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Seasonal changes in the distribution and infection rate of schistosome intermediate hosts in river Kubanni and its tributaries

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ABSTRACT: A 12-months snail sampling using the man/time method was carried out in river Kibanni and its tributaries in order to determine the seasonal abundance and infection of schistosome vectors within the Ahmadu Bello University community. Two genera of snails *Bimphalaria* and *Bulinus* were recovered. With the exception of *Bulinus* recovered from the temporary flowing tributary all others were capable of carrying cercariae of human schistosome. Of the 4119 schistosome vectors collected, 204 (5%) were carrying schistosome infection. *Bulinus* (0.6%) and *Biomphlaria* (7.8%). Both snail density and infection were profoundly influenced by rainfall with both indices reaching their peak in dry season (November – April). Transmission of *Schistosoma mansoni* by *Biomphlaria pfeifferi* was not only exceptionally higher than *S. haematobiu* by *Bulinus* in the permanent flowing habitat, but was the sole schistosome transmitted in the temporary flowing tributary (ibfection rate: 8.8% vs 2.3% and 7.4% vs 0.0%). This study demonstrate therefore, the seasonal occurrence and infection of schistosome intermediate host and the high transmission of especially schistosomiasis mansoni.

Key words: *Biomphlaria, Bullinus* seasonal distribution, snail infection, transmission.

Introduction

Schistosomiasis remains one of the most prevalent parasitic infection worldwide, second only to malaria in terms of economic and public health significance (1,2). The construction of water resource schemes to meet the power and agricultural requirements for the growing population has led to the proliferation of the snail vectora and hence, transmission of the disease worldwide (3). The snail intermediate host continues to play a significant role in the transmission of schistosomiasis and to date, snail control has remain an essential component of the integrated schistosomiasis control programmes, partly because of its cost effectiveness (1,3) and partly because, certain water associated activities which are essential for the transmission of the disease are not likely to change significantly with health education and the provisions of treated potable water supplies (4).

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In planning snail control reassures and evaluating their impact, knowledge of their ecology, population trends and dynamism are essential pre-requisite towards understanding disease transmission and control (5,6). No work of this nature has been carried out in the study area and based on this assertion the present study is designed to study the relative abundance, seasonality and infection rates of schistosome vector in the study area.

Materials and Method

Study Location

The study was carried out in River Kubanni and its tributaries. The river is fed by two major tributaries one arising from the plains of the Institute for Agricultural Research (IAR), A.B.U., Samaru, Zaria while the other has its source from ungwar Maigamo village. Both meet near ABU main campus where they are dammed. The effluent from the dam thereafter flows down as the main river. Several other temporary flowing tributaries which gets dried in dry season also empty their contents into this river, prominent of these is the one draining from Area 'A' quarters into the river via Kore village (Fig. 1).

Snail Sampling

One year sampling using the man-time technique as described by Klumpp and Chu (7) was carried out fortnightly between April 1999 and March 2000. Snails were collected from several sites within the river (permanent flowing or Habitat 1) and Area 'A' tributary (temporary flowing or Habitat 2). The fortnightly collections were pooled each month for convenience of presentation. Weeds associated with the snails were collected and identified in the herbarium of Biological Science Department while rainfall data was obtained from IAR weather station.

Laboratory Analysis of Snail Infection

Snails collected were immediately transported to the laboratory for analysis. They were first of all washed and identified morphologically according to the specified guidelines (8). Snail infection was mainly determined by the shedding method but where infection could not be detected by this method, such snails were crushed to reveal possible latent infections (6). Cercariae were examined and identified first as unstained wet mount and as stained preparation by adding a drop or two of neutral red to the wet mount (9).

Results

Schistosome vectors recovered from the study habitat included *Biomphalaria pfeifferi* and *Bulinus* species comprising of *Bulinus globosus* and *Bulinus truncates*. They were commonly found attached to water weeds of the species *Commelina gbenghalensis, Hypoethes carcellata, Eichornia crassipes, Ipomea aquatica, Hydrophilla auriculata* and *Vossia cuspidate*. They were sometimes found attached to surfaces of submerged rocks, dead logs and other junks in water. The monthly relative abundance of the snail in both habitat is summarised in Table 1.

