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Gastro-intestinal nematodes and cestodes of cattle in Burkina Faso

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A survey of the parasites of abomasa, small, and large intestines of 94 bovines conveyed to the main slaughterhouse of Ouagadougou from the central and northern part of Burkina Faso allowed the identification of nine different worm species: *Cooperia punctata*, *Cooperia pectinata*, *Haemonchus contortus*, *Trichostrongylus colubriformis*, *Bunostomum phlebotomum*, *Moniezia expansa*, *Avitellina* sp., *Oesophagostomum radiatum*, and *Trichuris* sp. By far, *Cooperia* sp. was the most prevalent (89.4%), followed by *H. contortus* (66%), and *O. radiatum* (42.6%). The other worm species were much less prevalent. While only one cattle was free of parasites, it was noticed that polyparasitism was very common. There was a wide range of worm burden (0 to 42290) with however in most animals high worm numbers specially of *Cooperia* sp. This study confirmed that the rainy season constitutes a period of worm explosion. During the hot and dry season, *H. contortus* seemed primarily able to undergo arrested development in the L4 stage and secondarily to remain in the adult stage. Statistical analyses of levels of infestation did not show any significant difference according to age, sex, and weight of cattle.
Keywords. Abomasum, intestines, bovines, parasites, seasonability, prevalence, Burkina Faso.

Nematodes et cestodes gastro-intestinaux des bovins au Burkina Faso. Une enquête sur les parasites de la caillette, de l'intestin grêle et du gros intestin, menée sur 94 bovins abattus à l'abattoir de Ouagadougou et provenant du centre et du nord du Burkina Faso, a permis l'identification de neuf espèces différentes de vers : *Cooperia punctata*, *Cooperia pectinata*, *Haemonchus contortus*, *Trichostrongylus colubriformis*, *Bunostomum phlebotomum*, *Moniezia expansa*, *Avitellina* sp., *Oesophagostomum radiatum* et *Trichuris* sp. Les parasites suivants étaient les plus fréquents : *Cooperia* sp. (89,4 %), *H. contortus* (66 %), et *O. radiatum* (42,6 %). Les autres espèces de parasites étaient moins représentées. L'infestation parasitaire semble être une règle chez les bovins de la région d'étude (99 %), particulièrement sous forme de polyparasitisme (91,5 %). Les degrés moyens d'infestation parasitaire observés étaient très disparates avec cependant, pour le plus grand nombre des animaux adultes et âgés étudiés, des degrés moyens d'infestation relativement élevés. La saison pluvieuse constitue une période d'explosion parasitaire. *H. contortus* aurait, pendant la dure saison chaude et sèche, la possibilité principalement d'arrêter son développement au quatrième stade larvaire et secondairement de rester au stade adulte. Les analyses statistiques n'ont révélé aucun effet significatif de l'âge, du sexe et du poids de l'animal sur la charge parasitaire.
Mots-clés. Caillette, intestin, bovin, parasite, saison, infestation, Burkina Faso.

1. INTRODUCTION

Burkina Faso like many other Sahelian countries in West Africa has always been considered to have great potentialities in animal production. More than 90% of its population makes their living from animal breeding and agriculture. However since about twenty years, drought, demography, and reduction of pasture land have all contributed to hamper the development of animal breeding.

Cattle digestive tract infestation by helminths and protozoa may cause significant economical loss. If clinical parasitism has been under scrutiny since a while, that has not been the case for sub-clinical infestations. However it is recognized that cattle or other ruminants could be undergoing gastro-intestinal infestations leading to economical losses without clinical signs (Cox, Todd, 1962). Those economical losses have not been estimated in the Sahelian countries in West Africa where they are expected to be even higher than in other parts of the world due to combined malnutrition (Kaufmann, Pfister, 1990; Zinsstag *et al.*, 1997). Now that in West Africa the major contagious epidemics such as rinderpest are almost under control, more attention should be paid to parasitic diseases causing production losses (Zinsstag *et al.*, 1997). Before it is possible to study the pathological impact of parasites on animal

productivity in Burkina Faso, it seemed logical to start looking in the present study for few epizootiological information such as the species of parasites involved, their numerical importance, their anatomical locations in the hosts, and the impact of the seasons on their biology.

2. MATERIALS AND METHODS

2.1. Animals and area of study

With the exception of September (n=6), February (n = 7), and August (n = 10), eight cattle were obtained each month from September 1995 to August 1996. All 94 cattle studied were from the local zebu Peul breed and were purchased by three butchers from the central and northern part of Burkina Faso. The area of the study covered about the same Soudano-sahelian climate with rainfalls of 500 to 900 mm and two main seasons. The rainy season extends from June to October and the dry season, from November to May. All animals were conveyed to the main slaughterhouse of Ouagadougou where clinical inspection was done.

