Chapter 3 Helminth occurrence in dogs from resource-limited communities in Boksburg, Gauteng Province

3.1 **Background:** Boksburg is an urban community in Gauteng; the town centre is situated at 28°18'E; 26°12'S. The surrounding veld type is the central version of Bankenveld (Acocks, 1975) with sour grass, sandy soil, an annual rainfall of 700-750 mm and frosty winters.

The low-income informal settlement suburbs around the business and older residential areas were targeted mainly because it was desirable to collect samples from animals which had not received worm control interventions (i.e., not been treated with deworming remedies) and to interview their owners.

Figs. 3.1 and 3.2 represent maps of the sampling area. The purpose of the interviews was to assess the management of the dog and environment where they were kept. This

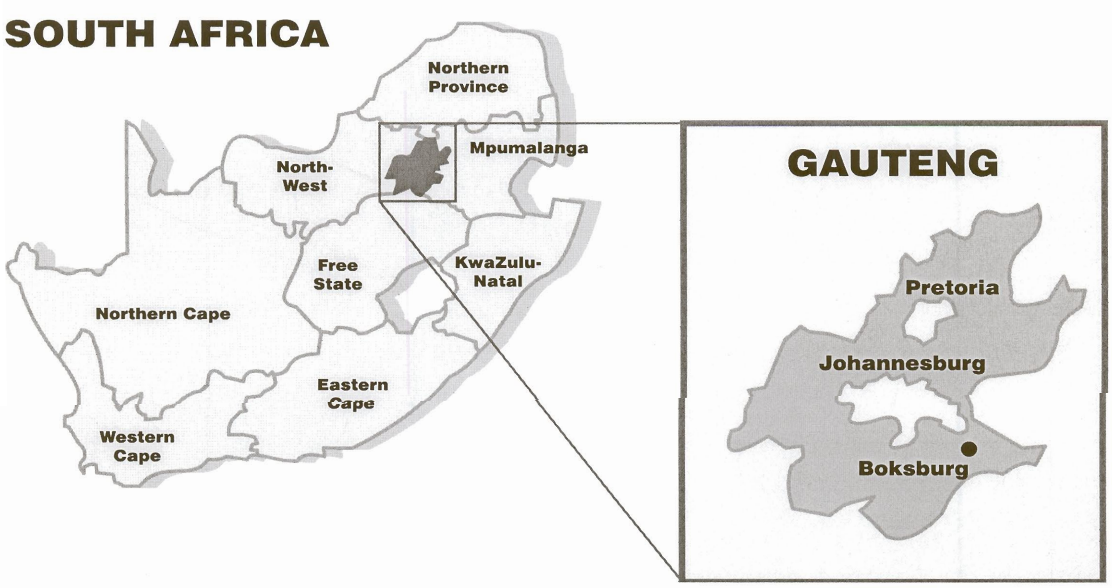


Fig. 3.1 **The geographic locality of Boksburg in Gauteng Province**

was particularly useful as exposure to the common problems the residents of poor communities have with their dogs created a better understanding as to what extent their everyday life contributed to the level of parasitism and overall health of their dogs.

