2 or 3 days. Use 1 l as a drench for cattle, 0.5 l for sheep and goats. (Treatment for cattle, sheep and goats.)
- Pound a handful of fresh leaves of *Aloe secundiflora* to extract the juice. Mix the juice with 2 l of water. Give to affected animals as their drinking water. Continue daily until the animals recover. (Treatment for cattle, sheep, goats, dogs, donkeys and chicken.)
- Chop 2 or 3 red, hot *Capsicum frutescens* fruit and mix with 0.5 l of water. Present to animals as drinking water. (Treatment for poultry.)
- Crush a few long pieces of fresh *Commiphora africana* bark and soak in 2 l of water until the water turns red. Give the liquid to affected animals to drink instead of regular water. (Treatment for cattle, sheep and goats.)
- Crush a handful of fresh *Grewia similis* roots and boil in 0.5 l of water for 10 minutes. Cool and sieve. Use the liquid as a drench. Give 0.5 l to cattle and camels, 0.25 l to goats and sheep, three times a day for 2 days. (Treatment for cattle, camels, sheep and goats.)
- Pound 0.5 kg of tender leaves of *Psidium guajava* with a piece of fresh *Zingiber officinale* root (rhizome). Boil the mixture in 1 l of water for 10 minutes. Add half a teaspoon of salt. Drench cattle and camels once with 1 l of the mixture, use 0.5 l for smaller stock. (Treatment for cattle, camels, sheep and goats.)
- Crush 0.5 kg of *Zanthoxylum chalybeum* seed and mix with 2 l of warm water. Use the liquid immediately as a drench. Give 2 l to cattle and camels, 1 l to goats, sheep and calves once. (Treatment for camels, cattle, sheep and goats.)
- Stir 5 tablespoons of sugar and 1 tablespoon of salt into 2 l of water. Drench with 2 l for cattle, 1 l for calves, goats and sheep. (Treatment for dehydration caused by diarrhoea for cattle, goats and sheep.)

- Pound a cup of dry grains such as millet, sorghum or cow pea and soak in 1 l of warm water. Mix thoroughly, sieve and use all the liquid as a drench (dose for camels and cattle; use half the volume for calves, goats and sheep). (Treatment for camels, cattle, goats and sheep.)

2.2.6.3. Constipation

If an animal does not defecate, or strains while trying to pass faeces, it is constipated. Animals kept in pens or houses are more likely to be constipated due to their restricted movement. Insufficient water, sudden changes in diet and stress can cause constipation.

Local names: Begicafna (Afar); Egwee/ Kketetarit akook (Ngakarimojong); Nawoisin (Turkana); Emonirata (Maasai-Kenya); Emanyita (Maasai-Tanzania); Ringiur (Rendille); Gogiinsagaraa (Oromo); Uhasi/ Hasi (Swahili); Kuduma kunya (Sukuma).

Signs

- Hard, pelleted, dry faeces.
- Animal forcing or straining to pass stool.
- No faeces from the animal over a whole day.

If they do not have sufficient drinking water, animals may become constipated when they feed on dry maize or sorghum leaves, stalks and grains

Prevention and control

- Give plenty of drinking water to animals after feeding.
- Provide enough green forage; do not feed animals only on dry grains and legumes.

Treatments

- Take half a cup of fresh, crushed *Carica papaya* seed and force the affected animal to eat. Alternatively, crush the seed, mix with water and use once as a drench. (Treatment for cattle, goats and sheep.)
- Dose cattle and camels with 0.5 l of *Ricinus communis* oil (castor oil). Use 0.25 l for goats and sheep. **(Do not overdose.)** (Treatment for cattle, camels, goats and sheep.)
- Dissolve 0.25 kg of Magadi soda in 2 l of water. Use 2 l to drench cattle and camels, 0.5 l for goats and sheep. (Treatment for cattle, camels, goats and sheep.)

2.2.6.4. Coccidiosis (coccidia) and colibacillosis

Coccidiosis (coccidia) can affect all animals, especially the young. The most susceptible are very young calves and lambs and animals being weaned. Animals are more likely to develop coccidiosis if they live in wet, dirty places contaminated by faeces, and if they are stressed and crowded. Local breeds are more likely to have some resistance compared to exotic animals. Coccidiosis is caused by protozoa (*Eimeria* or *Isopora*) that invade the intestines.

Colibacillosis can affect all animals except poultry. Animals that live in damp, wet conditions and in dirty housing are more likely to suffer from the condition. It is probably the most common cause of diarrhoea in young animals, especially those that have not taken their mother's colostrum. It is a bacterial infection.

Severely affected animals die if they are not treated.

Local names: Begeabla (Afar); Lochit (Turkana); Enkorotik (Maasai-Kenya); Olodo kurum/ Engorotikit (Maasai-Tanzania); Kipseret (Pokot); Nkeeya elodo (Ilchamus); Kipkaiwat (Tugen); Harr (Rendille); Ngoloso (Samburu); Akiurut/ Akiurut angikokoroi (Ngakarimojong); Shuban (Somali-Ethopia); Kunyalala munda (Luo); Albaatiidhiigaa/ Albaatiiqallooakkabishaanii (Oromo); Harr (Rendille); Kupanza mininga (Sukuma).

Signs

In sheep, goats and calves:

- Diarrhoea with blood and mucus in the faeces in animals with coccidiosis.
- Profuse watery diarrhoea in the case of animals with colibacillosis.
- Loss of appetite, loss of weight, weakness and sluggishness.
- Calves do not suckle.
- Dehydration.
- The animal's hair/sheep's wool breaks easily.
- Little or no fever.

In birds:

- Tiredness and weakness; eyes are closed and wings hang down.
- Loss of appetite.
- Dark and bloody diarrhoea.
- Many birds die after 2 to 3 weeks, especially young ones.

Birds less than two months old often contract coccidiosis

Young animals are very susceptible to colibacillosis

Prevention and control

- Avoid overcrowding.
- Keep animal houses dry and clean up faeces.
- Elevate feeding and drinking bowls to stop faeces getting into them.
- When an outbreak occurs, isolation and sanitation are crucial for preventing spread.

Treatments

- Crush a leaf of *Aloe secundiflora* and mix with 1 l of warm water. Give this to affected poultry as drinking water. (Treatment for poultry.)
- Crush a handful of fresh bark of *Acacia mellifera* or *Acacia xanthophloea* and soak in 1 l of cold water for 6 to 7 hours. Sieve and drench with 1 l of the liquid every morning until the animal recovers. (Treatment for calves, goat kids and lambs.)
- Pound 0.2 kg of fresh roots of *Cissus quadrangularis* and mix with 0.5 l of water. Leave for 12 hours. Sieve and drench the sick animal with the liquid. Repeat morning and evening on a single day. The animal should not be allowed to suckle for 12 hours before treatment starts. (Treatment for suckling camels and calves.)

2.2.6.5. Salmonellosis (fowl typhoid, pullorum disease)

Animals of all ages can contract salmonellosis, although animals that always live in pastures are rarely affected. Donkeys and camels do not often contract the disease, but if camels do the disease may be severe and animals often die. It is more prevalent in cool wet locations and where animals are kept in houses or in large crowded groups. Infection is from food or water contaminated by the faeces of infected animals.

Forms of salmonellosis in poultry are known as fowl typhoid and pullorum disease. Many birds that recover from salmonellosis carry the infection and lay infected eggs. Salmonellosis is caused by *Salmonella* bacteria, fowl typhoid by *Salmonella gallinarum* and pullorum disease by *S. pullorum*. Humans can contract salmonellosis from infected eggs or meat that are not properly cooked, or from drinking unboiled milk from infected animals.

Local names: Begeabla (Afar); Albati (Gabbra); Nyabola (Luo); Kunyalala nkiriata (Samburu); Har (Somali, Kenya and Ethiopia); Iyalaara (Ngakarimojong); Albaatii dhiigaa (Oromo); Kupanza minzi minzi/ Kupanza mininga (Sukuma); Enkorotik (Maasai-Kenya); Eboloto (Maasai-Tanzania).

Signs

In livestock:

- Very high fever.
- Profuse watery diarrhoea that smells bad and contains blood and mucus.
- Pregnant animals often abort.
- Severe dehydration, loss of appetite and weakness.
- In severe cases, cattle may kick their own stomachs to relieve pain.
- Animals at any age can contract severe salmonellosis and collapse and die rapidly.

In birds:

- Young chicks under 20 days old suddenly become tired and weak and have a high fever.
- Birds stand with their wings down and eyes closed.
- Feathers are rough and birds cry out frequently.
- Birds become sick 4 to 7 days after they are infected by fowl typhoid.
- Some birds die before there are any signs of fowl typhoid.
- In the case of fowl typhoid, birds have yellow/brown/green, foul-smelling diarrhoea.
- In the case of pullorum disease, many birds have whitish/grey, foul-smelling diarrhoea and the feathers around the anus become covered in faeces.
- Many young birds with pullorum disease collapse and die when they are 10 to 20 days old.

Birds can contract fowl typhoid by direct contact with infected birds, from contaminated food and water, and from housing contaminated by the faeces of infected birds

Cattle with salmonellosis suffer from high fever, severe dehydration, loss of appetite and weakness

Prevention and control

- Keep sick animals away from healthy ones. It is difficult, however, to stop salmonellosis from spreading, because some infected animals that act as carriers show no sign of disease.
- Treat infected animals as soon as possible.
- Avoid contamination of water and feed with faeces from animals that may be infected.
- Keep animal housing/pens clean and dry.
- Reduce stress by not overcrowding animals and by providing them with proper shelter.
- Cook infected animals well before eating them and bury any remains.

Treatments

- Crush 1 big leaf of *Aloe secundiflora* and mix with 5 l of water. Use as a drench. On the first day, drench calves with 1.5 l, repeat after 2 hours and give a third dose in the evening. For the next 3 days, drench with 1.5 l once a day. (Treatment for calves.)
- Crush 1 leaf of *Aloe secundiflora* and mix with 1 l of water. Give the liquid to chicks and chicken as their drinking water. (Treatment for chickens.)
- Chop and pound 0.5 kg of fresh bark of *Azadirachta indica*. Take the extracted juice and mix with regular feed. (Treatment for cattle and chickens.)
- Chop 0.5 kg of fresh young leaves of *Croton megalocarpus* and soak in 2 l of water. Leave for 3 to 5 minutes until the water turns green. Give the liquid to chicks as their drinking water for up to 3 days. (Treatment for chickens.)
- Stir 5 tablespoons of sugar and 1 tablespoon of salt into 2 l of water as a rehydrating solution. Drench with 2 l for cattle, 1 l for calves, goats and sheep. (Treatment for dehydration caused by diarrhoea for cattle, goats and sheep.)

2.2.7. Respiratory diseases and problems

2.2.7.1. Colds, coughs and pneumonia

Colds and coughs are diseases of the nose and throat. Pneumonia is an infection of the lungs that results in inflammation and filling of the alveoli with pus and fluid. Colds, coughs and pneumonia in animals can have a number of different causes including bacteria, viruses and worms. Infections can be triggered by changes in weather (e.g., by cold, wet, windy conditions), stress and overcrowding. Coughs can also be caused by mechanical irritation of the throat such as by hard and coarse feed, particularly in chickens. Prolonged, persistent coughing can severely damage the lungs.

Local names: General Saa (Gabbra); Cheboliot (Kipsigis); Ruhayo (Kikuyu); Erenui (Luo); Hergeb (Somali-Kenya); Ekiroket/ Enkirroget (Maasai); Malole (Luhya); Buhui (Afar); Qufaa (Oromo). **Cold** Kivuti (Kamba); Nchoma (Meru); Nkijepe (Samburu); Homa ya mapua (Swahili, Kenya and Tanzania); Erujuraj-akatorot (Turkana); Chebuon (Tugeu); Ilnkirobi (Ilchamus); Oloirobi (Maasai, Kenya and Tanzania); Sim (Rendille); Mafun'gha (Sukuma). **Cough** Likolota (Maragoli); Gikorora (Meru); Nkiluata/ Ichama (Samburu); Kikohozi (Swahili); Loola (Turkana); Arakum (Ngakarimojong); Katopwa (Tugeu); Ngiroget (Ilchamus); Ekiroket/ Enkirroget (Maasai-Kenya); Egerroget (Maasai-Tanzania); Yera/ Yera (Rendille); Kukolola (Sukuma). **Camel Cough** Oufa (Gabbra); Yahar (Rendille); Ichama (Samburu); Dhugato (Somali-Kenya); Arrkum (Turkana); Enkirroget (Maasai); Kukolola (Sukuma). **Pneumonia** Kitetema (Kamba); Livumba (Maragoli); Ntigana (Meru); Ikirobi (Samburu); Homa ya mapua (Swahili, Kenya and Tanzania); Loukoi (Turkana); Awala (Ngakarimojong); Chebuon (Tugeu); Rongi-rongi (Ilchamus); Emoyian enkijape (Maasai, Kenya and Tanzania); Buhui (Afar); Qufaa (Oromo); Kabulabu (Sukuma).

Signs

- Discharge from the nose, mouth and eyes. If creamy, sticky and yellowish, see contagious pleuropneumonia (2.2.7.5) and other bacterial infections. If watery, see foot-and-mouth disease (2.2.8.7), and avian coryza (2.2.7.3) and fowl cholera (2.2.7.4) (for chickens).
- Coughing and sneezing.
- In the case of pneumonia, difficult, distressed and faster breathing.
- Animals with pneumonia usually have a fever.
- Weakness and reduced appetite.
- Snoring and gasping for air in chickens.

A sheep suffering from pneumonia due to the cold and wet conditions

Prevention and control

- Shelter animals, young animals especially, from dusty, windy and rainy conditions.
- Light a bonfire to keep small stock and young animals warm on cold nights.
- Keep animal houses dry and clean, sweeping with a broom made of fresh branches of *Ocimum kilimandscharicum* or *Azadirachta indica*.
- Avoid overcrowding.
- Control for lungworms (2.2.5.1, 2.2.5.2).
- To prevent coughs, moisten dry feed before presenting to animals.

Treatments

- Crush a few leaves of *Aloe secundiflora* and mix with 1 l of water. Leave for 15 minutes. Sieve and present the liquid as drinking water until the animal recovers. (Treatment for all animals.)
- Grind a handful of *Zanthoxylum chalybeum* seed into powder. Put the powder into the animal's mouth and pour 0.5 l of water down the throat to cause swallowing. Repeat once a day for 3 days. (Treatment for camels.)
- Dissolve 0.25 kg of Magadi soda in 2 l of water and give as a drench to the affected animal. Repeat every 4 days until the animal recovers. (Treatment for camels.)
- Crush a few cloves of *Allium sativum* and mix with 0.5 l of water. Use as a drench to help recovery from breathing problems. (For all animals; use 0.5 l for large animals, less for smaller ones.)
- Crush a handful of *Capsicum frutescens* seed and mix with 1 l of water. Present the liquid as drinking water for 2 to 3 days. (Treatment for chickens.)

2.2.7.2. Newcastle disease (fowl pest)

Newcastle disease is a major killer of poultry. The disease can be very severe, especially for young birds. All young birds but only a few adults at a location may die. Many birds die suddenly before showing signs of the disease. Birds are infected through the eggs, faeces and dead bodies of infected birds. Drinking water becomes contaminated. Wild animals and dogs can spread the disease when they carry away dead infected animals. The disease is caused by a virus (*Paramyxovirus*). Other diseases with some similar characteristics include avian coryza and fowl cholera. The disease can cause mild eye infection in humans.

Local names: Buhui (Afar); Kihuruto (Kikuyu); Lukuzu/ Rukuzu (Luhya); Amalda (Kipsigis); Kihuruto (Kikuyu); Oduye (Luo); Marare/ Kipkaiwat (Tugen); Nkiriaroto (Ilchamus); Akiurut angikokoroi (Ngakarimojong); Ikula (Sukuma); Harr (Rendille); Qufaa (Oromo); Kipseret (Pokot).

Signs

- Watery, whitish or greenish bloody diarrhoea with a very unpleasant odour.
- Coughing, sneezing and discharge from the nostrils.
- Distressed breathing.
- Birds stop eating, become weak and stop laying eggs.
- Drooping wings and dragging legs, restlessness and sleepiness.
- Swelling of the head and neck; head and neck twisted to one side; walking in circles.
- Convulsion, paralysis and death.

Inform the officer in charge in the Government Veterinary Department if you suspect that birds have Newcastle disease.

Diarrhoea with an unpleasant smell is a sign of Newcastle disease

Severe cases of Newcastle disease lead to the death of birds

Prevention and control

- Keep sick birds separate from healthy birds.
- In severe cases, kill sick birds and bury them away from healthy birds.
- Clear away faeces from the birds' living area.
- Ensure birds have clean drinking water.

Treatments (May only work with birds with mild infections.)

- Crush a few leaves of *Aloe secundiflora* or *Aloe vera* and soak in 1 l of water. Leave for 30 minutes. Strain off the the liquid and present as drinking water to birds for 3 days.
- Crush 2 handfuls of *Capsicum frutescens* seed and mix with 1 l of water. Present the liquid as drinking water to birds for 3 days. Make afresh every day.
- Crush together 4 or 5 fruit of *Capsicum frutescens,* 1 or 2 leaves of *Aloe secundiflora* and a handful of *Amaranthus hybridus* leaves. Soak in 2 l of water for 6 hrs. Drench each bird with 2 tablespoonfuls twice a day until recovery. Also leave the mixture for birds to drink.
- Crush very hot red or green fruit of *Capsicum frutescens* and leave for sick birds to eat for 2 or 3 days.

CAUTION: Wear hand protection (plastic bags over the hands or surgical gloves) when applying treatments. Wash hands thoroughly with soap and water afterwards to prevent cross-contamination.

2.2.7.3. Avian coryza (infectious coryza)

Chicken and other birds of any age can contract this disease, which can be mild, acute or chronic. It is spread by faecal matter, through contaminated feed and water, and through aerosols. Birds become sick 1 to 10 days after infection. Avian coryza is caused by *Haemophilus* and other bacteria. Other diseases with some similar characteristics include Newcastle disease and fowl cholera.

Local names: Kihuruto (Kikuyu); Amalda (Kpisigis); Oduye (Luo); Marore (Maragoli); Malole (Luhya); Kipkaiwat (Tugen); Nkiriaroto (Itchamus); Malole (Luhya); Emoyiarn enkijape (Maasai); Awala (Ngakarimojong); Ikipei (Samburu, Rendille).

Signs

- Swollen head and face.
- Swollen watering eyes and discharge from the nostrils; discharge from the nostrils is first clear, later white/yellow with a bad odour.
- Distressed, noisy breathing and frequent sneezing.
- Drop in egg production or no eggs.
- Birds shake their heads and stretch their necks out.

Isolate sick birds from healthy birds to prevent spread

Give birds plenty of clean drinking water

Prevention and control

- Isolate sick birds from healthy birds.
- Keep birds in clean conditions and make sure they are well fed.
- Give birds plenty of clean drinking water.
- Birds with severe infection should be destroyed.

Treatments (May only work with birds with mild infections.)

- Crush a few leaves of *Aloe vera* or *Aloe secundiflora* and place in 1 l of water. Present to birds as drinking water.
- Crush together 4 or 5 red fruit of *Capsicum frutescens,* 1 leaf of *Aloe secundiflora* and a handful of *Amaranthus hybridus* leaves and flowers. Soak in 2 l of water for 4 to 6 hrs. Present the liquid to birds as drinking water. If birds refuse to drink, drench adult birds with 2 tablespoonfuls twice a day until they recover. For young birds, drench with one tablespoonful twice a day.

2.2.7.4. Fowl cholera (pasteurellosis)

Chickens and other birds contract fowl cholera through the bacterium *Pasteurella multocida*.

Signs

- As for avian coryza, except birds have severe watery green/grey/yellow diarrhoea and the feathers around the tail become dirty with faeces. The comb and wattle are hot and dark red in severe fowl cholera. Some birds die suddenly without showing other indications of the disease.

Prevention and control

- See Newcastle disease for prevention and control (2.2.7.2).

Treatments

- See Newcastle disease for treatments (2.2.7.2).

2.2.7.5. Contagious pleuropneumonia (bovine and caprine)

This is a disease of cattle and goats and occasionally sheep. In cattle, it is sometimes called contagious bovine pleuropneumonia; in goats, contagious caprine pleuropneumonia. The disease can kill 60 to 100% of the animals in herds. Cattle become sick about a month after infection, goats after 20 to 30 days. Infection comes from the nose discharges of infected animals. The disease is caused by *Mycoplasma* bacteria. Animals that recover from the disease can still carry it deep in their lungs; if they suffer stress, they may become sick again.

Local names: Buhui (Afar); Sombessa (Gabbra); Kyambo (Kamba); Chebwonit (Kipsigis); Aremo (Luo); Olkipei longishu (Maasai, Kenya and Tanzania); Ikipei (Rendille); Mahori (Meru); Ikipei (Samburu); Sambab/ Harwein/ Gesdowr (Somali-Kenya, Swahili); Loukoi (Turkana); Loukoi (Ngakarimojong); Chebuon (Tugen); Rongi-rongi (Ilchamus); Mabuupu (Sukuma); Yera (Rendille); Sombeesa looni/ Sombeesa re'ee (Oromo).

Signs

- Fast, difficult and painful breathing, with grunting.
- Animal lowers its head, places its front legs wide apart and stretches its head forward, trying hard to draw more air into the lungs.
- Body temperature very high.
- Lack of appetite and loss of weight.

- Rough hair texture.
- Dry cough, then yellow discharge from the nose.
- Swelling under the chest.
- Death in cattle 2 to 3 weeks after symptoms in severe cases. Many goats die 4 to 5 days after symptoms appear.

A yellow discharge from the nose is a common sign of contagious caprine pleuropneumonia

Prevention and control

- Keep sick animals separate from healthy animals.
- Large groups of cattle that are stressed are more likely to catch the disease from other animals. Avoid overcrowding.

Treatments (May only work with animals with mild infections.)

