The Control of Bilharziasis by the Use of Molluscicides

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Introduction

Previous speakers have discussed the requirements of control, and of the control of bilharziasis by rural management. Without entering into these fields I would ask you to now consider the usefulness and role of molluscicides in the control of tranmission of this disease.

Due to the more-or-less stringent requirements in dispensing molluscicides, the application generally rests with specially trained personnel. Snail control can therefore be carried out with little or no co-operation from those people who are being protected.

In this country the cost of molluscicide, and its application, is borne by Government, thus virtually putting no strain on the rural communities. It must be realised that this plays an important part in maintaining the efficiency of the control programme.

Methods of Control

In any large area where intensive agriculture is practised, there are two types of waterbody. These are: one, the natural waterbodies, i.e. springs, streams, rivers, vleis, etc.; and two, irrigation water — usually meaning water that is channelled via regulated and man-made canals and reservoirs.

Natural Waterbodies:

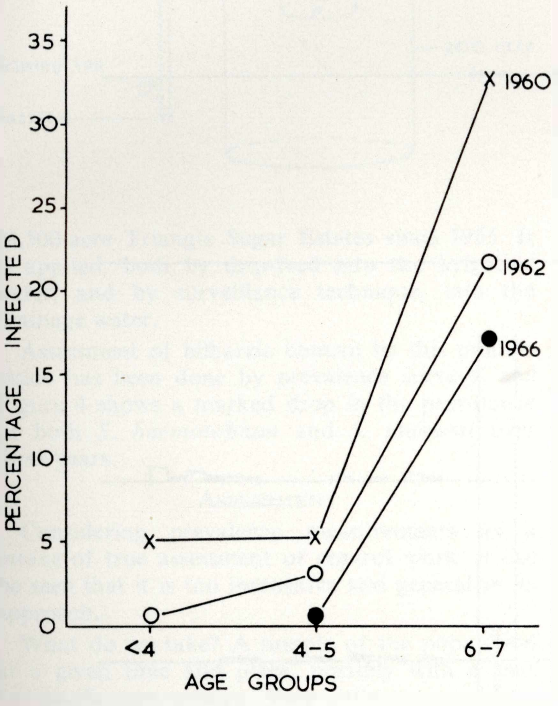
Ideally the whole watercourse (i.e. catchment) should be given a blanket treatment of molluscicide regardless of the snail population. This heavy application has the effect of killing the vast majority of snails within a very short time.

It then becomes much easier to bring in the second type of treatment — surveillance. Here, a team of rangers covers the area on a regular six-weekly cycle searching for snails which are generally found in pockets, and then spraying molluscicide above and below the focus to control the snail population.

Clarke and Shiff (1966) have shown that on the Rhodesian highveld the snail populations fluctuate considerably over a year, but that two high peaks occur — one before and one after the rains. Theoretically, if a waterbody were to be blanket-sprayed at the beginning of one of these peaks thus preventing it from developing, and surveillance carried on thereafter, it is highly probable that snail numbers would be kept to a minimum. Once this stage has been reached it is hoped that transmission would be limited.

This system was used on the Kyle Catchment when in April 1960 the area was blanket treated prior to the "after" rains peak. Snail surveillance was carried out for the next six years. Assessment of control was attempted by single urine specimen prevalence surveys carried out in 1960, 1962 and 1966, and they show a definite decrease in *Schistosoma haematobium*. (See Fig. 1.)

FIG. 1



Irrigation Waterbodies:

Apart from blanket and surveillance methods, the main approach to snail control in irrigation systems is by the drip-feed technique. Here, simple devices feed the molluscicide at a constant rate into a known flow of water, thus attaining a far greater degree of dispersal and accuracy of concentration than in the previously mentioned methods.

With the use of Frescon — a 16 per cent. active ingredient emulsifiable concentrate — only 0.05 to 0.075 ppm. is generally required to kill snails over a 24-hour period. It is not ovicidal at this concentration, and the duration of application must be prolonged to kill hatching snails.

The drip-feed apparatus (Crossland, 1967) consists of a sealed 200-litre drum with a lower outlet nozzle and a pressure compensating tube which maintains a constant head. At a constant flow rate of 140 ml./min. the dispenser empties in 24 hours, thus for a 10-day drip-feed the dispenser is attended to once daily.

Assessment of Frescon is based on snail control only. A drip-feed was run at 0.05 parts per million for 21 days on a simple irrigation system, and gave six months of absolute snail control. In a complex system comprising three interconnected reservoirs, each one feeding the next, two months control in the first two was effected before observing that large numbers of adult snails were moving in via the inlet canal.

