

Ethnobotanical inventory of medicinal plants used in traditional veterinary medicine in Northern Côte d'Ivoire (West Africa)

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Abstract

This paper reports an ethnobotanical and ethnopharmacological survey describing medicinal plants used for veterinary purposes by rural communities of Northern Côte d'Ivoire. For a large majority of these resource-poor breeders, ethnoveterinary medicine is the main resort for treating various diseases and ailments of their livestock. Breeders reported 55 medicinal recipes that employ 44 plant species belonging to 40 genera and 30 families. The botanical names, plant parts used, multiple usages, forms of preparation and applications are described here. Herbal remedies were mostly used as decoctions, pounded fresh plants or powdered plant material to treat diseases of the skin, eyes, gastrointestinal and respiratory tracts. Administration was oral in most cases, followed by topical applications, and drops to treat ears and eyes. This study contributes to the conservation *ex situ* of ethnoveterinary knowledge of herdsmen, covering 25 plants species described for the first time for veterinary use in Côte d'Ivoire.

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Keywords: Côte d'Ivoire; Ethnobotany; Ethnopharmacology; Livestock; Medicinal plants

1. Introduction

An important part of Côte d'Ivoire's biological resources are plants, many of which are used since a long time in traditional medicine. So far, ethnoveterinary medicine has been neglected in favour of human ethnomedicine. Although a number of ethnobotanical inventories concerning the use of medicinal plants in human health have been completed in Côte d'Ivoire (Bouquet and Debray, 1974; Adjanohoun and Aké Assi, 1979; Bellomaria and Kacou, 1995; Koné et al., 2002), the ethnoveterinary medicine is poorly described. Only Aké Assi (1992) reported some veterinary applications used in Côte d'Ivoire. This scarce description of the ethnoveterinary resources of Côte d'Ivoire are in stark contrast to the problems

of livestock rearing, where the lacking regular access to essential medicines greatly hampers productivity. According to the FAO (2002), the lack of drugs to treat diseases and infections causes losses of 30 to 35% in the breeding sector of many developing countries, where poor animal health remains the major constraint to breeding. In an earlier survey carried out in Côte d'Ivoire, the mortality rate ranged between 11.5% and 25%, and is more important in young animals during the raining season due to parasitic infections (Jousset, 1985). Epidemiological studies carried out in Northern Côte d'Ivoire showed that 96.5% and 97.6% of sheep and goats are infected by helminths such as *Haemonchus contortus* (Achi et al., 2003). However, in most cases, breeders refuse to apply the recommended deworming scheme which recommends 6 treatments per year. Ticks and tick-borne diseases are also found in livestock in the savannah of Côte d'Ivoire. Five different tick species were identified; the four genera in order of frequency were: *Amblyomma* (overall prevalence 96%), *Boophilus* (47%), *Hyalomma* (<1%) and *Rhipicephalus* (<1%). *Amblyomma*

