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Full Length Research Paper

Ethnobotanical survey on medicinal plants traditionally used for treatment of intestinal parasitosis of animals and humans in Northern Benin

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Parasitic nematodes of the gastrointestinal (GI) tract remain a major threat to both human beings and livestock. The aim of this study was to document medicinal plants used in the management of intestinal parasitosis in the small ruminants and humans. Information relating to the different plants used in the treatment of human intestinal parasitosis and small ruminants was collected through an ethnobotanical survey carried out in the DONGA Department of Benin. On subjecting the traditional healers and small ruminant breeders to a questionnaire, it appears that intestinal parasitosis is manifested mainly by transit disorders (vomiting, abdominal pain, diarrhoea). Forty-four species belonging to twenty-two families were documented and used in the treatment of intestinal parasitosis. Fabaceae is the most represented family and species common to traditional human and veterinary medicine have been reported. *Khaya senegalensis* was the most cited species used in the treatment of intestinal parasitosis by traditional healers (9%) and small ruminant breeders (27%). A brief review of the literature provided summary of the medicinal plants used in the treatment of intestinal parasitosis. It also made it possible to bring a resemblance between human traditional medicine and veterinary medicine.

Key words: Intestinal parasitosis, Indigenous knowledge, Medicinal plants, Ethnobotanical survey, Benin.

INTRODUCTION

Intestinal parasitosis are diseases caused by presence of parasites (protozoa and or helminths) in the human or animal digestive tract. They constitute a real health problem in both humans and animals (Adebayo and

Joshua, 2018; Kpabi et al., 2020).

Globally, they are among the first causes of morbidity but require little attention. They are classified as a neglected tropical disease (Zhou et al., 2019). The endemic areas are tropical and subtropical regions (Kpabi et al., 2020). The prevalence rate of human intestinal parasitosis is poorly known or often biased owing to the symptomatology of the disease, late diagnosis, methods and techniques of diagnosis, the specificity of geographical, ecological and hygienic conditions (sanitation and measures) of each region (Yaro et al., 2019; Mbouombouo et al., 2020). Indeed, climatic conditions, the absence or inadequacy of hygiene and sanitation measures, and poverty are factors that favor the development of parasites. Vulnerable people are children, pregnant women and people with low immunity (cancer, HIV, organ transplantation) (Umezurike et al., 2018; Yaro et al., 2019). They are implicated in malnutrition, anaemia, and stunted growth in children.

Digestive parasitosis caused by gastrointestinal nematodes are major pathologies in small ruminants kept on pasture and, at times, can lead to significant production losses threatening food security (Alowanou et al., 2015; Akouedegni et al., 2019). They result in reduced feed intake, reduced body weight, reduced wool production and reduced milk production in sheep. The pathogenic action of gastrointestinal strongyles is mainly due to: anaemia due to blood loss directly from hematophagous species or indirectly from damage to the digestive mucosa; a reduction in ingestion proportional to the dose of infesting larvae ingested; altered nutrient degradation and absorption due to altered digestive motor function, altered pH in the abomasum and gastrointestinal secretions, and worm-induced damage to the intestinal epithelium (Aguerre, 2020).

The use of synthetic anthelmintics has limitations related to the presence of residues in the environment or in consumer products and the development of parasite resistance to synthetic anthelmintics. Indeed, a large part of anthelmintics is eliminated in the feces of treated animals in active or metabolized form (Mahieu, 2014; Alowanou, 2016; Aguere, 2020). Cases of parasite resistance to synthetic anthelmintics have been reported (Furtado et al., 2019; Richelme and Greil, 2019). Factors favouring parasite resistance to anthelmintics are: frequency of treatments per time interval, adherence to dosage (under-dosing), exclusive use of a single anthelmintic or family of anthelmintics and grazing management. Other so-called intrinsic factors are related to parasite life cycle (short cycle), prolificity (high) and pathogenicity (highly pathogenic) (Fluck and Laporte, 2018; Richelme and Greil, 2019). Therefore, a strong impetus for researchers to develop alternative control methods, such as the use of traditional plants has recently been promoted (Garba et al., 2017). The present study aimed to synthesize the medicinal plants used in the DONGA Department and to compile the data with those of previous studies.

METHODOLOGY

Ethnobotanical survey

Study area

Republic of Benin is located in West Africa, between 6°100 and 12°250 of latitudes north and 0°450-3°550 of longitudes East 6. The current study was carried out in department of DONGA situated in North of Benin with a total area of 11126 km² and 543130 inhabitants in 2013. It is subdivided into four (04) municipalities: Bassila, Ouake, Djougou and Copargo (Figure 1). This region is predominantly populated by the Dendi, Yom and Lokpa.

Data collection

The survey was conducted in July - September 2020 in the Department of DONGA (Figure 1). Before each interview, the consent of informants was obtained and the aims of the study were presented. Informants were selected randomly among the traditional healers and small ruminant breeders. The method used is direct interviews using a structured questionnaire which were administered to randomly selected informants. The information collected relates to:

(i) identification of the informants (age, ethnicity, sex, level of education),
(ii) knowledge of intestinal parasitosis,
(iii) investigation of the mode of treatment of animals by small ruminant breeders,
(iv) investigation of the mode of treatment of human by traditional healers, and
(v) knowledge of medicinal plants used (local name, parts used, method of preparation and posology).

Plants identification

Collected species were identified using the analytical flora of Benin (Akoègninou et al., 2006).

Data analysis

The data were entered in Microsoft Excel software which was also used for plotting the graphs. Age groups: young people (23 to 29 years old), adults (30 to 59 years old) and elders (60 to 83 years