- Take 1 fresh fruit of *Solanum incanum,* 2 or 3 fruit of *Capsicum frutescens*, 0.25 kg of fresh *Warburgia ugandensis* bark, and half a teaspoon of crushed limestone (calcium carbonate). Crush together and place in 1 l of warm water. Leave for 15 to 20 minutes. Sieve the mixture and use the liquid as a drench for sick animals. Use 1 l for cattle, 0.5 l for goats, once daily for 2 or 3 days, making fresh mixture each day. (Treatment for cattle and goats.)
- Crush 2 or 3 fruit of *Capsicum frutescens* with 1 fresh fruit of *Solanum incanum*. Place in 0.5 l of water and add half a teaspoon of crushed limestone (calcium carbonate). Leave for 15 minutes. Sieve the mixture and use the liquid as a drench for sick animals. Use 0.5 l for cattle, 0.25 l for goats, once daily for 2 days (Treatment for cattle and goats.)
- Crush a handful of fresh roots of *Harrisonia abyssinica* and place in 1 l of water. Boil for 10 minutes, cool and sieve. Use the liquid as a drench. Use 1 l for cattle, 0.5 l for goats, once daily for 2 days (Treatment for cattle and goats.)

2.2.8. Reproductive and other infectious diseases

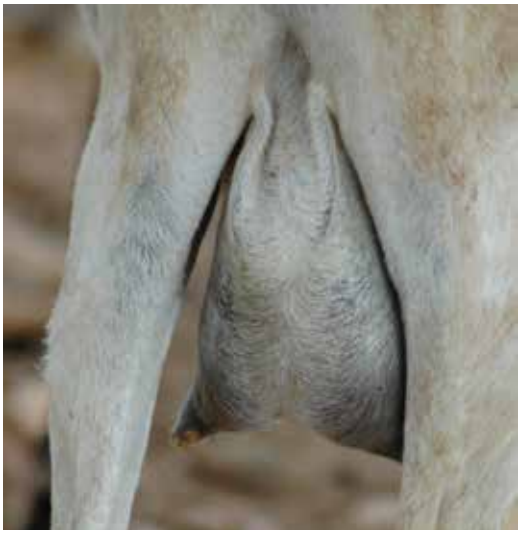
2.2.8.1. Mastitis (inflammation of the udder, sore teats) and contagious agalactia (reduced milk)

Female animals can contract mastitis from injuries to the teats of their udder as they feed their suckling young and/or when they are milked by humans. Mastitis is more common in imported breeds than in local breeds. Contagious agalactia (severe mastitis) can be contracted by contact with infected animals. It is a bacterial infection caused by *Mycoplasma agalactiae*. Young animals can contract contagious agalactia from drinking infected milk.

Local names: Angulekima (Afar); Yele (Embu); Hiha goru (Gabbra); Miatapkinai (Kipsigis); Lifuuti (Maragoli); Nolkina (Samburu); Candhobarar (Somali-Ethiopia); Candabarar (Somali-Kenya); Loebeta (Turkana); Ugonjwa wa mawele na matiti/ Kititi/ Upungufu wa maziwa (Swahili); Ebuunit aaket (Ngakarimojong); Dhukkubaamuchaa/ Nyaqarsaa (Oromo); Nranu (Sukuma); Ejani (Maasai-Tanzania).

Signs

- Animals produce less milk, which is in abnormal in colour, consistency (lumpy, watery) and smell; sometimes the milk is stained with blood and is pink.
- Swollen, red and tender teats; sometimes with wounds, abscesses and cracks; the udder can feel hot when touched.
- The animal is restless when milked or suckled by young.
- The udder sometimes contains hard lumps that are painful to the animal when touched.
- In cases of severe mastitis, the udder can become dark blue/black and feels cold when touched.
- If contagious agalactia is not treated, the animal stops producing milk, becomes weak, tired and feverish, and stops eating.
- Other signs of contagious agalactia include swollen joints and lameness, a clear discharge from eyes, blindness, and pneumonia in young animals.



Mastitis causes inflammation of the udder and teats

Prevention and control

- Isolate sick animals from healthy animals.
- Keep the animal enclosure clean.
- Gently rub the teats of animals before they are milked/suckled.
- Wash the udder and teats with clean water, and dry with a clean cloth, before milking. Wash again afterwards.
- After milking, keep animals standing in a clean area for an hour (to allow teats to completely close).

Treatments (Express milk from animals before treatment.)

- Pound a handful of *Ajuga remota* leaves and stems and add a little water to make a paste. Apply directly onto the udder once a day for 7 days. (Treatment for all animals.)
- Sieve wood ash remaining from cooking to produce a powder. Mix with water to produce a paste. Apply the paste to the udder of the cow. Repeat daily until the condition has cleared. (Treatment for cattle.)
- Crush a handful of leaves of *Sesbania sesban* and mix with a quarter of a cup of warm butter or cream. Leave for 5 to 10 minutes and then rub the mixture on the affected area. Repeat daily until the condition has cleared. (Treatment for cattle, goats and sheep.)
- Burn dry dung from cattle or donkeys in a pot placed under the udder of the sick animal until it sweats. Repeat twice a day until the animal's condition improves. (Treatment for cattle and goats.)

CAUTION: In order not to spread infection, wash hands before and after handling animals with mastitis.

2.2.8.2. Retained placenta (retained afterbirth)

The placenta should be discharged soon after an animal gives birth. Sometimes it stays inside the animal, where it can rot. Retention can be caused by disease or by a difficult birth. Untreated animals may die.

Local names: Poroet (Kipsigis); Dilluu ittifamtee (Oromo); Engirangata e lashe/ Olekae ashe (Maasai-Kenya); Engiragata oloshe/ Eguseti/ Emudong'u (Maasai-Tanzania); Lihanda lyo muriiko (Maragoli); Ngitorunoto e lashe (Samburu); Mader ceshi (Somali); Kutokutoga kando ya nyumba (Swahili); Ng'humbi ilihanze na itungilu lya ng'wana (Sukuma); Parwa (Pokot); Mudong (Ilchamus); Barua ni majono(Tugen); Angasep (Ngakarimojong); Mederjesei (Rendille).

Signs

- The placenta has not been discharged 12 hours after giving birth.
- The placenta hangs from the vulva and looks and smells rotten.

The placenta should discharge soon after birth

A discharged goat placenta

Prevention and control

- Encourage new-born animals to suckle from their mother as soon as possible. This helps the uterus to contract and squeeze the placenta out.

Treatments

- Wash hands and an arm with soap and water, insert the arm into the vagina, grip the placenta and gently pull it out. If possible, wear a clean plastic bag or surgical glove over the inserted hand during the procedure. If the placenta does not pull out easily, leave it there and use one of the treatments below (otherwise, the uterus may be damaged by pulling).
- Pound 0.5 kg of *Moringa stenopetala* bark and mix with 1 l of warm water. Sieve and give the mixture as a drench to animals. Use 1 l for a cow, 0.5 l for a sheep or goat. Repeat until the placenta is discharged. (Treatment for cattle, sheep and goats.)
- Crush 0.5 kg of *Salvadora persica* roots and soak in 1 l of water for 12 hours. Use the liquid as a drench. Give 1 l to large stock, 0.5 l to smaller animals. Repeat daily until the placenta is expelled. (Treatment for all livestock.)
- Place a handful of fresh stems of *Cissus quadrangularis* and half a cup of wood ash in 0.5 l of water. Leave for 10 to 15 minutes. Sieve and give the liquid as a drench to animals, 0.5 l for large animals and 0.25 l for small stock. Administer twice a day until the placenta is discharged. (Treatment for all livestock.)
- Crush 0.5 kg of roots or bark of *Balanites aegyptiaca* and place in 1 l of water. Boil for 10 minutes. Cool, sieve and drench with 1 l for cows, donkey and camels, 0.5 l for sheep and goats. Repeat once. (Treatment for all livestock.)
- Crush 0.25 kg of fresh leaves and 0.25 kg of fresh roots of *Harrisonia abyssinica* and boil for 15 to 20 minutes in 1 l of water. Cool, sieve and drench the affected animal with all of the liquid. The placenta should be discharged between 1 and 2 hours later. (Treatment for cattle.)
- Cut into small pieces and crush 0.5 kg of root bark of *Acacia drepanolobium*. Soak in 2 l of water overnight and then boil until the water turns reddish-black. Allow to cool and present to the affected animal as drinking water. The placenta should be discharged between 1 and 3 hours later. (Treatment for camels and goats.)
- Crush 10 large leaves of *Carica papaya* and place in 2 l of water. Drench large animals with 1 l of the liquid in the morning and 1 l in the evening. Use half this dose for small stock. The next day the placenta should be discharged. (Treatment for all animals.)

- Take 0.5 kg of fresh roots of *Ricinus communis* and 1 teaspoonful of Magadi soda and boil in 1 l of water for 10 to 15 minutes (until the water turns green). Cool and present to the affected animal as drinking water. The placenta should be discharged between 1 and 3 hours later. (Treatment for camels, sheep and goats.)
- Pound 2 kg of fresh leaves and 0.25 kg of roots of *Grewia villosa* and soak in 10 l of water for 6 hours. Drench with 4 l of the mixture for cattle, donkeys and camels, 2 l for sheep and goats, once only. (Treatment for camels, cattle, donkeys, sheep and goats.)

2.2.8.3. Brucellosis (contagious abortion)

Brucellosis is a disease that causes abortion. It can also cause infertility in both female and male animals. Cattle, sheep, goats and camels can all contract the disease, caused by the bacteria *Brucella abortus*. The most common route of infection is when new, infected animals are brought into a herd. Aborted foetuses, foetal membranes, vaginal discharge, milk, colostrum, faeces and urine from infected animals can all lead to infection. Brucellosis may spread to many females in a group that then abort at the same time. Humans can contract brucellosis by drinking the milk and blood of sick animals and by exposure to aborted animals.

Local names: Kuvuna (Embu); Salesa (Gabbra); Muhuno/ Kihuna (Kikuyu); Olikibiroto (Maasai, Kenya and Tanzania); Koyoos (Kipsigis); Luhuusidza (Maragoli); Sutonik (Nandi); Ikiboroto/ Nkibiroto (Samburu); Dhies (Somali-Ethopia); Kukenangala/ Kukenya (Sukuma); Akiyech (Turkana); Ugonjwa wa kutoa mimba (Swahili); Gatachiisa/ Dhukkubaasalleessaa (Oromo); Abwangun (Ngakarimojong).

Signs

- Foetuses abort, usually after 5 to 6 months for cows. Retention of the placenta afterwards.
- Birth of a dead calf at full term. Retention of the placenta afterwards.
- Bulls often have swollen joints and very hard, swollen testicles. The swelling lasts for a long period and when it reduces the animal is usually sterile.
- In cows, infection of the uterus can cause sterility.

Inform the officer in charge in the Government Veterinary Department if you suspect brucellosis.

Pregnant goats often contract brucellosis and abort as a result

Prevention and control

- Isolate animals that have had abortions from healthy animals for 3 weeks.
- Dispose of anything contaminated with the infection, preferably by burying it.
- Kill and burn or bury animals that carry severe infection.

Treatments

- Crush 0.5 kg of fresh roots of *Salvadora persica* and boil in 5 l of water for 1 hour. Cool, sieve and use the liquid as a drench for animals that have aborted. Use 2 l for cows, 1 l for goats and sheep. Drench once only. (Treatment for cattle, goats and sheep.)
- Take 2 kg of dry *Kigelia africana* fruit and grind into a fine powder. Mix with 1 kg of powdered horse bone and 18 kg of salt. Present as a supplement to affected animals every day for 1 month. (Treatment for all animals.)

CAUTION: To prevent human infection, wear hand protection (plastic bags over the hands or surgical gloves) when applying treatments or when handling aborted foetuses, infected placenta, etc. Wash hands thoroughly with soap and water after handling affected animals. Boil milk and cook blood before human consumption when a herd is infected.

2.2.8.4. Venereal diseases

Venereal diseases are spread by sexual contact. They include metritis and sheath rot, which are dealt with further in the sections following this (2.2.8.5, 2.2.8.6).

Local names: Gaudile (Gabbra); Kipsununut (Kipsigis); Nyach (Luo); Kisununu (Maragoli); Nkula naaibor (Samburu); Jabto (Somali); Bunyolo (Sukuma); Eloro (Turkana); Olbolbol/ Olpaee (Maasai-Kenya); Orborboli (Maasai-Tanzania); Angac (Ngakarimojong); Dhibee hormaata saala (Oromo).

Signs

- Abortion and delayed breeding; females do not become pregnant after mating.
- Cows abort before the 4th month of pregnancy.
- White discharge from the vulva of females (see 2.2.8.5).
- Male animals may not show any signs of disease initially.
- Discharge from the penis of male goats and sheep in severe cases (see 2.2.8.6).

Prevention and control

- Isolate infected males from females.
- Select and buy new stock carefully.
- Slaughter infected males or remove them from the herd to prevent them from mating.

Treatments

- Dry 0.25 kg of leaves of *Acalypha fruticosa* in the sun and crush into a powder. Apply directly to the birth opening (vulva) of the female animal. (Treatment for cattle, camels, donkeys, goats and sheep.)
- Take the soft inner bark of *Acacia oerfota* and fold into a small ball. Tie with a string and insert into the birth canal, with the end of the string hanging out of the vulva. Leave overnight and remove the next day. (Treatment for all livestock.)
- Squeeze the juice from a leaf of *Aloe secundiflora* and apply directly to the genitalia. (Treatment for goats, sheep and donkeys).
- Soak a handful of inner bark of *Acacia drepanolobium* in 1 l of water for half an hour. Wash the animal's genitalia with the infusion. Repeat once a day until the animal recovers. (Treatment for cattle, goats and sheep.)
- Wash the animal's genitalia with warm water mixed with Magadi soda or ordinary salt. Take the paste from crushed *Azadiracta indica* seed and apply. Repeat once a day until the animal recovers. (Treatment for all animals.)

CAUTION: Wear hand protection (plastic bags over the hands or surgical gloves) when applying treatments. Wash hands thoroughly with soap and water afterwards to avoid infection.

2.2.8.5. Metritis (infected uterus and vaginal discharge)

Metritis is a type of venereal disease caused by a bacterial infection. Animals may contract metritis after they have given birth, when the vagina or cervix has been damaged. Infection enters the uterus through the vagina, and can be more likely when an animal gives birth in a dirty location. Animals can also contract the disease when the placenta is retained after giving birth.

Local names: See under 2.2.8.4.

Signs

Mild infection:

- A cloudy white discharge from the vulva, which does not smell particularly badly.
- The animal does not show any signs of sickness or fever.

Severe infection:

- Yellow or dark brown discharge from the vulva that smells very badly.
- The animal is feverish, very sick and stops eating.
- The animal lies down and will not stand up.
- Sometimes the animal dies after a few days.
- Animals that recover may become infertile.

Cloudy white vaginal discharge from a goat infected with metritis

Prevention and control

- Ensure the location where an animal gives birth is clean and dry.
- Wash your hands and arms and wear plastic bags or gloves if inserting your hand into the animal's body to help in giving birth.

Treatments

- As for 2.2.8.4.

2.2.8.6. Sheath rot (discharge from the penis)

Most male livestock can contract sheath rot, caused by a bacterial infection. Goats and sheep are more affected than other animals. The disease normally clears over a few weeks.

Local names: See under 2.2.8.4.

Signs

- Waxy scabs and wounds on the penis sheath that ooze pus.
- A white or yellow discharge from the penis.

Prevention and control

- Separate infected males from the rest of the herd.

Treatments

- Apply the last three treatments as for 2.2.8.4.

2.2.8.7. Foot-and-mouth disease

Cattle, camels, sheep, goats and pigs can all contract this disease, which is one of the most infectious diseases of livestock and caused by *Apthovirus.* The disease is spread by direct contact with infected animals. Feed and water become contaminated by the saliva of infected animals and the disease is also spread inadvertently by humans. The disease usually lasts about a month, but can last longer. It often kills young animals. Exotic breeds of cattle suffer from the disease more severely than local breeds.

Local names: Annaso (Afar); Oyale (Gabbra); Ngworek (Kipsigis); Muguruma (Kikuyu); Muthingithu (Kamba); Ngworek (Kipsigis); Achany (Luo); Loirobi/ Olorobi (Maasai, Kenya and Tanzania); Azuya (Maragoli); Ikulup (Samburu); Dila (Somali-Ethopia); Labeb (Somali-Kenya); Ugonjwa wa miguna na mdomo (Swahili); Lojaala (Turkana); Ejota (Ngakarimojong); Bugigi (Sukuma); Afturo (Rendille); Nremen (Pokot); Ooyyalee (Oromo).

Signs

- Blister-like sores and ulcers on the udder, teats, feet, inside the mouth, on the nose muzzle and on the tongue. When blistering around the hoof is very bad the hoof may fall off.
- Lameness. Usually, all four feet are painful.
- Loss of appetite, high fever and weakness.
- Drooling and smacking of the lips.
- Rough, dull coat.
- Reduction in milk production.
- Pregnant animals often abort.

Blister-like sores around a young goat's mouth

Prevention and control

- Keep infected animals well away from healthy animals.
- Encourage infected animals to eat, give soft green feed which is easy to chew.
- Give infected animals plenty of water, and shade them from the hot sun.
- Burn or bury animals that have died from the disease.
- Stop taking sick animals for grazing until they have recovered.
- Avoid herding in hard, rocky areas.

Treatments

- Mix 0.5 kg of Magadi soda with 5 l of water. Drench animals with this solution. Use 5 l for cattle and camels, 2.5 l for calves, sheep and goats. Repeat twice a day until the animal recovers. (Treatment for camels, cattle, sheep and goats.)
- Pound 0.25 kg of fresh roots and 0.25 kg of fresh leaves of *Vernonia amygdalina* and mix with 4 kg of finger millet flour in 5 l of water. Sieve and drench animals with the liquid. Use 2 l for cattle and camels, 1 l for calves, sheep and goats. Repeat twice a day until the animal recovers. (Treatment for camels, cattle, sheep and goats.)
- Grind 0.5 kg of dry *Acalypha fruticosa* leaves into a powder. Apply a teaspoonful to each foot wound. Repeat every 2 days until the animal recovers. (Treatment for all animals.)
- Pound a handful of fresh leaves of *Vernonia amygdalina* and mix with 0.5 l of ghee. Apply the paste to the animal's blisters/sores/ulcers twice a day until they heal. (Treatment for donkeys, cattle, sheep and goats.)
- Extract the juice of crushed leaves and fruit of *Solanum incanum* and apply directly to foot sores. (Treatment for all animals.)
- Crush 0.5 kg of fresh root of *Acacia tortilis* with 0.3 kg of fresh bark of *Acacia oerfota*. Boil in 1 l of water for 10 to 15 minutes. Drench the sick animal morning and evening with 0.5 l of the liquid for 3 days (Treatment for sheep and goats.)

CAUTION: The disease is easily transmitted from animal to animal by humans. Wear hand protection (plastic bags over the hands or surgical gloves) when applying treatments. Wash hands thoroughly with soap and water afterwards.

2.2.8.8. Anthrax

Anthrax is a highly infectious disease caused by the bacterium *Bacillus anthracis* that can be contracted by both livestock and humans. Cattle, sheep and goats contract anthrax most often, camels, dogs and donkeys sometimes. Pigs contract the disease but not as severely. The disease does not affect chickens. Animals become infected by ingestion or inhalation during grazing from soil where infected animals have previously grazed and left anthrax spores. These spores can survive for a long time in the soil. Some animals, especially camels, become infected when they are bitten by flies that carry the disease. Animals become sick 12 to 24 hours after infection. Animal often collapse and die before signs of the disease are noted.

Local names: Geno (Afar); Chimale (Gabbra); Bursta (Kipsigis); Likenji (Maragoli); Lokuchum (Samburu); Kut (Somali); Imetha (Swahili); Busatu bo kutuma mining ng'ombe pyeumili (Sukuma); (Sukuma); Enomokere (Turkana); Koroitab koristo (Tugen); Korkor (Ilchamus); Entemelua (Maasai-Kenya); Entemulokie (Maasai-Tanzania); Lopid (Ngakarimojong); Abba sangaa (Oromo).

Signs

- Very high fever and blood in the urine, faeces or milk.
- Difficulty breathing.
- Collapse and death after 1 to 3 days.
- Cattle have swelling under the jaw, sometimes under the neck and of the abdomen.
- In dead animals, dark blood sometimes comes from the nose, mouth, ears, anus and vagina; the dead animal's blood does not clot.
- The carcass is bloated and normally becomes rigid 1 to 12 hours after death.

Inform the officer in charge in the Government Veterinary Department if you suspect that an animal has anthrax.

Isolate sick animals that show signs of anthrax from the herd

Traditionally, pastoralists apply hot powdered ash of *Balanites aegyptiaca* to the animal's skin at the early signs of anthrax

Prevention and control

- Isolate sick animals from healthy animals.
- Burn or deeply bury (1 to 2 m) the carcass of an animal believed to have died from anthrax.
- During burial, sprinkle Magadi soda on the carcass and the burial site. Also bury soil contaminated with the blood of the dead animal.
- Choose a burial site far away from sources of animal and human drinking water.
- Fence off the area where the animal died.

CAUTION: Do not open the carcass of an animal that is believed to have died from anthrax or eat its meat.

Treatments (Animals often die too quickly for treatment to be administered. However, when some animals within a group die of anthrax, watch the others carefully for 1 to 2 weeks and treat immediately any that develop fever.)

- Pound 0.5 kg of fresh roots and 0.5 kg of fresh leaves of *Salvadora persica* and boil for 30 minutes in 8 l of water. Present as drinking water until the animal recovers. (Treatment for all animals.)
- Crush 0.25 kg of fresh fruit of *Grewia villosa* and boil in 1 l of water for 15 minutes. Pour the warm solution over the affected animal once every morning for 4 days. (Treatment for all animals.)
- Take the warm powdered ash of *Balanites aegyptiaca* wood and rub on the body of the sick animal. Repeat daily for 3 days. (Treatment for cattle, camels, sheep and goats.)

CAUTION: To prevent human infection and animal cross-infection, wear hand protection (plastic bags over the hands or surgical gloves) when applying treatments. Wash hands thoroughly with soap and water afterwards.

2.2.8.9. Footrot

Footrot, caused by bacteria including *Fusiformis necrophorus,* is a common condition of cattle and sheep, rarely of goats. It is most prevalent under wet conditions such as seasonal rains. Animals become infected when walking in wet muddy locations. Foot injuries increase infection.

