



## Short communication

*Anatrichosoma* sp. in the footpads of a cat: Diagnosis and pathology of Namibian caseB.H. Noden<sup>a,\*</sup>, E.C. Du Plessis<sup>b</sup>, C. Morkel<sup>c</sup>, U. Tubbesing<sup>c</sup>, M. Soni<sup>c</sup><sup>a</sup> Department of Biomedical Science, School of Health and Applied Science, Polytechnic of Namibia, Windhoek, Namibia<sup>b</sup> IDEXX Laboratories, Pretoria, South Africa<sup>c</sup> Rhino Park Veterinary Clinic, 54 Rhino St., Rhino Park, Windhoek, Namibia

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## ABSTRACT

*Anatrichosoma* species are an unusual group of zoonotic trichuroid nematodes. Due to limited knowledge of their life cycle and diagnostic challenges, anatrichosomiasis has been reported only 3 times in domestic animals. A short-haired cat from central Windhoek, Namibia, presented with ulceration, swelling, and sepsis on all four paws, a severe generalized lymphadenopathy and considerable invasive eosinophilia. Histological analysis revealed epidermal hyperplasia, with severe serocellular crusting on the skin surface. One specimen revealed a series of thick-walled eggs within nematode segments with a few sections containing eggs with biopericulate appearance which is compatible with the Aphasmid group of nematodes, more specifically, the genus *Anatrichosoma*. Ivermectin treatment completely cleared the condition. This is the first report of *Anatrichosoma* sp. in the Republic of Namibia, identified from a unique location in the capital, Windhoek.

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## 1. Introduction

*Anatrichosoma* species are an unusual group of zoonotic trichuroid nematodes. Their occurrence is so rare that knowledge is limited and diagnosis is uncommon (Orihel, 1970; Nunez, 2010). These rare nematodes have been identified in opossums in the US (Pence and Little, 1972), rats in the Philippines (Jueco and Zabala, 1990), primates in Africa and Asia (Allen, 1960; Orihel, 1970; Pence and Little, 1972) and tree shrews in Asia (File, 1974). They have also been identified occasionally in humans, in mouth lesions (Eberhard et al., 2010; Nunez, 2010) and even the breast (Pampiglione et al., 2005). The life cycle remains unknown.

Infections are normally recognized through the observation of adult worms from biopsy rather than the recovery of eggs. Their embryonated eggs are known to be sloughed off from female worms in what is described as 'trails', swallowed and passed out of the feces of the infected animal (Orihel, 1970). Whether the life cycle involves an arthropod intermediate host or is direct remains to be determined.

To date, anatrichosomiasis has been reported only 3 times in domestic animals. Lange et al. (1980) and Ramiro-Ibanez et al. (2002) reported an *Anatrichosoma* sp. infestation in the footpads of cats in South Africa and the United States, respectively, while Hendrix et al. (1987) reported a lumbar nodule in a dog. The purpose of this study is to provide the first report of *Anatrichosoma* sp. in Namibia in the footpad of a cat.

## 2. Materials and methods

On April 20, 2011, a 1.5 year old, black and white, domestic, female, short-haired cat was brought to the Rhino Park Veterinary Clinic, Rhino Park, Windhoek. The

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cat lived in a closed neighborhood in southern Windhoek (Pioneerspark) in a house surrounded by fences/walls near a busy shopping center. The cat was not particularly amenable to handling, but the owners noted ulceration when the cat spent a particularly long time licking its paw the night before coming to the clinic. Aside from that, no other physical signs indicated that the cat was affected. It had been spayed 1 year previously.

Initial presentation identified sloughing on all four feet with the principle pads most affected as well as most of the smaller pads. There was apparent swelling and ulceration on the pads which created a moist septic condition. *Staphylococcus* infection was suspected. The cat had a severe generalized lymphadenopathy with the blood smear showing considerable eosinophilia. Needle aspirate from lymph node also showed severe eosinophilic infiltration. Cytology of the pad exudates showed cocci bacteria, eosinophils and neutrophils.

Initial consideration was that the cat has stepped on something hot like a stove or hot roof. Because of the eosinophilia, the initial diagnosis was either allergic dermatitis or a pemphigus complex because of the sloughing pads on all four feet or fungal infection. However, the condition was not pruritic as the cat never indicated any discomfort aside from the initial licking of her paws. A fungal culture was negative for ringworm.