2.2. Sampling, worm recovery, identification, and enumeration

At the slaughterhouse, the abomasum, the small and the large intestines of each animal were isolated, carefully trimmed from fat and mesenteries, placed in separate labeled plastic buckets, and taken to the laboratory for processing. For the recovery of the nematodes and the digestion of the abomasums, slight modifications were made on the methods described by Belem *et al*. (1993). Contents and washing of each part of the gastro-intestinal tract were brought in a graduated bucket to a volume of 5 l and aliquots of 500 ml (10%) were taken and labeled. Formaldehyde was added to approximate 10% (v/v). Following washing, each abomasum was incubated in tap water for 16 to 18 hours under room temperature. Then, 10% aliquots were taken and handled as above. The small and large intestines were not incubated in tap water.

All formalin-fixed samples were stored in ambient temperature until use. Before use, the aliquot was washed through a sieve with a mesh of 38 µm openings to clear the sample. Using scribed glass Petri dishes and a stereoscopic dissecting microscope, nematodes were recovered, then transferred to labeled slides with drops of lactophenol until identification and enumeration with the aid of a compound microscope (Belem *et al.*, 1993). Identification of *Haemonchus*, *Cooperia*, and *Trichostrongylus* species as well as the L4s were performed according to several keys (Anantaraman, 1942; Sprent, 1946; Keith, 1953; Stewart, 1954; Douvres, 1957a, 1957b; Anderson *et al.*, 1974; Soulsby, 1986; Thomas, Probert, 1993).

2.3. Statistical analysis

Prevalences or percentages were analyzed by the Ki-square (X2) test while mean worm numbers were compared by analysis of variance (ANOVA) test followed by the Student-Newman-Keuls (SNK) mean separation method. All statistical analyses were performed using the Statistical Analysis System (SAS Institute, 1987).

3. RESULTS

3.1. Identified nematode and cestode species

Atotal of seven nematode and two cestode species were found from the cattle: *Cooperia punctata* (Linstow, 1907), *Cooperia pectinata* (Ransom, 1907), *Haemonchus contortus* (Rudolphi, 1803), *Oesophagostomum radiatum* (Rudolphi, 1803), *Bunostomum phlebotomum* (Railliet, 1900), *Trichostrongylus colubriformis* (Giles, 1892), *Trichuris* sp. (Roederer, 1761), *Moniezia expansa* (Rudolphi, 1810), and *Avitellina* sp. (Gough, 1911). Females of *Cooperia* were not identified to the species.

T. colubriformis as well as adults and L4s of *H. contortus* were collected in the abomasums. *Cooperia* species adults and L4s, *B. phlebotomum*, and all tapeworms species (*M. expansa* and *Avitellina* sp.) were found in the small intestines. However, it was interesting to note that, in about 40% of the cattle, 25% of *Cooperia* adult worm burden was collected from the abomasums. Large intestines harbored *O. radiatum* adults and L4s, and *Trichuris* sp.

3.2. Seasonal changes in prevalences and mean worm numbers

Nematode and cestode prevalences were estimated for the year as well as for the rainy and dry seasons. Most prevalent worm species in the area were *Cooperia* sp. (89.4%), followed by *H. contortus* (66%) and *O. radiatum* (42.6%). The prevalence of *H. contortus* adults in the rainy season (80.5%) was different at highly significant level from that of the dry season (54.7%) ($X2 = 6.8$, $DF = 1$, $p = 0.009$). Their L4s were more prevalent in the dry (73.6%) than in the rainy season (58.5%). While the L4s of *Cooperia* sp. were more prevalent in the rainy (63.4%) than in the dry season (54.7%), their adults specially those of *C. punctata* were more prevalent in the dry season. If cestodes and *Trichuris* sp. were noticed to be parasites of mainly the rainy season, *O. radiatum* as well as *B. phlebotum* and *T. colubriformis* on the contrary seemed to be parasites of the dry season.

Table 1 presents the monthly and the seasonal variations of the mean worm numbers for the three major species seen in the area of study, *H. contortus*,

Table 1. Mean ± standard error and range (in parentheses) numbers of nematodes in the gastro-intestinal tract — *Moyennes ± écart-type et valeurs extrêmes (entre parenthèses) des charges parasitaires en nématodes du tube digestif.*