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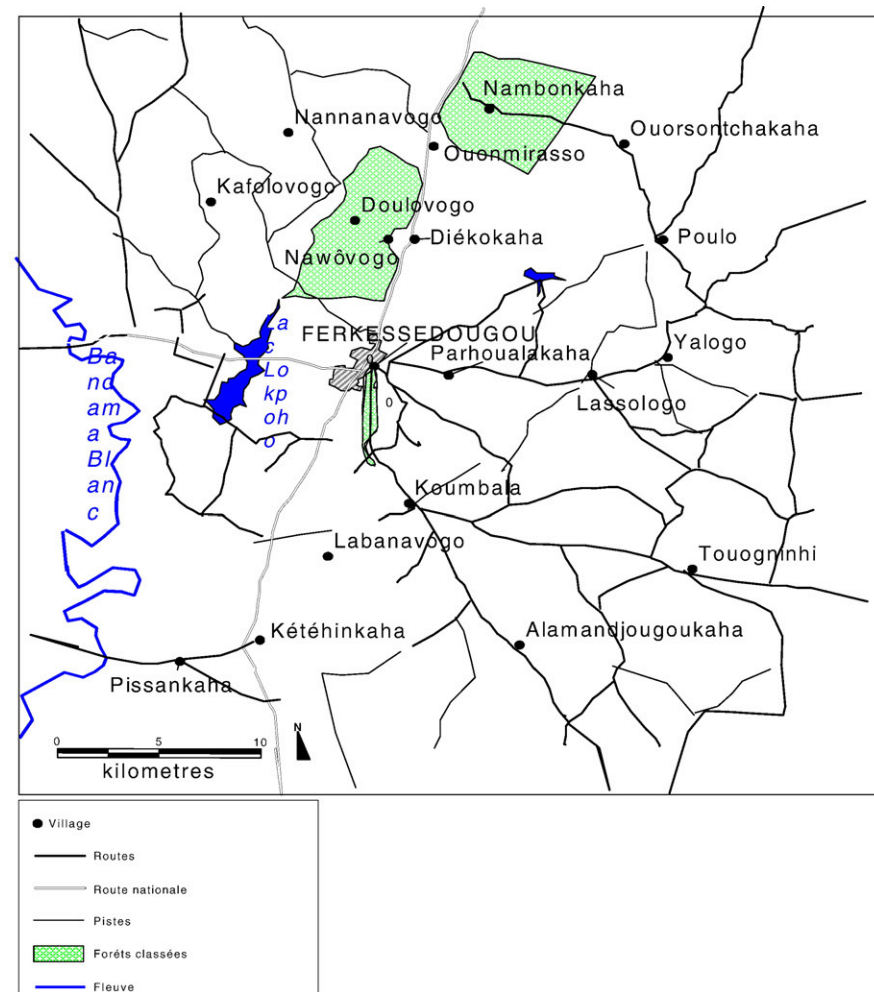
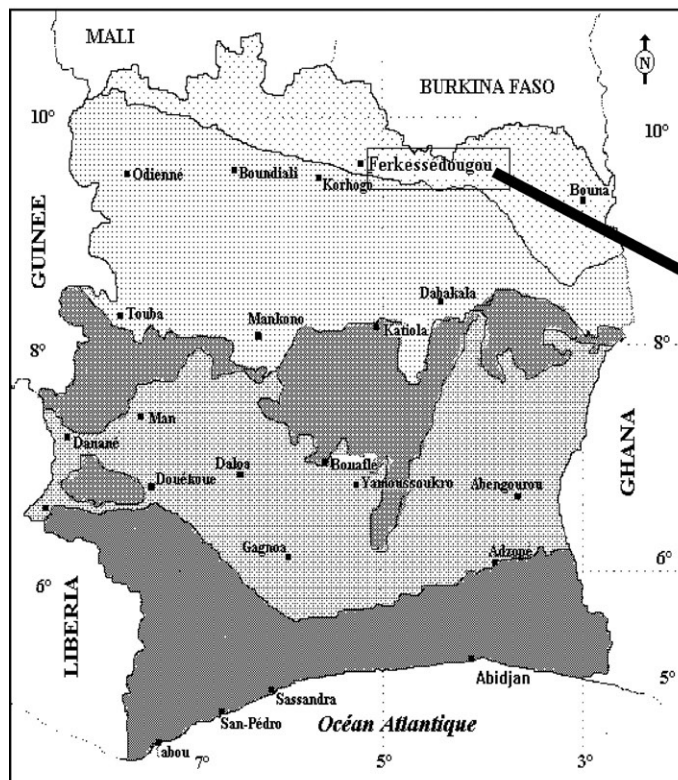


Fig. 1. Map showing the location of villages where key informants on ethnoveterinary pharmacology were interviewed (Ecological map of Côte d'Ivoire based on Monnier, 1983).

