Diversity of plants used in traditional veterinary medicine in Central-Eastern Burkina Faso

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Ethnobotany Research and Applications 30:2 (2025) - http://dx.doi.org/10.32859/era.30.2.1-30
Manuscript received: 23/10/2024 - Revised manuscript received: 05/01/2025 - Published: 06/01/2025

Research

Abstract

Background: In the West African Sahel, ethnoveterinary medicine is widely practiced by livestock farmers but remains poorly documented. This study aims to describe the medicinal plants and traditional recipes used for treating major animal diseases in Burkina Faso, specifically in the Centre-Eastern region.

Methods: Semi-structured surveys were conducted from August to October 2024 with 120 livestock farmers randomly selected from five communes in the Centre-Eastern region of Burkina Faso. Data were analyzed using relative frequency of citations and Sankey diagrams.

Results: A total of 38 animal diseases were reported, with diarrhea (11%), trypanosomiasis (10%) and retained placenta (9%) being the most frequently cited. The primary causes of animal diseases were nutritional (28.72%), parasitic (26.28%) and environmental (16.26%). Livestock farmers used 88 plant species from 73 genera and 34 families to treat these diseases. The most represented families were Fabaceae (21.59%), Malvaceae (9.08%) and Poaceae (6.82%). The most frequently used species were *Khaya senegalensis* (34.02%), *Parkia biglobosa* (18.40%), *Terminalia leiocarpa* (10.00%), *Vachellia nilotica* (9.03%) and *Vitellaria paradoxa* (8.00%). All plant parts were used in the disease treatment, with bark (35.56%), leaves (21.08%) and fruits (11.88%) being the most frequently used. Six preparation methods were identified in the formulation of ethnoveterinary remedies, with maceration (38.82%) and decoction (34.04%) being the most common. Approximately 86.45% of the recipes were plant-based, while 13.55% included mineral products. Eight administration routes were reported with oral (46.15%), anal (17.31%) and topical (17.31%) applications being the most frequent.

Conclusions: This study documents the use of plants in traditional veterinary medicine practiced by livestock farmers and provides important information to complement modern veterinary medicine in addressing livestock health issues.

Keywords: Ethnoveterinary medicine, Animal diseases, Medicinal plants, Sahel.

Background

Livestock farming is one of the main activities undertaken by vulnerable communities as a food security strategy in the Sahelian countries of West Africa (Eeswaran *et al.* 2022). In Burkina Faso, the contribution of the livestock sector to the country economy and development is estimated at 18% of gross domestic product and 26% of exportation (FAO 2019). Livestock is the country's third largest export sector, after gold mining and cotton production (INSD 2020). The country's livestock includes a wide range of species, with around 9 million cattle, 14 million goats, 9 million sheep and 44 million poultry (FAO 2019). These well-stocked herds are a valuable source of meat, milk, eggs, manure and draught power for the population (Molina-Flores *et al.* 2020). Unfortunately, livestock are frequently affected by a wide range of stress factors, mainly disease, but also physical injury and other poor husbandry conditions. All these factors are exacerbated by water scarcity and the lack of fodder available to the herd due to the worsening climate (Hiernaux *et al.* 2015) in a country already subject to recurrent water stress such as Burkina Faso. The occurrence of diseases in livestock herd results in severe economic and protein losses for livestock farmers in particular and for the whole population of the country in general (WOAH 2018).

Losses due to animal diseases are sometimes attributed to low vaccination coverage and the inaccessibility or high cost of veterinary medicines. In some cases, little is known about their application and effectiveness (Upadhyay *et al.* 2011). In addition, since the domestication of animals, all societies around the world have developed effective local practices for preventing and treating animal diseases. Such traditional practices are commonly known as veterinary ethnomedicine (Bâ 1996; Baerts *et al.* 2002; Lans *et al.* 2007) or ethnoveterinary medicine. African ethnomedicine and veterinary pharmacopoeia are practised and transmitted from generation to generation, with the contents remaining the heritage of either a family or a particular social group in a village or region (Tamboura *et al.* 1998). Many years of daily and artisanal practice have led to the belief that reliable recipes exist within African communities (Ki-Zerbo 1994).

The World Health Organisation estimates that 80% of the populations of Asia, Africa and Latin America use traditional medicine to meet their primary health care needs (Kasilo *et al.* 2010). According to Mathias (2010), ethnomedicine is more understandable and better adapted to local realities than modern veterinary medicine. Ethnomedicine is accessible, easy to prepare and administer, inexpensive and integrated into the traditional culture of its users (Anyinam 1987). Ethnoveterinary medicine is also less prone to pathogen resistance problems and has fewer environmental side effects than modern medicines (Toyang *et al.* 2007). Unfortunately, with the rise of modern healthcare methods, veterinary ethnomedicine is at risk of extinction. The majority of indigenous knowledge is held by the elder members of the community, who often pass away without having imparted all of their insights to the next generation. In addition, modernization of the society and its practices encourages young African generations to abandon the beliefs and traditions of their ancestors (Toyang *et al.* 2007; Kpodékon *et al.* 2016; Aswani *et al.* 2018). As a result, there is a continuous erosion of traditional knowledge, particularly in the area of ethnoveterinary practices. However, given its significance, preserving this knowledge as a cultural heritage is crucial.

This research seeks to document the use of plants in traditional veterinary medicine. Specifically, it aims to: (i) Identify the most common animal diseases in the study area; (ii) Identify the plant species and the specific plant parts used in the treatment of these diseases, along with the recipes used by livestock farmers. The hypotheses underlying this study are as follows: (i) livestock farmers are knowledgeable about the diseases affecting their animals, (ii) various plant species are utilized to treat these animal diseases, and (iii) multiple remedies are traditionally formulated to address animal diseases.

Materials and Methods

Study area

The study was conducted in the province of Boulgou, located in the Centre-Eastern region of Burkina Faso. The study area includes six communes namely the urban communes of Tenkodogo and Garango and the rural communes of Komtoèga, Boussouma, Béguédo and Niaogo (Figure 1). The province of Boulgou covers a total area of 6,692 km². It is bordered to the north by the provinces of Kouritenga and Ganzourgou, to the south by Ghana and Togo, to the east by the provinces of Gourma and Koulpélogo, and to the west by the provinces of Zoundwéogo and Nahouri. Population is mainly composed of ethnic groups Bissa, Mossi, Peulh, Koussassé and Yanna (INSD 2020). The administrative centre of the province is Tenkodogo, located 185 km away from Ouagadougou, the capital of Burkina Faso, 105 km away from the border with Togo and 78 km away from the border with Ghana.

The province belongs to the Sudano-Sahelian climatic zone of Burkina Faso, which is characterised by isohyets of 600 to 900 mm and two alternating seasons: a long dry season from November to May and a short rainy season from June to October. The mean annual rainfall and temperature over the last 30 years (1990 to 2024) were 819.75 ± 195.48 mm and 28.94 °C, respectively (National Meteorology Agency of Burkina Faso, 2024).

The degradation of plant resources in the province of Boulgou is more pronounced. Agroforestry parks and other anthropogenic configurations dominate the natural vegetation, which consists mainly of shrub and tree savannahs (Fontès & Guinko 1995). However, the province of Boulgou hosts two classified forests (Oulingouré and Yakala, which are completely flooded by the Bagré dam and one intercommunal forest (Sablogo). The province hosts several other protected areas, spanning communal forests, botanical gardens, sacred forests, elephant migration corridor and fenced areas. The most common woody species are *Vitellaria paradoxa* C.F. Gaertn., *Combretum glutinosum* Perr. ex DC., *Terminalia leiocarpa* (DC.) Baill., *Senegalia gourmaensis* (A. Chev.) Kyal. & Boatwr, *Piliostigma reticulatum* (DC.) Hochst., *Balanites aegyptiaca* (L.) Delile, *Guiera senegalensis* J.F. Gmel. (Nacoulma et al. 2018). The most abundant herbaceous species are *Schoenefeldia gracilis* Kunth, *Andropogon gayanus* Kunth, *Andropogon pseudapricus* Stapf, *Loudetia togoensis* (Pilg.) C.E. Hubb., *Spermacoce stachydea* DC, *Hyptis suaveolens* (L.) Poit., *Pennisetum pedicellatum* Trin..

