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The role of permanent and seasonal freshwater bodies in the distribution of molluscan vectors of urinary schistosomiasis in Borno State, Nigeria

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ABSTRACT: Disease vectors control has been known to be the gateway to the control of water borne and water related diseases. There is an upsurge of current emphasis on vector biology and control rather than chemotherapy as better strategies for disease reduction or eradication. The role of permanent and seasonal freshwater bodies in the distribution and control of Molluscan vectors of urinary schistosomiasis in Borno State was studied. There were significant ($P \leq 0.05$) differentials in the distribution of the two snail species investigated. Permanent bodies of water accounted for 90.21% and 90.40% of *Bulinus globosus* and *Bulinus forskali* respectively while seasonal habitats accounted for 9.79% and 9.60% of the snail species respectively. There was also a highly significant ($P \leq 0.05$) difference in the grand total species percentage abundance of 98.57% and 10.43% for *B globosus* and *B. forskali* respectively. The drying up of the aquatic vegetation during the dry season was observed as veritable component of snail reduction and control.

Key Words: Urinary schistosomiasis; Vector control; Freshwater bodies; Moluscs; Borno State; Nigeria.

Introduction

Aquatic habitats contribute immensely to the shaping and modification of the economy of many nations globally. Such contributions are more magnified in the areas of agriculture, health, transportation, mineral resources, defense, environmental impact and tourism. For the purpose of this study, emphasis will be placed more on the aquatic habitat in relation to health and agriculture. The geographical and ecological location of Borno State excludes it among the States that derive benefit or loss from marine habitat(1). Consequently the water bodies in Borno State are freshwater habitats.

Depending on the availability of water in the habitat during the year, these freshwater bodies are broadly classified as permanent (water available throughout the year) and temporary/seasonal (water available for 4 – 6 months consecutively). These freshwater bodies are used mainly for agriculture (through irrigation)

and fishing activities. The stagnant nature of these aquatic habitats provide favourable conditions for the establishment and proliferation of snail vectors of schistosomiasis (2,3,4). The permanent and seasonal nature of the habitats will affect the breeding, maturity and multiplication of the vectors which survival and continuity will depend, among other factors, on the variability of the physical features of the water bodies (5). Consequently, this study focused on the role of permanent and temporary freshwater bodies.

Materials and Methods

The Research Area

The study was carried out in Central and Northern Borno extending over a distance of 160 km (Alau to Gamboru). The area is characterized by prolonged dry season with few trees and mostly shrubs with grassy to sparsely grassy vegetation(6).

The Freshwater Bodies

Permanent freshwater bodies are very scarce in this semi-arid region of Nigeria. Consequently, two permanent water bodies were used for this study on the basis of their intensive use by the inhabitants for agricultural, domestic and fishing activities. These are the Alau Dam in Central Borno and the Ngala reservoir in Northern Borno. Six temporary (seasonal) freshwater bodies were selected on the same basis. The seasonal water bodies also must last up to five months and above before drying up.

Sampling of snail vectors

The eight freshwater bodies were sampled for *Bulinus globosus* and *B. forskali*. The sampling method of Olivier & Schneiderman (7) was used. The sampling was done using standard sieves of 0.05 mm – Imm mesh.

Results

Table I shows the comparative abundance of the snail vectors in the eight aquatic habitats. LCRI canal and Alau reservoir accounted for 49.95% and 40.46% respectively of all the *B. globosus* recovered from all the eight habitats. Temporary (seasonal) habitats recorded significantly ($P \leq 0.5$) low percentage abundance. The table also shows that LCRI canal and Alau reservoir accounted for 52.92% and 37.31% of all snails recovered. Table 2 shows that permanent habitat significantly ($P \leq 0.5$) harboured more snails (90.23%) than seasonal habitat (9.77%). *B. globosus* was also significantly ($P \leq 0.5$) more abundant (98.57%) than *B. forskali* (10.43) in the two habitats.

Table 3 shows that there were significant ($P \leq 0.5$) differentials in the distribution of the two snail species in the two types of habitats. Permanent bodies of water accounted for 90.21% and 90.40% of *B. globosus* and *B. forskali* respectively while seasonal (temporary) habitat accounted for 7.79% and 9.60% of the snail respectively.