Table 1
Plants used in the preparation of herbal remedies for livestock

No	Scientific name	Family	Life form and distribution	Part used	Therapeutic indication	Preparation and administration	Target
1	<i>Acacia nilotica</i> (L.) Willd. Ex Delile	Mimosaceae	Paltr, Kl, Zm, SO, Dr.	Leaves	Diarrhoea of the calf, hair loss	Decoction is administered orally (0.5 L) as beverage, once daily	Cattle, sheep and goats
2	<i>Acanthospermum hispidum</i> L.	Asteraceae	Th, AN, GC-SZ	Leaves	Febrifuge	Decoction is administered orally as beverage to cattle (0.5 L), sheep and goats (0.25 L), twice daily	Cattle, sheep and goats
3	<i>Adansonia digitata</i> L.	Bombacaceae	mp, A, SZ	Stem bark	Tonic, appetizer	Powder is licked by animals as food complement	Sheep and goats
4	<i>Afraegle paniculata</i> (Schum.) Engl.	Rutaceae	mp, A, GC-Sz	Leaves	Cough	Ground with the bulb of <i>Allium sativum</i> L., added to water and filtered; the resulting solution is administer orally (1 L), or as drops it in nostrils, twice daily	Cattle
5	<i>Agelanthus dodoneifolius</i> (DC.) Pohl. & Wiens	Loranthaceae	Ep (Par), A, GC-SZ	Leaves	Skin diseases	Decoction is mixed with salt and administered orally (1 L), twice daily	Cattle
6	<i>Anogeissus leiocarpus</i> (DC.) Guill. & Perr.	Combretaceae	mp, A, SZ	Fruit, Leaves	Intestinal worms, gastrointestinal disorders, bites	1) Ground, dry fruit is mixed with the bran of <i>Pennisetum glaucum</i> L. or <i>Sorghum bicolor</i> (Linn) Moench and salt, then fed to the animal.2) Ground leaves are taken up in water, filtered, and administered orally as well as applied opically on the wound, once daily for 3 days	Cattle, sheep and goats
7	<i>Blighia sapida</i> Koenig	Sapindaceae	mP, PanT, GC-SZ	Leaves (young)	Tonic, lactogogue	Decoction is administered orally (1 L), once daily	Cattle
8	<i>Bridelia ferruginea</i> Benth ex Planch	Euphorbiaceae	mp, A, GC-SZ	Stem bark	Intestinal worms, febrifuge, tonic	Decoction is administered orally (0.5 L), once daily	Cattle, sheep and goats
9	<i>Calotropis procera</i> (Aiton) Aiton. f.	Asclepiadaceae	np, PT, GC-SZ	Leaves	Stomach pains, cold	Ground leaves are added to water and lemon, filtered, and administer orally (0.5 L), once daily	Cattle
10	<i>Cassia occidentalis</i> L.	Caesalpiniaceae	np, Pt, GC-SZ	Leaves	Constipation, tonic, febrifuge	Ground leaves are added to water and lemon, filtered, and administer orally (0.5 L), twice daily	Cattle, sheep and goats
11	<i>Cassia siamea</i> Lam.	Caesalpiniaceae	mp, AS, i	Leaves	Cough, stomach pains	Decoction is administered orally (0.5 L), twice daily	Sheep and goats
12	<i>Cassia sieberiana</i> DC.	Caesalpiniaceae	mp, A, GC-SZ	Roots	Intestinal worms, febrifuge	Ground roots are incubated in water overnight, then administered orally (33 cL-1 L) on an empty stomach	Cattle, sheep and goats
13	<i>Cissus populnea</i> Guill. & Perr.	Vitaceae	np, A, SZ	Climber	Artificial relief	Ground climber is squeezed; the resulting juice is administered orally to expel the placenta	Cattle
14	<i>Cochlospermum planchoni</i> Hook. f. ex Planch	Cochlospermaceae	Lmp-A-GC-SZ	Roots	Febrifuge, tonic	Decoction is administered orally on an empty stomach (0.5 L for calf and small ruminants; 1 L for adults cows), once daily	Cattle, sheep and goats
15	<i>Daniellia oliveri</i> (Rolfe) Hutch. Dalz	Caesalpiniaceae	mp, A, GC-SZ	Stem bark	Tonic	Decoction is administered orally (1 L), once daily	Cattle
16	<i>Detarium microcarpum</i> Guill. & Perr.	Caesalpiniaceae	mp, A, SZ	Stem	Artificial relief	Heated stem is applied topically in order to help cow to expel the placenta	Cattle
17	<i>Diospyros mespiliformis</i> Hochst.ex A. DC	Ebenaceae	mp, A, GC-SZ	Leaves, unripe fruit	Diarrhoea, tonic, febrifuge, skin diseases, zootechnic	Decoction obtained from leaves or fruit in association with leaves of <i>Vitellaria paradoxa</i> is given orally (0.5 L), and applied topically on the body	Cattle
18	<i>Faidherbia albida</i> (Delile) A. Chev.	Mimosaceae	Mp, A, SZ	Leaves	Anaemia, tonic	Decoction with added salt is administered orally (1 L), once daily	Cattle
19	<i>Ficus glumosa</i> Del.	Moraceae	Mp, A, GC	Leaves	Intestinal worms, cough, weight loss	Decoction is administered orally (1 L) as beverage, twice daily	Cattle, sheep and goats
20	<i>Ficus sur</i> Forssk.	Moraceae	mp-A-GC-SZ	Leaves, stem bark	Zootechnic fertility)	Decoction is administered orally (1 L), once daily	Cattle, sheep and goats