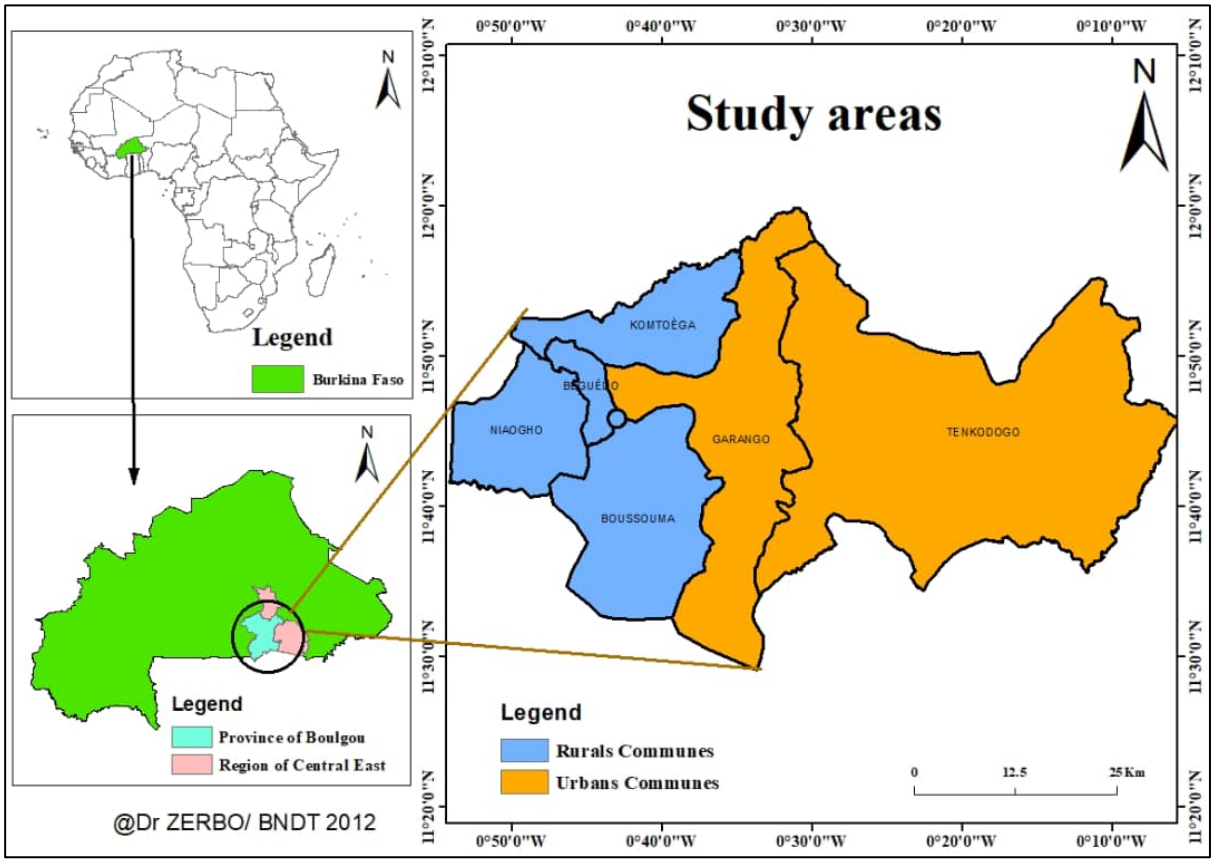

Figure 1. Map showing the study area

Sampling and data collection

The study was conducted from August to October 2024 in six communes of the Boulgou province namely Tenkodogo, Garango, Komtoèga, Boussouma, Béguédo and Niaogo. These communes were selected based on the reputation or the popularity of the villages in traditional veterinary medicine and the predominant use of plant in traditional veterinary medicine (van den Veerle *et al.* 1993). Before data collection, a meeting was held with livestock department extension officers of each commune, village development advisors and local village leaders. This facilitated the presentation of the study's objectives and allowed for obtaining verbal consent from all participants prior to the surveys. The size of livestock and socio-linguistic groups were finally used following Dassou *et al.* (2015). This resulted in 120 livestock farmers interviewed across the six communes.

Individual semi-structured surveys were used. The components of the questionnaire included:

i. the socio-demographic information (identity, age, sex, ethnic group, social function, level of education, social status),
ii. the type of health management used (veterinary pharmacopoeia or veterinary medicine),
iii. the names of the animal diseases in vernacular languages and according to modern medicine,
iv. the target group of animal species affected,
v. the syndromes, the etiology and the period of the disease, and
vi. the plants used (species, plant parts, formulation and method of administration).
The animal diseases were described with the help of veterinary staff in the different localities of the study area.

Data analysis

Relative frequencies of citation (RFC) were used to determine the most frequently cited animal diseases. Using the networkD3 package (Allaire et al. 2017) through the R4.2.3 software (R Core Team 2023), the Sankey diagram was used to assess the relationship between the most cited diseases and the type of livestock species (cattle, sheep, goats, pigs, donkeys and poultry). In addition, the taxonomic diversity of plant species used in the treatment of animal diseases was assessed by the number of botanical families, the number of genera and the number of plant species cited by livestock farmers. The names of each plant species and botanical family were transcribed according to the International Plant Names Index (https://www.ipni.org/) and the Catalogue of Vascular Plants of Burkina Faso (Thiombiano et al. 2012). Relative frequencies of citation were then used to determine the most commonly used plant species, the most commonly used plant parts in the preparation of remedies, the methods of preparation of remedies, the types of combination of remedies and the methods of administration of remedies. The relative frequency of citations (RFC) was calculated using the formula:

$$RFC\ (\%) = ni/N \times 100$$

where
ni = the number of citations of the modality and
N = the total number of respondents.

The R4.2.3 software (R Core Team 2023) and the ggplot2 package (Wickham 2016) were used to plot the various graphs.

Results

Socio-demographic characteristics of livestock farmers

The majority of livestock farmers were men (95.80%) (Table 1). The most representative ethnic groups were Fulani (67.46%), Bissa (21.30%) and Mossi (11.24%). The average age of the respondents was 51 years, with more than 52% of the respondents being over 50 years. In terms of education the results showed that 82.10% of respondents were illiterate, 13.35% had their education up to primary level and 5.65% had up to secondary level.

Table 1. Socio-demographic characteristics of respondents

Socio-demographic characteristics	**Percentage (%)**
Ethnic group	
Fulani	67.46
Bissa	21.30
Mossi	11.24
Total	**100**
Gender	
Men	95.80
Woman	4.20
Total	**100**
Age classes	
Youngs (20-39 years)	24.58
Adults (40-59 years)	48.88
Olds (≥ 60 years)	26.54
Total	**100**
Education level	
Illiterate	82.10
Primary school	12.35
Secondary school	5.65
Total	**100**

Relationship between diseases, livestock and pathological syndromes

A total of 38 diseases and other ailments from six classes of livestock (cattle, sheep, goats, donkeys, pigs and poultry) were identified by the livestock farmers in the study area (Figure 2). The most common ailments were diarrhea (10.60%), trypanosomiasis (9.78%), retained placenta (8.70%), Newcastle disease (7.61%) and helminthosis (7.34%).

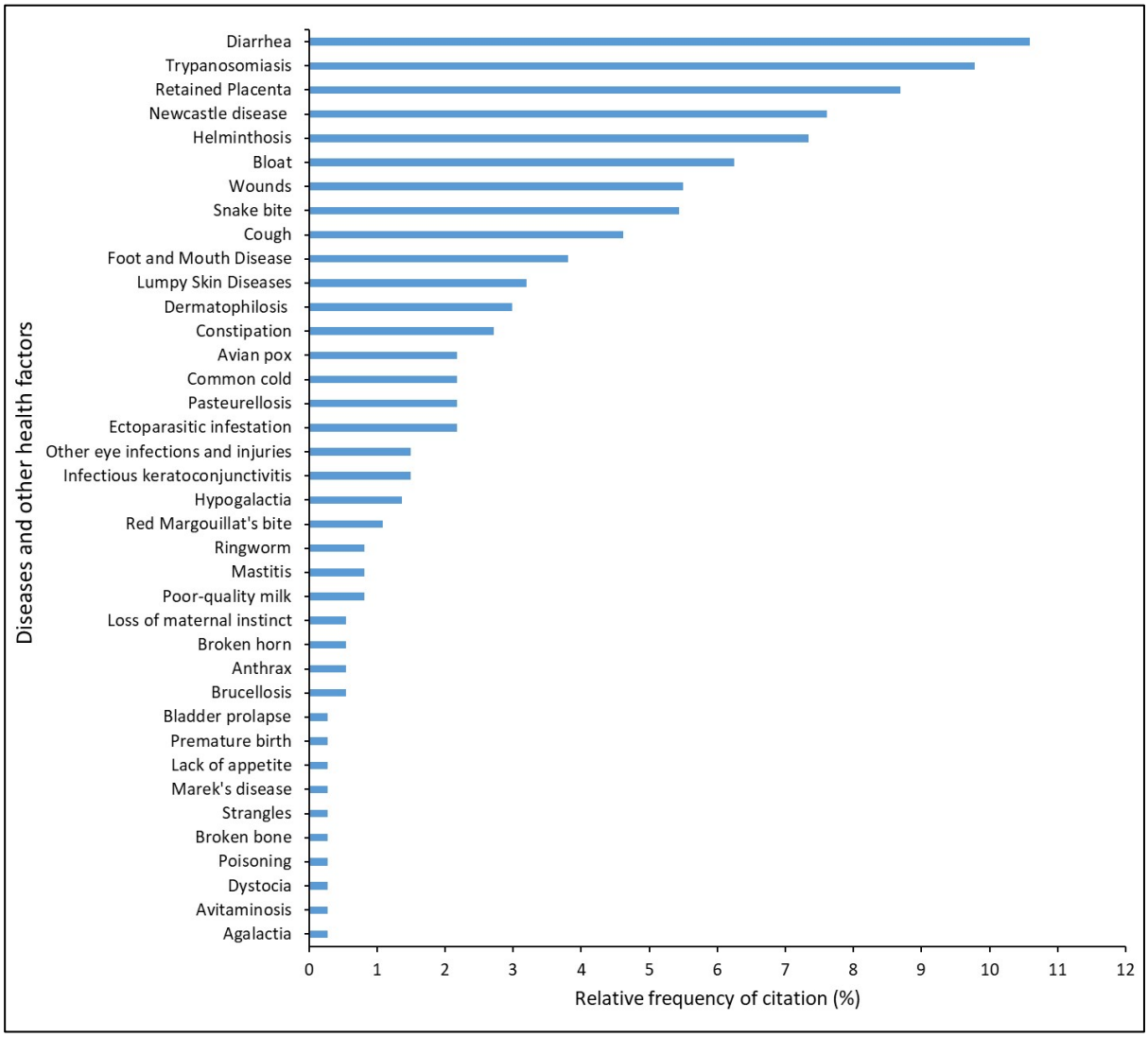

Figure 2. Livestock ailments affecting livestock health in the study area.

These diseases and other non-disease factors had different effects on the livestock in the study area (Figure 3). However, ruminants (cattle, sheep, goats), non-ruminants (donkeys) and poultry were affected by internal parasite infestations. In addition, infestations due to ectoparasites have affected both ruminants and poultry. Additionally, ruminants and poultry were found to be susceptible to pasteurellosis and diarrhea, while trypanosomiasis impacted both ruminants and pigs. Donkeys and ruminants were particularly affected by wounds and coughing. Pseudo-fowl pest and avian pox were specific to poultry, while foot-and-mouth disease affected only ruminants.

The pathological syndromes described by livestock farmers indicate that several factors contribute to livestock diseases (Table 2). Among these, nutritional causes were the most frequently cited, accounting for 28.72%. This was followed by parasitic factors (helminths and external parasites) at 26.28% and environmental factors (such as wind, rain, and water) at 16.26%.

