Trop. Anim. Hlth Prod. (1980) 12, 97–104

INCIDENCE OF LIVER FLUKE INFECTIONS (*FASCIOLA GIGANTICA* AND *DICROCOELIUM HOSPES*) IN RUMINANTS IN NORTHERN NIGERIA

T. W. SCHILLHORN VAN VEEN,[1] D. O. B. FOLARANMI, S. USMAN and T. ISHAYA

Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria

SUMMARY

One thousand and twenty-four cattle, 550 sheep and 1,748 goats slaughtered in a rural slaughter slab during 1973 to 1975 were examined for evidence of liverfluke infections. The prevalence rate of Fasciola gigantica *and* Dicrocoelium hospes *infections was respectively 65·4% and 56·0% in cattle, 40·8 and 13·1% in sheep and 17·6 and 5·2% in goats. Other trematodes detected were* Schistosoma bovis *and paramphistomes. The seasonal incidence of* F. gigantica *as well as of* D. hospes *was highest during and directly after the rainy season. The lower prevalence rate of* F. gigantica, *especially in the younger animals, during 1973–1974 was thought to be related to the 1973 drought. This was supported by the low prevalence rate in the long-range trade cattle which originated from drier areas. The results are discussed in relation to the climatic conditions during the survey period, as well as to the difference in epidemiology of* F. gigantica *and* D. hospes *infections in northern Nigeria.*

INTRODUCTION

Although reports exist about the prevalence of fascioliasis in cattle slaughtered in large abattoirs in Nigeria (Ferguson, 1964; Ikeme and Obioha, 1973; Babalola and Schillhorn van Veen, 1976), little is known about the seasonal and regional incidence of the disease. This is due to various reasons among which the lack of reliable data on age, infection rate and disease condition of slaughtered animals, as well as the nomadic way of life of most of the cattle and their owners which limit the possibilities of determining the specific areas where fluke infections are acquired. Moreover many animals, and often not the better ones, are slaughtered in rural slaughter slabs without veterinary supervised meat inspection. Rural slaughter slabs could however provide fairly reliable data on the history of the slaughter animals as most of the livestock slaughtered there originate directly from their owners without the use of middlemen. When small ruminants, which are often owned by settled farmers, are included in such a survey, an accurate picture may be obtained of the prevalence of fascioliasis and other diseases in the villages around the slab.

The following study was carried out in a rural slaughter slab in Soba, Zaria province, which obtained cattle and small ruminants from livestock owners in the Soba district, generally within 10 km of that village.

MATERIALS AND METHODS

During 1974 and 1975 all cattle, sheep and goats slaughtered in the Soba slab (an open concrete platform of 8 × 10 m) were recorded and sampled with the assistance of an enumerator and of the local butchers. Occasionally also the animals slaughtered

[1] Present address: Veterinary Clinical Center, Michigan State University, East Lansing, Michigan 48824, USA.

outside the slab *in extremis* or for other reasons were included. Male sheep slaughtered during Muslim festivals were excluded.

Data on cattle were collected during 1974, 1975 and during January, March and April of 1976. The small ruminants were surveyed during 1974 and from January till September of 1975; the number slaughtered after September was too small to provide any reliable information.

Records were taken of age, origin and management of the animals. The liver of each animal slaughtered was superficially examined by lay personnel. The gallbladders of the examined livers were removed, stored in a jar and brought to the Faculty. In the laboratory, the contents of the bladder were centrifuged and the sediment was examined for eggs. The number of fluke eggs found were roughly graded from 1 (very few) to 4 (over 1,000).

In small ruminants the cleaned rumen and reticulum were examined on the slaughter slab for the presence of adult paramphistomes. Rectal faecal samples were collected at regular intervals and examined for trematode eggs using a formol–ether sedimentation technique (Folaranmi, 1975). The egg counts were expressed in eggs per gram (epg). A 4% representative sample of livers was obtained from the slaughter animals and examined for flukes; in the laboratory the bile ducts were opened and the flukes removed, then the liver was sliced and all other flukes were rinsed out.

RESULTS

A total of 1,024 cattle, 550 sheep and 1,748 goats were recorded to have been slaughtered in Soba during the survey period. Respectively, 16·7% of the cattle, 32·7% of the sheep and 50% of the goats were owned by settled livestock owners; 5·5% of the cattle but very few of the small ruminants were brought in by traders. The rest of the animals were owned by semi-nomadic Fulani herdsmen (Table I).

