Rhabditis axei (NEMATODA: OXYURIDAE) INFECTION AMONG TERRESTRIAL SNAILS IN SOUTHERN NIGERIA

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Abstract

Terrestrial snails, *Archachatina marginata ovum, Archachatina papyracea* and *Limicolaria aurora* collected from different localities in Cross River, Edo and Kogi States were examined for parasitic infections. Some 235 (31.8%) of the 740 snails examined were infected with the nematode *Rhabditis axei*. The prevalences of infection were 41.8% for *A. marginata ovum*, 23.3% for *A. papyraceae*, and 10.1% for *L. aurora*; 70.2% of the infected snails were *A. marginata ovum*, 22.6% *A. papyracea* and 7.2% *L. aurora*. This study revealed that size of snails had influence on the prevalence of infection, as the bigger snail species, *A. marginata ovum* were more infected. Small size *A. marginata ovum* had a mean worm burden of 3.48 worms per infected snail, whereas the big-size snails had a mean worm burden of 0.51 worms per infected snail. This study also showed that location of sampling and season had a significant influence on prevalence of infection in *L. aurora*. For *A. marginata ovum* however, only site of sampling impacted on the prevalence of infection significantly. Though the percentage of infected *A. marginata ovum* increased with increased rainfall, the relationship was not significant. Infection as recorded in this report occurred mostly in the mantle and digestive gland of the snail. The study is indicative that *A. marginata ovum, A. papyracea* and *L. aurora* collected from various study sites in Cross River, Edo and Kogi States in Nigeria are definitive hosts to the nematode *R. axei*.

Keywords: *Archachatina marginata, Limicolaria aurora*, *Rhabditis axei*, snails.

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Introduction

Archachatina and *Limicolaria* belong to the class gastropoda, which is the largest class of the Phylum Mollusca, a biologically successful group occurring in large numbers in the sea, freshwater and land. *Achachatina* spp are highly prized as food in West and Central Africa as well as Asia and are reared commercially (Hardouin, 1995). In southern Nigeria, they are commonly found under moist vegetation and are important as sources of protein, vectors of parasites and defoliators (Yoloye, 1988). These snails are of great relevance during social and cultural festivities and are useful in traditional medicine (Osemeobo, 1992).

Many species of snails have been found to serve as intermediate hosts to many parasites of man and his domestic animals. A survey of parasitic stages in *Limicolaria* species collected from Edo State by Ogedegbe (1988) and Oyibo (1989) revealed the presence of unidentified trematode larvae and juveniles. *Limicolaria* species have also been recorded as intermediate host of *Dicrocoelum hospes* in some part of Africa (Lucius and Frank 1978; Lucius *et al* 1981). Awharitoma *et al* (2003) reported *Limicolaria aurora* as an intermediate host of the trematode *Brachylaima*

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fuscatum in Nigeria. *Archachatina fulia* is an intermediate host of *Parastrongylus cantonensis* which causes lethal eosinophilic meningitis in humans, affecting the brain and nervous systems (Klik, and Palumbo, 1992). The disease originally described from China has also been reported in West Africa (New *et al* 1995). *Archachatina marginata ovum*, *A. marginata saturalis* and *Achatina achatina* have been reported by Odaibo *et al* (2000) to be infected by the nematode *Rhabditis axei*.

The present study is an investigation of the prevalence and seasonal variation of *R. axei* infection in *A. marginata ovum, A. papyracea* and *L. aurora*, which constitute the most conspicuous and important commercial terrestrial molluscs in Nigeria.

Materials and methods

A total of 740 snails consisting of 343 *A. marginata ovum,* 228 *A. papyracea* and 169 *L. aurora* were examined in this study. The snails, most of which were market-derived were collected from Calabar in Cross River State (4°34′N and 6°58′E) and Idah in Kogi State (7°05′N and 6°45′E) while the others were collected from different localities in Edo State covering the rainforest zone, Benin (6°19′N and 5°36′E), Ekpoma (6°45′N and 6°08′E), Siluko (6°31′N and 5°09′E), Udo (6°20′N and 5°16′E), Ugbojobo, Umaza and savannah mosaic zone Auchi (7°04′N and 6°16′E).

