EFFECT OF SOME PHYSICO-CHEMICAL PARAMETERS ON ABUNDANCE OF INTERMEDIATE SNAILS OF ANIMAL TREMATODES IN IMO STATE, NIGERIA

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ABSTRACT: Physico-chemical parameters of water bodies could act to reduce or otherwise increase the prevalence, abundance and distribution of snail intermediate host. This current study investigated the effects of some Physico-chemical parameters on abundance of intermediate snails of animal trematodes in Imo State, Nigeria. The study was carried out between April 2005 and April 2006. Mapping of snail intermediate hosts in the three geographical zones of Imo-State was determined by surveys of selected community water contact sites such as swamps, pond fast and slow flowing water bodies. With the assistance of an attendant, two scoop nets were used to harvest snail species from water bodies. Snail species collected namely,*Pila ovata, Lymnea natalensis* and *Anisus stagnicola* were taken to the Laboratory for analysis. Temperature was determined right there at the site, water samples were collected from the same site where snail species were collected , taken to the laboratory and analyzed for dissolved oxygen, conductivity and p.H. Pond produced the highest density of 1,380 (58.2%) snail species. While fast flowing water produced no snail species. Over all numbers of snail species were 1,559 (14.0%), 330 (12.1 %) and 441 (7.9%) for *L. natatesis*, *A. Stagnicola* and *P. ovata* respectively. snail abundance varied significantly from one site to the other. Physico-chemical parameters vary significantly as months ran from April to December. Snail population expansion was recorded in the dry season and contraction during the rainy season. This study therefore calls for adequate Molluscan control programme and Environmental sanitation awareness in the study area.

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INTRODUCTION

Many species of freshwater snails belong to the class of highly infective flukes of veterinary importance. The flukes cause severe debilitating illness in millions of animals. The infections are widespread and prevalent in areas where the snail intermediate hosts breed in water bodies contaminated by feces or urine or even infected animals, Smith (1982) and Brown (1980) Animals acquire these infections through repeated grazing on contaminated vegetation. The snails are considered to be intermediate host because snails habour the asexual stage of the parasite while humans habour the sexual stage of the parasites. Transfer of the infection requires no direct contact between snails and the animal Okwuosa (1979). Freshwater snails are also intermediate hosts of food borne fluke infection affecting the liver, lung and intestines of animals (Agi, 1980).

Snail ecologist have tried to correlate snail distribution with physico chemical factors and to discover the ranges of these factors within which the snails thrive (WHO, 1994).

Under natural conditions, snails are exposed to a range of varying and often interacting environmental factors which produce collective effect on them and it is usually difficult to separate the effect of any one factor from others (Berrie, 1970).

This present study reports the effects of some physico-chemical parameters on the abundance and distribution status of snail species and therefore underscores the need for adequate environmental management.

Materials and Methods

Study Area

Imo state is one of the states of the eastern states of the federal republic of Nigeria. It is located within latitude 5`10 and 5`67N, and longitude 6`36 and 7`28`E. The state is bounded on the North West by Anambra State, on the south-west by River State and on the eastern boarder by Abia State. The State has two main geographical regions-the coastal plain, covering the central and southern part of the state and the plateau and escapement zones in the northern part of the state. The soil of the coastal plain is sandy/loam and vegetation is typical rainforest, while

that of the North-Eastern geographical plain is clay with rich savannah vegetation. There are two distinct seasons, the rainy and dry seasons with the rainy season lasting from March to October with peak rainfall occurring in July and September and short slightly drier spell in August popularly known as August break. Annual rainfall ranges from 0.0mm to 2,500mm. The mean temperature over most of the state is 27`C, while relative humidity is about 70-80 [IMSG,1993].The main occupation of the populace is agriculture. There are civil and public servants also, as well as fishermen and traders.