Local names: Bargao (Gabbra); Moeet (Kipsigis); Abok (Luo); Elelei (Maasai); Bulwaye vwe tsimbagayu (Maragoli); Ngojini (Samburu); Raaf-dila (Somali-Ethiopia); Rafqarir (Somali-Kenya); Ekichodunu (Turkana); Afturo (Rendille); Annaso (Afar); Ooyyalee (Oromo); Ajome (Ngakarimojong); Bugigi (Sukuma).

Signs

- Swollen foot just above the hoof.
- Sudden lameness in a foot or feet.
- Whitish, rotting tissue and pus between the two parts of the hoof, which has a bad odour.
- Loss of appetite due to pain, loss of weight and weakness.
- Fever.

Prevention and control

- Isolate animals with severe infection from healthy animals.
- Keep animals away from wet areas; standing on sandy and dry areas is better.
- The floor of animal enclosures and houses should be kept clean and dry.

Treatments (Before applying any treatment, wash the foot with hot water, especially the skin between the claws of the hoof, and gently trim away any decayed part of the hoof to remove/expose infection.)

- Pound a handful of fresh *Vernonia amygdalina* leaves and mix with half a cup of ghee or animal fat. Apply this paste between the claws of the affected hoof twice a day until it heals. (Treatment for cattle, sheep and goats.)
- Grind 0.5 kg of dry leaves of *Acalypha fruticosa* into a powder. Put 1 teaspoonful of the powder directly on to the wound. Repeat on alternate days until the animal recovers. (Treatment for all animals.)
- Wash the affected foot with warm salty water twice a day until the animal recovers. (Treatment for all animals.)
- Apply used engine oil or brake fluid twice a day for 1 week. (Treatment for all animals.)

2.2.9. Injuries, simple operations and emergencies

2.2.9.1. Wounds

Cuts and breaks in the skin have multiple causes, including fighting, insect and tick bites, thorns, predators, skin infections and injuries caused by humans (poor tethering, whipping, saddle sores, burns, etc.). Untreated wounds may become infected with diseases or infested with maggots.

Local names: Galidele (Afar); Gubata (Gabbra); Adhola (Luo); Itau (Kamba); Moetet (Kipsigis); Ingwaagu (Maragoli); Ngolonyot/ Ibaa(Samburu); Boog (Somali); Nhondo (Sukuma); Ngajemei (Turkana); Vidonda (Swahili); Ajome (Ngakarimojong); Enkiroda (Maasai-Kenya); Enkidoda (Maasai-Tanzania); Ilpai (Ilchamus); Madda/ Muramuugogaa (Oromo); Giss (Rendille).

Signs

- Bleeding and pus.
- Dirt collects around the affected area.
- Red and swollen skin.
- Pale mucous membrane if significant bleeding.

Wounds on a donkey's legs and back caused by whipping

Rope damage on a cow's legs

Prevention and control

- Keep sharp objects out of animal enclosures and houses.
- Avoid overcrowding animals.
- Protect animals from predator attack.
- When tying animals, use thick rather than thin ropes and do not tie too tightly.
- Avoid whipping wounded animals on their wounds.
- Treat skin infections immediately.
- Sterilise knives used for castration by holding them over a hot flame. Allow to cool before using.

Treatments

Before applying the below treatments, for fresh wounds first stop bleeding by pressing a clean, wet cloth over the wound. Then wash the wound with clean water containing a pinch of salt, and clip hair or wool away from the edges of the wound. For older wounds that have not properly healed, cut away scab material from around the wound.

- Take 0.25 kg of crushed *Ricinus communis* seed and heat to extract the oil. The dry leaves of *Ricinus communis* can also be used after being crushed into a powder. Apply the oil or leaf powder to the wound, repeat daily until it heals. (Treatment for all animals.)
- Dry a piece of *Adenium obesum* bark and crush into a powder. Apply the powder to the wound and cover with a piece of cloth until it has healed. (Treatment for all animals.) **CAUTION: *Adenium obesum* is very poisonous and should be handled with care. Wear plastic bags over the hands or surgical gloves when handling and applying. Keep out of reach of children and prevent animals from licking the treated area.**
- Crush a leaf of *Aloe secundiflora* and apply the pulp to the wound. Repeat the treatment daily until the wound has healed. (Treatment for cattle, donkeys, sheep, goats and dogs.)
- Take fresh sap from *Euphorbia candelabrum* and apply directly to the wound. Repeat daily until the wound heals (Treatment for cattle, donkeys, sheep and goats.)
- Take a handful of fresh bark of *Elaeodendron buchananii* and soak in water for 1 to 2 hours. Apply the liquid to the wound once a day until it heals. (Treatment for all animals.) **CAUTION: *Elaeodendron buchananii* is very poisonous and should be handled with care. Wear plastic bags over the hands or surgical gloves when handling and applying. Keep out of reach of children.**
- Crush a handful of bark of *Acacia etbaica* or *Acacia bussei* and mix with 1 l of water. Leave for 1 to 2 hours. Drop the liquid onto the wound and repeat daily until it heals. (Treatment for all animals.)

- Crush *Bulbine abyssinica* leaves and apply the juice and pulp to the wound. Repeat 2 or 3 times a day until the wound heals. (Treatment for cattle, sheep and goats.)
- Pound a handful of dry *Myrsine africana* seed into a powder. Apply the powder directly to the wound. Alternatively, mix 0.25 kg of the powdered seed with half a cup of sheep fat. Boil and then allow to cool. Pour the mixture onto the wound before the fat sets. Repeat either treatment daily until the wound heals. (Treatment for camels, cattle, sheep and goats.)
- Crush very young branches of *Croton megalocarpus* or *Croton macrostachyus* and collect the sap. Apply the sap to the wound. Repeat once a day until the wound heals. (Treatment for cattle and goats.)
- Take a handful of gum from *Commiphora erythraea* or *Commiphora myrrha* and a handful of *Acacia senegal* gum. Add 0.25 l of water to the gum and make a paste. Apply to the wound. *Acacia senegal* gum helps dry the wound and *Commiphora* gum controls bleeding, repels flies and assists healing. (Treatment for camels, cattle, sheep and goats.)

2.2.9.2. Abscesses

An abscess is a collection of pus at a localised site anywhere on the skin or within an animal's body, often resulting from a bacterial infection due to bites, cuts or skin punctures.

Local names: Tantidelaie (Afar); Matoo (Embu); Mala (Gabbra); Muhuhu (Kikuyu); Muimu (Kamba); Bur (Luo); Qanyaraa (Oromo); Masunguti (Maragoli); Ntubui (Samburu); Mal (Somali-Ethiopia); Bahtin (Somali-Kenya); Lobus (Turkana); Abuth/ Abus (Ngakarimojong); Simbiryon (Tugen); Nkee ya elchomi (Ilchamus); Ekimeeto (Maasai-Kenya); Enkimaito (Maasai-Tanzania); Giss (Rendille); Ibute (Sukuma).

Signs

- Abscesses often start as hard, hot swellings, which later become painful and gather pus.
- Abscesses burst open and release the pus.
- Hair is lost around burst abscesses.

Prevention and control

- Treat wounds immediately so that they do not become infected.
- Try to keep browsing animals away from thorny bushes.
- Do no keep sharp objects within animal enclosures and houses.

Treatments

To ripen abscesses:

- Take 4 leaves of *Datura stramonium,* crush 2 of them and heat the other 2 over a fire. Apply the crushed leaves to the swelling and place the heated leaves on top. Tie on with a bandage. Repeat 2 to 3 times a day until the swelling ripens. Then squeeze the abscess gently to burst it (or pierce the skin over the abscess with a sharp knife) and release the pus. Clean the wound and again apply crushed *Datura stramonium* leaf. (Treatment for all animals.)
- Pound a handful of leaves of *Harrisonia abyssinica* and mix with 0.25 kg of warm ghee or animal fat. Apply directly to the abscess twice a day until it ripens. Then squeeze the abscess gently to burst it and release the pus. Apply a bandage to prevent the animal licking the site during and after treatment. (Treatment for all animals.)
- Take fresh cow dung and make into round or oval shaped cakes or patties that fit in the palm of the hand. Heat over a fire and place on the abscess. Repeat once a day until the abscess ripens. Then squeeze the abscess gently to burst it and release the pus. (Treatment for cattle, sheep and goats.)
- Heat a hard, iron object and apply when hot to the abscess until the hair is burnt off. Make a small cut and press out the pus. (Treatment for all animals.)

Treating the wounds caused by abscesses:

- Take a handful of *Commiphora erythraea* gum, add 50 ml of water and heat until the mixture boils. Cool and apply warm to the abscess wound. Apply once only. (Treatment for all animals.)
- Wash the wound with warm salt water. Pound a handful of fresh *Azadirachta indica* leaves and apply. (Treatment for all animals.)

CAUTION: To prevent cross-infection, wash hands, and any equipment (e.g., knives) used to treat the abscess, thoroughly with soap and water afterwards.

2.2.9.3. Castration

Closed and open methods of castration are practiced. Both are best practiced on young animals. Castration is carried out to prevent breeding, make animals less aggressive and to increase the rate of weight gain. Castration is best carried out in the dry season when flies are less prevalent.

Local names: Gakaramba (Embu); Kolansiti (Gabbra); Kuhakura (Kikuyu); Kilat (Kipsigis); Khulata (Maragoli); Rocho (Luo); Aukaba/ Guakuru (Meru); Ngelemata (Samburu); Dhufan (Somali-Ethiopia); Uhasi/ Hasi (Swahili); Kusula (Sukuma); Akldougi (Turkana); Kolaasuu (Oromo); Sibnan (Rendille); Engidong'oto (Maasai, Kenya and Tanzania).

Carrying out castration

Restraining the animal:

- Make the animal lie down.
- One person should hold the front legs and neck of the animal, while another should hold the rear legs, during the procedure.

Closed castration methods:

- Pull both testicles down in the scrotum. Tie a string tightly around the upper part of the scrotum close to the animal's body. Remove the string after 3 weeks. (Method for camels, cattle, sheep and goats.)
- Hold the testicles tightly within the scrotum. Put a piece of wood below the scrotum. Take another piece of wood and crush the cord that links the testicle to the rest of the animal's body (the 'spermatic cord'). The procedure may be carried out one testicle at a time. Do not crush the cord too near the testicle. (Method for camel, cattle, sheep and goats.)

Open castration methods (first sterilise in a flame the sharp knife/razor blade used for the procedure):

- Pull the testicle tightly downwards in the scrotum. Make a cut down the side of the scrotum, avoiding the blood vessels, and squeeze the testicle out. Push back the fatty membrane that covers the testicle and cut the spermatic cord, or wind it around the fingers and pull it until it snaps. Repeat the procedure for the other testicle. (Method for cattle, goats, sheep and donkeys).
- In chickens, make a cut in the abdomen, pull the testicles out, and cut them off. (Method for poultry.)

Treatments (For the wounds caused by open castration; in all cases, first wash wounds with warm water.)

- Crush a leaf of *Aloe secundiflora* and collect the juice. Apply 1 teaspoonful of the juice to the wound and then dust it with ash. Repeat daily until the wound heals. (Treatment for all animals.)
- Chop and crush a handful of fresh *Elaeodendron buchananii* bark and mix with 0.25 l of water. Apply the liquid to the wound once a day for 4 to 5 days until the wound heals. (Treatment for all animals.) **CAUTION: *Elaeodendron buchananii* is very poisonous and should be handled with care. Wear plastic bags over the hands or surgical gloves when handling and applying. Keep out of reach of children.**
- Take fresh leaves of *Acalypha fruticosa* and dry in the sun. Pound to a powder and sprinkle on the wound. Repeat after every 3 days until the wound heals. (Treatment for all animals.)

The closed castration method being carried out on a goat

The open castration method. A cut must be made down the side or at the bottom of the scrotum and the testicle is then squeezed out

2.2.9.4. Broken bones (fractures)

Closed fractures occur when broken bones remain inside the skin, open fractures when the broken bones pierce the skin. Single breaks are termed simple fractures, while multiple breaks are termed compound fractures. Fractures above the knee or elbow or compound fractures that affect the joints of cattle and camels may be difficult to treat. Such animals are better slaughtered for meat.

Local names: Kuvenia (Embu); Chachaba (Gabbra); Kunika mahindi (Kikuyu); Itulika (Kamba); Koil (Kipsigis); Tur (Luo); Lafee caphxee/ Lafee dayyaatee (Oromo); Vyasia/ Vuvuni (Maragoli); Ngilata e loito (Samburu); Jab (Somali-Ethiopia); Kubudika iguhwa (Sukuma); Abila (Turkana); Kivinjo/ Kuvinjiga Kka mifupa (Swahili); Endarata-ooloik (Maasai-Kenya); Engilata oloiki/ Endarata (Maasai-Tanzania).

Signs

- The animal limps and holds a broken leg off the ground.
- The animal lies down and is unwilling to get up or walk.
- The affected limb is painful and the fracture can be felt on examination.
- A cracking sound may be heard when the fractured bone or bones are moved.
- Swelling is observed around the fracture.
- Reduced appetite.

A goat with a fractured leg

An animal limping due to a leg fracture

A sheep with a leg injury holds its leg off the ground

Prevention and control

- Herd animals away from public roads to prevent accidents.
- Animal enclosures and houses should have flat, rough-surfaced floors.
- Try to avoid taking animals for grazing on slippery or steep areas.

Treatment (For fractures below the knee or elbow; treatment for camels, donkeys, cattle, sheep and goats)

1. Before restraining the animal, collect together the materials needed for treatment (see below).
2. Restrain the animal with the help of others to hold it and/or by tying it.
3. If the area around the broken bone is swollen, dip a cloth in warm salt water and press it against the swelling. Alternatively, pound fresh leaves of *Vernonia amygdalina* or *Vernonia auriculifera* and apply the mixture to the area. If the skin is torn, wash the affected area with warm salt water and remove matted hair. Rub butter around the affected area.
4. Align the bones back into their normal positions and wrap with a piece of cloth to keep the bones in position. Place two strong pieces of splint around the broken bone and tie together with bandage, without restricting blood flow.
5. Retain the animal in a confined area for 2 days or until it starts to walk. Provide good quality feed and water.
6. Examine the fracture after 1 week. If the fracture has not healed, repeat the treatment and check again after a further 2 weeks.

Two pieces of splint for setting a broken bone

Splints tied together with a piece of cloth around a break

2.2.9.5. Poisoning

Poisoning can be the result of exposure to agricultural chemicals that have been misapplied (pesticides, animal dips, etc.), to toxic plants and to snake or scorpion venom, among other sources. Poisonous plants include *Adenium obesum, Calotropis procera, Capparis tomentosa, Datura stramonium, Lantana camara and Ricinus communis.* Some plants such as cassava release cyanide (if not properly treated). Aflatoxin is a poison produced by the fungus *Aspergillus flavus* that grows on badly dried groundnut meals.

(The particular case of snake bites is dealt with in 2.2.9.6.)

Local names: Sinilisie (Afar); Urogi (Embu); Thumu (Kikuyu); Shunki (Gabbra); Sumu (Kipsigis, Somali-Ethiopia, Swahili); Sum (Luo); Vusungu/ Isumu (Maragoli); Sayet (Samburu); Biir (Somali-Kenya); Esayiet (Maasai, Kenya and Tanzania); Lesana (Pokot); Ngov (Rendille); Hadhaahoriimiidhu (Oromo); Ekitubon/ Akook (Ngakarimojong); Sumu (Sukuma).

Signs (any of the following)

- Bloated stomach, abdominal pain and kicking of the abdomen.
- Groaning, bleating.
- Foaming at the mouth, drooling and vomiting.
- Excitement, depression.
- Lack of co-ordination, jumping, unusual movements, stiffness and weakness.
- Fits, shivers, convulsions.
- Difficulty in breathing.

- Excessive sweating.
- Uncontrolled urination and severe diarrhoea with blood.
- Paralysis, loss of consciousness and death.

Uncontrolled urination is one of the signs of poisoning

Too high a concentration of chemical in dips and sprays can cause poisoning

Plant poisoning causes severe stomach pains and diarrhoea in this baby goat, which groans and bleats as a result

Prevention and control

- Follow the manufacturers' instructions on the application of agricultural chemicals.
- Store such chemicals away from animals.
- Avoid taking animals to drink from ponds that are contaminated by poisonous blue-green algae.
- Provide plenty of drinking water before dipping livestock.
- Try to prevent animals from browsing on toxic plants.

Treatments

- Mix 1 kg of ground charcoal with 2 l of fresh milk and 2 l of water. Drench cattle with 4 l of the mixture, calves, sheep and goats with 2 l. Drench once daily until the animal recovers. (Treatment for cattle, sheep and goats.)
- Drench cattle with 6 l of milk, use 2 l for calves, sheep and goats. (Treatment for cattle, sheep and goats.)
- If a dog has been poisoned, pour 10 ml of concentrated salt solution into the back of its throat to cause vomiting.
- If an animal's skin has been exposed to poison, thoroughly wash it with soap and water.

2.2.9.6. Snake bite

Snakes bite all animals, dogs quite commonly. Some snakes spit poison into the eyes' of animals. Some East African snakes are highly venomous and bites are fatal.

Local names: Kwich thoul (Luo); Kulumwa nenzoka (Maragoli); Onyoto-yalasurai (Samburu); Akonyat-emun (Turkana); Akanyet-emum/ Akanyet ke emun (Ngakarimojong); Kuumwa na nyoka (Swahili); Alasuray (Maasai, Kenya and Tanzania); Hidduu bofaa hadhaa qabu (Oromo).

Signs

- Restlessness, lack of co-ordination and stop feeding.
- Sweating, swelling at the site of the bite, bleeding from the bite in some cases.
- Foaming at the mouth, protruded tongue and difficulty breathing.
- Death if bitten by a highly venomous snake.

The black mamba, Africa's most venomous snake

Prevention and control

- Clear the bush around animal enclosures and houses.
- Burn car tyres; snakes dislike the smoke.
- Pour salt on locations where snakes have been observed.

Treatments

- Immediately after an animal has been bitten, tie a tight bandage above the bite, cut the bite open so that it bleeds and press out as much blood as possible. Crush together fresh roots of Gardenia *ternifolia* var. *jovis-tonantis* and fresh roots of *Steganotaenia araliacea* in equal proportions and apply the juicy paste once to the bite. (Treatment for camels, cattle, donkeys, dogs, sheep and goats.)
- For the treatment of snake spit in the eyes' of animals, crush 0.2 kg of fresh roots of Gardenia *ternifolia* var. *jovis-tonantis* and 0.2 kg of fresh bark and stems of *Steganotaenia araliacea* and add 0. 25 l of water. Sieve and wash the animal's eyes with the liquid. Alternatively, apply the crushed paste to the eyes and cover with a bandage. Repeat daily until the eyes have healed. (Treatment for all animals.)

Part 3


a


b


c

Medicinal plants for ethnoveterinary treatments

a. A school boy about to plant a medicinal tree
b. School girls are planting a medicinal tree
c. A Samburu warrior planting a medicinal tree

3.1. Collecting and storing medicinal plants

Medicinal plants are the most commonly used ingredients in the preparation of ethnoveterinary medicines. **It is important to know which plant to use to treat a particular condition**, as wrong identification and use may lead to harmful effects and even animal death. The photographs given in Section 3.3 of this manual assist in plant identification.

As already described in Section 2.2, depending on the particular condition, different parts of plants – leaves, bark, fruit, flowers, roots and seeds – may be used in treatment. The part of the plant required for the treatment needs to be collected from the plant in the right way.

The concentration of active chemical compounds may depend on plant part, growth stage, the time/season of harvest, and the handling methods used during collection and subsequent storage.

3.1.1. Obtaining plant material: guidelines for collection and sustainable harvesting

General guidelines for collecting plant material include the following:

- The harvest of leaves and stems is usually best done under dry conditions, as otherwise material may become mouldy during storage.
- Flowers are best collected just when the buds are opening.
- Underground roots, bulbs, stolons, rhizomes, tubers, etc., should be collected before flowering.
- Fruit should be collected when ripe, unless noted as required otherwise. Seeds should be harvested when fruit are fully ripe, but before shedding.
- Bark collection from trees should generally be carried out from trunks and thick branches, not from small, tender branches. When removing bark, only a portion of the circumference of the trunk should be taken; if the entire circumference is taken this may kill the tree.

Where possible, plant parts should be harvested in a manner that does not kill the plant. If harvesting is inevitably destructive, however, then some plants in a location should be left unharvested. These can then seed and maintain the population there. Several medicinal plants in East Africa, such as indigenous *Aloe* species, *Prunus africana* and *Warburgia ugandensis*, plants described in Section 3.3 of this manual, have populations that are vulnerable to over-harvesting for medicinal and other uses. Medicinal plants are also vulnerable due to the clearance of land for agriculture and for settlements, animal grazing, and other pressures.

The loss of important medicinal plants reduces the options for local communities' ethnoveterinary practices, and damages traditional herbalists' livelihoods. In this situation, there is a danger that knowledge on the ethnoveterinary uses of plants may be lost from communities. One option in the face of the loss of natural plant populations is to encourage cultivation. This is successfully being done in East Africa for medicinal trees such as *Prunus africana* and *Warburgia ugandensis*.

Farmers, however, often find it hard to obtain appropriate planting material of medicinal plants, while little is known on how to manage many species under cultivation. Moreover, the markets for cultivated medicinal products often do not work well. Experience shows that sufficient impetus to ensure the concerted planting of medicinal plants is often reached only after wild resources have been largely depleted. In these circumstances, cultivation – if seed that can be planted can still be found – may not support wild stand conservation, but it can of course still support farmers' livelihoods and continued access to traditional medicines. Further efforts to encourage cultivation with local communities are required.

3.1.2. Storing plant material after harvesting

After harvesting, medicinal plant parts need to be handled appropriately. Some parts may need to be used immediately, while others can be stored and their activity retained. Clearly, storage needs to be carried out in such a way that the chemical compounds needed for therapeutic activity are maintained as effectively as possible.

The container used for storage – calabashes, clay pots, plastic tins and bottles, animal horns, animal skins, pans, polyethylene and paper bags, etc. – will depend on the background and resources of the particular traditional healer or farmer.

Dry storage: Medicinal plant material stored after drying may remain active for several years. Air-drying in partial shade is preferred compared to drying under full sun, over a fire or in an oven, as too much heat may destroy active compounds. Adequately-dried plant material can be stored in clean, closed containers, either in pieces (e.g., bark) or after grinding into a powder (leaves, bark, etc.). Containers should be labelled with their content and kept in a cool, dry place.