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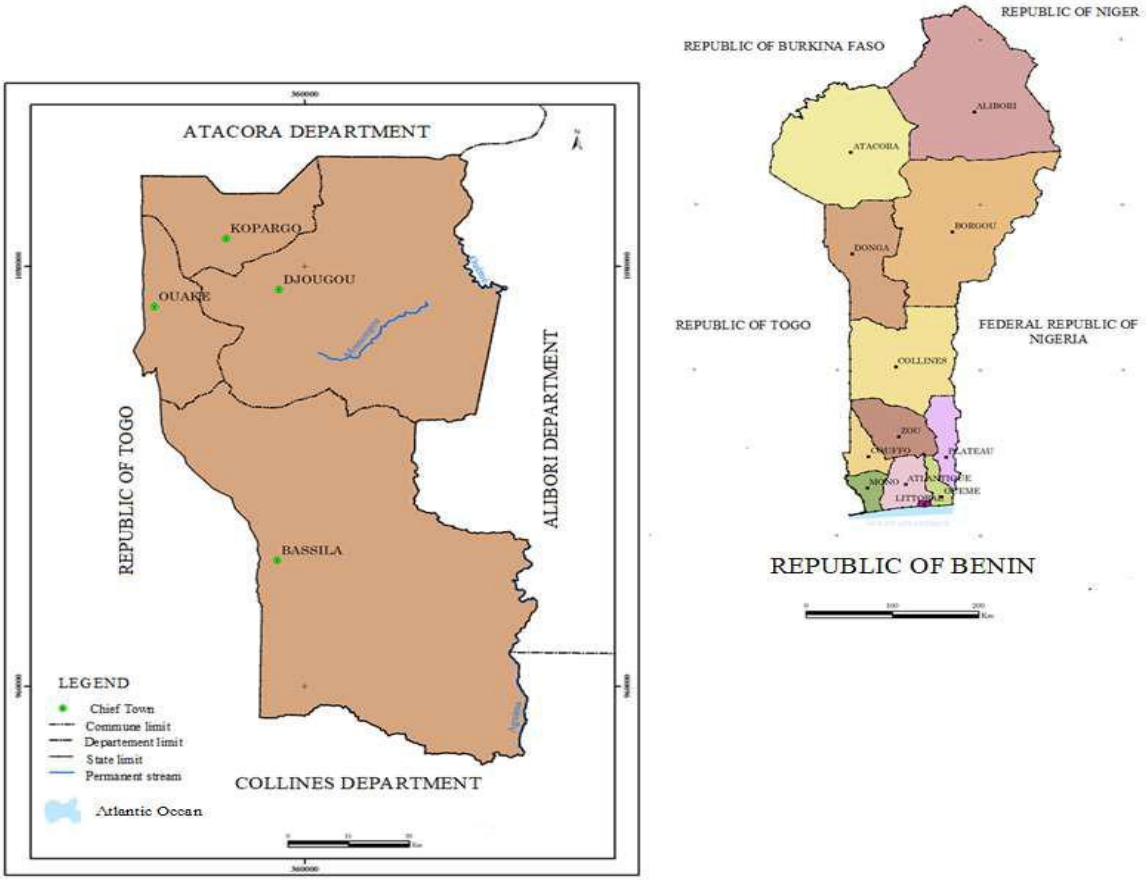

Figure 1. Map showing the distribution of the surveyed communes in the Department of DONGA in Benin.

old) were used to characterize the informants (Assogbadjo et al., 2008).

Species collected data were analyzed using the Relative Frequency of Citation (Fr), use value (VUe), and importance value (VI).

$Fr = S/N \times 100;$

$VI = Vue/Ne$

RESULTS

Identification of the informants

The documentation was performed on the basis of information collected from knowledgeable healers and small ruminant breeders. Informants who participated in the survey are mostly adults [Traditional healers: 79%; small ruminant breeders: 67% (Figure 2)]. In the traditional healers, the youngest is 29 years old, the oldest 83 years old while the average age is 50 years. According to Figure 3, the informants are mostly men (Traditional healers: 9.9%; small ruminant breeders: 81%). Figure 4 shows the distribution of informants according to ethnic groups. It appears that within the population of traditional healers, the representative ethnic groups are: Lokpa (65%), the Yom (15%) and the Peulhs (9%); while among small ruminant breeders they are Yom (44%), Dendi (28%), Ahoussa (12%) and Peulhs (10%) (Figure 4). According to Figure 5, informants are also mostly illiterate (Traditional healers: 79%; small ruminant breeders: 55%); whereas 18% (Traditional healers: 18%; small ruminant breeders: 18%) of them went to primary school. Only 3% of traditional healers went to secondary school while 18% of the small ruminant breeders went to secondary, and 9% to universities (Figure 5). Informants who participated in the survey also engage in other activities such as agriculture (43%), crafts (14%) among traditional healers while among small ruminant breeders, it was trade (32%), agriculture (23%), and crafts (10%) (Figure 6).

Knowledge of intestinal parasitosis

Based on information received from informants and

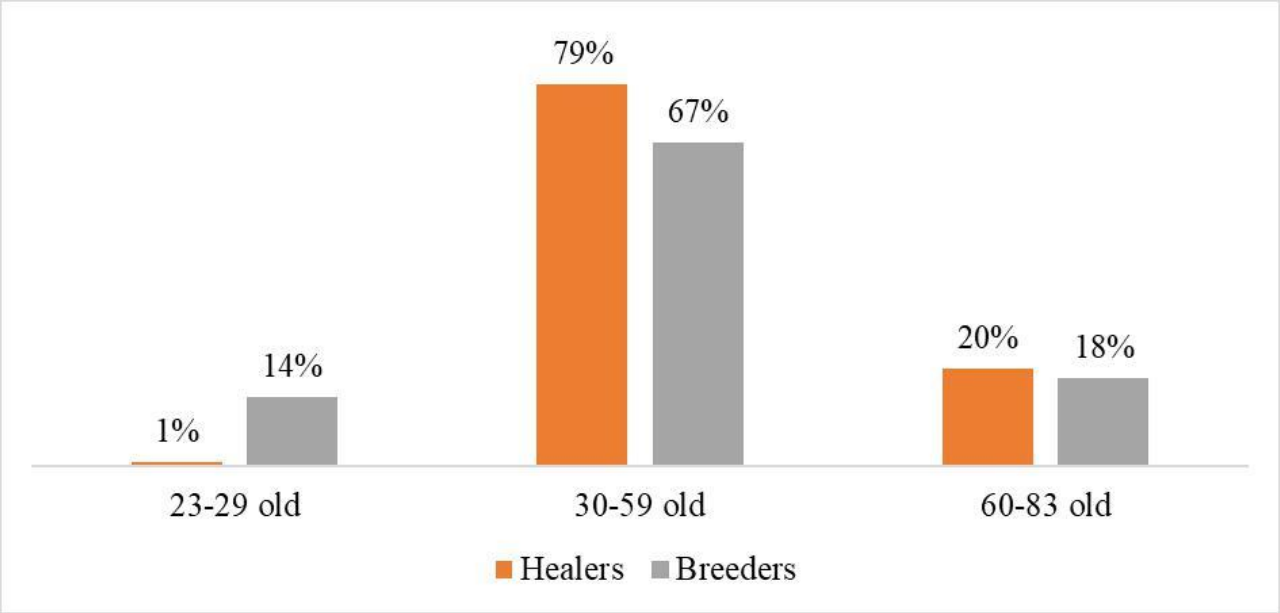

Figure 2. Distribution of respondents according to their age group.