Of the 4,119 snails collected, 2,509 (60.9%) were *Biomphalaria* while 1,610 (39.1%) were *Bulinus*. The bulk of the snails (3,116) were collected from the temporary flowing habitat. Greater number of the snail were collected between November and April.

Snail density in the permanently flowing habitat varied markedly with season being lowest during the period of heavy rainfall (Table 1(a) on the other hand, habitat 2 only became established with water in August consequently, snail sampling begun then. Snail population started to mount in this habitat following the decrease in rains to reach the peak in October and thereafter declined till no snail was recovered in January following the desiccation of the habitat consequent to the stoppage of rains (Table 1 (b).

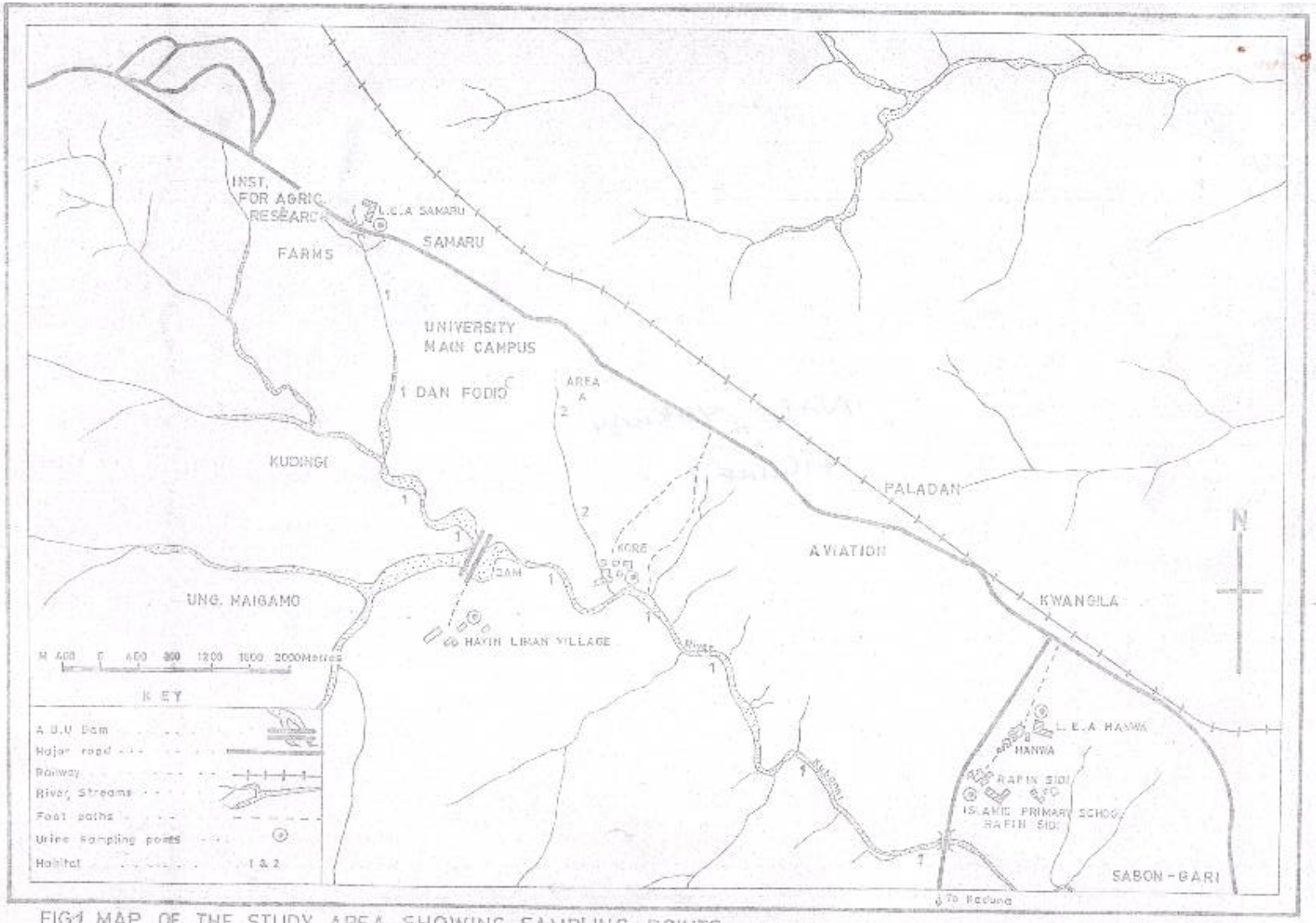

FIG1 MAP OF THE STUDY AREA SHOWING SAMPLING POINTS.

