

Occurrence Of Nematodes And Trematode Cercariae In *Lymnea* Species Of Danmadahun Part Of Jakara Dam, Kano State, Nigeria

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Abstract: This paper reports the occurrence of nematodes and trematode cercariae in *Lymnea* species of one part of Danmadahun in Jakara dam, Kano state, Nigeria. This study was initially carried out between October to January 2017 to determine the types of trematode cercariae in freshwater snails in the water body. Freshwater snails were collected from the accessible sites on Danmadahun part of Jakara dam and placed individually in compartmented petridishes for cercarial shedding. A total of 67 *Lymnea* snails (made up of eight species) were collected from this part of the study site out of which four forms of nematode, *Chaetogaster* species and five forms of cercariae, three *Gymnocephalus* and two unidentified cercaria were encountered. The prevalence of nematodes in these snails is 6% and that of cercariae is 7.46% with 11.94% as the overall prevalence of infection. This study presents the first report of nematodes in snails of Jakara dam. There is the need for thorough investigation and control of *Lymnea* and other snail species in this area because of the diverse infections they can transmit in humans, animals and agriculture since this is an irrigation site.

Keywords: Cercariae, Danmadahun, Jakara dam, *Lymnea* species, Nematodes.

I. Introduction

Freshwater snails are important in the transmission of parasitic diseases. They have been reported as serving as intermediate hosts to parasites of man and animals (Duwa and Oyeyi, 2009; Duwa, 2017 and Ofoezie, 2002). The different parts of Jakara dam harbour different species of snails and only the occurrence of trematode cercaria has been reported until now. Most studies carried out on the dam focused only on the presence of snails and prevalence of infection among communities around the dam. Cercariae are the free swimming larval stage of flukes of schistosomiasis and Fascioliasis. Jakara dam has been investigated for its role in the transmission of schistosomiasis but not for other diseases transmitted by snails. Different snails can carry the same type of cercaria and a single snail can carry more than one type of cercaria (Kuris and Lafferty, 1994; Sousa, 1993 and Duwa, 2017). Martins and Alves (2010) reported the occurrence of *Chaetogaster limnaei* K. von Baer, 1927 (Oligochaeta, Naididae) in Gastropoda mollusks in horticultural channels of Southeastern Brazil. Grewal *et al* (2003) reported that nematodes form diverse associations with slugs and snails that range from paratenic relationships to parasitic or pathogenic relationships and that a majority of the Metastrongyloidea (Order: Strongylida) use molluscs as intermediate hosts for which vertebrates serve as final hosts while a majority of Rhabditoidea (Order: Rhabditida) use molluscs as definitive hosts in which the entire nematode life cycle is completed. Mohammad (2015) reported the occurrence of cercariae, nematode and nematode larva in freshwater snails collected from central Iraq during cercarial shedding.

II. Material And Methods

2.1 Study area: This study was carried out in Danmadahun part of Jakara dam which is located between (Latitude N12°05.452' and Longitude 8°40.418'E) in Gezawa local government area of Kano state. Jakara dam was constructed in 1976 and is situated in Wasai, Minjibir Local Government Area (LGA) in the North Eastern part of Kano metropolis about 41.5Km from the city centre. The area in terms of geology falls within the tip end of the Basement complex adjoining Chad formation, which is characterized by disappearing type of streams. Jakara dam is one of the most grossly polluted dam in West Africa, because during the dry season all the streams that feed it dry up with the exception of the major Jakara stream which sustain it. The water bodies contain muddy substrata and gentle flowing, low turbidity water with rich growth of algae and macrophytes.

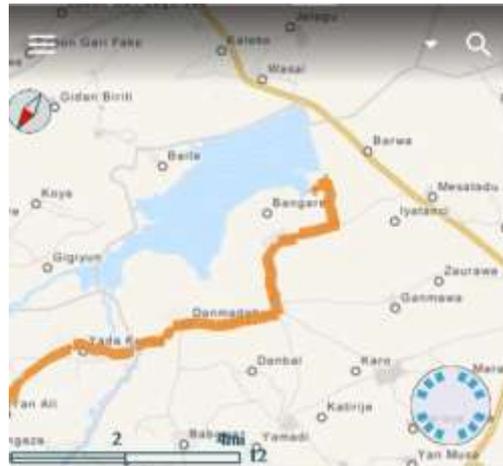


Fig.1: Map of Jakara dam

2.2 Snail collection

Freshwater snails were searched for and collected from two accessible sites on Danmadahun part of Jakara dam between October and January 2017. The accessible areas were reduced with each visit by farmers who cultivate the land as the water recedes after the rainy season. The sites where these snail species were collected are 300m apart, one part has vegetation (water hyacinth) and harbouring *Lymnea* and *Bulinus* species (reported in Duwa, 2017), the other with no vegetation containing bigger *Lymnea* species lying freely in water. Snails were collected by hand picking only into wide mouthed plastic containers and brought to the laboratory. It was then sorted out into different species for further investigation. These snails were fed with lettuce during this study.

