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Bilharziasis in Africa

A REVIEW

BY

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INTRODUCTION

The Federation of Rhodesia and Nyasaland stands on the threshold of great water conservation schemes, plus great industrial expansion based on hydro-electric facilities. This is perhaps then an appropriate time to review the position in Africa, to examine the ever-increasing spread of the disease in this continent, and to look clearly at the implication for the Federation, of the large-scale interference with natural waters which is taking, and is about to take place. The writer is indebted to the work of Dawood and Gismann, to many reports submitted to the World Health Organisation by consultants and countries, and to many discussions, verbal and written, with workers on the disease in Africa.

DISTRIBUTION OF S. HAEMATOBIUM

Probably the most logical sequence in which to discuss the distribution of *S. haematobium* infections would be simply to start at the top of the continent and work down, but it is very likely that such a sequence would become little more than a list.

I propose therefore to attempt to discuss the distribution in terms of regions, beginning with the British East African territories and passing down through Mozambique to the Union.

1. *Uganda.* Uganda presents a curious picture, with quite high rates in the north and east, and a gradual spread of the disease into the west. At present a large area in the south west appears to be free of the disease, as does Ruanda Urundi on its border.

2. *Kenya.* The Kavirondo Gulf (Lake Victoria) is one of the hyperendemic areas of Africa with percentage rates, in school children, running up to 100 per cent. The coastal areas are also reported to show moderately high prevalence of the disease, but its distribution is, naturally enough, extremely focal in the desert areas of the Northern Frontier District, being concentrated round the few permanent watering places in the district.

The writer still remembers somewhat ruefully the difficulties encountered by the staff of the Southern Rhodesian General Hospital in Nairobi, in 1940 and 1941, when they tried to persuade local practitioners that bilharziasis was quite a common disease in Kenya. This may be as good a place as any to interpolate that many of the figures given for bilharziasis incidence reflect more the interest of the various National Health Authorities in the disease, than its actual prevalence. It is perhaps fair to suggest that in most cases the figures vary in direct proportion to the amount of time and thought given to bilharziasis by administrations.

3. *Tanganyika.* Tanganyika is, in the writer's opinion, likely to become a classic example of the dangers inherent in the economic opening up of Africa by irrigation and water conservation, if the present figures given are accurate. It appears that the infection is wide spread throughout the territory, but that nowhere is the percentage of infected persons very high, nor is the disease regarded as very serious. Irrigation schemes are morally certain to increase the snail populations, and when this happens in a country where the infected human population is widely spread, little else but a great and increasing epidemic of bilharziasis can be expected.

4. *Mozambique.* Not surprisingly, Mozambique is reported to show large numbers of cases. Some 15,000 school children examined between 1952 and 1956 gave a percentage positive rate of 66 per cent., and even in adults over 30 years of age a rate of 37 per cent. was found. The disease is wide spread throughout the colony, with district rates ranging from 40 to 80 per

cent. There are few large irrigation systems, and most of the infections must be contracted in natural waters.

5. *Southern Rhodesia.* This country has an unenviably high place in percentages infected, a dubious distinction that might well be shared by Northern Rhodesia and Nyasaland, were adequate surveys to be carried out in these countries to-day. In Mashonaland repeated surveys have continued to show figures well in excess of 50 per cent. for whole population groups, while the rate in African school boys is nearer 80 per cent. for all those examined. These infections also have been contracted in a country where there are very few large irrigation schemes in existence.

6. *Union of South Africa and High Commission Territories.* The distribution of the disease in the Union is not yet a fully told story, but apart from Natal where cases have been known to occur for many years, an alarmingly high figure of positives is being reported from the Transvaal, particularly in the eastern low veld and the north, and it is likely that the extension of irrigation schemes in these areas will make the Transvaal a much more dangerous province than Natal, if it is not so already. The Free State appears to be free, as does South West Africa, although the disease is reported on the Southern border of Angola (P.W.A.) on the Okavango, in the Caprivi Strip.

Basutoland is also free of the disease, but it is wide-spread and increasing in Swaziland, with its irrigation schemes. Bechuanaland, with its large stretches of arid Kalahari country, shows focal distribution — at water holes and pans, but is for the most part free.

British West Africa

7. *Nigeria.* In discussing Nigeria it must be remembered that this is a very big country with several different "climates" within its borders. The disease is widespread, with a fairly large number of infections, in the north and west. However, in other regions the distribution is patchy, and near the coast the figures are probably very low, a strange feature of almost all the North West African coast countries.