A large-scale trial was completed when several miles of canal and 24 reservoirs on a 2,500-acre estate were treated. The experiment was designed to test the efficacy of the molluscicide applied for three 10-day periods separated by 30-day intervals. This worked well until the final application when 10 cm. rain on the fourth day stopped irrigation for a week. The final six days application was then applied and this short-term split-dosage drip-feed seems to have been far more effective than the long-term drip-feed. (See Fig. 2).

In this trial seven of the 24 reservoirs were examined, and for the final 10-day application the flow of water for irrigation purposes was such that only the lower portion of the scheme (including only three of the assessment reservoirs) could be treated. The follow-up snail surveys on the previously treated reservoirs shows that the snails returned quickly but were well controlled after the short-term drip-feed.

On a wide scale the molluscicide, Bayluscide, is used. This is dispensed through a constant head siphon device which gives a constant application rate. The apparatus consists of an open 200-litre drum with a floating siphon to ensure a constant head. (See Fig. 3) The molluscicide, being a wettable powder, must be mixed with water and constantly agitated during its application. It is ovicidal and therefore requires a shorter application period than Frescon. Although it must be used at a concentration of 0.4 ppm. which will kill snails, the amount consumed is not higher than that of Frescon because Bayluscide is used for a shorter period; and has been used exclusively on the

FIG 2

FRESCON SPLIT – DOSAGE DRIP FEEDS

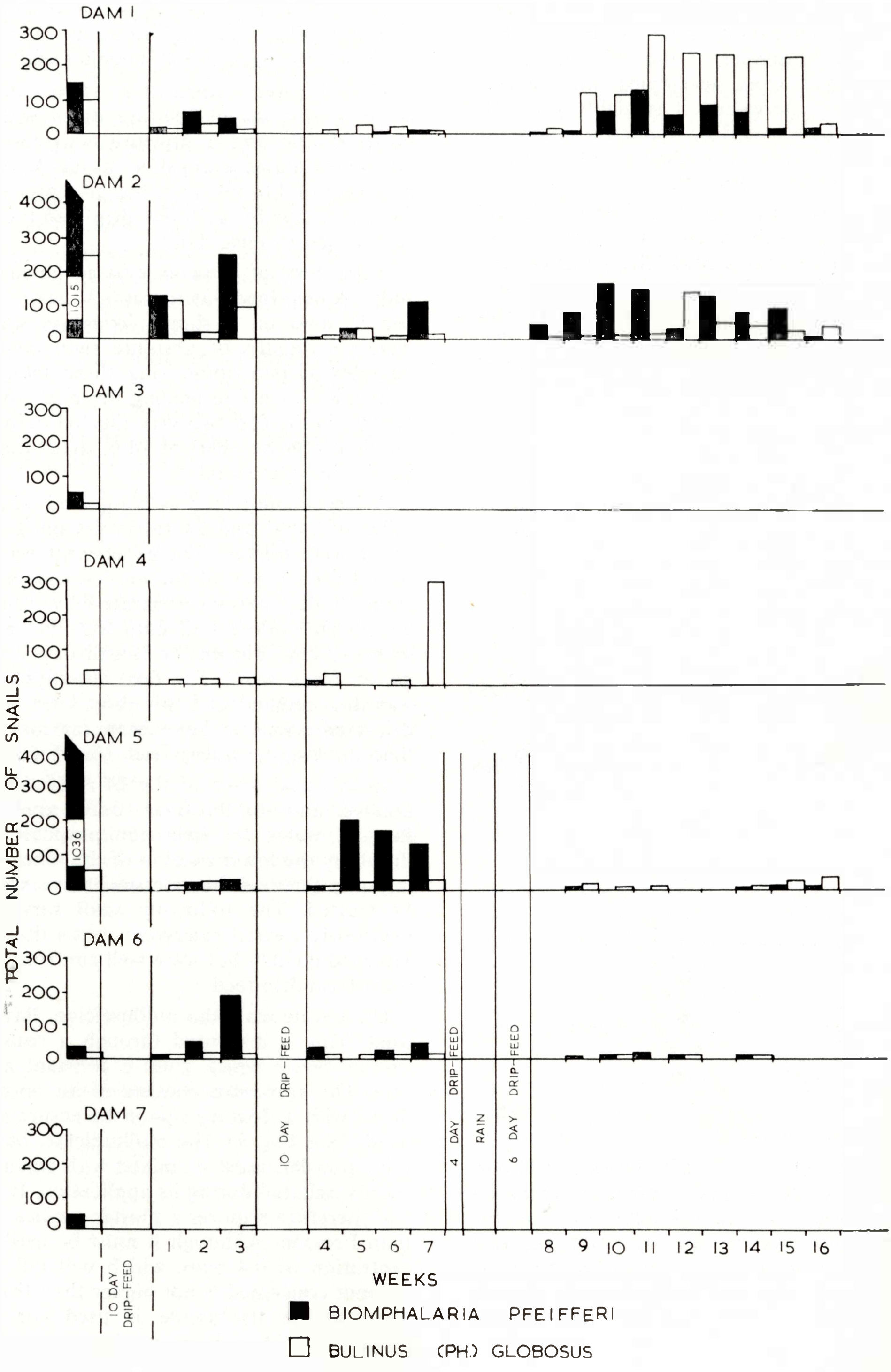
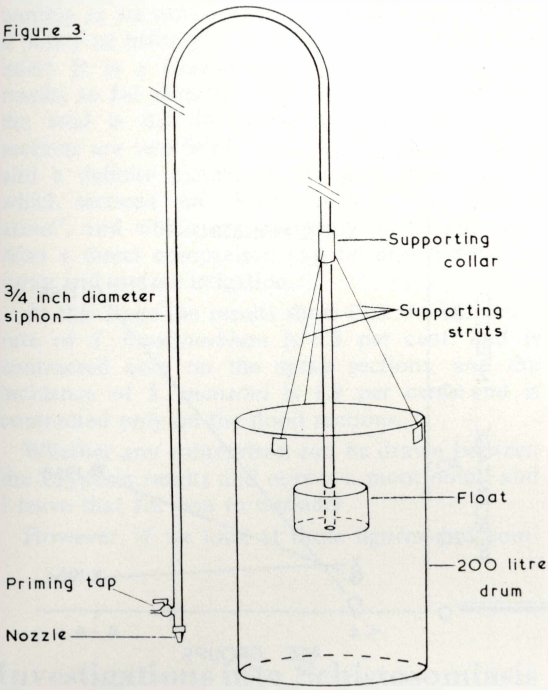


