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PARASITES OF DOMESTIC AND WILD ANIMALS IN SOUTH AFRICA. VII. HELMINTHS IN PIGS SLAUGHTERED AT THE PRETORIA MUNICIPAL ABATTOIR*

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Abstract

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A total of 52 pigs slaughtered at the Pretoria Municipal Abattoir over a period of 1 year was examined for parasitic helminths.

Twenty-six of these pigs were marketed by farmers and 26 by speculators. Of the pigs marketed by farmers 73,1% were found to be infested:—30,8% with *Ascaris suum*, 65,4% with *Ascarops strongylina*, 3,8% with *Metastrongylus apri*, 26,9% with *Oesophagostomum* spp., 15,4% with *Trichostrongylus colubriformis* and 15,4% with *Trichuris suis*. All the pigs marketed by speculators were infested:—7,7% with *A. suum*, 92,3% with *A. strongylina*, 11,5% with *Oesophagostomum* spp., 65,4% with *Physocephalus sexalatus*, 7,7% with *T. colubriformis* and 11,5% with *T. suis*.

The findings obtained in surveys conducted in Canada, Greece, India, the Philippines, the United Kingdom and the United States of America are quoted for comparison.

Trichostrongylus colubriformis and *Oesophagostomum quadrispinulatum* are recorded for the first time in pigs in the Republic of South Africa.

Résumé

PARASITES DES ANIMAUX DOMESTIQUES ET SAUVAGES EN AFRIQUE DU SUD. VII. HELMINTHES DE PORCS ÉGORGÉS À L'ABATTOIR MUNICIPAL DE PRETORIA

On a recherché les helminthes chez un total de 52 porcs, pris parmi ceux égorgés à l'abattoir municipal de Pretoria dans le courant d'une année. 26 de ces porcs avaient été mis sur le marché par des fermiers et les 26 autres par des spéculateurs.

73,1% des porcs vendus par les fermiers ont été trouvés infestés: 30,8% *par* Ascaris suum, 65,4% *par* Ascarops strongylina, 3,8% *par* Metastrongylus apri, 26,9% *par* Oesophagostomum *spp.*, 15,4% *par* Trichostrongylus colubriformis *et* 15,4% *par* Trichurus suis. *Tous les porcs venant des spéculateurs étaient infestés:* 7,7% *par* A. suum, 92,3% *par* A. strongylina, 11,5% *par* Oesophagostomum *spp.*, 65,4% *par* Physocephalus sexalatus, 7,7% *par* T. colubriformis *et* 11,5% *par* T. suis.

Les résultats d'enquêtes menées au Canada, en Grèce, en Inde, aux Philippines, au Royaume-Uni et aux Etats-Unis d'Amérique sont cités aux fins de comparaison.

C'est la première fois qu'on enregistre en Afrique du Sud la présence chez des porcs de Trichostrongylus colubriformis *et d'*Oesophagostomum quadrispinulatum.

Introduction

Helminth infestations in pigs based on worm recovery at necropsy have been determined in Canada (Martin, Gibbs & Pullin, 1974), Denmark (Jacobs, 1967), Greece (Himonas & Triantaphyllou, 1972), India (Sinha, 1968a, b), Papua, New Guinea (Talbot, 1972), the Philippines (Tongson, Castillo, Arambulo & Sarmiento, 1971), the United Kingdom (Morgan, 1924; Jenkins & Erasmus, 1963; Jacobs & Dunn, 1969) and the United States of America (Andrews & Connelly, 1945; Goldsby & Todd, 1957; Gaafar, 1961; Bennett & Copeman, 1970; Riddle & Forrester, 1972). In South Africa a check-list of the parasites of the domestic pig was published by Mönnig (1928), and Ortlepp (1964) has described some of the helminths parasitic in bushpigs and warthogs, but no actual surveys have been conducted in this country.

At the Pretoria Municipal Abattoir a large number of pigs originating from virtually the entire province of the Transvaal and part of the northern Orange Free State are slaughtered daily. Of the pigs marketed by farmers, most have usually been subjected to some form of confinement during market preparation. Speculators, on the other hand, generally purchase pigs on free range and market them directly.

This readily available source of material presented the opportunity for determining the nature and incidence of helminth parasitism in pigs and the present paper describes the findings of a survey conducted over a period of 1 year at this abattoir.

Materials and Methods

The lungs, livers and gastro-intestinal tracts of 2 pigs were collected from the abattoir at intervals varying from 7–20 days from March 1968 to February 1969. During the last 5 months of the survey the stomachs only of an additional 2–4 pigs were collected on each occasion. As a rule only pigs with a live mass of less than 100 kg were considered for survey purposes because of the greater difficulty in processing the organs of larger pigs for worm recovery, but when stomachs only were collected pigs with a mass of up to 220 kg were included.

