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Prevalence of *Libyostrongylus douglassii* in commercially reared ostriches in the highveld region of Zimbabwe

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Abstract

A total of 435 freshly dropped faecal samples were collected from 11 randomly selected ostrich farms during September and November 2002 to determine the prevalence of *Libyostrongylus douglassii* (ostrich wireworm) in the highveld region of Zimbabwe. Samples, which consisted of 339 samples from breeder birds and 96 samples from pre-slaughter grower birds were screened for nematode eggs using the modified McMaster technique before being individually cultured in an incubator at 28°C. Cultures were examined for the presence of *L. douglassii* third stage larvae (L3). Using faecal egg counts, eight of 11 farms (72.7%) were positive for *L. douglassii* in breeders but no eggs were detected in the growers. The faecal culture method detected wireworm larvae in the breeding stock of all farms that were surveyed (100%) and five of the eight farms (62.5%) which had grower birds. *Libyostrongylus douglassii* was detected in all farms (100%) based on the faecal culture method. *Libyostrongylus douglassii* was detected for the first time in 7 of 11 farms (64%) surveyed. Data from questionnaires designed to assess farm management practices showed that four out of seven (57.1%) of the ostrich producers were unaware of the importance of wireworms in ostriches. The farms did not have a regular deworming programme for their birds and no faecal samples were sent routinely to the veterinary laboratory for screening of wireworms. Wireworm infections were not taken into consideration by farmers during buying and selling of birds.

Introduction

Domestic ostrich production in Zimbabwe began in 1985 and is still considered to be a new industry compared to the well established operation in South Africa (Cooper, 1999). Ostrich farms are located mainly in two regions of Zimbabwe, i.e. the provinces of Mashonaland and Matabeleland (Cooper, 1999). The Ostrich Producers Association of Zimbabwe (TOPAZ) comprises more than 60 producers, with a population of breeder birds of 6446 by the end of 2001 compared with an estimated population of 2000 wild birds in 1999 (Cooper, 1999).

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Ostriches are mainly farmed for leather and meat, with feathers becoming of less importance (Dzoma & Dorrestein, 1998). There are two ostrich abattoirs in the country, one in Norton (Mashonaland catchment area) and the other in Bulawayo (Matabeleland catchment area), both of which process slaughtered birds mainly for export (Cooper, 1999). Two main tanneries process skins from each of the abattoirs into high quality leather (Cooper, 1999). Live birds are also exported to several countries overseas (Dzoma & Dorrestein, 1998).

Libyostrongylus douglassii, the ostrich wireworm, is a major parasite of ostriches in the tropics (Malan *et al.*, 1988). It was originally described in South Africa by Cobbold in 1882, and may be endemic or common in southern Africa (Hoberg *et al.*, 1995). Adult worms live on the surface epithelium of the proventriculus, under the koilin layer and feed on blood (Shane, 1998). Young stages

of *L. douglassii* penetrate and reside in the glandular crypts of the proventriculus and occlude the ducts of the proventricular glands (Craig & Diamond, 1996) causing severe irritation resulting in diphtheric proventriculitis, commonly termed 'vrotmaag' (rotten stomach) (Reinecke, 1983; Shane, 1998). The mucosa is desquamated in patches, and diphtheric and pseudo-membranes may be present, covering haemorrhagic areas (Lapage, 1965; Dunn, 1978; Soulsby, 1982). In heavy infections, severe proventriculitis subsequently leads to gastric stasis (Huchzermeyer, 1999). Clinical signs of infection with *L. douglassii* include anorexia, cachexia and generalized muscle wasting, anaemia, listlessness and death (Reinecke, 1983; Barton & Seward, 1993; Craig & Diamond, 1996).

According to the Zimbabwe Animal Health Act, libyostrongylosis is a notifiable disease, and therefore any diagnosis or suspicion of the disease is reported to the Department of Veterinary Services and a record of infected farms is maintained by the department. Records from the Wildlife Unit of the Central Veterinary Laboratory, Harare, for 2002 indicated the presence of *L. douglassii* in 15 farms in the country. Infections were only recorded in adult breeder birds and based on faecal egg counts.

As no previous studies have been carried out on the prevalence of *L. douglassii* in the main ostrich farming region in Zimbabwe, the objective of the present study was to determine the prevalence of *L. douglassii* in the highveld region, which constitutes the main ostrich farming region and those factors which contribute to the occurrence of the nematode in ostriches in Zimbabwe.