Sample Collection

The effects of physico-chemical parameters on snail intermediate host abundance was carried out from April 2005 to 2006 by Malacological mapping of selected community water contact sites such as fast flowing water, slow flowing water, ponds and stagnant water body. A 8.5" > 5.5" wire mesh scoop nets were used to scoop snail species, operators were protected from direct contact with water by making knee-length rubber boots and elbow length rubber hand gloves. A 10 minutes sampling period per habitat was adopted (Hira, 1970). Snails gotten were put in specimen bottles bearing labels showing the location of collection; reference number and date of collection. Small snails were separated from big ones and put in small specimen bottles of 250ml. while big ones were put in bigger specimen bottle of 500ml, taken to the laboratory for analysis. Water samples were also collected from the sites and taken to the laboratory and analyzed for dissolved oxygen, conductivity and Ph. Temperature was determined by dipping a centigrade thermometer with a range of O'C to 50^0C in water and readings recorded. Conductivity was determined using conductance bridge, pH was determined using a Lovibond comparator pH range while dissolved oxygen was determined by wicklers method (Oliver and Ansari, 1973). Abundance was expressed as percentage of snail species present in each site.

STATISTICAL ANALYSIS: Data collected was subjected to analysis of variance which was crossed checked by student t- test for the establishment of significance (Steel and Torrie, 1980).

RESULT

Table 1 showed the prevalence and overall distribution of snail species in the study area. Out of 2,380 snail species, 300 (12.6%) were infected. *L. natalensis* had 1,559 snail species examined, 219 (14.0%) infected, *A. Stagnicola* had 380 species examined, 46 (12.1%) infected, while *P. Ovata* had 442 examined, 35 (7.9%).

Table 1 overall distribution and prevalence of snail species

Snail species	Number examined	Number infected	% infected
Lymnea	1,559	219	14.0
Natalensis	380	46	12.1
Anisus	441	35	7.9
Stagnicola			
Pila Ovata			
Total	**2,380**	**300**	**12.6%**

Table 2 showed the monthly abundance of snail species for dry and wet season

A total of 1,961 and 419 snail species were collected in the dry and wet season respectively, snail species collected in dry season was significantly higher than those collected in the rainy season at ($P < 0.05$) A total of 1,186 and 373 species of *L. natalensis* was collected in the dry and rainy season respectively , 412 and 29 *P. ovata* snail species were collected in dry and rainy season while 363 and 17 *A. stagnicola* snail species were collected in the dry and wet period respectively.

Table 3 showed snail occurrence in relation to physico-chemical factors. Surface temperature of all the sampled water bodies was between 22- 33C. pH value ranged between 5.0-7.9%, Dissolved oxygen(Do2) and conductivity(umhos) varied between 2.4-9.5mg/li and 11-110umhos respectively.

Table 4 showed the average monthly variation of physico-chemical parameters in water bodies. Physico-chemical parameters varied from months to month throughout the study period. While both conductivity and temperature values increased those of dissolved oxygen and pH decreased as the months progressed from April to December**.**

Table 5: Showed percentage occurrence of snails in the four main water contact sites sampled. Of the 2,380 snail species collected from different water bodies, no snail species was collected from fast flowing water, 496 (20.8%) was collected from slow flowing water, 498 (20.9%) was collected from burrow pits, while 1,386 (58.2%) were collected from swamps.

Table 2: monthly abundance of snail for dry and wet seasons

Dry Season								Wet season							
	Months							Months							
Snails Species	Nov 2005	Dec. 2005	Jan 2006	Feb 2006	Mar 2006	April 2006	Total	May	June	July	Aug	Sept	Oct	Total
L. Natalensis	162	185	195	136	220	287	1186	235	138	-	-	-	-	373
p. ovata	30	34	83	40	100	125	412	25	4	-	-	-	-	29
A. stagnicola	15	73	50	70	50	101	363	12	3	2	-	-	-	17
Total							**1961**							419