The lungs, livers and the contents of the gastro-intestinal tracts were processed in a modified Baermann apparatus in a waterbath, and scrapings of the gastro-intestinal mucosa were subjected to pepsin/HCl digestion as described for the recovery of nematodes and liver fluke of sheep (Reinecke, 1967; Horak & Pienaar, 1972; Horak, Snijders & Louw, 1972). Because the digested tissue yielded nothing but a few immature *Ascarops strongylina* during the first 8 months of the survey, the mucosae of the stomachs only were scraped, these scrapings being added to the stomach ingesta and processed in the waterbath.

* This survey was conducted while the author was employed at the MSD Research Centre, Hennops River

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Worm burdens were calculated from total microscopic or macroscopic worm counts and from counts made on 2×1/10th or 1/20th aliquots of the ingesta of the various organs.

The 3rd stage parasitic larvae of *A. strongylina* and *Physocephalus sexalatus* were identified from the descriptions of Alicata (1935) for the 3rd stage infective larvae.

The stomachs of most of the pigs were also examined for lesions of ulceration.

Results

For purposes of comparison, the worm burdens of pigs marketed by farmers are tabulated separately from those marketed by speculators. Comparisons are also made between the findings of this survey and those in other countries.

The mean worm burdens of pigs marketed by farmers and by speculators are summarized in Table 1.

The frequency of infestation and the mean worm burdens of *Trichostrongylus colubriformis, Ascaris suum, Oesophagostomum* spp. (*Oesophagostomum dentatum* and *Oesophagostomum quadrispinulatum*) and *Trichuris suis* were greater in the pigs marketed by farmers than in those marketed by speculators. The converse, however, was true for *A. strongylina, Physocephalus sexalatus, Cysticercus cellulosae* and *Cysticercus tenuicollis.*

One of the pigs, originating from a farm in the Belfast district of the eastern Transvaal Highveld and marketed by a farmer, harboured 244 adult *Metastrongylus apri.* All the other pigs marketed by farmers were consigned from farms in the Pretoria district or in the northern Transvaal.

One of the pigs, marketed by a speculator, was infested with *C. cellulosae* and also harboured an *Echinococcus* sp. cyst. It was impossible to trace the districts from which speculators bought their pigs because they refused to divulge this information.

The results of this survey and those in other countries are compared and summarized in Table 2.

The overall incidence of infestation in the pigs of farm origin was lower than that recorded in other surveys, while the 100% infestation of the pigs from speculators compares with that of some of the surveys conducted in the United States of America.

The incidence of *A. suum, Oesophagostomum* spp. and *T. suis* infestation was generally lower than that encountered elsewhere, particularly in the pigs marketed by speculators. These pigs, however, had a higher incidence of *A. strongylina* and *P. sexalatus* than that recorded in any other survey. Infestations with *Globocephalus* spp., *Hyostrongylus rubidus, Macracanthorhynchus hirudinaceus* or *Strongyloides ransomi* were not present in any of the pigs examined in the present survey.

TABLE 1 The mean worm burdens of pigs slaughtered at the Pretoria Municipal Abattoir

Source	Farmers			Speculators			Farmers			Speculators		
No. of pigs examined	26			26			22			20		
Live mass	20–100 kg			30–90 kg			25–220 kg			30–55 kg		
Organs examined	Gastro-intestinal tract			Gastro-intestinal tract			Stomach			Stomach		
	No. infested	Worm burden		No. infested	Worm burden		No. infested	Worm burden		No. infested	Worm burden	
		Mean	Range		Mean	Range		Mean	Range		Mean	Range
Helminth species												
A. strongylina												
Immature worms	5	6	0–90	9	31	0–475	2	1	0–11	13	476	0–5441
Adults	16	54	0–1 130	24	313	0–2 030	11	17	0–125	18	198	0–978
P. sexalatus												
Immature worms	0	0	0	2	4	0–80	0	0	0	0	0	0
Adults	0	0	0	17	39	0–319	1	<1	0–3	10	11	0–71
T. colubriformis												
Adults	4	2	0–26	2	1	0–20	—	—	—	—	—	—
A. suum												
4th stage larvae	2	1	0–11	0	0	0	—	—	—	—	—	—
Adults	7	2	0–15	2	<1	0–3	—	—	—	—	—	—
Oesophagostomum spp.												
4th stage larvae	2	11	0–280	0	0	0	—	—	—	—	—	—
O. dentatum												
Adults	7	124	0–1 760	3	27	0–702	—	—	—	—	—	—
O. quadrispinulatum												
Adults	2	69	0–1 203	1	1	0–32	—	—	—	—	—	—
T. suis												
Immature worms	2	<1	0–2	0	0	0	—	—	—	—	—	—
Adults	4	1	0–15	3	1	0–8	—	—	—	—	—	—
C. cellulosae	0	0	0	2	—	—	—	—	—	—	—	—
C. tenuicollis	0	0	0	2	—	—	—	—	—	—	—	—