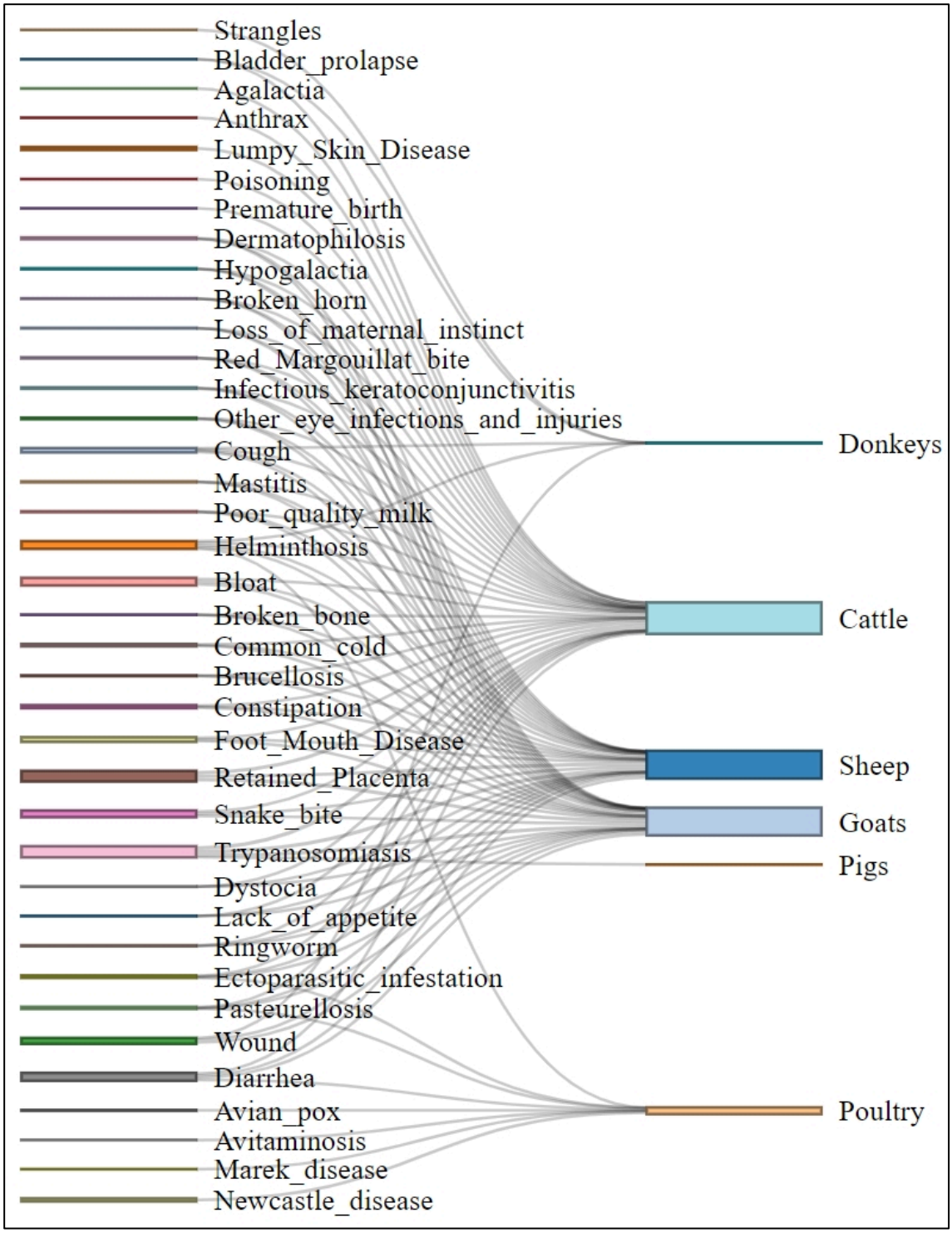

Figure 3. Interrelationship between livestock category and factors affecting their health

Table 2. Farmers' local knowledge on diseases and non-diseases factors affecting livestock health (B =Bissa, F= Fulani, M= Mossi)

Diseases and non-diseases factors	Disease local name	Affected animals	Syndromes	Etiology	Period of disease
Agalactia		Cattle, Sheep, Goats	Complete absence of milk excretion	Hereditary	All year round
Anthrax	Pidoel (F) Taondré (M)	Cattle	Loss of appetite, fever, diarrhea, epistaxis, prickly hair, salivation, hyperthermia	Contaminated grass and water	Beginning of the rainy season
Avian pox	Noondjogma (M)	Poultry	Depression, nodules on bare head, and high mortality rates among the chicks	Domestic sewage, waste, and excrement from sick animals, along with dust.	Harmattan
Avitaminosis		Poultry	Feathers pluck easily, weight loss, dull appearance of feathers	Underfeeding and low nutritional feed quality	All year round
Bladder prolapse		Cattle, Donkey	There is a noticeable mass or pressure in the vagina, causing the vaginal wall to stretch in the area where the bladder is located.	Trypanosomiasis	All year round
Bloat	Puwuka (M)	Cattle, Sheep, Goats	Left flank swelling, dyspnea, bloated abdomen, percussive bruit, inappetence	Diet origin	All year round
Brucellosis	Puuwudgu (M)	Cattle, Sheep, Goats	Abortion after 5 months of gestation, stillbirth, sterility of both sexes, knee hygroma, lameness, retained placenta/bull: mating causes abortions,	Contagion	All year round
Broken bone		Cattle, Sheep, Goats	Lameness - loss of leg support	Poor diet	All year round
Broken horn		Cattle, Sheep, Goats	Part of the horn breaks	Accidental	All year round
Cold	Meongo (M)	Cattle, Sheep, Goats	Nasal discharge, animal breathes heavily and rapidly	Cold weather and cold water	Cold period
Constipation	Poukenga (M)	Cattle, Sheep, Goats	Inappetence, difficulty defecating, hard black faeces	Low-fibre diet	All year round
Cough	Konsgo (M)	Cattle, Sheep, Goats	Strong, dry cough, respiratory discomfort	Cold weather, dust	Harmatan
Dermatophilosis	Burgumdi (M)	Cattle	Skin inflammation, hair loss, abnormal hair appearance	Unknown	rainy season
Diarrhea	Noonn-sanga (M)	Poultry	Whitish diarrhea, after eating cereal regrowth: small millet, white sorghum	Poor diet due to feeding on cereal regrowth	All year round
Diarrhea	Sanga (M)	Sheep, Goats	Greenish diarrhea	Diet due to old, rotting or fermenting fodder.	Beginning of the rainy season
Diarrhea	Sanga(M)	Cattle, Sheep, Goats, Poultry	Ruffled hair/feathers -abnormal stool color-liquid, foul-smelling stool	Poor diet	Rainy season
Diarrhea	Sanga (M)	Poultry	Yellowish diarrhea	Poor diet	All year round

Diseases and non-diseases factors	Disease local name	Affected animals	Syndromes	Etiology	Period of disease
Diarrhea	Sanga (M)	Cattle, Sheep, Goats	Soiled hindquarters, bloody diarrhea	Diet contaminated with pathogens	All year round
Diarrhea	Sanga (M)	Cattle	Greenish or blackish diarrhea	High protein content in the diet	All year round
Diarrhea	Sanga (M)	Cattle, Sheep, Goats	Bloody Blackish diarrhea in calves	Diet contaminated with pathogens	All year round
Diarrhea	Sanga (M)	Sheep, Goats	Animal does not eat, liquid faeces containing mucus	Poor diet	Beginning of the rainy season
Dystocia		Cattle, Sheep, Goats	Difficulty giving birth-requires human intervention	Status of primiparous females and their youth.	All year round
Ectoparasite infestation	Ambsés (M)	Poultry	The animal experiences weight loss, a decrease in appetite, changes in droppings, alterations in the appearance of its skin and feathers, and the presence of parasites on its body.	Ticks, lice	All year round
Ectoparasite infestation	Karinssé (M)	Cattle, Sheep, Goats	Parasite visible on the body	Ticks, lice	All year round
Foot and mouth disease	Saafo (M)	Cattle, Sheep, Goats	Presence of lesions on the muzzle, tongue, lips, around the hooves, inappetence, anorexia	Contaminated water	Beginning of dry season
Helminthosis	Puregdo (M)	Poultry	Weight loss, diarrhea containing parasites	Parasites, lack of hygiene	All year round
Helminthosis	Puregdo (M)	Cattle, Sheep, Goats, Donkey	Inappetence, weight loss, diarrhea containing parasites, growth retardation, loss of productivity.	Contaminated water and grazing land	Rainy season, fin de la Dry season
Hypogalactia		Cattle	Animal produces less milk; whitish diarrhea	Diet, pathology	All year round
Infectious keratoconjunctivitis	Ninzabré (M)	Cattle, Sheep, Goats	Tearing, presence of small white worms in the eye	Unknown	All year round
Lack of appetite		Cattle, Sheep, Goats	The animal eats little or not at all	Fever	All year round
Loss of maternal instinct		Cattle, Sheep, Goats	Female rejects offspring, refuses to nurse	Unknown	All year round
Lumpy skin disease	Noondré (M)	Cattle	Swollen lymph nodes, skin and mucous membrane nodules, perment skin damage	Unknown	All year round
Marek’s disease	To-ogo(B)	Poultry	Paralysis of legs and neck, the hen remains lying down	Roaming poultry	All year round
Mastitis	Low-rè (F)	Cattle, Sheep, Goats	Redness and ticks on the udders	Ticks	All year round

Diseases and non-diseases factors	Disease local name	Affected animals	Syndromes	Etiology	Period of disease
Other eye infections and injuries	Ninzabré (M)	Cattle, Sheep, Goats	Tearing, eye reddened and partially closed, agitated animal, later development of a white patch in the eye	Parasites or accidents, poison, snake venom	All year round
Snake bite	Waafo (M)	Cattle, Sheep, Goats	Ruffled hair-nodules on neck, belly-hair pulls out easily, inflammation of bitten area, eyes swell, bleeding from oral mucosa	Snake	Particularly in the rainy season
Red margouillat bite	Bandadjadja (M)	Cattle, Sheep, Goats	Nodules on the body, swollen eyes and ears	Red Margouillat	Cold period
Premature birth		Cattle	Gestation less than nine months	Heifers, Stress, hereditary	All year round
Pasteurellosis	Zuzabré (M)	Poultry	Fever, depression, mycoid discharge from beak, ruffled feathers, greenish-yellow diarrhea	Diet contaminated with pathogens	Beginning of the rainy season
Poisoning		Cattle, Sheep, Goats	Muscle spasms-difficulty breathing-convulsion	Consumption of poisonous plants or chemical products	All year round
Porcine Trypanosomosis	Weogo (M)	Pigs	Fever, respiratory discomfort, cold extremities, oedema	Moisture	Rainy season
Pseudo-fowl-Pest or Newcastle disease	Noon-koom (M)	Poultry	Greenish diarrhea, prostration, torticollis, paralysis, loss of balance, convulsions	Dust, contaminated water	
Retained placenta	Sagdo (M)	Cattle, Sheep, Goats	The animal eats very little, keeps its head lowered, has part of the placenta visible in the vulva, experiences foul-smelling vulval discharge, and shows signs of meteorization.	Underfeeding and low nutritional feed quality	All year round
Strangles		Donkey	Breathes with difficulty-nasal discharge-eats little or not at all	Unknown	All year round
Trypanosomiasis	Somè (F) Weogo (M)	Cattle, Sheep, Goats	The animal is prostrate with its head lowered, exhibiting progressive weight loss, lacrimation, and slight keratoconjunctivitis. It has prickly hair, is grinding its teeth, experiences difficulty defecating, and produces hard feces.	Moisture, flies, pasture in grazing lands	All year round
Wounds	Noondré (M)	Sheep, Goats	The animal exhibits limping and has wounds in the interdigital space of its paw that contain worms.	Room humidity, flies	Rainy season
Wounds	Noondré (M)	Sheep, Goats, Donkey	Skin lesion, bleeding	Accident, predatory birds by pecking the animal	All year round

Harmattan: a dry dusty wind from the Sahara blowing towards the West African coast, especially from November to March

Diversity and use of plants species in the treatment of animal diseases

About 88 medicinal plant species belonging to 73 genera and 34 families were used in the treatment of animal diseases (Appendix I). The most represented families were Fabaceae (21.59%), Malvaceae (9.08%) and Poaceae (6.82%) (Figure 4a; full list in Appendix 1).

