Investigation of Plants Used for the Ethnoveterinary Control of Gastrointestinal Parasites in Bénoué Region, Cameroon

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Summary

This study was conducted in the localities of Laindé Karewa and Israël, in the Bénoué region of Cameroon. Carefully structured questionnaires and discussions were used to identify 25 plant species used for traditional veterinary treatment in the Mbororo settlements, in order to control internal worms and parasites in cows, sheep and goats. These plant species belong to 16 families. Combretaceae were most frequently used, while Mitragyna inermis *(14.07%) and* Anogeissus leiocarpus *(20.96%) were most frequently used for sheep and goats, respectively. Stem bark was the most frequently used part of the plant (58.33%), generally in decoction form (31.25%) or by mixing the whole plant with the animal's food (31.25%), and represented the majority of medicinal preparations. Medicinal plants are generally used on their own and rarely in combination with other plants. These medicinal plant remedies are almost always administered orally. Even if their safety and effectiveness have yet to be proven, they could represent an alternative strategy for managing helminthiases in the region.*

Résumé

Investigation sur les plantes à potentialités anthelminthiques utilisées dans la région de la Bénoué- Cameroun

Cette étude a été réalisée dans les localités de Laindé Karewa et d'Israël, situées dans la région de la Bénoué- Cameroun. Les conversations et les questionnaires bien structurés ont permis d'identifier 25 espèces végétales utilisées en médecine vétérinaire traditionnelle dans les campements Mbororos pour traiter les vers intestinaux, parasites des bovins, ovins et caprins. Ces espèces de plantes appartiennent à 16 familles. Les plantes appartenant à la famille des Combretacées sont les plus citées. Mitragyna inermis *(14,07%) et* Anogeissus leiocarpus *(20,96%) sont les plantes les plus utilisées respectivement chez les bovins, caprins et ovins. La partie végétale la plus utilisée est l'écorce (58,33%) généralement sous forme de décoction (31,25%) ou mélangée à l'alimentation animale (31,25%). Les plantes sont généralement utilisées seules donc rarement en association. L'administration à l'animal se fait presque toujours par voie orale. Même si l'innocuité et l'efficacité restent encore à prouver, elles constitueraient une alternative dans la gestion des helminthiases dans la région.*

Introduction

In the developing countries, demand for meat has increased rapidly over the last 20 years at the rate of 5.6% per year, due to an increasing tendency to consume animal products. This growing demand for animal products provides an opportunity for the world's 675 million poor people, who live in rural areas and rely on cattle, to improve their lives (11). However, parasitic diseases and other endemics represent a major barrier for the development of profitable animal production. Infections caused by nematodes (helminthiasis), particularly in small ruminants, create major problems in southern hemisphere countries, especially in areas affected by poor nutrition and hygiene (12, 23). These nematodes are responsible for the major fall in (milk and meat) production and sometimes even for mortality on goat and sheep farms (6, 24). The problem is even more noticeable in tropical countries and during the rainy season (22).

In Cameroon, it has been shown that nematodes and gastro-intestinal cestodes are responsible for high sheep and goat mortality (2, 19, 20). A post-mortem examination, conducted on sheep at the IRAD (Institute of Agricultural Research for Development) research station in Garoua in 1994, revealed the presence of nematodes (*Haemonchus contortus*, *Trichostrongylus colubriformis*, *Oesophagostomum columbianum*, *Gaigeria pachyscelis*, *Bunostomum trigonocephalum*, *Trichuris glubolusa)* and one cestode (*Moniezia expenza*). Over 75% of mortalities have been attributed to helminthiases, particularly

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haemonchosis and monieziosis.
In the developed countries, relatively successful results achieved in terms of combating helminthiases are linked to the availability and easy application of anthelmintics, as well as improved diagnostic tests and knowledge of parasite epidemiology in ruminants. However, the inadequate use of anthelmintics has rapidly led to increased resistance, thus limiting the effectiveness of current and future programmes aimed at controlling these parasites.
In the developing countries, livestock farmers do not have access to conventional medicines. They see the use of medicinal plants as an alternative due to ever-increasing impoverishment. Although the traditional use of some plants has been tried and tested, the effectiveness of most plants has not yet been demonstrated. This makes it necessary to conduct scientific studies aimed at efficient and appropriate use, without the risk of intoxication.
Veterinary research has also focused on the use of anthelmintic plants, particularly in western countries before the Second World War and subsequently in oriental countries and India. Data exists concerning the action of several plants and plant extracts, which are used to combat certain parasites in various African countries and Cameroon (1, 21).
The aim of this study is to analyse the traditional use of plants for the treatment of intestinal worms in ruminants by livestock farmers in the localities of Laindé Karewa and Israël, in the Bénoué region of Cameroon.