	Haemonchus contortus			***Cooperia* sp.**			***Oesophagostomum radiatum***		
	Adult	L4	Total	Adult	L4	Total	Adult	L4	Total
Sep.	5904±3225 (2400–10930)	1537±2498 (80–6590)	5534±5875 (250–17520)	7573±5636 (300–15250)	5183±3281 (1800–10300)	12016±8456 (300–24020)	250±212 (100–400)	200±141 (100–300)	300±200 (100–500)
Oct.	1208±1282 (110±3100)	3102±2948 (430–9410)	3857±3873 (430–12510)	8362±6322 (100–18230)	7025±7660 (200–19600)	15387±13065 (3320–37830)	350±71 (300–400)	100±0 (100–100)	267±153 (100–400)
Nov.	977±1008 (20–2030)	3468±3405 (210–9706)	3887±4151 (210–11736)	3812±2073 (100–6200)	4114±3696 (100–9600)	7381±5783 (100–15800)	150±71 (100–200)	125±50 (100–200)	160±89 (100–300)
Dec.	55±64 (10–100)	2296±1439 (120–4400)	2310±1452 (120–4400)	1546±1335 (100–3420)	3729±6396 (300–18000)	4809±6348 (100–19700)	200±0 (200–200)	150±71 (10–200)	167±58 (100–200)
Jan.	270±240 (100–440)	852±623 (200–1860)	942±685 (200–1860)	7141±7664 (100–21700)	5920±5914 (700–14700)	10841±13008 (100–36400)	1000±1158 (100–2600)	100±0 (100–100)	1050±1139 (100–2600)
Feb.	2220±2857 (200–4240)	7653±12359 (200–21920)	6850±12877 (200–26160)	1370±1201 (200–3220)	700±424 (400–1000)	1603±1509 (200–3620)	200±0 (200–200)	0	200±0 (200–200)
Mar.	995±908 (20–2800)	4833±4791 (200–12200)	4620±4993 (20–13000)	3992±4841 (400–15600)	3280±4908 (200–12000)	6042±6630 (400–17200)	600±673 (200–1600)	400±163 (200–600)	667±787 (200–2200)
Apr.	880±973 (220–2820)	880±878 (200–2600)	1430±1091 (220–3160)	10274±6388 (3880–20980)	2000±1980 (600–3400)	10846±7325 (3880–24380)	400±200 (200–600)	200±0 (200–200)	350±191 (200–600)
May	1913±1839 (400–5440)	830±325 (600–1060)	2190±1829 (820–5440)	2323±1673 (800–5300)	800±0 (800–800)	2457±1656 (800–5300)	467±306 (200–800)	600±0 (600–600)	667±231 (400–800)
Jun.	871±554 (200–1820)	127±151 (20–300)	810±569 (20–1820)	6168±4641 (200–12820)	600±0 (600–600)	6288±4452 (800–12820)	0	600±0 (600–600)	600±0 (600–600)
Jul.	1932±2882 (60–8480)	287±280 (60–600)	240±2927 (60–8480)	8067±8671 (2600–25460)	4360±6154 (200–15200)	11700±14238 (4420–40660)	1067±1155 (400–2400)	200±0 (200–200)	1133±1102 (400–2400)
Aug.	382±566 (20–1620)	2450±3304 (600–7400)	1429±2338 (20–7400)	3091±2974 (860–10620)	2267±2130 (600–5200)	4602±3833 (1680–11820)	467±231 (200–600)	200±0 (200–200)	450±300 (200-800)
Dry season	1129±1311 (10–5440)	2757±4192 (120–21920)	2985±4559 (20–26160)	4457±5256 (100–21700)	3693±4731 (100–18000)	6510±7662 (100–36400)	539±647 (100–2600)	243±183 (100–600)	504±626 (100–2600)
Rainy season	1824±2614 (20–10930)	1878±2602 (20–9410)	2631±3691 (20–17520)	6485±5838 (100–25460)	4742±5423 (200–19600)	10008±10063 (300–40660)	580±657 (100–2400)	243±172 (100–600)	535±576 (600–2400)

Cooperia sp., and *O. radiatum*. While *H. contortus* adults had their highest level of infestation at the end of the rainy season in September with a mean number of 5904 adult worms per cattle (the maximum worm number collected being 10930), the L4s had their highest level during the dry season in February with a mean number of 7653 larvae per animal (the maximum collected being 21920 larvae). It is important however to notice that for the period of February and March at which L4 were most numerous in animals, the mean number of adult *H. contortus* also increased slightly. Statistical comparisons of worm monthly mean numbers of *H. contortus*, using the ANOVA test followed by the SNK mean separation method, showed that the adult mean number in September was significantly different ($p < .05$) from the others. If in the rainy season *H. contortus* adults and L4s showed very close mean numbers (respectively 1824 and 1878), these numbers were quite different in the dry season (respectively 1129 and 2757).