The most commonly used species were *Khaya senegalensis* (34.02%), *Parkia biglobosa* (18.40%), *Terminalia leiocarpa* (10.00%), *Vachellia nilotica* (9.03%), *Vitellaria paradoxa* (8. 00%), *Azadirachta indica* (7.15%), *Balanites aegyptiaca* (7.15%), *Feretia apodanthera* (7.15%), *Mitragyna inermis* (7.15%) and *Sorghum bicolor* (7.15%) (Figure 4b; full list in Appendix 1).

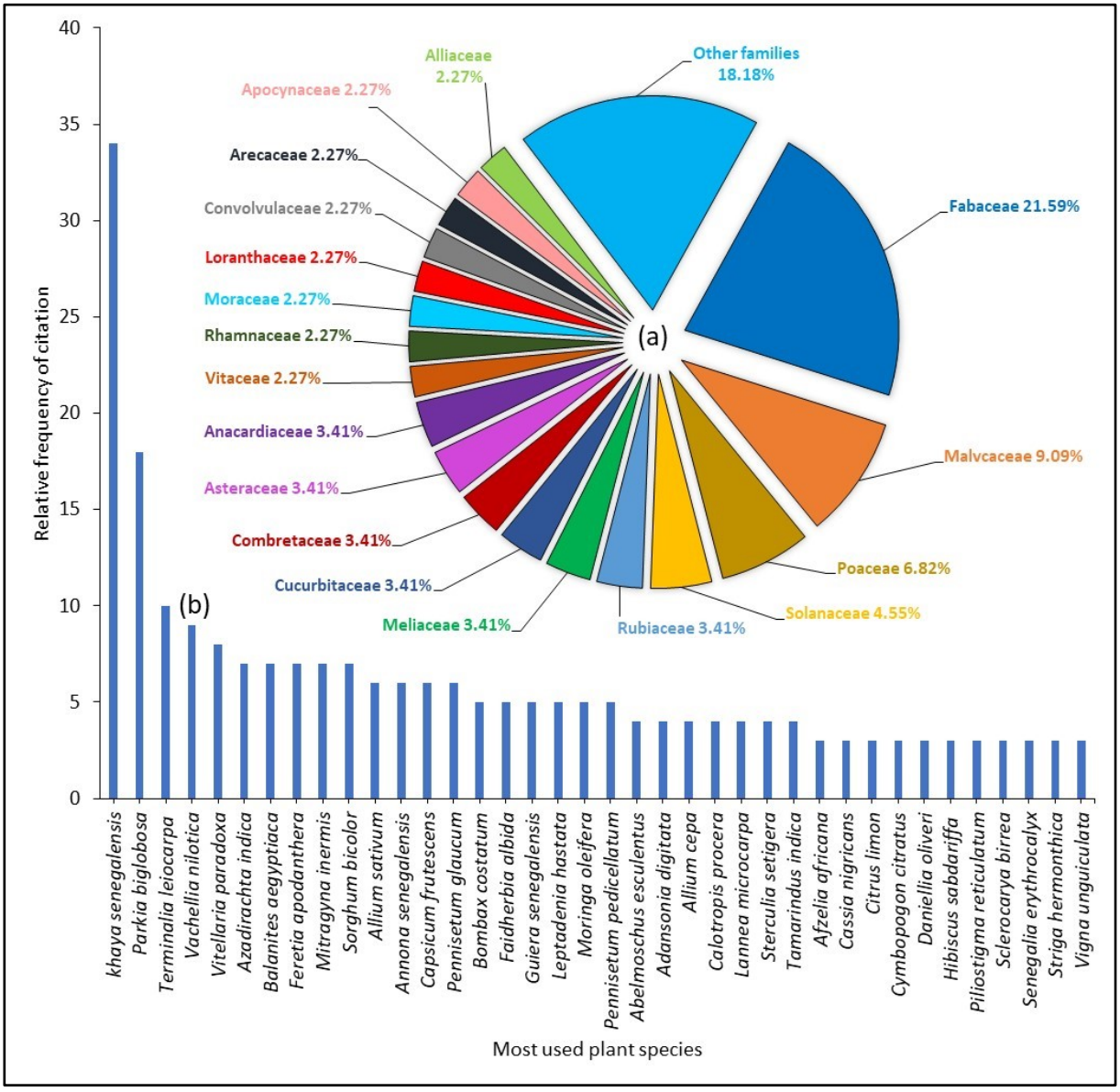

Figure 4**.** Families diversity (a) and most used plant species (b) in treating livestock ailments

All plant parts were used in the treatment of animal diseases (Figure 5a, Table 3). Bark was the most widely used plant part (35.56%), followed by leaves (21.08%), fruits (11.88%), whole plant for herbaceous species (8.30%) and seeds (7.62%). In the preparation of plant-based remedies, six methods were identified (Figure 5b, Table 3). Among these practices, maceration (38.82%), decoction (34.04%), direct consumption (11.17%) and trituration (10.63%) were the most commonly reported. Approximately 86.45% of the recipes mentioned were based solely on plants alone (Figure 5c, Table 3). These remedies can be used independently or in combination with other plant species to produce medicinal products. Combinations involving mineral products account for 13.55% of the prescriptions. Eight routes of administration were recorded, with the most common being oral (46.15%), anal (17.31%) and topical (17.31%) application (Figure 5d, Table 3).

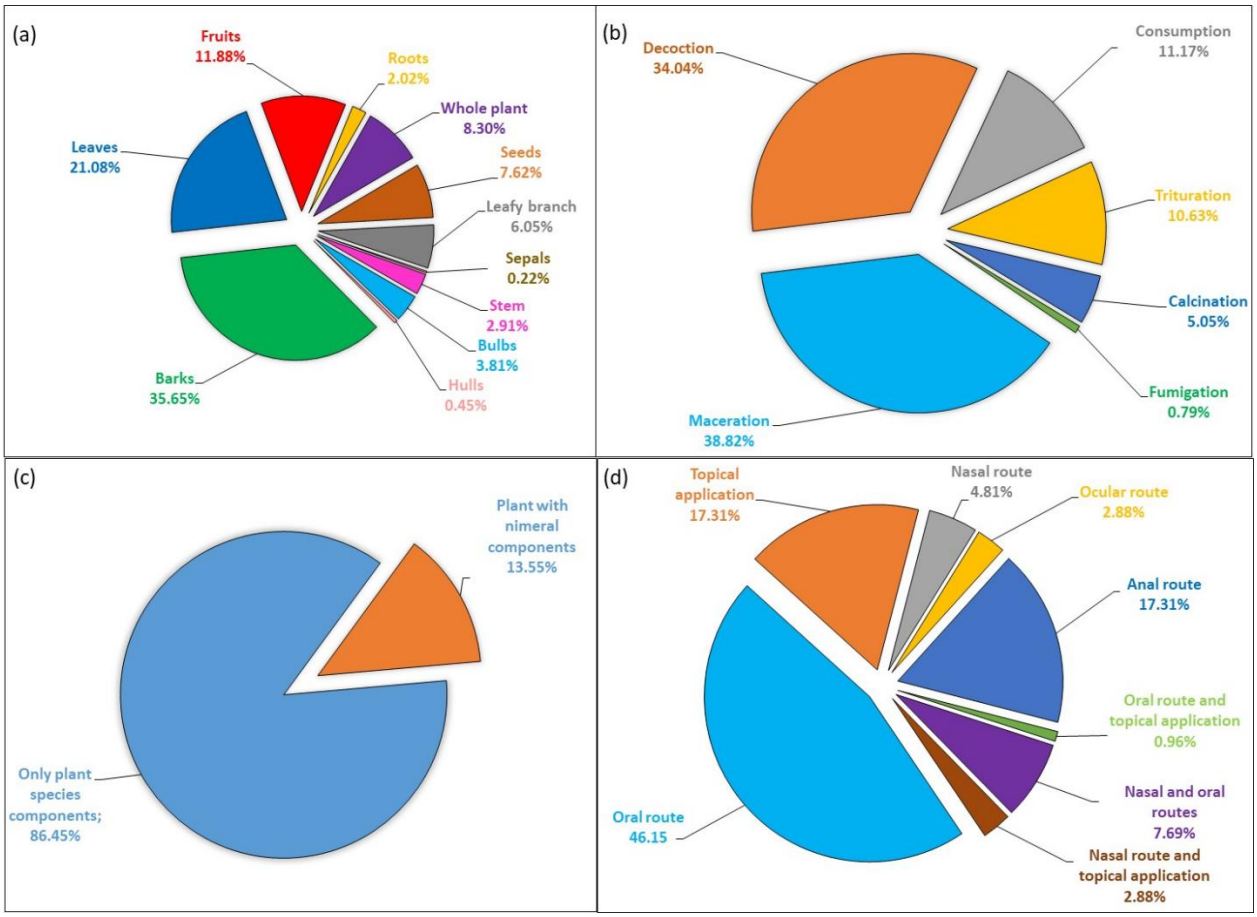

Figure 5. Parts of plants used (a), preparation methods of remedies (b), types of combinations of remedies (c), and methods of remedy administration (d) used in livestock health management

Table 3: Ethnoveterinary remedies used to treat livestock diseases in Central-Eastern Burkina Faso