Methods

Study site

The localities of Laindé Karewa and Israël in Bénoué-Cameroon are located in the Sudano-Guinean region.

Table 1
Overview of plants used as anthelmintics for the treatment of cattle

N°	Scientific name	Local name (Peul)	Families	Parts used	Associated plants	Administered form	Administration route
1	*Anogeissus leiocarpus*	Godoli	Combretaceae	Bks		De	Or
2	*Bombax costatum*	Bouboli	Bombacaceae	Bks		De	or
3	*Boswellia dalzielii*	Anakehi	Burseraceae	Bks		Wo	or
4	*Bridelia ferruginea*		Euphorbiaceae	bks		De	or
5	*Calotropis procera*	Baladi	Asclepiadaceae	rts		Wo	or
6	*Carissa edulis*		Apocynaceae	fr		Wo	or
7	*Combretum glutinosum*	Dooki	Combretaceae	brch		Fu	in
8	*Daniella oliveri*	Karlahi	Caesalpiniaceae	bks		Wo	or
9	*Detarium macrocarpum*		Caesalpiniaceae	bks		De	or
10	*Entada africana*	Fadowandoki	Mimosaceae	bks		Ma	in
11	*Guiera senegalensis*	Gelohi	Combretaceae	brch		Fu	in
12	*Harungana madagascariensis*		Clusiaceae	bks and lvs		Ma	or
13	*Khaya senegalensis*	Dalehi	Meliaceae	bks		De	or
14	*Lannea acida*	Siibihi	Anacardiaceae	bks	*Lannea acida* *Guiera senegalensis*	Ma	or
15	*Maytenus senegalensis*	Yengotehi	Celastraceae	lvs		De	or
16	*Mitragyna inermis*	Kadioli	Rubiaceae	bks		If	or
17	*Parkia biglobosa*	Narehi	Mimosaceae	bks		If	or
18	*Piliostigma reticulatum*	Barkelehi	Caesalpiniaceae	bks		Ma	or
19	*Sbksuridaca longepedunculata*	Alali	Polygalaceae	bks		De	or
20	*Terminalia collinum*	Koulahi	Combretaceae	lvs and brch		Fu	in
21	*Terminalia laxiflora*		Combretaceae	bks		De	or
22	*Trianthema portulacartrum*		Aizoaceae	lvs		n-ins	n-ins
23	*Vitellaria paradoxa*	Kareji	Sapotaceae	bks	*Bombax costatum,* *Vitellaria paradoxa*	Ma	or

bks= barks; de= decoction; lvs= leaves; fr= fruits; if= infusion; in= inhalation; n-ins= nasal instillation; rts= roots; brch= branches; ma= maceration; wo= whole organ.

Table 2
Overview of plants used as anthelmintics for the treatment of sheep and goats

N°	Scientific name	Local name (Peul)	Families	Parts used	Associated plants	Administered form	Administration route
1	*Acacia seyal*	Badehi	Mimosaceae	fr and bks		wo	or
2	*Anogeissus leiocarpus*	Godali	Combrétacées	bks		wo	or
3	*Detarium macrocarpum*		Caesalpiniaceae	rts and bks	*Detarium macrocarpum* *Khaya senegalensis*	wo	or
4	*Gardenia ternifolia*	Dingali	Rubiaceae	rts		ma	or
5	*Khaya senegalensis*	Dalehi	Meliaceae	bks		wo	or
6	*Maytenus senegalensis*	Yengotehi	Celastraceae	lvs		de	or
7	*Parkia biglobosa*	Narehi	Mimosaceae	gr		wo	or
8	*Piliostigma reticulatum*	Barkelehi	Caesalpiniaceae	bks		wo	or
9	*Securidaca longepedunculata*	Alali	Polygalaceae	rts		de	or

bks= barks; de= decoction; lvs= leaves; fr= fruits; gr= grains; ma= maceration; or= oral; wo= whole organ; brch= branches; rts= roots.