TABLE I
Number, sex and origin of the animals slaughtered in Soba

Animals	Number examined	Origin			Sex	
		Trader	Settled	Semi-nomadic	Male	Female
Cattle	1,024	57 (5·5%)	171 (16·7%)	796 (77·8%)	778 (76%)	246 (24%)
Sheep	550	0	180 (32·7%)	370 (67·3%)	60 (10·9%)	490 (89·1%)
Goats	1,748	9 (0·5%)	909 (52%)	830 (47·5%)	828 (47·3%)	920 (52·7%)

The trade cattle were mainly slaughtered during Muslim festivals when the demand for beef was high and during the end of the dry season of 1973 to 1974 when the cattle prices in the large cattle markets like Zaria were considerably lower than in rural areas. In Soba these trade cattle constituted respectively 18·3, 11·9 20·9 and 4·5% of the cattle slaughtered in January, February, March and April of 1974.

The overall prevalence rate of *Fasciola* infected livers as detected by bile examination was 65·4% in cattle, 40·8% in sheep and 17·6% in goats. The monthly incidence varied with the highest rates during the beginning of the dry season (Figs 1 and 2). Acute fascioliasis was rarely observed, only 3 cattle showing high numbers of juvenile flukes and severe changes in the livers. Young flukes were occasionally found in small ruminants but casualties due to acute fascioliasis did not reach the slaughter slab.

Mixed infections with *Dicrocoelium hospes* were found in 45·5% of the cattle, 10·7% of the sheep and 2·9% of the goats.

The faecal egg output showed a seasonal pattern which was more or less similar to the infection rate observed by bile examination. There were no significant[2] differences in the pattern of egg output between the 3 animal species. The egg counts were highest during and directly after the wet season and lowest at the end of the dry season (Table II). The number of livers examined for flukes was too small to reveal a seasonal pattern in fluke counts (Table III). There was no significant[2] difference between the number of flukes per liver in old and young animals though the latter showed slightly heavier infections. Also, no detectable differences could be established between the number of flukes (*Fasciola* as well as *Dicrocoelium*) in single and in mixed infections.

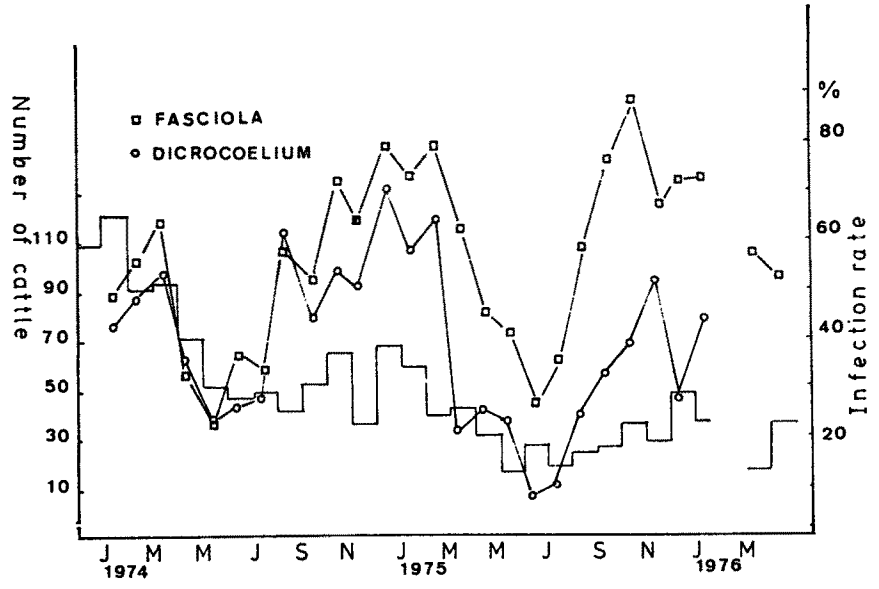

FIG. 1. Monthly incidence of *F. gigantica* and *D. hospes* in cattle slaughtered in Soba. The columns indicate the total number of animals slaughtered monthly.

Most of the livers also contained some *Schistosoma bovis* but those infected with *F. gigantica* showed more definite signs of fibrosis.