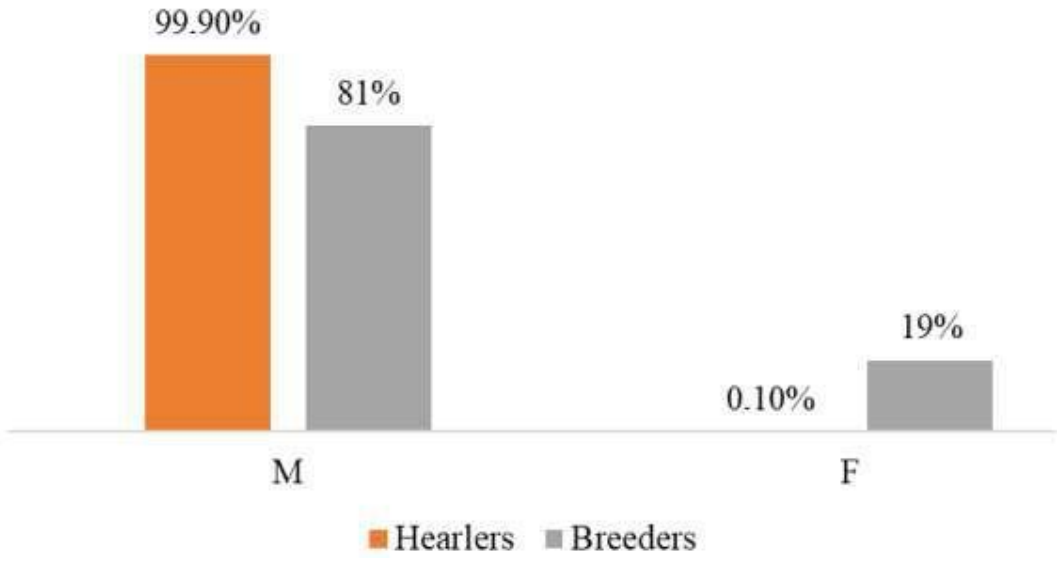

Figure 3. Distribution of respondents according to gender.

summarized Figure 7, intestinal parasitosis is manifested mainly by transit disorders (vomiting, abdominal pain, diarrhea) (84% in men; 58% in small ruminants), and biting hairs in ruminants (14%) (Figure 8).

Investigation of the mode of treatment of animals by small ruminant breeders

Small ruminant breeders use veterinary products (50%), medicinal plants (8%) or a combination of the two to treat their animals (42%) (Figure 9). The determinants of one or other of the practices are: accessibility of the product or medicinal plants, efficacy, origin of knowledge, initiation, and limits linked to the use of the products (Figure 10). The group of breeders who use only veterinary products do so because of the effectiveness of the products (42%) and/or because they have no knowledge of the traditional remedies used (16%). Those who use traditional remedies have inherited it from their

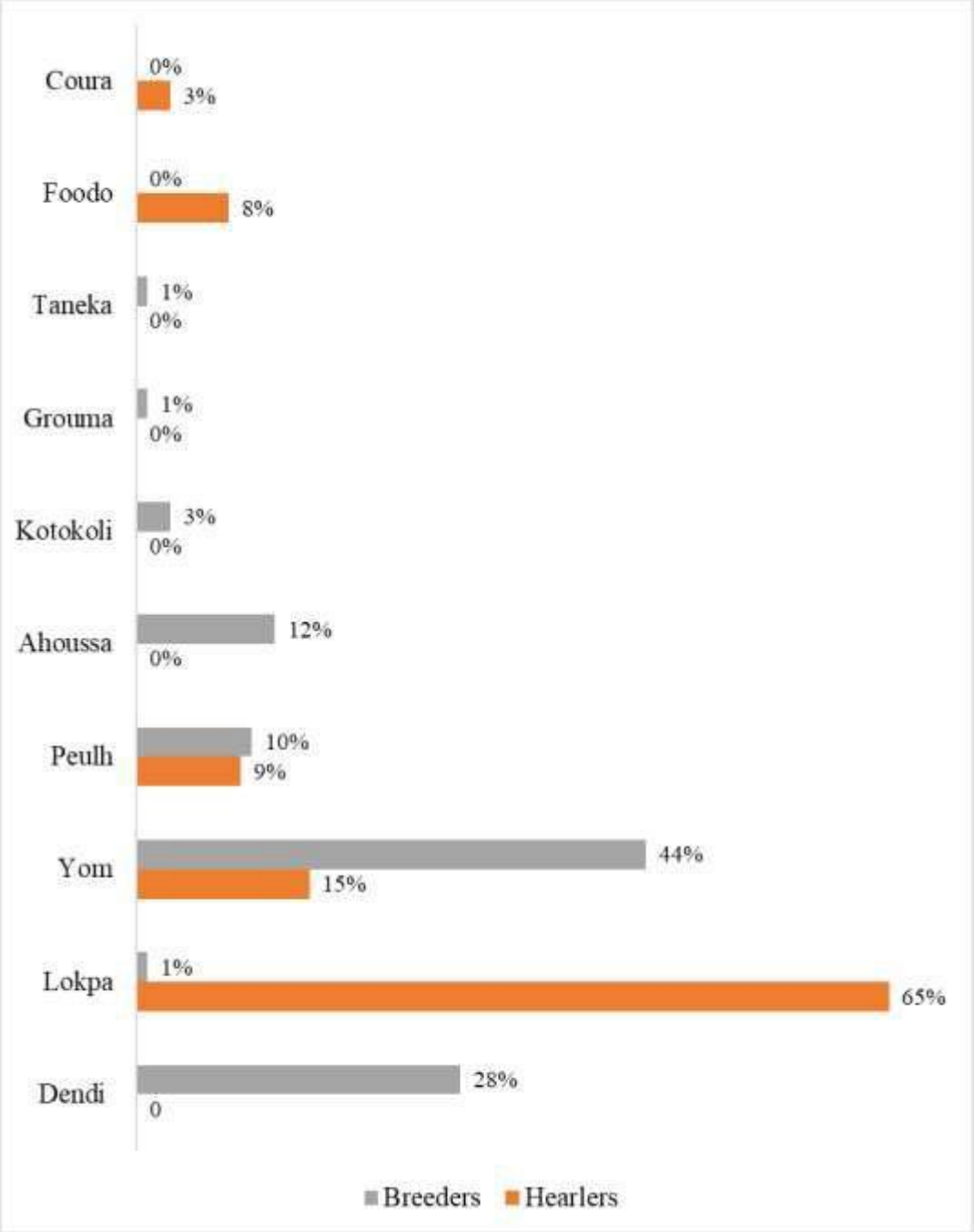

Figure 4. Distribution of respondents by ethnicity.

parents (74%). They resort to veterinary products when they have known failure with traditional remedies (18%) (Figure 10).

