



RESEARCH COMMUNICATION

Helminth parasites of Natal long-fingered bats, *Miniopterus natalensis* (Chiroptera: Miniopteridae), in South Africa

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ABSTRACT

JUNKER, K., BAIN, O. & BOOMKER, J. Helminth parasites of Natal long-fingered bats, *Miniopterus natalensis* (Chiroptera: Miniopteridae), in South Africa. *Onderstepoort Journal of Veterinary Research*, 75:261–265

The helminth community infecting *Miniopterus natalensis* was studied at two localities, the De Hoop Nature Reserve (DHNR) ($n = 57$), Western Cape Province and Pretoria ($n = 12$), Gauteng Province, South Africa. Hosts from the DHNR had formed part of an earlier, unrelated study and were all pregnant females. A single hymenolepidid cestode species, the nematodes *Molinostrongylus ornatus* and *Litomosa chiropteroorum* together with nematodes of the subfamily Capillariinae were present at both study sites, while a single digenean, *Allassogonoporus* sp., was only found in hosts from the DHNR. The prevalence of helminth infections was high at both localities, 68.4% in the DHNR and 77.7% in Pretoria, whereas the mean intensity of infection was low at the DHNR (3.76 ± 3.15), but higher in Pretoria (10.4 ± 9.9). *Molinostrongylus ornatus* and, to a lesser extent *L. chiropteroorum*, were the main contributors to the higher intensities in Pretoria. The species richness ranged from 0 to 4 at both localities.

Keywords: Cestoda, Chiroptera, Digenea, Nematoda

INTRODUCTION

The Natal long-fingered bat, *Miniopterus natalensis* (= *Miniopterus schreibersii natalensis*), is a member of a genus of bats with an almost world-wide distribution and, together with its congeners from the Afrotropic, Palearctic, Indomalayan and Australasian ecozones, forms the recently erected family Miniopteridae (Miller-Butterworth, Murphy, O'Brien, Jacobs, Springer & Teeling 2007). They are gregarious cave dwellers whose diet consists predominantly of insects (Skinner 1990).

By far the majority of publications on the helminth fauna of bats of the genus *Miniopterus* are based on *Miniopterus schreibersii*, mainly in the Palearctic and Indomalayan parts of its geographic range, and some 20 nematode, 67 trematode and approximately 20 cestode species are listed in the host-parasite database of the Natural History Museum (2008). The few studies pertaining to *M. natalensis* in southern Africa are mostly of a taxonomic nature (Ortlepp 1932; Anciaux de Faveaux 1974; Petit 1980).

This communication reports on the helminth community of *M. natalensis* at two localities in South Africa.

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MATERIAL AND METHODS

Study localities

The bats originated from the De Hoop Guano Cave (34°25' S, 20°21' E) in the De Hoop Nature Reserve

(DHNR), Western Cape Province and the Monument Park Cave in Pretoria (25°43' S, 28°17' E), Gauteng Province.

The main vegetation type in the DHNR is classified as Coastal Macchia (Acocks 1975) or, more recently, as De Hoop Limestone Fynbos (Mucina & Rutherford 2006), and mean annual precipitation ranges from 250 to 530 mm with a mean of 385 mm (Mucina & Rutherford 2006). Rainfall peaks slightly in autumn and winter, and is at its lowest during December to February. Frost is restricted to about 3 days per year.

The vegetation in the Pretoria area is characterized as Bankenveld (Acocks 1975). Situated in the summer rainfall region, the mean annual precipitation is 593 mm, summer temperatures are high and frosts are frequent during winter (Acocks 1975).

Study material and procedures

During September 2006, 57 Natal long-fingered bats, all pregnant females, were collected from the DHNR for research purposes unrelated to this study. In March 2007, these animals, preserved in 70% ethanol, were made available to the authors for the removal of their gastro-intestinal tracts.

During April 2007, 12 bats, five males and seven females, were obtained from Pretoria and euthanased by an overdose of isoflurane followed by decapitation, whereafter the parasites were collected.

The stomach and intestine of each host were opened under a stereoscopic microscope and the contents as well as the organs themselves were examined for parasites. All parasites were fixed and stored in 70% ethanol. The cestodes and digeneans were cleared and mounted in Hoyer's medium, and nematodes were cleared in lactophenol. All worms were identified under a light microscope.

The ecological terms are used in accordance with Bush, Lafferty, Lotz & Shostak (1997). Following the classification of Fellis, Negovetich, Esch, Horak & Boomker (2003) helminths were classified as common if their prevalence exceeded 50% and as rare if they infected less than 10% of the hosts. A prevalence of more than 10% but less than 50% was considered intermediate.

RESULTS

The prevalence and intensities of infection of the parasites collected from both localities are listed in Table 1. *Litomosa chiropterorum* was recovered from the peritoneal cavity, whereas the remaining helminths occurred in the small intestine. A single bat from Pretoria yielded three unidentified nematodes, but it is likely that these belong to the species listed in Table 1.

