Available online at www.sciencedirect.com
SCIENCE DIRECT
Veterinary Parasitology 127 (2005) 303–312
veterinary parasitology
www.elsevier.com/locate/vetpar

A 12-month survey of the gastro-intestinal helminths of antelopes, gazelles and giraffids kept at two zoos in Belgium

Els Goossens[a,b,c,*], Pierre Dorny[a,b], Joop Boomker[d], Francis Vercammen[c], Jozef Vercruysse[a]

[a]*Department of Parasitology, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, B9820 Merelbeke, Belgium*
[b]*Department of Animal Health, Prince Leopold Institute of Tropical Medicine, Nationalestraat 155, B2000 Antwerp, Belgium*
[c]*Centre of Research and Conservation, Royal Zoological Society of Antwerp, Koningin Astridplein 26, B2018 Antwerp, Belgium*
[d]*Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort 0110, South Africa*

Received 12 May 2004; received in revised form 6 October 2004; accepted 19 October 2004

Abstract

Faecal egg count patterns and clinical signs associated with gastro-intestinal (GI) nematodes of 107 zoo ruminants were monitored at fortnightly intervals for 1 year. The ruminants in this study were kept under different husbandry conditions at two sites of the Royal Zoological Society of Antwerp, the Antwerp Zoo and the Animal Park Planckendael. Artiodactylids involved were Arabian oryx (*Oryx leucoryx*), scimitar-horned oryx (*Oryx dammah*), bongos (*Tragelaphus eurycero*s *isaaci*), sitatungas *(Tragelaphus spekii gratus*), common eland (*Taurotragus oryx*), impala (*Aepyceros melampus)*, slender-horned gazelles, (*Gazella leptoceros*), blue wildebeest (*Connochaetes taurinus taurinus*), Kordofan giraffes (*Giraffe camelopardalis antiquorum*) and okapi (*Okapia johnstoni*). Nematode eggs were recovered from 586 of 1606 (36.5%) individual faecal samples, using flotation techniques. Infection levels were distinctly low at Antwerp Zoo, probably due to zero grazing and daily dung removal. At Planckendael, the herds of Arabian oryx, scimitar-horned oryx and slender-horned gazelles showed markedly higher egg counts than the other herds, with more than 10% of the faecal egg counts having more than 100 eggs per gram (epg) and maximum faecal egg counts of 600, 750 and 1350 epg, respectively. Faecal egg counts increased during the mid-grazing season (July) and peaked at the end of the grazing season (October). No clinical signs, such as loss of faecal consistency, could be correlated with faecal egg counts ($P > 0.05$). With the exception of significantly more *Nematodirus* spp. eggs that were present in juvenile eland, no differences in faecal egg counts could be found between the sexes and different age groups. Abomasa and intestines of 17 animals that died during the survey were available for total worm counts. In one Arabian oryx, four slender-horned gazelles and one sitatunga low burdens ranging from 200 to 14,300 were found. Nematode species recovered were *Camelostrongylus mentulatus* from the abomasa and *Trichostrongylus retortaeformis, Nematodirus fillicollis*, *Capillaria* spp. and *Trichuris* spp. from the intestines. Our findings suggest different nematode infection levels between herds, which are mainly

* Corresponding author. Tel.: +32 32024548; fax: +32 32024549.
E-mail address: goossensels@hotmail.com (E. Goossens).

0304-4017/$ – see front matter
doi:10.1016/j.vetpar.2004.10.013

due to husbandry conditions but to a lesser extent to species- or individual susceptibility. Identification of ungulates that are highly infected and knowledge of the seasonal variation of their helminths can contribute greatly to a well-adjusted species-specific management and helminth control program.

Keywords: Antelope; *Camelostrongylus mentulatus*; Gastro-intestinal nematodes; Gazelles; *Trichostrongylus retortaeformis*; Zoo-ruminants

1. Introduction

Due to declining free-ranging populations, wild ungulates kept at zoological collections have become increasingly important as stock for conservation, exhibition and study. Consequently, knowledge of their diseases needs to be gained, especially when bred for re-introduction in the wild (Kirkwood et al., 1987). A survey conducted in zoos in North America indicated that 91 out of the 99 parks experienced problems with internal parasites in their hoofed stock (Isaza et al., 1990). Despite extensive quarantine periods, repeated faecal examinations and anthelmintic treatment to prevent their introduction, gastro-intestinal (GI) nematodes remain a serious health problem in captive wild ruminants. Studies on and case reports of zoo animals reported prevalences of GI nematodes ranging from 65 to 100%, and mortality due to parasitic gastro-enteritis, ranging from 5 to 17% (Geraghty et al., 1982; Kaneene et al., 1985; Gorman et al., 1986; Meister et al., 1993). A few case studies described the occurrence in antelopes and gazelles of severe GI nematode infections, which were caused by *Camelostrongylus* spp., *Nematodirus* spp., *Haemonchus contortus, Ostertagia* spp., *Trichostrongylus* spp. and *Trichuris* spp. (Church, 1986; Kock, 1986; Flach and Sewell, 1987). In these cases, higher faecal nematode egg counts (FEC) appeared mainly in late winter and summer and were associated with loss of body condition, diarrhoea and death of individual animals. In comparison, wild or semi-wild gazelles, antelopes and giraffids are known to host a broad spectrum of GI nematodes. In these animals, seasonal variations and worm burdens differ markedly between hosts, climatic and environmental conditions, stocking density and feeding behaviour (Horak, 1981; Boomker et al., 1986; Boomker et al., 2000). Insufficient nutrition and to a lesser extent, inbreeding, seems to especially favor nematode infections (Anderson, 1983; Cassinello et al., 2001). While the above-mentioned references indicate the widespread occurrence of GI nematodes in zoo ruminants, substantial studies about the epidemiology, factorial influences (like housing) and host population impact are limited. Among the main reasons for the lack of in-depth studies are the wild and unapproachable nature of these animals and the small group sizes, which impede the traditional approaches used in parasitological research in domesticated ruminants. Physical contact without full sedation is seldom possible, and weight, condition and illness can only be estimated by observation from a distance, often accompanied by lack of individual identification. The tendency of zoological collections to keep animals in larger mixed species enclosures and the fact that in wild animals clinical signs only become perceptible at high-disease levels, does not facilitate the assessment of infections.

In this study, a survey of 1-year duration was instigated to firstly assess patterns of faecal egg counts of 107 exotic ungulates of the zoological gardens of Antwerp, Belgium, and which were kept at two different localities. Secondly, morbidity due to gastro-intestinal nematodes was studied, by carefully recording clinical signs (e.g. loss of faecal consistency) and worm counts of animals that died during the study. Thirdly, the influences of age, sex and housing on the faecal egg count were considered.

2. Material and methods

2.1. Localities

The localities where this study took place were the Zoo of Antwerp (Antwerp, Belgium) and the Animal Park Planckendael (Mechelen, Belgium), both owned by the Royal Zoological Society of Antwerp. The localities differ substantially in husbandry conditions.