Figure 3.



26,500-acre Triangle Sugar Estates since 1965. It is applied, both by drip-feed into the irrigation water, and by surveillance technique, into the drainage water.

Assessment of bilharzia control by this molluscicide has been done by prevalence surveys, and Figure 4 shows a marked drop in the prevalance of both *S. haemotobium* and *S. mansoni* over three years.

Assessment

Considering prevalence measurements as a means of true assessment of control work, it can be seen that it is too insensitive and general in its approach.

What do we take? A sample of the population at a given time and place, possibly with a bias to specific age groups. Very little, or no background is considered, and neither is any consideration given to where the disease is contracted. Thus, at this particular time and place, so many people have bilharziasis. Is that sufficient? Yes, if all you require to know is the percentage or number of people who, at a given time and place, have bilharziasis.

In order to carry out follow-up prevalence surveys and expect significant results, a stable population must be examined. In the case of the Kyle Catchment area (previously mentioned), we were fortunate in having a relatively stable population, and in this country a rural population in a tribal trust land is probably stable.

However, where does the majority of control work take place? In this country is it in the farming communities where, generally, the only really stable population is the European. The labourers are a moving population — excess brought in for reaping tobacco, cotton, etc.

A true prevalence survey should have some fixed basis from which to work. It has been stated that a random 40 per cent. of the given population should be investigated. We all know how difficult it is to achieve this; thus our prevalence figures become inaccurate to some extent.

What better method is there of assessing control?

Within the sphere of work done by this laboratory the assessment of malaria control is one aspect at which we can look. The accepted method of assessment is by measuring the *incidence* of the disease in the control area: that is, by investigating the children born subsequent to the instigation of control. Here then, the workers are assessing transmission which has occured during control.

To apply this method of assessment of bilharzia can be difficult. Farooq and Hairston (1966) carried out an incidence trial on a reclaimed area of the Nile Delta a few years ago. Results, Table 1.

TABLE I.
Incidence of bilharziasis amongst pre-school children from the different areas of the Nile Delta Project 49 Area, Egypt. (From Farooq and Hairston, 1966.)

