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Malacological Survey of Intermediate Hosts of Public Health Importance in Akure South and Owo Local Government Areas of Ondo State, Nigeria.

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Abstract:
Freshwater snails serve as intermediate hosts to several trematode parasites of man and animals. Their distribution in freshwater bodies correlates closely with presence or absence of disease within human and animal population in such vicinity. Most snails are host specific and occur in relative abundance in favourable freshwater habitats, particularly in the tropics. The study assessed the diversity of freshwater snails in two local government areas (LGAs)in Ondo state, Nigeria. Thirty-two sites, from Akure South (21) and Owo (11) Local Governments areas, were sampled. A total of 169 snails were collected from the two Local Government areas. Results revealed snails from 3 families, 4 genera and 5 species including *Potadoma moerchi* with a relative abundance of (60.9%), *Potadoma freethi* (8.3%), *Lanestes ovum* (26.0%), *Melanoides tuberculata* (1.2%) and *Pila africana* (3.6%). More freshwater snail species were found in Akure South L.G.A. 130 (76.9%) compared to Owo LGA 39 (23.1%). In Akure south L.G.A., there was a positive relationship between *Lanestes ovum* and water velocity as the correlation was significant at 0.01 confidence level while in Owo L.G.A, there was a positive relationship between *Pila africana* and water conductivity as the correlation was significant at 0.01 confidence level. Freshwater snails of public health importance were found in the two LGAs surveyed. The presence of these species in some communities in Akure South and Owo LGAs suggests that vertebrate hosts in the areas may be predisposed to trematode infections due to *Schistosoma* sp, *Centrocetus sp*, *Paragonimus sp*, *Paraphistomum sp* and *Clonorchis sp*, hence the need to scale up prevention and control strategies against transmission.

Keywords: Intermediate host, disease, transmission, habitat, Physico-chemical properties.

Introduction

Freshwater snails serve as intermediate hosts to several trematode parasites of man and animals (Idris and Ajanusi, 2002). Their distribution in freshwater correlates closely with presence or absence of diseases within human population (Utzinger *et al*., 2011). The disease prevalence depends on the species of freshwater snail; the host-parasite precision can vary over small areas with uneven distribution (Rollinson *et al*., 2001). Freshwater snails of the genus *Bulinus*, *Biomphalaria* and *Lymnaea* are regular species belonging to the subfamily Planorbidae and Lymnaeidae, respectively and are generally diffused throughout most of Sub-Sahara Africa (Mandahi-Barth, 1962; Brown, 1980; Gryseels, 1989; WHO, 1995). Species of the above genera occupy several natural and artificial freshwater bodies such as streams, rivers, wetlands seasonal pools, shallow lakes, rice paddies, irrigation canals and ponds (Brown, 1980; Gryseels, 1989; Utzinger and Tanner, 2000). Freshwater snails transmit a number of diseases including schistosomiasis, paragonimiasis, dicrocoeliasis and fascioliasis (WHO, 1995). Schistosomiasis is a neglected tropical disease (NTD) affecting over 200 million people worldwide, with an at risk population estimated at 700 million (Murray *et al*., 2012). Ecological scrutinization of freshwater snails have demonstrated that the population dynamics and ecology of these animals depend on some factors such as the physical geography of a given region, soil composition, land contours, hydrography, type of bottom soil sediment and climate change (Yousiff *et al.*, 1998). Physico-chemical parameters such as temperature, nitrate level, pH, dissolved gases, alkalinity, calcium ions (Kloos *et al*.,2001) and biological factors such macrophytes (Ofoezie,1999) also affect their distribution.

Schistosoma haematobium is the causative agent of urinary schistosomiasis and it is most prevalent in Africa. *S. haematobium* infection is approximated to cause 32, 70, 18 and 10 million cases of dysuria, haematuria, bladder wall pathology and major hydronephrosis respectively (Van der werf *et al*., 2003). The highest prevalence and intensities are usually found in school-age children, adolescents and young adults (Jordan and Webbe, 1982). Some environmental and socio-economic factors have been spotted to be responsible for the keep up persistence of intestinal parasitic infection in children. These factors include scarcity of potable water, poor sanitary conditions, unhygienic living conditions, poor housing and poverty (Savioli *et al*., 2003). The lack of potable water in most rural areas of Sub-Saharan Africa (SSA) drives the people to access water from different sources, and the immediate alternatives are usually fresh water bodies, which are home to different aquatic molluscs of public health concern. The scarcity of potable water also transcends beyond the rural settlements in most African countries into peri-urban and urban settlements. The role of snail vectors in the transmission of parasitic diseases cannot be over emphasized, as the distribution correlates closely with the presence or absence of diseases within human population.