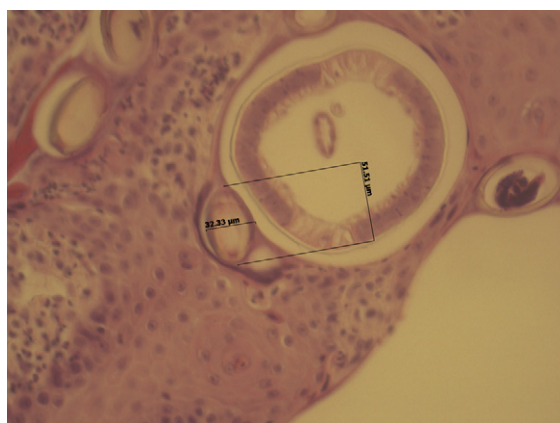
Because of the symptoms, the veterinarian consulted with the owner concerning biopsies from the affected pads to be sent for further consideration. After agreeing, the cat was anesthetized and three skin biopsies were taken, each from one principal pad on an affected paw, and sent in 10% buffered formalin to IDEXX laboratories South Africa. The cat was given a treatment regimen of cephalexin (125 mg/2×/day × 7 days) and a daily decreasing dose of prednisolone while awaiting biopsy results. The feet were bandaged and the cat was sent home after 2 days.

Upon receipt by the laboratory, the formalin treated biopsy samples were sectioned according to standard operating procedure and resulting slides were stained and evaluated by light microscope (Olympus BX41).

Upon receipt of the diagnosis, a house visit was made to dose all animals with ivermectin (Ecomectin 1%). The cat received 0.3 ml subcutaneous dose which lead to an immediate improvement and cessation of symptoms within a week of injection. At the time of a 3 week follow-up visit for another ivermectin treatment, the cat had fully recovered from this condition.

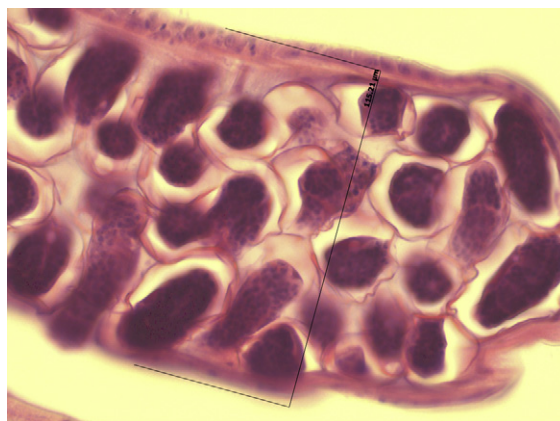
### 3. Results

The epidermis of the footpad sample revealed severe hyperplasia/acanthosis involving all layers of the epidermis, including the granular layer where large keratohyalin granules were visible in keratinocytes. Pseudoepitheliomatous hyperplastic and infiltrating epithelial cords extended into the underlying dermis. Severe compact orthokeratotic hyperkeratosis was evident on the skin surface, admixed with serocellular crusting populated by numerous cocci bacterial colonies (secondary). Few pustular structures were present in the stratum spinosum, and they contained large numbers of eosinophils.

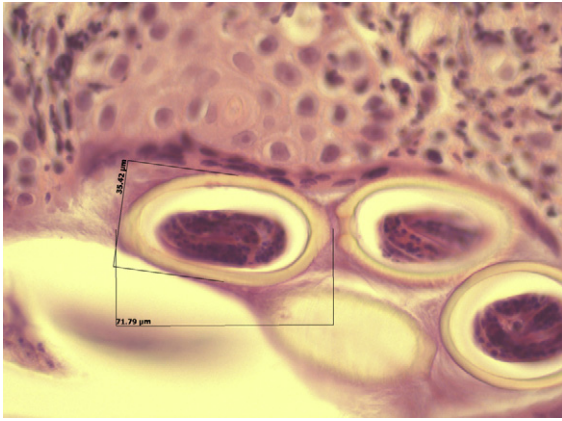


**Fig. 1.** Transverse section of a worm surrounded by bioperculate thick-walled eggs (32.33  $\mu\text{m}$   $\times$  51.51  $\mu\text{m}$ ) within the superficial dermal layer in the skin of the footpad (20 $\times$ ).