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
Agalactia	Cattle, sheep, goats	*Pennisetum glaucum*	Seeds	Trituration + salt	Oral route
		Leptadenia hastata	Leafy branch	Decoction	Oral route
		Ficus platyphylla	Leaves	Decoction	Oral route
		Pennisetum glaucum	Seeds	Trituration + water	Oral route
		Vigna unguiculata	Seeds	Trituration + water	Oral route
Avitaminosis	Poultry	*Solanum lycopersicum*	Fruits	For consumption	Oral route (1 time / month)
		Brassica oleracea	Whole plant	For consumption	Oral route (1 time / month)
		Lactuca sativa	Whole plant	For consumption	Oral route (1 time / month)
		Allium cepa	Bulbs	For consumption	Oral route (1 time / month)
		Allium sativum	Bulbs	For consumption	Oral route (1 time / month)
		Spinacia oleracea	Leaves	For consumption	Oral route (1 time / month)
		Ipomoae eriocarpa	Leafy branch	For consumption	Oral route (1 time / month)
Brucellosis	Cattle, sheep, goats	*Afzelia africana*	Leaves	Decoction	Oral route
		Leptadenia hastata	Leafy branch	Maceration	Oral route
Anthrax	Cattle	*Cymbopogon citratus*	Whole plant	Pounding, maceration	Oral route (1 times /day, up to 5 days)
		Sterculia setigera	Barks	Pounding, maceration	Oral route (1 times /day, up to 5 days)
Constipation	Cattle, sheep, goats	*Parkia biglobosa*	Barks	Maceration	Oral route (2 times/day, up to 3 days)
		Pseudocedrela kotschyi	Barks	Decoction	Oral route (1 time of 1 L/cattle, 0.5 L/cattle and goats)
		Adansonia digitata	Leaves	Crushing + salt + water	Oral route (1 time of 1 Ll/cattle, 0.5 L/cattle and goats)
		Daniellia oliveri	Barks	Decoction	Oral route (1 time of 1 L/cattle, 0.5 L/cattle and goats)
		Khaya senegalensis	Barks	Decoction	Oral route (1 time of 1 L/cattle, 0.5 L/cattle and goats)
		Pterocarpus erinaceus	Barks	Decoction	Oral route
		Mitragyna inermis	Barks	Decoction	Oral route

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
		Parkia biglobosa	Barks	Decoction	Oral route (1 time of 1 L/cattle, 0.5 L/cattle and goats)
		Bombax costatum	Barks	Decoction	Oral route (1 time of 1 L/cattle, 0.5 L/cattle and goats)
		Pennisetum pedicellatum	Whole plant	For consumption	Oral route
Dermatophilosis	Cattle, sheep, goats	*Parkia biglobosa*	Fruits	Trituration (powder)	Topical application (1 times per day until recovery)
		Bombax costatum	Leaves	Pounding, maceration	Oral route (as desired, until recovery)
		Azadirachta indica	Seeds	Pounding, maceration	Topical application (1 times per day until recovery)
Diarrhea	Sheep, goats	*Sorghum bicolor*	Seeds	For consumption	Oral route
	Poultry	*Khaya senegalensis*	Barks	Maceration + water	Oral route (as desired, 1 time / month)
	Cattle, sheep, goats, Poultry	*Azadirachta indica*	Leaves	Macerate 0.5kg of leaves in 5l of water	Oral route (as desired, 1 time/day, up to 2 days)
		Psidium guajava	Leaves	Macerate 0.5kg of leaves in 5l of water	Oral route (as desired, 1 time/day, up to 2 days)
	Cattle, sheep, goats	*Khaya senegalensis*	Barks	Decoction	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times in 1 day)
		Guiera senegalensis	Leaves	Maceration	Oral route
		Vitellaria paradoxa	Barks	Maceration	Oral route
		Terminalia leiocarpa	Barks	Decoction	Oral route (1 L/cattle 2 times/day, up to 3 days)
		Ficus sycomorus	Fruits	Maceration + fresh milk	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times in 1 day)
		Terminalia leiocarpa	Barks and leaves	Decoction + shea butter	Oral route (1 L/cattle, 0.5 L/goats and sheep, 1 time/day, up to 3 days)
	Cattle	*Mitragyna inermis*	Barks	Decoction	Oral route (1 L/cattle, 2 times/day, up to 3 days)
	Sheep, goats	*Adansonia digitata*	Leaves	For consumption	Oral route
		Vachellia nilotica	Leaves or barks or fruits	Maceration	Oral route
	Cattle, sheep, goats	*Guiera senegalensis*	Leaves	Pounding and maceration	Oral route (1 L/cattle 2 times/day, up to 3 days)
		Leptadenia hastata	Leafy branch	Pounding and maceration	Oral route (1 L/cattle 2 times/day, up to 3 days)
		Indigofera tinctoria	Leaves	Pounding and maceration	Oral route (1 L/cattle 2 times/day, up to 3 days)

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
	Poultry	*Allium cepa*	Leaves or fruits	3 pods in 1l water	Oral route (as desired, until 3 days)
		Abelmoschus esculentus	Seeds	For consumption, 2 to 3 seeds	Oral route
		Moringa oleifera	Leaves	Crushing, mixing with water or feed	Oral route (1 time / month)
		Vernonia pauciflora	Leaves	Decoction	Oral route
		Lannea microcarpa	Barks	Maceration	Oral route
Dystocia	Cattle, sheep, goats	*Ziziphus mucronata*	Barks	Maceration	Anal route
Poisoning	Cattle, sheep, goats	*Khaya senegalensis*	Barks	Decoction + shea butter	Oral route
Foot and Mouth Disease	Cattle, sheep, goats	*Pseudocedrela kotschyi*	Barks	Decoction	Oral route and topical application (until recovery)
		Bombax costatum	Barks ou Fruits	Decoction	Topical application (2 times a day, up to 7 days)
	Cattle	*Phragmites australis*	Leaves	Decoction	Oral route (1 time/day, until recovery)
		Vitellaria paradoxa	Seeds	Butter	Oral route and topical application (until recovery)
		Citrus limon	Fruits	Direct use	Topical application (2 times/ day, up to 5 days)
		Vachellia nilotica	Barks	Decoction	Oral route and topical application (until recovery)
		Vachellia nilotica	Leaves or fruits	Decoction	Oral route and topical application (until recovery)
		Hibicus sabdariffa	Seeds	Maceration	Topical application (2 times/ day, up to 5 days)
		Parkia biglobosa	Fruits	Powder + salt	Oral route (1 time/day, until recovery)
Broken bone	Cattle, sheep, goats	*Flueggea virosa*	Stems	Direct use	Spread in the henhouse
Strangles	Donkeys	*Sorghum bicolor*	Seeds	Decoction	Oral route
Hypogalactia	Cattle	*Vigna unguiculata*	Seeds	Trituration + water	Oral route
		Pennisetum glaucum	Seeds	Trituration + water	Oral route
	Cattle	*Bombax costatum*	Barks	Decotion +salt	Oral route
	Cattle, sheep, goats	*Pennisetum glaucum*	Seeds	Piling + water	Oral route
		Sorghum bicolor	Seeds	Pounding	Oral route
	Cattle	*Vigna unguiculata*	Seeds	Piling + water	Oral route
		Pennisetum glaucum	Seeds	Piling + water	Oral route
Ectoparasite infestation	Poultry	*Azadirachta indica*	Leaves	Direct use	Spread in the henhouse
	Cattle, sheep, goats	*Balanites aegyptiaca*	Barks	Pounding, maceration	Topical application (3 times/day, up to 3 days)

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
		Azadirachta indica	Leaves	Maceration	Topical application (1 time fois/jour, 2jour,
Internal parasite infestation	Cattle, sheep, goats	*Piliostigma reticulatum*	Leaves	Decoction	Oral route (on an empty stomach: 1.5 L/cattle, 0.5 L/cattle and goats)
		Ipomoea asarifolia	Leafy branch	Decoction	Oral route (on an empty stomach: 1.5 L/cattle, 0.5 L/cattle and goats)
		Mitragyna inermis	Leaves	Decoction + shea butter	Oral route (on an empty stomach: 1.5 L/cattle, 0.5 L/cattle and goats)
		Sclerocarya birrea	Barks	Decoction + salt	Oral route (as desired, in 1 time)
		Mitragyna inermis	Barks or leaves	Decoction	Oral route (1L/cattle and 0.25 L/ sheep and goats, in 1 time)
		Faidherbia albida	Leaves	Pounding, maceration	Oral route (1 L/cattle, 1 time/day, up to 2 days)
		Mitragyna inermis	Barks and leaves	Decoction	Oral route (1L/cattle and 0.25 L/ sheep and goats, in 1 time)
	Poultry	*Allium sativum*	Bulbs	Maceration	Oral route (as desired, up to 3 days)
		Moringa oleifera	Leaves	Piling + water	Oral route (as desired, up to 3 days)
		Parkia biglobosa	Barks	Maceration	Oral route (as desired, up to 3 days)
	Cattle, Donkeys	*Sorghum bicolor*	Seeds	Decoction (dolo=local beer)	Oral route (on an empty stomach: 1.5 L/cattle, 0.5L/ sheep and goats)
	Cattle	*Khaya senegalensis*	Barks or leaves	Decoction + Fulani soap	Oral route (on an empty stomach: 1 L/cattle 2 times/day, up to 3 days)
	Cattle, sheep, goats, Poultry	*Khaya senegalensis*	Barks	Maceration	Oral route (as desired, 1 time / month)
	Cattle, sheep, goats	*Balanites aegyptiaca*	Barks or leaves	Decoction + Fulani soap	Oral route
		Khaya senegalensis	Barks	Decoction + Fulani soap	Oral route
	Cattle, sheep, goats	*Khaya senegalensis*	Barks	Decoction	Oral route
		Balanites aegyptiaca	Barks	Decoction	Oral route
Poor-quality milk	Cattle, sheep, goats	*Khaya senegalensis*	Barks or leaves	Maceration	Oral route
	Cattle	*Vigna subterranea*	Seeds	Pounding	Oral route
		Piliostigma reticulatum	Barks	Decoction	Oral route
	Cattle, sheep, goats	*Manihot esculenta*	Bulbs	Piling + water	Oral route