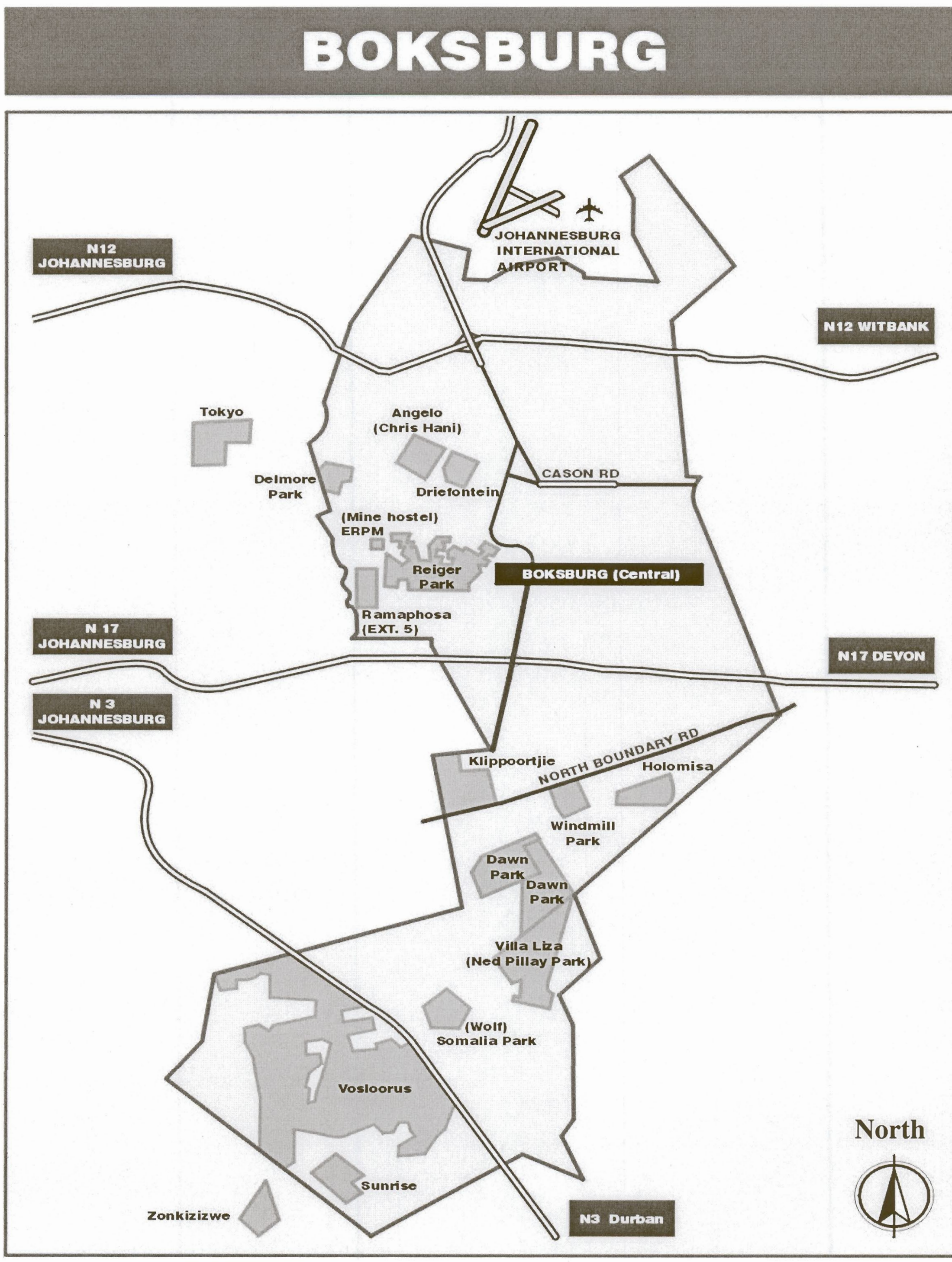


Fig. 3.2 **Area map of Boksburg**

The communities visited (Fig. 3.2) were: Tokyo, Angelo, Delmore Park, Driefontein, ERPM (Mine hostel), Reiger Park, Boksburg Central, Ramaphosa (Ext. 5), Klippoortjie, Holomisa, Windmill Park, Dawn Park, Villa Liza, Wolf (Somalia Park), Vosloorus, Sunrise and Zonkizizwe.

The residents were mostly African. They were largely Zulu or Sotho speaking, although some also spoke Tsonga, Xhosa or Setswana. A number were illegal immigrants from Zimbabwe and Mozambique, and many were unemployed.

3.2 **Materials and methods:** This was a long-term cross-sectional study. The sampling period was from 30 April 1997 - 27 May 1998. Information on and samples from the live animal (Chapter 2) were obtained during visits to the residents (Fig. 3.3) in the resource-limited communities surrounding Boksburg, and included: questionnaires, blood samples, adhesive tape swabs and faecal samples. Impounded, homeless dogs were euthanazed by the SPCA and the following samples were collected monthly at necropsy examination: blood samples, adhesive tape swabs, faecal samples and organ samples.

Fig 3.3 **Interviewing dog-owners in Holomisa, outside Boksburg**

3.3 **Results:** The results of the blood sample analyses of 132 dogs and the adhesive tape swab results of 148 dogs are given in Table 3.1. The total numbers and species of helminths recovered from 69 dogs that were examined at necropsy from the Boksburg area are in Table 3.2. Figs. 3.4 - 3.8 give the results of helminth species identified in 164 faecal samples and 69 necropsies from dogs in Boksburg. A total of 163 faecal flotations were performed, and *Ancylostoma* spp. eggs were observed in 77.3%.