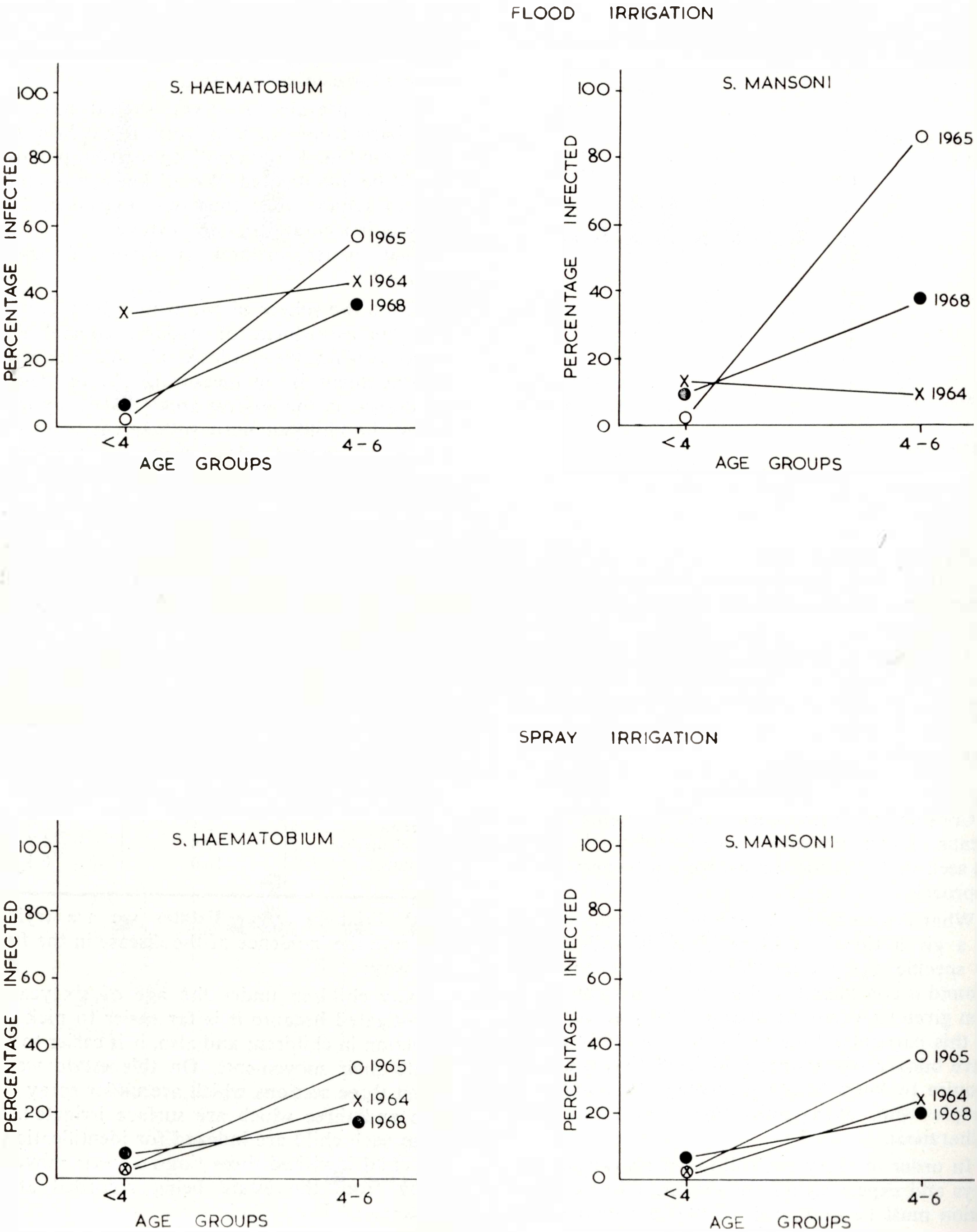
Area	Incidence (%) of Infection	
	S. haematobium	*S. mansoni*
Rural	22.8	8.5
Urban	3.15	1.0
Reclamation	12.8	4.7
Control	18.0	6.4

At Triangle Sugar Estates we are trying to measure the incidence of the disease in the following way:

Only children under the age of six years are investigated because it is far easier to pick up an infection in children; and also, it is easier to investigate their movements. On this estate we have taken three sections which are under spray irrigation and three which are surface irrigated. Data from each child are indexed for identification and the child is visited three times a year; movements away from the estate being recorded at each visit.

FIG. 4

TRIANGLE LTD. PREVALENCE SURVEY



Specimen production is frequently not as forthcoming as we would wish and so we have adopted a policy of bribery — urine and stool first, sweets later! It is a time-consuming business, but the results so far seem to be well worth it. Although the trial is still in operation, four of the six sections are two-thirds of the way to completion, and a definite picture is emerging. We can see which sections out of the six are "transmission areas", and which are seemingly well controlled. Also a direct comparison can be drawn between spray and surface irrigation.

At this stage the results show that the incidence rate of *S. haemotobium* is 0.8 per cent. and is contracted only on the spray sections, and the incidence of *S. mansoni* is 1.9 per cent. and is contracted only on the flood sections.

Whether any comparison can be drawn between the Egyptian results and ours is a moot point, and I leave that for you to consider.

However, if we look at these figures and compare them with the prevalence survey, it appears that as a method of assessing the control of bilharziasis, the picture given by incidence measurement is far more realistic than that given by prevalence.

We should now look into this method of assessment more closely and gather comparable data from the various types of communities, the indications being that the incidence picture could tell us far more about our control methods.

Acknowledgments

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