Table 3: Snail occurrence in relation to physico-chemical parameters

S/N		Site	Temp ^{0}C	Ph %	Dissolved Oxygen D_{02}	Conductivity	*P. Ovata*	*L. natalensis*	*A. stagnicola*
1	Owerri	A	28^{0}C	7.0	9.5	31	13	14	-
2		A	28^{0}C	7.4	9.2	34	-	24	-
3		A	28^{0}C	7.4	9.0	91	-	112	75
4		A	33^{0}C	7.4	8.1	38	5	-	-
5		A	29^{0}C	7.3	8.4	51	59	-	-
6		A	28^{0}C	7.3	9.0	52	58	4	-
7		A	25^{0}C	7.2	6.6	56	55	8	22
8		A	33^{0}C	7.6	6.7	51	-	30	-
9		A	27^{0}C	7.4	8.4	83	12	63	30
10		A	29^{0}C	7.4	5.8	22	-	-	-
11	Okigwe	B	290C	7.3	5.8	110	11	180	28
12		B	290C	7.6	7.4	91	28	86	42
13		B	310C	7.3	5.8	90	-	76	52
14		B	290C	7.9	4.6	45	21	30	-
15		B	330C	6.4	5.7	34	-	-	-
16		B	220C	5.4	5.8	18	-	46	-
17		B	230C	5.0	5.8	11	-	100	48

18		B	280C	7.3	5.9	56	15	-	20
19		B	300C	7.3	6.8	11	-	18	-
20		B	270C	7.2	6.9	41	-	49	-
21		B	250C	7.3	6.9	100	50	118	-
22		B	310C	7.3	6.9	89	33	58	-
23		B	270C	7.2	6.6	37	-	23	-
24	Orlu	C	300C	5.9	2.5	26	-	-	-
25		C	310C	7.4	5.5	37	-	23	20
26		C	250C	7.3	4.7	29	-	15	-
27		C	320C	7.2	5.9	86	30	156	12
28		C	320C	5.4	4.7	99	-	136	20
29		C	240C	7.2	2.2	41	10	25	-
30		C	30C	7.2	5.2	54	-	36	-
31		C	320C	7.3	3.7	55	15	-	-
32		C	310C	7.3	3.5	32	26	-	11
33		C	240C	7.3	2.4	70	-	21	
Total							**441**	**1.559**	**380**

Key: A = sites in Owerri

B = sites in Okigwe

C = sites in Orlu

Table 4:Average monthly variation of Physico-chemical Parameters in various freshwater habitats

Months	Temperature (oC)	pH%	Dissolved oxygen (mg/I)	Conductivity (umhos)
April 2005	29.1	7.3	3.5	38.2
May 2005	26.2	7.3	6.2	43.6
June 2005	28.2	7.3	7.1	50.2
July 2005	20.3	7.3	8.5	50.2
August 2005	30.3	7.2	7.3	41.5
September 2005	30.8	7.2	7.2	70.5
October 2005	31.8	6.2	4.2	99.1
November 2005	32.4	6.2	4.2	99.1
December 2005	32.4	5.1	3.7	110.2
January 2006	32.9	4.1	3.2	110.5
February 2006	33.8	4.2	2.3	90.5
March 2006	33.5	4.2	2.3	90.5

Table 5:Percentage occurrence of snails in the four main fresh water habitats

Snail species	Total no of snails	Fast flowing water	Slow flowing water	Swamps	Ponds
P. ovata	441	0 (0.0)	96 (19.3)	71 (14.3)	274 (19.8)
L. natalensis	1559	0 (0.0)	300 (60.5)	369 (74.3)	890 (64.2)
A. stagnicola	380 (0.0)	100 (20.2)	100 (20.2)	58 (11.6)	22 (16.0)
Total	**2,380**	**0 (0.0)**	**496 (20.8)**	**498 (20.9)**	**1386 (56.2)**

Number in brackets show percentage occurrence.