Of all the statistical procedures applied to the data in this chapter, there were few significant differences between the means of the data categories. Those that were positively infected included significantly increased incidences of *T. canis* in the pup age group (P=0,0001) and *D. caninum* during the summer months (P=0,0233).

It is well documented that *T. canis* occurs more commonly in pups (Holland et al., 1991; Jacobs et al., 1994; Woodruff, 1975) than in adult dogs; this is supported by the Boksburg findings (P=0,0001).

The only breed difference found with regard to helminth parasite incidence, was a higher tendency of infection with *A. caninum* in Boel-type breeds compared to all other breeds (P=0,0001), and terrier breeds compared to the breed-types of sheepdogs, retrievers, toy dogs and crossbreeds (P=0,0001 throughout) in Boksburg.

Table 3.1 **Number and results of blood samples and adhesive tape swabs examined in dogs from Boksburg**

Test	Number tested	Number positive	Percentage (%)
Thin blood smears (Diff Quick)	132	1 (*Babesia canis*)	0.8
Thick blood smears (Giemsa)	132	0	0
Blood filters	132	3 *Dipetalonema reconditum*	2.3
Adhesive tape swabs	148	3 *Dipylidium caninum*	2.0
		3 Taeniid	2.0
		2 *Toxocara canis*	1.4

Table 3.2 **Helminth species recovered from 69 necropsy examinations of dogs in Boksburg**

Date	Dog number	*Ancylostoma caninum*		*Ancylostoma braziliense*		*Toxocara canis*		*Toxascaris leonina*		*Spirocerca lupi*		*Trichuris vulpis*		*Dipylidium caninum* (scoleces)	*Joyeuxiella pascualei* (scoleces)	*Taenia* spp. (scoleces)
		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀			
28/05/1997	2.2	28	33	1	3	0	0	0	1	0	0	0	0	3	0	0
28/05/1997	2.3	10	21	0	0	2	1	0	0	0	0	0	0	0	0	0
25/06/1997	3.1	26	42	0	0	0	0	1	2	0	0	0	0	1	0	0
25/06/1997	3.2	2	4	0	0	1	0	0	0	0	0	0	0	4	0	0
25/06/1997	3.3	3	7	0	0	0	0	0	0	0	0	0	0	3	0	0
25/06/1997	3.4	53	68	4	11	0	0	0	0	0	0	0	0	1	0	0
09/07/1997	R1	51	75	0	0	2	0	0	0	2	0	0	0	2	0	1
09/07/1997	R2	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0
09/07/1997	R3	3	6	0	0	4	3	0	0	0	0	0	0	0	0	0
30/07/1997	4.1	3	1	0	0	3	0	0	0	0	0	0	0	0	0	0
30/07/1997	4.2	1	0	0	0	2	1	0	0	0	0	0	0	8	0	0
30/07/1997	4.3	53	95	0	0	0	0	0	0	0	0	0	0	6	0	0
30/07/1997	4.4	3	4	0	0	0	0	0	0	125	18	0	0	6	0	0
27/08/1997	5.1	27	42	1	2	0	0	0	0	4	14	0	0	0	0	0
27/08/1997	5.2	122	152	2	2	0	0	12	4	0	0	0	0	0	0	0
27/08/1997	5.3	37	44	10	15	0	0	0	0	28	16	0	0	110	0	0
27/08/1997	5.4	17	31	0	0	0	0	0	0	0	0	0	0	0	0	0
27/08/1997	5.5	16	20	0	0	2	0	0	0	7	0	1	0	16	0	0
27/08/1997	5.6	26	21	9	11	0	0	0	0	0	0	0	0	64	0	0
27/08/1997	5.7	47	89	9	3	0	0	6	0	20	0	0	1	11	0	0
27/08/1997	5.8	10	7	2	2	0	0	0	0	0	0	0	0	9	0	0
27/08/1997	5.9	165	223	35	8	0	0	0	0	0	0	0	0	0	0	0
27/08/1997	5.10	10	25	0	0	0	0	0	0	0	0	0	0	0	0	0
27/08/1997	5.11	1	1	0	0	22	0	0	0	0	0	0	0	0	0	0
27/08/1997	5.12	1	3	0	0	20	0	0	0	0	0	0	0	0	0	0
27/08/1997	5.13	3	7	0	0	31	0	0	0	0	0	0	0	0	0	0
01/10/1997	6.1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
01/10/1997	6.2	1	1	0	0	0	0	0	0	0	0	0	0	0	38	0
05/11/1997	7.1	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0
05/11/1997	7.2	4	3	2	2	0	0	0	0	0	0	0	0	0	0	0
05/11/1997	7.3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03/12/1997	8.1	1	2	0	0	0	0	0	0	0	0	0	0	32	0	0
03/12/1997	8.2	28	36	0	0	10	0	0	0	0	0	0	0	0	39	0
03/12/1997	8.3	3	11	3	3	0	0	0	0	0	0	0	0	9	0	0