It is characterised by a rainfall of 1000-1300 mm and dominated by ferruginous soils. These localities are situated between Touboro (7°30') and Garoua (9°30'). The vegetation consists essentially of forest and wooded Sudanian savannas, open dry Sudanian forests and Sudano-Guinean savanna shrublands with high-altitude formations. Vegetation in the Guinean-Sudanian zone consists of two floristic sectors, which are separated by the 9th parallel. The southern part consists of wooded savannas and dry open forests with *Isoberlinia doka, Monotes kerstingii* and *Uapaca togoensis*. The northern half is home to the same physiognomic types, dominated by *Boswellia papyrifera, Boswellia dalzielii, Sclerocarya birrea* and *Parkia biglobosa.* The savanna shrublands with combretaceae represent anthropogenic degradation types for these formations (13).

Ethnobotanical surveys

Ethnobotanical surveys were conducted during 2007. The plants used for the traditional treatment of intestinal worms in cattle, sheep and goats and chiefly nematodes have been identified. The method described by Jovel *et al.* (16) was used. It uses interviews, conversations and questionnaires to obtain information on plants used for the treatment of parasite worms in cattle, sheep and goats. The information was obtained from 73 people aged between 20-60, including 31 farmers and 19 livestock farmers.
Plants were selected, for which the information was consistent for several livestock farmers. The plants listed were collected, harvested and identified by Mr Tsobsala, who is a botanist at the Faculty of Science of the University of Ngaoundéré. The plant samples collected were deposited at the Biology Laboratory of the University of Douala.

Results

The surveys made it possible to identify a total of 32 potentially anthelmintic plants used for traditional medicine in the Mbororo settlements. Of this total, 23 plants are used for the treatment of intestinal worms in cattle and 9 plants are used to treat the same problem in sheep and goats. For each plant mentioned, we indicated the family, scientific name and popular/local name (Peul), the plant part(s) used, the administered form and method of administration to the animal (Tables 1 and 2). It emerged that 25 plant species from 16 families are used by the Bororo people (Tables 1 and 2) and that the combretaceae family is the most widely used (16.66%). Stem bark is the most commonly used plant part (58.33%). The parts used (roots, leaves, grains, fruits) are generally administered in decoction form (31.25%) or whole (31.25%), but may sometimes be macerated (18.75%), infused (6.25%) or inhaled (9.37%). Administration to the animal is generally by the oral route (84.37%). Table 3 shows the methods used to prepare plant extracts for administration to animals. It should be noted that some plant extracts administered to sheep and goats are first mixed with the animal's food, such as cereal bran, oil cakes and sometimes rock salt. The doses are not generally defined and no undesirable secondary effects have been reported.
The most frequently used plants are *Boswellia dalzielii*, *Daniellia oliveri*, *Mytragina enermis* for cattle (Figure 1) and *Gardenia ternifolia*, *Piliostigma thonningii* and *Anogeissus oleacarpus* for sheep and goats (Figure 2).

Discussion

This preliminary study made it possible to identify 25 plant species from 16 families, which are commonly used as anthelmintics for traditional veterinary