The specimens were transported to the laboratory for parasitological investigations. The snails were weighed in a meter balance, after which they were de-shelled using a vice to crack open the shell and the visceral mass pulled out and placed in a Petri dish. The haemolymph was collected into separate Petri dish, while the different body parts of the snails, notably, the intestine, stomach, digestive gland, crop, kidney, mantle, and were cut into separate Petri dishes containing normal saline (0.85% NaCl solution). The organs were teased out and examined for parasites under a dissecting microscope. Parasites were collected, counted, fixed in 70% alcohol and preserved in the same fixative. The number of parasites per snail and their location in the hosts were recorded. Identification of parasites was carried out using appropriate keys (Yamaguti 1961; Goodey, 1963). Nematode identification was confirmed at the British Museum of Natural History. Statistical analysis involved *chi*-square contingency analysis.

Results

The nematodes isolated from the examined snails were identified as *R. axei*. Of the snails species examined 31.8% were infected with *Rhabditis axei* (Table 1). Prevalence in *Archachatina marginata ovum* was 48.1%, 23.3% in *Archachatina papyracea* and 10.1% in *Limicolaria aurora.* Majority of the nematodes (76.4%) were isolated from *A. marginata ovum*, and comprised male and female worms in the ratio of 1:3.

Table 1: Prevalence of *Rhabditis axei* in snail species examined.

Snail species	Total number examined	Total number infected (%)	No. *R. axei* Isolated (%)	Mean intensity of infection
A. marginata ovum	343	165 (48.1)	1613 (76.4)	9.8
A. papyracea	228	53 (23.3)	453 (21.4)	8.5
L. aurora	169	17 (10.1)	46 (2.2)	2.7
Total	740	235 (31.8)	2112	8.9

Table 2: Prevalence of Rhabditis axei according to snail location.

Location	*A. marginata ovum*		*A. papyracea*		*L. aurora*	
	No. examined	No. infected (%)	No. examined	No. infected (%)	No. examined	No infected (%)
Auchi	100	16 (16.0)	–	–	100	50 (50.0)
Benin	–	–	–	–	100	12 (12.0)
Calarbar	–	–	–	–	52	2 (3.8)
Ekpoma	101	33 (32.7)	–	–	–	–
Idah	–	–	35	35 (100.0)	–	–
Siluko	100	60 (60.0)	–	–	–	–
Udo	100	43 (43.0)	–	–	–	–
Ugbojobo	–	–	40	18 (45.0)	–	–
Umaza	100	10 (10.0)	–	–	–	–

Snails from all sampled sites were found to be infected though with varied infection rates (Table 2). *A. marginata ovum* collected from the savannah had 16.0% prevalence of infection while those from the rainforest had 36.4% prevalence of infection. Site of sampling had a high significant influence on rate of infection in *A. marginata ovum* ($p< 0.001$).But for *L. aurora* in which no parasite was found in January, February and December snails were found to be infected throughout the year but with varied prevalence of infection (Figure 1). Prevalence of infection also varied with seasons in the sampling site (Figure 2). In *A. marginata ovum,* prevalence of infection for all sampling sites was consistently higher (50.0% to 68.0%) in the raining season than in the dry season (10.0% to 55.0%), whereas more *L. aurora* (8 to 55.0%) were infected in the dry season than in the rainy season (5 to 18%). Season has no significant influence on infection of *A. marginata ovum* ($p>0.005$), but there is a high significant influence on infection of *L. aurora* ($p<0.05$).

Most of the small sized *A. marginata ovum* (40.4g-198.6g) were infected by parasites and had the highest intensity of infection with a mean worm burden of 3.48 nematode per infected snail. The big-size snails (310.2g-452.9g) had a mean worm burden of 0.51 per infected snail. The mantle of infected snails had the highest prevalence of infection 64.5%, followed by the digestive gland, 15.5%, kidney 14.4%, stomach, 5.5% and crop, 0.3%. No infection was recorded in the haemolymph and foot.

