

Emergence of New Snail Species and Cercariae on Jakara Dam

Rabi Suraj Duwa

Nigeria Police Academy, Wudil, Kano state

Abstract: Fresh water snails in Jakara dam were investigated for different types of cercariae. Snails were collected from different parts of the dam in Minjibir, Ugoggo and Gezawa local government area between October 2016 and January 2017 by hand picking only and placed separately in compartmented petridishes for cercarial shedding. Result showed that twenty one snail species from two families comprising Lymnaeidae and Planorbidae were encountered. *Bulinus* species collected are *B. globosus* morelet, *B. reticulatus*, *B. truncatus* rohlfsi, *B. truncatus truncatus* Egypt, *B. jousseammei*, *B. succinoides* and *B. camerunensis*. Fourteen species of *Lymnea* were encountered from different parts of the dam. *Lymnea* species encountered are *Peplimnea affinis* ((Küster,1862), *Lymnea (Pseudosuccinea) columella*, *L. natalensis*, *Lymnaea ollula*, *L. tormentosa*, *L.auricularis rubiginosa* with one of them shedding more than a hundred cercariae. Most of these *lymnea* species cannot be identified or named. Twelve different types of cercaria were discovered but only nine of them were presumably identified as *Virgulate*, *Ubiquita*, *Gymnocephalus*, *Amphistome*, *Echinostome*, *Armatae* cercaria, *Parapleurolophocercous* cercariae, *Ornatae* and *Fucocercus* cercaria (videos of swimming available), three of them cannot be identified. *Lymnea* species from Bangare showed the most infection with one of them shedding more than a hundred cercariae. There was no schistosome cercariae. This is the first time more than three types of cercariae were observed in Jakara dam. Data analysis was done descriptively. The presence of these new types of cercariae may not be unconnected with the presence of different species of *Lymnea* encountered in the water body and may mean a new trend in trematode infection.

Keywords: *Bulinus* species, Cercariae, Jakara dam, Kano state, *Lymnea* species.

I. Introduction

Most dams were constructed to achieve food security, through river impoundment, to provide sufficient water for year-round irrigation. Within a short time the dams started harbouring fresh water snails that can transmit diseases by serving as intermediate hosts. The rates of infection with Schistosomiasis begins to increase. Fascioliasis was also observed. These two diseases were transmitted by Bulinid, Biomphalaria and Lymnoid snails. In Jakara dam *Bulinus globosus*, *Biomphalaria glabrata* and *Lymnea natalensis* are the only snails found as intermediate hosts until recently when many other species of *Bulinus* were encountered in the other parts of Jakara dam. It was the result of this previous study that motivated the present study. The roles of dams in the transmission of schistosomiasis and fascioliasis cannot be over-emphasized. Ofoezie (2002) reported that 20(43%) out of the 47 investigated dams harboured *Bulinus globosus* and / or *Biomphalaria pfeifferi*, the local intermediate host species for *Schistosoma haematobium* and *S. mansoni*, respectively. Most studies carried out in these dams has only emphasized their roles in the transmission of schistosomiasis (Duwa and Oyeyi,2009; Ofoezie *et al.*, 1991, 1996). Schistosomiasis is not the only disease transmitted by freshwater snails found in dams that can affect man. *Lymnea* species are the intermediate hosts of Fascioliasis. Fascioliasis is a parasitosis mainly infecting cattle, but it is now considered to be an emergent disease of humans in many countries all over the world (Mas-Coma, 2005). *L. natalensis* transmits *Fasciola* parasites to animals and man causing fascioliasis (Utzing and Tanner, 2000; Dida *et al.*, 2014). It is widespread in tropical Africa, but it is rare in the Northeast coastal area (Appleton *et al.*, 2009). This disease is endemic in 61 countries and has become a food-borne infection of public health importance in parts of the world such as the Andean Highlands of Bolivia, Ecuador, and Peru; the Nile Delta of Egypt; and Northern Iran. It is estimated that more than 180million people are at risk of infection, and infection rates are high enough to make fascioliasis a serious public health concern WHO, (1998). Fasciolosis due to *F. gigantica* has been reported in several parts of Africa (Abebe *et al.*,2010) and Nigeria (Umar *et al.*, 2009). Elelu *et al* (2016) reported the presence of positive cases of *Fasciola gigantica* in Kwara state. In other places where this disease was reported *Lymnea* species other than *Lymnea natalensis* has been identified as the intermediate host. *Lymnea natalensis* has been reported in Northern Nigeria (Betterton *et al.*, 1988; Duwa and Oyeyi, 2009;Duwa,2017) especially in the Southwest region (Ndifon and Ukoli, 1989), with habitat fragmentation that has resulted in their patchy distribution in lakes, dams, canals, ponds and rivers. Despite the fact that this snail is well distributed in Nigeria with wide geographical range, there is identification and information problem of the different species in the different water bodies if there is any record of their existence in the first place. Since there is no knowledge or record of their existence control efforts to limit disease transmission through vector control will not be possible.