Fresh storage: For some plants, fresh plant material can be mixed with honey and stored in a clean container for some time while retaining activity.

Liquid storage: Decoctions (water extracts) can be preserved for a few months; tinctures (alcoholic extracts) typically for at least six months. The boiling of water extracts can support their preservation, but it is only appropriate if the active compounds are not destroyed by heat. Clean, sterilised (by boiling water) containers with good covers support preservation. Preservatives such as castor oil can be useful.

Plant material being pounded into a powder before storage

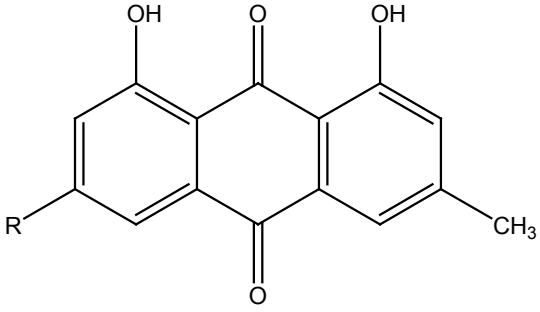
Dried plant material in powder form being tipped into a bottle for storage

3.2. Active compounds in medicinal plants

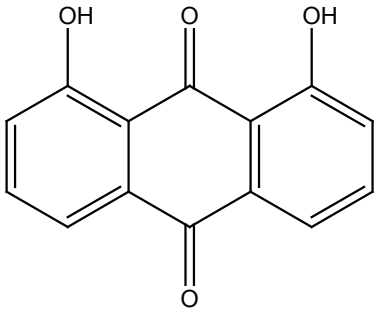
Plants produce a wide range of secondary metabolites for purposes including combating herbivores and pathogens. Many of these compounds have found wide use in both human and veterinary medicine, with many modern drugs either isolated from plants directly or manufactured as synthetic analogues. The classification of secondary metabolites is principally based on the way they are synthesised from primary metabolites. Major classes are described below.

3.2.1. Polyketide derivatives

Polyketide derivatives are formed from acetic acid through polymerisation. When polymerisation is accompanied with the removal of oxygen at each step, fatty acid derivatives are formed. Polymerisation followed by aromatisation produces quinones, including benzoquinone, naphthoquinones and anthraquinones. Anthraquinones are found in bacteria, fungi, lichens and in a large number of higher plant families, including the Verbenaceae, Bignoniaceae, Rhamnaceae, Polygonaceae, Leguminosae and Rubiaceae. The most widely distributed anthraquinones include chrysophanol and emodine. An example of (human) medicinal use is the prescription of the anthraquinone dantron, to relieve constipation in geriatric and terminally-ill patients.



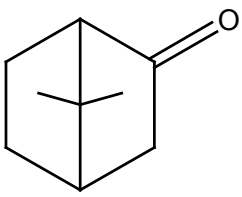
Chrysophanol R = H
Emodine R = OH



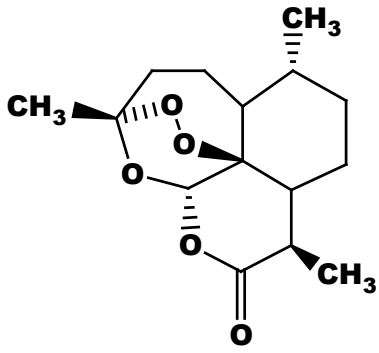
Dantron

3.2.2. Terpenes

Terpenes are constructed from the joining together of two or more units of a five carbon precursor. Based on the number of units used in construction, they are referred to as monoterpenes (C_{10}), sesquiterpenes (C_{15}), diterpenes (C_{20}), sesterterpenes (C_{25}), triterepenes (C_{30}), tetraterpenes (C_{40}) and polyterpenes (C_n). They usually contain one or more oxygen atoms on the basic skeleton. Terpenoids (modified terpenes) are widely distributed in higher plants. Monoterpenes (such as camphor) and sesquiterpenes are volatile components of plants used in the perfume industry and as flavouring agents in the food industry. Some are active ingredients in oral hygiene products. Artemisinin is a sesquiterpene lactone that is extremely important for the treatment of malaria in humans.



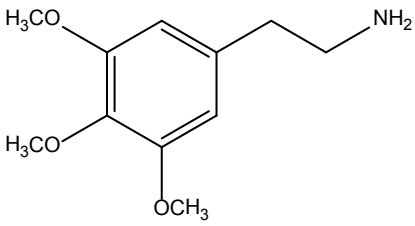
Camphor



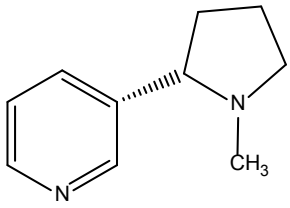
Artemisinin

3.2.3. Alkaloids

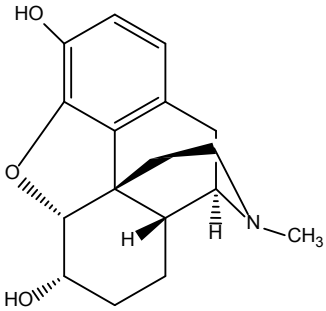
Alkaloids are divided into three major classes, true alkaloids, pseudo alkaloids and proto alkaloids. All contain nitrogen. True alkaloids, such as nicotine and atropine, are derived from amino acids, are basic and contain nitrogen in a heterocyclic ring. Pseudo alkaloids such as caffeine are basic but are not derived from amino acids. Proto alkaloids, including phenylethylamine-derived alkaloids such as mescaline, are derived from amino acids, are basic but the nitrogen is not in a heterocyclic ring. Alkaloids occur widely in plants and are well known for their pharmacological properties, with many common drugs alkaloid-based. Examples with mild physiological effects include mescaline and nicotine; more potent examples include cocaine and morphine.



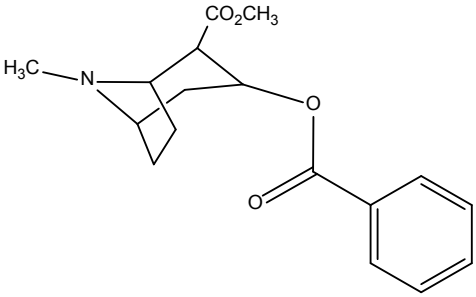
Mescaline



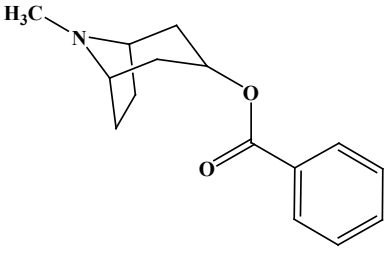
Nicotine



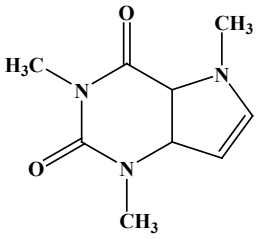
Cocaine



Morphine



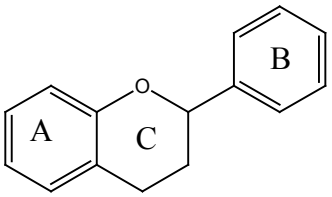
Atropine



Caffeine

3.2.4. Flavonoids

Flavonoids have a C_6-C_3-C_6 structure in which two aromatic rings (C_6) are linked together by a third heterocyclic ring. The basic skeleton is formed through the union of the phenyl propanoid pathway (C_6-C_3) with the polyketide pathway (C_6). Flavonoids constitute one of the largest groups of naturally occurring phenols. It has been estimated that around 2% of all carbon photosynthesised by plants is converted into flavonoids or closely-related compounds. Flavonoids contribute to plant colours: chalcones and flavonols are yellow, while anthocyanidin pigments contribute to the red, blue and violet colours of flowers. Some flavonoids absorb strongly in the UV range and are less obvious to humans but important in attracting pollinating insects. Flavonoids such as quercetin are considered powerful antioxidants.



Flavonoids (2-phenylbenzopyran)

3.3. Plant species used in ethnoveterinary practices in East Africa

The common and local names, animal conditions treated/controlled (as described in Part 2), and active/potentially active chemical compounds (when information is known), are given here for 53 important medicinal plant species. These plants are either indigenous to East Africa or are exotic but are widely cultivated (and are sometimes naturalised) there. The indigenous or exotic status of plants to East Africa is noted in the descriptions.

3.3.1. *Acacia brevispica*

MIMOSOIDEAE Indigenous

Acacia brevispica leaves

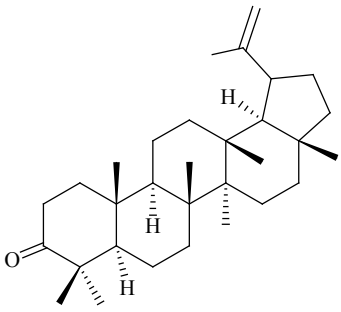
Acacia brevispica flowers and buds

Common name: Wait-a-bit thorn.

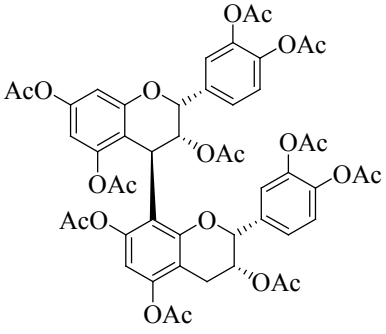
Local names: Hammaress/ Amares (Boran, Borena); Osiri (Luo-Kenya); Mwarara (Swahili); Ol-girigiri orok (Maasai, Kenya and Tanzania); Ekurau (Turkana); Kaptarun (Pokot); Igirigiri (Samburu); Gorgor/ Fugori (Somali, Kenya and Ethiopia); Gornista (Tugen); Amezaze/ Hamarecha/ Kwanta/ Qwentre (Oromo); Mageye (Sukuma).

Conditions treated/controlled: Nasal bot (fly larvae).

Active/potentially active compounds reported in *Acacia* species: Chemical investigations on *Acacia mellifera* have led to the isolation of cytotoxic triterpenoids such as lupenone (1, 2). *Acacia* species also contain different flavonoids such as catechin, epigallocatechin-5,7-digallate and kaempferol (3, 4, 5, 6, 7, 8).



Lupenone



Catechin

The bark and leaves of *Acacia* species contain tannins and the bark contains benzenoids such as catechol (4), alkanols such as octacosan-1-ol (5) and triterpenes such as b-amyrin (6, 7, 8).

Anti-uveal melanoma activity-guided fractionation of the methanol extract of *Acacia nilotica* pods resulted in the isolation of methyl gallate (9), gallic acid (10), catechin (11), catechin 5-*O*-gallate (12), 1-*O*-galloyl-β-D-glucose, gallocatechin-5-*O*-gallate (13, 14), 1,6-di-*O*-galloyl-β-D-glucose (15) and digallic acid (16). Phytochemical screening of the stem bark of *Acacia nilotica* revealed terpenoids, alkaloids, saponins and their glycosides (17).

References (various *Acacia* species)

1. Mutai C *et al.* (2004) Cytotoxic lupane-type triterpenoids from *Acacia mellifera*. Phytochemistry, 65, 1159-1164.
2. Mutai C *et al.* (2007) Lupane triterpenoids from *Acacia mellifera* with cytotoxic activity. Molecules, 12, 1035-1044.
3. Heerden *et al.* (1981) Metabolites from the purple heartwoods of the Mimosoidae. Part 4, *Acacia fasciculifera* F. Muell ex. Benth: fasciculiferin, fasciculiferol, and the synthesis of 7-aryl-and 7-flavanyl-peltogynoids. J. Chem. Soc. Perkin Trans. I, 2483-2490.
4. Ayoub SMH (1984) Polyphenolic molluscicides from *Acacia nilotica*. Planta Med., 50, 532-537.
5. Ayoub SMH (1985) Flavanol molluscicides from the Sudan *Acacias.* Int. J. Crude Drug Res., 23, 87-90.
6. Saharia GS, Sharma M (1981) Chemical examination of *Acacia senegal*. Willd. Indian J. For., 4, 63-67.
7. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
8. Dharani N *et al.* (2010) Common antimalarial trees and shrubs of East Africa. A description of species and a guide to cultivation and conservation through use. Dawson I ed. The World Agroforestry Centre, Nairobi, Kenya.
9. Hadidi MN, Boulos L (1988) The street trees of Egypt. American University in Cairo Press, Cairo, Egypt.
10. Boulos L (1999) Flora of Egypt: volume one. Al Hadara Publishing, Cairo, Egypt.
11. Boulos L (1983) Medicinal plants of North Africa. Reference Publications Inc., Algonac, Michigan.
12. Singh BN *et al.* (2009) Antioxidant and anti-quorum sensing activities of green pod of *Acacia nilotica* L. Food Chem. Toxicol., 47, 778-786.
13. Singh BN *et al.* (2009) Potential chemoprevention of N-nitrosodiethylamine-induced hepatocarcinogenesis by polyphenolics from *Acacia nilotica* bark. Chem. Biol. Interact., 181, 20-28.
14. Ahmad M *et al.* (2008) Antidiabetic and hypolipidemic effects of aqueous methanolic extract of *Acacia nilotica* pods in alloxan-induced diabetic rabbits. Scand. J. Lab. Anim. Sci., 35, 29-34.
15. Fatima F *et al.* (2005) *In vitro* assessment of anti-cutaneous leishmaniasis activity of some Sudanese plants. Turkiye Parazitol. Derg., 29, 3-6.
16. El-Tahir A *et al.* (1999) Antiplasmodial activity of selected Sudanese medicinal plants with emphasis on *Acacia nilotica*. Phytother. Res., 13, 474-478.
17. Banso A (2009) Phytochemical and antibacterial investigation of bark extracts of *Acacia nilotica*. J. Med. Plants Res., 3, 82-85.

3.3.2. *Acacia drepanolobium*

MIMOSOIDEAE Indigenous

Acacia drepanolobium shrub

Acacia drepanolobium flowers

Acacia drepanolobium galls

Common name: Whistling thorn.

Local names: Grar (Amharic); Eluai/ Iluaa (Maasai, Kenya and Tanzania); Eiyellel/ Eyelel (Turkana); Adugo/ Dunga/ Oduga (Luo); Sitowonyon/ Sloghoonion (Pokot); Fulaay (Rendille); Luai/ Rankau (Samburu); Fullai (Somali); Mbalibali (Swahili); Ngowo (Tugen); Ilula/ Ilua Iyape (Sukuma); Eyele (Ateso-Ngakarimojong).

Conditions treated/controlled: Metritis (infected uterus and vaginal discharge); Retained placenta (retained afterbirth); Sheath rot (discharge from the penis); Venereal diseases.

Active/potentially active compounds reported: See under *Acacia brevispica* (3.3.1).

3.3.3. *Acacia mellifera*

MIMOSOIDEAE Indigenous

Acacia mellifera shrub

Acacia mellifera branches with leaves

Acacia mellifera pods

Common name: Hook-thorn.

Local names: Sabansa gurach/ Sabansa (Boran, Borena); Sa'pans gurrach (Gabbra); Eiti/ Oiti orok (Maasai, Kenya and Tanzania); Habakoles (Orma); Sebansa-grar (Oromo); Musawasa (Pokomo); Mkilawata/ Kikwata (Swahili, Kenya and Tanzania); Adal/ Bilel/ Hadad (Somali-Ethiopia); Mrugara (Sukuma); Mkambale Eregai (Ngakarimojong); Panyarit/ Talamoh (Pokot); Biahen (Rendille); Iti (Samburu); Bilil (Somali); Ngoronet (Tugen); Ebenyo (Turkana); Mrugara (Sukuma); Ebenyo (Ateso-Tororo).

Conditions treated/controlled: Coccidiosis (coccidia) and colibacillosis; Eye diseases and problems, general treatments.

Active/potentially active compounds reported: See under *Acacia brevispica* (3.3.1).

3.3.4. *Acacia nilotica*

MIMOSOIDEAE Indigenous

Acacia nilotica pods

Acacia nilotica flowers and leaves

Acacia nilotica bark

Common name: Nile-thorn.

Local names: Buruge/ Burquqis/ Burguge (Boran, Borena); Burkuke/ Bur'uk'e (Gabbra); Mtsemeri/ Mahegakuluu (Giriama); Lkiloriti (Ilchamus); Burquqe/ Kasale (Oromo); Mgunga/ Mjungu (Swahili, Kenya and Tanzania); Ol-kiloriti/ Ol-giloriti (Maasai, Kenya and Tanzania); Kopkwo/ Kopko (Pokot); Ilgiliti (Rendille); Ilkilositi (Samburu); Tuger/ Tuwer/ Galol (Somali, Kenya and Ethiopia); Mdubilo/ Muhale (Sukuma); Gered/ Cha (Tigray); Chebiwo (Tugen); Ekapilimen (Turkana); Ekapelimen (Ateso-Ngakarimojong).

Conditions treated/controlled: Orf (contagious pustular dermatitis, contagious ecthyma).

Active/potentially active compounds reported: See under *Acacia brevispica* (3.3.1).

3.3.5. *Acacia oerfota*

MIMOSOIDEAE Indigenous

Acacia oerfota shrub

Acacia oerfota leaves

Acacia oerfota pods

Common name: Green-barked acacia.

Local names: Ol-depe (Maasai, Kenya and Tanzania); Epetet (Turkana, Ngakarimojong); Ajo/ Wangai/ Wanga (Gabbra, Boran, Borena, Oromo); Pelili/ Pilil (Pokot); Aluia/ Dahar (Rendille); Ldepe (Samburu); Gummr/ Gomur/ Gumari (Somali, Kenya and Ethiopia); Nsese/ Sese (Sukuma); Epetet (Ateso-Tororo).

Conditions treated/controlled: Anaplasmosis; Babesiosis (redwater fever); Diarrhoea; Foot-and-mouth disease; Metritis (infected uterus and vaginal discharge); Venereal diseases.

Active/potentially active compounds reported: See under *Acacia brevispica* (3.3.1).

3.3.6. *Acacia senegal*

MIMOSOIDEAE Indigenous

Acacia senegal branches with leaves

Acacia senegal bark

Acacia senegal flowers

Common name: Gum arabic.

Local names: Iddaado/ Burra/ Sapans (Boran); Iddaado (Gabbra); Lderkesi (Ilchamus); Kumung'ang'a (Luhya-Bukusu); Otiep/ Kiluor (Luo-Kenya); Ol-terkesi/ Enderkesi (Maasai, Kenya and Tanzania); Bura diima (Oromo); Chemangayan/ Chemanga (Pokot); Hadhaagh/ Mirgi (Rendille); Ikerdedi/ Lderkesi (Samburu); Adad/ Edad (Somali-Kenya); Kikwata/ Mgunga (Swahili); Ekunoit (Turkana); Igwata/ Mkwat (Sukuma); Ekodokodwa (Ateso-Ngakarimojong); Ekonoit (Ateso-Tororo); Alal/ Okutoketch (Luo-Lango); Idado/ Sabansa dima/ Sapessa (Oromo, Borena); Adad/ Adad-meru/ Agabo/ Galol (Somali-Ethiopia).

Conditions treated/controlled: Wounds.

Active/potentially active compounds reported: See under *Acacia brevispica* (3.3.1).

3.3.7. *Acacia tortilis*

MIMOSOIDEAE Indigenous

Acacia tortilis bark

Acacia tortilis branches with leaves and flowers

Acacia tortilis tree

Common name: Umbrella-thorn.

Local names: Bebbey/ Behebei (Afar); Dadaach/ Dadacha (Boran, Borena, Gabbra); Lkunyi/ Ltepes (Ilchamus, Samburu); Otiep (Luo-Kenya); Oltepesi (Maasai-Kenya); Ol asili/ Olgorete/ Oldepesi (Maasai-Tanzania); Debaso/ Dedech (Oromo); Ses/ Sesoy (Pokot); Dahar/ Gahar (Rendille); Abaa/ Abak/ Abab (Somali, Kenya and Ethiopia); Hyale-ngokidaki (Sukuma); Mgunga/ Mugumba (Swahili, Kenya and Tanzania); Sesya/ Sesiet (Tugen); Ewoi/ Etir (Turkana); Eoi (Ateso-Ngakarimojong); Etirr (Eteso-Tororo); Lotoba/ Tedecha (Oromo).

Conditions treated/controlled: Foot-and-mouth disease.

Active/potentially active compounds reported: See under *Acacia brevispica* (3.3.1).

3.3.8. *Acalypha fruticosa*

EUPHORBIACEAE Indigenous

Acalypha fruticosa leaves

Acalypha fruticosa flowers and fruits

Common name: Acalypha.

Local names: Mchacha (Swahili, Giriama); Ossiaitiado (Maasai); Kaparsamogh (Pokot); Siati/ Seti (Samburu); Loguru/ Segoya (Tugen); Eteteleit (Turkana); Bogama (Amharic); Dijileh/ T'iri (Oromo).

Conditions treated/controlled: Castration; Foot-and-mouth disease; Footrot; Metritis (infected uterus and vaginal discharge); Pox; Venereal diseases.

Active/potentially active compounds reported: Phytochemical screening of five *Acalypha* species has indicated the presence of alkaloids, tannins, saponins and cardenolides (1).

Reference

1. Soladoye MO *et al.* (2008) Phytochemical and morphometric analysis of the genus *Acalypha*. J. Appl. Sci., 8, 3044-3049.

3.3.9. *Adenium obesum*

APOCYNACEAE Indigenous

Adenium obesum leaves and flowers

Adenium obesum bark

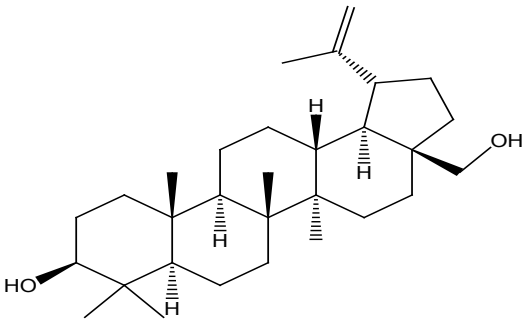
Adenium obesum shrub

Common name: Desert rose.