In all, 256 (6.2%) of the snails collected were shedding trematode cercariae, 204 (%5) of these were shedding human schistosome and 52 shed cercariae of animal trematodes identified as *Xiphidiocercariae, Cystrophorus monostome, Echinstome, Gymnoscephalous* and *Longifurcate*. There were several cases of mixed infection with human schgistosomes and animal trematodes especially in *Biophlaria*. Schistosome infection rate in both habitats were 0.6% (in *Bulinus*) and 7.8% (in *Biomphlaria*).

Transmission analysis based on snail infection rate (Table 1) shows that *S. mansoni* was not only transmitted more than *S. haematobium* in the permanent flowing habitat (8.8% vs 2.3%), but was exclusively transmitted in the temporary flowing habitat (7.4% vs 0.0%).

Figures 2 and 3 shows the relationship between rainfall and schistosome infection rate in habitats 1 and 2 respectively. Schistosome infection rates especially in Biomphalaria varied markedly with season with peak infection occurring in dry season (November – April). In habitat 1, snail infection was lowest in the months of heavy rainfall (June to August) and only rose to peak in January long after the cessation of rains (Fig. 2). On the other hand, the peak infection (n = 72) was recorded just after the stoppage of rains (November) in habitat 2 (Fig. 3).

Discussion

The above results show that snail density and infection in both habitats were seasonal. The marked influence of rainfall on aquatic snails population and indeed infection has been described by several authors (10,11,12,13,14). Rainfall cycles thus, probably influenced snail population and infection rate in two ways:

(i) In the permanent flowing habitat the swift water currents due to heavy rainfall easily dislodged and flushed away the snails attached to the vegetations and hence account for low or lack of snails during the heavy rainy period and the gradual rise long after the stoppage of rains (Fig. 2).

(ii) In the tributary the heavy rains during this period helped to established the habitat with the consequent reactivation of snails which had previously passed through aestivation in dry mud (15) and that in part explains the increase in both the density and infection rate of snails as from August couple with the fact that this habitat has dense vegetation than the former and also less turbulent water current to wash away the snails.

Schistosome infection rate was generally low, a trend often reported in schistosomiasis endemic areas (6,11,15,16,17). The higher schistosome infection rate in *Biomphlaria* over that of *Bulinus* is an indication of higher transmission of *S. haematobium* over *S. mansoni* in the study area which has also been reported elsewhere (18). A primary survey previously carried out around this area further proved this assertion (19).

The higher number of *Biomphalaria* and its infection in the temporary habitat than in the main riover is not unusual and may be attributed to the preference of this snail species to microhabitat as opposed to *Bulinus* which is better adapted to larger water bodies (5,12,13,20). In addition, *Biomphalaria* has better adaptability to temperature and able to survive the aestivation period than *Bulinus*(10,15,21). The latter factors may also be responsible for the non-infectivity of *Bulinus* found in habitat 2 since infection with schistosome renders snail less tolerant to desiccation hence, only those snails which have better adaptability are capable of reactivating from aestivation bearing schistosome infection (15).

Higher number of infected snails recorded in dry season signifies the period of intense transmission which incidentally coincides with the time of greatest water activities as reported by some workers (11,12,13,22). It is therefore imperative for snail control strategy to be planned towards this period.

In conclusion, it was clear from the results that the distribution and infection rate of schistosome intermediate host was greatly influenced by rainfall. Though infection rate was generally low and much higher in *Biomphalaria* than in *Bulinus*, nevertheless there is evidence of high transmission of schistosomiasis in the study area.

