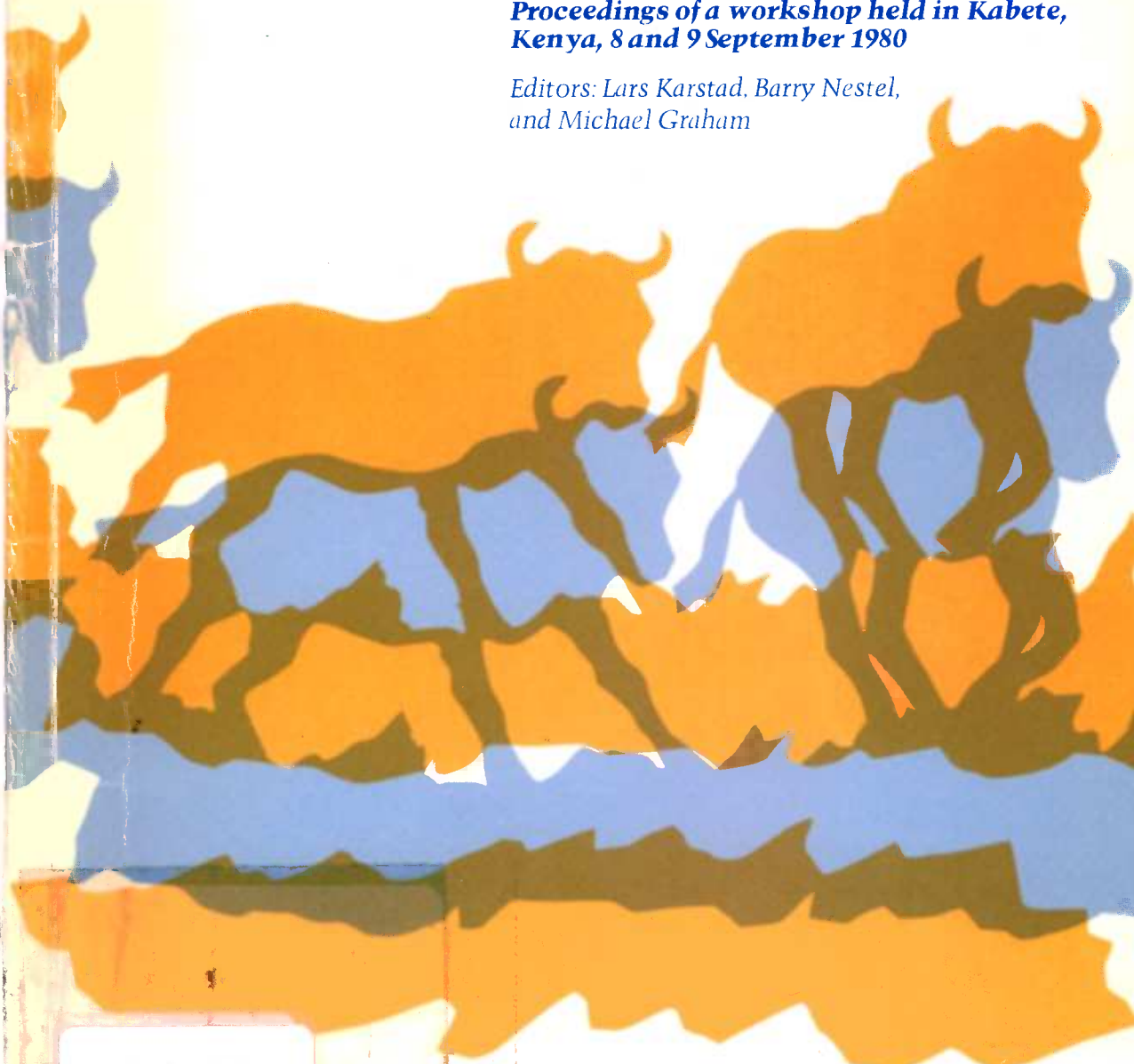


# Wildlife Disease Research and Economic Development

*Proceedings of a workshop held in Kabete,  
Kenya, 8 and 9 September 1980*

*Editors: Lars Karstad, Barry Nestel,  
and Michael Graham*



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Head Office: 60 Queen Street, Ottawa

Karstad, L.  
Nestel, B.  
Graham, M.