The monthly mean numbers of *Cooperia* adults and L4s in the small intestines showed an interesting similar evolution in successive waves throughout the year except for April. In April, at the end of the dry season, while *Cooperia* adults (comprising mainly females) increased to their highest mean amount of the year (10274 worms with a range of 3880 to 20980

worms), the L4s decreased to a mean number of 2000 worms. The monthly mean numbers of both stages showed an increase during the rainy season (June to October), reaching a peak in October with 8362 for adults and 7025 for L4s. Individual levels of infestation in *Cooperia* for cattle showed high variations with a range of 100 to 25460 worms for adults and 200 to 19600 worms for L4s. Total of *Cooperia* sp. adults and L4s mean number was higher in the rainy season (10008±10063 worms) than in the dry season (6510±7662 worms).

O. radiatum was prevalent all year round either in adult or in L4 stage with adults being always more numerous. The dry as well as the rainy season mean numbers of this parasite were close, respectively 504 and 535 parasites per animal. From single animals the range of *O. radiatum* burden extended from 200 to 2400. The levels of infestation by *B. phlebotomum*, *T. colubriformis*, and *Trichuris* sp. were relatively low in cattle. These nematodes species never exceeded 350 per cattle.

3.3. Impact of age, weight, and sex of animals on nematode burdens

Most of the animals examined from the main slaughterhouse of Ouagadougou were very old. 78% of them showed all their eight adult teeth (73 cattle). Two cattle only had two adult teeth, nine cattle had four adult teeth, and ten had six adult teeth. No statistical difference was found among the mean burdens of each nematode for each age group of cattle. However *H. contortus* and L4s tend to be more numerous in younger animals.

Three groups of cattle were arbitrary created according to weight: cattle under 65 kg, from 66 to 85 kg, and over 86 kg. No statistical difference was found among worm burdens of each group.

The 94 cattle studied comprised 71 females and 23 males. Worm burdens did not show any statistical difference according to the sex of animals.

4. DISCUSSION

The identified cattle parasites have already been described from other parts of West Africa (Assoku, 1983; Kaufman, Pfister, 1990; Zinsstag *et al.*, 1997). In the present study it was similarly found that *H. contortus* and *T. colubriformis* were located in the abomasa, *C. punctata*, *C. pectinata*, *B. phlebotomum*, and the cestodes *M. expansa* and *Avitellina* sp. in the small intestines, and finally *O. radiatum* and *Trichuris* sp. in the large intestines. It is important however to notice that in this study 25% of the *Cooperia* adults were collected from the abomasums. Abomasal localization of *Cooperia* sp. worms has already been reported in large areas of Africa (Kaufman, Pfister, 1990; Chollet *et al.*, 2000). More studies are needed to better understand the role of abomasal worm species in digestive disorders.

From the 94 cattle examined, only one was free of any type of parasite. It can be concluded from the study that parasite infestation on cattle is very common in the area (98.9%). Single species infestation was rare (7.4%) and concerned only *Cooperia* sp. and *H. contortus*. Multiple worm species infestations were the rule (91.5%). *Cooperia* sp. worm were not only the most prevalent parasites in the central and northern area of Burkina Faso (with an annual global prevalence of 89.4%), but also the most numerically encountered in cattle (**Table 1**). Analysis of monthly parasite prevalences and levels of infestation confirmed that the rainy season (June to September) represented, as already published by several authors for other parts of the world (Soulsby, 1986; Kaufman, Pfister, 1990), a period of parasite explosion in Burkina Faso.

H. contortus showed particular biological phenomena. Adults were more prevalent and more numerous during the rainy than the dry seasons; while L4s were more prevalent and more numerous during the dry than the rainy seasons. However both adults and L4s were seen at each month of the year. These observations suggest that, as described elsewhere (Kaufman, Pfister, 1990; Soulsby, 1986), *H. contortus* survives the very difficult dry and hot season in the area of study not only in the adult stage but also by undergoing arrested development in the L4 stage.

Almost all cattle examined had *Cooperia* parasites at each month of the year. Monthly levels of infestation by *Cooperia* L4s and adults varied very similarly in successive waves except for the hot and dry season (March to June) where L4 mean numbers were very low compared to those of the adults. These observations confirmed that the phenomenon of arrested development in the L4 stage may not exist for the *Cooperia* worms in this part of Burkina Faso.

O. radiatum was collected from the cattle at all months of the year, showing their permanence in the cattle of the studied area of Burkina Faso. The other different parasite species found, *Trichuris* sp., *B. phlebotomum*, and the cestodes, were not important in the conditions of living of the cattle studied.

Unexpectedly high worm burdens specially of *Cooperia* sp. were found in adult and old animals. Protective immunity does not seem to play a big role in cattle of this area of Burkina Faso as it does in cattle of temperate climate (Fritsche *et al.*, 1993). It is therefore necessary to include adult and older animals in control campaigns to increase their productivity and decrease pasture contamination.

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