A review of the schistosomiasis risk in South African dams

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Abstract

Information obtained from the data base of the former Snail Research Unit of the South African Medical Research Council at the University of Potchefstroom for CHE, as well as from the *Atlas of Bilharzia*, was used to evaluate the risk of contracting schistosomiasis in South African dams. The results showed that almost all dams in the schistosomiasis endemic area contained snails belonging either to the *Bulinus africanus* group, the intermediate hosts of *Schistosoma haematobium* and/or *Biomphalaria pfeifferi* (intermediate host of *S. mansoni*). Dams in this area have the potential for schistosomiasis transmission and consideration should be given to introducing snail control measures. *Bulinus africanus* species group occurred sporadically in dams in areas bordering the endemic regions and therefore snail and parasite surveys should be conducted periodically to monitor possible changes in distribution. At present dams in the rest of the country do not pose any risk of schistosomiasis infection as the intermediate host snails do not occur in them.

Introduction

Most of the dams in this country provide recreational facilities and in view of the fact that numerous persons indulge in activities such as sailing, swimming, fishing, diving and skiing, the question frequently arises as to the risk of contracting schistosomiasis in these water bodies (Gear *et al.*, 1986). It is imperative that the general public, as well as the authorities controlling the dams, be aware of the risks involved and where necessary, take steps to obviate exposure of humans to the schistosome parasites.

In previous reports on the mollusc distribution in certain South African rivers, only cursory references were made as to the risk of contracting schistosomiasis in dams (Pretorius *et al.*, 1974; Pretorius *et al.*, 1976; Pretorius *et al.*, 1980). Joubert *et al.* (1983), investigating the freshwater molluscs of the Magaliesberg mountain range between Pretoria and Rustenburg, evaluated the risk in the Hartbeespoort Dam. The possible inter-basin transfer of the intermediate host snails from areas in which they commonly occur into the Hendrik Verwoerd and Sterkfontein Dams, is discussed by Pretorius *et al.* (1974) and Pretorius *et al.* (1976) while Wolmarans *et al.* (1986) described the occurrence and distribution of *Biomphalaria pfeifferi* and speculated on the schistosomiasis risk in dams in the Lichtenburg town area.

In order to establish the schistosome transmission potential of dams, the data we collected at the Snail Research Unit over the last 40 years and the information on the parasite distribution published in the *Atlas of Bilharzia in South Africa* (Gear *et al.*, 1980) were analysed.

Method

The more than 19 000 records in the data base were searched and only those pertaining to large dams and from the dam proper, were selected for analysis. This gave a total of 679 collections from 95 different dams.

The *Atlas of Bilharzia in South Africa* (Gear *et al.*, 1980) was consulted to demarcate schistosomiasis endemic and non-endemic regions. This information, i.e. the location of the dams harbouring the intermediate host snails as well as those in which they were absent but in which other freshwater molluscs were found, is presented in Fig. 1.

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Results

The intermediate host snails for urinary schistosomiasis are *Bulinus africanus* and *Bulinus globosus* and for intestinal schistosomiasis *B. pfeifferi*. Because it is at present impossible to distinguish reliably between the first two species, we used the convention of Brown (1980), and referred to them as the *B. africanus* species group.

As expected, the intermediate host snails occur further south in the Transvaal and eastern Cape than the schistosomes themselves (Van Eeden, 1970). Details of dams in the area between the snail and parasite distribution limits in which the intermediate hosts snails were found are given in Table 1.

A variety of snail species was found to inhabit South African dams. Those that occurred in 10% or more of the dams are listed in Table 2. Apart from the intermediate hosts, *B. africanus* group and *B. pfeifferi*, two other species viz. *Bulinus depressus* and *Gyraulus costulatus* occurred more frequently in dams in the endemic region while *Ceratophallus natalensis* occurred more commonly in dams outside the endemic region. The foreign snail *Lymnaea columella*, introduced into this country from North America (Van Eeden and Brown, 1966) has invaded a number of dams, particularly in the endemic region, to such an extent that nearly a third of the dams involved in this study were inhabited by this species.

