Anoplocephala sp. Infection in a Captive Asian Elephant in Sri Lanka

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Introduction

Adult *Anoplocephala* tapeworms live in the ileum and cecum of the definitive host. The infective cysticercoids of this cestode occur in *Oribatid* sp. of mites, which are the intermediate hosts. *Oribatid* mites are commonly found in grass. When an elephant feeding on grass ingests infected *Oribatid* mites, the cysticercoids find their way to the cecum of the elephant in which the adults develop. They eventually produce large numbers of proglottids full of eggs, which are excreted in the faeces of the elephant. Proglottids are segments of the tapeworm containing a complete sexually mature reproductive system. The eggs hatch and infect *Oribatid* mites on the ground, starting another life cycle.

Adult *Anoplocephala* live for up to 6 months and cause anaemia and hypo-proteinaemia in elephants (McAloon 2004). Typical clinical signs of elephants affected with this cestode include anorexia, mud and soil eating and general deterioration of body condition (Chandrasekaran 1979).

Anoplocephala manubriata has been previously reported from a post-mortem of a wild Asian elephant (*Elephas maximus*) in Sri Lanka (Perera *et al*. 2017). In India *Anoplocephala* sp. has been reported both in wild and captive elephants (Vimalraj & Jayathangaraj 2015).

Case study

In May 2017, a captive tusker in a temple in Kandy, Sri Lanka, started losing body condition rapidly with reduced appetite and diarrhoea, immediately after musth. The keeper noticed whitish elongated rectangular pieces (approximately 2 cm x 0.2 cm) with a creamy substance inside, in the faeces of the tusker (Fig. 1), which were identified as segments of *Anoplocephala* sp. based on morphological features of proglottids and eggs, at the laboratory (Fig. 2).

Immediate rest of the tusker was recommended and faecal and blood samples were collected and submitted to the laboratory for examination (see Table 1).

Investigation of the presence of mites

Five hundred g of fresh grass was collected from the area where the tusker was managed. The sample was mixed with 1.5 l of tap water and 3 ml of detergent (Teepol) and mixed vigorously 3 times within 2 hours. The sample

Figure 1. *Anoplocephala* segments in faeces.

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Table 1. Changes in haematological parameters of the tusker after observing *Anoplocephala* proglottids in faeces. Other haematological parameters were within their normal range.

Parameter	Reference value	Day 1	Day 8	Day 15	Day 22
PCV (%)	30–40	13.6	23.1	24.7	23.0
White blood cells; absolute range (10^3/µl):					
Lymphocytes	5–8	0.96	0.88		
Monocytes	2–4	4.55	7.11		
White blood cells; differential count (%):					
Lymphocytes	30–40	13	8		
Monocytes	25–30	61	64		
Eosinophils	<5	25	4		

was then filtered using a stainless steel sieve (45 μm; D-5657 HAAN/ Germany). The fluid collected at the bottom was kept still overnight for sedimentation. The supernatant was removed and the sediment and sieve were washed with 70% ethanol and stored in 15 ml centrifuge tubes. Centrifugation was performed at 2000 rpm for 5 minutes, for washing. The supernatant was discarded and the sediment was examined under the light microscope and mites were isolated for morphological identification. *Oribatid* sp. mites were identified. They were approximately 1 μm length (Fig. 3).

Treatment

Supportive treatment consisting of Amino acids, Vitamins A, B, D, E and iron was given parenterally and a balanced mineral mixture orally, to address needs for protein synthesis and produce new blood cells. One month after initiating the treatment, PCV of the tusker improved from 13.6 to 23, RBC count from 1.27 x 10^6 to 2.2 x 10^6 and MCV from 106 fl to 116 fl. However, during this period, the total serum protein changed from 7.09 to 8.8 g/dl and albumin from 2.6 to 2.0 g/dl (Table 1). The tusker was found to be energetic thereafter.

Figure 2. *Anoplocephala* segments.

