

Snail-paced parasite that is marching through South America

Schistosomiasis, otherwise known as Bilharzia, is a debilitating disease causing anaemia, diarrhoea, abdominal pain and sometimes death. Its spread, initially through a particular species of freshwater snail, is now being accelerated by human carriers—Brazil's millions of migrant workers

Report by David Bousfield of Sussex University

UNTIL the 1920s schistosomiasis, a debilitating parasitic disease caused by *Schistosoma mansoni* which is transmitted by certain species of freshwater snail, was more or less restricted to the north-east of Brazil—an area which includes the states of Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas and Sergipe. Then, as now, sugar cane cultivation along the coastal 'zona da mata' was a major source of employment. The sugar mills or 'engenhos' were invariably associated with river valleys providing alluvial fertilisation during the winter, water for irrigation, and ideal habitats for *Biomphalaria glabrata*, the main intermediate host of schistosomiasis in the area, which is capable of adapting to almost any kind of freshwater environment. Inland the climate becomes progressively drier and the corresponding vegetational zones, the 'agreste' and the 'sertão', supported simple farming and cattle ranching. In these semi-arid regions limited and intermittent sources of water meant concentration of population, pollution and disease and provided an environment for an intermediate host, *Biomphalaria straminea*, that was well adapted to temporary desiccation. Today, estimates for the levels of infection in Sergipe and Alagoas are above 30%, and even in the most developed state, Pernambuco, the level was almost 16% before 1975.

Unfortunately the disease did not remain in the north-east. Competition from the more progressive plantation owners in the south closed many 'engenhos' and forced others to adopt more mechanised, less labour intensive methods, whilst in the interior the severe droughts of 1958 and 1970, together with the 'strong-arm' tactics of the richer landowners forced many 'nordestinos' off their land and on to the road. These migrants travelled mainly to the south in search of work, taking their diseases with them. During the 1970 drought, for example, out of the total population of 30 million, 2 million people left the north-east. In 1937 schistosomiasis reached the state of Minas Gerais, and the states of Rio de Janeiro and São Paulo in 1950. In 1953

the disease reached Paraná bordering with Argentina and Paraguay, and it was recorded in Brasília in 1973. Since potential intermediate hosts were already to be found in all of these states it is presumed that human migration was responsible for the spread of the disease. By 1975 it was estimated that there were between 8 million and 18 million carriers and the disease cost \$150 million per year.

Human migration, however, is not the only reason for the rapid increase in size of the endemic area. Until about two decades ago only *Biomphalaria glabrata* and *B. straminea* were recognised as being the important intermediate hosts for schistosomiasis in South America. A third species *B. tenagophila*, found only in the south of the country (but whose distribution stretches westward and southward into neighbouring Bolivia, Paraguay, Argentina and Uruguay) was thought to have a very low susceptibility to infection by the miracidia of *S. mansoni*. Indeed in 1923 the Brazilian taxonomist Adolpho Lutz had proposed that the species be called *Planorbis immunis*. In 1956, however, Lygia Corrêa and others found a number of foci in the Paraíba valley which were maintained solely by *B. tenagophila*—in some areas snail infection rates were as high as 48%. Subsequent laboratory work conducted by Lobato Paraense and his co-workers have shown that *S. mansoni* is gradually adapting to its new snail host and that in the case of the strain from the Paraíba valley this process is particularly well advanced.

Will the strain spread to Amazonia?

In a recent paper by Paraense and Corrêa they remark that "the susceptibility of most *B. tenagophila* populations to the S. J. [Paraíba] strain points to a fact of practical significance—the possibility of expansion of that strain to a wide South American area, most of which is still free of schistosomiasis". They also report that the strain is gradually spreading, and that this rate will increase as stronger migration incentives and better economic opportunities are developed in the region.



Brazil's waterside shanty towns: a focus for transmission of disease

In addition to this movement south, spread of schistosomiasis has been recorded, albeit on a much smaller scale, in the northern states of Maranhão and Pará. The intermediate host here is *B. Straminea* but a new potential host *B. amazonica* has recently been discovered to the west with a distribution stretching from Porto Velho, along the Rio Solimoes to Manaus. The possibility of spread to Amazonia is generally acknowledged amongst public health workers to be small. This judgement is based on the low population densities and high flow volumes involved, and the unsuitability of the water chemistry. However, the development of the Transamazonian Highway, built specifically to act as a 'safety valve' for the drought-plagued northeast, must challenge some of these assumptions. The original project, announced in 1970, called for settlement of 100,000 families along the pioneer highway by 1976—although, in fact, by September 1977 only 5,333 had actually been settled. Small towns were constructed every 10 km (agrovilas) with larger administrative and manufacturing centres built at 100 and 400 km intervals. Research conducted by Dr Nigel Smith (INPA, Manaus), however, has shown that as of September 1974 only 4 out of 26 agrovilas were equipped with piped water and