21	<i>Ficus sycomorus</i> L. subsp. <i>gnaphalocarpum</i> (Miq.) Berg.	Moraceae	mp-A-SZ	Leaves, Stem bark	Zootechnic (fertility)	Decoction is administered orally (1 L), once daily	Cattle
22	<i>Flueggea virosa</i> (Roxb. ex Willd.) Voigt	Euphorbiaceae	np, PT, GC-SZ	Leaves	Febrifuge	Decoction is administered orally to cattle (0.5 L), calves and small ruminants (0.25 L), once daily	Cattle, sheep and goats
23	<i>Guiera senegalensis</i> J. F. Gmel	Combretaceae	np, A, SZ	Stem bark	Diarrhoea, eye diseases, skin diseases	1) Powder is mixed with warm water and given orally (1 L), once daily. 2) For eye diseases, the powder is applied to the eyes, twice daily 3) Against scabies, the powder is mixed with shea butter and applied topically on the skin	Cattle, sheep and goats
24	<i>Heliotropium indicum</i> L.	Boraginaceae	Th, PT, GC-SZ	Leaves	Acute diarrhoea, cough	Ground leaves are mixed with water, filtered, and administered orally (0.5 L), twice daily	Cattle, sheep and goats
25	<i>Khaya senegalensis</i> (Ders.) A. Juss.	Meliaceae	mP, A, SZ	Stem bark	Diarrhoea, cough, intestinal worms, febrifuge, weight loss, constipation, respiratory diseases	1) Decoction alone or mixed with salt is administered orally (1 L), once daily. 2) Against worms, treatment on empty stomach is recommended	Cattle, sheep and goats
26	<i>Landolphia heudelotii</i> A. DC.	Apocynaceae	Lmp, A, GC	Leaves, bark	Diarrhoea, intestinal worms	1) Decoction is administered orally (0.5 L) to calf and small ruminants on an empty stomach, once daily; 2) Ground stem bark is taken up in water, filtered and mixed with the flour of <i>Pennisetum glaucum</i> . The paste is given to the animal on an empty stomach	Cattle, sheep and goats
27	<i>Lophira lanceolata</i> Van Tiegh. Ex Keay	Ochnaceae	mP, A, SZ	Stem bark	Diarrhoea, intestinal worms	Ground stem bark is taken up in water, filtered and mixed with the flour of <i>Pennisetum glaucum</i> . The paste is given to the animal on an empty stomach	Cattle
28	<i>Maytenus senegalensis</i> (Lam.) Exell	Celastraceae	np, A, SZ	Leaves	Diarrhoea and intestinal worms in calf, dog bites	1) Decoction is administered orally (33 cL) to calf, twice daily 2) Ground leaves are pressed. The juice is applied to the left eye and the right nostril, and applied topically on the wound	Cattle
29	<i>Mitragyna inermis</i> (Willd.) O. Kuntze	Rubiaceae	mp, A, SZ	Leaves	Intestinal worms	Decoction is administered orally (33 cL)	Cattle, sheep and goats
30	<i>Olax subscorpioidea</i> Oliv.	Olacaceae	mp, A	Roots	Intestinal worms	Ground roots are squeeze and the juice mixed with the flour of <i>Pennisetum glaucum</i> . The paste is given the paste for eating	Cattle, sheep and goats, dogs
31	<i>Opilia amantalea</i> Roxb.	Opiliaceae	mp, A, GC-SZ	Leaves	Intestinal worms, anorexia	Decoction is administered orally (33 cL-1 L)	Cattle, sheep and goats
32	<i>Passiflora foetida</i> L.	Passifloraceae	Lnp, AN, GC-SZ	Whole plant	Prevention of diseases	Ground plants are added to water and administered orally	Poultry
33	<i>Pterocarpus erinaceus</i> Poir.	Fabaceae	mp, A, SZ	Stem bark	Eye diseases	Decoction is administered orally (0.5 L) and used as eye drops	Cattle

Table 1 (continued)