II. Material and Methods

2.1 Study area: This study was carried out in five parts of Jakara dam, Bangare and Danmadahun in Gezawa local government area; Yadakunya in Ungoggo local government area, Fako and Kwata both in Wasai, Minjibir local government area of Kano state. Wasai (Latitude N12°09.589' 8⁰ and Longitude 40.422'E), Fako (Latitude N12°08.940' and Longitude 8° 39.113'E), Bangare (Latitude N12°07.221' and Longitude 8°41.800' E), Danmadahun (Latitude N12°05.452' and Longitude 8°40.418'E) Yadakunya (Latitude 12°05.073' N and Longitude 8°38.823' E). 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.

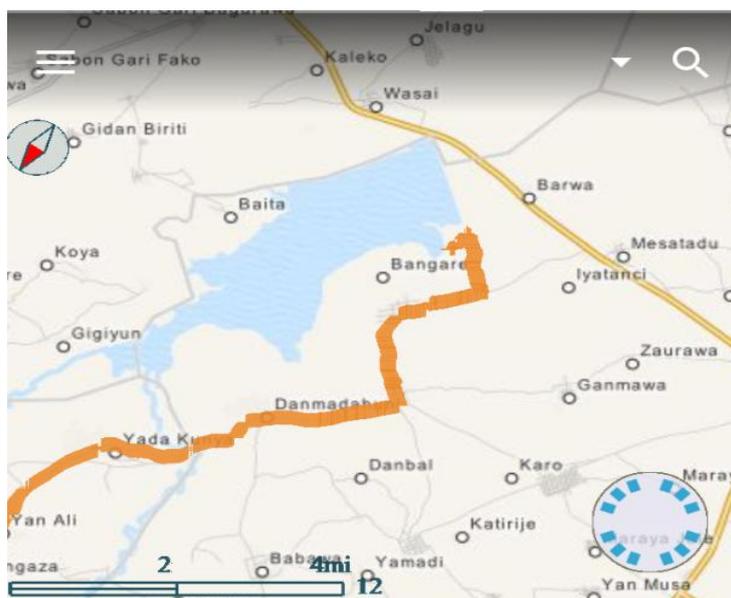


Fig.1: Map of Jakara dam

2.2 Snail collection

Five parts of Jakara dam were investigated for the presence of freshwater snails between October 2016 to January 2017. These parts are located on three local government areas of the state (Gezawa, Minjibir and Ungoggo). Snails were collected by hand picking only into a wide mouthed plastic container 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 3.1 digital camera fitted to the microscope through a USB and cercariae were identified using keys provided by Frandsen and Christensen (1984) and Key to cercarial identification.

III. Results and discussion

3.1 Snails discovered

All the study areas except one (Fako) were harbouring snail species. Two families of freshwater snails were discovered in Jakara dam (Fig.1). A total of 367 snails were collected out of which 200 (54.5%) were different species of *Bulinus* and 167(45.5) were different *Lymnea* species. Kwata has the highest diversity with eight species, *Bulinus* species *B. globosus morelet*, *B. reticulatus*, *B. truncatus rohlfsi*, *B truncatus truncatus*