In of all the 18 Local Government Areas in Ondo State, Nigeria, schistosomiasis, a water-borne, snail-vectored disease, have reported prevalence rates of 41- 95.7%, where Ifedore Local Government had 47.3% (FMoH, 2012).Urinary schistosomiasis is endemic specially in Ipogun village of Ifedore Local Government Area, The village first came to public notice in 2001 when Newsline‟, a national television documentary programme, reported the village as one where" men menstruate" referring to symptom of the disease (presence of blood in the urine). From that time, it has remained endemic with prevalence rates ranging from 59% in 2003 (Odaibo *et al*., 2004) to 53.1% in 2006 (Oniya and Odaibo, 2006). In five of the primary schools in Ipogun village, Oniya *et al.* (2013) recorded a prevalence rate of 18%.

Methodology

Study Areas

The study was carried out in Akure south and Owo Local Government Areas (LGAs) of Ondo State, Nigeria. Thirty (32) water bodies (sites) including Ala River, drainage canals and stagnant pools were selected on the basis of preliminary observation for obvious water contact activities like water fetching, clothes washing, bathing, swimming etc. The geographical locations of all

sampling sites were taken with a hand-held differential global positioning system.

Snail Survey

The Survey was designed to cover the onset of rainy season (March to April 2021) and the peak of rainy season (May to June 2011). The research was undertaken in Akure south and Owo Local Government Areas (LGAs) of Ondo State, Nigeria. The snails were collected using a scoop net made from kitchen sieve and mounted on a 1.5m wooden pole (Oniya *et al.*, 2013).The sampling period lasted ten minutes at each site.

Identification of Snails

At each collection, snails from each site were appropriately labeled and transported in separate plastic containers with source water to the Public Health Laboratory, Biology department, Federal University of Technology, Akure, Ondo State, at each survey, snails were grouped by site, washed, sorted, counted and identified. Identification was done using standard morphometric identification keys by Brown and Kristensen (1993). Morphometric measurement of the shells was taken with the aid of a vernier scale. The selected measurable parameters were shell height (SH), shell width (SW), and aperture width (AW). Other shell components considered during identification included number of whorls, shape of the shell, type of apex (sharp or blunt) and shape of the aperture. All snails collected from each site were recorded as number of snails per site.

Check for Infectivity

Snails of the genus *Potadoma* and *Melanoides* recovered from the sampled sites were each kept in a de-chlorinated water in separate 100ml beakers and exposed to sunlight to trigger the release of cercariae. After two hours, the water was examined for released cercariae. The snails were re-exposed the second day for cercariae shedding.

Data Analysis

Data obtained from this survey was presented using tables, bar chart and maps. t- test was used for the comparison of freshwater snails sampled from different sites with respect to their months of collection in the two study areas using Microsoft excel and Correlation analysis at a statistical relevance of p-value > 0.05, using SPSS version 20, was used to check the relationship between the snail species and the physico-chemical parameters of the snail habitat.

Results

Five species of freshwater snails belonging to 3 families, 4 genera and 5 species, were identified in the 32 sampled water bodies. The identified species were *Potadoma moerchi*, *Potadoma freethi*, *Lanestes ovum*, *Melanoides tuberculata* and *Pila africana*.

The morphometric of the collected snails showed that the shell height of the species ranged between 18.52mm to 74.02mm. the shell width, between 7.35mm to 43.54mm. The aperture width ranged between 4.95mm to 43.80mm. Their shell orientation was mostly dextral with the exception of *Lanestes ovum* which possessed sinistral orientation (Table 1).

Table 1: Morphometric of Snails Collected during the Study Period

S/N	Snail species	Size range (mm)			Shell Orientation
		SH	SW	AW	
1	*Potadoma moerchi*	26.51-33.85	10.05-11.40	6.99-8.50	Dextral
2	*Potadoma freethi*	25.70-29.90	9.40-9.51	6.80-8.35	Dextral
3	*Lanestes ovum*	18.52-48.75	13.12-40.85	7.43-33.35	Sinistral
4	*Melanoides tuberculata*	19.75	7.35	4.95	Dextral
5	*Pila africana*	73.50-74.02	41.85-43.54	36.85-43.80	Dextral

The different freshwater snail species in Akure South and Owo Local Government Areas are shown in Tables 2 and 3.