Local names: Obbe/ Iperantai (Boran, Borena, Gabbra); Mwadiga (Giriama); Madiga (Swahili-Kenya); Oleteti/ Ol-orogesalik (Maasai-Kenya); Mukfadjie (Orma); Koliya (Pokomo); Kaluni (Pokot); Ipirintai (Samburu); Obe/ Uba/ Marud (Somali-Kenya); Abei/ Rabej/ Hombi/ Ombi (Somali-Ethiopia); Mwadiga/ Mdagu/ Wanj (Swahili-Tanzania); Egales/ Egeleth/ Elemu (Turkana).

Conditions treated/controlled: Biting flies; Fleas; Ticks; Wounds.

Active/potentially active compounds reported: Phytochemical screening has revealed alkaloids, steroids, saponins, glycosides, anthraquinones, tannins, terpenoids (e.g. betulin), coumarins and flavonoids, in different parts of the plant (1, 2, 3).



Betulin

References

1. Sofowora A (1993) Medicinal plants and traditional medicine in Africa. Spectrum Books Ltd, Ibadan, Nigeria.
2. Trease GE, Evans CW (1984) Pharmacognosy. 12th edition. Balliere Tindall, London, UK.
3. Trease GE, Evans CW (1989) Pharmacognosy. 13th edition. ELBS/Balliere Tindall, London, UK.

3.3.10. *Ajuga remota*

LABIATAE Indigenous

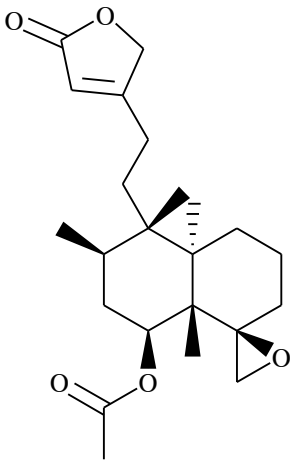
Ajuga remota flowers and leaves

Common name: Ajuga.

Local names: Mataliha (Luhya); Osogonoi (Maasai); Chemogong/ Cheborus (Tugen, Kipsigis); Tale (Wolayita).

Conditions treated/controlled: Mastitis (inflammation of the udder, sore teats) and contagious agalactia (reduced milk); Ticks.

Active/potentially active compounds reported: Diterpenes such as ajugarin B have been isolated from leaves (1, 2), some steroids such as cyasterone from leaves and roots (1, 3).



Ajugarin B

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Kobo I *et al.* (1983) Structure of ajugarin-V. Chem. Lett., 2, 223-224.
3. Kubo I *et al.* (1981) Insect ecdysis inhibitors from the East African medicinal plant *Ajuga remota* (Labiatae). Agr. Biol. Chem., 45, 1925-1927.

3.3.11. *Albizia anthelmintica*

MIMOSACEAE Indigenous

Albizia anthelmintica bark

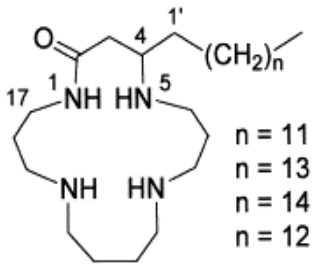
Albizia anthelmintica tree

Common name: White albizia.

Local names: Bisena (Amharic); Mporojo (Swahili); Howacho (Boran, Borena); Olmugutan (Maasai); Habacha (Orma); Kamakitan/ Mukotonwo (Pokot); Olmukutan (Samburu); Habasho/ Reidep/ Reidup; Radeb (Somali, Kenya and Ethiopia); Iregeyege/ Mayegeyege (Sukuma).

Conditions treated/controlled: Liver fluke disease (fasciolosis); Lungworms (ascaris worms).

Active/potentially active compounds reported in Albizia species: Constituents of the bark so far described include musennin, histamine, sesquiterpenes, kasotoxin and saponins (1, 2, 3). Bioassay-guided fractionation of the methanol extracts from the stem bark and leaves of *Albizia adinocephala* led to the isolation of two new bioactive spermine alkaloids, budmunchiamines L4 and L5, along with the known alkaloids budmunchiamines L1 and L2, which inhibit the malarial enzyme plasmepsin II (4).



n = 11 budmunchiamine L4 (**1**)
n = 13 budmunchiamine L5 (**2**)
n = 14 budmunchiamine L1 (**3**)
n = 12 budmunchiamine L2 (**4**)

References (various *Albizia* species)

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya
2. Watt JM, Breyer-Brandwijk MG (1962) The medicinal and poisonous plants of South and East Africa. 2nd edition. Livingstone, Edinburgh, UK.
3. Tschesche R, Kammerer FJ (1969) The structure of musennin and deglucomusennin. Liebigs. Ann. Chem., 724, 183.
4. Ovenden SPB *et al*. (2002) Spermine alkaloids from *Albizia adinocephala* with activity against *Plasmodium falciparum* plasmepsin II. Phytochemistry, 60, 175-177.

3.3.12. *Albizia coriaria*

MIMOSACEAE Indigenous

Albizia coriaria bark

Albizia coriaria branches with flowers

Albizia coriaria leaves

Common name: Giant albizia.

Local names: Mugavu (Swahili); Ober (Luo-Kenya); Omubele (Luhya); Etek/ Etekwa (Ateso- Ngakarimojong); Mubere (Luo-Acholi); Omogi; Ober (Luo-Lango); Iregeyege (Sukuma).

Conditions treated/controlled: Liver fluke disease (fasciolosis); Lungworms (ascaris worms).

Active/potentially active compounds reported: See under *Albizia anthelmintica* (3.3.11).

3.3.13. *Allium sativum*

LILIACEAE Exotic: Native to Asia

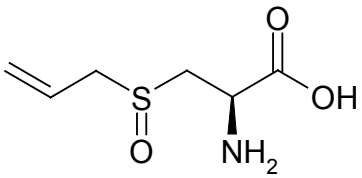
Allium sativum fresh plants and bulbs

Common name: Garlic.

Local names: Kitunguu sum (Swahili, Kenya and Tanzania); K'ulubi-adi (Oromo); Adu-besela (Afar); Nech'i-shinkurt (Amharic); Shitungulu shilulu (Sukuma).

Conditions treated/controlled: Colds, coughs and pneumonia; Lice; Stomach and intestinal worms; Ringworm.

Active/potentially active compounds reported: Numerous sulphur-containing compounds have been isolated from garlic, such as ajoene from the bulb (1, 2). The whole plant, especially the bulb, contains alliin, lipids such as allium cerebroside AS-1-1 (1, 3) and carbohydrates such as allium fructan K-1 (1, 4).



Alliin

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Voigt M, Wolf E (1986) HPLC determination of garlic components in extracts, powder, and pharmaceuticals. Dtsch. Apoth. Ztg., 126, 591-593.
3. Inagaki M *et al.* (1998) Isolation and structure determination of cerebrosides from garlic, the bulbs of *Allium sativum* L. Chem. Pharm. Bull., 46, 1153-1156.
4. Koch HP *et al.* (1993) Carbohydrates from garlic bulbs (*Allium sativum* L.) as inhibitors of adenosine deaminase enzyme activity. Phytother. Res., 7, 387-389.

3.3.14. *Aloe secundiflora*

ASPHODELACEAE Indigenous

Aloe secundiflora plants

View with *Aloe secundiflora* flowers

Common name: Aloe.

Local names: Iret (Amharic); Harguessa (Boran, Borena); Kitori (Giriama); Ogara (Luo-Kenya); Argesa/ Argesa-korma/ Hargesa (Oromo); Tangaratwet/ Tangaratuet (Tugen); Olkos/ Sikorowet (Pokot); Esuguroi (Maasai); Kigaka/ Lineke (Maragoli); Kisimamleo/ Kisimando (Swahili); Dahar-lebi (Somali-Ethiopia); Echuchuka/ Echichuviwa (Turkana); Magaka (Sukuma).

Conditions treated/controlled: Avian coryza (infectious coryza); Castration; Coccidiosis (coccidia) and colibacillosis; Colds, coughs and pneumonia; Diarrhoea; Eye diseases and problems, general treatment; Fleas; Fowl cholera (pasteurellosis); Lumpy skin disease; Metritis (infected uterus and vaginal discharge); Mites; Newcastle disease (fowl pest); Pox; Salmonellosis (fowl typhoid, pullorum disease); Sheath rot (discharge from the penis); Ticks; Venereal diseases; Wounds.

Active/potentially active compounds reported in Aloe species: The leaves of bitter aloe contain an anthraquinone glycoside (1) and quinoids such as aloin A (2) and homonataloin A (3).

References (various *Aloe* species)

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Saccu D *et al.* (2001) Aloe exudate: characterization by reversed phase HPLC and headspace GC-MS. J. Agr. Food Chem., 49, 4526-4530.
3. Rauwald HW, Niyonzima DD (1991) A new investigation on constituents of *Aloe* and *Rhamnus* species, XV. Homonataloin A and B from *Aloe lateritia*: isolation, structure and configurational determination of the diastereomers. Z. Naturforsch. Ser. C, 46, 177-182.

3.3.15. *Aloe vera*

ASPHODELACEAE
Exotic: Native to southern Africa

Aloe vera young plants

Aloe vera mature plants

Common name: Aloe vera.

Local names: Iret (Amharic); Harguessa (Boran, Borena); Kitori (Giriama); Ogara (Luo); Tangaratwet/ Tangaratuet (Tugen); Olkos/ Sikorowet (Pokot); Esuguroi (Maasai); Kigaka/ Lineke (Maragoli); Argesa/ Argesa-korma/ Hargesa (Oromo); Kisimamleo/ Kisimando (Swahili); Echuchuka/ Echichuviwa (Turkana).

Conditions treated/controlled: Avian coryza (infectious coryza); Fowl cholera (pasteurellosis); Newcastle disease (fowl pest).

Active/potentially active compounds reported: See under *Aloe secundiflora* (3.3.14).

3.3.16. *Azadirachta indica*

MELIACEAE
Exotic: Native to north-east India, Burma

Azadirachta indica tree

Azadirachta indica bark

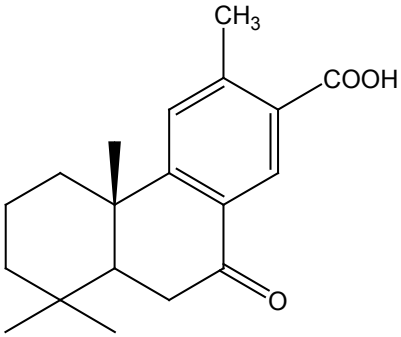
Azadirachta indica leaves and flowers

Common name: Neem.

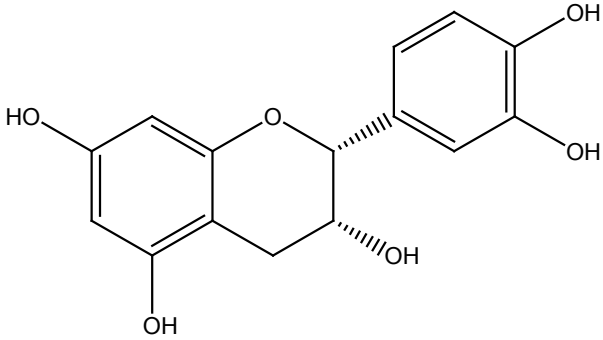
Local names: Mkilifi (Giriama); Mwarubaini/ Mkilifi (Luhya, Swahili); Nibe/ Niff/ Niph (Oromo); Get kharerow (Somali, Kenya and Ethiopia); Nim (Tigray); Mwatobaini (Sukuma).

Conditions treated/controlled: Abscesses; Anaplasmosis; Babesiosis (redwater fever); Biting flies; Colds, coughs and pneumonia; Dermatophilosis (streptothricosis, lumpy wool); East Coast fever; Eyeworms (thelaziosis); Fleas; Heartwater (cowdriosis); Lice; Metritis (infected uterus and vaginal discharge); Mosquitoes; Pink-eye (kerato-conjunctivitis); Pox; Ringworm; Salmonellosis (fowl typhoid, pullorum disease); Sheath rot (discharge from the penis); Ticks; Trypanosomosis/trypanosomiasis (sleeping sickness, surra); Tsetse flies (glossina); Venereal diseases.

Active/potentially active compounds reported: Phytochemical studies have resulted in the isolation of isoprenoids (including diterpenoids, e.g., margolone, and triterpenoids containing protomeliacins), limonoids (e.g., azadirone and its derivatives), gedunin and its derivatives, vilasinin-type compounds and csecomeliacins such as nimbin, salanin and azadirachtin (1, 2, 3). Non-isoprenoids include flavonoids (e.g., epicatechin) and their glycosides, dihydrochalcones, coumarins and tannins (1, 2, 3).



Margolone



Epicatechin

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Dharani N et al. (2010) Common antimalarial trees and shrubs of East Africa. A description of species and a guide to cultivation and conservation through use. Dawson I ed. The World Agroforestry Centre, Nairobi, Kenya.
3. Kraus W (1995) Biologically active ingredients. In: Schmutterer H (ed.) The neem tree: source of unique natural products for integrated pest management, medicine, industry and other purposes. Oxford and IBH, UK, pp. 35-88.

3.3.17. *Balanites aegyptiaca*

BALANITACEAE Indigenous

Balanites aegyptiaca tree

Balanites aegyptiaca bark

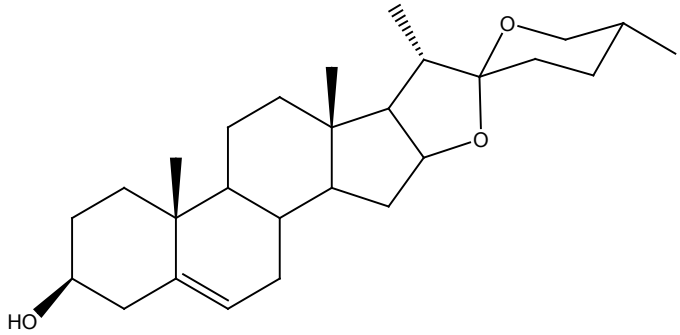
Balanites aegyptiaca flowers

Common name: Desert date.

Local names: Goza (Amharic); Baddan (Boran, Borena); Baddana (Gabbra); Mkonga (Giriama); Lowa/ Lowei (Ilchamus); Othoo (Luo-Kenya); Olng'oswa/ Olokwai (Maasai, Kenya and Tanzania); Tuyunwo (Pokot); Lowai (Samburu); Kullan/ Kulung (Somali-Kenya); Mjunju (Swahili); Eroronyit (Turkana); Ng'oswo/ Ngosyek (Tugen); Nyuguyu/ Muyuguyu (Sukuma); Ekorete (Ateso-Ngakarimojong); To (Luo-Acholi); Bedena/ Baddano (Oromo); Got/ Gueza/ Gut (Somali-Ethiopia); Indrur/ Nogah/ Kak (Tigray).

Conditions treated/controlled: Anthrax; Eye diseases and problems, general treatment; Retained placenta (retained afterbirth).

Active/potentially active compounds reported: Phytochemical investigations of *Balanites aegyptiaca* have revealed cumarins, flavonoids and steroidal saponins (1, 2, 5). From the roots and bark, yamogenin glycosides were isolated (1, 2, 3, 6). Two furostanol glycosides and diosgenin were also obtained from fruit (4, 7).



Diosgenin

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Dharani N *et al*. (2010). Common antimalarial trees and shrubs of East Africa. A description of species and a guide to cultivation and conservation through use. Dawson I ed. The World Agroforestry Centre, Nairobi, Kenya.
3. Liu H, Nakanishi K (1982) The structures of balanitins, potent molluscicides isolated from *Balanites aegyptiaca*. Tetrahedron, 38, 513- 519.
4. Kamel MS (1991) Studies on *Balanites aegyptiaca* fruits, an antidiabetic Egyptian folk medicine. Chem. Pharm. Bull., 39, 1229-1233.
5. Sarker SD *et al*. (2000) Alkaloids from *Balanites aegyptiaca*. Fitoterapia, 71, 328-330.
6. Pettit GR *et al*. (1991) Isolation and structure of cytostatic saponins from the African medicinal plant *Balanites aegyptica*. J. Nat. Prod., 54, 1491-1502.
7. Hosny M *et al*. (1992) Balanitoside, a furostanol glycoside, and 6-methyl-diosgenin from *Balanites aegyptiaca*. Phytochemistry, 31, 3565-3569.

3.3.18. *Boscia coriacea*

CAPPARACEAE Indigenous

Boscia coriacea flowers

Boscia coriacea shrub

Boscia coriacea leaves and flowers

Common name: Boscia.

Local names: Galgacha hareh (Boran, Borena); Sericho/ Serichoi (Ilchamus); Engamuluki/ Enkapalases (Maasai); Mukukube (Pokomo); Sorichon (Pokot); Lyoror/ Yoror (Rendille); Dagayar/ Dakkiyar (Somali-Kenya); Mnafisi (Swahili); Dakiyah (Somali-Ethiopia); Eedung (Turkana); Kalkach (Orma); Nyaror (Rendille); Siriko/ Sirkwa (Tugen).

Conditions treated/controlled: Eye diseases and problems, general treatment.

Active/potentially active compounds reported: To our knowledge, no phytochemical investigations on *Boscia coriacea* have been published. Flavonoids from *Boscia salicifolia* have however been reported (1).

References

1. Walter A, Sequin U (1990) Flavonoids from the leaves of *Boscia salicifolia*. Phytochemistry, 29, 2561-2563.

3.3.19. *Capsicum frutescens*

SOLANACEAE Exotic: Native to Latin America

Capsicum frutescens fruit (Red pepper)

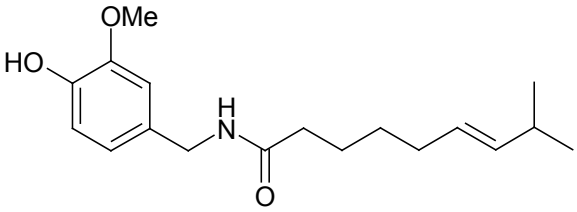
Capsicum frutescens fruit (Green pepper)

Common name: Hot pepper (Green and Red).

Local names: Berbere (Amharic, Oromo, Tigray); Hindi-barbare (Afar); Pili-pili (Swahili); Bupilipili (Sukuma).

Conditions treated/controlled: Anaplasmosis; Avian coryza (infectious coryza); Colds, coughs and pneumonia; Contagious pleuropneumonia (bovine and caprine); Diarrhoea; Fowl cholera (pasteurellosis); Heartwater (cowdriosis); Newcastle disease (fowl pest); Stomach and intestinal worms.

Active/potentially active compounds reported: Peppers contain the alkaloid capsaicin (1, 2), more in hotter-tasting types.



Capsaicin

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Hirt HM, M'Pia B (2001) Natural medicine in the tropics. Action for natural medicine, Winnenden, Germany.

3.3.20. *Carica papaya*

CARICACEAE Exotic: Native to tropical America

Carica papaya bark

Carica papaya unripe fruit

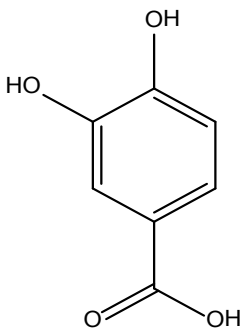
Carica papaya leaves

Common name: Papaya.

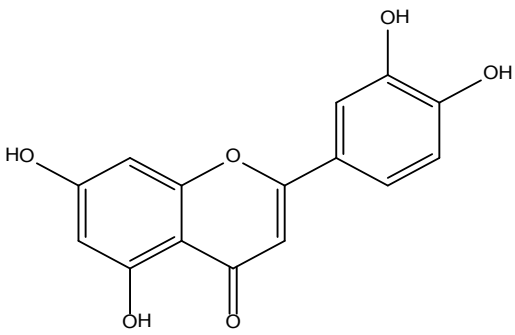
Local names: Emba (Afar); Papaya (Amharic, Oromo); Mpapai (Swahili, Kenya and Tanzania); Mabapaya (Sukuma).

Conditions treated/controlled: Constipation; Retained placenta (retained afterbirth).

Active/potentially active compounds reported: The leaves, latex, seed of ripe fruit and pulp of unripe fruit contain papain, a protein-digesting enzyme, which is known primarily as a worm killer (1). The plant also contains flavonoids with antibiotic and fungicidal properties (1, 2). In the leaves, the phenolic compounds protocatechuic acid, p-coumaric acid, caffeic acid, chlorogenic acid, kaempferol and quercetin have been identified (3).



Protocatechuic acid



Quercetin

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Osato JA *et al.* (1993) Antimicrobial and antioxidant activities of unripe papaya. Life Sci., 53, 1383-1389.
3. Canini A *et al.* (2007) Gas chromatography–mass spectrometry analysis of phenolic compounds from *Carica papaya* L. leaf. J. Food Comp. Analysis, 20, 584-590.

3.3.21. *Carissa spinarum*

APOCYNACEAE Indigenous

Carissa spinarum branch with leaves and flowers

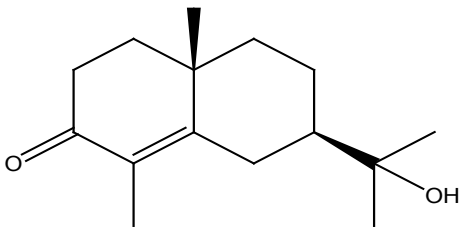
Carissa spinarum fruit

Common name: Carissa.

Local names: Agam (Amharic); Dagams/ Dagamsa(Boran, Borena, Gabbra); Mtandamboo (Giriama); Shikata/ Sirwa (Luhya); Ochuoga (Luo-Kenya); Olamuriaki (Maasai, Kenya and Tanzania); Mlalanche (Pokomo); Lokotetwo (Pokot); Godhoom boor (Rendille); Lamuriei/ Lamuriai (Samburu); Mtanda-mboo (Swahili, Kenya and Tanzania); Legetetwo/ Legetetik (Tugen); Ekamuria (Turkana); (Ateso-Ngakarimojong); Achuga (Luo-Acholi and Luo-Lango); Agamsa/ Hagamsa (Oromo); Orgabat (Somali-Ethiopia).

Conditions treated/controlled: Ringworm; Stomach and intestinal worms.

Active/potentially active compounds reported: Chemical constituents include steroids, terpenes (e.g., carissone), tannins, flavonoids, cardiac glycosides (1, 2), benzenoids, phenylpropanoids (e.g., conifealdehyde), sesquiterpenes and cumarins (3, 4).