2.3 Cercarial shedding

Snails were separately placed in compartmented petridishes and exposed to artificial light (rechargeable lamp) for 2-3 hours to stimulate cercarial shedding, they were also exposed to sunlight on a sunny day (this is harmattan period in Kano). Few drops of water was then taken from the petridish and placed on a glass slide using a pipette and narcotized with neutral red to demobilize them before examination with a compound microscope for more detailed identification. Those snails that do not shed cercaria on the first day were re-exposed on the second day and those that shed cercariae were continuously exposed and observed under the microscope until the water in which they were placed was exhausted. Photomicrograph of the cercariae were taken using Toupview 3.7 digital camera fitted to the microscope through a USB. Efforts were made to identify cercariae and nematodes using keys provided by Frandsen and Christensen (1984), Key to cercarial identification and website resources. During this period, snails were fed lettuce.

III. Results And Discussion

3.1 Snails discovered

Only one family of freshwater snails was encountered in this part of Danmadahun in Jakara dam (Fig.1). Table 1 shows the frequency of snails encountered in this part of Danmadahun and the types of infection they are carrying. Altogether 67 *Lymnea* snails made up of eight different species were collected. The *Lymnea* species encountered (Fig.2) were presumably identified as *Limnaeus cerasum* Troschel, *L.nyansae*, *L.elgonensis* Preston, *L.undussumae* von Martens, 1897 *Limnaeus javanicus* var., *A. pfefferiana* Dunker, *Amphipeplea cumingiana* and *L. kempfi* Preston (Fig.3). The most abundant snail is *Limnaeus cerasum* Troschel (19.4%) followed by *Limnaeus javanicus* var (16.41%), *A. pfefferiana*, Dunker (14.92%). There are no *Bulinus* or other snail specie in this part of Danmadahun. Out of the 67 snails collected 8 were infected, three were harbouring nematodes (*Chaetogaster* species) only and four were shedding cercariae only and one shedding both cercaria and nematode.

3.2 Cercariae and Nematodes encountered

Four types of nematodes (Fig.5a-d), *Chaetogaster* species and five types of cercariae (Fig.4a-f), three *Gymnocephalus* (a,b and e), two unidentified cercariae (c and d) and a metacercaria (f) were encountered. The prevalence for cercarial infection is 7.46% and for nematode infection is 6% while the overall prevalence of infection is 11.94%.

Table 1: Frequency of occurrence of *Lymnea* species in Danmadahun 2

| Snails species | Number collected | Number infected | Cercarial infection | Nematode infection |
|---------------------------------------|------------------|-----------------|---------------------|--------------------|
| <i>Limnaeus cerasum</i> Troschel | 13 | 1 | + | - |
| <i>L.nyansae</i> | 8 | 1 | + | - |
| <i>L.elgonensis</i> Preston | 8 | 1 | + | + |
| <i>Limnaeus javanicus</i> var. | 11 | 1 | + | - |
| <i>Amphipeplea cumingiana</i> | 3 | 1 | - | + |
| <i>A. pfefferiana</i> Dunker | 10 | 1 | - | + |
| <i>L. kemp</i> Preston | 5 | 1 | + | - |
| <i>L.undussumae</i> von Martens, 1897 | 9 | 1 | - | + |
| Total | 67 | 8 | 5 | 4 |

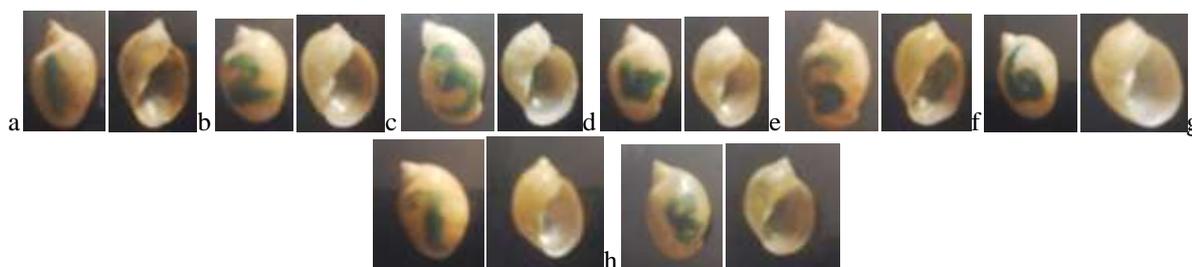
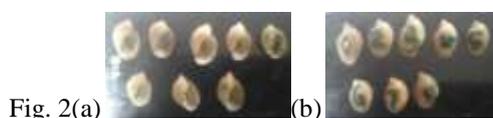


Fig.3 (a-h): Abapertural and apertural view of *Lymnea* species the study area

(a)*Limnaeus cerasum* Troschel (b) *Limnaea nyansae* von Martens, 1892 (c) *Limnaea elgonensis* Preston (d) *Limnaeus javanicus* var. *intumescens* von Martens, 1867 (e) *Amphipeplea cumingiana* Pfeiffer, 1845 (f) *Amphipeplea pfefferiana* Dunker (g) *Limnaea kemp* Preston, 1911 (h) *Limnaea undussumae* von Martens, 1897