Table 2: Different Species of Freshwater Snail Samples in Akure South L.G.A

Name of town/village	Sites No	Coordinates (Latitude; Longitude)	Snail species	No of Snail species	Site Type	Common use of water body
Okeodu	1	7º17´48´´N; 5º 9´ 14´´E8	*Pila africana* *Lanestes ovum*	2 4	drainage canal	Construction purposes
Malaika	1	7º 18´34´´N; 5º 8´33´´E	*Potadoma moerchi* *Potadoma freethi* *Melanoides tuberculata*	14 9 1	river	Recreational purposes
	2	7º18´41´´N; 5º8´31´´E	-	-	drainage canal	Fishing activities
FUTA area	1	7º17´14´´N; 5º9´25´´E	*L. ovum*	4	Solab drainage canal	Fishing activities
	2	7º17´24´´N; 5º9´20´´E	*L. ovum*	4	Solab drainage canal	Washing of motorbikes
	3	7º17´49´´N; 5º9´34´´E	-	-	Agape drainage canal	Fishing activities
Araromi	1	7º15´28´´N; 5º11´34´´E	*L. ovum*	1	Ala river	Fishing activities
Okeijebu	1	7º16´57´´N; 5º11´31´´E	-	-	Ala river	Fishing activities
Aule	1	7º17´8´´N; 5º9´43´´E	*P. moerchi* *P. freethi* *M. tuberculata*	12 5 1	Agbede drainage canal	Farming activities
	2	7º17´3´´N; 5º8´35´´E	*P. moerchi*	10	Asuwamo drainage canal	Fishing activities
Oda road	1	7º12´45´´N; 5º13´24´´E	-	-	Oda road stagnant pool	Farming activities
	2	7º13´30´´N; 5º12´34´´E	-	-	Oda road drainage canal	Washing of bikes
Kajola	1	7º12´29´´N; 5º13´26´´E	-	-	Kajola drainage canal 1	Washing of bikes
	2	7º14´35´´N; 5º12´15´´E	*P. moerchi*	7	Kajola drainage canal 2	Washing of bikes
Benin/Owo road by NNPC	1	7º17´38´´N; 5º10´19´´E	*L. ovum*	5	Ala river	Fishing activities

Aponmu	1	7º14´5´´N; 5º3´48´´E	*P. moerchi*	17	Aponmu stagnant pool	Palm oil processing activities and bathing
	2	7º14´3´´N; 5º5´26´´E	-	-	Aponmu drainage canal	Palm oil processing activities and washing of clothes
Army barracks, Ondo road	1	7º13´21´´N; 5º10´24´´E	*P. moerchi* *L. ovum*	17 13	Yoruba camp drainage canal	Farming activities and bathing
Ipinsa	1	7º19´57´´N; 5º8´9´´E	-	-	Ipinsa drainage canal	Farming activities
Ita-oniyan	1	7º16´13´´N; 5º10´24´´E	*L.ovum*	4	Ita-oniyan drainage canal	Fishing activities
Ilasun	1	7º14´25´´N; 5º7´36´´E	-	-	Ilasun drainage canal	Farming activities
Total				**130**		

Table 3: Different Species of Freshwater Snails Sampled in Owo L.G.A and their Sites of Collection

Towns/Villages	Site No	Coordinates	Snail species	No of Snail spp	Site Type	Common use of water bodies
Owo	1	7º13´2´´N, 5º33´28´´E	*Potadoma moerchi*	19	drainage canal	Farming activities
	2	7º12´37´´N, 5º32´51´´E	*Lanestes ovum*	6	drainage canal	Washing clothes and motor bikes
	3	7º14´4´´N, 5º33´25´´E	-	-	drainage canal	Farming activities
Ipele	1	7º7´42´´N, 5º39´5´´E	*P. moerchi*	7	drainage canal	Bathing and washing
Uso	1	7º16´12´´N, 5º25´39´´E	*Pila africana*	2	drainage canal 1	Wood production activities
	2	7º16´12´´N, 5º25´35´´E	-	2	drainage canal 2	Farming activities
Isuada	1	7º13´32´´N, 5º35´2´´E	-	-	drainage canal	Washing of bikes

Kajola (Owo)	1	7º13′23′′N, 5º33′46′′E	Shell of *P. moerchi*	-	drainage canal	Palm Plantation activities
Upenmen	1	7º15′33′′N, 5º37′49′′E	-	-	stagnant pool	Palm oil processing and washing of clothes
Idasen	1	7º10′9′′N, 5º35′52′′E	*L. ovum*	3	Idrainage canal	Farming
Old Ikare road	1	7º13′24′′N, 5º36′49′′E	-	-	drainage canal	washing
Total			-	**39**		