With the exception of the digenean *Allassogonoporus* sp., which was absent in the Pretoria bats, and rare in bats from the DHNR, bats from the DHNR and Pretoria harboured the same parasites. However, from being a common parasite at the DHNR, *L. chiropterorum* was only intermediately prevalent in Pretoria, and the hymenolepidid cestode, which had an intermediate prevalence at the DHNR was a rare species in the bats from Pretoria. *Molinostrongylus ornatus* was a common nematode at both localities.

The overall prevalence of helminth infections in the bats from the DHNR and Pretoria was 87.7% and 75%, respectively, and seven hosts from the DHNR and three from Pretoria harboured no helminths. The species richness ranged from zero to four species per host at both localities (Fig. 1). The majority of infected bats from the DHNR and Pretoria harboured only one or two helminth species (68.4% and 77.7%, respectively). While 20% and 11.1%, respectively,

TABLE 1 The prevalence and intensity of helminth infections in *Miniopterus natalensis* at the De Hoop Nature Reserve, Western Cape Province and Pretoria, Gauteng Province, South Africa

Helminths	De Hoop (n = 57)			Pretoria (n = 12)		
	Prevalence (%)	Mean intensity (SD)	Range	Prevalence (%)	Mean intensity (SD)	Range
<i>Allassogonoporus</i> sp.	7	4.0 (± 2.16)	1–6	–	–	–
Hymenolepidid cestode	35.1 ^a	2.0 (± 2.04) ^a	1–8	8.3	2	2
Capillariinae	10.5	1	1	25	1.3 (± 0.58)	1–2
<i>Litomosa chiropterorum</i>	50.9	2.3 (± 1.44)	1–5	41.7	4.0 (± 2.31)	2–6
<i>Molinostrongylus ornatus</i>	59.6	2.09 (± 1.69)	1–9	50	9.7 (± 9.85)	1–28

^a The intensity of infection is based on 15 hosts in which scolex counts were possible. Hosts from which only fragments of cestodes were recovered are, however, included in the prevalence

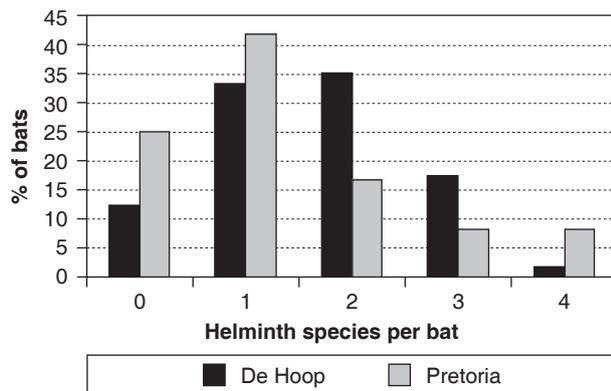


FIG. 1 Frequency histogram of the number of helminth species per bat, *Miniopterus natalensis*, at two study sites

were parasitized by three species and 2% and 11.1%, respectively, had four species.

The intensity of infection ranged from 1 to 14 in the bats from the DHNR and from 2 to 34 in the bats from Pretoria, with mean intensities of infection of $3.76 (\pm 3.15)$ and $10.4 (\pm 9.9)$, respectively. *Molinostrongylus ornatus* and *L. chiropterorum* were the most numerous helminths at the Pretoria site.

The presence of *Allassogonoporus* sp. in *M. natalensis* in South Africa constitutes a new host record as well as a new geographic record for this genus.

DISCUSSION

The species diversity and intensity of infection of the helminth community of Natal long-fingered bats were low at both study sites. The same trend had been observed in an earlier study by Ortlepp (1932), who recovered only three nematode species from this host. Given the insectivorous nature of *M. natalensis* together with its gregarious life-style one might have expected a helminth community richer in species and more abundant in numbers.

It should, however, be born in mind, that the insectivorous nature of *M. natalensis* would only result in increased parasite diversity if a wide variety of insects were taken, whereas a restricted or specialized diet would likely decrease parasite diversity (Price 1990). Unfortunately, information on the prey spectrum of *M. natalensis* is scant.

Increased host density has been linked with higher prevalences and helminth burdens in several mammalian hosts (Moore, Simberloff & Freehling 1988; Altizer, Nunn, Thrall, Gittleman, Antonovics, Cunningham, Dobson, Ezenwa, Jones, Pedersen, Poss & Pulliam 2003; Eira, Torres, Miquel & Vingada

2007). Moore *et al.* (1988) found that especially nematodes with short, direct life cycles, benefit from increased covey sizes in Bobwhite quail, *Colinus virginianus*. With exception of the heteroxenous *L. chiropterorum*, which had a slightly higher intensity of infection than *M. ornatus* at the DHNR, host density-induced accumulation of infective stages in the environment might explain why the only monoxenous helminth in the present study, *M. ornatus*, had the highest prevalence and intensity of infection at both study sites. Since insects are caught in flight and Natal long-fingered bats do not spend much time on the ground, the most likely source of infection would be a commonly used, contaminated water source.