Table 3.2 **Helminth species recovered from 69 necropsy examinations of dogs in Boksburg (continued)**

03/12/1997	8.4	39	48	0	0	7	9	0	0	0	1	0	0	0	0	0
03/12/1997	8.5	4	6	0	0	13	10	0	0	0	0	0	0	0	0	0
03/12/1997	8.6	3	8	0	0	0	0	0	0	0	0	0	0	2	0	0
03/12/1997	8.7	2	6	0	0	19	16	0	0	0	0	0	0	0	0	0
03/12/1997	8.8	35	33	0	0	11	10	0	0	0	0	0	0	0	0	0
03/12/1997	8.9	45	53	0	0	10	3	0	0	0	0	0	0	0	0	0
07/01/1998	9.1	52	50	0	0	0	0	0	0	0	0	0	0	23	0	0
07/01/1998	9.2	27	21	2	0	4	5	0	0	0	0	0	0	130	0	1
07/01/1998	9.3	0	0	0	0	44	57	0	0	0	0	0	0	0	0	0
07/01/1998	9.4	0	0	0	0	48	42	0	0	0	0	0	0	0	0	0
07/01/1998	9.5	4	4	1	0	0	0	0	0	0	0	4	1	42	0	0
07/01/1998	9.6	0	3	0	0	0	0	0	0	0	0	0	0	29	0	0
07/01/1998	9.7	0	1	0	0	9	13	0	0	0	0	0	0	0	0	0
25/02/1998	11.1	4	5	0	0	1	1	0	0	0	0	0	0	30	0	0
25/02/1998	11.2	7	4	0	0	0	0	0	0	6	0	0	0	5	0	0
25/02/1998	11.3	0	7	0	0	3	1	0	0	3	0	0	0	288	0	0
25/02/1998	11.4	623	977	0	0	0	0	0	0	6	7	0	0	0	0	0
25/02/1998	11.5	54	40	0	0	7	0	0	0	0	0	0	0	0	0	0
25/03/1998	12.1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25/03/1998	12.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25/03/1998	12.3	7	12	0	0	0	0	0	0	0	0	0	0	0	0	0
25/03/1998	12.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25/03/1998	12.8	24	35	0	0	0	0	0	0	0	0	0	0	67	0	0
25/03/1998	12.9	7	7	0	0	0	3	0	0	0	0	0	0	0	0	0
25/03/1998	12.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25/03/1998	12.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25/03/1998	12.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25/03/1998	12.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27/05/1998	14.1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
27/05/1998	14.2	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0
27/05/1998	14.3	18	31	0	0	0	0	0	0	0	0	0	0	0	0	0
27/05/1998	14.4	3	5	0	1	0	0	0	3	0	0	0	0	57	0	1
27/05/1998	14.5	29	50	0	0	0	0	0	0	0	0	2	6	0	96	0
27/05/1998	14.6	182	203	0	0	0	0	8	11	0	0	0	0	0	0	0
27/05/1998	14.7	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	69	1 944	2 698	81	63	276	175	27	21	197	56	7	8	959	174	3

Fig. 3.4 Helminth parasite species identified in faecal flotations of dogs (n=164) from Boksburg