Table 3
Preparation of plants used as anthelmintics for the treatment of cattle

N°	Scientific name	Parts used	Methods for administration to the animal
			For cattle
1	*Anogeissus leiocarpus*	bks	Boil and administer bark to animal in any quantity until cured
2	*Bombax costatum*	bks	Boil and administer bark to animal in any quantity
3	*Boswellia dalzielii*	bks	Grind barks of *Boswellia dalzielii* with those of *Khaya senegalensis*, add rock salt and administer to the animal
4	*Bridelia ferruginea*	bks	Grind, boil roots and administer to the animal
5	*Calotropis procera*	rts	Grind roots, mix with rock salt and give to the animal in any quantity until it is cured
6	*Carissa edulis*	fr	Grind the fruits, mix with cereal bran and administer to the animal for 2 days (morning, noon and evening)
7	*Combretum glutinosum*	brch	Burn the branches and make the animal inhale the smoke in any quantity
8	*Daniella oliveri*	bks	Grind the roots, add cereal brans and administer to the animal within two days (morning, noon and evening)
9	*Detarium macrocarpum*	bks	Boil the barks and administer to the animal in any quantity
10	*Entada africana*	bks	Macerate the barks for one day and make the animal drink any quantity
11	*Guiera senegalensis*	brch	Burn the branches and make the animal inhale the smoke
12	*Harungana madagascariensis*	bks and lvs	Grind the leaves in water and make the animal drink any quantity
13	*Khaya senegalensis*	bks	Boil the roots and make the animal drink the liquid (morning, noon and evening) until it is cured
14	*Lannea acida*	bks	Macerate barks of *Lannea acida* with those from *Guiera senegalensis* and make the animal drink any quantity until cured
15	*Maytenus senegalensis*	lvs	Boil the leaves and the animal drink the liquid until it is cured
16	*Mitragyna inermis*	bks	Crush the roots, soak them in warm water for several hours and make the animal drink the liquid (morning, noon and evening) until cured
17	*Parkia biglobosa*	bks	Grind the roots, soak them in water and make the animal drink any quantity of the liquid
18	*Piliostigma reticulatum*	bks	Macerate the barks for one day and make the animal drink the liquid
19	*Securidaca longepedunculata*	bks	Boil the roots and make the animal drink the liquid until it is cured
20	*Terminalia collinum*	lvs and brch	Burn the leaves and/or branches and make the animal inhale the smoke
21	*Terminalia laxiflora*	bks	Boil the barks and make the animal drink the liquid in any quantity
22	*Trianthema portulacastrum*	lvs	Grind the leaves and make the animal inhale
23	*Vitellaria paradoxa*	bks	Macerate barks of *Bombax costatum* with those of *Vitellaria paradoxa* and make the animal drink any quantity until cured
			For sheep and goats
1	*Acacia seyal*	fr and bks	Mix the fruits and ground barks with rock salt and administer to the animal until it is cured
2	*Anogeissus leiocarpus*	bks	Grind the barks and administer to the animal, in rock salt, millet bran or oil cakes
3	*Detarium macrocarpum*	rts and bks	Mix ground barks of *Detarium macrocarpum* and *Khaya senegalensis* and administer to the animal
4	*Gardenia ternifolia*	rts	Wash and grind the roots, then administer ¼ litre of the solution via the animal's mouth every day until it is cured
5	*Khaya senegalensis*	bks	Burn the barks, mix with rock salts and administer to the animal in its food until cured
6	*Maytenus senegalensis*	lvs	Boil the leaves and administer in any quantity to the animal until it is cured
7	*Parkia biglobosa*	gr	Grind the grains and mix with rock salt before administering to the animal
8	*Piliostigma reticulatum*	bks	Grind the barks and administer to the animal, either in rock or cereal brans
9	*Securidaca longepedunculata*	rts	Boil the roots and administer in any quantity to the animal until it is cured

bks= barks; de= decoction; lvs= leaves; fr= fruits; gr= grains; ma= maceration; wo= whole organ; brch= branches; rts= roots.