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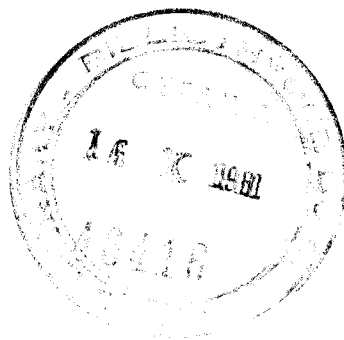
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# Helminths in Wild Ruminants in Central Africa: Impact on Domestic Ruminants<sup>1</sup>

M. Graber<sup>2</sup>

Central Africa covers an immense area that includes Chad, the Central African Republic, and Northern Cameroon. It is divided into four climatic zones:

(1) A desert zone, north of the 15th parallel, covering, in Chad, the Borku, Ennedi, and Tibesti regions. With the exception of Borku, these are mountainous areas where rainfall is rare and irregular. Vegetation is sparse and in general there are few animals.

(2) A middle Sahelian zone called the steppe zone, from the 11th to the 15th parallel. Covered in the north with barren, sandy dunes, in the south it forms a vast, flat plain, rising in the west (Cameroon) and in the east (Guerrah, Ouaddai). The climate is tropical, with a single rainy season lasting from July to October. Annual rainfall ranges between 250 and 750 mm, and the region is rich in pasture lands and becomes increasingly wooded in the south. Here and there, the streams are lined with arcade-like stretches of relatively dense forest growth.

(3) A Sudanese savanna zone, from the 7th to the 11th parallel, straddling Chad and the northern regions of the Central African Republic. It is a flat land, dotted with a few hills and plateaus. In the south there is a large mountainous massif comprising the Yade Mountains in the west and the Bongo Mountains in the east. The rainy season lasts 4 months (end May to end September) and rainfall ranges from 900 to 1300 mm. The vegetation is of the savanna type; areas with scant tree and shrub growth are interspersed with wide bands of grassy pasture land.

(4) A Guinean zone, from the 3rd to the 7th parallel. The rainy season lasts 6 months and rainfall ranges from 1300 to 1600 mm. Generally, it is a

wooded savanna that turns into dense forest stretches along the rivers.

The granitic barrier of the Yade and Bongo Mountains in the Central African Republic marks the dividing line between the streams flowing northward to Lake Chad through the Chari and its tributaries (Lim, Pende, Bahr Sara, Bahr Aouk, Bahr Salamat), and southward to Zaire through the Ubangui, Sangha, and Lobaye.

The best area for herding domestic ruminants lies between the 9th and 15th parallels, in Chad and Northern Cameroon. In Chad, prior to the great drought of 1972-74, there were, between the 13th and 16th parallel, some 4 million zebu, 4 million sheep and goats, and 350 000 camels. Most of these animals belonged to nomadic herders who travelled northward in the rainy season, and southward in the dry season, in search of richer pastures and water. These same areas are frequented by many wild ruminants (25 different species) that often wander along the same trails.

In the Central African Republic, domestic herding is a fairly recent activity. The first Bororo herdsman settled in the Yade savanna in 1924. Since then, they have spread throughout the western half of the country. The number of bovines is estimated at 800 000. In the eastern half, a large number of wild animals of many different species occupy a vast hunting zone covering 320 000 km<sup>2</sup>. This area is fairly isolated, sparsely populated, and herding is nonexistent. However, the northern section (Bahr Aouk) is at times invaded by clandestine herds from Chad and the Sudan. It is also crossed by two cattle import routes: one that goes from Birao to Bangassou via Ouadda and Bria; and, farther to the west, one that goes from Sahr in Chad to Bangui via Ndele, Fort-Crampel, and Fort-Sibut.

The fact that both domestic and wild ruminants are found in the same areas and along the same trails poses a number of problems, and we considered it worthwhile to determine what impact, if any,

<sup>1</sup>This paper was originally in French; with the author's permission, it was translated into English by IDRC.

<sup>2</sup>Chaire de parasitologie, École nationale vétérinaire, Marcy l'étoile, 69260 Charbonnières les Bains, France.

Table 1. Number of autopsies performed on domestic ruminants.

	Zebu			Sheep	Goats	Camels
	Suckling calves	Young bulls	Adults			
Chad	3955	1690	4743	5382	781	159
Central African Republic	422	123	627	38	4	—
Northern Cameroon	106	—	409	—	—	—

internal parasites infecting wild herbivores were having on domestic ruminant herds.