8. *Gold Coast.* Here again distribution is patchy, with high figures in the north and south. and low figures in the Central Provinces. What the Volta River Barrage scheme will do to bilharziasis prevalence in this country is not completely clear, since various population centres, at present infected, will be wiped out, but it is reasonably certain that any irrigation schemes, stemming from the large water body to be formed, will become progressively more infective.

9. *The Gambia.* Distribution is again localised in this small country, with a higher rate in the eastern half, very low rates in the western, and very few infections at the coast. Much of the disease is centred round the Gambia River, but strangely enough the river itself is not incriminated.

10. *Sierra Leone.* Sierra Leone gives a similar picture with a reputed 65 per cent. positive rate in an inland, high-lying area, and comparative or complete freedom from the disease near the coast. Although *Liberia* is not in British West Africa, it may be noted here that the writer found exactly the same state of affairs in this country—high rates in the high country, absence of the disease at the coast line.

11. *French West Africa.* There are ten French West African territories, and all show varying degrees of *S. haematobium* infections. French Togo seems to be least heavily infected, with the French Sudan and the Upper Volta territories probably the scene of the heaviest infection rates. In the areas around Lake Chad, in the Upper Volta region, up to 70 per cent. of the whole population is infected, in direct contrast to lightly infected areas around. However, this is rather a special area, periodically flooded, and highly cultivated, with large bodies of stagnant water.

12. *Portuguese Guinea.* This territory also shows an unusual geographical distribution, but in this case it is not a division between coast and hinterland, but between the northern and southern halves of the country. Here again the disease is not much, if at all, influenced by irrigation practices, but is a disease of parts of the river valleys, where the incidence can be described as light to moderate.

13. *Angola (Portuguese West Africa).* This country has been investigated with some thoroughness quite recently, and it is clear that once again urinary bilharziasis cannot be said to be equally important in each zone of the country. The western half of the country is extensively infected, with figures running up to 100 per cent. in school children in localised areas, while the eastern half (although a few cases have been seen) appears to fall into line with a broad belt of country stretching right across Central Africa, including the rain forest zone and the Central Congo basin. All this area is free from the disease. It should, however,

be noted that the careful studies carried out in the Congo, particularly by Dr. Gillett, show that *S. haematobium* infections are spreading into the North Eastern Belgian Congo, previously uninfected.

14. *Belgian Congo.* It is interesting to us in the Federation to note that the authorities in the Belgian Congo ascribe the many *S. haematobium* infections in the Katanga area, to the immigration of infected labourers from Northern Rhodesia, since much the same belief is held in Southern Rhodesia that immigrant labour from the north brought the disease. Elsewhere in the Congo *S. haematobium* infections are scattered and sporadic, and large areas of this vast country are relatively free. The note under Angola regarding the extension of the disease should, however, not be forgotten.

North, North East and East Africa

15. *Morocco, Algeria and Tunisia.* Most of the cases in Morocco occur on the southern slopes of the Atlas Range — the Sahara side, at altitudes below 3,500 feet, and follow the water courses as they slow down from their beginnings in the mountains. There is a report of one infected area in Spanish Morocco, where rates in school children are quite high. Again in Algeria the known *foci* are in the extreme north of the territory, while in Tunisia the infection appears to be generally confined to the north west of the territory. As these areas merge rapidly into the Great Sahara Desert, such focal distributions are to be expected.

16. *Egypt.* The entire Nile Valley is probably the most heavily infected area in the continent. In this context it should be noted that the vast irrigation network supplied by the Nile is responsible for the millions of cases seen annually, and not the Nile River itself.

17. *Sudan.* There is much to be learnt from the Sudan which is a semi-arid, almost desert country, except along its big rivers and its irrigation schemes. Its areas of greatest prevalence were, until recently, along the Blue, White and Main Niles, with perhaps the heaviest infections occurring in the north, near the Egyptian border. The advent of the big Gezira irrigation project has changed the picture completely in the last twenty years, even although the authorities realised the danger inherent in such a scheme. In the formerly arid Gezira, infection rates have risen year by year from the previously unimportant few per cent. The position here is not helped by an annual influx of migrant labourers, many of whom are infected.

18. *Eritrea.* This area is reputed to be completely free of the disease, but it is very possible that *ad hoc* investigations would reveal infections.

19. *French and British Somaliland.* These two territories are also said to be free, and the few cases found are assumed to have been infected elsewhere. The nomadic habits of the pastoral tribes of these areas makes it possible that this is true.