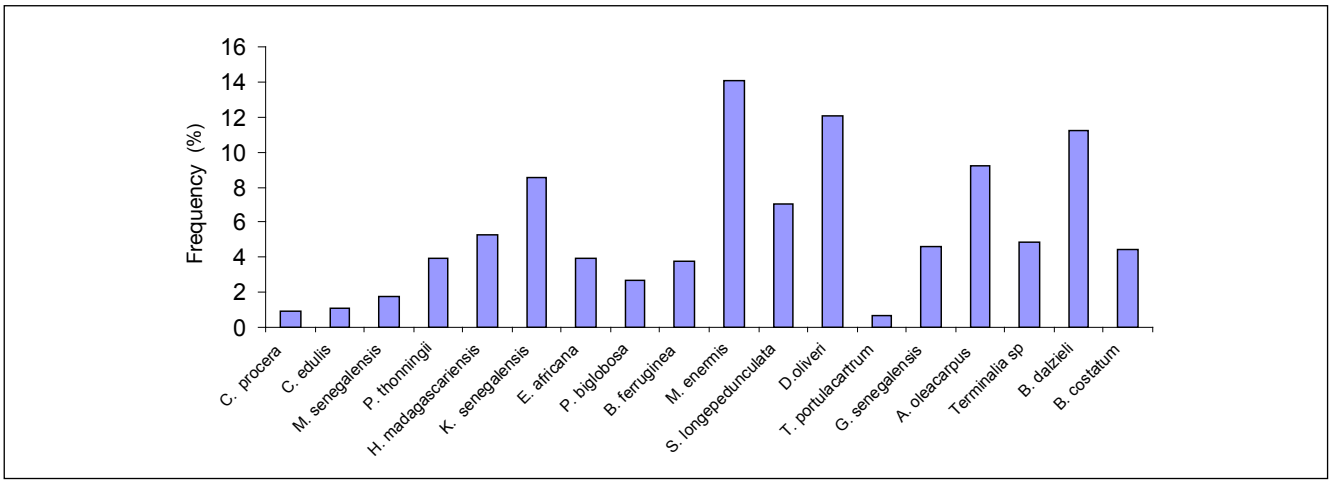

Figure 1: Frequency of response in plants used to combat cattle parasites in Northern Cameroon.

medicine by the Mbororo of Laindé Karewa and Israël in the Bénoué basin, in order to treat cattle, sheep and goats for intestinal worms. For many generations, these plants have been known to the local population as highly effective remedies and this knowledge is passed on by word of mouth between livestock farmers, who jealously guard it as family secrets (21).

Of the plant species identified, *Calotropis procera, Harungana madascariensis, Khaya senegalensis, Guiera senegalensis* and *Combretum glutinosum* were also recognised as having an anthelmintic effects on people (1). In addition, species such as *Carissa edulis, Maytenus senegalensis, Piliostigma thonningii, Entada africana, Parkia biglobosa, Bridelia ferruginea, Mitragyna inermis, Securidaca longepedunculata, Anogeissus oleocarpus, Boswellia dalzielii, Gardenia ternifolia,* and *Acacia seyal* have already been identified by Nsekuye (21) for treatment of the same parasites. The plants used to treat goats and sheep are identical to those used for cattle, except for *Gardenia ternifolia* and *Acacia seyal*.

The plants identified as being used by Mbororo livestock farmers are those used to combat intestinal worms. In Africa, and specifically in Sierra Leone, livestock farmers believe that intestinal problems are generally caused by worms (21), in other words helminths (platyhelminthes and nemathelminthes). As a parasite, nematodes are specific to a given host. When it comes to digestive or pulmonary strongyles, or even cestodes (tapeworms) in the digestive tract, the worms present in cattle are generally different from those encountered in sheep and goats. In contrast, trematodes appear to be far less restricted to a particular host (14). This tells us that the wide range of plant species used and particularly the variety of methods used to prepare extracts, for administration to cattle, sheep or goats, are due to parasite specificities and their similarities result from the treatment of similar worms (trematodes), or the wide spectrum of effects produced by these plant species.

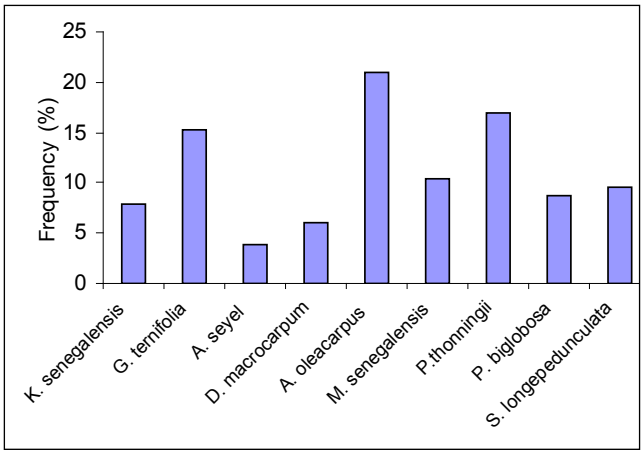

Figure 2: Frequency of response in plants used to combat sheep and goat parasites in Northern Cameroon.

The most widely used plant family for cattle are combretaceae. This family has also been observed in the treatment of helminths by the Baka pygmies in the Dja (Cameroon), a people who are known for their effective use of forest resources (5). Mimosaceae and caesalpiniaceae are used predominantly for sheep and goats.