Tables 1 and 2 present figures for autopsies performed in Central Africa from 1954 to 1972. The helminths that were found were examined in accordance with standard methods: clearing with lactophenol for nematodes, staining with carminic acid, and serial sectioning for cestodes and trematodes.

It was found that a large number of helminths in wild ruminants are specific and affect domestic ruminants very rarely or not at all. These include:

(1) Nematodes: almost all the *Setaria* of the peritoneum, with the exception of *Setaria labiatopapillosa*, observed only twice in the buffalo in Chad and the Central African Republic (a single specimen in each case); the *Elaeophora* of the circulatory system; *Ashworthius lerouxi*, *Parabronema skrjabini*, *Ostertagia thalae*, *Haemonchus vegliai*, and all the *Longistrongylus* of the fourth stomach; *Bunostomum dentatum*, *Agriostomum cursoni*, *Paracooperia daubneyi*, and *Cooperia fuelleborni* of the small intestine; several esophagostomes (*Oesophagostomum synceri* and *Oesophagostomum lechwei*) of the large intestine and *Pygarginema africana*;

*Pneumostrongylus cornigerus* of the respiratory system.

(2) Cestodes of the small intestine (*Moniezia monardi*, *Avitellina edifontaneus*, *Avitellina sandgroundi*, *Avitellina buechneri*) and bile ducts (*Crosotaenia baeri*).

(3) Trematodes of the first stomach: *Cotylophoron macrosphinctris*, *Carmyerius endopapillatus*, *Carmyerius schoutedeni*, *Carmyerius exoporus*, *Carmyerius minutus*, and *Stephanopharynx coilos*. *Schistosoma margrebowiei* parasitizes only the kobs (Buffon's kob and waterbuck) and it has been recorded only in southern Chad, in the Kyabé area between the two tributaries of the Chari, the Bahr Salamat and the Bahr Aouk.

Conversely, several zebu and sheep parasites have never been found in Central African wild ruminants, in particular *Schistosoma mattheei* and *Onchocerca gutturosa*, as well as some very abundant, very pathogenic nematodes: *Bunostomum phlebotomum* and *Oesophagostomum radiatum* found in the zebu and *Bunostomum trigonocephalum* found in sheep (Table 3). As far as sucking calves are concerned, there are two parasites that

Table 2. Number of autopsies performed on wild ruminants.

	Central African Republic	Chad	Northern Cameroon
<i>Babalus (Syncerus) caffer</i>	74	13	1
<i>Alcelaphus lelwel</i>	14	20	1
<i>Damaliscus korrigum</i>	1	8	—
<i>Sylvicapra grimmia</i>	3	2	2
<i>Ourebia ourebi</i>	5	4	4
<i>Redunca redunca nigeriensis</i>	2	8	—
<i>Adenota cob</i>	5	15	2
<i>Kobus defassa</i>	7	18	—
<i>Gazella dorcas</i>	—	37	—
<i>Gazella rufifrons</i>	—	21	—
<i>Gazella dama</i>	—	9	—
<i>Hippotragus equinus</i>	7	13	1
<i>Oryx algazel</i>	—	9	—
<i>Addax nasomaculatus</i>	—	1	—
<i>Taurotragus derbianus</i>	3	—	1
<i>Tragelaphus scriptus</i>	4	—	1
<i>Strepsiceros strepsiceros</i>	—	2	—

Table 3. Rate of infestation (%) of *Bunostomum phlebotomum*, *B. trigonocephalum*, and *Oesophagostomum radiatum*.

	Chad	Central African Republic	Northern Cameroon
<i>B. phlebotomum</i>			
Young bulls	55	56	—
Adults	5	4	7
<i>B. trigonocephalum</i>	1	52	—
<i>O. radiatum</i>			
Young bulls	51	53	—
Adults	15	38	10

Table 4. Rate of infestation (%) of *Toxocara vitulorum* and *Strongyloides papillosus* in zebus.

	Chad	Central African Republic	Northern Cameroon
<i>T. vitulorum</i>	0-20 <sup>a</sup>	33	32
<i>S. papillosus</i> <sup>b</sup>	0-8	11	2

<sup>a</sup>Depending on region.