Ethnobotanical data

This study recorded 44 species of plants belonging to 22 families for the treatment of intestinal parasitosis (Table 1) including 18 species (41%) from small ruminant breeders. It is observed that the most represented family is Fabaceae. Species common to both medicines (human and veterinary) have been reported (18%) (Figure 11). *Khaya senegalensis* was the most cited species used in the treatment of intestinal parasitosis by traditional healers (9%) and by small ruminant breeders (27%) (Table 1). Whole plant as well as aerial part, leave, stem, root, bark, fruits, and seed were used. Aerial part was the

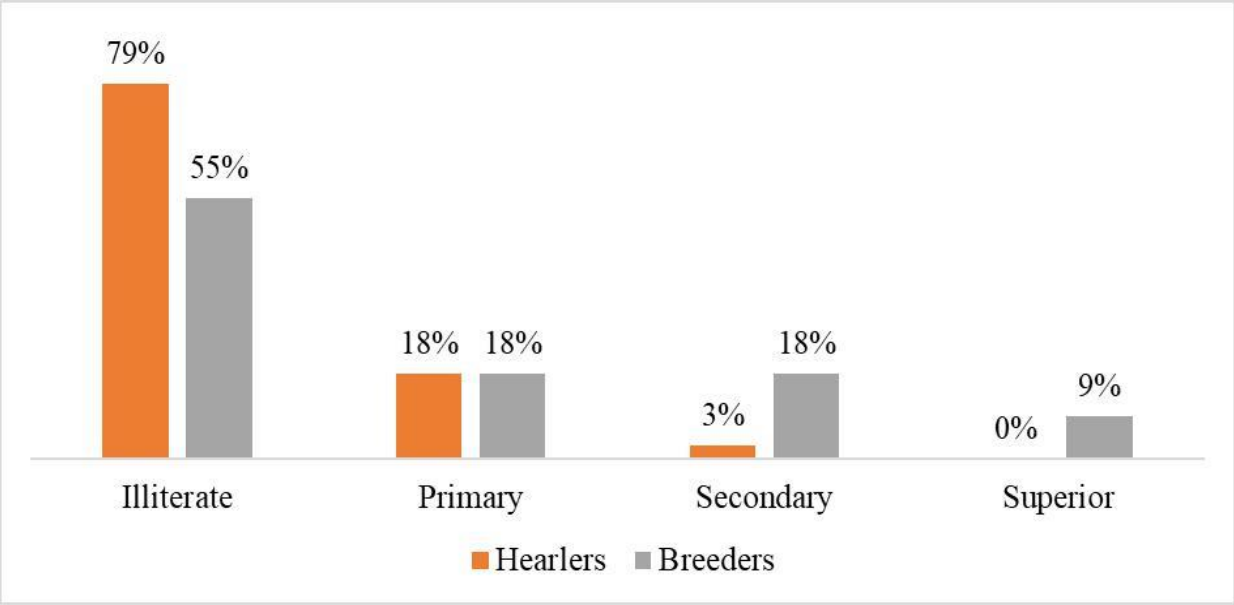

Figure 5. Distribution of respondents according to their level of education.

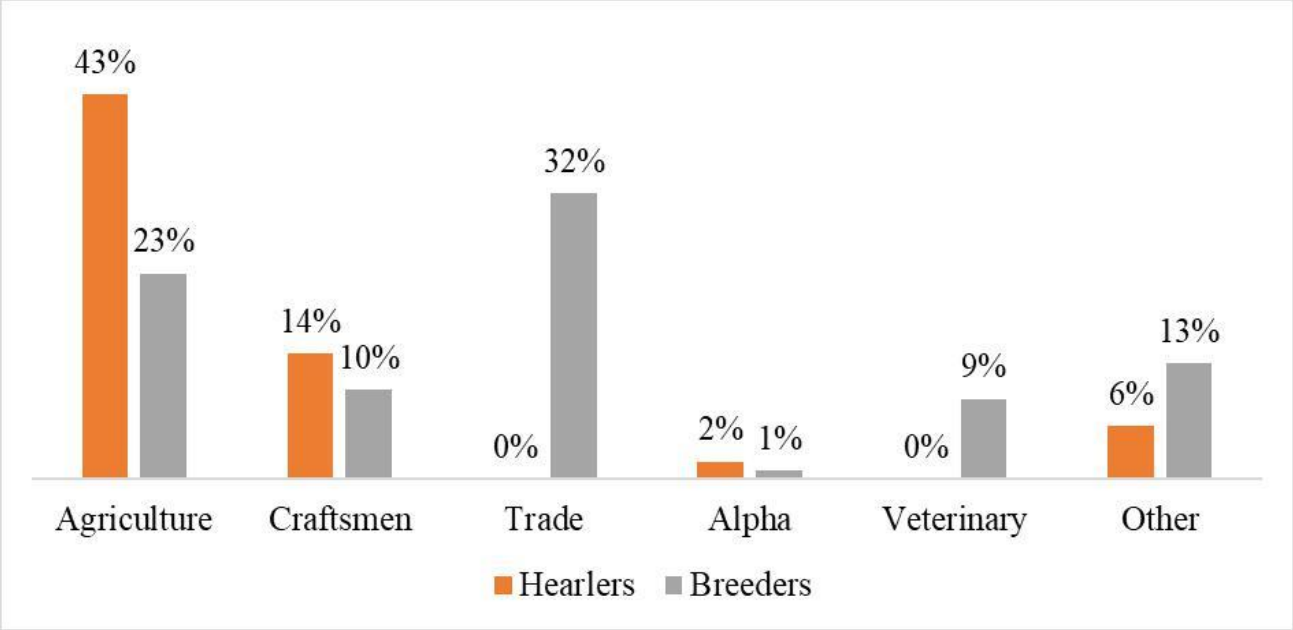

Figure 6. Frequency of other activities carried out by respondents in the study population.

most used by traditional healers in the preparation of herbal remedies followed successively by leaves (35%), seed (20%), bark (18%), fruit (9%) and root (6%) while small ruminant breeders use bark (60%), leaves (31%) and roots (6%) the most (Figure 12). Among the methods of preparation are: maceration, infusion and powder. The most common method of preparation by traditional healers is decoction (50%) and by small ruminant breeders, it is maceration (47%) and powders (42%). The main mode of administration was the oral route.