TABLE 2 The incidence of helminth infestations in pigs determined in various surveys

Item	Percentage of pigs infested														
	Canada		Greece	India	United Kingdom				United States of America					South Africa	
	Québec Québec Martin *et al.* (1974)		Northern Greece Himonas & Triantaphyllou (1972)	Bihar Sinha (1968a)	Wales Jenkins & Erasmus (1963)	Scotland Scotland Scotland Jacobs & Dunn (1969)			South Eastern States Spindler (1934)*	Wisconsin Goldsby & Todd (1957)	Indiana Gaafar (1961)	Indiana Bennett & Copeman (1970)	South Carolina Riddle & Forrester (1972)	Transvaal Farmers	Transvaal Speculators
Mass/Age of pigs.....	Market mass	Mature swine	—	—	—	41 kg	72 kg	Adults	—	Market mass	<110 kg	16,1 kg	Brood sows & market hogs	<100 kg	<90 kg
All helminths.....	—	—	—	—	88,9	—	—	—	100,0	100,0	79,2	95,1	—	73,1	100,0
Ascaris.....	38,9	2,9	36,7	23,4	40,7	34,2	28,6	11,4	74,0	65,4	48,4	64,6	0,0	30,8	7,7
Ascarops.....	0,0	0,0	11,4	55,5	0,0	0,0	0,0	0,0	53,0	46,5	17,4	19,1	43,0	65,4	92,3
Globocephalus.....	0,0	0,0	14,6	0,0	0,0	0,0	0,0	1,4	11,0	0,0	0,0	1,6	0,0	0,0	0,0
Hyostrongylus.....	0,0	35,3	0,0	0,0	0,0	0,0	0,0	50,7	15,0	49,5	22,6	0,0	0,0	0,0	0,0
Macracanthorhynchus.....	0,0	0,0	3,2	0,0	0,0	0,0	0,0	0,0	25,0	5,9	3,7	6,1	7,0	0,0	0,0
Metastrongylus.....	NE	NE	43,1	2,0	40,7	NE	5,6	15,0	69,0	55,8	NE	NE	23,0	3,8	0,0
Oesophagostomum.....	25,6	67,6	32,4	>81,0	40,0	67,0	43,0	94,0	100,0	77,2	51,9**	47,1	57,0	26,9	11,5
Physocephalus.....	0,0	0,0	20,0	44,2	0,0	0,0	0,0	0,0	47,0	19,8	2,2	1,2	14,0	0,0	65,4
Strongyloides.....	0,0	0,0	9,7	0,0	0,0	0,0	0,0	0,0	26,0	13,9	0,0	NE	NE	0,0	0,0
Trichostrongylus.....	0,0	0,0	14,6	0,0	0,0	0,0	0,0	1,4	0,0	0,0	0,0	NE	0,0	15,4	7,7
Trichuris.....	13,3	0,0	6,5	4,6	63,6	42,0	29,4	14,3	23,0	13,9	NE	77,2	15,0	15,4	11,5

NE—Not examined

* Cited by Bennett & Copeman (1970)

** Based on lesions in the intestinal wall or parasites in the contents

TABLE 3 The incidence of stomach helminth infestations in pigs

Country	No. of stomachs examined	Incidence of infestation %				
		A. strongylina	*P. sexalatus*	*H. rubidus*	*S. paradoxa*	*G. doloresi*
India (Sinha, 1968b)	154	56,5	44,2	0,0	29,9	0,0
Philippines (Tongson *et al.*, 1971)	1 011	45,1	3,0	23,4	0,0	2,3
S.A. Farmers	48	58,3	2,1	0,0	0,0	0,0
S.A. Speculators	46	91,3	58,7	0,0	0,0	0,0

S.A.—South African

The combined results of all the pig stomachs examined in this survey and those of surveys conducted in India and the Philippines, in which stomachs only were examined, are summarized and compared in Table 3.