Discussion

The highly significant ($P \leq 0.05$) percentage abundance differentials in the permanent and temporary (seasonal) habitats sampled deserve special attention. The probable implication is that these two permanent bodies of water serve as the reservoir habitats from where eggs and juvenile snails are dispersed, by flood, wind and wave actions, to the temporary pools, ponds and burrow pits. The subjection of these temporary surface waters to constant drying up as a result of less precipitation, solar radiation, high and erratic change

in temperature places the snail vectors therein under risk of desiccation thereby leaving them with the choice of hibernation, aestivation, emigration (through flood) or death. This observation is inconsonance with those of MacArthur and Connel (8). The danger is that the permanent freshwater bodies act as suitable habitat and from them, infected snails produce the schistosome cercariae for infection and these are also dispersed through flood, wind and wave action to the temporary habitats. This scenario has an important implication in vector snail control measures. For effective snail control and reduction in schistosomiasis incidence, temporary pools should not be encouraged near or around permanent bodies of freshwater.

The low abundance recorded in temporary pools and ponds for both species revealed that probably they are affected by the erratic changes in water level, temperature, desiccation and drying up of the vegetation. These observations are corroborated by the reports of earlier authors (4). The study also revealed that ***B. globosus*** is probably more adapted to temporary habitats than *B. forskali* as shown by their distribution. Out of the 117 snails recovered from seasonal (temporary) habitat, *B. globosus* accounted for 105 (89.74%) while *B. forskali* was 12 (10.27%). This is in consonance with the report of Betterton-Jones *et al.* (9) that it is now apparent that *B. forskali* group of snails found in any temporary habitat must be regarded with suspicion and deserve close examination adding that the presence of both ***B. senegalensis*** and *B. forskali* in more permanent habitats adds a further complication to the epidemiological picture.

Table 1: Comparative abundance of *B. globosus* and *B. forskali* In the eight aquatic habitats

Nature of Water body	**STATIONS**	**SNAIL SPECIES** *B. globosus*				**HABITAT** ***B.forskali***	
TOTALS		No.	%	No	%	No.	%
		Collected	Abundance	Collected	Abundance	collected	Abundance
Permanent	LCRI Canal,Ngala	536	49.95	98	78.40	634	52.92
"	Alau Dam	432	40.26	15	12.00	447	37.31
Temporary/ Seasonal	Ngadda river, p.I	35	3.26	2	1.60	37	3.09
"	" " p.II	23	2.15	1	0.80	24	2.00
"	CBDA Canal p.l	15	1.40	4	3.20	19	1.59
"	Pool, Ngala	0	0.00	0	0.00	0	0.00
"	CBDA Canal, p.ll	12	1.12	3	2.40	15	1.25
"	Ebeji river, Gamb.	20	1.86	2	1.60	22	1.84
	Snail Species Totals	1073	100 00	125	100.00	1198	100.00
Grand Total Species % Abund.		1073	89.57	125	10.43	1198	100.00

Table 2: Comparative abundance of the two snail species in relation to the two types of habitats.

SNAIL SPECIES	HABITAT TYPE			
	Permanent	**Temporary**	**Total**	**%**
B. globosus	968	105	1073	98.57
B. forskali	113	12	125	10.43
Total	1081	117	1198	
% Abundance	90.23	9.77	100%	100%

Table 3: Percentage abundance of each of the snail species in each of the habitat types.

NATURE OF HABITAT	SNAIL SPECIES			
	B. globosus		*B. forskali*	
	No. Collected	%	No. Collected	%
Permanent	968	90.21	113	90.40
Temporary (Seasonal)	105	9.79	12	9.60
TOTAL	1073	100%	125	100%

Conclusion

There were highly significant differences in the abundance of both snail species in the two freshwater habitats. The permanent habitats serve as reservoir foci for both snails and the infected snails (which can release schistosome cercariae) are eventually carried (through flood, wind and wave actions) to the temporary habitats. This posses health hazard to the communities that use the water habitats. Location of temporary freshwater habitats side by side with permanent water bodies should therefore be prevented as much as possible.

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