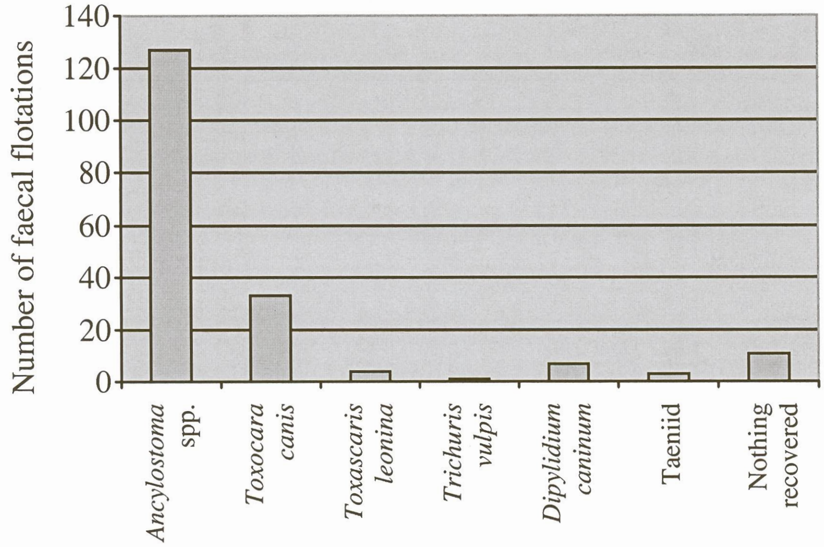


Fig. 3.5 Mean number of nematodes recovered per infected dog necropsied in Boksburg

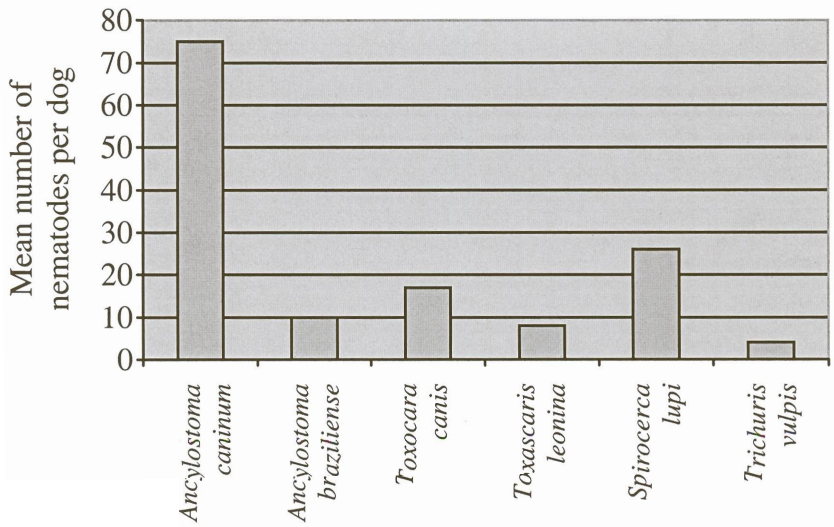


Fig. 3.6 Nematode species identified and number of dogs infected (n=69) in Boksburg

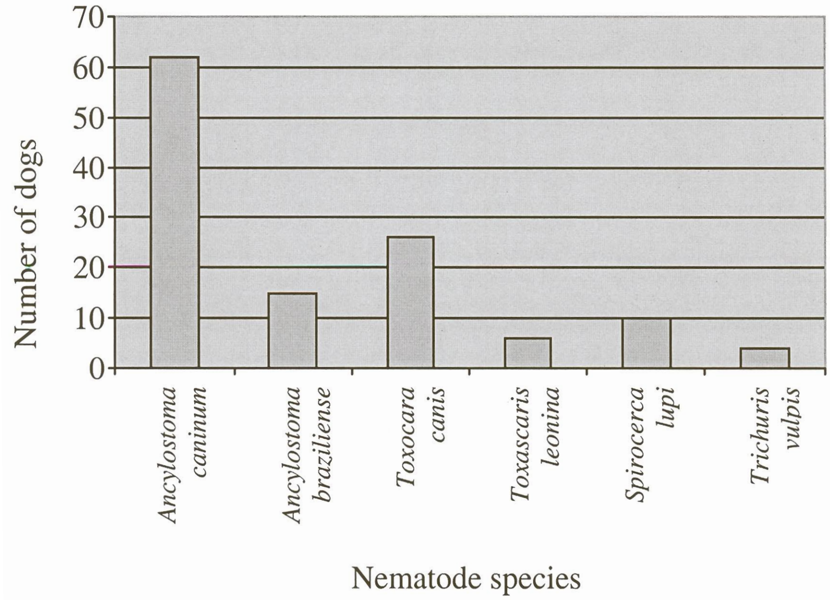


Fig. 3.7 Mean number of cestodes recovered per infected dog necropsied in Boksburg