DISCUSSION

Snail species of animal trematode was illustrated in table 1. *L. natalensis* ranked highest with 14.0% followed by *A. Stagnicola* with 12.1% and *P. ovata* with 7.9%. The high abundance of *L. natalensis in* the study area confirms that this snail species is the Chief vector for fascioliasis in the area. This is in line with the work of Anosike et al (2005) on parasitic helminthes among ruminants in Etiti Area of Imo State which gave 57.0% prevalence of fascioliasis infection.

Analysis on the effect of wet and dry period of snail species abundance showed an expansion of snail population density during the dry season and the contraction of snail population density during the rainy season. This present study agrees essentially with this particular findings by other researchers as (Sodeman, 1979) who reviewed studies of monthly changes in snail vector population in several West African countries. Water habitats protected from excessive drying and over flooding tended to show a more stable snail population all year round (Soladin, et al 1980). Such control of water body level was lacking in most of the water habitats worked on. The water habitats such as ponds and burrow pits usually dry up during dry periods. As snails are usually affected by excessive drying and desiccation, snail species in such water bodies also died off.

Another characteristics of snail population in the study area is a decrease in population size of snails towards the end of the dry season and the beginning of rainy season. A similar decline in snail population density was recorded by (Soladin, et al 1980) and (Sodeman, 1979). This decline in population size observed towards the end of the dry season was probably as a result of heat stress of the period.

A. stagnicola and P. ovata stood as intermediate host of paramphistomiasisis and trematode infection of Lower animals in the study area. Anosike et al, (2005) and Okafor et al, (1988) The state has the physico-chemical factors that favoured the growth and abundance of intermediate snails. Parts of the study area such as Okigwe area has fertile soils and vegetation which allows for high density of pulmonate snails which serves as hosts for the parasites they harbour. (Njoku-Tony, 2007). Some parts of the area also shares boundaries with other endemic areas of other states such as Abia and Enugu state. Nduka et al (1995). Most parts of the states have their land criss-crossed by many stagnant water bodies, slow flowing streams and vegetation around them including the topography and climatic conditions which encourage the growth and survival of these intermediate snails. Ekejindu et al (2002), Nale et al, (2003) Bello et al (2003).

Analysis on snail occurrence in relation to physico chemical parameters showed variations in different physico chemical factors (Fashuyi, 1979). Temperature ranged between 22^0C- 33^0C, Temperature has been recognized as an important factor on any biotope especially freshwater (Hira, 1970). High temperature causes thermal stress in snail vectors (Hofkins et al ,1991) it also reduces dissolved gas content of the water body. Most of the snail recorded in this study tolerated the minimum /maximum temperature of 23^0C-33^0C in their natural habitats. *L. natalensis* tolerates a relatively high temperature medium and that probably accounted for its high abundance in this study area (Njoku-Tony, R.F (2007).

Dissolved oxygen ranged between 2.2 – 8.5mg/Li. At dissolved oxygen concentration above 7%, respiratory pigment of planobid snails remained saturated (WHO, 1994). Snail pigments show affinity between 1 – 7% saturation and snails die below 1% saturation (Wright, 1959). Vector snail attach to green aquatic plants for dissolved oxygen especially when dissolved oxygen tension in freshwater is low. (WHO, 1990). In this study, dissolved oxygen tension varied with sampling periods and water bodies. (Hira, 1970). In fast flowing water body, dissolved oxygen was higher than in slow or stagnant water bodies. Do2 tended to reduce with increase in temperature and this is in line with (Hira 1970) observation that oxygen increases with the rains. This therefore accounted for the high number of snail species in dry season. During the rains also, there is an absence of dissolved or suspended matter which tend to absorb the sun rays thus reducing photosynthesis and release of oxygen. At the tail end of dry season however, oxygen tension falls below 1% and snails tend to suffocate (WHO, 1990) At this time, ponds, ditches and even most rivers dry off. This results in mass morbidity. (Malek and Cheng, 1974). This factor is therefore limiting to snail growth. Maximum and minimum pH values were 4.1 and 7.5. (WHO, 1990). At pH below 5.8 lime deposition during shell formation is inhibited (Malek, 1958). In this study, no snail of any species occurred in sites with less than 5.0% and vector snails were rarely found in sites with 8.0%.. This study reveals that acidic pH of 5.0 is limiting to vector snails and that pH slightly less than 7.0% is optimal for these vector snails. (Njoku-Tony, 2007) .