The incidence of *D. hospes* was more or less similar to that of *Fasciola* during 1974 but was considerably lower in 1975. The overall prevalence was 56% in cattle, 13·1% in sheep and 5·2% in goats. The number of flukes per liver varied from 6 to 3,680 (Table III). Detectable gross pathological changes due to *Dicrocoelium* were not observed. Most of the examined livers, however, were also infected with *F. gigantica* and the lesions caused by the latter probably overshadowed possible damage due to *D. hospes*. Livers with mixed infections did not apeear to be more severely affected than livers with *Fasciola* infections only. Paramphistomes in the small ruminants were mainly observed during the end of the dry season and beginning of the wet season. The prevalence rate was 14·3% in sheep and 11·2% in goats.

[2] Student *t*-test $P < 0{\cdot}05$.

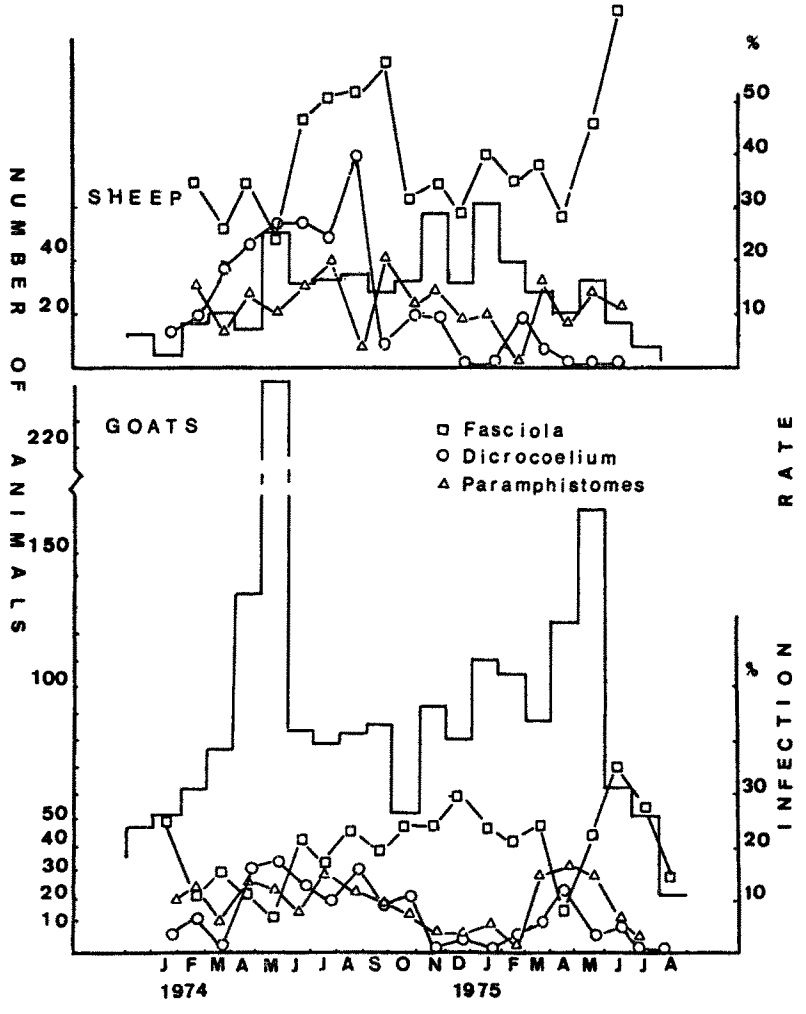

FIG. 2. Monthly incidence of *F. gigantica*, *D. hospes* and paramphistomes in sheep and goats slaughtered in Soba. The columns indicate the total number of animals slaughtered monthly

DISCUSSION

The climatic conditions in the Zaria-Soba area with a rainy season from May till September, a cool dry season from October to January and a hot dry season from February till April are well explained in other publications (Kowal and Knabe, 1974). The year 1974, following the very dry year of 1973, which was the driest during the "Sahel drought", showed a relatively short rainy season with rainfall below normal; 1975 was a normal year with the rains starting in the second decade of April and ending in the second decade of October.