TABLE 1
DAMS IN THE TRANSITIONAL REGION IN WHICH THE INTERMEDIATE HOST SNAILS WERE FOUND

Name of dam	District	Locus	N	Year
1. Boskop	Potchefstroom	2627CA	25	1966-77
2. Bronkhorstspruit	Bronkhorstspruit	2528DC	12	1968-77
3. Dauth Roode*	Lichtenburg	2626AA	2	1981
4. Dam at fountain*	Lichtenburg	2626AA	1	1981
5. Howisons Poort	Albany	3326AD	2	1977-82
6. Makwassie	Wolmaransstad	2726AC	2	1966-69
7. Nahoon	East London	3227DD	2	1977-78
8. Nooitgedacht	Carolina	2530CC	8	1966-71
9. Potchefstroom	Potchefstroom	2627CA	41	1953-77
10. Setlaars	Albany	3326AD	4	1976-82
11. Wagendrift	Estcourt	2929BB	7	1967-80
12. Wolmaransstad	Wolmaransstad	2725BB	1	1969
13. Wentzel	Schweizer-Reineke	2725AB	4	1958-77

N Number of collections
* Only *Biomphalaria pfeifferi* present

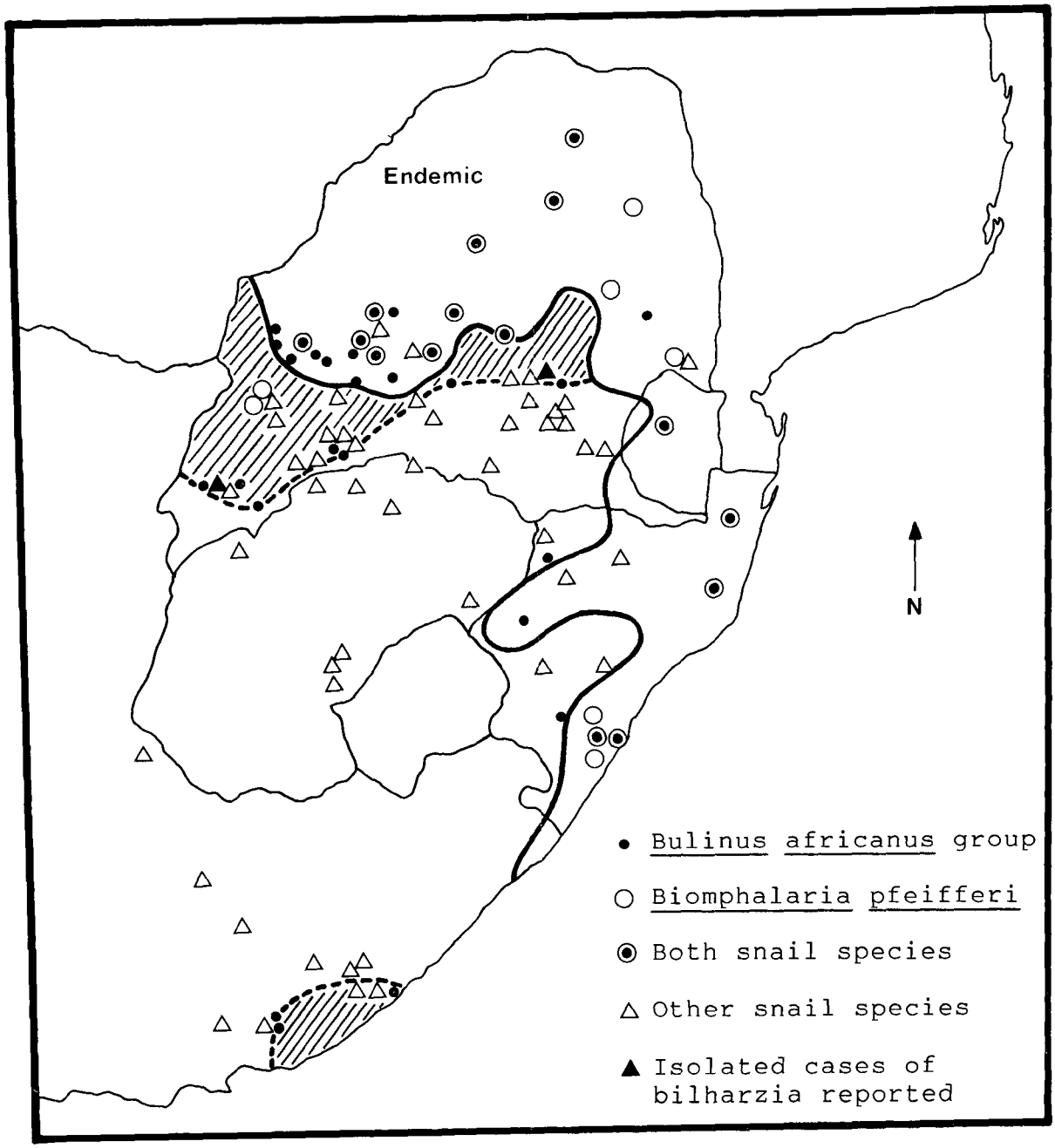

Figure 1
The occurrence of freshwater molluscs in South African dams superimposed on the schistosomiasis endemic and non-endemic regions. The solid line represents the southern distribution limit of schistosomiasis and the broken line the southern distribution limit of the intermediate host snails.