Materials and methods

Study sites and animals

A list of all registered ostrich farms in Zimbabwe was obtained from the Wildlife Unit of the Central Veterinary Laboratory and, of 23 farms contacted in the highveld, only 11 were fully operational in ostrich farming. A total of 435 faecal samples were collected from these 11 farms between September and November 2002. These included 339 samples from breeder stock and 96 samples from grower stock. A questionnaire designed to assess farm management practices and information on wireworm infection and control was administered to either the farm owner or manager of the farm during sample collection.

From each farm, freshly dropped faecal samples from the breeding stock and growers were collected in plastic bags. Each sample was labelled with the farm name, category of bird, and pen number (where available) and transported to parasitology laboratory of the Faculty of Veterinary Science, University of Zimbabwe for storage in a refrigerator and analysed within two days of collection.

Parasitological techniques

Nematode eggs were determined using the modified McMaster technique as described by Sloss *et al.* (1994) which has a sensitivity of detecting as low as 50 eggs per gram of faeces. Faecal cultures were prepared by mixing faecal samples with wood shavings into a crumbly paste and put into plastic bottles with lids. All samples were cultured individually in an incubator at 28°C for 10 days. Larvae were recovered from the cultures using a modified Baermann technique as described by Sloss *et al.* (1994). This involved filling up each sample bottle containing the culture with water then each bottle was inverted in a Petri dish and the space left in the Petri dish was filled with water and left overnight. The following morning, water in each Petri dish was transferred via a test tube to a fresh Petri dish and any larvae present were pipetted onto a slide and a drop of Lugol's solution added to kill the larvae for easy identification. To clearly show the characteristic knob at the extremity of the larval tails, the protective sheaths were removed by submerging the larvae in a 1:4 dilute sodium hypochlorite solution as described by Barton & Seward (1993).

Data analysis

Descriptive statistics using a Statistix program was applied to compute the prevalence of *L. douglassii* on each farm, based on faecal egg counts and cultures, for breeders and growers. A Student t-test was used to determine if the mean egg counts for breeders were significantly different among farms.

Results

All eggs observed were of the strongylid type and all larvae recovered from faecal cultures before and after removal of the protective sheath were positively identified as those of *L. douglassii* by the presence of a short constriction tipped by a spiny knob at the extremity of the larval tail as described by Barton & Seward (1993).

Eggs of *L. douglassii* were detected in samples from breeder stock in eight of 11 farms (72.7%) surveyed. These accounted for 61 of 339 breeder stock samples (18.0%). Egg counts for the breeders ranged from 0 to 1550 eggs per gram of faeces. A total of 108 of 278 breeder stock samples (38.8%) with negative egg counts had *L. douglassii* larvae detected by faecal culture. Based on faecal culture, *L. douglassii* was detected in 169 of 339 breeder stock samples (49.9%), and all farms (100%) tested positive for *L. douglassii* in the breeder stock (see table 1).

All samples from growers showed negative results using faecal egg counts, although 17 of these (17.7%) were positive for *L. douglassii* using faecal cultures (table 2). The latter also showed that five of the eight farms (62.5%) were positive for *L. douglassii* in the growers.

Seven of the 11 farms surveyed (63.6%) responded to the questionnaire. All farms did not have a regular deworming programme for their birds. Four of seven producers (57.1%) were not aware of the importance of *L. douglassii* in ostriches. Three of the seven producers (42.9%) occasionally bought live birds from other farms and these birds were obtained from more than one source. However, all new birds were quarantined before mixing them with their flocks. Two of these three producers also occasionally sold live birds to other farms. It should be noted that in one of these two farms *L. douglassii* was present in faecal samples in the growers with a prevalence of 46.7%.

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Table 1. Prevalence of *Libyostrongylus douglassii* in ostrich breeders based on faecal egg counts and faecal cultures.

Farm name	*n*	Mean epg ± SE (range)	Prevalence (%)	
			Faecal egg counts	Faecal cultures
Reitpoort	20	0	0	7 (35.0)
New Forest	5	0	0	4 (80.0)
Ostrich Ventures	12	20.8[a] ± 16.8 (0–200)	2 (16.7)	11 (91.7)
Wakefield Estate	49	165.3[b] ± 39.5 (0–1300)	27 (55.1)	47 (95.9)
Charlestone 'B'	25	12.0[c] ± 10.1 (0–250)	2 (8.0)	4 (16.0)
Thursfield	24	281.3[b] ± 78.1 (0–1550)	20 (83.3)	24 (100)
Woodleigh	40	0	0	20 (50.0)
Barrowdale	38	1.3[d] ± 1.3 (0–50)	1 (2.6)	11 (28.9)
Montgomery	69	2.1[d] ± 1.6 (0–100)	2 (2.9)	15 (21.7)
Msengi	20	5.0[e] ± 3.4 (0–50)	2 (10.0)	10 (50.0)
Excelsior	37	6.7[e] ± 2.8 (0–50)	5 (13.5)	16 (43.2)

Epg, number of eggs per gram of faeces.
Values with a different superscript letter within a column are significantly different ($P < 0.01$).