The number of cattle presented for slaughter was highest during the dry season of 1973 to 1974. This was probably associated with the drought conditions during this period. The dry season of 1973 to 1974 started more than a month earlier than

usual and the available fodder (mainly standing hay) was poor in quality and quantity. The nutritional level and subsequently the health of the animals deteriorated and many animals had to be sold and slaughtered in poor condition (Jiya, 1974; Schillhorn van Veen, 1974). Cattle were especially affected and the slaughter pattern with high numbers presented for slaughter during the dry season was characteristic for the drought period. Babalola and Schillhorn van Veen (1976) in north-east Nigeria also

TABLE II
Seasonal Fasciola *egg-output in bile and faeces*

	1974			1975	
	HDS	RS	CDS	HDS	RS
Output in bile					
Sheep up to 1 year	0·84	1·36	1·19	0·81	1·5
Over 1 year	0·52	1·4	0·78	1·13	1·52
Goats up to 1 year	0·21	0·35	0·34	0·36	0·49
Over 1 year	0·28	0·75	0·44	0·39	0·71
Output in faeces					
Cattle	0·94	3·25	1·79	0·94	3·65
Sheep	1·02	4·78	1·35	1·2	10·15
Goats	0·04	0·5	0·29	0·54	1·01

HDS=hot dry season; RS=rainy season; CDS=cold dry season. The output in bile is listed as the mean grade; the faecal egg output concerns the mean epg of all slaughtered animals examined.

TABLE III
Mean number of flukes found in infected livers

	Cattle	Sheep	Goats
Fasciola gigantica			
Number of livers examined	14	10	8
Mean number and range	99 (8–548)	19 (5–57)	16 (3–39)
Dicrocoelium hospes			
Number of livers examined	14	6	3
Mean number and range	400 (8–3680)	178 (6–273)	19 (16–26)

found the highest infection rates in the dry season, especially in the beginning when the owners had to sell some animals in order to be able to pay the cattle tax. The absence of this "beginning dry-season peak" in the infection rate in this study confirms that observation, as the cattle tax has been abolished in Nigeria since 1975. Small ruminants showed a different pattern. Many animals were slaughtered just before the beginning of the rains. During this period most of the farmers and settled livestock owners are in need of cash in order to pay for farm labour, fertiliser and, in very dry years, for food. Most of this cash money is apparently obtained by selling some small ruminants.

The prevalence of *Fasciola* infected livers of 65·4% in cattle was fairly high when compared to the 38·3% in cattle in the nearby Zaria abattoir but is in accordance with the 52% detected by faecal examination in the adjacent and ecologically similar Makarfi district (Schillhorn van Veen, 1974). Large abattoirs like Zaria, however,

mainly slaughter long-range trade cattle and the infection rate with *Fasciola* in these animals originating from more northern and drier areas is lower than found in local animals. This is supported by a peculiar situation which developed at the end of the dry season of 1973–1974 when the supply of cattle from the drought-affected (Sahel) area was so high that the prices in the large cattle markets (like Zaria) dropped below the normally lower prices in the rural areas. Subsequently, the butchers in Soba bought these cheaper animals and approximately 17% of the slaughter cattle during the period January to April 1974 originated from outside the Soba area. The infection rate with large liver flukes in these animals of 8%, was considerably lower than the 61·3% in the local animals slaughtered during the same period. This high rate of 61·3% in local cattle, however, was mainly due to the contribution of the older cattle. These animals constituted 46% of the slaughtered animals during that period and showed an infection rate of 82·2% compared to 36·8% in cattle between 3 and 7 years of age and 25% in the younger animals. The higher infection rate in the older cattle is probably associated with their age and consequently longer exposure time. Moreover, the chances of acquiring fluke infections were diminished during the dry years. The higher rates in old cattle give also some support to the postulation that *F. gigantica* infections are not as well and as rapidly expelled as *F. hepatica* infections (Hammond and Sewell, 1975); most infected cattle, also the older ones, carried 50 or more *F. gigantica* in their livers.

The lower infection rates in young cattle during 1974 was probably associated with the previous drought which also reduced the populations of the snail intermediate hosts, theoretically resulting in a lowered infection pressure which could have caused a reduction in the prevalence rate in cattle as well as in the small ruminants. This reduction was less obvious in older cattle as these animals carried residual infections from previous years.

Generally, the differences in prevalence rate between cattle, sheep and goats are due to 3 reasons. Firstly, cattle achieve an older age than small ruminants and consequently their exposure time is longer. Secondly, sheep and especially goats are often confined by their owners and hand-fed; this of course greatly reduces their chances of acquiring fluke infections. Thirdly, goats and to a lesser extent sheep browse more than cattle which are basically grazers. This different grazing behaviour is probably the major reason for the low infection rate in goats. These differences in behaviour and, subsequently, infection risks elucidate the importance and possibilities of animal management in the control of fascioliasis. A fourth possibility, a lower prevalence rate associated with the fact that most small ruminants succumbed to acute fascioliasis and never reached the slab, is unlikely as such cases were not reported whereas most livestock owners were aware of the post-mortem signs of this condition.