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
		Pennisetum glaucum	Seeds	Piling + water	Oral route
Marek's disease	Poultry	*Moringa oleifera*	Leaves	Pounding	Oral route (mix with water or feed)
Mastitis	Cattle	*Parkia biglobosa*	Barks	Calcination + milk butter	Topical application
	Cattle, sheep, goats	*Cassia nigricans*	Whole plant	Maceration + salt	External route (until recovery)
		Senegalia pennata	Stems	Calcination +salt	Topical application
Lack of appetite	Cattle, sheep, goats	*Capparis corymbosa*	Roots	Decoction	Oral route
Infectious keratoconjunctivitis and other eye infections and injuries	Cattle	*Hibicus sabdariffa*	Sepal	Maceration	Ocular route
		Feretia apodanthera	Leaves	Maceration	Ocular route (morning/evening)
		Citrus limon	Fruits	Trituration	Ocular route
	Cattle, sheep, goats	*Dichrostachys cinerea*	Leaves	Calcination	Oral route
		Pennisetum pedicellatum	Whole plant	Trituration	Ocular route (up to 3 days)
		Khaya senegalensis	Barks	Pounding	Ocular route
		Scoparia dulcis	Whole plant	Trituration + salt + eau	Ocular route
		Terminalia leiocarpa	Leaves	Trituration+water	Ocular route
Bloat	Cattle, sheep, goats	*Khaya senegalensis*	Barks	Maceration	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Tamarindus indica	Fruits	Direct use	Anal route (1 time)
		Parkia biglobosa	Barks	Maceration + Fulani soap	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Senegalia senegal	Barks	Maceration + Fulani soap	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Pterocarpus erinaceus	Barks	Decoction	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Mitragyna inermis	Barks	Decoction	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Khaya senegalensis	Barks	Decoction	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Parkia biglobosa	Barks	Maceration + Fulani soap	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Daniellia oliveri	Leafy branch	Decoction	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Terminalia leiocarpa	Leaves	Maceration	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Capparis corymbosa	Roots	Decoction	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Tamarindus indica	Leaves	Decoction	Oral route (1 L/cattle, 0.5 L sheep, goats)
		Striga hermonthica	Whole plant	Pounding, maceration	Oral route (1 L/cattle, 0.5 L sheep, goats)

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
		Parkia biglobosa	Leaves	Maceration	Oral route (1 L/cattle, 0.5 L sheep, goats)
Red margouillat bite	Cattle, sheep, goats	*Combretum glutinosum*	Stems	Maceration +soumbala + old cereal paste	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Annona senegalensis	Leaves or roots	Decoction	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
	Cattle	*Parkia biglobosa*	Leaves	Maceration	Oral route (0.5 L/cattle 2 times/day, in 1 day)
Snake bite	Cattle, sheep, goats	*Annona senegalensis*	Barks	Pounding, maceration	Topical application, 1 time
		Vitellaria paradoxa	Barks and leaves	Maceration + sand (termite mound)	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Feretia apodanthera	Leafy branch	Decoction	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Annona senegalensis	Leafy branch	Pounding, maceration	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Feretia apodanthera	Leafy branch	Maceration + sand (termite mound)	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Vitellaria paradoxa	Barks	Maceration + sand (termite mound)	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Feretia apodanthera	Leafy branch	Maceration	Oral route
		Parkia biglobosa	Barks	Maceration	Oral route
		Hibiscus cannabinus	Seeds	Fumigation	Nasal route (3 times a day)
		Parkia biglobosa	Barks or leaves	Maceration	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Crotalaria retusa	Leaves	Maceration + sand	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Feretia apodanthera	Leafy branch	Pounding, maceration + water	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Feretia apodanthera	Leafy branch	Pounding, maceration + water + sand (termite mound)	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
		Feretia apodanthera	Leafy branch	Decoction	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
		Annona senegalensis	Roots	Decoction	Oral route (1 L/cattle and 0.5 L/ sheep and goats, 2 times/day, in 1 day)
	Cattle	*Parkia biglobosa*	Leaves	Maceration	Oral route (0.5 L, 2 times/day, up to 2 days)
		Annona senegalensis	Roots	Decoction	Oral route
		Parkia biglobosa	Barks	Decoction	Oral route
		Vitellaria paradoxa	Barks	Decoction	Oral route
		Hibicus sabdariffa	Seeds	Fumigation	Nasal route
		Cymbopogon citratus	Whole plant	Fumigation	Nasal route
Premature birth	Cattle	*Leptadenia hastata*	Leafy branch	Maceration	Oral route (1 L/cow, 2 times/day, 3 days)
Pasteurellosis	Cattle, sheep, goats	*Vachellia tortilis*	Stems	Calcination, dissolve 2 spoonfuls in 1/4 l water	Oral route (0.5 L/cattle, 0.25 L/ sheep and goats, 1 time/day until recovery)
		Citrus limon	Leaves or fruits	Maceration, filtering	Oral route and by nasal route (1 L/cattle, 0.5 L/sheep and goat, 2 times/day, until recovery).
		Cymbopogon citratus	Whole plant	Fumigation: grass + poultry droppings	Nasal route (1 time / day, until recovery)
		Khaya senegalensis	Barks	Decoction	Oral route (2 times/day)
	Poultry	*Nymphaea lotus*	Leaves	Decoction	Oral route (as desired)
Loss of maternal instinct	Cattle, sheep, goats	*Annona senegalensis*	Roots	Pounding, maceration	Topical application (Brush over the veal)
		Parkia biglobosa	Seeds	Pounding, maceration	Topical application (Brush over the veal)
	Cattle	*Ampelocissus africana*	Leafy branch	Maceration +salt	Topical application (Brush over the veal)
Lumpy skin disease and other wounds on animal body	Cattle, sheep, goats	*Khaya senegalensis*	Barks	Decoction	Topical application (Clean and apply powder)
		Vachellia nilotica	Fruits	Pounding (powder)	Topical application (Clean and apply powder)
		Khaya senegalensis	Barks	Trituration	Topical application
		Vachellia nilotica	Barks	Decoction	Topical application
		Vachellia nilotica	Fruits	Trituration	Topical application
		Ceiba pentandra	Barks	Trituration	Topical application
		Senegalia senegal	Stems	Calcination	Topical application
		Khaya senegalensis	Barks	Decoction	Topical application
		Senegalia pennata	Stems	Calcination	Topical application

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
		Ficus platyphylla	Leaves	Calcination	Topical application
		Combretum glutinosum	Leaves	Calcination	Topical application
		Terminalia leiocarpa	Leaves	Calcination	Topical application
		Cassia nigricans	Whole plant	Trituration + water	External route (until recovery)
		Calotropis procera	Stems	Calcination	Topical application
		Pennisetum pedicellatum	Whole plant	Trituration	Topical application
		Striga hermonthica	Whole plant	Trituration+water	Topical application
		Senegalia gourmaensis	Stems	Calcination	Topical application
		Senegalia pennata	Stems	Calcination	Topical application
		Corchorus olitorius	Leaves	Calcination	Topical application
		Terminalia leiocarpa	Barks or leaves	Decoction	Topical application
	Sheep, goats	*Vachellia nilotica*	Fruits	Decoction + shea butter	External route (clean and apply butter)
	Donkeys	*Sclerocarya birrea*	Barks	Decoction + trituration	External route (clean and apply with powder)
Bladder prolapse	Cattles, Donkeys, Camels	*Bauhinia rufescens*	Fruits	Decoction	Oral route (1 time/day until recovery)
		Cissus quadrangularis	Leafy branch	Maceration	Oral route (as desired)
		Ziziphus mauritiana	Roots	Decoction	Oral route (as desired)
		Ocimum basilicum	Whole plant	Maceration	Oral route (as desired)
		Guiera senegalensis	Barks	Maceration	Oral route (as desired)
		Vernonia colorata	Leaves	Maceration	Oral route (as desired)
Pseudo-fowl pest or Newcastle disease	Poultry	*Khaya senegalensis*	Barks	Maceration	Oral route (as desired, 1g per 2L of water/month)
		Capsium frutescens	Fruits	Maceration	Oral route (as desired, 1g per 2L of water/month)
		Azadirachta indica	Leaves	Maceration	Oral route (as desired, 1g per 2L of water/month)
		Allium sativum	Bulbs	Maceration	Oral route (as desired, 1g per 2L of water/month)
		Capsium frutescens	Fruits	Maceration	Oral route (as desired, 1g per 2L of water/month)
		Khaya senegalensis	Barks	Maceration	Oral route (As desired, 3 times per month)
		Parkia biglobosa	Barks	Maceration	Oral route (As desired, 3 times per month)
		Moringa oleifera	Leaves	Pounding	Oral route (mixed with feed)

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
		Lannea microcarpa	Barks	Maceration	Oral route (as desired)
		Khaya senegalensis	Barks	Maceration	Oral route (to be repeated 4 days later)
		Faidherbia albida	Leaves or barks	Maceration	Oral route (as desired)
		Azadirachta indica	Leaves	Maceration	Oral route
		Parkia biglobosa	Barks	Maceration	Oral route
		Khaya senegalensis	Barks	Maceration + oxytetraction	Oral route
Retained placenta	Cattle, sheep, goats	*Balanites aegyptiaca*	Leaves	Maceration + salt	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Ceiba pentandra	Leaves	Maceration	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Khaya senegalensis	Barks	Decoction	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Bombax costatum	Leaves	Direct use	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Leptadenia hastata	Leafy branch	Decoction	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Parkia biglobosa	Barks	Decoction	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Tamarindus indica	Leaves	Decoction	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Piliostigma reticulatum	Leaves	Decoction	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Ampelocissus africana	Leafy branch	Decoction	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Sorghum bicolor	Seeds	Decoction (dolo=local beer)	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
		Sarcocephalus latifolius	Barks	Decoction	Oral route (1 L/cattle, 0.5 L/sheep and goat, 1 time)
Common cold	Cattle, sheep, goats	*Allium cepa*	Bulbs	Pounding, maceration	Nasal route
		Allium sativum	Bulbs	Maceration	Nasal route (2 times/day, up to 4 days)
	Cattle	*Sterculia setigera*	Barks	Decoction	Nasal route
	Sheep, goats	*Lannea microcarpa*	Barks	Decoction	Nasal route (1/2 L for head bath)
Ringworm	Cattle, sheep, goats	*Cocos nucifera*	Hulls	Calcinate, reduce to powder	Topical application
Cough	Cattle, Donkeys	*Lagenaria siceraria*	Fruits	Calcination	Oral route (Mix with feed)
	Cattle, Donkeys	*Lagenaria briviflora*	Fruits	Calcination	Oral route (Mix with feed)
	Cattle	*Adansonia digitata*	Barks	Maceration	Oral route (1 L/cattle, 2 times/day)
		Tapinanthus sp. on Ziziphus mauritiana	Leafy branch	Maceration	Oral route (1 L/cattle, 2 times/day)
		Khaya senegalensis	Barks	Decoction	Oral route (1 L/cattle, 2 times/day)