The findings of this study were communicated to the Wildlife Unit of the Central Veterinary Laboratory as required by the Zimbabwe Animal Health Act since *L. douglassii* is a notifiable disease/condition in Zimbabwe.

Discussion

The present results confirm that the faecal culture method is more sensitive than the conventional faecal egg count method as previously reported by Button *et al.* (1993). Although Button *et al.* (1993) recommended the pooling of faecal samples for culture, the disadvantage with this method is that of not knowing which individual birds are infected if the pooled sample is positive. Individual faecal cultures will avoid expensive programmes in which drugs are administered to uninfected birds (Craig & Diamond, 1996). Apart from the expense, unwarranted use of anthelmintics may promote the development of resistant strains of the parasite (Malan *et al.*, 1988).

Table 2. Prevalence of *Libyostrongylus douglassii* in ostrich growers based on faecal cultures*.

Farm name	*n*	Prevalence (%)
Reitpoort	17	5 (29.4)
New Forest	15	7 (46.7)
Ostrich Ventures	7	1 (14.3)
Charlestone 'B'	17	0
Thursfield	8	2 (25.0)
Barrowdale	8	0
Montgomery	7	0
Excelsior	17	2 (11.8)

*No faecal egg counts were recorded.

Button *et al.* (1993) detected *L. douglassii* in 75% of farms surveyed in Eastern Victoria, Australia, using faecal egg counts. The 100% prevalence value for *L. douglassii* in breeders in the farms surveyed in this study is comparable to that reported in Eastern Victoria by Button *et al.* (1993). However, according to the records from Central Veterinary Laboratory in Zimbabwe, breeders in only four of the farms surveyed were known to harbour the parasite. Therefore, *L. douglassii* was detected for the first time in 7 of 11 farms (64%) surveyed, indicating a significant increase in the spread of this nematode amongst ostrich farms in Zimbabwe.

The occurrence of *L. douglassii* in growers in 62.5% of farms is a very important finding. Since the pre-slaughter quarantine period is only 14 days compared with the prepatent period of 36 days, it is unlikely that these ostriches picked up the infection from the quarantine pens. Though it is not known at which stage of growth these birds became infected, this finding indicates that the grower bird paddocks in some farms harboured the parasite, hence increasing the likelihood of transmission of *L. douglassii* to the chick rearing facilities.

The questionnaire revealed that the old practice of feeding dung from adult birds to newly hatched chicks in the ostrich industry (Reinecke, 1983; Barton & Seward, 1993; Button *et al.*, 1993; Craig & Diamond, 1996) was not practiced in the farms that were surveyed. Such a practice, which allows the intestinal flora in the chicks to become established (Craig & Diamond, 1996), has been strongly criticized by several workers (Barton & Seward, 1993; Button *et al.*, 1993; Craig & Diamond, 1996) and could produce disastrous results if adult birds are already infected with *L. douglassii*.

All the farms surveyed did not have regular deworming programmes for their ostriches. Five of seven farms (57.1%) dewormed their breeding stocks infrequently. An interesting observation was that three of four farms (75%) that dewormed the breeders had no known previous diagnoses of *L. douglassii* or any other ostrich helminth. This indiscriminate and unwarranted use of anthelmintics may accrue unnecessary expenses and also promote the development of anthelmintic resistance (Craig & Diamond, 1996).

The finding of *L. douglassii* in growers on some farms that were occasionally selling birds to other farms is important in the spread of the parasite. The introduction of new gene pools into farms in the form of eggs, as opposed to live birds could be a safer practice in as far as parasite and disease transmission is concerned and should be considered for exploitation.

Most ostrich producers (57.1%) that responded to the questionnaire did not appreciate the significance of *L. douglassii* infection in ostriches and the consequent risks involved. The present results were communicated to owners of all the farms that took part in this study, briefly discussing *L. douglassii* and its importance, and possible management practices for control such as quarantine of new birds, separation of breeders from grower birds, regular monitoring of wireworm infection through faecal cultures and treatment of infected birds.

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Such information, however, needs to be made available to all ostrich producers in the country.

Although mature birds appear to tolerate high burdens of *L. douglassii* without showing clinical disease, the levels of infection which might interfere with the normal physiological processes of the birds have not been determined. These levels might be associated with poor reproductive results (Tully & Shane, 1996) and therefore regular deworming programmes for the breeding stock will minimize the risk of contamination of chick pens and thus reduce the danger posed by this nematode species to juvenile birds.

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