Oxyclosanide, a non-specific anthelmintic, was orally given twice at a dose of 5 mg/kg, three weeks apart (day 0 and day 21), to all 12 elephants managed in the same premises as the tusker (No. 12 in Table 2) and faeces were examined for eggs (Table 2). Males No. 3 and 11 were nearing the end of their musth periods while No. 12 was immediately after musth. According to the results, Oxyclosanide did not have a clear effect on the eggs per gram of faeces.

Subsequently, Praziquantel (600 mg tablets), which is considered the best drug against *Anoplocephala* infection, was imported and administered to the 12 elephants. Seven attempts to administer Praziquantel to the tusker in question failed while other elephants in the temple were given the drug. However, their faecal egg counts could not be monitored since they were away from the facility.

In addition, 9 other captive adult elephants managed in a separate location were monitored and Praziquantel was administered at a dose of 15 tablets per adult elephant as a trial. These elephants are regularly de-wormed once in 3 months with Febentel. However, two males and one female out of these 9 elephants were positive

Table 2. Eggs per gram of faeces of 12 elephants given Oxyclosanide on day 0 and day 21.

#	Gender	*Anoplocephala* / strongyle eggs per gram of faeces						
		Day 0	Day 4	Day 8	Day 12	Day 16	Day 20	Day 24
1	Male	0/0	0/0	0/0	0/0	0/0	0/0	0/0
2	Male	0/0	0/0	0/0	0/0	0/0	0/0	0/0
3	Male	0/50	0/0	0/0	0/0	0/0	0/0	0/0
4	Male	0/0	0/0	0/0	0/0	0/0	0/0	0/0
5	Male	0/0	0/0	0/0	0/0	0/0	0/0	0/0
6	Male	0/0	0/0	0/0	0/0	0/0	0/0	0/0
7	Male	50/0	0/0	0/0	0/50	0/0	0/0	0/0
8	Male	0/0	0/0	0/0	0/0	0/0	0/0	0/0
9	Male	0/0	0/0	0/0	0/0	0/0	0/0	0/0
10	Female	0/0	0/0	0/100	0/150	0/0	0/0	0/0
11	Male	3150/1750	600/650	3700/600	600/0	150/250	3700/600	3000/250
12	Male	150/0	200/500	100/0	50/0	50/0	150/0	0/0

for *Anoplocephala* proglotids in faeces (Table 3). Both the *Anoplocephala* positive males were immediately after musth. Worm eggs of either strongyles or *Anoplocephala* were not detected on the 12th day after treatment with Praziquantel.

Discussion

Oxyclosanide was ineffective against *Anoplocephala* sp. at the dose we used, while Praziquantel was effective. The fact that strongyle egg counts