DISCUSSION

The aim of the present study was to document plants used in the management of intestinal parasitosis in DONGA Department. In this study, informants are predominantly men. The knowledge and use of medicinal plants is a kind of tradition that has passed from one generation to another following a long-accumulated experience and is transmitted orally (Minaflinou et al., 2017; Fah et al., 2013; Kouchadé et al., 2017).

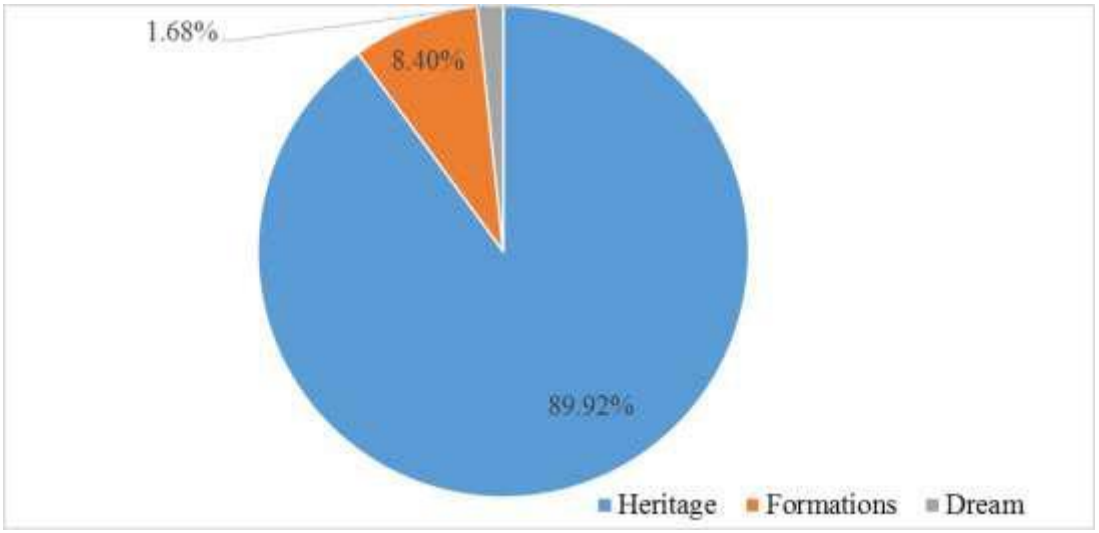

Figure 7. Frequency of use of medicinal plants and sources of endogenous knowledge in the study population.

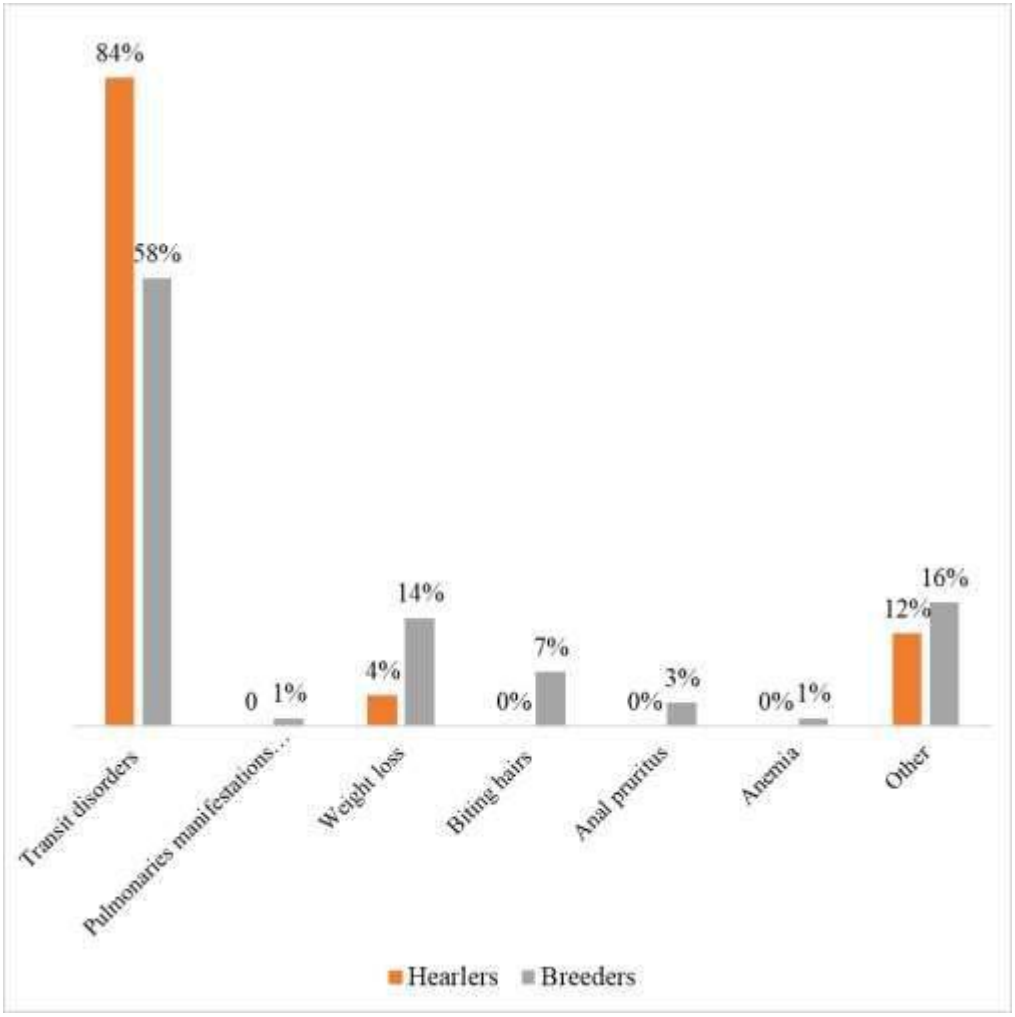

Figure 8. Frequency and manifestations of small ruminant gastrointestinal parasitosis in the study population.