Table 1: **Relative abundance and infection of Schistosome vectors by month.**

Month	(a) Habitat 1						(b) Habitat 2						Mean Monthly Rainfall (mm)
	Bulinus species			Biomphalaria species			Bulinus species			Biomphalaria species			
	No examined	+ve *S. haema*	+ve others	No. examined	+ve *S. mansoni*	+ve others	No. examined	+ve *S. haema*	+ve others	No examined	+ve *S. mansoni*	+ve others	
1999													
APR	81	5	0	59	17	22	0	0	0	0	0	0	40
MAY	69	3	0	11	0	1	0	0	0	0	0	0	39
JUN	0	0	0	0	0	0	0	0	0	0	0	0	199
JUL	0	0	0	0	0	0	0	0	0	0	0	0	143
AUG	0	0	0	0	0	0	62	0	0	178	7	17	91
SEP	5	0	0	15	1	4	203	0	1	118	11	2	109
OCT	11	0	0	32	1	4	497	0	0	892	7	71	55
NOV	17	1	0	116	0	2	318	0	0	308	72	6	0
DEC	19	0	0	5	1	0	80	0	0	266	29	2	0
2000													0
JAN	8	0	0	80	22	8	60	0	0	134	15	12	0
FEB	87	0	2	149	4	4	0	0	0	0	0	0	0
MAR	93	0	0	146	4	6	0	0	0	0	0	0	0
Total	390	9(2.3%)	2	613	54(8.8%)	48	1220	0	1	1896	141(7.4%)	110	

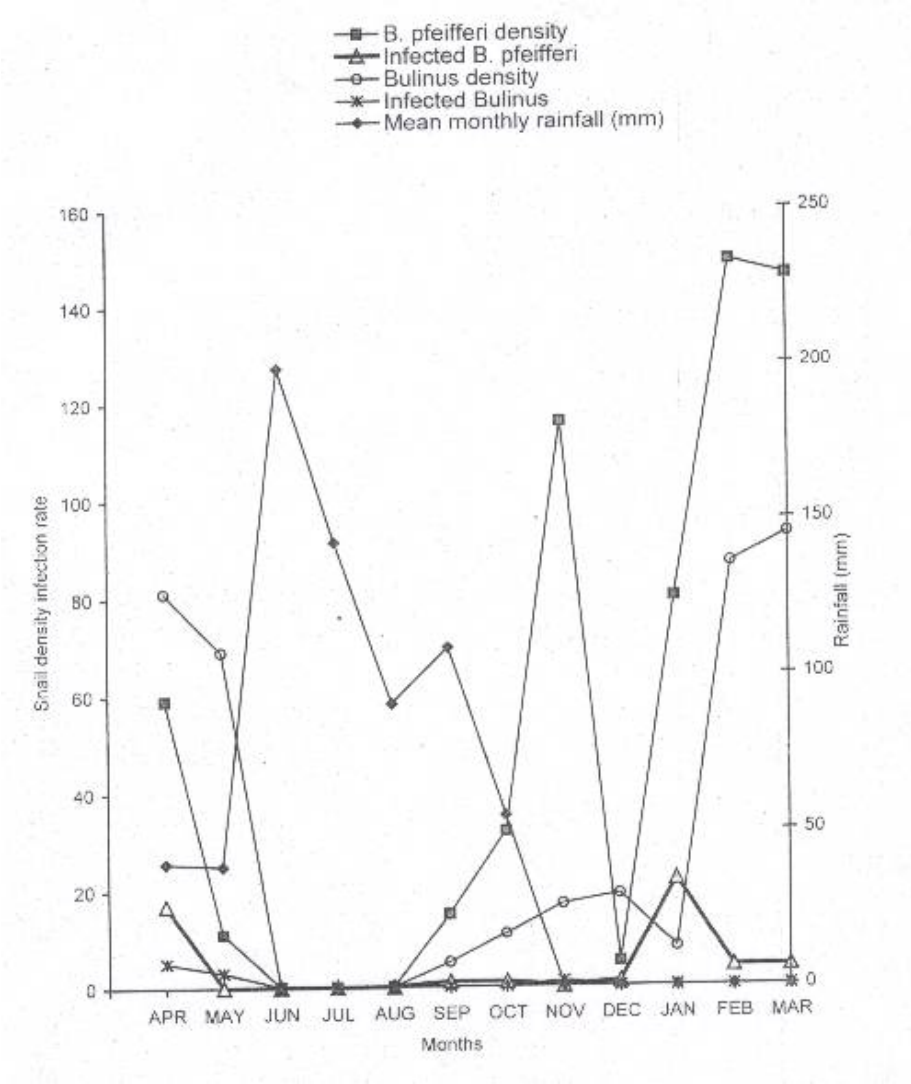

Fig. 2: Relationship between snail density, infection rate and rainfall in Habitat 1