Carissone

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Ibrahim H (1997) Pharmacognostic and biological (analgesic activity) studies of *Carissa edulis* Vahl. PhD thesis, Ahmadu Bello University, Zaria, Nigeria.
3. Achenbach H. *et al.* (1983) Constituents of West African medicinal plants. 12 lignans and other constituents from *Carissa edulis*. Phytochemistry, 22, 749-753.
4. Bentley *et al*. (1984). 2-hydroxyacetophenone, principal root volatile of the East African medicinal plant, *Carissa edulis*. J. Nat. Prod., 47, 1056-1057.

3.3.22. *Cissus quadrangularis*

VITACEAE Indigenous

Cissus quadrangularis fruit

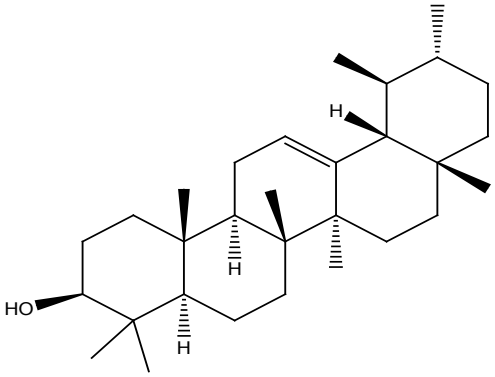
Cissus quadrangularis flowers

Common name: Cactus vine.

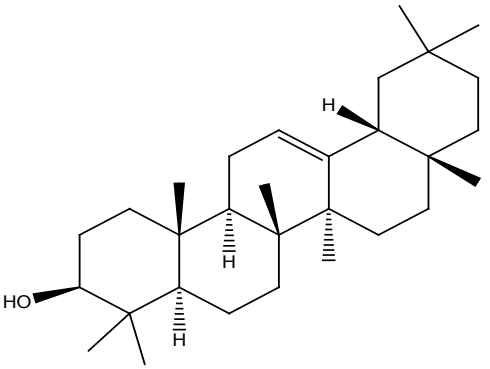
Local names: Chobi kawra (Boran, Borena); Mtsuchi (Giriama); Mbugu-nyama (Swahili); Olrarait/ Sugurututi (Maasai, Kenya and Tanzania); Mido-korba (Oromo); Tutuyon (Pokot); Egis/ Lorodo (Turkana); Cherorowo (Tugen); Alge (Tigray); Rarait (Samburu); Chabhi (Somali-Kenya).

Conditions treated/controlled: Coccidiosis (coccidia) and colibacillosis; Retained placenta (retained afterbirth).

Active/potentially active compounds reported: Phytochemical studies on methanol extracts of *Cissus quadrangularis* have revealed a- and ß-amyrins, ß-sitosterol, ketosteroids, phenols, tannins and carotene. Seven alicyclic lipid constituents have also been reported from the species (1, 2). Unsymmetric tetracyclic triterpenoids such as d-amyrin, onocer-7-ene-3a,21b-diol and d-amyrone have also been reported. The flavonoids quercetin and kaempferol, quadrangularins A, B and C, resveratrol, piceatanon, pallidol, perthenocissi and phytosterols, have also been isolated.



a-Amyrin



ß-Amyrin

References

1. Deka DK *et al*. (1994) Effect of *Cissus quadrangularis* in accelerating healing process of experimentally fractured radius ulna of dog: a preliminary study. Ind. J. Pharma., 26, 44-48.
2. Mallika J, Shyamala Devi CS (2005) *In vitro* and *in vivo* evaluation of free radical scavenging potential of *Cissus quadrangularis*. Afric. J. Biomed. Res., 8, 95-99.

3.3.23. *Combretum molle*

COMBRETACEAE Indigenous

Combretum molle flowers

Combretum molle leafy branch

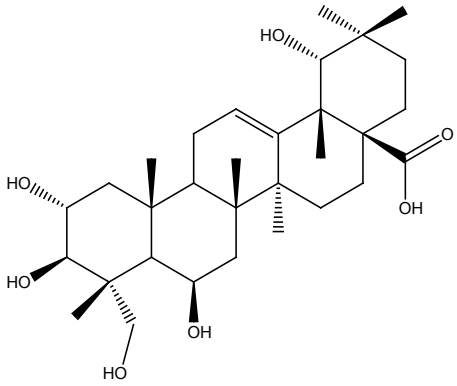
Combretum molle tree

Common name: Velvet-leaved combretum.

Local names: Agalo/ Avalu (Amharic); Rokess (Boran, Borena); Rukeesa (Gabbra); Mukhungula/ Kumukimila (Luhya);Adugo/ Keyo (Luo-Kenya); Okechu/ Oduk (Luo-Acholi); Iworo/ Iyoro (Luo-Lango); Ol-mararoi/ Emararoi/ Olmororoi (Maasai, Kenya and Tanzania); Komel/ Cheprosto/ Cheprosho (Pokot); Rokess (Samburu); Kemelet (Tugen); Ekamiro/ Eguyen (Turkana); Mgurure (Swahili); Kagua/ Nama (Sukuma); Ekworo/ Eworo (Ateso-Ngakarimojong); Bik'a/ Dandamsa/ Didegsa (Oromo); Anfarfaro/ Haziba/ Weiba (Tigray).

Conditions treated/controlled: Pink-eye (kerato-conjunctivitis).

Active/potentially active compounds reported: Phytochemical studies have led to the isolation of triterpenoids such as combregenin, saponins and tannins (1, 2).



Combregenin

References

1. Ares K *et al*. (2001) *In vitro* antiprotozoal activity of extract and compounds from the stem bark of *Combretum molle*. Phytother. Res., 15, 613-617.
2. Ponou BK *et al*. (2008) Polyhydroxyoleanane-type triterpenoids from *Combretum molle* and their anti-inflammatory activity. Phytochem. Let., 1, 183-187.

3.3.24. *Commiphora africana*

BURSERACEAE Indigenous

Commiphora africana trees

Commiphora africana bark

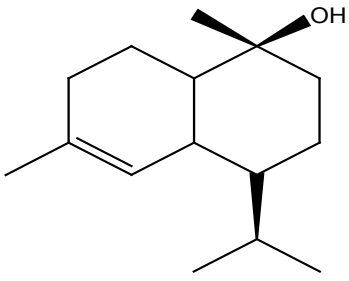
Commiphora africana fruit

Common name: Poison-grub commiphora.

Local names: Ududu-e-ta (Afar); Ank'wa/ Wanka (Amharic, Tigray); Ammess/ Hames (Boran, Borena); Hammeessa (Gabbra); Musishwi (Giriama); Arupiny/ Arupien (Luo-Kenya); Osilalei (Maasai, Kenya and Tanzania); Komper (Orma); Mundorotwo/ Mindarotwo (Pokot); Komper (Orma); Lcheningiro (Samburu); Hammes sagara (Somali-Kenya); Mbambara (Swahili-Kenya); Ekadeli (Turkana); Mturituri (Swahili-Tanzania); Ekadeli/ Etopojo (Ateso-Ngakarimojong); Hamessa (Oromo); Agag/ Agarat (Somali-Ethiopia); Anqwa/ Ank'way (Tigray).

Conditions treated/controlled: Diarrhoea; Ticks.

Active/potentially active compounds reported in Commiphora species:
Terpenoids (e.g., t-cadinol) commonly occur in the genus *Commiphora.* Steroids and polypodane triterpenoids have also been reported in the genus (1, 2).



t-Cadinol

References (various *Commiphora* species)

1. Shen T *et al*. (2012) The genus *Commiphora*: a review of its traditional uses, phytochemistry and pharmacology. J. Ethnopharm., 142, 8378-8741.
2. Dekebo A *et al*. (2002) Furanosesquiterpenes from *Commiphora sphaerocarpa* and related adulterants of true myrrh. Fitoterapia, 73, 48-55.

3.3.25. *Commiphora erythraea*

BURSERACEAE Indigenous

Commiphora erythraea gum

Commiphora erythraea tree

Commiphora erythraea bark

Common name: Commiphora.

Local names: Hagar/ Hagar-ad/ Hagarso/ Hagarsu (Borena, Oromo); Hagar/ Hagar-ad/ Hagar-medow (Somali, Kenya and Ethiopia; Rendille); Lachimi (Samburu).

Conditions treated/controlled: Abscesses; Mites; Mosquitoes; Ringworm; Ticks; Wounds.

Active/potentially active compounds reported: See under *Commiphora africana* (3.3.24).

3.3.26. *Commiphora myrrha*

BURSERACEAE Indigenous

Commiphora myrrha leaves

Commiphora myrrha bark

Commiphora myrrha tree

Common name: Gum myrrh tree.

Local names: Ududu-e-ta (Afar); Khumbi/ Kumbi (Boran); Hamessa/ Hames/ Ames (Oromo); Malmal/ Molmol (Somali, Kenya and Ethiopia); Marmar (Rendille); Lachimi (Samburu).

Conditions treated/controlled: Ticks; Wounds.

Active/potentially active compounds reported: See under *Commiphora africana* (3.3.24).

3.3.27. *Croton macrostachyus*

EUPHORBIACEAE Indigenous

Croton macrostachyus leaves

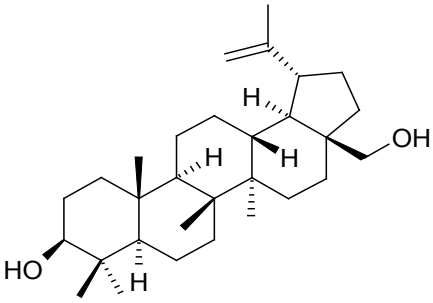
Croton macrostachyus tree

Common name: Broad-leaved croton.

Local names: Bisana (Amharic); Mukanisa (Boran); Ngong'ngong' (Luo); Ol-keparke (Maasai-Kenya); Musutsu/ Kumukunusia/ Kumutoboso (Luhya); Tebesuet (Tugen); Toboswa (Pokot); Olobiago/ Ololyapiyapi (Maasai-Tanzania); Ekwanga/ Ekwanga (Luo-Acholi); Ekwango (Luo-Lango); Ankowa/ Bakanissa/ Bakano/ Dogoma (Borena, Oromo); Masincho/ Wush (Somali-Ethiopia); Beriberi-islamy/ Tambush (Tigray).

Conditions treated/controlled: Wounds.

Active/potentially active compounds reported in Croton species: The stem bark of *Croton megalocarpus* contains triterpenes such as betulin and phenylpropanoids including ferulic acid; *trans*-hexacosyl ester is found in the bark (1, 2). Nor-clerodane diterpenes such as crotonin are commonly found in *Croton* species (1, 3).



Betulin

References (various *Croton* species)

1. Addae-Mensah I *et al.* (1989) A clerodane diterpene and other constituents of *Croton megalocarpus.* Phytochemistry, 28, 2759-2761.
2. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
3. De Paula, ACB *et al.* (2008) The antiulcer effect of *Croton cajucara* Benth in normoproteic and malnourished rats. Phytomedicine, 15, 815.

3.3.28. *Croton megalocarpus*

EUPHORBIACEAE Indigenous

Croton megalocarpus tree

Croton megalocarpus bark

Croton megalocarpus leaves

Common name: Silvery-leaved croton.

Local names: Nyapo (Boran, Borena); Nyaap'po (Gabbra); Muyama (Giriama); Musine (Luhya); Olmergoit (Maasai-Kenya); Ortuet (Tugen); Marakuet/ Laeruguet (Samburu); Ol-mergoit/ Ol-margait/ Ol-marbait (Maasai-Tanzania).

Conditions treated/controlled: Anaplasmosis; Salmonellosis (fowl typhoid, pullorum disease); Wounds.

Active/potentially active compounds reported: See under *Croton macrostachyus* (3.2.27).

3.3.29. *Datura stramonium*

SOLANACEAE
Exotic: Native to tropical America

Datura stramonium fruit

Datura stramonium leaves and flowers

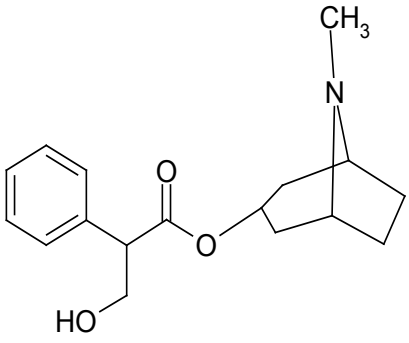
Datura stramonium plants

Common name: Devils's trumpet.

Local names: At'efaris (Amharic); Darto/ Manji (Oromo); Banji (Afar); Mranaa (Swahili); Barutu/ Chemogong' (Kipsigis); Mezerbai (Tigray); Ibongebonge (Sukuma).

Conditions treated/controlled: Abscesses; Ringworm.

Active/potentially active compounds reported: *Datura stramonium* contains atropine and other anti-spasmodic alkaloids (1, 2). In particular, seeds contain 0.4% alkaloids, including hyoscine and scopolamine as well as atropine (hyoscyamine) (1, 2, 3, 4).



Atropine

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Bruneton J (1995) Pharmacognosy. Phytochemistry. Medicinal plants. Intercept, Hampshire, USA.
3. Stuart M (1979) The encyclopedia of herbs and herbalism. Orbis Publishing Ltd., London, UK.
4. Sofowora A (1982) Medicinal plants and traditional medicine in Africa. John Wiley & Sons Ltd., New York, USA.

3.3.30. *Eucalyptus citriodora*

MYRTACEAE Exotic: Native to Australia

Eucalyptus citriodora bark

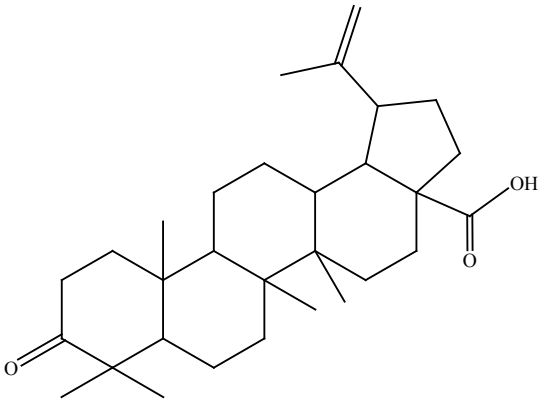
Eucalyptus citriodora leaves, flowers and fruit

Common name: Lemon-scented gum.

Local names: Shito-barzaf zaf (Amharic); Makaratusi (Swahili); Mbanyi (Chagga); Kalitunsi (Luganda); Mkaratusi (Sukuma).

Conditions treated/controlled: Lice; Mosquitoes.

Active/potentially active compounds reported: *Eucalyptus* essence contains monoterpenes such as cyneol, eucalptol (1, 2, 3), borneol and terpinen-4-ol (4). It also contains sesquiterpenes such as aromadendrene (2, 4) and triterpenes such as betulonic acid (5).



Betulonic acid

References

1. Hirt HM, M'Pia B (2001) Natural medicine in the tropics. Action for natural medicine, Winnenden, Germany.
2. Dethier M *et al.* (1994) Aromatic plants of tropical Central Africa. XVI. Studies on essential oils of five *Eucalyptus* species grown in Burundi. J. Essent. Oil Res., 6, 469-473.
3. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
4. Zrira SS *et al.* (1992) Essential oils of twenty-seven eucalyptus species grown in Morocco. J. Essent. Oil Res., 4, 259-264.
5. Dayal R (1980) Chemical components of *Eucalyptus citriodora* leaves. Curr. Sci., 49, 116.

3.3.31. *Euphorbia candelabrum*

EUPHORBIACEAE Indigenous

Euphorbia candelabrum tree

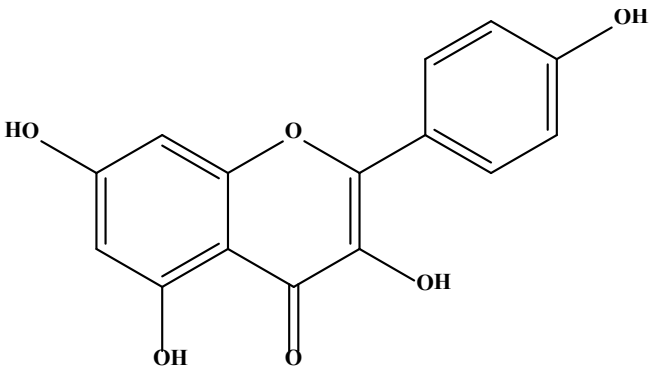
Euphorbia candelabrum stems

Common name: Tree euphorbia.

Local names: K'ulk'wal (Amharic); Adama (Boran, Borena, Gabbra); Kithongothongo (Giriama); Kumutua/ Ludua (Luhya); Bondo (Luo-Kenya); Mtungutungii/ Mtupa (Swahili); Ol-bobongo/ Olpopong'i (Maasai-Kenya); Kresua (Pokot); Darkhen (Somali, Kenya and Ethiopia); Kuress (Tygen); Adami/ Hadami/ Abishoka (Oromo); Epopong (Ateso-Ngakarimojong, Luo-Lango).

Conditions treated/controlled: Pink-eye (kerato-conjunctivitis); Wounds.

Active/potentially active compounds reported in Euphorbia species: Diterpenoids (1, 4), triterpenoids, steroids (2), flavonoids (including kaempferol), coumarins (3) and phenolic compounds have all been reported for different *Euphorbia* species.



Kaempferol

References (various *Euphorbia* species)

1. Evans FJ, Taylor SE (1983) Pro-inflammatory, tumor promoting and antitumor diterpenes of the plant families Euphorbiaceae and Thymelaeaceae. In: Herz W *et al*., eds., Progress in the Chemistry of Organic Natural Products, Vol. 44. Springer-Verlag, New York, USA, pp. 1-99.
2. Jassbi AR *et al*. (2004) Chemical constituents of *Euphorbia marschalliana* Bioss. Z. Naturforsch., 59c, 15-18.
3. Ulubelen R *et al*. (1986) Hydrocarbons from *Euphorbia larica*. Doga: Tip Eczacilik, 10, 211-213.
4. Ahmad VU, Jassbi AR (1998) Three tricyclic diterpenoids from *Euphorbia decipiens*. Planta Med., 64, 732-735.

3.3.32. *Euphorbia robecchii*

EUPHORBIACEAE Indigenous

Wild *Euphorbia robecchii*

Euphorbia robecchii branch propagated in a pot

Common name: Euphorbia.

Local names: Dagerai/ Shatetai (Maasai-Kenya); Hadhame (Orma); Eopong (Turkana); Mhunga/ Munyala (Sukuma); Mnyara (Swahili).

Conditions treated/controlled: Contagious skin necrosis.

Active/potentially active compounds reported: See under *Euphorbia candelabrum* (3.3.31).

3.3.33. *Grewia villosa*

TILIACEAE Indigenous

Grewia villosa leaves

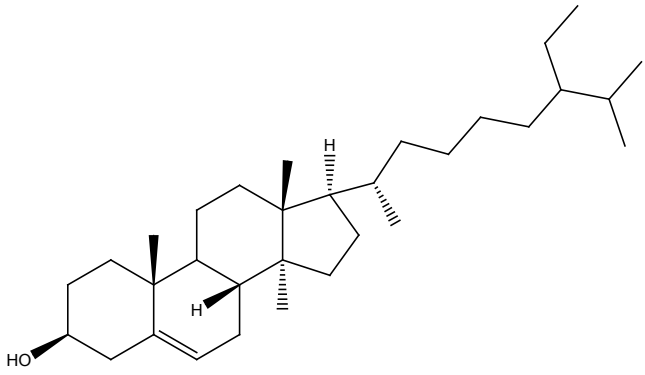
Grewia villosa leaves and flowers

Common name: Grewia.

Local names: Ogomdi/ Ogumdi/ Muruudo/ Moorodah (Boran, Borena, Oromo); Ogomdi (Gabbra); Lpupoi/ Lpupo (Ilchamus); Ner powo (Luo-Kenya); Nabwor (Luo-Acholi); Opobo (Luo-Lang); Olmankulai/ Emankulai/ Olpompoi (Maasai-Kenya); Mokoghio/ Mokuwo/ Makow (Pokot); Mukone-moruke/ Mbavungombe (Pokomo); Obhoob (Rendille); Lpupoi/ Lpopoi (Samburu); Mukorobosho (Swahili); Kobbish/ Kubesh/ Gumesh (Somali, Kenya and Ethiopia); Mokuiwo (Tugen); Hawene/ Hafule (Tigray); Epongae/ Epokoo (Turkana); Olmalungai (Maasai-Tanzania); Msarasi (Sukuma).

Conditions treated/controlled: Anthrax; Retained placenta (retained afterbirth).

Active/potentially active compounds reported: *Grewia* species contain a wide range of triterpenoids, including betulin in the roots of *Grewia bicolor* (1, 2) and a-amyrin in the stem bark of *Grewia tenax* (3). Several steroids have been reported, including stigmasterol in the roots of *Grewia bicolor* (1, 2) and b-sitosterol in the stem bark of *Grewia tenax* (1, 3). The presence of indole alkaloids such as harman in the roots of *Grewia bicolor* (2) and alkanols such as triacontan-1-ol in the stem bark of *Grewia tenax* (3) have also been reported.



b-Sitosterol

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Jaspers MWJM *et al.* (1986) Investigation of *Grewia bicolor* Juss. J. Ethnopharmacol., 17, 205-211.
3. Prakash L *et al.* (1979) Chemical identification of the stem barks of *Grewia tenax* (Forsk) Aschers and *Grewia flavescens* Juss. Ind. J. Chem., 17B, 537-538.

3.3.34. *Harrisonia abyssinica*

RUTACEAE Indigenous

Harrisonia abyssinica leaves

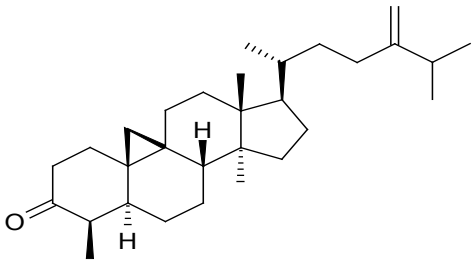
Harrisonia abyssinica branch with fruit and leaves

Common name: Harrisonia.

Local names: Raga (Boran); Mkithunga (Giriama); Gora (Orma); Pedo/ Omindi (Luo-Kenya); Mkidunya/ Sipondwe (Luhya); Cheewa (Pokomo); Mkidori/ Msamburini (Swahili-Kenya); Mukurkona (Pokot); Lasaramai/ Muruguti (Samburu); Eddih-chabel (Somali-Kenya); Eduget (Somali-Ethiopia); Ekalale (Turkana).