TABLE 2
THE SNAIL SPECIES WHICH OCCURRED IN MORE THAN 10% OF ALL THE DAMS

Snail species	Percentage occurrence			
	Endemic	Transitional	Non-endemic	Dams
Bulinus tropicus	18	17	28	63
Lymnaea natalensis	25	16	11	52
Bulinus africanus group*	28	10	0	38
Lymnaea columella	17	9	7	33
Ceratophallus natalensis	3	15	11	29
Biomphalaria pfeifferi	20	2	0	22
Gyraulus costulatus	13	3	2	18
Bulinus depressus	13	2	1	16
Gyraulus connollyi	3	5	4	12

* Either *B. africanus* or *B. globosus*

The snail species which occurred most frequently were *Bulinus tropicus* (63% of all dams) and *Lymnaea natalensis* (52%). None of these had any obvious preference for the selected regions.

The presence and distribution of intermediate host snails are given in Fig. 1. In the schistosomiasis endemic region, 33 of the 38 dams were inhabited by them. In 18 of these at least one of the intermediate hosts for either intestinal or urinary schistosomiasis was present. In the remaining 15, both were recorded from the same dam.

Discussion

The intermediate host snails are entirely aquatic and are mostly, but not exclusively, found foraging within the littoral zone amongst the marginal vegetation of the shores. Normally the snails are not found in the open deep waters; however, it has been observed on occasion that snails were floating or clinging to floating debris in the open water.

From the human exposure point of view it can be argued that the exposed shores and open waters pose a far lesser risk than the shallow water of small creeks and streams flowing into dams and the pools below the dam wall (McIntosh *et al.*, 1973). One of the reasons that can be given to substantiate this view is the generally low snail densities on exposed shores and in deeper open waters. This, together with the large volume of water involved and the mixing action of waves would result in low and perhaps negligible cercarial densities. The chances of becoming infected in such areas are admittedly low, but it has been a sound presumption that if the intermediate host snails are present a risk exists of becoming infected.

Initially we intended to classify and list all the dams according to the presence of intermediate host snails. During this exercise however it became evident that with the exception of five, all other dams situated in the endemic region were potential transmission sites. The absence of intermediate host snails in these five dams is of no particular importance because they were surveyed only once and the snails may have been missed. Furthermore, they are either surrounded or in close proximity to dams harbouring the intermediate host snails, which may be introduced at any time. It therefore seems that it would be more realistic to accept that all dams in the endemic region pose a risk.

In delineating the schistosomiasis endemic region we excluded two localities from which parasites were recorded. They are detached from the main endemic region and, more importantly, the validity of these records can be questioned because subsequent surveys by Visser (1984) failed to confirm them. The consequence of this omission was that an extensive area in the western and eastern Transvaal was not considered part of the schistosomiasis endemic region although the intermediate host snails have been recorded from dams in this region. The intermediate host for urinary schistosomiasis was recorded from eight, and for intestinal schistosomiasis, from two dams in this region (Table 1).

The presence of these snails, the recorded presence of parasites, the apparent absence of parasites in recent times, and the persistent but unconfirmed reports from the medical fraternity that infections may have originated from this area, create some measure of uncertainty and consequently the risk of becoming infected in this part of the Transvaal is unresolved. This so-called 'transitional' area extends roughly from the line formed by the Magaliesberg mountain range, southward to the Vaal River in the west, through the highly populated central Transvaal and narrowing towards the eastern parts. (Fig. 1).

In the eastern Cape three dams were found harbouring the intermediate hosts for urinary schistosomiasis but Gear *et al.* (1980) do not record any parasites from there.

The intermediate host snails were absent from the dams in the rest of the country. Transmission of the parasite is therefore impossible and no risk of infection exists in these water bodies (Fig. 1).

Preventative measures

Appropriate measures such as controlling the presence of the intermediate host snails should be considered in dams in the schistosomiasis endemic region – at least in those places where people come into contact with the water. An effective molluscicide is commercially available in South Africa and regular treatment of selected sites along the margins of the dams to decrease snail densities, is advisable. Restricting in-shore recreational activities and entry into deeper water to such treated sites will minimise the risk even further.

In the areas bordering the endemic region similar regular control measures are not necessary, but we suggest that surveys should be undertaken annually during the late summer and early winter to monitor the situation. Control measures should be temporarily implemented only if the intermediate host snails become established.

No control or monitoring is necessary in dams in the rest of the country.

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