The prevalence rate of *D. hospes* in cattle is comparable to the 58% found by Odei (1966) in Ghana, as well as by Graber and Oumatie (1964) in Cameroon. The 13·1% in sheep is slightly lower than the 22·4% observed in sheep slaughtered in Zaria during 1968 to 1969 (Kuil, 1973).

Whereas the incidence of *F. gigantica* increased during the survey period that of *D. hospes* declined. Especially among the small ruminants very few *D. hospes* infected animals were detected in 1975. The infection rate in cattle, which was nearly identical to the infection rate with *F. gigantica* during 1974, also decreased in 1975. This was mainly due to the sharp decline in the infection rate in young animals. The young cattle showed a seasonal incidence which is comparable to that in small ruminants.

Little is known about the lifecycle of *D. hospes* in West Africa. Sequin (1975) working in Togo found that the development of this fluke in the first intermediate

host, land snails of the genus *Limicolaria*, takes approximately 4 months; cercariae embedded in jelly-like slime balls were most commonly released in the rainy season just before or during periods of high rainfall. Lucius and Frank (1978), however, considered sunlight as the main trigger for shedding of slime balls. The development and survival time in the second intermediate hosts, probably ants of the genera *Dolyrus* and *Crematogaster* (Sequin, 1975) has not been established. Sequin's data indicate that the second intermediate host acquires the infection in the rainy season and, if the development time is similar to that of *D. dendriticum* (Dunn, 1978), this means that the ants are infective from the first half of the dry season onwards. Assuming that the infected ants are found in the same environment as the snails would mean that the ruminants acquire the infections not too far from suitable land snail habitats. *Limicolaria* spp. are generally located in fairly cool and shady places with a moist soil type. Such places are rare in the Soba area but are more common in the adjacent foothills of the Jos Plateau and around the inselbergs which are scattered all over the Zaria area.

These places, however, were also drier than normal during the 1973–1974 drought and indeed, although no quantitative records were taken, the land snails were less commonly observed during the drought than before. This reduction in the population of the first intermediate host could explain the reduction in the incidence of *Dicrocoelium* infections in small ruminants and young cattle. Due to the longevity of the flukes the incidence in adult cattle did not change significantly. It can be speculated that the recovery of the *Dicrocoelium* population involving 2 intermediate hosts is slower than that of *Fasciola* in which only 1 intermediate host, which is probably faster proliferating, is required.

Although the prevalence of paramphistomes in the stomach of small ruminants was fairly low, a pattern with the highest incidence during the end of the dry season and beginning of the wet season could be recognised. The pattern is in accordance with the limited information on *Paramphistomum* infections in the Zaria area, of which an outbreak was reported during the middle of the dry season in February 1974 (Schillhorn van Veen and Bida, 1975). The increase in the incidence during the end of the dry season appears, at least in goats (Fig. 2), 2 months earlier than the increase in the incidence of *Fasciola* infections. This is in accordance with the known information on the lifecycle of both flukes; *Fasciola* infections become clinically evident after approximately 2 to 3 months compared to 3 to 5 weeks in heavy *Paramphistomum* infections. This indicates that the increases in prevalence rates, as detected by egg output, of both fluke species is due to recently acquired infections and not to "flare-ups" of existing infections.

ACKNOWLEDGEMENTS

The authors wish to thank the Sarkin Pawa and Soba butchers for their kind co-operation and Ml. Audu Magaji Soba for his assistance. The constructive comments of Drs J. Armour and H. J. Over were highly appreciated. This study was supported by a grant from the Netherlands Foundation for the Advancement of Tropical Research.

Accepted for publication July 1979

REFERENCES

BABALOLA, D. A. & SCHILLHORN VAN VEEN, T. W. (1976). *Tropical Animal Health and Production*, **8**, 243–247.

DUNN, A. M. (1978) **Veterinary Helminthology**, 2nd edn, Heinemann, London.

FERGUSON, W. (1964). *Bulletin of Epizootic Diseases of Africa*, **12**, 331–338.