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
		Ziziphus mucronata	Barks and leaves	Decoction	Oral route (1 L/cattle, 2 times/day)
		Adansonia digitata	Barks	Maceration	Oral route (1 L/cattle, 2 times/day)
		Tapinanthus sp. on Diospyros mespiliformis	Leafy branch	Decoction	Oral route (1 L/cattle, 2 times/day)
		Striga hermonthica	Whole plant	Decoction	Oral route (1 L/cattle, 2 times/day)
	Cattle, sheep, goats	*Andropogon gayanus*	Whole plant	Calcination + salt	Oral route (Mix with feed)
		Mitragyna inermis	Barks	Decoction	Oral route (1 L/cattle, 0.5 L/sheep and goat, 2 times/day, up to 5 days)
		Allium sativum	Bulbs	Pounding	Nasal route (Put juice in nostrils, 1 time per day, up to 3 days)
		Balanites aegyptiaca	Barks	Maceration	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times per day)
		Diospyros mespiliformis	Barks	Maceration	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times per day)
		Faidherbia albida	Barks	Decoction	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times per day)
		Calotropis procera	Stem	Calcination + salt	Oral route (Mix with feed)
		Allium cepa	Bulbs	Pounding	Nasal route (Put juice in nostrils, 1 time per day, up to 3 days)
		Faidherbia albida	Barks	Decoction + Fulani soap	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times per day)
		Guiera senegalensis	Leaves	Maceration	Oral route
		Sterculia setigera	Barks	Decoction	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times per day)
		Terminalia leiocarpa	Leaves and barks	Decoction	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times per day)
Trypanosomiasis	Cattle, sheep, goats	*Daniellia oliveri*	Leaves and barks	Decoction + shea butter	Oral route
		Khaya senegalensis	Barks	Maceration	Oral route
		Khaya senegalensis	Barks	Decoction	Oral route
		Khaya senegalensis	Barks	Decoction	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times in 1 day)

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
		Vitellaria paradoxa	Barks	Decoction	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times in 1 day)
		Azadirachta indica	Barks	Decoction	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times in 1 day)
		Terminalia leiocarpa	Barks	Decoction	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times in 1 day)
		Vachellia nilotica	Barks	Decoction	Oral route (1 L/cattle and 0.5 L/sheep and goats, 2 times in 1 day)
		Khaya senegalensis	Leaves	Maceration	Oral route
		Terminalia leiocarpa	Leaves	Maceration	Oral route
		Allium sativum	Bulbs	Maceration	Oral route
		Bauhinia rufescens	Fruits	Decoction	Oral route (2 times/day, up to 3 days)
		Lannea microcarpa	Leaves and barks	Decoction + Fulani soap	Oral route (3 to 4 days)
		Khaya senegalensis	Barks	Maceration + salt	Oral route
		Faidherbia albida	Barks	Decoction	Oral route
		Indigofera tinctoria	Leaves	Maceration	Oral route
		Lannea acida	Barks	Decoction	Oral route
		Sclerocarya birrea	Barks	Decoction + salt	Oral route
		Afzelia africana	Barks	Decoction	Oral route (1 L/cattle, 2 times/day, morning and evening)
		Pennisetum pedicellatum	Whole plant	Maceration	Oral route and Topical application (until recovery)
		Afzelia africana	Barks	Decoction + shea butter	Oral route (1L /day, up to 3 days)
		Balanites aegyptiaca	Barks	Decoction + Fulani soap	Oral route
		Khaya senegalensis	Barks	Decoction + Fulani soap	Oral route
		Khaya senegalensis	Barks	Decoction + shea butter	Oral route
		Lagenaria siceraria	Fruits	Maceration: put in fresh milk and allow to macerate for one day	Nasal route
	Cattle	*Sterculia setigera*	Barks	Maceration	Oral route
	Pigs	*Khaya senegalensis*	Barks	Pounding	Oral route (Mix with feed)

Diseases	Affected animals	Plant scientific *names*	Plant parts used	Formulation	Method of administration
Avian pox	Poultry	*Solanum incanum*	Fruits	Maceration	Oral route
		Elaeis guineensis	Seeds (oil)	Direct use	Topical application
		Abelmoschus esculentus	Seeds	Direct use	Oral route
		Guiera senegalensis	Barks	Maceration	Oral route
		Vitellaria paradoxa	Seeds	Butter	Topical application
		Khaya senegalensis	Barks	Direct use	Topical application
		Vitellaria paradoxa	Seeds	Butter + potash	Topical application
		Solanum aethiopicum	Fruits	Maceration	Oral route (up to 5 days)
		Citrullus colocynthis	Fruits	Maceration	Oral route (up to 5 days)

Discussion

Relationship between socio-demographic characteristics and traditional knowledge

Elderly livestock farmers (more than 69% of the respondents were over 50 years old) were most represented, likely due to the fact that younger individuals are comparatively less interested in traditional veterinary practices. These findings corroborate those of Tamboura *et al.* (1998) in Burkina Faso, and Kpodékon *et al.* (2016) in Benin on traditional veterinary medicine, which similarly reported a close relationship between respondents' age and traditional knowledge**.**

In accordance with other studies (Gao *et al.* 2024), the proportion of illiterate people exceeded that of literate people, and the proportion of men was higher than that of women. However, there is no relationship between the level of education and knowledge of medicinal plants (Yaro 2018). The low participation of women in our samples (4%) is attributed to the fact that usually or traditionally women are not livestock owners (Dassou et al. 2014). Indeed, Gao *et al.* (2024) also noted lower representation of women among their sampled population and pointed out that traditionally, women are responsible for housework and men are the breadwinners in the family. As a result, men are responsible for the management of livestock (Gao *et al.* 2024).

Diversity of diseases and proficiency in veterinary knowledge

A total of 38 diseases were described by livestock farmers during the surveys, with the most frequently mentioned being diarrhea, trypanosomiasis, retained placenta, and wounds. These diseases are recognised by the Ministry of Agriculture and Animal and Fishery Resources in Burkina Faso as the main animal pathologies for which control measures are routinely implemented (MRAH 2019). The occurrence of these diseases in the various study sites can be attributed to climate conditions and the livestock farming systems practiced by the farmers. Indeed, the agro-ecological zones in which livestocks are bred play a significant role in the occurrence of certain diseases, such as trypanosomosis, cowdriosis, etc., due to the presence of vectors responsible for transmitting these diseases (Chartier *et al.* 2000). In addition to these factors, the liberalization of the veterinary profession by the state government and the shortage in the number of staff in public services responsible for the systematic vaccination of livestock against certain viral, bacterial, and parasitic diseases could also be contributing causes (FAO 2014; Dovonou 2016).

The results suggest a notable connection between disease categories and animal species. Findings of Araya *et al.* (2015) and Zabouh *et al.* (2018), conducted in Togo and Ethiopia respectively, also highlight this relationship. Some diseases affect several animal species, while others are specific to one or a few animal species. Parasitic diseases such as helminthiasis and ectoparasitism are prevalent in all livestock species, while avian pox and fowl pox are specific to poultry. Considering the varied animal diseases available in the different study sites, livestock farmers demonstrated remarkable proficiency in diagnosing the majority of diseases affecting their animals based on clinical signs and symptoms they described. This observation aligns with findings by Tamboura *et al.* (1998), who observed that with a comprehensive description of symptoms, the livestock farmers' messages were easily perceived and certainly understood by the veterinary services. This demonstrates their profound knowledge of disease epidemiology, acquired through years of practical experience in animal husbandry (Tchetan *et al.* 2021, Busari *et al.* 2021).

Plant diversity and formulations used

A total of 88 plant species belonging to 34 families with traditional veterinary uses were identified in the study area. The most important families in terms of species richness were Fabaceae, Malvaceae and Poaceae. From the total species identified, only eight (08) were cultivated species, while eighty (80) were spontaneous species. A similar study carried out in northern Benin reported 56 species (Dassou *et al.* 2014) with a lower species richness than in the current study. This difference could be explained by the sample size or the state of farmers traditional knowledge of veterinary medicine. The percentage of common species between this study and Dassou *et al.* (2014) is 71.42%. This high similarity could be explained by the phytogeographical affinity of the two study areas, which belong to the same Sudanian region. Geographical proximity creates opportunity for the exchange of knowledge regarding plant utilized as ethnoveterinary remedies for different ailments. Knowledge exchange benefits from geographic and cross-cultural connections (Gobvu *et al.* 2023).

Stem bark and leaves were the most used plant parts. These findings corroborate those of Houndje *et al.* (2016), who reported that bark and leaves were the most frequently employed plant parts in the formulation of animal disease remedies in Benin. Conversely, Araya *et al.* (2015) found that the use of leaves (44%) significantly surpassed bark utilization (4%), indicating a notable disparity in plant part medicinal usage preference between these studies. The high use of bark and leaves could be related to their high concentration of active principles in plants and their effectiveness against pathogens. Indeed, Masika and Afolayan (2002) demonstrated the significant effect of bark extracts of some plant species, including *Combretum*

caffrum Kuntze, *Salix capensis* Thunb and *Schotia latifolia* Jacq. against Gram-positive bacteria tested in South Africa with minimum inhibitory concentrations ranging from 0.1 to 5.0 mg/ml. Leaves and bark extracts of about ten plants were shown to be effective against goat gastrointestinal nematodes in Bangladesh (Sujon *et al.* 2008).

The plant species most frequently cited in this study, including *Khaya senegalensis*, *Parkia biglobosa* and *Vachellia nilotica*, were found to be utilized in numerous remedies. These results corroborate those reported by Zabouh *et al.* (2008) and Bhatti *et al.* (2017), thereby confirming the efficacy of these plants against the aforementioned diseases. However, besides *K. senegalenis*, Traore *et al.* (2019) mentioned *Annona senegalensis* Pers., *Daniellia oliveri* (Rolfe) Hutch. Dalziel and *Securidaca longipedunculata* as the most used veterinary medicinal plant in the treatment of cattle in southwestern Burkina Faso. This difference can be explained by the climatic constraints leading to changes in the abundance and diversity of plant species available in each zone. Indeed, the Central-Eastern region of Burkina Faso belongs to the Sudano-Sahelian climate, while the South-Western region belongs to the Sudanian climate. According to Zizga *et al.* (2015), these two climates differ by 34% in terms of flora. However, the abundance of species common to both zones is strongly influenced by climate, thus affecting their availability (Zerbo *et al.* 2016; Compaoré *et al.* 2020).