In Akure South Local Government Area, where the higher number of snails were collected, a total of 130 snail species were collected in the 21 sampled sites *Potadoma moerchi*, *Potadoma freethi*, *Lanestes ovum*, *Melanoides tuberculata* and *Pila africana* with the most dominant species being *Potadoma moerchi* (77) while the least dominant were *Melanoides tuberculata* and *Pila africana* (2). Equal number of snails were recovered during the onset of the rainy season and during the peak of the rainy season. The highest number (30) of snail species was collected in Army barracks, Ondo Road while the lowest number (1) was collected from Araromi. No freshwater snail was recovered in Oke- Ijebu, Oda Road, Ipinsa and Ilasun. A single species was collected in FUTA area, Araromi, Kajola, Benin/Owo Road, Aponmu and Ita-Oniyan. No cercariae were shed from the *Potadoma sp* and *Melanoides sp*.

In Owo Local Government Area, where the lesser number of snail samples were collected, a total of 39 snail samples were collected in the 11 sampled sites, belonging to 2 families, 3 genera and 3 species which include *Potadoma moerchi*, *Lanestes ovum* and *Pila africana*. The most abundant species was *Potadoma moerchi* (26) while the least present was *Lanestes ovum* (3) The highest number of snail samples was collected during the onset of the rainy season (22) while the lowest was collected during the peak of the rainy season (17). The highest number of snail samples (19) was found in Owo while the lowest number (3) was found in Idasen.

In Akure South L.G.A., the highest number of Freshwater snails were collected Army barracks while Araromi had the least number of collected snails 1 (0.8%). In Ipinsa, Oke-ijebu, Oda Road and Ilasun no snails were seen (Table 4).

Table 4: Percentage Occurrence of Freshwater Snails from Akure South L.G.A

Village/Town	No of Snails Collected	Percentage (%)
Okeodu	6	4.6
Malaika	24	18.5
FUTA Area	8	6.2
Araromi	1	0.8
Okeijebu	0	0
Aule	28	21.5
Oda road	0	0
Kajola	7	5.4
Benin/Owo road	5	3.8
Aponmu	17	31
Army barracks, Ondo road	30	23.1
Ipinsa	0	0
Ita-Oniyan	4	3.0
Ilasun	0	0
Total	130	100%

From Owo L.G.A, Owo town had the highest number of snails collected (64.1%) and Idasen had the least number of snails (7.7%). In Kajola, Upenmen, Isuada and old Ikare road no snails were collected (Table 5).

Table 5: Percentage Occurrence of Freshwater Snails from Owo L.G.A

Village/Town	No of Snail collected	Percentage (%)
Owo	25	64.1
Ipele	7	17.9
Uso	4	10.3
Isuada	0	0
Kajola	0	0
Upenmen	0	0
Idasen	3	7.7
Old Ikare road	0	0
Total	39	100%

The percentage occurrence of the different snail species in the study areas (Table 6), showed marked variation with *Potadoma moerchi*, having the highest occurrence of 60.9% of the total snails collected. This was followed by *Lanestes ovum* 26.0%. the least collected was *Melanoides tuberculata* with 1.2% *Potadoma moerchi* was the most occurring snail species encountered in the two study areas (Fig. 1).

Table 6: Occurrence of the different Freshwater Snail Species in the study areas

Snail Species	Number of Snails	Relative Percentage (%)
Potadoma moerchi	103	60.9
Potadoma freethi	14	8.3
Lanestes ovum	44	26.0
Melanoides tuberculata	2	1.2
Pila africana	6	3.6
Total	169	100%