Conditions treated/controlled: Abscesses; Contagious pleuropneumonia (bovine and caprine); Lumpy skin disease; Retained placenta (retained afterbirth).

Active/potentially active compounds reported: Terpenoids including harrisonin have been isolated from root bark (1, 2, 3). Isolates from stem bark include prenylated polyketides (4) and the cyclotriterpene cycloabyssinone (5).



Cycloabyssinone

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Dharani N *et al.* (2010) Common antimalarial trees and shrubs of East Africa. A description of species and a guide to cultivation and conservation through use. Dawson I ed. World Agroforestry Centre, Nairobi, Kenya.
3. Massele AY, Nshimo CM (1995) Brine shrimp bioassay for biological activity of medicinal plants used in traditional medicines in Tanzania. E. Afr. Med. J., 72, 661-663.
4. Balde AM *et al.* (1999) Oumarone, bissaone, and aissatone, unusual prenylated polyketides from *Harrisonia abyssinica*. J. Nat. Prod., 62, 364-366.
5. Baldé AM *et al.* (2001) Cycloabyssinone, a new cycloterpene from *Harrisonia abyssinica.* Fitoterapia, 72, 438-440.

3.3.35. *Lantana trifolia*

VERBENACEAE
Exotic: Native to Tropical America

Lantana trifolia flowers and leaves

Lantana trifolia shrub

Common name: Lantana.

Local names: Yemichi-medihanit/ Kese (Amharic); Kosa/ Kusaye (Oromo); Kate (Boran, Borena); Esimenenua/ Lumenenambuli (Luhya); Nyabend-winy/ Magwaga (Luo-Kenya); Ol-magirigiriana/ Ol-makongora (Maasai, Kenya and Tanzania); Sekechewo (Tugen); Nyanhunda (Sukuma).

Conditions treated/controlled: Liver fluke disease (fasciolosis); Lungworms (ascaris worms).

Active/potentially active compounds reported: A wide range of compounds have been isolated from *Lantana* species, including sesquiterpenes (e.g., a-acorenol) (1, 5), triterpenes (e.g., a-amyrin) (2), phenylpropanoids (e.g., calceolarioside A) (3) and flavonoids (e.g., umuhengerin) (1, 44).

References

1. Weyerstahl P *et al.* (1999) Constituents of commercial Brazilian lantana oil. Flav. Fragr. J., 14, 15-28.
2. Ahmed ZF *et al.* (1972) Phytochemical study of *Lantana camara*. Terpenes and lactones. II. Planta Med., 22, 34-37.
3. Taoubi K *et al.* (1997) Phenylpropanoid glycosides from *Lantana camara* and *Lippia multiflora*. Planta Med., 63, 192-193.
4. Rwangabo PC *et al.* (1988) Umuhengerin, a new antimicrobially active flavonoid from *Lantana trifolia*. J. Nat. Prod., 51, 966-968.
5. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.

3.3.36. *Microglossa pyrifolia*

COMPOSITAE Indigenous

Microglossa pyrifolia leaves

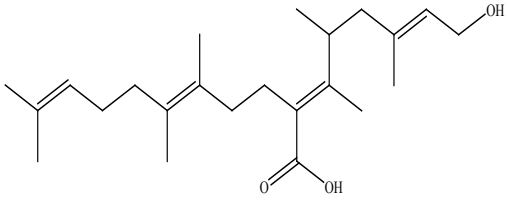
Microglossa pyrifolia shrub

Common name: Microglossa.

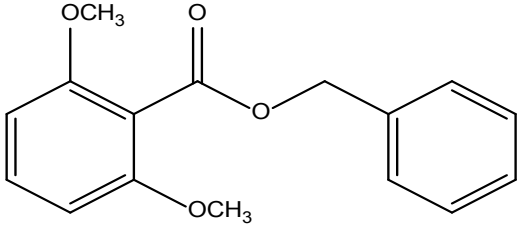
Local names: Nech'i-weyinagift (Amharic); Enguu (Luhya); Kwambereriet (Kipsigis); Ol-ogomati/ Engokumati (Maasai, Kenya and Tanzania).

Conditions treated/controlled: Pox.

Active/potentially active compounds reported: Acyclic diterpenes (e.g., 6E-geranylgeraniol-19-oic acid), diterpenes and benzyl-2,6-dimethoxylbenzoate have been isolated and contribute antiplasmodial activity (1).



6E-geranylgeraniol-19-oic acid



Benzyl-2,6-dimethoxylbenzoate

References

1. Kohler *et al.* (2002) Herbal remedies traditionally used against malaria in Ghana: bioassy-guided fractionation of *Microglossa pyrifolia* (Asteraceae). Z. Naturforsch., 57c, 1022-1027.

3.3.37. *Moringa stenopetala*

MORINGACEAE Indigenous

Moringa stenopetala leaves

Moringa stenopetala tree

Common name: Drum-stick tree.

Local names: Mokor/ Dumor (Somali-Ethiopia); Etebusoit (Turkana); Lorsanjo (Samburu); Mau/ Mawali/ Mawe (Somali, Kenya and Ethiopia); Mlonge (Swahili); Kagubwa inhale (Sukuma).

Conditions treated/controlled: Retained placenta (retained afterbirth).

Active/potentially active compounds reported: Compounds reported from the genus *Moringa* include monoterpenes, sequiterpenes (1), phenylpropanoids, isothiocyanates, alkaloids, flavonoids (e.g., quercetin) (2), tannins and phenolics (3).

References

1. Bennett H *et al.* (2003) Profiling glucosinolates and phenolics in vegetative and reproductive tissues of the multi-purpose trees *Moringa oleifera* L. (horseradish tree) and *Moringa stenopetala*. J. Agric. Food Chem., 51, 3546-3553.
2. Bakkali E *et al.* (2008) Biological effects of essential oils. Food Chem. Toxicol., 46, 446-475.
3. Edeoga A *et al.* (2005) Phytochemical constituents of some Nigerian medicinal plants. African J. Biotech., 4, 685-688.

3.3.38. *Myrsine africana*

MYRSINACEAE Indigenous

Myrsine africana branches, leaves and flowers

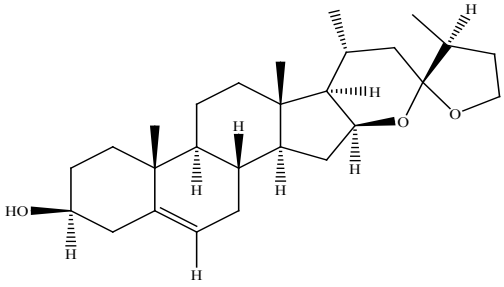
Myrsine africana fruit and leaves

Common name: Myrsine.

Local names: K'ech'emo/ Fiyelefej (Amharic); Eseketeti/ Olseketeti/ Seketeti/ Enkoduai (Maasai); Seketeta (Samburu); Segetetwa (Tugen); Ekaiyi (Turkana); Parapara (Pokot); K'ech'emo/ K'ach'emo (Oromo); Zadse /Zoso (Tigray).

Conditions treated/controlled: Stomach and intestinal worms; Wounds.

Active/potentially active compounds reported: Phytochemical investigations have revealed triterpenes such as myrsigenin, as well as benzoquinones, flavonoids and steroids (1).



Myrsigenin

References

1. Sadiq Azam *et al.* (2011) Anti-spasmodic action of crude methanolic extract and a new compound isolated from the aerial parts of *Myrsine africana*. BMC Compl. Alt. Med., 11, 5.

3.3.39. *Nicotiana tabacum*

SOLANACEAE
Exotic: Native to South and Central America

Nicotiana tabacum flowers

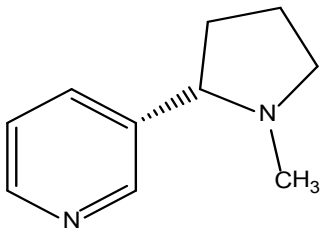
Nicotiana tabacum leaves

Common name: Tobacco plant.

Local names: Dinbako (Afar); Timbaho/ T'inbaho (Tigray, Amharic); Arado (Sidama); Itumbati (Sukuma).

Conditions treated/controlled: Eye diseases and problems, general treatment; Eyeworms (thelaziosis); Ticks.

Active/potentially active compounds reported: *Nicotiana tabacum* contains nicotine and other structurally-related alkaloids (1).



S-Nicotine

References

1. Wei *et al.* (2005) Identification and synthesis of novel alkaloids from the root system of *Nicotiana tabacum*: affinity for neuronal nicotinic acetylcholine receptors. Life Sci., 78, 495-505.

3.3.40. *Ocimum kilimandscharicum*

LABIATAE Indigenous

Ocimum kilimandscharicum plant

Ocimum kilimandscharicum leaves

Common name: Camphor basil.

Local names: Anch'eba (Amharic); Vambamanga (Giriama); Okita/ Bwar/ Olururuecha (Luo-Kenya); Mwonyi (Luhya); Ol emoran (Maasai-Kenya); Supko (Pokot); Kameteber/ Ichoke (Turkana); Kirumbasi (Swahili); Lemurran (Samburu); Abonata/ Nehra (Tigray).

Conditions treated/controlled: Colds, coughs and pneumonia; Fleas; Mosquitoes; Pink-eye (kerato-conjunctivitis).

Active/potentially active compounds reported: Compounds isolated from *ocimum* species include sesquiterpenes (e.g., a-bisabolene, a-epicadinol) (1, 2), monoterpenes (e.g., camphor) (3), benzenoids (e.g., benzaldehyde) (4) and phenylpropanoids (e.g., rosmarinic acid) (5).

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Pino JA *et al.* (1994) The essential oil of *Ocimum basilicum* L. from Cuba. J. Essent. Oil. Res., 6, 89-90.
3. Charles DJ, Simon JE (1992) Essential oil constituents of *Ocimum kilimandscharicum* Guerke. J. Essent. Oil. Res., 4, 125-128.
4. Fleisher Z, Fleisher A (1992) Volatiles of *Ocimum basilicum* traditionally grown in Israel. Aromatic plants of the holy land and the Sinai. Part VIII. J. Essent. Oil. Res., 4, 97-99.
5. Surveswaran S *et al.* (2007) Systematic evaluation of natural phenolic antioxidants from 133 Indian medicinal plants. Food Chem., 102, 938-953.

3.3.41. *Prunus africana*

ROSACEAE Indigenous

Prunus africana leaves

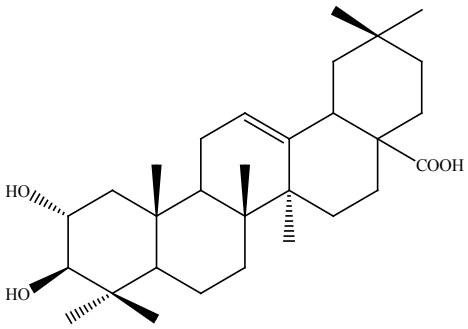
Prunus africana trunk and bark

Common name: Red Stinkwood.

Local names: Mwiritsa/ Kumuturu (Luhya); Kiburabura (Swahili); Kunyukwa (Tugen); Olkoijuk (Maasai-Kenya); Lemalan (Samburu); Olgujuk/ Olkonjuku (Maasai-Tanzania); Ngwabuzito/ Ntasesa (Luganda); Bouraio/ Buraya/ Homi/ Mukoraja (Oromo); Mrchiko (Sidamia).

Conditions treated/controlled: Babesiosis (redwater fever).

Active/potentially active compounds reported: Bark contains triterpenoic acids such as 2a,3b-dihydroxyolean-12-en-28-oic acid (1, 2) and phytosterols such as ß-sitosterol and campesterol (1, 3, 4). Bark extract is used globally to treat benign prostatic hyperplasia in humans, resulting in natural stands of the tree being threatened in Africa.



2a,3b-Dihydroxyolean-12-en-28-oic acid

References

1. Catalano S *et al*. (1984) New constituents of *Prunus africana* bark extract. J. Nat. Prod., 47, 910.
2. Fourneau C *et al*. (1996) Triterpenes from *Prunus africana* bark. Phytochemistry, 42, 1387-1389.
3. Bruneton J (1995) Pharmacognosy. Phytochemistry. Medicinal plants. Intercept, Hampshire, USA.
4. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.

3.3.42. *Psidium guajava*

MYRTACEAE
Exotic: Native to South and Central America

Psidium guajava fruit

Psidium guajava bark

Fresh leaves of *Psidium guajava*

Common name: Guava.

Local names: Zeyitum (Amharic, Afar, Oromo); Lipera (Luhya); Mapera (Luo-Kenya, Luo-Acholi); Mpera (Swahili, Kenya and Tanzania); Zeituna (Amara); Zeitun (Somali, Kenya and Ethiopia); Mupeera (Luganda); Ipela (Sukuma).

Conditions treated/controlled: Diarrhoea.

Active/potentially active compounds reported: Flavonoids, saponins combined with oleanolic acid, triterpenic acids and avicularin, which has strong antibacterial action, have been isolated from leaves (1, 2, 3, 4). Nerolidiol, b-sitosterol, ursolic, crategolic and guayavolic acids have also been identified.

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Arima H, Danno G (2002) Isolation of antimicrobial compounds from guava (*Psidium guajava* L.). Biosci. Biotech. Biochem., 66, 1727-1730.
3. Oliver BB (1986) Medicinal plants in tropical West Africa. Cambridge University Press, Cambridge, UK, pp. 457-461.
4. Nadkarni KM, Nadkarni AK (1999) Indian Materia Medica with Ayurvedic, Unani-Tibbi, Siddha, allophatic, homeopathic, naturopathic and home remedies. Volume 1. Popular Prakashan Private Ltd., Bombay, India, pp. 142-149.

3.3.43. *Ricinus communis*

EUPHORBIACEAE Indigenous

Ricinus communis fruit

Ricinus communis flowers

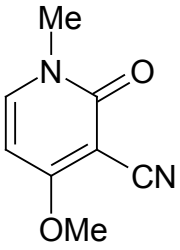
Ricinus communis leaves

Common name: Castor-oil plant.

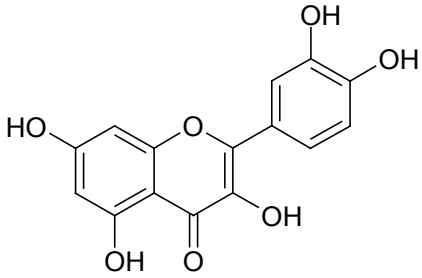
Local name: Kibor (Boran, Borena); M'bono (Giriama); Mbonu (Ilchamus); Libono/ Mubonebone / Kumubono (Luhya); Odagwa/ Obala ndagwa (Luo-Kenya); Oldule/ Orpaliki (Maasai-Kenya); Koboo/ K'obo (Orma); Qobo/ Obo (Oromo); Pondon (Pokot); Fololo (Rendille); Laibelelhi/ Lampalegi (Samburu); Gitkalat (Somali-Kenya); Bor/ Kalika/ Balkon (Somali-Ethiopia); Bonoo (Swahili-Kenya); Ng'hale lya mtono/ Madingwa-ngolo (Sukuma); Gulii (Tigray); Ebune (Turkana); Mbono/ Mbarika/ Nyonyo (Swahili-Tanzania); Nsogasoga (Luganda).

Conditions treated/controlled: Constipation; Dermatophilosis (streptothricosis, lumpy wool); Lumpy skin disease; Retained placenta (retained afterbirth); Wounds.

Active/potentially active compounds reported: Seeds contain around 50% oil, ricinine (an alkaloid) and ricin, which is a very toxic glycoprotein (1, 2). An intake of just two seeds can cause the death of a child, 10 to 15 seeds the death of an adult (1). The seed oil contains glycerides of ricinoleic, isoricinoleic, stearic and dihydroxystearic acids (3). Aerial parts of the plant contain flavonoids such as quercitrin (4). The roots contain alkaloids such as indole-3-acetic acid (5).



Ricinine



Quercitrin

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Wei CH (1973) Two phytotoxic antitumor proteins: ricin and abrin. J. Biol. Chem., 248, 3745-3747.
3. Trease GE, Evans WC (1987) Pharmacognosy. 12th edition. ELBS Alden Press, Oxford, UK.
4. Ahn BT *et al.* (1995) A chemotaxonomic study on Euphorbiaceae in Korea. Nat. Rod. Sci., 1, 86-98.
5. Hall SM, Medlow GC (1974) Identification of alkaloids in phloem and root pressure saps of *Ricinus communis* by mass spectrometry. Planta, 119, 257-261.

3.3.44. *Salvadora persica*

RUTACEAE Indigenous

Salvadora persica bark

Salvadora persica leaves

Salvadora persica tree

Common name: Toothbrush tree.

Local names: Dadaho (Afar); Huda (Boran, Borena, Oromo); Aadde (Gabbra); Mswak/ Nyamit amita (Luo-Kenya); Mswaki (Giriama; Swahili, Kenya and Tanzania); Olremit/ Oremit/ Iremito (Maasai, Kenya and Tanzania); Adhe (Orma); Muade (Pokomo); Asiokonion/ Chokowo (Pokot); Hayay/ Akhai (Rendille); Sokotu/ Sokotei (Samburu); Adhee/ Adhei (Somali-Kenya); Aday/ Aras/ Rumei (Somali-Ethiopia); Mswake/ Muche (Sukuma); Hadai/ Haday (Tigray); Sogotaiwa/ Barsute (Tugen); Esekon/ Esokon (Turkana).

Conditions treated/controlled: Anthrax; Brucellosis (contagious abortion); Mites; Retained placenta (retained afterbirth); Trypanosomosis/trypanosomiasis (sleeping sickness, surra).

Active/potentially active compounds reported: Chemical analysis of *Salvadora persica* has revealed b-sitosterol and m-anisic acid (1), pyrrolidine, pyrrole, and piperidine derivatives (2), glycosides (e.g., salvadoside, salvadoraside) (3) and flavonoids (e.g., kaempferol, quercetin, rutin) (4).

References

1. Ezmirly S *et al.* (1979) Saudi Arabian medicinal plants: *Salvadora persica*. Planta Med., 35, 191-192.
2. Galletti G *et al.* (1993) Pyrolysis/ gas chromatography/ ion-trap mass spectrometry of the 'tooth brush' tree (*Salvadora persica* L.). Rapid Comm. Mass Spect., 7, 651-655.
3. Kamel M *et al.* (1992) Lignan glycosides from stems of *Salvadora persica*. Phytochemistry, 31, 2469-2471.
4. Abdel-Wahab S *et al.* (1990) Investigation of the flavonoid content of *Salvadora persica* L. Bull. Fac. Pharm. Cairo Univ., 28, 67-70.

3.3.45. *Sesbania sesban*

PAPILIONOIDEAE Indigenous

Sesbania sesban leaves, flowers and fruit

Sesbania sesban shrub

Common name: River bean.

Local names: Alk'im/ Digit'a/ Borefe (Amharic); Girangire (Amara); Daisa (Boran, Borena); Kinuka muhondo (Giriama); Chisubasubi/ Lukhule (Luhya); Oyieko/ Sawo sawo (Luo-Kenya); Oloiyangalani (Maasai, Kenya and Tanzania); Enchini/ Harcha (Oromo); Loiyangalani (Samburu); Balembal-biot/ Get-beo (Somali, Kenya and Tanzania); Zuzuma (Sukuma); Muzimbandeya/ Mubimba (Luganda); Tetem agazen (Tigray).

Conditions treated/controlled: East Coast fever; Mastitis (inflammation of the udder, sore teats) and contagious agalactia (reduced milk); Tsetse flies (glossina).

Sesbania sesban has identified alkaloids, flavonoids, phenols and phytosterols (1).

References

1. Mythili T, Ravindhran R (2012) Phytochemical screening and antimicrobial activity of *Sesbania sesban* (L.) Merr. Asian J. Pharm. Clin. Res., 5, 179-182.

3.3.46. *Solanum aculeastrum*

SOLANACEAE Indigenous

Solanum aculeastrum leaves and flowers

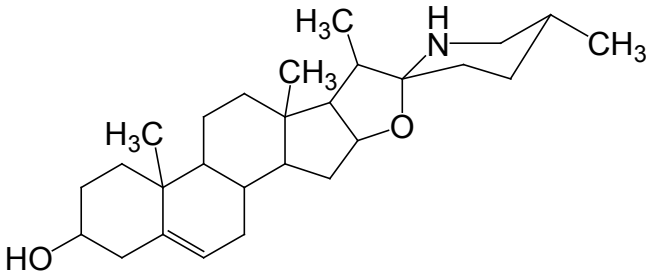
Solanum aculeastrum fruit

Common name: Poison apple.

Local names: Kurara-e (Afar); Idd/ Ano (Boran, Borena); Siganet (Kipsigis); Osigawai (Maasai-Kenya); Hidi (Oromo); Kriri (Somali-Kenya); Adur/ Moh (Somali-Ethiopia); Ettengolyabalalo/ Etengoeddene (Luganda); Matula-mado (Sukuma).

Conditions treated/controlled: Contagious skin necrosis; Dermatophilosis (streptothricosis, lumpy wool).

Active/potentially active compounds reported in *Solanum* species: Solasodine is a poisonous alkaloid that occurs in plants of the Solanaceae family. Solamargine, a glycoalkaloid derived from solasodine, is reported as the main active ingredient in *Solanum incanum* (1, 2). Other compounds isolated from *Solanum* species include sapogenins such as diosgenin and neochlorogenin, found in fruit (1, 3, 4).



Solasodine

References (various *Solanum* species)

1. Elsadig A *et al.* (1997) Changes in the steroidal alkaloid solasodine during development of *Solanum nigrum* and *Solanum incanum*. Phytochemistry, 46, 489-494.
2. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
3. Ntahomvukiye D *et al.* (1981) Diosgenin content of various *Dioscorea* and *Solanum* species grown in Rwanda (Central Africa). J. Nat. Prod., 44, 596-597.
4. Son KH *et al.* (1991) Neochlorogenin from the fruits of *Solanum nigrum*. Kor. J. Pharmacog., 22, 142-143.

3.3.47. *Solanum incanum*

SOLANACEAE Indigenous

Solanum incanum fruit

Solanum incanum flowers

Solanum incanum leaves

Common name: Sodom apple.