No	Scientific name	Family	Life form and distribution	Part used	Therapeutic indication	Preparation and administration	Target
34	<i>Saba senegalensis</i> (A. DC.) Pichon	Apocynaceae	Lmp, A, SZ	Leaves	Diarrhoea	Decoction is administered orally (0.25 to 1 L according to age), twice daily	Cattle, sheep and goats
35	<i>Sclerocarya birrea</i> (A. Rich) Hochst.	Anacardiaceae	mp, A, SZ	Stem bark	Respiratory diseases	Shea butter or milk cream is added to a decoction and administered orally (0.5 L), once daily	Cattle
36	<i>Sterculia setigera</i> Del.	Sterculiaceae	mp, A, SZ	Stem bark, seeds	1) Intestinal worms, tonic and appetizer, 2) artificial relief, 3) relief of sprain, skin diseases	1) Decoction is administered orally as beverage (33 cL-1 L) to cattle, sheep and goats, twice daily 2) Stem barks are mixed with water and poured on the uterus to facilitate/stimulate the birth process; 3a) Hot stem bark is placed on the affected body part 3b) Burnt seeds are ground, mixed with shea butter, and applied topically on the skin	Cattle, sheep and goats
37	<i>Strychnos spinosa</i> Lam.	Loganiaceae	mp, AM, SZ	Leaves	Dermatitis, loss of fur, skin diseases	Decoction of the leaves in association with the ones of <i>Crossopteryx febrifuga</i> (G. Don) Benth, is administered orally (1 L), and applied topically on the skin	Cattle
38	<i>Terminalia laxiflora</i> Engl. & Diels	Combretaceae	mp, A, SZ	Roots	Eye diseases	Decoction is administered orally to cattle (0.5 L), calves and small ruminants (0.25 L). Eye drops of the same decoction are applied, all once daily for 3 days	Cattle
39	<i>Vitellaria paradoxa</i> C. F. Gaertn.	Sapotaceae	mp, A, SZ	Leaves	Diarrhoea with blood, tonic and appetizer	1) Decoction is mixed with lemon juice and administered orally, once daily. 2) Decoction can also be prepared together with leaves of <i>Diospyros mespiliformis</i>	Cattle, sheep and goats
40	<i>Waltheria indica</i> L.	Sterculiaceae	nP, PanT, GC-SZ	Leaves	Diarrhoea, tonic	Decoction is administered orally (0.5-1 L) once daily	Cattle, sheep and goats

Life form: Ch = Chamephytis; Ep = Epiphytis; Gr = Rhizomatous Geophytis; H = Hemicryptophytis; Hyd = Hydrophytis; L = Liana; mp = Microphanerophytis; np = Nanophanerophytis; Par = Parasite; Th = Therophytis.

Distribution: A = African Taxa (Intertropical Africa); Aco = Taxa common to Africa and Comoro islands; AM = Taxa common to Africa and Madagascar; AN = Taxa common to Africa and Tropical America (Afro-neotropical); As = Asian Taxa or sometimes common to Africa and Tropical Asia; Dr = Desert; GC = Taxa of the Guineo-Congolian (rainforest); GC-W = Endemic taxa from the block of forest to the west of Togo comprising Ghana, Côte d'Ivoire, Liberia, Sierra Leone, Guinea, Guinea Bissau, Gambia, Senegal; i = Cultivated Taxa; Jav = Taxa from Java; Kl = Kalaharian; N = Neotropical; PaleoT = Paleotropical Taxa common to Africa, Asia, Australia, Pacific islands; PanT = Taxa common to all tropical countries of the world; SO = Somalian; SZ = Taxa of the Sudano-zambesian region (savanna, steppes).

Table 2

Number of persons indicating a veterinary property of a particular plant in the Ferkessédougou Region, Northern Côte d'Ivoire (N=14 informants)