<sup>b</sup>In camels 27%; sheep 12%.

cause serious losses every year (5-20%): *Toxocara vitulorum* and *Strongyloides papillosus* (Table 4).

Autopsies on wild ruminants are normally performed on adult animals, less often on young ones, and never on sucking calves. Information on the latter age group is therefore completely lacking, and it is desirable that in future at least some fecal examinations be performed, especially among very young buffalo, because it is not difficult to find the eggs of *Toxocara vitulorum*.

Some other parasites are also common to both wild and domestic ruminants.

*Dicrocoelium hospes* is found in buffalo (16%), sheep (0.2%), and zebus (14-15%). It is found throughout the Central African Republic, in southern Chad, and in northern Cameroon below the 10th parallel. The role of the buffalo in the epidemiology of bovine and ovine dicrocoliasis appears limited. These animals are rarely found in the most affected areas, where domestic herding is fully or semi-sedentary (northern Cameroon, southwest Chad, western Central African Republic). Elsewhere (southeast Chad, northeast Central African Republic), the first intermediate hosts, the Achatinae of the genus *Limicolaria* resume their activity only in the wet season, at a time when the transhumant herds have already returned to the north. This explains why the disease is nonexistent in this type of herding. In these areas, it is likely that dicrocoliasis is

maintained from buffalo to buffalo to the exclusion of any other domestic or wild ruminant.

The trematode *Fasciola gigantica* is also common to both wild and domestic ruminants (Table 5). It is much more widespread in wild ruminants where the disease strikes mostly waterbuck (40%), buffalo (38%), hartebeest (6%), Buffon's kob and *Hippotragus* (5%).

In the domestic herding zone, dissemination of the parasites is effected by both the domestic and wild Artiodactyla which, during the dry season, use the same trails. But this is not always the case, and in the southern part of the Central African Republic hunting zone, some centres of infection are far removed from cattle trails, and it may be supposed that propagation of hepatic distomatosis is effected by wild ruminants, especially the buffalo.

*Schistosoma bovis*, nonexistent in the Central African Republic, is frequently encountered in Chad in the camel (5%), sheep (11%), and zebu (34%), and in northern Cameroon in the zebu (35%). In these same areas, the percentage of wild herbivores that are infested is only 2.8% (Buffon's kob, waterbuck, buffalo, *Hippotragus*, *Damaliscus*, reedbuck). This indicates that the role of wild ruminants in the epidemiology of this infestation is not very important. As Dinnik pointed out in 1965, this trematode is more likely to infest domestic ruminants.

Table 5. Rate of infection (%) of *Fasciola gigantica*.

	Chad	Central African Republic	Northern Cameroon
Zebu			
Young bulls	3	28	—
Adults	28	62	43
Sheep	0.8 <sup>a</sup>	2	—

<sup>a</sup>These low percentages are due to the fact that infested sheep often die of acute distomatosis and therefore never reach the slaughter house.

This is not true of the nonspecific Paramphistomidae and Gastrothylacidae (Table 6). Except in northern Cameroon, Gastrothylacidae appear to be associated with wild ruminants, and all the species examined, except for the crowned duiker, are hosts to a few. The rate and level of infestation of domestic herbivores is much lower, especially in the Central African Republic and in the northern section of Chad's Sahelian zone.

Like *Fasciola gigantica*, the Paramphistomidae gastric trematodes are very widespread among both wild and domestic herbivores. The intermediate host is *Bulimus*, which often coresides with the *Limnaea* that transmit hepatic distomatosis. In Central Africa,



Table 6. Percentage of animals parasitized.

	Paramphistomidae	Gastrothylacidae
Chad/Northern Cameroon		
Zebu	13-48	2 <sup>a</sup> -29 <sup>b</sup>
Sheep	22	1.2
Wild ruminants	35	15
Central African Republic	33-86	4
Zebu	13	—
Sheep	44	43
Wild ruminants		

<sup>a</sup>Chad.<sup>b</sup>Northern Cameroon.

the reproduction rhythm of *Bulimus* is similar to that of *Limnaea*. In Sahelian and Sudanese zones, the multiplication period begins in September–October and spans almost all of the dry season, ending in May or June. Paramphistomosis and distomatosis are dry-season diseases contracted by a large variety of animals (including a great many wild ruminants) while they graze marshy regions, the bottoms of drying lakes and ponds, and the shores of certain rivers.

