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Occurrence and distribution of *Rhabditis axei* (Rhabditida; Rhabditidae) in African giant snails in southwestern Nigeria

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Summary

African giant snails (*Archachatina marginata ovum* Pfeffer, 1858; *A. marginata saturalis* Philippi, 1849 and *Achatina achatina* Linne, 1758) were examined for the occurrence of *Rhabditis axei* Cobbold, 1884.
Differences in parasite intensity between size groups of snails were highly significant ($P < 0.05$) for the 3 species compared. The mean egg and larval output per gram of faeces was higher in larger snails. The mean intensity of the nematode eggs excreted was higher ($P < 0.05$) than the mean of larval output for the 3 species of snails. The distribution of *R. axei* within the snail hosts revealed site preferences. They are mostly (88 %) located in the rectum of the snails.

Key words: *Archachatina marginata ovum; A. marginata saturalis; Achatina achatina; Rhabditis axei;* Snails

Introduction

Rhabditis axei Cobbold, 1884 is a saprophilic nematode (Levine, 1968) that occurs in decaying vegetable and animal matter. The adults and larvae are sometimes recovered as pseudoparasites from the faeces or tissues of animals. A conspecific *Rhabditis maupasi* Seurat, 1919 has been recovered from the mantle cavity of terrestrial snail *Helix aspersa* Mueller, 1774 imported from Morocco (Brockelman and Jackman, 1974).
Rhabditis sp. is the most common nematode in the gastrointestinal tract of living African giant snails in Nigeria (Odaibo, 1997) but no detailed studies have been made on the occurrence and distribution of the nematode in the wild population of snails. This seemed important in view of the growing interest in the cultivation of African giant snails in Nigeria.
This study presents the occurrence and distribution of *R. axei* in the wild population of African giant nails in southwestern Nigeria.

Materials and Methods

A total of 105 specimens of African giant snails (40 *Archachatina marginata ovum*, Pfeiffer, 1858; 35 *A. marginata saturalis* Philippi,1849 and 30 *Achatina achatina* Linne, 1758) of different sizes obtained from the wild in southwestern Nigeria were used for this study. The snails were maintained in rectangular glass aquaria with wire gauze lids. The aquaria were filled halfway with moist humus soil and the snails were fed *ad libitum* on *Tridax procumbens, Talinum triangulare* and *Carica papaya* (leaves and fruits).
Each snail was numbered using indelible ink and the sizes (shell height and body weight) were determined using a vernier caliper. Each snail was placed in a covered glass compartment overnight and faeces deposited was collected and weighed. A small portion of the snail faeces was homogenized in a drop of saline solution on a clean glass slide. The resulting mixture was then covered with a cover slip and examined under the microscope. When a snail was infected, 1g of faeces was processed for a quantitative estimation of the number of eggs, larvae and adults of the nematode.
Parasites or eggs were counted individually when their number appeared not to exceed about 200. When larger numbers of eggs or larvae were present, numbers were estimated by counting the larvae/eggs in 3 aliquots of 1ml in the sedgewick-Rafter counting cell. The mean number of larvae/eggs in the 3 aliquots was multiplied by the volume of the original sample to arrive at an estimate of the number of total larvae, eggs, or adult parasites.
Worm burden and worm localization in the individual snail were determined by dissection. The alimentary tract of each snail was removed as described by Segun (1975) and each tract was divided into four sections (crop, stomach, intestine and rectum). Each section was cut open and rinsed into a Petri dish containing 0.9 % NaCl solution. The number of parasites in each section was counted under the microscope.

The nematode parasite was identified as *Rhabditis axei* Cobbold , 1884 following Goodey (1963). The snails were identified by their shells after Bequaert (1950). Most raw data were overdispersed [variance/mean >1] hence non-parametric statistics were used for hypothesis testing. To calculate significance between sets of data, the Wilcoxon rank sum test was used. Significance was taken at $P < 0.05$.

Results

The nematode *Rhabditis axei* were recovered from all the three snail species examined. All the stages of *R. axei* occurred in the faeces of the snails. The adult and larval stages have rhabditiform oesophagus and long slender tails. The nematode *R .axei* coexisted with the ciliate *Balantidium* sp. in all the snails.

The mean nematode egg output per gram of fresh faeces from *A. marginata ovum*, *A. marginata saturalis* and *Achatina achatina* are shown in Table 1. *A. marginata ovum* had the highest mean egg count of 11317 ± 3054 and the mean { x } to variance (s^2) ratio { s^2/x } of egg counts were significantly greater than unity for the three species of snails ($P < 0.05$). The mean egg and larval output per gram of faeces in relation to size of snails are shown in Table 2. The larger sized snails excreted more eggs than the smaller sized snails for the 3 species. The mean intensity of eggs excreted was higher than ($P < 0.05$) the mean larval output for each of the 3 species of snails (Table 2).