Contrary to the current findings, Ortlepp (1932) reported only "a few specimens" of *M. ornatus* from one of 40 *M. natalensis* from the Irene Caves, Pretoria. In addition, he recovered five specimens of a second member of the genus, namely *Molinostrongylus alatus*, from one of the latter hosts. Hence, the prevalence of this genus recorded by Ortlepp (1932) was distinctly lower than that seen in the present study. Without background information on the hosts examined by the latter author, it is impossible to speculate on reasons for these differences.

The filaria *L. chiropterorum* displayed the second highest prevalence in the helminth communities at both study sites, indicating that vector transmission is a successful mode of parasite transfer within *M. natalensis* colonies. While the natural vector of *L. chiropterorum* is as yet unknown, filarioids in general are transmitted by haematophagous arthropods when feeding on the host (Anderson 1992), and this trophic relationship between the vector and the final host seems an effective way of parasite transmission.

A trophic relationship of a different nature facilitates the indirect life cycle of the hymenolepidid cestode collected from the bats. While the predator/prey relationship between the final host and the, usually arthropod, intermediate host can expose the former to high burdens of infective stages, life cycle completion will be impossible if either of the hosts is absent from the environment. Hence, a reason for the lower prevalence of the hymenolepidid cestode at the Pretoria site versus the DHNR could be a reduced availability of the intermediate host at the former locality.

The low cestode prevalence in bats from the Monument Park Cave in Pretoria, is in keeping with Ortlepp (1932), who did not report any cestodes in 40

Miniopterus natalensis, 11 *Myotis tricolor* and six *Rhinocephalus zuluensis* from the Irene Caves close to the same city.

Data on the intensity of cestode infections in bats from other African countries vary. Jenzen & Howell (1983) found a prevalence of 10.1% of *Vampirolepis schmidtii*, another hymenolepidid, in *Triaenopus persicus* in Tanzania, with the intensity of infection ranging from one to two. Edungbola (1981) found a prevalence for *Vampirolepis kerivoulae* of 35.9% and 35.2% in *Hipposiderus caffer* and *Nycteris gambiensis* respectively, in Nigeria, which is close to the 35.1% prevalence of cestodes in the DHNR.

Taking everything into account, it is difficult to judge if the differences between the cestodes at the two study sites in South Africa are true, or to what extent the findings have been influenced by the different gender compositions of the samples and by seasonal differences. Increased food intake by pregnant females could result in increased exposure to infected intermediate arthropod hosts.

The development of *Alassogonoporus* in African hosts has as yet not been investigated, but the congeneric species *A. vespertilionis* from American bats has a three-host life cycle. Bat faeces containing parasite eggs need to reach water, in which the miracidia hatch and infect freshwater snails. Cercariae shed by the latter enter a second aquatic intermediate host, namely caddisfly (*Acroneuria* sp.) or stonefly (*Dicosmoecus* sp.) larvae, and develop into metacercariae, which encyst and are infective to the chiropteran final host (Knight & Pratt 1955; Burns 1961). Hence, the absence of *Alassogonoporus* from Pretoria bats could be attributable to the absence of one or both of the required intermediate hosts in the environment. Whereas the DHNR offers terrestrial as well as vleiland/wetland habitat, there is no similar aquatic habitat in the immediate vicinity of the Monument Park Cave.

The importance of the availability of aquatic habitats in the foraging area of bats with respect to trematode infections is apparent from a study on the helminth communities of *Pipistrellus pipistrellus* from two localities in Spain. Both helminth communities were dominated by digeneans and both study sites offered extensive aquatic habitats (Esteban, Amengual & Cobo 2001).

A number of species belonging to the filarial genus *Litomosa* have been recorded from African bats. *Litomosa hugoti* was collected from bats in Gabon, *Litomosa pujoli* parasitizes three different chiropteran hosts in Nigeria, and *Litomosa adami* has been

found in the Congo and parasitized *M. natalensis* in Zaire (Petit 1980; Edungbola 1981). To date, the only *Litomosa* species recovered from bats in South Africa is *Litomosa chiropterorum*, which parasitizes *M. natalensis* as well as *Neoromicia capensis* (= *Eptesicus capensis*) (Ortlepp 1932). The prevalence of *L. chiropterorum* in *M. natalensis* in the present study was considerably higher than that found for the congeneric species *L. pujoli* in *H. caffer*, *Nycteris gambiensis* and *Tadarida chaerephon* in Nigeria, namely, 4.8, 9.0 and 2.7% (Edungbola 1981). The intensity of infection, on the other hand, was equally insubstantial in all hosts from all localities, ranging from a mean intensity of 2.0 to 3.3 in the bats in Nigeria and 2.3 to 4.0 in the South African bats (Edungbola 1981).

Given the size of *L. chiropterorum*, females reach 77 mm in body length (Ortlepp 1932), versus the small body size of *M. natalensis*, a burden of six worms per host, which was the highest intensity recorded in Pretoria, might be close to the sustainable capacity of *M. natalensis* without being severely affected by these parasites.

While the present material was not specifically collected for the purpose of analyzing and comparing the helminth communities of Natal Long-fingered bats, and thus not ideally suited for the task, the results nevertheless suggest that there is much scope for future research on the helminth communities of not only miniopterid but other bat species in South Africa as well.

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