No.	Scientific name	Medicinal properties	Number of persons indicating a property
1	<i>Acacia nilotica</i> (L.) Willd. ex Delile	Diarrhoea of calf Loss of fur	3 3
2	<i>Acanthospermum hispidum</i> L.	Febrifuge	5
3	^a <i>Adansonia digitata</i> L.	Tonic and appetizer	6
4	<i>Afraegle paniculata</i> (Schum.) Engl.	Cough	5
5	<i>Agelanthus dodoneifolius</i> (DC.) Pohl. & Wiens	Skin diseases	2
6	<i>Allium sativum</i> L.	Ingredients	4
7	^a <i>Anogeissus leiocarpus</i> (DC.) Guill. & Perr.	Intestinal worms Gastrointestinal disorders Animal bite	7 5 3
8	<i>Blighia sapida</i> Koenig	Tonic Lactagogue	4 3
9	^a <i>Bridelia ferruginea</i> Benth ex Planch	Intestinal worms Febrifuge Tonic	8 5 6
10	^a <i>Calotropis procera</i> (Aiton) Aiton. f.	Stomach pains Cold	4 5
11	^a <i>Cassia occidentalis</i> L.	Constipation Tonic Febrifuge	3 3 5
12	<i>Cassia siamea</i> Lam.	Cough Stomach pains	3 4
13	^a <i>Cassia sieberiana</i> DC.	Intestinal worms Febrifuge	7 3
14	^a <i>Cissus populnea</i> Guill. & Perr.	Artificial relief	4
15	^a <i>Cochlospermum planchonii</i> Hook. f. ex Planch	Febrifuge Tonic	6 4
16	<i>Crossopteryx febrifuga</i> (G. Don) Benth	Dermatitis Coat loss Skin diseases	5 6 5
17	<i>Daniellia oliveri</i> (Rolfe) Hutch. Dalz.	Tonic	3
18	<i>Detarium microcarpum</i> Guill. & Perr.	Artificial relief	6
19	^a <i>Diospyros mespiliformis</i> Hochst.ex A. DC.	Diarrhoea Tonic Febrifuge Skin diseases Zootechnic	5 5 3 7 6
20	<i>Faidherbia albida</i> (Delile) A. Chev.	Anaemia Tonic	4 4
21	<i>Ficus glumosa</i> Del.	Intestinal worms Cough Weight loss	5 3 5
22	<i>Ficus sur</i> Forssk.	Zootechnic	6
23	^a <i>Ficus sycomorus</i> L. subsp. <i>gnaphalocarpum</i> (Miq.) Berg.	Zootechnic	5
24	^a <i>Flueggea virosa</i> (Roxb. ex Willd.) Voigt	Febrifuge	5
25	^a <i>Guiera senegalensis</i> J. F. Gmel	Diarrhoea Eye diseases Skin diseases	4 5 6
26	<i>Heliotropium indicum</i> L.	Acute diarrhoea Cough	6 6
27	^a <i>Khaya senegalensis</i> (Ders.) A. Juss.	Diarrhoea Cough Intestinal worms Febrifuge Weight loss Constipation Respiratory diseases	7 5 10 10 5 6 5
28	<i>Landolphia heudelotii</i> A. DC	Diarrhoea Intestinal worms	3 5
29	<i>Lophira lanceolata</i> Van Tiegh. ex Keay	Diarrhoea Intestinal worms	3 4
30	^a <i>Maytenus senegalensis</i> (Lam.) Exell	Diarrhoea Intestinal worms in calf Dog bite	5 5 3

(continued on next page)

Table 2 (continued)

No.	Scientific name	Medicinal properties	Number of persons indicating a property
31	^a <i>Mitragyna inermis</i> (Willd.) O. Kuntze	Intestinal worms	5
32	<i>Olex subscorpioidea</i> Oliv.	Intestinal worms	3
33	<i>Opilia amantalea</i> Roxb.	Intestinal worms	10
		Anorexia	5
34	<i>Passiflora foetida</i> L.	Prevention of diseases	3
35	<i>Pennisetum glaucum</i> L.	Ingredients	
36	^a <i>Pterocarpus erinaceus</i> Poir.	Eye diseases	6
37	<i>Saba senegalensis</i> (A. DC.) Pichon	Diarrhoea	7
38	^a <i>Sclerocarya birrea</i> (A. Rich) Hochst.	Respiratory diseases	8
39	<i>Sorghum bicolor</i> (Linn) Moench	Ingredients	8
40	<i>Sterculia setigera</i> Del.	Intestinal worms	9
		Tonic and appetizer	6
		Artificial relief	3
		Relief of sprain	4
		Skin diseases	9
41	^a <i>Strychnos spinosa</i> Lam.	Dermatitis	5
		Coat loss	6
		Skin diseases	5
42	<i>Terminalia laxiflora</i> Engl. & Diels	Eye diseases	4
43	^a <i>Vitellaria paradoxa</i> C. F. Gaertn	Diarrhoea with blood	7
		Appetizer	5
44	<i>Waltheria indica</i> L.	Diarrhoea	8
		Tonic	6

^a Plants reported as used in ethnoveterinary medicine, in previous studies (Ake Assi, 1992; Bizimana, 1994).

variegatum was the most-abundant tick on cattle in all seasons (Knopf et al., 2002).

Particularly in the Northern part of Côte d'Ivoire, where 80 to 90% of the livestock are kept, and which provides the lion's share of meat (Jousset, 1985) to the south, the weak performance of animal production is due to lacking control of diseases.

The provision of veterinary services by the public sector has declined dramatically in the last two decades. We assume therefore that the traditional knowledge of the livestock owners and their herders, and the use of ethnoveterinary medicine still play an important role in complementing the private and state veterinary services in Côte d'Ivoire.