In this study, conductivity ranged between 11- 110 umhos. Snail population was high in medium with conductivity range between 50-110 umhos than in medium with lower ranges. Conductivity is therefore a limiting factor to snail growth and abundance. Low conductivity range below 50umhos coincides with low snail abundance. This is in line with Hairson et al (1958) who observed that intermediate snails are not found in waters with low concentration of salts. It has been observed that conductivity was low in flowing water and snails were collected from sites with high conductivity level than sites with low conductivity level (Odum, 1971).

Table four Illustrated the average monthly variation.

Temperature and conductivity decreases with the rains and increased in the dry season months (September – March), dissolved oxygen and pH increased with the rains (April-Aug.) and decrease with dry season (September-March). High temperature causes reduction of dissolved gas content of water especially oxygen Fashuyi, (1979). Dissolved oxygen is usually high in fast flowing water and tend to be high with the rains, this explains why Do2 content of water bodies was high between April and September still snail population contracted.

It was also observed that snail population density expanded during the dry season months when conductivity was high.

Table five showed the percentage snail occurrence in the four main water contact sites namely, swamp, fast flowing river, slow flowing River. In this present study, snail population density in pond was highest, this could be attributed to the fact that favourable conditions such as presence of organic matter content and high concentrations of electrolytes abound in pond water. (Agi, 1980) There was absence of snail species in fast flowing river body because fast flowing water does not allow snail population to build up, it washes and sweeps off the foot of snails. There is also absence of organic matter/suspended matter to support snail population. Oburuleke et al (1980)

CONCLUSION

This present study revealed that the study area has water contact sites that have the physico chemical parameters such as contaminated water, pH, temperature, Do2 and conductivity and are also surrounded by vegetations that hold high density of snail species population. This therefore suggest that adequate snail vector control programme be mounted to check intermediate snail population expansion in the study area.