The average rate of hepatic stilesiosis in wild ruminants that are hosts to *Stilesia hepatica* is 12%. In the domestic herding areas of Chad, it definitely exceeds the rate in domestic animals, which is 0.06% in bovines, 2.4% in ovines, and 0.5% in goats. This indicates that, at least in these regions, hepatic stilesiosis is ascribable to wild rather than domestic ruminants. The latter are contaminated in areas where antelopes are numerous, especially near streams and lakes, i.e., in humid areas (Chari and tributaries). As early as 1911, Gough wrote in this regard: "it is probable that *Stilesia hepatica* was originally a parasite of the wild ruminants, and we may suppose that it adapted secondarily to sheep. The fact that this parasite is not reported in other parts of the world, its presence in antelopes, its numerous hosts, lead us to believe that in the beginning it was not a parasite of sheep."

Intestinal taeniasis in wild herbivores affects on the average one in five animals. It is more consequent in Chad (< 1%) than in the CAR (16%). Its nature is not the same: in the Central African Republic, *Stilesia globipunctata* and *Moniezia* are much less in evidence (less than 1.5%) than *Avitellina* (15%). In Chad and northern Cameroon, *Avitellina* and *Stilesia globipunctata* are found in equal numbers (9%), with *Moniezia* and *Thysaniezia* being much less numerous (1–2.5%).

The importance and the structure of intestinal taeniasis in domestic ruminants are completely different. In western Central African Republic, in the

zebu, the disease is due to *Moniezia* and *Thysaniezia* cestodes, the average rate of infestation is 3%. In Chad and northern Cameroon, about 15% of zebu are parasitized, with *Thysaniezia* and *Moniezia* again predominant, as they are in goats. In sheep, 67% of which are affected, the species most commonly encountered are *Avitellina centripunctata* (43%), *Stilesia globipunctata* (35%), and *Moniezia expansa* (16%). In camels, 58% of which are affected, *Stilesia* are most numerous (28%), followed by *Moniezia* (15%), *Avitellina* (11%), and *Thysaniezia* (2.5%). In domestic herding, monieziosis and duodenal stilesiosis are particularly serious in sheep and camels. In areas inhabited by camels, the antelopes always harbour a large number of cestodes whose eggs they disseminate as they move toward their dry season pastures in the northern section of the Sahelian zone.

Cysticercosis due to *Cysticercus tenuicollis* (adult form: *Taenia hydatigena* of the dog) is also, in northern Chad, a common disease in sheep, goats, gazelles and, to a lesser degree, camels. In central and southern Central Africa, cysticerci collected from many antelopes have the larval shape of the *Taenia* of the lion, *Taenia regis*.

In Chad, systematic research has been carried out on nonspecific nematodes, which include:

(1) *Gaigeria pachyscelis*, a common parasite in sheep and goats (6–8%), found in the intestine of three buffalo (a few specimens).

(2) *Skrjabinema ovis*, a very rare oxyuridae in the sheep, goat, and hartebeest.

(3) *Impalaia tuberculata* of the zebu (0.1%) and camel (14%) and *Haemonchus longistipes* of the camel (72%), found in four gazelles in the north.

(4) *Cooperia punctata* and *Cooperia pectinata*, trichostrongyles of the zebu (10–20%), found in two hartebeest and one waterbuck.

(5) *Trichuris globulosa* and *Oesophagostomum [Proteracrum] columbianum* (Table 7) are well known in the Sahelian zone wherever there is herding of sheep and camels. Like the large intestine cestodes, *Impalaia tuberculata* and *Haemonchus longistipes*, they also affect the antelopes that have adapted to these dry areas. They are much rarer in central and southern Chad.

Table 7. Percentage of infestation of *Trichuris globulosa* and *Oesophagostomum columbianum*.

	<i>T. globulosa</i>	<i>O. columbianum</i>
Camel	34	28
Zebu	1-7.5	—
Sheep	4.5	40
Goat	3	15
Antelope	8	7.5

(6) *Haemonchus contortus*, a parasite of the fourth stomach, deserves particular attention. This is a Trichostrongylidae, with a short evolution cycle, that is well established in the Sahelian zone where it affects 20–50% of zebu, 37% of sheep, 35% of goats, 0.7% of camels, and 20% of antelopes, principally gazelles and oryxes. Many specimens have also been collected from hartebeest in Sudan and waterbuck in southern Chad near the border with the Central African Republic. *Haemonchus contortus* is therefore numerous and widespread in both domestic and wild herbivores.