20. *Somalia.* The north of this territory is practically free, but in the south heavy infection rates are found along the two rivers, the Webi Shebeli and the Juba, where rates up to 80 per cent. have been quoted.

21. *Ethiopia (Abyssinia).* *S. haematobium* infections are common in the north-west, but in the rest of the country cases are said to be few and far between.

S. Mansoni Infections

I am going to deal very summarily with *S. mansoni* infection rates; statistics of these infections can be even more misleading than those of *S. haematobium*, depending, as they do, entirely on the skill and perseverance with which proof of the disease is sought.

In the Federation for instance, only Buckley in Northern Rhodesia, and Blackie in Southern Rhodesia, can be said to have conducted intensive investigations into *S. mansoni* rates, and they were not able to sample really large numbers. In this connection, the digestion-of-tissues investigations carried out in Salisbury by Gelfand and Ross, Alves, and Alves, Gelfand and Woods, have shown that *S. mansoni* infections are far more numerous than would be suspected from returns from laboratories examining stools, and it is extremely probable that the rates given for most countries are too low. Rectal biopsy studies in the Eastern Transvaal and in Swaziland have likewise revealed unexpectedly high figures, and I am certain that wherever administrations are interested enough, or can afford, to carry out really intensive and painstaking surveys, the figures for *S. mansoni* will be found to be much higher than the present estimates.

S. mansoni infections are found over West, Central, East and South Africa, but are absent from the whole of Northern Africa, with the exception of the Nile Delta. The Gambia, and

Portuguese Guinea, on the west coast, are also said to be free. Generally speaking, *S. mansoni* is more patchy in its incidence than *S. haematobium*, but large areas in the Belgian Congo show the reverse of the pattern, with heavy endemicity reported from many parts.

Pitchford, working in the Eastern Transvaal, has produced some very interesting figures which tend to show that where populations are congregated together in irrigation schemes, rural industries, and the like, so will the *S. mansoni* rates go up.

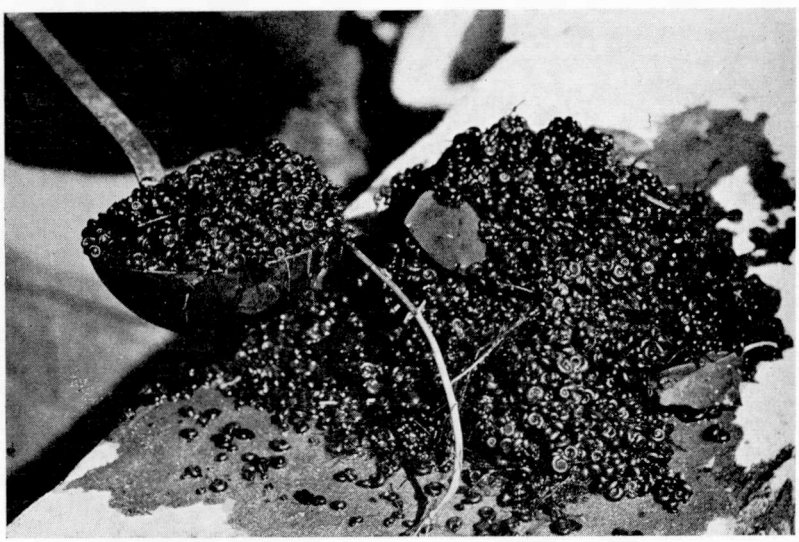
The Intermediate Hosts

It is not proposed to enter into a detailed discussion of this highly specialised and still controversial aspect of bilharziasis. It will suffice to say perhaps that it is probable that all species of Biomphalaria snails ("Planorbis" of the old nomenclature) in a geographical region, can act as hosts of *S. mansoni* from the same region. In South-Central and Southern Africa it is clear that most if not all of the Bulinus (Physopsis) group act as hosts of *S. haematobium*, while in a "border" region somewhere in the Sudan the role of Physopsis s.l. is taken over by Bulinus (bulinus), which acts as the host in North Africa, Egypt and possibly in a small focus on the West Coast.

In the Federation three species of Biomphalaria snails have been shown to be intermediate hosts, *Biomphalaria pfeifferi*, *B. angulosa* and *B. rhodesiensis*, while both of our "physopsis" species *Bulinus (ph.) africanus* and *B. (ph.) globosus* are hosts for *S. haematobium*.