Numerous cross sections of nematodes were present in the epidermis (Fig. 1), surrounded by spaces that may represent migratory tracts due to burrowing and one was closely associated with the pustules in the epidermis. Adult nematodes were characterized by a cuticle, pseudo-coelom, coelomyarian musculature, intestine, one genital tract with developing eggs present in the uterus and multicellular hypodermal bacillary bands (Figs. 1 and 2). These characteristics confirmed that the worms were from the Aphasmid group of nematodes. The worms were often surrounded by several oval embryonated eggs embedded in scant fibrillar pale basophilic matrix (Figs. 1 and 3). Some of the eggs contained coiled larvae (Figs. 1 and 3). These ova had thick bright yellow polarizing shells and some were cut in such a manner as to clearly demonstrate bioperculation. The light microscopic morphology of the ova was compatible with the genus *Anatrichosoma*. The dermis was infiltrated by numerous inflammatory cells, of which eosinophils were most prominent, and also included admixed neutrophils, macrophages and lymphocytes. Eosinophils formed dense aggregates around the few nematode segments that penetrated the epidermis and underlying superficial dermis.



**Fig. 2.** Transverse section of worm (diameter 115.21  $\mu\text{m}$ ) containing bioperculate eggs and coiled larvae inside (40 $\times$ ).



**Fig. 3.** Transverse section of bioperculate thick-walled eggs ( $35.42\ \mu\text{m} \times 71.79\ \mu\text{m}$ ) within the superficial dermal layer in the skin of the footpad ( $40\times$ ).

#### 4. Discussion and conclusion

This is the first report of this rare zoonotic trichuroid nematode in Namibia. *Anatrichosoma* sp. has also been reported in a cat in South Africa (Lange et al., 1980). Feline pododermatoses can be traced to a number of conditions including microbial, allergic, autoimmune, parasitic, environmental and endocrine (reviewed by Gauguere, 1992). The combination of necrotic ulcerations in all four paws, the massive eosinophilia together with the notable bioperculate eggs within adult female worms scattered throughout the dermis and the quick resolution of the case using ivermectin all point to a species of *Anatrichosoma* as primary cause of the pododermatitis in this case. However, without molecular testing, it was not possible to identify the species of *Anatrichosoma*.

In 1922, Swift, Boots, and Miller described a species of *Anatrichosoma* that caused blisters on the palms of the hands and feet of rhesus monkeys (Allen, 1960). It was later reclassified as *Anatrichosoma cutaneum* (Chitwood and Smith, 1958). Interestingly, the two reported cases in Southern Africa (Lange et al. (1980) and current case) have been found only on the paws of the affected cats. The severity of the lesions and complete sloughing of the dermis leads one to classify this as an example a cutaneous larval migrans in an abnormal host in which these zoonotic nematodes cannot complete their life cycles.

This report provides only the third in the literature of this rare nematode affecting the footpads of a cat (Lange et al., 1980; Ramiro-Ibanez et al., 2002), the second involving cats in Southern Africa. *Anatrichosoma* sp. have been reported mainly in the mucosa of wild animals such as the mouth of opossums (Long et al., 1976), the esophagus of rats (Jueco and Zabala, 1990), the nasal passages of various monkeys (Allen, 1960; Orihel, 1970) and the eyes of tree shrews (File, 1974). A common nematode of monkeys, both wild and in captivity (Allen, 1960; Orihel, 1970), the first report in a Southern African domestic cat was thought to be monkey-related as the cat lived near the veld in the Transvaal where monkeys were frequently present (Lange et al., 1980). The discovery of this rare nematode in a cat

living in a suburban area in central Windhoek is peculiar. The cat is from a suburban house, 4 blocks from any wilderness area where monkeys (baboons) may be present.

A possible reservoir clue may come by studying animal movement in the dry riverine areas which snake through the community and also provide access to the wilderness areas outside the suburb. While these riverine areas are not frequented by baboons, other small mammals, such as black-tipped mongoose (*Galerella sanguinea*) or field mice, may access the wilderness areas through them and may play a role as reservoirs. This conjecture is based on the identification and characterization of *Anatrichosoma* sp. from rats (Jueco and Zabala, 1990), opossums (Pence and Little, 1972) and tree shrews (File, 1974). However, confirmational studies remain to be done.

Another significant aspect of this case is the possible under-reported public health component. As emerging zoonotic diseases have become more prominent in recent years, several studies have identified *Anatrichosoma* sp. as a type of larval migrans in humans (Pampiglione et al., 2005; Eberhard et al., 2010; Nunez, 2010). Because of the difficulty to diagnose, it is usually not considered by most medical professionals (Brustoloni et al., 2009; Nunez, 2010). As such, it is not possible to speculate concerning the prevalence in any given location. The presence of this emerging zoonotic nematode in Namibia suggests that more research is needed to establish the epidemiology and prevalence in animals and, possibly, humans.

#### Conflict of interest statement

None declared.

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