only 10 out of 26 possessed privies. Gastrointestinal problems due to the use of water from streams and ponds contaminated by human and animal faeces are already one of the major reasons for hospital admission. SUCAM, the government organisation responsible for disease control, maintains surveillance at Marabá, Altamira and in Rondônia, but to date no transmission has been reported, although many of the settlers are infected. However, at SUCAM's headquarters in Brasília, Dr Solon Camargo pointed out to me that agricultural activity and other attempts to modify forest ecology might produce favourable snail habitats in the vicinity of the highway. According to Dr Smith the 'slash and burn' techniques of the settlers and the application of lime to the soil has produced a large modification in the chemistry of stream and pond water close to the road and at a number of sites, notably Altamira *B. straminea* populations already thrive.

Until 1975 attempts to control Brazilian schistosomiasis took the form of small pilot projects usually aimed at reduction or eradication of snail populations using molluscicides. Some attempts to reduce the incidence of the disease by chemotherapy had also been made but neither strategy had been particularly useful in controlling transmission—small residual populations of infected snails could still maintain high rates of transmission and treated patients soon became reinfected, although it might be several years before disease reached its more advanced forms again. Indeed by this time many Brazilians working in schistosomiasis control felt that attempts to reduce the disease should be linked to community health programmes, and in particular to the provision of piped water, toilets and communal laundries. In rural Brazil

75% of households were without any form of toilet and 71% without protected water supplies in 1975. Dr F. S. Barbosa, a specialist in snail control wrote in 1974 that "attempts to control schistosomiasis, in a large scale, by using the conventional single control methods are futile and, more than this, may become detrimental to the developing communities."

Better sanitation key to prevention

When the first national plan to control schistosomiasis (PECE) was announced in 1975 at the beginning of the term of office of President Geisel it was greeted by considerable criticism from the scientific community, for the Minister of Health, Dr Paulo de Almeida Machado proposed the eliminate, or at least control, the disease by mass chemotherapy—the drug oxamniquine (Mansil) being used most extensively. This choice of strategy was based on the success of a small pilot scheme in Paraná and the success of an earlier mass injection scheme in which 80 million people were vaccinated against meningitis in 10 months. It is probable too that the need for positive results before the next election in 1978 played a part in the design of the programme. PECE began with two closely monitored experimental projects—one at the town of Touros (population 2,250) in the state of Rio Grande de Norte, and the other at Santo Antonio das Trempes (pop. 571) in Pernambuco. At Touros almost all the population was treated 'en masse' with oxamniquine during December 1975. Infection levels dropped from 56% to 5% but rose to 19% after one year. Indeed, for children under 15 years, the highest risk group, more than 50% became re-infected during this period. On the other hand, at Santo

Antonio das Trempes where chemotherapy was preceded by mollusciciding and installation of piped water, toilets, showers and communal laundries, the infection rate, which originally had been 50.4%, was still only 2% twenty months later. PECE has since been extended to cover seven north-eastern states, yet still relies heavily on drug therapy. Oxamniquine will be given to 12 million people (already between 1 and 2 million have been treated) whereas provision of sanitation is planned for only 2.6 million.

Additional programmes designed to control and stem the spread of schistosomiasis in the south are being undertaken by the São Paulo Secretariat of Health and in the neighbouring state of Paraná by SUCAM. São Paulo's problems began with its rapid industrial and agricultural growth with the concomitant need for manpower, irrigation systems and power stations. For example the state is now the country's biggest producer of sugar cane, a crop whose importance to the national economy will increase rapidly as the government's programme to substitute ethanol, produced from sugar, for gasoline gets under way. The need to reduce energy imports has also made hydroelectric power an increasingly attractive alternative and new schemes, such as the one at Itaipú, now have catchment areas extending into Argentina and Paraguay, making international transfer of schistosome strains a possibility. During the period 1967-70, the state received 113,054 migrants, mostly from the north-east and Mina Gerais. Routine coprological examination showed that an average 23% had schistosomiasis. By 1974 it was estimated that a quarter of a million infected migrants had entered the state. Attempts have been made to screen and treat infected migrants as they arrive. However, in order to prevent the spread of schistosomiasis such a scheme required that all migrants register with the local authorities, and that diagnosis and treatment are 100% effective. To date none of these standards has been achieved and the number of active foci within the state increases.

Whatever else happens in the future, it is clear that Brazil's need for cheap migratory workforces will continue to increase, and it is to be hoped that the new Minister of Health, Dr Mario Augusto de Castro Lima, with an extended 6 year term of office in front of him, will realise that chemotherapy is no match for the powerful social and economic forces which have made schistosomiasis a major problem in Brazil's agro-industrial age. □



Migrant sugar workers: attempts to screen them medically have failed

David Bousfield visited Brazil on a Nature Writing Fellowship