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REFERENCES

1. Agi, P.I. (1980). Studies on the Ecology of Vector Snails of Schistosomiasis In Jos. M.Sc Thesis, University of Jos, Nigeria P. 147.
2. Anosike, J.C, M.N. Opara, C.G. Okoli and I.C. Okoli,(2005) Prevalence of parasitic Helminthes among ruminants in Etiti area of Imo State Nigeria. *Animal production research advances* 1(1)13- 19.
3. Bello, Y.M. Adams, T. Abubaka, U. and Muhamed A.A (2003). Urinary Schistosomiasis in some villages around the Gonoyo Dam, Sokoto State, Nigeria. *Nigeria Journal of Parasitology* 24: 109-114.
4. Berrie, A.D. (1970). Snail problems in African Schistosomiasis. *Advances in Parasitology*, Dawes, B.E.B; Academic Press, New York 8. 43.
5. Brown, D.S. (1980). Freshwater snails of Africa and their Medical Importance. Taylor and Francis Ltd, London, P. 487.
6. Ekejindu, I.M; Ekejindu, G.O.C. and Andy A. (2002). *Schistosoma haematobium* infection and nutritional status of residents in *Nigeria. Nigeria Journal of Parasitology*. 23: 131-138.
7. Fashuyi, S.A. (1979): The freshwater gastropod snails of medical and veterinary importance in Sierra Leone, *Revul de Zoologia African* 93:910-911.
8. Hairson, N.G; Hubenick, B. Watson, J.M. and Oliver L.J. (1958). An evaluation of techniques used in establishing snail population *Bulletin of world health organization* 19:661-672.
9. Hira, P.R. (1970): The temperature, pH and oxygen content of water habouring the intermediate snail host of *Schistosoma haematobium* Nigeria Journal of Science. Vol. 3 (2) 131-138.
10. Hofkins, B.V; Mokoji G.M; Keochi loker, E.S. (1991b) controlling Schistosoma transmitting snails in Kenya by the North American Crayfish procambus clarki. *American Journal of tropical medicine and hygiene* 45:339-334.
11. IMSG Imo State government Owerri (1993) Directorate for Primary Schools in Imo State.
12. Malek, E.A. and Cheng T.C (1974). Medical and Economic Malacology. *Academic Press* London, 298p.
13. Malek, E.A. (1958) factors conditioning the habitat of bilhaziasis intermediate hosts of the family planobidae. *Bulletin of the world Health Organization* 27, 41-58e World.
14. Nale, Y. Soladima, M. and Yakubu, S.C. (2003). Index of potential contamination for urinary schistosomiasis in five settlements near river Kubanni in Zaria. *Nigeria Journal of Parasitology*. 24:95-101.
15. Nduka F.O., Nwaugo V.O. and Nwachukwu, Net (1995). Bacteria associated with paragnomiasis infection in Okigwe Area of Imo State Nigeria. *Nigeria Journal of Biotechnology* 11:65-75.
16. Njoku-Tony, R.F. (2007) Ecological studies on some human and Animal trematodes in parts of Imo State, Nigeria. Ph.D. Thesis, Imo State University, Owerri.
17. Obureke J.U; Arene, F.O.I. and Ufodike, E.B .C. (1987). Occurrence and habitat preferences of freshwater snails of the River State; Nigeria. *Nigeria Journal of Applied Fisher's and Hydrobiology* 2:39-43.
18. Odum (1971). Freshwater Ecology, in fundamentals of Ecology (3rd edition) Sander Co. Philadelphia. 547p.
19. Okafor, F.C, Mbata G. Anosike, J.C; (1988). Studies on *Paramphistomum cervi* Infections of Ruminants in Imo State, Nigeria with special reference of the role played by *Bulinus B. Forskalii* in their transmission. *Bulletin of Animal Health Product ion in Africa* 36:142-146
20. Okwosa, V.N. (1979). Ecological studies of freshwater snails, with particular reference to schistosome in Lagos, Oyo and Ogun State of Nigeria. Ph.D. Thesis University of Ibadan. Pg 300.
21. Oliver and Ansari, N (1973) Epidemiology and control of Schistosomisis. N.Ansari (Ed). WHO Geneva page 752
22. Smith, V.G.F (1982). Distribution of snails of veterinary importance in an organically polluted water course in Nigeria. *Annals of tropical medicine and parasitology*. 76 (5): 539-546
23. Sodeman, W.A. (1979). A longitudinal study of schistosome vector snail population in Liberia. *American Journal of tropical medicine and Hygiene* 28:531-538.
24. Soladin, B; Saladin, K. Dennis E. Degremount, A. (1980). Preliminary epidemiological survey of schistosomiasis in central and southern Liberia *Actatropica* 37:53-62.
25. Steel, R.G.D and Torrie,J.H (1980). Principles and procedure of statistics, 2nd edition, McGrew-Hill, New York Ny,389p.

26. Ukoli, F.M.A. and Asumu (1979). Freshwater snails of the proposed Federal Capital Territory in Nigeria. *Nigeria Journal of Natural Science* (1) 47-56.
27. World Health Organization, (1990). Health Education in the control of Schistosomiasis. World Health Organization Working Committee 56:810.
28. World Health Organization, (1994) Qualitative research methods: Teaching materials for TDR Workshop. TDR.SER/RP/94.
29. Wright, S.A. (1959). A note on the ecology of some molluscan intermediate host of African Schistosomiasis *Annals of Tropical medicine and Parasitology* 50 (4) 345-349.

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