The incidence of infestation with *A. strongylina* in the farm pigs (58,3%) was similar to that encountered in India (56,5%) and the Philippines (45,1%), while that of *P. sexalatus* (2,1%), though similar to that in the Philippines (3,0%), was considerably less than that in India.

The incidence of the above parasites in the pigs marketed by speculators exceeded that in both India and the Philippines.

Simondsia paradoxa was encountered in India and *H. rubidus* and *Gnathostoma doloresi* in the Philippines, but were absent in this survey.

Discussion

The pigs originating from farms could have been subjected to various forms of management and housing. They would most probably have been kept in concrete-floored pens, regularly or irregularly cleaned, or on earth in small or large pens, in large paddocks with or without vegetation, or on free range.

The pigs marketed by speculators, however, would probably have been reared in the most primitive conditions either on earth floors in large pens, in paddocks or on free range.

Housing pigs in concrete-floored pens which are regularly cleaned should eliminate the possibility of helminth infestation. The stomach worms, *A. strongylina* and *P. sexalatus,* are notable exceptions because dung-beetles, their intermediate hosts, could readily enter or leave the pens.

In small earthern-floored pens the chances of *A. suum* and *T. suis* infestation are much greater as infestation is concentrated in a small area and pigs are inclined to root in the earth of these pens and thus readily ingest the eggs containing infective larvae.

Large pens or paddocks favour all types of nematode infestation, but, because of the more extensive form of confinement, *A. suum* and *T. suis* will play a lesser role, as pig faeces and hence infestation may be concentrated in the pigs' dunging area and only become disseminated as the dung breaks up and is spread. The larvae of *Trichostrongylus* spp. and *Oesophagostomum* spp. will have a better chance of reaching the infective stage under these conditions, whereas in smaller pens they would either be eaten, trampled, exposed to direct sunlight or buried before reaching this stage of development.

On free range, pig excreta will usually be deposited in certain selected dunging areas and the dung-beetles, which serve as intermediate hosts of the larvae of *A. strongylina* and *P. sexalatus,* will afford these species greater chance of survival until they have reached the infective stage than would be the case in a more confined space. In addition, human and canine excreta are frequently present on free range, and in this way pigs may become infested with tapeworm cysts.

The stomach worm *H. rubidus* was recovered in many of the overseas surveys and the results of those conducted in Scotland by Jacobs & Dunn (1969) and the United States of America by Bennett & Copeman (1970) suggest that it is a parasite of older pigs. This is true for adult pigs in Scotland, but in the United States *H. rubidus* has been found in young pigs by the time they have reached a mass of 90 kg. Few pigs of breeding mass were examined in the present survey and therefore the presence of this nematode cannot be excluded, although there is no previous record of its recovery in South Africa.

Third stage parasitic larvae of *A. strongylina* or *P. sexalatus* were recovered from 13 pigs in this survey and they are included in the immature worm burdens of these species summarized in Table 1.

The recovery of *T. colubriformis* is a new record for pigs in South Africa. The infestation of 6 of the pigs examined indicates that *T. colubriformis* is fairly common and that its presence must have been overlooked rather than that it has only recently acquired the pig as a host. It was recorded for the first time in pigs in Hungary, however, by Kotlán & Von Mócsy (1933); in Britain by Dunn & Jacobs (1966) and in Greece by Himonas & Triantaphyllou (1972).

Though the recovery of *O. quadrispinulatum* is a new record for South Africa, it is probable that this helminth occurs as widely in pigs in South Africa as in England (Taffs, 1967).

The lungworm *M. apri* is a new record for the Transvaal. It is interesting that the only pig found to be infested with this parasite in this survey came from a district of the Transvaal where the climate is generally considerably cooler and moister than that in the remainder of the Province since, according to Rose (1959), it generally prefers cool and moist conditions.

Six of the 36 stomachs of pigs marketed by farmers examined for ulceration were found to be affected, while 19 of the 46 stomachs of pigs marketed by speculators had lesions. It was at first thought that these lesions were caused by infestations with *A. strongylina* and *P. sexalatus,* but they were frequently encountered in pigs harbouring no worms, while a pig with more than 5 800 stomach worms exhibited no visual gastric abnormalities. These stomach ulcers

were probably due to one or more of the numerous causes listed by Kowalczyk (1969) in a review of the aetiology of gastric ulcers in swine.

The high incidence of stomach ulceration in the pigs marketed by speculators could possibly be traced to 2 factors; first, these pigs are generally subjected to a low level of nutrition and, second, pigs from various sources, purchased, transported and even housed together for a short period prior to marketing, are subjected to conditions of severe stress (Kowalczyk, 1969).

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