Egypt, *B. jousseammei*, *B. succinoides* and *B. Camerunensis* and only one *Lymnea* specie, *Lymnea natalensis*, no single live snail was encountered in the Fako part. Altogether Fourteen species of *Lymnea* were encountered from the dam. *Lymnea* species encountered were presumably identified as *Peplimnea affinus* ((Küster,1862), *Lymnea (Pseudosuccina) columella*, *L. natalensis*, *Lymnaea ollula*, *L. tormentosa*, *L.auricularis rubiginosa*. The names of some of the *Lymnea* species encountered cannot be determined. *Bulinus* species were not encountered in Bangare part of the dam. Kwata has the highest number of snails with 120 (32.7%) followed by Danmadahun 91 (24.8), Bangare 89 (24.25) and the least 67(18.25). Out of the 167 *Lymnea* snails examined only 30(18%) were infected (Table 2).

3.2 Cercariae encountered

Out of the 200 *Bulinus* snails collected (Table 3) only 12 (6%) (Table 4) were infected. The overall prevalence of infection is 11.4%. Twelve different types of cercaria were discovered but only nine of them were presumably identified as Virgulate, Ubiquita, Gymnocephalus, Amphistome, Echinostome ,Armatae cercaria ,Parapleurolophocercous cercariae, Ornatae and Fucocercus cercaria (Fig.4) (videos of swimming available), three of them cannot be identified.

Table 1: Frequency of occurrence of *Lymnae* species in different parts of the dam

Snail species	Study Sites			
	Danmadahun	Bangare	Kwata	Yadakunya
<i>L. natalensis</i>	12	13	6	9
<i>P. affinus</i>	17	0	0	0
<i>L.(Pseudosuccina) columella</i>	2	05	0	0
<i>Lymnaea ollula</i>				0
	5	4	0	0
<i>L. tormentosa</i> <i>L.auricularis</i>				
<i>rubiginosa</i>	12	9	0	0
	15	0	0	0
<i>Austropeplea lessoni</i>	0	4	0	0
<i>Radix ovata</i>	0	6	0	0
<i>Lymnea peregra</i> muller	0	9	0	0
Unknown (MI)	0	2	0	0
Unknown K	0	15	0	0
Unknown L	0	5	0	0
Unknown M	0	7	0	0
Unknown N	0	10	0	0
Total	63	89	6	9

Table 2: Types of cercariae recovered from *Lymnea* species

<i>Lymnea</i> species	Number collected	Number infected	Type of cercariae
<i>L. natalensis</i>	40	12	Virgulate, Ubiquita, Armatae Unidentified
<i>P. affinus</i>	17	3	Gynocephalus
<i>L.(Pseudosuccina) columella</i>	7	3	Unidentified, gymnocephalus
<i>pervia(Austropeplea ollula)</i>	9	1	fucocercus
<i>L.tormentosa</i> <i>L.auricularis</i>			
<i>rubiginosa</i>	21	1	gymnocephalus
<i>Austropeplea Lessoni</i>	15	1	gymnocephalus
<i>Radix ovata</i>			
<i>Lymnea peregra</i> muller	4	0	
Most infected	6	1	Gymnocephalus
	9	2	gymnocephalus
K			

L	2	2	Amphistome,Echinostome
M			Parapleurolophocercous,
N	15	2	gymnocephalus
	5	0	gymnocephalus
	7	2	gymnocephalus
	10	0	gymnocephalus
Total	167	30	

Table 3: Bulinus species recovered from the study sites

Snail species	Study Sites			
	Kwata	Bangare	Danmadahun	Yadakunya
<i>Bulinus globosus</i>	40	0	0	0
<i>B. reticulates</i>				
<i>B.truncatus rohlfsi</i>	8	0	3	5
<i>B. truncate</i>	15	0	3	13
<i>truncates Egypt</i>				
<i>B. jousammei</i>	9	0	8	3
<i>B.succinoides</i>				
<i>B. camerunensis</i>				
	19	0	3	11
	13	0	8	11
	10	0	3	15
Total	114	0	28	58