Stem barks and decoction represent the most commonly used plant parts and preparation method. This observation confirms those made by Masika and Afolayan (18), Maphosa and Masika (17) who reported that, in the Cape region in South Africa, decoction is the preparation method most widely used by livestock farmers. Decoction is a method used to extract active substances and involves boiling part of the plant, as opposed to infusion, which means adding the plant material or plant itself to boiling water then allowing it to cool. The latter preparation method was used less by the Mbororo livestock farmers (6.25%). Decoction extracts water-soluble polar compounds. The high water temperature at the point of extraction using this method could lessen or alter the effects and even reduce the toxicity of thermolabile compounds. But the reasons for favouring decoction over other types of

preparation remain largely unknown. It would therefore be interesting to conduct a comparative study on the effectiveness of various types of preparation.
Similarly, the results show us that certain plants administered to sheep and goats are usually mixed with foodstuffs, such as cereal bran, rock salt and oil cakes, which means that the relevant organs (plant parts) are administered whole to the animals. The effects of the active substances are then influenced by the animal's food and other non-food substances (rock salt). In fact, mixing plants with the animal's food may influence the absorption of compounds contained in these plants. For example, as a fresh foodstuff, cereal bran could accelerate gastric emptying in ruminants. Due to its emulsifying properties, rock salt forms stable emulsions in the gastro-intestinal tract and also increases the solubilisation of alkaline compounds contained in the plant extracts, which thus increases their absorption. Due to their lipid value, oil cakes increase bile secretion, which in turn promotes the solubilisation of non-water soluble compounds (10). In addition, alkaline compounds are soluble if rock salt is present and could be absorbed in greater quantities.
In addition to these various preparation methods, some plants are burned before use, which means that the molecules contained in the inhaled smoke are absorbed and reach the blood circulation via the respiratory route. These preparations are almost always administered orally.
As the treatment methods used in the Mbororo settlements are empirical (traditional), it is not possible to identify the doses administered. At the same time, the effectiveness of a treatment depends on the administration of medication doses at very precise and regular intervals. It is therefore important to conduct studies aimed at standardising plant extracts, in order to make treatments more efficient and avoid problems of toxicity and resistance.
Previous phytochemical studies have shown the prevalence of secondary metabolites, such as triterpenoids (*D. oliveri, S. longipedunculata, M. senegalensis, A. leiocarpus*, etc.), flavonoids (*D. oliveri, S. longipedunculata, P. thonningii*, etc). The anthelmintic activity of these plants is therefore linked to the presence of some of these chemical compounds in the extracts, as it has been shown that pentacyclic triterpenoids (4) and flavonol glycosides (3) have anthelmintic properties. In addition, *in vitro* tests on eggs, using the method developed by Coles *et al.* (8), and on adult worms (*Haemonchus contortus)* using the method described by Hounzangbe-Adote *et al.* (15), have demonstrated the anthelmintic activity of some of these extracts (results not shown). The methanolic extract from the roots of *P. thonningii*, aqueous *D. oliveri* stem bark extract and root extract from *M. senegalensis* have shown major inhibitory effects on the egg hatching rate for *H. contortus*. At the same time, the methanol extracted from *P. thonningi* roots and that extracted from the stem bark of *S. longepedunculata* also inhibited, to a great extent, the activity of adult worms (*Haemonchus contortus)*.
It has been reported that most of the plants used by livestock farmers have other therapeutic effects, such as anti-inflammatory, immunoregulatory, analgesic, antimicrobial and purgative properties. For example, *Calotropis procera* is used for the treatment of boils and toothache; *Combretum glutinosum* is used for rheumatism (whole plant) (1); *Securidaca longepedunculata* is used for the treatment of inflammations (9).

Their use could equally be effective for the symptomatic treatment of helminthiases and for reinforcing animals' immune systems. This shows that alleviating clinical signs is also an objective for the treatment. Purgative effects help to flush out the gastro-intestinal contents, which is the desired effect when treating this type of parasite. In fact, most of the anthelmintics currently used also have purgative constituents, which expel worms (7).

Conclusion

The survey conducted in the localities of Laindé Karewa and Israël, in the Bénoué-Cameroon region, made it possible to identify 25 plants species used as anthelmintics for traditional veterinary medicine in the Mbororo settlements. Stem bark represents the most widely used plant part, generally in decoction form. The doses are not defined and no secondary or side effects have been reported. In order to complete this study, we plan:

- To continue to identify anthelmintic plants used in traditional veterinary medicine;
- To determine anthelmintic effects (*in vitro* and *in vivo*) of these plants and thus approve their use by the livestock farmers;
- To determine the most active extract fractions and isolate the molecules responsible for the activities observed.

Acknowledgements

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