Discussion

There was variation in the infection of individual snail species with *R axei*. In this study, the prevalence recorded for *A. marginata ovum, A. papyracea* and *L. aurora* were 48.1%, 23.3% and 10.1% respectively. In contrast, Odaibo *et al* (2000) reported 100% prevalence of infection with *R. axei* for *A. marginata ovum, A. marginata satura* and *A. achatina*. The difference in the prevalence of *R. axei* observed for *A. marginata ovum* may be due to differences in geographical locations and seasonality which in turn influence the availability of the nematode ova and eventually the level of infection in a particular geographical area.

In the present study only the nematode *R. axei* was isolated from the examined snails. However, *Achatina* species have been reported as an intermediate host of the rat lungworm, *Angiostrongylus contonensis*, which causes the potentially lethal eosinophilic meningitis (cerebral angiostrongliasis) in humans (Bowden, 1981).

The isolated nematode *R. axei* has been reported as a saprophytic nematode occurring in decaying vegetable and animal matter and a facultative parasite

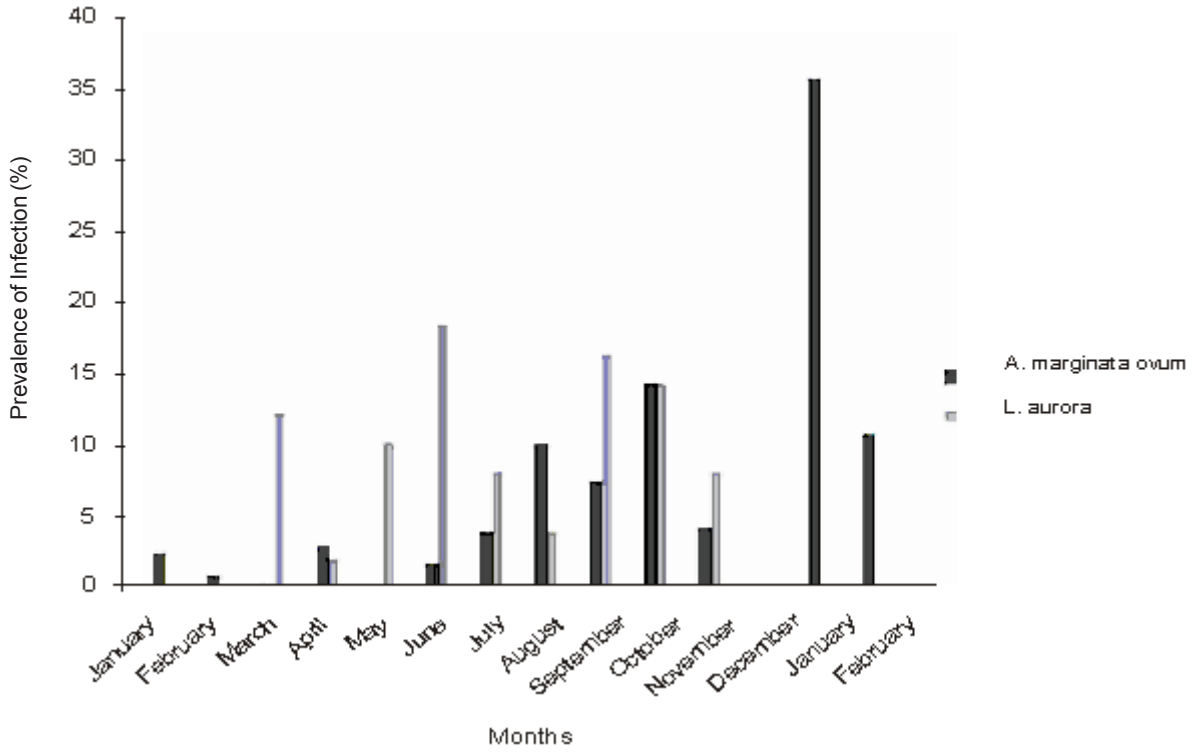

Figure 1: Prevalence of *R. axei* in *A. marginata ovum* and *L. aurora* according to month.