Table 3 shows the pooled data on the positions of *R. axei* in the gut of the 3 species of African giant snails. The distribution of *R. axei* within the snail hosts revealed site preferences. The adult and larvae of *R. axei* were mostly (88 %) located in the rectum of the snails. No larval stages were recovered from the crop and stomach of the giant African snails. Few (17.8 %) adult parasites were recovered from the crop and stomach of the snails.

The distribution of *R. axei* in a single snail host was consistent with the overall distribution of the species in all the snail hosts examined.

Discussion

Rhabditis axei was recovered from all the snail species examined in this study. The larger snails excreted more parasite eggs and larvae than the smaller snails. This difference in parasite intensity between groups of different sizes was expected. Smaller snails have less opportunity to in-

Table 1. The prevalence and mean intensity of *R. axei* in 3 species of African giant snails in southwestern Nigeria

Snail species	No. examined	Prevalence (%)	Nematode population/g faeces			Variance/ mean ratio
			Adult	Larval	Eggs	
A. marginata ovum	40	100	40 ± 30	1000 ± 600	11317 ± 3054	824
A.marginata saturalis	35	100	35 ± 21	896 ± 567	10096 ± 4806	2287
A. achatina	30	100	22 ± 18	685 ± 592	6571 ± 2960	1333

* - ± SD; *- s^2/ x Significantly different from unity: ($P < 0.05$)

Table 2. Mean intensity of *R. axei* in relation to snail sizes

Snail species	Size group (cm)	Number examined	% of total	Mean egg/ g faeces	Mean larvae/ g faeces*
A. marginata ovum	8.0-10.0	11	28	14710 ± 2960	682 ± 400
	11.0-13.0	16	40	19136 ± 3034	1472 ± 880
	14.0-16.0	13	32	23567 ± 3107	1961 ± 782
A. marginata saturalis	8.01-10.0	8	23	10227 ± 5331	585 ± 500
	11.0-13.0	15	43	16500 ± 2960	714 ± 651
	14.0-16.0	12	34	21145 ± 4491	890 ± 900
A. achatina	8.0-10.0	8	27	5581 ± 2341	401 ± 306
	11.0-13.0	12	40	10511 ± 314	566 ± 511
	14.0-16.0	10	33	12516 ± 3142	752 ± 812

*- ± SD

Table 3. Mean number and percentage (in parentheses) of adults and larvae of *R. axei* in different sections of African giant snail's gut

Stages of *R. axei*	Mean number (%) of parasites recovered*			
	crop	stomach	intestine	rectum
Adult	5.4 ± 3.0 (13.5)	1.7 ± 0.5 (4.3)	2.6 ± 0.6 (6.5)	30 ± 20 (75)
Larvae	0.0 (0.0)	0.0 (0.0)	1.3 ± 1.1 (2.5)	55 ± 25 (98)
Total	**2.9±3.8 (0.6)**	**0.9±1.2 (1.8)**	**2.0±0.9 (4.5)**	**42.5±17.6 (88)**

* - ± SD

gest infective stages because they consume less decaying vegetable matters than larger snails, and have been alive for less time to allow for exposure or development of the parasites. Baruš (1964) has shown that size of the mouth opening and the contents of the digestive tracts of snail are some the most important factors that may influence the intensity of infective larvae in snails.

The infections in all the snail species were largely over dispersed. Similar parasite distribution has been reported for many other hosts (Crofton, 1971; Anderson, 1982). Of the many possible causes of such distribution (Crofton 1971; May, 1977; Anderson 1982) it is possible that the overdispersed distribution of the *R. axei* in the snail population is created by the heterogeneous distribution of the parasite in the environment.

The distribution of the parasite within the snail host revealed site preferences. The site of *R. axei* in the snails is typically the rectum and less frequently in the intestine or stomach. This may be due to the fact that the parasites feed mainly on bacteria (Anderson, 1992) which would readily be available in the rectum of the snails.

The recovery of all stages (adult, larvae and eggs) from the faeces of all the snails shows that there is a continuous flow of the parasite from the soil through the snails and back to the soil. *R. axei* are soil-dwelling nematodes (Goodey, 1963) and are most abundant in moist soil enriched with decomposing organic matter (Anderson, 1992). The African giant snails are also inhabitants of moist soil enriched with decomposing organic matter (Odaibo, 1997). The regular contact between the parasite and the snail host is therefore ensured. In the natural population, it would be expected that a greater number of snails would become infected and high prevalence and intensity of infection would result as the present study has shown.

A large number of larvae and few adult males and females of *R. axei* have also been reported as pseudoparasites in faecal samples of dogs (Levine, 1968) and a conspecific, *R. maupasi* had been recovered from terrestrial snail, *Helix aspersa* from Morocco (Brockman and Jackman,1974). The pathologic significance of the infection in the snails is unknown, but it appears that the African giant snails tolerate the infections without much difficulty.

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