Table 4:Types of cercariae recovered from Bulinus species

Snail species	Number collected	Number infected	Type of cercariae
<i>Bulinus globosus</i>	40	12	Unidentified, unidentified fork-tailed,Gymnocephalus,
<i>B. reticulates</i>			0
<i>B.truncatus rohlfsi</i>	16	0	0
<i>B. truncate</i>	31	0	0
<i>truncates Egypt</i>			0
<i>B. jousammei</i>	20	0	0
<i>B.succinoides</i>			0
<i>B. camerunensis</i>			0
	33	0	0
	32	0	0
	28	0	0
Total	200	12	3

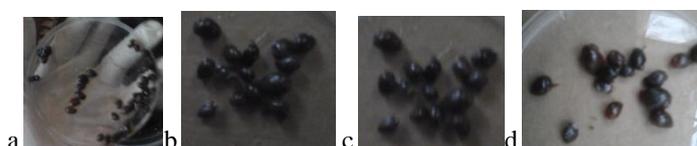


Fig.2 abcd : Bulinus species collected from Kwata



Fig.3: Bulinus species collected from the four parts of the dam

a.*Bulinus globosus* (b) *B. Truncates truncates Egypt* ,(c)*B. Camerunensis*, (d) *B. jousammei gambia* (e)*B. reticulatus* (f)*B. truncatus rohlfsi* (g) *B. succinoides*

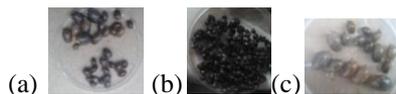


Fig.4a-c: (a) Lymnea and Bulinus species (c)Bulinus species(c) Lymnea species



Fig.4: Identified Lymnea species a. *Austropeplea lessoni* (Deshayes, 1830) b. *Lymnea natalensis* c. *Radix rubiginosa* d. *Peplimnea affinus* e. *Radix ovata* f. *L. pervia* (*Austropeplea ollula*) g. *Austropeplea tomentosa* h. *Lymnaea* (*Pseudosuccinea*) *columella* i. *Lymnea peregra* muller



Fig.5: Most infected Lymnea specie (Bangare)



Fig.6: Unidentified lymnea species (Bangare)

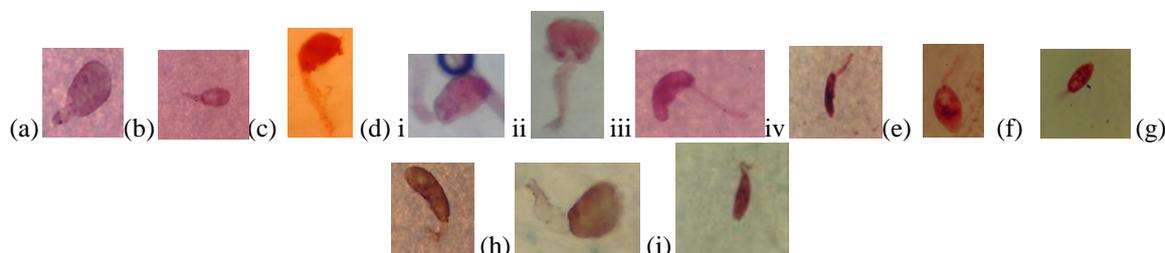


Fig.7a: Trematode cercariae recovered from Lymnea species (a)Virgulate cercaria(b)Armatae Xiphidiocercous cercariae (c)Ubiquita (d) Gymnocephalus (e)Echinostome (f) Parapleurolophocercous cercariae (g) Ornatae Cercaria (h) Fucocercus cercaria (i) Amphistome.

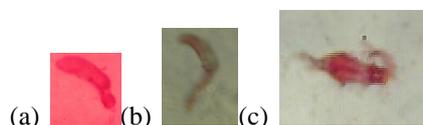


Fig.7b Unidentified cercariae (a) (b) (c)