Local names: Kurara-e (Afar); Imbway (Amharic); Idi gaga (Boran, Borena); Iddi-loonni (Gabbra); Mtonda (Giriama); Indulandula (Luhya); Ochok (Luo-Kenya); Endulelei (Maasai-Kenya); Hidi (Orma); Hidi (Oromo); Yohola (Rendille); Ltulelei (Samburu); Karir (Somali-Kenya); Adur/Moh (Somali-Ethiopia); Etulelo (Turkana); Mutunguja-mwilu (Swahili); Matula-amatale (Sukuma).

Conditions treated/controlled: Contagious pleuropneumonia (bovine and caprine); East Coast fever; Foot-and-mouth disease; Heartwater (cowdriosis); Liver fluke disease (fasciolosis); Lumpy skin disease; Nasal bot (fly larvae).

Active/potentially active compounds reported: See under *Solanum aculeastrum* (3.3.46).

3.3.48. *Tagetes minuta*

COMPOSITAE Exotic: Native to USA

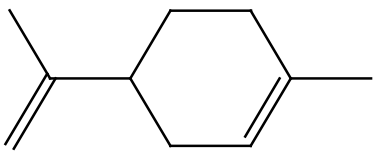
Tagetes minuta leaves and flowers

Tagetes minuta plants

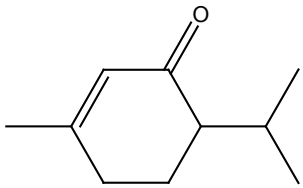
Common names: Khaki weed; Mexican marigold.

Conditions treated/controlled: Fleas; Lice; Mosquitoes; Ringworm; Trypanosomosis/ trypanosomiasis (sleeping sickness, surra).

Active/potentially active compounds reported: *Tagetes minuta* is rich in phytochemicals, including acyclic, monocyclic (e.g., limonene, piperitone) and bicyclic monoterpenes, as well as sesquiterpenes, flavonoids and thiophenes (1).



Limonene



Piperitone

References

1. Adams RP (2007) Identification of essential oil components by gas chromatography/mass Spectroscopy. 4th edition, Allured Publishing, Carol Stream, Illinois, USA.

3.3.49. *Vernonia amygdalina*

ASTERACEAE Indigenous

Vernonia amygdalina tree with flowers

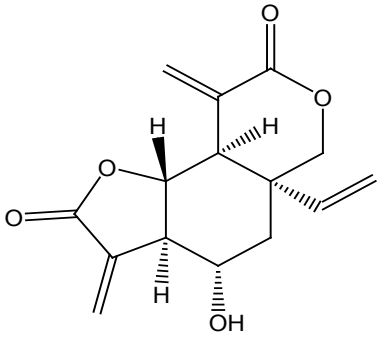
Vernonia amygdalina leaves and flowering buds

Common name: Tree vernonia.

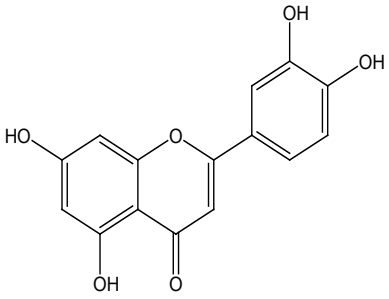
Local names: Grawa (Amharic); Ebicha (Oromo); Musuritsa/ Omulusya/ Olumulusya/ Kumwilulusia (Luhya); Olulusia/ Olusia (Luo-Kenya); Mtukutu (Swahili); Mgumambu (Sukuma); Mululuza (Luganda); Labori (Luo-Acholi); Okelo-okelo (Luo-Lango).

Conditions treated/controlled: Bloat (tympany); Broken bones (fractures); East Coast fever; Foot-and-mouth disease; Footrot.

Active/potentially active compounds reported in *Vernonia* species: Phytochemical investigations of *Vernonia* have revealed oxalates, tannins, stigmastane-type saponins, sesquiterpene lactones (e.g., vernolepin), coumarins, phenolic acids, xanthones, flavonoids (e.g., luteolin) and anthraquinones (1, 2, 3, 4, 5, 6, 7).



Vernolepin



Luteolin

References (various *vernonia* species)

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Dharani N *et al*. (2010) Common antimalarial trees and shrubs of East Africa. A description of species and a guide to cultivation and conservation through use. Dawson I ed. The World Agroforestry Centre, Nairobi, Kenya.
3. Harborne JB (1973) Phytochemical methods. Chapman and Hall, London, UK.
4. Eleyinmi AF *et al*. (2008) Nutritional composition of *Gongronema latifolium* and *Vernonia amygdalina*. Nutr. Food Sci., 38: 99-109.
5. Erasto P *et al*. (2006) Bioactive sesquiterpene lactones from the leaves of *Vernonia amygdalina*. J. Ethnopharmacol., 106, 117-120.
6. Tona L *et al*. (2004) *In vitro* antiplasmodial activity of extracts and fractions of seven medicinal plants used in the Democratic Republic of Congo. J. Ethnopharmacol., 93, 27-32.
7. Ijeh II, Ejike CECC (2011) Current perspectives on the medicinal potentials of *Vernonia amygdalina* Del. J. Med. Plants Res., 5, 1051-1061.

3.3.50. *Vernonia auriculifera*

ASTERACEAE Indigenous

Vernonia auriculifera shrub with flowers

Vernonia auriculifera leaves

Common name: Vernonia.

Local names: Gujo (Amharic); Grawa (Amara); Olusia (Luo); Ol-masakwa (Maasai-Kenya); Tebinguet (Tugen); Kikokooma (Luganda); Aebicha/ Reji (Oromo, Sidiamo).

Conditions treated/controlled: Broken bones (fractures); East Coast fever.

Active/potentially active compounds reported: See under *Vernonia amygdalina* (3.3.49).

3.3.51. *Warburgia ugandensis*

RUTACEAE Indigenous

Warburgia ugandensis bark

Warburgia ugandensis leaves

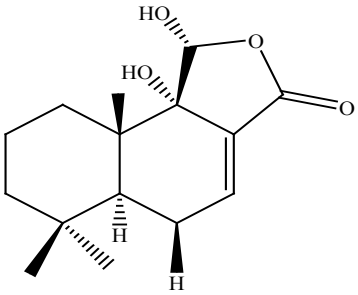
Warburgia ugandensis tree

Common name: East African greenheart.

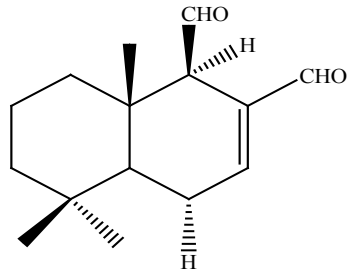
Local names: Kanafa/ Zogdom (Amara); Apacha/ Apachi/ Abaki/ Kumusikha (Luhya); Abaki/ Soko/ Sogo-maitha (Luo-Kenya); Olsogonoi/ Olsokonoi (Maasai-Kenya); Sorget/ Soke (Tugen); Olmsogoni/ Msokonoi (Maasai-Tanzania); Mukuzanume/ Muwiya (Luganda); Befti (Oromo).

Conditions treated/controlled: Anaplasmosis; Babesiosis (redwater fever); Contagious pleuropneumonia (bovine and caprine); East Coast fever; Heartwater (cowdriosis); Trypanosomosis/trypanosomiasis (sleeping sickness, surra).

Active/potentially active compounds reported: A number of drimane-type sesquiterpenes such as ugandenial A and polygodial (1, 2, 3, 4) have been reported, as well as flavonoids and flavonol glycosides (5, 6). The sesquiterpenes of *Warburgia* species are known to possess insect antifeedant, antimicrobial, antiulcer, molluscicidal and antifungal properties (1, 2, 7). The bark is widely harvested in East Africa for human medicinal use.



Ugandenial A



Polygodial

References

1. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
2. Dharani N *et al.* (2010) Common antimalarial trees and shrubs of East Africa. A description of species and a guide to cultivation and conservation through use. Dawson I ed. The World Agroforestry Centre, Nairobi, Kenya.
3. Kubo I *et al.* (1976) Potent army worm antifeedants from the East African *Warburgia* plants. Chem. Commun., 24, 1013-1014.
4. Wube *et al.* (2005) Sesquiterpenes from *Warburgia ugandensis* and their antimycobacterial activity. Phytochemistry, 66, 2309-2315.
5. Manguro LOA *et al.* (2003) Flavonol and drimane-type sesquiterpene glycosides of *Warburgia stuhlmannii* leaves. Phytochemistry, 63, 497-502.
6. Manguro LOA *et al.* (2003) Flavonol glycosides of *Warburgia ugandensis* leaves. Phytochemistry, 64, 891-896.
7. Kubo I *et al.* (1983) Structure of mukaadial, a molluscicide from the *Warburgia* plant. Chem. Lett., 979-980.

3.3.52. *Zanthoxylum chalybeum*

RUTACEAE Indigenous

Zanthoxylum chalybeum leaves

Zanthoxylum chalybeum young stem bark

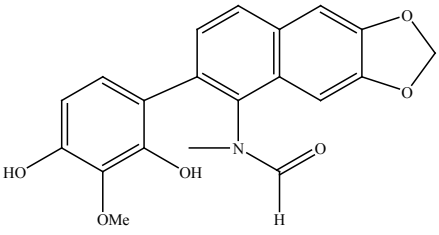
Zanthoxylum chalybeum old tree bark

Common name: Knobwood.

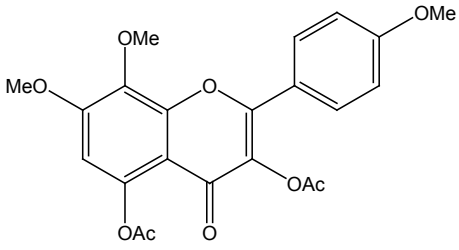
Local names: Eusuk (Ateso-Ngakarimojong); Gadda (Boran, Gabbra); Mudhungu (Giriama); Loisuki/ Lousukui (Ilchamus); Roko (Luo-Kenya); Kichuk/ Roki (Luo-Acholi); Ntaleyedungu (Luganda); Oloisugi/ Oloisuki (Maasai, Kenya and Tanzania); Songowo/ Songooh (Pokot); Loisugi/ Loisuki (Samburu); Mjafari (Swahili, Kenya and Tanzania); Kokian (Tugen); Eusugu (Turkana); Ntaleyedungu (Luganda).

Conditions treated/controlled: Colds, coughs and pneumonia; Diarrhoea.

Active/potentially active compounds reported: Phytochemical studies on the genus *Zanthoxylum* have revealed alkaloids (such as iwamide), flavonoids (such as 3,5-diacetyltambuline), sterols and terpenes (1, 2).



Iwamide



3,5-Diacetyltambuline

References

1. Dharani N *et al.* (2010) Common antimalarial trees and shrubs of East Africa. A description of species and a guide to cultivation and conservation through use. Dawson I ed. The World Agroforestry Centre, Nairobi, Kenya.
2. Adesina SK (2005) The Nigerian *Zanthoxylum*: chemical and biological values. Afric. J. Trad. Compl. Altern. Medi., 2, 282-301.

3.3.53. *Zingiber officinale*

ZINGIBERACEAE Exotic: Native to Asia

Rhizomes of *Zingiber officinale*

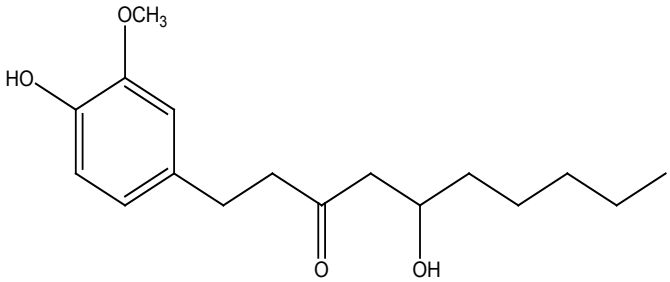
Zingiber officinale plants removed from soil

Common name: Ginger.

Local names: Jinjibil/ Zinjibil (Amharic); Kunidi (Boran, Borena); Jinjibili/ Zinjibili (Afar, Oromo); Ntangawizi (Swahili, Tanzania and Kenya); Jinjibili/ Dendabili (Tigray); Tangawizi (Sukuma).

Conditions treated/controlled: Diarrhoea; Stomach and intestinal worms.

Active/potentially active compounds reported: Rhizomes of ginger contain up to 3% of volatile oils (1), with several monoterpenoids (e.g., camphene, neral, ß-phellandrene) and sesquiterpenoids (e.g., α-zingiberene) (1, 2, 3, 4, 5). Anti-inflammatory activity is associated with gingerol and its analogs (6).



6-Gingerol

References

1. Stuart M (1979) The encyclopedia of herbs and herbalism. Orbis Publishing, London, UK.
2. Van Beek TA (1991) Special methods for essential oil of ginger. In: Linskens HF, Jackson JF (eds.) Essential oils and waxes. Springler-Verlag, Berlin, Germany, pp. 79-97.
3. Bruneton J (1995) Pharmacognosy. Phytochemistry. Medicinal plants. Intercept, Hampshire, USA.
4. Trease GE, Evans WC (1987) Pharmacognosy. 12th Edition. ELBS Alden Press, Oxford, UK.
5. Dharani N, Yenesew A (2010) Medicinal plants of East Africa: an illustrated guide. Najma Dharani in association with Drongo Editing & Publishing, Nairobi, Kenya.
6. Lantz RC *et al.* (2007) The effect of extracts from ginger rhizome on inflammatory mediator production. Phytomedicine, 14, 123-128.

Appendix 1. Animal conditions and plants indicated for treatment/control

The conditions listed below, in alphabetical order, are those found in Part 2 of this manual. Subsection references in Part 2 are given in parentheses. Plants that are described in Part 3 of this manual for the treatment and control of these conditions are given in bold for each condition (plant species given in normal type are mentioned in Part 2 of this manual but are not included in the descriptions of Part 3). In total, Part 3 of this manual, where plants are listed in alphabetical order by their Latin binomial, contains reference to 53 species.

Abscesses (2.2.9.2.)
Azadirachta indica
Commiphora erythraea
Datura stramonium
Harrisonia abyssinica

Anaplasmosis (2.2.2.3.)
Acacia oerfota
Aspilia mossambicensis
Azadirachta indica
Capsicum frutescens
Croton megalocarpus
Solanum nigrum
Warburgia ugandensis

Anthrax (2.2.8.8.)
Balanites aegyptiaca
Grewia villosa
Salvadora persica

Avian coryza (infectious coryza) (2.2.7.3.)
Aloe secundiflora
Aloe vera
Amaranthus hybridus
Capsicum frutescens

Babesiosis (redwater fever) (2.2.2.4.)
Acacia dolichocephala
Acacia oerfota
Azadirachta indica
Prunus africana
Warburgia ugandensis

Biting flies (2.2.1.7.)
Adenium obesum
Azadirachta indica

Bloat (tympany) (2.2.6.1.)
Vernonia amygdalina

Broken bones (fractures) (2.2.9.4.)
Vernonia amygdalina
Vernonia auriculifera

Brucellosis (contagious abortion) (2.2.8.3.)
Kigelia africana
Salvadora persica

Castration (2.2.9.3.)
Acalypha fruticosa
Aloe secundiflora
Elaeodendron buchananii

Coccidiosis (coccidia) and colibacillosis (2.2.6.4.)
Acacia mellifera
Acacia xanthophloea
Aloe secundiflora
Cissus quadrangularis

Colds, coughs and pneumonia (2.2.7.1.)
Allium sativum
Aloe secundiflora
Azadirachta indica
Capsicum frutescens
Ocimum kilimandscharicum
Zanthoxylum chalybeum

Constipation (2.2.6.3.)
Carica papaya
Ricinus communis

Contagious pleuropneumonia (bovine and caprine) (2.2.7.5.)
Capsicum frutescens
Harrisonia abyssinica
Solanum incanum
Warburgia ugandensis

Contagious skin necrosis (2.2.3.2.)
Euphorbia robecchii
Solanum aculeastrum

Dermatophilosis (streptothricosis, lumpy wool) (2.2.3.1.)
Azadirachta indica
Khaya anthotheca
Ricinus communis
Solanum aculeastrum

Diarrhoea (2.2.6.2.)
Acacia oerfota
Aloe secundiflora
Acacia seyal
Capsicum frutescens
Commiphora africana
Grewia similis
Psidium guajava
Zanthoxylum chalybeum
Zingiber officinale

East Coast fever (2.2.2.1.)
Adansonia digitata
Azadirachta indica
Sesbania sesban
Solanum incanum
Vernonia amygdalina
Vernonia auriculifera
Warburgia ugandensis

Eye diseases and problems, general treatment (2.2.4.)
Acacia mellifera
Aloe secundiflora
Balanites aegyptiaca
Boscia coriacea
Nicotiana tabacum

Eyeworms (thelaziosis) (2.2.4.2.)
Azadirachta indica
Nicotiana tabacum
Piliostigma thonningii

Fleas (2.2.1.2.)
Adenium obesum
Aloe secundiflora
Azadirachta indica
Ocimum kilimandscharicum
Tagetes minuta

Foot-and-mouth disease (2.2.8.7.)
Acacia oerfota
Acacia tortilis
Acalypha fruticosa
Solanum incanum
Vernonia amygdalina

Footrot (2.2.8.9.)
Acalypha fruticosa
Vernonia amygdalina

Fowl cholera (pasteurellosis) (2.2.7.4.)
Aloe secundiflora
Aloe vera
Amaranthus hybridus
Capsicum frutescens

Heartwater (cowdriosis) (2.2.2.2.)
Azadirachta indica
Capsicum frutescens
Solanum incanum
Strychnos henningsii
Warburgia ugandensis

Lice (2.2.1.3.)
Azadirachta indica
Allium sativum
Eucalyptus citriodora
Tagetes minuta
Tephrosia vogelii

Liver fluke disease (fasciolosis) (2.2.5.3.)
Albizia anthelmintica
Albizia coriaria
Lantana trifolia
Solanum incanum
Trichilia emetica

Lumpy skin disease (2.2.3.4.)
Aloe secundiflora
Harrisonia abyssinica
Ricinus communis
Solanum incanum

Lungworms (ascaris worms) (2.2.5.2.)
Albizia anthelmintica
Albizia coriaria
Lantana trifolia
Trichilia emetica

Mastitis (inflammation of the udder, sore teats) and contagious agalactia (reduced milk) (2.2.8.1.)
Ajuga remota
Sesbania sesban

Metritis (infected uterus and vaginal discharge) (2.2.8.5.)
Acacia drepanolobium
Acacia oerfota
Acalypha fruticosa
Aloe secundiflora
Azadirachta indica

Mites (2.2.1.8.)
Aloe secundiflora
Commiphora erythraea
Juniperus procera
Salvadora persica

Mosquitoes (2.2.1.5.)
Azadirachta indica
Commiphora erythraea
Eucalyptus citriodora
Ocimum kilimandscharicum
Tagetes minuta

Nasal bot (fly larvae) (2.2.1.6.)
Acacia brevispica
Solanum incanum

Newcastle disease (fowl pest) (2.2.7.2.)
Aloe secundiflora
Aloe vera
Amaranthus hybridus
Capsicum frutescens

Orf (contagious pustular dermatitis, contagious ecthyma) (2.2.3.6.)
Acacia nilotica

Pink-eye (kerato-conjunctivitis) (2.2.4.1.)
Azadirachta indica
Combretum molle
Euphorbia candelabrum
Ocimum kilimandscharicum

Pox (2.2.3.5.)
Acalypha fruticosa
Agave sisalana
Aloe secundiflora
Azadirachta indica
Microglossa pyrifolia

Retained placenta (retained afterbirth) (2.2.8.2.)
Acacia drepanolobium
Balanites aegyptiaca
Carica papaya
Cissus quadrangularis
Grewia villosa
Harrisonia abyssinica
Moringa stenopetala
Ricinus communis
Salvadora persica

Ringworm (2.2.3.3.)
Allium sativum
Azadirachta indica
Carissa spinarum
Commiphora erythraea
Datura stramonium

Tagetes minuta

Salmonellosis (fowl typhoid, pullorum disease) (2.2.6.5.)
Aloe secundiflora
Azadirachta indica
Croton megalocarpus

Sheath rot (discharge from the penis) (2.2.8.6.)
Acacia drepanolobium
Aloe secundiflora
Azadirachta indica

Stomach and intestinal worms (2.2.5.1.)
Allium sativum
Capsicum frutescens
Carissa spinarum
Cucurbita maxima
Hagenia abyssinica
Myrsine africana
Rhus vulgaris
Zingiber officinale

Snake bite (2.2.9.6.)
Gardenia ternifolia var. jovis-tonantis
Steganotaenia araliacea

Ticks (2.2.1.1.)
Adenium obesum
Ajuga remota
Aloe secundiflora
Azadirachta indica
Commiphora africana
Commiphora erythraea
Commiphora myrrha
Nicotiana tabacum

Trypanosomosis/trypanosomiasis (sleeping sickness, surra) (2.2.2.5.)
Acacia reficiens
Azadirachta indica
Salvadora persica
Tagetes minuta
Warburgia ugandensis

Tsetse flies (glossina) (2.2.1.4.)
Azadirachta indica
Sesbania sesban

Venereal diseases (2.2.8.4.)
Acacia drepanolobium
Acacia oerfota
Acalypha fruticosa
Aloe secundiflora
Azadirachta indica

Wounds (2.2.9.1.)
Acacia bussei
Acacia etbaica
Acacia senegal
Aloe secundiflora
Adenium obesum
Bulbine abyssinica
Commiphora erythraea
Commiphora myrrha
Croton macrostachyus
Croton megalocarpus
Elaeodendron buchananii
Euphorbia candelabrum
Myrsine africana
Ricinus communis

In sub-Saharan Africa, tens of millions of people rely on livestock as important sources of food and income. Poor animal health is a major constraint to livestock production in East African countries, with the impacts of disease particularly severe for poor communities that have limited access to modern veterinary services. Rural communities have engaged in a long tradition of ethnoveterinary practices to care for their animals, involving the use of many plants to prevent and treat different diseases and health conditions. This manual documents ethnoveterinary practices in Ethiopia, Kenya, Tanzania and Uganda and describes 53 of the plants involved. The information provided is based on written sources and discussions with the communities that engage in the practices described.

ISBN: 978-92-9059-335-5

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