Maceration and decoction were the most widely employed methods for preparing remedies. According to previous studies, several researchers have confirmed that plant parts are primarily utilized in the form of decoction and maceration (Dassou *et al.* 2014; Dougnon *et al.* 2017; Ouachinou *et al.* 2017, Busari *et al.* 2021). Notably, decoction facilitates the extraction of the most active principles and reduces or eliminates the toxic effect of certain recipes (Salhi *et al.* 2010). According to Lezoul *et al.* (2020), maceration was suitable for flavonoid extractions. The effect of maceration time on the efficacy of plant extracts has also been documented by the authors (Yeo *et al.* 2014). In fact, of four maceration times (6 h, 12 h, 24 h and 48 h), 6 h was found to give the best inhibition zone of antimicrobial activity with economic feasibility (Yeo *et al.* 2014).

Conclusion

This study on traditional veterinary medicine elucidated animal health issues in the province of Boulgou and the plant species employed for addressing these animal diseases. A total of eighty-eight plant species were identified. This diversity underscores the state of indigenous knowledge preserved by livestock farmers. Ethnoveterinary medicine exhibits significant potential to complement modern veterinary medicine in combating animal diseases. Given the current context of climate change, animal health problems are likely to intensify in the future due to the strong correlations between climate parameters and animal disease outbreaks. Accordingly, to optimize the outcomes of this study, future investigations should focus on:

i. Extending the study to other districts provinces or regions to compile a more comprehensive inventory of plants suitable for veterinary applications;
ii. Conducting research to validate experimentally the efficacy and safety of proposed formulations, based on pharmacotoxicological, phytochemical, and bioclinical analyses;
iii. Developing hygienic formulations and appropriate presentations for safer utilization of scientifically validated traditional remedies;
iv. Promoting the establishment of ethnoveterinary associations and botanical gardens to preserve local knowledge as cultural heritage while conserving biodiversity;
v. Foster the use of plants in veterinary medicine as an alternative method for safeguarding public veterinary health.

Declarations

List of abbreviations: INSD: Institut National de Statistique et de Demographie, RFC: relative frequency of citation, B =Bissa, F= Fulani, M= Moore.

Ethics approval and consent to participate: Informed consent was obtained verbally prior to the survey.

Consent for publication: Verbal consent was obtained from all the participants involved in this study.

Availability of data and materials: All supporting data available in the article.

Competing interests: The author declared no competing interests.

Funding: This work was supported by the research allowances of the Ministry of Higher Education, Research and Innovation of Burkina Faso.

Author contributions: I.Z. designed the questionnaire, carried out the survey, collected the data analysed the data, wrote the original draft of the manuscript. L.H.B. critically revised and edited the manuscript. C.L.S. critically revised and edited the manuscript. A.T. critically revised the manuscript and supervised the study. All authors approved the final draft of the manuscript.

Acknowledgements

The authors thank the heads of the livestock services in Boulgou Province, the development advisors, and the local village chiefs for facilitating interactions with livestock farmers. They also extend their heartfelt gratitude to the farmers who generously shared their knowledge of traditional veterinary medicine and Mr Yaméogo Wend-Goudou Armand Ismaël for his invaluable help in data collection.

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Appendix 1

Families	Genera	Plant scientific names
Malvaceae	*Abelmoschus*	*Abelmoschus esculentus* (L.) Moench
Malvaceae	*Adansonia*	*Adansonia digitata* L.
Fabaceae	*Afzelia*	*Afzelia africana* Sm. ex Pers.
Alliaceae	*Allium*	*Allium cepa* L.
Alliaceae	*Allium*	*Allium sativum* L.
Vitaceae	*Ampelocissus*	*Ampelocissus africana* (Lour.) Merr.
Poaceae	*Andropogon*	*Andropogon gayanus* Kunth
Annonaceae	*Annona*	*Annona senegalensis* Pers.
Meliaceae	*Azadirachta*	*Azadirachta indica* A. Juss.
Zygophyllaceae	*Balanites*	*Balanites aegyptiaca* (L.) Delile
Bauhinia	*Bauhinia*	*Bauhinia rufescens* Lam.
Malvaceae	*Bombax*	*Bombax costatum* Pellegr. & Vuill.
Brassicaceae	*Brassica*	*Brassica oleracea* L.
Apocynaceae	*Calotropis*	*Calotropis procera* (Aiton) R.Br.
Capparidaceae	*Capparis*	*Capparis sepiaria* L.
Solanaceae	*Capsicum*	*Capsicum frutescens* L.
Fabaceae	*Cassia*	*Cassia nigricans* Vahl
Malvaceae	*Ceiba*	*Ceiba pentandra* (L.) Gaertn.
Vitaceae	*Cissus*	*Cissus quadrangularis* L.
Cucurbitaceae	*Citrullus*	*Citrullus colocynthis* (L.) Schrad.
Rutaceae	*Citrus*	*Citrus limon* (L.) Burm.f.
Arecaceae	*Cocos*	*Cocos nucifera* L.
Combretaceae	*Combretum*	*Combretum glutinosum* Perr. ex DC.
Malvaceae	*Corchorus*	*Corchorus olitorius* L.
Fabaceae	*Crotalaria*	*Crotalaria retusa* L.
Poaceae	*Cymbopogon*	*Cymbopogon citratus* (DC.) Stapf
Fabaceae	*Pericopsis*	*Pericopsis laxiflora* (Benth.) Meeuwen
Fabaceae	*Daniellia*	*Daniellia oliveri* (Rolfe) Hutch. & Dalziel
Fabaceae	*Dichrostachys*	*Dichrostachys cinerea* (L.) Wight & Arn.
Ebenaceae	*Diospyros*	*Diospyros mespiliformis* Hochst. ex A.DC.
Arecaceae	*Elaeis*	*Elaeis guineensis* Jacq.
Fabaceae	*Faidherbia*	*Faidherbia albida* (Delile) A. Chev.
Rubiaceae	*Feretia*	*Feretia apodanthera* Delile
Moraceae	*Ficus*	*Ficus platyphylla* Delile
Moraceae	*Ficus*	*Ficus sycomorus* L.
Phyllanthaceae	*Flueggea*	*Flueggea virosa* (Roxb. ex Willd.) Voigt
Combretaceae	*Guiera*	*Guiera senegalensis* J.F. Gmel.
Malvaceae	*Hibiscus*	*Hibiscus cannabinus* L.
Malvaceae	*Hibiscus*	*Hibiscus sabdariffa* L.
Fabaceae	*Indigofera*	*Indigofera tinctoria* L.
Convolvulaceae	*Ipomoea*	*Ipomoea eriocarpa* R.Br.
Convolvulaceae	*Ipomoea*	*Ipomoea asarifolia* (Desr.) Roem. & Schult.
Meliaceae	*Khaya*	*Khaya senegalensis* (Desr.) A. Juss.
Asteraceae	*Lactuca*	*Lactuca sativa* L.
Cucurbitaceae	*Lagenaria*	*Lagenaria breviflora* (Benth.) Roberty
Cucurbitaceae	*Lagenaria*	*Lagenaria siceraria* (Molina) Standl. [
Anacardiaceae	*Lannea*	*Lannea acida* A. Rich.
Anacardiaceae	*Lannea*	*Lannea microcarpa* Engl. & K. Krause

Apocynaceae	*Leptadenia*	*Leptadenia hastata* (Pers.) Decne.
Euphorbiaceae	*Manihot*	*Manihot esculenta* Crantz
Rubiaceae	*Mitragyna*	*Mitragyna inermis* (Willd.) Kuntze
Moringaceae	*Moringa*	*Moringa oleifera* L.
Nymphaeaceae	*Nymphaea*	*Nymphaea lotus* L.
Lamiaceae	*Ocimum*	*Ocimum basilicum* L.
Fabaceae	*Parkia*	*Parkia biglobosa* (Jacq.) R.Br. ex G. Don
Poaceae	*Pennisetum*	*Pennisetum glaucum* (L.) R.Br.
Poaceae	*Pennisetum*	*Pennisetum pedicellatum* Trin.
Poaceae	*Phragmites*	*Phragmites australis* (Cav.) Steud.
Fabaceae	*Piliostigma*	*Piliostigma reticulatum* (DC.) Hochst.
Meliaceae	*Pseudocedrela*	*Pseudocedrela kotschyi* (Schweinf.) Harms
Myrtaceae	*Psidium*	*Psidium guajava* L.
Fabaceae	*Pterocarpus*	*Pterocarpus erinaceus* Poir.
Rubiaceae	*Sarcocephalus*	*Sarcocephalus latifolius* (Sm.) E.A. Bruce
Anacardiaceae	*Sclerocarya*	*Sclerocarya birrea* (A. Rich.) Hochst.
Plantaginaceae	*Scoparia*	*Scoparia dulcis* L.
Fabaceae	*Senegalia*	*Senegalia pennata* (L.) Maslin
Fabaceae	*Senegalia*	*Senegalia gourmaensis* (A. Chev.) Kyal. & Boatwr.
Fabaceae	*Senegalia*	*Senegalia senegal* (L.) Britton
Solanaceae	*Solanum*	*Solanum aethiopicum* L.
Solanaceae	*Solanum*	*Solanum incanum* L.
Solanaceae	*Lycopersicon*	*Lycopersicon esculentum* Mill.
Poaceae	*Sorghum*	*Sorghum bicolor* (L.) Moench
Chenopodiaceae	*Spinacia*	*Spinacia oleracea* L.
Malvaceae	*Sterculia*	*Sterculia setigera* Delile
Orobanchaceae	*Striga*	*Striga hermonthica* (Delile) Benth.
Fabaceae	*Tamarindus*	*Tamarindus indica* L.
Loranthaceae	*Tapinanthus*	*Tapinanthus sp*. on *Diospyros mespiliformis*
Loranthaceae	*Tapinanthus*	*Tapinanthus sp*. on *Ziziphus mauritiana*
Combretaceae	*Terminalia*	*Terminalia leiocarpa* (DC.) Guill. & Perr.
Fabaceae	*Vachellia*	*Vachellia nilotica* (L.) P.J.H. Hurter & Mabb
Fabaceae	*Vachellia*	*Vachellia tortilis* (Forssk.) Hayne
Asteraceae	*Vernonia*	*Vernonia colorata* (Willd.) Drake
Asteraceae	*Vernonia*	*Vernonia pauciflora (Willd.) Less.*
Fabaceae	*Vigna*	*Vigna subterranea* (L.) Verdc.
Fabaceae	*Vigna*	*Vigna unguiculata* (L.) Walp.
Sapotaceae	*Vitellaria*	*Vitellaria paradoxa* C.F. Gaertn.
Rhamnaceae	*Ziziphus*	*Ziziphus mauritiana* Lam.
Rhamnaceae	*Ziziphus*	*Ziziphus mucronata* Willd.