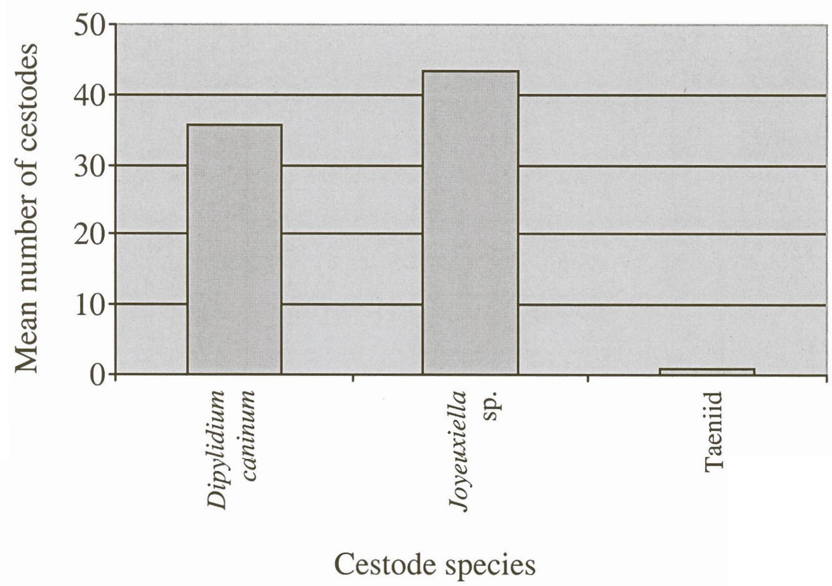
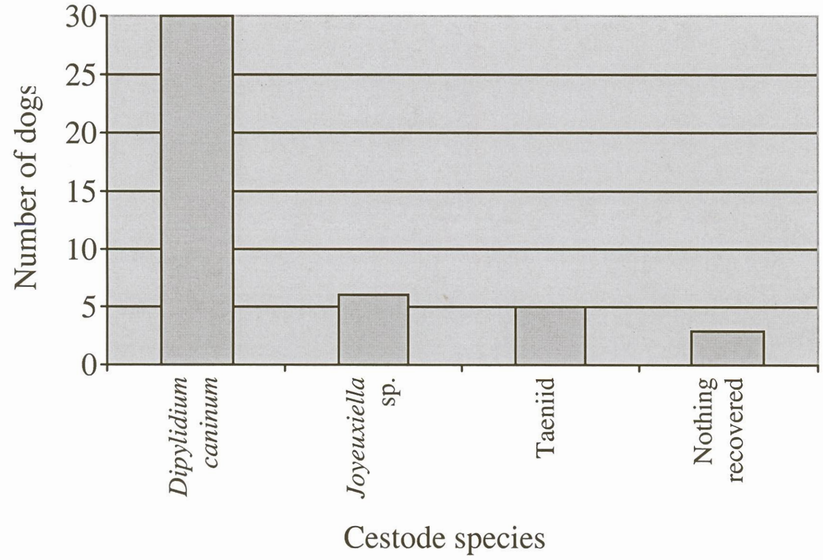


Fig. 3.8 Number of dogs from which cestodes were recovered (n=69) in Boksburg



3.4 **Discussion:**

Adhesive tape swabs:

Taenia hydatigena was recovered from three euthanazed dogs. Adhesive tape swabs were also collected from two of these dogs and both swabs showed the presence of taeniid eggs. However, in only one adhesive tape swab of 27 infected dogs was *D. caninum* observed. This finding suggests that this diagnostic method is not sensitive for detection of *D. caninum*.

Blood samples:

The only parasite observed in the blood smears was one in which *Babesia canis* was observed. The smear was made from the blood of a dog with severe icterus. The SPCA did not confirm diagnosis of babesiosis before the dog had been euthanazed.

Faecal flotations:

Faecal samples were collected and the flotation tests done on 61 of the dogs euthanazed to compare with the helminths recovered from the organs. Distinguishing between the eggs of *A. caninum* and *A. braziliense* microscopically is not possible. One flotation showed the presence of *Ancylostoma* spp. eggs, but no *Ancylostoma* spp. were recovered from the organs. The same phenomenon was seen with three *T. canis* positive faecal samples. This could possibly be as a result of the dog ingesting nematode eggs and not the infective larvae. The eggs, not being infective yet, then pass harmlessly through the intestine.