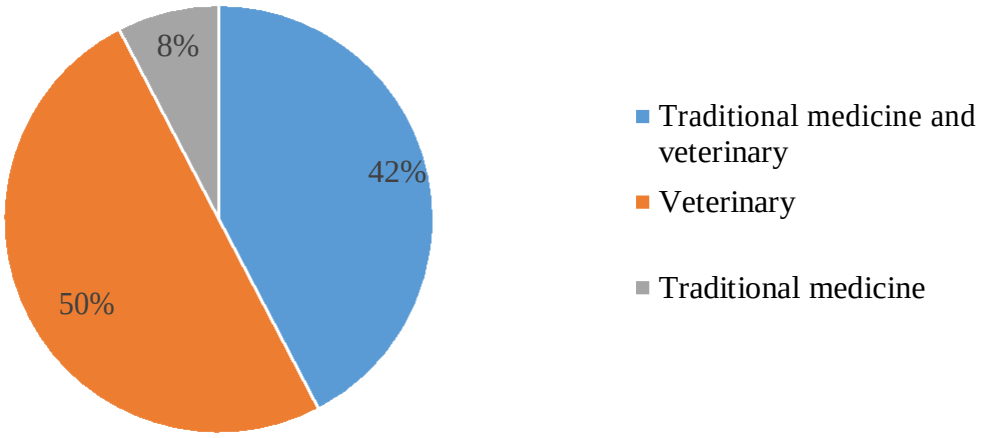

Figure 9. Differents types of treatment options for intestinal parasitosis in small ruminants.

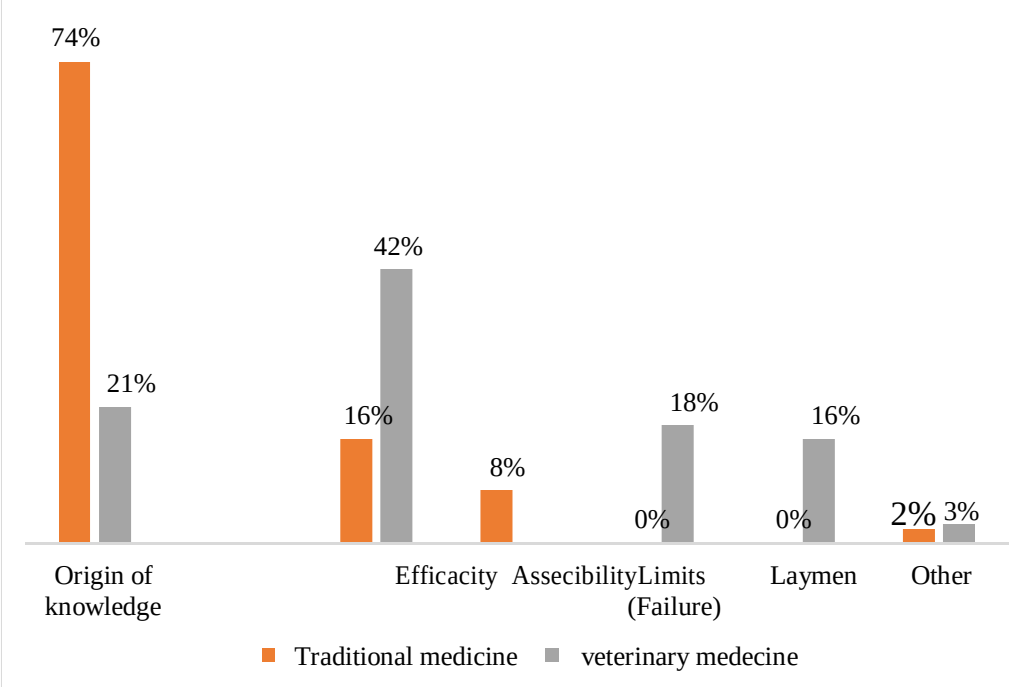

Figure 10. Reasons and frequencies for the choice of treatment method for small ruminant gastrointestinal parasitosis in the study population.

Endogenous knowledge is the heritage of either a family or a particular social group in the village or region (Minaflinou et al., 2017). Practices may differ from region to region and from population to population. In the present study, disparities are noted compared to the species cited to treat the same ailment, the parts used and the method of preparation of the recipes compared to previous studies (Hounzangbe-Adote et al., 2001; Attindéhou et al., 2012; Minaflinou et al., 2017). These differences are justified by the determinants of knowledge of medicinal recipes which are: agroecological and phytogeographic zones, ethnicity and education level (Alowanou et al., 2015; Kouchadé et al., 2017). In the present study, the representative ethnic groups are the Yom, Lokpa and Dendi. This is a new source of information. Also, no ethnobotanical study has yet investigated the medicinal plants used to treat human intestinal parasitosis in Benin. It turns out that the Yom, Lokpa and related populations have a wide knowledge of the medicinal plants used in the treatment of intestinal