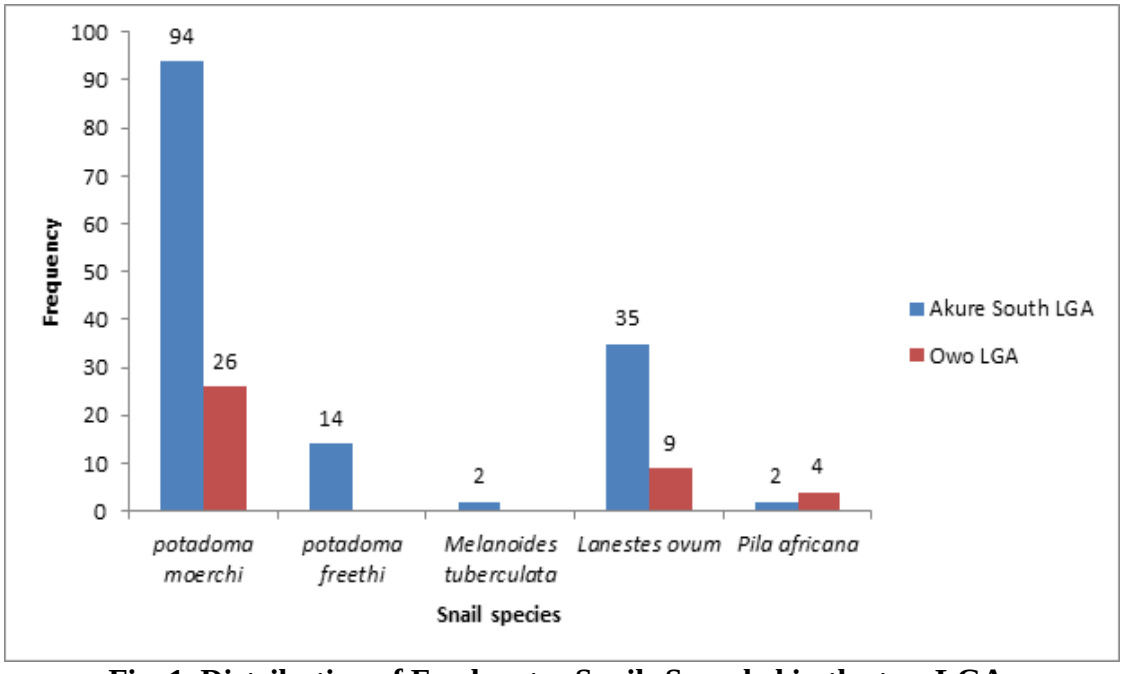

Fig. 1. Distribution of Freshwater Snails Sampled in the two LGAs

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Discussion and Conclusion

One hundred and Sixty-nine (169) Freshwater snails belonging to three families, four genera and five species were collected from the different water bodies within the 2 L.G.As. The study identified a total of fcive freshwater snails including *Potadoma moerchi*, *Potadoma freethi*, *Lanestes ovum*, *Melanoides tuberculata* and *Pila Africana* from two L.G.As in Ondo state Nigeria. In Akure South L. G. A., five species were found, *Potadoma moerchi, Potadoma freethi, Lanestes ovum, Melanoides tuberculata and Pila africana*. In Owo L.G.A., *Potadoma moerchi*, *Lanestes ovum* and *Pila africana* were found.

Out of the five snail species collected in the study areas, *Potadoma moerchi*, *Potadoma freethi* and *Melanoides tuberculata* are first intermediate host for parasites including *Paragonimus sp*, *Centrocetus sp*, *Clonorchis sp and Philophthalmus sp* (Pinto and De melo, 2011; Vogler *et al*., 2012). However, *P. moerchi* has been reported to harbour schistosome sporocysts (Agbolade and Agu, 2013). In their study, Agbolade and Agu (2013), observed Schistosome sporocysts in *P. moerchi* which eventually produced cercariae. *Lanestes ovum* is an edible snail in Nigeria and not a disease vector (Omudu and Iyough, 2005). *Pila africana,* Swainon 1822 was reported as one of the intermediate hosts of *Multicotyle purvisi*, a trematode parasite (Alves *et al*., 2015). The most occurring species in this study was *P. moerchi*, encountered in most of the sampled sites and an established intermediate host of *Paragonimus*, the lung fluke.

The presence of *Potadoma* species and *Melanoides* in communities in Akure South and Owo L.G.As revealed that vertebrate hosts may be predisposed to trematode infections due to *Centrocetus sp*, *Paragonimus sp* and *Clonorchis sp*. Ironically, its presence may also help in the biological control of Schistosomiasis vector as it competes and preys on the planorbid snails (WHO, 1993). More snail species were found in water bodies where excessive fishing activities were carried out which could be as result of few fish species available to feed on the snails. More snail species were found in Akure South L.G.A. 130 (76.9%) compared to Owo L.G.A.39 (23.1%). Although no cercariae were shed from the *Potadoma* spp and *Melanoides*. We also report that though schistosomiasis is endemic in Ondo state, we did not recover any species of *Bulinus* from the water bodies surveyed. Some of the recovered snails are of public health importance and hence disease surveillance and public enlightenment programmes in the two Local Government Areas are essential to prevent disease outbreak and subsequent management.

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