Larval sparganosis is unknown in domestic ruminants. For wild ruminants, no in-depth studies have been made. It is very likely that it exists in Central Africa because the corresponding adult cestode, *Diphylobothrium theileri*, has been identified on several occasions (lion in the Central African Republic; cheetah, jackal, and panther in Chad).

Larval echinococcosis due to *Echinococcus polymorphus* (adult, *Echinococcus granulosus granulosus* of the dog and jackal) is very rare in Central African wild ruminants. In Chad, the only known case is that of an oryx sacrificed in northern Ouaddai in 1965. In domestic ruminants, for the area as a whole, rates of infestation are low (zebu 1.4%; sheep 0.05%; goat 0%) except in the camel (57%). In the Central African Republic, no case of larval hydatidosis has been observed in either domestic or wild ruminants. However, in the northern section of the hunting zone, warthogs have been affected. The corresponding adult cestode could be a particular strain of *Echinococcus granulosus granulosus* adapted to the lion, with the possibility of a special lion/warthog cycle.

*Mammomonogamus nasicola*, a gapeworm of the larynx and pharynx, was found to affect 25% of the animals autopsied at Bouar (Central African Republic). The same parasite was found in a single buffalo in the eastern part of the Central African Republic. Information is still too fragmentary to allow definite conclusions to be drawn.

Generalized cenurosis due to *Coenurus cerebralis* (adult, *Taenia multiceps* of the dog) is the exception in Central Africa; it has been found only in the sheep and goat in Chad (0.1%).

Muscular cysticercosis involves two different parasites:

(1) *Cysticercus bovis*, an inermous cysticercus whose corresponding adult, *Taenia saginata*, resides in man's intestine. This zoonosis affects mainly the zebu; Chad, 8.5–19.5%, depending on the age group; northern Cameroon, 18.9%; and the Central African Republic, 21–49%. It is rare in wild ruminants: in Chad, only three observations have been recorded, in two gazelles in northern Ouaddai

and in a Buffon's kob from the N'Djamena (Fort-Lamy) area.

(2) On the other hand, Central African wild ruminants are often carriers of armed cysticerci whose adult cestodes, *Taenia hyaenae* and *Taenia crocutae*, parasitize hyenas and more rarely *Lycaon*. The average rate of infestation is 15% in the Central African Republic and 8.4% in Chad and northern Cameroon. All species, except some gazelles, are affected. In domestic ruminants (zebu and camel), the number of animals affected is only 0.7%.

This type of cysticercosis is therefore most common in wild animals and hardly affects domestic Bovidae.

## Conclusions

In Central Africa (northern Cameroon, Chad, Central African Republic), internal parasitism of wild herbivores is in most cases due to specific helminths that affect domestic ruminants only rarely or not at all. Conversely, certain pathogenic parasites frequently found in zebu and sheep do not exist among wild ruminants.

Where zoonoses are concerned, the role of wild herbivores is particularly discrete.

Nevertheless, certain infestations occur in both groups of herbivores. They are: hepatic distomatosis due to *Fasciola gigantica*; gastric paramphistomatosis due to Paramphistomidae and Gastrothylacidae; hepatic stilesiosis due to *Stilesia hepatica*; in northern areas, duodenal stilesiosis due to *Stilesia globipunctata* and monieziosis due to *Moniezia expansa*; haemonchosis of the fourth stomach due to *Haemonchus contortus* and to a lesser degree, trichuriasis due to *Trichuris globulosa* and nodular esophagostomiasis due to *Oesophagostomum columbianum*.

In areas where domestic and wild herds come into close contact, these diseases are liable to have certain repercussions on domestic herding. Here wild ruminants serve as parasite reservoirs and are liable to disseminate and disperse a number of parasites over large areas.

This mode of contamination mainly affects herds belonging to nomads because, with sedentary herds, the constant presence of humans means that fewer wild herbivores are normally present. In drawing up any plans for prevention, this situation must be kept in mind. Treatments must be adapted to the nature of the parasite transmitted by the wild ruminants. This treatment may be provided through the use of wide-spectrum drugs capable of destroying simultaneously hepatic and gastric distomes, intestine and liver Anoplocephalidae, and the most common nematodes.