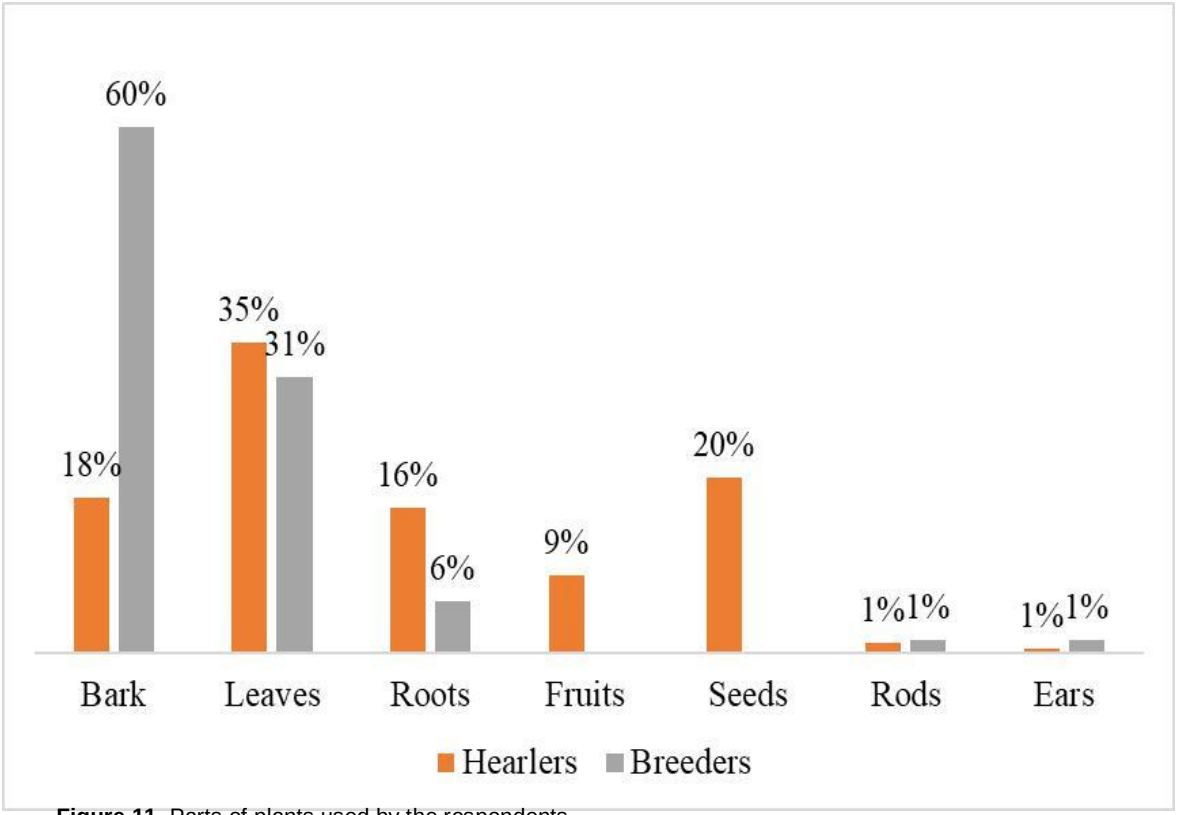

Figure 11. Parts of plants used by the respondents.

Table 1. Medicinal plants used in intestinal parasitosis management in Department of Donga.

Family	Species	Parts used		Mode of preparation and administration		VUe	Fr		VI
		HM	VM	HM	VM		HM (%)	VM (%)	
	Mangifera indica	B	-	Dec	-	5	2	-	0.02
	Lannea acida	L	-	Dec	-	12	6	-	0.05
Anacardiaceae	*Spondias mombin*	L;B;R	-	Dec	-	7	4	-	0.03
	Anacardium occidentalis	-	B	-	Mac	2	-	3	0.01
	Pupalia lappacea	-	L	-	Dec	7	-	10	0.03
Annonaceae	*Annona senegalensis*	S	L	Dec	Mac	4	2	3	0.02
Asteraceae	*Vernonia amygdalina*	L	L	Tr	Tr	8	4	2	0.04

Table 1. Cont'd

Fabaceae	*Tamarindus indica*	F	L	P	Dec	5	3	2	0.02
	Caesalpinia bonduc	R; L	-	Dec	-	1	1	-	0
	Desmodium velutinum	L ; R	-	Dec	-	3	2	-	0.01
	Cassia alata	L	-	Dec	-	3	2	-	0.01
	Cassia sieberiana	L	-	Dec	-	3	2	-	0.01
	Cajanus cajan	L	-	Dec	-	10	5	-	0.05
Caricaceae	*Carica papaya*	S	S	P	P	15	8	3	0.07
	Combretum micranthum	L	-	Dec	-	4	2	-	0.02
Cucurbitaceae	*Citrullus lanatus*	F	-	Dec	-	2	1	-	0.01
	Momordica charantia	L	-	Tr	-	2	1	-	0.01
	Jatropha gossypiifolia	S; L	-	Inf; Dec	-	6	3	-	0.03
Lamiaceae	*Ocimum canum*	L	-	Al	-	4	2	-	0.02
	Ocimum gratissimum	L	-	Al; Dec	-	11	6	-	0.05
	Hyptis suavolens	L	-	-	Mac	7	-	10	-
	Vitex doniana	B	L	Dec	Dec	6	3		0.03
Lythraceae	*Lawsonia inermis*	R	-	Dec	-	3	2	-	0.01
Maliaceae	*Khaya senegalensis*	Ec ; R; L	B	Dec	Mac, P	17	9	27	0.08
	Azadirachta indica	L ; S	L	-	Tr	5	3	2	0.02
	Parkia biglobossa	B;R;F	B	Dec	Mac	10	5	8	0.05
Moringaceae	*Moringa oleifera*	L ; B	-	Dec	-	5	3	-	0.02
Myrtaceae	*Eucalyptus camaldulensis*	B	-	Dec	-	3	2	-	0.01
	Psidium guajava	F, L	-	Pd; Dec	-	10	5	-	0.05
Phyllanthaceae	*Bridelia ferruginea*	R ; B	-	Dec	-	3	2	-	0.01
Poaceae	*Zea mays*	Ep	C	Brulé	Br	1	1	2	0
Rubiaceae	*Sarcocephalus latifolius*	B; R	-	Dec	-	2	1	-	0.01
	Mitracarpus hirtus	L ; St	-	Inf; Dec	-	3	2	-	0.01

Table 1. Cont'd

Rutaceae	*Citrus limon*	S ; F	-	Pd; Inf	-	5	3	-	0.02
	Zanthoxylum zanthoxyloïdes	R ; B	B	Dec	P	13	7	6	0.06
Spotaceae	*Vitellaria paradoxa*	L	-	Dec	-	1	1	-	0
Verbenaceae	*Gmelina arborea*	L	B	Dec	P	1	1	-	0
Chenopodiaceae	*Chenopodium ambrosioides*	L	-	Tr	-	2	1	-	0.01
Bignoniaceae	*Newbouldia laevis*	L	-	Dec	-	2	1	-	0.01
	Kigelia africana	-	B	-	Mac	4	-	5	0.02
Alliaceae	*Allium sativum*	-	F	-	-	1	-	2	0
Solanaceae	*Nicotiana tabacum*	-	L	-	T	1	-	2	0
Malvaceae	*Abelmosehus eseulentus*	-	F	-	-	3	-	2	0.01
	Adansonia digitata	S	B	P	P	4	2	8	0.02

HM : Traditional Human Medicine; VM : Traditional Veterinary Medicine; L : Leaves, R : Roots, F: Fruits, S : Seeds ; B : bark ; St: stem; Dec : Decoction ; Mac : Maceration ; Pd : Powder; Inf : Infusion, VUe: Use Value; FR: Frequency of Citation; VI: Importance Value; C: Corn on the cob.

parasitosis both in humans and in small ruminants.