The Intermediate Hosts in Irrigation Schemes

It is probably important, in the shape of things to come, that irrigation schemes in Southern Rhodesia which have been examined by us show a completely different pattern of snail distribution from that obtaining in natural waters. In natural water courses it is usual to find that biomphalaria snails are greatly outnumbered by members of other species of snails. In irrigation furrows, and in the night storage dams of irrigation schemes, this proportion is upset, and a much larger number of biomphalaria snails is found. This might remain an interesting and possibly academic illustration of the fact that irrigation furrows and the like are better habitats for biomphalaria than they are for bulinus, if it were not for the truly frightening increase in actual numbers of all snails. In many irrigation channels in the warm low-veld of Southern Rhodesia there are hundreds, perhaps thousands of snails to the square yard. When such numbers of snails are exposed to infection, and become infected, the number of cercariae at large in the restricted area of an irigation furrow will be enormous.



Snails collected in a few minutes from an irrigation canal at Debuli, S.R.
[*Photograph:* J. J. Fourie, G.H.I.

The Present and Future Position in Southern Rhodesia

I propose in this section to quote very briefly from a thesis for the Ph.D. degree of London University, because what I wrote then is, I believe, substantially true to-day; the words have also been used in a World Health Organisation working paper recently presented at the Brazzaville Conference on Bilharziasis.

"When the picture over the years in Southern Rhodesia is studied, it is clear that, far from progress in the control of bilharziasis being achieved, the situation has steadily worsened. The disease claims many new sufferers every year in the African population, in spite of the greater attention that is being paid to it. The European population is in a happier position. The infection rate has not increased in the last fifteen years, and, among school children, is in fact slightly less. . . .

"It is with mixed feelings that one reads Fleming's statement in the "Annual Report on the Public Health" published in Southern Rhodesia, in 1922. He says, 'The protracted nature of the disease, and its after effects, have in the past rendered it one of the most serious of the helminthic infections, but the discovery by Leiper of the intermediate host in certain varieties of fresh-water snails, and the results obtained by Archibald in Egypt and by others in the treatment by intravenous injection of tartar of antimony have robbed it of much of its dangers.'

"In brutal fact the disease has spread widely throughout Rhodesia and South Africa since he penned these words, and Leiper's brilliant discovery has not been followed up with equal brilliance by the chemists, the sanitarians, or the zoologists."

In 1948, I closed an address to the Ross Institute Advisory Committee with the following words, which are also just as true to-day:

"I would like to mention at this stage the importance of this disease (bilharziasis) in Africa's future. Everywhere can be found discussion of Africa's potentialities; large-scale agricultural projects and industrial and mineral exploitation are being mooted at this moment.

"It is not sufficiently appreciated that all 'opening-up' of Africa will mean opening-up of water supplies whether hydro-electric, irrigation, or just plain domestic, and with every extra mile of water will go the bilharzia snail with his 'quiverful of arrows,' striking man down, and, to put it at its lowest, making him an uneconomic labour unit . . .

"May I then close this talk with a plea that the irrigation and construction engineers, the agriculturists, the pastoralists and the 'openers-up' generally will exploit to the full one of their most important assets: the eagerness of public health workers to advise and co-operate."

What perhaps needs most emphasis is the likely situation with irrigation projects, which is gradually being elucidated, particularly by Pitchford in the Eastern Transvaal, and Gillett in the Belgian Congo, because there is no reason to hope that anything different will happen here. Not only will there be many more cases of bilharziasis, particularly of *S. mansoni* infections, but also this greater number of cases will contain a high proportion of heavily infected people with serious symptoms, and many will be gravely ill. The almost "benign Bantu bilharziasis" will not be seen long in these irrigation projects, it will be replaced by a malignant killing disease like the bilharziases of Egypt. It is much more logical to believe that the severity of the disease in Egyptian fellaheen is due to the gross infections they are exposed to in their contacts with water, than that the Egyptian schistosome has a peculiarly invasive and toxic power.

We will pay a grave price in human health if we do not succeed in reducing the dangers inherent in irrigation farming in Africa, and aid must be sought from all sources. It cannot be too strongly said that this is not a medical problem alone, and that no health department can itself prevent this forecast of the future from becoming stern reality. Anti-bilharziasis measures must be foreseen, and budgeted for, from the start, and while no responsible bilharziologist would promise eradication of the disease from a country, it is feasible to-day to promise that its local incidence, in an irrigation scheme, can be kept to a minimum, or even prevented, by intelligent planning and construction. This may well cost less than the inevitable sickness and loss of production that must ensue, if we permit ourselves to become another Egypt.

REFERENCE

Dawood, M. & Gismann, A. (1956). *World Atlas Infectious Diseases*, Part III. Falk Verlag, Hamburg I (243 references).

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