Faecal egg counts on carnivore faeces may be inaccurate (Miller, 1966), as the fibre and bulk content of the diet or the consistency of the faeces will influence the results. One may also argue that the number of eggs found on flotation only reflect the population of patent *Ancylostoma* spp. females present. The number of eggs produced per female per day also varies as the duration of the nematode infection progresses. *A. braziliense* females also produce less eggs per day than do *A. caninum* females, and the presence of immature stages and the male : female ratio of *A. caninum* will also influence the egg yield per gram faeces (Miller, 1966). It is still uncertain to what extent concurrent infection with other species of nematodes and environmental factors such as limited (dog) freedom to roam, re-infection rate, nutrition, clinical disease, etc., will have on the faecal egg count.

Necropsy recovery:

A. caninum: This was the most common helminth encountered. The actual number of *A. caninum* as a fraction of the total *Ancylostoma* spp. hookworms recovered from the

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Necropsy recovery:

A. caninum: This was the most common helminth encountered. The actual number of *A. caninum* as a fraction of the total *Ancylostoma* spp. hookworms recovered from the intestines at necropsy is more reliable as differentiation between *A. caninum* and *A. braziliense* can not be made by faecal flotation. In this study area, 97% of all *Ancylostoma* spp. recovered from 61 infected dogs, i.e. a total of 4 642 hookworms, were *A. caninum*.

The fact remains that the incidence of *A. caninum* at the levels encountered in Boksburg is a cause for concern. Only a few owners were aware of the possibility of their dogs harbouring internal parasites although some (11%) treat their dogs against worms.

A. braziliense: Although *A. braziliense* was less common in dogs from Boksburg (23% dogs infected with *Ancylostoma* spp.), its mere presence in the community is significant. It does not cause anaemia to the same extent and severity as seen with *A. caninum*, (Miller, 1967) but it is well known as a zoonosis that may cause cutaneous larval migrans in humans. As medical records were unavailable, the occurrence of larval migration in human patients could not be expressed in numbers for that area.

T. canis: This nematode was recovered from 25 of 69 dogs. Fifteen (i.e. more than one-fifth) of these dogs were infected with gravid females. These are probably responsible for recontamination of the home environment, and again could pose a threat to public health, as this species is also zoonotic.

These data also support the theory that *T. canis* favours pups or immature dogs, bitches in late pregnancy and lactating bitches. Of the 25 dogs infected with *T. canis*, 17 were pups, two subadults, two lactating bitches, and only four were adults. The reason why these four adult dogs harboured *T. canis* is uncertain, but may be related to sub-clinical disease or recent recovery from disease, nutritional deficiencies, or stress-related relaxation of immunity. Many dogs in these communities are fed only maize porridge, and often one may find that a lack of protein may undermine the efficiency of the immune system. The number of worms recovered from the adult dogs was low, two to four on average, except for one dog that had 10 adult *T. canis* males in its small intestine.

T. leonina: The occurrence of *T. leonina* in the Boksburg study area is considerably less than *T. canis*. Only six dogs were infected. The most recovered were 19 from an apparently healthy dog. Another dog had 16 adult *T. leonina* in the small intestine, and this dog's immunity was clearly compromised as it was also suffering from parvoviral enteritis. The other dogs infected carried an average of just more than three worms each.

S. lupi: This is a nematode of which the importance is greatly underestimated on both prevalence and pathogenicity. *S. lupi* is diagnosed in the live dog only when oesophageal granulomas cause physical obstruction, or from resulting secondary osteosarcomas. On diagnosis, the condition is already far advanced (Harrus et al., 1996), and the prognosis is guarded. Some of these cases are misdiagnosed, as opacity of oesophageal or aortic granulomas only show up on x-ray film when calcification of lesions takes place. Oesophageal endoscopy may show granulomas, but this procedure is seldom performed on patients. Faecal flotation and sedimentation techniques are not very effective for the same reason, and the sensitivity thereof is questionable (Evans, 1983; Markovics and Medinski, 1996), as patent females have to be present to produce eggs. The author also performed several faecal sedimentation tests (Sloss et al., 1994) without demonstrating a single *Spirocerca* sp. egg. Many dogs probably die from old age or other causes while being asymptomatic hosts to this parasite, without the owner ever knowing.

In this study area, 10 dogs were infected with *S. lupi*. One dog harboured as many as 143 adult worms of which 8 were situated in the aorta and 135 in numerous nodules embedded in the oesophagus. Sixteen of the worms that were found in the oesophagus (12%) were patent females.