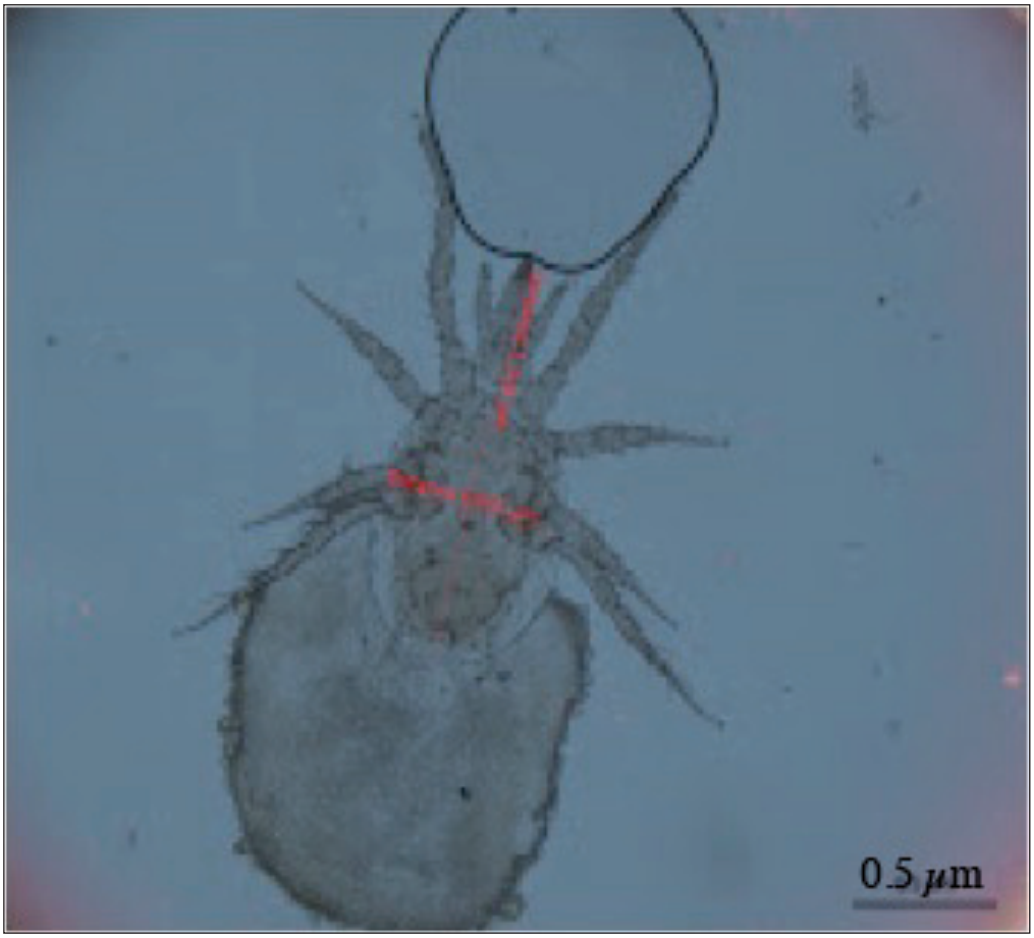

Figure 3. Ventral view of an *Oribatid* sp. mite found in the grass sample (100 x magnification).

Table 3. Eggs per gram of faeces of 9 elephants administered Praziquantel (600 mg x 15 tablets per elephant) on day 4.

#	Gender	*Anoplocephala* / strongyle eggs per gram of faeces				
		Day 0	4	6	12	16
1	Male	0/0	0/0	0/0	0/0	0/0
2	Male	0/0	0/0	0/0	0/0	0/0
3	Male	0/50	0/0	0/0	0/0	0.0
4	Male	0/0	0/0	0/0	0/0	0/0
5	Male	0/0	0/0	0/0	0/0	0/0
6	Male	0/0	0/0	0/0	0/0	0/0
7	Male	350/100	3250/150	0/0	0/0	0/0
8	Male	100/0	250/0	0/0	0/0	0/0
9	Female	300/0	4800/0	0/0	0/0	0/0

were also reduced after Praziquantel treatment needs further investigation since it is generally considered to be ineffective against strongyles. The observed relationship of *Anoplocephala* infection with the post-musth period suggests the possibility of immunosuppression in musth due to elevated serum cortisol levels (Vendramini *et al*. 1991; Fijak *et al*. 2011).

Studies on gastrointestinal helminths in elephants at the Pinnawela Orphanage, Sri Lanka have concentrated on nematodes and a reduction in prevalence has been attributed to frequent anthelmintic treatment (Abeysinghe *et al*. 2017). Regular anthelmintic treatment of elephants in Sri Lanka does not include drugs against cestodes such as *Anoplocephala* sp. Though we identified *Oribatid* sp. of mites in grass samples, it is unknown whether they were infected with cysticercoids of *Anoplocephala*. Therefore, we recommend that captive elephants should be tested for the presence of *Anoplocephala* and Praziquantel should be included in the deworming schedules of the infected elephants and elephants sharing the same premises and food, in addition to regular anthelmintics.

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