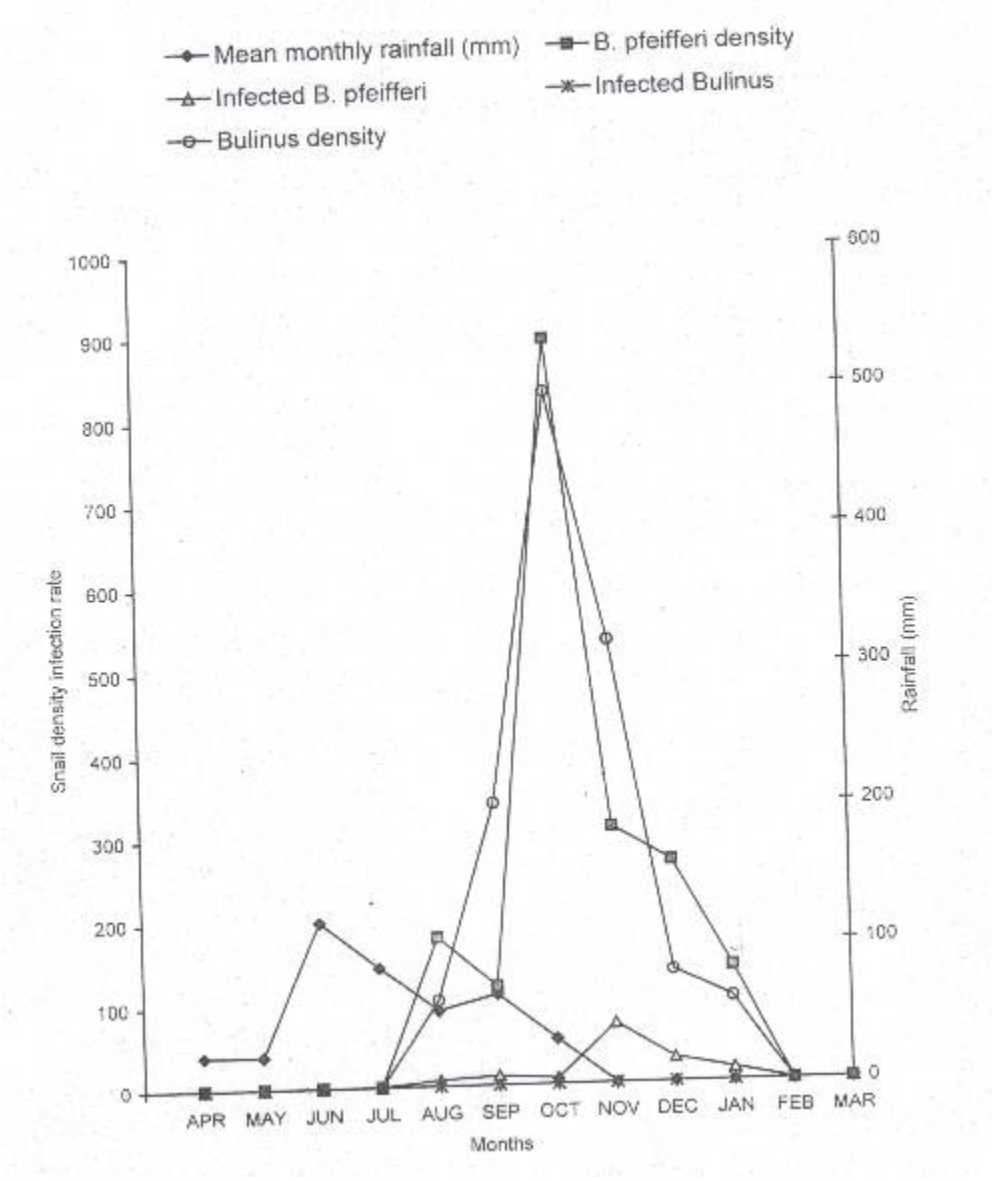

Fig. 2: Relationship between snail density, infection rate and rainfall in Habitat 2

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