T. vulpis: Whipworms were found in four dogs, with the highest count of eight worms in one dog. Reinecke (1983) refers to the distribution of *T. vulpis* in the Durban area. The low prevalence in Boksburg may be attributed to the geographic distribution since this nematode prefers a warmer and wetter environment than in the drier region of the current study.

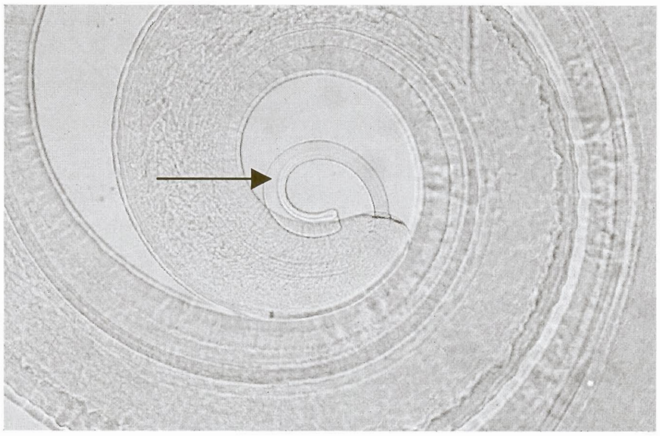

Fig. 3.9 ***Trichuris vulpis*, male prepuce (arrow)**

Cestodes: *D. caninum* is by far the most common cestode of dogs in this area, and of all the helminths, the occurrence of *D. caninum* is second only to *A. caninum*. In the

Boksburg area, 44% dogs were hosts to this tapeworm, with up to 288 scoleces recovered from one dog. The intermediate host that transmits this tapeworm, the common flea (*Ctenocephalides* spp.), was present on many of the dogs that were infected.

The presence of *D. caninum* in the dogs suggests that neither flea control nor deworming with a cestocide is being implemented. In a resource-limited community such as this it is possible to imagine that fleas and therefore also *D. caninum* would be abundant.

The level of infection with *Joyeuxiella* sp. (6%) was only one-seventh as high as *D. caninum*. *T. hydatigena* was present in 3 dogs.

Although some owners said that they treated their dogs regularly for internal parasites, no significant change in the helminth results of the faecal flotations of their dogs could be demonstrated.

Recommendations for dog-owners in the Boksburg area:

The most practical control measure to reduce the chance of transmission of helminth parasites between dogs and from dogs to humans is to prevent contamination of the environment with infective eggs and larvae by regular removal of dog faeces from the living area. Therefore, faeces should be picked up at least on a daily basis, and disposed of by either throwing it into a long-drop toilet pit, burying or burning it. Regular municipal garbage disposal may not be the answer, as dogs often roam the area, knock over garbage cans and scavenge for food, and may therefore become infected. In the Boksburg area, bitches should be dewormed before breeding, shortly before and about three weeks after whelping to reduce the transmission of infective larvae to the pups in the milk. Taeniid and ascarid eggs may cling to the dog's coat, therefore the dog should also be washed. The control of vermin such as mice and flies that can act as paratenic hosts should also be considered. *S. lupi*, *T. canis* and *T. leonina* were identified from necropsy samples from the Boksburg area, therefore dogs from particularly semi-rural areas should be prevented from eating dung beetles, frogs, mice, lizards or uncooked chicken scraps. Flea control using dips, pour-ons, flea powders and flea collars will also help prevent transmission of *D. caninum*.

From a public health point of view, with many dog helminths being infectious also to humans, education in the community to ensure an understanding of the reasons for introducing new or different habits is called for. Helminth larvae and eggs might be ingested by eating or placing hands in the mouth or not rinsing fresh vegetables before eating. Children should avoid playing where dogs have defaecated, and people should prevent direct skin contact with the soil, e.g., wearing shoes especially in sandy areas. Small children ought to be prevented from eating soil.

There was a constant SPCA presence in the resource-limited communities of Boksburg. The residents knew the personnel and co-operated with them. In addition to enforcing animal health regulations, the SPCA could also extend their involvement in the communities by educating animal owners on parasite control, either by providing information during their daily visits in the areas, or by organising information days.

Well-informed owners will also be aware of alternative opportunities when seeking veterinary help. The communities are situated close to Boksburg town, where veterinary advice and services are available. There are opportunities for future research projects, and the communities could also benefit from this as the animal owners now know that research will eventually improve animal and community health and therefore serve for the upliftment of living standards in the community.