Traditional medicine based on phytotherapy may complement and offer alternatives for animal disease control, in particular for resource-poor breeders. More studies are needed to describe the efficiency of these ethnobotanicals. The first step in this direction is to record and describe the use of medicinal plants and to identify them correctly on a botanical level. The preservation of the traditional know-how, but also of the medicinal plants themselves, is essential for safekeeping the cultural heritage and biodiversity of Côte d'Ivoire, where both indigenous knowledge systems and the ecosystems that harbour the vast majority of biodiversity, are under great pressure and changing rapidly.

The main scope of the present study was to collect and describe the knowledge of rural communities of several villages from the Ferkessedougou region (Northern Côte d'Ivoire) on the ethnoveterinary medicine. This paper reports the findings of

this survey on the medicinal plants and herbal remedies used to treat several diseases in livestock.

2. Material and methods

2.1. Study area

The Ferkessedougou region is located in the savanna region (9–11°N, 4–7°W) of the Côte d'Ivoire (Fig. 1). This area is characterized by a sub-Sudanese climate (Eldin, 1971) with a dry season from November to April, and a rainy season from mid-April to October. The annual mean temperature is about 25 °C. The annual rainfall ranges from 1200 to 1500 mm with a peak in August and September. The predominant vegetation is characterised by grasslands and gallery forests (Guillaumet and Adjanohoun, 1971).

The traditional pastoral activities are characterised by the rearing of cattle, sheep, goats and poultry. For the predominantly poor and rural people, livestock rearing is considered as a form of saving the money gained from other agricultural activities, and as a source of income diversification. The loss of an individual animal has a great significance.

2.2. Interviews with the breeders

The survey was conducted from May to September 2002, when animal feed is abundant and herdsmen do not stay far from the villages. During 6 field visits, 14 key informants, who were older members of the village communities, or were known

to be knowledgeable about medicinal uses of plants, were interviewed. The interviews were carried out in the village of Pissankaha, Doulovogo, Labanvogo, Village C (SUCAF-CI), Parhoualakaha, Kethinkaha, Dekokaha, Nambonkaha, Ouonmirasso and Nawovogo (Fig. 1). Ethnoveterinary information was collected during the interviews following the instructions on ethnobotanical and ethnopharmacological surveys proposed by Etkin (1983), Waller (1983) and Hedberg (1983). The questionnaire addressed to each traditional practitioner included local name(s) and plant parts used, therapeutic indications, remedies, administration routes and known side effects. Each interviewer was visited 3 times during 6 months, i.e. every 2 months, and interviewed with the same questions in order to confirm the robustness of received information. An alleged pharmacological value of a particular plant was recorded as valid only if it was mentioned by at least 3 independent sources.

Voucher specimens of the recorded medicinal plants were collected by us with the informant, dried and processed according to standard practice, identified and then stored together with photos at the University of Abobo-Adjamé and at the Herbarium of the Centre Suisse de Recherches Scientifiques. Botanical nomenclature follows the flora of Côte d'Ivoire (Aké Assi, 2001) and the flora of West Tropical Africa (Hutchinson and Dalziel, 1954–1972; Lebrun and Stork, 1991, 1992, 1995, 1997).

3. Results and discussion

For the discovery of new drugs and a good use of traditional medicine, it is essential to record and preserve the traditional knowledge on medicinal plants intended for treating humans and animals. Furthermore, botanical knowledge is instrumental for the correct identification of plant species and thus avoiding errors in the gathering of medicinal plants.

During the ethnobotanical and ethnopharmacological survey in the Ferkessedougou region, 44 plant species covering 40 genera and 30 families were identified. The plant species are shown in alphabetical order with their life form and distribution (Table 1). The interviewees did not mention side effects for any of the listed plants, which were reported to be used in the preparation of 55 medical remedies for treating diseased animals. Nearly half of the plants were reported for use in all common ruminants, i.e. cattle, sheep and goats, and the vast majority of the remaining preparations were aimed at cattle only. Only 2 plant species were for exclusively for sheep and goats, and one plant species, *Passiflora foetida* L., was used specifically for preventing diseases in poultry, while *Olex subscorpioidea* Oliv. was also indicated for deworming dogs.