FOLARANMI, D. O. B. (1975). The comparative efficiency of egg concentration methods for the recovery of fluke and schistosome ova. Communication at Meeting of the Nigerian Society for Laboratory Technologists, Zaria, 1975.
GRABER, M. & OUMATIE, O. (1964). *Revue d'elevage et de médicine vétérinaire des pays tropicaux*, **17**, 523–533.
HAMMOND, J. A. & SEWELL, M. M. H. (1975). *Tropical Animal Health and Production*, **7**, 105–113.
IKEME, M. M. & OBIOHA, F. (1973). *Bulletin of Epizootic Diseases of Africa*, **21**, 259–264.
JIYA, M. (1974). *Nigerian Journal of Animal Production*, **1**, 17–23.
KUIL, H. (1973). Gastro-intestinal nematodes in sheep in the Zaria area of northern Nigeria. Mimeo, Institute Tropical Diseases, Utrecht and Department of Parasitology, Ahmadu Bello University, Zaria.
KOWAL, J. & KNABE, M. (1974). **An Agroclimatological Atlas of Northern Nigeria**, Ahmadu Bello University Press, Zaria.
LUCIUS, R. & FRANK, W. (1978). *Acta tropica*, **35**, 161–181.
ODEI, M. A. (1966). *Annals of Tropical Medicine and Parasitology*, **60**, 215–218.
SCHILLHORN VAN VEEN, T. W. (1974). *Nigerian Journal of Animal Production*, **1**, 231–236.
SCHILLHORN VAN VEEN, T. W. & BIDA, S. A. (1975). Proceedings XXth World Veterinary Congress, Thessaloniki, pp. 519–520.
SEQUIN, D. (1975). Contribution à l'étude des distomatoses hépato-biliaires des ruminants au Togo. Thesis, Ecole Nat. Vétérinaire de Lyon.

INCIDENCE DE LA DISTOMATOSE (*FASCIOLA GIGANTICA* ET *DICROCOELIUM HOSPES*) CHEZ LES RUMINANTS DE NIGERIA DU NORD

Résumé—1 024 bovins, 550 moutons et 1 748 chèvres abattus dans les abattoirs ruraux de 1973 à 1975 ont été examinés pour l'étude des affections hépatiques à trématodes. La répartition moyenne des infections à *Fasciola gigantica* et à *Dicrocoelium hospes* a respectivement été de 65,4 p. 100 et 56 p. 100 chez les bovins, de 40,8 p. 100 et de 13,1 p. 100 chez les moutons, et de 17,6 p. 100 et 5,2 p. 100 chez les chèvres. Les autres trématodes mis en évidence ont été *Schistosoma bovis* ainsi que des paramphistomes. L'incidence saisonnière de *Fasciola gigantica* tout comme celle de *Dicrocoelium hospes* a été plus élevée durant et directement après la saison des pluies. Le niveau plus bas de *Fasciola gigantica* spécialement chez les animaux les plus jeunes durant 1973–1974 paraît être en relation avec la sécheresse de 1973, de qui semble être confirmé par le taux peu élevé observé chez le bétail de commerce originaire des régions les plus sèches.

Les résultats observés sont discutés en relation avec les conditions climatiques dominantes durant la période de l'enquête aussi bien qu'en fonction des différences épidémiologiques des infections à *Fasciola gigantica* et *Dicrocoelium hospes* en Nigeria du Nord.

INCIDENCIA DE INFECCIONES POR DISTOMA HEPATIOC (*FASCIOLA GIGANTICA Y DICROCOELIUM HOSPES*) EN RUMIANTES EN EL NORTE DE NIGERIA

Resumen—Con el propósito de estudiar la prevalencia e incidencia de infecciones por fasciola, se examinaton 1·024 bovinos, 550 ovinos y 1·748 caprinos, en un matadero—laboratorio en el norte de Nigeria. El estudio tuvo lugar en el año 1973 y se prolongó en el 74 y 75. La tasa de prevalencia de las infecciones por *Fasciola hepatica* y *Dicrocoelium hospes* fue respectivamente 65·4% y 56·0% en bovinos, 40·8% y 13·1% en ovinos y 17·6% y 5·3% en caprinos. Otros tremàtodos encontrados fueron *Schistosoma bovis* y paranfistomus.

La incidencia estacional de *F. gigantica* y de *D. hospes* fue alta durante y directamente despues de la estación lluviosa. La tasa de prevalencia más baja de *F. gigantica* especialmente en animales pequeños, durante 1973 y 74, parece estuvo relacionada con la seuía de 1973. La prevalencia baja encontrada en ganado comercial proveniente de regiones más secas, le dá fuerza a esta hipótesis.

Los resultados se discuten en relación con las condiciones climáticas encontradas durante la encuesta y a las diferencias epidemiológicas de *F. gigantic* y *D. hospes* en el norte de Nigeria.