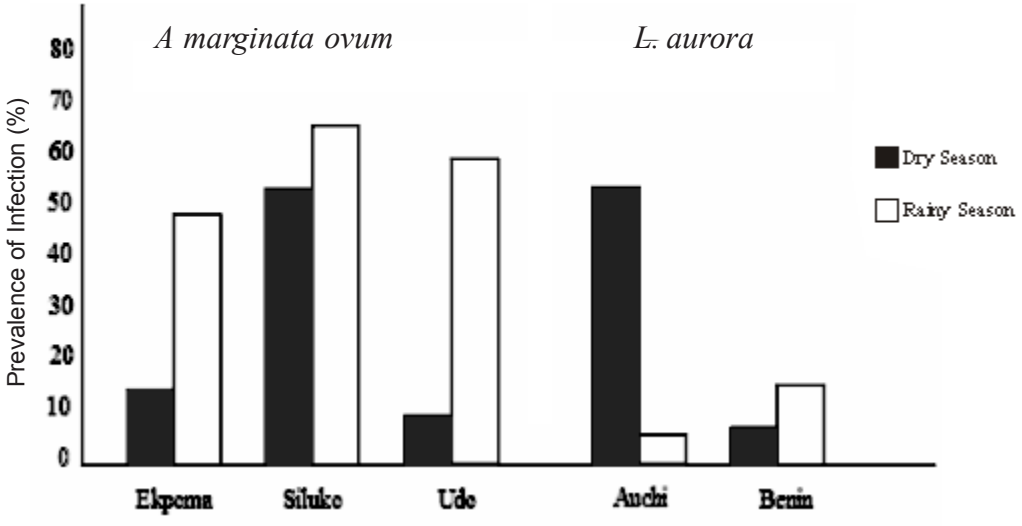

Figure 2: Prevalence of *R. axei* in *A. marginata ovum* and *L. aurora* according to sites and season.

of arthropods, earthworms, molluscs and vertebrates (Goodey, 1963). A conspecific *Rhabditis maupasi* has been recovered from the mantle cavity of the snail, *Helix aspersa* (Brockelman and Jackson, 1974). In this study, *L. aurora* had a lower prevalence of infection (10.1%) than *A. marginata ovum* (48.1%). This observation may be as a result of size difference between the two snail species. *A. marginata ovum* is larger (average size 7.8 cm) than *L. aurora* (average size 4.6 cm). Barus (1964) has shown that size of the snail mouth opening and the contents of the digestive tracts are important factors influencing the intensity of infective larvae of nematode in snails.

The present report indicates that small size *A. marginata ovum* were more infected by *R. axei* than big size snails, contrary to the report of Odaibo *et al* (2000) in which larger *A. marginata ovum* were more infected. The observed variation in the two reports could be due to difference in accessibility of *R. axei* to the different snail size groups in the locations of study. Furthermore, the present report can be explained by the findings of Rezac *et al* (1993) that there was a decline in penetration rate of parasites with increasing size of snails due to inhibition of larvae infectivity by mucus secreted more intensively by larger snails.

The high prevalence of parasite in the mantle, digestive gland and kidney could be due to the fact that these organs are highly vascularized and rich in accessible nutrients (Madsen, 1982).

For the entire snail species, location of sampling had a significant influence on prevalence of infection (Ho rejected $p<0.001$). *A. marginata ovum* collected from the savannah had a lower infection rate (16.0%) than those from the rainforest (10.0-60.0%). Higher temperature and less rainfall in the savannah may be major factors responsible for lower infection rate in the savannah, especially for a soil-dwelling parasite like *R. axei*. An increase in infection with increased rainfall could be due to the fact that contact between parasite and snail host is ensured during this period because animal wastes easily come in contact with water, rate of decomposition is higher and more parasites eggs hatch.

The occurrence of *R. axei* in *L. aurora* represents a new host record in Nigeria and in *A. marginata ovum* in Edo State, it is a new geographical record. The pathologic significance of the *R. axei* infection in *A. marginata ovum* and *L. aurora* is yet to be determined. However, it was observed during the study that both infected and uninfected *A. marginata ovum* and *L. aurora* were very active.

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