The most common plants used by breeders were *Cassia sieberiana* DC., *Khaya senegalensis* (Ders) A. Juss, *Diospyros mespiliformis* Hochst. ex A. DC., *Sterculia setigera* Del, *Bridelia ferruginea* Benth, *Guiera senegalensis* J F Gmel., *Opilia amantalea* Roxb., *Saba senegalensis* (A. DC.) Pichon and *Vitellaria paradoxa* C F Gaertn (Table 2). These plant species are more often used to treat gastroenteritis and skin diseases. This may be explained by the prevalence of parasitic gastroenteritis and ticks.

The routes of administration of these herbal remedies were essentially oral, followed by topical applications and drops to

treat ears or eyes (Table 1). For most of the remedies, the dose depended on age or breed of the sick animal. For applications in liquid form, the recommended quantities seemed to be a function of body size, and were generally 0.25 l for sheep and goats, 0.5 l for calf and 1 l for cattle.

The use of 25 plants species as ethnoveterinary medicinal plants out of 44 is reported here for the first time in Côte d'Ivoire (Table 2). To our knowledge, only the remaining 19 species had been recorded in previous ethnoveterinary surveys for veterinary care in West Africa, including Northern Côte d'Ivoire (Aké Assi, 1992) or in Africa (Bizimana, 1994). However, these plants had been described for the treatment of other diseases. Only 5 species, namely *Maytenus senegalensis*, *Mitragyna inermis*, *Khaya senegalensis*, *Vitellaria paradoxa* and *Anogeissus leiocarpus*, had been reported for the same therapeutic indication in our survey as in previous ones, namely against diarrhoea and infection with intestinal worms. The latter, traditional property has been linked to the promising anthelmintic activity of *Khaya senegalensis* (Ademola et al., 2004), *Vitellaria paradoxa* and *Anogeissus leiocarpus* (Koné et al., 2005).

Our surveys revealed that the stem bark of *K. senegalensis* is used to treat a host of diseases. The species was mentioned by nearly all interviewees (Table 2) and confirmed its high value as a medicinal plant for veterinary health in the Ferkessedougou region. That observation is in full agreement with the statement of Iwu (1993) who recognized the great importance of *K. senegalensis* in traditional veterinary medicine in Africa. In Nigeria, this plant species is one of the most common plants used for treatment of trypanosomiasis in domestic animals (Atawodi et al., 2002).

Decoctions of *Diospyros mespiliformis* were frequently used by breeders for treating skin diseases and fever. This is understandable because *D. mespiliformis* displayed a broad antimicrobial spectrum (Adeniyi et al., 1996) and a potent antipyretic effect (Adzu et al., 2002).

The most species rich families were the Caesalpiniaceae (5 species), Moraceae (4 species) and Combretaceae (3 species). These families are among the most dominant of the savanna vegetation in Côte d'Ivoire (Guillaumet and Adjanohoun, 1971). The richest genera are *Ficus* and *Cassia* with 3 species each.

The pharmacological preparations were mostly decoctions, pounded fresh plants or powders of dried or burned plant parts, primarily leaves and stem barks. Water is the principal solvent used in preparation while powders are mixed to fodder. Furthermore, most of the remedies were prepared from a single plant species. Only two preparations involve two reported medicinal plants, namely *Diospyros mespiliformis* Hochst. ex A. DC. and *Vitellaria paradoxa* C. F. Gaertn to treat diarrhoea, increase tonic, and *Strychnos spinosa* Lam. combined to *Crossopteryx febrifuga* (G. Don) Benth to treat dermatitis and other skin diseases. Occasionally, herders employed additional ingredients such as salt, shea butter, lemon, flour, garlic, or bran of the seeds of *Pennisetum glaucum* (L.) R. Br. to prepare plants with an otherwise bitter taste. This clearly demonstrated the herdsman's intimate knowledge on the action, taste or role of the medicinal plants in question. These supplementary ingredients may act as sweetener, or in some cases, decrease toxicity of the plants by countering the pharmacological effects of some plant components (Houghton, 2002).

4. Conclusion

Our ethnobotanical and ethnopharmacological survey shows that medicinal plants are still widely used in Northern Côte d'Ivoire for improving animal health. The survey contributes to a growing knowledge of the traditional veterinary medicine used in Côte d'Ivoire, ensuring a thorough documentation and conservation *ex-situ* of these ethnoveterinary practices. Furthermore, the survey allowed the correct identification of 44 plants species used for animal health, 25 of which were reported for the first time for this utilization. Among the listed remedies, some could be of real interest in improving animal production if studied and developed further. Pharmacological and toxicological studies are underway on some plants in order to ascertain the effectiveness as well as the toxicity.

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