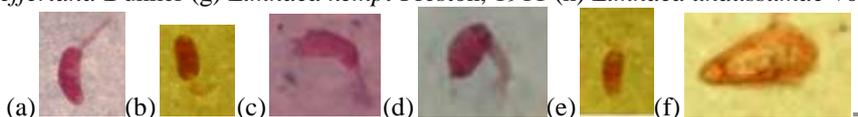


Fig.4a-f: Trematode cercariae recovered from *Lymnea* species in the study area

(a)*Gymnocephalus* cercaria (b)*Gymnocephalus* cercaria(c)Unidentified cercaria(d)Unidentified cercaria(e)*Gymnocephalus* cercaria (f) Metacercaria



(a) *Chaetogaster limnaei* spp (b) *Chaetogaster limnaei* spp (c) *Chaetogaster limnaei* spp (d) *Chaetogaster limnaei* spp

Fig. 5a-d: Nematodes found in *Lymnea* species in Danmadahun part of Jakara dam

Different types of *Lymnea* species were found on Danmadahun part of Jakara dam. The findings on this part of Danmadahun were reported separately because of its uniqueness which is the habitat preference of the snails observed, their size and what they were parasitized by. *Lymnea natalensis* and other *Lymnea* species were found attached to the macrophyte, water hyacinth in muddy substrata with *Bulinus* species in the first part

(Duwa 2017). In this second part the snails are much bigger and were picked 300 meters away, in clear water of pH7.2. It is noteworthy that only *Lymnea* species were supported by this part of Danmadahun, which is in contrast with the other part 300 meters away that was dominated by *Bulinus* species and smaller sized *Lymnea* species. Since this is the first time snail species in this part of the dam were reported it cannot be ascertained whether it was dominated by other species in earlier times, farmers were found planting (cassava) as the water recedes after the rainy season (this is an irrigation system). In this part of the dam the snails were both infected with nematodes and cercariae. The nematodes encountered in this study *Chaetogaster limnaei* (Naidinae) has two known species that parasitize freshwater snails, one endoparasitic in the kidney and the other ectoparasitic on the outer surfaces of the host. *C. limnaei limnaei* was found to attach itself to the mantle cavity and pulmonary cavity of the host and feeds on microorganisms, such as protozoa, rotifers and algae (Michelson, 1964; Fried *et al.*, 2008; Stoll *et al.*, 2013), hence it is regarded as a commensal (Young, 1974). An experiment conducted by Stoll *et al.* (2013) showed that the relationship between *C. limnaei limnaei* and *Physa acuta* can be described as epizotic antibiosis at high infestation rates, due to the fact that hosts had lower growth rates and productivity. It is not known whether these nematodes can affect infection of snails by trematodes but in this study it was observed that the snails that were harbouring cercariae are not harboring any nematode and vice versa except for the case of only one snail specie (*Lymnae elgonensis*) which was harboring cercaria and nematode at the same time, this showed that the snail can both be infected with a nematode and a trematode. The report of Martins and Aves (2010) and Agbolade *et al* (2007) showed that *Chaetogaster limnae* were found in different snail species including *Biomphalaria* and *Potadoma moerchi* respectively, this findings proved that *Chaetogaster* species can use different organisms that are present in an aquatic environment as substrate since in this study they were found in *Lymnea* species. Earlier studies by Rodgers *et al* (2005) has shown that the prevalence of infection was significantly higher in snails that were not harboring *C. limnaei limnaei* relative to those that were colonized by the commensal, indicating that the oligochaete may protect the host from trematode infection, this may only happen in water bodies that favor the snail host considering the fact that these nematodes were found in snails in very clear water with no vegetation and most intermediate hosts of trematodes such as *Bulinus* species were mostly found attached to vegetation in muddy substrata. Although there is no report yet of *Chaetogaster* infecting crops a number of nematodes have been found to infect crops in farm lands thereby reducing yields. A report by Nagesh *et al* (2005) stated that all the four major species of Meloidogyne including; *M. javanica*, *M. arenaria*, *M. incognita* and *M. hapla* are known to readily attack tomato crops in outdoor as well as in indoor cultivations. About 2000 plants are susceptible to infection by the root-knot nematodes and they cause approximately 5% of global crops loss (Sasser and carter, 1985). Nematodes of *M. incognita* were isolated from crop roots of paprika plant and *M. hapla* was isolated from galls of vegetables grown in the open field in Jublijana (Sirca, *et al.*, 2004). There is likelihood that nematodes that are harmful to agriculture or agricultural products may invade the water body. The types of associations between these snails and the nematodes they are harbouring needs to be investigated. There is also the need for further studies on the snail species in this area considering the fact that other snail species have been found as intermediate hosts of parasitic nematodes. Such studies will provide relevant information on the potential risks of *Lymnea species* in transmitting diseases other than *Fascioliasis* which is already known.

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