This present study was motivated by the result of a previous study where many species of *Bulinus* were encountered in other parts of Jakara dam (Duwa, 2017) apart from the popular Wasai part (Kwata and Fako) in Minjibir local government area. In a previous study (Duwa and Oyeyi,2009;Duwa,2017) only two and three parts of the dam respectively were investigated and encountered only *Lymnea natalensis* as the only *Lymnea* species, there was no report of other *Bulinus* species apart from *Bulinus globosus* in Wasai (Fako and Kwata) (Duwa,2017). This is also the first time different species of *Lymnea* were reported in Jakara dam, and even in Nigeria to the best of my knowledge. This may be the reason why identification was difficult. Further observation always reveal a new difference between two species that were initially grouped together as the same specie. These snail species have been classified based on morphology only. The different *Lymnea* species encountered in this study are twice larger than those *Lymnea natalensis* encountered in previous studies (physical observations).Whether *Lymnaea natalensis* species should be placed in the genus *Lymnaea* or in the

genus *Radix*, formerly considered a subgenus of the first, remained unresolved for a long time (Bargues *et al.* 2001). Brown (1994) and Appleton (1996) refer to it as *Lymnaea natalensis*, but the molecular study of Correa *et al.* (2010) provides definite arguments for the use of *Radix natalensis*. This applies to other *Lymnaea* species that are referred to as *Radix*. The identification of large *Radix* specimens from the Arabian Peninsula as *Lymnaea (Radix) natalensis* remains doubtful. Maybe the large Nigerian species will be named *Lymnaea (Radix) nigeria*. *Lymnaea mauritiana* Morelet, 1875 is in recent literature also considered as a synonym of *Radix natalensis*. Pointier *et al.* (2009) reported the presence of *Lymnaea columella* from Güügüe, state of Carabobo; *L. Columella* from El Valle, state of Mérida. There were two *Lymnaea* species of different sizes and habitat preference in Danmadahun part of Jakara dam. *Lymnaea natalensis* was found attached to the macrophyte, water hyacinth in muddy water with *Bulinus* species while the other and much bigger *Lymnaea* species presumably identified as *Lymnaea tormentosa* were picked from another 300 meters away, in clear water of pH7.2. The overall prevalence of infection is 11.4%. Although the number of *Bulinus* species are more (54.5%), *Lymnaea* species (45%) are the most infected in all the study sites with only 18% of the total *Lymnaea* species (167) collected being infected while that of *Bulinus* is 6%, these 18% from the *Lymnaea* species were heavily infected, with one of them carrying more than one hundred cercaria and each slide containing different multiple infections. Although more *Lymnaea natalensis* were infected than any other *lymnaea* specie the most infected snail according to the number of cercariae found in the snail was the unidentified snail from Bangare and there are just two of them. These cercariae were presumably identified as Virgulate, Ubiquita, Gymnocephalus, Amphistome, Echinostome, Armatae cercaria, Parapleurolophocercous cercariae, Ornatae and Fucocercus cercaria because the keys used did not exactly give the description of the type of cercariae encountered in this study. Ndifon (1990) reported the presence of Ornatae xiphidiocercaria; Virgulate xiphidiocercaria; Apharyngeate echinostome cercaria; Pleurolophocercous Echinostome cercaria; Collared non-echinostome cercaria; Gymnocephalous cercaria; Amphistome cercaria; *Schistosomatium* type cercaria; mammalian schistosome type brevifurcate cercaria; Echinocercous brevifurcate cercaria; Clinostomatid brevifurcate cercaria; Diplostomatid longifurcate cercaria; Strigeid longifurcate cercaria; and Furcocercous cercaria inflaticauda in Kano state but the full article was not available for comparison. Most of the cercariae were shed even without exposure to light. No live snail was encountered in the Fako part of the dam, this may be due to the fact that there are no macrophytes on which they can attach at the edges of water and also lay their eggs. The environment may not also be favourable for those species that does not need macrophytes as in the case of Danmadahun. Most of the snails collected from Bangare and Danmadahun were not attached to vegetation. Bangare (Gezawa LGA) part of Jakara dam is the most polluted part of the dam followed by Fako and Kwata in Wasai, Minjibir Local government area of the state.

IV. Conclusion

These results provide a new insight into *Lymnaea* snails in Jakara dam and in Nigeria as a whole. The emergence of these new *Bulinus* and *Lymnaea* species may lead to a new trend in the transmission of both Schistosomiasis and Fasciolopsis because with time these new species can spread to other parts of the dam where it wasn't encountered before. The water body therefore poses a threat to human and animal health and therefore calls for an urgent snail control strategy.

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