A total of eighteen species involved in the recipes used in the treatment of intestinal parasitosis in small ruminants are inventoried. This number is relatively low compared to similar works carried out in southern Benin (Hounzangbe– Adote et al., 2001; Attindéhou et al., 2012; Minaflinou et al., 2017) and outside the country (Garba et al., 2019) and higher than that carried out in the north (Dassou et al., 2015). These results corroborate the observations of (Dassou et al., 2015) according to which there is a decreasing south-north knowledge gradient linked to the use of plants for veterinary purposes. The number of species for veterinary use cited in the present study relatively higher than that of Dassou et al. (2015) can also be explained by ethnic mixing, the frequency of citation of the disease in the population surveyed and the specificity of disease. Indeed, listed species for veterinary use and foot-and-mouth disease was the most cited disease (Dassou et al., 2015).

Annona senegalensis, Vernonia amygdalina, Tamarindus indica, Carica papaya, K. senegalensis, Azadirachta indica, Parkia biglobossa, Zea mays, Adansonia digitata and *Zanthoxylum zanthoxyloïdes* are some species used both in small ruminants and humans in the treatment of intestinal parasitosis. These results corroborate the observations of Ouachinou et al. (2017) according to which the same species can be used to treat ailments common to animals and humans.

Intestinal parasitosis is mainly manifested by transit disorders (vomiting, diarrhoea, anorexia, and abdominal pain), skin manifestations and pulmonary manifestations (Yaro et al., 2019). The same manifestations are reported in veterinary medicine (Kabore et al., 2007). Moreover, these manifestations are not specific to intestinal parasitosis, hence the importance of a diagnosis before any treatment. Although there have not yet been other studies on the use of medicinal plants in the treatment of human intestinal parasitosis in Benin, it should be noted that several species cited in the present study are potential candidates for the symptomatic treatment of intestinal parasitosis. That is, the treatment of symptoms that are related to intestinal parasitosis. Among others, *K. senegalensis*, *A. senegalensis*, *Chenopodium ambrosioides*, *Ocimum gratissimum, V. amygdalina*, *Moringa oleifera*, *Psidium guajava, Momordica charantia,* and *A.*

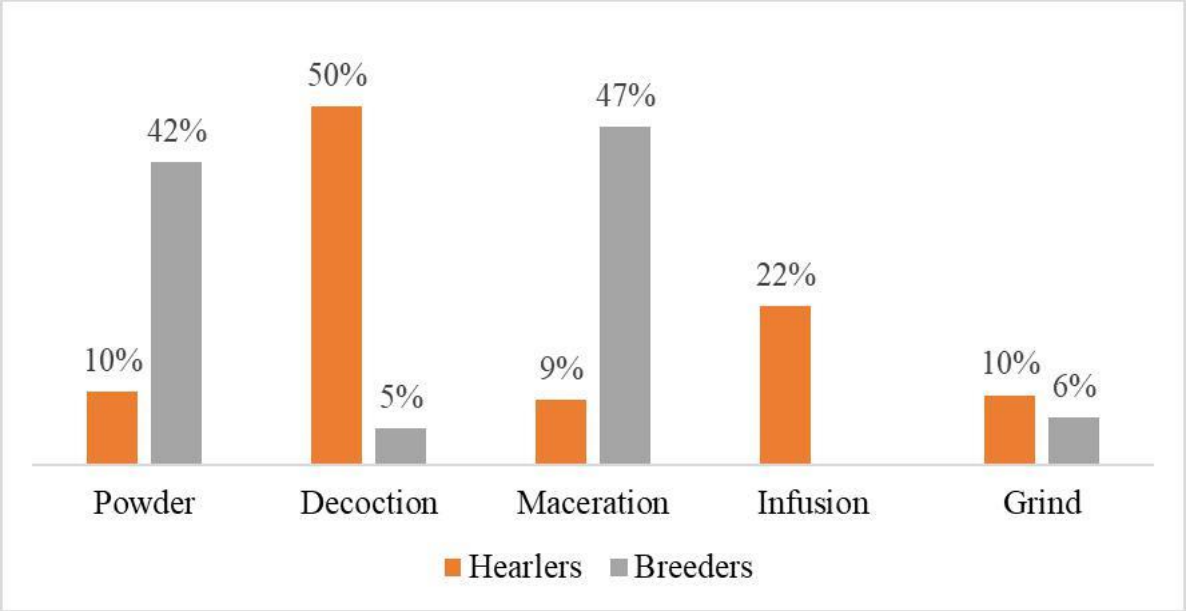

Figure 12. Methods of preparation of traditional remedies.

senegalensis are used in the treatment of diarrhea, stomach aches and vomiting (Adomou et al., 2012; Agbankpe et al., 2015; Kouchadé et al., 2017) manifestations but not specific of intestinal parasitosis. These symptoms can also be caused by other illnesses.

Among the different organs of medicinal plants used by the populations are the barks and roots, but their use is detrimental to the monitoring of the species (Dassou et al., 2014). The decoction is the drug form mostly used in traditional medicine (Ogni et al., 2014; Ouachinou et al., 2017). The decoction provides the most active ingredients and reduces or cancels the toxic effect of some recipes (Salhi et al., 2010). On the other hand, in the present study, it is the maceration and then the powders that are mostly used by small ruminant breeders in the treatment of intestinal parasitosis.

Small ruminant breeders are increasingly relying on veterinary products (63%). This observation contradicts the work of Garba et al. (2019) that identified 72% of informants who resort to self-medication and 12% who make veterinary medicine the second alternative. In the present study, 42% of breeders use mixed treatments. This observation is not very far from that of Kaboré (2009). It is among this group that the use of veterinary products is a second alternative. They consider that they resort to veterinary products in the event of failure of traditional medicine. These failures could be justified by: failure to identify the pathogen in question, ignorance of the dosage and the number of days of application, the method of preparation of the recipes and the recurrence of certain pathologies (Kaboré, 2009). Further studies are needed to highlight the various reasons for the possible failures in the use of medicinal recipes, since medicinal plants are endowed with innumerable riches, which are alternatives to control emerging diseases.

Conclusion

Overall, this survey shows that a large number of medicinal plants are used in Department of Donga in Benin to manage intestinal parasitosis. The collected data provide an effective means of preservation of traditional knowledge in the management of intestinal parasitosis by medicinal plants. Depending on the geographic area and the population encountered, practices may experience differences. In the north of Benin, *K. senegalensis* is the most used in the control of intestinal parasitosis. These data provide a new basis for new research topics on intestinal parasitosis.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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